

SurPro6.0 User Manual

Copyright ©GUANGZHOU ALPHA GEO-INFO CO., LTD

***All Rights Reserved**

Contents

Chapter Ⅰ SurPro6.0 Software Overview 5

1.1 Software Introduction 5

1.1.1 Project 5

1.1.2 Device 5

1.1.3 Survey 6

1.1.4 Tools 6

1.2 Software Installation and uninstallation 6

Chapter Ⅱ Project 7

2.1 Project Management 7

2.2 Localization 9

2.3 Calibrate Point 11

2.4 Coordinate System 13

2.5 Points Database 16

2.6 Code library management 18

2.7 Survey Area Settings 19

2.8 Software Settings 20

2.9 About Software 22

2.10 Export Data 22

2.11 Project File 23

2.12 Import Data 25

2.13 Grid to Ground 26

2.14 Offset Point Correction 26

2.15 Layers Settings 27

Chapter Ⅲ Device 27

3.1 Communication 27

3.2 Rover 29

3.3 Base 33

3.4 Static 36

3.5 Device Information 36

3.6 Device Activation 37

3.7 Device Settings 38

3.8 NMEA Settings 38

3.9 Re-Positioning 38

3.10 Device Self-Check 38

3. 11 Other 38

Chapter Ⅳ Survey 40

4.1 Point Survey 41

4.2 Detail Survey 45

4.3 Control Point Survey 45

4.4 Point Stakeout 46

4.5 CAD Stakeout 48

4.6 Line Stakeout 50

4.7 DSM Stakeout 51

4.8 Stake Road 53

4.9 Photographic Survey 57

4.10 Images Database 61

4.11 Electric Lines Survey 62

4.12 Spiral Stakeout 64

4.13 Polyline Survey 65

4.14 Polygon Survey 67

4.15 Electric Towers Stakeout 68

4.16 Laser Measurement 69

4.17AR Stakeout 72

Chapter Ⅴ Tools 74

5.1 Coordinate Converter 74

5.2 Angle Converter 75

5.3 Perimeter and Area 76

5.4 Volume Calculation 76

5.5 Calculator 77

5.6 Post-Measure Correction 78

5.7 Share File 78

5.8 Coordinate Positive Calculation 79

5.9 Circle Center Calculation 80

5.10 Average Calculation 80

5.11 Vector 81

5.12 Coordinate Inverse Calculation 82

5.13 Point Line Calculation 82

5.14 Angle Calculation 83

5.15 Intersection Calculation 84

5.16 Resection 84

5.17 Forward Intersection 85

5.18 Offset Point Calculation 86

5.19 Extend Point Calculation 86

5.20 Equal Point Calculation 87

Chapter I SurPro6.0 Software Overview

1.1 Software Introduction

SurPro6.0 software is GUANGZHOU ALPHA GEO-INFO CO.,LTD. developed based on GNSS high-precision location application development of engineering surveying application software, developers according to years of mapping development and market experience accumulation, combined with a large number of industry users using habits and Android operating style habit fusion, Developed high-precision position measurement and acquisition, point line stake, road design stake, CAD and other powerful and simple operation of engineering measurement application software.The software has the characteristics of simple operation and user-friendly operation process, powerful road design and construction stake function, powerful CAD drawing stake function, functional menu display is convenient for users to customize design and so on.

The following describes the basic functions of the software: The software mainly includes four parts: project, instrument, measurement and tool.

1.1.1 Project

This part is mainly for project configuration, project data management and software Settings and other related operations, mainly including project management, calculation of conversion parameters, base station translation calibration, coordinate system parameter setting, coordinate point library, code library management, survey area setting, conversion setting, software and other functions.

1.1.2 Device

This part is mainly aimed at the operation related to the connection of high-precision GNSS equipment and equipment setting, mainly including communication setting, mobile station mode setting, reference station mode setting, static mode setting, instrument information viewing, instrument setting, satellite star map star map and positioning information viewing.

1.1.3 Survey

This part mainly uses GNSS position to carry out field data measurement, stake and other operations related to industry application, mainly including point measurement, fragment measurement, control point measurement, point stake, CAD, linear stake, site elevation control, road design stake, GIS data collection and other functions.

1.1.4 Tools

This part is mainly related to the measurement of some common practical tools, mainly including coordinate conversion, Angle conversion, perimeter area calculation, calculator and other functions.

1.2 Software Installation and uninstallation

Installation process:

1. Download android SurPro6.0 software installation (*.apk).

2. Copy the SurPro6.0 software installation program to your mobile phone (Handheld) device. Find the software installation in file Management on your handheld device and click the installer to install it.

3. Click the desktop SurPro6.0 software to enter the software (you need to create a project when entering the software for the first time, and it will automatically open the software and use the project after each startup).

Uninstallation process:

Uninstall Method 1: Hold down the software icon on the desktop, drag it to the Uninstall option box, and click OK to uninstall the software.

Chapter II Project

The main window is displayed. Click Project. Figure 2-1 shows the corresponding menu. The project includes project management, localization, calibrate point, coordinate system, point database, code library management, survey range settings, software setting, about software and other functions.

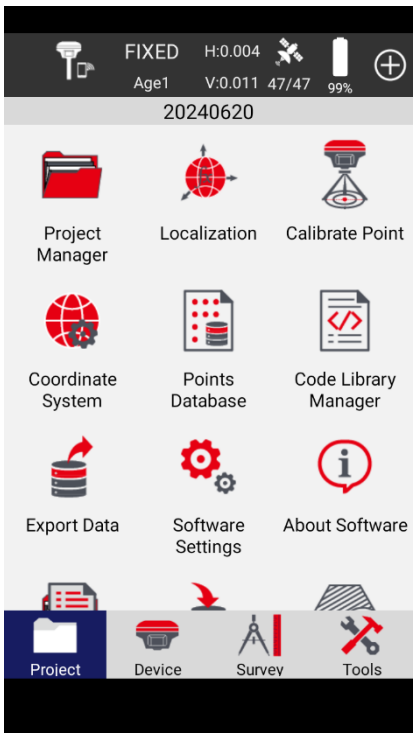


Figure 2-1

All data and operations of the software are stored and managed by engineering projects. After entering the software for the first time, you must create a project first. After entering the software each time, the software will automatically load the project used for the last time. Each Project is stored in the corresponding directory (default location: Internal storage ->SurPro->Project) as a Project name folder. The basic information of the Project is stored in Project name, job, and other data is stored in the corresponding directory file.

2.1 Project Management

Click Project Project Manager, as shown in Figure 2.1-1. Project management includes creating a project, removing a project, opening a project, and opening a disk project that is not in the list.

Click the item shown in the item list, and the functions of remove and open will appear, as shown in Figure 2.1-2. Click Remove, as shown in Figure 2.1-3, to remove the project from the list. If you select Delete data file at the same time, the data on the disk of the project will be deleted; if you do not select delete data file at the same time, the project will only be removed from the list, and you can open the project in other projects later, as shown in Figure 2.1-4.

Click New Project, as shown in Figure 2.1-5. To create a Project, you need to fill in the Project name, operator, Project description and other basic information of the Project. You can also modify the path of the Project in disk (internal storage ->SurPro->Project by default), click Next, and fill in the coordinate system parameters used by the Project. As shown in Figure 2.1-6, click Finish to complete the new project.

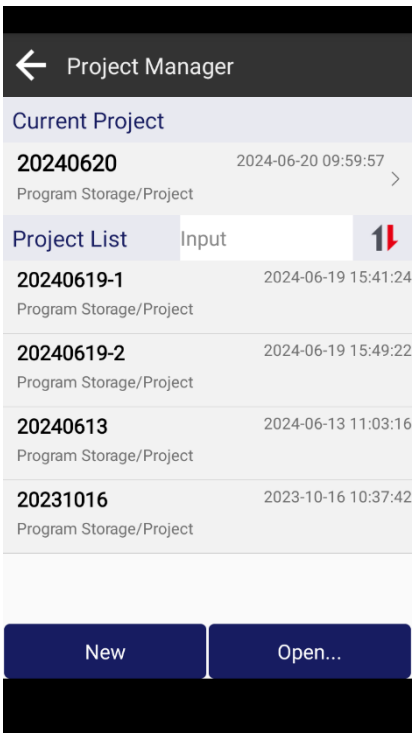


Figure 2.1-1

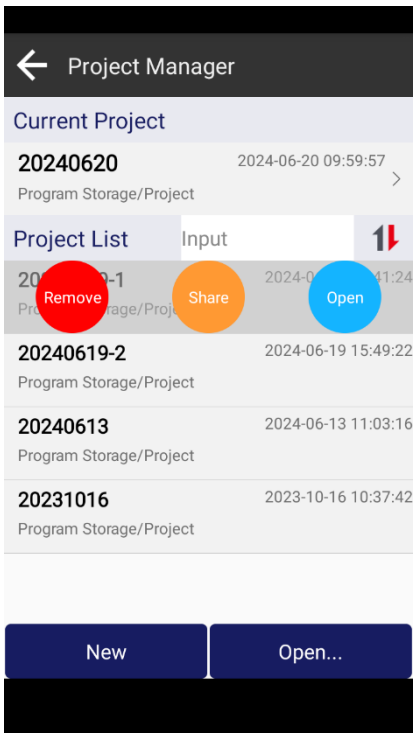


Figure 2.1-2

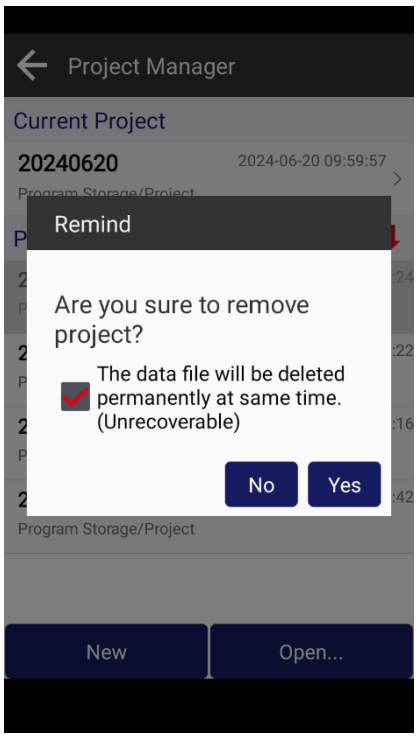


Figure 2.1-3

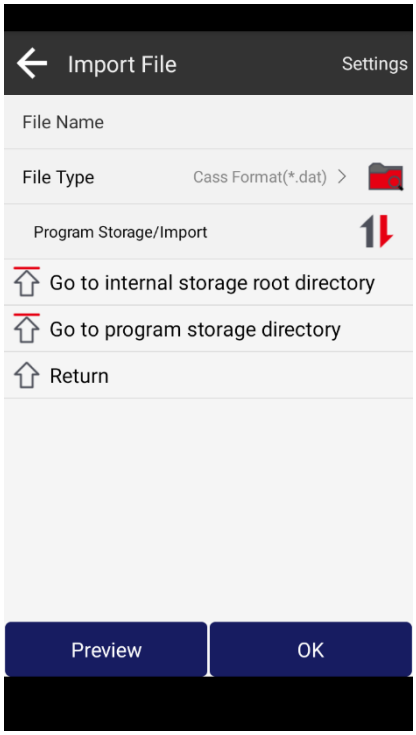


Figure 2.1-4

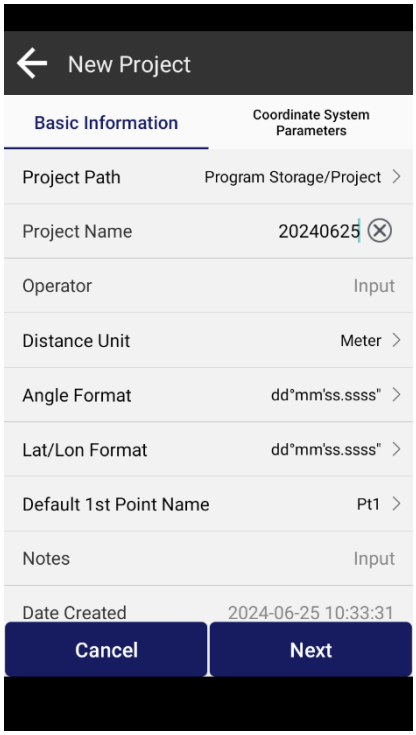


Figure 2.1-5

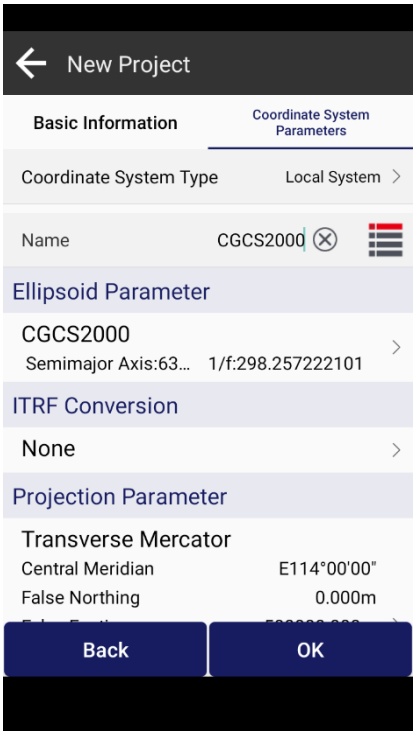


Figure 2.1-6

2.2 Localization

Click [Project] -> [Calculate conversion parameters], as shown in Figure 2.2-1. The high-precision position obtained by the software from GNSS equipment is the longitude and latitude coordinates of satellite positioning, but in actual engineering operations, the plane coordinates of the ground are ultimately needed for measurement and application. If the customer has coordinate conversion parameters, the coordinate system parameter values can be directly set in the coordinate system (Detail 2.4). If the customer does not have specific coordinate system parameters, but the corresponding values of longitude and latitude coordinates and plane coordinates are called control points. In the case of control point data, conversion parameters can be calculated by this function and applied to engineering projects.

In conversion parameter management, you can manually 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. You can set a format to be commonly used or not, as shown in Figure 2.2-4, or add a custom format, as shown in Figure 2.2-5. In the control point list, click the data item to enter modify edit control point parameters. You can hold down a data item to select multiple data items and delete all data items, as shown in Figure 2.2-6. You can also export control point data to a file and provide it to third-party software.

After editing the control point parameters, calculate the conversion parameters of the control point and click "Calculate" to pop up the setting of calculation parameters, as shown in Figure 2.2-7. The

parameter conversion process includes ellipsoid datum conversion, horizontal correction and vertical correction. The conversion parameters that can be calculated may be all or part of the combination. The calculated conversion parameters are considered usable as long as the corresponding accuracy is achieved within the permissible accuracy range. Ellipsoid reference conversion is usually seven parameters, which is the conversion parameter of spatial rectangular coordinates between two ellipsoids. Horizontal correction method includes four parameters and horizontal difference parameters, and elevation correction method includes weighted average, plane fitting, surface fitting and vertical plane error. Under normal circumstances, if the operation scope is very wide, it is necessary to use ellipsoidal datum conversion to meet the accuracy requirements of all control points; if the operation scope is relatively small, the corresponding accuracy can be achieved by plane correction.

After the calculation conditions are configured, click OK to display the calculation results of conversion parameters, as shown in Figure 2.2-8. After the conversion parameters are calculated, the 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 the normal measurement operation can be carried out.

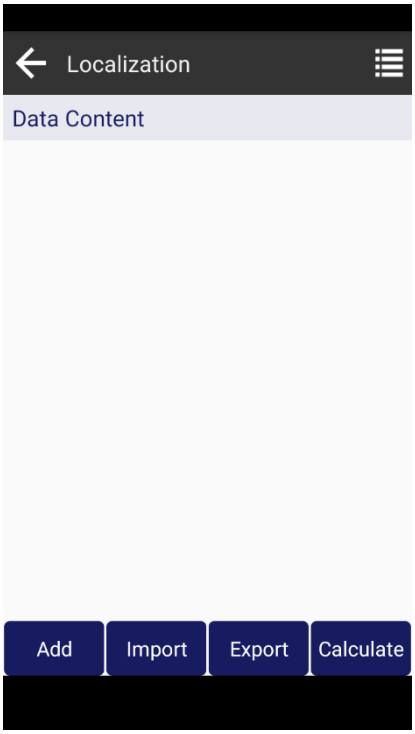


Figure 2.2-1

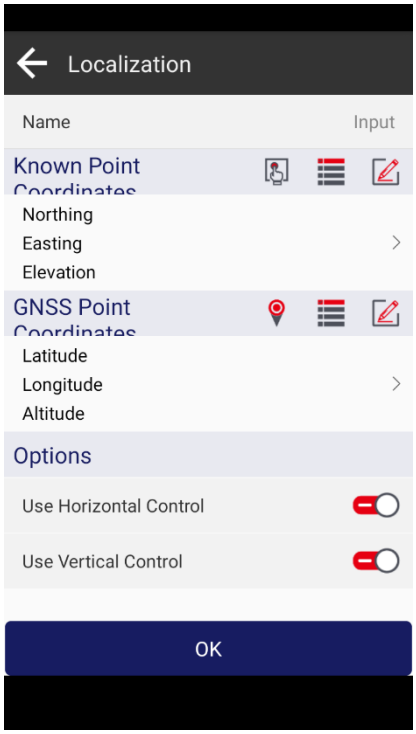


Figure 2.2-2

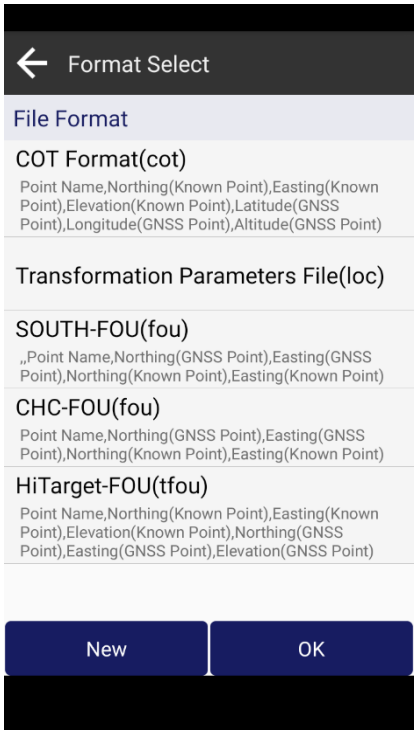


Figure 2.2-3

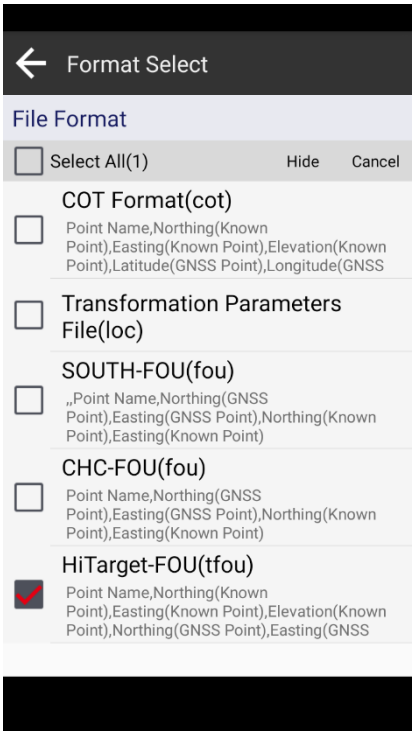


Figure 2.2-4

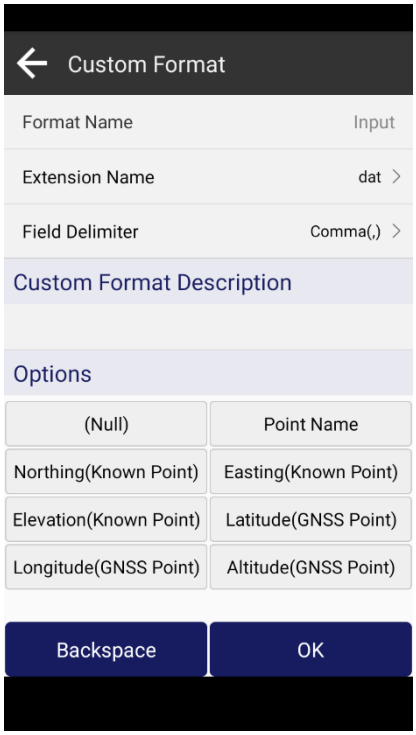


Figure 2.2-5

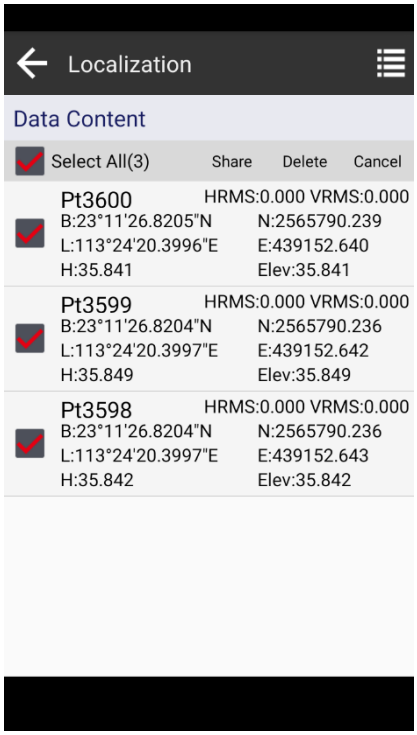


Figure 2.2-6

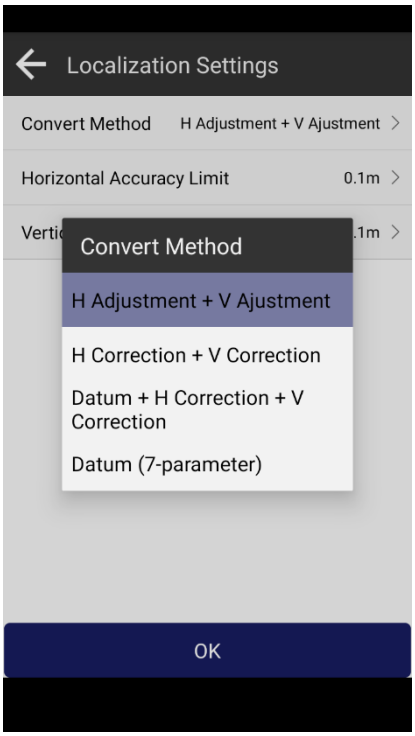


Figure 2.2-7

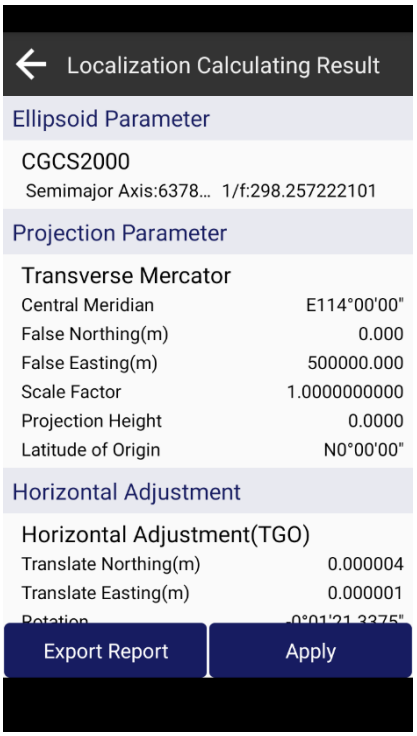


Figure 2.2-8

2.3 Calibrate Point

Click on [project] - > calibrate point, as shown in Figure 2.3 1, in the process of practical application, GNSS difference data combined solution of equipment through the base station is of high precision

position, here we know reference station coordinates is known, in fact, the output of high-precision GNSS equipment location is the relative position of base station. In the actual application process, apart from some users using the differential data of CORS reference station, a considerable number of users also use the differential data of reference station transmitted by their own GNSS equipment. When transmitting differential data by their own station construction, a project may involve multiple startup of reference station, and when starting reference station, The start position and start the base station coordinates may change, and start the coordinates are not necessarily the right, in the case of without calibration, use these stations difference of mobile station coordinates would be a mistake (in the same place, the use of differential data measurement and the coordinates of the new differential data before get the coordinates of the different). Therefore, translation calibration is required when the mobile station receives the differential data of the new base station for measurement operations, so that the coordinates obtained by the software are matched with those obtained by connecting the last base station.

After the starting coordinate or starting 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 at a certain position of the last base station), then put GNSS equipment at the position of the known point to measure a new anchor point and calculate the deviation, as shown in Figure 2.3-2. After the point is determined, the coordinates received by the software are matched with those measured last time.

Base station coordinates changes remind whether to recalibrate. If it is to receive differential signals from self-built reference stations, base station coordinates change, indicating that base station translation calibration needs to be carried out, and translation calibration needs to be recalibrated.

Note: The CORS reference station is a long running reference station whose position and starting coordinates do not change. If the differential data of the CORS reference station is used, the obtained coordinates will be correct even though the received coordinates may change, without translation calibration.

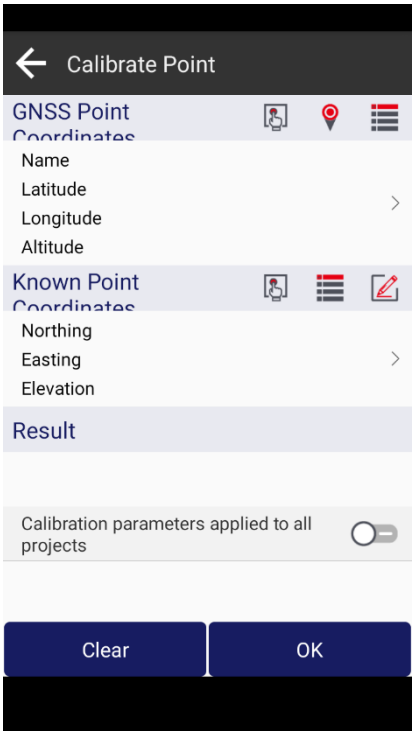


Figure 2.3 1

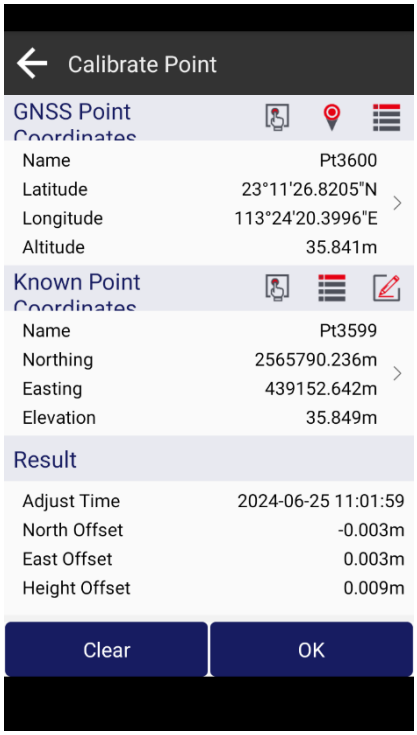


Figure 2.3 2

2.4 Coordinate System

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

1. Original latitude and longitude coordinates -> Spatial cartesian coordinates of the WGS84 ellipsoid: use the WGS84 ellipsoid parameter.

2. Spatial cartesian coordinates of WGS84 ellipsoid -> Spatial cartesian coordinates of target ellipsoid: use datum conversion parameters.

3. Spatial cartesian coordinates of target ellipsoid -> Target latitude and longitude coordinates: use target ellipsoid parameters.

4. Target latitude and longitude coordinates -> Projection plane coordinates: use target ellipsoid + projection parameters.

5, projection plane coordinates -> target plane coordinates: use plane correction + vertical correction parameters.

Click "Ellipsoid Parameters" to enter the ellipsoid management interface, as shown in Figure 2.4-2. Select the required ellipsoid from the ellipsoid list. You can also add or delete ellipsoid parameters.

Click "Projection Parameters" to enter the interface for editing projection parameters, as shown in Figure 2.4-3. You can choose gaussian projection, UTM projection, Mercator projection, tilted stereographic projection, double stereographic projection, etc. If it is gaussian projection, enter the correct central meridian, north plus constant, east plus constant, projection scale, datum latitude and other parameters.

Click "Datum Parameters" to enter the interface for editing datum conversion parameters, as shown in Figure 2.4-4. The transformation models include Boolean sand, Boolean sand (with origin parameters), Boolean sand strict algorithm, Helmert, three-parameter transformation models, etc.

Click "Horizon Adjustment" to enter the interface for editing plane correction parameters, as shown in Figure 2.4-5. The transformation model includes four parameters and horizontal adjustment model. Also support grid conversion file conversion, import grid offset file, according to the transition point in the grid position, to correct the coordinates.

Click "Vertical Adjustment Parameters" to enter the interface for editing vertical correction parameters, as shown in Figure 2.4-6 and 2.4-7. The transformation model includes fixed error, surface fitting and vertical adjustment model. Also support geoid file conversion, import geoid file, according to the conversion point in the level position, to correct the coordinate elevation. Levelling file management interface, as shown in Figure 2.4-8, allows users to import and remove levelling files and set parameters by selecting required levelling files.

Click "Local Offsets" to enter the local offsets editing interface. In small scale jobs, sometimes there is only one control point, and you just need to translate from the projected plane coordinates to the target plane coordinates, which can be set here. The difference between translation parameters here and base station translation calibration is that coordinate system parameter setting here will affect all data of the whole project. If there is any change, the transformation of longitude and latitude coordinates and plane coordinates will be recalculated, while base station translation calibration will only affect the measurement coordinates after calibration operation.

In addition to manually entering coordinate system parameters, you can also click after the name , select coordinate system parameters from the list of commonly used coordinate systems. Common coordinate system management can be added, imported, or selected from a template, or removed from the list with a long press.

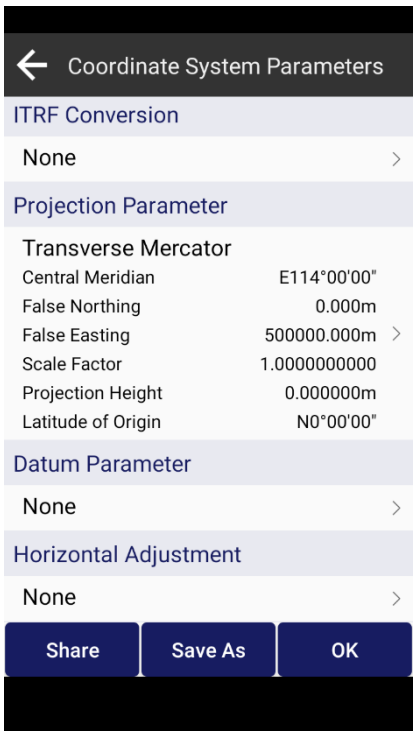


Figure 2.4-1

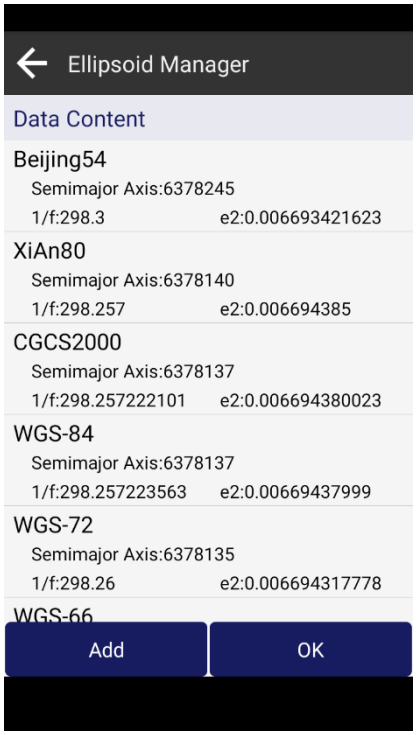


Figure 2.4-2

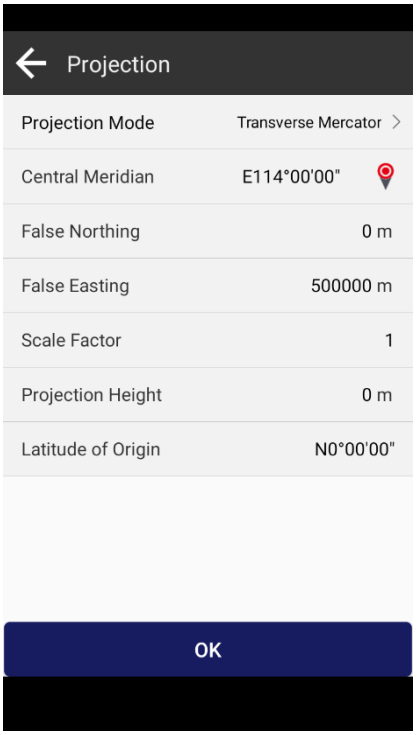


Figure 2.4-3

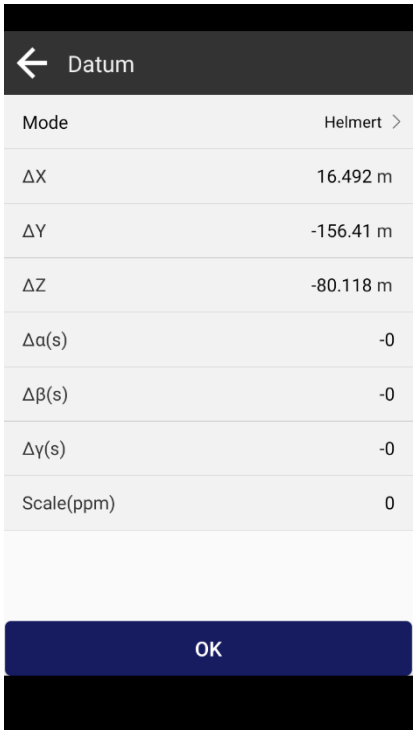


Figure 2.4-4

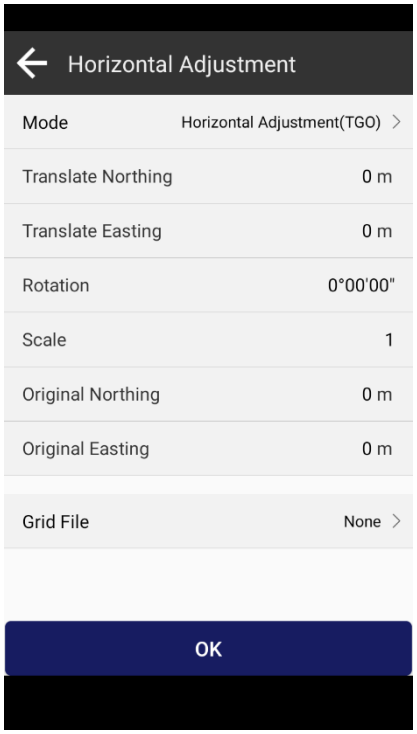


Figure 2.4-5

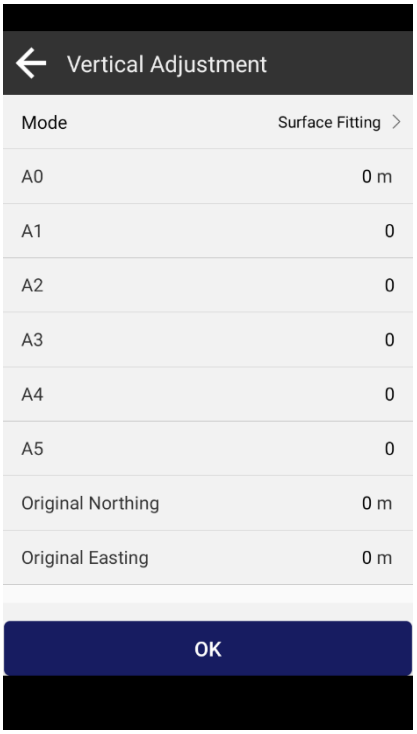


Figure 2.4-6

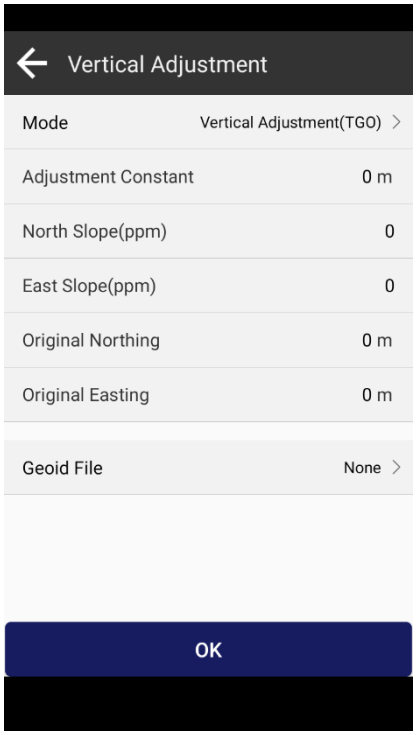


Figure 2.4-7

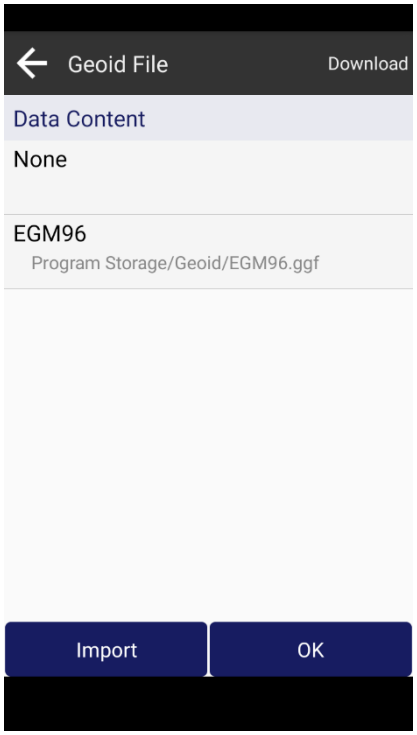


Figure 2.4-8



Figure 2.4-9

2.5 Points Database

Click [Project] -> [Points Database], as shown in Figure 2.5-1. Here you can view and manage the point data in the project, including adding, deleting, restoring, viewing point details, importing, exporting and other functions.

Add: as shown in Figure 2.5-2, manually input roll call, code and corresponding coordinates.

Delete: As shown in Figure 2.5-3, you can hold down and select points in batches to delete.

Recover: Restore the point data that is mistakenly deleted, as shown in Figure 2.5-4.

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

Import: Select the format of the data to be imported, and select a data file to import the data, as shown in Figure 2.5-7. You can also set common formats and add or delete custom formats in format management.

Export: Select the data format, location, and file name, and click Export to export data, as shown in Figure 2.5-8. If you choose to export multiple formats, it will be generated in a folder.

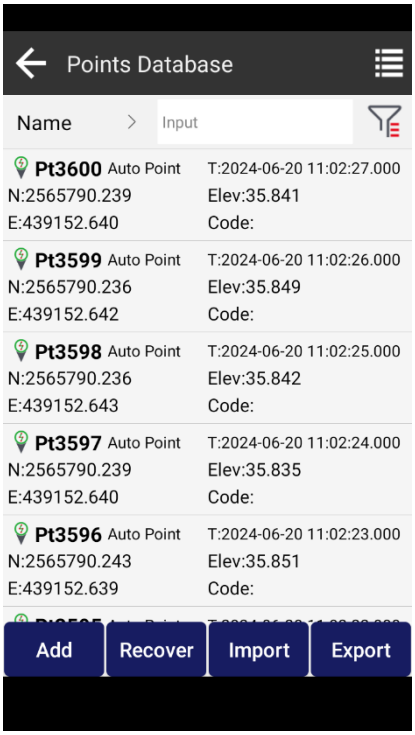


Figure 2.5-1

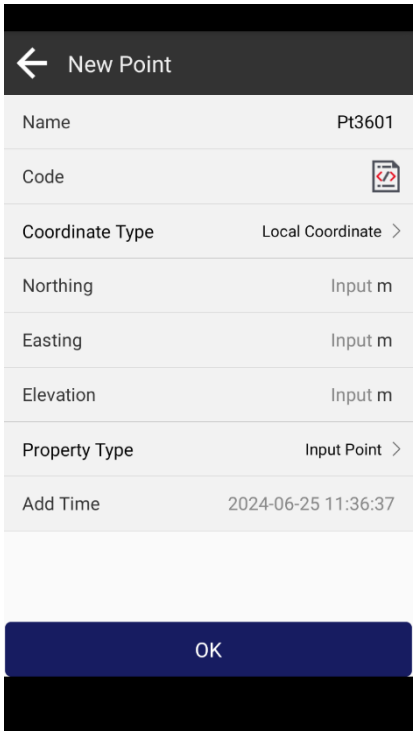


Figure 2.5-2

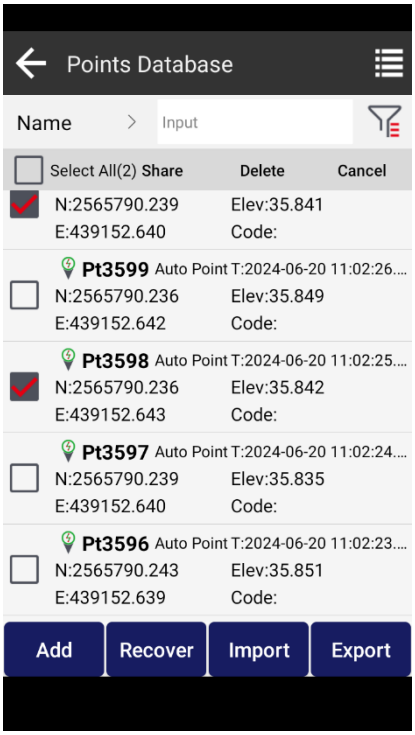


Figure 2.5-3

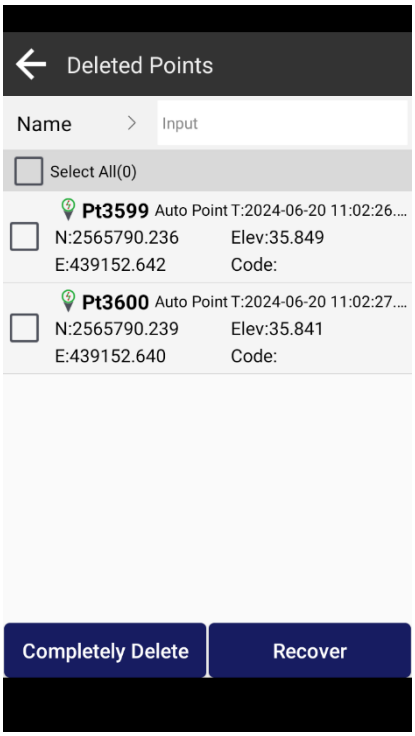


Figure 2.5-4

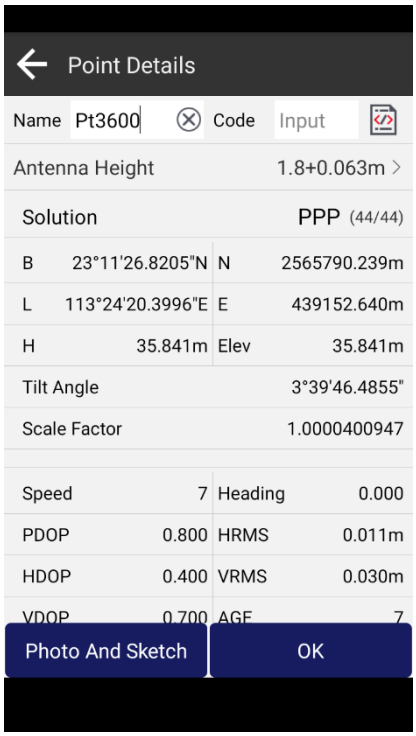


Figure 2.5-5

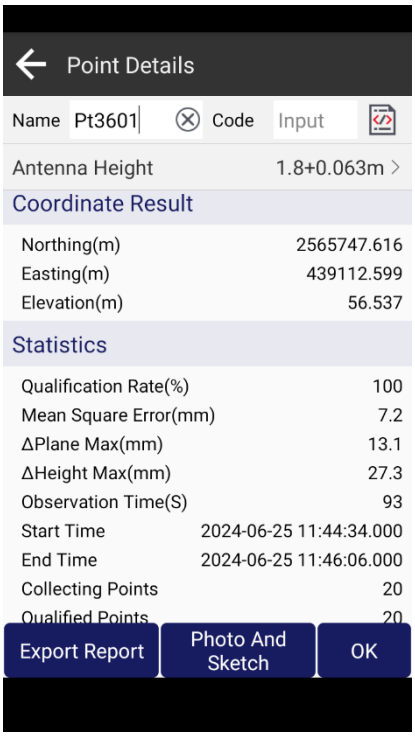


Figure 2.5-6

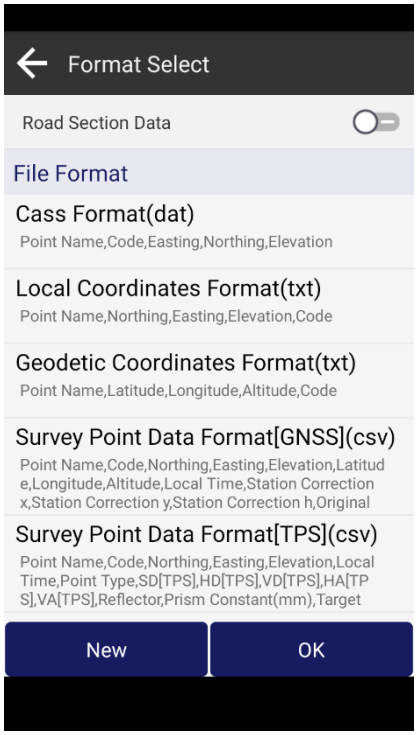


Figure 2.5-7

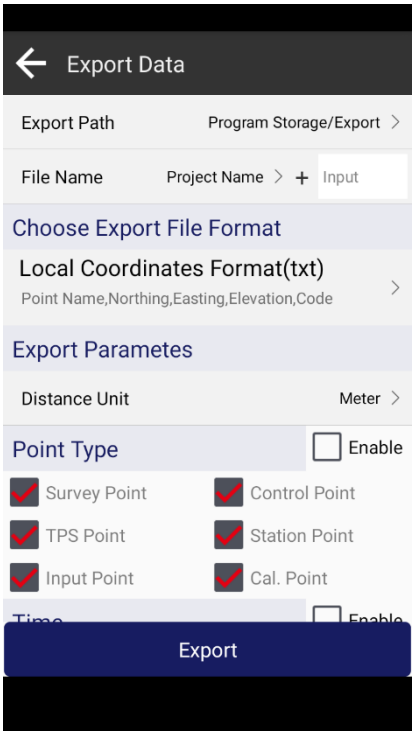


Figure 2.5-8

2.6 Code library management

Click "Project" -> "Code Library Management", as shown in Figure 2.6-1. The code base is pre-defined by the code attributes of the external collection points, and the code values are quickly filled in by the choice of the image name description.

In code library management, as shown in Figure 2.6-2, select the code library to be used by the project. You can import the code library, as shown in Figure 2.6-3, or manually add the code library, as shown in Figure 2.6-4 and 2.6-5. In addition to filling the code in the collection point, the same code value can also be set for automatic mapping, which can quickly and conveniently measure the ground object icon of straight line and line removal type.

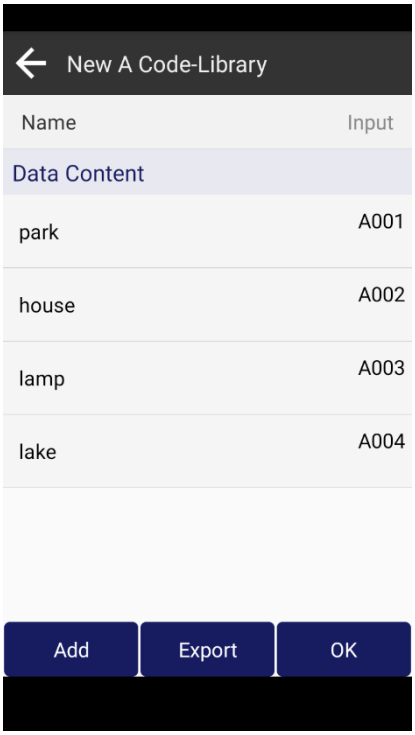


Figure 2.6-1

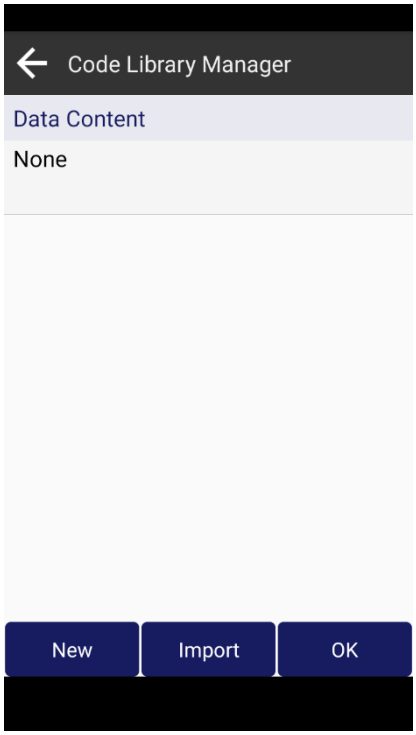


Figure 2.6-2

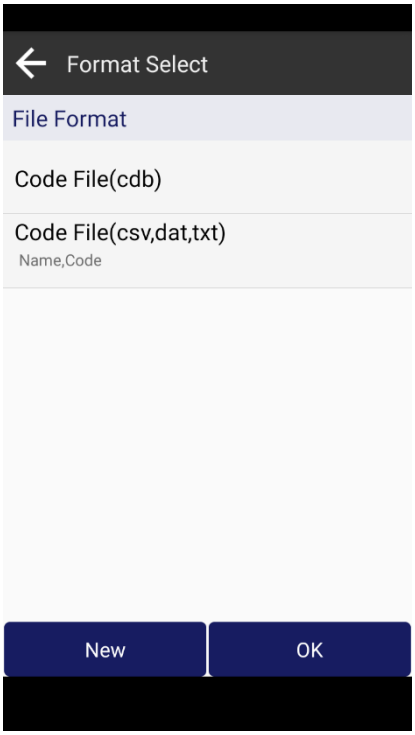


Figure 2.6-3

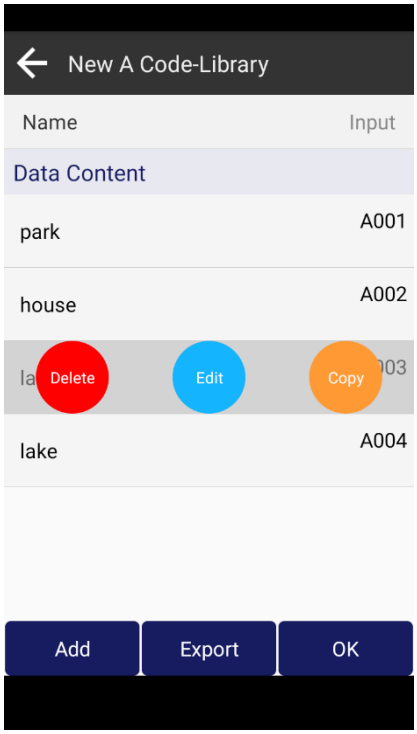


Figure 2.6-4

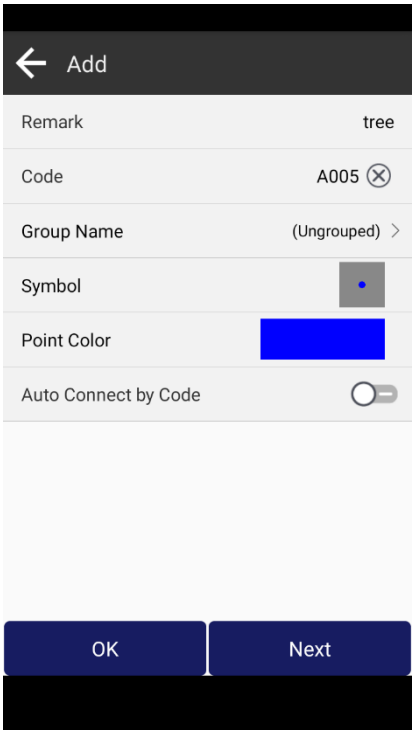


Figure 2.6-5

2.7 Survey Area Settings

Click [Project] -> [Survey Range Settings], as shown in Figure 2.7-1. The function is to determine whether the current positioning position is within the range of the measurement area in real time by setting a certain range of coordinates in the process of field measurement. If it is beyond the range, it

will timely remind the user of the scope of the work beyond the scope, so as to avoid the user to do the work beyond the scope of work.

Edit and manage the test range, including adding coordinates, batch selecting from the point database, as shown in Figure 2.7-2, and importing and exporting the coordinates of the test range. You can view a preview of the test area, as shown in Figure 2.7-3.

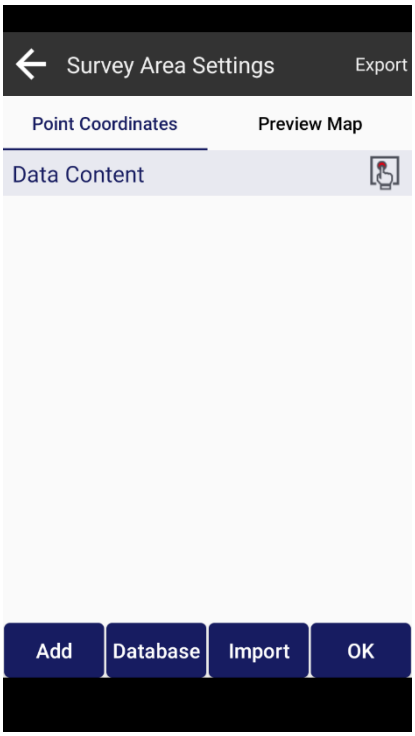


Figure 2.7-1

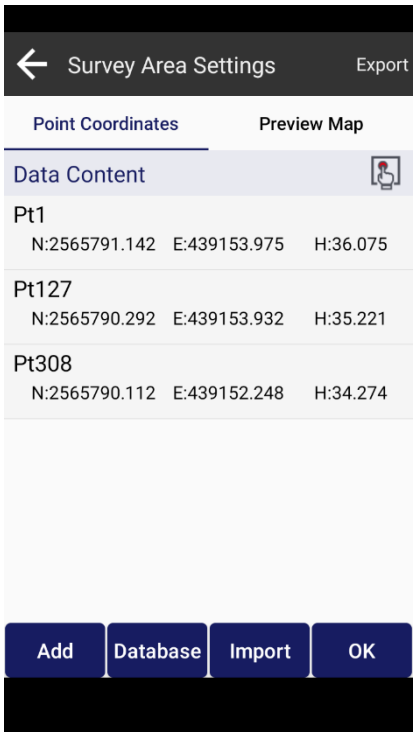


Figure 2.7-2

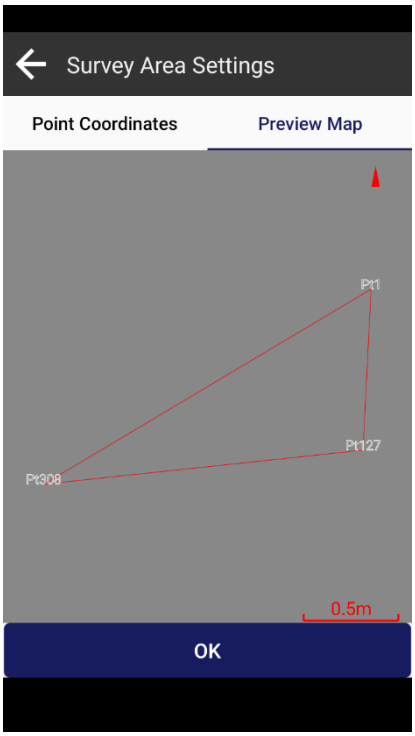


Figure 2.7-3

2.8 Software Settings

Click [Project] -> [Software Settings], as shown in Figure 2.8-1, 2.8-2, 2.8-3, 2.8-4. The settings include system Settings, display Settings, voice prompt Settings, and shortcut key Settings.

System Settings: As shown in Figure 2.8-1, the settings mainly include length unit, Angle display format, mileage display format, language, and text coding.

Display setting: as shown in Figure 2.2-2, it mainly includes mapping display of measurement data, display sequence of north coordinate and east coordinate in the database, interface style, screen direction and other Settings.

Shortcut key Settings: As shown in Figure 2.8-4, the manual physical keyboard is predefined to trigger corresponding functions, and shortcut keys are added, as shown in Figure 2.8-5. Select a function for which you want to define a shortcut key and set a shortcut key. This function can be triggered quickly during application measurement. You can also hold down and delete defined shortcut keys.

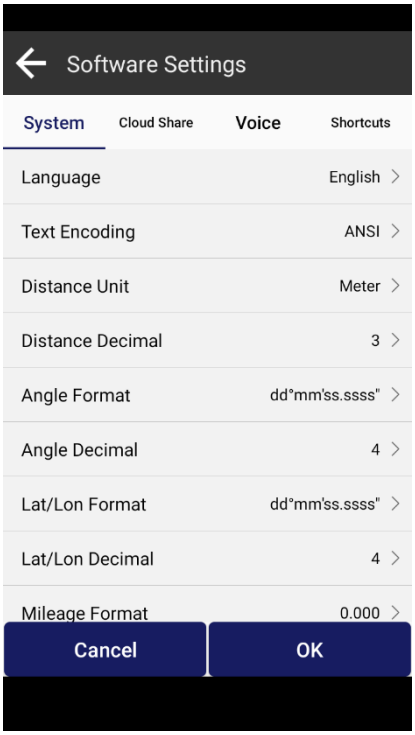


Figure 2.8-1

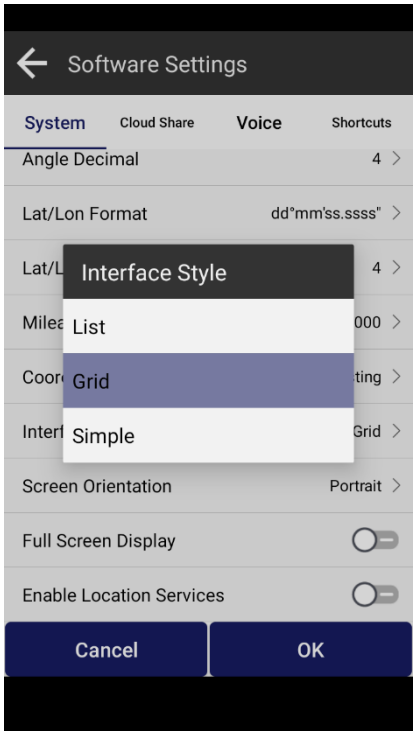


Figure 2.8-2

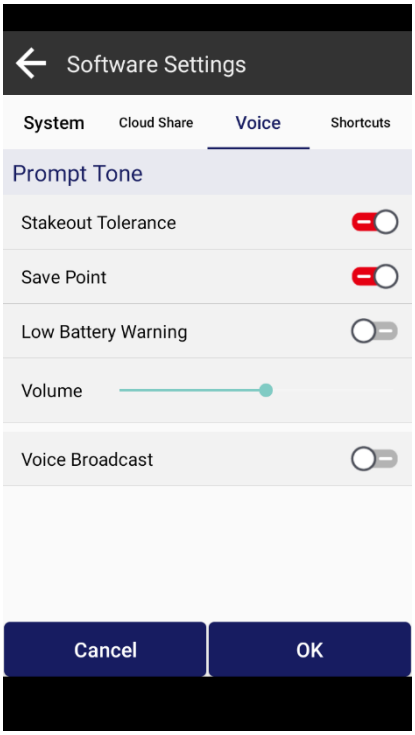


Figure 2.8-3

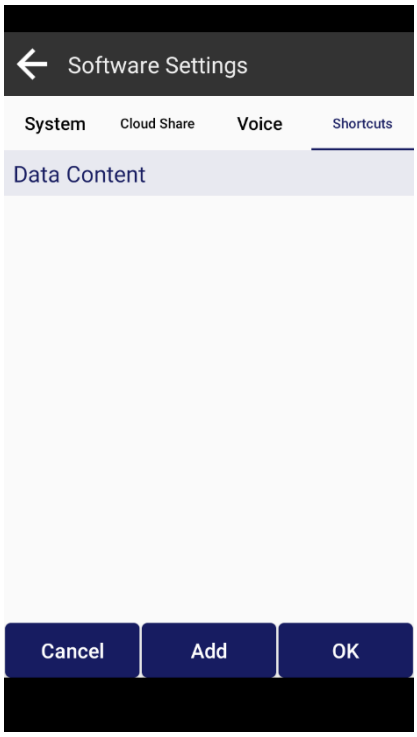


Figure 2.8-4

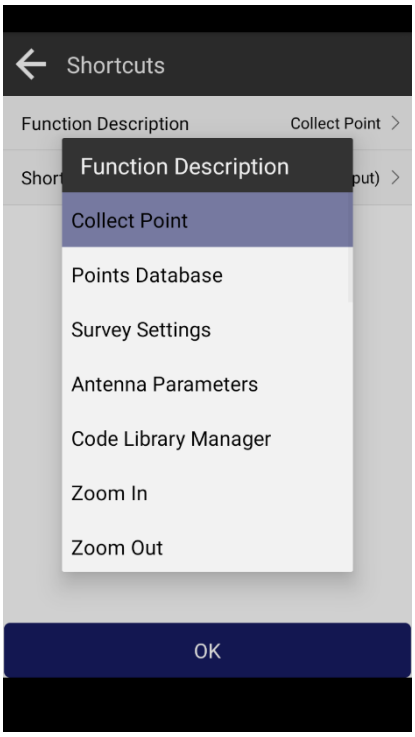


Figure 2.8-5

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 you can activate authorization, transfer authorization, check the new version and give feedback.

Software activation: Enter the entitlement code or scan the QR code to activate the software, as shown in Figure 2.9-2.

Check the new version: if there is a new version, the new version information will pop up. Click Update to update the software to the latest version. If there is no new version, a message is displayed indicating the latest version.

Feedback: As shown in Figure 2.9-3, in order to provide better services to users, if you have any problems during the use of the software, you can feedback the problems to our technology through here, and we will provide you with immediate support. Note: Be sure to leave your contact information (mainly email), the problem description is as complete as possible, if there is any attachment (icon, video, document, etc.), you can submit it together, thank you!

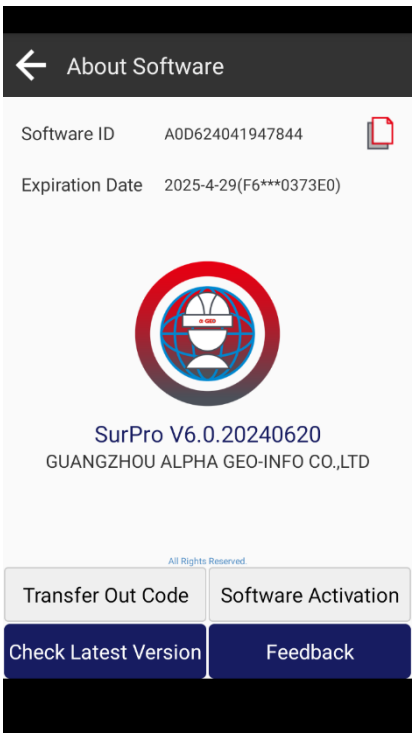


Figure 2.9-1

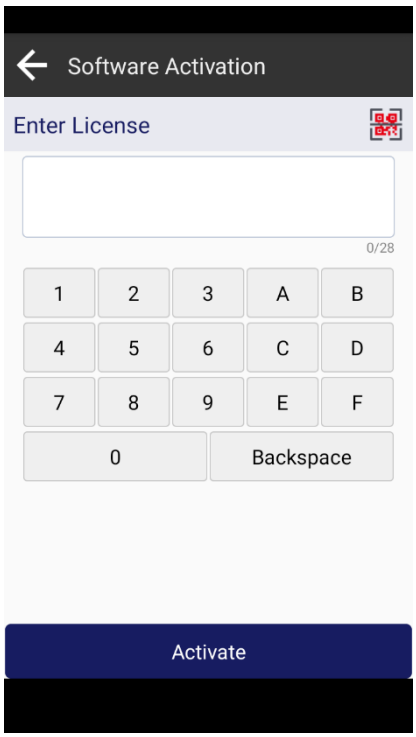


Figure 2.9-2

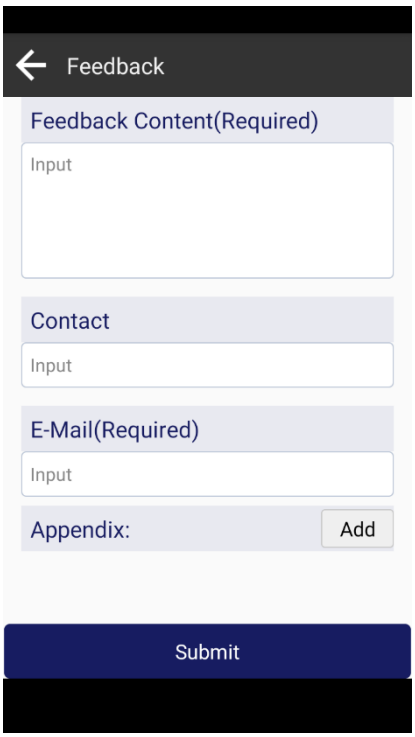


Figure 2.9-3

2.10 Export Data

Click **[Project] -> [Data Export]**, as shown in Figure 2.10-1. Data export refers to converting measurement data files into the data format required for users to create maps.

Select the export path, file name, and data format (different formats require setting different file content parameters). Set various export parameters such as length unit and number of significant digits, enable or disable the "Export Image Markers" option, select the layer, point type, and start/end time, then click **[Export]** to export the file to the specified path.

File formats (Figure 2.10-2): Original measurement data (xls, csv), Cass format (dat), Kaisi Scsg2000 (dat), AutoCAD file format (dxf), Google Earth file format (kml), DOL data (csv, html), custom file format (edited in Format Management), etc.

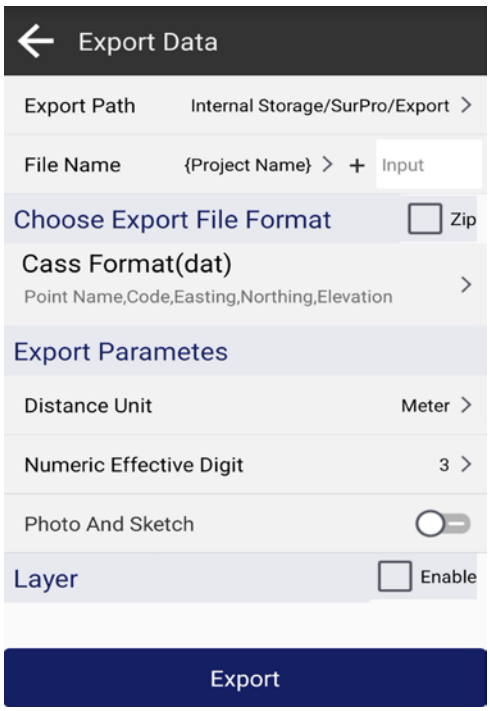


Figure 2.10-1

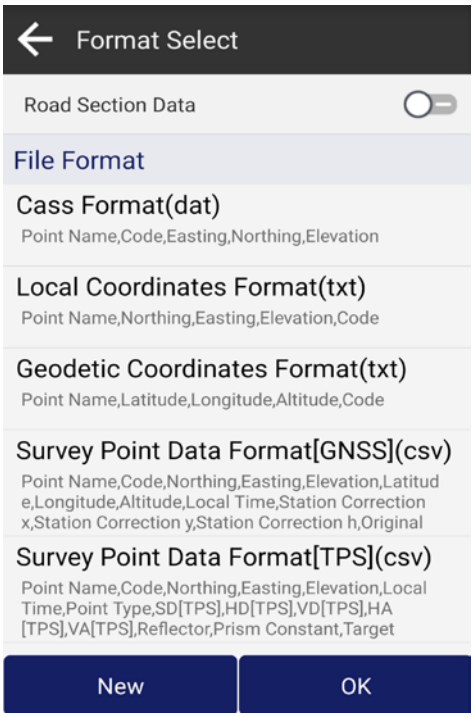


Figure 2.10-2

2.11 Project File

During usage, if a project has an excessively large amount of data, or if you need to distinguish between two different coordinate point files, this function can be used.

On the interface shown in Figure 2.11-1, click **[New]** to bring up the interface shown in Figure 2.11-2. Create a new data file to store and record measurement data; this newly created file will be set as the default data file for storing and recording data of the current project. The name of the new file can be customized, and its file extension is *.db. The newly created data file is subordinate to the current project.

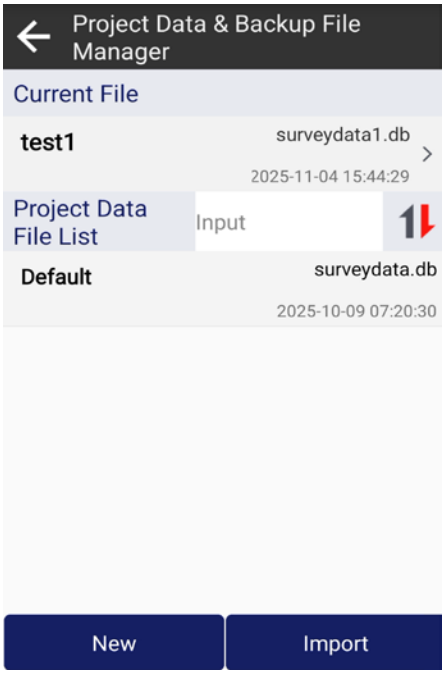


Figure 2.11-1

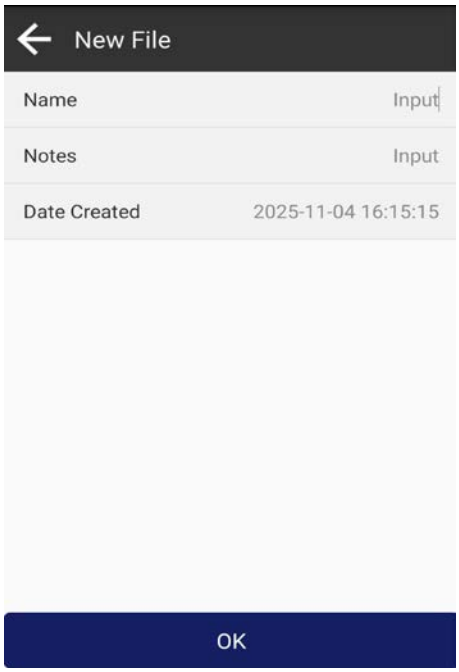


Figure 2.11-2

Click **[Import]** (as shown in Figure 2.11-3), select the file path, and you can import files with the suffix *.bak.

Select a file from the file list and click **[Remove]** (as shown in Figure 2.11-4). Then click **[Confirm]** to delete the data file.

When a project contains multiple data files, select a data file from the data list and click **[Open]** to switch between different data files.

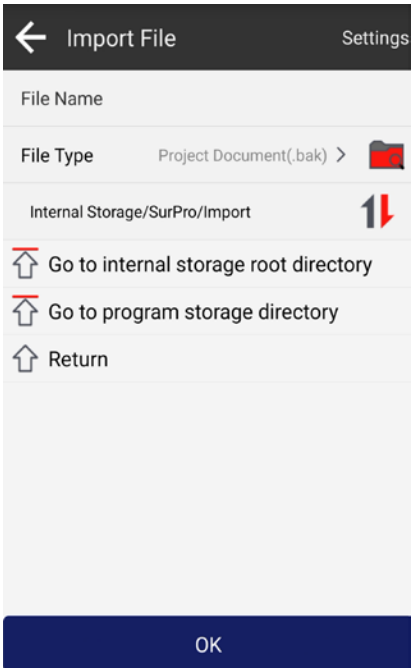


Figure 2.11-3

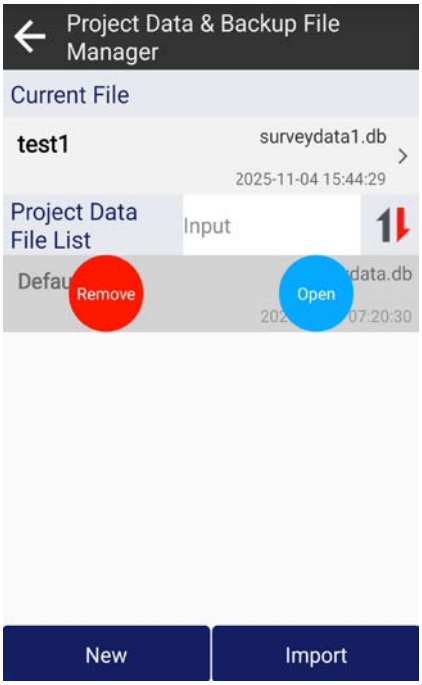
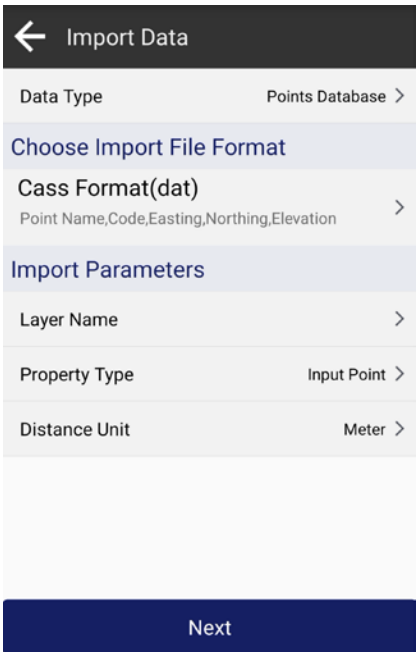


Figure 2.11-4

2.12 Import Data

Before field surveys, it is sometimes necessary to import certain data files into Surpro. Manual entry would result in time waste. Open Surpro, select **[Project] -> [Import Data]** (as shown in Figure 2.12-1), then choose the corresponding data type (as shown in Figure 2.12-2). Next, select the data format to be imported, layer name, attribute type (input points, control points), and the corresponding length unit. Click **[Next]**, then select the data file in the corresponding format to complete the import.



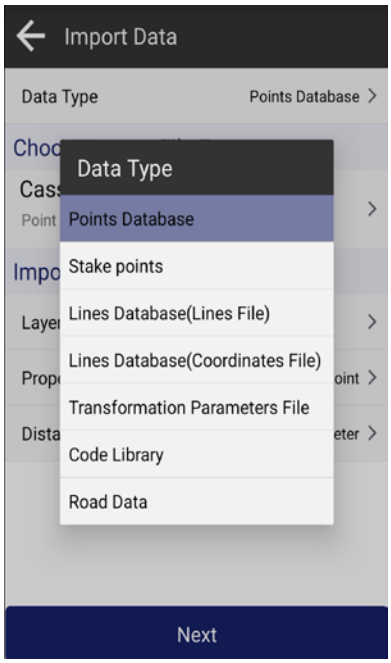


Figure 2.12-1 Figure 2.12-2

2.13 Grid to Ground

Due to the gap between the reference ellipsoid in GNSS measurement and the actual geodetic surface, there will be a discrepancy between the distance between two points on the reference surface and the actual distance between the two corresponding points on the ground. To align the results of GNSS measurement with those of total station measurement, the "Grid to Ground" function is introduced.

Click **[Tools] -> [Grid to Ground]** (as shown in Figure 2.13-1). You can set an origin point by acquiring the current point, manually entering coordinate points, selecting points from the coordinate point library, or picking points from the map. Click **[Apply]** to apply the Elevation Scale Factor (ESF), Grid Scale Factor (GSF), and Combined Scale Factor (CSF).



Figure 2.13-1

2.14 Offset Point Correction

2.15 Layers Settings

Click **[Project] -> [Layer Settings]**. This function is used to import a background base map, which serves as a reference base map for survey operations and supports formats such as dxf/dwg, shp, and xml.

Chapter III Device

On the main interface of the software, click the corresponding function menu of [Device], as shown in Figure 3-1 and 3-2. The instrument includes communication setting, mobile station mode, base station mode, static mode, instrument information, instrument registration and other functions.

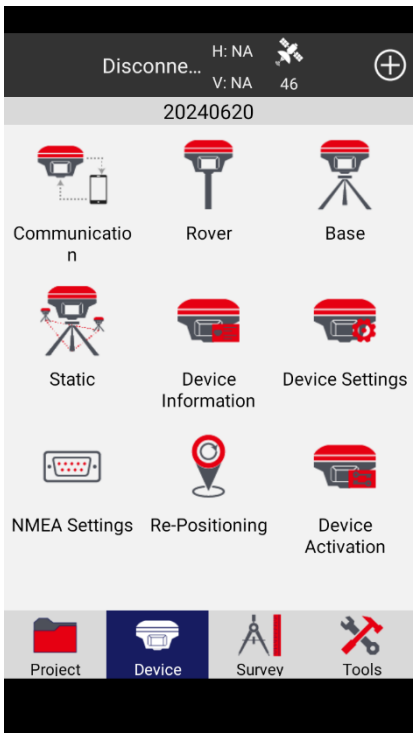


Figure 3-1

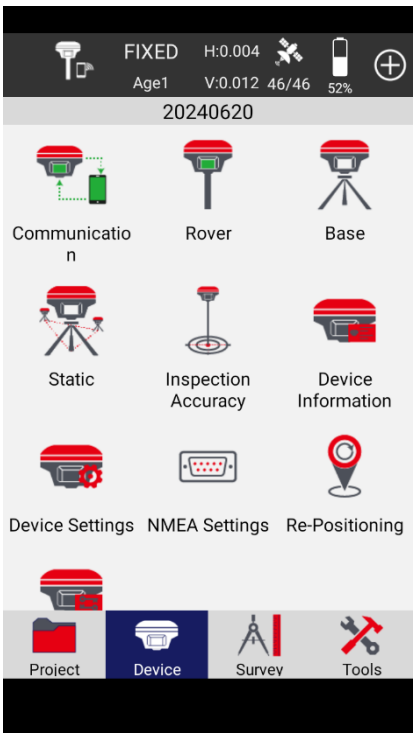


Figure 3-2

The data measurement, collection and application of the software are based on the application of GNSS high-precision position. Before operation, it is necessary to establish communication with GNSS positioning equipment. The software obtains high-precision position from the equipment, and the equipment also needs certain conditions to obtain high-precision position, and equipment parameters need to be configured.

3.1 Communication

Click [Device] -> [Communication], as shown in Figure 3.1-1. Select the instrument manufacturer, instrument type and connection mode, then select the device parameters, and click "Connect" to complete the device connection. After the device is successfully connected, the main window of the

software is displayed, as shown in Figure 3-2. Then enter communication Settings, as shown in Figure 3.2-2, and click to stop cross-sectional device connection.

1. Device manufacturer: The software supports access of positioning equipment from GNSS instrument manufacturers such as Topcon, Sokkia, Trimble, Emlid, ect as shown in Figure 3.1-3.

2, Device type: usually RTK, some manufacturers of equipment according to the equipment model.

3, Connection type: WIFI connection, serial port connection, TCP client connection, etc., which may be supported by different instrument manufacturers. The basic Bluetooth mode is basically supported by all manufacturers.

4. Click ‘Search’ to enter Bluetooth search and selection, as shown in Figure 3.1-4. Click device to select the device to be connected.

5. After the device is successfully connected, click "Debug" to view the data of communication between the software and the device, as shown in Figure 3.1-4. Debugging commands can be sent to the device to troubleshoot problems related to device positioning through the communication data.

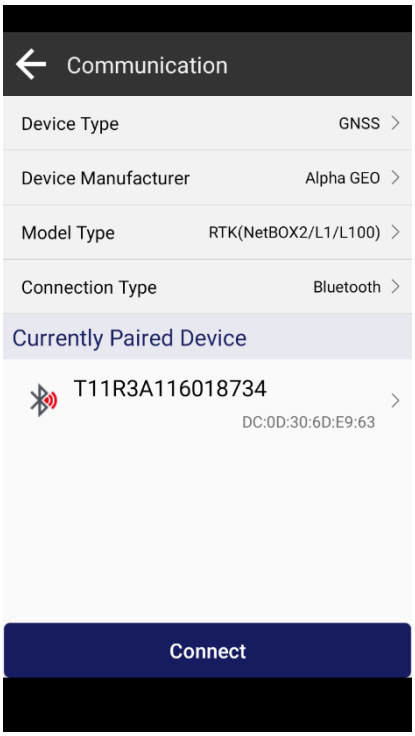


Figure 3.1-1

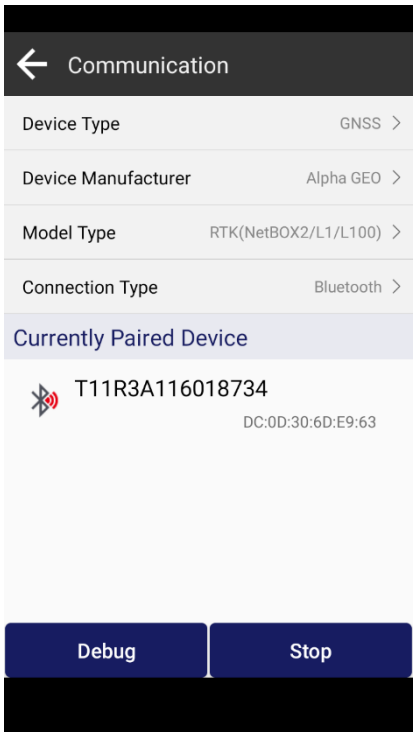


Figure 3.1-2

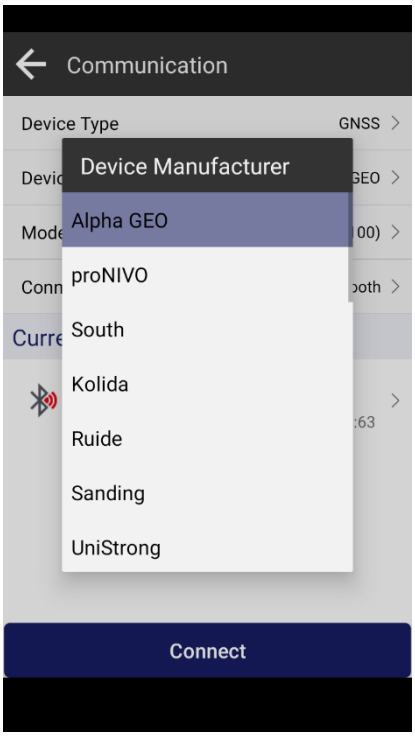


Figure 3.1-3

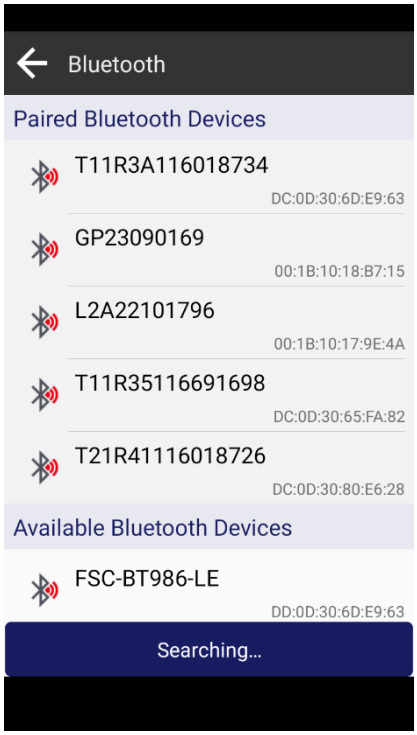


Figure 3.1-4

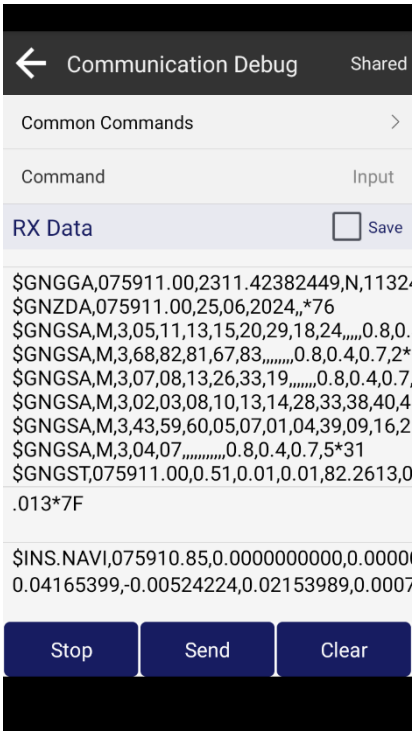


Figure 3.1-5

3.2 Rover

Click [Device] -> [Rover], as shown in Figure. 3.2-1.GNSS positioning device can be calculated by satellite reception positioning coordinates, in the case of no other conditions, due to the effect of atmosphere of signal positioning device can only get a single point in the coordinates of the location, the accuracy is not high, in order to ensure the GNSS can get high precision position, in addition to GNSS satellite reception decoding position with the device itself, Also need to receive another near the fixed position of GNSS signal equipment, signal as reference signal to another device, because of the influence of the atmosphere to the signal in a certain region within the scope of basic consistent, reference signal in the condition of known coordinates, two groups of GNSS calculated can be high precision position, fixed position of GNSS device known as the base station, GNSS equipment with unfixed position is called rover. Compared with GNSS satellite signal of rover, data transmitted from reference station is called differential data. The setting of rover mode is to set GNSS as rover and configure certain parameters to receive differential data from the reference station in a certain way, so that the GNSS equipment can obtain high-precision positioning position.

In addition to differential data transmission configuration, basic parameters such as height cutoff Angle of GNSS and whether PPK is enabled can also be set. Click basic parameter content to enter the parameter editing interface, as shown in Figure 3.2-2. When the altitude Angle is lower than a certain value, the satellite signal cannot be received. In the case of poor satellite signal at a low Angle, it is conducive to precision calculation. The PPK parameter is to record the original GNSS observation data to the GNSS receiver and use the post-processing algorithm to calculate the high-precision coordinates.

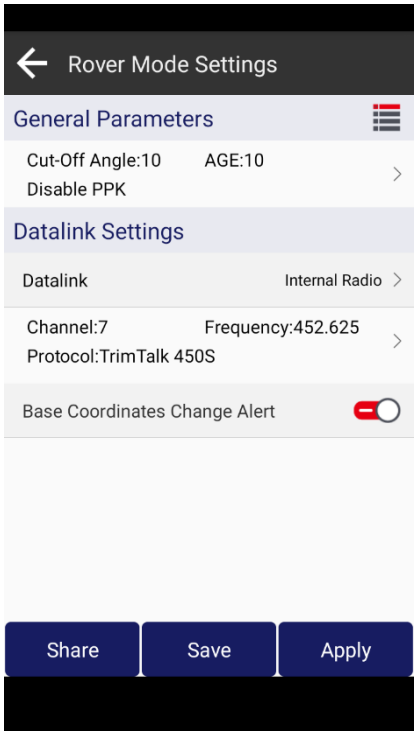


Figure 3.2 1

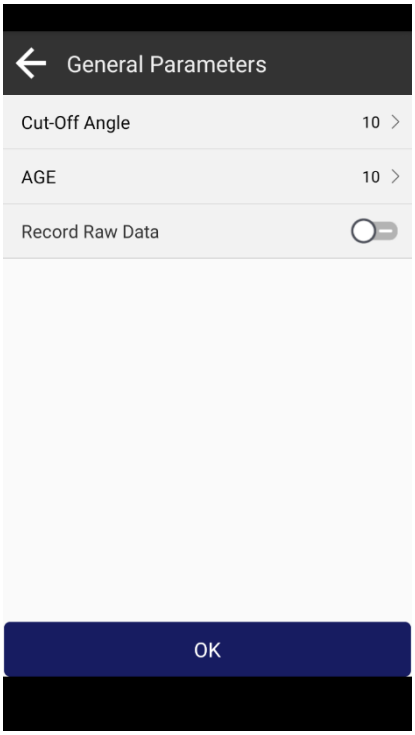


Figure 3.2 2

Differential data parameter setting is mainly to set that the differential data of the reference station will be transmitted to the current equipment in some way, so as to provide necessary calculation conditions for the equipment to solve high-precision coordinates. Data link mode mainly includes built-in radio, external radio, device network, phone network and so on. Among them:

1. Built-in radio: as shown in Figure 3.2-1, the built-in radio of GNSS equipment receives differential data of the radio station according to a certain protocol and frequency for high-precision calculation. Click Parameters to modify and edit the parameters, as shown in Figure 3.2-3. Ensure that the protocol and frequency of the radio station are consistent with that of the transmitting radio station, so that the data of the normal receiving radio station can be received. If the frequency corresponding to the channel is inconsistent with that of the transmitting radio station, click "Default Station Settings" to modify the frequency corresponding to each channel of the radio station, as shown in Figure 3.2-4. Click on the icon You can select the channel frequency configuration from the predefined channel management list, as shown in Figure 3.2-5.

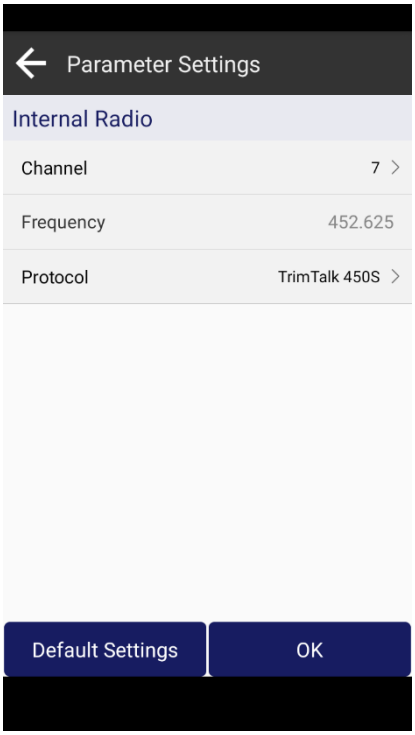


Figure 3.2-3

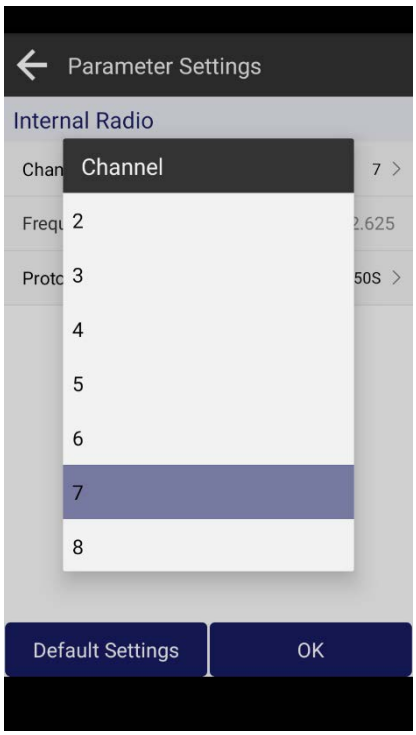


Figure 3.2-4

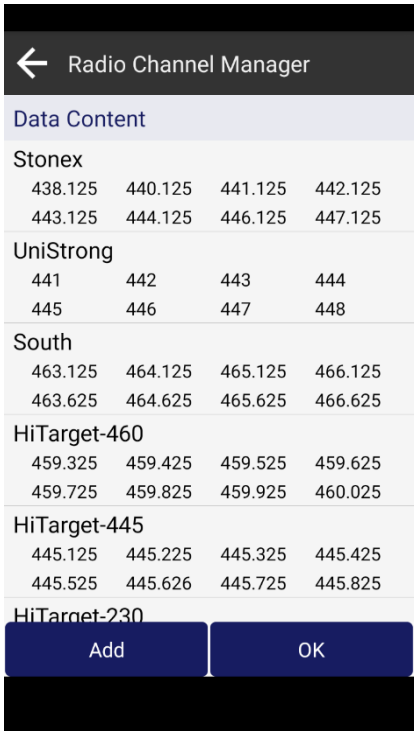


Figure 3.2-5

2. Device network: as shown in Figure 3.2-7, it refers to obtaining differential data from the specified server address according to a certain protocol through the SIM card network of GNSS equipment for high-precision calculation. Click Parameters to modify and edit the parameters, as shown in Figure 3.2-8. When the connection mode is differential data transmission protocol, NRTIP and TCP client are used to input the server IP address, port number, username and password. The SIM network is a dedicated network, and APN parameters need to be set. CORS server parameters can be selected from the server management list, as shown in Figure 3.2-9. After the server address is correctly configured, obtain the access point list and select the corresponding access point to obtain differential data. In addition to obtaining an access point from the host network, you can also obtain the access point from the corresponding network of a mobile phone.

3. Phone network: as shown in Figure 3.2-10, differential data is obtained from the specified server address according to a certain protocol through the network of the device where the software is located, and then sent to the device through the communication connection between the software and GNSS equipment for high-precision calculation. Click Parameters to modify and edit the parameters. The parameter Settings are similar to those of the host network. You do not need to configure APN parameters. Click start connection, if the configuration is ok, the data receiving progress bar will move around. If the progress bar has no data, check whether the parameters are correctly configured.

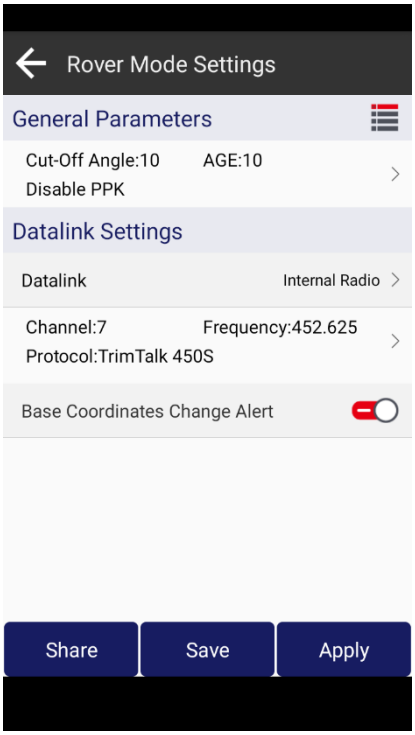


Figure 3.2-6

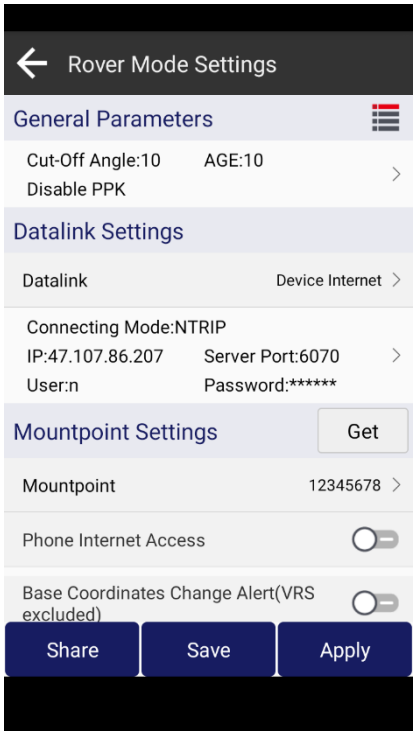


Figure 3.2-7

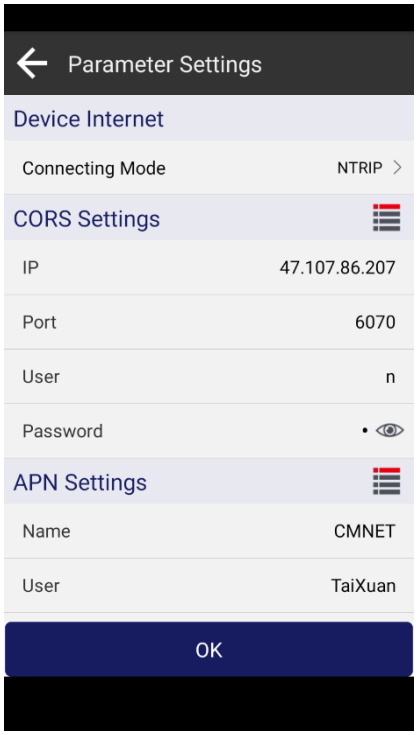


Figure 3.2-8

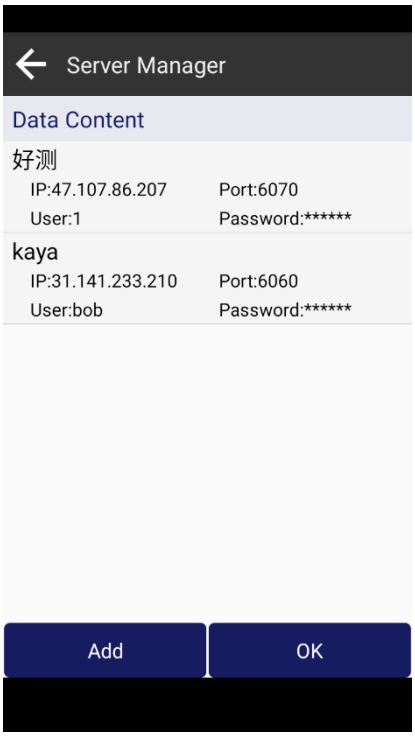


Figure 3.2-9

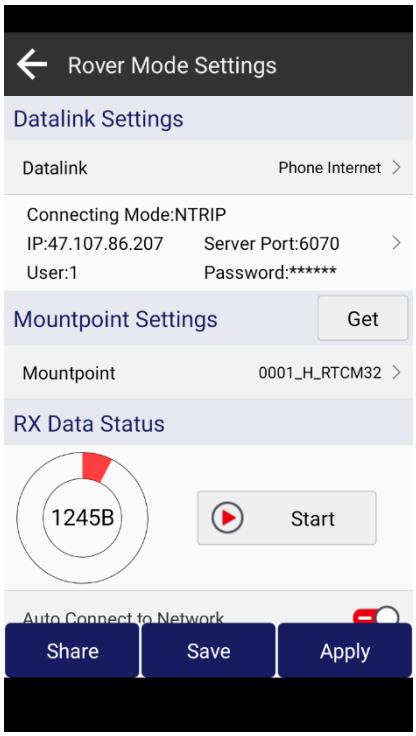


Figure 3.2-10

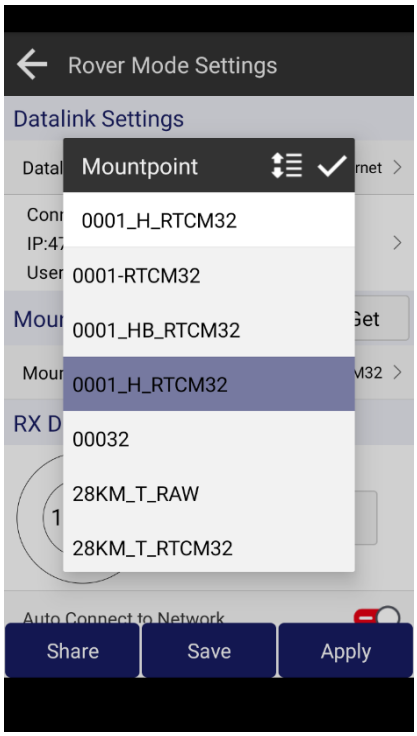


Figure 3.2-11

3.3 Base

Click [Device] -> [Base], as shown in Figure 3.3-1. The function is that GNSS equipment acts as a reference station to send satellite information data in a certain way and provide it to the mobile station for reception, providing high-precision calculation conditions. It is necessary to set up the starting condition parameters, starting mode and data broadcast parameters of the base station.

Note: The device is not allowed to move during the base station startup, otherwise the coordinates calculated by the mobile station will be wrong.

Start conditions include base station ID, height cutoff Angle, differential data format, PDOP limit, delay start and other parameters. Click the parameter content to enter the parameter editing interface, as shown in Figure 3.3-4. Differential data formats include RTCM30, RTCM32 and other commonly used differential data encoding formats.

The startup mode includes single point positioning startup, designated base station coordinate startup, and measuring point coordinate startup, among which:

1. Single point positioning startup: it means that GNSS equipment outputs differential broadcast data for startup coordinates according to the current positioning value (low accuracy).

2. Start with specified coordinates: as shown in Figure 3.3-2, it means that the early user knows the coordinate position in advance according to the location of the equipment and uses the coordinate value as the starting coordinate to output differential broadcast data; Click the coordinate parameter content to enter the parameter editing interface, as shown in Figure 3.3-3. You can click on the  measurement icon measures a point in real time, or you can click on the coordinate content to select a coordinate value from the point library.

Note: built-in radio and external radio data link can be set whether the base station coordinate change reminder, mainly because the radio is a one-way transmission, there may be more of the same frequency radio source, can lead to a radio signal gathering, if the received signal, the other may result in inaccurate coordinates, to remind the user to check.

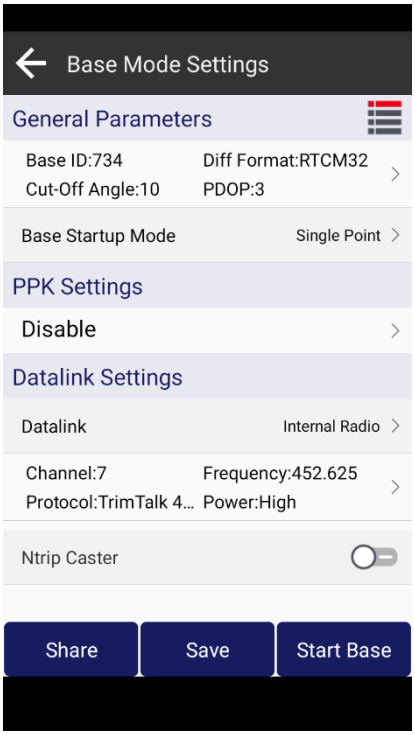


Figure 3.3-1

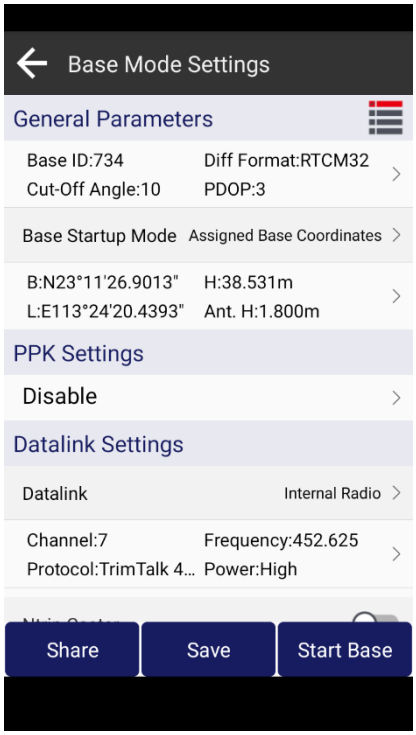


Figure 3.3-2

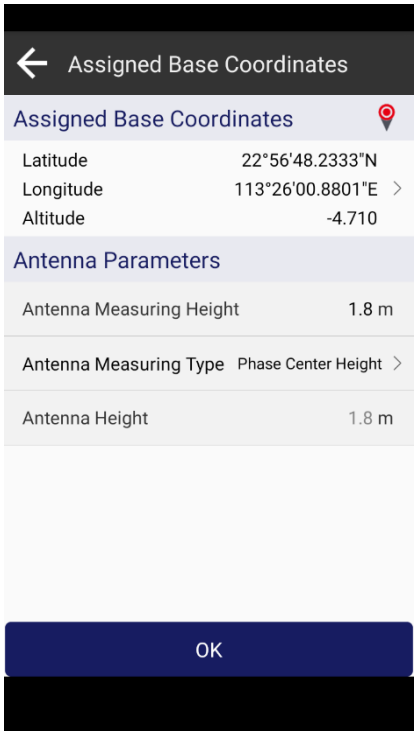


Figure 3.3-3

3. Use current coordinates, as shown in Figure 3.3-4, means that the user collects a real-time point according to the positioning data of the current GNSS equipment and certain collection and measurement conditions, and starts the real-time point according to the specified coordinates. Click the parameter content to enter the parameter editing interface, as shown in Figure. 3.3-5.

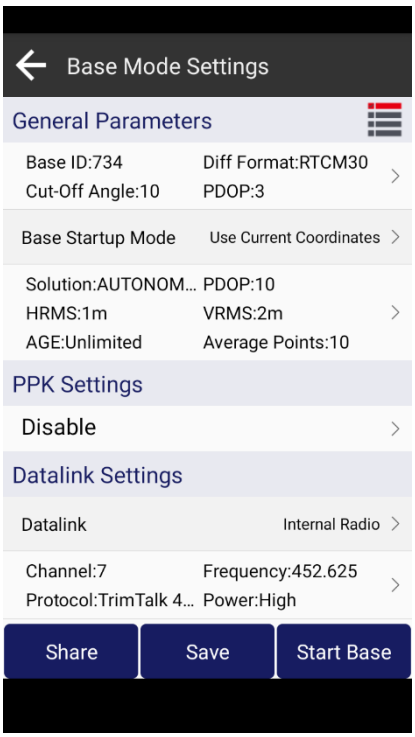


Figure 3.3-4

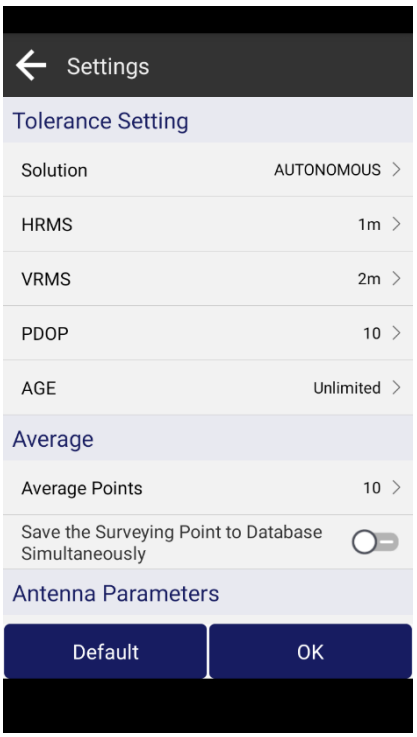


Figure 3.3-5

Differential data parameters are mainly the differential data output by the device after the base station is started and transmitted in certain ways, which are received and used by the mobile station. The main ways include host network, built-in radio, external radio and dual-transmission combination. Parameter Settings are similar to those of mobile stations, the differences are as follows:

1. Built-in radio will have transmitting power. The higher the transmitting function, the farther the distance and the greater the power consumption.

2. External radio: as shown in Figure 3.3-7, GNSS equipment connects to external independent radio equipment through serial port. After receiving differential data from external radio equipment, it is transmitted to GNSS equipment for high-precision calculation. Click Parameter to modify and edit the serial port baud rate parameters. In addition to ensuring that the serial port parameters of the device connecting to the external radio are correct, ensure that the protocol and frequency of the external radio are consistent with that of the transmitting radio.

3. For device network NTRIP protocol, the base station is to set the access point for starting transmission, while the rover is to obtain the access point list and select the corresponding base station access point for connection, as shown in Figure 3.3-8.

4. The reference station uses the manual network to broadcast differential data independently.

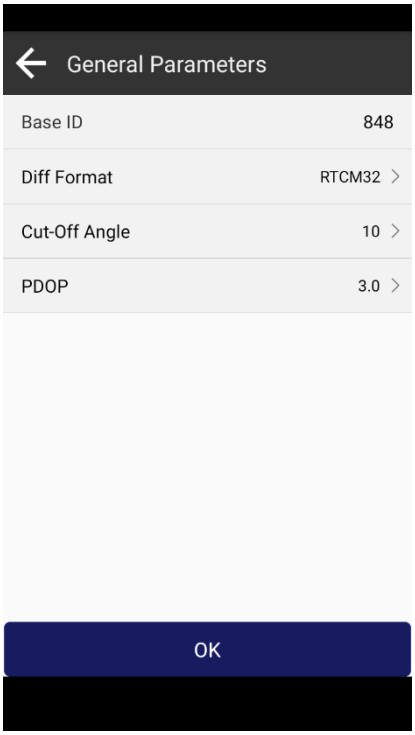


Figure 3.3-6

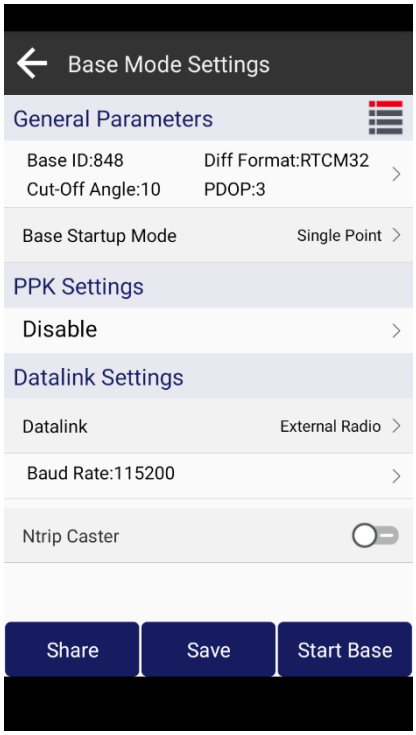


Figure 3.3-7

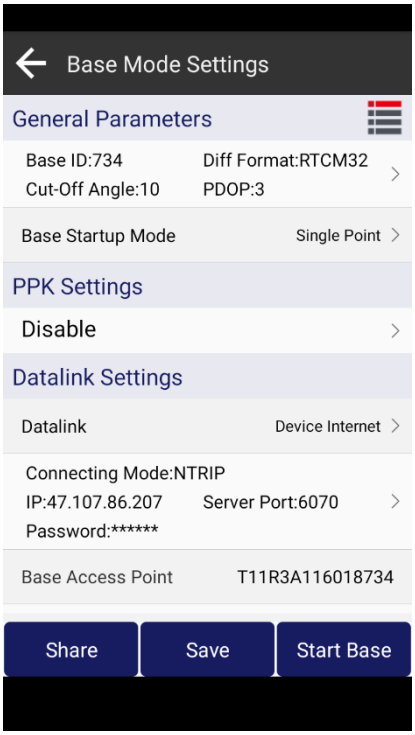


Figure 3.3-8

3.4 Static

Click [Device] -> [Static], as shown in Figure.3.4-1. The purpose of this function is to store the original satellite observation data of GNSS equipment in the setting disk file, record the observation data of one time for solving the high-precision coordinate position with static post-processing software, usually used for control point acquisition. Static file roll call, PDOP limit, height cutoff Angle, acquisition interval, antenna parameters and other recording conditions need to be set.

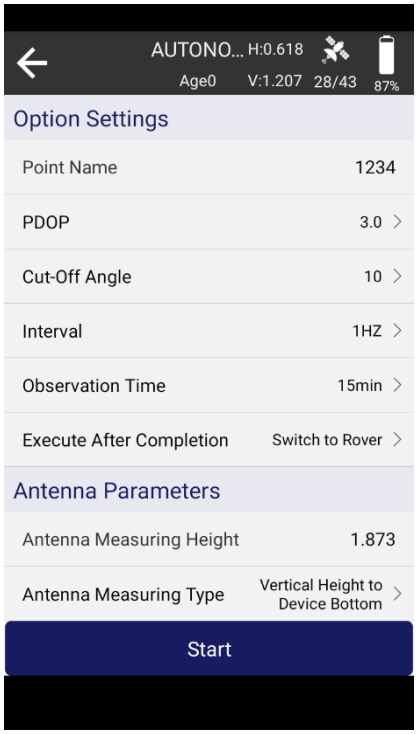


Figure 3.4-1

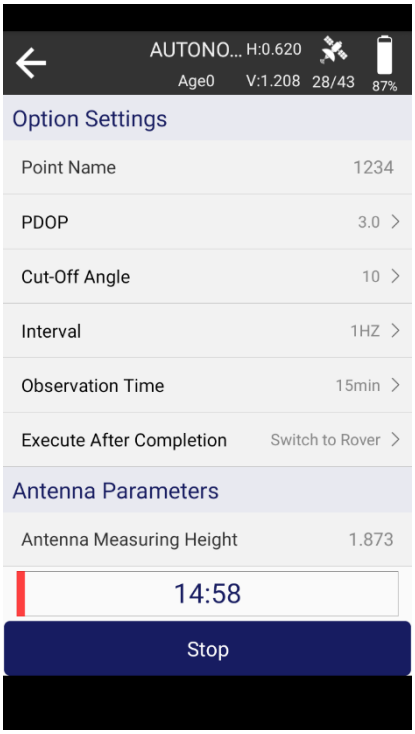


Figure 3.4-2

Note: During static recording, the device is not allowed to move, otherwise it will lead to the coordinate error calculated after processing.

3.5 Device Information

Click [Device] -> [Device Information], as shown in Figure 3.5-1. You can view basic information about GNSS devices, such as the instrument serial number, firmware version, mainboard type, and mainboard serial number.

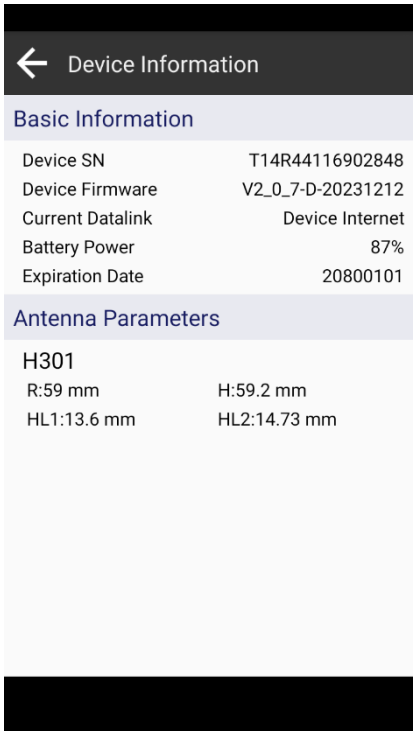


Figure 3.5 1

3.6 Device Activation

Click [Device] -> [Device Activation], as shown in Figure 3.6-1. If the GNSS equipment has expired, you can obtain the registration authorization code from the dealer and register the equipment here.

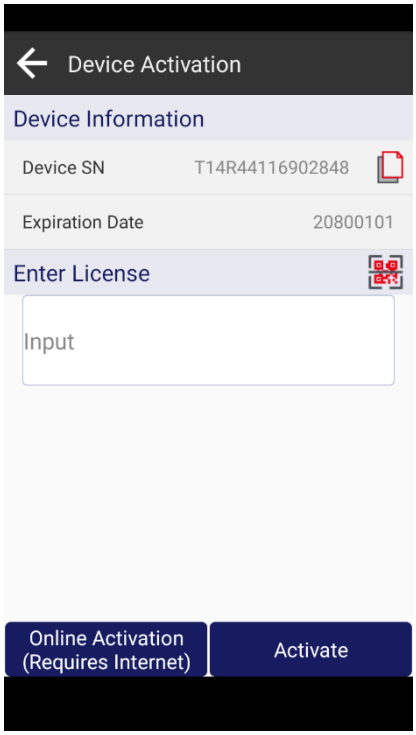


Figure 3.6 1

3.7 Device Settings

3.8 NMEA Settings

It supports the configuration of frequencies for commonly used messages such as GGA, GSA, GSV, GST, ZDA, RMC, and VTG

3.9 Re-Positioning

Click **[Instrument] -> [Re-Positioning]** to clear the current GNSS satellite ephemeris and re-search for satellites to perform positioning calculation.

3.10 Device Self-Check

3. 11 Other

1. Click the "battery quantity icon" in the title bar of the software , you can view the battery status, as shown in Figure 3.7-1.

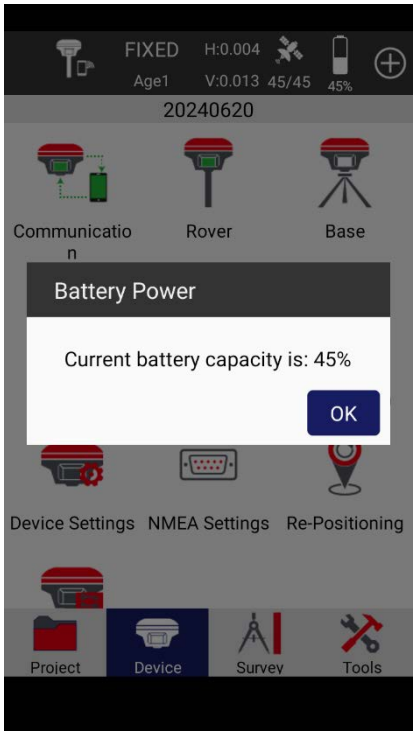


Figure 3.7-1

2. Click 

on the title bar of the software to enter the communication setting function, refer to Figure 3.1-1.

3. Click 

on the title bar of the software, you can view the location coordinates output by the device, as shown in Figure 3.7-2. You can view the base station information and skyplot and satellite table information, as shown in Figure 3.7-3, 3.7-4, and 3.7-5. As the antenna parameters of the base station are not transmitted in the differential data, only the phase center coordinates of the base station are transmitted. In order to get the ground coordinates corresponding to the starting of the base station, the antenna parameters corresponding to the base station can be input.

4. Click 

on the title bar of the software, you can view the information received by the device satellite, as shown in Figure 3.7-5.

5. Click "Settings" in the title bar of the star map star list to set the switch of the satellite system, as shown in Figure 3.7-6.

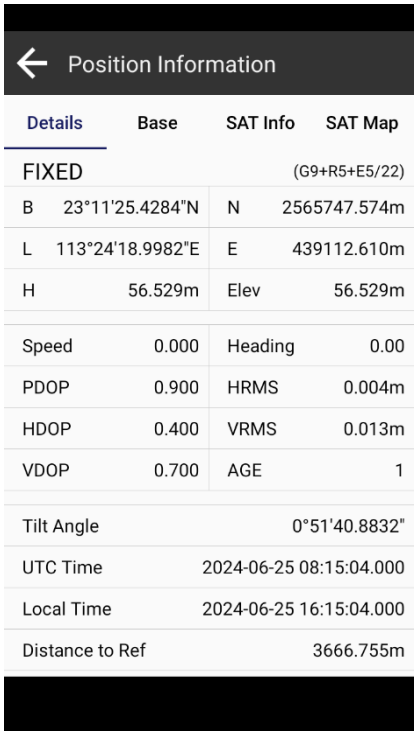


Figure 3.7-2

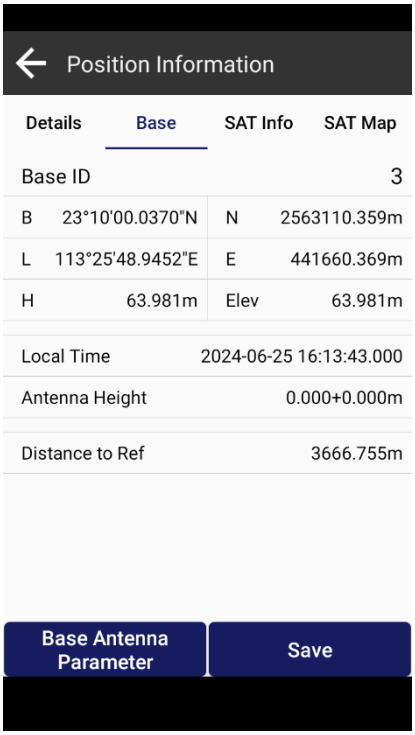


Figure 3.7-3

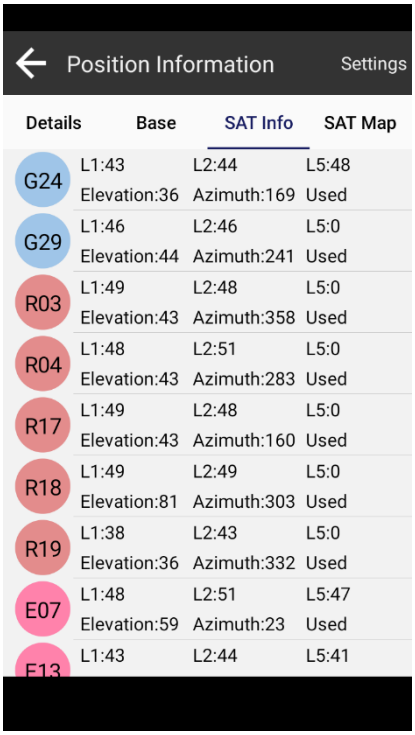


Figure 3.7-4

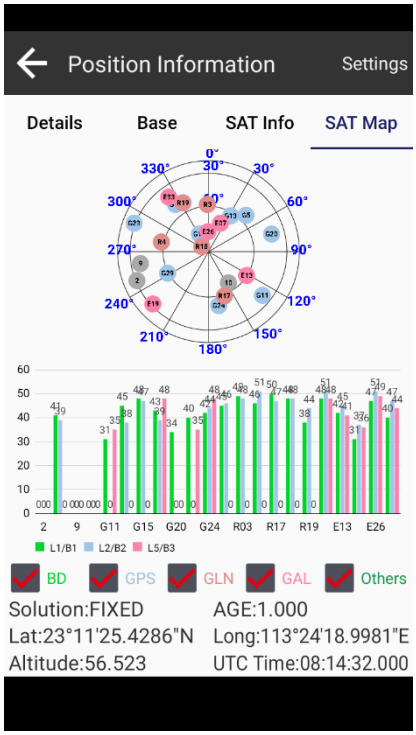


Figure 3.7-5

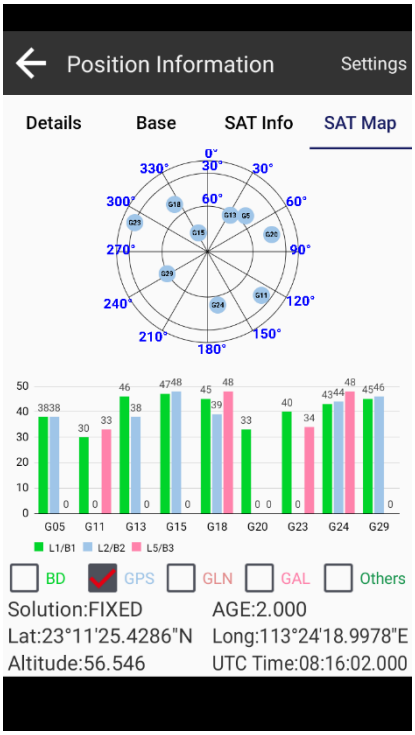


Figure 3.7-6

Chapter IV Survey

On the main interface of the software, click [Survey], as shown in Figure 4-1. It includes point survey, detail survey, control point survey, point stakeout, CAD, line stakeout, DSM stakeout, Stake road, polyline survey, polygon survey and function customization (GIS).

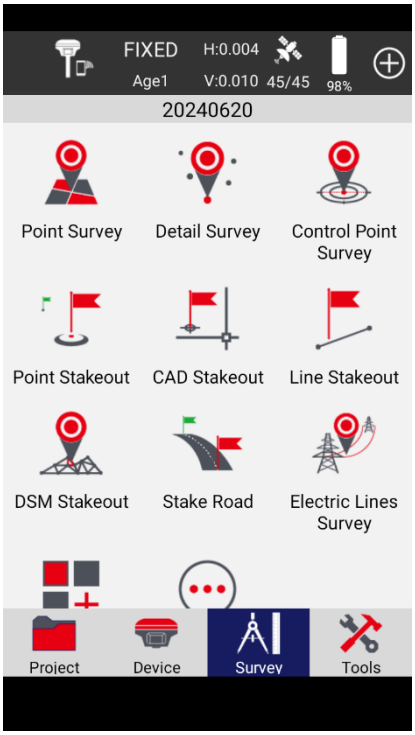


Figure 4-1

In the software, the project is the engineering data management and parameter configuration, for the field measurement function to do the necessary preparation and the measurement results of the data export; Instrument is the basic necessary condition for software to obtain high-precision position; And measurement is the main work of the software, which deals with what to do with high-precision coordinates and how to do it.

4.1 Point Survey

Click [Survey] -> [Point Survey], as shown in Figure 4.1-1. The positioning of GNSS equipment output is measured and collected according to certain precision limitation conditions and stored in coordinate point database. In the point measurement interface, the title bar displays the basic positioning information output by the current GNSS device, including the current solution state, difference delay, HRMS, VRMS and other positioning accuracy evaluation values, as well as the number of receiving satellites. Below the title bar is displayed in the status bar, other important information display content can be set according to user's interest in the set, the default display in the north east high in point measurement coordinates and the distance from the base station information, the middle area is measured data mapping information, also can set the display network map, drawing area in the top right corner of the electronic compass for hand thin compass shows, It is convenient for users to judge the direction when needed. Painting area, according to the left here are functions of the acquisition of these functions can also according to the needs of the user in the Settings menu will display the required functionality here fast operation certain functions, area of the lower right corner drawing scale, scale the icon above is triggered measurement acquisition function keys, the keys can

be used in the according to user's mobile location, Put it in a more convenient place. Click the button to start the measurement function, as shown in Figure 4.1-2. Below the drawing area are the measurement attribute roll call and coding input positions, as well as the antenna height Settings and the entrance to the coordinate point library.

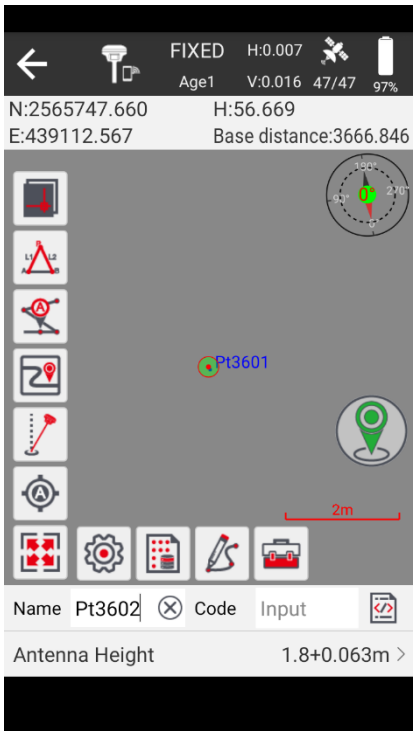


Figure 4.1-1



Figure 4.1-2

Click on the icon  to create a figure, as shown in Figure 4.1-3. Including line segment, broken line, arc, polygon, two-point fixed square, center point + length fixed square, three-point fixed rectangle, center point + length + width fixed rectangle, center point + radius fixed circle, three-point circle, curve and other types of graphics. You can draw a new graph directly in the drawing area, and point elements can select existing points or freely take points from the screen.

Click on the icon  to perform some CAD tool calculations, as shown in Figure 4.1-4. Including two circle intersection point, two lines intersection point, two arbitrary graph intersection point, distance offset point calculation, element translation, according to the number of equal points, according to the distance calculation point, element reverse and line extension and other functions.

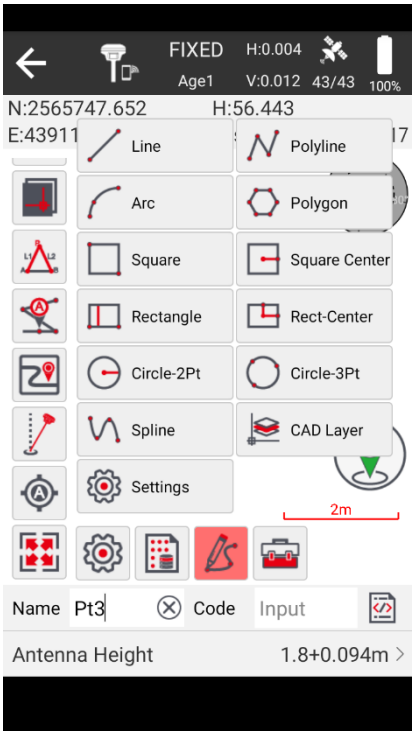


Figure 4.1-3

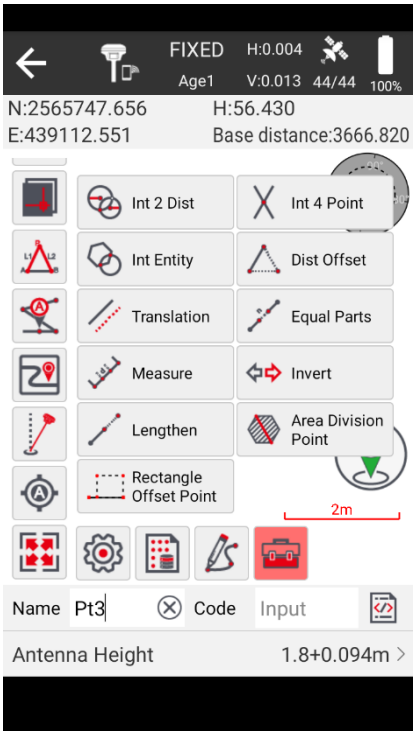


Figure 4.1-4

Click Settings  icon, enter the measurement setting interface, as shown in Figure 4.1-5. The limitation conditions of measurement and collection are set here, such as solution state, HRMS, VRMS, PDOP, differential delay, etc. Users can set the limitation conditions according to the accuracy requirements of the operation. The setting of smoothing points is to collect the average value of multiple anchor points to indicate the accuracy. You can also set default roll call and default encoding. Setting the information display is to set the content displayed in the status information bar. Users can set the information displayed according to their priorities, as shown in Figure 4.1-6. Toolbar menu setting is to display common function Settings to the left menu bar according to the needs of users in the process of operation, so that users can call some functions quickly and conveniently. These features include: tilt measuring switch selector switch, network map, drawing zoom in the full positioning center, take the screen, such as CAD text annotation, length, area measurement, the drawing set the background color, CAD layer set, the function such as coordinate transformation tool, calculator tool, click on the left side of the menu icon to trigger the corresponding function, as shown in Figure4.1-7.

Measuring a collection point usually requires entering a roll call and a code, click code icon , the icon can select the preset code in the code base for quick filling of ground object attributes, as shown in Figure 4.1-8. If there are many codes in the code library, the codes that are used more frequently will be displayed in the front for users to quickly select.

Click the antenna height display to modify and edit the antenna height information, as shown in Figure 4.1-9. The antenna height is set to obtain the actual position of the measurement target on the ground by subtracting the antenna height from the phase center coordinates of GNSS. If the antenna information is incorrect, click the antenna information to select the correct antenna type in Antenna Management, as shown in Figure 4.1-10.

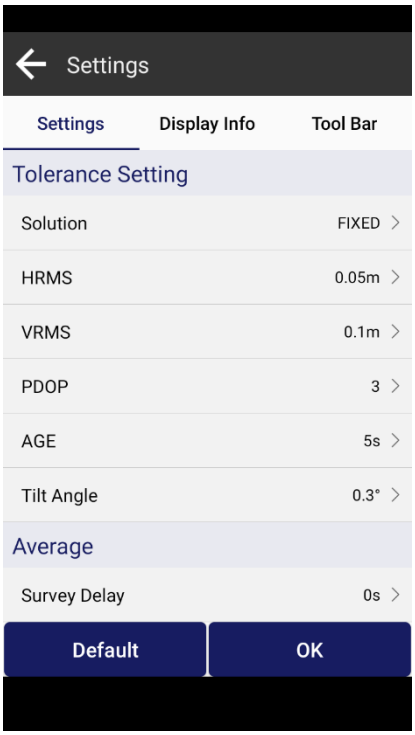


Figure 4.1-5

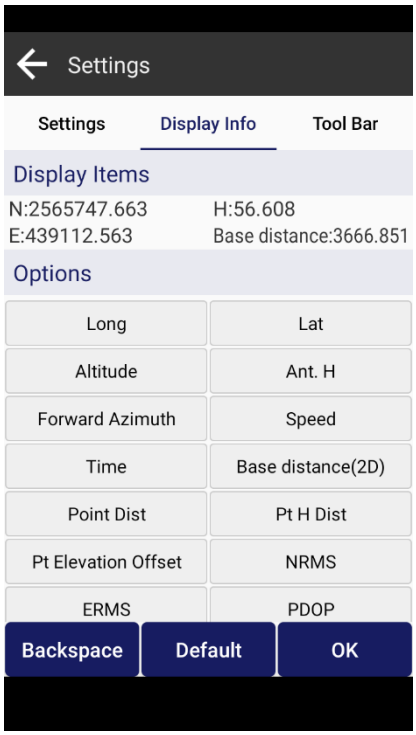


Figure 4.1-6

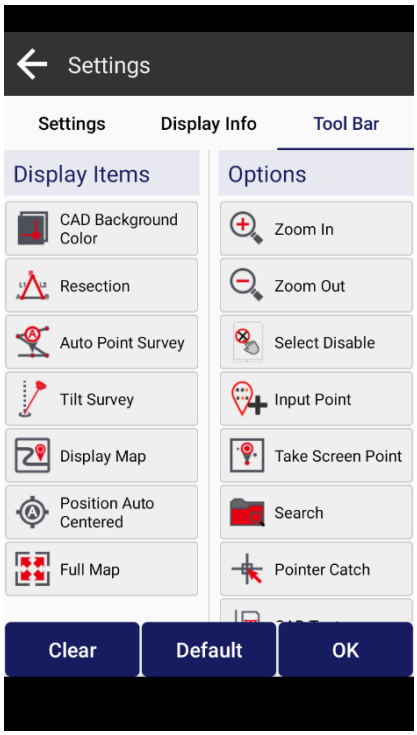


Figure 4.1-7

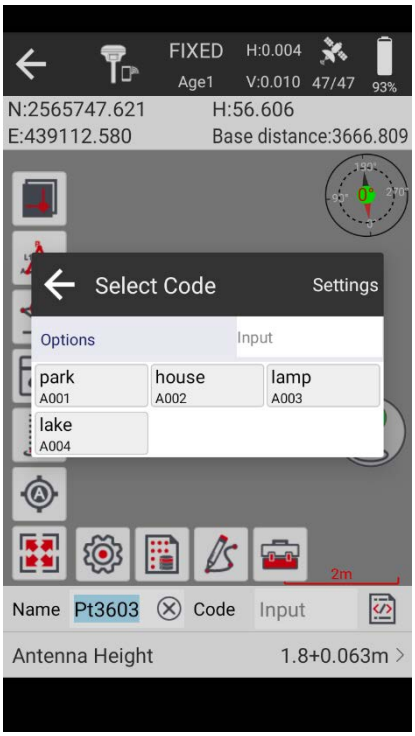


Figure 4.1-8

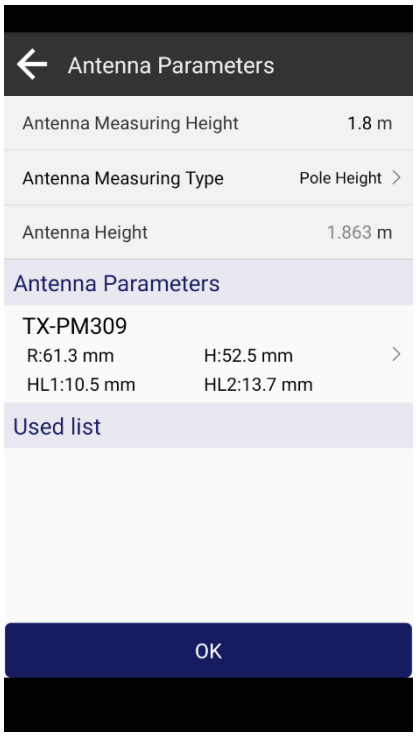


Figure 4.1-9

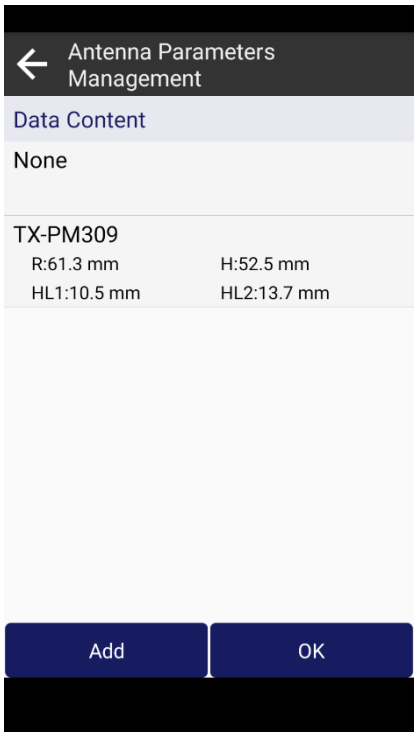


Figure 4.1-10

4.2 Detail Survey

Click [Survey] -> [Detail Survey], as shown in Figure 4.2-1. This function is similar to point measurement, but without the graphical interface of point measurement, the content required for measurement of collection points can be displayed more concisely and intuitively. This feature can be used to measure the collection point directly when the user does not need a drawing reference. The lower part of the interface is the function entrance of measurement Settings, point library and tilt measurement switch.

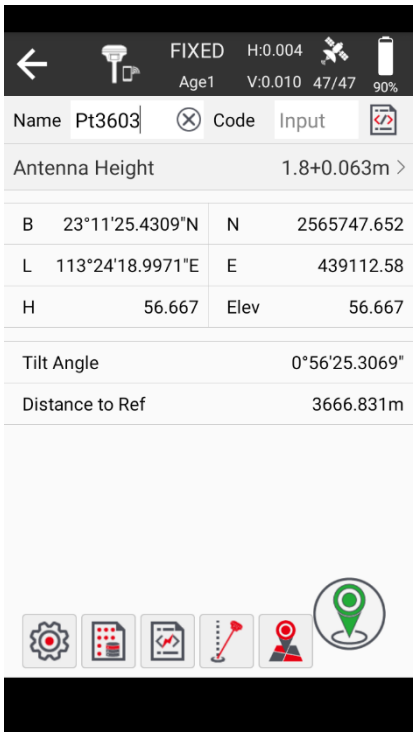


Figure 4.2-1

4.3 Control Point Survey

Click [Survey] – [Control Point Survey], as shown in Figure 4.3-1, sometimes need to measure a high accuracy point, collecting the points need to reset the device for many times, asking for a fixed solution for a period of time after acquisition, and need to collect a lot of points, through a certain way of calculation, playing in addition to the average value of the deflection point, A high-precision anchor point is obtained by taking the average value of the basic several optimal values. The points collected by this method have high accuracy guarantee, and we call this type of points as control points. In the control point measurement interface, all coordinate points collected by the control point are displayed in the middle area in real time, and the graph distribution of the measurement points of the control point can be seen, so the precision of the control point can be judged in a certain program. The two ICONS below the figure are the measurement Settings and point library function entrance respectively.

Measurement Settings, as shown in Figure 4.3-2, in addition to setting acquisition limit, control point

acquisition parameters, such as smoothing points, smoothing interval, repetition times, etc.

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

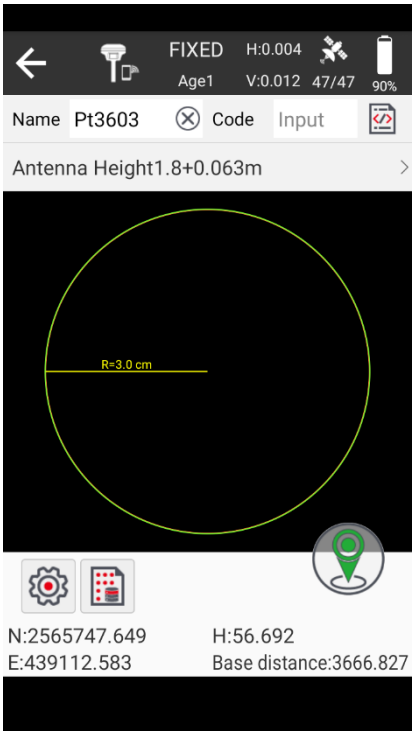


Figure 4.3-1

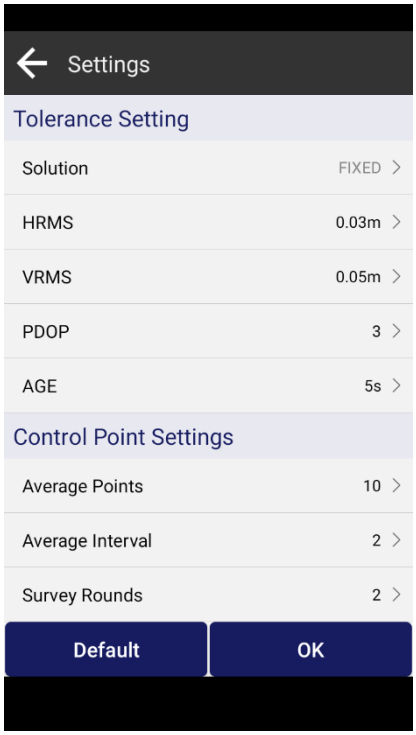


Figure 4.3-2

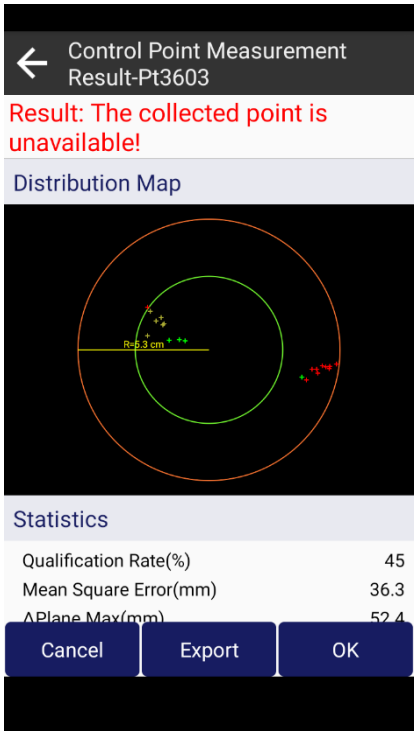


Figure 4.3-3

4.4 Point Stakeout

Click [Survey] -> [Point Stakeout] to enter the interface of stakeout point library, as shown in Figure 4.4-1. Point stake means to find the location of points through coordinate points in the field site under the condition that point coordinates are known. Unstakeout points and stakeout points will be displayed in the points. Click stake points to remove staked points, view details and staked points. Stake points are part of the coordinate point library, and the operation of adding and removing stake points is consistent with the coordinate point library. You can also select points in coordinate points (all points in the coordinate point library) to stake. After selecting a point for stake, enter the stake interface, as shown in Figure 4.4-2.

Point stake interface layout is similar to point measurement, but there are some differences, in the status information bar to display the value of the target, northwest, southeast deviation value of fill. Compass is not in the upper right corner of the drawing area and is currently positioned together. At the bottom of the drawing area, in addition to the measurement Settings function, there are also stake the nearest point, stake point, stake next point these functions.

In addition to measurement Settings, information display Settings and function menu Settings in point measurement, the settings also include stake Settings, as shown in Figure 4.4-3. You can set the target according to the southeast, northwest or around the reference direction can be the front direction of the host or according to the known reference point direction, in addition, you can set the prompt range, stake limit difference, etc.

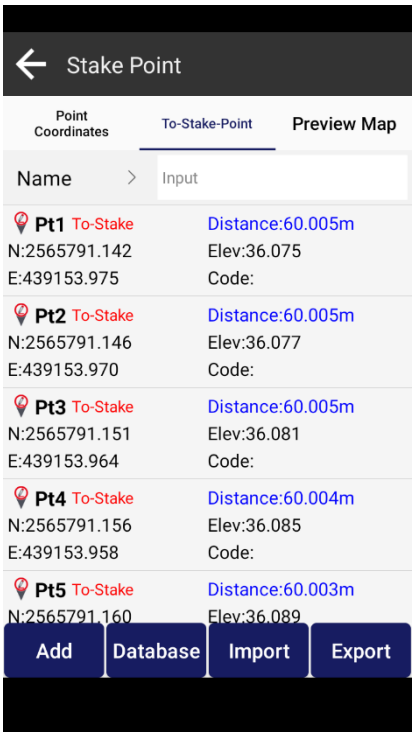


Figure 4.4-1

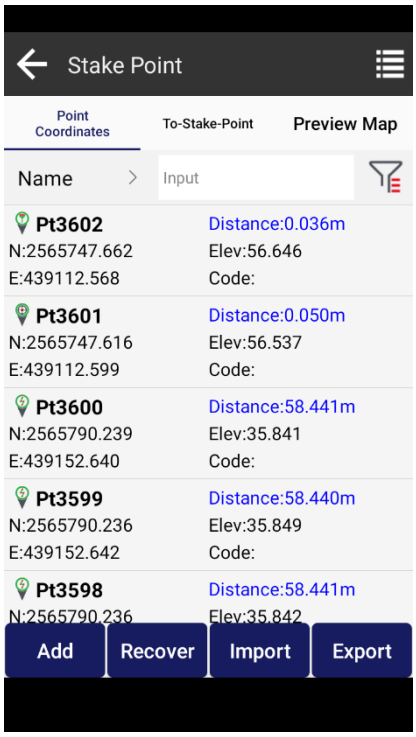


Figure 4.4-2

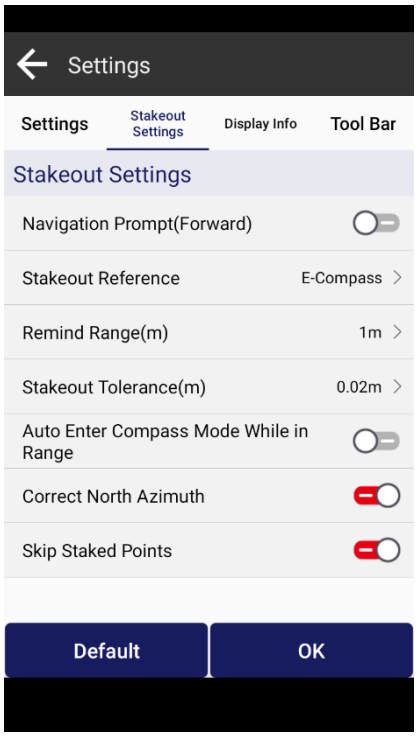


Figure 4.4-3

How to get to the target point faster?

If the user has a good sense of direction, in the real-time field can distinguish between the southeast and northwest, stake compass display, you can directly see the continuity of the current anchor point and the target point, pointing to which direction to which direction can go past. As shown in Figure 4.4-4, the target point Pt3603 can be found by walking southwest.

If the user has a poor sense of direction and can't tell the difference between east, west and west, look at the small arrow of the current position. The small arrow points to the direction of the hand when the hand is flat, as shown in Figure 4.4-4, the current hand is pointing south. You can turn the hand thin pointing, when the hand thin pointing and the current point and the target point coincide, that the hand thin pointing and the target point azimuth is consistent, this time according to the hand thin pointing, go forward.

In the stake points to be staked, click the data item and click Details to enter the detailed information of stake points, including the information of each stake point and the distribution diagram of stake targets and stake collection points, as shown in Figure 4.4-5 and Figure 4.4-6.

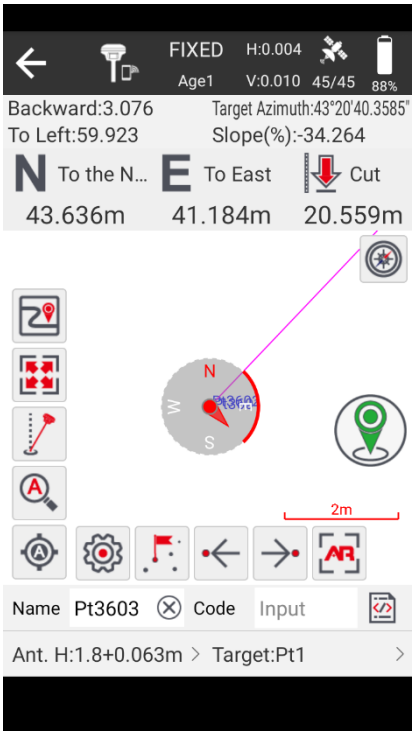


Figure 4.4-4

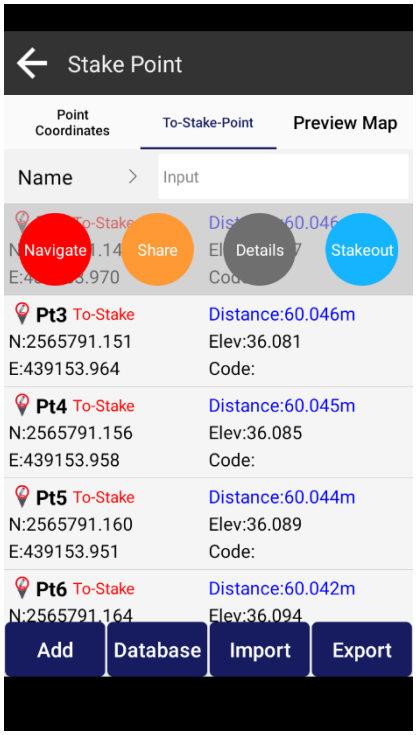


Figure 4.4-5

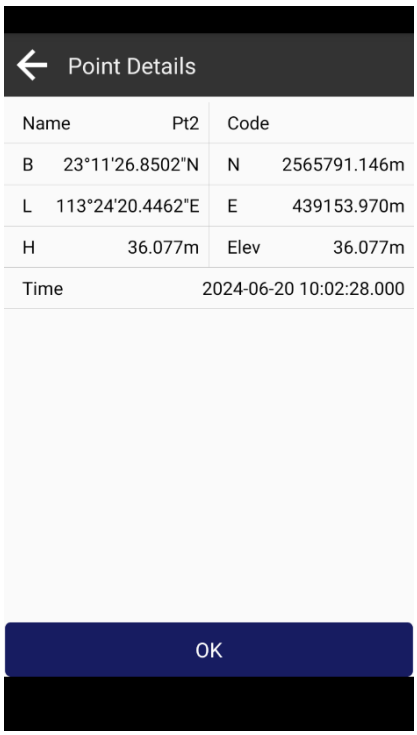


Figure 4.4-6

4.5 CAD Stakeout

Click [Survey] -> [CAD Stakeout], as shown in Figure 4.5-1. CAD Stakeout functions include CAD graphic display, drawing of ICONS such as lines, broken lines, arcs and polygons, graphic calculation, import and export of DXF and DWG graphics, layer management and stake of CAD graphics.

Click on the icon  to enter CAD layer management, as shown in Figure 4.5-2. You can create and delete layers, set whether layers are visible. Click icon  to import DXF and DWG drawings, as shown in Figure 4.5-3, and set a layer as a working layer, or choose the elements to stakeout as usual.

Click on the icon  to create a figure, as shown in Figure 4.5-4. Including line segment, broken line, arc, polygon, two-point fixed square, center point + length fixed square, three-point fixed rectangle, center point + length + width fixed rectangle, center point + radius fixed circle, three-point circle, curve and other types of graphics. You can draw a new graph directly in the drawing area, and point elements can select existing points or freely take points from the screen.

Click on the icon  to perform some CAD tool calculations, as shown in Figure 4.5-5. Including two circle intersection point, two lines intersection point, two arbitrary graph intersection point, distance offset point calculation, element translation, according to the number of equal points, according to the distance calculation point, element reverse and line extension and other functions.

After selecting the CAD figure, see Figure4.5-4. You can delete graphics, view details, stake and other operations.

After selecting elements, click Stake to enter stake CAD interface, as shown in FIG. 4.5-5. Stake is to find the location of the target coordinates in the actual location, stake operation is similar to point stake, line stake.

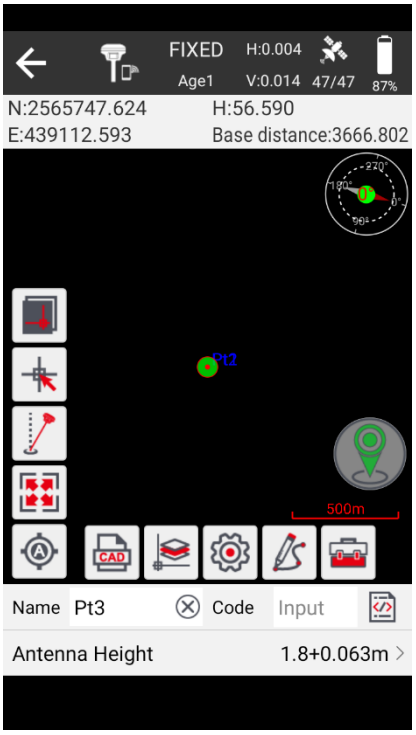


Figure 4.5-1

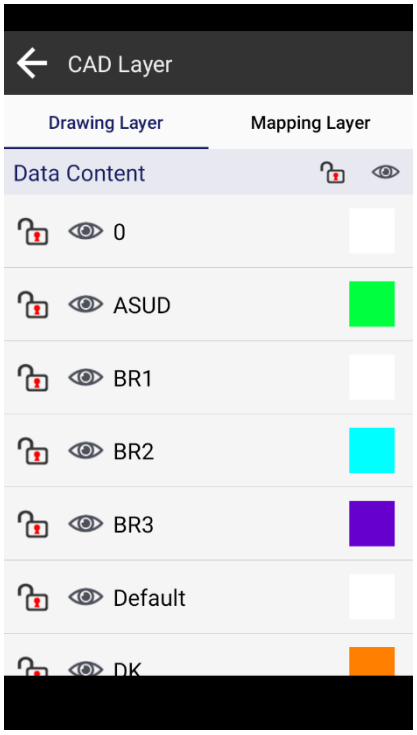


Figure 4.5-2

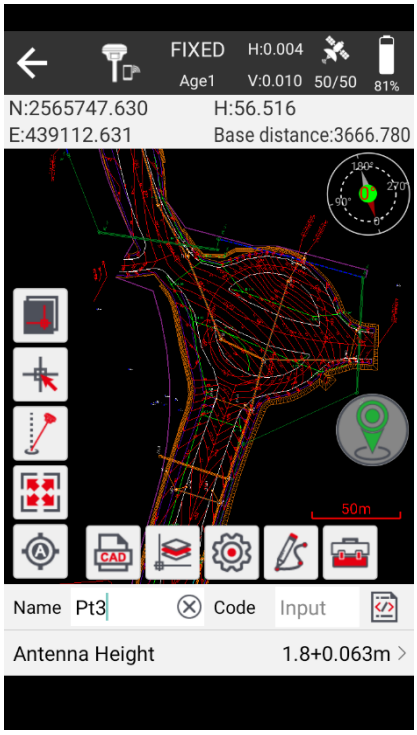


Figure 4.5-3

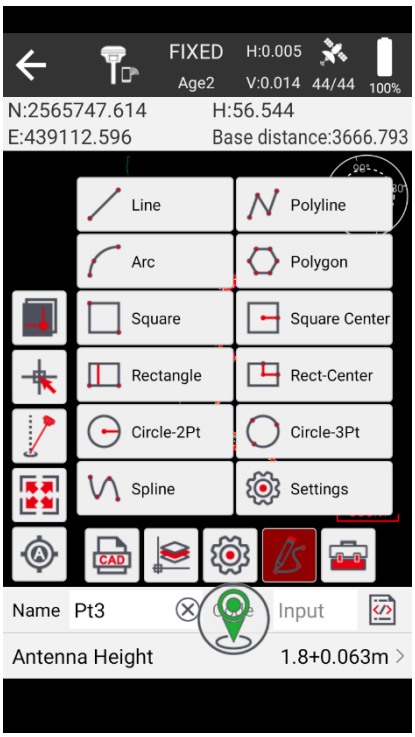


Figure 4.5-4

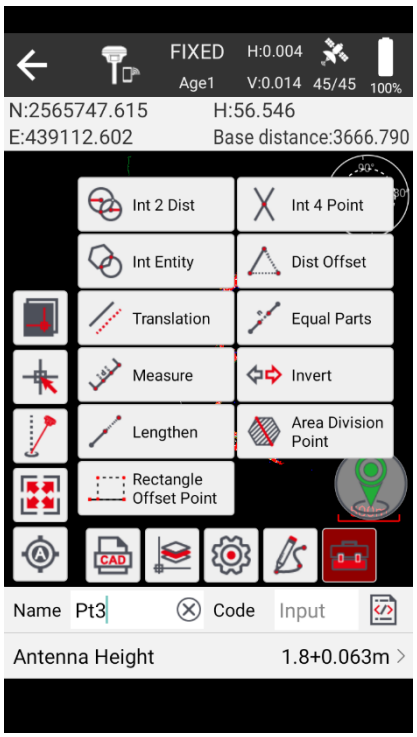


Figure 4.5-5

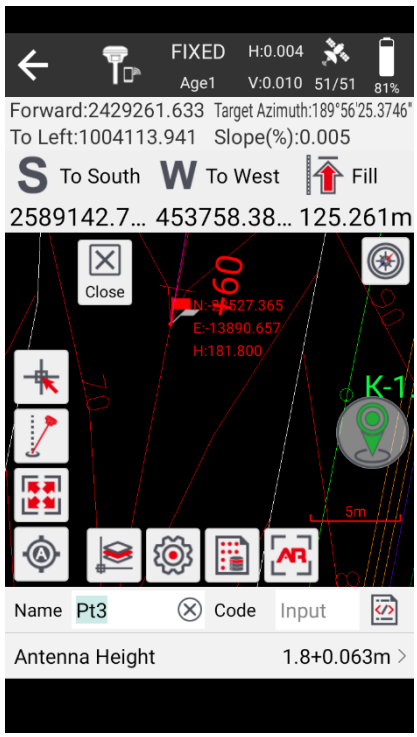


Figure 4.5-6

4.6 Line Stakeout

Click [Survey] -> [Line Stakeout] to enter the interface of line library, as shown in Figure 4.6-1. Line stakeout is to provide a designed line, input it into the line library, and perform field stake on the line. Points on a straight line can be staked point by point according to real-time stake mileage, skew distance, height difference, etc., or by dividing the line into points at a certain interval.

Line library management, can add, delete, import, export line data; Create a line, as shown in Figure 4.6-2. Output the line name and set the starting point and ending point coordinates and create a line by starting point + azimuth + length. Click on the icon  to select point data from the coordinate point library and click point information to enter the point editing interface, as shown in Figure 4.6-3.

Click the line list item to delete the edit stake line. Click Stake, as shown in Figure 4.6-4. You can set stake in the form of line or point by point. If it is point by point, you need to set the calculation method according to pile number or the whole pile distance, distance interval and whether to automatically stake the nearest point.

Then press OK to enter the line stake interface, as shown in Figure 4.6-5. Can operate through the menu stake a line, a line, a point, a point, etc.

Stake point by point, sometimes need to stake calculation outside the point, need to specify the range and offset stake point, this is called piling, click Pile stake.



Figure 4.6-1

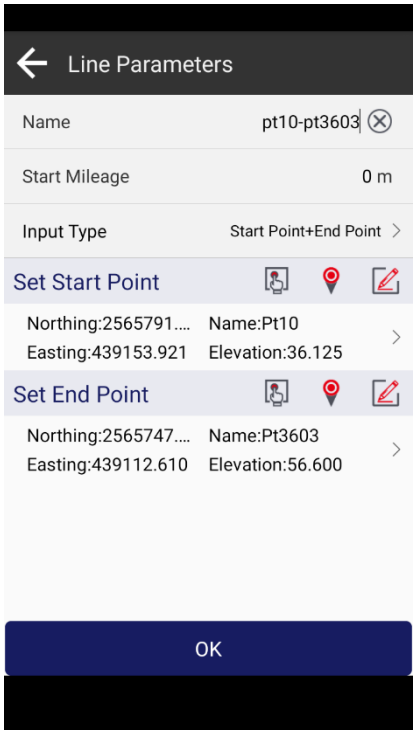


Figure 4.6-2

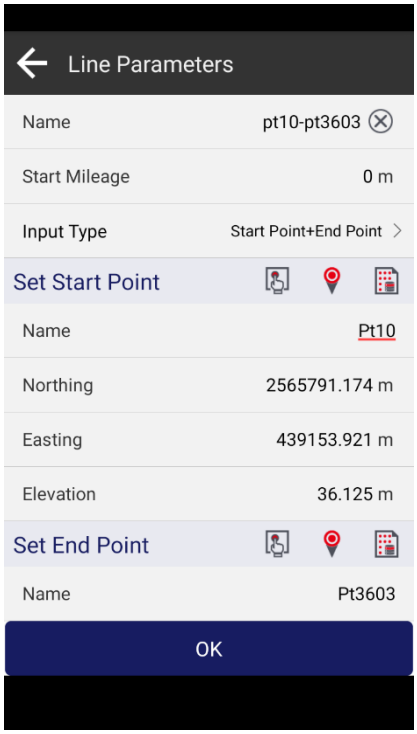


Figure 4.6-3

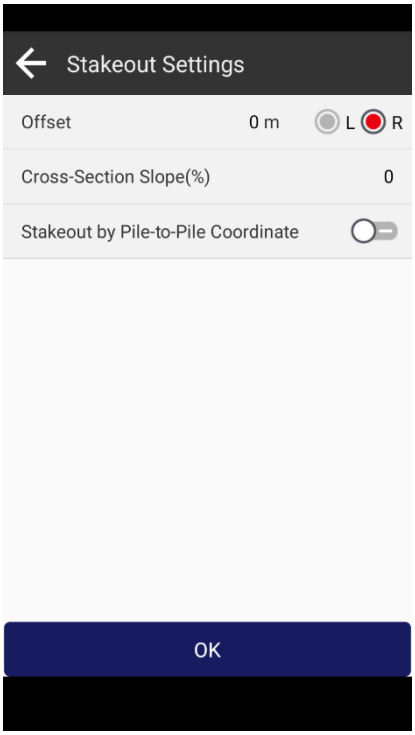


Figure 4.6-4

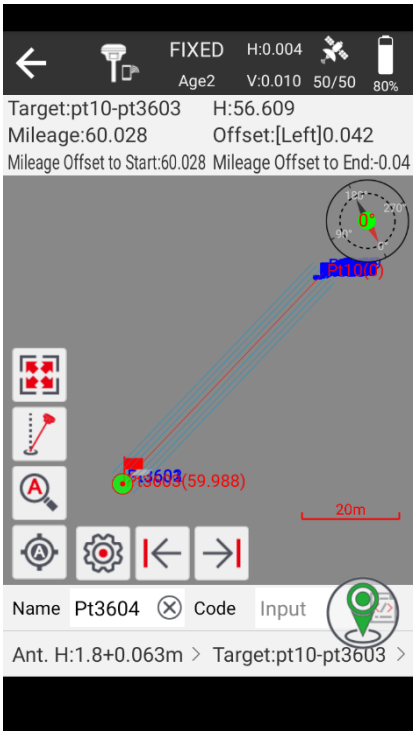


Figure 4.6-5

4.7 DSM Stakeout

Click [Survey] -> [DSM Stakeout], as shown in Figure 4.7-1. According to the existing site triangulation data, the current positioning coordinates are used to carry out elevation stake of the site to determine whether the real-time site at a certain location needs to be filled or dig.

The site elevation database can be created, imported, edited and deleted, etc., and the site elevation file can be created, as shown in Figure 4.7-2 and 4.7-3. The coordinate of triangulation net file can be input manually, also can choose from the point library with batch, can adjust the order of point coordinate up and down, also can import coordinate and so on.

Click the site elevation database data item to edit and delete the elevation file and click the stake to enter the elevation stake interface, as shown in Figure 4.7-4.



Figure 4.7-1

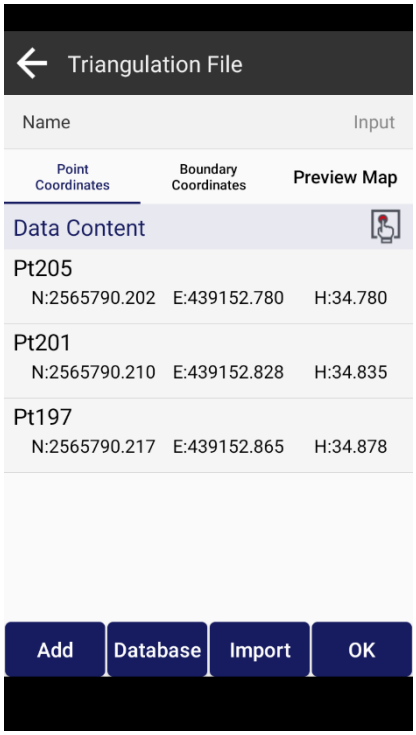


Figure 4.7-2

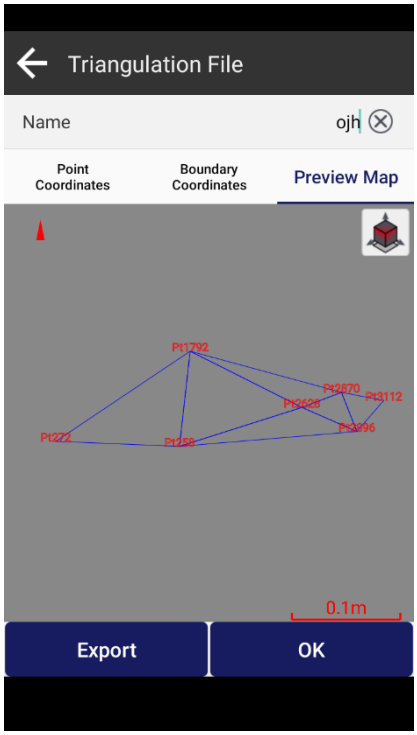


Figure 4.7-3

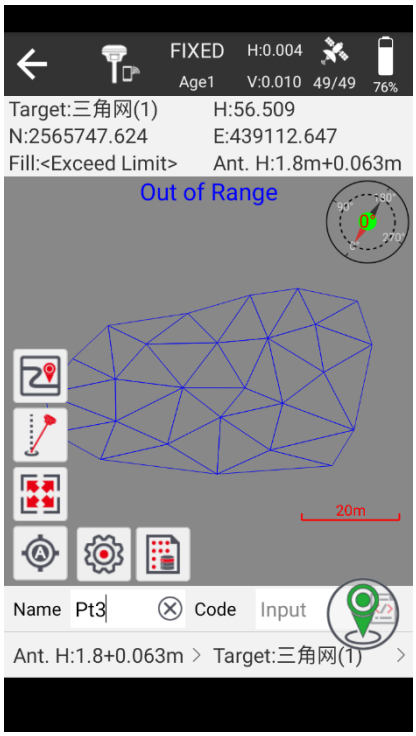


Figure 4.7-4

4.8 Stake Road

Click [survey] - > [Stake Road] into the interface, as shown in Figure 4.8-1, by way of plane curve and vertical curve, chain scission, standard cross-sectional, ultra-high, widen design, slope design elements such as data file, according to the circuit design documents and GNSS satellite positioning, Thread construction stake, section data collection and a series of road thread related applications. It is suitable for data survey and collection, line construction, line acceptance and other engineering operations of highway and railway lines at all levels.

Road design, as shown in Figure 4.8-2. The elements of road design include flat curve, vertical curve, chain break, standard cross section, slope, standard cross section includes the elevation and widening of section plate, etc.

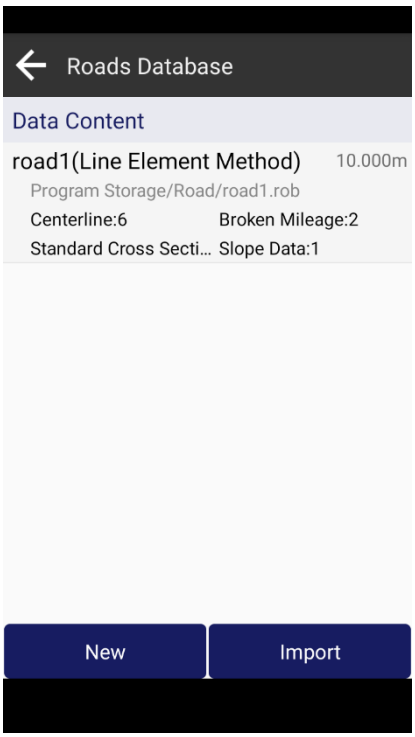


Figure 4.8-1

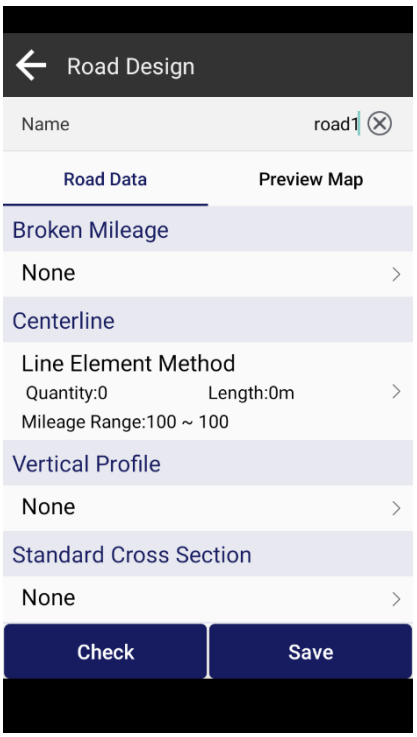


Figure 4.8-2

1. Flat curve design: as shown in Figure 4.8-3. The flat curve is the center line of the road, which is the direction of the whole road. The methods of flat curve design are linear element method, intersection point method and coordinate method. All roads are composed of road starting points, straight lines, relaxation curves, and circular curves. The line element method is a design line formed by directly inputting the elements of the road, in which the starting point contains the starting distance and starting point coordinates, the straight line contains the starting azimuth of the element and the length of the line, the easing curve contains the starting azimuth of the element and the starting and ending radius and the length of the curve, and the circular curve contains the starting azimuth of the element and the radius and the length. In general, the end azimuth of the former element is equal to

the starting azimuth of the next element, the radius of the connecting end of the easing curve and the straight line is infinite, and the radius of the connecting end of the easing curve and the circle is equal to the circle radius. Intersection point method is to calculate the combination of road design elements through some algorithms through the coordinates of control points and corresponding easing curve length, easing curve parameters, circle radius and other parameters. The coordinate method calculates the combination of road design elements according to the coordinate points on the line and the radius of the arc before the coordinate points according to a certain algorithm. The road generated by the coordinate method only has the starting point, straight line and arc, which is a simplified line without easing curve.

2. Vertical curve design: as shown in Figure 4.8-4. The vertical curve is the elevation fluctuation of the road center line at each mileage. It is the design height of the line center line, which needs to input the elevation corresponding to each mileage of the line elevation change point and the arc radius corresponding to the slope change point. The software calculates the elevation value of the line at each mileage point according to these design elements.

3. Chain break design: as shown in Figure 4.8-5.In the process of circuit design, sometimes in advance design good lines due to the actual environmental conditions do not allow the building or construction cost is too high, had to be somewhere to local modification of circuit design, circuit changes, line may be long or short, than the original line at this time in order to modify the line behind the design of the mileage data remains unchanged, then use broken, Broken chains are divided into long and short chains. At a certain mileage point, start using a new mileage value, leaving the mileage data following this mileage value unchanged.

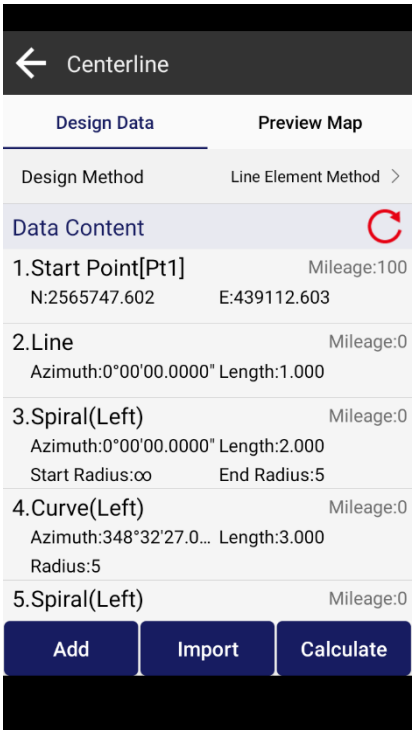


Figure 4.8-3

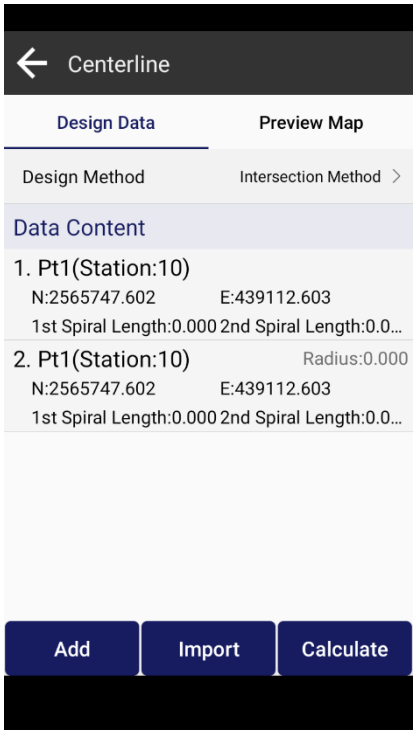


Figure 4.8-4

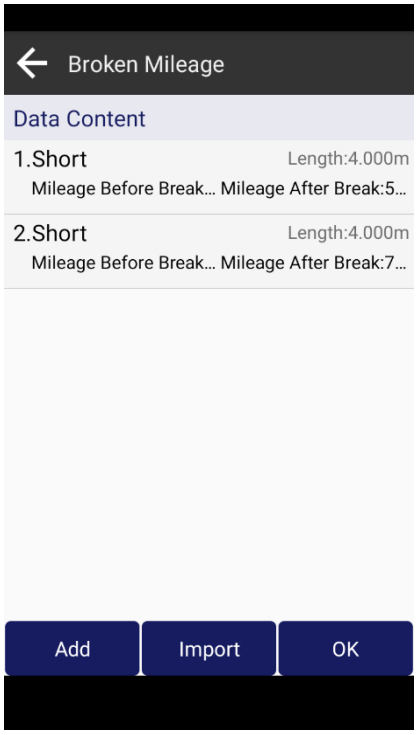


Figure 4.8-5

4. Standard cross section design: as shown in Figure 4.8-6. In the actual construction road, the road center line is only the planning direction of the line, and the actual road includes motor vehicle lane, non-motor lane, green belt, sidewalk and other road plates for various purposes. The width, slope and other parameters of the whole road of these plates are called the standard cross section. In a real-time way, because of the influence of the built environment, often cannot be built according to the standard cross section, sometimes some plates may need to start at a particular narrow width, sometimes due to the large road camber, extensions to slope safety need somewhere, there needs to be widened parameters Settings section plate high, as shown in figure 4.8-7. Ultra wide set according to the needs of each plate, add according to the changing mileage.

5. Slope design: as shown in Figure4.8-8. In the actual process of road construction, in addition to building the road outside of the main road, the road may through the mountain, lake and road environment of the elevation difference is large, if after the mountain digging up roads could lead to a mountain fall damage road, so I need to fill the lake mountain and according to certain standard building slope, protect the road.

If the roads according to the above elements design, is a complete line of design, sometimes different need only part of the basic construction units, will not have all the design data, users according to their own actual project requirements in terms of design, good road design can be used after the road design documents for construction work.

Note: In order to facilitate road design editing, the software supports road import in various formats, which are not described here.



Figure 4.8-6

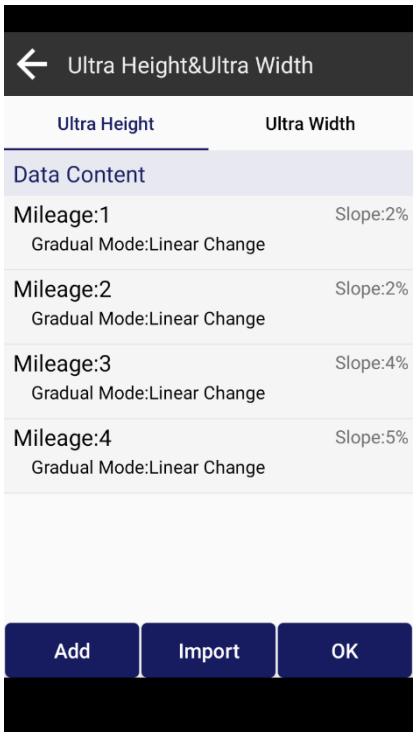


Figure 4.8-7

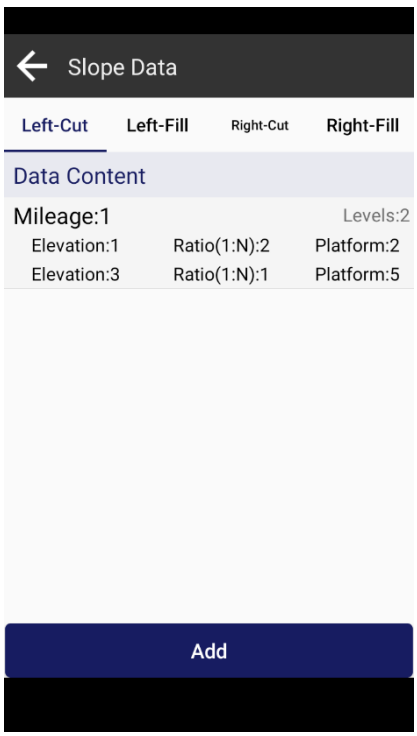


Figure 4.8-8

Road stakeout: the design of the road line files, construction operations.

Figure 4.8-9 shows the stake of a road center line. The stake interface and operation are similar to point stake and line stake. Click line stake to switch to other stake modes, including line stake point by point, cross section stake, cross section measurement and other road stake related operation functions.

Line stake point by point, as shown in Figure 4.8-10. Click the function menu icon below to enter the measurement Settings, enter the stake library, stake the upper point, stake the next point, piling and so on. The stake library is displayed, as shown in Figure 4.8-11.You can select a point in the base for stakeout, or automatically stake the nearest point, and recalculate the pile-by-pile coordinate points of the road center line, as shown in Figure 4.8-12.Set the coordinate point according to the whole pile number or the whole pile distance, and calculate the coordinate point according to a certain mileage deviation distance. You can also set up a calculation of the left and right side pile with stake.

Measure the cross section, as shown in Figure 4.8-13. According to a certain mileage interval, collect the elevation data of the section of the road line and its surroundings, which can be used for the preliminary survey work of the road construction, calculate the amount of road earthwork and evaluate the construction cost.

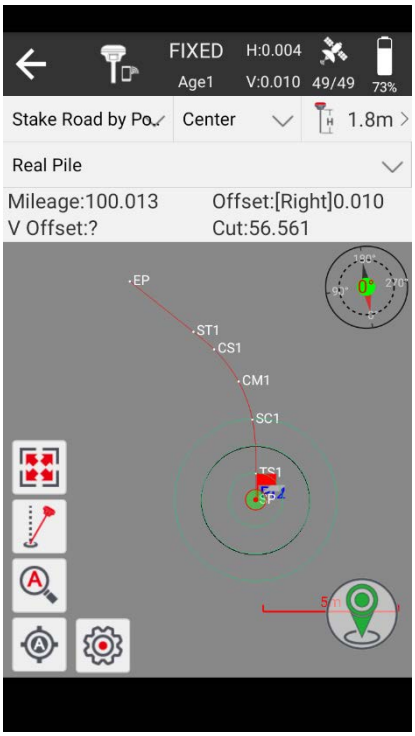


Figure 4.8-9

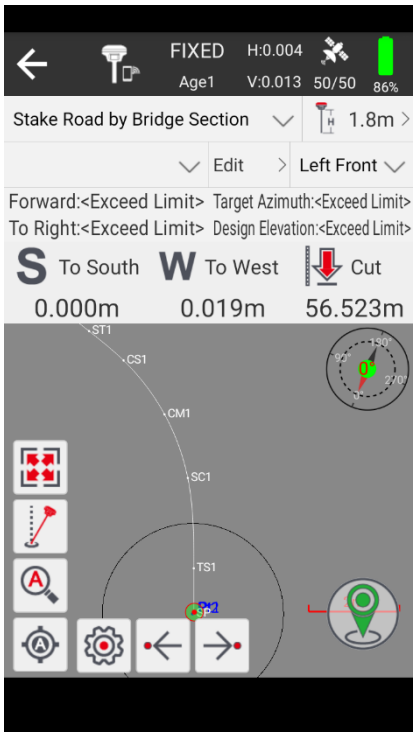


Figure 4.8-10



Figure 4.8-11

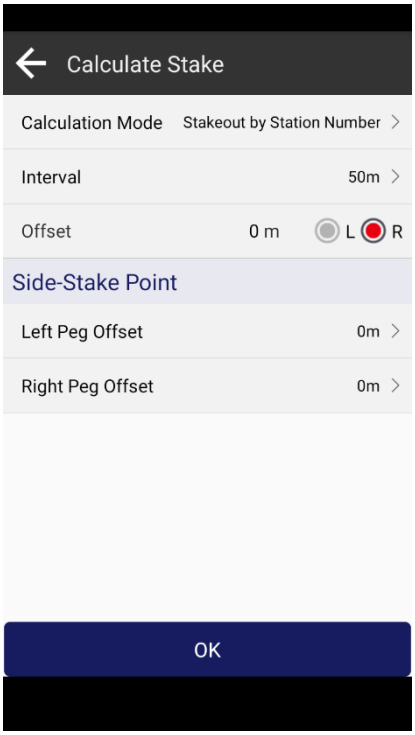


Figure 4.8-12

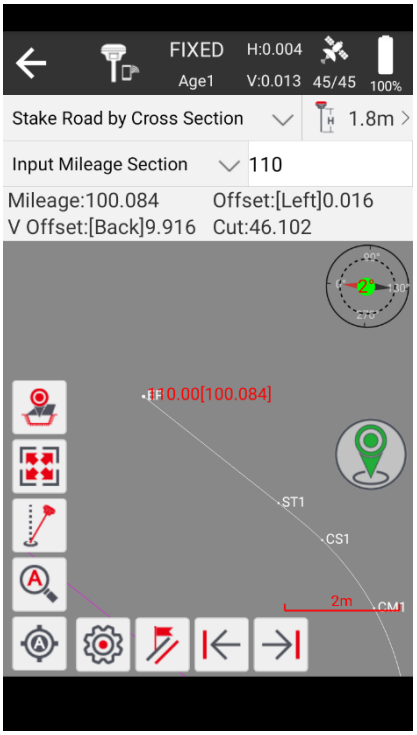
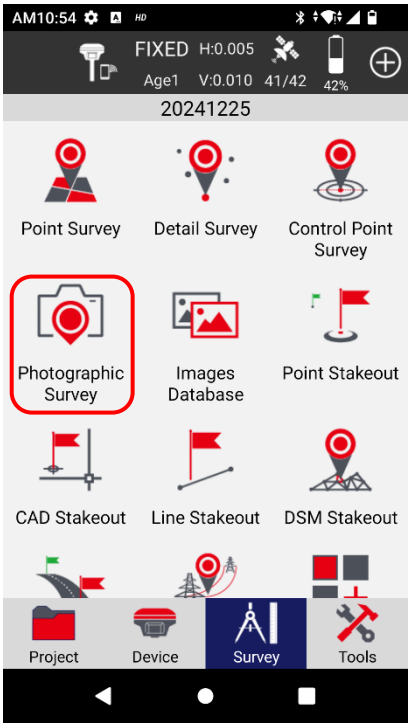
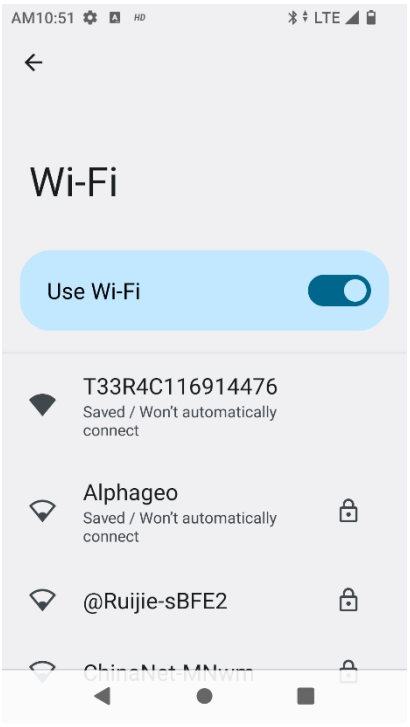


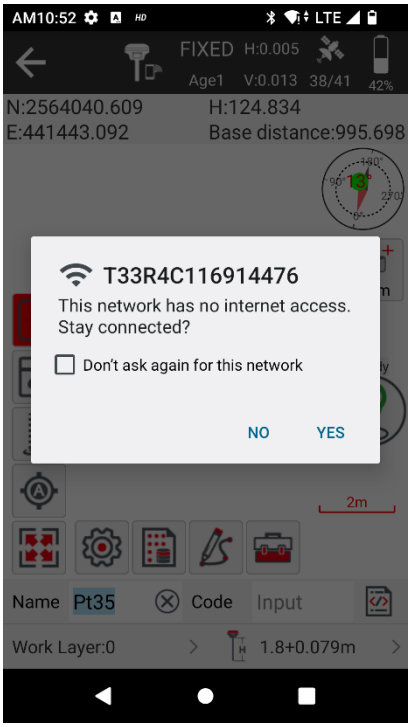
Figure 4.8-13

4.9 Photographic Survey

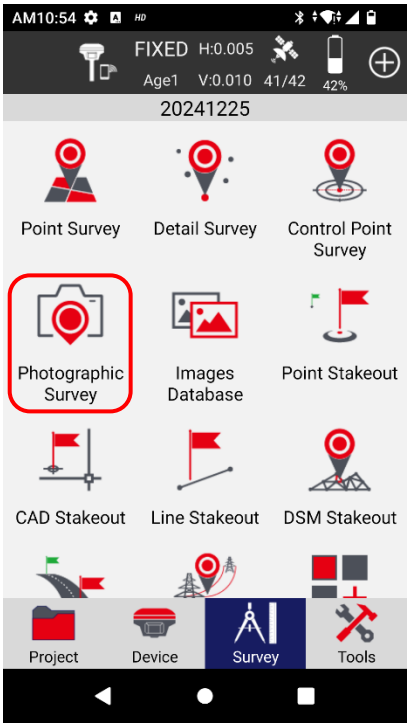
1) After Matrix VI achieves fixed solution, go to “Photographic Survey” in “Survey” menu, software will jump to the system WiFi setting and require the WiFi connection between controller and receiver, after the WiFi is connected, a pop-up dialog with the reminding message says “This network has no internet access, stay connected?”, click “YES” to keep the connection. (If the wifi was connected, software will skip this step).

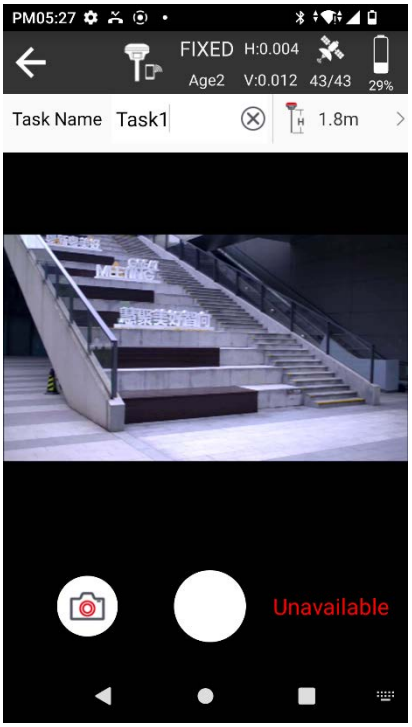


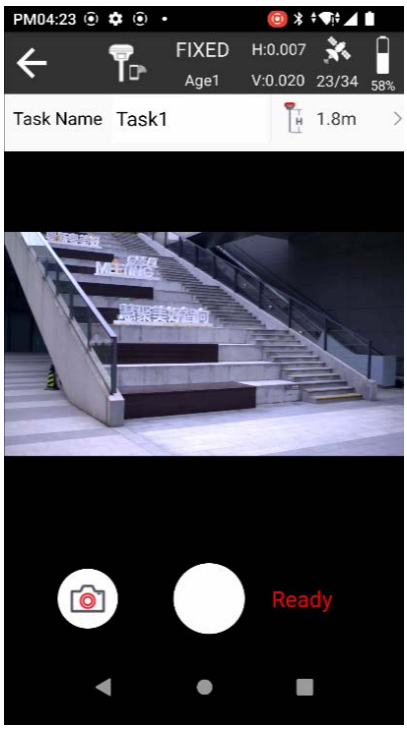




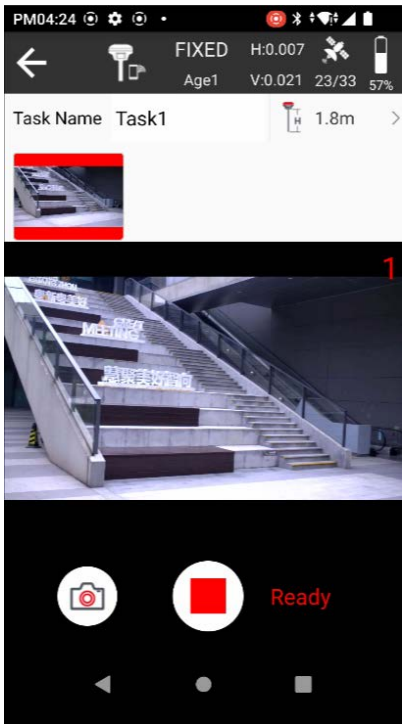
2) Return to "Survey", click "Photographic Survey" again, the camera image will appear on interface, if there shows "Unavailable" at the bottom right corner of interface, that means the IMU is not initialized yet, at this moment, lift the receiver and walk for 3~5 meters or shake the receiver back and forth (we recommend to walk for 3~5 meters), the status will turn to "Ready", that is to say the IMU initialization completed and ready for the photogrammetry. As shown at the pictures below.

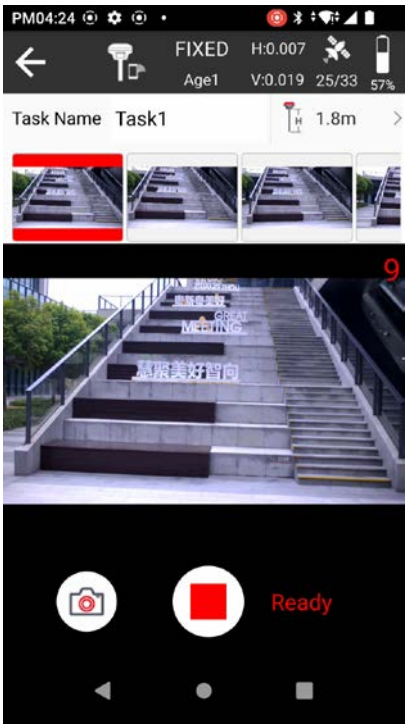




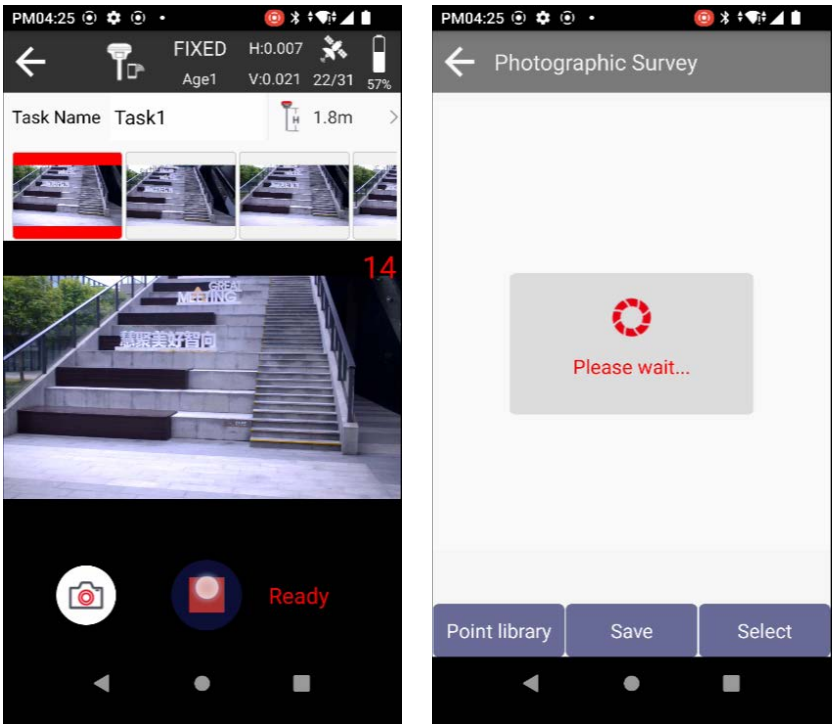


3) Click the white round button at the bottom center of interface to start, at this moment, lift the receiver and move slowly aiming at the target area, the photos will be taken automatically and appear at the top of interface, as well as the taken photos quantity. As shown at the pictures below.

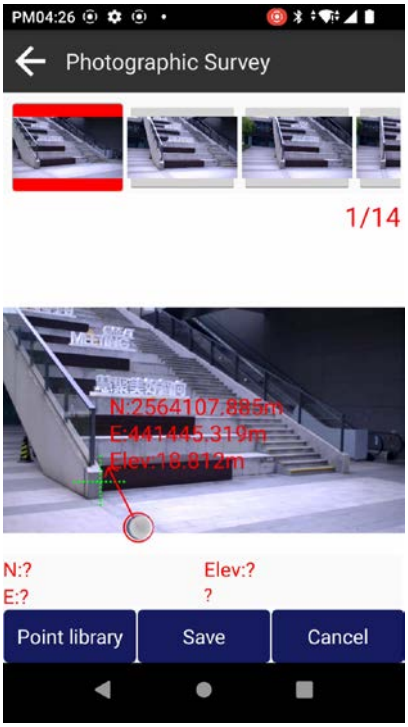




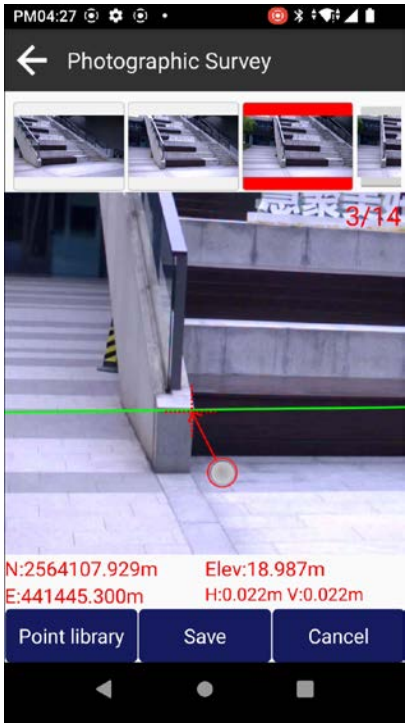
4) In order to ensure good overlap of the measurement area, we need to take at least 5 photos. After taking enough photos, click the stop button to finish the shooting.



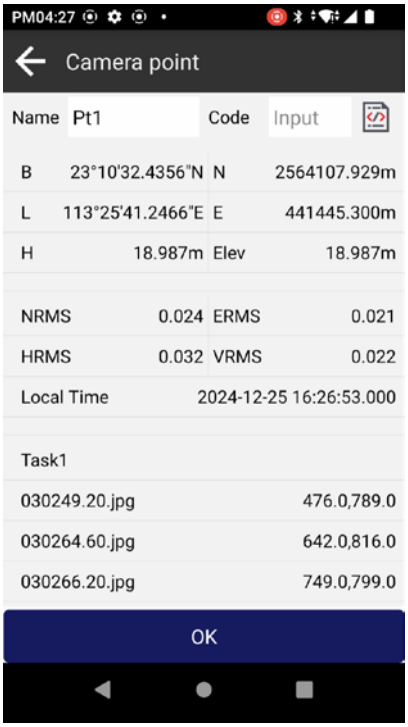
5) Click on the photos directly, zoom in on the target feature in the photo, press and hold on the photo for about 1 second, a selection arrow will appear, move the arrow to the target point, when there appears the coordinate, release the arrow, as this moment, we can click “Save” button to save the coordinate into database, or we can continue to obtain the coordinate for the same point in the other photos, with this method, the coordinates obtained in different photos can be averaged.

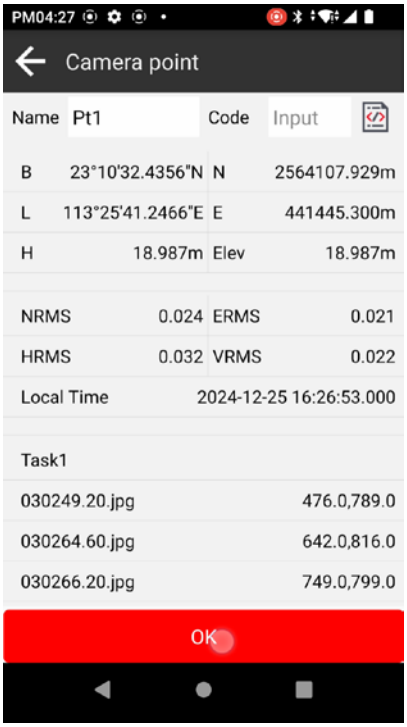












4.10 Images Database

Images Database is mainly used to access image files that have already been captured, and can re-perform settlement and collect point data based on historical image files.

4.11 Electric Lines Survey

Click 【Measurement】 -> 【Power Line Survey】, as shown in Figure 4.11-1. The power line survey function is used to set out known power lines while collecting feature data near the power lines. The surveyed feature data (as the survey results) is exported and used in professional power design software to determine whether the set power lines meet the specification requirements based on the survey data.

Click  to enter the power line survey settings, as shown in Figure 4.11-2. Here, you can modify the power survey data storage type and stakeout prompt settings. Click "Power Data Storage Type" to enter the Power Data Storage Type Management Library, as shown in Figure 4.11-3. In addition to supporting domestic Daoxiang and Siwei formats, it also supports the customization of feature element data for data types, as well as the creation, editing, management, sharing and application of data types. For details on creation and editing, see Figures 4.11-4 and 4.11-5.

Click  to enter the Power Line Library, as shown in Figure 4.11-6. Click  to enter the Power Line Library Management, as shown in Figure 4.12-7. Here, you can create, import, edit and delete power lines.

Click  to enter the bisector stakeout, as shown in Figure 4.11-8 and 4.11-9, and stake out the bisector of the power line tower foundation.

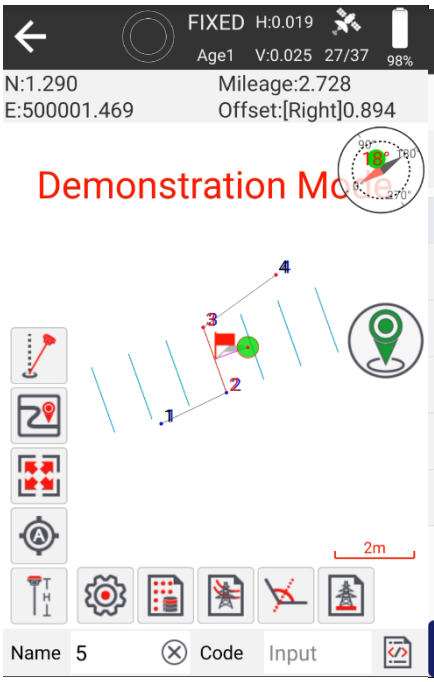


Figure 4.11-1

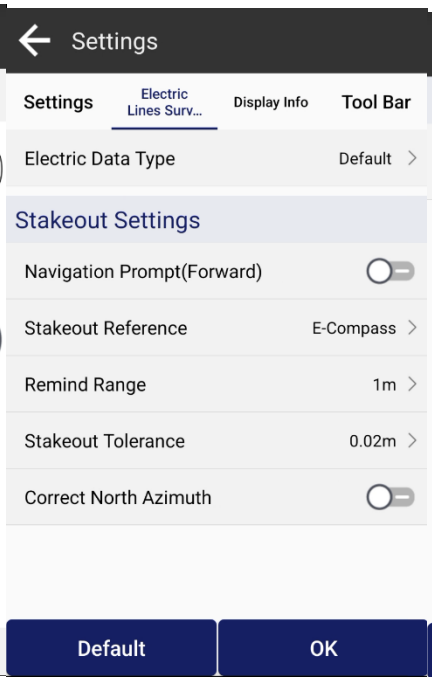


Figure 4.11-2

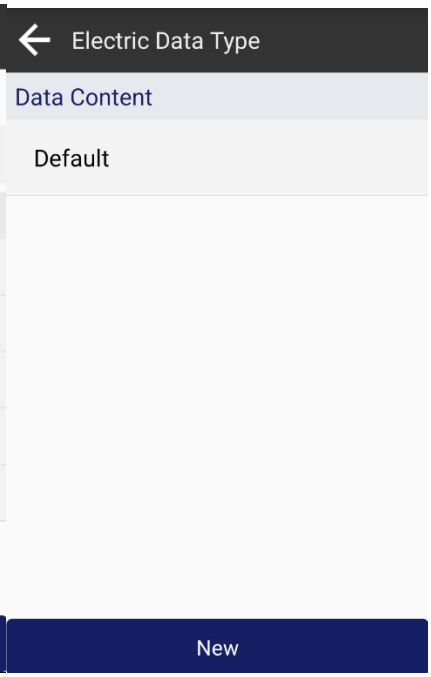


Figure 4.11-3

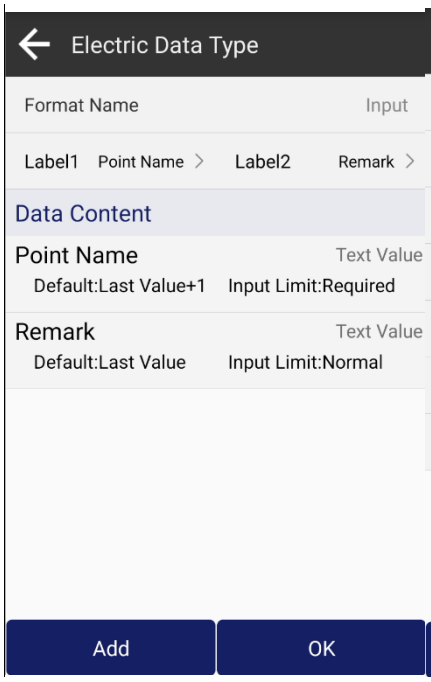


Figure 4.11-4

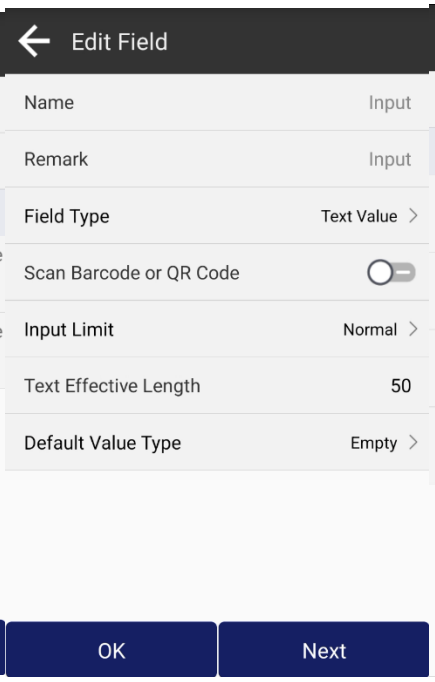


Figure 4.11-5

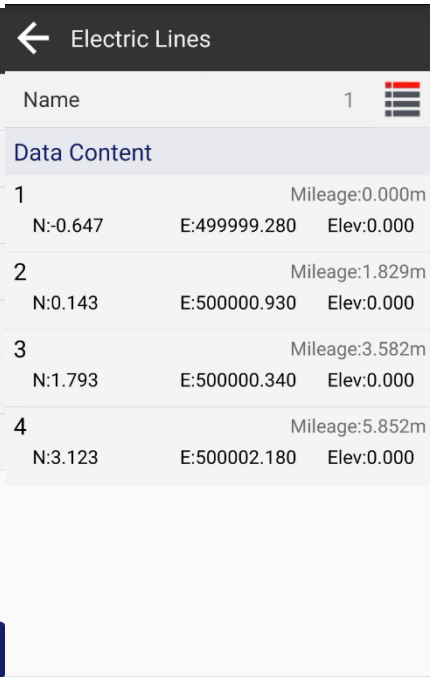


Figure 4.11-6

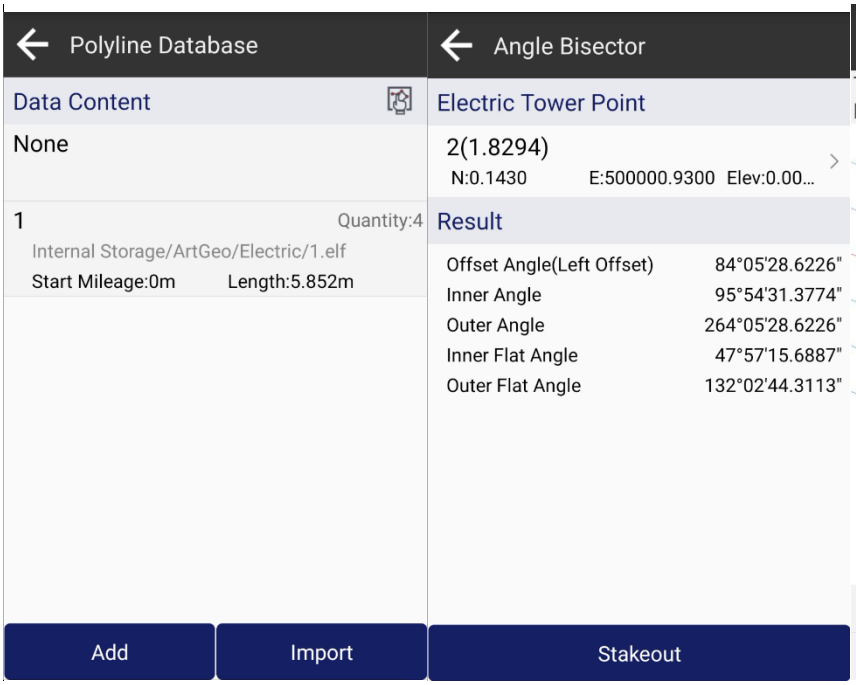


Figure 4.11-7

Figure 4.11-8

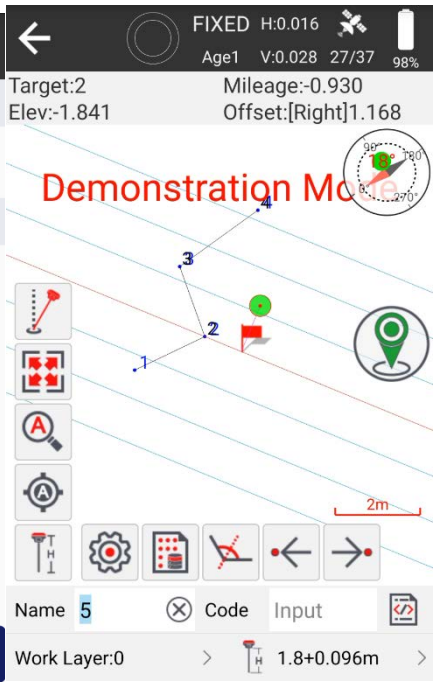


Figure 4.11-9

4.12 Spiral Stakeout

Click 【Measurement】 -> 【Curve Stakeout】 to enter the Curve Library interface, as shown in Figure 4.12-1. The curve stakeout function involves inputting pre-designed curves into the Curve Library and conducting on-site stakeout of the curves. It allows for real-time stakeout of curve-related data such as mileage, offset, and height difference. Alternatively, the curve can be divided into points at specific intervals to perform point-by-point stakeout of the points on the curve.

For Curve Library Management, you can add or delete data, and create new curves (as shown in Figure 4. 12-2). The supported types of new curves include circular curves (defined by deflection angle and intersection point), circular curves (defined by coordinates and radius), circular curves (defined by three points), and transition curves.

Click an item in the curve list to delete or edit the stakeout curve; then click "Stakeout" (as shown in Figure 4. 12-3). Here, you can set the stakeout mode to either "line-based stakeout" or "point-by-point stakeout". If the point-by-point mode is selected, you need to configure the calculation method (either by station number or by full station interval), set the distance interval, and specify whether to automatically stake out the nearest point.

Click "Confirm" to enter the Curve Stakeout interface (as shown in Figure 4. 12-4). Through the menu, you can perform operations such as staking out the previous point, the next point, and adding additional stakes.

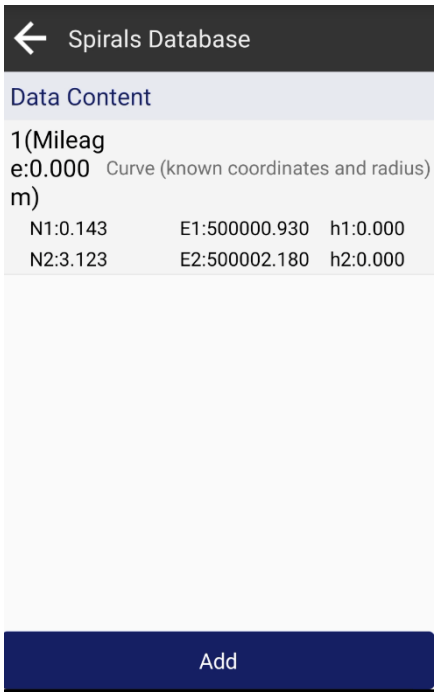


Figure 4. 12-1

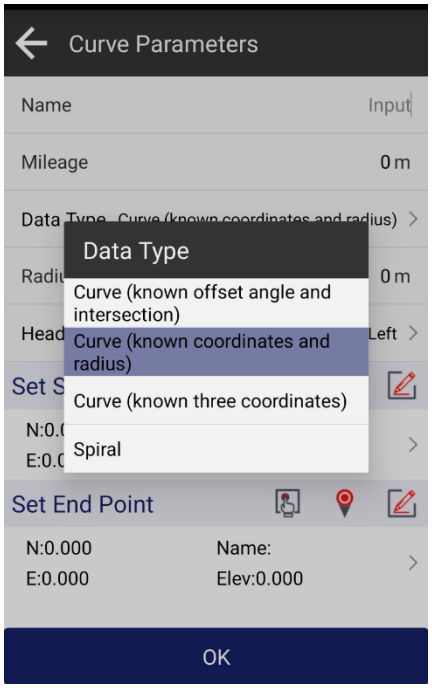


Figure 4. 12-2

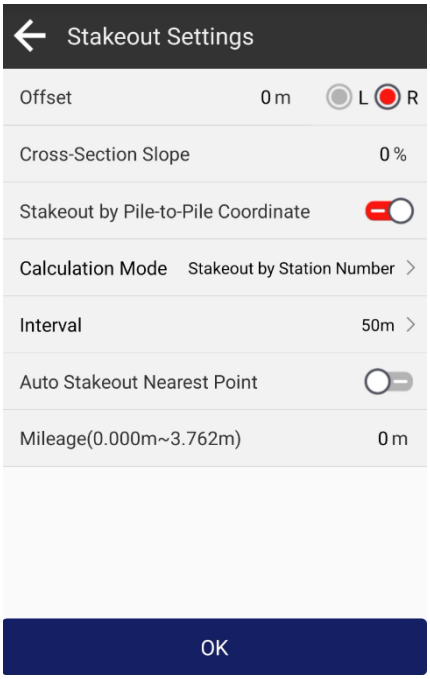


Figure 4. 12-3

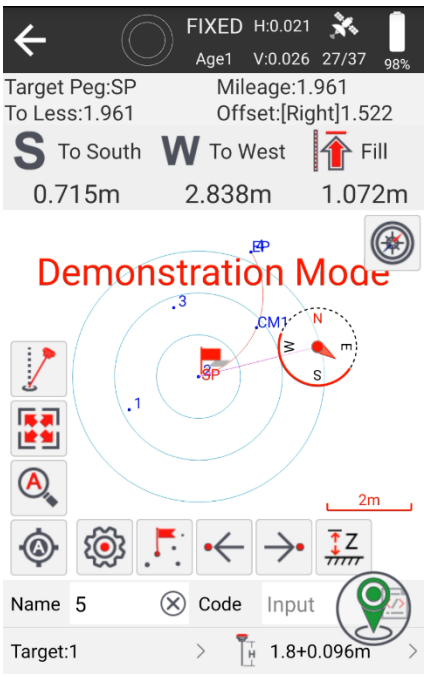


Figure 4. 12-4

4.13 Polyline Survey

The polyline measurement function is the same as the polyline measurement function in CAD. Click 【Measurement】 -> 【Polyline Measurement】, then click 【Collect】 to start collecting

the first polyline point, as shown in Figure 4.13-1. Click 【Collect】 again to collect points one by one to form the points on the polyline. Can also manually select known points on the map. When the collection of polyline points is completed, click  and enter the line name and code, as shown in Figure 4.13-2. All the collected polyline points will be automatically connected on the map to form a polyline, as shown in Figure 4.13-3

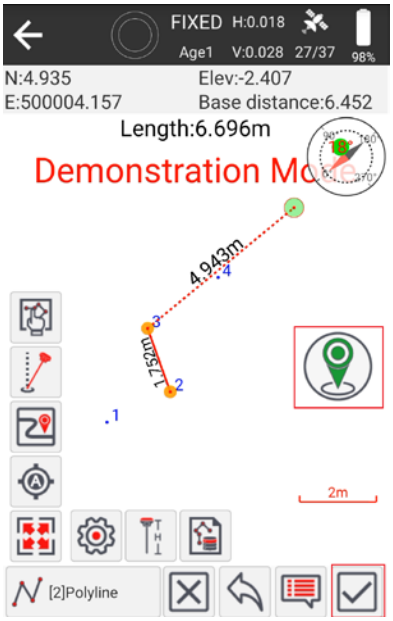


Figure 4.13-1

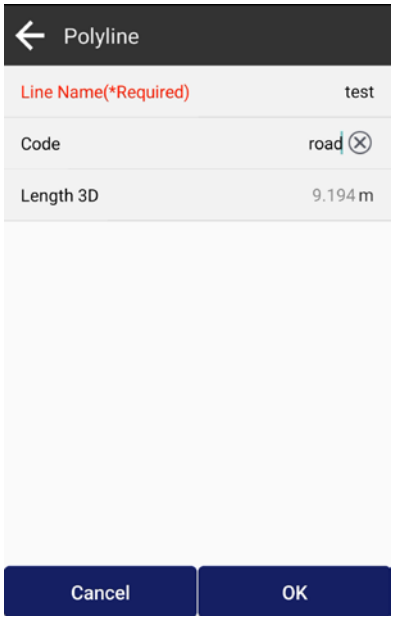


Figure 4.13-2

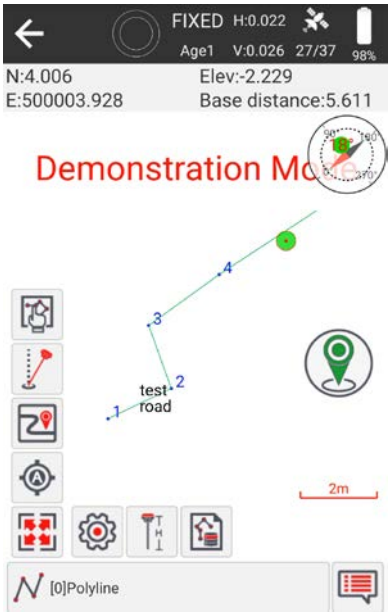


Figure 4.13-3

Click  to check Polyline. as shown in Figure 4.13-4, clicking on a polyline allows you to delete it, continue its measurement, or view the polyline's feature information. As shown in Figure 4.14-5, "Continue Measurement" enables you to keep collecting points to form the polyline. Click 【Export】, as illustrated in Figure 4.13-6, to export the polyline data in a specific format to a designated path.

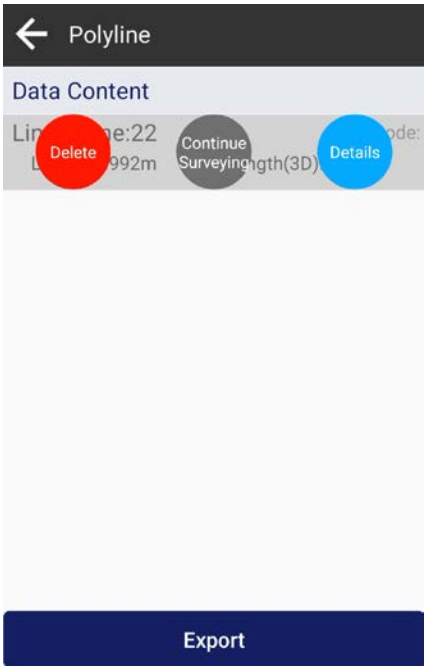


Figure 4.13-4

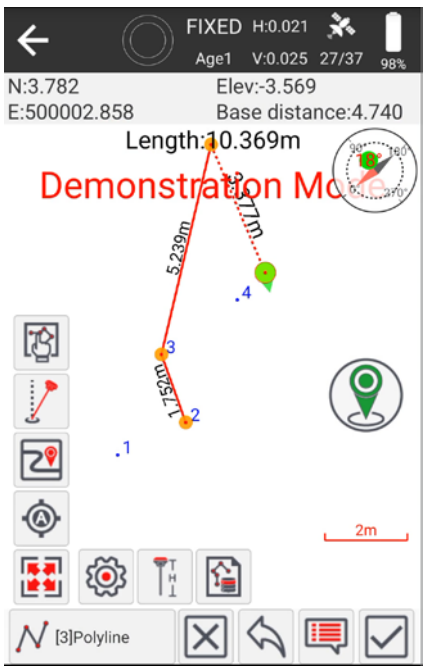


Figure 4.13-5

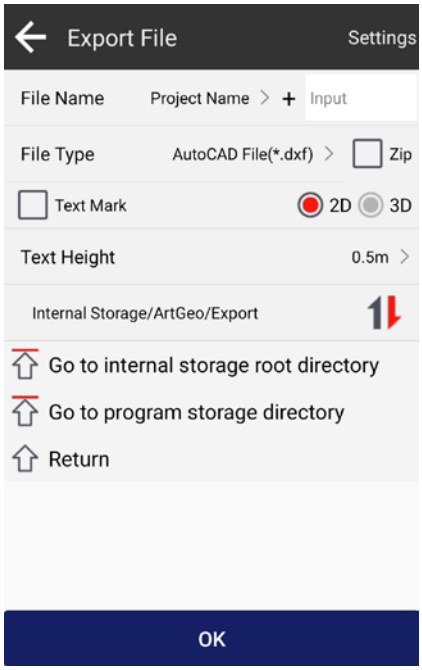


Figure 4.13-6

4.14 Polygon Survey

Click 【Measurement】 — 【Polygon Survey】. You can collect an area file based on the terrain, and the software will automatically calculate the area of this area. The point selection mode can be either real-time collection or on-map point selection, as shown in Figure 4.14-1. After collection, click  to complete the area construction, and you need to enter the area name, as shown in Figure 4.14-2.

Click 【 】 to select a specific area to view its detailed information, and you can also continue the measurement, as shown in Figure 4.14-3.

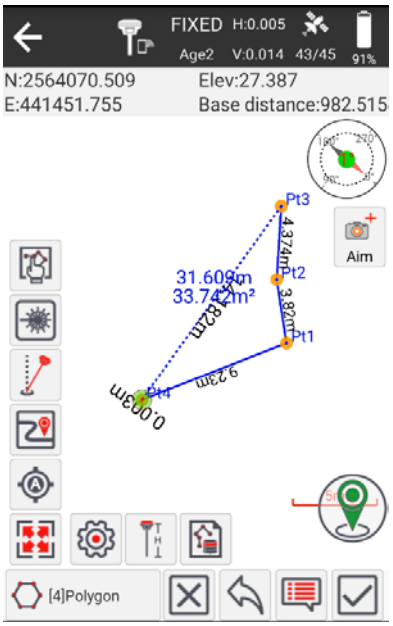


Figure 4.14-1

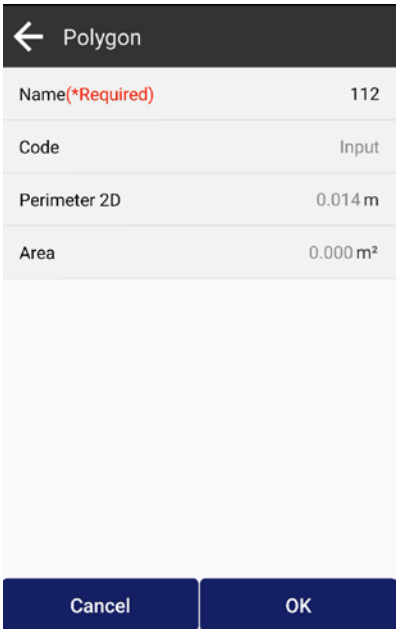


Figure 4.14-2

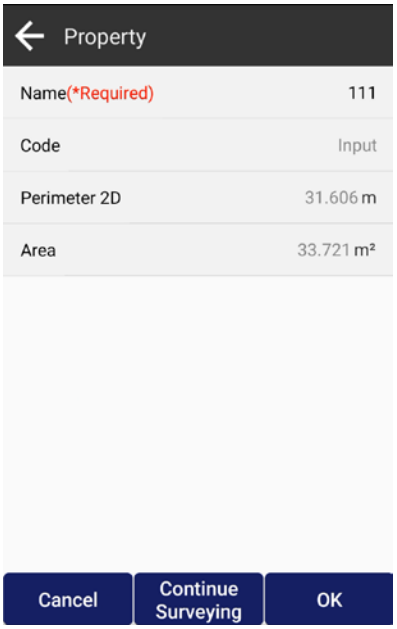


Figure 4.14-3

4.15 Electric Towers Stakeout

Click 【Measurement】 -> 【Electric Towers Stakeout】, as shown in Figure 4.15-1. This function is used to perform stakeout on the tower base line of the tower foundation points of a power line. Select the tower foundation that needs to be staked out, set the tower foundation parameters, and calculate the tower foundation points. It supports two calculation methods: four-section and eight-section. Enter the length and width of the tower foundation, as shown in Figure 4.15-2. Select the tower foundation point and click 【Stakeout】, as shown in Figure 4.15-3.

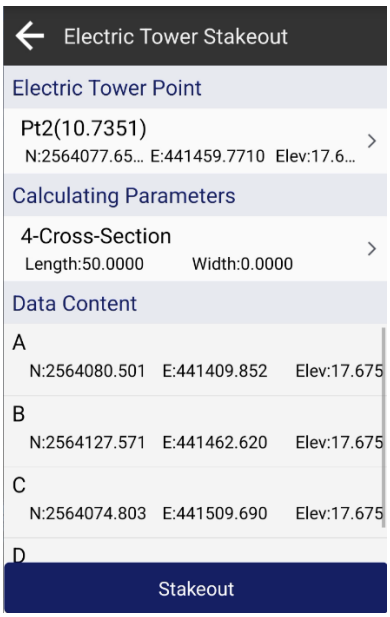


Figure 4.15-1

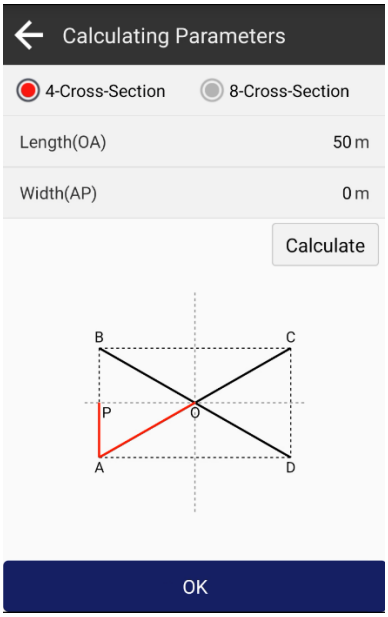


Figure 4.15-2

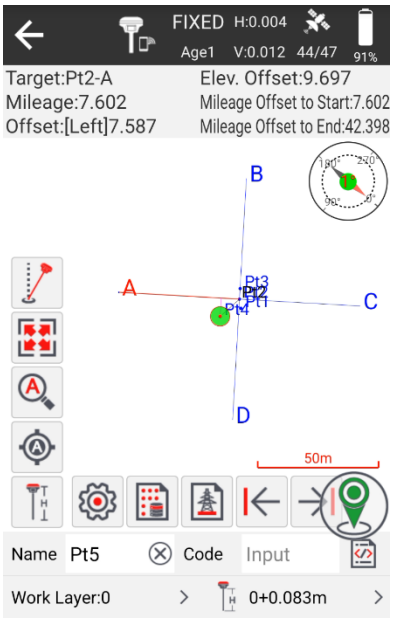
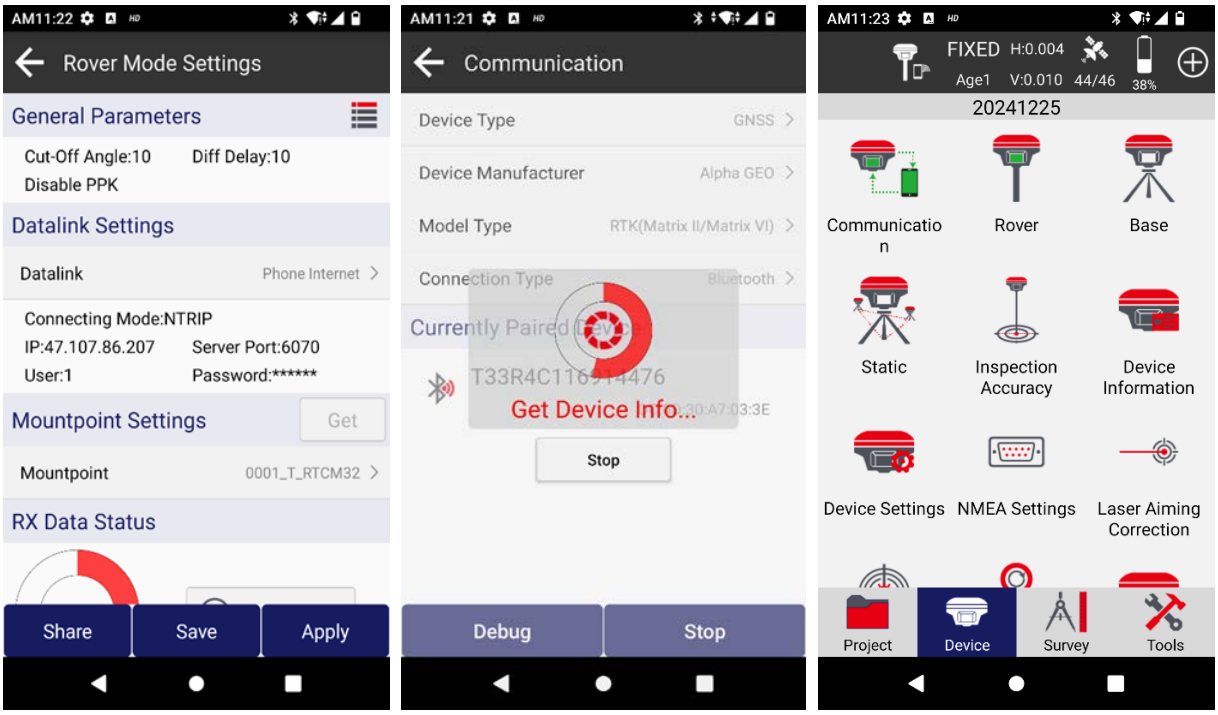


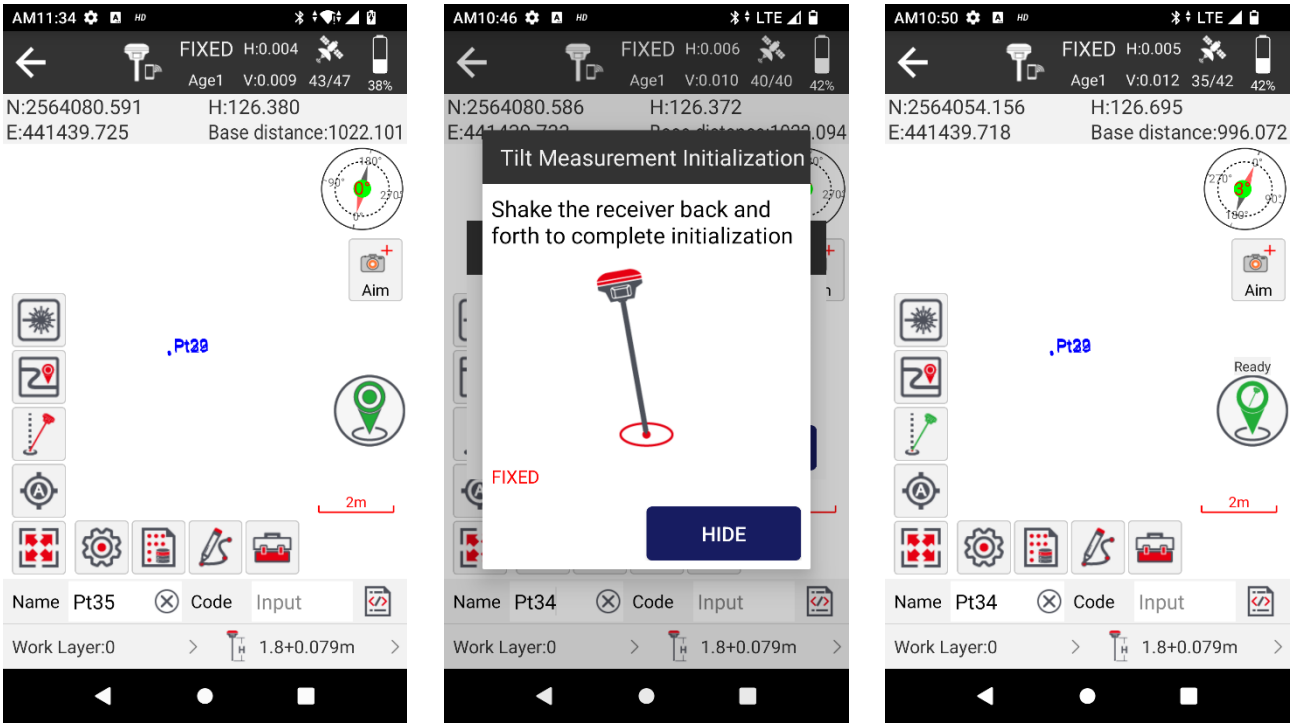
Figure 4.15-3

4.16 Laser Measurement

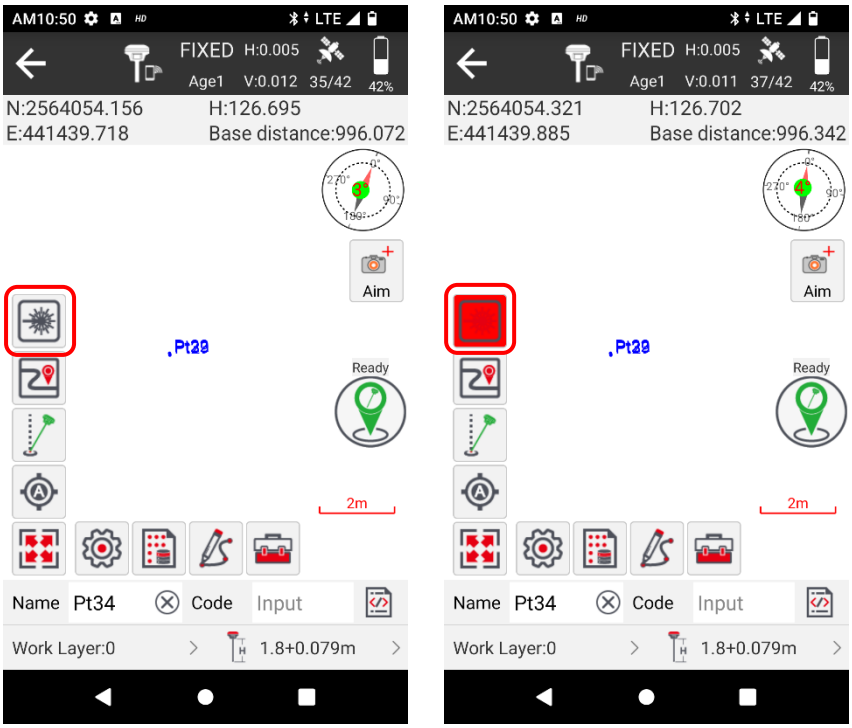
1) Establish Bluetooth between controller and receiver, then configure the resource parameters for Matrix VI, as long as it achieves fixed solution, go to next step.



2) Go to “Survey” → “Point Survey” interface, enter correct antenna height, and enable tilt sensor (IMU), there will be a pop-up dialog to ask you to initialize IMU, walk for 3~5 meters or shake receiver to initialize IMU, after the initialization completed, the collection button will turn to green, as shown in the pictures below.

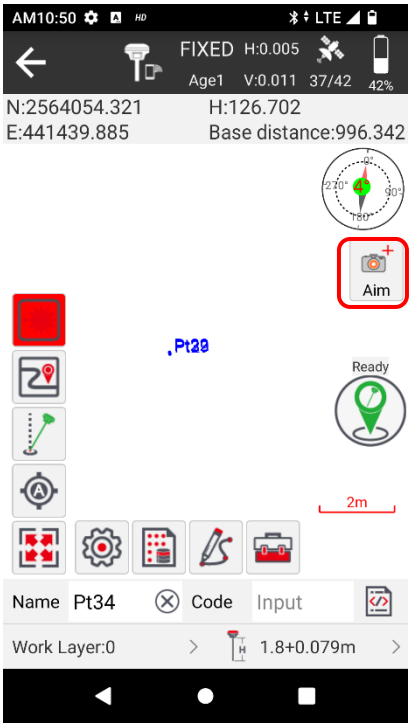


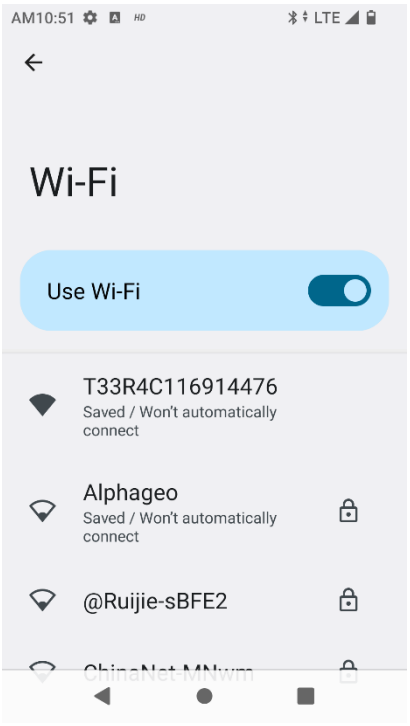
3) Click on the laser button to turn on laser, find the laser spot and aim at the target point, click collection button to save a laser measurement coordinate.

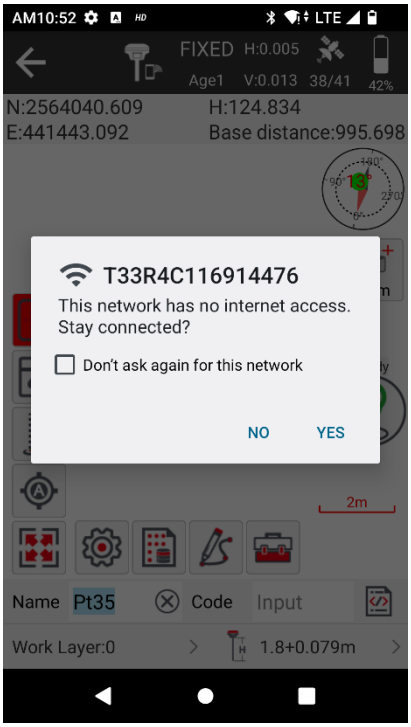


4) If the laser spot is not so clear outside sometimes, using the float window with the help of camera. Click icon at the right side of interface, while the receiver WiFi is not connected, software will jump to system WiFi setting interface, requires the WiFi connection between controller and receiver, after the WiFi is connected, a pop-up dialog with the reminding message says “This network has no internet

access, stay connected?", click "YES" to keep the connection.

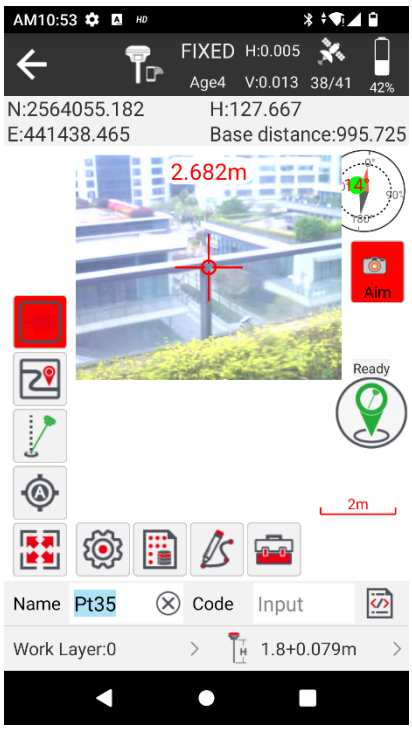






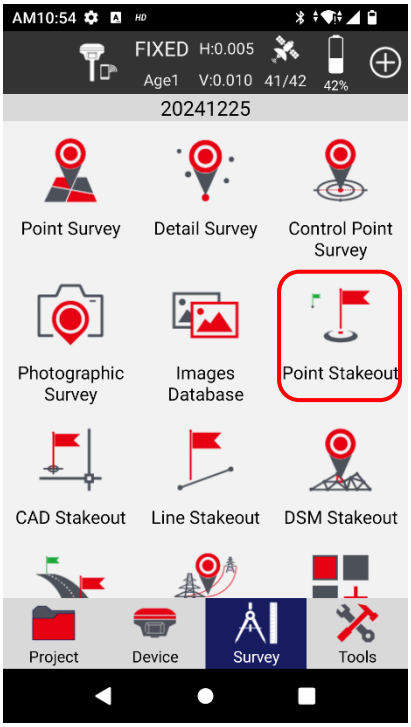
5) Return to "Point Survey" interface, click the float window icon again, appears the camera image on the screen, aim at the red cross to a target point and click collection button to save a laser coordinate.

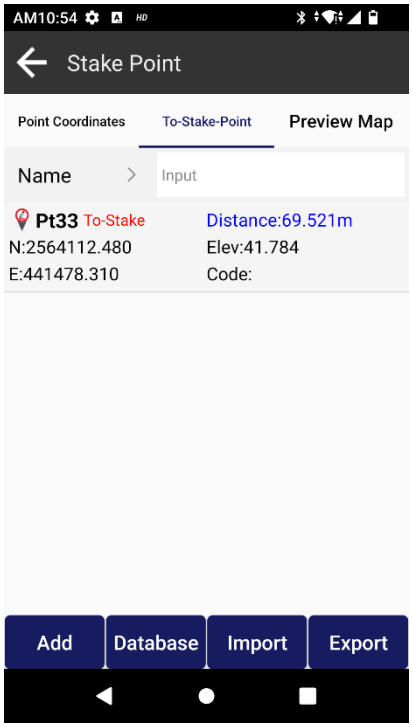
6) If the laser spot is not at the center of cross, go to "Device" menu, and click "Laser Aiming Correction", there will be camera image appears on the screen, align the laser spot to the cross center by the help of arrows or navigation keys.

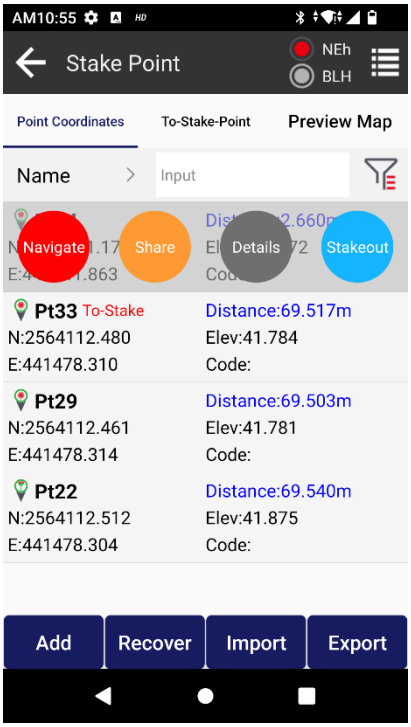


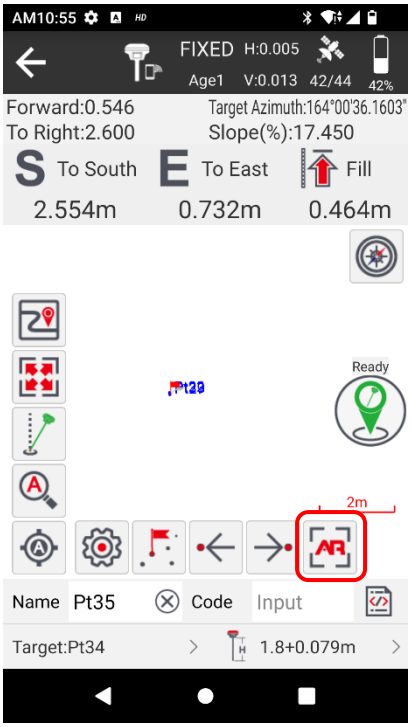
4.17AR Stakeout

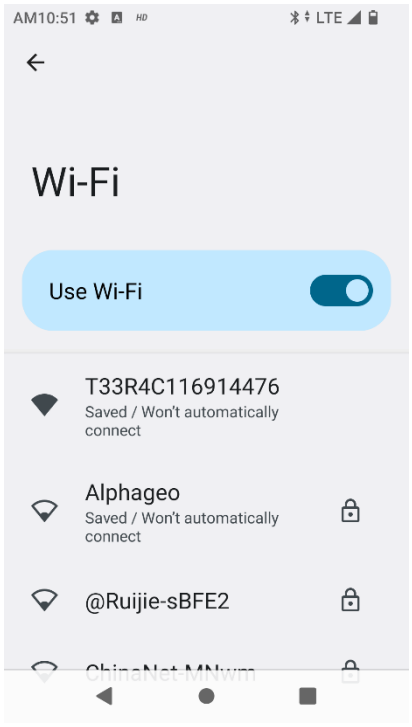
a) Go to “Point Stakeout” in “Survey” menu, choose the coordinate in the stakeout point list, or in the point library, then click the stakeout button to go to stakeout interface, click “AR” button and software will jump to the system WiFi setting and require the WiFi connection between controller and receiver, after the WiFi is connected, a pop-up dialog with the reminding message says “This network has no internet access, stay connected?”, click “YES” to keep the connection. (If the wifi was connected, software will skip this step).

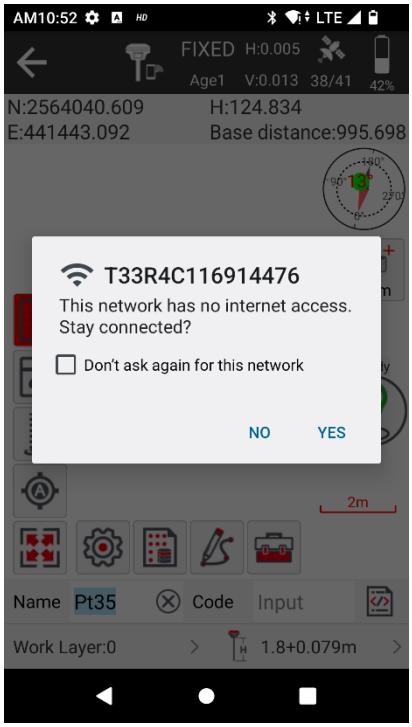




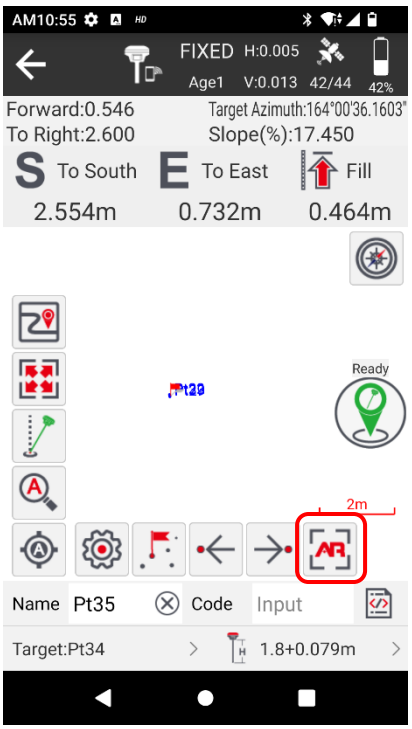


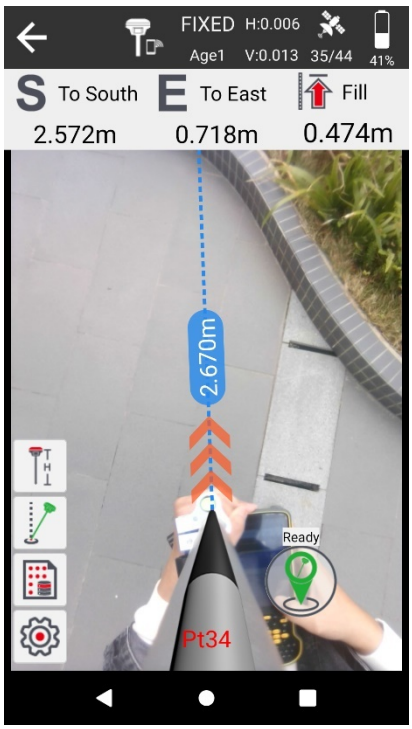






b) Return to stakeout interface, click “AR” button again, the camera image will appear on interface, go to the target stakeout point following the guide line in real scene.







Chapter V Tools

On the main interface, click Tools, as shown in Figure 5-1. The tools include coordinate conversion, Angle conversion, perimeter area calculation, calculator and other common measurement tools.

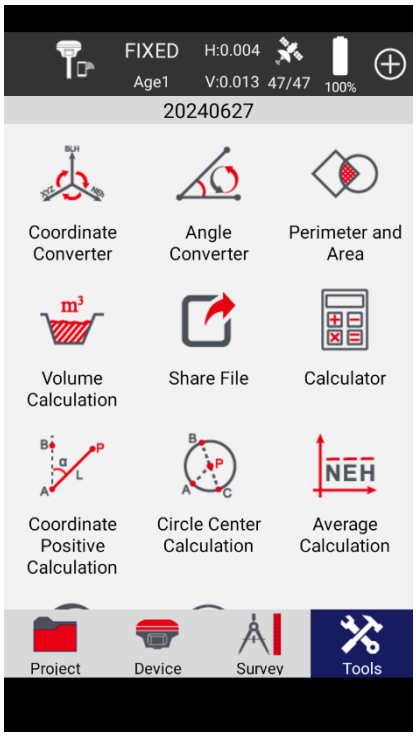


Figure 5-1

5.1 Coordinate Converter

Click [Tools] -> [Coordinate Converter], as shown in Figure 5.1-1, 5.1-2 and 5.1-3. The coordinate system parameters set by the current project are used to convert the coordinates of plane, geodetic and space.

Click on the icon , you can select a point from the point library to perform the calculation transformation, and you can save the calculation point to the point library.

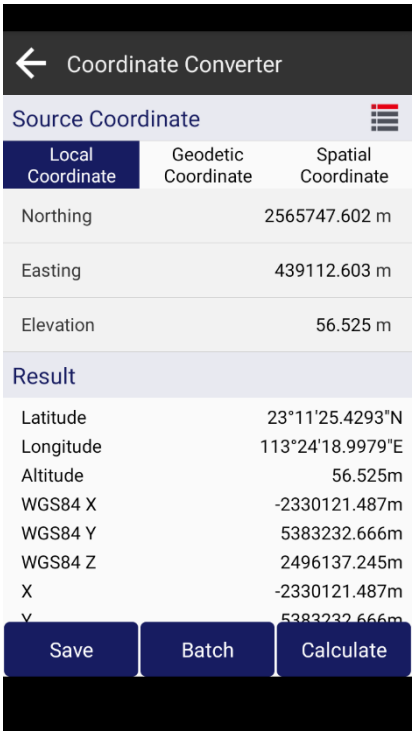


Figure 5.1

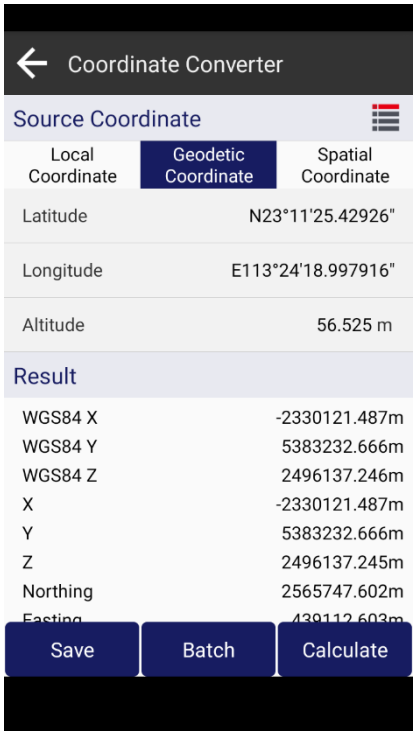


Figure 5.1 2

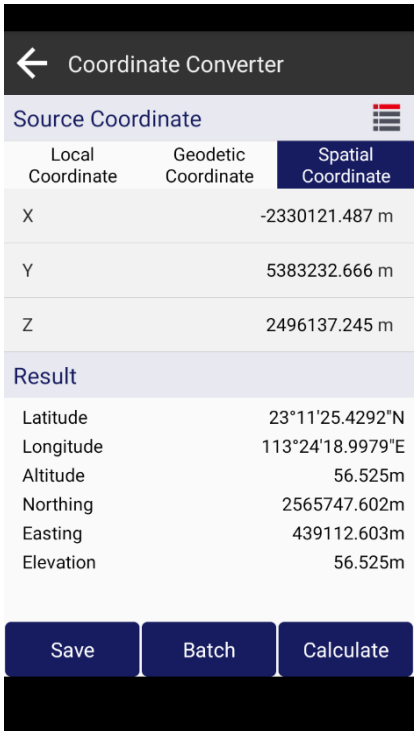


Figure 5.1-3

5.2 Angle Converter

Click [Tools] -> [Angle Converter], as shown in Figure 5.2-1. Through the function of degree, degree minute second, radian and other Angle display formats before the transformation, select input one of the formats, calculate the value of the other formats.

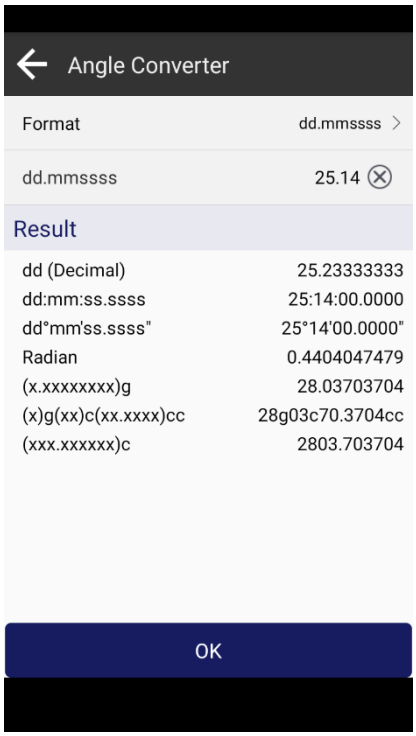


Figure 5.2-1

5.3 Perimeter and Area

Click [Tools] -> [Perimeter and Area], as shown in Figure 5.3-1. You can add and delete coordinate points, import and export coordinate points, and view the block graph in the preview view, as shown in Figure 5.3-2. Click to calculate, as shown in Figure 5.3-3.

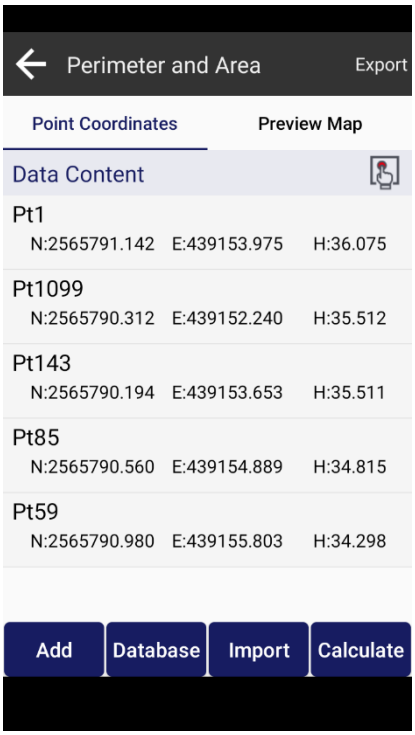


Figure 5.3-1

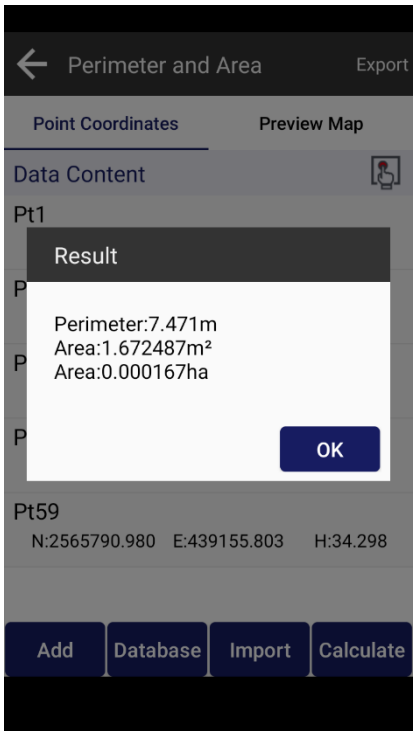


Figure 5.3-2

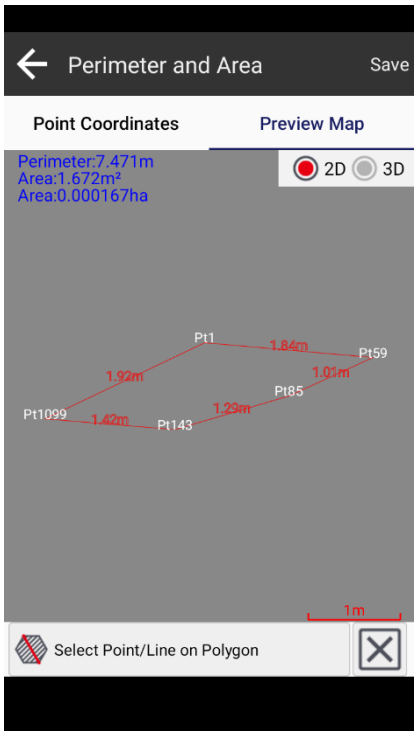


Figure 5.3-3

5.4 Volume Calculation

Click "Tools" -> "Volume Calculation", as shown in Figure 5.4-1. To calculate the volume for the area you want.



Figure 5.4-1

5.5 Calculator

Click "Tools" -> "Calculator", as shown in Figure 5.5-1. Do some simple math.



Figure 5.5-1

5.6 Post-Measure Correction

Click "Tools" -> "Post-Measure Correction", as shown in Figure 5.5-1. To correct the coordinates after finishing the daytime job while the base coordinate is incorrect as you found, calibrate the base coordinate and correct the coordinates.

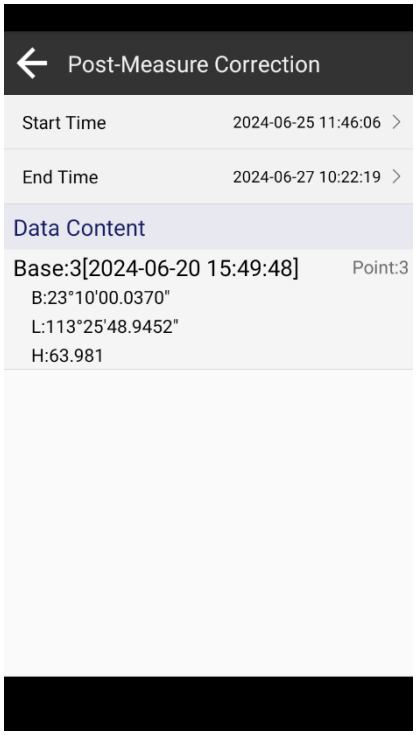


Figure 5.6-1

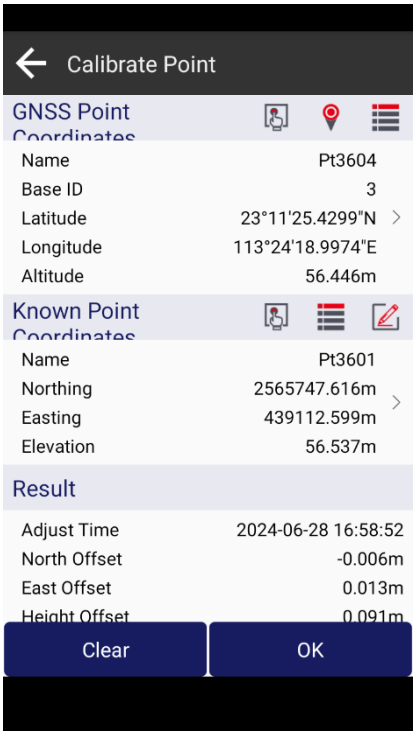


Figure 5.6-2

5.7 Share File

Click 【Tools】 -> 【Share File】, as shown in Figure 5.7-1. Select the file(s) you need to share and share them. After the sharing is completed, the interface will be as shown in Figure 5.7-2. Other handsets can obtain the shared file(s) by entering the sharing code or scanning the QR code on the software's home screen, as shown in Figure 5.7-3.

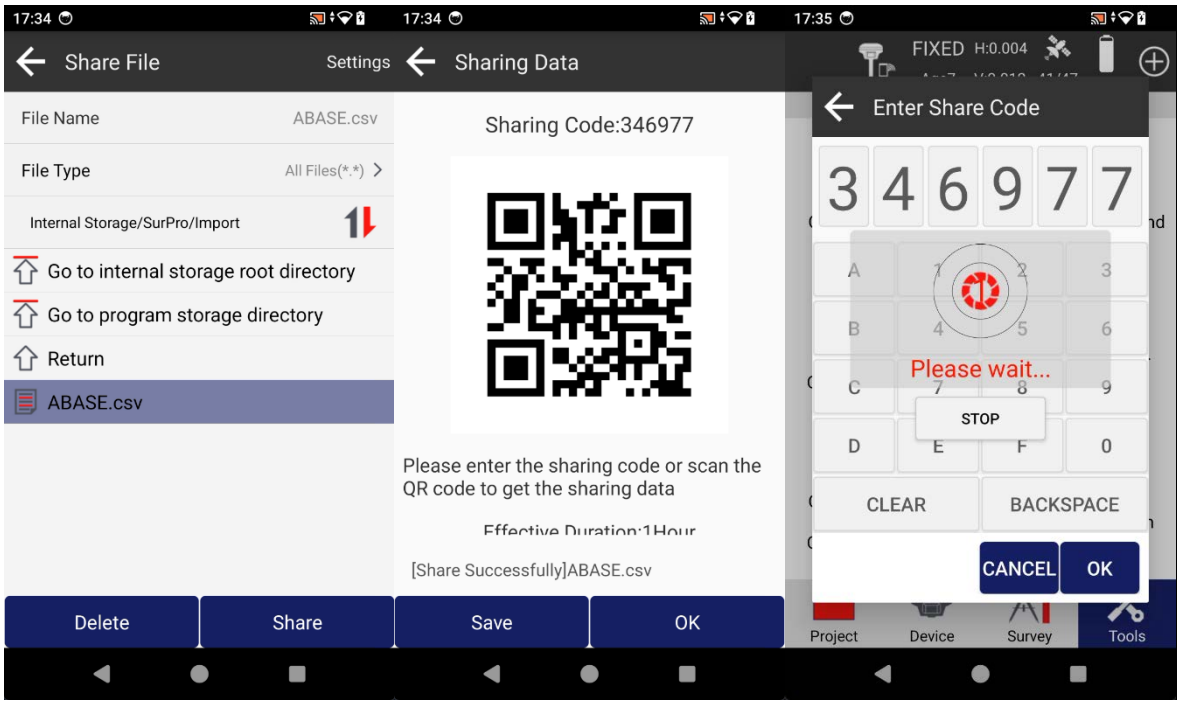


Figure 5.7-1 Figure 5.7-2 Figure 5.7-3

5.8 Coordinate Positive Calculation

Click 【Tools】 -> 【Coordinate Positive Calculation】, as shown in Figure 5.8-1. Input/select the known point A and the azimuth reference point B, enter the distance length L and the deflection angle, calculate the offset point, and save the result to the point library, as shown in Figure 5.8-2.

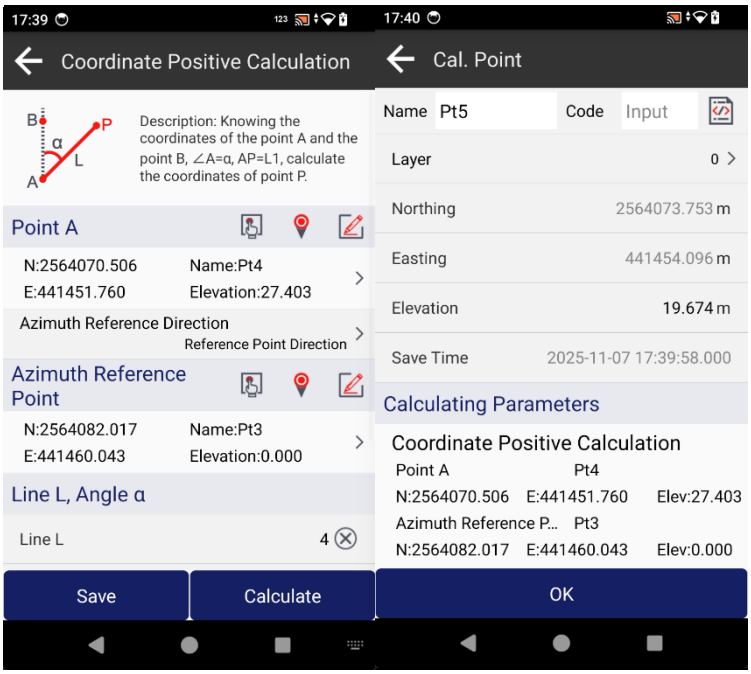


Figure 5.8-1 Figure 5.8-2

5.9 Circle Center Calculation

Click 【Tools】 -> 【Center Center Calculation】, as shown in Figure 5.9-1. Input/select three existing points and calculate the center point of these three points.

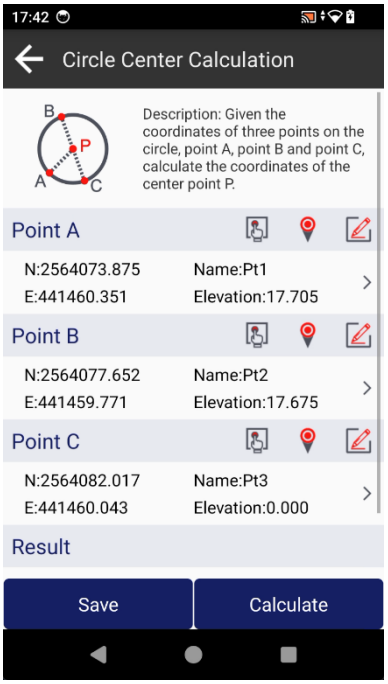


Figure 5.9-1

5.10 Average Calculation

Click 【Tools】 -> 【Average Calculation】, as shown in Figure 5.10-1. This function can calculate the average value of N points and save the result to the point library, as shown in Figure 5.10-2.

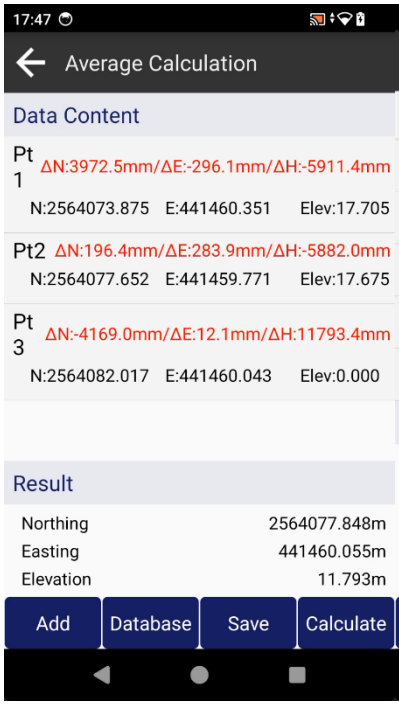


Figure 5.10-1

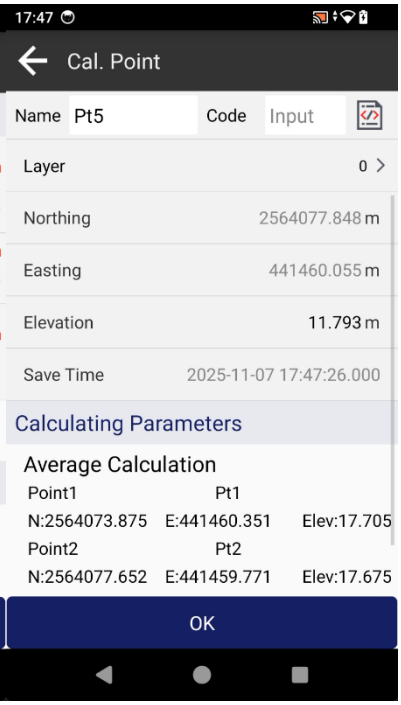


Figure 5.10-2

5.11 Vector

Click 【Tools】 -> 【Vector】, as shown in Figure 5.11-1. Input/select two existing points and calculate the spatial distance.

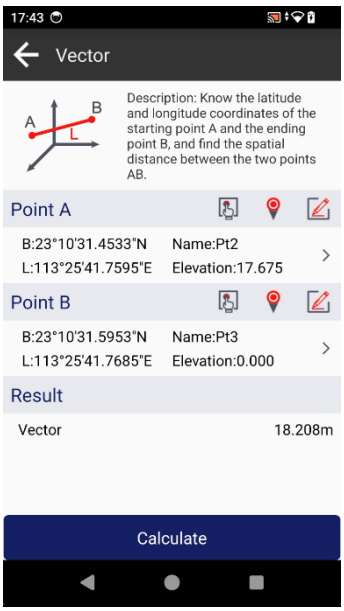


Figure 5.11-1

5.12 Coordinate Inverse Calculation

Click 【Tools】 -> 【Coordinate Inverse Calculation】, as shown in Figure 5.9-1. Input/select the known points A and B, and calculate the distance, azimuth, slope ratio, etc., between the two points.

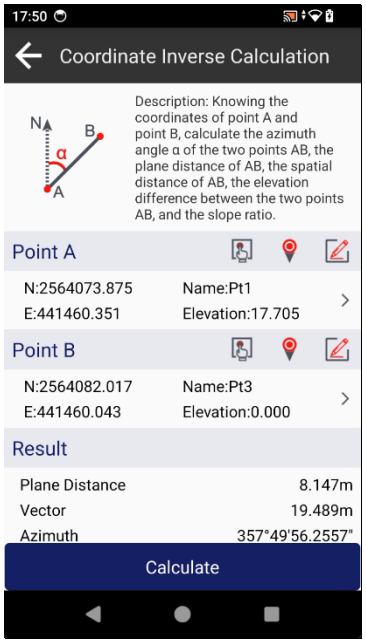


Figure 5.12-1

5.13 Point Line Calculation

Click 【Tools】 -> 【Point-Line Calculation】, as shown in Figure 5.13-1.、Figure 5.13-2.Input/select three known points, and calculate parameters such as the distance between points, perpendicular distance, deflection angle, and turning angle.

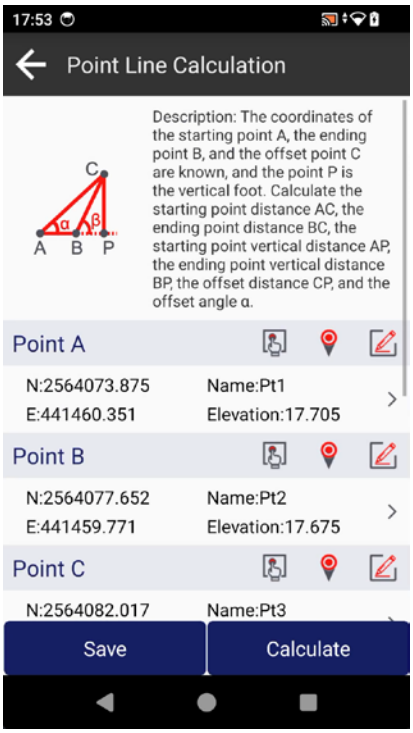


Figure 5.13-1

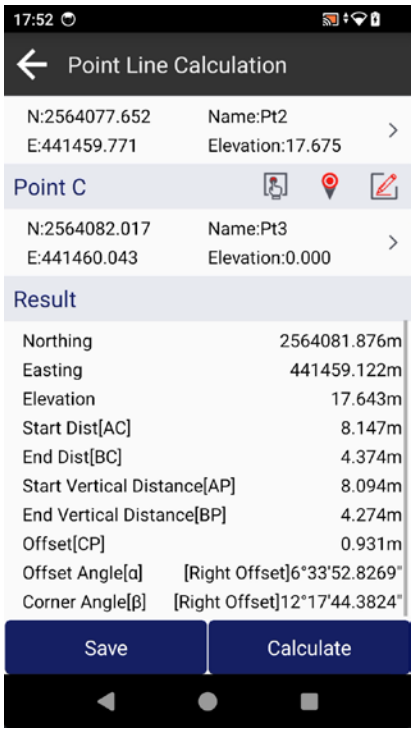


Figure 5.13-2

5.14 Angle Calculation

Click 【Tools】 -> 【Angle Calculation】, as shown in Figure 5.14-1, Figure 5.14-2.

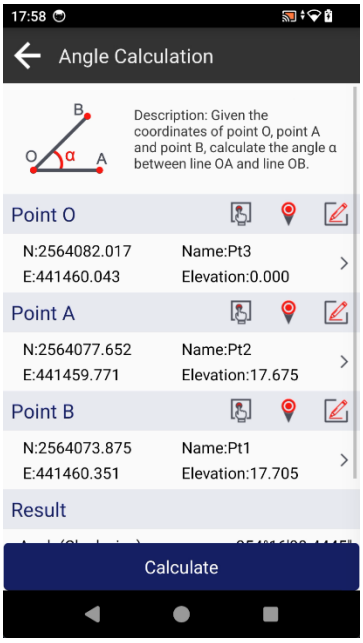


Figure 5.14-1

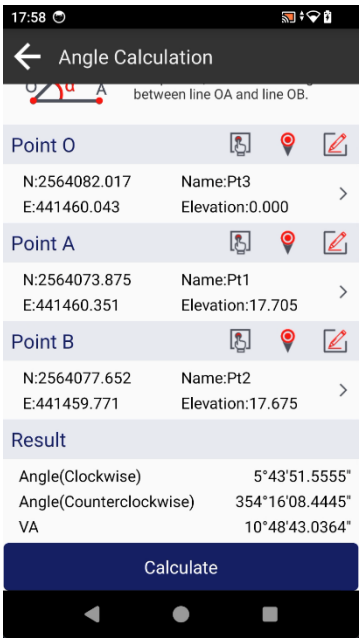


Figure 5.14-2

5.15 Intersection Calculation

Click 【Tools】 -> 【Intersection Calculation】, as shown in Figure 5.15-1. Calculate the intersection point of two lines and save the result to the point library, as shown in Figure 5.15-2.

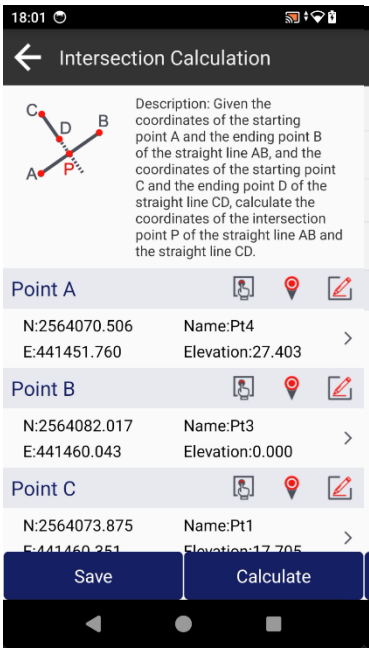


Figure 5.15-1

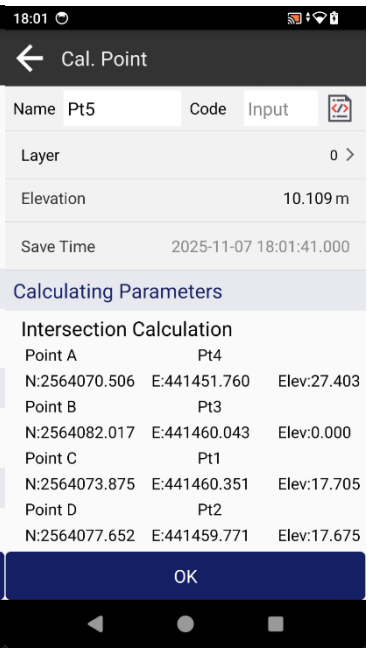


Figure 5.15-2

5.16 Resection

Click 【Tools】 -> 【Resection】, as shown in Figure 5.16-1. With two known points and their respective distances to the target point, calculate the target point and save the result to the point library, as shown in Figure 5.16-2.

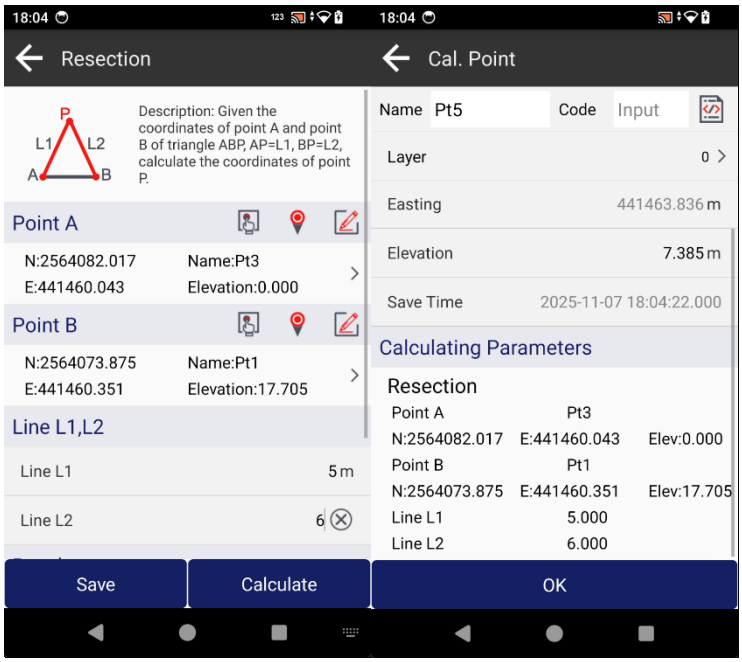


Figure 5.16-1 Figure 5.16-2

5.17 Forward Intersection

Click 【Tools】 -> 【Forward Intersection】, as shown in Figure 5.17-1. With two known points and the included angle between them (relative to the target point), calculate the target point and save the result to the point library, as shown in Figure 5.17-2.

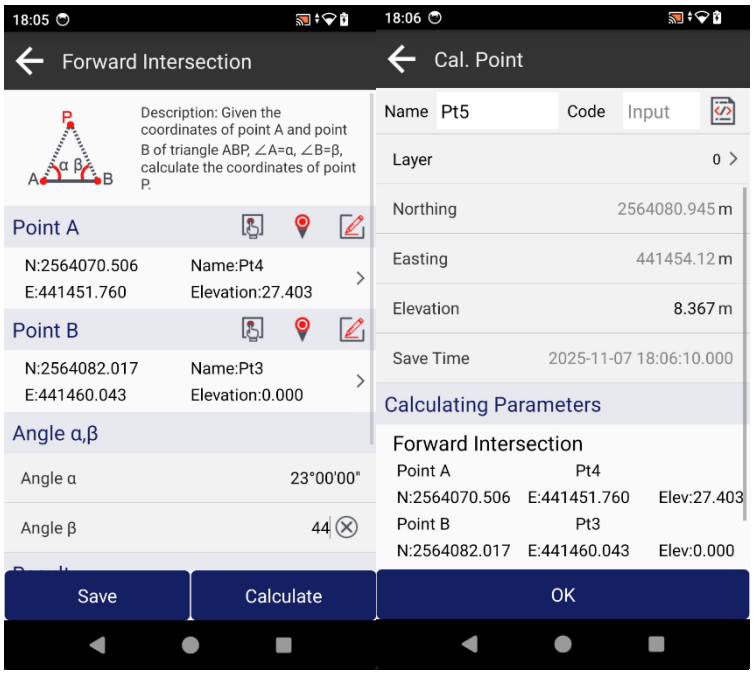


Figure 5.17-1 Figure 5.17-2

5.18 Offset Point Calculation

Click 【Tools】 -> 【Offset Point Calculation】, as shown in Figure 5.18-1. With two known points, calculate the coordinate position corresponding to the specified mileage and offset, and save the result to the point library, as shown in Figure 5.18-2.

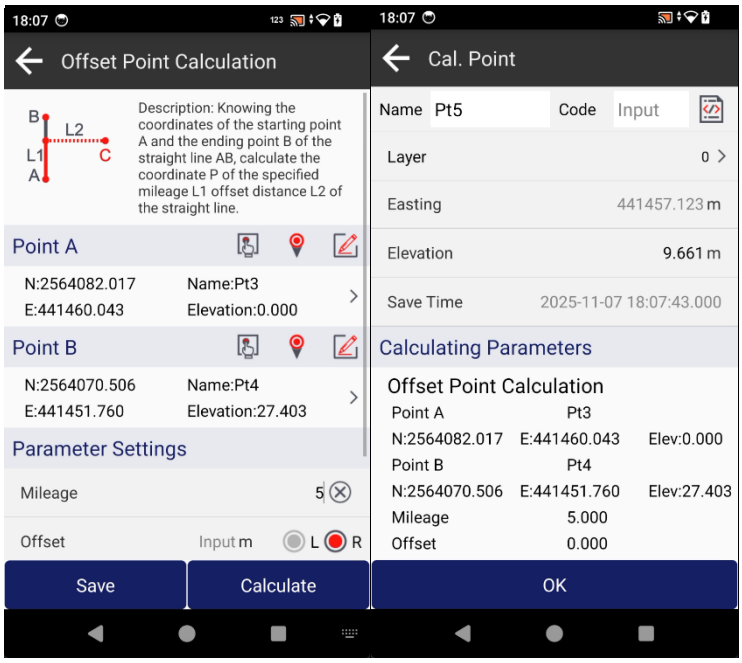


Figure 5. 18-1 Figure 5. 18-2

5.19 Extend Point Calculation

Click 【Tools】 -> 【Extended Point Calculation】, as shown in Figure 5.19-1. Input two known points, calculate the point on the extended line of the segment formed by these two points, and save the result to the point library, as shown in Figure 5.19-2.

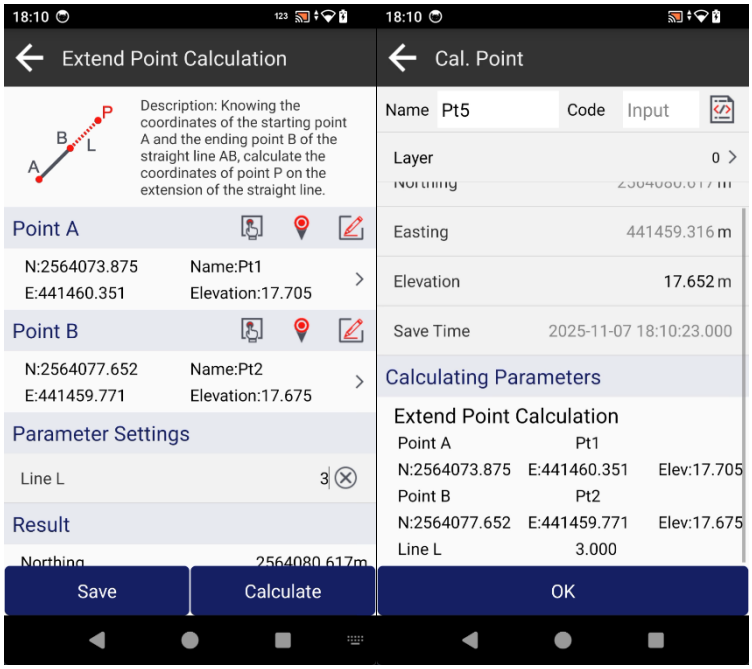


Figure 5.19-1 Figure 5.19-2

5.20 Equal Point Calculation

Click 【Tools】 -> 【Equal Point Calculation】, as shown in Figure 5.20-1. Input two existing points, calculate the equally divided points of the line segment formed by these two points, and save each equally divided point to the point library, as shown in Figure 5.20-2.

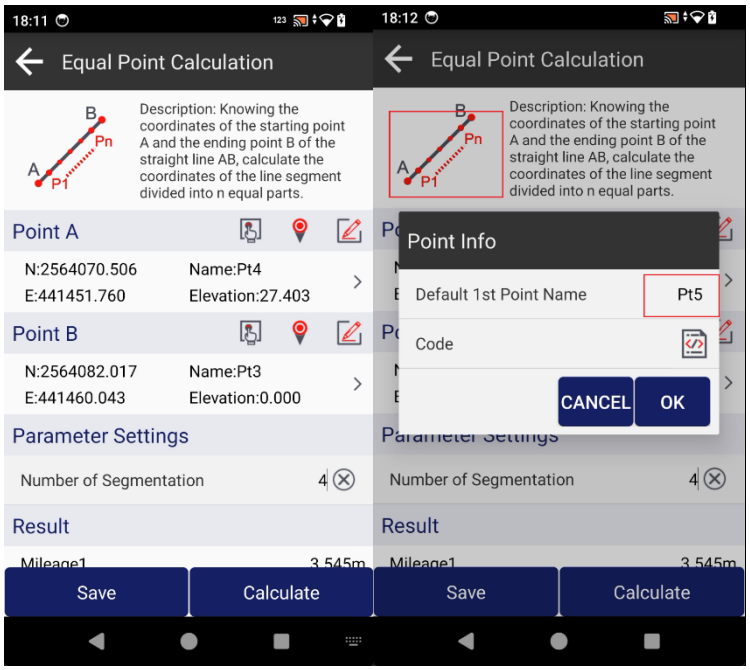


Figure 5.20-1 Figure 5.20-2