SurPro6.0 User Manual for TPS

Contents

Chapter I SurPro6.0 Software Overview

1.1 Software Introduction

SurPro6.0 software , developed by GUANGZHOU ALPHA GEO-INFO CO.,LTD. , is an engineering surveying application software based on Total Station Measurement applications. 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.

It sets the position of the total station as a known reference coordinate through known point orientation and free station setting, and then uses the angle and distance measurement functions of the total station to calculate the coordinate of the total station's measurement position. It uses the measurement result coordinates for point survey, multi-round survey, angle ccentricit, distance eccentricit, plane eccentricity, cylindrical eccentricity, remote heigh, point and line stakeout, road design and stakeout, CAD stakeout, electric lines survey and easy-to-use engineering surveying application software. The software has the characteristics of simple and user-friendly operation process, powerful road design and construction stakeout functions, powerful CAD mapping functions, and convenient display of function menus for users to customize designs and so on.

The following describes the basic functions of the software: the software mainly includes four parts: Project, Device, Survey and tool.

1.1.1 Project

This part is mainly for project configuration, project data management, and software settings related operations, including Project Manager, Project File, Points Dababase, Code Library Manager, Import data, Export data, Survey Area Settings, Layers Settings, Software Settings, About Software.

1.1.2 Device

This part is mainly aimed at the operations related to connect total station and set station orientation for the device, including Communication, Station Setup & Orientation, Free Station Setup, Orientate to Line, Height Transfer, Device Settings, and other functions.

1.1.3 Survey

This part mainly utilizes the measuring coordinates of the total station for field data surveying, stakeout, and industry applications related operations, including Point Survey, TPS Survey, Multi-Round Survey, Point Stakeout, CAD Stakeout, Line Stakeout, Spiral Stakeout, DSM Stakeout, Road Design and Stakeout, Angle Eccentricity, Distance Eccentricity, Plane Eccentricity, Cylindrical Eccentricity, Remote Heigh, Electric Lines Survey, Electric Towers Stakeout, Function Customization.

1.1.4 Tools

This part is mainly related to some common practical tools for measurement field work, including Angle Converter, Perimeter and Area, Volume Calculation, Share File, Calculator, Circle Center Calculation, Average Calculation, Coordinate Positive calculation, Coordinate Inverse Calculation, Point Line Calculation, Angle Calculation, Intersection Calculation, Resection, Forward Intersection, Offset Point Calculation, Extension Point Calculation, Equal Point Calculation.

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 Total Station. Find the software installation in file Management and click to install.

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 as shown in Figure 2.1 when entering the software. Click［Project]. The project includes Project Manager, Project File, Points Dababase, Code Library Manager, Import data, Export data, Survey Area Settings, Layers Settings, Software Settings, About Software.

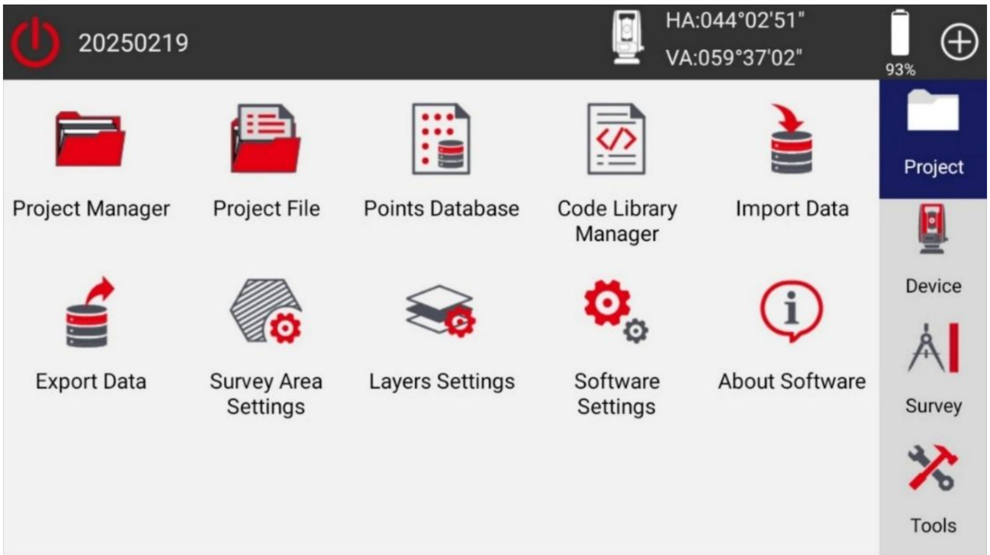


Figure 2.1

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 that, every time when you enter the software it will automatically load the project last used. 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 the "Project name.job", and other data is stored in the corresponding directory file.

2.1 Project Management

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

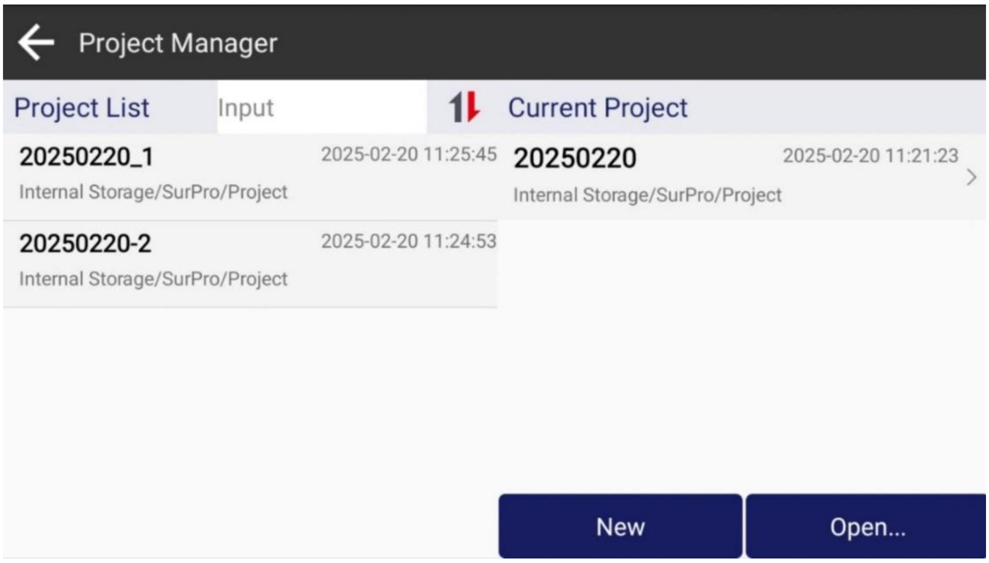
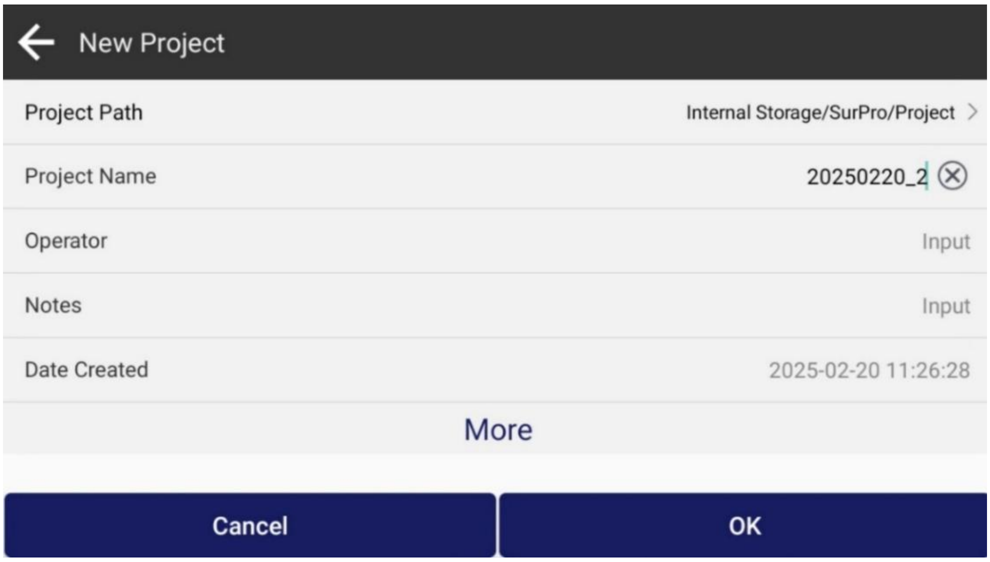


Figure 2.1-1

Click [New] as shown in Figure 2.1-1. To create a new project, you need to fill in the Project Name, Operator, Distance Unit, Angle Format, Default 1st Point Name, Notes 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 OK start the new project.



Click [Open…] as shown in Figure 2.1-1 to open an existing project.

Click the project shown in the list, and the functions of “Remove”, “Share” and “Open” will appear, as shown in Figure 2.1-2.

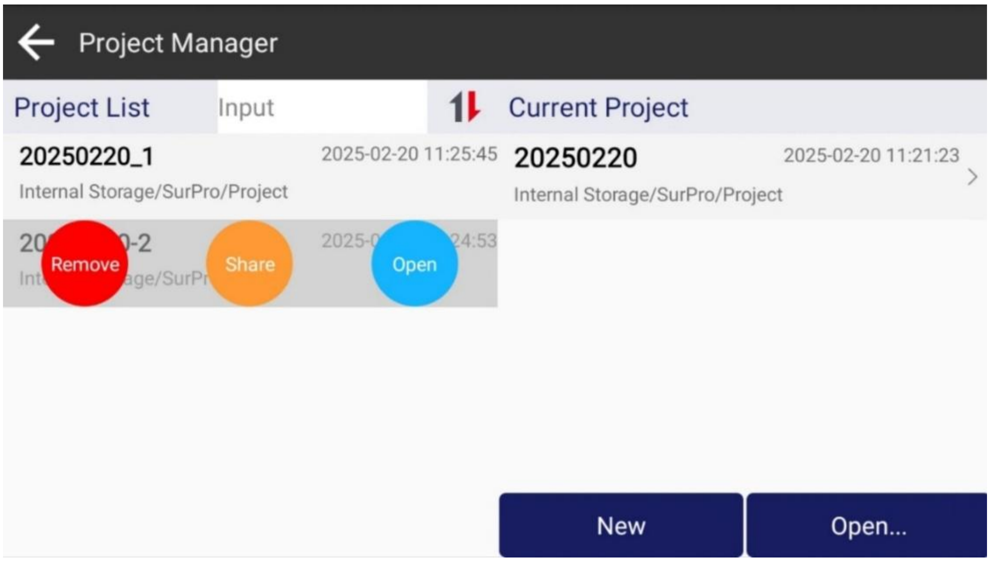
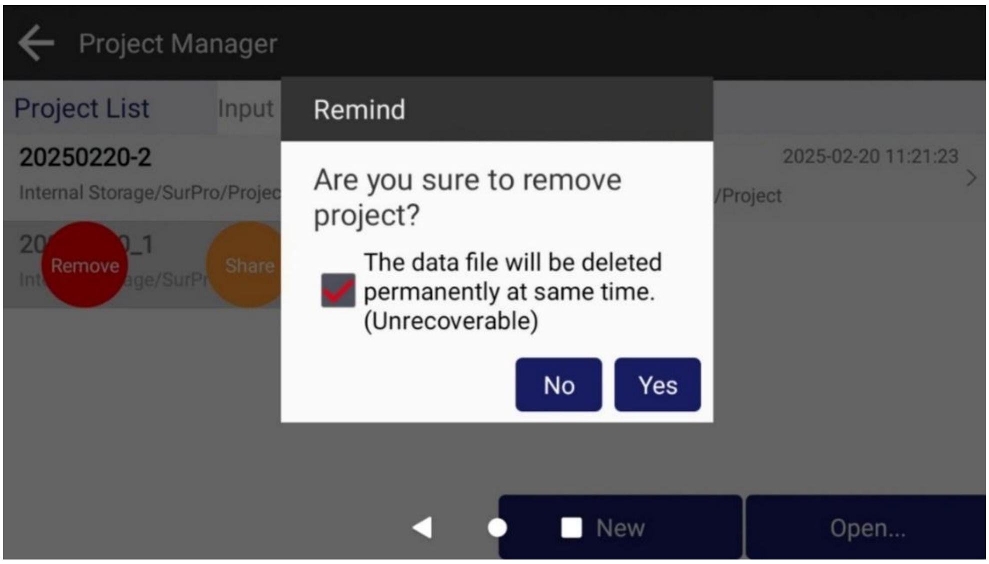


Figure 2.1-2

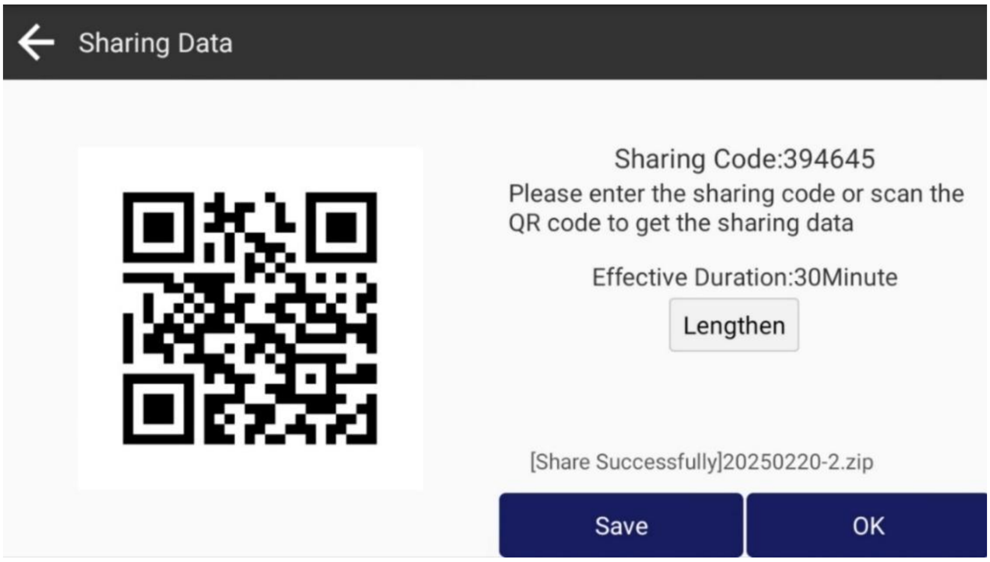
Remove

Click［Remove], as shown in Figure 2.1-2, to remove the project from the list. If you select “The data file will be deleted permanently at the same time”, the data of the project on the disk will be deleted and can not be recovered any more; if not select, the project will only be removed from the list, and you can open the project again when you want.



Share

Click [Share] to send the project to the cloud server, it will display the sharing code and QR code for obtaining data. You can get the sharing data on other devices via the button ⊕ in the main interface , entering the sharing code or scanning the QR code to obtain the data (the same applies to data sharing in other functions when using the software).



Open

Click [Open] to open the project that selected in the list.

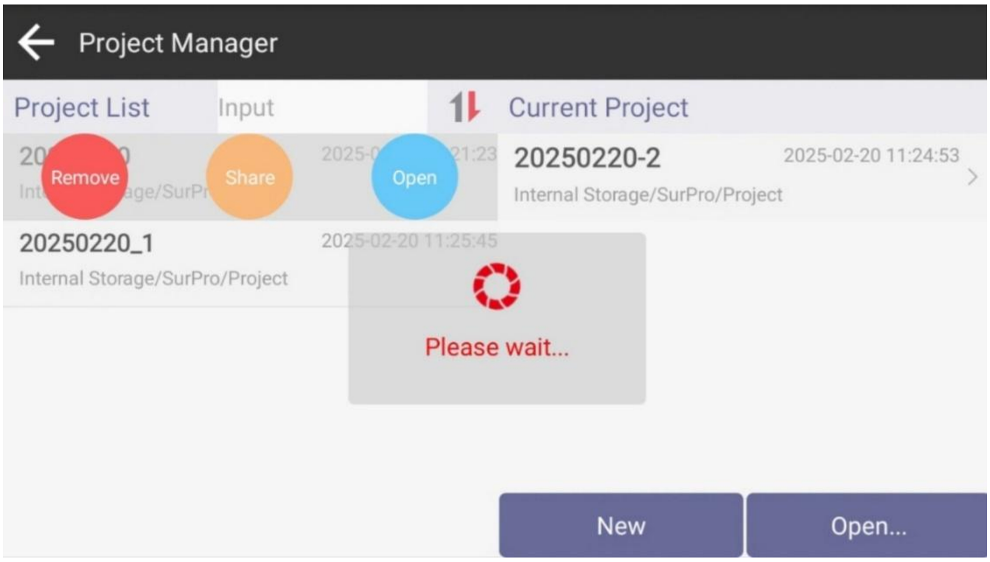
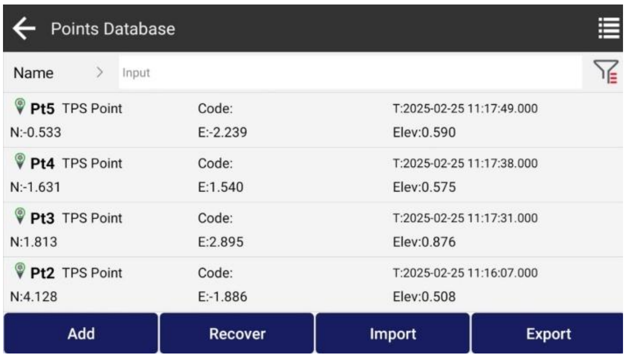


Figure 2.1-4

2.2 Points Dababase

Click [Points Dababase] as shown in Figure 2.2-1, 2.2-2. View and manage point data in the project here, including functions such as Add, Delete, Share, Point Details, Recover, Import, Export, etc.

[Long press] the data item to select it for deleting or sharing.



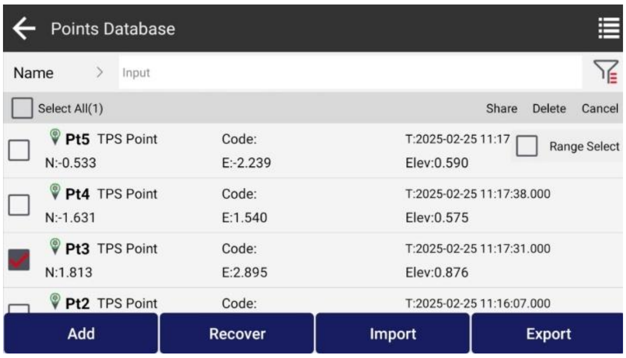
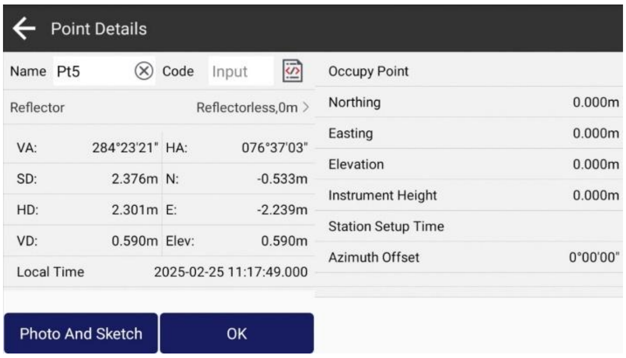


Figure 2.2-1

Figure 2.2-2

Click on the data item in the list to view detailed information, modify name and code, as shown in Figure 2.2-3.

Click on the icon in the upper right corner can switch to list mode to view the data, as shown in Figure 2.2-4.



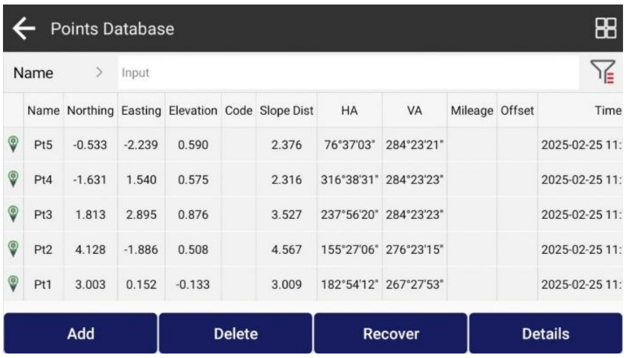


Figure 2.2-3

Figure 2.2-4

Click [Add] to manually enter point coordinate information as shown in Figure 2.2-5.

Click [recover] can restore the accidentally deleted point data as shown in Figure 2.2-6.

Figure 2.2-5

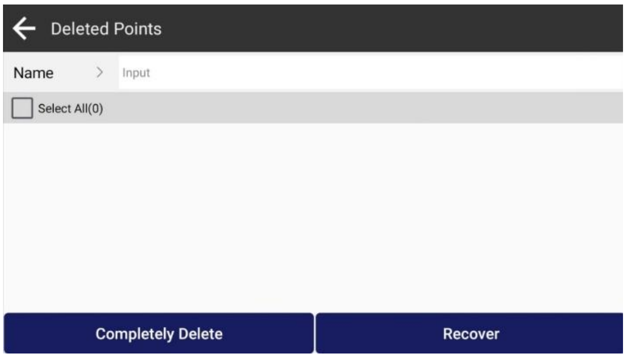


Figure 2.2-6

Click [import], select the corresponding data format, and the next step is to select the imported file for data import, as shown in Figure 2.2-7.

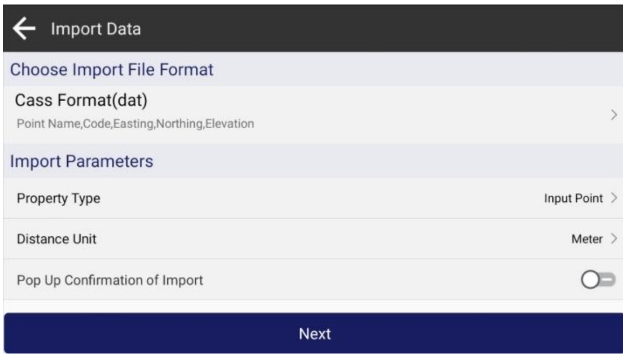


Figure 2.2-7

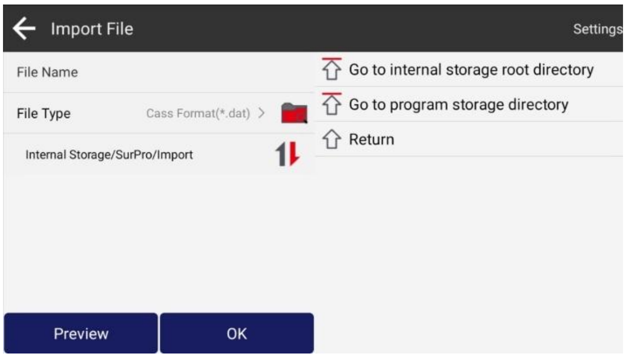


Figure 2.2-8

Click [Export], select the data format for export, choose the export location, and export the data results as shown in Figure 2.2-9. The data formats for export can be customized by adding custom formats in the format representation according to requirements, as shown in 2.2-10.

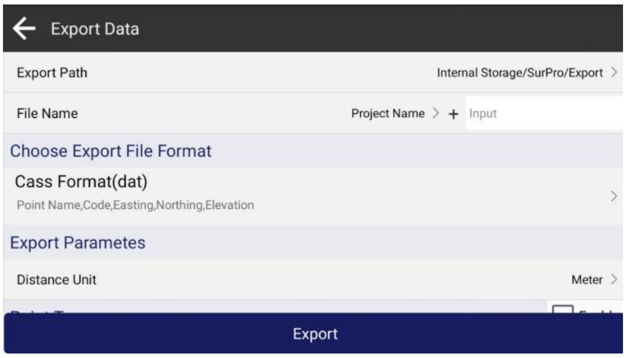


Figure 2.2-7

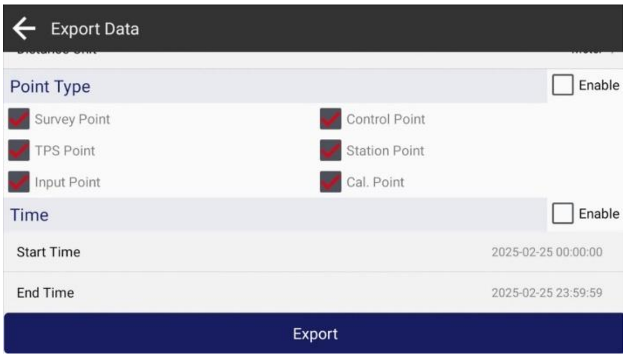


Figure 2.2-10

2.3 Code Library Manager

Click [Code Library Manager]. The Code Library is a pre-defined set of coding attributes for external collection points, which can be quickly filled in with coding values through the selection of visual name descriptions.(The first time you use the code library, there is none to be chosen as shown in Figure 2.3)

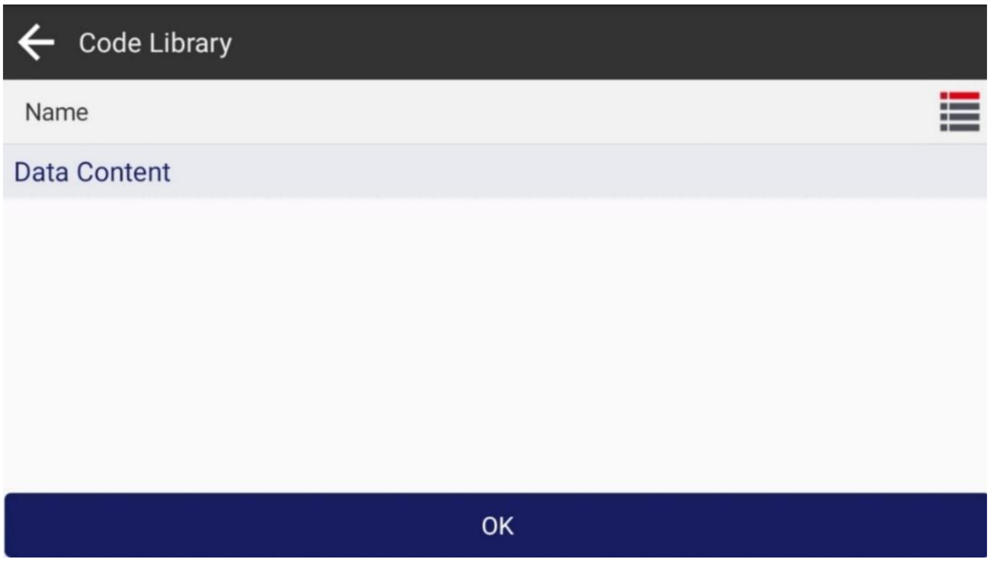


Figure 2.3-1

In the Code Library Manager, operations such as New, Import, Delete, Edit, Share and Apply the code library.

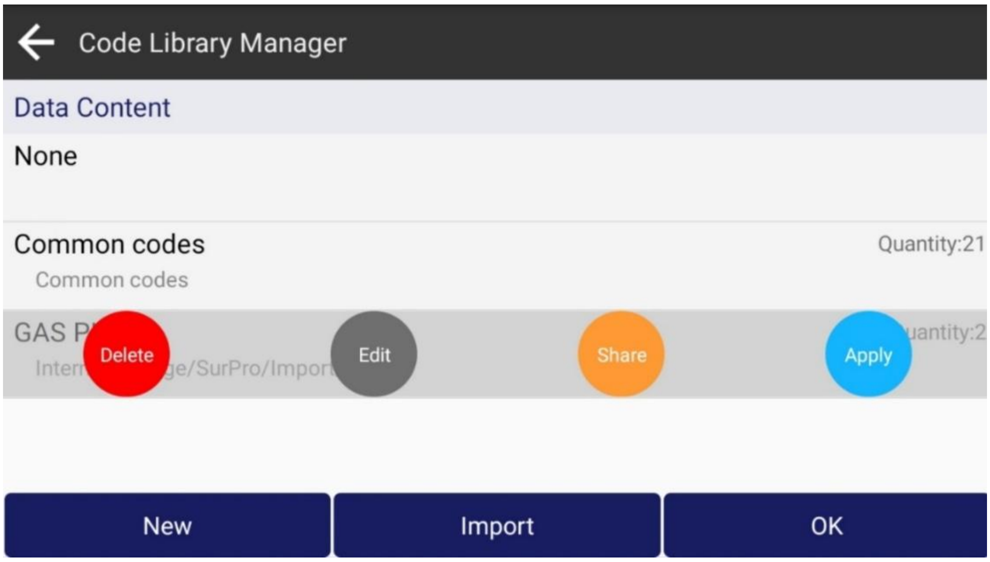


Figure 2.3-2

To create a new code library

Click on the icon as shown in Figure 2.3-1 to create a new code library. Click [new], input the code library name, and click [Add] to add a function module

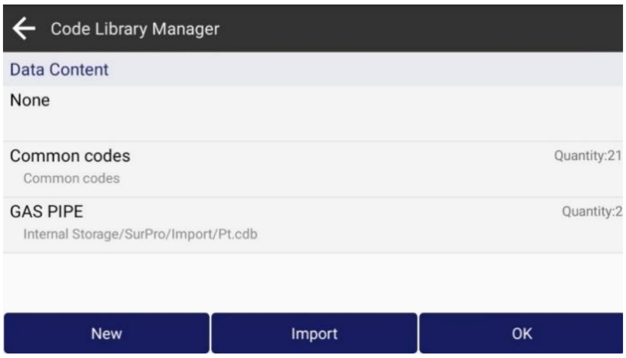


Figure 2.3-3

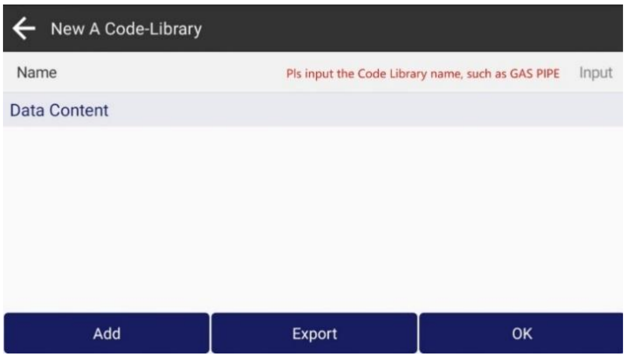


Figure 2.3-4

The code library can be predefined according to the user's project needs, and the symbols and colors of the survey points corresponding to the coding can be set, as shown in Figure 2.3-5. It can also be set whether the survey points corresponding to the coding are automatically measured into a graph (line, polyline, polygons), as well as the color, layer, line style, line width, etc. of the lines, as shown in Figure 2.3-6.

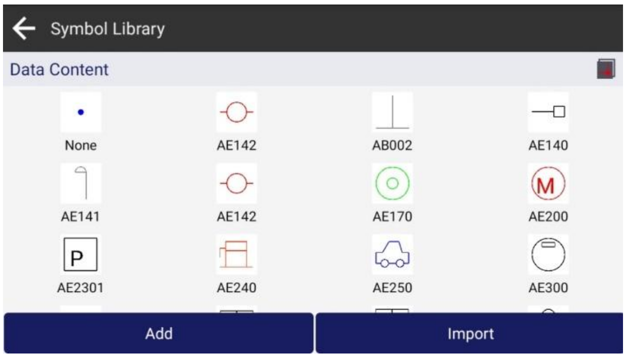


Figure 2.3-5

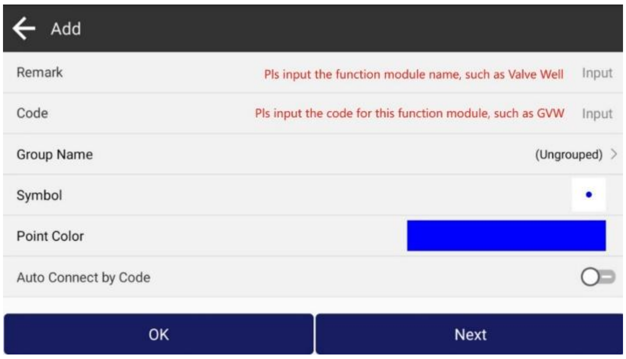


Figure 2.3-6

2.4 Import Data

Click [Import data], as shown in Figure 2.4-1. This function is a unified entrance for data import, where you can import coordinate points database, stake points, lines dabase, Transformtion parameters file, code library, road datas, etc. Select the data type and format for import, and then choose the import file to import the relevant data, as in Figure 2.2-5 and Figure 2.2-6.

Figure 2.4-1

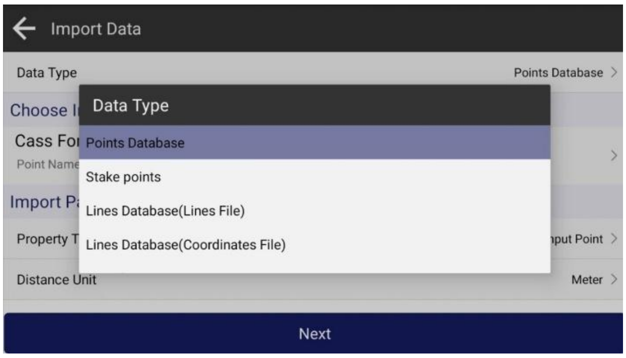


Figure 2.4-2

2.5 Export Data

Click [Export data], select the data format that needs to be exported, choose the export location and enter the export file name, click Export to complete the data export, as shown in Figure 2.5-1, 2.5-2.

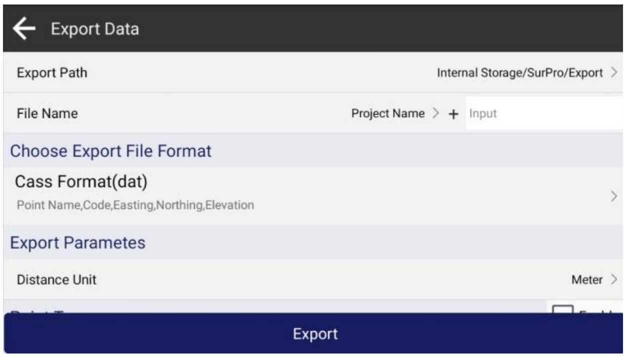


Figure 2.5-1

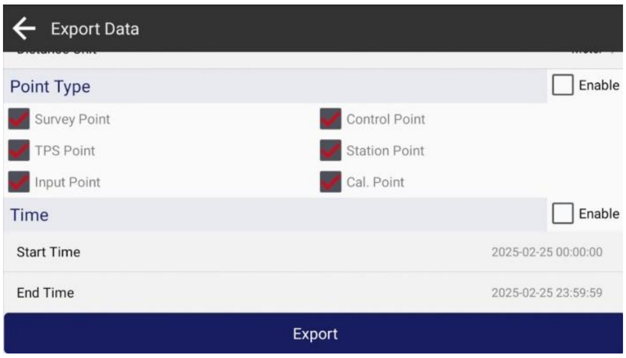


Figure 2.5-2

2.6 Survey Area Settings

Click [Survey Area Settings], as shown in Figure 2.6-1. 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.

Editing and management of the survey range, including Add, Delete, Move Up and Down coordinates, batch selecting coordinates from the point database, and import and export coordinates of the survey range; The range of the survey range can be previewed through a rough graphic, as shown in Figure 2.6-2.

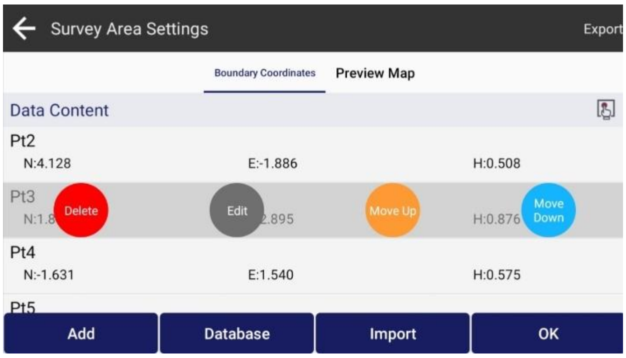


Figure 2.6-1

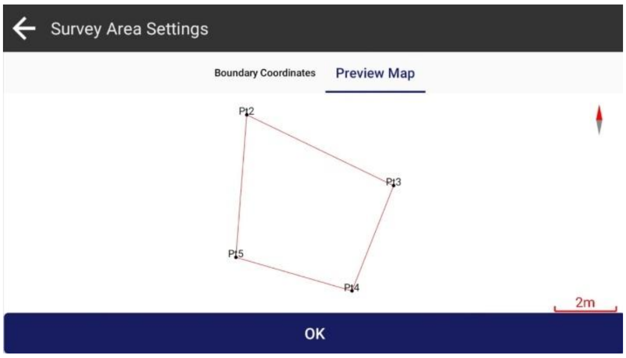


Figure 2.6-2

2.7 Layers Settings

Click [Layers Settings], as shown in Figure 2.7-1, click [Import] to import graphic data in formats such as DXF, DWG, SHP, and LandXML as the working background, and display the background base during the survey operation.

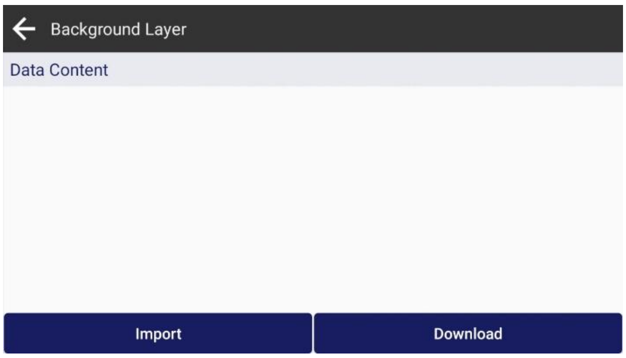


Figure 2.7-1

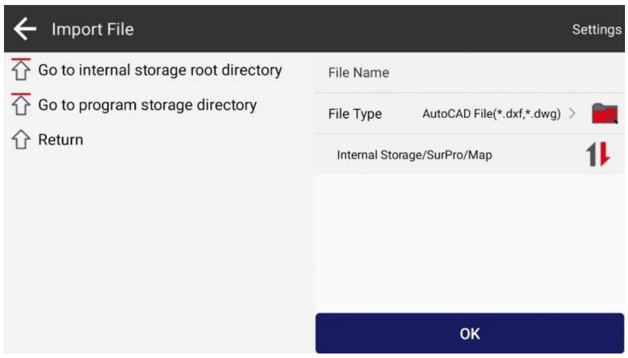


Figure 2.7-2

2.8 Software Settings

Click [Software Settings], the settings include System Settings, Cloud Share Settings, Voice Settings, and Shortcuts Settings.

System Settings: As shown in Figure 2.8-1, the settings mainly include Language, Text Encoding, Distant Unit, Distance Decimal, Angle Format, Angle Decimal, Mileage Format, Coordinate Order, Interface Style, Full Screen Display.

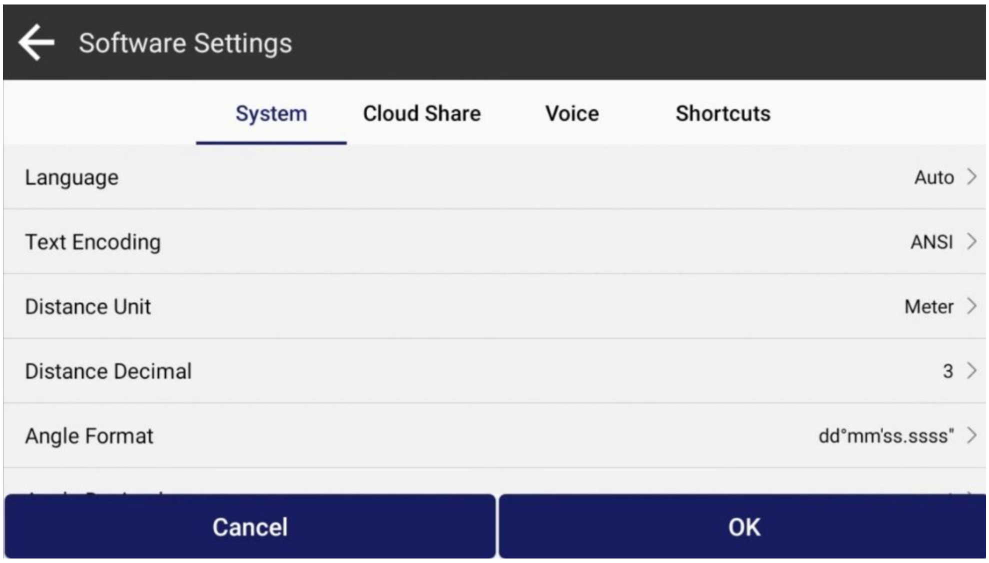


Figure 2.8-1

Cloud Share Setting: as shown in Figure 2.8-2, it mainly includes Server Address, Effective Duration, Private ID.

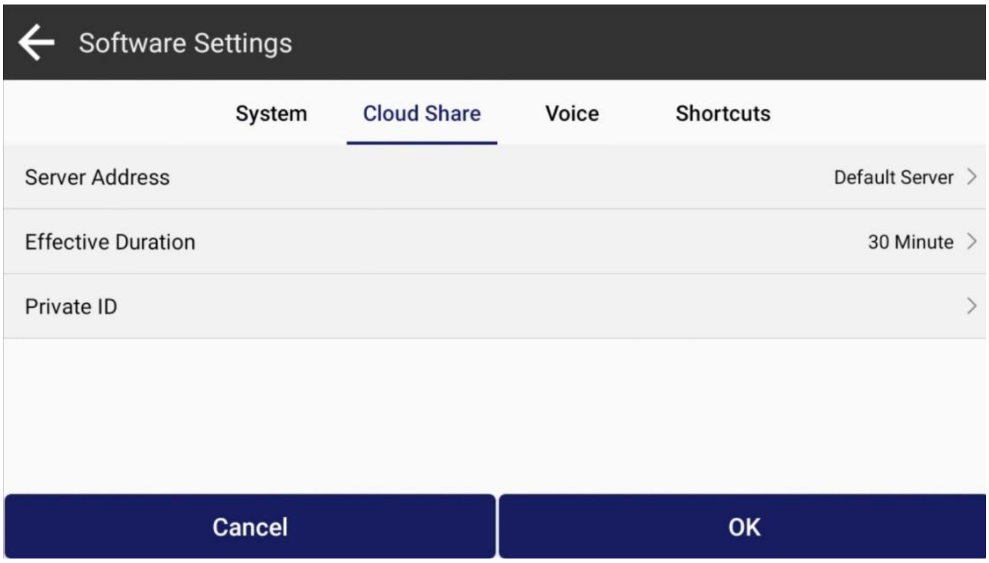


Figure 2.8-2

Voice Settings: As shown in 2.8-3, it includes prompt tone of Stakeout Tolerance, Remind Range, Save Point, Low Battery Warning, Voice Broadcast and Volume level.

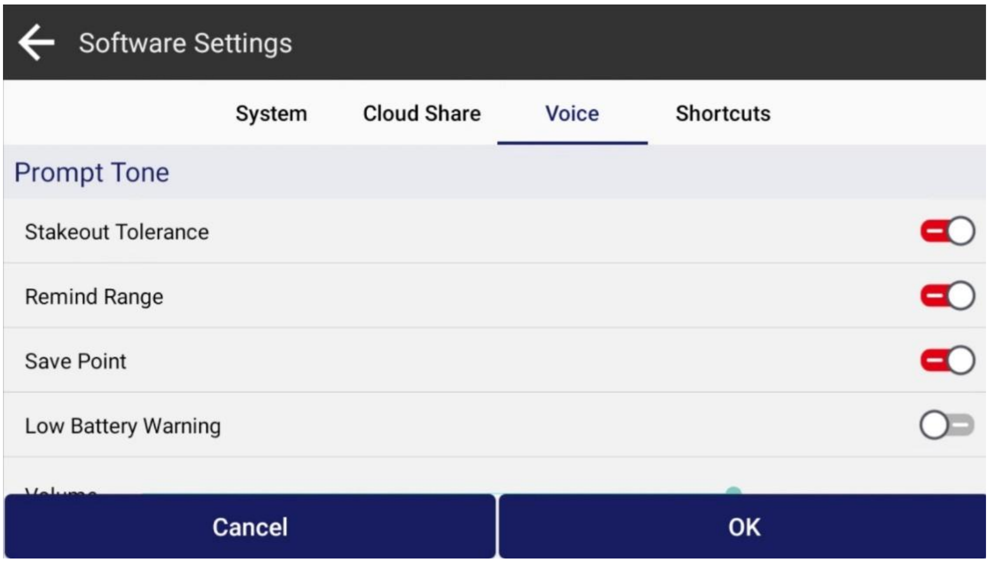


Figure 2.8-3

2.9 About Software

Click [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 get feedback.

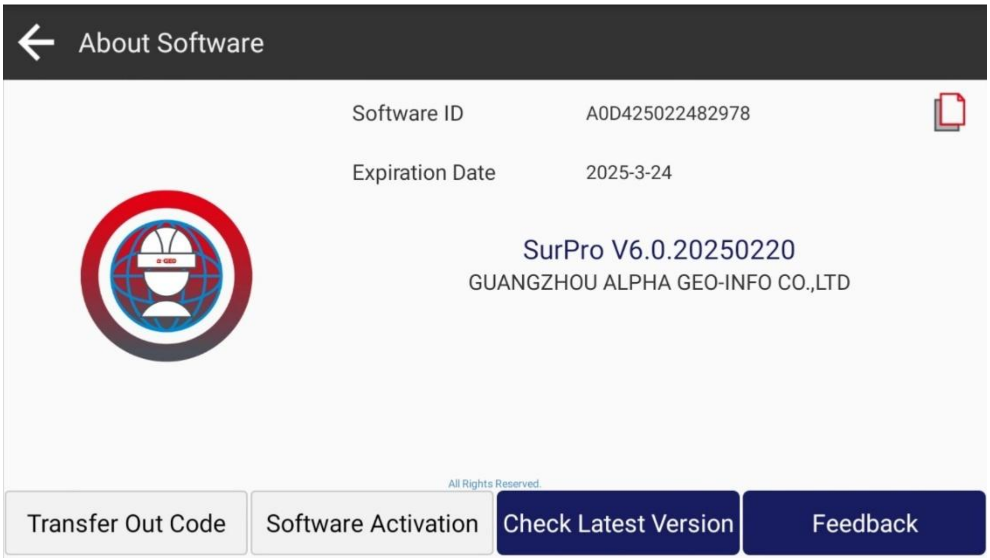


Figure 2.9-1

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

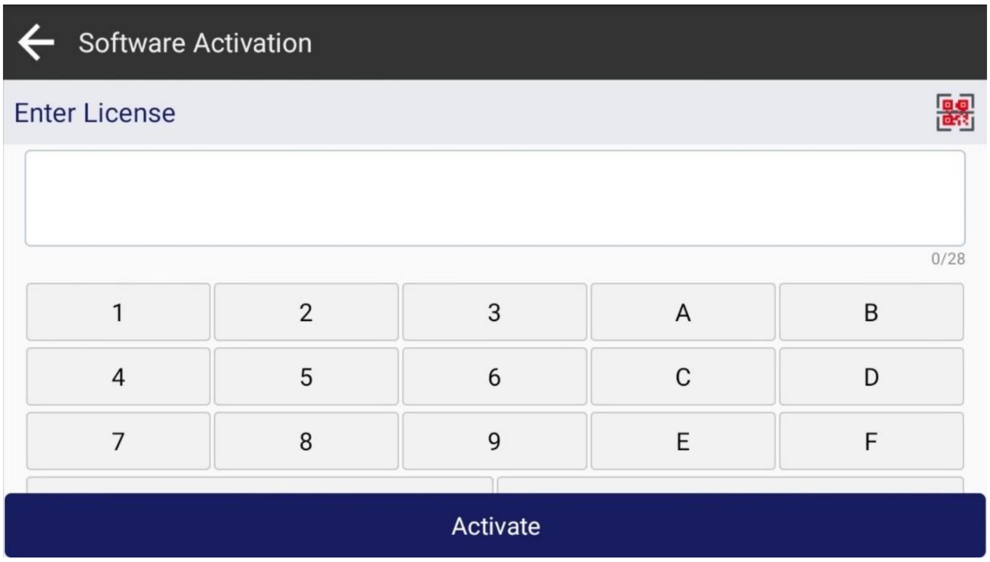
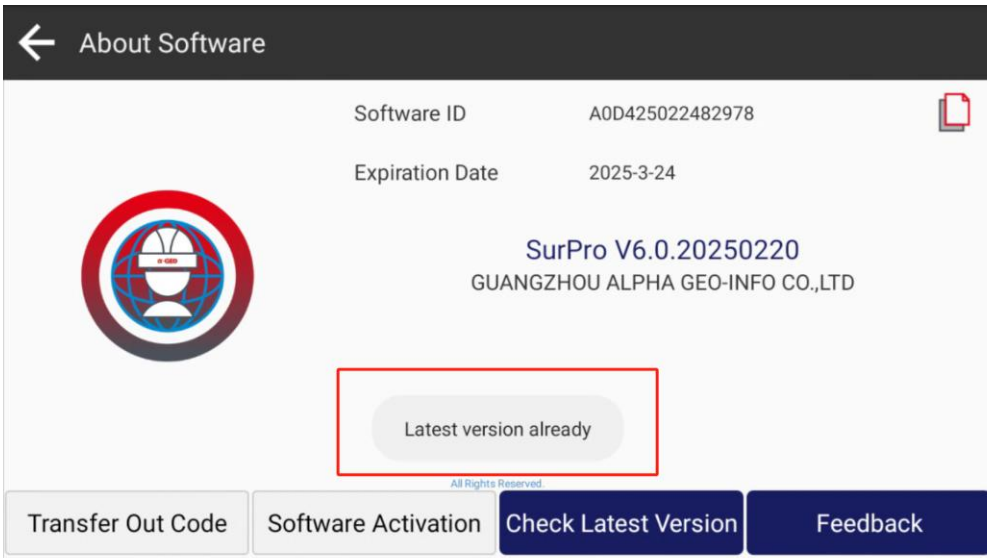


Figure 2.9-2

Check Latest 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.

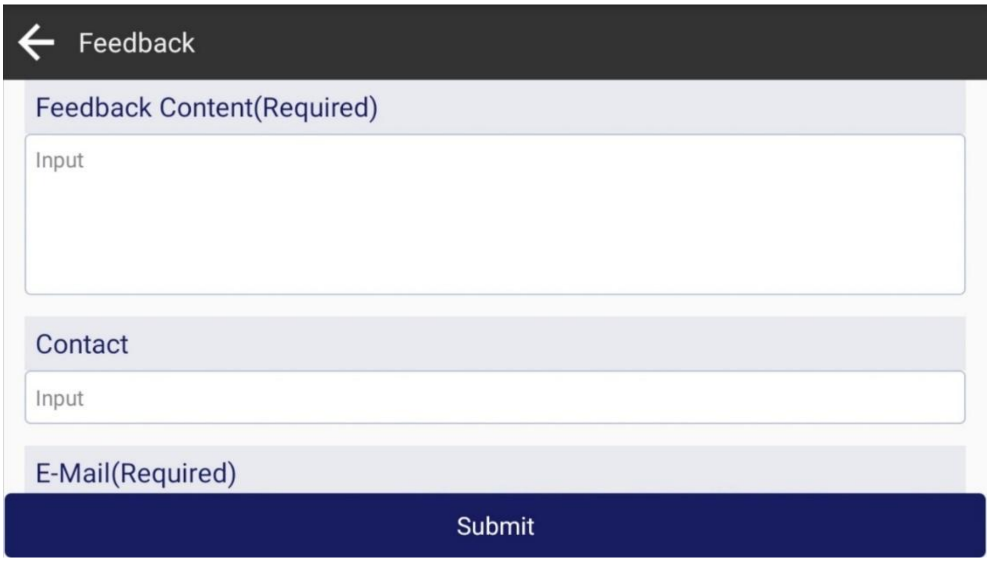


Figure 2.9-3

Note: Be sure to leave your contact information (mainly email), and describe the problem in as much detail as possible, if there is any attachment (icon, video, document, etc.), you can submit it at the same time, thank you!

Chapter III Device

On the main interface of the software, click the corresponding function menu of [Device], as shown in Figure 3.1-1. The device includes Communication, Station Setup & Orientation, Free Station Setup, Orientate to Line, Height Transfer, Device Settings, and other functions.

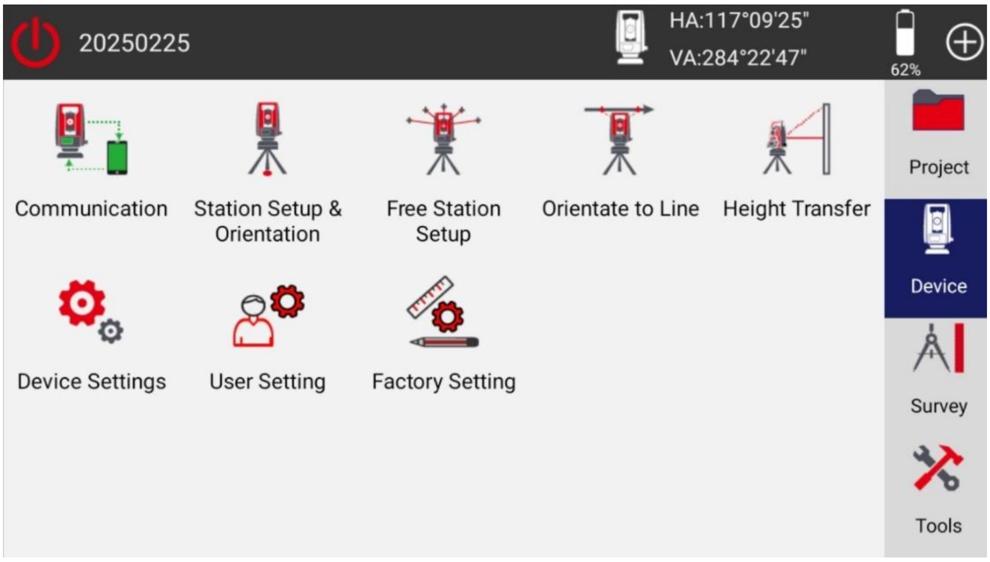


Figure 3.1-1

The data survey and application of the software are based on the application of measuring coordinate positions with a total station. Before the operation, communication needs to be established with the total station. The software obtains the measurement distance, angle, and reference coordinates of the position from the device to calculate the coordinate position of the survey point.

3.1 Communication

Click [Communication] as shown in Figure 3.1-1. Select the Device Type, Device Manufacturer, Model Type, and Connection Type, and click "Connect" to complete the device connection as shown in Figure 3.1-2. After successfully connecting the device, it will directly return to the software main interface.

The connection methods include Bluetooth, WIFI, serial port, TCP client, etc. The supported methods for different models of devices may vary. Android total stations with Surpro 6.0 installed should choose “Connection Type” with “Internal” to connect. Remember to click [Connect] to complete connection.

If you need to use commands to troubleshoot problems during use, you can click [Debug] as shown in Figure 3.1-3, and manually send commands for data debugging. Check [save] as shown in Figure 3.1-4, will save the communication data during software use to the debugging file for easy troubleshooting.

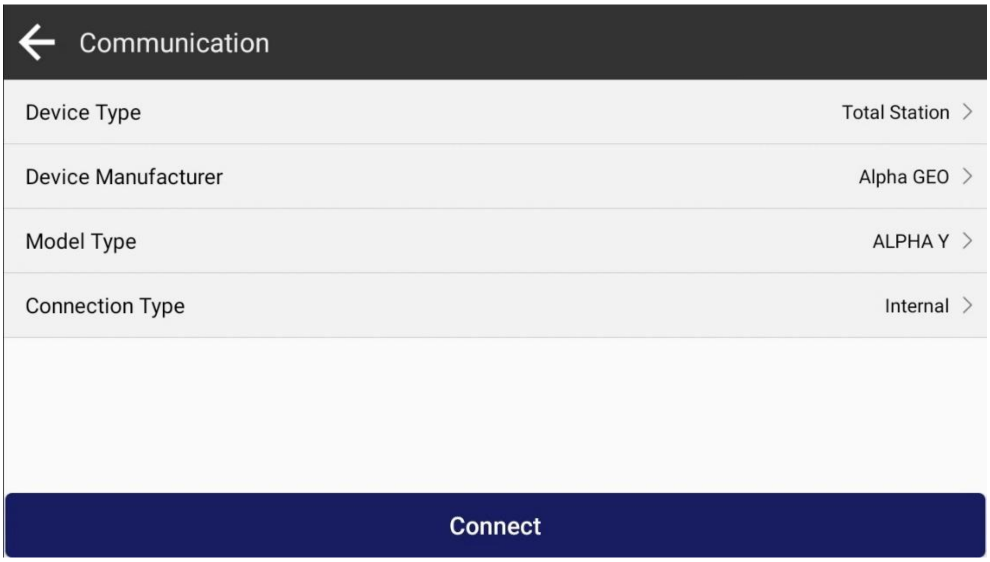


Figure 3.1-2

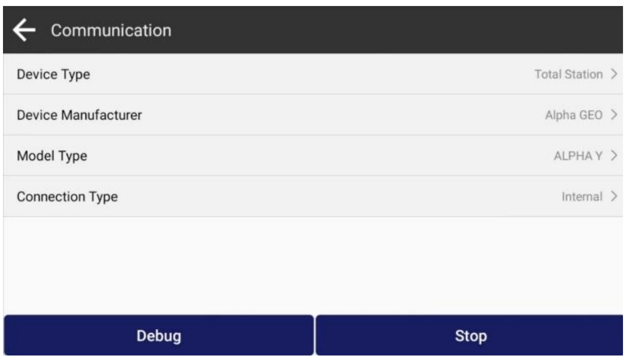


Figure 3.1-3

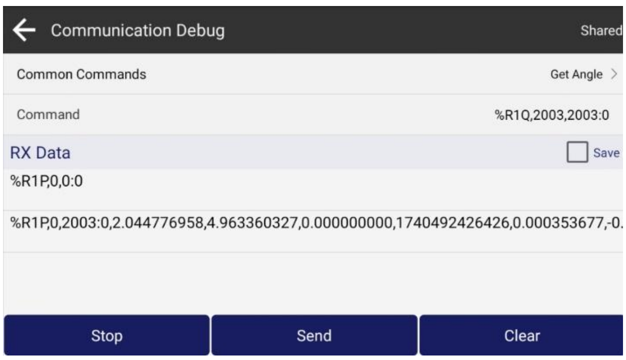
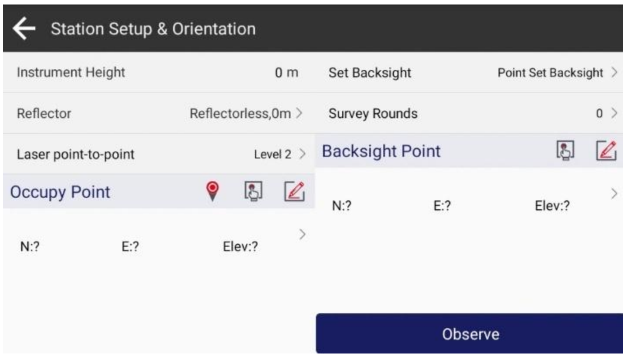


Figure 3.1-4

3.2 Station Setup & Orientation

Click [Station Setup & Orientation] to set up the total station at a known point, input the coordinates of the total station's location and the known coordinate or angle of the backsight point, and set the angle to the device, so that the angle output by the device is consistent with the azimuth angle of known point. There are three ways to set up a station:

1. Point Set Backsight, as shown in Figure 3.2-1, 3.2-2. Set a known backsight point, and then observe the backsight point, obtain the angle and distance of device to the known backsight point, Surpro 6.0 will calculate the angle difference as well as the distance difference and height difference from the device towards the known backsight point itself. Determine whether there is a possibility of aiming error based on the distance difference and height difference, and set the angle difference to the device. At the same time, the scale correction factor can be calculated based on the distance, which can be used to correct the distance measured by the total station.



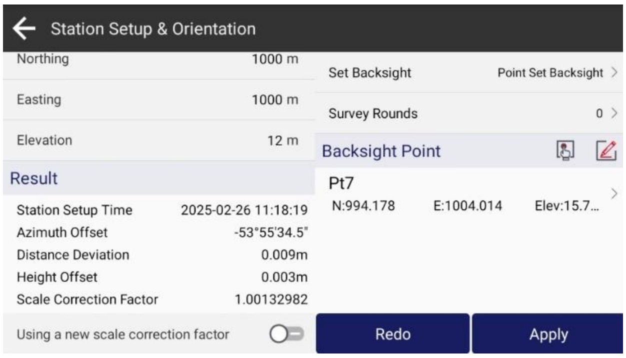
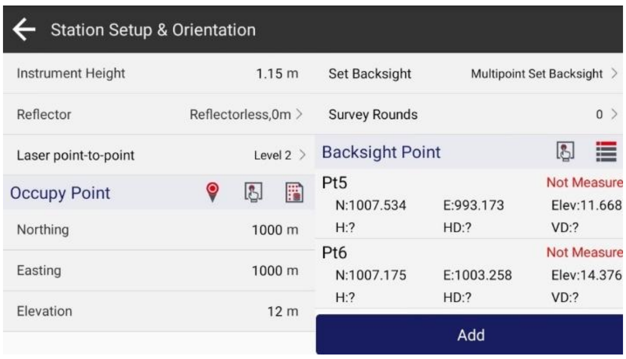


Figure 3.2-1

Figure 3.2-2

2. Multipoint Set Backsight, as shown in Figure 3.2-3, 3.2-4. Set multiple known backsight points, observe them separately, obtain device angles and distances to the known points, Surpro 6.0 will calculate the angle differences, as well as the accuracy error of each point, and set the angle difference to the device. At the same time, the scale correction factor can be calculated based on the distance, which can be used to correct the distance measured by the total station.



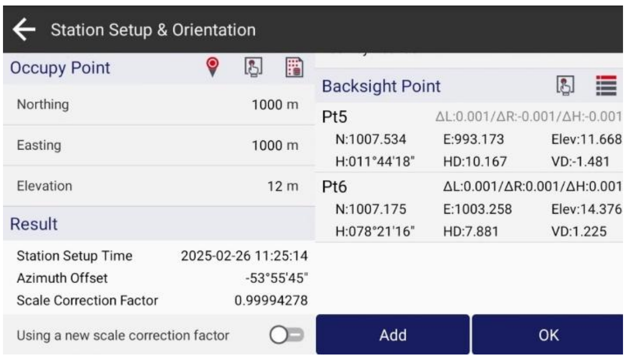


Figure 3.2-3

Figure 3.2-4

3. Azimuth Set Backsight, as shown in Figure 3.2-5,6,7. Set a known angle of the backsight point, observe the backsight point, obtain the current device’s angle to the backsight point, Surpro 6.0 will calculate the difference between the known angle and the device’s angle itself, and then set the known angle to the device when [Apply] is clicked.

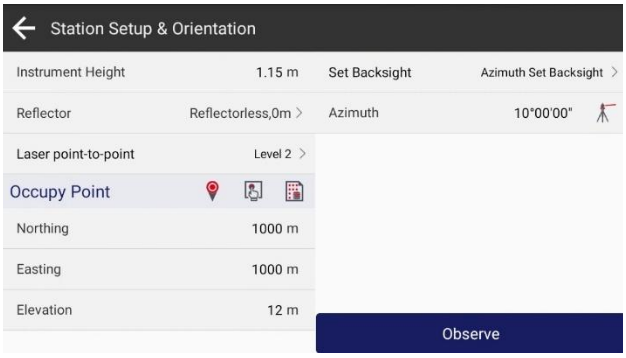


Figure 3.2-5

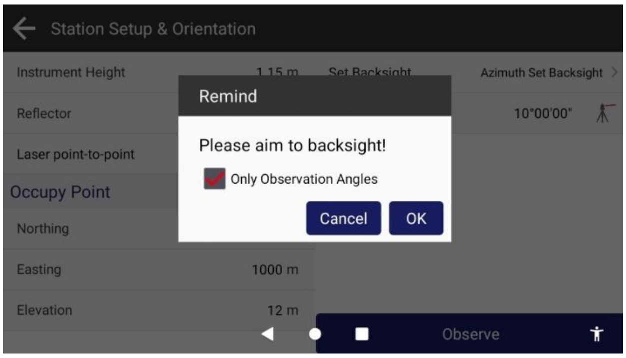


Figure 3.2-6

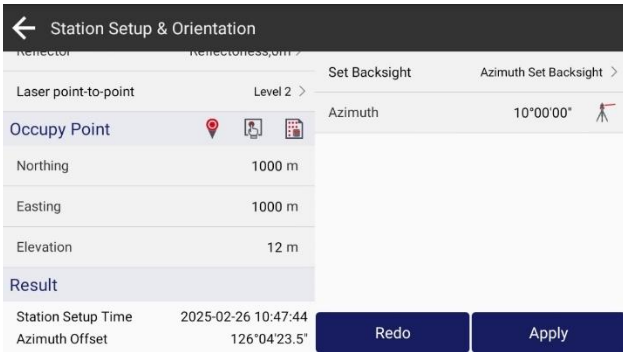


Figure 3.2-7

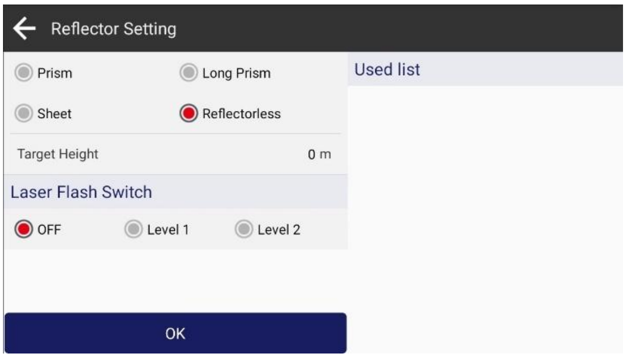


Figure 3.2-8

Note: The instrument height and reflector (as shown in Figure 3.2-8) need to be set according to the actual situation.

3.3 Free Station Setup

Click [Free Station Setup]. Set up the total station on an unknown point, measure the angle and distance of the known point and calculate the coordinates and the angle difference of the total station, set the azimuth angle to the total station, and match the subsequent survey coordinates with the known points.

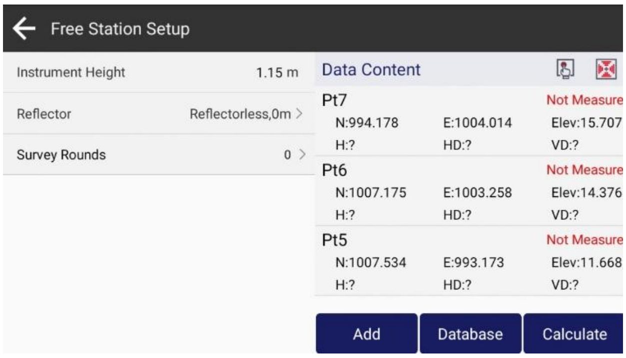


Figure 3.3

3.4 Orientation to Line

Click [Orientation to Line], as shown in 3.4-1. Given a coordinate origin and axis direction position, set up a total station at an unknown point, measure the angle and distance between the known point and axis point, calculate the coordinates of the station and the angle difference of the total station, set the azimuth to the total station, and match the subsequent survey coordinates with the known point.

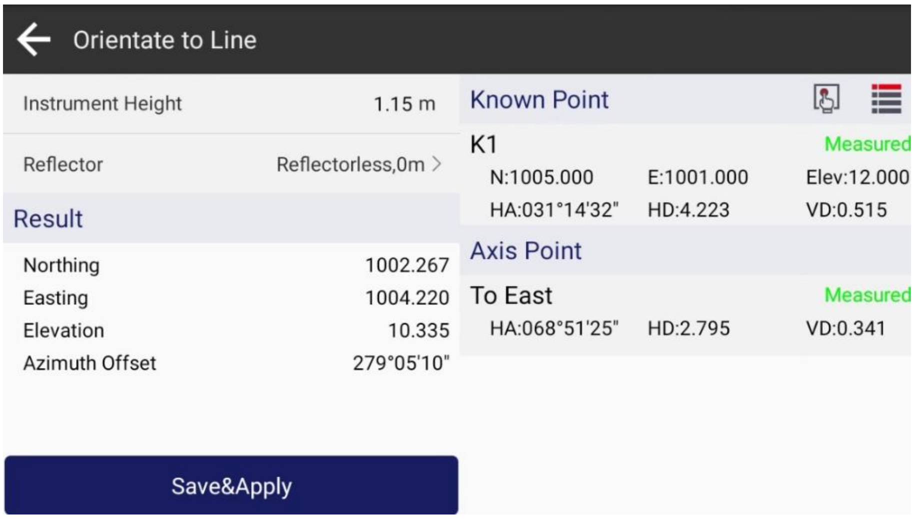


Figure 3.4-1

3.5 Height Transfer

Click [Height Transfer], as shown in Figure 3.5-1. Given the height of a certain observation point, measure the angle and distance of the observation point, calculate the height difference between the station and the observation point, and then calculate the height of the current station and apply it to subsequent measurements.

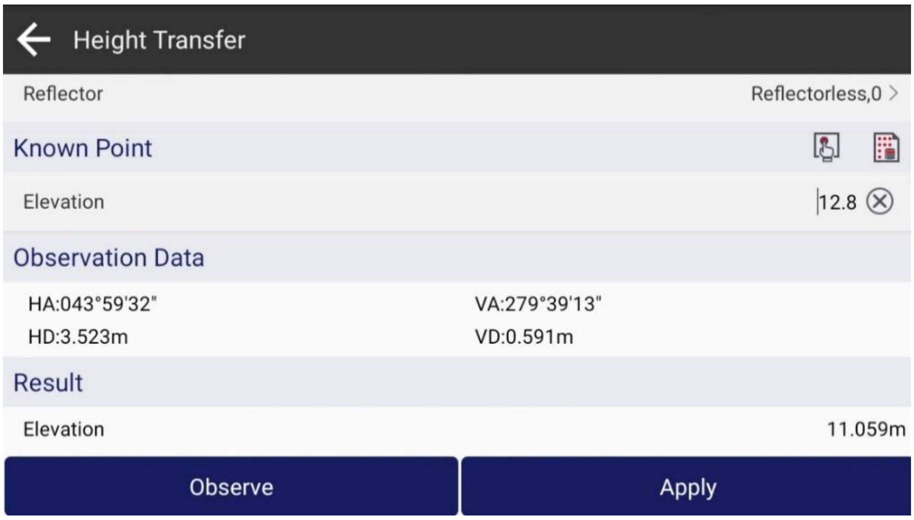


Figure 3.5-1

3.6 Device Setting

Click [Device Settings], as shown in Figure 3.6-1. You can swap the left and right sides. If you want to set up display information, click on the angle display at the top of the main interface, as shown in Figure 3.6-2, to enter the display information settings, as shown in Figure 3.6-3. You can set the angle resolution, angle mode, scale correction factor, etc.

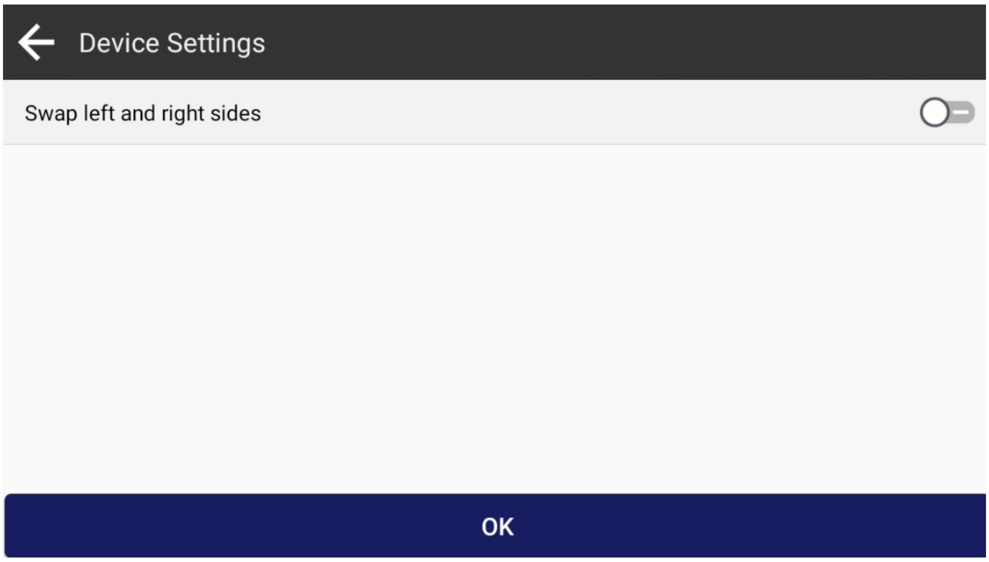


Figure 3.6-1

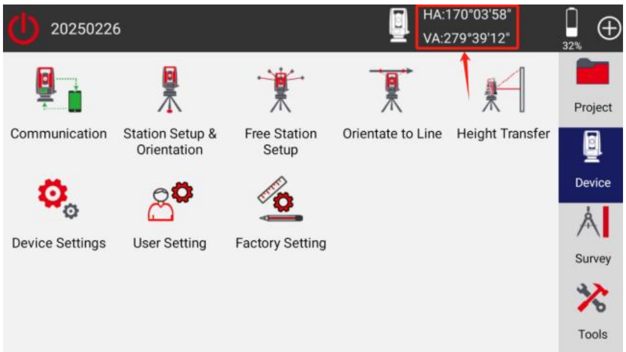


Figure 3.6-2

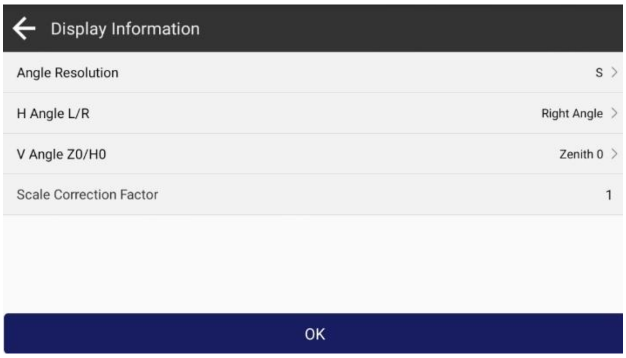


Figure 3.6-3

Chapter IV Survey

On the main interface of the software, click [Survey] as shown in Figure 4.0. The Survey includes Point Survey, TPS Survey, Multi-Round Survey, Point Stakeout, CAD Stakeout, Line Stakeout, Spiral Stakeout, DSM Stakeout, Stake Road, Angle Eccentricity, Distance Eccentricity, Plane Eccentricity, Cylindrical Eccentricity, Remote Heigh, Electric Lines Survey, Electric Towers Stakeout, Function Customization and other functions based on total station coordinates.

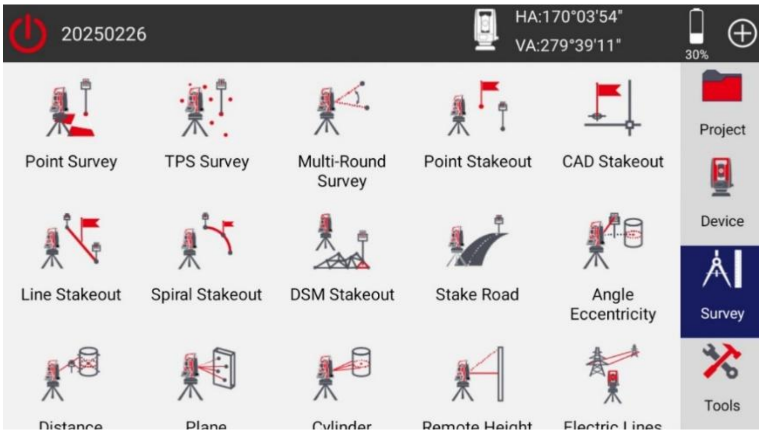


Figure 4.0

4.1 Survey

Click [Point Survey], as shown in Figure 4.1-1. In the point survey interface, the title bar displays the *Horizontal and Vertical Angles* of the total station as well as the instrument's *Power Level*. The right area displays survey information, while the left area is the drawing range.

On the left lower corner of the drawing range are the function menu keys, which can display other functions according to the user's needs in the settings.

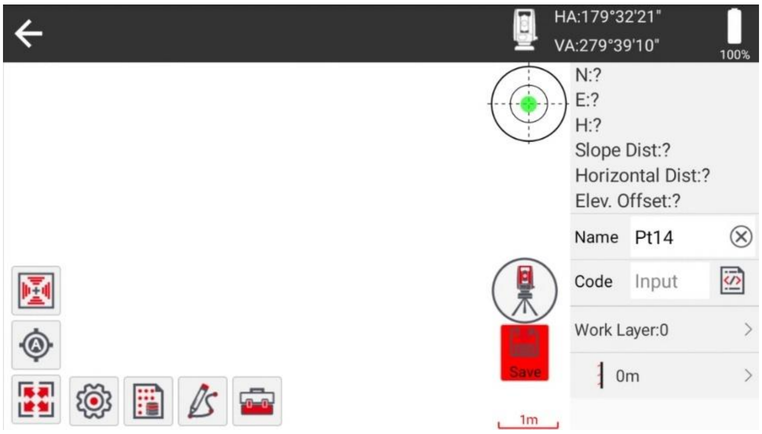


Figure 4.1-1

 is the survey function key. Click this button to survey coordinates, as shown in Figure 4.1-2. Below the survey key is the switch for whether to save the survey results or not. Measuring a collection point usually requires entering name and 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 4.1-3. 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.

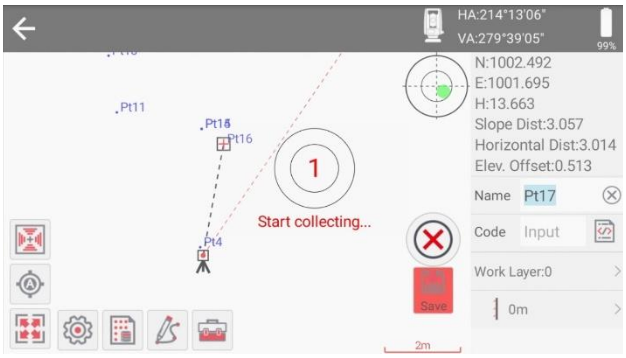


Figure 4.1-2

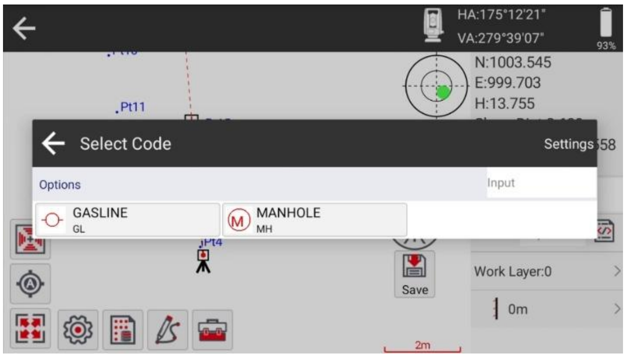


Figure 4.1-3

Click , call the CAD drawing function to draw while survey. As shown in Figure 4.1-4, it includes various types of shapes such as Line, Polyline, Arc, Polygon, Square, Square Center, Rectangle, Rect-Center, Circle-2Pt, Circle-3Pt, Spline, etc. 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 , call CAD tools for calculation, as shown in Figure 4.1-5, including intersection point of two circles, intersection point of two lines, intersection point of two entities, distance offset point, entity translation, dividing points by number, calculating points by distance, line invert, line lengthen and area division point, rectangle offset point, etc.

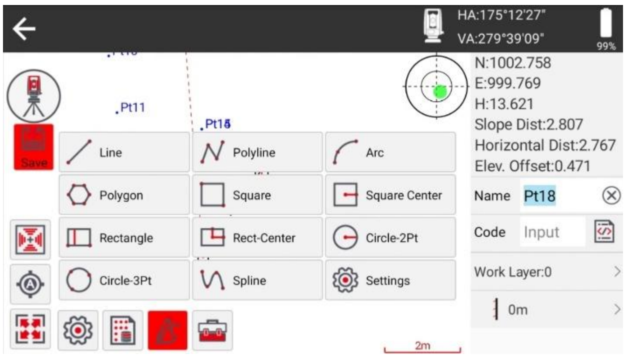


Figure 4.1-4

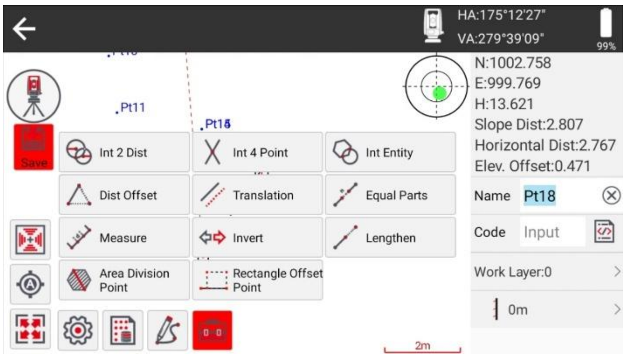


Figure 4.1-5

Click  to enter the settings interface and make settings for survey, information display, tool bar, etc. As shown in Figure 4.1-6, 4.1-7, and 4.1-8.

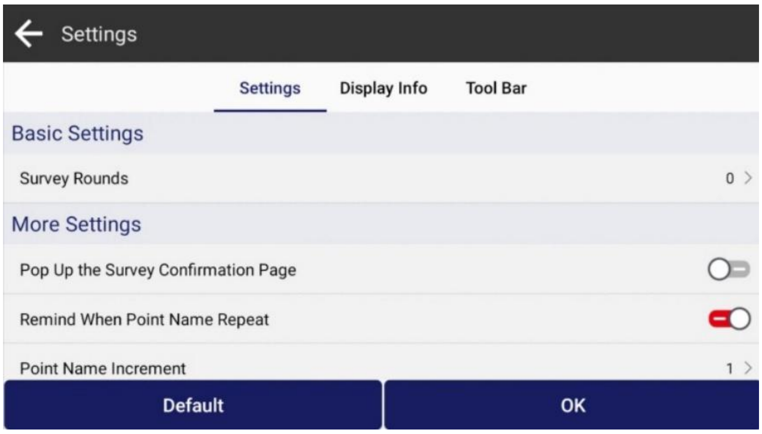


Figure 4.1-6

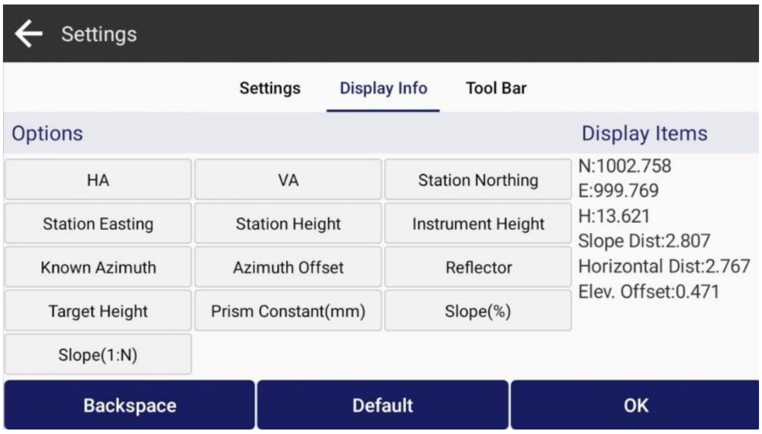


Figure 4.1-7

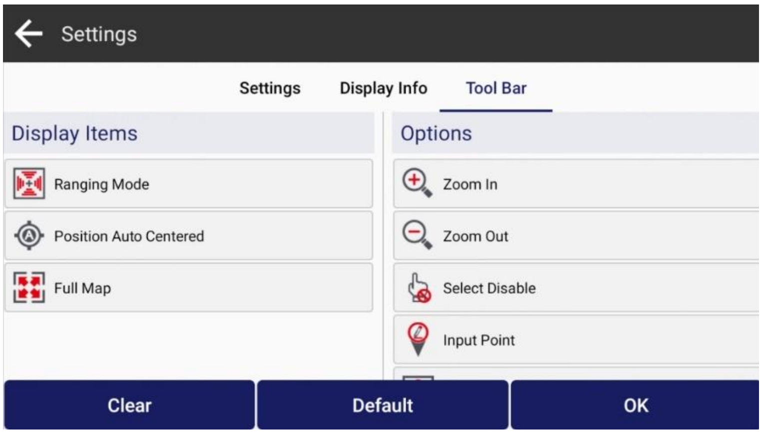


Figure 4.1-8

4.2 TPS Survey

Click [TPS Survey], as shown in Figure 4.2-1. This function has a similar function to point survey, but does not have a graphical interface for point survey. It provides a more concise and intuitive display of the content required for measuring and collecting points, as well as information about the current site. Users can use this function to directly survey points without the need for drawing references. At the bottom of the interface are the entry of survey settings and point database.

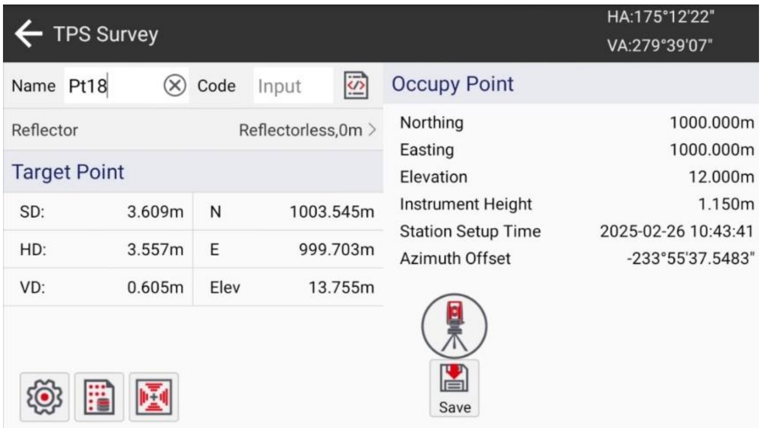
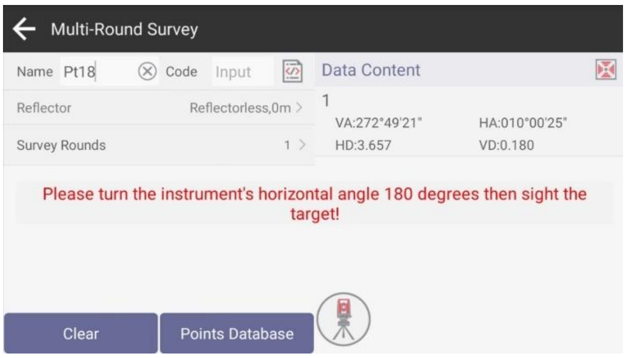


Figure 4.2-1

4.3 Multi-Round Survey

Click [Multi-Round Survey], as shown in Figure 4.3-1, 4.3-2. This function eliminates angle errors and improves the accuracy of survey points through multiple positive and negative mirror measurements. After each survey, the instrument needs to be rotated 180 degrees clockwise before measurement. After measuring you should click [Save] to save the point you want or click [Clear] to abandon the current data and measure again.



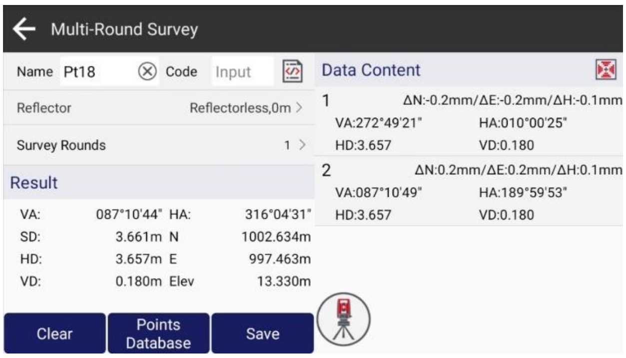


Figure 4.3-1 Figure 4.3-2

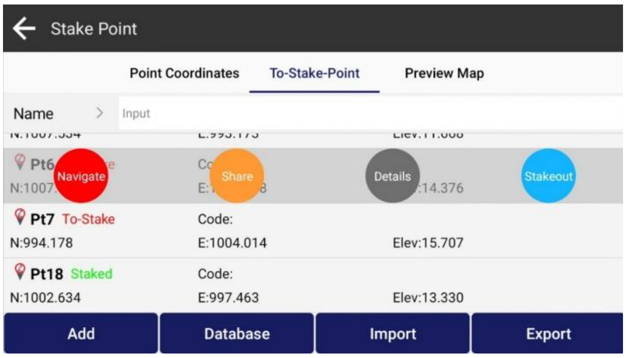
Note: When it asked you to turn the instrument's horizontal angle 180 degrees, you should go clockwise, otherwise, it wouldn't work.

4.4 Point Stakeout

Click [Point Stakeout] to enter the interface of stakeout point library. Point stakeout refers to finding the location of a point on the field site through coordinate points with known coordinates.

Unstakeout points and stakeout points will be displayed in the “To-Stake-Point”. If there isn’t any data, you can choose it from the “Point Coordingnates”, which are measured before, or click [Add] to manually add points or click [Import] to import the points. Click the item in point list and you can Navigate, Share, view Details and Stakeout the point as shown in Figure 4.4-1.

Long press the item and you can Share or Remove the points that have been selected as shown in Figure 4.4-2.



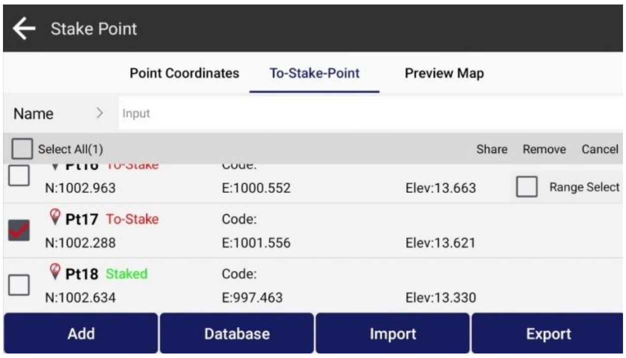


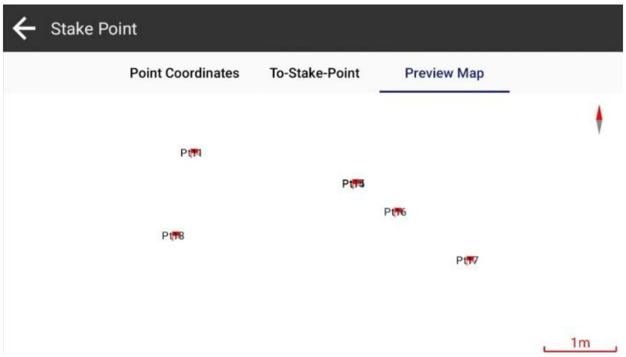
Figure 4.4-1

Figure 4.4-2

You can also see the Preview Map after you have add the points to the “To-Stake-Point” as shown in Figure 4.4-3.

The layout of the point stakeout interface is similar to point measurement but with some differences. The deviation values of Forward/Backward, Left/Right and Filling/Excavation from the target are displayed in the status information bar when you aim to the target and click measure key.

In addition to the survey function, there are also functions such as stakeout the previous point, and stakeout the next point below the drawing range.



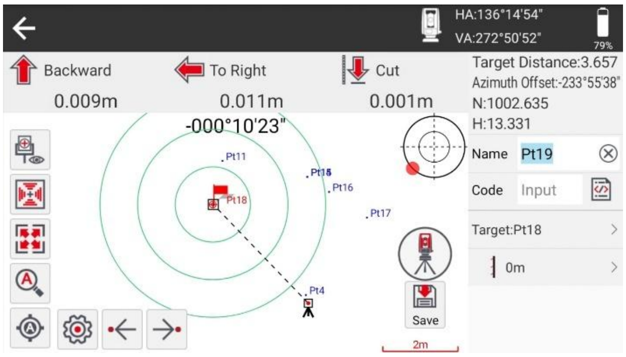


Figure 4.4-3

Figure 4.4-4

How to stakeout quickly with a prism?

Click , enable the auxiliary viewing function if you use the Prism to stakeout. After turn on this function, as shown in Figure 4.4-5, 4.4-6, it will provide you a sharing code as shonw in Figure 4.4-7 and the prism operator can get the stakeout information via scanning the sharing code with Surpro 6.0 installed in his phone or tablet. After Connection, every time you click the measure function key, the prism operator will immediately get the direction and distance information between the current position and the target position, as shown in Figure 4.4-8, which can greatly improve the speed of stakeout.

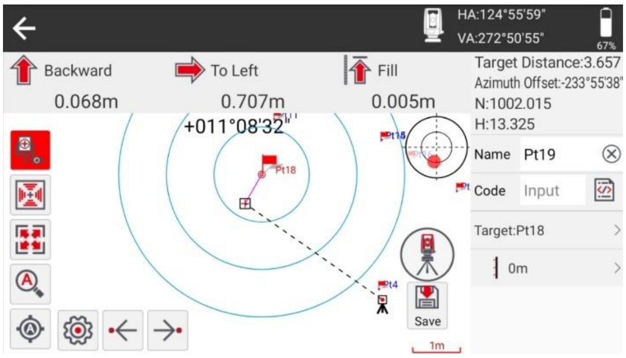


Figure 4.4-5

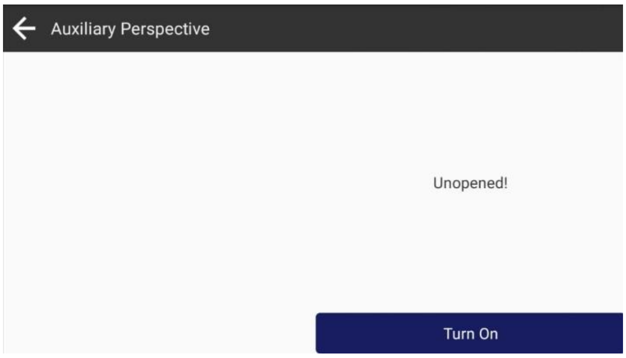


Figure 4.4-6

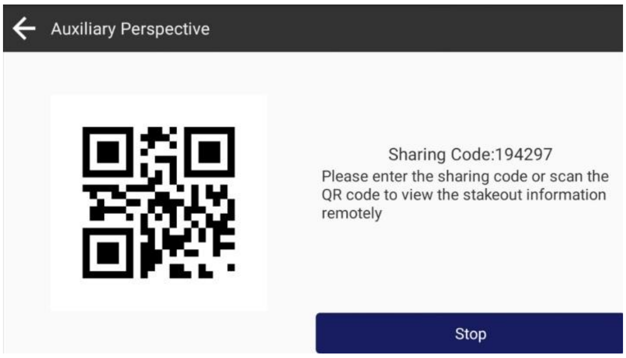


Figure 4.4-7

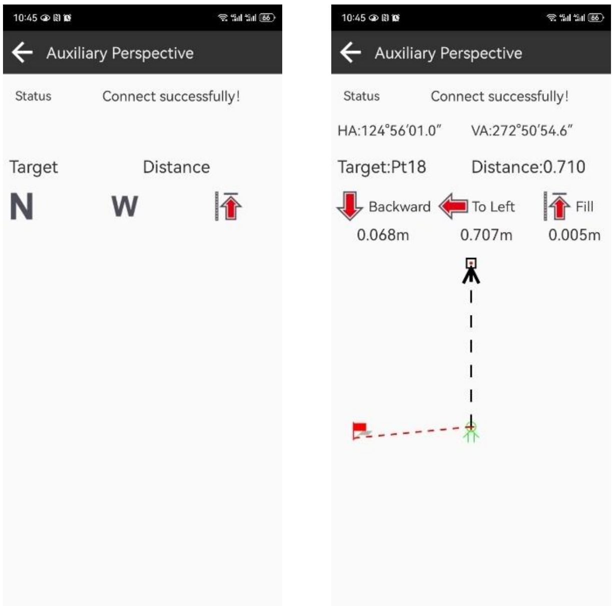


Figure 4.4-8

4.5 CAD Stakeout

Click [CAD Stakeout], as shown in Figure 4.5-1. The CAD stakeout function is to open the CAD drawing and stakeout it. You can capture points for stakeout or select entity data for stakeout; In addition to stakeout the drawings, CAD mapping and some CAD tool calculations can also be performed.

Figure 4.5-1

Click icon  to enter the interface for opening CAD drawing files, where the historical file records are listed. You can click to quickly open them or open drawings from other locations. Long press to select data for deletion and share. As shown in Figure 4.5-2, 4.5-3, 4.5-4, 4.5-5.

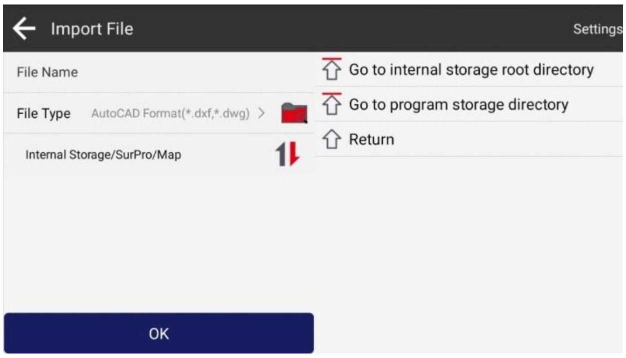


Figure 4.5-2

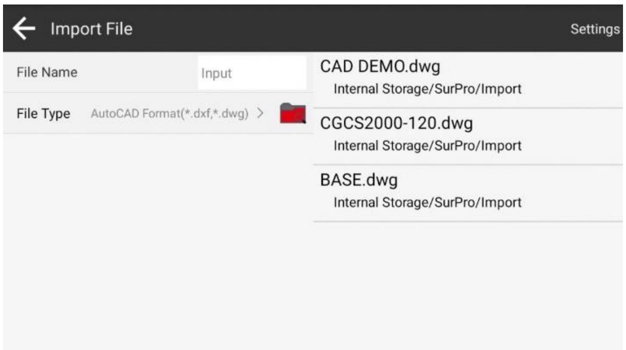


Figure 4.5-3

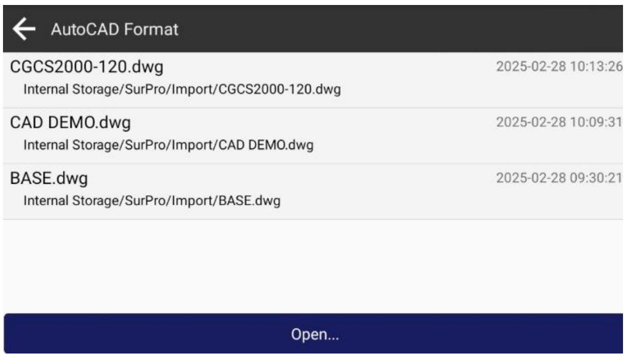


Figure 4.5-4

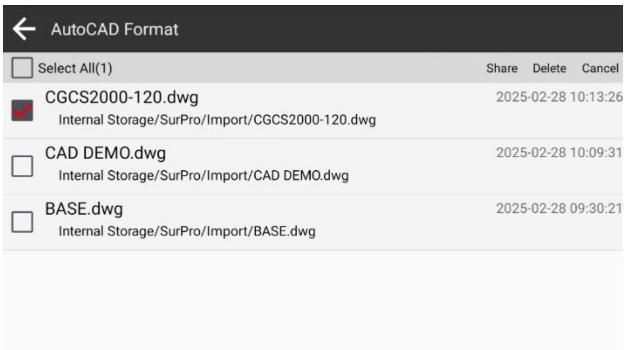
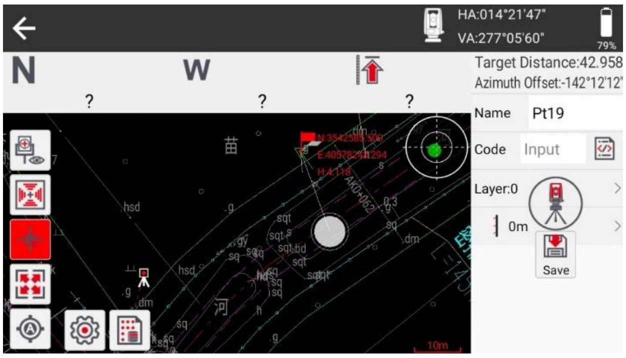


Figure 4.5-5

Click icon  to capture the points on the drawing for stakeout, as shown in Figure 4.5-6, 4.5-7.



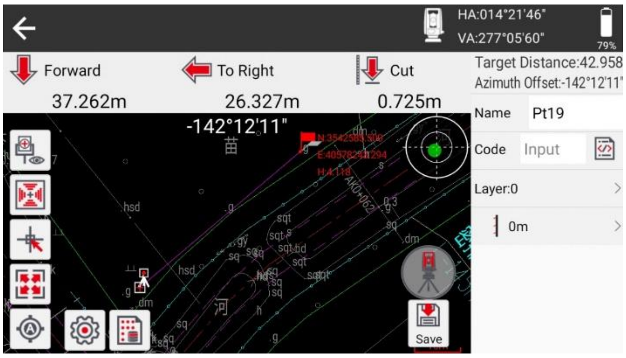


Figure 4.5-6

Figure 4.5-7

Click the drawing data on the screen, select the entity, as shown in 4.5-3. You can perform operations such as delete, details, and stakeout on the data. Click to stakeout and stakeout the data, as shown in 4.5-4. According to actual stakeout needs, stakeout can be carried out using methods such as centerline, left and right side line, real-time pile, input pile, key pile, and divide pile.

Figure 4.5-8

Figure 4.5-9

4.6 Line Stakeout

Click [Line Stakeout] to enter the Lines Database. 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.Lines Database, as shown in Figure 4.6-1, can Add, Import, Export line data. Add a line, as shown in Figure 4.6-2. There are two Input Type, "Start Point + End Point and Start Point" + "Azimuth + Length".

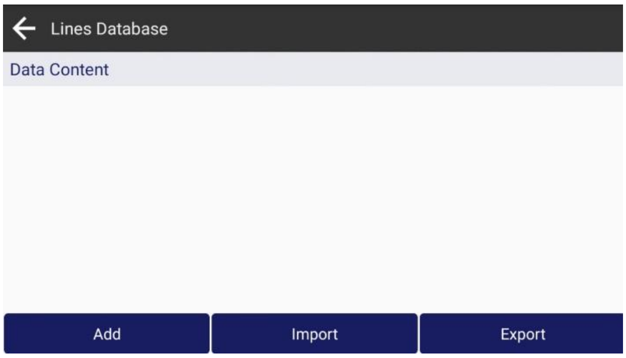


Figure 4.6-1

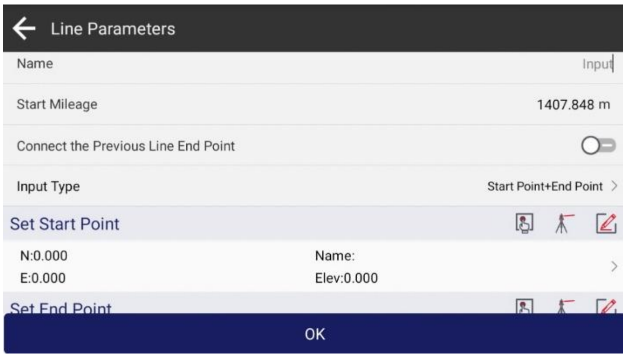


Figure 4.6-2

Click the line list item to Delete, Edit, Insert and Stakeout lines as shown in Figure 4.6-3. Click stakeout, and you can make the Stakeout Settings as shown in Figure 4.6-4, then click OK to enter the line stakeout interface, as shown in Figure 4.6-5. You can also click to add Pile Stake.

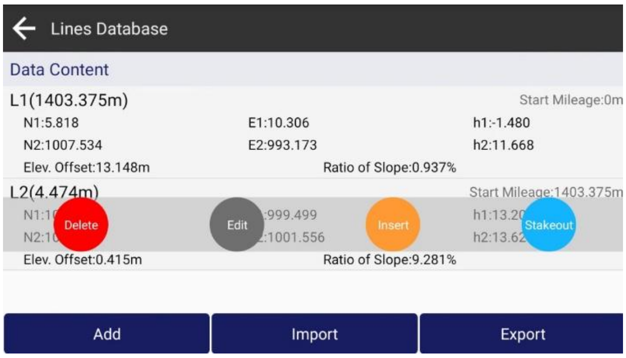


Figure 4.6-3

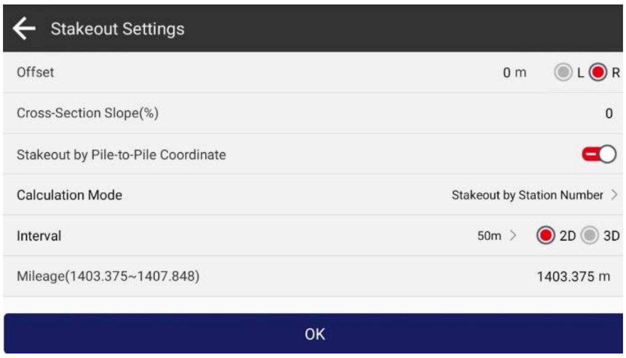


Figure 4.6-4

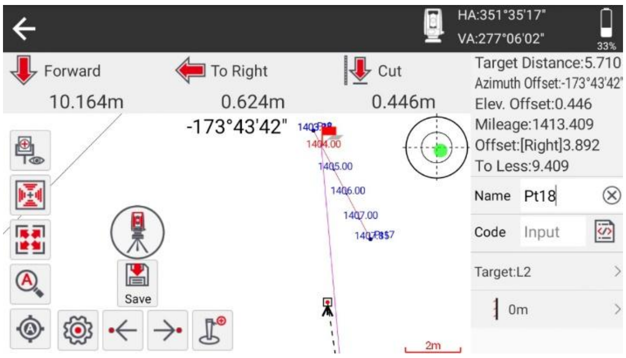


Figure 4.6-5

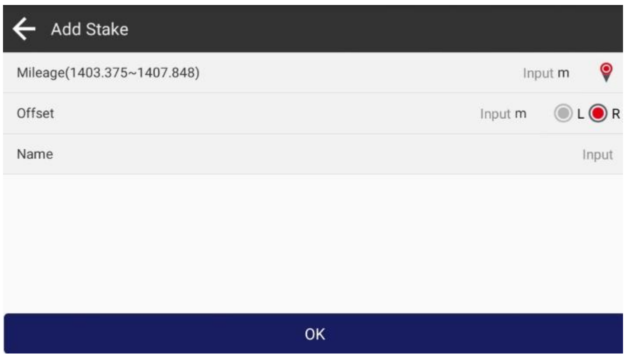


Figure 4.6-6

4.7 Spiral Stakeout

Click [Spiral Stakeout] to enter the Spirals Database interface, as shown in Figure 4.7-1. Spiral Stakeout is the process of inputting data such as circular curves and spiral curves into the Spirals Database and stakeout the curves.

Add a new curve as shown in Figure 4.7-2. You can input a circular curve using known offset angle and intersection, coordinates and radius, three points, and other methods.

Click the curve list item to Delete, Edit, and Stakeout curves. Click Stakeout to enter spiral stakeout settings, as shown in 4.7-3. Perform operations such as the previous point, the next point, and add pile as shown in Figure 4.7-4.

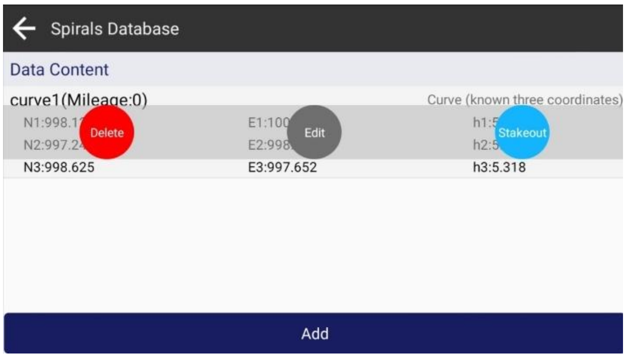


Figure 4.7-1

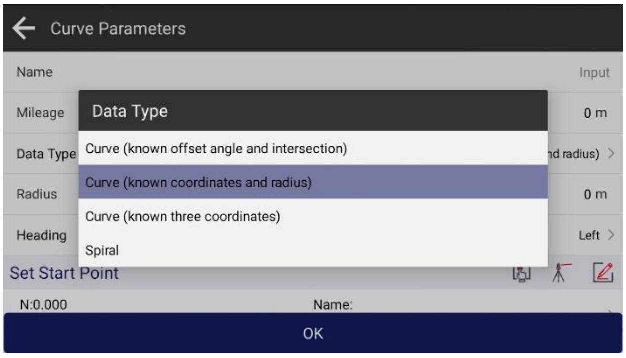


Figure 4.7-2

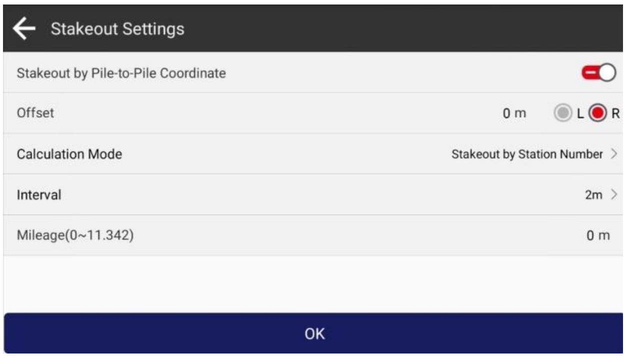


Figure 4.7-3

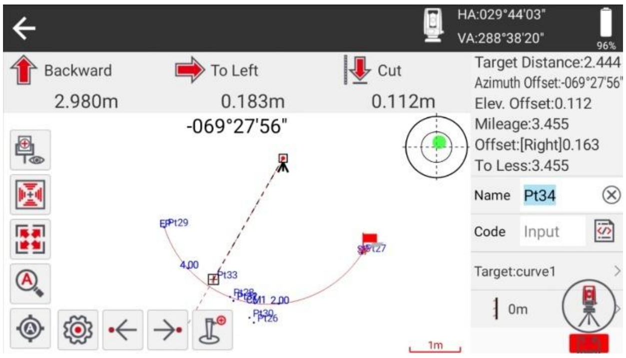


Figure 4.7-4

4.8 DSM Stakeout

Click [DSM Stakeout] to enter the DSM management interface, as shown in Figure 4.8-1, where you can create, Import, Remove, Share, and Stakeout the DSM data.

Create DSM data, as shown in Figure 4.8-2. You can create data such as One-Point Area, Two-Point Area, Three-Point Area, Triangulation File, etc; Create a new Triangulation File data, as shown in Figure 4.8-3, select coordinate points and boundary points to generate the triangulation file.

Click stakeout to stakeout the DSM data, as shown in Figure 4.8-4, and indicate the amount of cut and fill based on the survey coordinate.

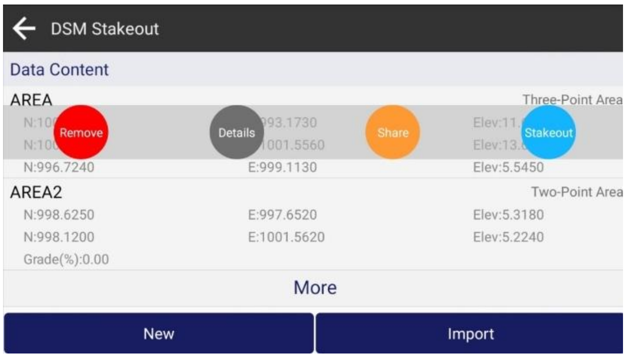


Figure 4.8-1

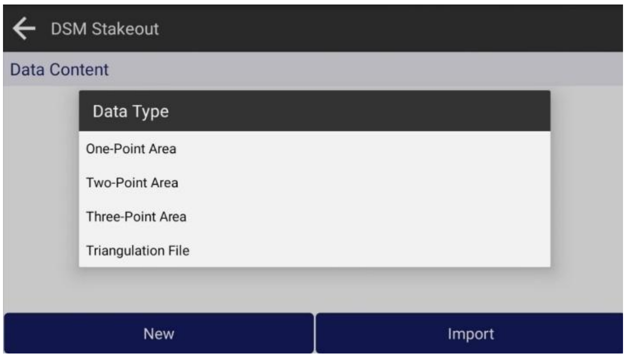


Figure 4.8-2

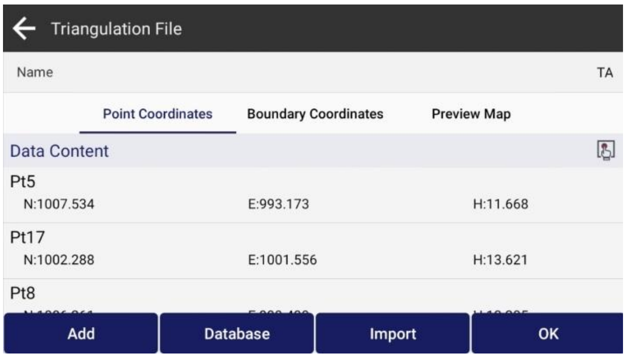


Figure 4.8-3

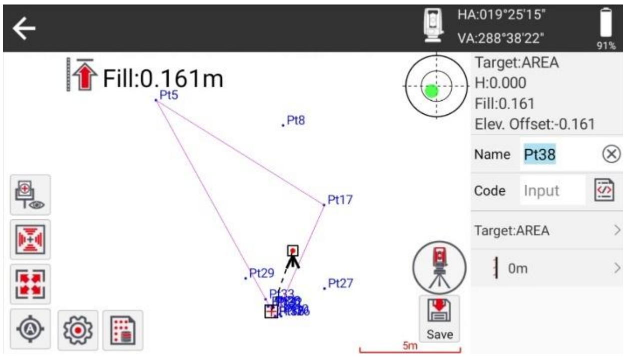


Figure 4.8-4

4.9 Road Design and Stakeout

Click [Stake Road] to enter the Road Database interface, as shown in Figure 4.9-1. The road design and stakeout function is to design the road file based on the design element data of the road's centerline, vertical profile, broken mileage, standard cross section, ultra height, ultra width, slope data, bridges and culverts, and conical slope. According to the road design file and the total station survey coordinates, a series of road thread related applications such as construction stakeout and section data measurement are carried out for the thread.

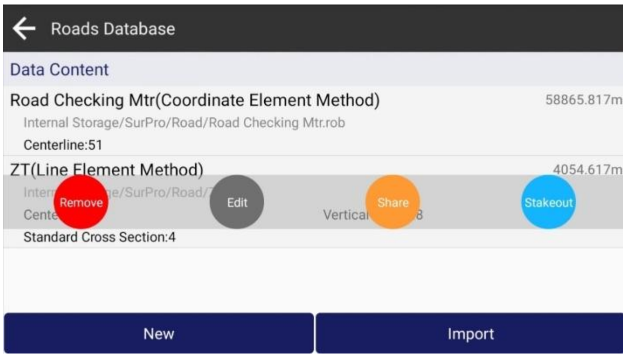


Figure 4.9-1

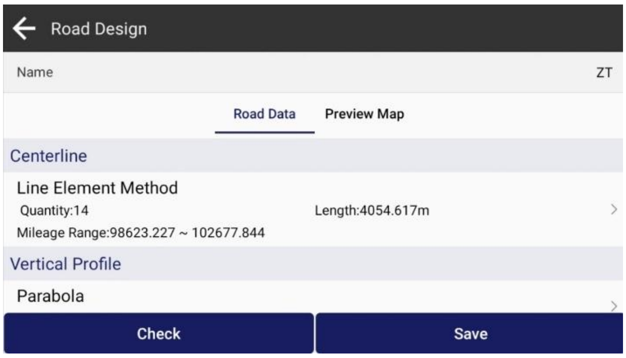


Figure 4.9-2

Road design, as shown in Figure 4.9-2. The road design elements includes centerline, vertical profile, broken mileage, standard cross sections, slopes, bridges and culverts, and conical slope. The standard cross-section includes the ultra height and ultra width of the section blocks. After the road design is completed, the road data can be previewed in a preview image, as shown in Figure 4.9-3.

Figure 4.9-3

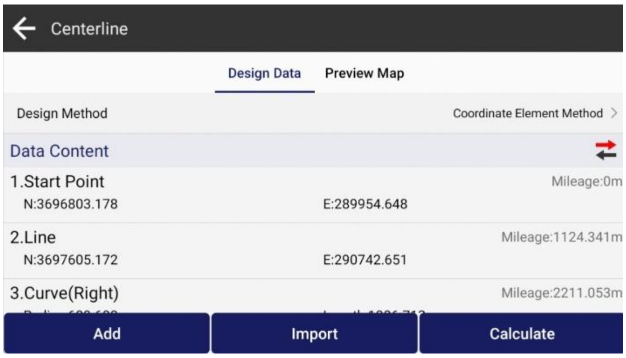


Figure 4.9-4

1. Centerline: As shown in Figure 4.9-4. The methods for designing centerline include line element method, intersection method, and coordinate element method. All roads are composed of a combination of road start point, line, spiral, and curve. The line element method is a design road by input the elements of the road, where the start point includes the start station and coordinates, the line includes the start azimuth and length, the spiral includes the start azimuth and start radius, end radius and length, and the curve includes the start azimuth, radius and length. Usually, in the line element method, the endpoint azimuth of the previous element is equal to the start azimuth of the next element. The radius of the connecting end of the sprial and the line is infinite, and the radius of the connecting

end of the sprial and the circle is equal to the radius of the circle. The intersection method calculates the combination of road design elements through a certain algorithm based on the coordinates of control points on the road and the sprial length, sprial parameter, circle radius, and other parameters of the control points. The coordinate method calculates the combination of road design elements using a certain algorithm based on the coordinate points on the road and the radius of the arc before the coordinate points. The road generated by the coordinate method only has a start point, line, and arc, which is a simplified road without sprial.

2. Vertical profile: as shown in Figure 4.9-5. The vertical profile is the elevation fluctuation of the road centerline at each station. It is the design height of the centerline of the line, which requires the input of the elevation to each station of the line elevation point and the arc radius to the elevation point. The software calculates the elevation values of the line at each station point based on design elements.

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

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

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

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

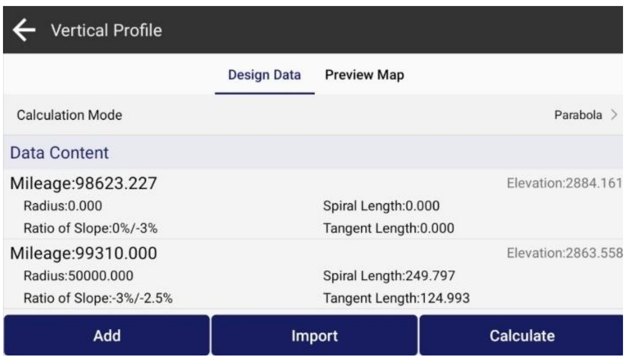


Figure 4.9-5

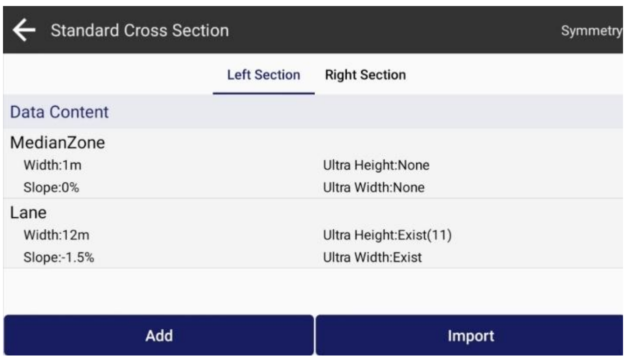


Figure 4.9-6

4.10 Angle Eccentricity

Due to the influence of survey environmental, it is not possible to directly measure the target point, but it is possible to measure the position at the same distance as the target point.
Click [Angle Eccentricity] to enter, and Click Survey function key to measure the same distance point as shown in Figure 4.10-1, then rotate the device to align with the target point. By using the angle at which the device is aligned with the target and the distance measured previously, the coordinates of the target point can be calculated, as shown in Figure 4.10-2.

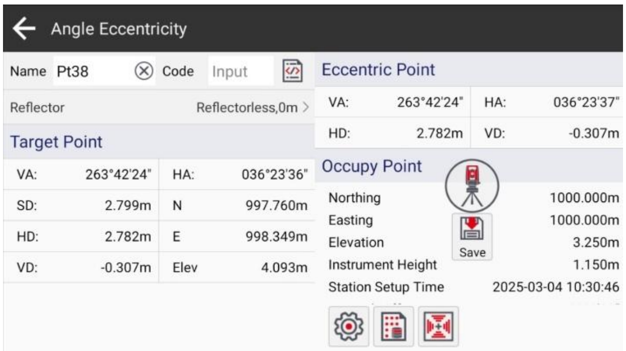


Figure 4.10-1

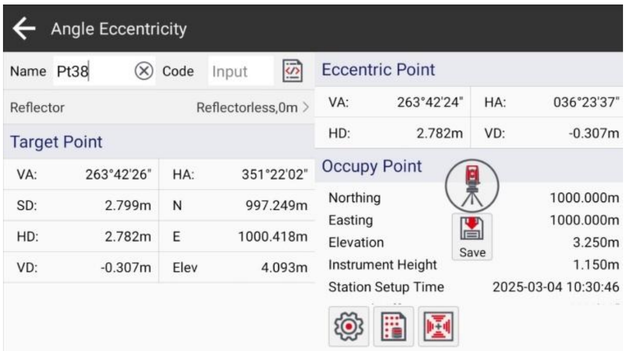


Figure 4.10-2

4.11 Distance Eccentricity

Click [Distance Eccentricity], as shown in Figure 4.11-1. Click Survey function key to measure the eccentric point as shown in Figure 4.11-2 and input the offset value from the target point to determine the coordinates of the target point, as shown in Figure 4.11-3.

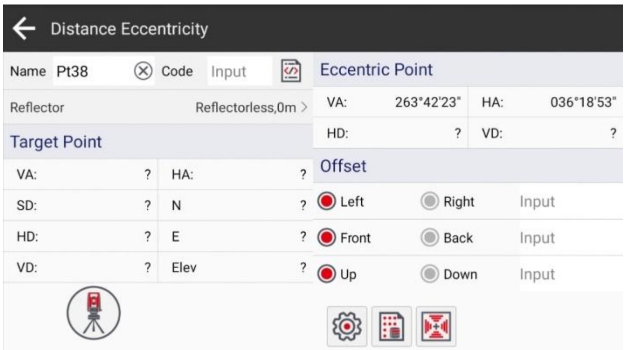


Figure 4.11-1

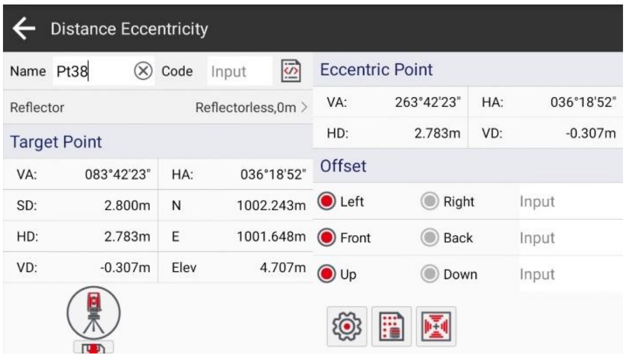


Figure 4.11-2

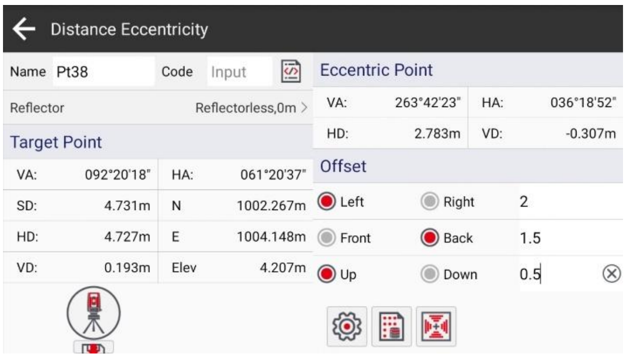


Figure 4.11-3

4.12 Plane Eccentricity

Due to the influence of measurement environmental, it is not possible to directly measure the target point, but it is possible to measure other positions on the plane where the target point is located. Click [Plane Eccentricity], as shown in Figure 4.12-1, measure the three positions of this plane separately as shown in Figure 4.12-2., then rotate the instrument to align with the target point, and the coordinates of the target point can be calculated, as shown in Figure 4.12-3.

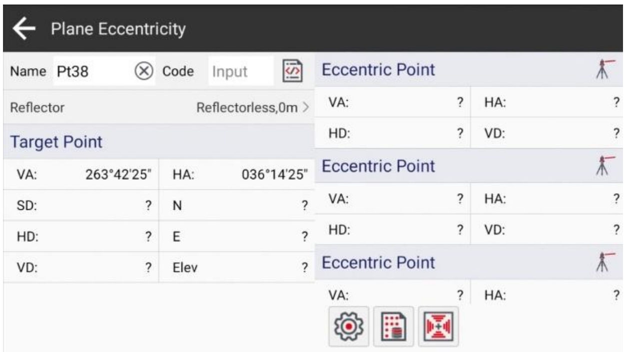


Figure 4.12-1

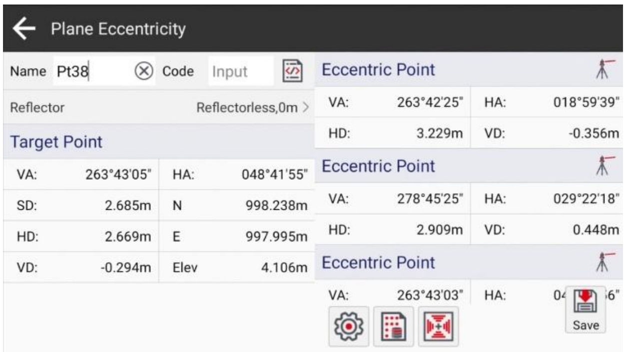


Figure 4.12-2

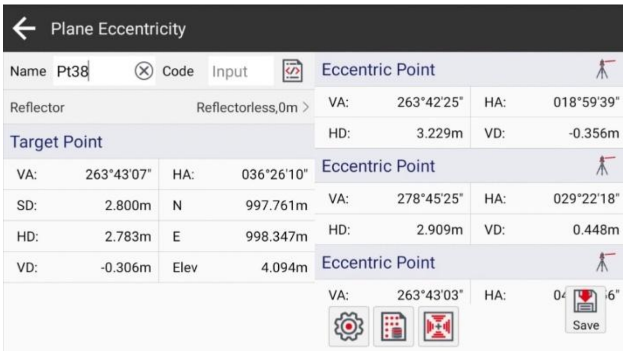


Figure 4.12-3

4.13 Cylinder Eccentricity

Click [Cylinder Eccentricity], as shown in Figure 4.13-1. The total station cannot directly measure the coordinates of the center position of the circular pile. You can measure the distance of the cylinder surface and angles of the two edges of the cylinder separately, you will get the coordinates of the center of the cylinder, as shown in Figure 4.13-2.

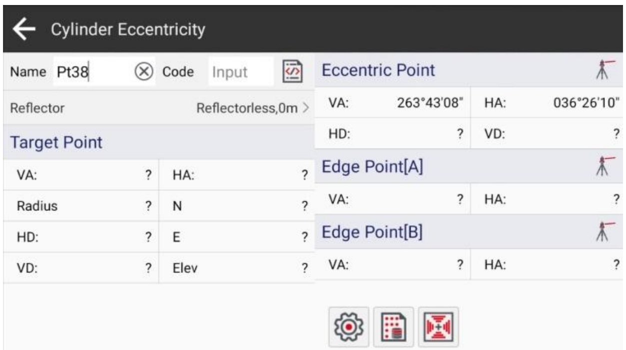


Figure 4.13-1

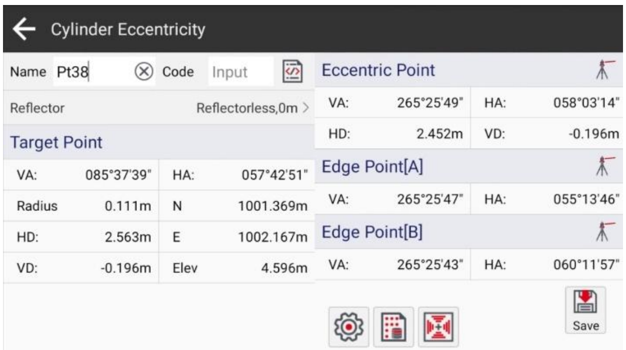


Figure 4.13-2

4.14 Remote Height

Click [Remote Height], as shown in Figure 4.14-1, to measure the height of a vertical object. First, measure the distance and angle at the bottom of the target, and then align it with the top of the target by rotating the angle to calculate the height of the target.as shown in Figure 4.14-2.

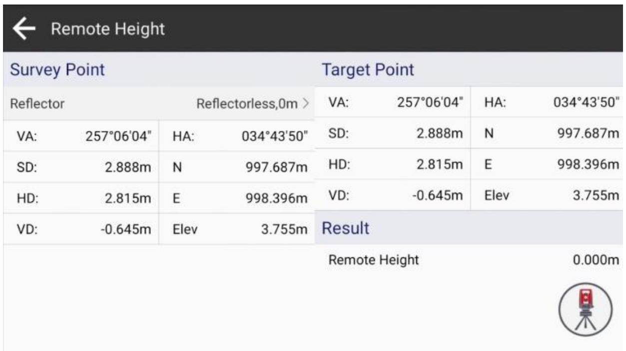


Figure 4.14-1

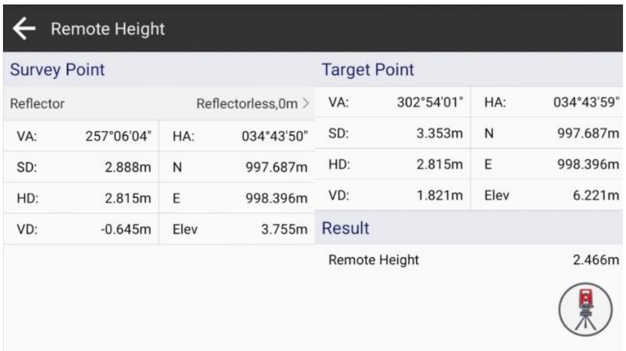


Figure 4.14-2

4.15 Electric Lines Survey

Click [Electric Lines Survey], as shown in Figure 4.15-1. The Electric Lines Survey function is to stakeout known power lines and record survey object data near the electric lines. The surveyed object data is exported and used in professional electric lines design software to determine whether the set electric lines meet the specifications based on the survey data.

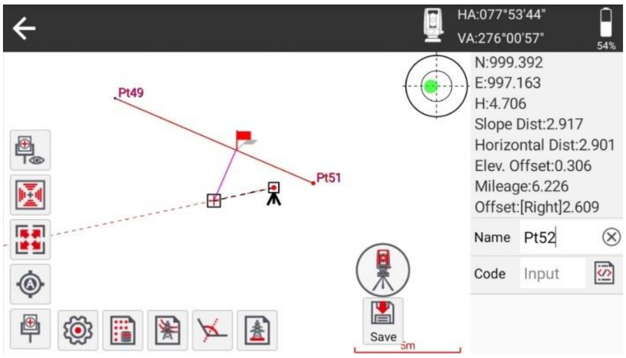


Figure 4.15-1

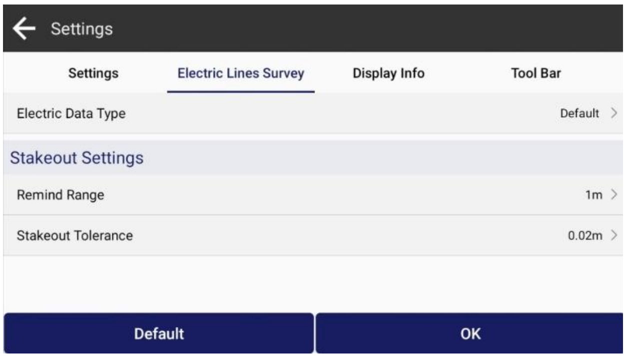


Figure 4.15-2

Click on , enter the electric lines survey settings, as shown in Figure 4.15-2, where you can modify the storage type of electric lines survey data and the stakeout prompt settings. You can click the Electric Data Type to enter the electric object data storage type management library. In addition to supporting default point saving, it also supports customization of electric object types, as well as create, edit, delete, share, and apply data types.

Click Survey&Save to save the survey data.

Click  to enter the electric lines library management, you can add, edit, import, and delete electric lines.

Click  to enter the electric point database, view the surveyed electric point data, export the result data, etc.

Click to enter the bisector stakeout and stakeout the bisector of the electric line towers.

Click to enter the towers for stakeout.

4.16 Electric Towers Stakeout

Click [Electric Towers Stakeout] to stakeout tower point of the electric lines. Select the tower that needs to be surveyed, set the tower's parameters, calculate the tower point, and it also support the calculation methods of four section and eight section. Enter the length and width of the towers, select the tower point, and click stakeout, as shown in Figure 4.16-1 to 4.

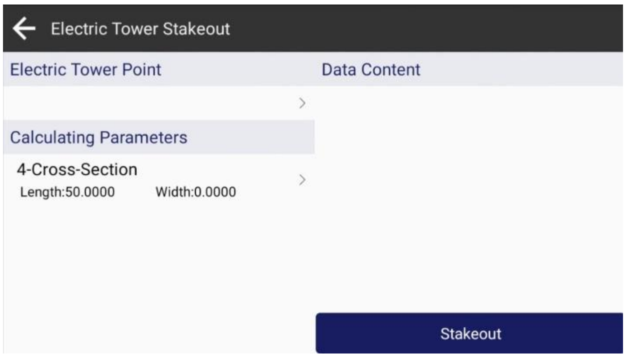


Figure 4.16-1

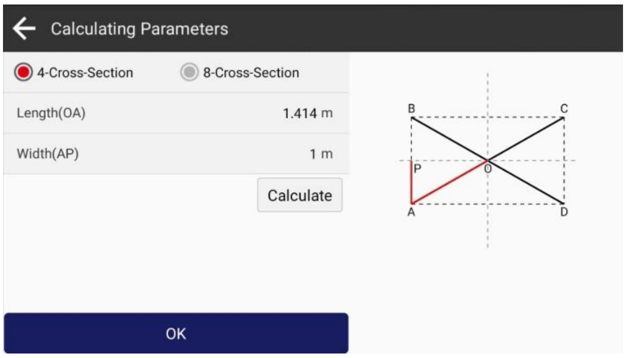


Figure 4.16-2

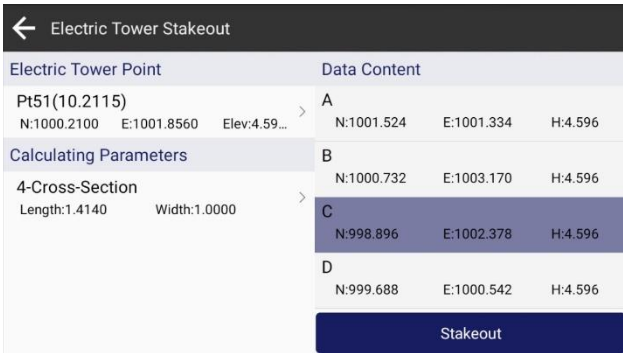


Figure 4.16-3

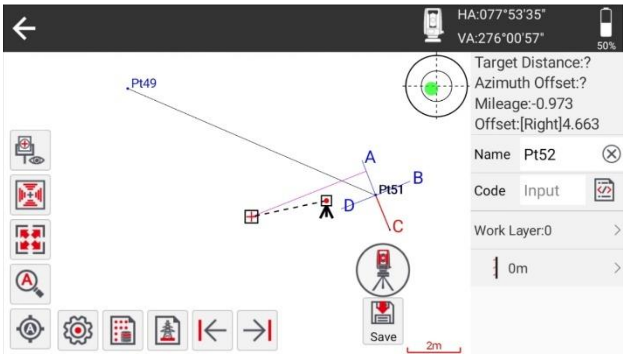


Figure 4.16-4

4.17 Function Customization

Click [Function Customization], as shown in Figure 4.17-1. You can define various types of terrain data and their attributes required for the project as need, and use them as a functional module. You can directly use this functional module to record and export the data results required for the project.

You can perform operations such as create, edit, delete, hide, and share on functional modules. Each function can define multiple different types of features and attributes data, as shown in Figure 4.17-2 and Figure 4.17-3.After defining the function, it will be displayed on the main interface. Click to enter the data survey interface. Select the terrain to be surveyed, as shown in 4.17-5.

Click on , View the survey result data as shown in Figure 4.17-6.

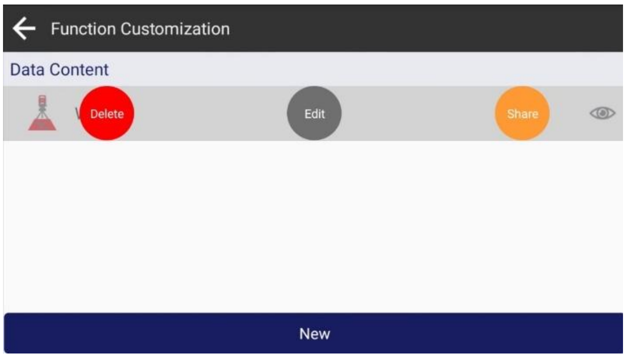


Figure 4.17-1

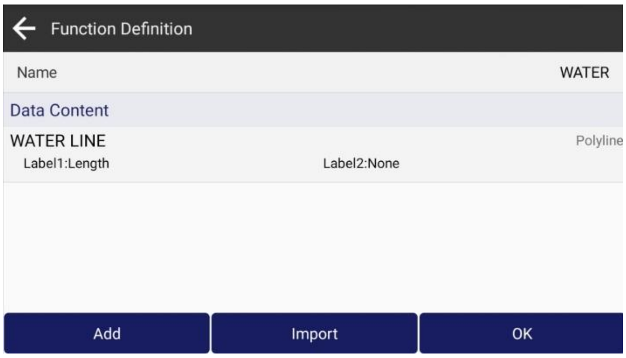


Figure 4.17-2

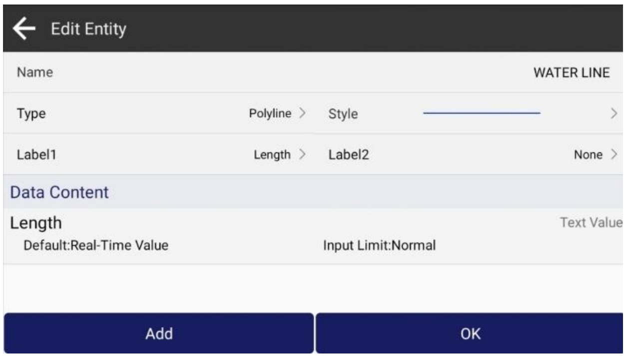


Figure 4.17-3

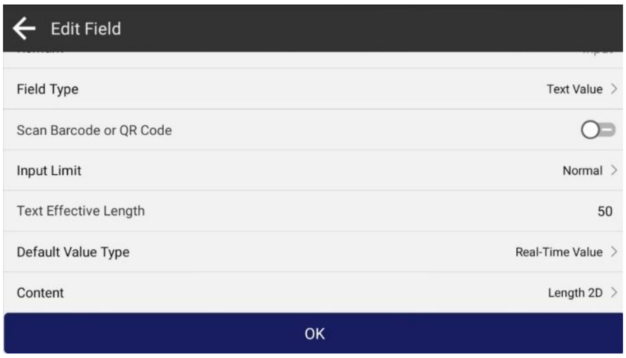


Figure 4.17-4

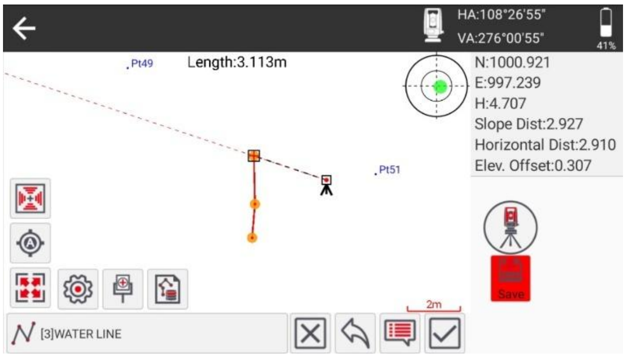


Figure 4.17-5

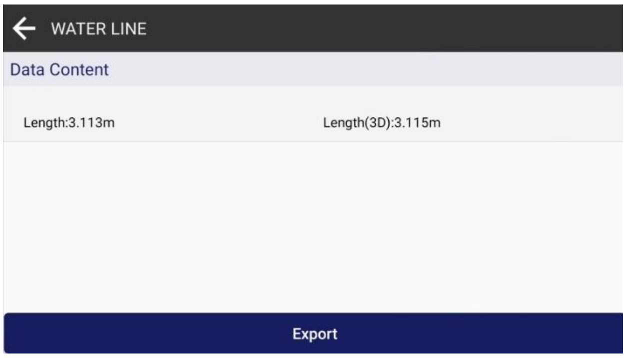


Figure 4.17-6

Chapter V Tools

On the main interface, click [Tools], as shown in Figure 5.1. The tools include Angle Converter, Perimeter and Area, Volume Calculation, Share File, Calculator, Circle Center Calculation, Average Calculation, Coordinate Positive Calculation, Coordinate Inverse Calculation, Point Line Calculation, Angle Calculation, Intersection Calculation, Resection, Forward Intersection, Offset Point Calculation, Extension Point Calculation, Equal Point Calculation.

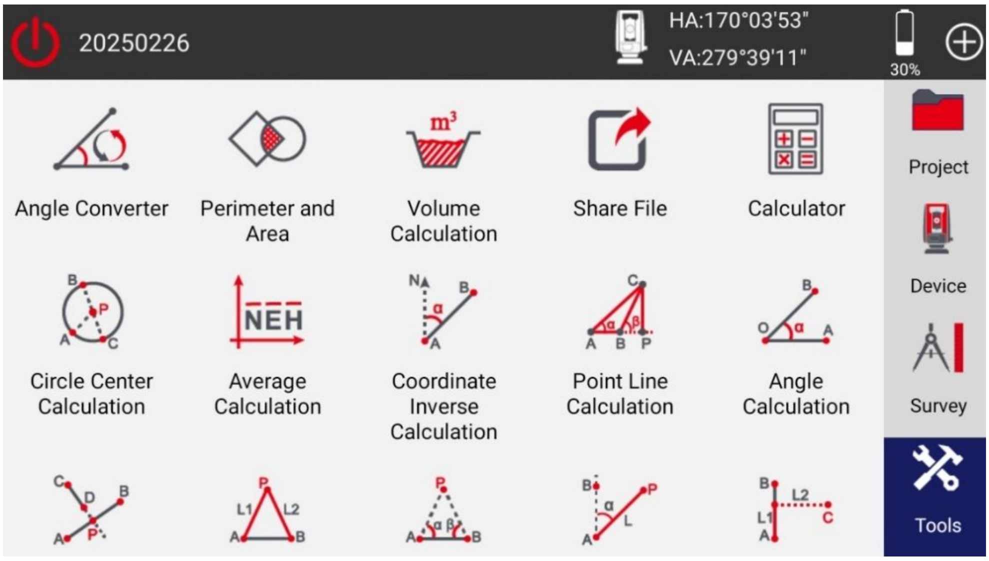


Figure 5.1

5.1 Angle Converter

Click [Angle Converter], as shown in Figure 5.1-1. 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.

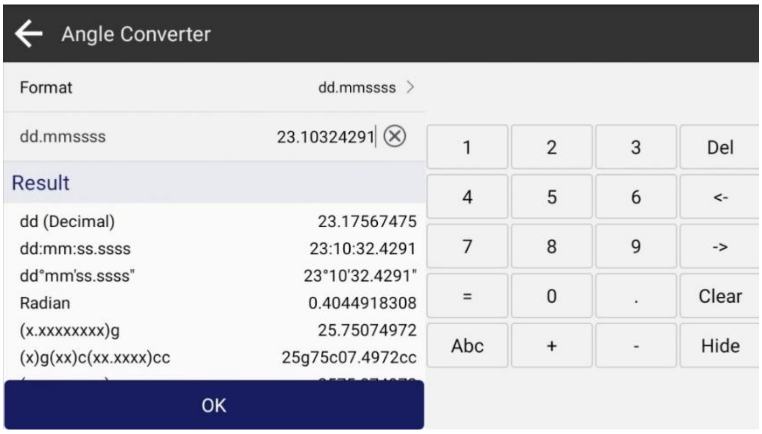


Figure 5.1-1

5.2 Perimeter and Area

Click [Perimeter and Area], as shown in Figure 5.2-1, 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 5.2-2.

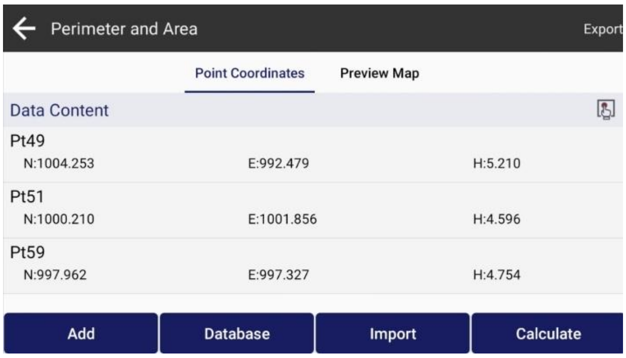


Figure 5.2-1

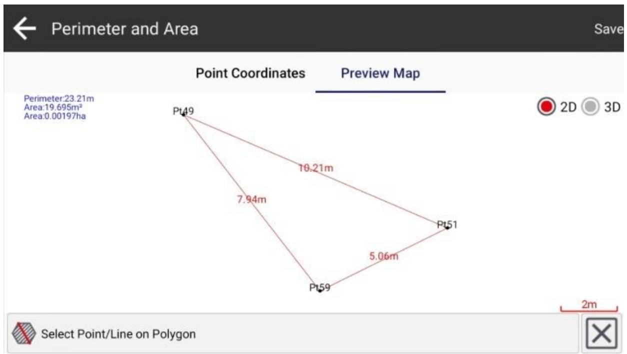


Figure 5.2-2

5.3 Volume Calculation

Click [Volume Calculation] to Enter the triangulation database as shown in Figure 5.3-1. And select the calculation surface, as shown in Figure 5.3-2. After selecting the calculation surface, enter the reference height or select the reference surface to calculate the earthwork volume of the positive and negative volume for that surface.

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

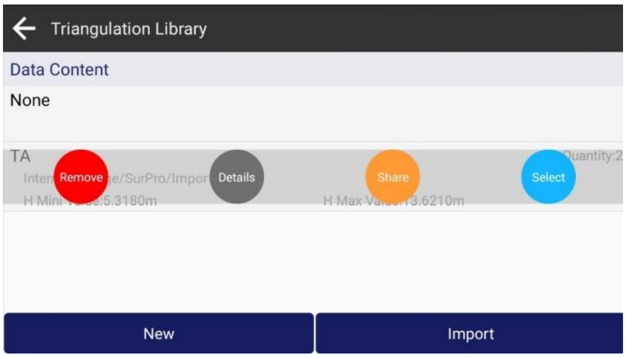


Figure 5.3-1

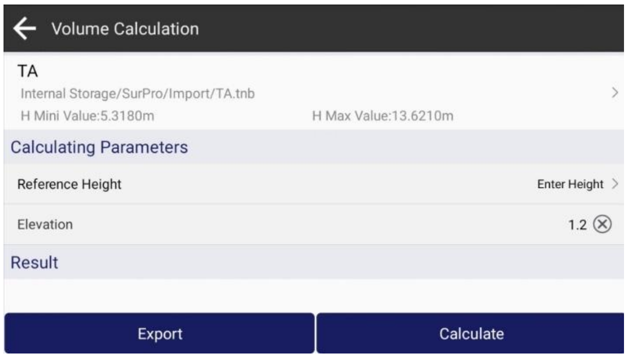


Figure 5.3-2

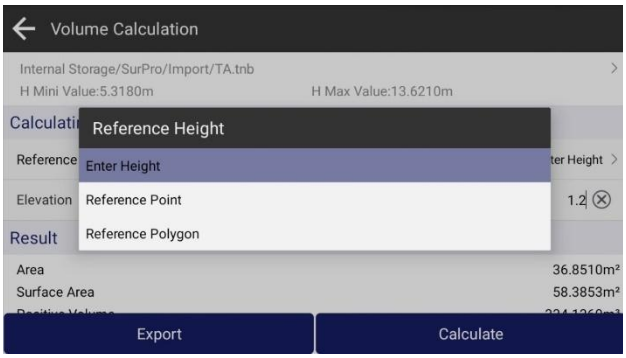


Figure 5.3-3

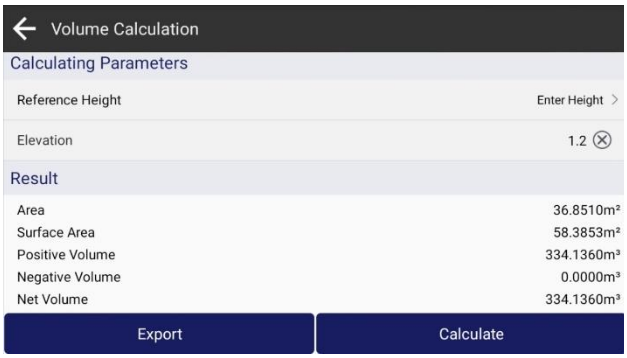


Figure 5.3-4

5.4 Share File

Click [Share File], as shown in Figure 5.4-1. Select the files that need to be shared. After sharing, as shown in Figure 5.4-2, other devices can enter the sharing code or scan the QR code on the main interface of the software to obtain the shared files.

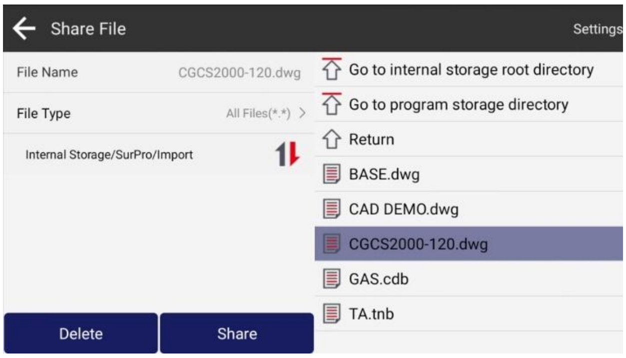


Figure 5.4-1

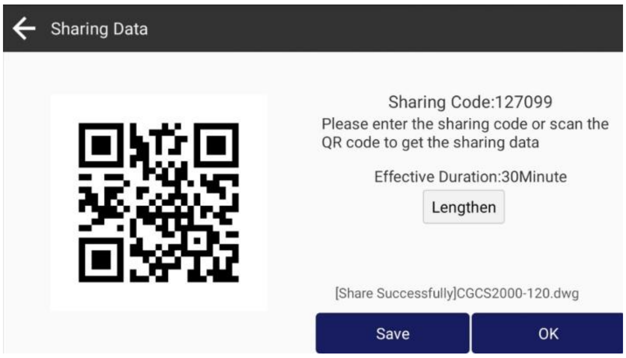


Figure 5.4-2

5.5 Calculator

Click [Calculator], as shown in Figure 5.5-1. Perform some simple mathematical operations.

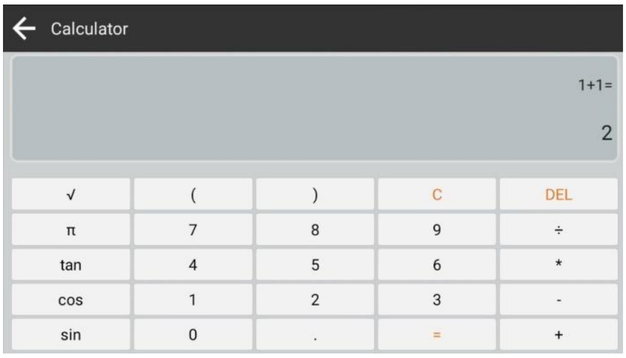


Figure 5.5-1

5.6 Center Point Calculation

Click [Center Point Calculation], as shown in Figure 5.6-1. Calculate the center point using three known points and save the result to the point database.

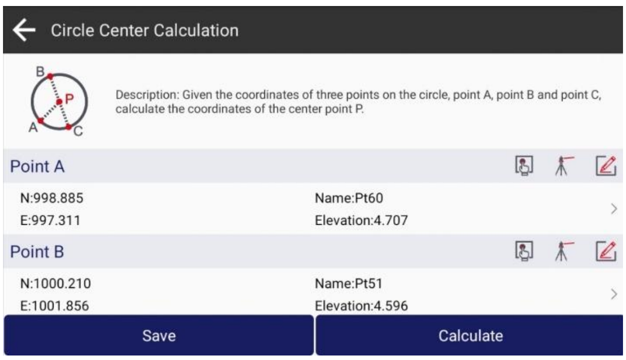


Figure 5.6-1

5.7 Average Calculation

Click [Average Calculation], as shown in Figure 5.7-1. It is possible to calculate the average of N points, display the difference between each point and the result, and save the result to the point database.

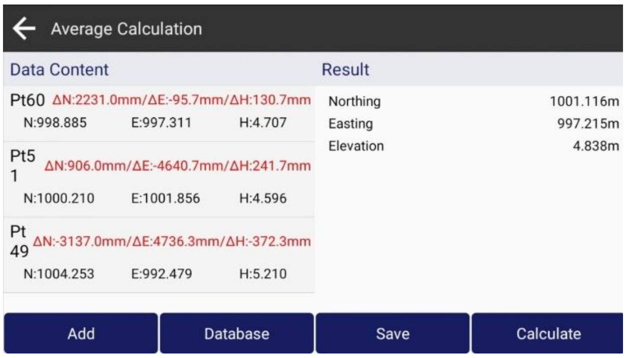


Figure 5.7-1

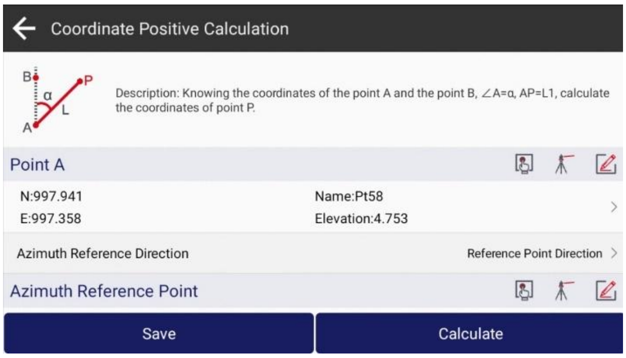


Figure 5.8-1

5.8 Coordinate Positive Calculation

Click [Coordinate Positive Calculation], as shown in Figure 5.8-1. Input/select known point A and azimuth reference point B, input offset distance and angle, calculate the offset point coordinates, and save the results to the point database.

5.9 Coordinate Inverse Calculation

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

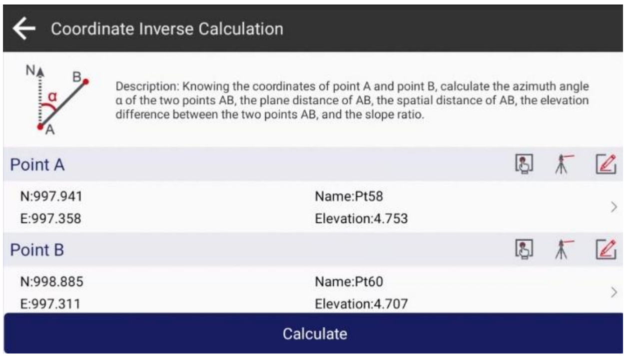


Figure 5.9-1

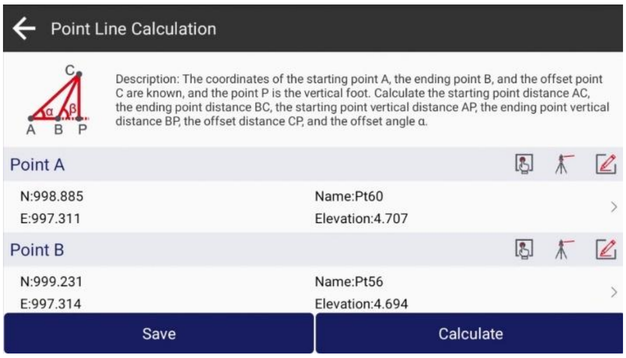


Figure 5.10-1

5.10 Point Line Calculation

Click [Point Line Calculation], as shown in Figure 5.10-1. Input/select three known points, calculate the distance, vertical distance, deviation angle, corner, etc. of the points.

5.11 Angle Calculation

Click [Angle Calculation], as shown in Figure 5.11-1. Calculate the angle by three points.

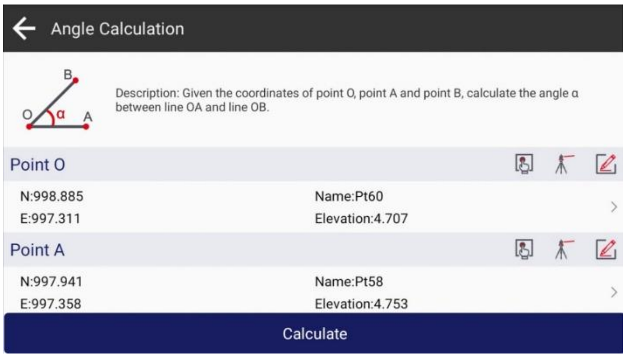


Figure 5.11-1

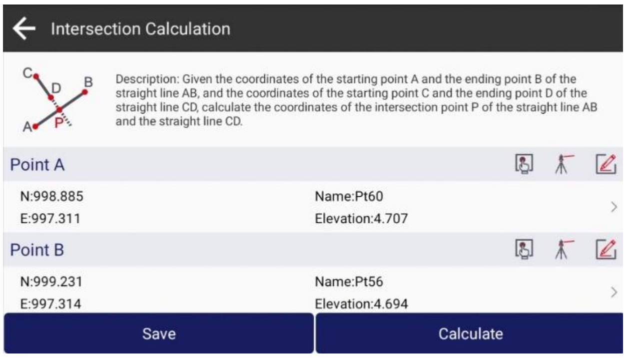


Figure 5.12-1

5.12 Intersection Calculation

Click [Intersection Calculation], as shown in Figure 5.12-1. Calculate the intersection point of two lines and save the result to the point database.

5.13 Resection

Click [Resection], as shown in Figure 5.14-1. Given two points and their respective distances to the target, calculate the target points and save the results to the point database.

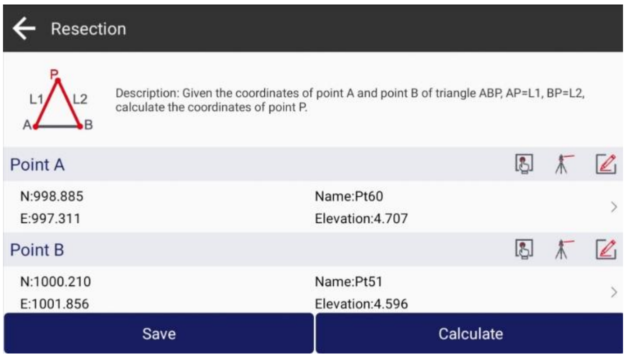


Figure 5.13-1

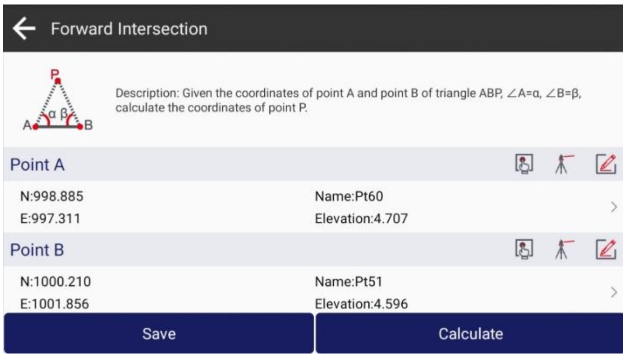


Figure 5.14-1

5.14 Forward Intersection

Click [Forward Intersection], as shown in Figure 5.15-1. Given two points and their azimuth angles with the target, calculate the target point and save the result to the point database.

5.15 Offset Point Calculation

Click [Offset Point Calculation], as shown in Figure 5.16-1. Given two points, calculate the coordinate of the mileage and offset, and save the results to the point database.

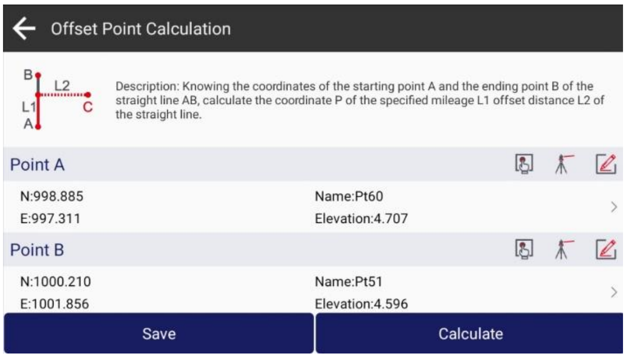


Figure 5.15-1

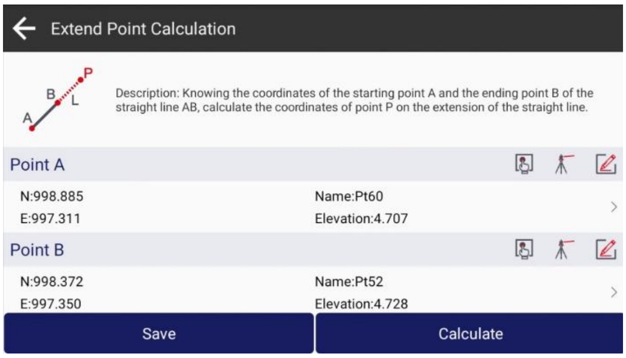


Figure 5.16-1

5.16 Extend Point Calculation

Click [Extend Point Calculation], as shown in 5.17-1. Enter two known points, calculate the coordinate on the extension line, and save the results to the point database.

5.17 Equal Point Calculation

Click [Equal Point Calculation], as shown in 5.18-1. Enter two known points, calculate the coordinates of the line segment, and save the results to the point database.

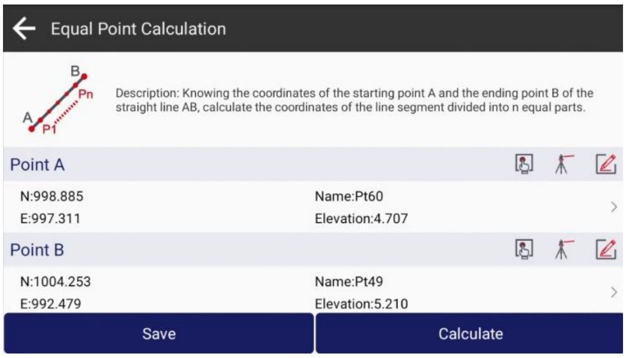


Figure 5.17-1