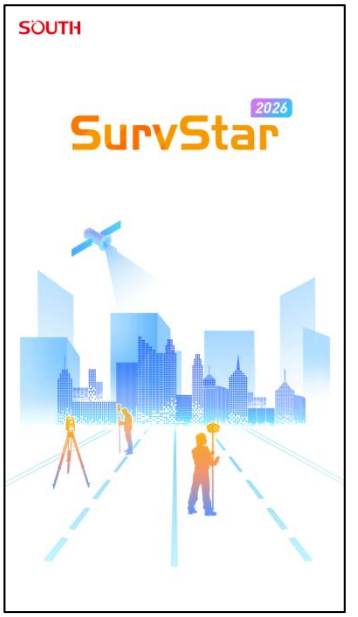


Survstar User Manual

V3.03 2026

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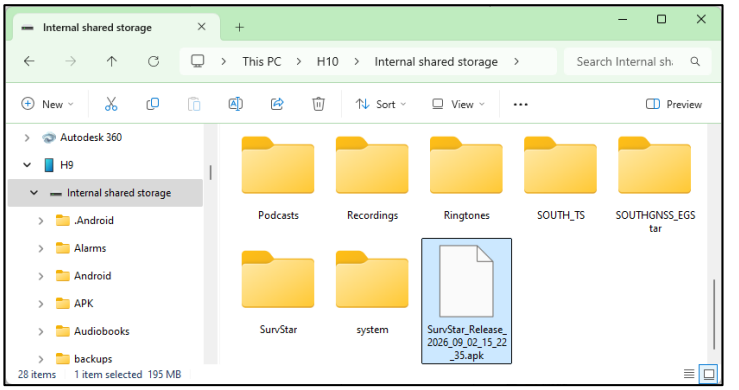
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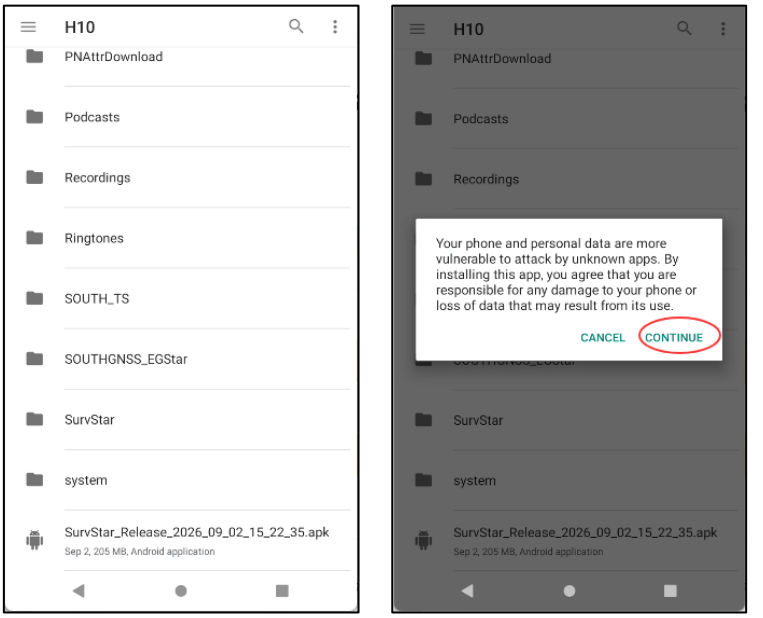
Chapter 1 Installation & Uninstall

1-1 Installation

1. Copy the APK file to android device storage.

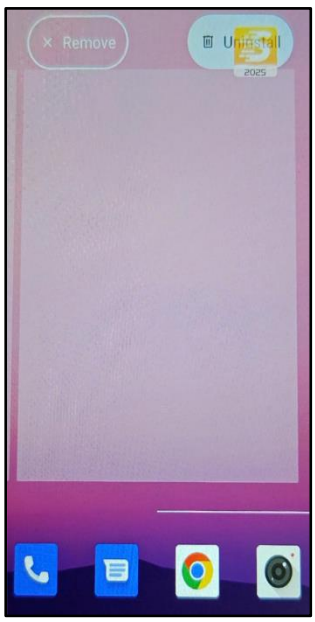


2. Find the APK file in android device and click it to install Survstar.



1-2 Uninstall

Find the Survstar icon in android device, and long press it then drag and drop it to Uninstall.





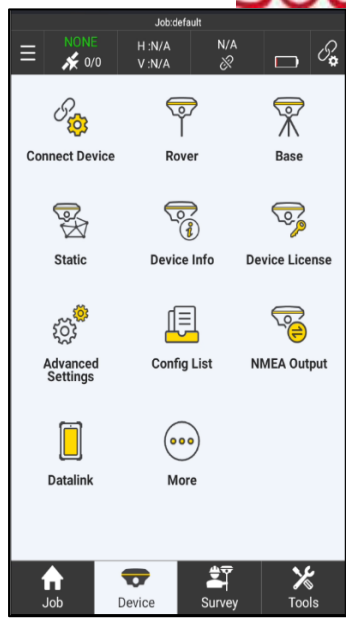
Chapter 2 Main Interface

2-1 Introduction

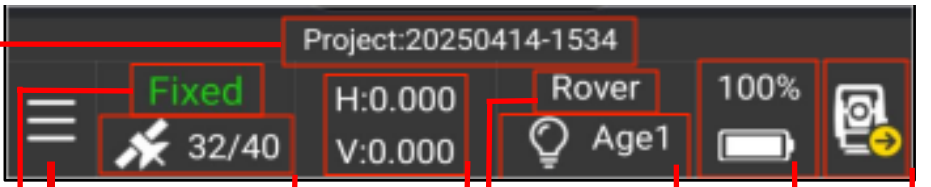
Open Survstar, on the top it is General Information section (including the current Job name, gnss quality status, satellite number, HRMS and VRMS, work mode and datalink, device battery percentage, device connection), on the bottom it is the Function section (including four main functions: Job, Device, Survey and Tools)


2026
SurvStar


SOUTH
SurvStar
2026


Job:default
NONE
0/0
H :N/A
V :N/A
N/A
Connect Device
Rover
Base
Static
Device Info
Device License
Advanced Settings
Config List
NMEA Output
Datalink
More
Job
Device
Survey
Tools

2-2 General Information section



online services

current Job name.

gnss status: Single, DGPS, Float or Fixed.

satellite number: Used/Tracked satellites.

H and V: HRMS and VRMS, displayed in meters.

work mode: Base, Rover or Static.

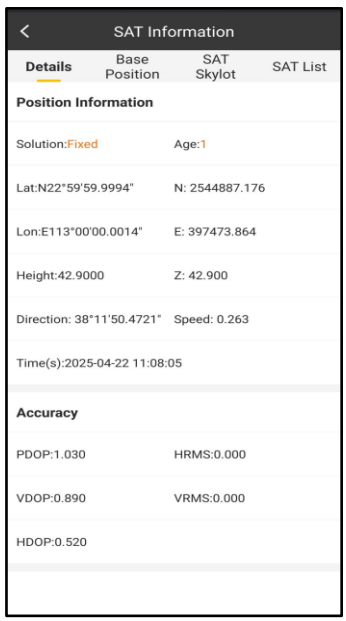
datalink: UHF, internet, external or Bluetooth (by collector internet).

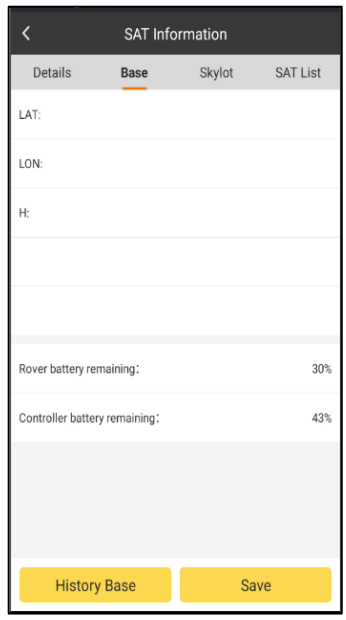
device battery percentage.

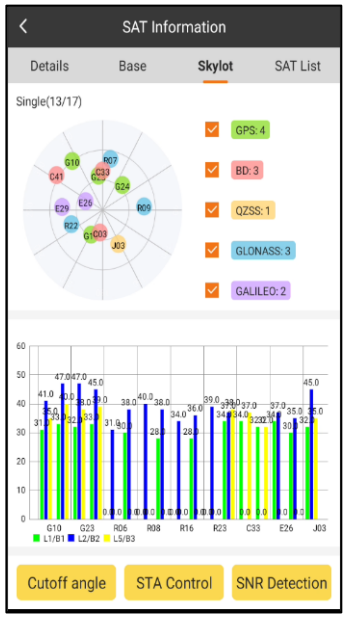
device connection: check the device connection quickly.

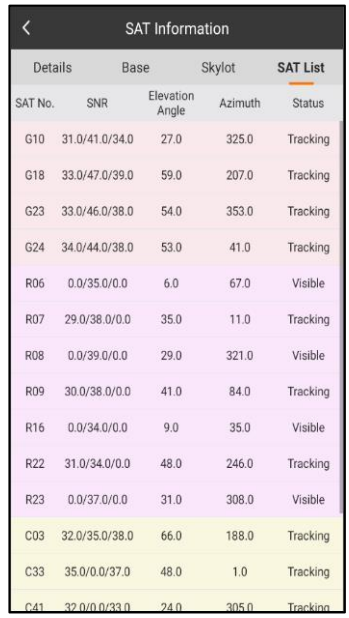
Click 

, we will enter to SAT Information page. In that page, we can check the position information, accuracy, base position, SAT skylot, SNR and SAT list.

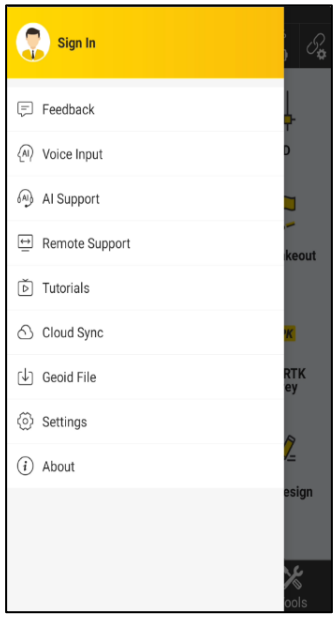








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2-3 Function section

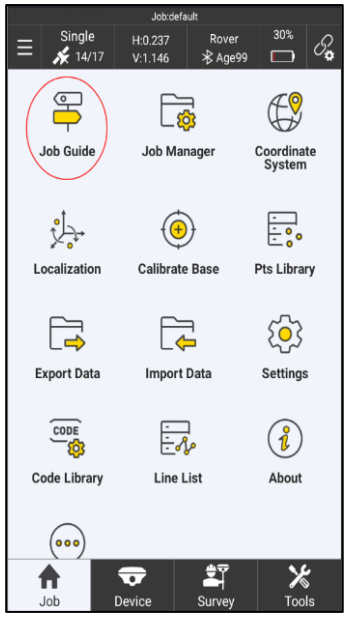
There are four main section on the bottom: Job (*Chapter 3*), Device (*Chapter 4*), Survey (*Chapter 5*), Tools (*Chapter 6*)

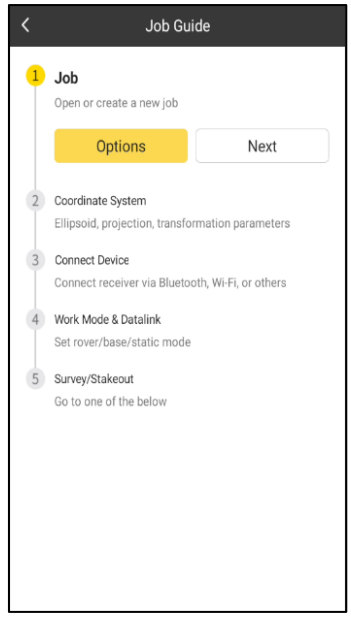
Chapter 3 Job

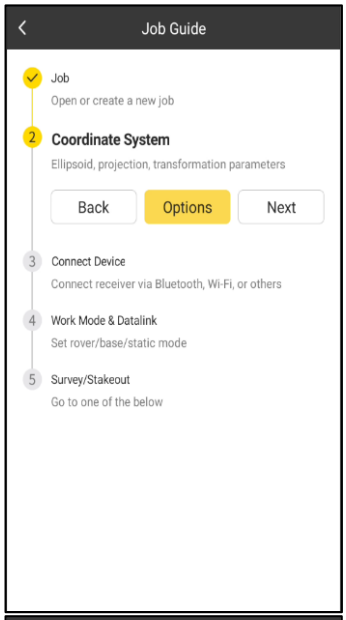


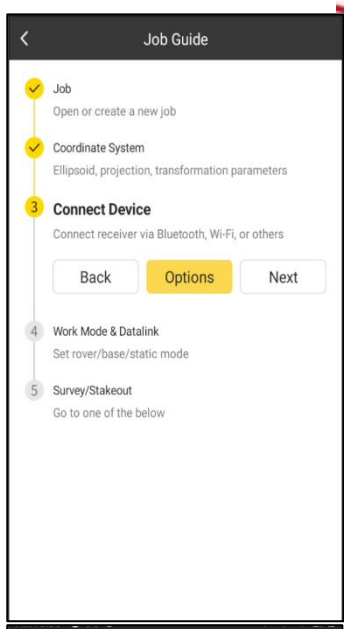
3-1 Job Guide

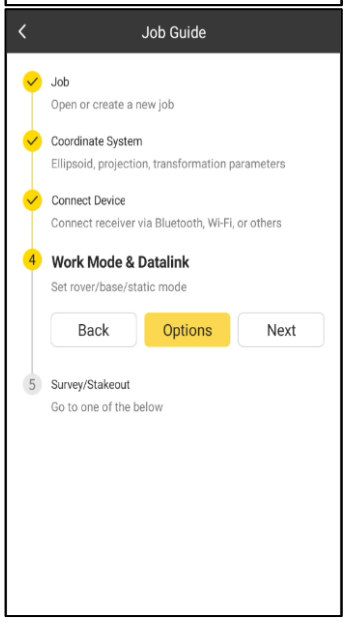
Job Guide is a quick workflow to start working by Survstar, it contains the Job (Job Manager, Coordinate System), Device (Connection, Rover/Base/Static mode and datalink), Survey(Point Survey, Point Stakeout, Line Stakeout) configuration, Click the “Options” to change the configurations.

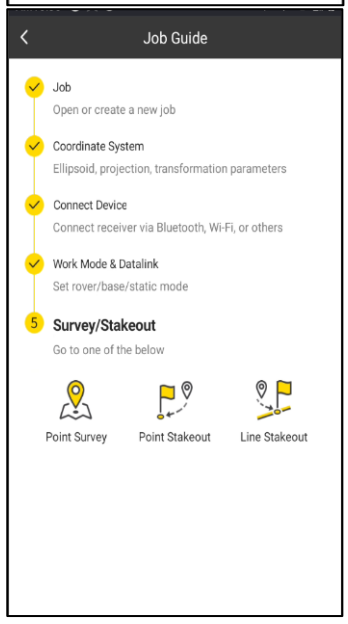






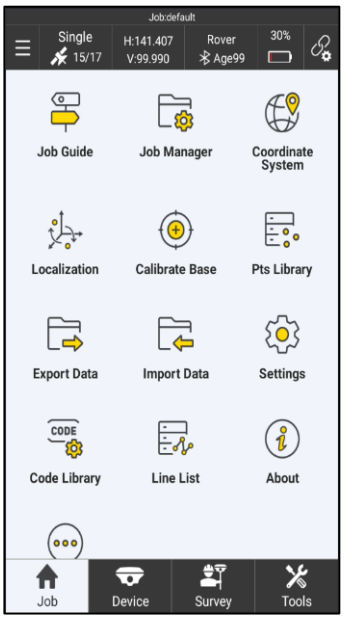




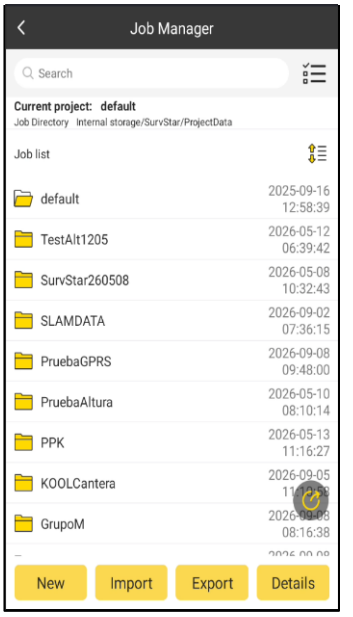


3-2 Job Manager

Job Manager defines the title of a Job, and where the job folder store. You can choose and check the data on the previous job, or create a new job file.

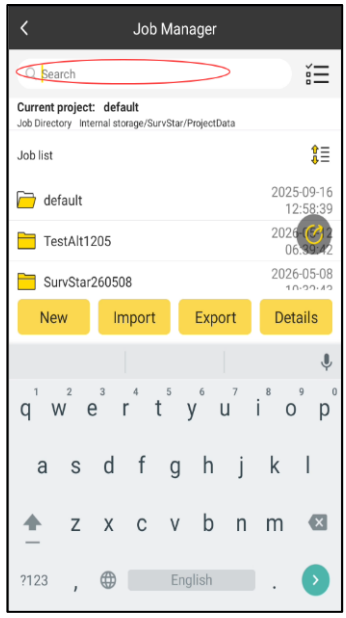


job we created are saved in the default directory of controller: Internal storage/Survstar/JobData.



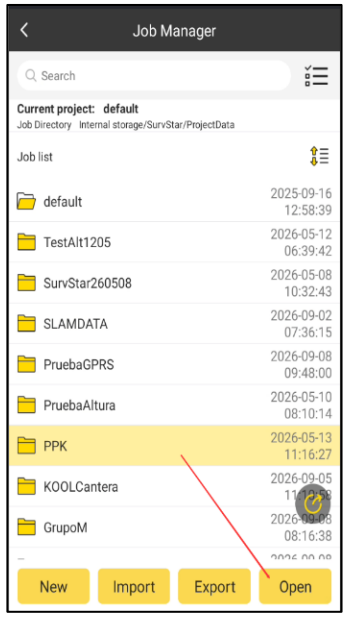
3-2-1 Search Job

In Job Manager-Job List, we can search jobs.



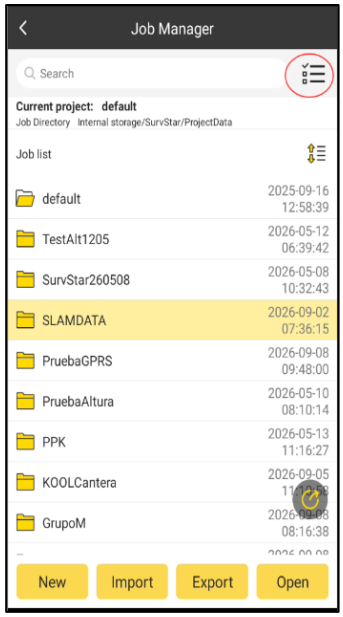
3-2-2 Open Job

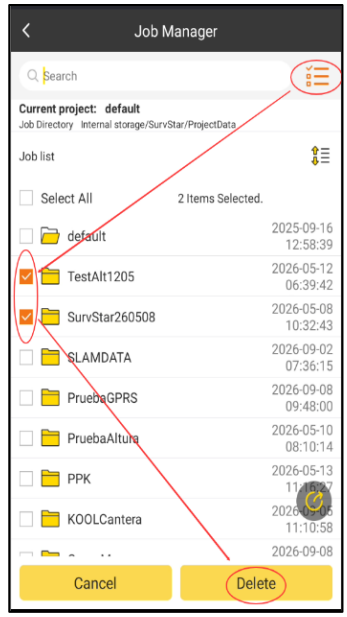
Choose the Job, Click Open, then the job selected will be opened.



3-2-3 Delete Job

Click the multi-select button, then select the job you want delete, click Delete， and this job will be deleted.

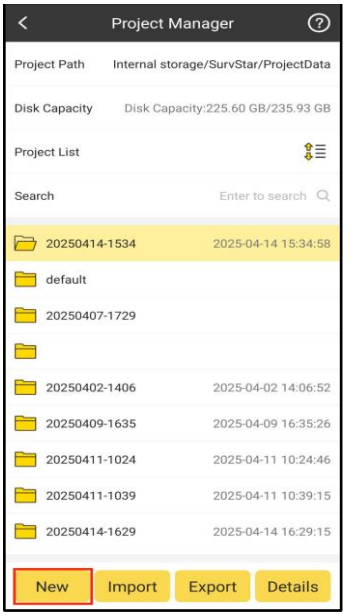




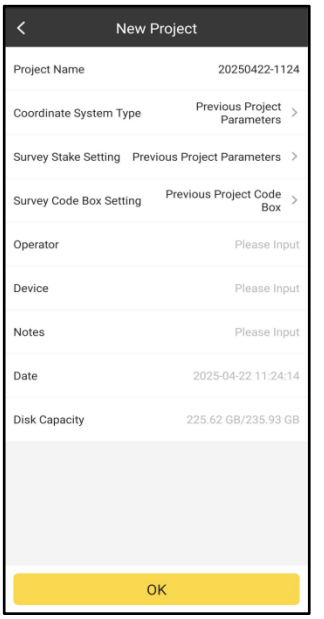
3-2-4 Create new Job

When we run Survstar, we need to create a Job and define basic information such as Job name, operator and coordinate system type.

Click New to create a new Job.

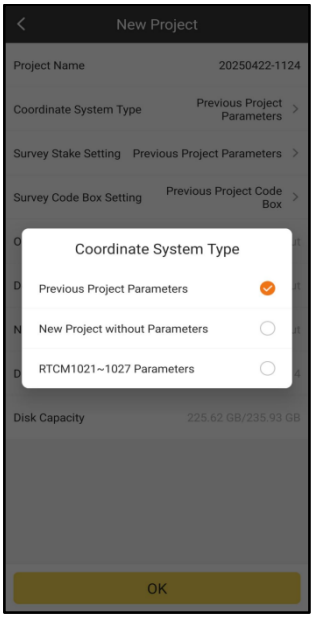


Input the Job Name, Job name doesn't not support "space", supports numbers/letters/-



Coordinate system type: Previous Job Parameters (use the same coordinate system

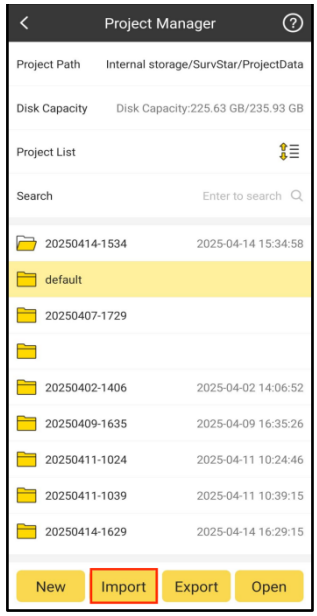
parameters in previous Job), New Job without parameters (no Jobion and ellipsoid parameter, you need to set it on Survstar-Job-Coordinate system later), RTCM1021~1027 Parameters (if select this one, then the Coordinate System parameter in Survstar will not be used, Survstar will use the coordinate system parameters which received by NTRIP CORS with RTCM1021~1027).



3-2-5 Import Job

If Jobs from other controllers are copied into Survstar/JobData, we can open them directly; if they are copied into other directory, we can import them by loading their Job file (*.configure).

Click Import in Job Manager.

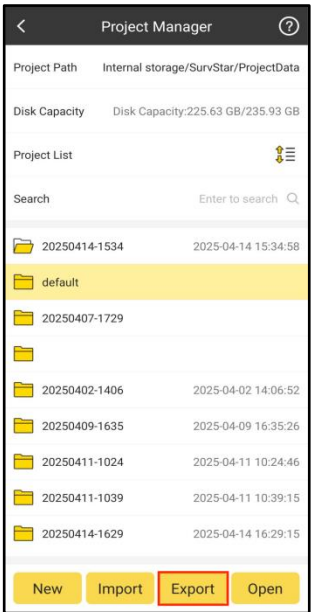


Find the target Job folder, choose the Job file (*.configure) saved before, and click OK. Then the Job will be opened.



3-2-6 Export Job

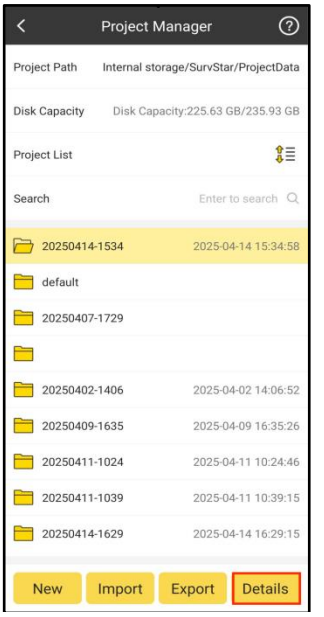
Click Export in Job Manager.



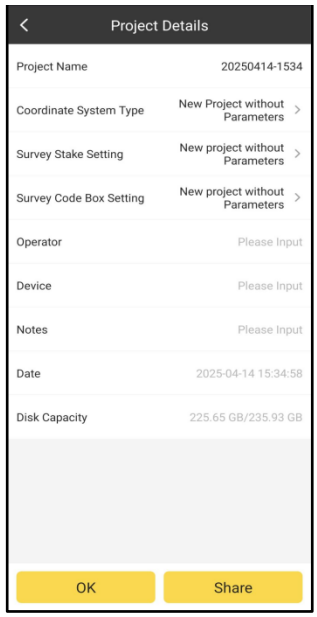
Choose the directory we want to save the Job. Click OK. Then the Job will be saved.

3-2-7 Job Details

Choose the target Job, and Click Details



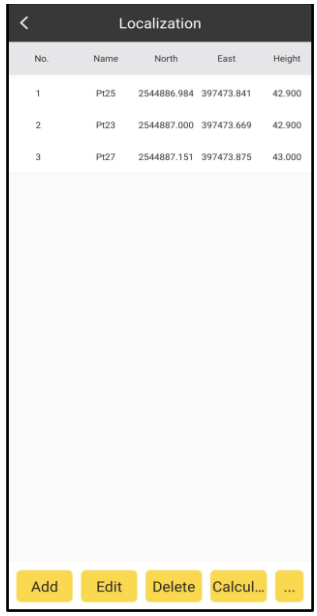
2.We can find relevant Job information, such as Job Name, Coordinate System type etc.



3-3 Localization

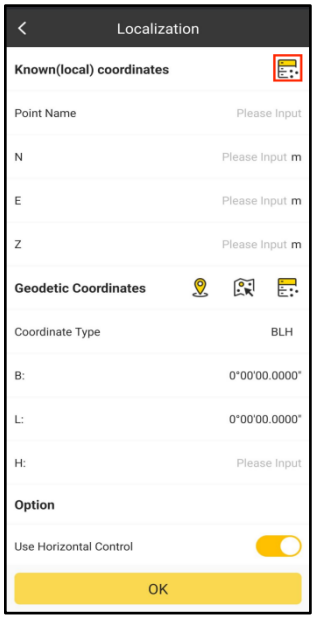
In general, GPS receiver output data is WGS-84 latitude and longitude coordinates. The coordinates need to be converted to the construction measure coordinates, which requires software to calculate and configure coordinate conversion parameters. Localization is the main tool to complete this conversion.

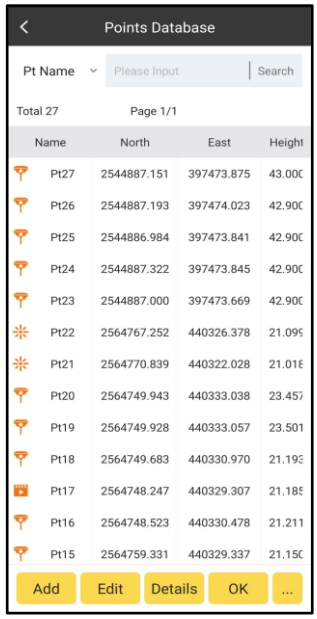
It contains Add, Edit, Delete, Calculate, Import, Export and Settings operation.

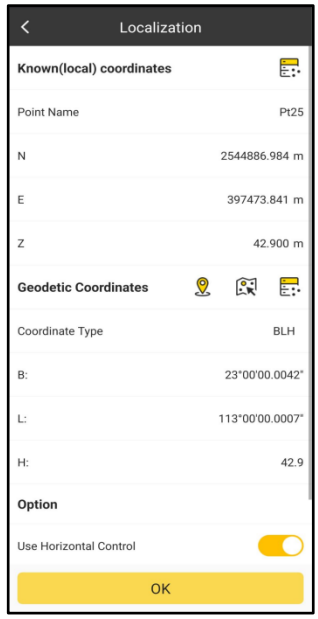


Add:

Click Add, we can add the coordinate point. If we have the surveyed point in database, we can click the icon in the right of the Known(local) coordinates bar. And select the coordinate transformation points with the targeted coordinate. Click OK. Then the NEH will input automatically.

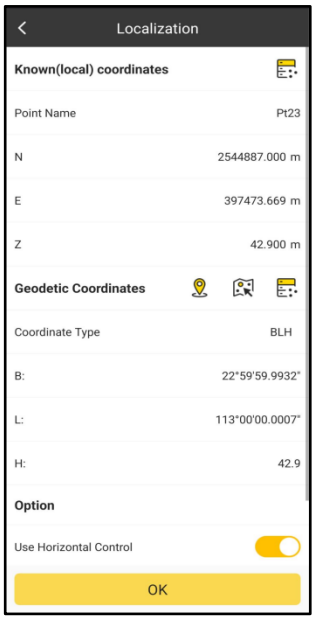


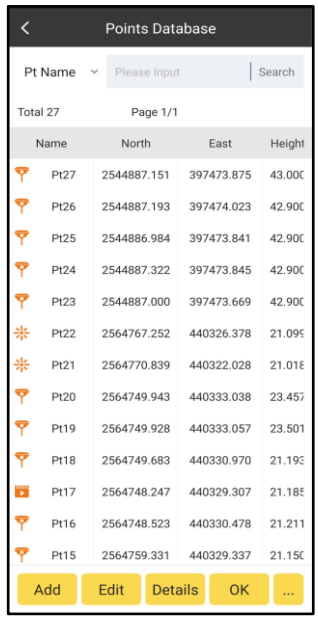


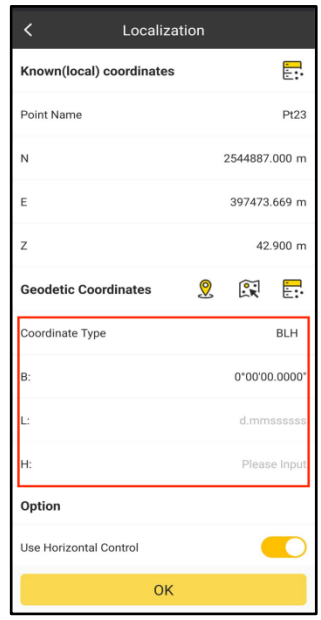


Or we can input the coordinate directly.

nd then we need to input the same point's BLH to it. If we If we have the surveyed BLH in point database, we can click the icon in the right of the Geodetic Coordinates bar. And select the same points with the BLH. Click OK .Then the BLH will input automatically.

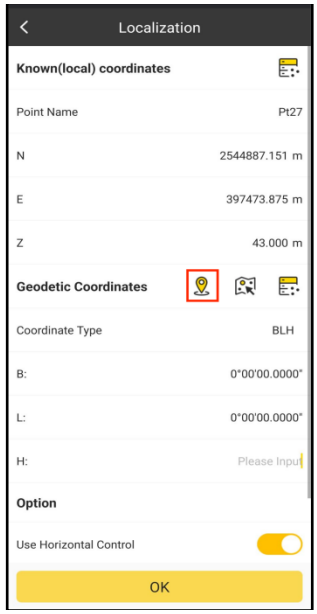


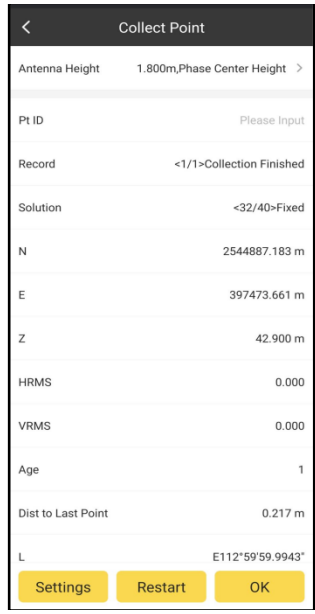




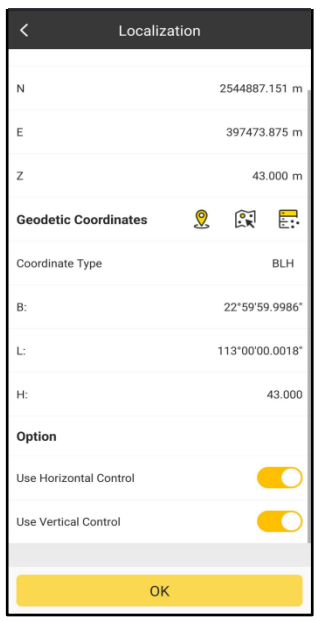
We can also input BLH directly.

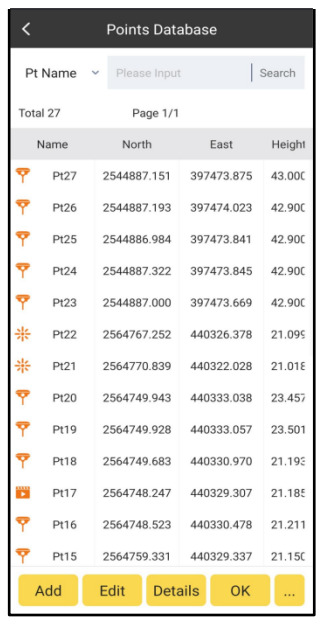
We can also put the device in the point and collect the BLH in site. Click the icon in the right of the Geodetic Coordinates bar. And click OK to collect it.





Then we need to select whether to use the point with horizontal control or vertical control. And Click OK. This point will participate in calculation.



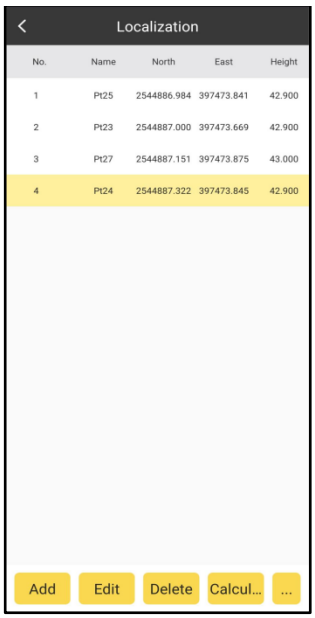


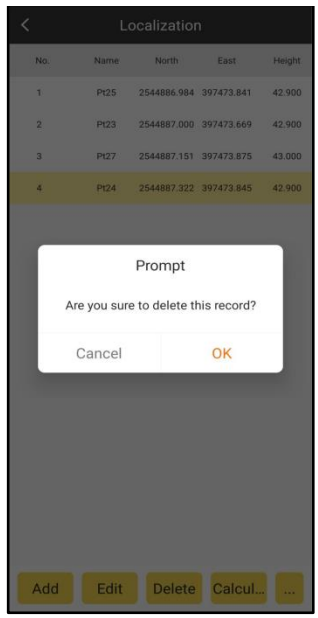
Edit:

Select any point and click Edit We can edit the coordinate of the selected point and select whether to use the point with horizontal control or vertical control.

Delete:

Select any point and click Delete .We can delete the selected point.

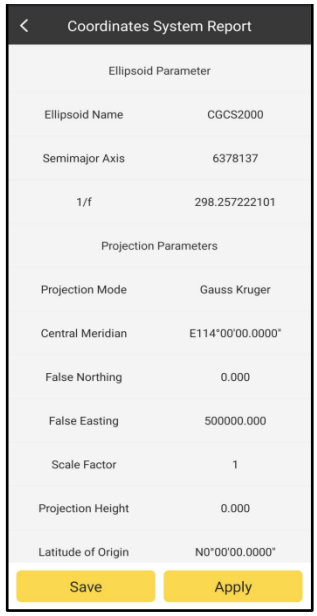






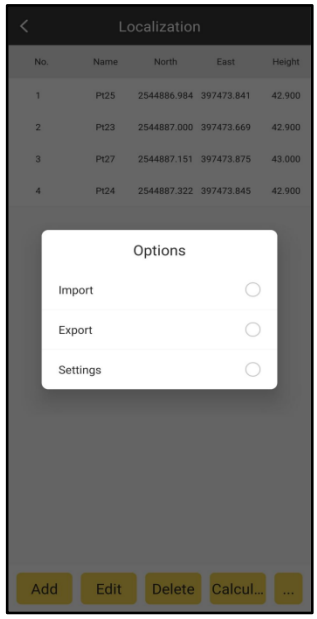
Calculate:

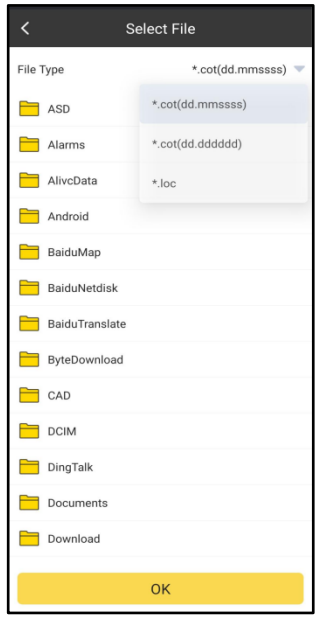
After the coordinate transformation points all inputted. We can click Calculate. Then there will show a coordinates System report. We can save the report by clicking Save. And click Apply, the parameters will apply to the current Job.



Import:

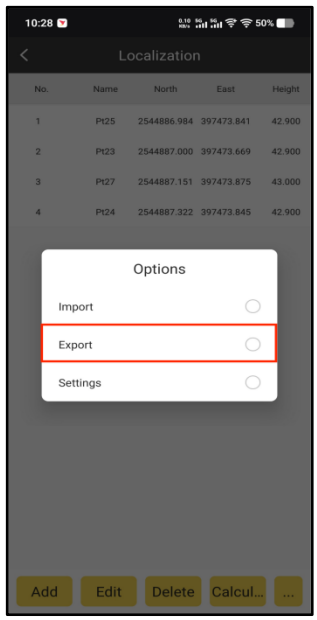
Click ... and Click Import . Select the file type: *.cot(dd.mmssss), *.cot(dd.dddddd) and*.loc. Select file path and click the file. Click OK

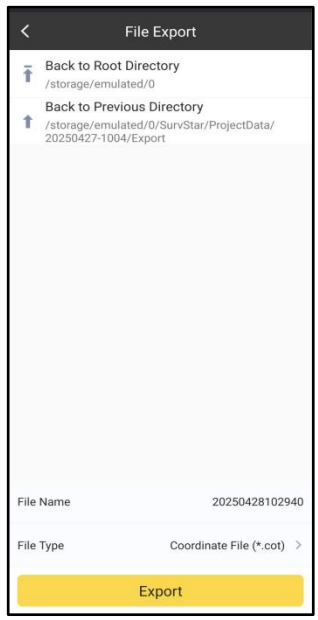




Export:

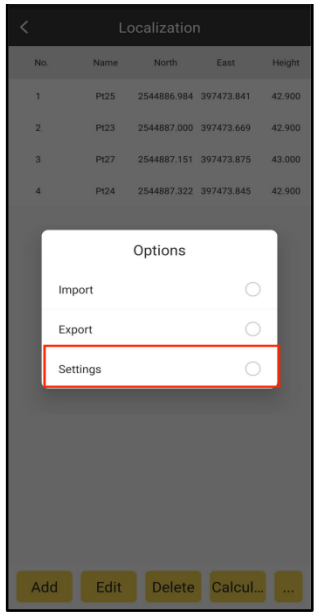
Click ... and Click Export.. Select the file type: *.cot(dd.mmssss). Select file path and click the file. Click Export.

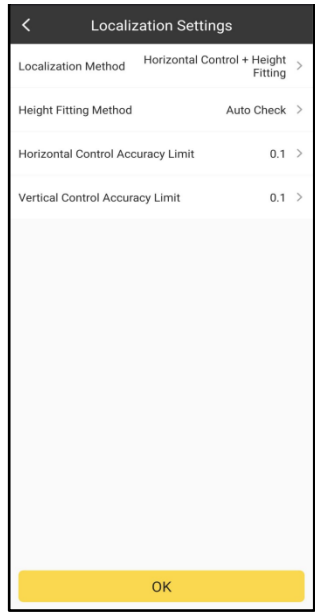




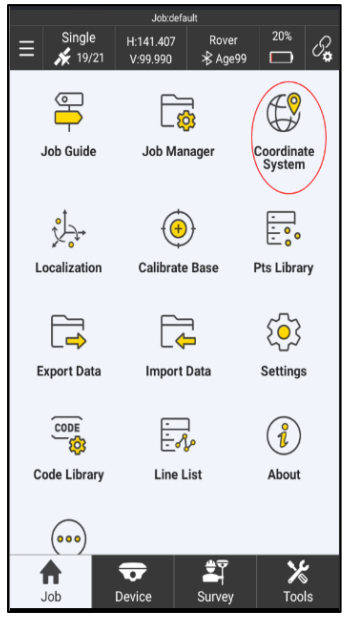
Ings:

Click ... and Click Setting We can set localization method, height fitting method, horizontal control accuracy limit and vertical control accuracy limit.

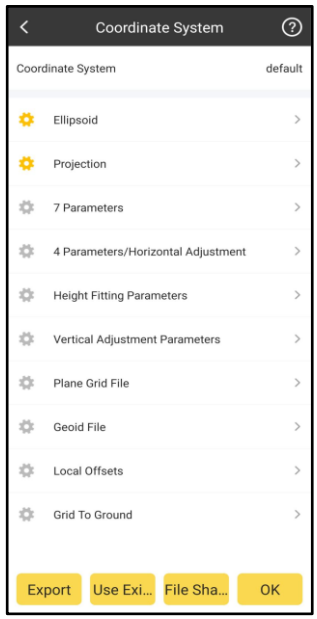




3-4 Coordinate System

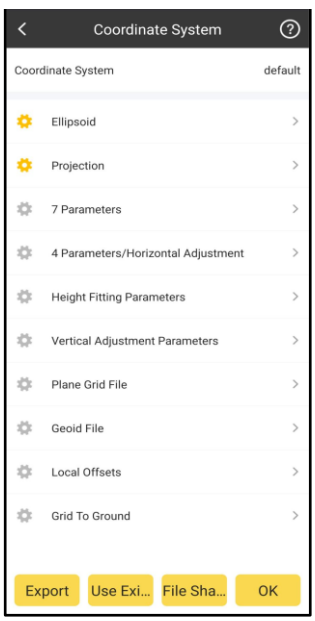


In coordinate system, we can create new coordinate system by defining the name, ellipsoid, Jobion, 7 parameters, 4 parameters, height fitting parameters, vertical adjustment parameters, plane grid file, geoid file and local offsets.

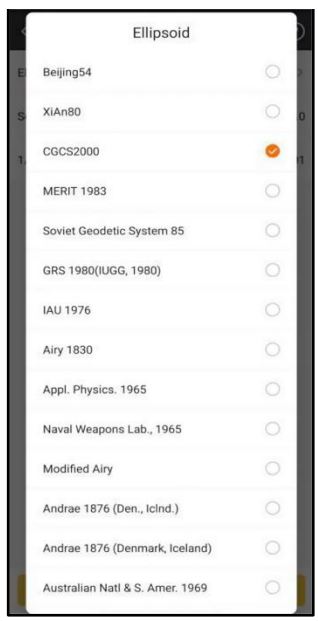


Ellipsoid:

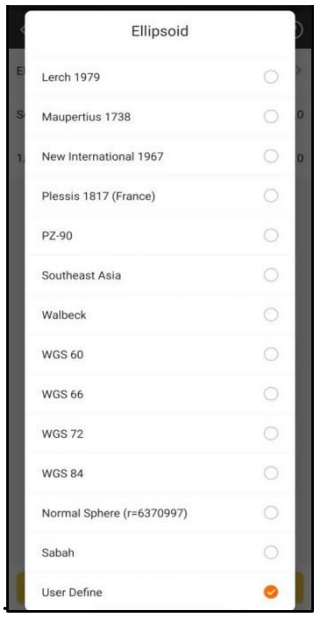
1. In Ellipsoid, we can define the existing Ellipsoid fo current Job.







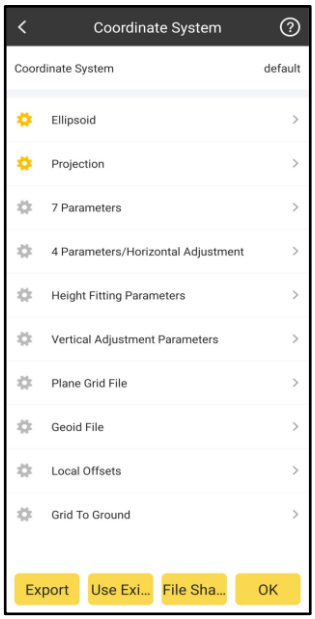
2. Also in User Define ,, we can define the ellipsoid by inputting Semimajor Axis and 1/f parameters.

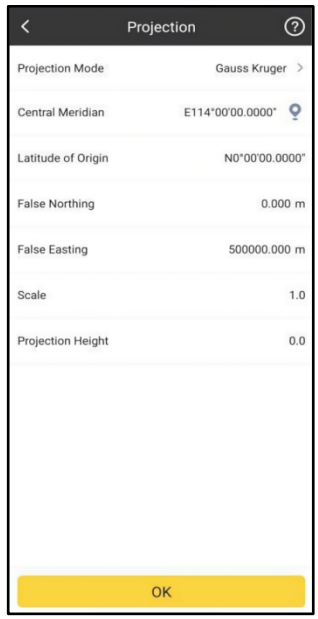


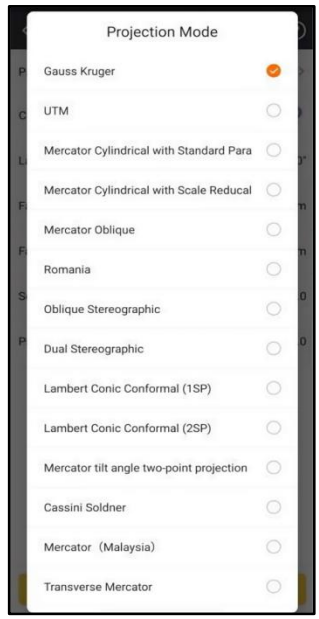


Jobion:

In Jobion, we can define relevant Jobion parameters such as Jobion Mode, Central Meridian, Latitude of Origin and so on.



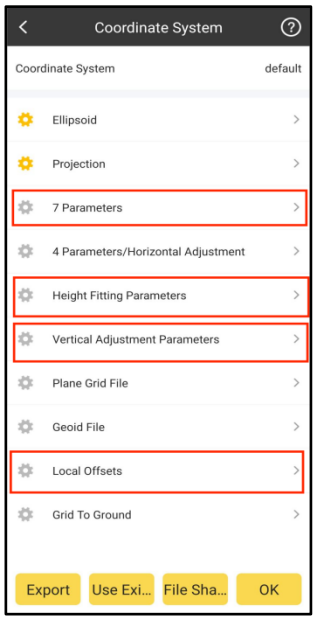




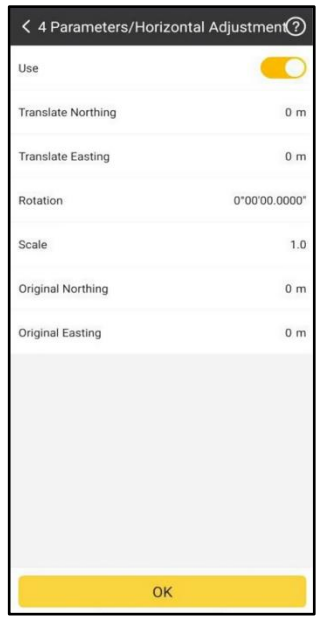
Note: We can acquire Central Meridian of current position by clicking .

Coordinate Parameters:

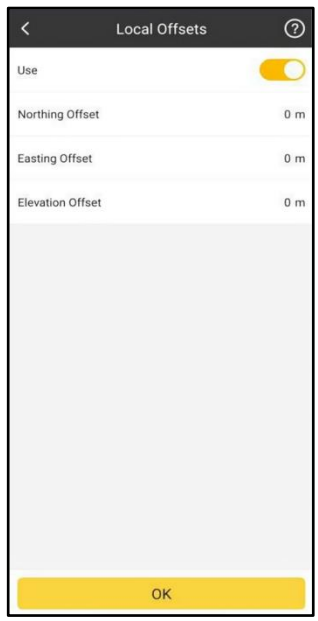
Also we can define 7 Parameters, 4 Parameters, Height Fitting Parameters, Vertical Adjustment Parameters and Local Offsets.

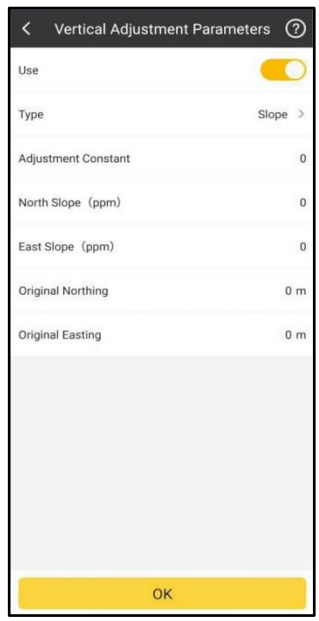








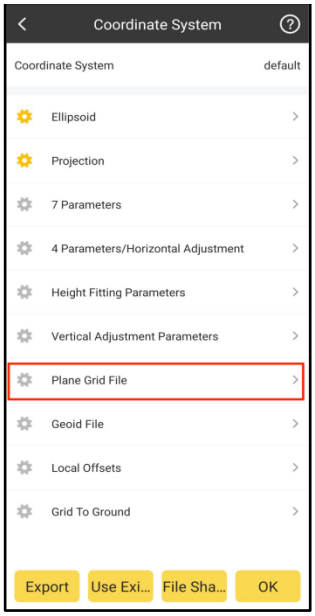


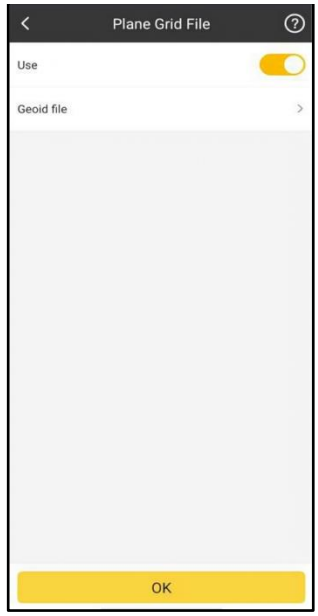


If the function is enabled, the icon in front of it will turn to .

Plane Grid File:

In Plane Grid File, we can add *.GSB format file to adjust plane coordinates.

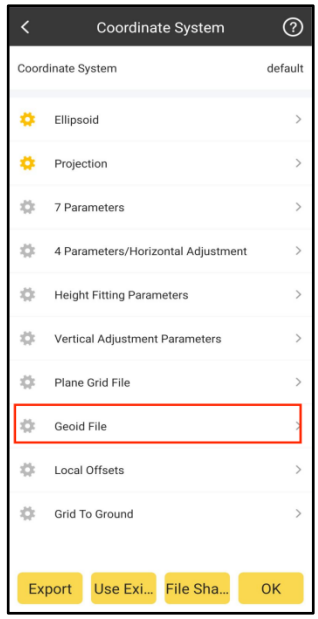






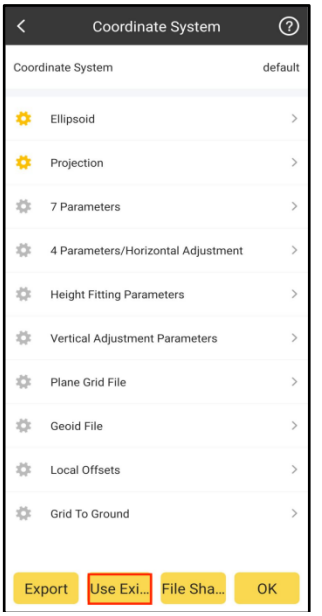
Geoid File:

In Geoid File, we can add *.SGF or *.GGF format file to adjust elevation coordinates.

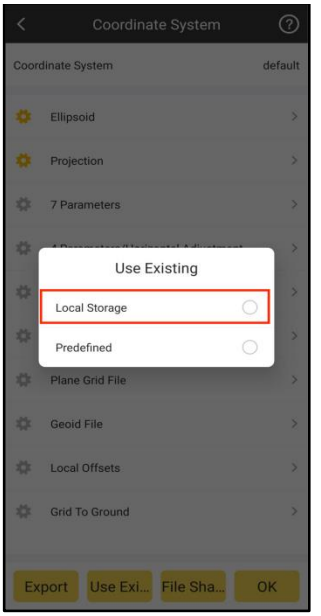


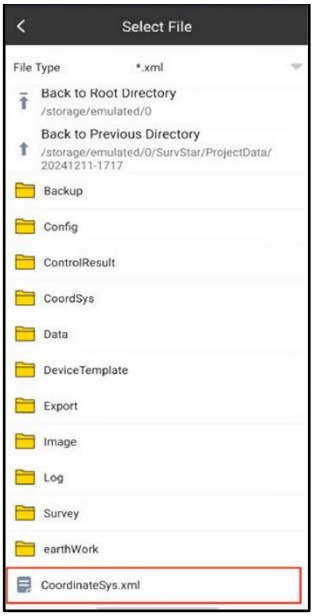
Use Existing File:

We can click User Existing ,to select and apply the existing predefined coordinate system or use the coordinate system file (*.xml).

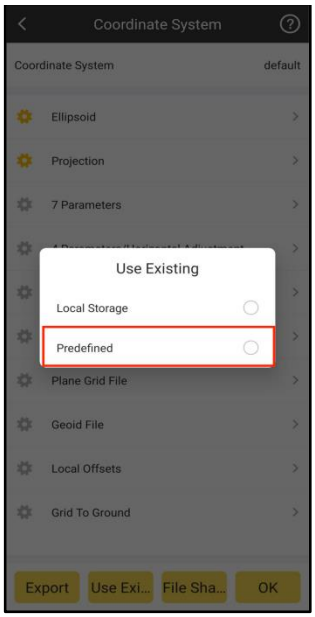


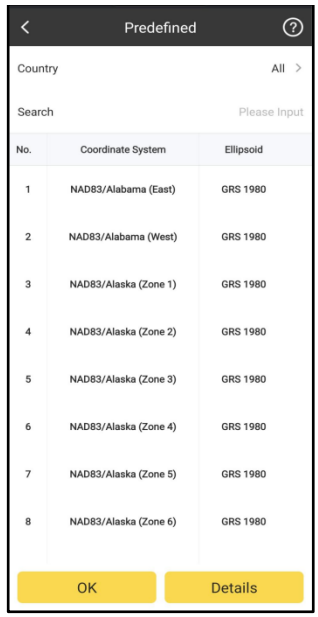
Click Local Storage , find the coordinate system file (*.xml) and click it, the coordinate. system will be applied.

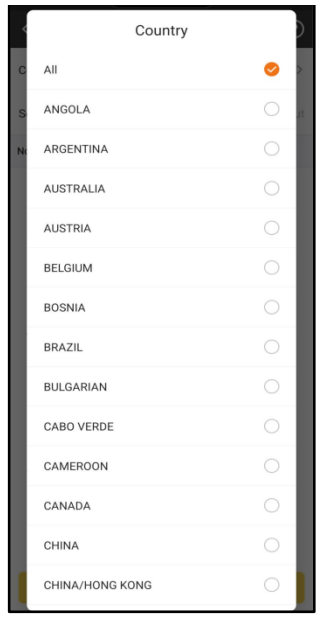




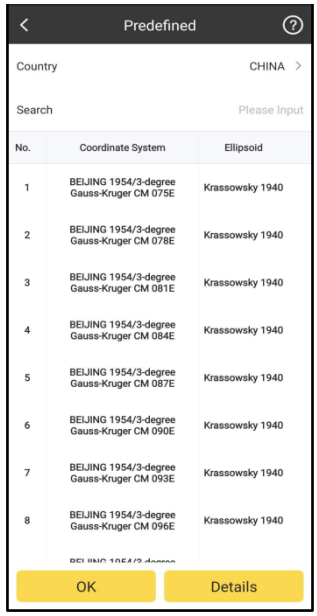
Click predefined, then click Country and select the country or region (Alphabetical) where the needed coordinate system is located.

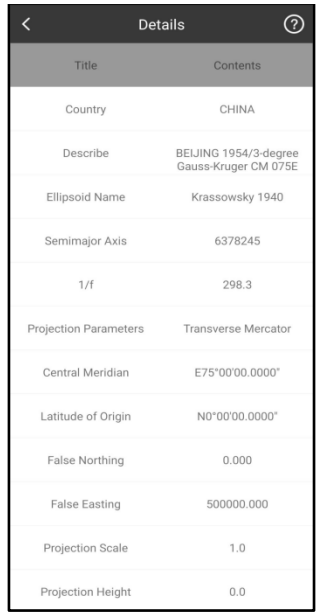




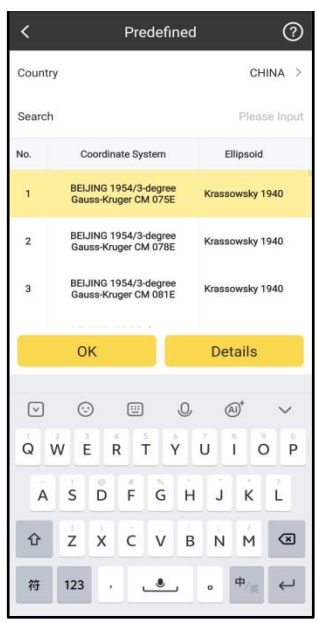


Then select the needed coordinate system and click OK to apply it, we can click Details to check its information.



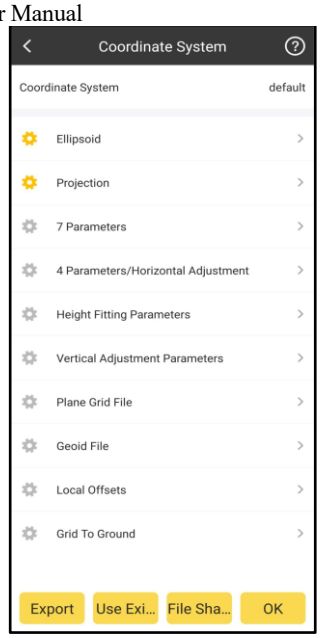


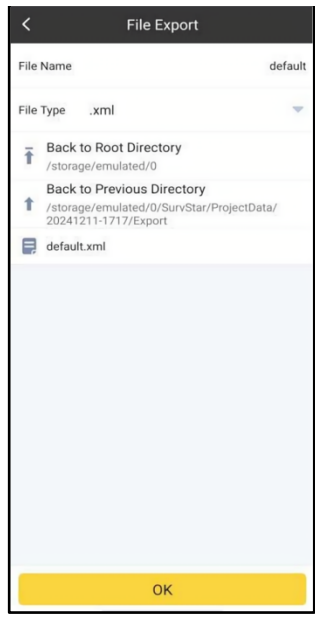
We can also search coordinate system with keywords in Search bar.



Export:

If we need to save the coordinate system in file, we can click Export, input File Name, select the path to save it and click OK, the coordinate system file will be exported.

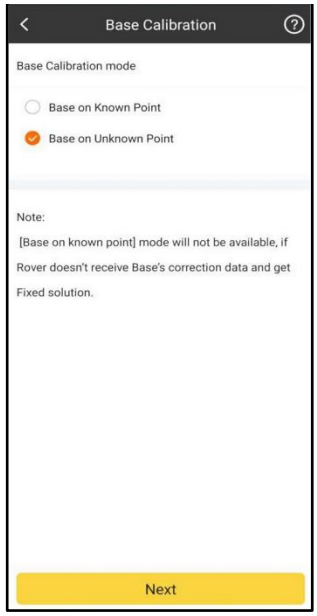




3-5 Base Calibration

We can calibrate the base coordinate using this function.

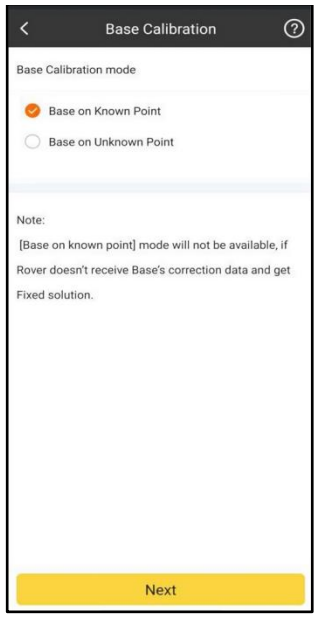
There are two ways to calibrate: one is Base on Known Point Calibration, set up base on a known point, and when rover gets fixed solution, input known point coordinates to calibrate; the other is Base on Unknown Point Calibration, set up base on an unknown point, when rover gets fixed solution, put rover on a known point and known point coordinates to calibrate.

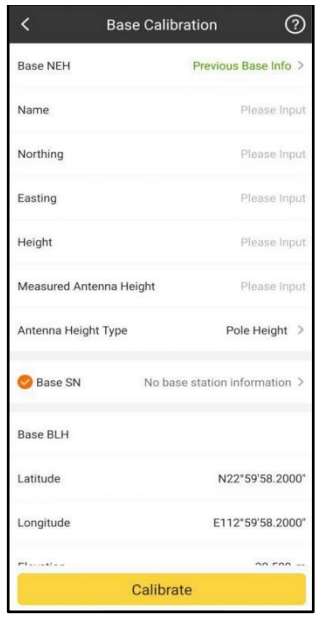


Base on Known Point:

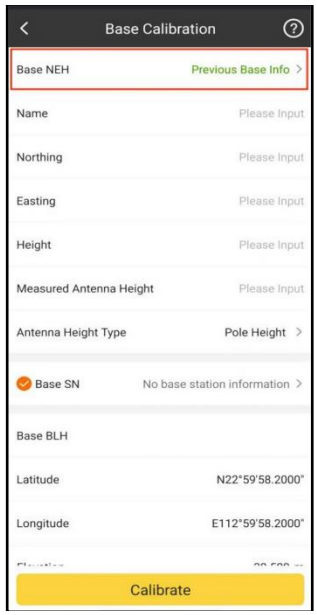
Set up base on a known point, after rover gets fixed solution, we can start do the calibration.

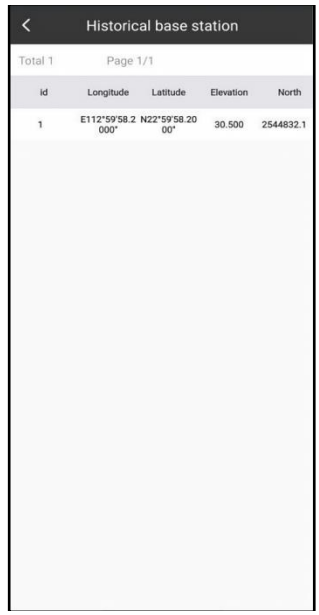
1.Choose Base on Known Point, and click Next.



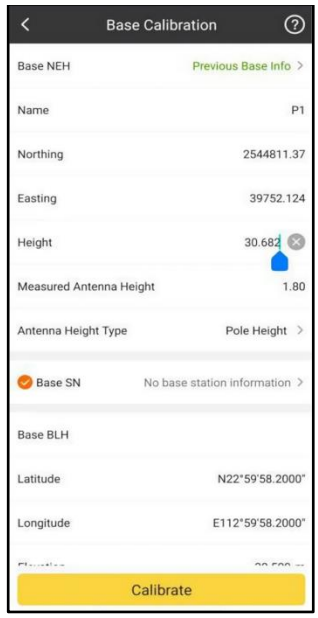


2.In this page, we can click Base NEH ,to find the historical base station information.

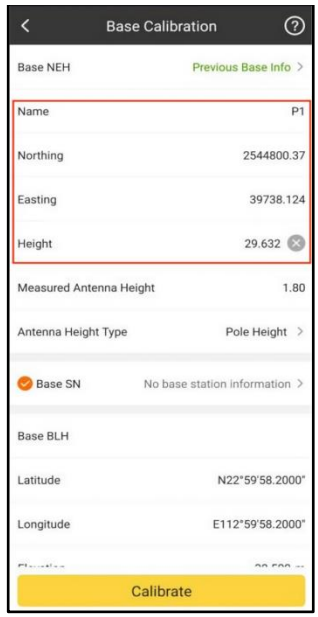




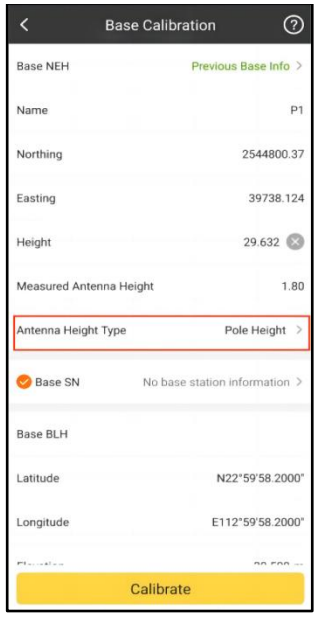
3.Find the right historical base station, and click Choose, then the relevant coordinates information will be applied.

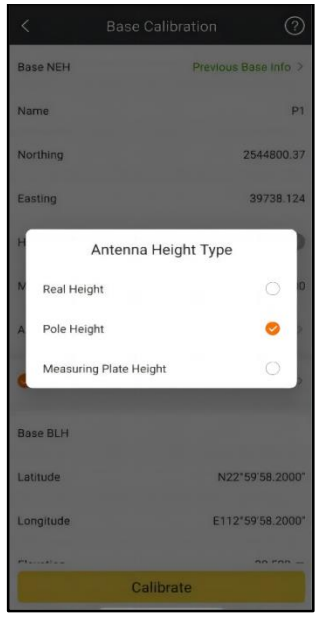


4. Also we can input base information manually.

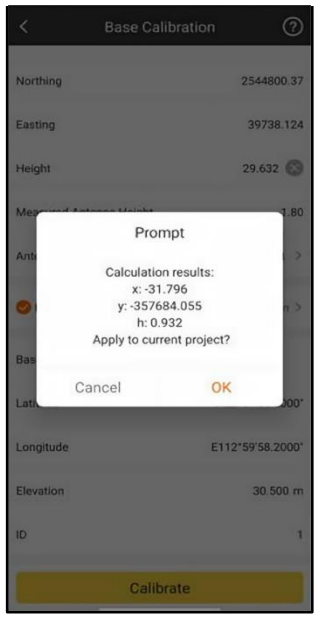


5.Then we can select right antenna type and input relevant antenna height.



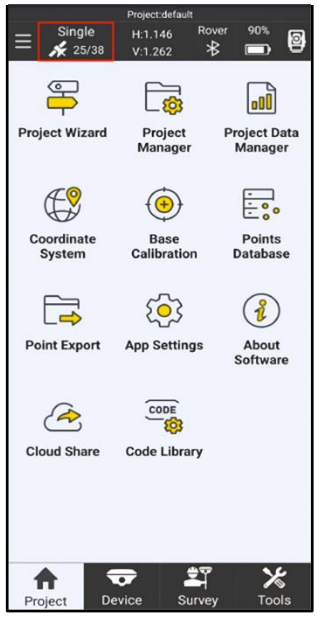


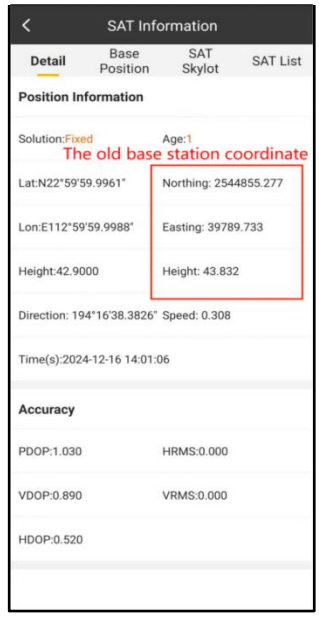
6.Click Calibrate and then there will be a popup to show the calculation results. Click OKthen the results will be applied.

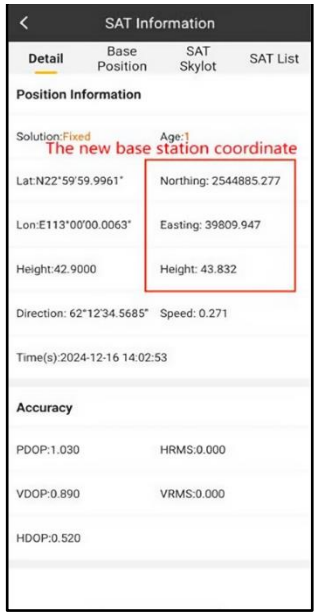


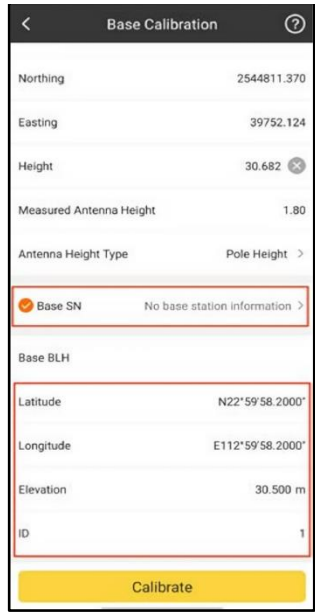


7. And then in Survstar, we can go to SAT Information, find the base position has been changed.



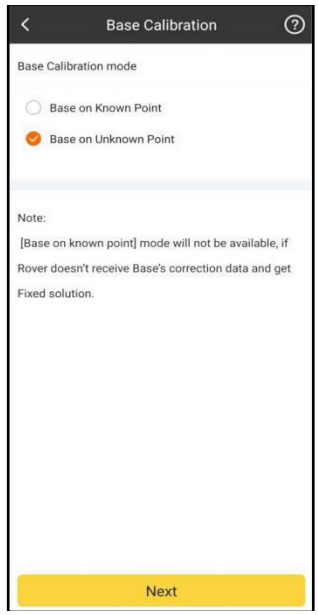




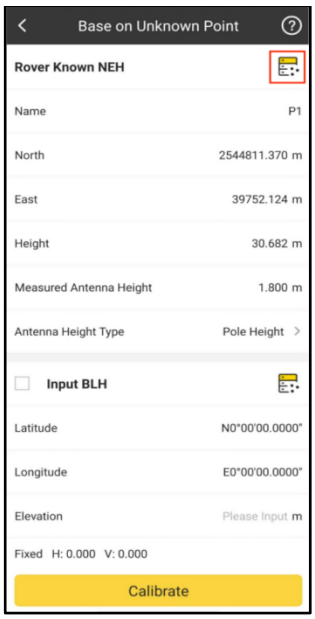


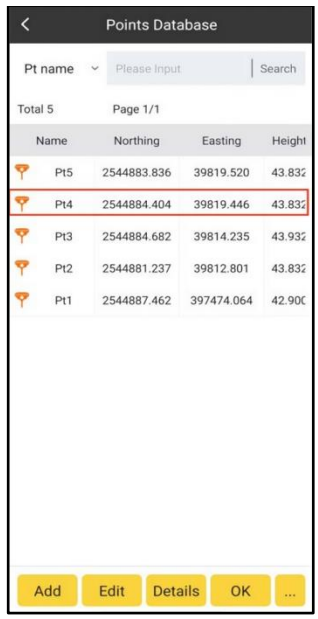
Base on Unknown Point:Set up base on a unknown point, after rover gets fixed solution, we move rover on a known point and then start calibration.

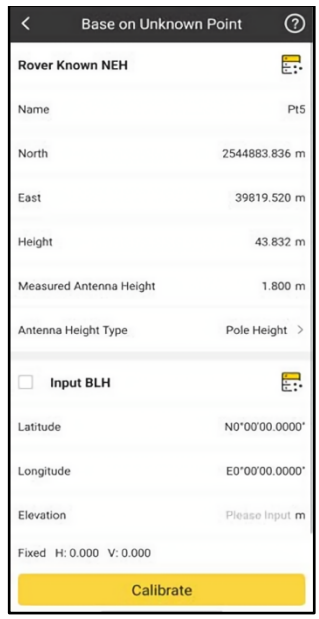
Choose Base on Unknown Point and click Next.



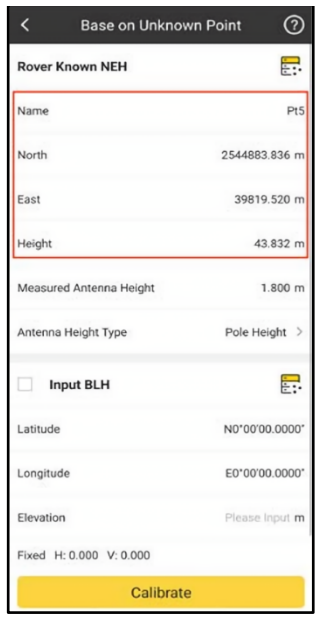
2. We can input the known points coordinates by selecting it from data base (if it is in the Point Data base).



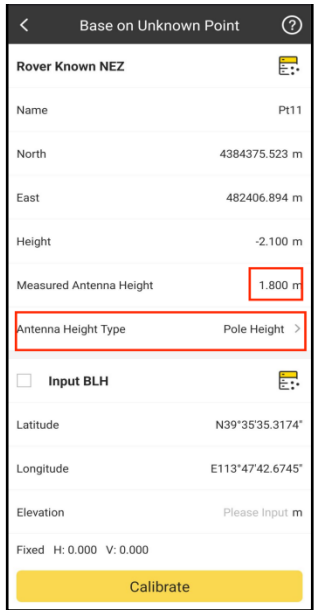


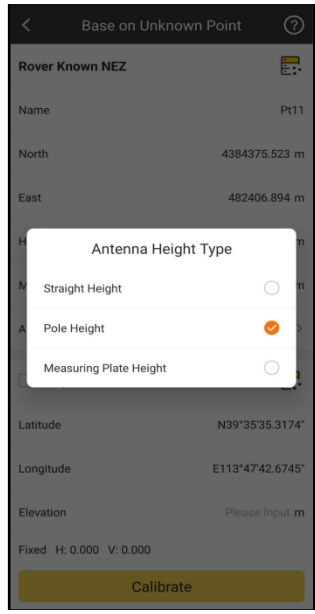


Or we can input NEH information manually.



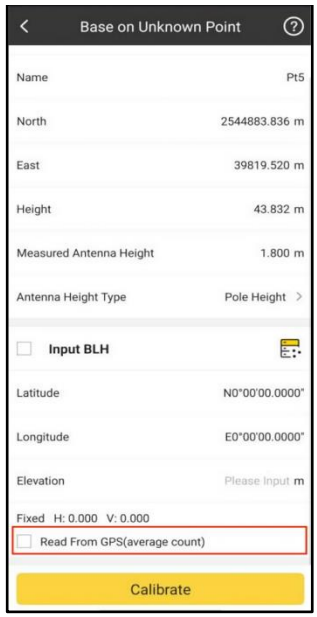
3. Then we can select right antenna type and input relevant antenna height.

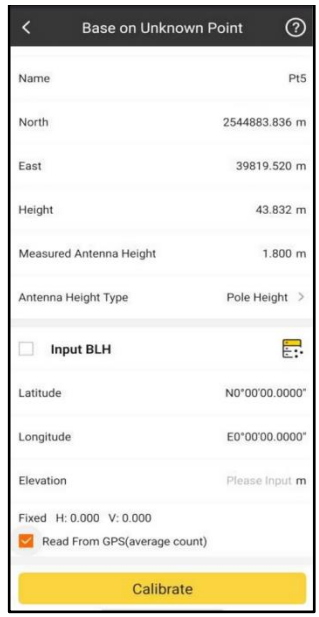




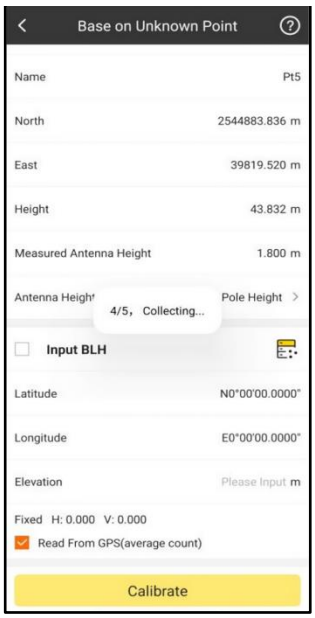
Then click Calibration to calculate the calibration parameters.

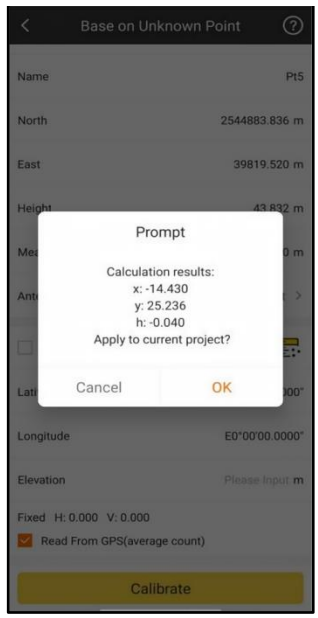
Note: we can acquire current position's BLH automatically here. if ReadFrom GPS(average count) is enabled, then ARCSuer will collect current position's BLH for 5 times and take the average value.

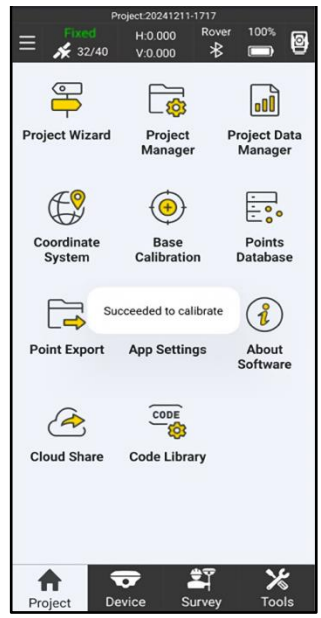




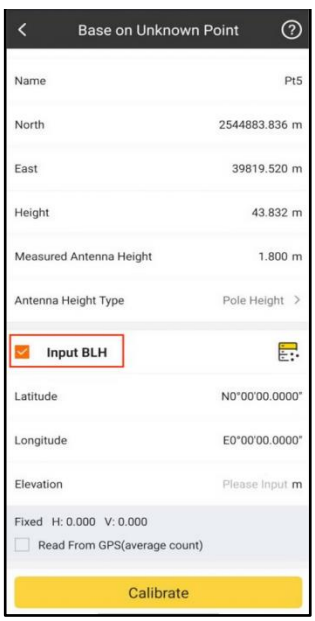
It will show the calculation results, and click OK to apply the result.

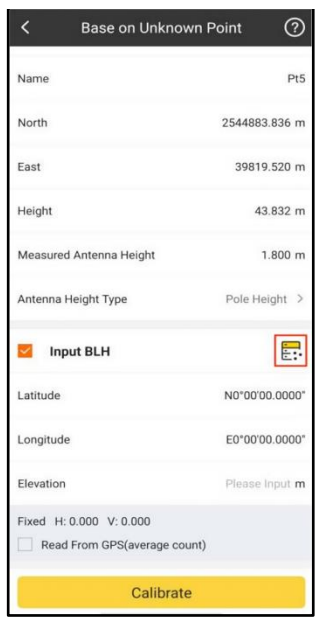


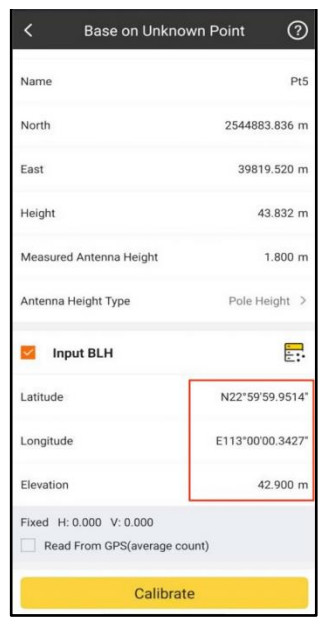


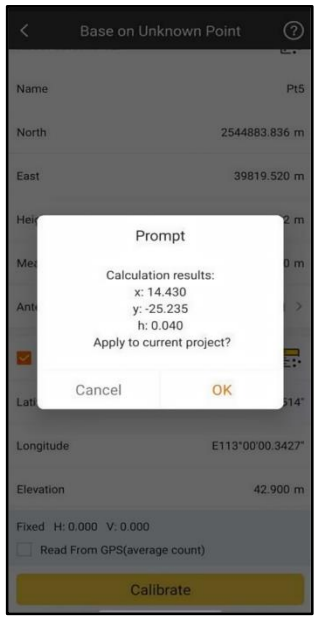


Note: if we enable Input BLH here, we can input current BLH manually or get it from Point Database directly.



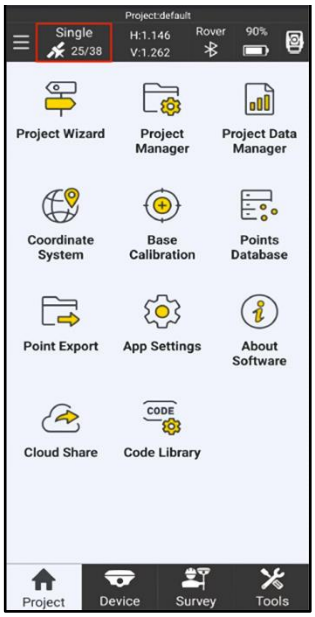


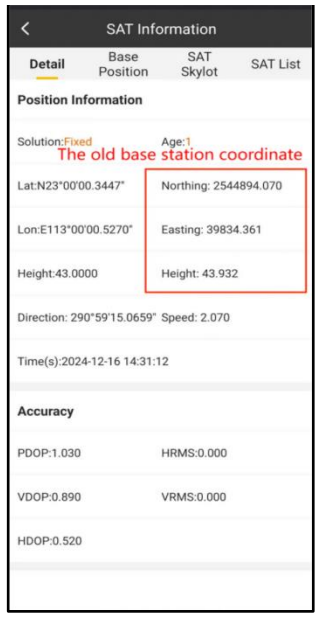


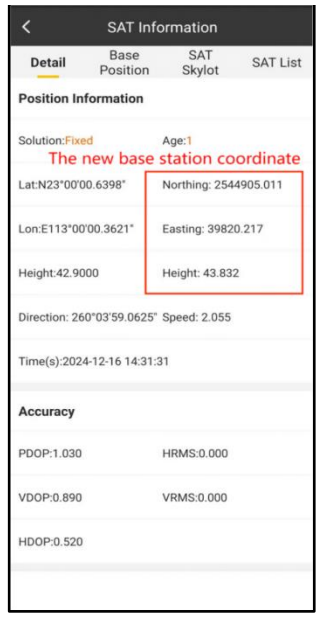




And then in Survstar, we can goto SAT Information, find the base position has been changed.

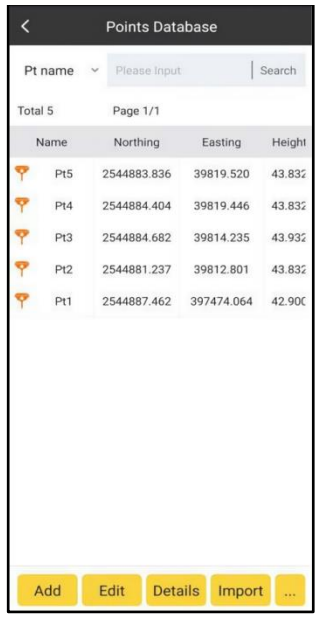






3-6 Points Database

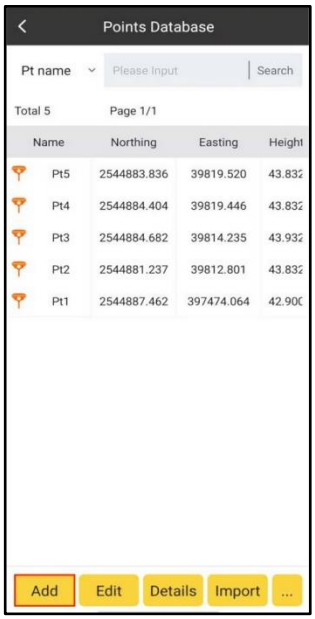
In Points Database, we can manage points by Add, Edit, Check Details, Import and other operations.

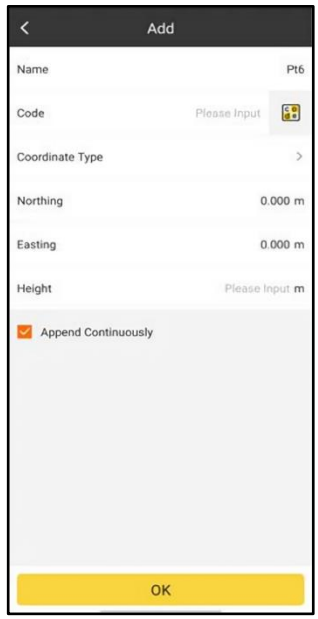


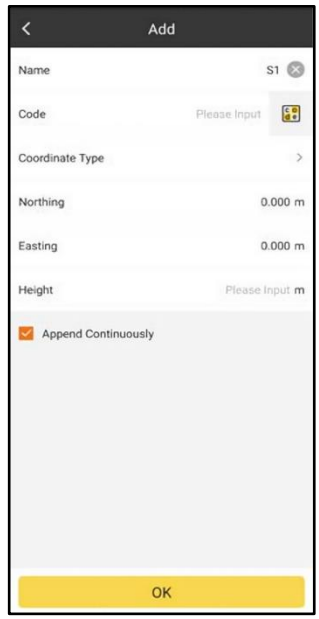
Add:

Click Add,we can input points coordinates manually here and add it to the Database.

Firstly, we need to define the Point Name.



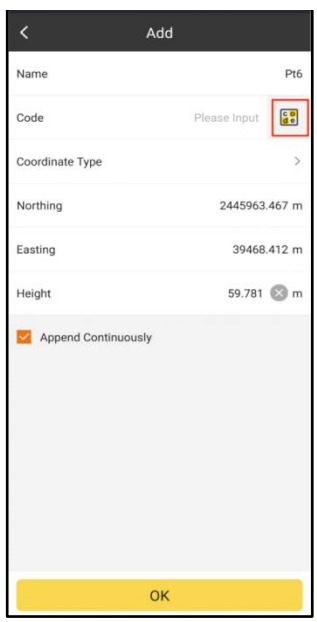


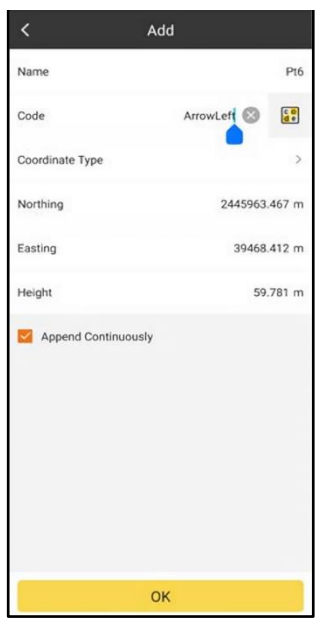


Then the Code:

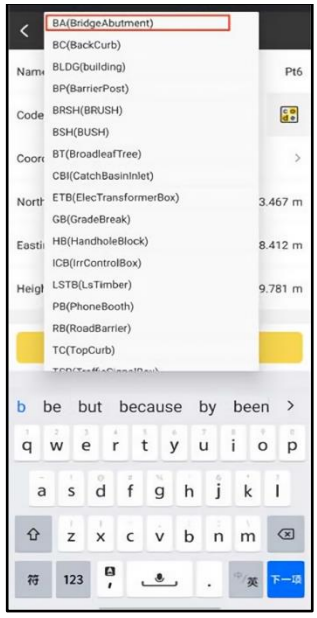
If we don't need Code property, we can leave it blank.

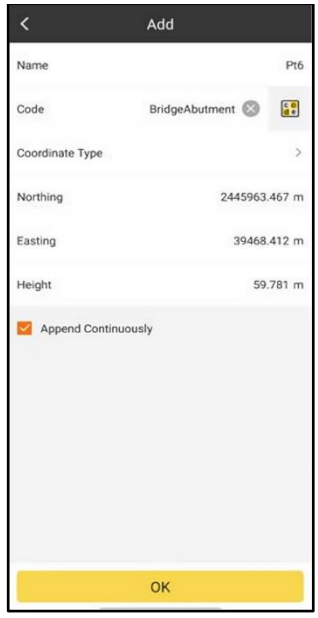
If we plan to attach Code property to the point, we can input code directly.



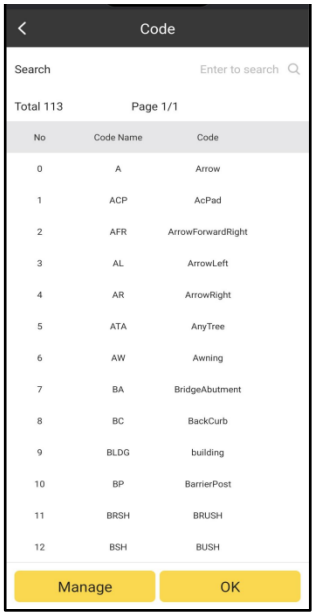


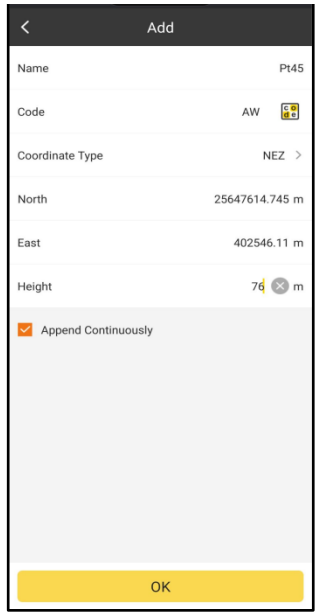
There are predefined codes in the data base, by searching and selecting, we can try to find the code we need.

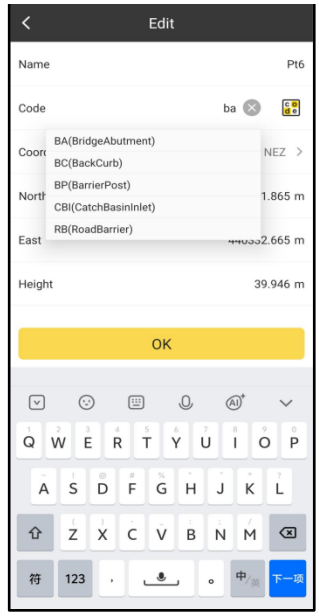




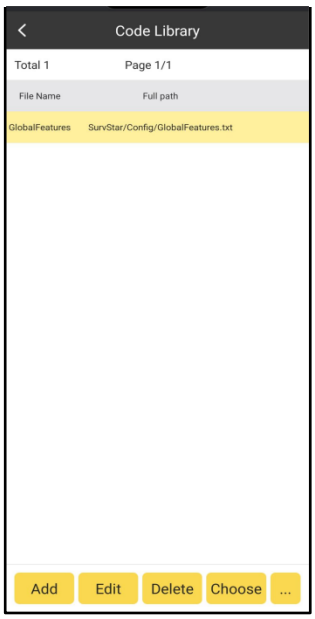
If we want to check the predefined code data base, we can click the icon to access.

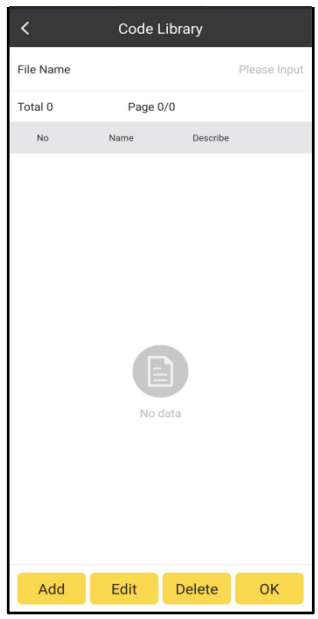


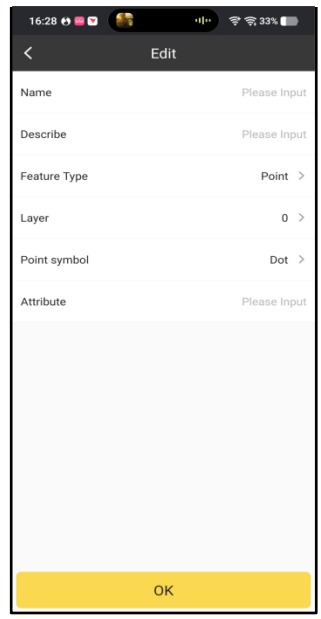




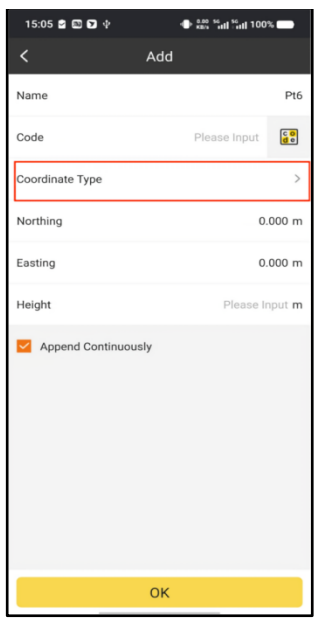
In Manage . We can manage the code database. It includes Add, Edit, Delete, Choose and Import. Click Add to add a code library. We can create the code we need.

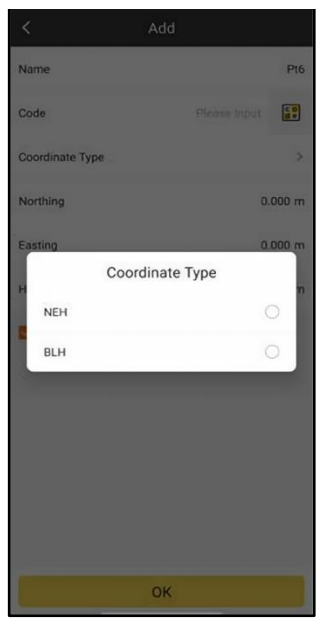




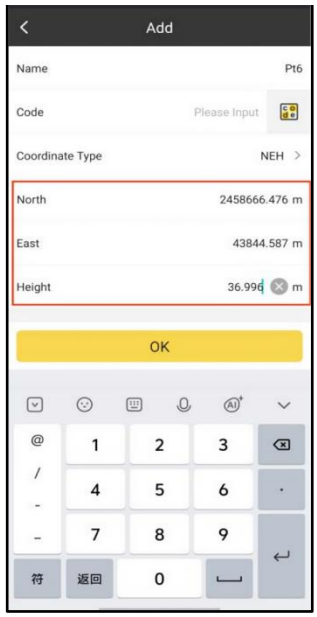


Then we need to choose the Coordinate Type. There are two types: NEH and BLH.





Then we can input the coordinate of the point.



Click OK. The new point is created in point database.



Eidt：

Select the point we want to edit and click Edit. We can edit the coordinate, code and name of the selected point.



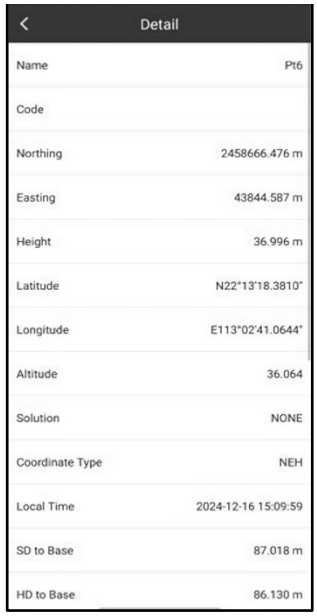


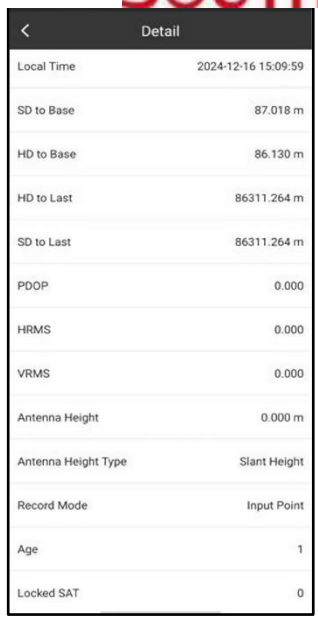
Note: for Survey Points and Stakeout Points, we can only edit Point Name and Code.

Details:

Select the point we want to check and click Detail We can check the details of the selected point.

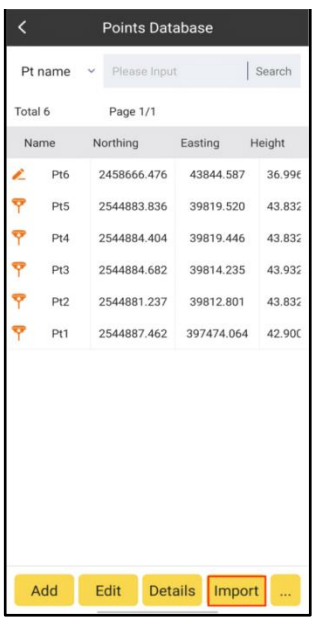


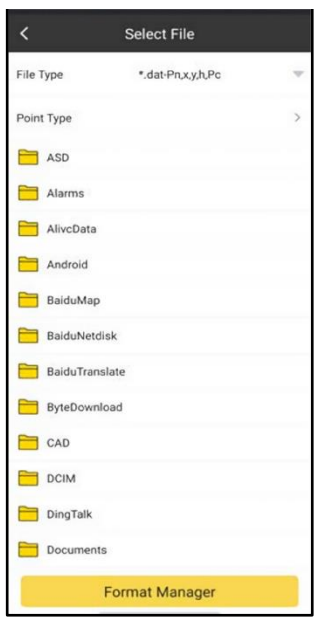




Import:

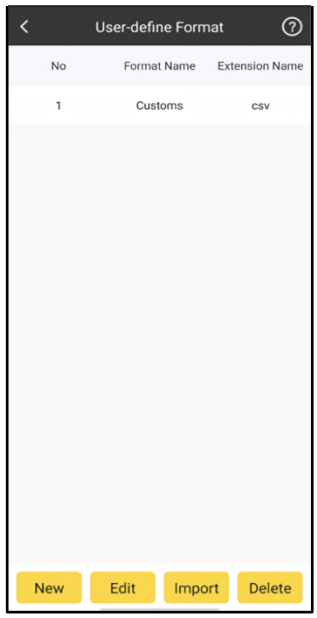
We can import points to Points Database Directly. When we import file, in Format Manager, we need to select the Import File Format, Point Type and Files Directory, then we can find the target file and load those points to Point Database.

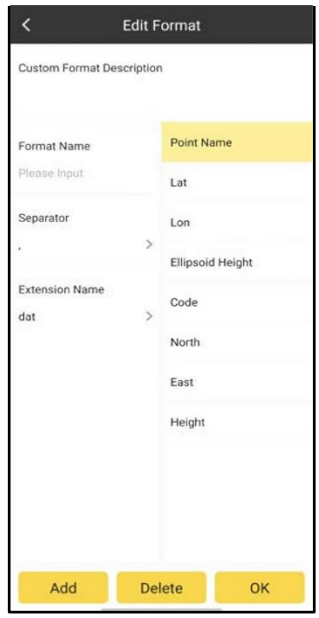


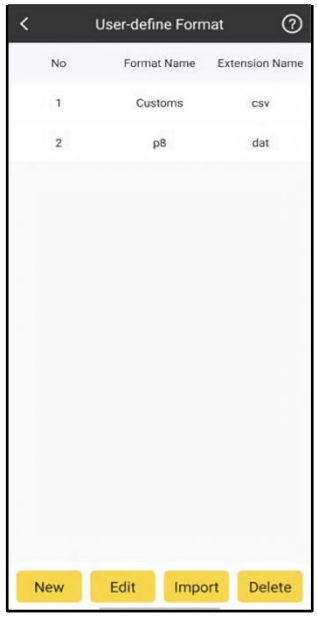




In Format Manager, we can define the imported file's format and contents. Then when we import files to Survstar, we just need to get the relevant format file, and import it directly.







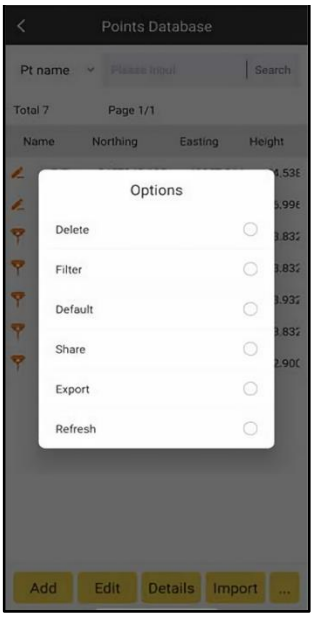


Options:

Besides basic, Add, Edit, Details and Import functions, by Clicking ...

in the right of the tool bar. Then we can use the other function as Delete, Filter, Recover, Share, Export and Refresh.

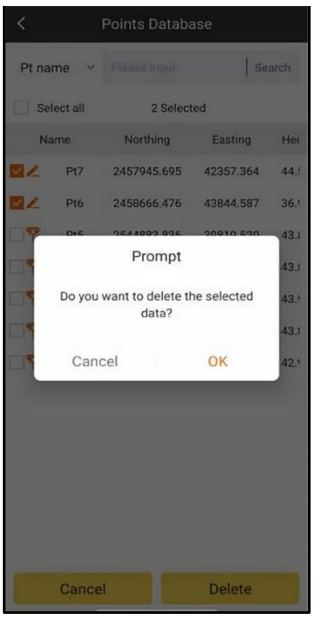


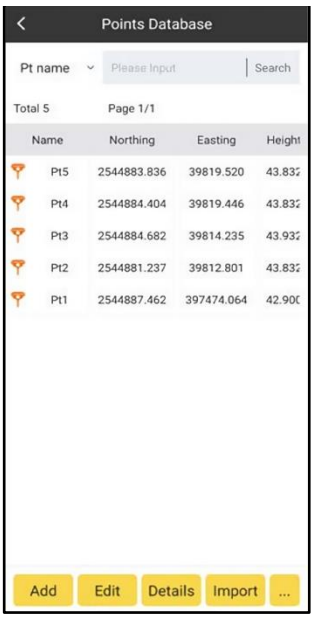


Delete:

We can delete the points selected.







Filter:

We can let Point Database filter and display the points (Survey Point , Input Point or Stake Point) we need automatically.

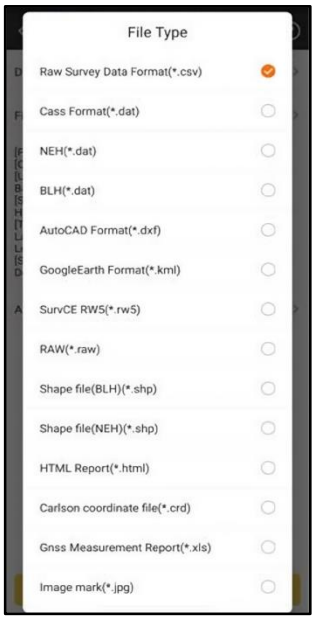
Share:

We can share the points to other users by QR code or Text format.



Export:

We can export data file in existing formats or self-define formats.



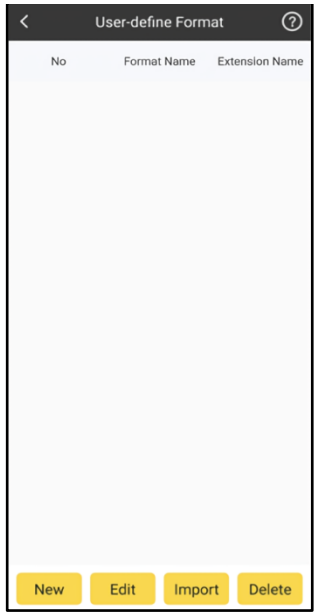


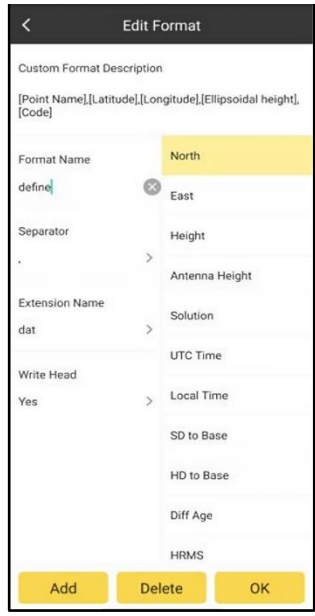


Select the export file path and click Export.



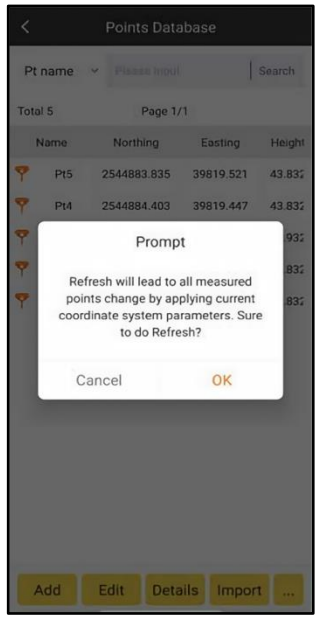






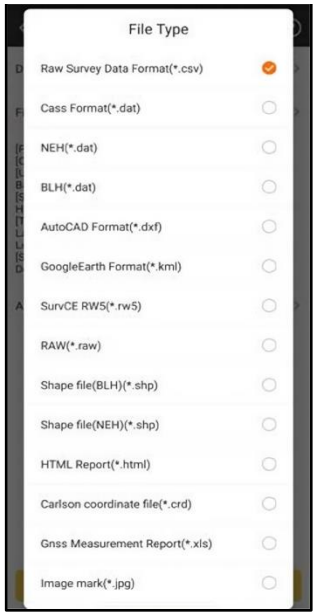
Refresh:

Click Refresh , we can apply the new Coordinate system parameters to the points in database.



3-7 Point Export

It is the same config as Point Export in Points Database.

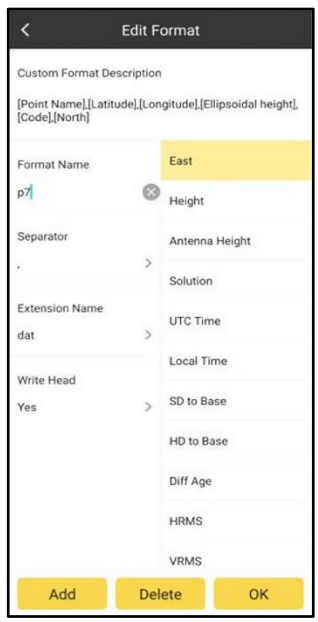






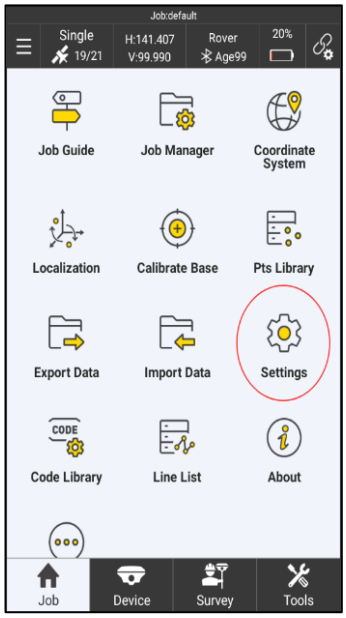


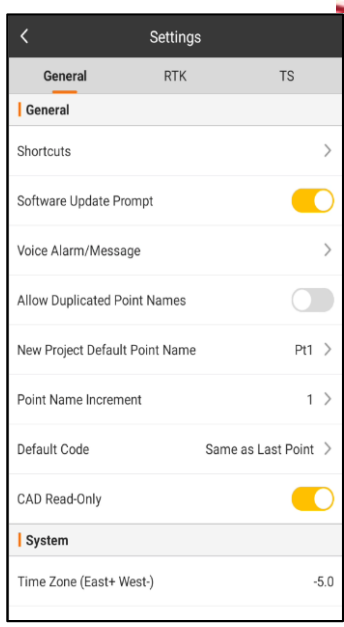




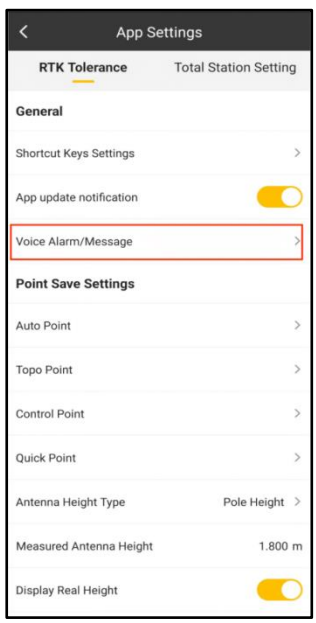
3-8 APP Settings - RTK

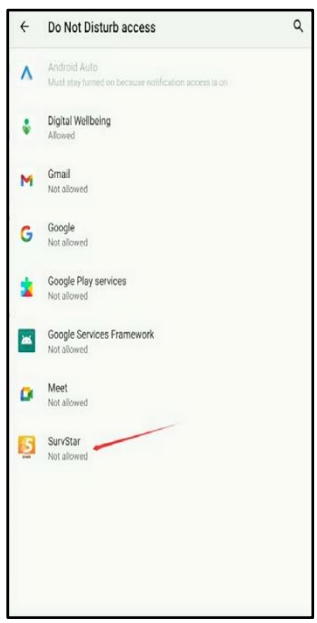
In APP Settings,we can do basic configurations (such as General config, Point Save Settings, System Settings and Display Settings) for Survstar.





In General Config, we can set App update notification and App Voice Alarm.

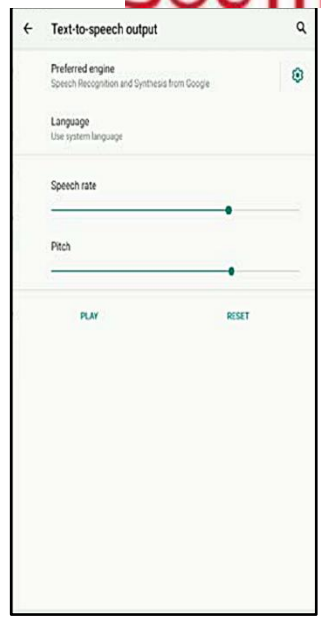




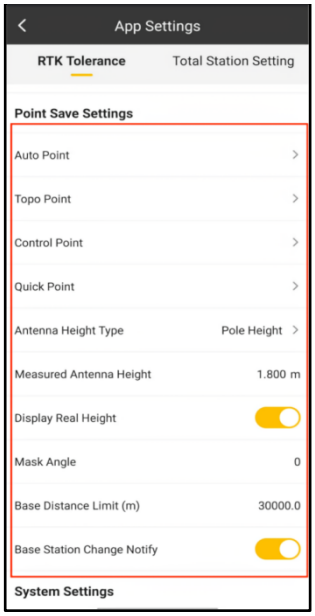


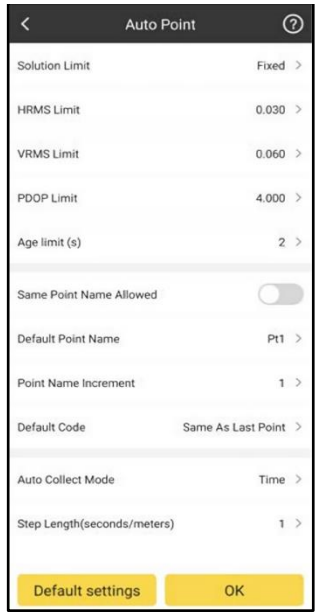


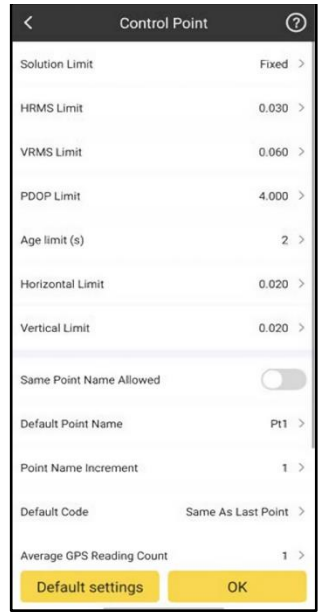


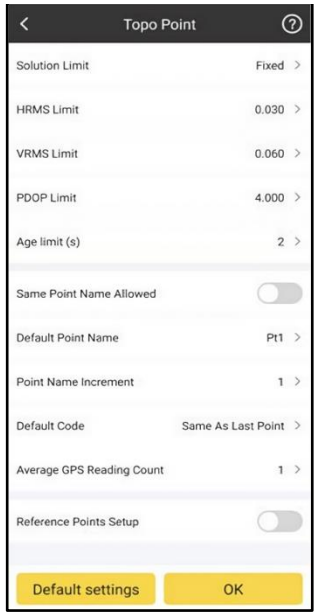


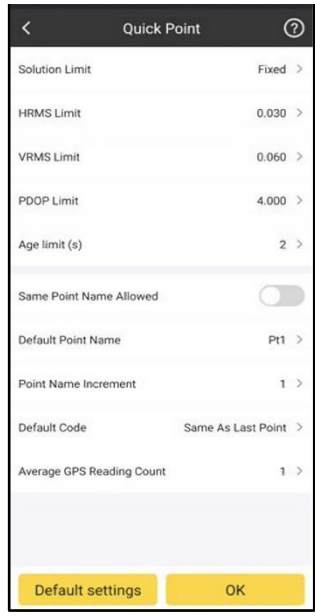
In Point Save Settings, we can set Point collection limits and parameters, Antenna Height, mask angle and so on.



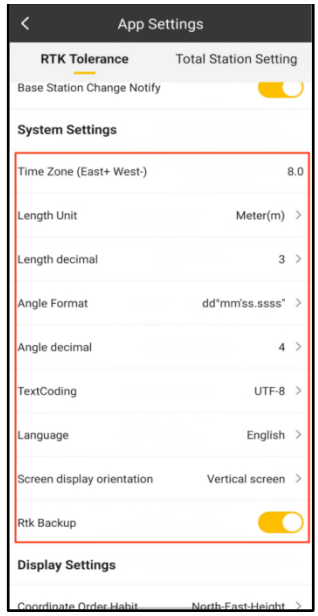




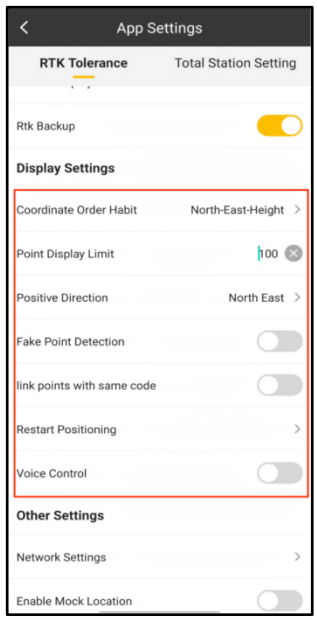




In System Settings, we can set the Time Zone, Length Unit, Length decimal,Angle Format, Angle decimal,Textcoding, Language,Screen display orientation.And set RTK backup on/off.



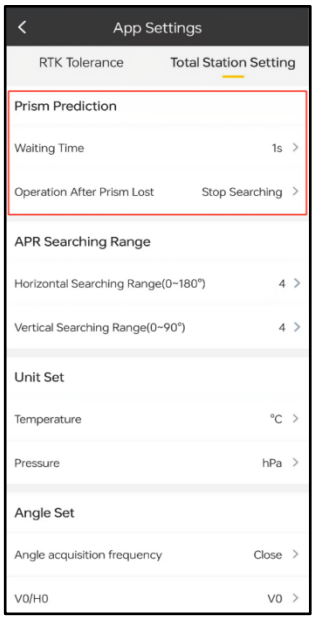
In Display Settings, we can set the Coordinate Order Habit, Point Display Limit, Positive Direction,Restart Positioning. And set Fake Point Detection , link points with same code and Voice Control on/off.

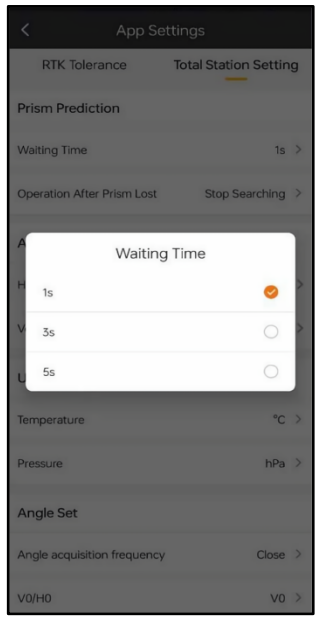


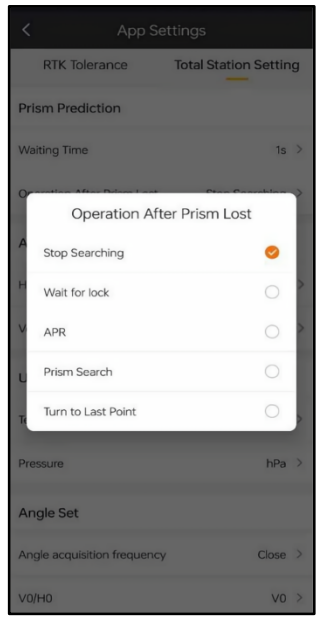
3-9 APP Settings – Total Station

By clicking this, we can set the settings of Survstar. It contains RTK and Total Station Settings.

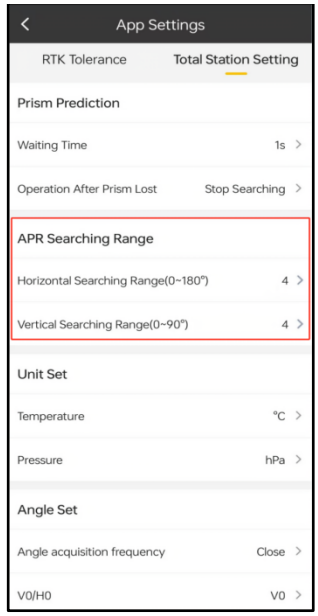
In Prism Prediction, we can set the waiting time after the prism lost and what the total station will do next.



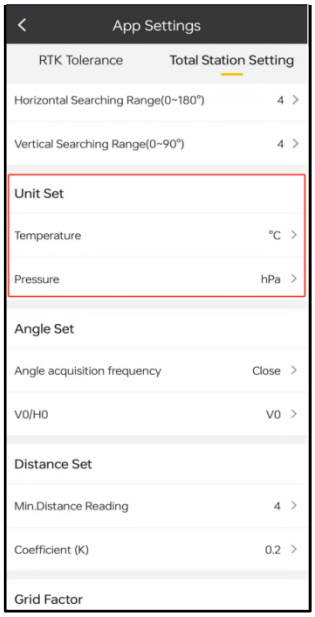


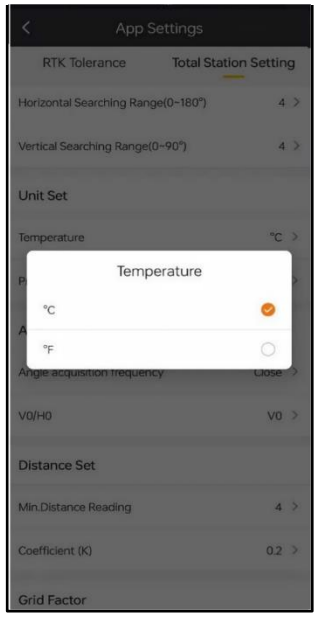


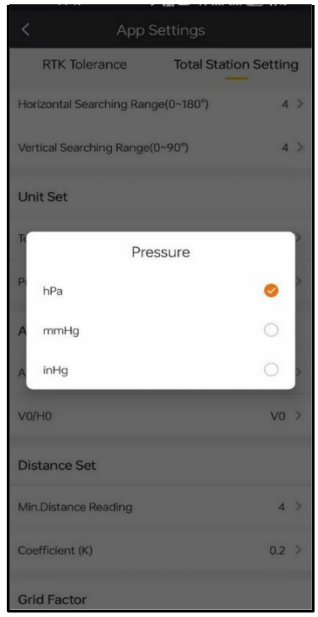
In APR Searching Range, we can set the horizontal and vertical search range.



In Unit Set, we can set the units of temperature and pressure.

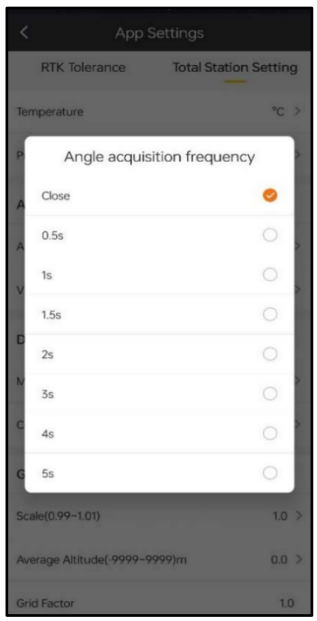


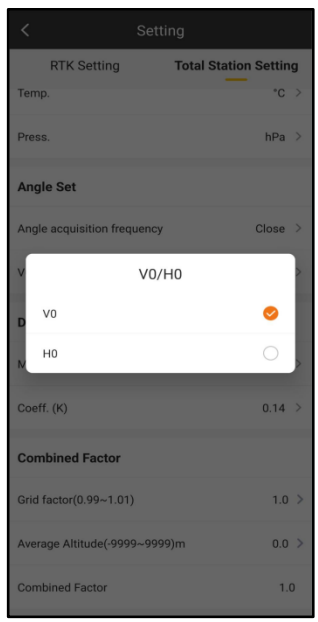




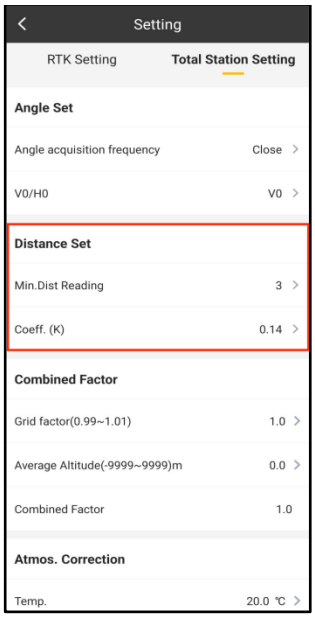
In Angle Set, we can set angle acquisition frequency and V0/H0.

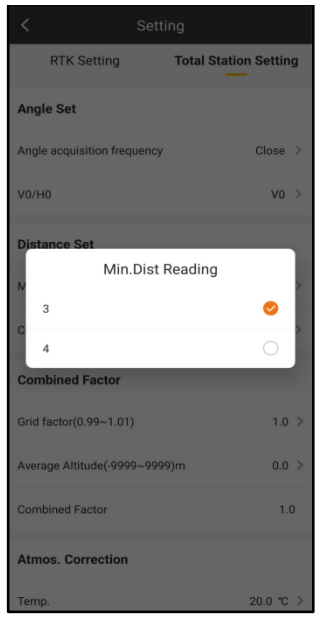


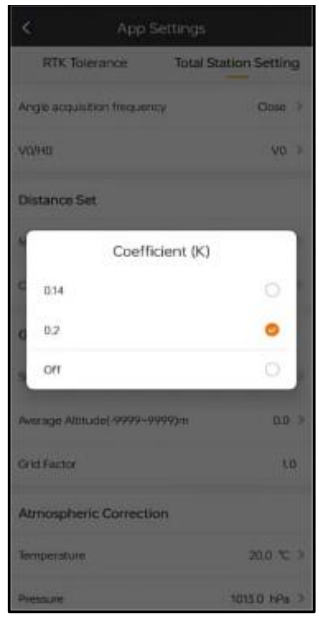




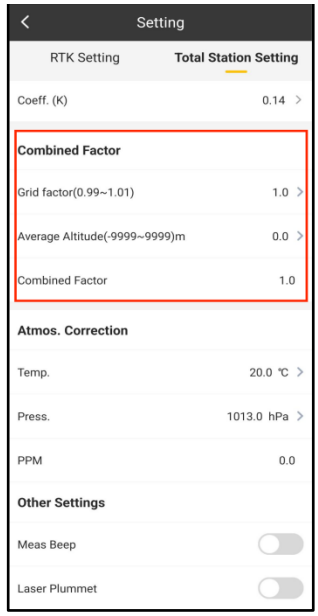
In Distance Set, we can set min. distance reading and coefficient.



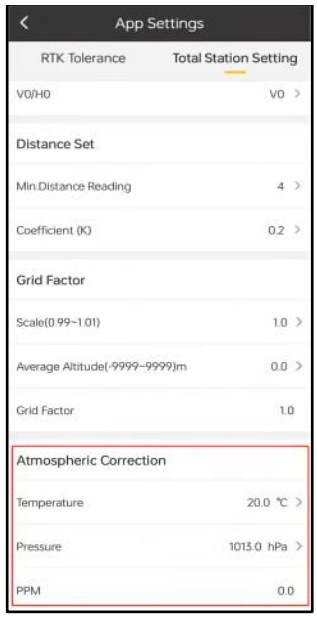




In Grid Factor, we can set scale and average altitude.



In Atmosohric Correction, we can set the correction of temperature and pressure.

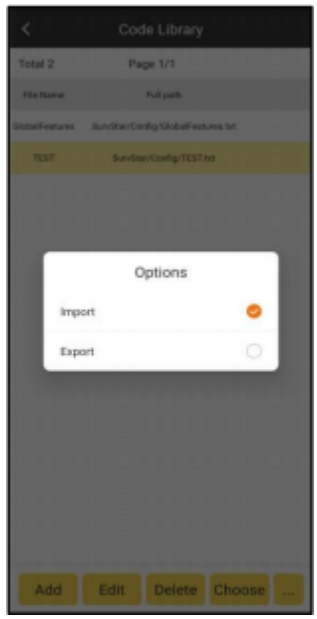


3-10 Code, Survey and Plot

3-10-1 Code library



1) Code library management: ato add, edit, delete, use, import, export code table file;



2) Add: support user to add code table and add custom code;

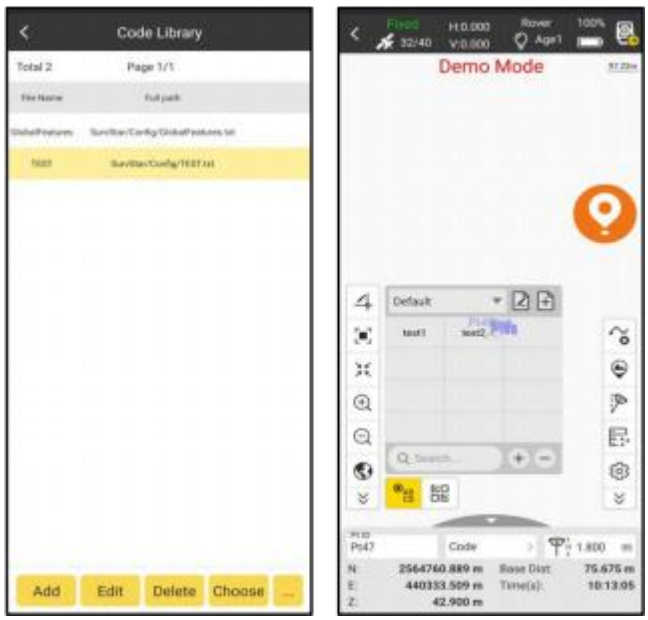




3) Edit: support users to edit the existing code table;

4) Delete: support to delete the code table;

5) Choose: Select the code table to be used, **which will be associated with the code box in the point measurement**, and display when the user adds the code to the code box;



6) Export code file: Support to export TXT/CSV/DAT and other formats code file;

7) Import code file: Support the import of TXT/CSV/DAT and other formats code files, import file format requirements are consistent with the export format;



3-10-2 Code box part

① Associated code library, support user to create a custom code box  ;

② Code box switching selection and editing 

; all codes of the current code library are added to the ‘default’ code box and cannot be modified.

③Add coding: Select a custom code box, click the blank cell, add code from code library currently in use;



④ Add repeated code: Select an existing code and click Add  (Repeated coding will be numbered to distinguish);



⑤Delete the code: Select the existing code, click delete  or long press to select the target code to delete;

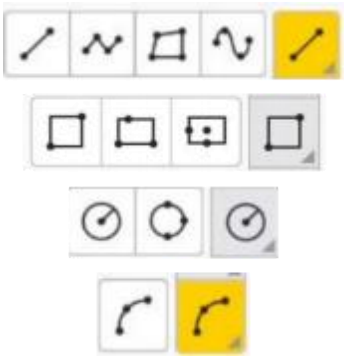
⑥ Code search: Support fuzzy search code;



⑦ Enable multiple selection code, support the same point to save multiple encoding attributes ;

3-10-3 Graph Part

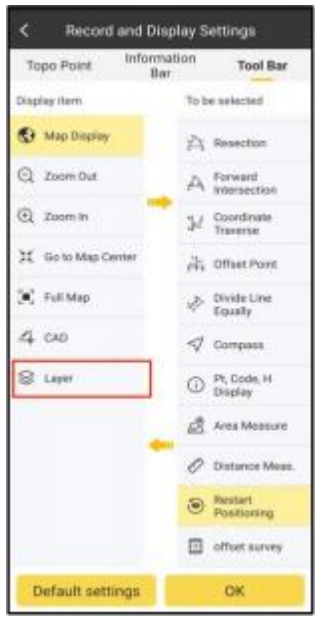
Support linear measurement such as straight line, multi-segment line, polygon, curve, two- point rectangle, three-point rectangle, two-point circle, three-point circle, three-point arc, etc. Long press to select a type.



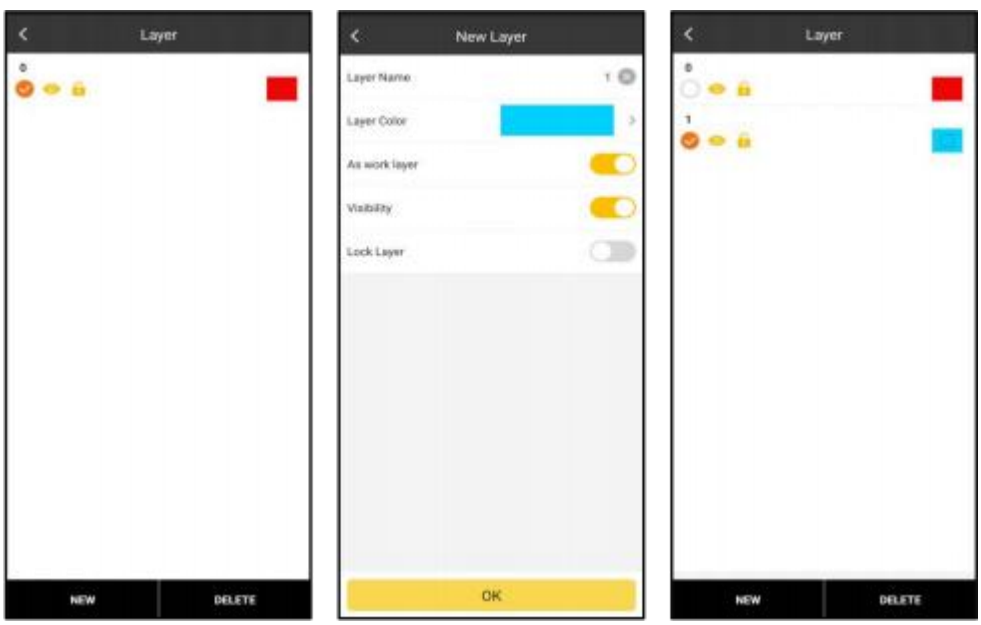


Layer manage

Add Layer button in Settings 

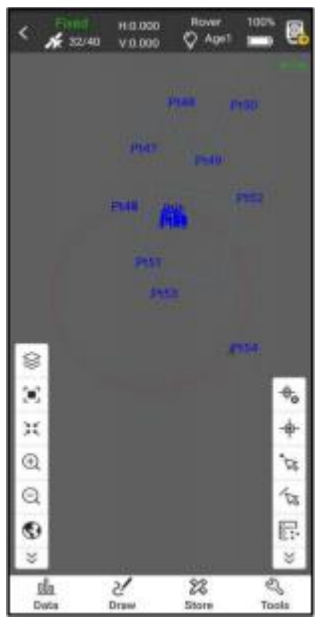


Open Layer Management to add a new layer, input layer name and select layer color.



Select whether to use it as work layer, visibility and lock layer.

The drawing opens in CAD function.



3-10-4 Main operation process:

Conventional measuring points: using code for measuring points;

Graphic mapping: measuring line segments, polygons, curves, rectangles, arcs and other independent features;

Multi-line surveying and mapping: multiple lines simultaneously surveying and mapping operations, Z-type measurement, multi-line measurement in the same direction;

3-10-4-1 Conventional measuring points:

① Click the code box, select the code you need to use, and the code will be automatically filled into the code input box for saving;

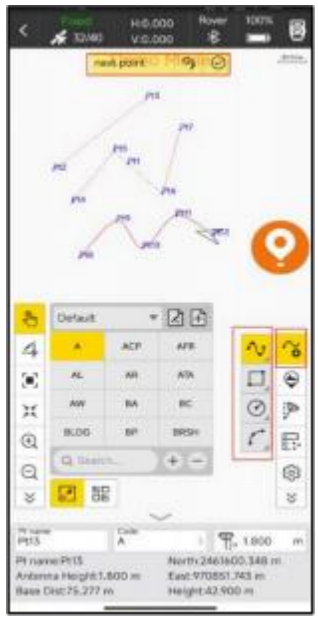
@ Open multi-selection coding, multi-selection to select the required coding, coding automatically fill in the coding input box, save;



3-10-4-2 Graphic mapping:

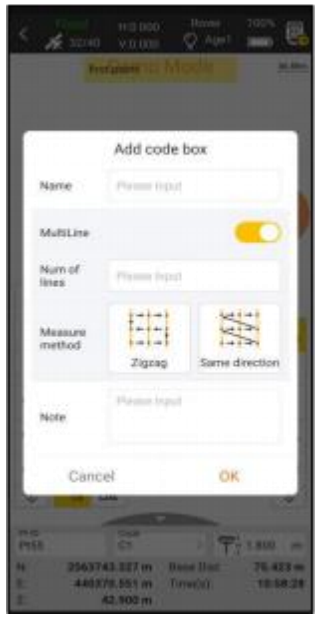
① Open the code box, add a custom code box, or use the default code box;

@ Turn on the graphic control function, select the graph to be drawn, long press to select more types and perform the measurement drawing according to the prompt information at the top ofthe interface;

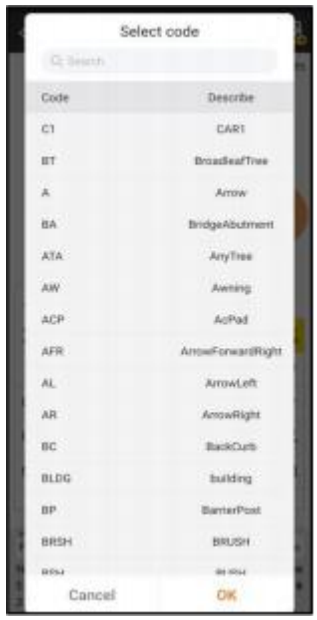


3-10-4-3 Multi-line mapping - Z-type mapping:

① Open the coding box, add the multi-line coding box, select the number of lines, Z-type measurement mode, click OK;



@ Add custom codes, select Start code;





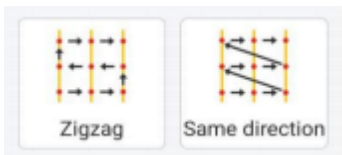
③ The user selects the polyline/curve line for measurement drawing;

④ In the measurement process, the measurement point drawing is carried out according to the selected measurement method, and the user needs to measure the number of lines in turn according to the number of lines set. The code of the same line is the same, and the coding order in the coding box is automatically switched to use;



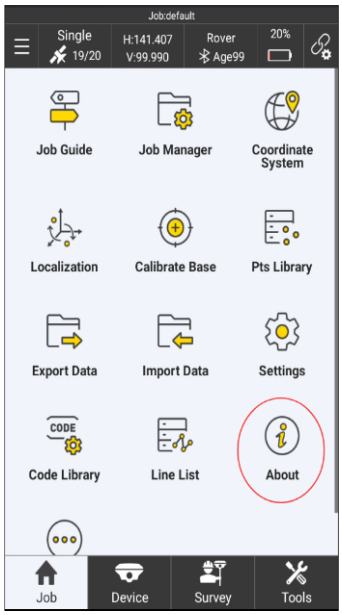
3-10-4-4 Multi-line mapping - Multi-line in the same direction:

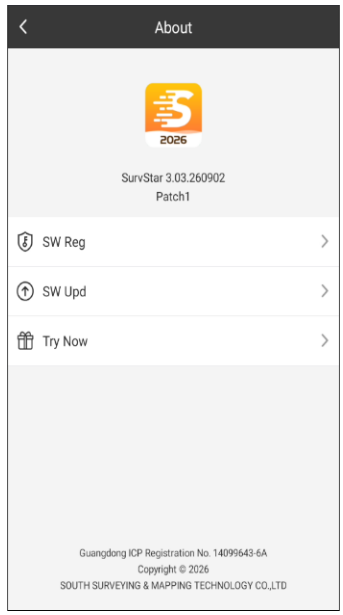
The process of multiline mapping in the same direction is basically the same as that of Z- type mapping. Attention should be paid to the difference of multiline mapping in the same direction.



3-11 About Software

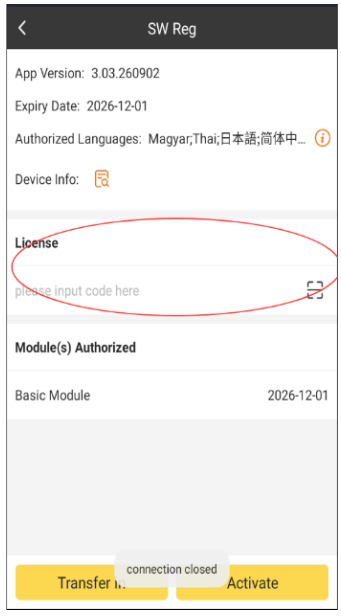
By clicking this, we can check the version of Survstar, register the Survstar and check new version manually.



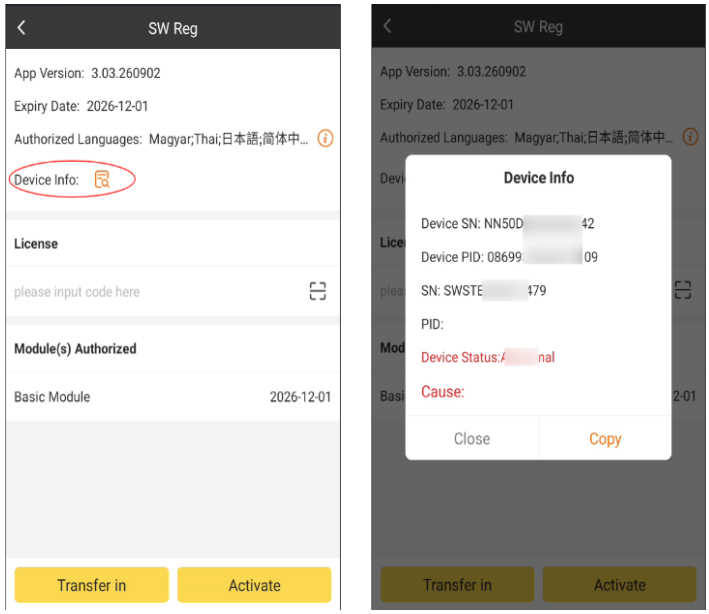


Software Register:

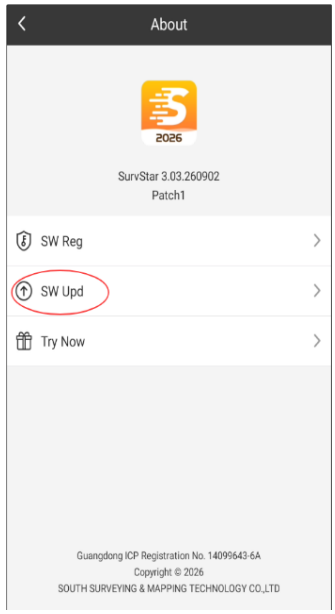
When we get the register code, we can click Soft Register , input the code in the bar,and click activate.



We can also check the information about the Register ID, Controller SN a, Expiry Date and PID.



We can click Check New Version to see if there is update or not.

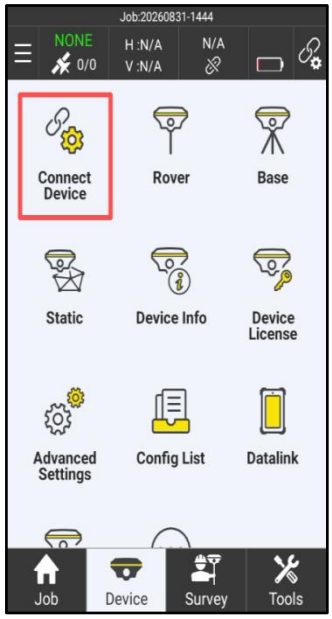


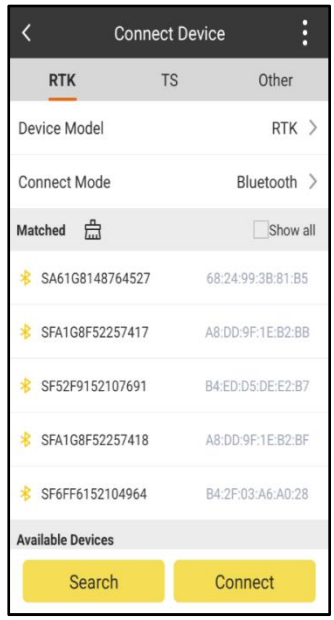
Chapter 4 Device - RTK

4-1 Communication

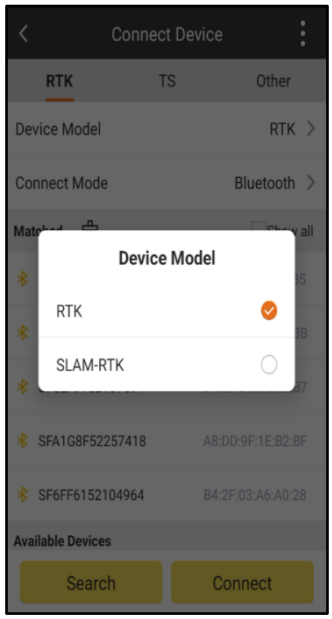
It is used to connect and communicate with receiver.

Click Device ->Connection or tap the  icon in the top to enter this interface.

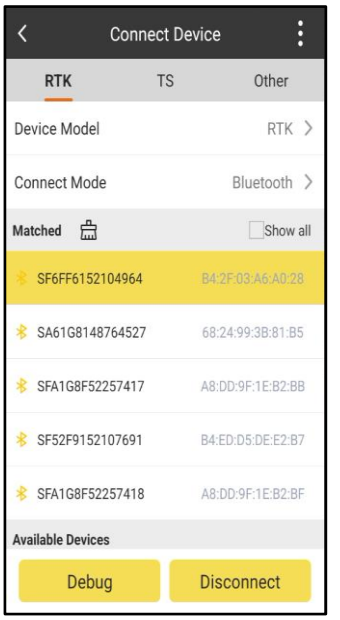




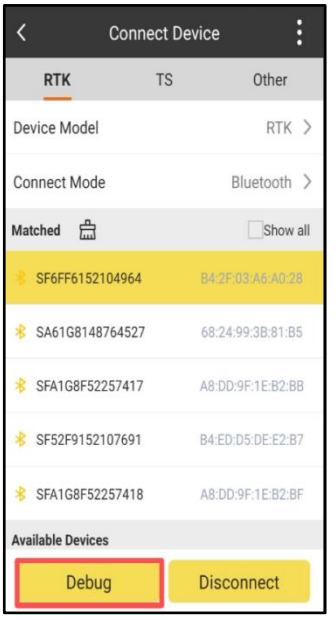
Select RTK Device Model



2. **Bluetooth** Select the Bluetooth and receiver's serial number, and click Connect to connect receiver The chosen device will highlight with yellow.



3. In Debug, we can monitor the data stream from the connected receiver.

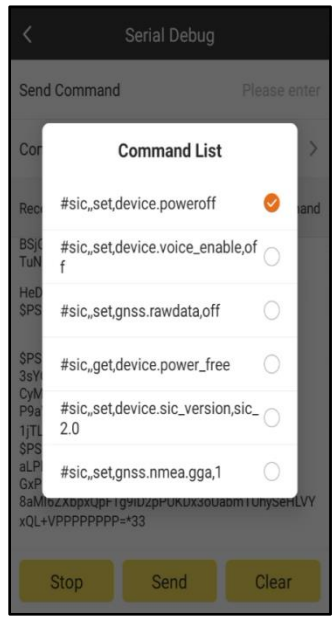




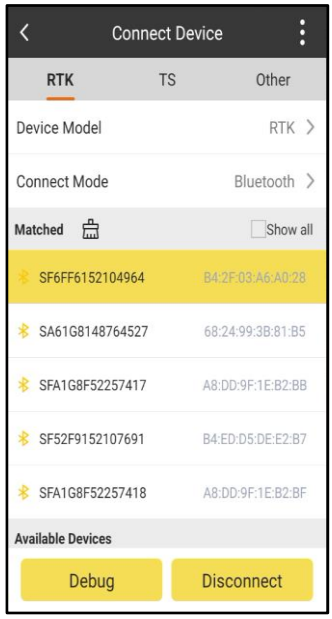
Start\Stop: Start\Stop data stream from the receiver; Send: send commands to communicate with receiver; Clear: Clear contents ofthe page;

Below are some commonly used commands' list.





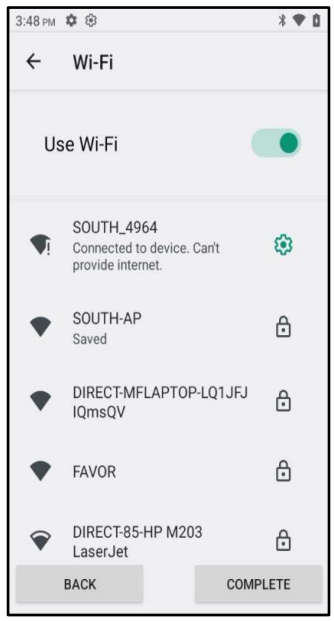
4. If we want to break communication with receiver, we can click Disconnect.



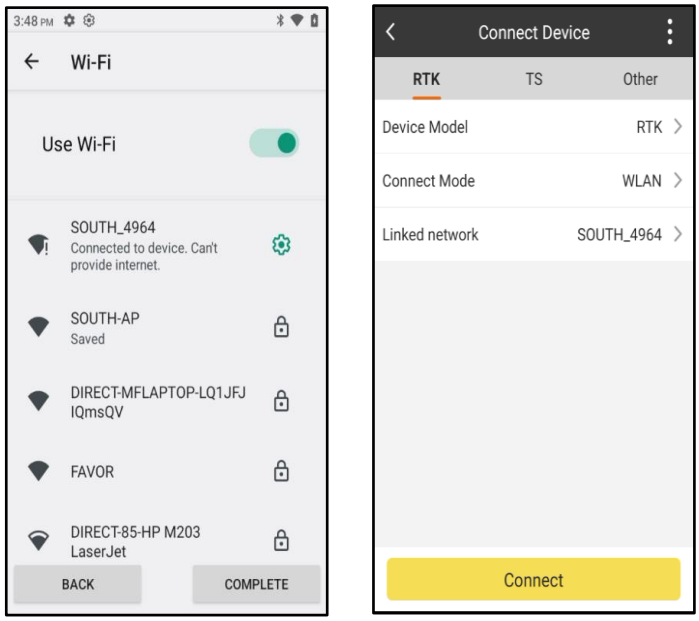
WLAN: Connect receiver by WIFI (It only supports the receiver with WIFI and WEB UI; and while connecting the receiver by WIFI, the android controller won't have access to the internet.)

1. Click the Device list bar to enter this page, choose Wi-Fi point name you want to connect.

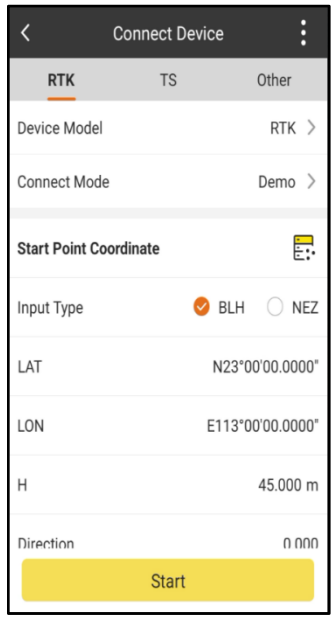




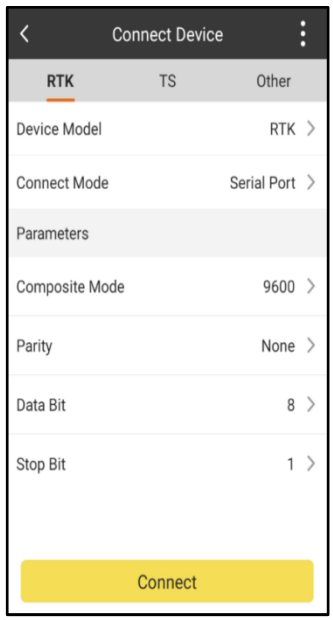
2. wipe down the screen then click the BACK icon to connect the WLAN ofthe receiver.



Demo: It is a mode used monitoring position to use Survstar (usually for tuition and Test purpose) without connecting real receiver. In this mode, we can define the starting point's coordinates, receiver moving direction and speed.



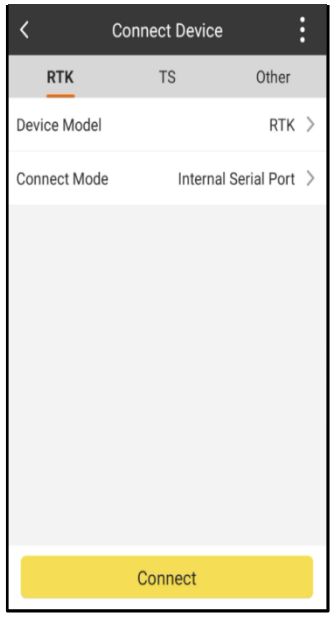
Serial port: Connect the receiver by cable (Not used so often)



Internal GPS: Suitable for device with satellites antenna port, like N80T



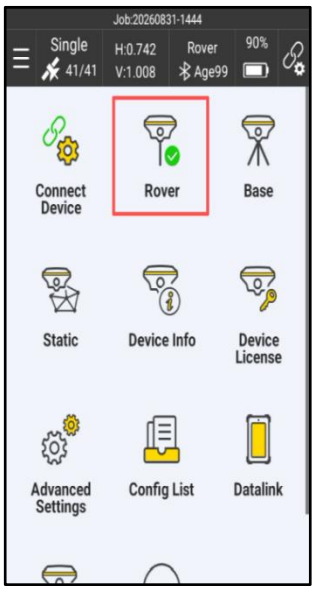
Internal serial port: Built-in serial port: not the RTK receiver hardware serial port, but a virtual serial channel on the controller to communicate with South receivers.

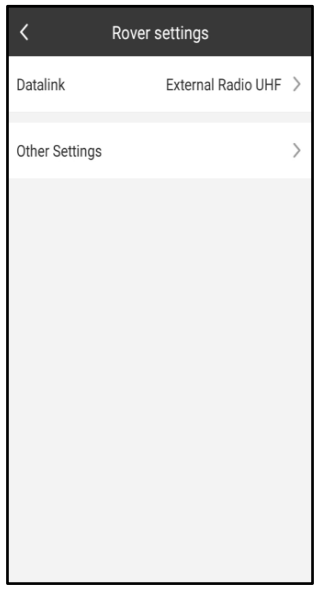


4-2 Rover Mode

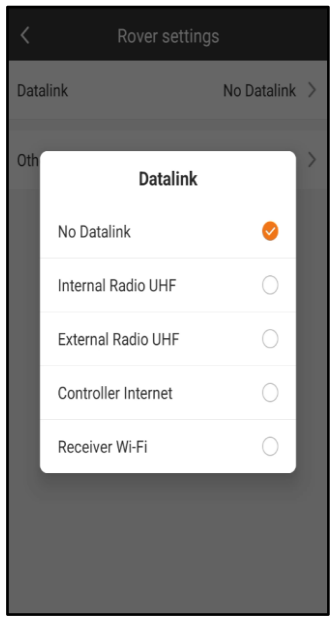
In Rover Mode, we can set receiver to rover mode and do some configurations

Click Device-> Rover to enter the interface of Rover Mode

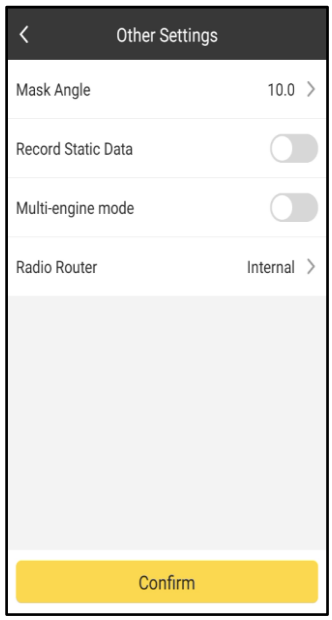




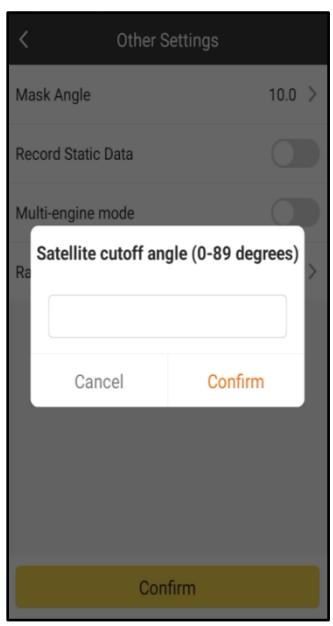
Datalink: Set datalink for rover.



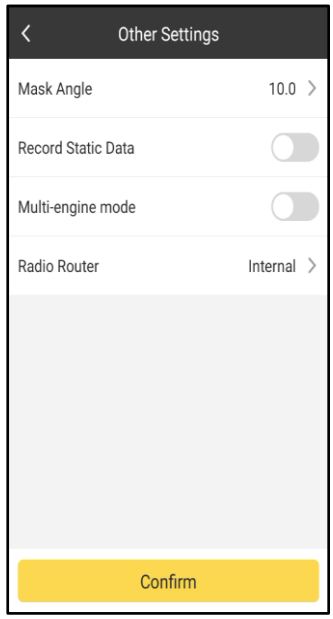
Other Settings



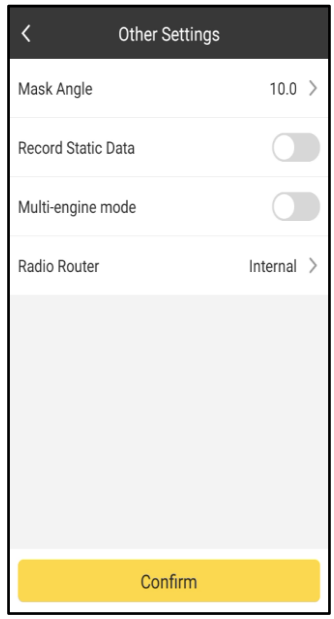
Mask Angle: to setting receiver mask angle, generally, the angle is higher, receive few number satellites, but quality is better. Default is 10.



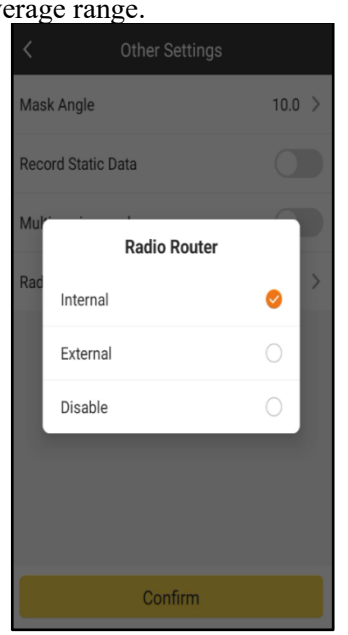
Record Static Data: Enable receiver to record raw data automatically (usually used in PPK mode).



Multi engine mode: Improve RTK performance when affected by the ionosphere.

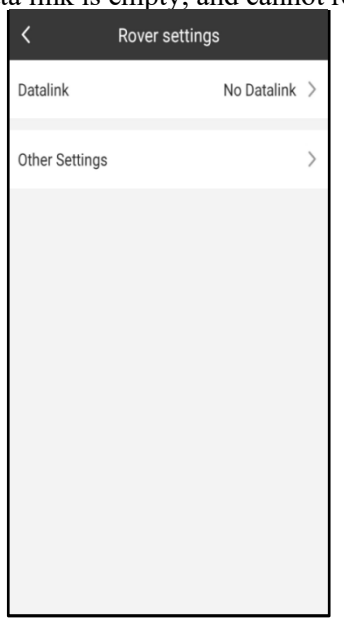


Radio router: The Radio Router function allows the GNSS receiver to receive UHF differential data from the base station and re-transmit the corrections via its internal radio module, extending the radio coverage range.



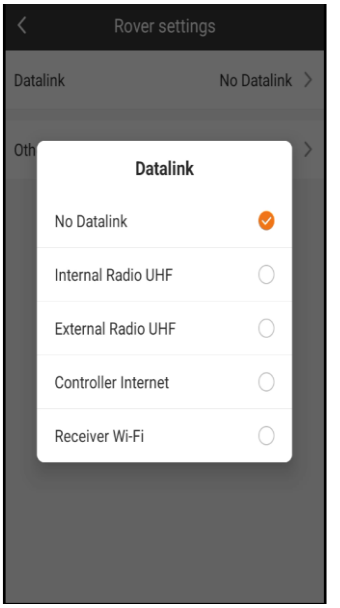
4-2-1 Rover-No Datalink

In No Datalink mode, rover's data link is empty, and cannot receive corrections from base.

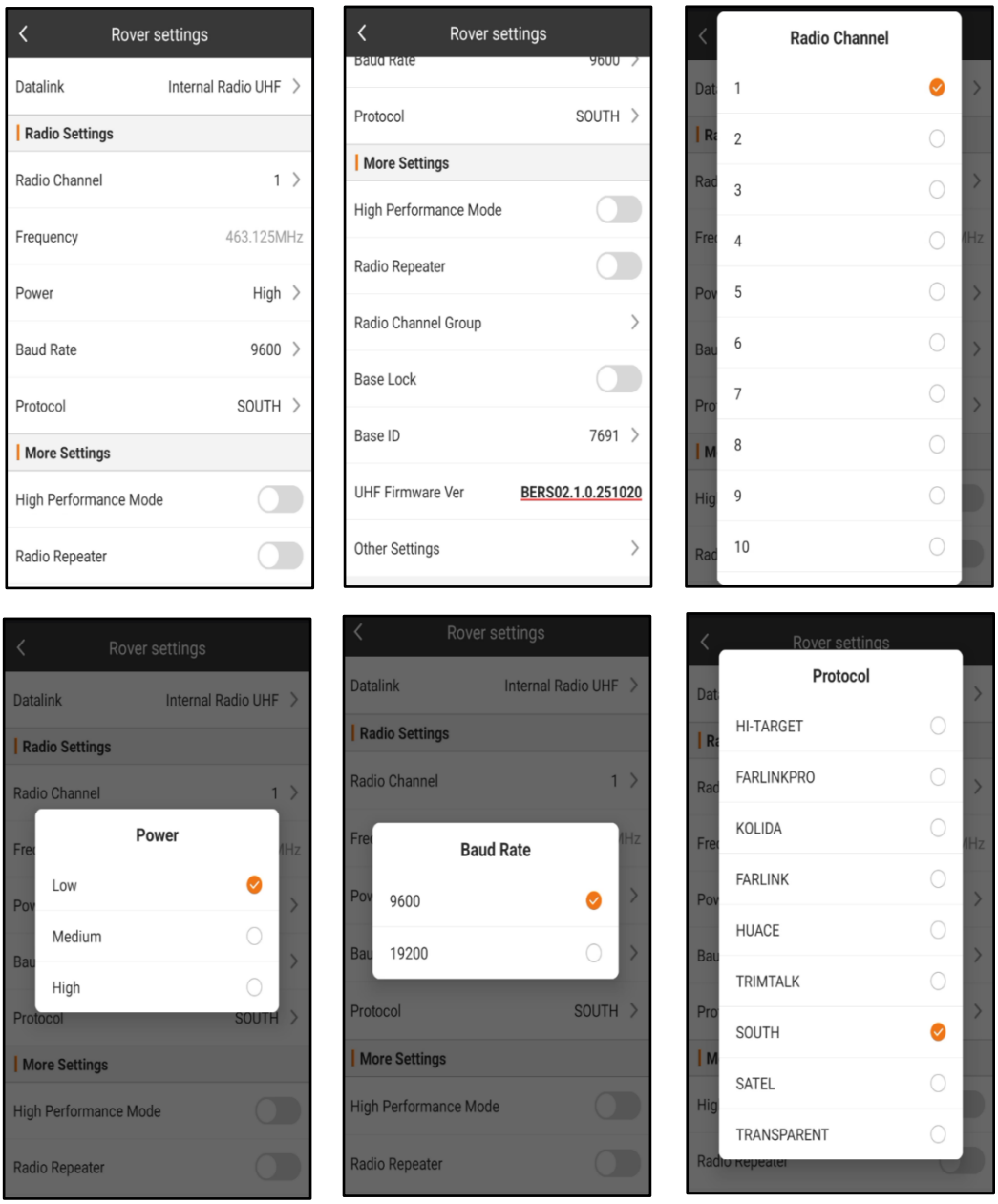


4-2-2 Rover.Internal UHF

In UHF mode, rover is able to receive corrections from base by internal radio.



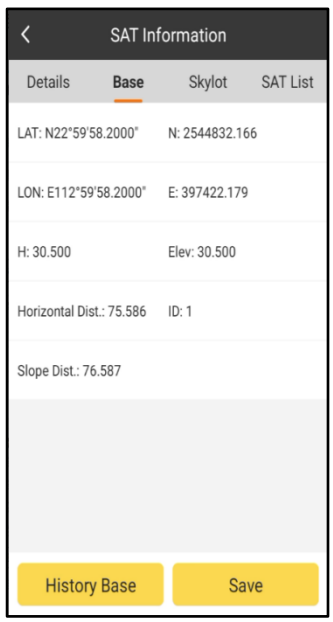
In UHF data link, we can set Channel, Frequency, Power, Baud Rate and Radio Protocol for rover, and you can turn on Radio Repeater if necessary, you can change frequency in Radio channel group. Here will showing base ID when you connect to base, and you can check receiver firmware version in here.



Click Radio Channel Group to change channel frequency.



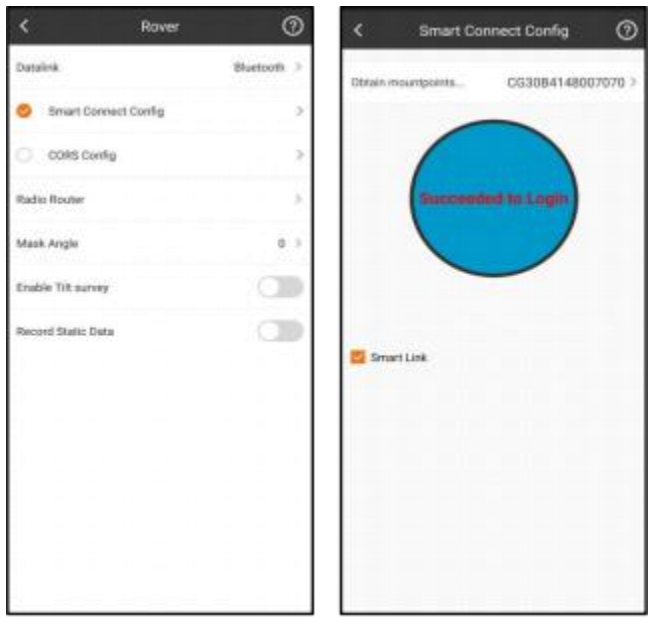
After those parameters above are set the same as base, rover can receive corrections from base and get base information.



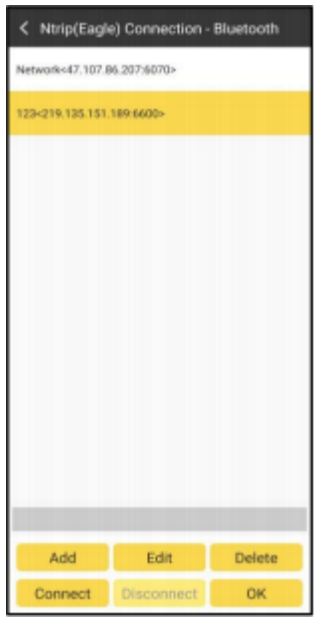
4-2-3 Rover-Cellular Network

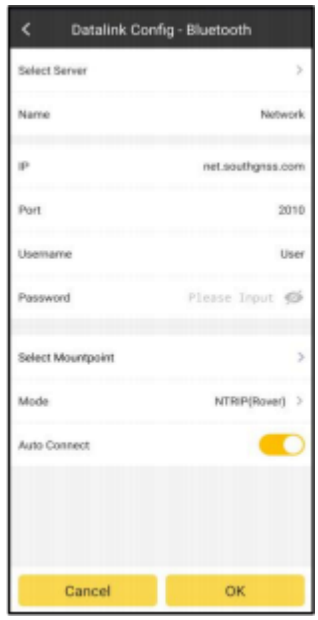
Input SIM card in receiver first, via SIM card to connect network, then choose Ntrip Connection account to log server and get fixed solution.

1.Choose Smart Connect Config and select mountpoint to one button connect network, then you will get fixed one click.

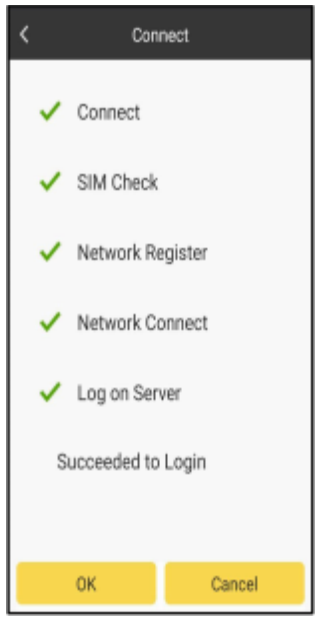


2.Choose CORS config to connect network, add one CORS account, enter IP Port Username and password, then select mountpoint and Mode.





3.Click OK then receiver will be auto log on server.

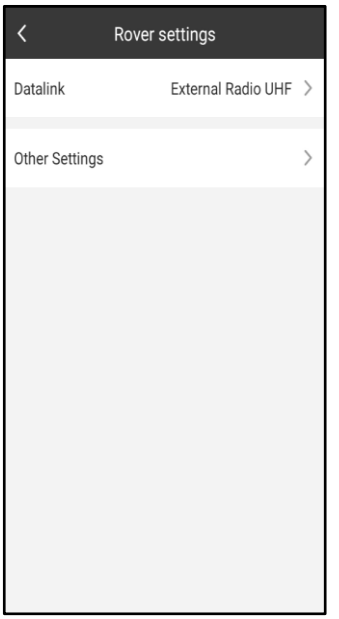


4-2-4 External Radio

In External Radio datalink, Rover can use external radio to receive radio signal from base.

1. Connect the receiver to external radio.

2. Click the Datalink mode bar, set the receiver to Rover- External mode.



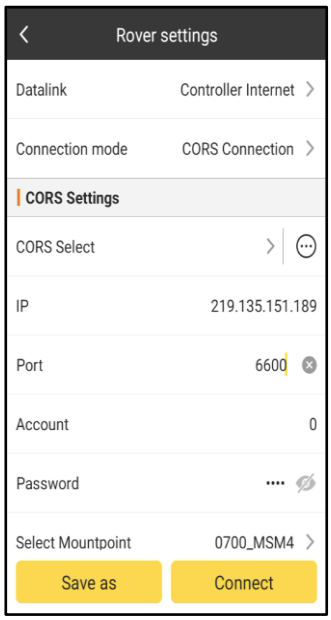
3. Config the external radio the same as base UHF.

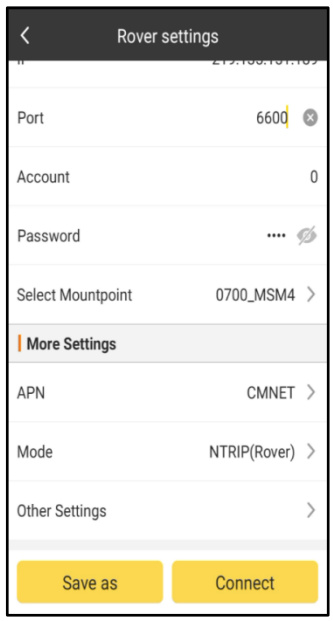
note: Configurations on external radio must be done on external radio itself.

4-2-5 Rover-Controller Network

In Controller Network, we can use controller's internet to access CORS server and download corrections. (Note: the controller must have access to the internet).

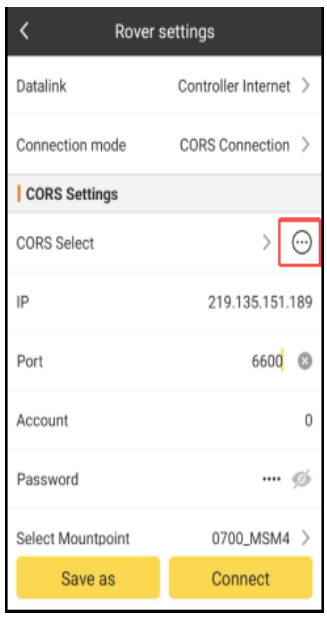
1. Click the Datalink mode bar, set the receiver to controller network.





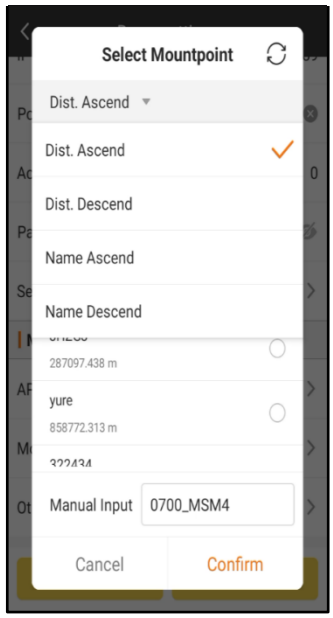
we can define a network config by inputting IP, Port, Username and mountpoint.

3.Click  button then click New we can add CORS account.

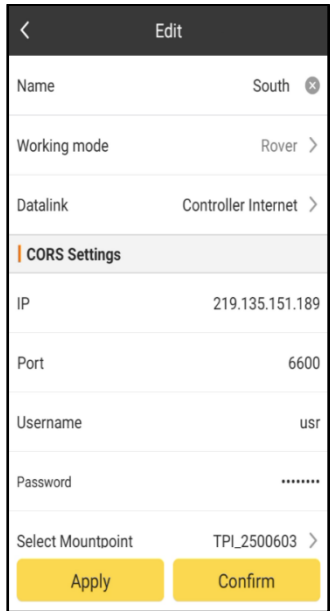




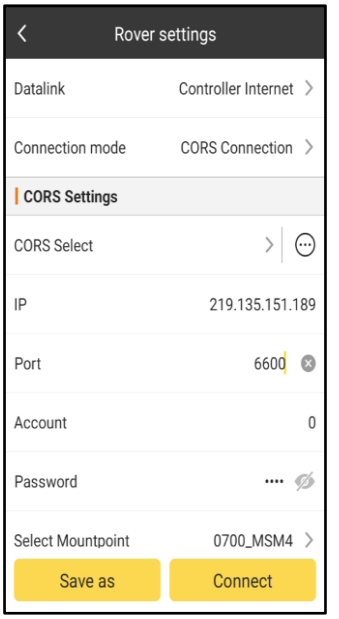
4. In Select Mountpoint, by Refreshing Mountpoints, we can get all the mountpointsavailable, select the one needed to finish Network config.



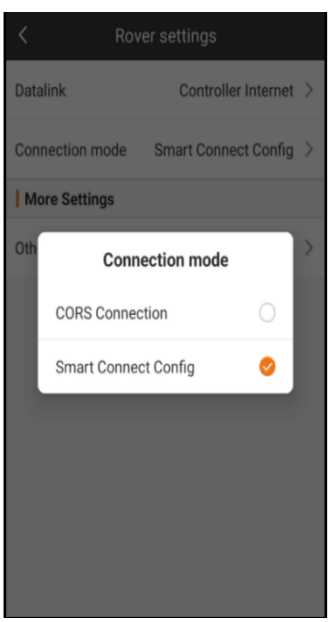
5.Click save as, enter name it will be saved at config list

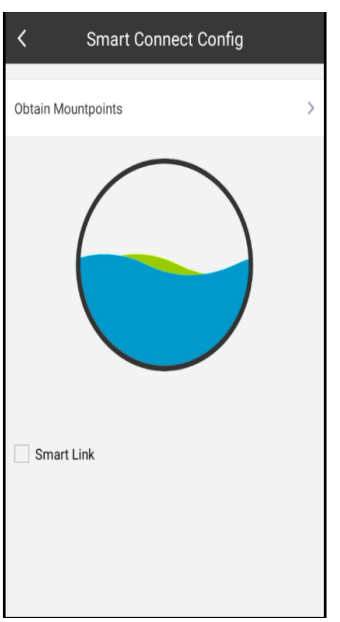


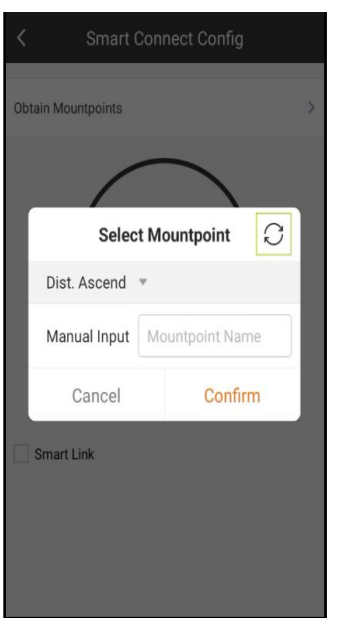
6.Click save as Connect, and differential corrections from base will be downloaded from the server.



7.Smart Connect Config: Auto connect with cors server, smart change to UHF mode if network mode can't used





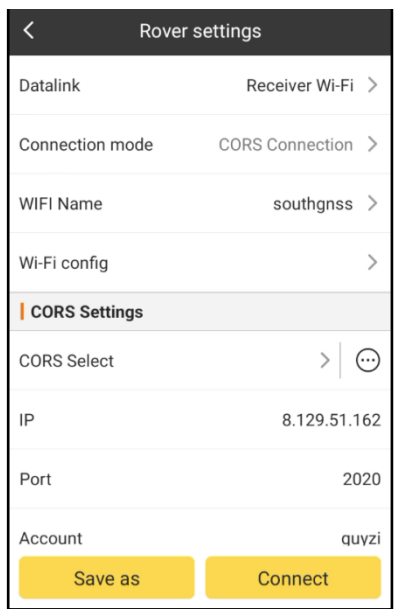


4-2-6 Rover-Receiver WiFi

In Receiver WiFi mode, we must ensure receiver itself has access to the internet, usually there are 2 ways: by receiver's WIFI or by receiver's network module.

By WIFI:

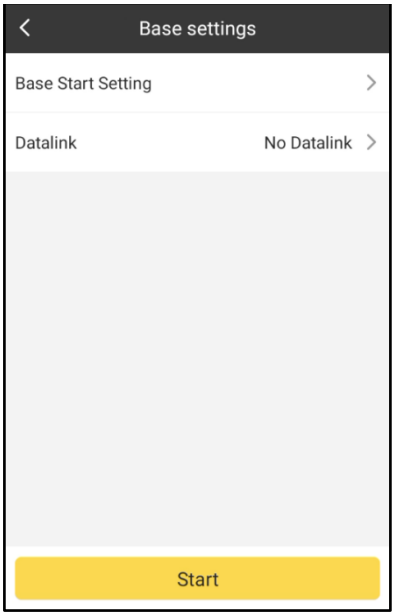
1.Click the Datalink mode bar, set the receiver to the Receiver WIFI mode.

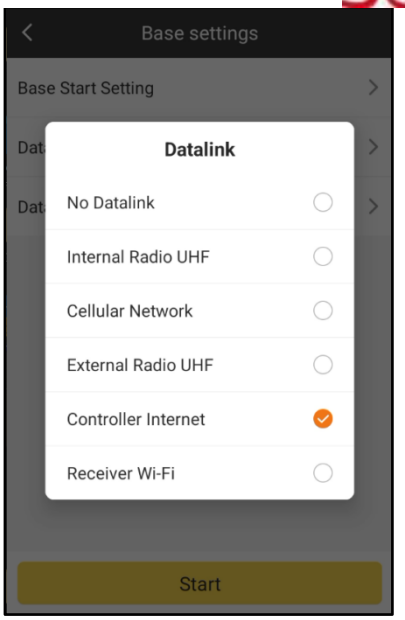


2. Build Network Config and connect (Operation is the same as we do when config Rover Bluetooth data link)

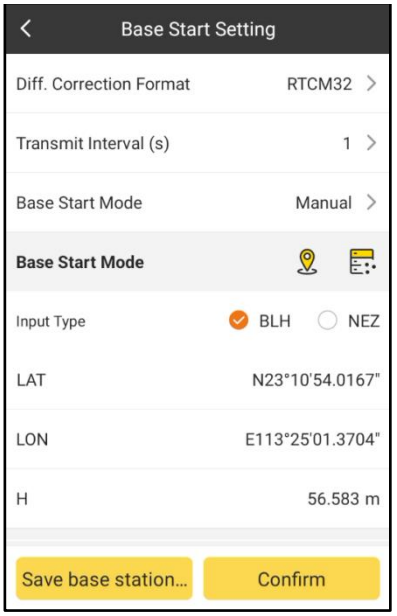
4-3 Base Mode

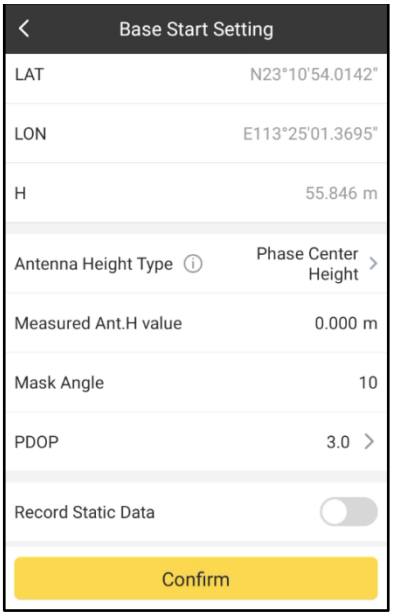
Base Mode is used to start base and transmit differential corrections in UHF, Network, and External Radio





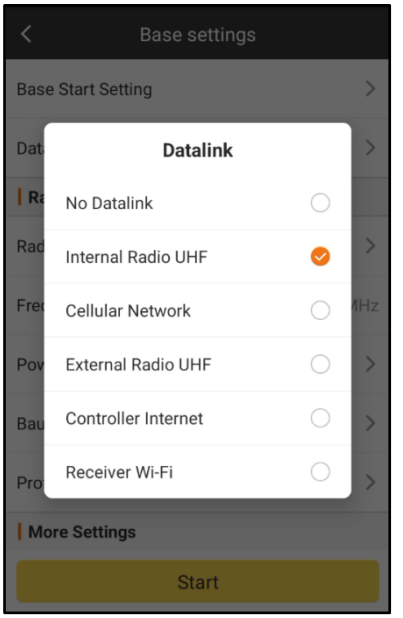
In Base Parameter config, we can set Base Correction Format, Transmit Interval, different Base Start Mode, Antenna Type and Height, Mask Angle, PDOP limit and record static data



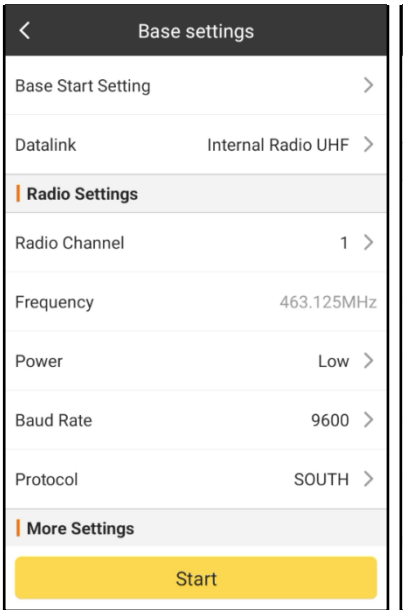


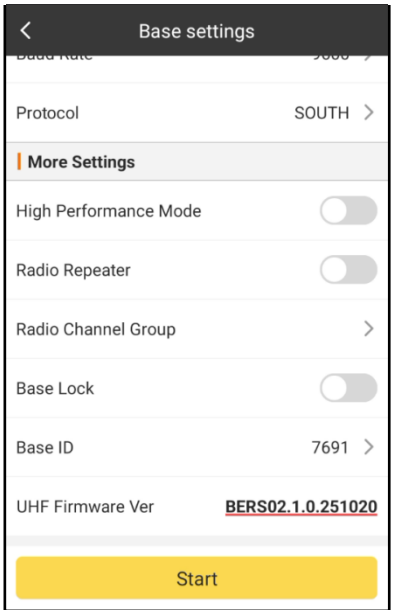
4-3-1 Base-Internal UHF

In this mode, Base is using its Internal UHF module to transmit differential corrections.



In UHF data link, we can set Channel, Frequency, Power, Baud Rate and Radio Protocol for base.



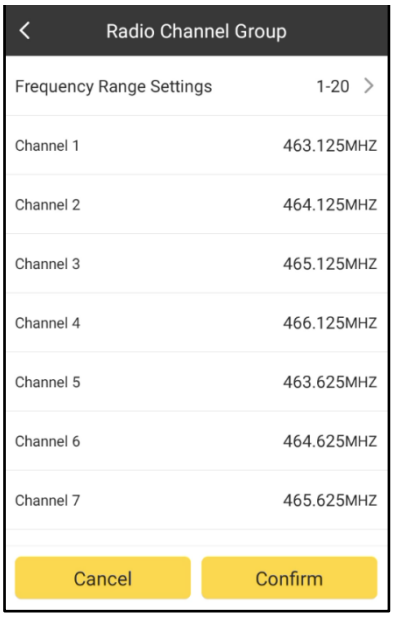


More settings:

High performance mode: If use high performance mode, please turn on it on base and rover same time.

radio repeater: RTK radio repeater receives GNSS differential correction data from the base station and retransmits it to extend the radio coverage for rovers to maintain positioning in obstructed areas.

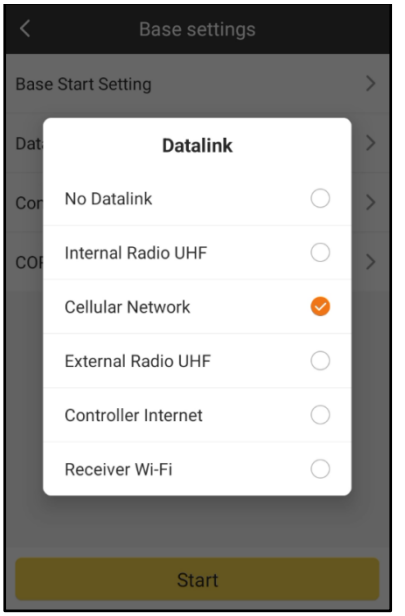
Radio channel group: you can change the radio frequency.



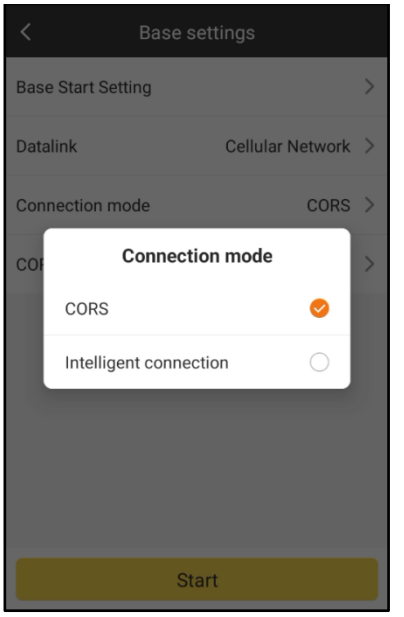
Base lock: base station stably tracks GNSS satellites and locks its coordinate reference to continuously broadcast reliable RTCM differential corrections for rovers. If dont need please turn off it.

4-3-2 Base-Cellular Network

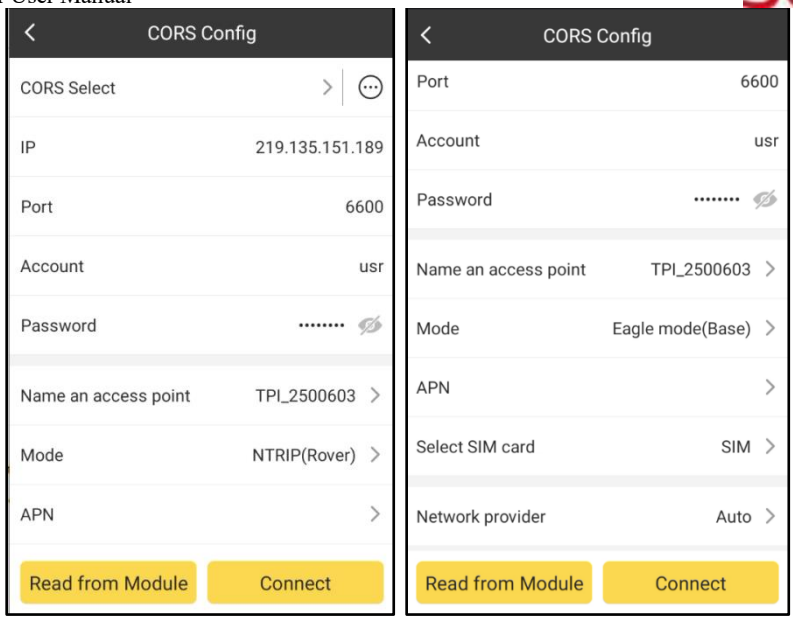
1.In this mode, Base is uploading its differential corrections to CORS server by Network. Then rover can download the corrections and get fixed solution.



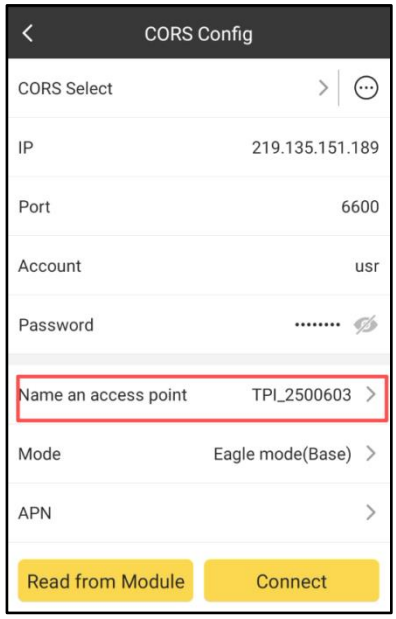
2.Choose Cellular Network and CORS mode.



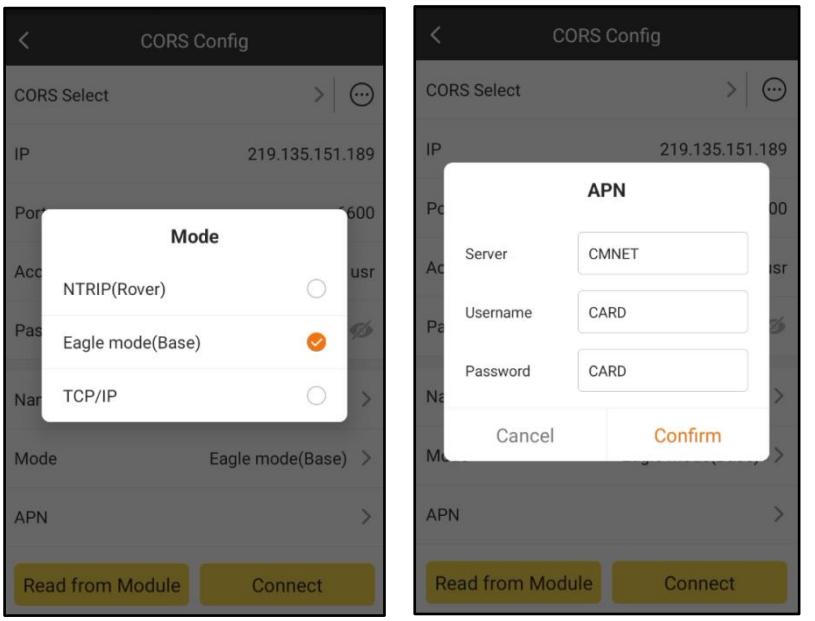
3.Click CORS Config and set CORS parameters.



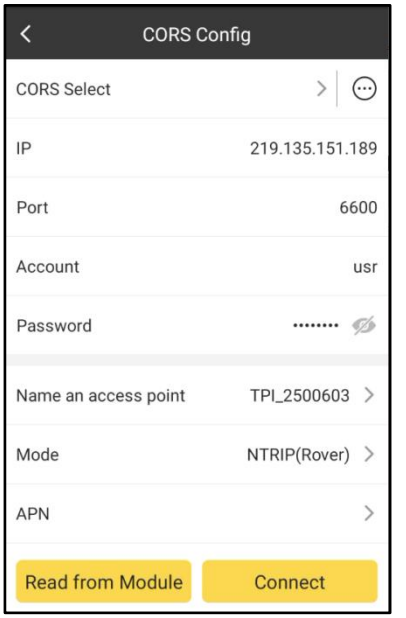
4.Click Name an access point bar to set the uploading differential corrections' access points, which cannot be set already exist in CORS.



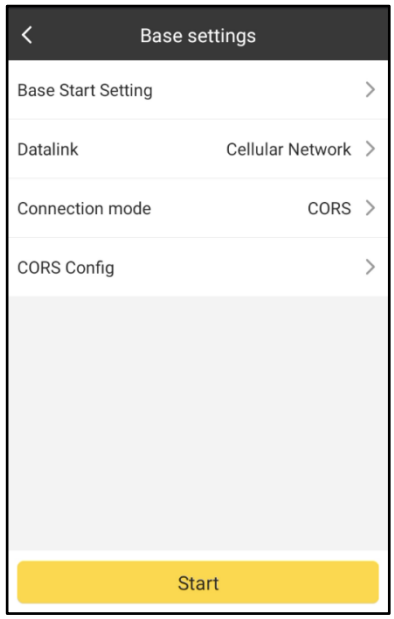
5.Set the Mode as Eagle mode (Base), and set the APN settings.



6.Click Connect bar to connect CORS server.

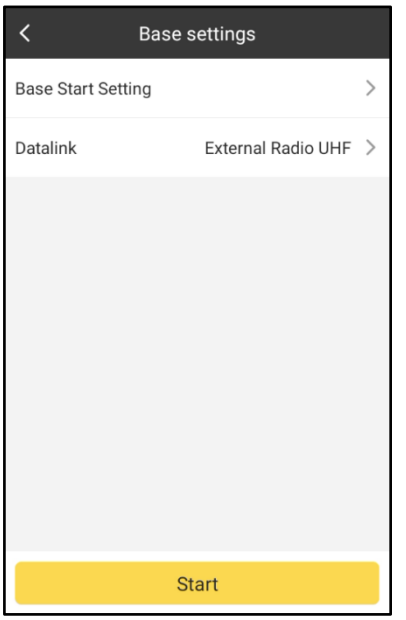


Once set, click Start to upload differential corrections.



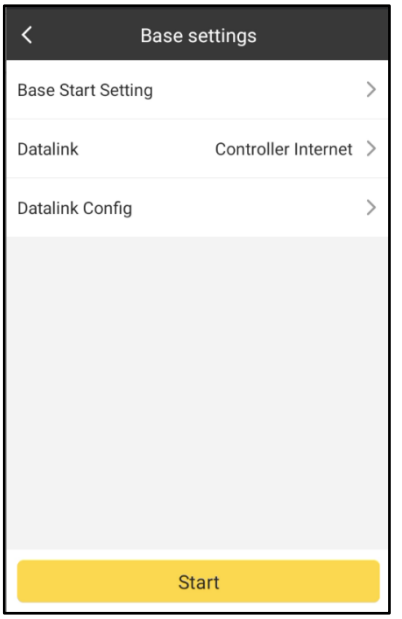
4-3-3 Base-External Radio

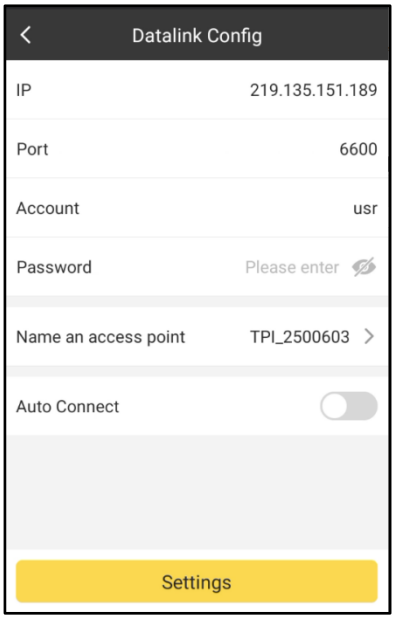
In this mode, Base is using External Radio to transmit differential corrections.



4-3-4 Base- Controller Network

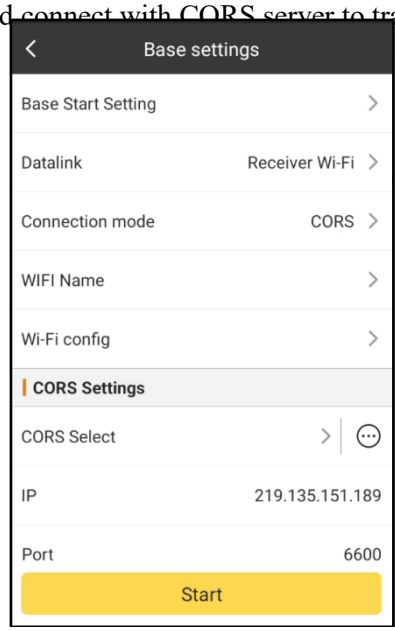
Insert enable SIM card in your device, via connect CORS to get base different signal then transmit to rover.





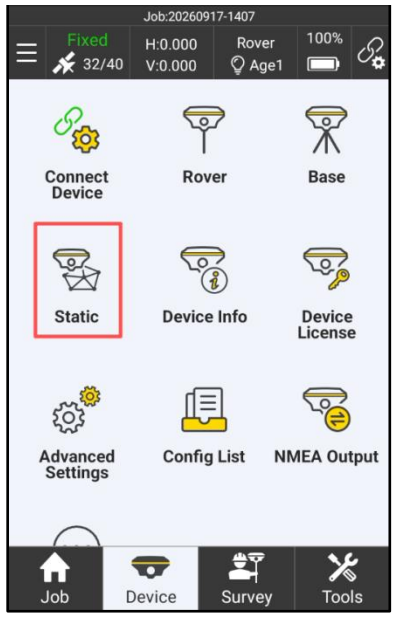
4-3-5 Base- WiFi mode

Use receiver itself WiFi and connect with CORS server to transmit base different signal.

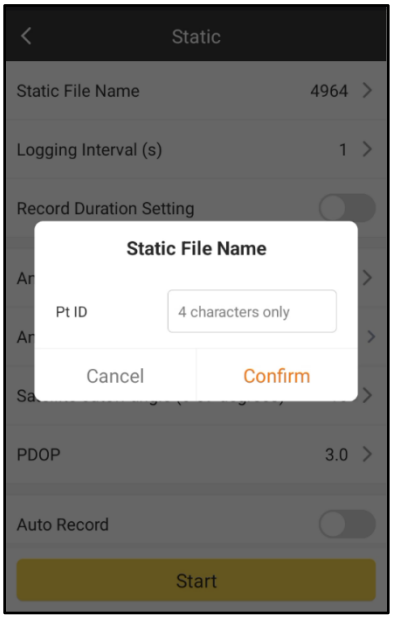


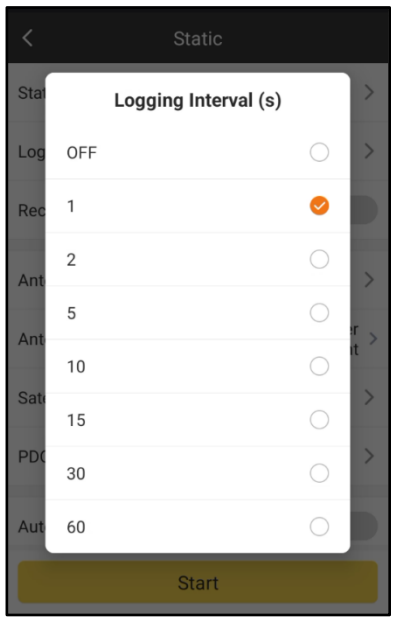
4-4 Static Mode

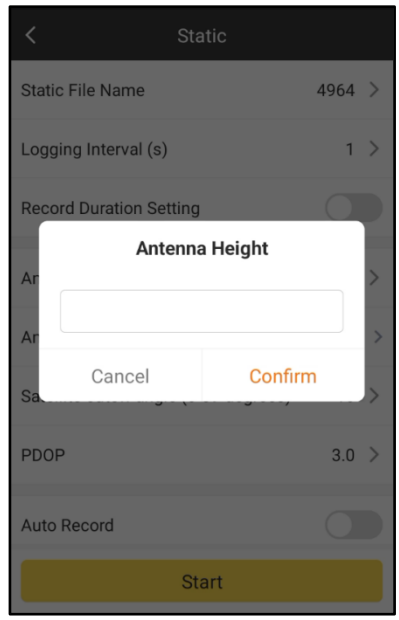
When we need to use receiver to do static work, we can go to Survstar-Device, set receiver into Static Mode.

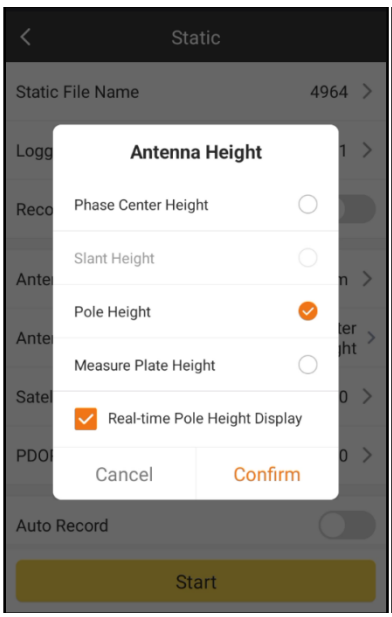


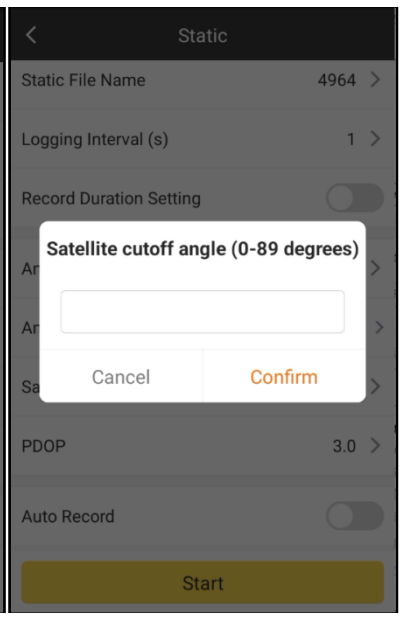
In Static Mode, we need config Static File Name, Collect Interval, Antenna Height and Type, Mask Angle, PDOP limit and Auto\Manual Record.

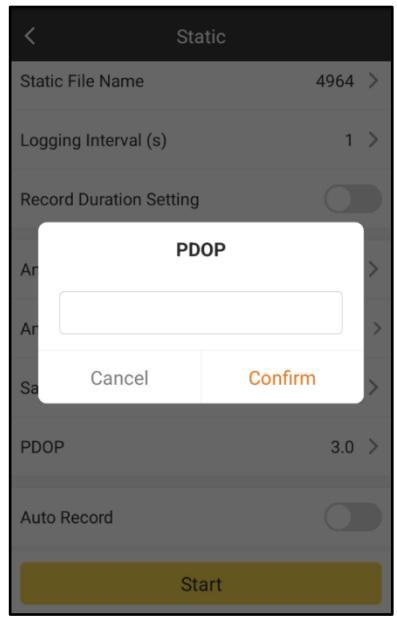






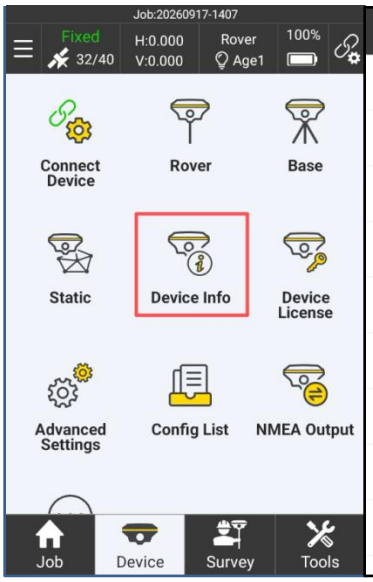


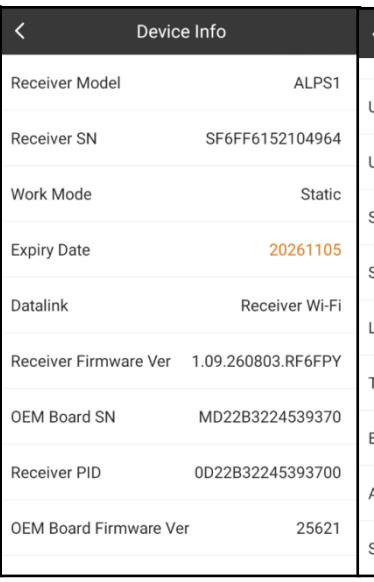


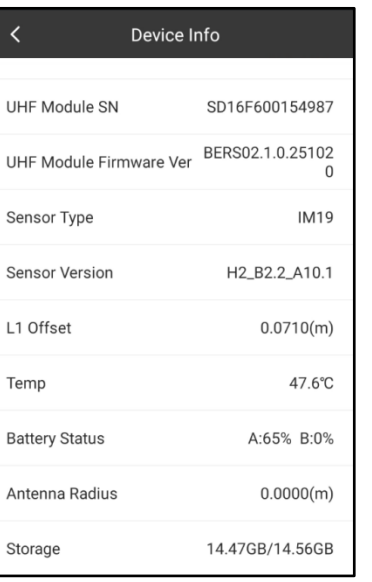


4-5 Device Info

In this sector, we can check the information of the device. It includes Receiver Model, Receiver SN, Work Mode, Datalink, L1 Offset, Antenna Radius, Temperature of the device, Battery Status, Memory, Receiver Firmware Version, Expiry Data, OEM Board SN, OEM Board Firmware Version, UHF Module SN and UHF Module Firmware Version.

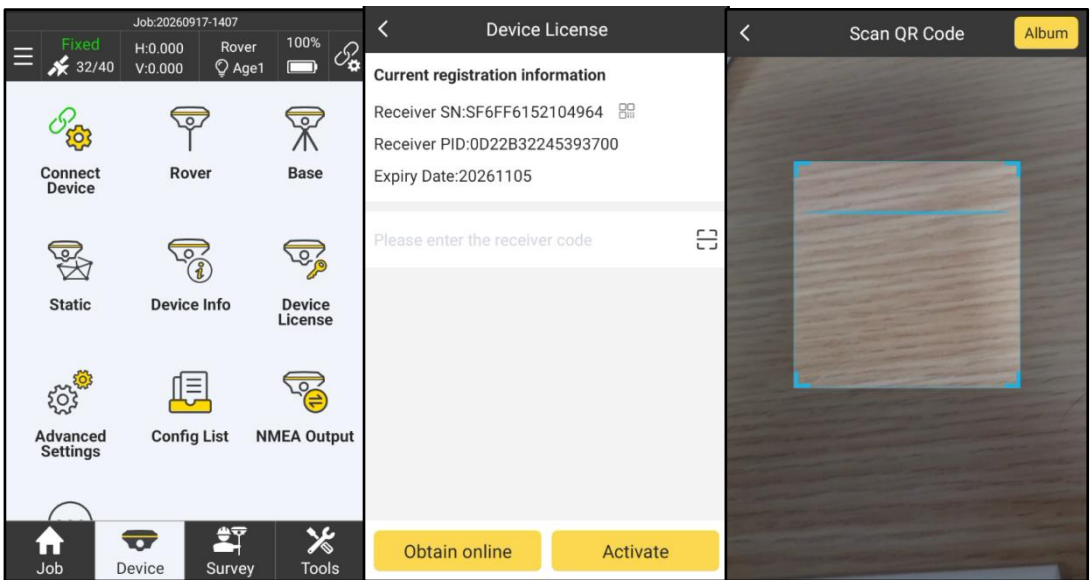






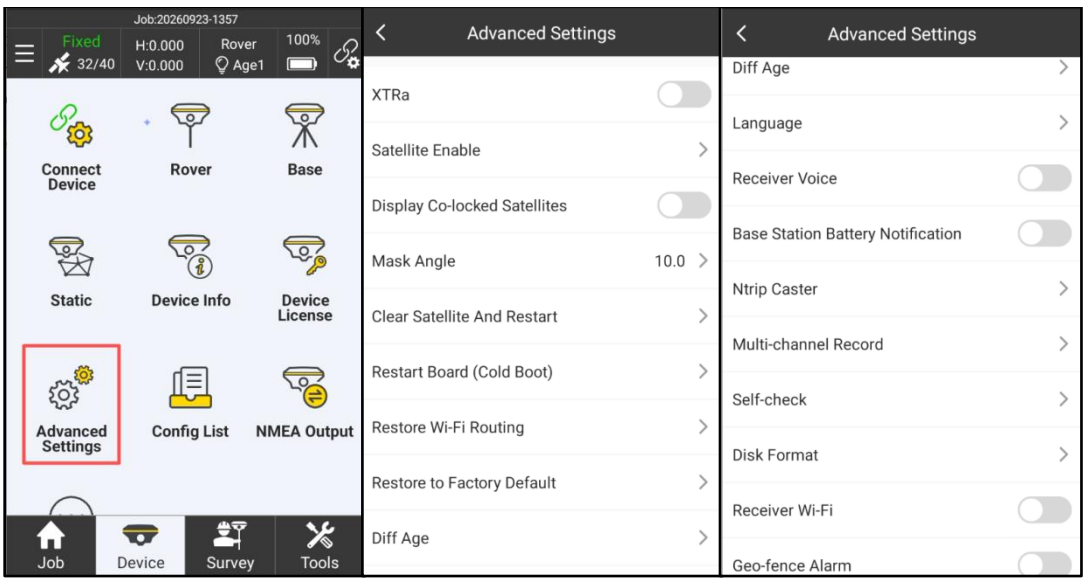
4-6 Device Register

In this page, we can check the device registration information and register device. Click Copy will copy the receiver SN. Input the registration code in the bar, and click Register, then the device will be registered. We can also Click SCAN to scan the QR code to register.



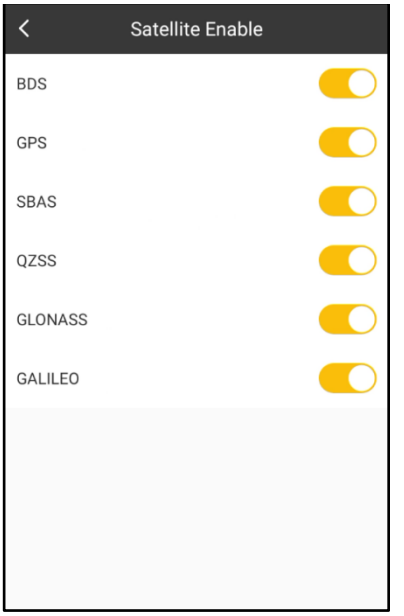
4-7 Advanced Setting

In this page, we can control weather track one satellite system and set the settings of the receiver. We can set the Voice of the device, Language of the device, Clean Ephemeris, Self- check, Restore to Factory Default and so on.



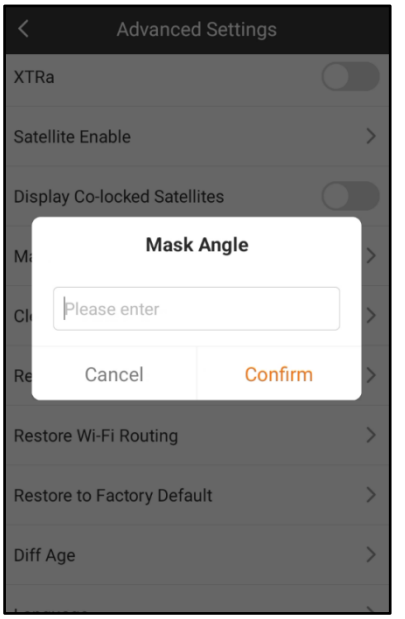
XTRa: Toggle to enable or disable the XTRa high-precision positioning enhancement function.

Satellite Enable: Select which GNSS satellite systems are allowed for tracking.



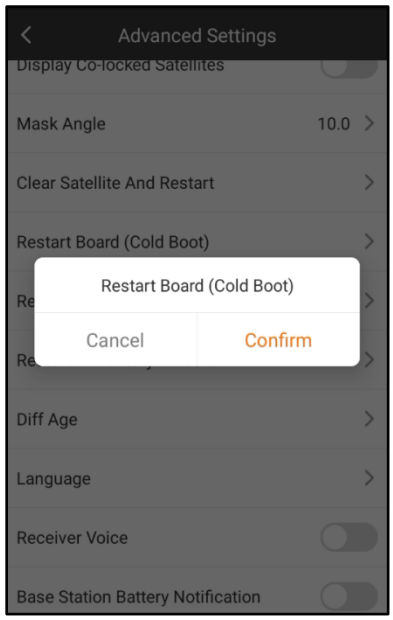
Display Co-locked Satellites: Toggle to show satellites locked by both base and rover stations.

Mask Angle: Set the elevation threshold; satellites below this angle will not be tracked.



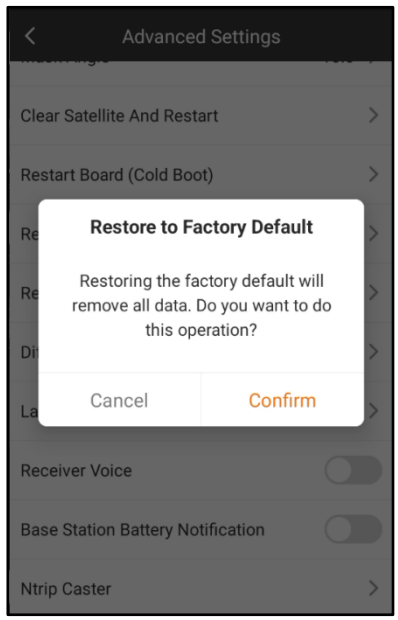
Clear Satellite And Restart: Erase satellite ephemeris data and reboot the receiver.

Restart Board (Cold Boot): Perform a cold restart of the GNSS main board.

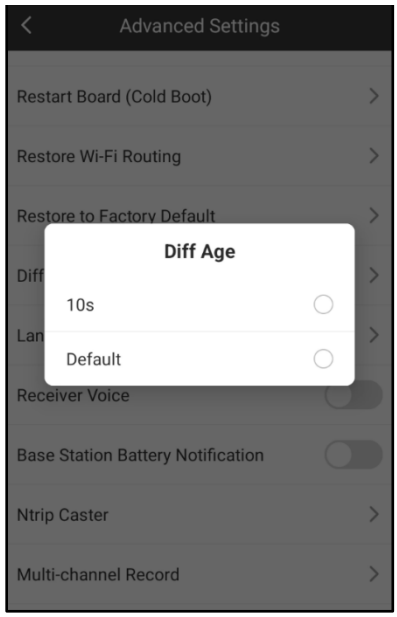


Restore Wi-Fi Routing: Reset the Wi-Fi network routing configuration.

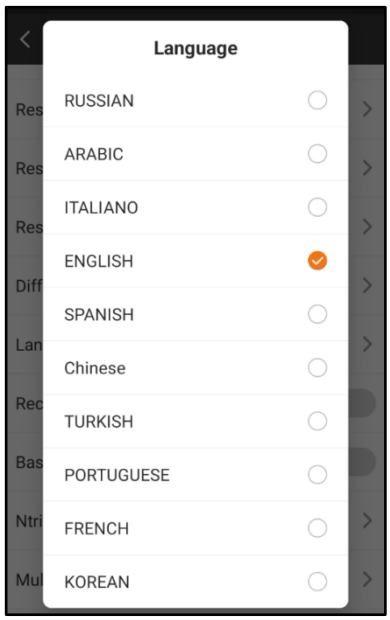
Restore to Factory Default: Reset all receiver settings back to factory values.



Diff Age: Configure the maximum acceptable time latency of differential correction data.



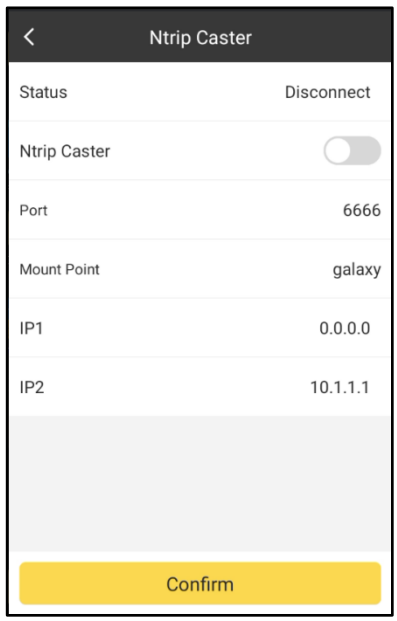
Language: Change the display language of the receiver software.



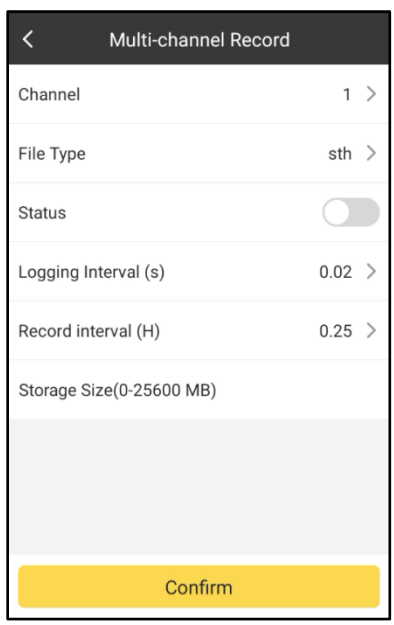
Receiver Voice: Toggle voice prompt alerts from the GNSS receiver.

Base Station Battery Notification: Turn on/off low battery alerts for the base station.

Ntrip Caster: Configure the built-in NTRIP caster service for differential data transmission.



Multi-channel Record: Enable and manage multi-channel raw data logging.

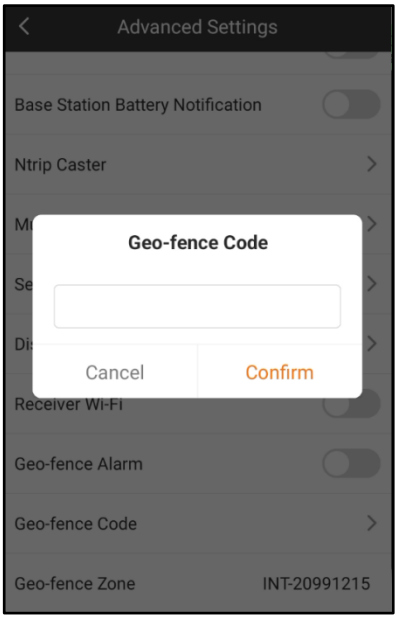


Self-check: Run automatic diagnostic tests on the receiver hardware.

Disk Format: Format the internal storage disk of the receiver.

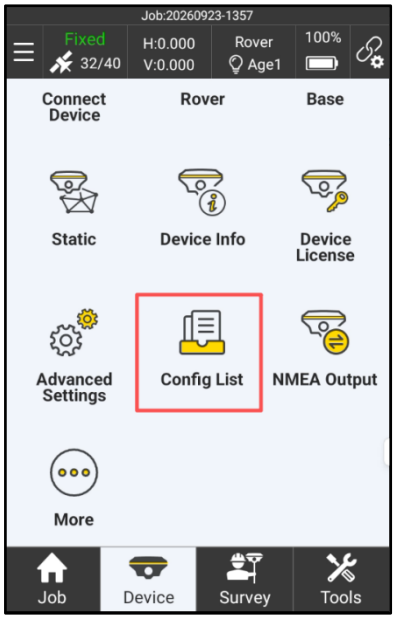
Receiver Wi-Fi: Toggle the built-in Wi-Fi module of the GNSS receiver.

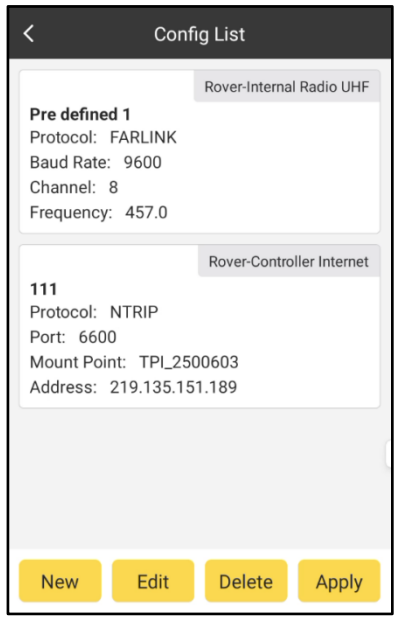
Geo-fence Alarm: Activate alarm when the receiver moves outside the preset geofence boundary.



4-8 ConfigList

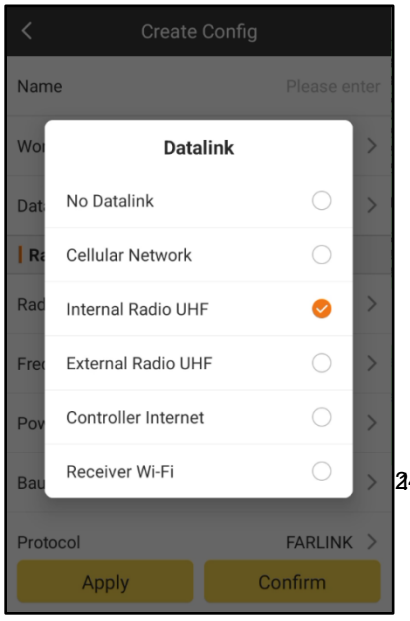
You can one-click setup datalink for in rover or base mode.

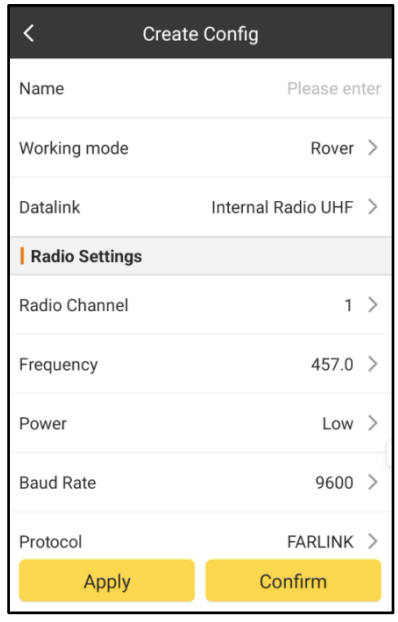




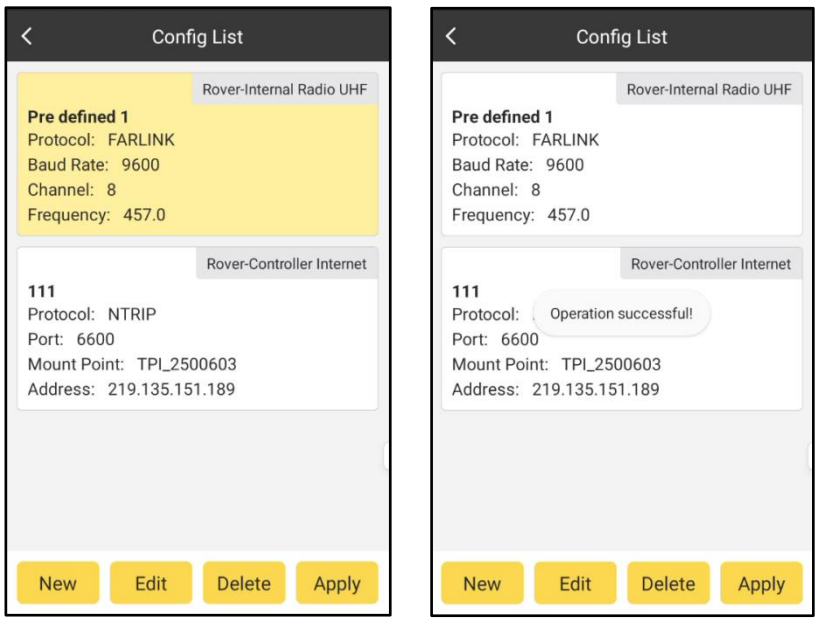
Click new button to add a configlist, you can set working mode and different settings in different datalink mode.

Such as rover mode and Internal UHF datalink.



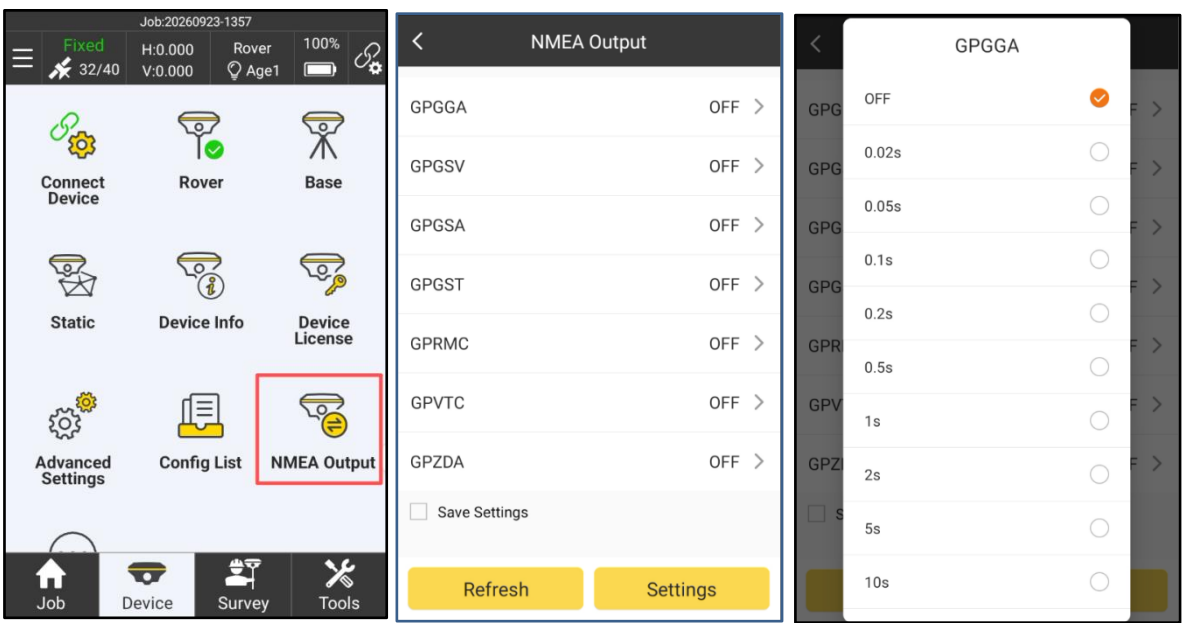


Click confim when you successful create Config, then click Apply, you can great use this ConfigList to use your receivers.



4-9 NAME Output

Set NMEA dataflow output frequency.



Chapter 5 Device – Total Station

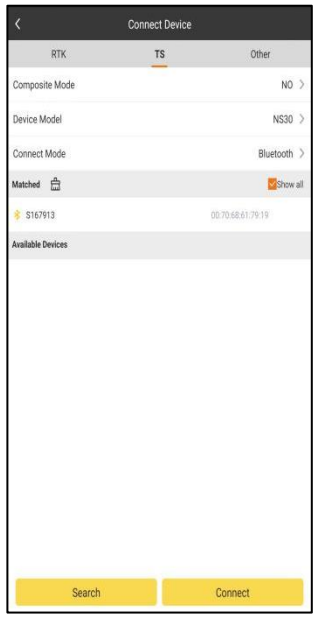
5-1 Connection

If you need to connect a robotic total station to a device such as a handbook or tablet, first open TServer on the onboard side.

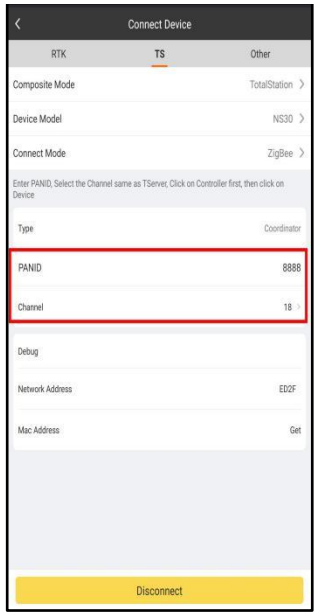
Click Device ->Connection to enter this interface .

Select the model of device needed, equipment model. If you ne`ed to connect to atotal station, the software only supports Bluetooth communication mode.

Search for nearby Bluetooth devices, when a Bluetooth device with the same name as the total station serial number appears, select the device and click Connect.



If connecting to a robotic TS, select "NS30" for the device mode and "ZigBee" for the connection mode; then, enter any four-digit number for the PANID and select any channel number (ensure the PANID and channel number on the robotic TS match those on the controller).Then, click the connection button at the same time.



Click Debug to monitor the data stream from the connected receiver.

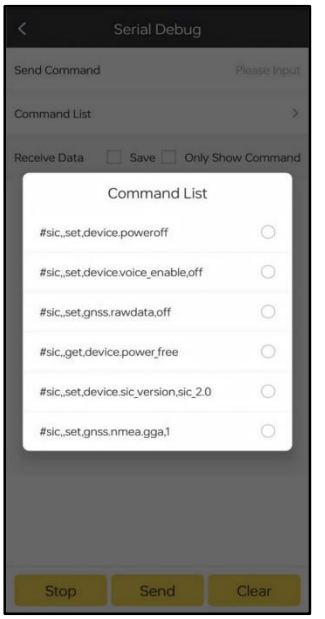


Click stop or start to stop/start the data stream from the receiver.

Input the commands at the Send Command bar, and click the Send to the commands to the receiver.

Click Clear to clear the contents of the page.

There are some useful commands in the Command List bar.

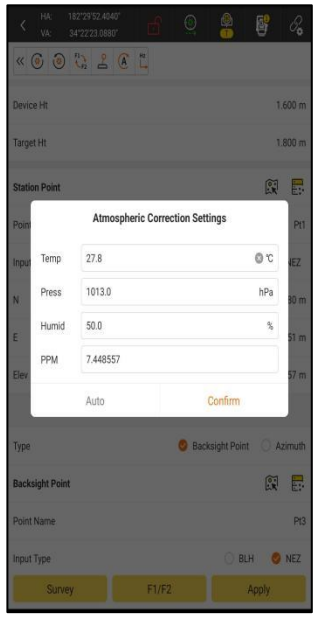


Break the blue tooth connection with the receiver by clicking Disconnect.

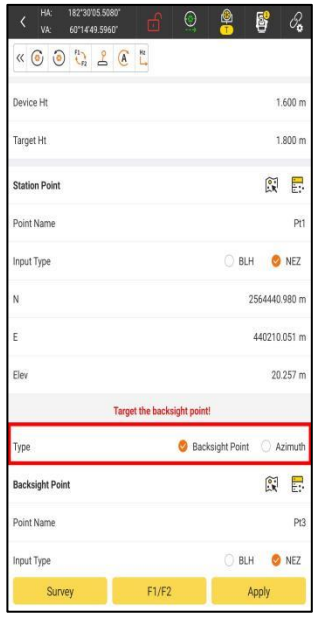
5-2 Instrument Station Setting

Click device->STN Setup .You can access the built station interface.

Click AUTO to retrieve atmospheric correction parameters.Then click Confirm Save Parameters



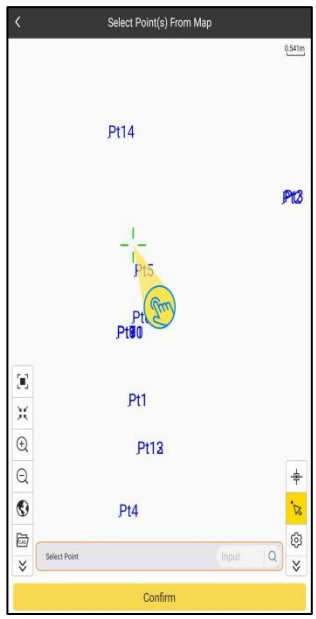
We can choose Backsight point or Azimuth



Known point: First enter the instrument altitude and the target altitude. Known points can be obtained in two ways.

Map Select: Click on the icon to open the chart selection interface. If there is a measured point on the map, click the right arrow icon, long press the green arrow in the

middle of the screen, drag the arrow to the position of the measured point, ‘Survey Point’ will appear on the map, proving that the point has been selected, click OK to complete the point selection.



:Full map

:Go to map center

:Map enlarge

:Map reduce

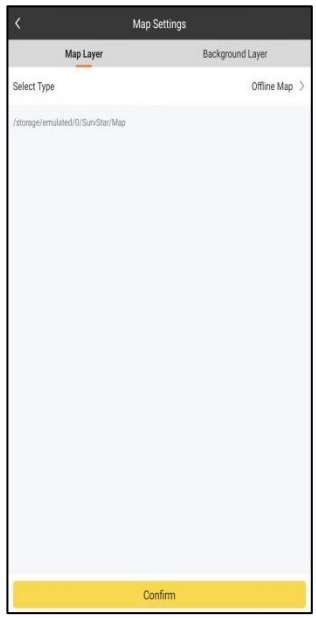
:Map settings. Select map layer or background layer. In ‘Map Layer’, there are three types of layers.

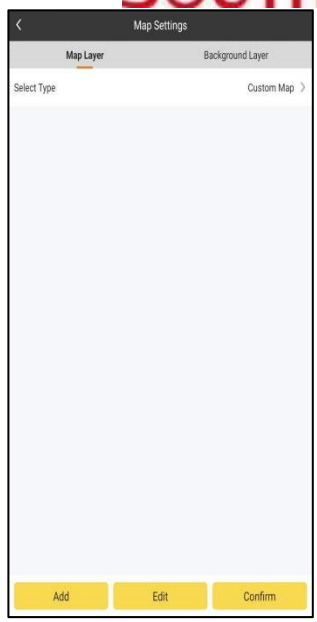
Online Map: Offer five online maps or choose ‘no.’

Offline Map: Offline maps are stored in a specified path and can be loaded when needed.

Custom Map: Enter the correct URL for the map.



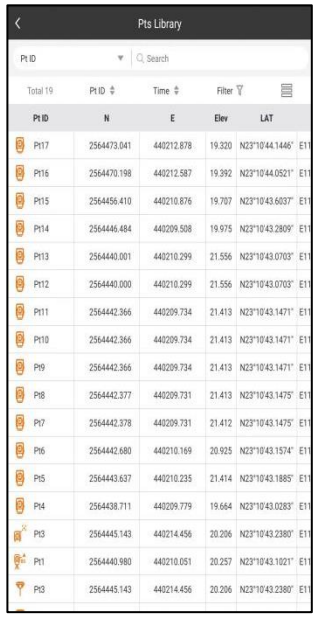




In ‘Background Layer’, store layers in shp, tif, jpg, kml formats under the specified storage path. Select the corresponding layer for adding, editing, moving, deleting and other operations when needed.

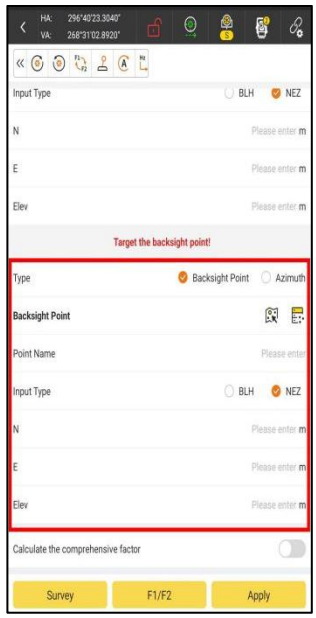
: Open CAD. Adding cad files by specified path or full disc search.

Point Database: Select the icon to choose a point from the Points Database, and manage all points by adding, editing, deleting, etc.



Input: Manually enter point name and coordinate information.

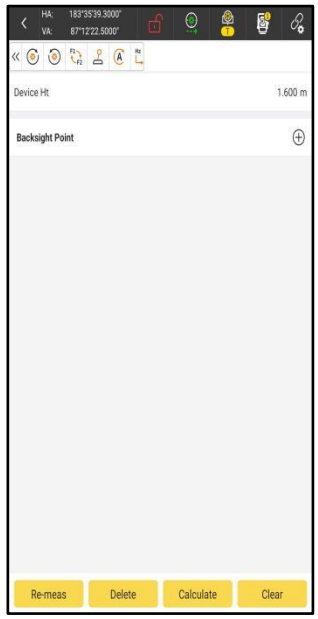
The station type consists of two types: Backsight Point and Azimuth.



Azimuth: After creating the station, enter the angle value and then click Apply.

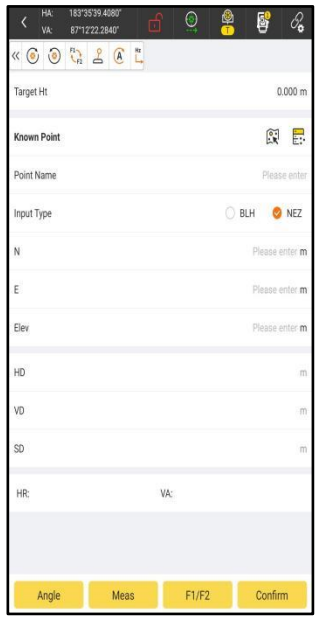
Click device->Resection .You can access the built station interface.

Enter Device Ht,then enter two or more backsight points.



Enter Target Ht,then via map or pts library choose point.

Aim the point,and click Mea getting data.Finally, click Confirm.



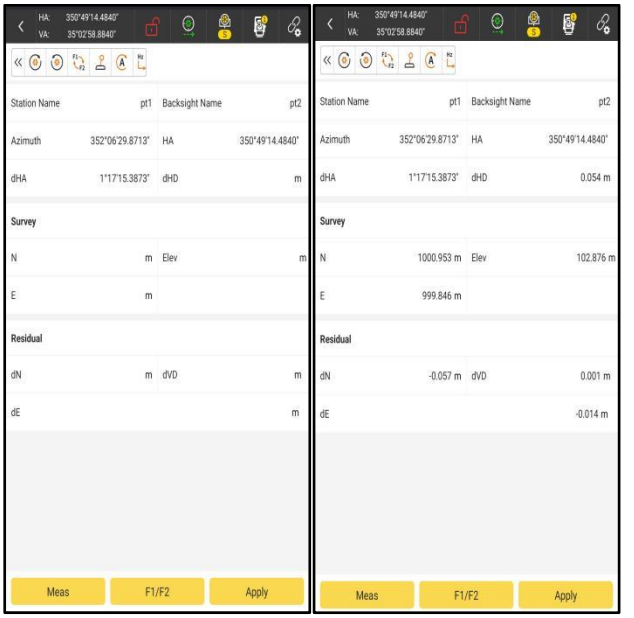
Repeat the above steps until there are two or more points in the rear view. Then, click Calculate to view the error; if the error is small, click Apply.

5-3 BS Check

1、Check whether the current angle value is consistent with the azimuth when setting up the station

2、Check whether the current back sight point coordinate measurement value is consistent with the existing value.

3、It is necessary to set up the station first to carry out the BS Check.

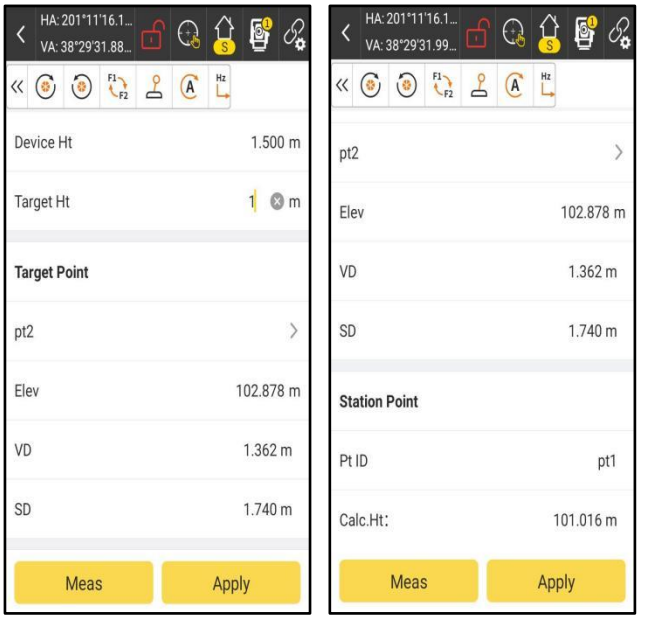


5-4 Height Transfer

The elevation of the current station is obtained by measuring a known elevation point, and the elevation of the station can be obtained by this method if the elevation of some stations is unknown.

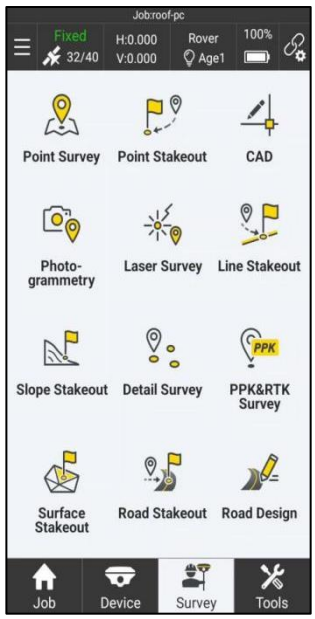
In the case that the elevation of some stations is unknown, the station elevation can be obtained by this method.

It is necessary to set up the station in order to set the station elevation.

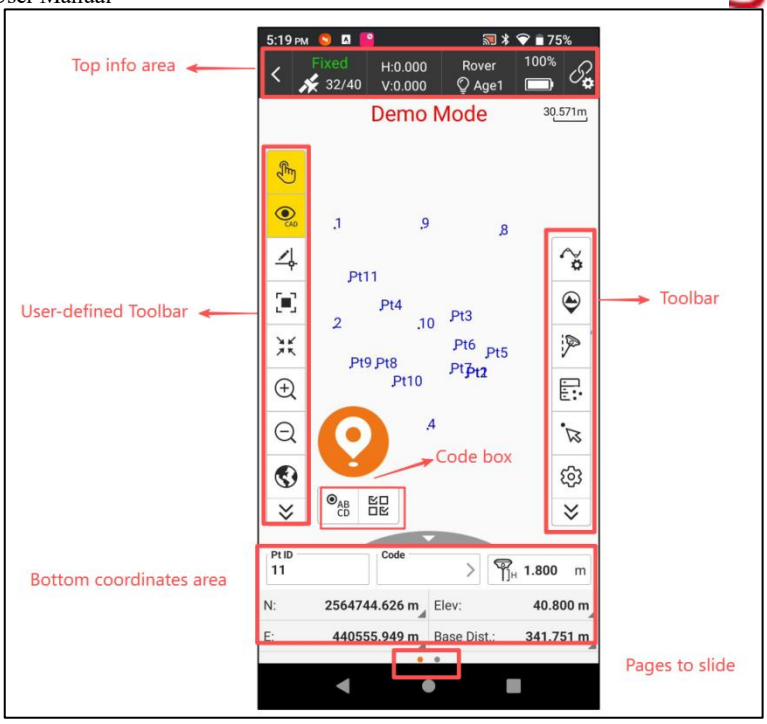


Chapter 6 Survey - RTK

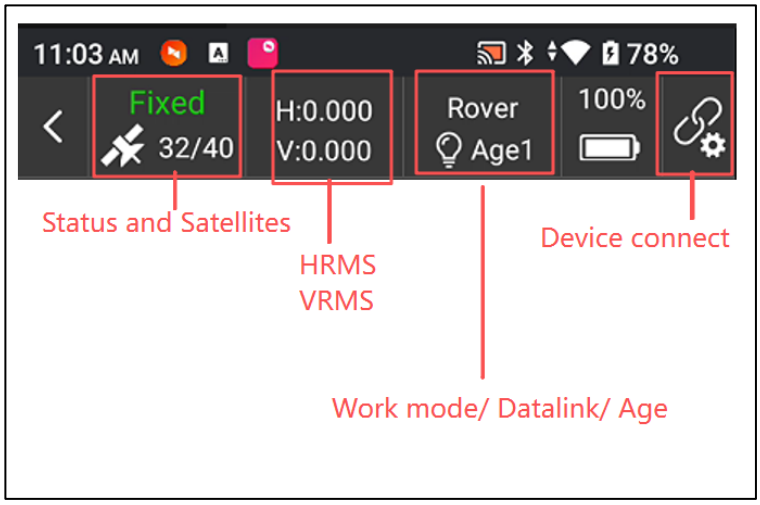
6-1 Point Survey





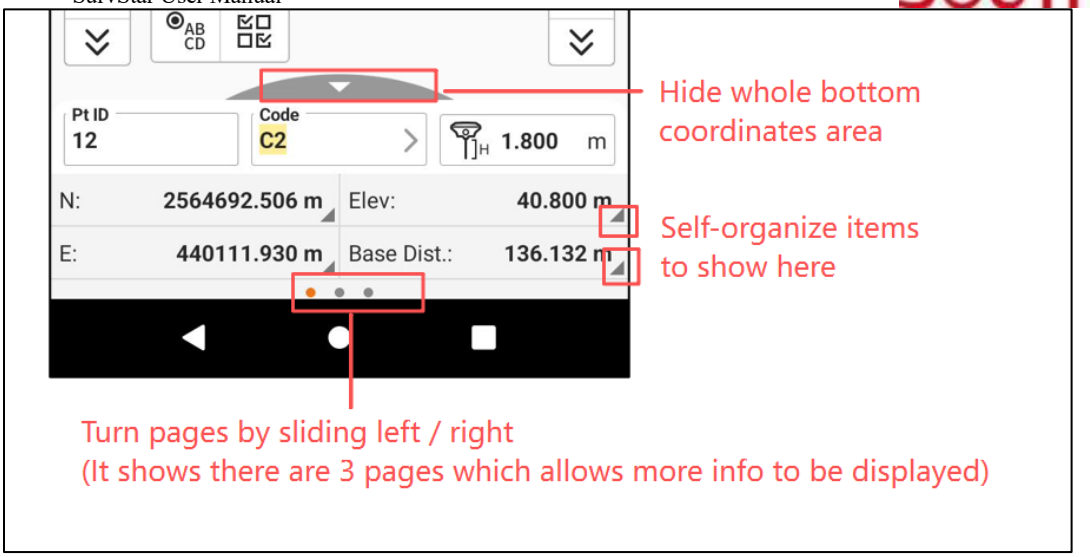


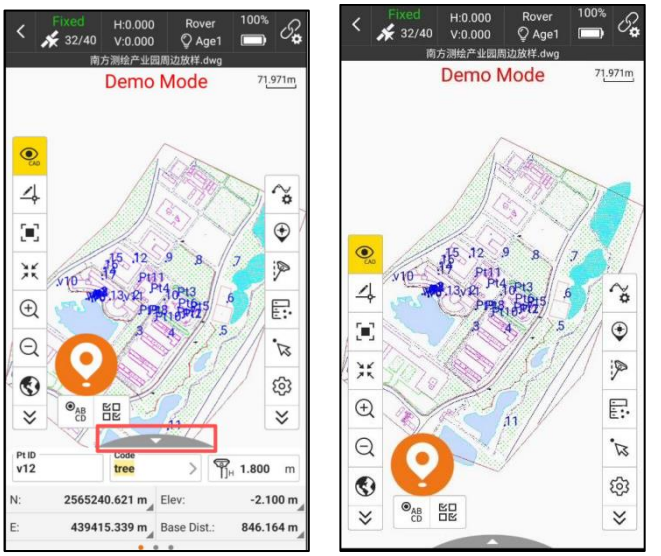
Top info area



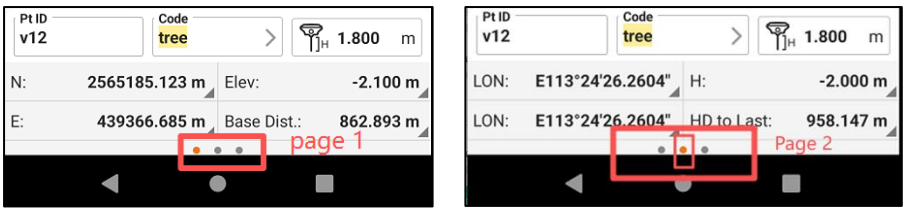
Left side toolbars (User-defined toolbars) as below can be add/remove at user's need.



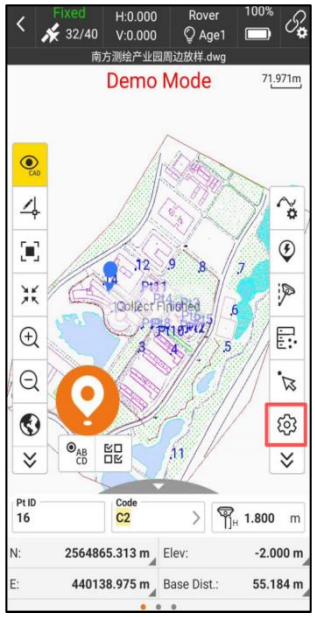


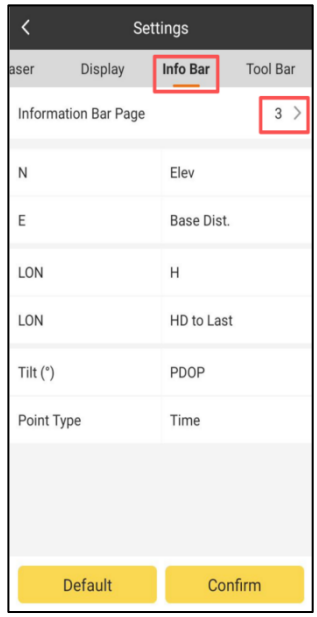


Click above icon to hide whole bottom coordinates area.

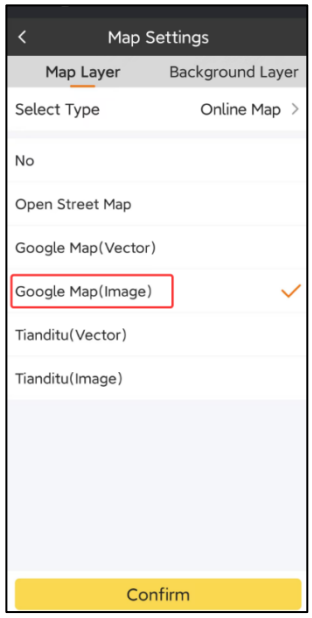


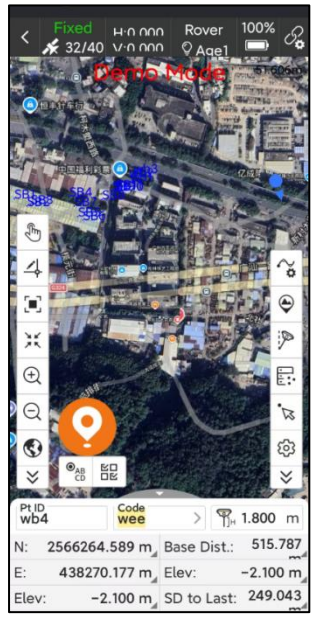
Slide above  icon left/ right to show more pages which allow more information is displayed. Below is an example that how could we allow 3 pages showed at bottom.





Click on  on the left side toolbar, choose a map as below, then there will be background map which might bring us work more convenience.

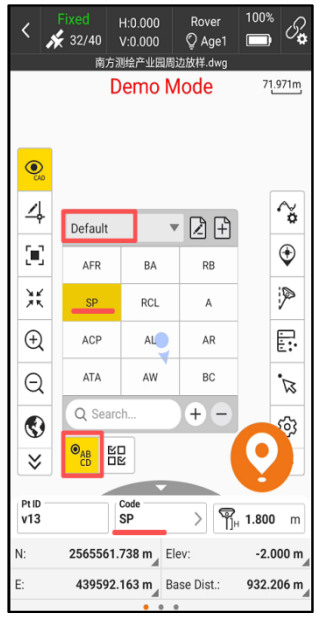


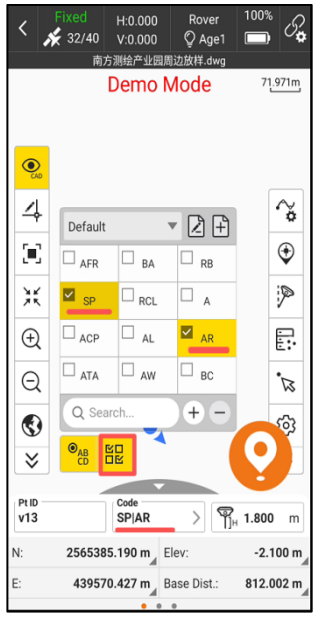


Code Box

Click icon  to choose a code from default Code box as below

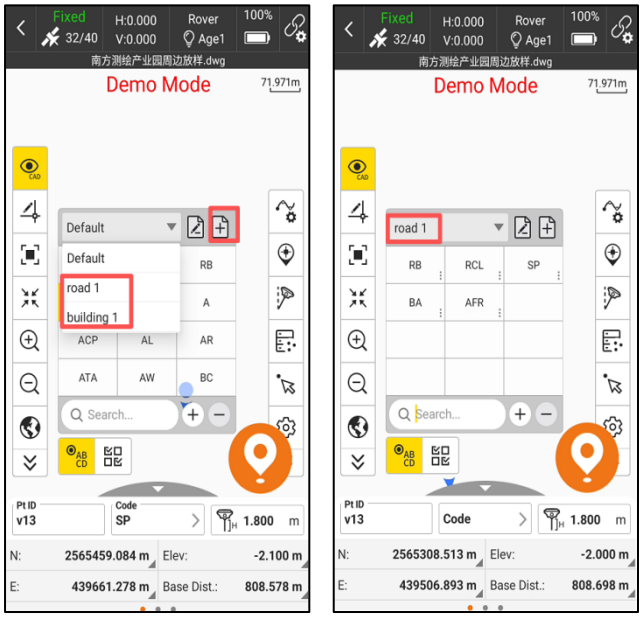






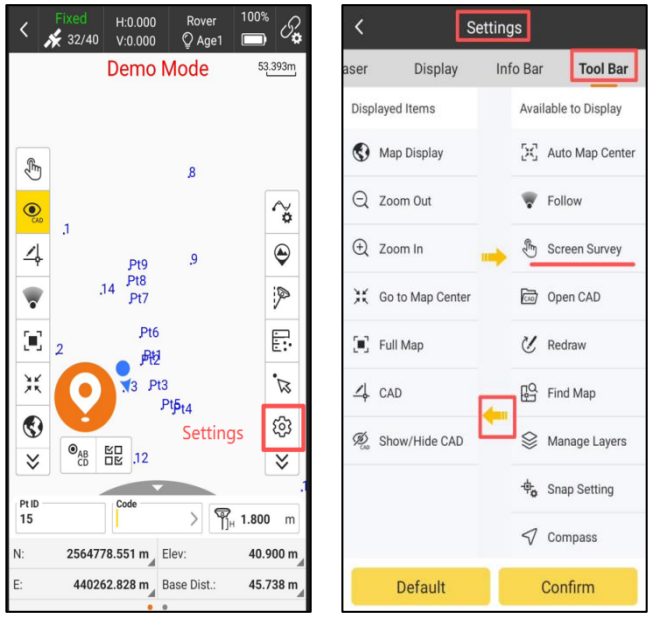
Click  for multi-selection as above.

Click icon  to create a user-defined code box in which there are the most frequently used codes.

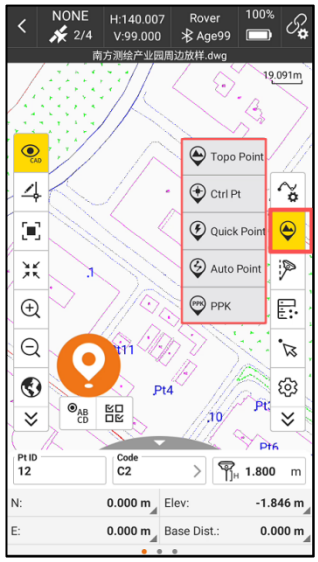


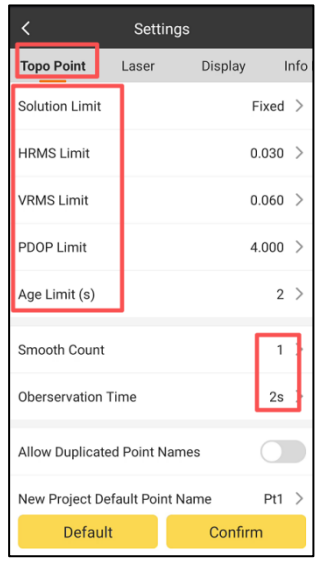
How can we define our own toolbars?

Click on the **settings** button on the right-side toolbar, then choose the tool in your need and click on **left arrow** to add it to the left-side toolbar (user-defined toolbar)



Click icon on the right-side toolbar to choose point survey mode (Topo point, Control point, Quick point, Auto store point, PPK). It will pop up the settings dialog box to remind you to check the setting value is ok or not.





From above image, if a surveyor wants to have fixed solution, but a little higher value for HRMS, VRMS and age, he can input the value by himself (such as HRMS 0.05, VMRS 0.10, age 4s).

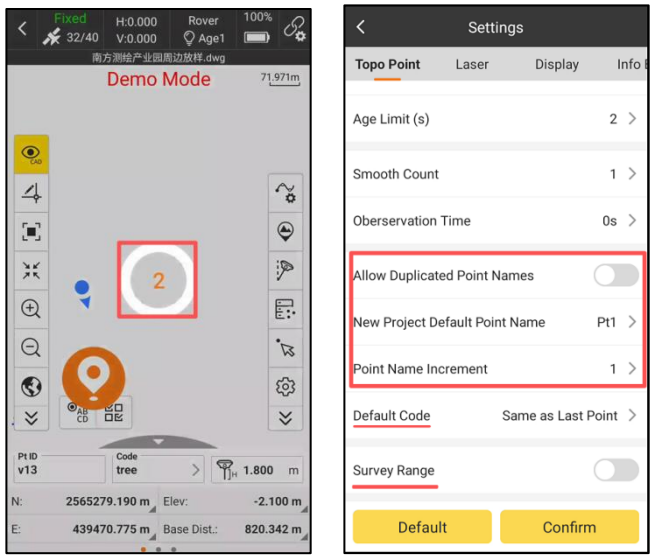
PDOP: It is suggested to keep the default value (less than 4)

Smooth Count : 5

It will measure the point 5 times then calculated the average coordinates.

Observation Time: 2s

When you click the store button. It will count down 2 seconds firstly and after that it begin to store the coordinates. If you set it 0 (default value), it will store point immediately when you click on store button.



As above, if you set default point name as A1, point name increment as 2, the points you get will be A1, A3,A5….

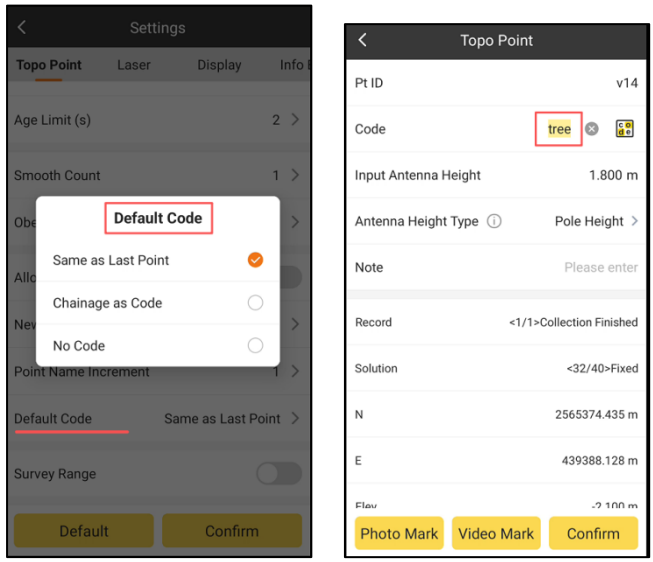
Default code

Same as last point

The point you are storing will has same code as previous point.

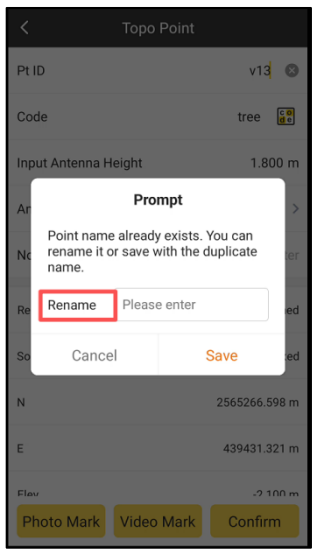
Chainage as code

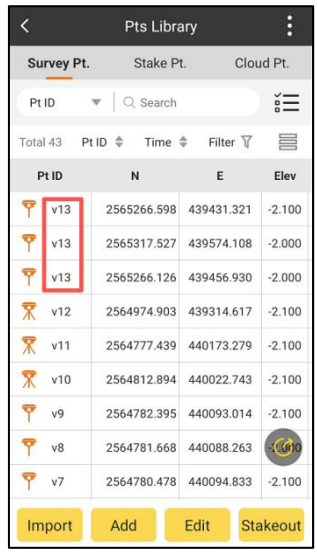
The point will have its chainage as its code during staking out a line or road survey.



Duplicate point name

If duplicate point name option is OFF (default is off), when you name a point with the same name which already exists in Pts library, it will pop up a prompt as below to remind you allow same name to give a new name.



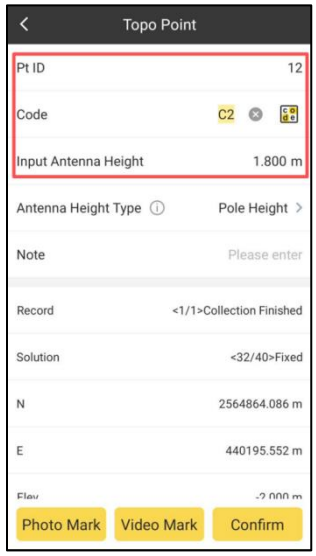


If you input a new name, then click on **Save** button, it will accept the new name.

If you directly click **Save** button, it will allow same name.

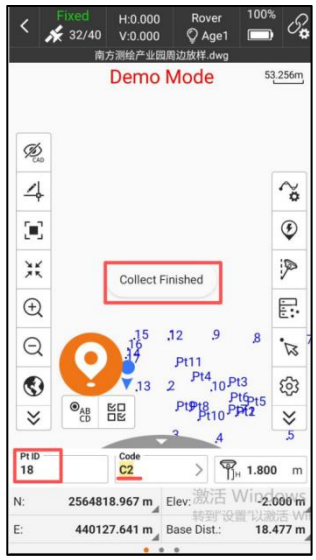
Topo point mode

It is the most frequently used mode in which the surveyor is asked to input point name, Code and antenna height. If you do not input them, the next point will be with Pt ID (13), Code and antenna height will be same as previous point as below.



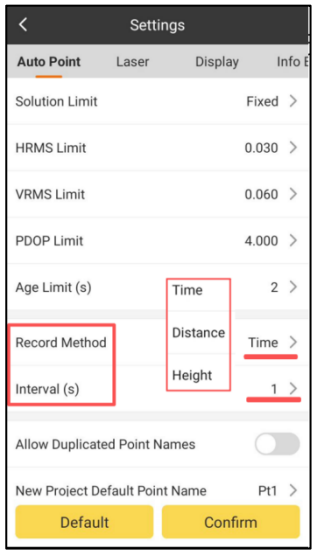
Quick point mode

In quick point mode, it will not pop up a dialog box to ask you to input Pt name, code, and antenna height. It will only pop up a message (Collect Finished) and Pt name will increment by one as blow and code remains same as previous point. It will save time when code is same and only the point name increments in this mode.



Auto store point mode

Below we choose **record method by time and interval 1 second**, it will automatically store points as your setting. As we give a point name v1 for the first point, it will automatically give the point name v2,v3,v4….

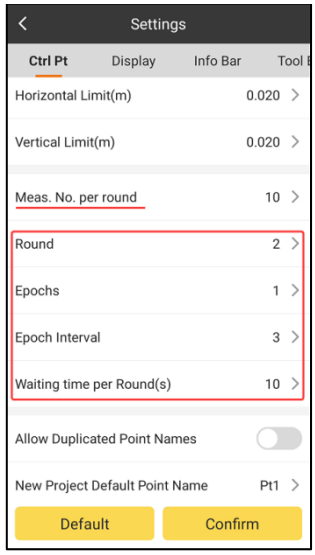


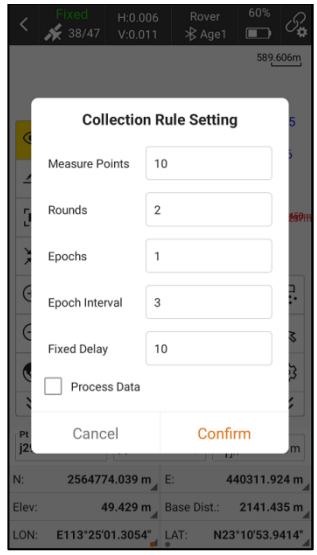


You can also choose record method as by distance.

For instance, record method by distance and interval 5m will allow it to store a point at every 5 meters distance automatically.

Click icon  to enter control point survey mode and in this mode a point will be measured many times as according to the setting. It is strongly suggested a bipod or tripod be used to keep the pole stable.





Meas.No. per round: 10

In each round, this point will be measured 10 times.

Round: 2

This control point survey for this point will be carried out in two rounds

Epochs: 1

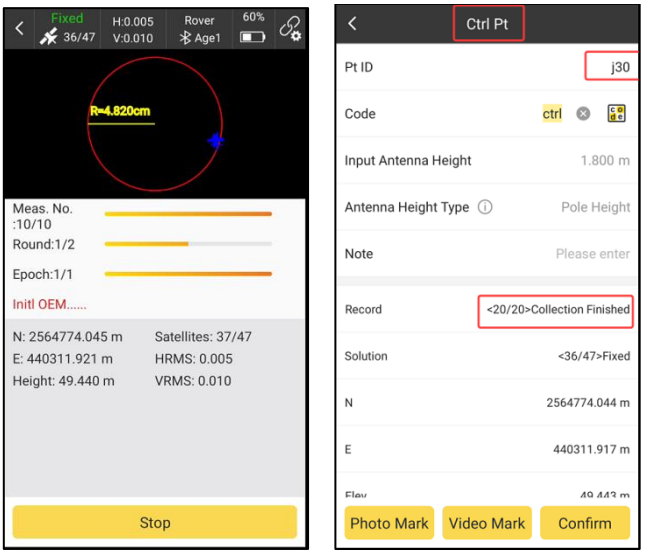
For each measurement, at least 1 epoch data is required.

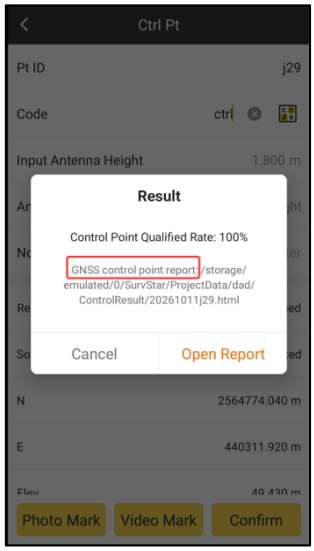
Epochs interval: 3

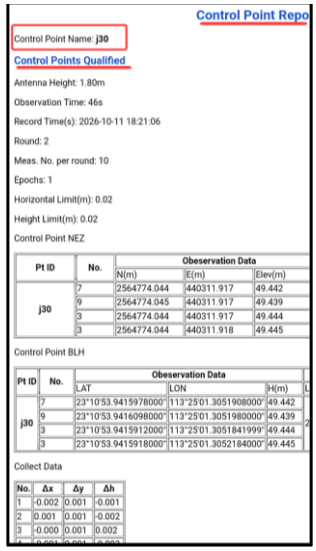
For each measurement, after 1 epoch data is collected it shall skip another 3 epoch, then take another 1 epoch data.

Waiting time per round (fixed delay)

Before start round 1 measurement, it will wait for 10 seconds and after round 1 is complete, it will initialize the OEM board and wait for another 10 seconds and then start round 2 measurement.

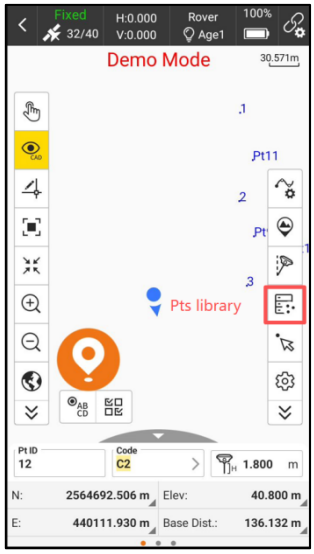


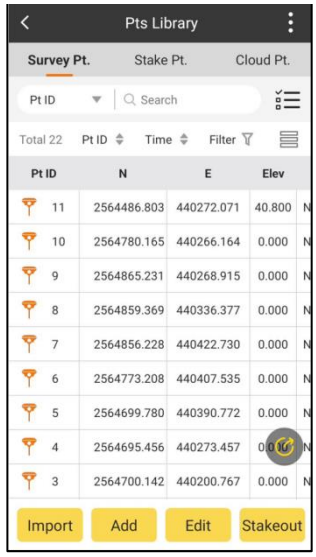




When the control survey is complete, a HTML format report will be produced as above.

Click icon  on the right-side toolbar to open the points library.





Capture a point from map

Click icon  on the right-side toolbar to capture a point from the map.

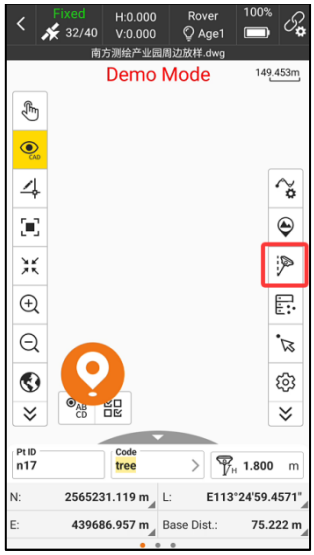




Once you capture a point, you can choose its coordinates or stake it out immediately (app will go to stakeout interface)

Tilt sensor

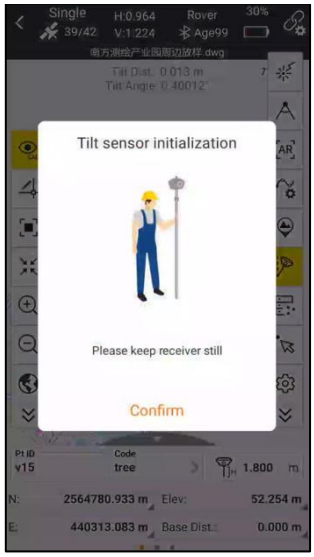
Click icon  to activate tilt sensor as blow. Just follow the instruction to keep the pole still (no need to be upright) and then shake the pole to initialize the tilt sensor. Once the tilt sensor is initialized successfully, the icon of tilt survey button will turn green, then you can start tilt survey.

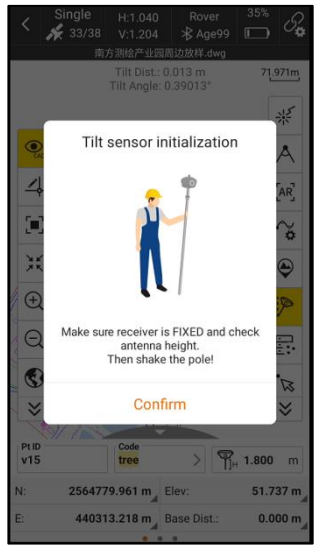




How to enable tilt survey?

Click on tilt sensor button. Then Keep the receiver still for a few seconds then shake the pole forward-backward to initialize the tilt sensor as above. After a successful initialization, the store button will turn into green color and it means you can start tilt survey now as below.







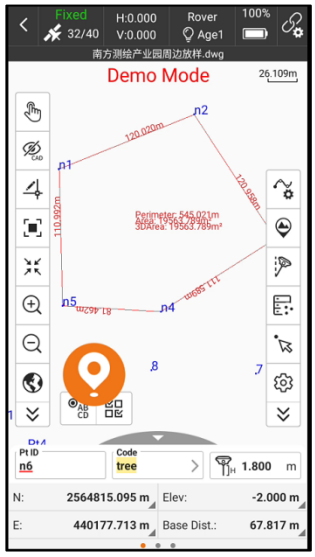
Draw Line /Arc/ Polygon

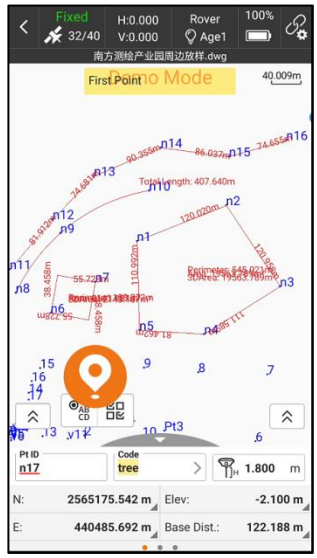
Click icon  to choose draw a line or arc or polygon when points are storing.

Here we give an example of draw a polygon. Choose polygon and save point (n1,n2, n3,n4,n5), then click on  button to complete.





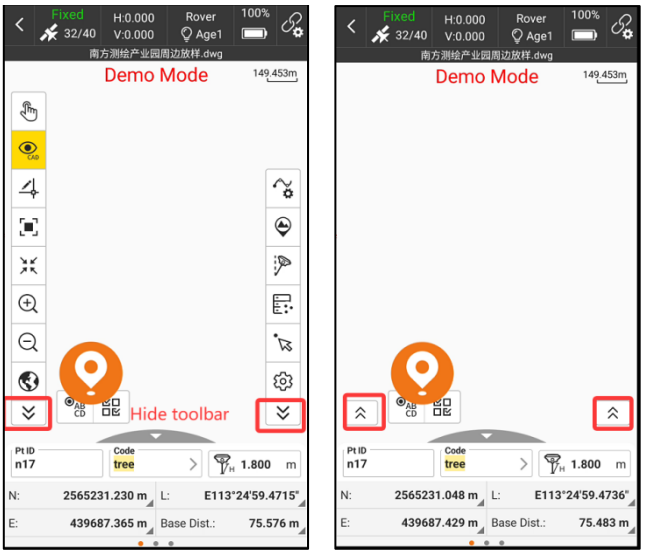




In similar way, arc, square and polyline when store the points.

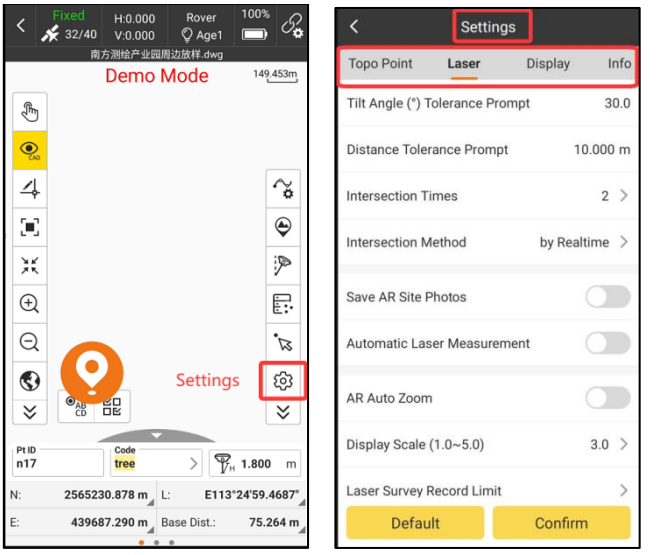
Hide/ show toolbar

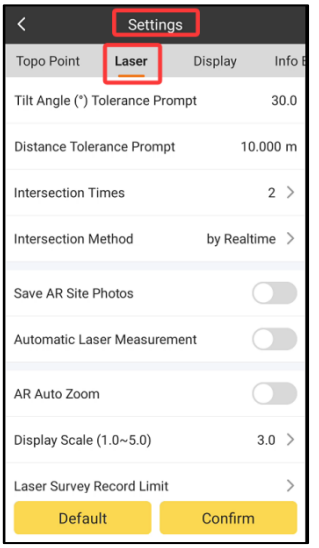
Click » button to fold/ unfold the toolbar as below.

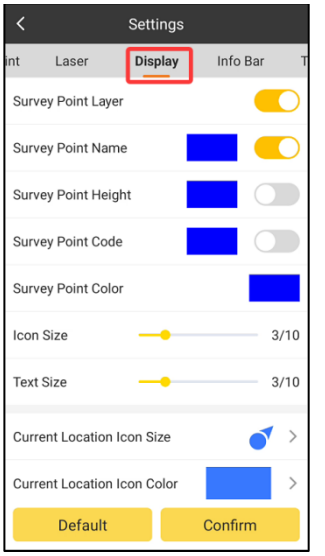


Settings

Click ⚙ button to make settings in different survey mode (Topo point, Control point, Quick point, Auto store point, PPK).





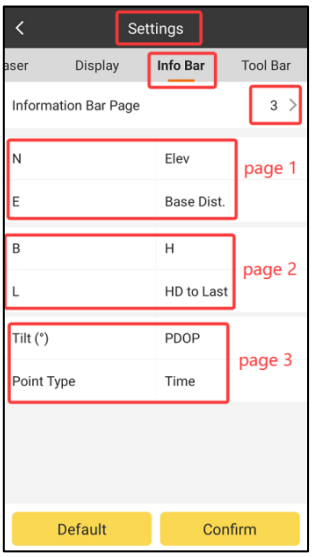


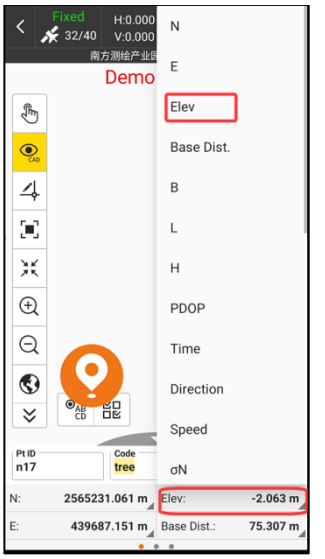
Laser option

All settings related to laser measurement are listed here.

Display option

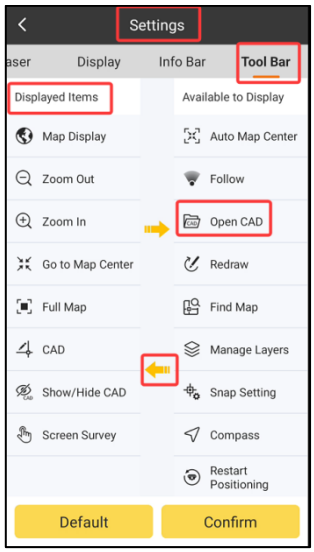
It will allow a user to self-define a point displaying related option such as the color and size of Pt name, display on/ off of Pt name, code or height, etc.

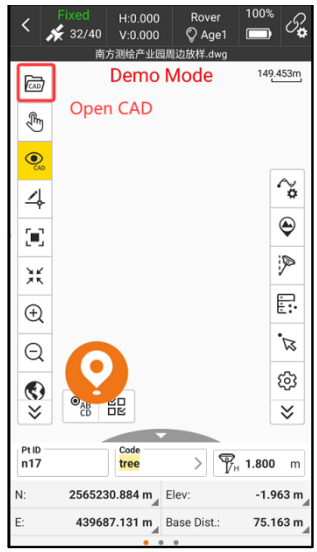




Info bar option

It will allow us to self-define how many pages will be showed at the bottom area and which items shall be displayed in a page. Above shows Elev. option is chosen to be dispalyed on page 1.





Toolbar option

Above shows a new toolbar (Open CAD) has been added to left side user-defined toolbar.

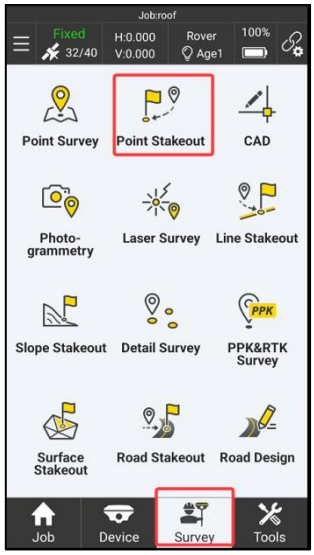
6-2 Point Stakeout

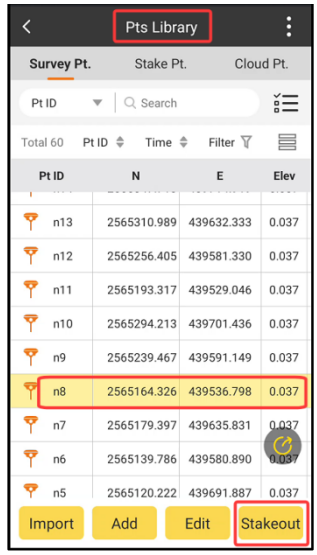
[Survey] – [Point Stakeout]

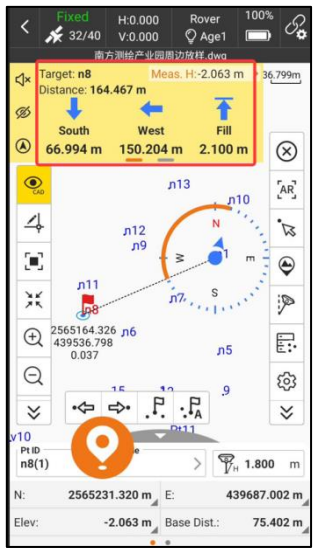
There are two ways to access point stakeout function as below.

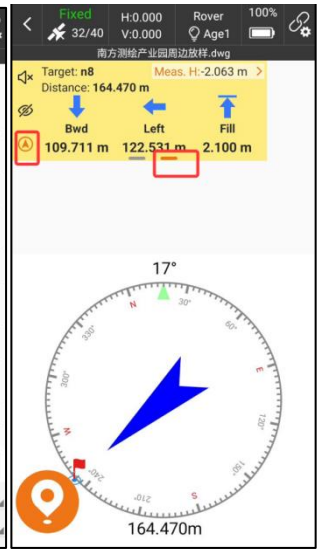
Way 1: Survey-Point Stakeout, then select a point from point library to stake out.

Way 2: When point library is opened, anytime a point can be selected to stake out.





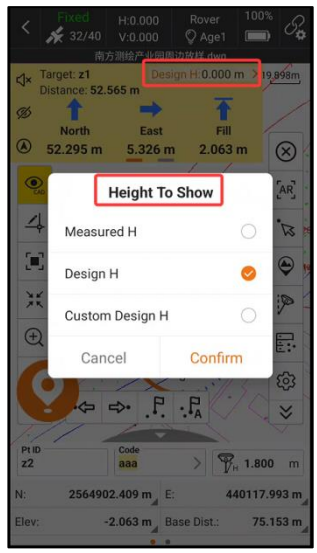




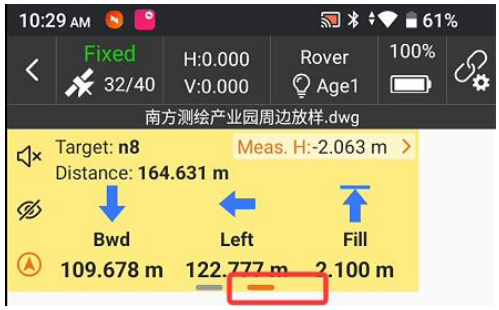
Above shows there are two ways for us to find the target point n8. Way 1 is moving to south 66.994m and west 150.204m and in this way you firstly need to find out where is the north direction.

Another way is click on compass button to show compass and move to target according to the guide of compass.





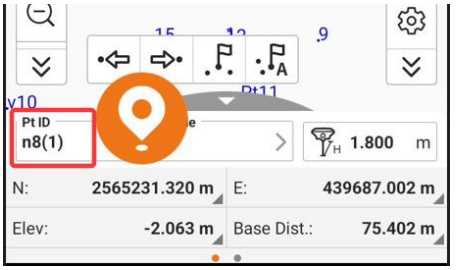
Click above **height to show** option, a height in your need can be displayed as above.



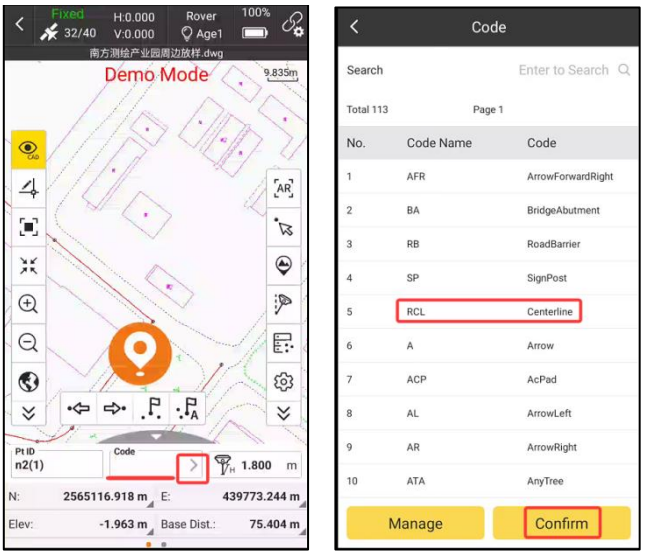
By sliding left/ right, it will allow us to choose North (south)-East(west) mode or Fwd(bwd)-Left (right) mode.



Stakeout previous point/ next point



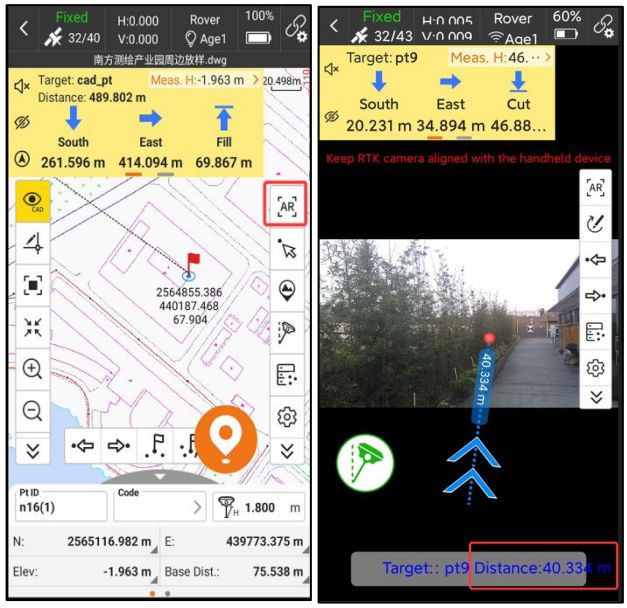
Once you find the target location, you can measure and save it with the default Pt name n8(1) and you can also give it a new name.



Above allow you to input a code manually or click the arrow-left to select a code from code libray in which you can create a user-defined code list or select a code from the pre-configured code list.

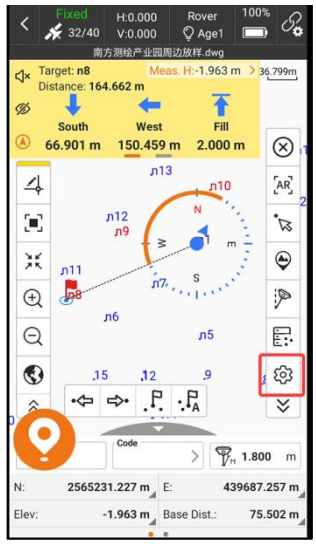


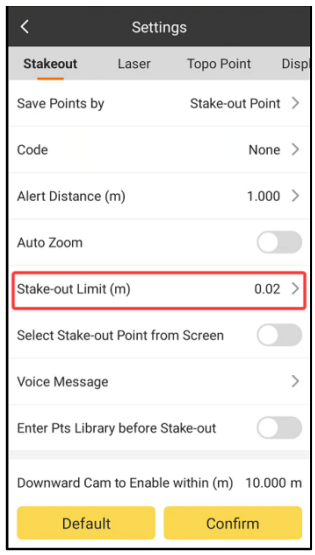
You can choose a pont from point library or click button to capture a measured point or select a point from CAD map to stake out.

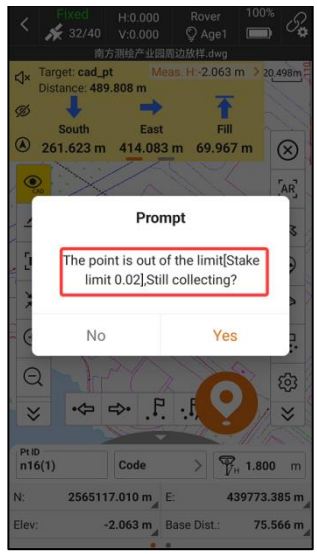


Click AR button to stake a point out in AR mode (Augmented Reality) in which mode camera will be utilized to guide you find the target point.

Click on ⚙ button to change the settings for staking out.

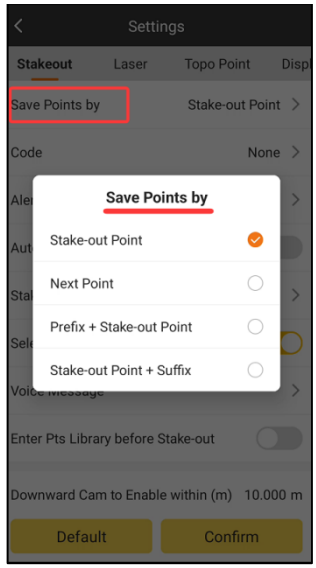






Above stakeout limit (m) option 0.02 means the default allowed accuracy of staking out.

When you find the target point and want to store it, if the distance between receiver location and target is more than 0.02m, it will pop up a prompt to remind you as above.



Save points by option

This allows you to give the measured target point a name in different ways.

Stakeout Point

When you find target point n8 and want to store it, the default Pt name will be n8(1).

Next Point

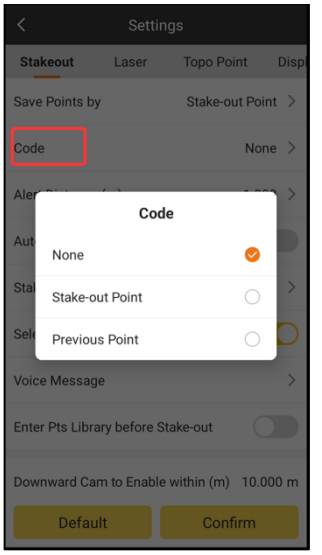
When you find target point n8 and want to store it, the Pt name will be n9.

Prefix + Stake-out Point

When you find target point n8 and want to store it, the Pt name will be St_n8 if you give prefix as St_.

Stake-out Point + Suffix

When you find target point n8 and want to store it, the Pt name will be n8_ST if you give prefix as _ST.



Code option

None

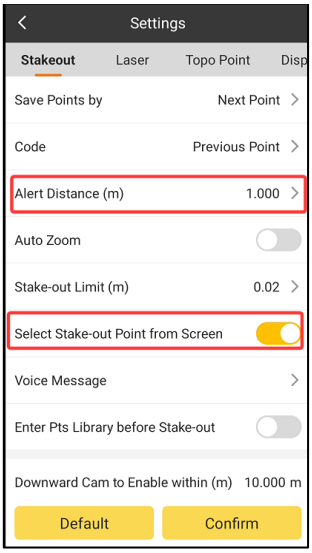
It means it will be blank in code box when you store the target point, you have to input the code by yourself.

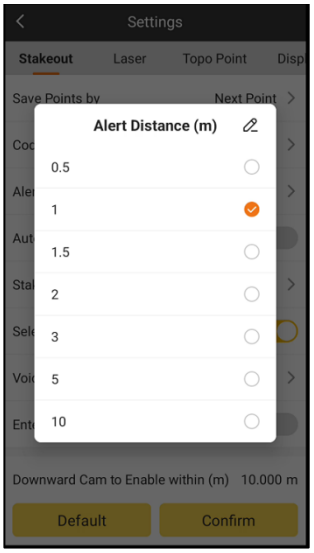
Stake-out Point

When you find target point n8 (for which the code is dddd for example) and want to store it, the Pt name will be n9 and code will be dddd.

Previous Point

When you have saved a point with the code aaa for example. Now you want to stakeout a point n8, when you save it, the point name will be n9 and its code will be aaa (same as previously measured point)



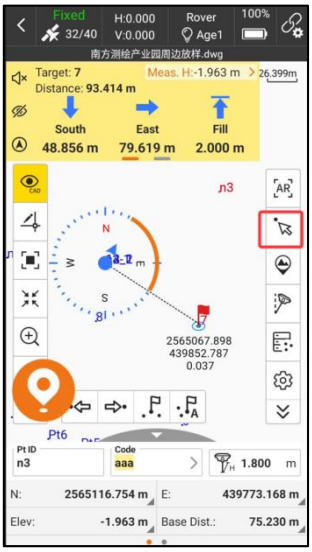


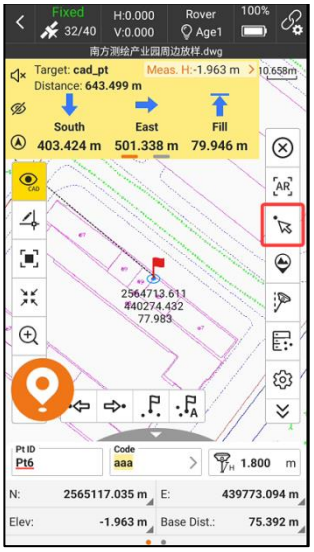
Alarm distance

It will allow the user to set a distance and it will give voice alarm when the receiver-target distance is less than the set value (default value is 1 meter).

Select Stake-out Point from Screen

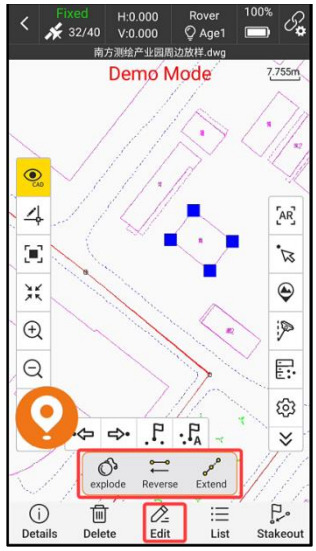
As introduced before, it supports capture a point to stakeout by toolbar as below.





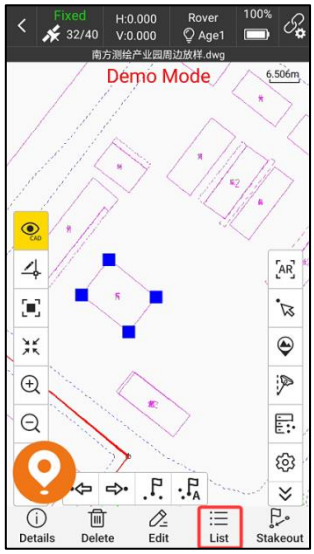
Besides above, It also supports select a measured point directly from screen or select a object (point, line, polyline) from CAD map by using your finger as below.

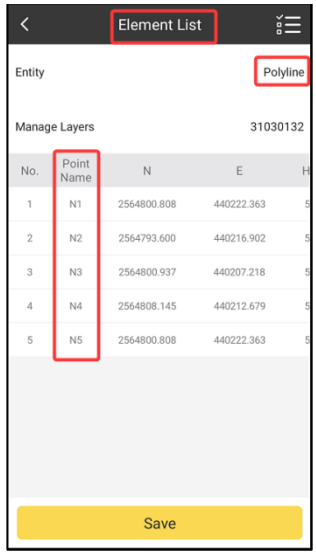




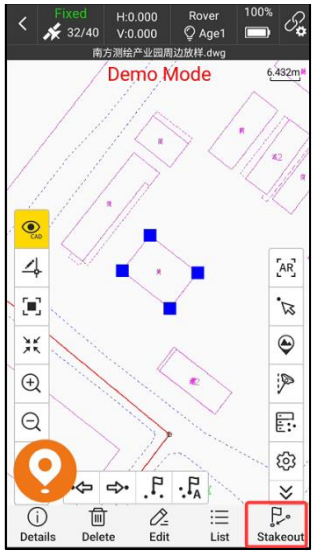
Above shows a polyline has been selected and it can be exploded into straight lines.

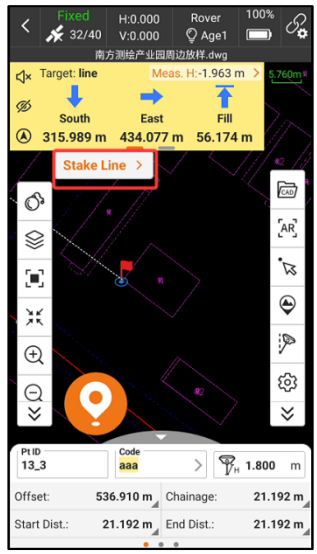
For a selected polyline, it can be listed as points list as below.





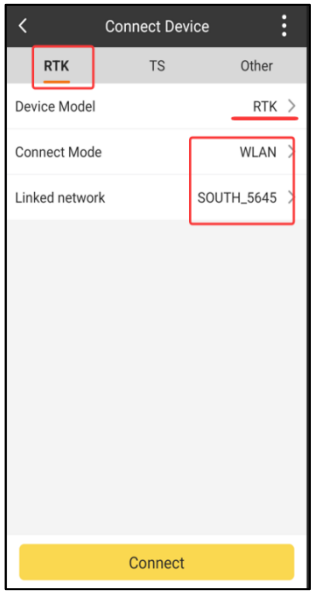
Select a polyline, then choose stakeout button, it will enter stakeout line function in CAD mode.

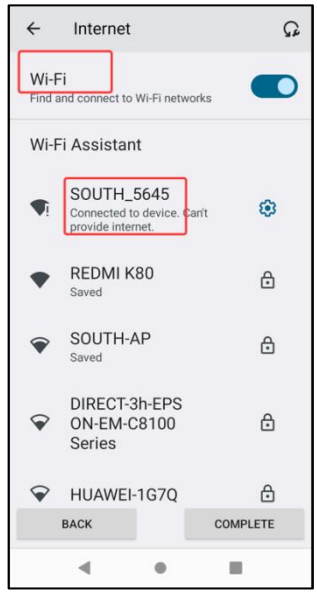




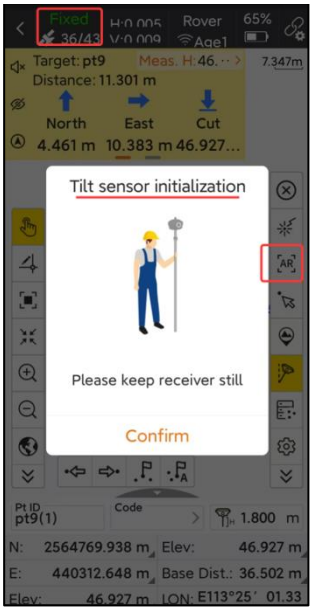
6-2-1 AR Stakeout

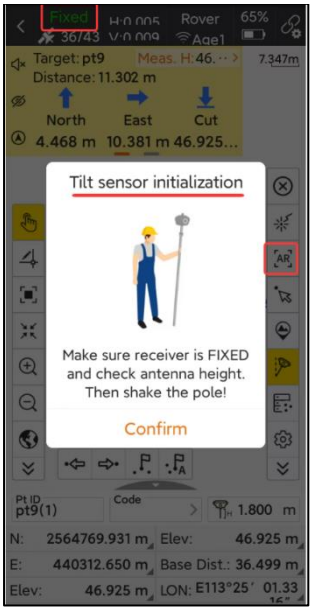
To AR statkeout a point, receive's camera will be used so the connection between receiver and controller shall be WLAN. Choose WLAN as connection mode and click on Linked network to choose receiver's WIFI as below.

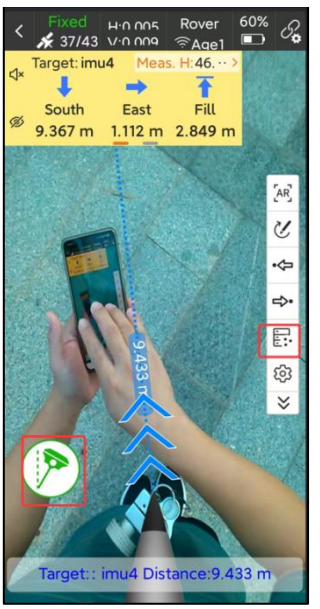


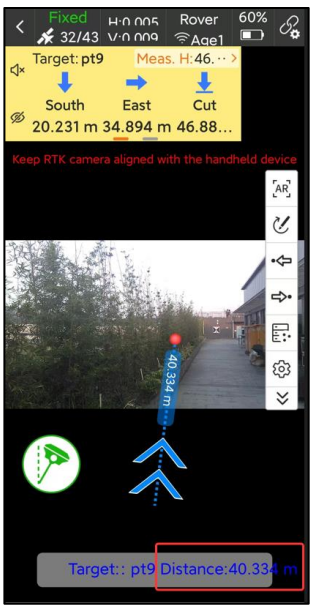


Make sure receiver get Fixed solution first, then click on AR button, now it will pop up a dialog to remind you to initialize tilt sensor as below. Keep the pole still for 1-2 seconds, then shake the pole as the prompt.









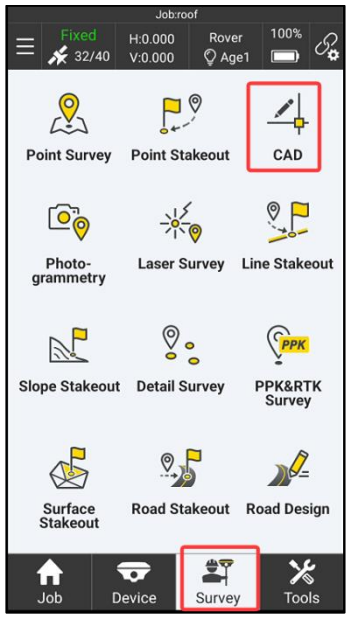
When the  icon turns into green, it means tilt sensor is initialized successfully. Now select a point from point library, it will take you to the point with AR guide as above.

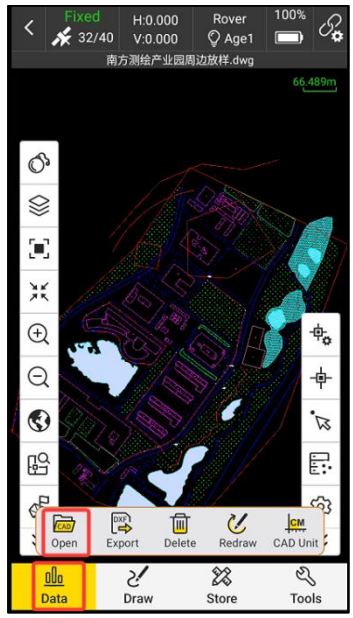
When the target is near (less than 10 meter), it will use receiver's bottom camera and when the distance is more (more than 10 meter), it will automatically active the side camera.

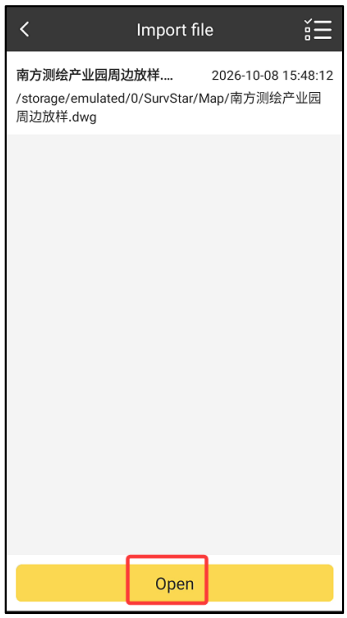
6-3 CAD Stakeout

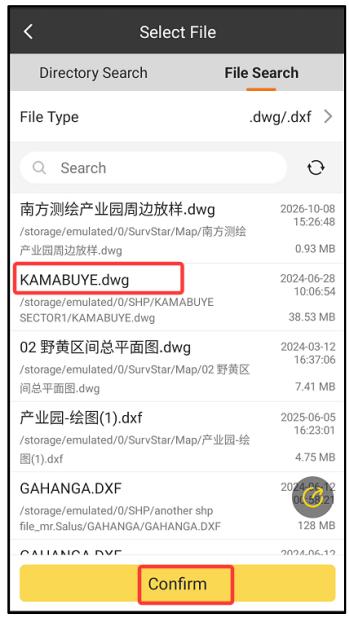
[Survey] – [CAD]

To load a CAD file is as below.



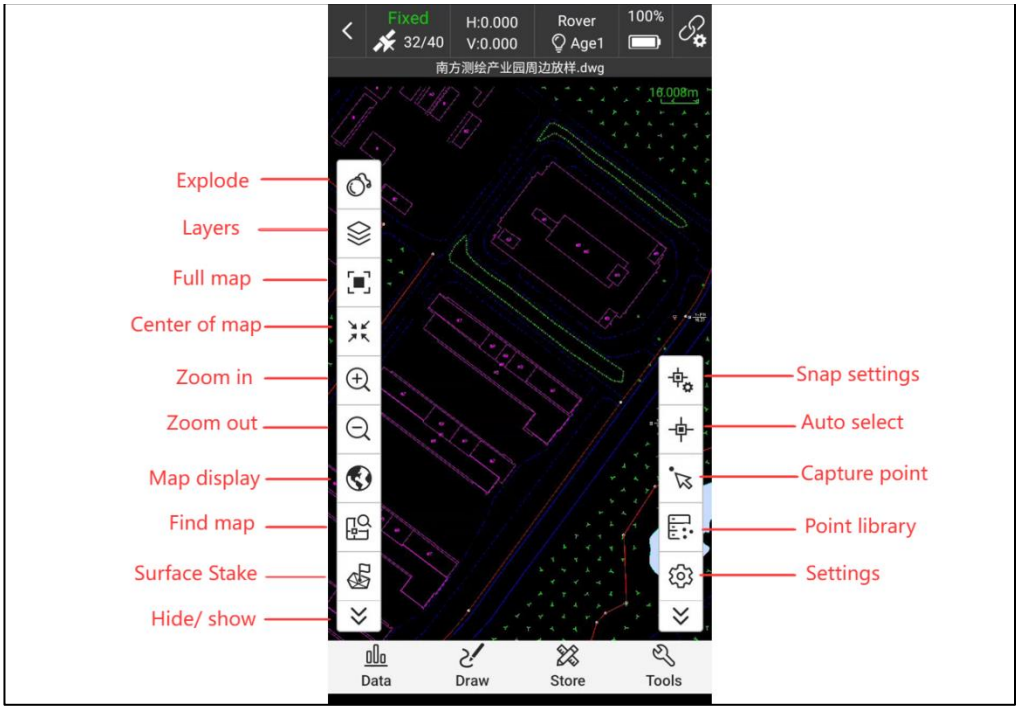






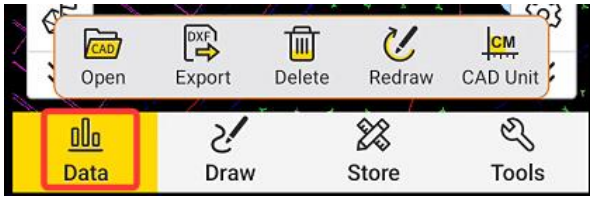
When you quit app and enter CAD stakeout again, it will prompt and ask if you'd like to load previous CAD file as below.





Bottom menus

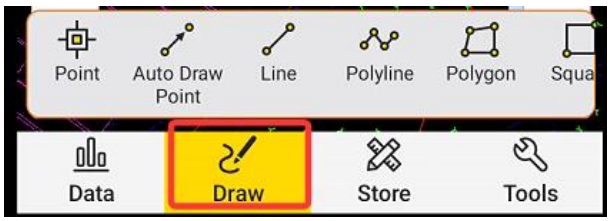
Data



Sometimes the CAD file is showed with a little distortion due to CAD file version. In such a case, please click on Redraw, then the CAD map will show properly.

Click on CAD Unit will change the unit of CAD file.

Draw



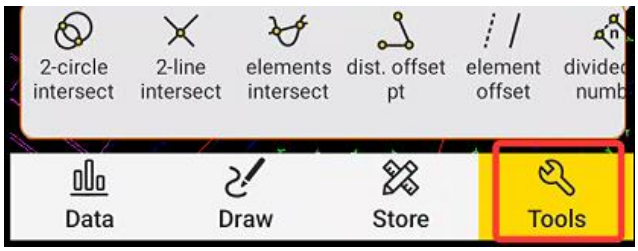
It allows you to draw point, line, polyline and polygon.

Store



It allows you to measure the angle, distace and area.

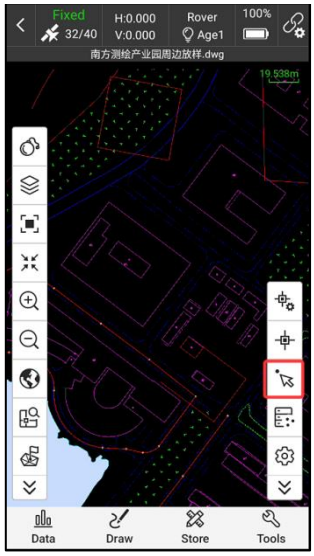
Tools

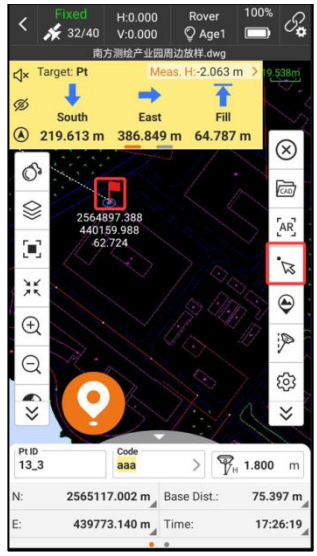


It provides some tools for you to calculate points, offset an object or divide a straight line into equal parts.

How to stakeout a point in CAD stakeout mode?

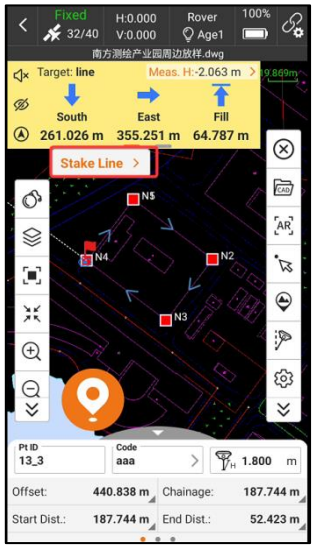
Method 1: It supports capture a point to stakeout by toolbar as below.

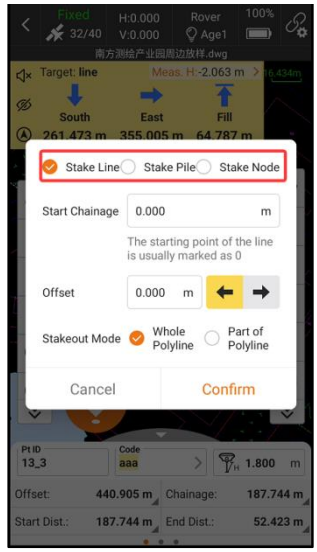




Method 2:

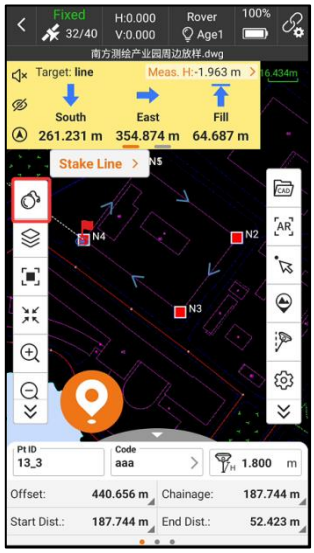
It also allows to select a polyline by directly clicking it as below, then it will enter stakeout line mode. In stakeout line mode, you can choose stakeout line or stakeout point or stake node.

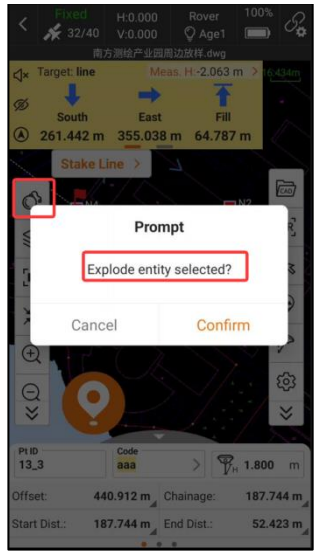




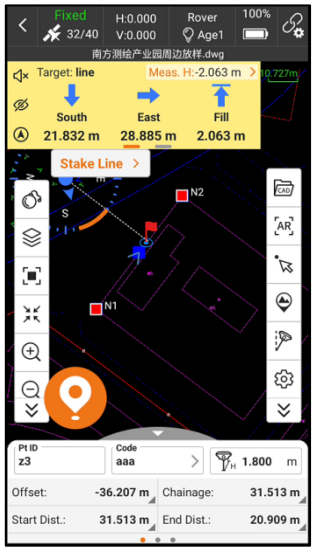
How to explode an entity such as polyline?

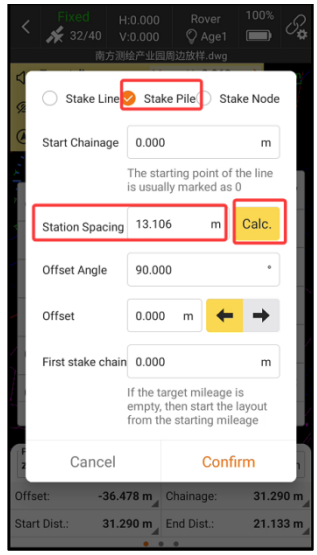
Select an entity, then click on explode toolbar to break it into lines



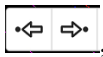


After exploding an entity (a polyline in this example), we can choose a line (N1-N2) to stakeout. You can choose stakeline mode or stake point mode. In below case, we choose stake point mode, and cut this line (N1-N2) into 4 equal parts.







By clicking , you can stake out all points (N1-N2 line has been divided into 4 equal parts)

6-4 Photogrammetry

[Survey] – [Photogrammetry]

RTK photogrammetry is a surveying technique that deeply integrates real-time kinematic (RTK) positioning with photogrammetry. By fusing centimeter-level GNSS absolute positioning, spatial geometry, and image texture, it enables non-contact, high-precision 3D coordinate acquisition.

The core principle is that the device uses the absolute coordinates provided by RTK as a reference, calculates the relative position of the target point through image matching, and directly solves the target's 3D coordinates in the field. This integrated approach effectively overcomes the limitation of conventional RTK, which requires holding a pole and aligning it with the point to be measured. It also compensates for the instability of pure photogrammetry in weak-texture or complex environments.

To use the photogrammetry function, you need a device that supports it and must connect the controller to the receiver via Wi-Fi. Contact technical support to confirm whether your device supports photogrammetry.

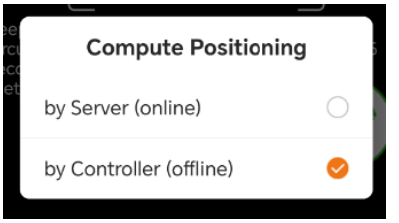
1. Photogrammetry Screen and Parameter Settings



Before starting photogrammetry, configure the relevant parameters, including the processing method, antenna height, and measurement mode.



Photogrammetry data can be processed in two ways:

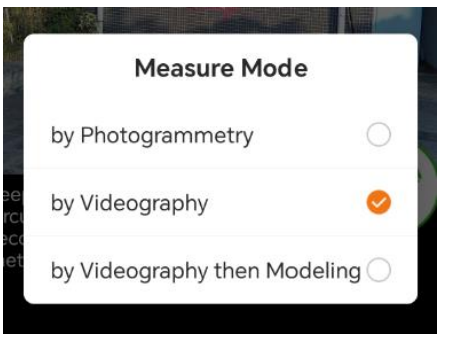


- **By Server (online):** Data is transmitted to a server for processing and computation.
- **By Controller (offline):** Data is processed locally on the controller.

Choose the appropriate data processing method based on network conditions and device performance.

Set the correct antenna height according to the actual antenna height type and value. Before starting photogrammetry, mount the receiver on top of the pole, stand the pole firmly on a hard surface, and initialize the IMU as prompted. This will affect the accuracy of the measurement results.

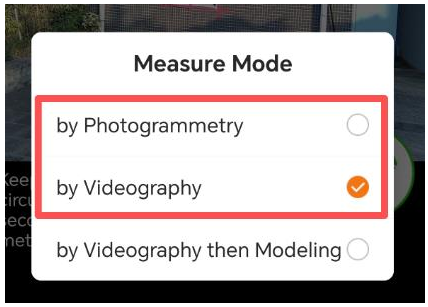
Several modes are available for photogrammetry:



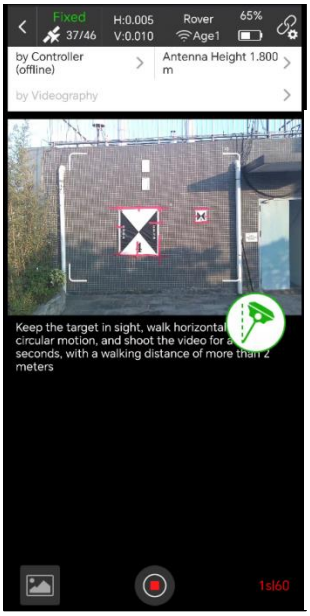
- **By Photogrammetry:** Capture several photos for photogrammetric processing.
- **By Videography:** Record a video; the software automatically converts it into multiple photos for processing.
- **By Videography then Modeling:** Record a video; the software automatically processes it and saves multiple images with coordinate information. You can then use SGO on a computer for modeling and measurement.

2. Point Coordinate Collection

To measure the coordinates of a single point or multiple points, use Photogrammetry or Videography to collect data.

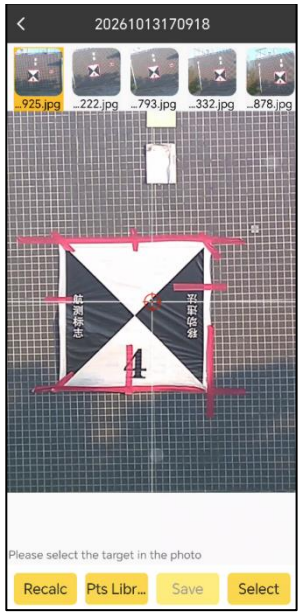


During collection, keep the target point within the central acquisition area on the screen. Walk 5–10 m along an arc-shaped path and capture photos/record video according to the on-screen prompts. When collection is complete, tap the End button at the bottom of the screen.



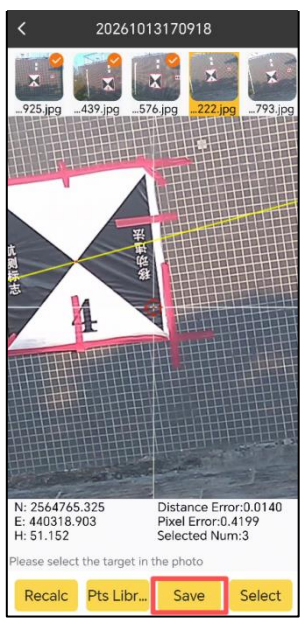


Photos are saved in the controller's storage. Tap Start Processing to process them. For previously collected data, you can also retrieve and process it using the Gallery button in the lower-left corner of the screen. Processing may take some minutes.

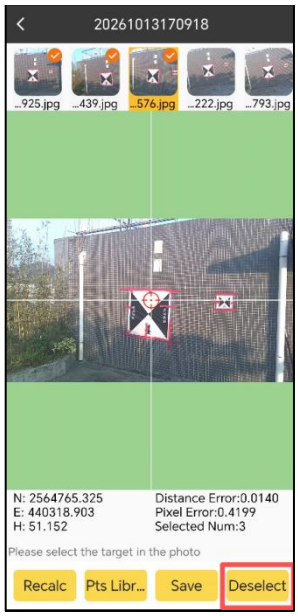


After processing is complete, you can select the target point you need to measure on the point selection screen. You must select the target point in at least three images, and make sure that the point selected in each image is the same point. The software will also provide prompts for the selected point location based on your selection. However, be sure to confirm again that the point is correct, as this affects coordinate accuracy.

After selecting the target point in multiple photos, tap Save to store the selected point in the point library.

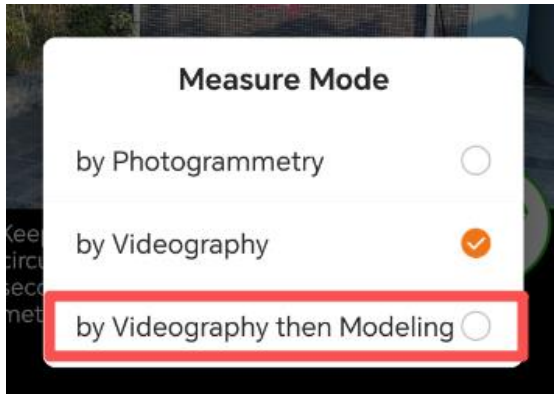


If you need to select additional points from the same photo dataset, please cancle all the previous selection, then reselect the target point.



3. 3D Modeling Data Collection

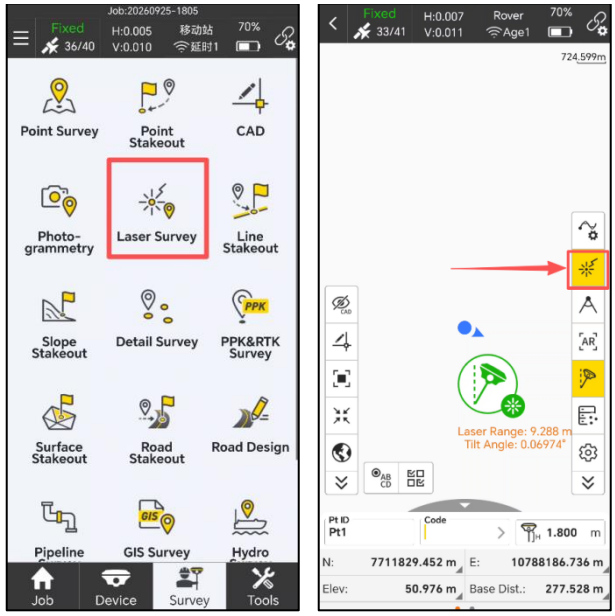
When using photogrammetry for 3D modeling, collect target data in video mode. Select **By Videography then Modeling** in Measure Mode. After tapping Start, aim the central camera area at the target object and move slowly and steadily. During collection, it is recommended to observe the same target from multiple angles to improve model accuracy. When collection is complete, tap the End button. The data will be saved in the receiver's internal storage. The folder will contain image data, the coordinates of each image, and IMU sensor data. Copy the entire folder to a computer and use SGO software for subsequent modeling.



6-5 Laser Survey

RTK laser Survey combines real-time kinematic (RTK) positioning with laser ranging technology. Using the centimeter-level absolute coordinates provided by RTK as a reference, it measures the distance to a target non-contact via a laser beam and then directly solves the 3D coordinates of the target point. It can quickly obtain precise spatial positions of points in hard-to-reach or dangerous areas without contacting the target or holding a pole. This effectively overcomes the limitation of conventional RTK, which requires contact with the point to be measured, and is suitable for collecting geometric information in complex scenarios such as cliffs, rooftops, tree canopies, and high-voltage power lines.

1. Laser Measurement

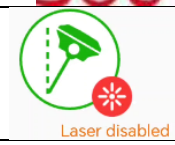


On the Survey screen, tap the Laser Survey icon to open and use the laser survey function.

Before using laser survey, initialize the IMU. Follow the on-screen prompts, set the correct pole height, and initialize the IMU while a fixed solution is available.

Once laser measurement is started, the receiver emits a laser beam. Aim the laser spot at the target point you want to measure. Wait for the laser measurement result to return, then tap the measure button to save the coordinates of the currently aimed target.

When laser measurement is enabled, the Measure button will indicate one of the following three states:

Status Indicator			
Status	Laser Survey normal	Laser Survey requires calibration	Laser Survey unavailable
Action	High-precision laser measurement can be performed normally.	The current target point can be saved, but laser measurement accuracy is lower. It is recommended to aim at the target more steadily or move to calibrate the IMU.	Ensure the laser is stably aimed at the target. With a fixed solution maintained, move 5–10 m. Alternatively, restart laser measurement and initialize the IMU.

2. Drawing while collecting

After initializing IMU, 1.enable laser 2.enable graphics to select the graphics which you need 3.enable AR, start to collect the point, make the center of laser cross hair aim on the target point, click the collecting button to save the point data. Then continue to collect the next point, the points will be connected to form graphics till you completing it.

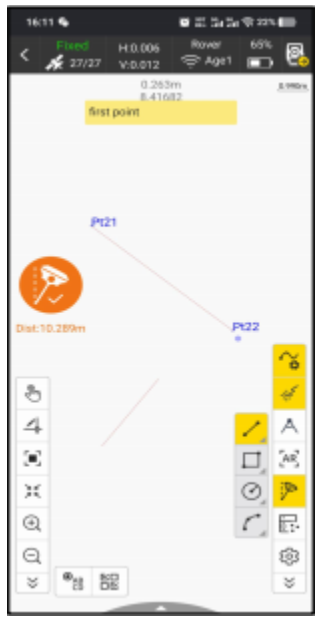








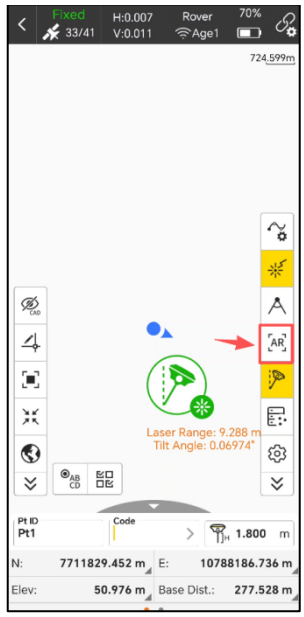




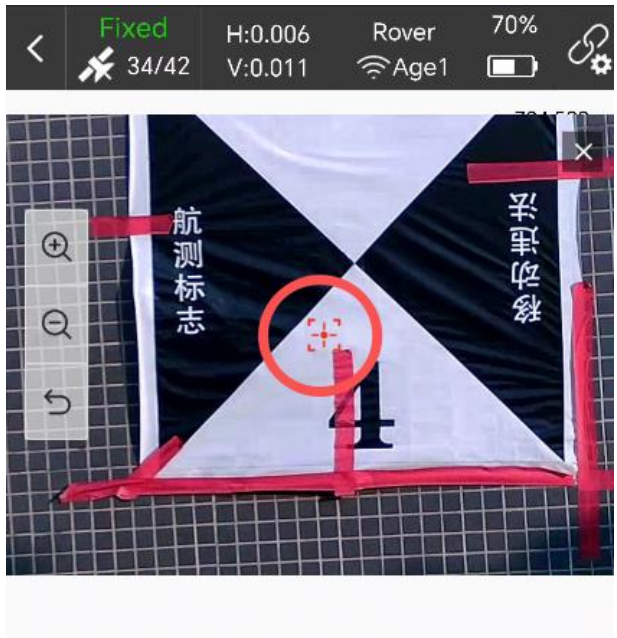
There multiple graphics can be selected



3. Using AR for Laser Measurement

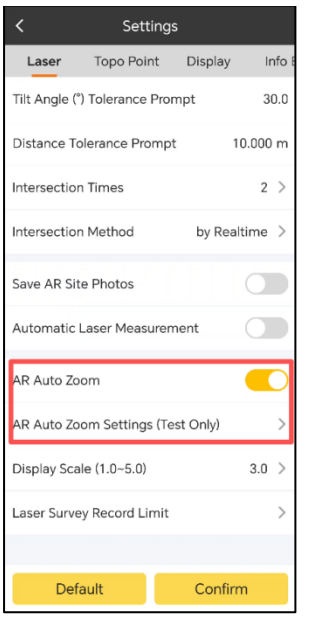


We recommend using the AR function to assist with laser measurement. The AR function uses the coaxial camera next to the laser module to provide real-time video that helps you find the target point aimed at by the laser. It is especially suitable for measuring distant targets, targets under strong light, and other situations where the target is difficult to find with the naked eye.

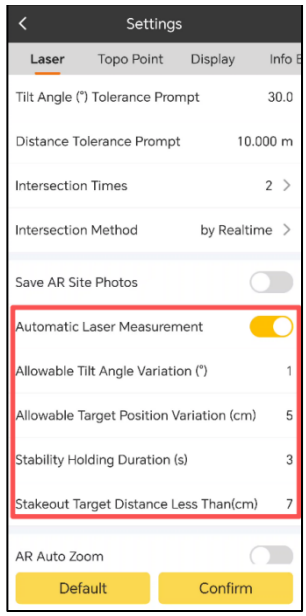


To use AR measurement, connect the receiver to the controller via Wi-Fi. On the Laser Survey screen, enable AR measurement from the quick toolbar on the right. The real-time video will then be displayed on the screen. First aim the laser roughly at the target you want to measure. Once it is stable, a crosshair will appear in the real-time video, indicating the target point currently aimed at by the laser. Adjust the crosshair so that it accurately aims at the target you want to measure. You can also use the "+" and "-" buttons on the left to adjust the magnification for clearer aiming.

In addition, you can enable **"AR Auto Zoom"** in Settings. When enabled, the video image will automatically adjust the magnification according to the target distance, making AR operation more convenient.



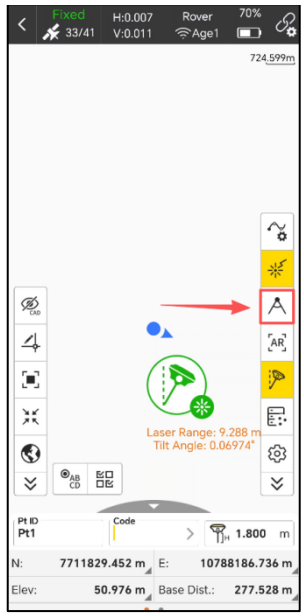
4. Automatic Laser Measurement



The automatic laser measurement function allows you to measure without manually tapping the screen to save points. This lets you focus more on aiming at the target and avoids reduced laser measurement accuracy caused by hand shake or laser spot shift when tapping the screen.

You can enable this function in Settings. Once enabled, as long as the target aimed at by the laser remains stable for a period of time, the software will automatically collect the current target point. You can also adjust how the “stable” state is defined as needed, including the allowed tilt angle variation, allowed target position variation, and automatic measurement trigger time.

5. Intersection Measurement (Rendezvous)



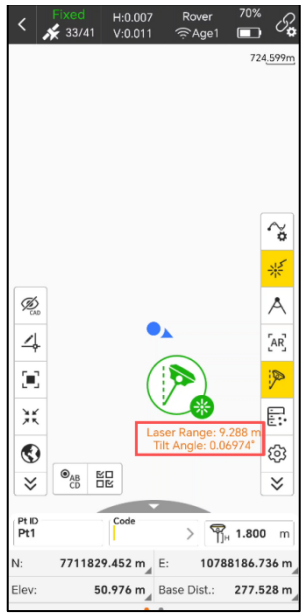
By measuring the same target point from two or more different positions, you can obtain higher-precision point coordinates. You can open the intersection measurement function from the toolbar on the right.

There are two ways to perform intersection measurement:

- **Direct rendezvous:** After collecting multiple points, obtain the intersection coordinates and save them.
- **Point library rendezvous:** First collect multiple points into the point library, then calculate the intersection coordinates.

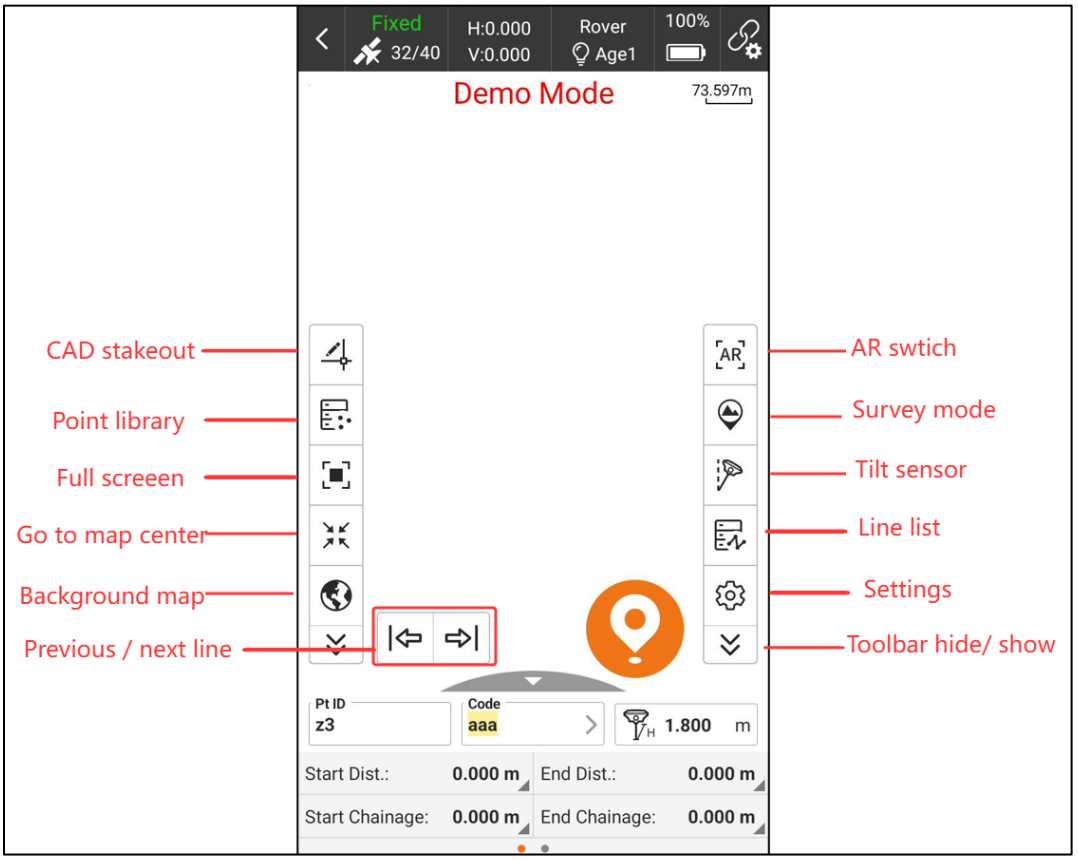
If you use the Direct rendezvous method, measure the same target point from multiple different positions on the Survey screen. Then you can calculate and save the target point coordinates.

6. Laser Distance Measurement

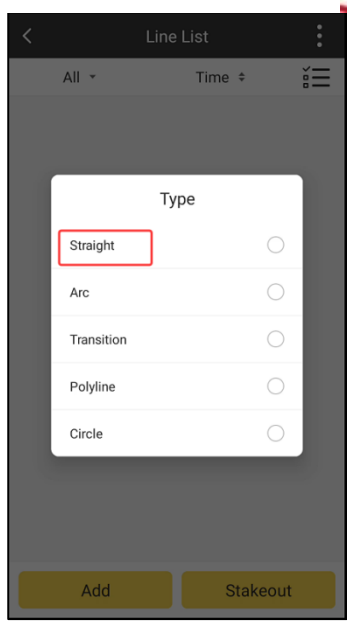


The laser measurement function can also be used as a simple laser distance measurement tool. In this case, GNSS satellite signal tracking is not required, and it can be used indoors or in obstructed environments. Simply enable laser measurement, and the laser distance value will be displayed below the Measure button.

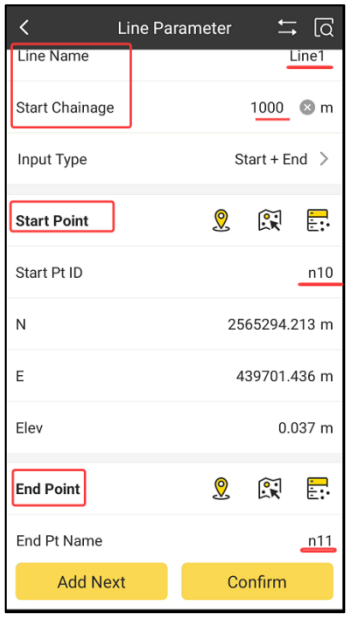
6-6 Line Stakeout





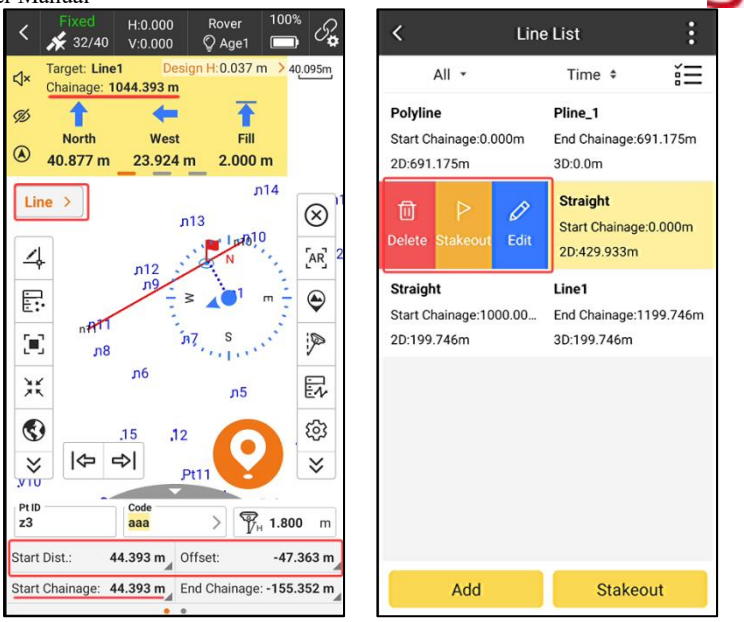


Add a line (e.g. straight line) to line list



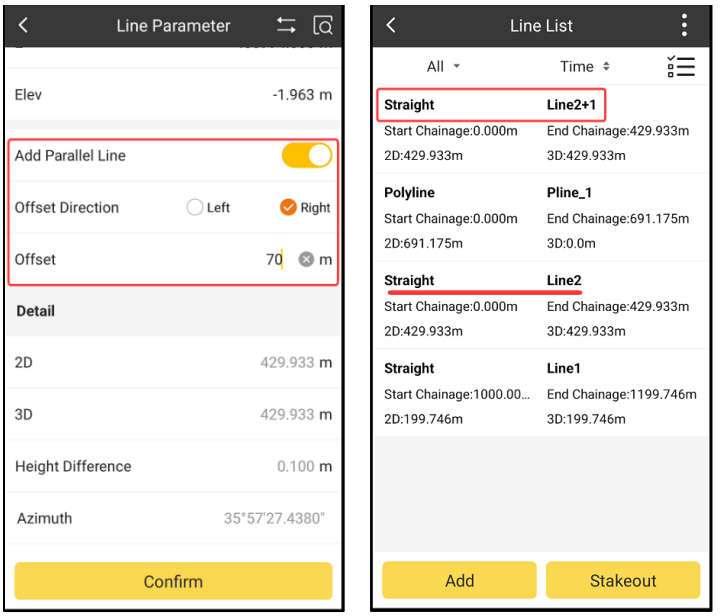


Choose start point, end point for a line and input line name and start point chainage, then a straight line will be added to line list. Choose a line then click on Stakeout button as above.



Above shows offset is 47.363m from line1 with start point n10 and end point n11 and start chainage is 44.393m (from n10 to red flag point).

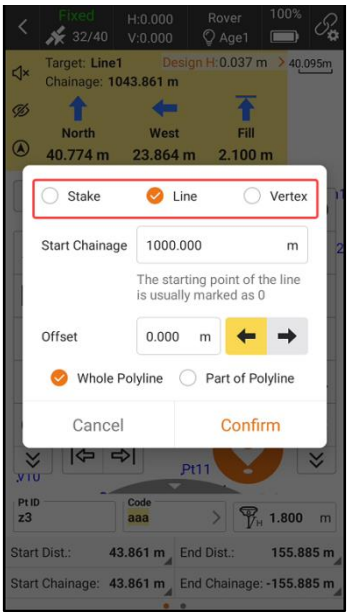
As above swipe right of a line, more options will be available, such as Delete, Edit.



When you want to add a line which is parallel to a line2. How to do it?

Enter line list, right swipe line2, choose Edit, then select add parallel line option. Input offset distance and offset direction, a new line (line2+1) will be created as above, then we can choose it and stake it out.





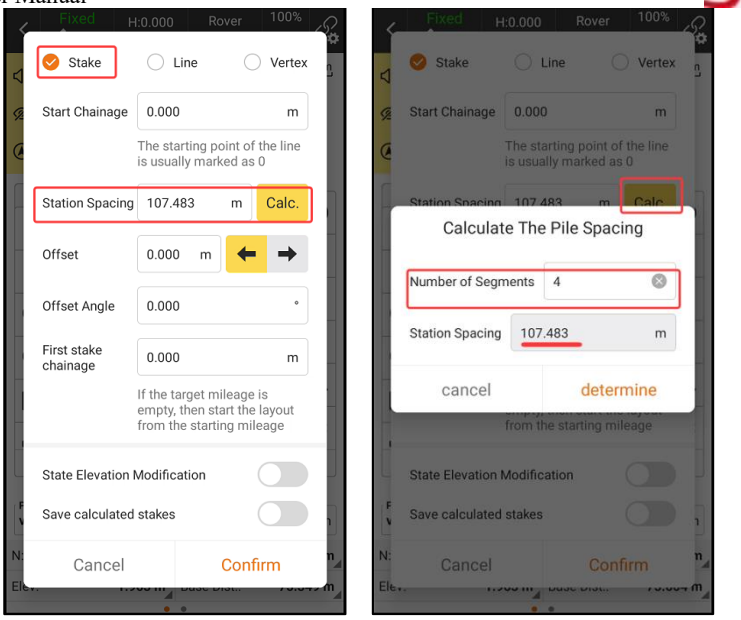
Clicking on Line button above, an option dialog will pop up and there are 3 options, Stake, Line and Vertex.

Line option

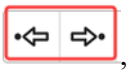
It was introduced above and if a line is chosen for staking out, it will enter line mode by default.

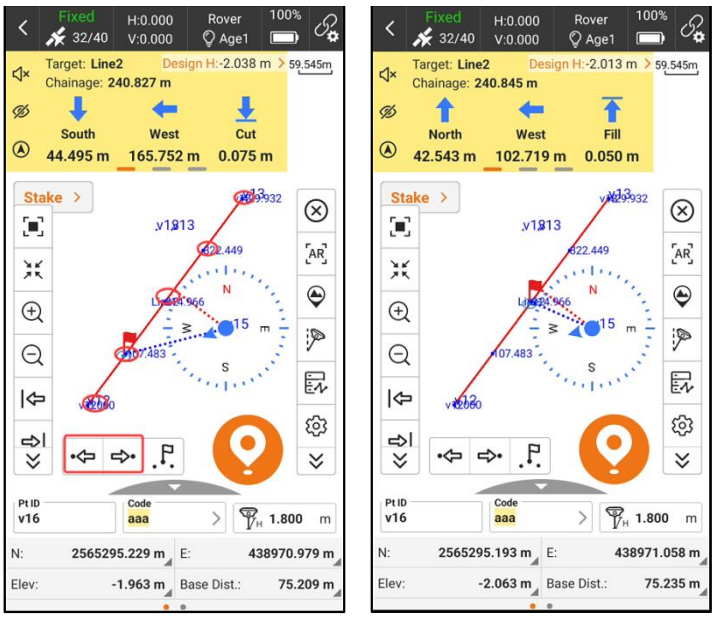
Stake option

It will enter stake point mode as below. Click Calc. button and input 4, it will divide the line into 4 equal parts and each one's length is 107.483m



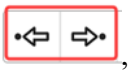
A line has been cutting into 4 equal parts, so there will be 5 points

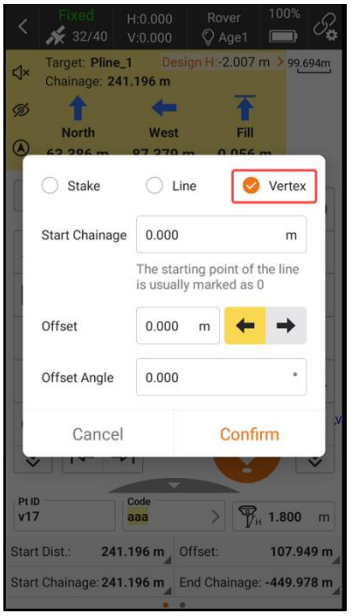
By clicking on , it will choose next/ previous points to stake out.

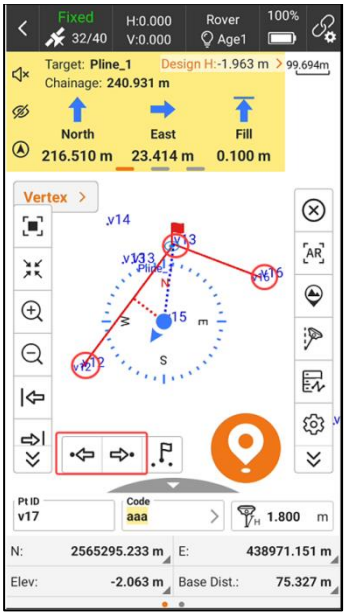


So, stake mode will actually lead to point stakeout.

Vertex option

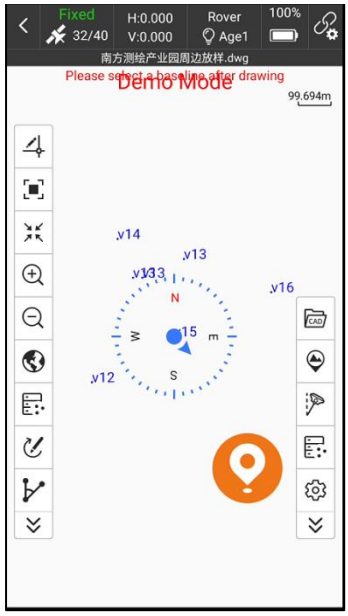
If not a straight line but a polyline, you may choose Vertex option to stakeout vertes of a polyline. By clicking on , it will choose next/ previous vertex point to stake out.

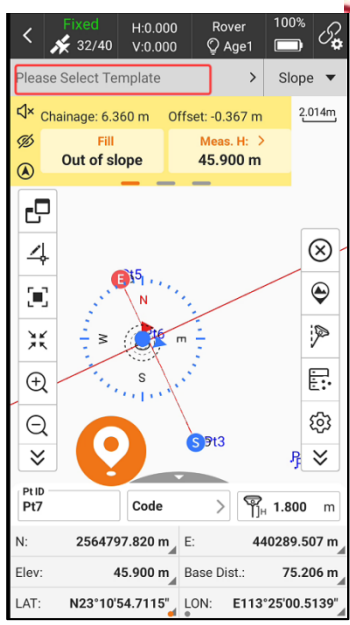




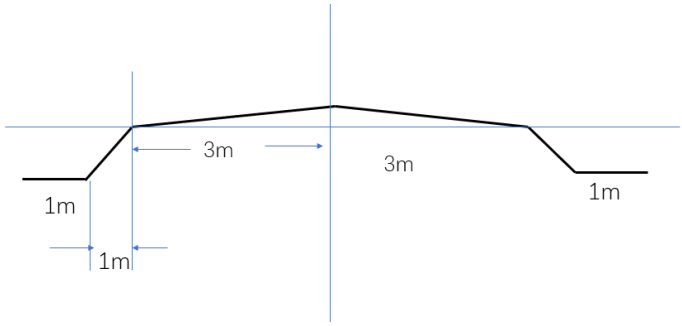
6-7 Slope Stakeout

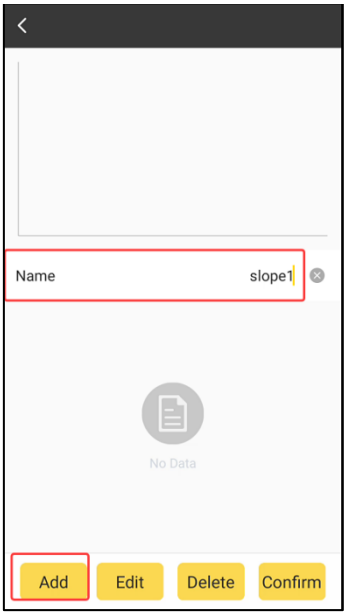
When you firstly open Slope Stakeout, it will ask you to select a baseline and after that please select template as below.

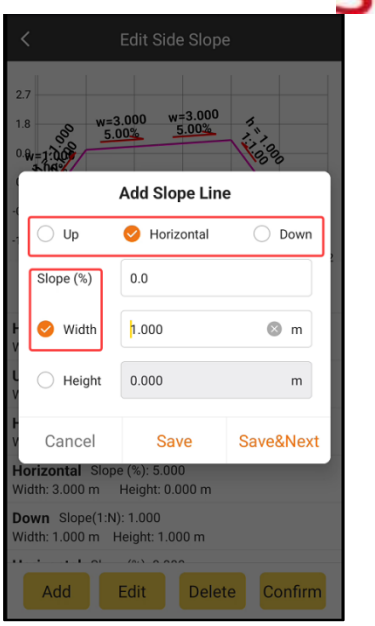


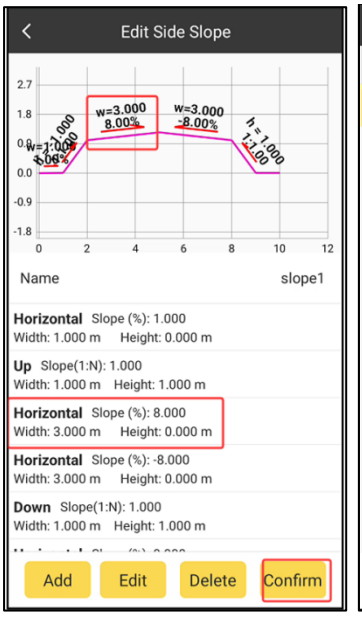


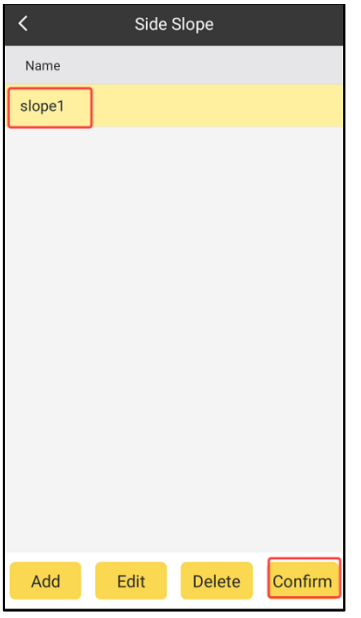
For instance, we need to design a slope like below:











Refer to above slope, we need to input each part of the slope from left to right.

Part 1: Horizontal （slope 0%, width 1m）

Part 2: Up （slope (1:N) 1:1, width 1m）

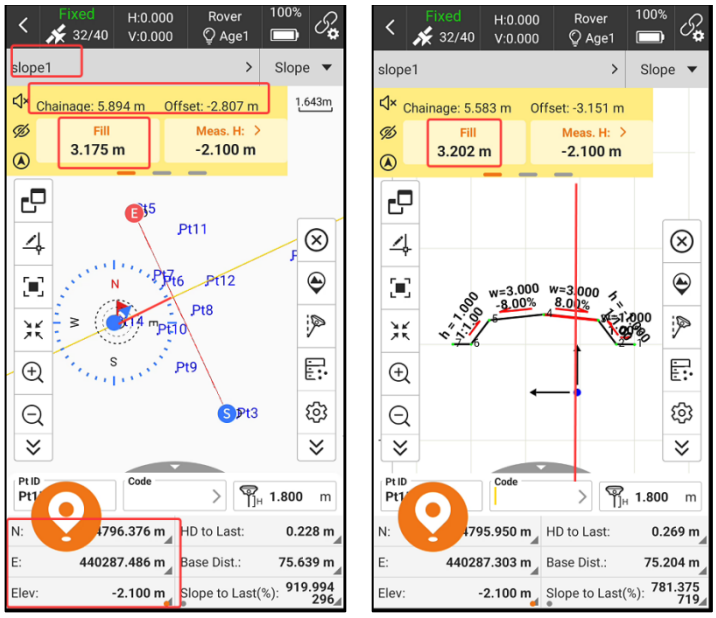
Part 3: Horizontal （slope 8%, width 3m）

Part 4: Horizontal （slope -8%, width 3m）

Part 5: Down （slope (1:N) 1:1, width 1m）

Part 6: Horizontal （slope 0%, width 1m）

After that click Confirm button, then select the slope, click Confirm it apply.

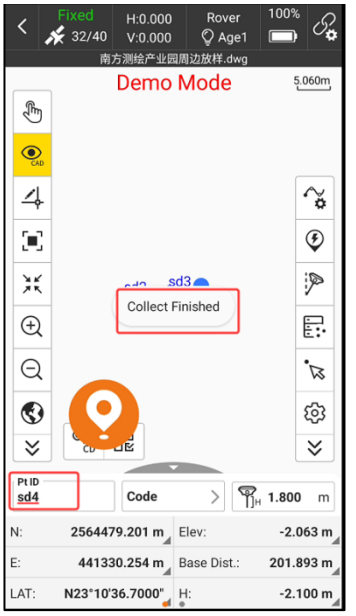


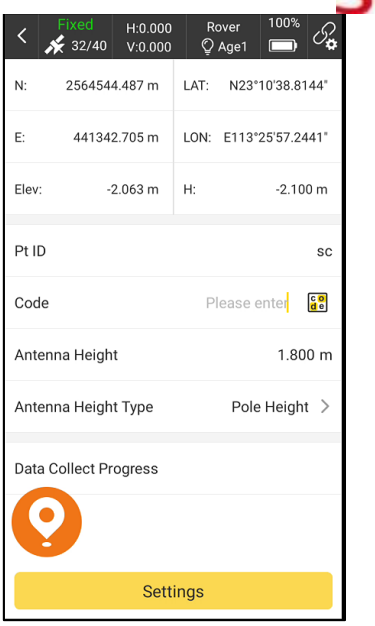
Above shows current position is off the baseline 0.241m(offset) and 6.358m from start point and it indicates to fill 2.102m. Click  icon it will show the slope shape and the current point location.

6-8 Detail Survey

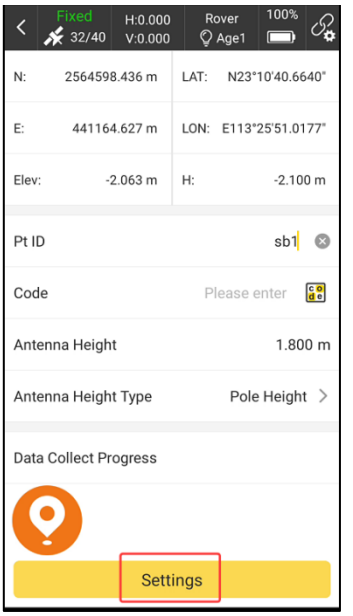
Detail survey is very similar to quick point measurement mode in Point Survey and both are fast survey compared to standard survey (Topo point mode in Point survey).

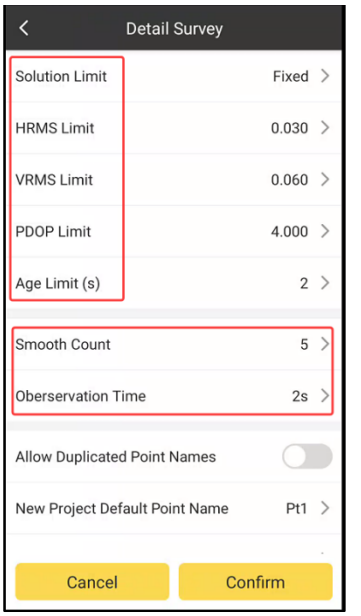
The only difference is quick point measurement mode is still in survey interface with only Pt name added automatically and code remaining same unless you input it manually. And in detail survey the interface is as below (there is no points display or background map)





Quick point mode in Point survey Detail Survey





As above some settings can be configured in detail survey.

Smooth Count: 5

It will measure the point 5 times then calculated the average coordinates.

Observation Time: 2s

When you click the store button. It will count down 2 seconds firstly and after that it begin to store the coordinates. If you set it 0 (default value), it will store point immediately when you click on store button.

6-9 PPK & RTK Survey

When the RTK receiver is used in practical survey work, high accuracy coordinates are always expected when there is correction data received via either CORS datalink or radio datalink. But there is a scenario that in some remote place or in even in town area, either CORS datalink or radio datalink is not available, in such a case, PPK survey might be useful. Without the need of correction data of any datalink, a surveyor can measure the points and record static raw data of each point in field, then process the raw static data with post-processing software when he returns office and get the coordinates.

It requires:

1. Both the base and rover receiver are required to record raw static data at same time at a recording interval 1 second.

2. Measure the antenna height for base (antenna type: measuring plate height) and for rover (antenna type: pole height).

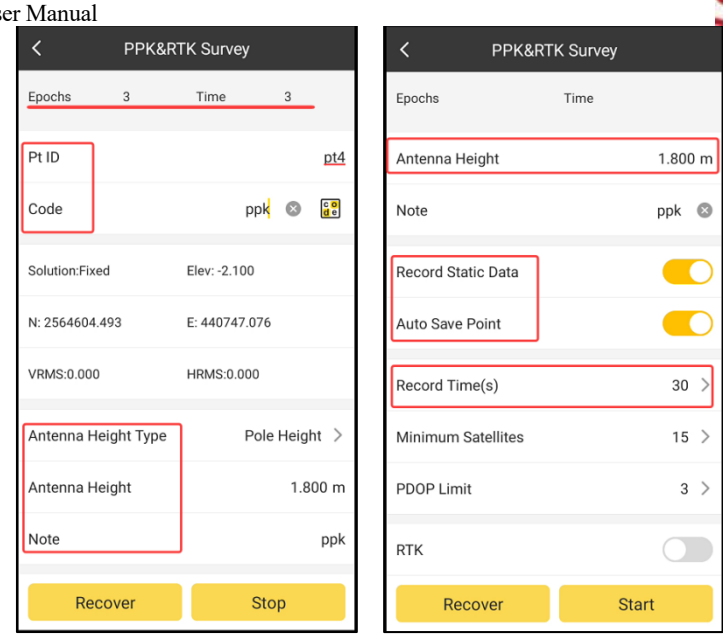
3. Base is required to setup over a known point and record static data continuously. Rover is required to stay stable over the point with pole upright for at least 30 seconds. In other words, Rover needs to record raw static data for at least 30 seconds to make sure there is enough qualified raw data for post-processing.

4. For Base, we can make it record static data at interval 1 second by using SurvStar app to configure it or visit its webpage to configure it (via either computer or our phone)

5. For Rover, we have to use Survstar app to make it record raw static data.

Below we will introduce how can we use a rover receiver to record PPK data for each point.

[Survey] – [PPK & RTK Survey]



Input Pt name, code and pole height.

Record Static Data: if tick on, receiver will start to record raw static data when we click on Start button.

Record Time: 30s

It means we have to hole the pole upright over the point for at least 30s. It is better to use a bipod to hole the pole to avoid pole shake caused by hand hold.

Epochs: it will count up 1,2,3…30

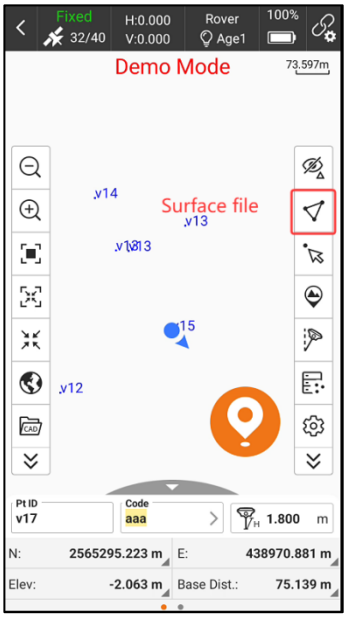
To achieve better static data quality, it is recommended to set record time 30s or more.

Auto Save Point

If this option is on, after 30s, it will save the point otherwise you have to click Save button to save it. So, it is suggested to tick on Auto Save Point.

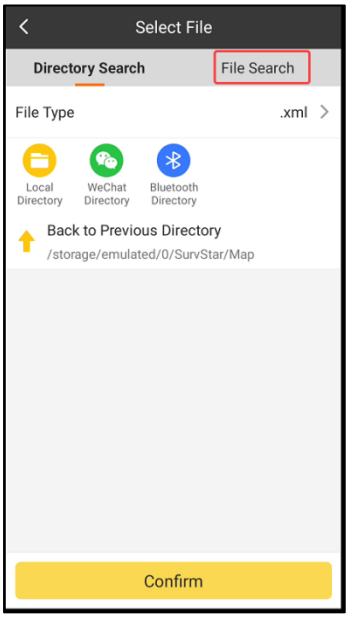
After the field work is done, we need to download static data from both base and rover receiver as well as the points data from SurvStar, then use post-processing software (SGO) to process it.

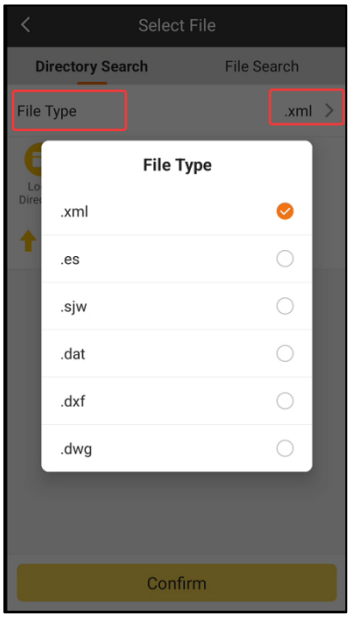
6-10 Surface Stakeout



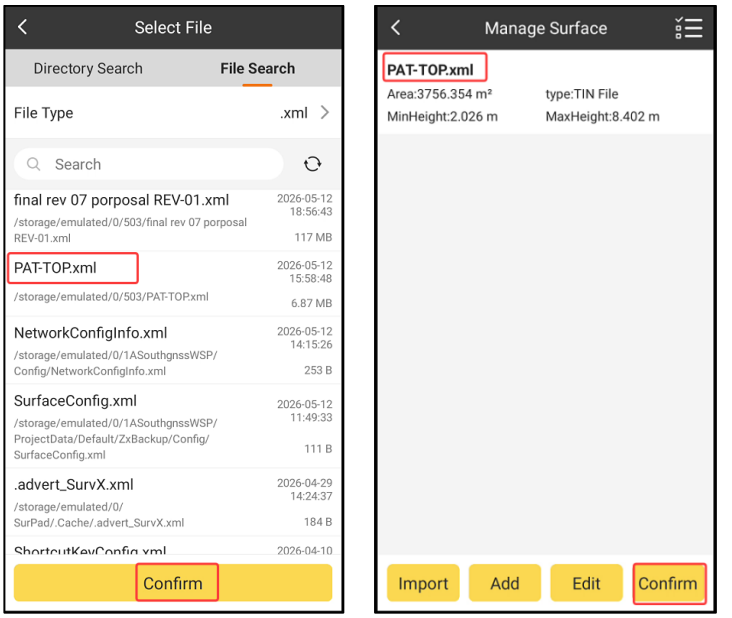


Click on button to import a surface file or maually add a surface file.

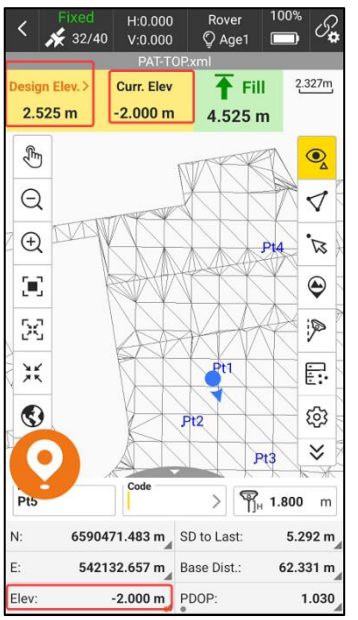




The most commonly used surface files are XML, DXF, DWG file.

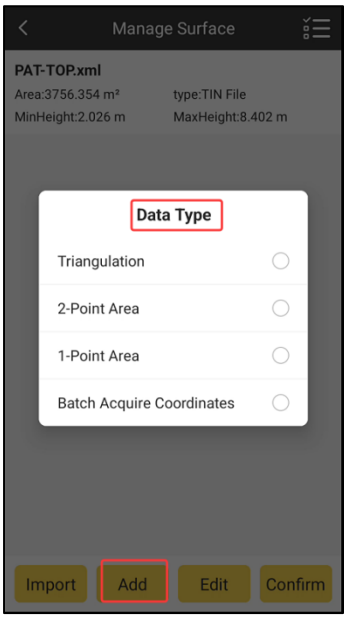


Choose the surface file from where you put them. It will show the basic information, such as area value , maximum H and minimum H.



Now a surface file (xml format) has been imported succesfully. The H value of current position, designed H and H difference are displayed on screen as above.

In additon to import a surface file, it also supports we add a surface manually. There are 4 methods to create a surface by ourself as below.



Triangulation

Input 3 points to form a surface.

2-Point Area

Input 2 points and a slope value to form a surface.

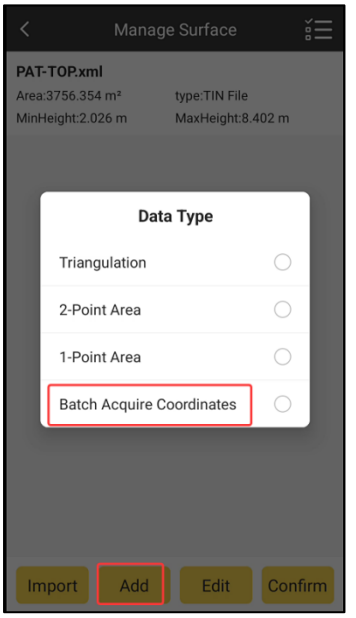
1-Point Area

Input only one points and two slopes value (X slope, Y slope) to form a surface.

Batch Acquire Coordinates

By inputting or selecting some points , a surface can be formed and the surface file is ES format.

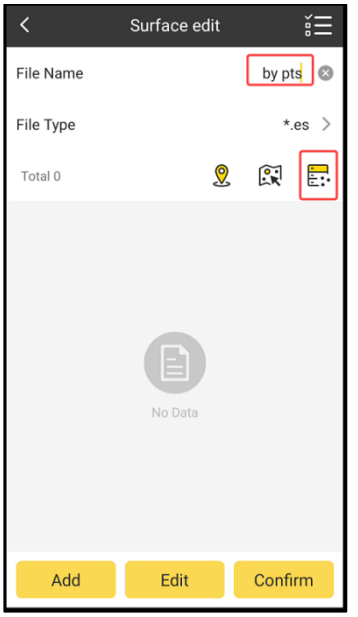
Here we giva an example of **Batch Acquire Coordinates method** to form a surface.

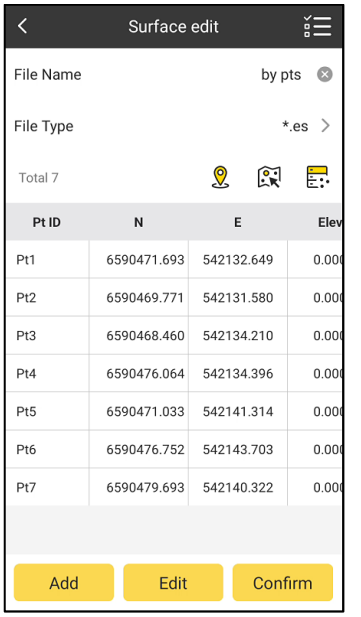


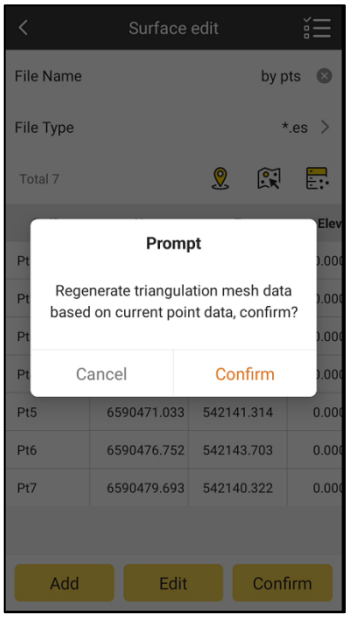


We will select the above 7 points to form a surface

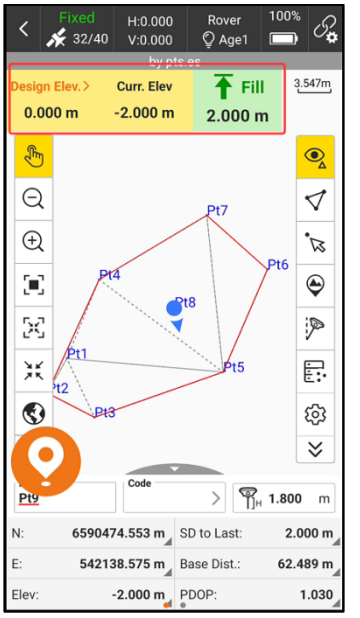
Click on  button to maually add a surface file.









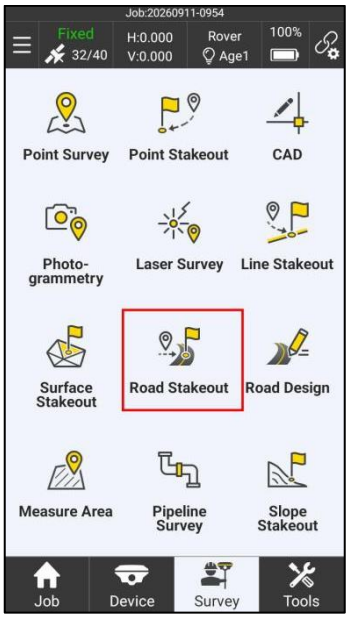


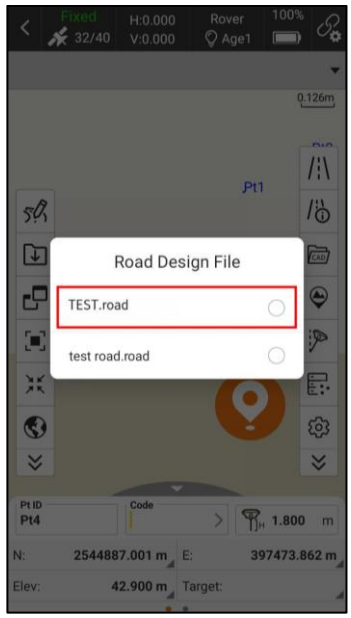
Now a surface file is created successfully as above.

6-11 Road Stakeout

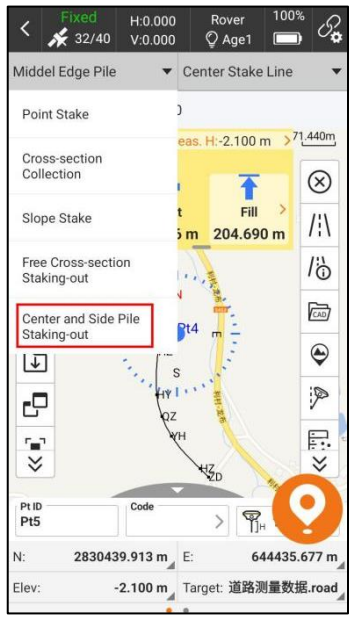
6-11-1 Center and Side Pile Staking-out

Click Road Stakeout to enter the function interface. The software automatically displays existing road design files; select the target road file for stakeout.

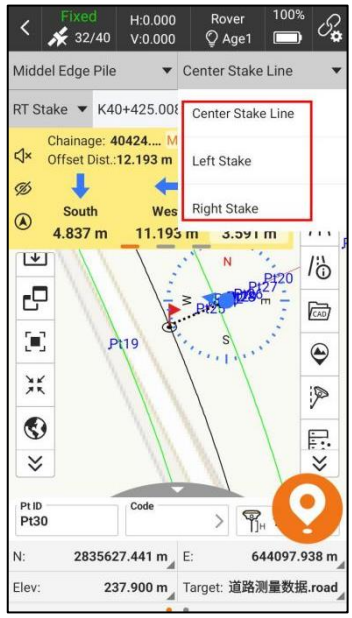




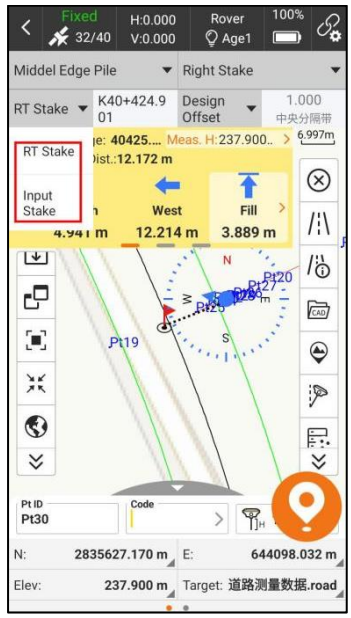
After opening the road file, click Center & Side Pile Stakeout to start stakeout of road centerline and sideline.



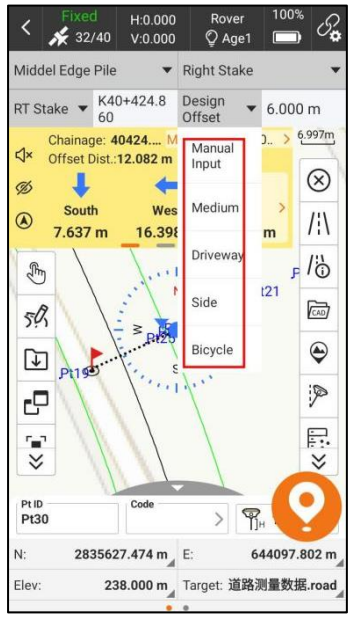
Road Width Selection: Switch between left and right side piles.



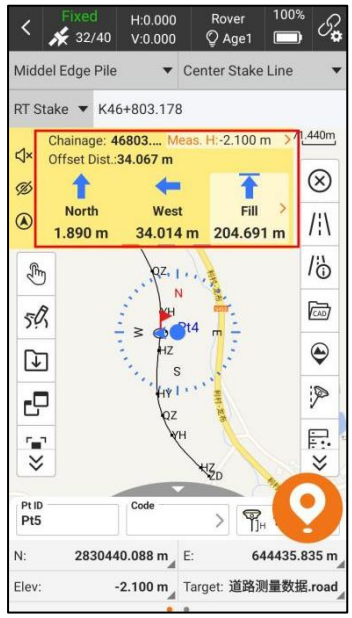
Stake Type Selection: Switch between real-time stake (mileage of current mobile station on the road) and manual input stake (manually input road mileage).



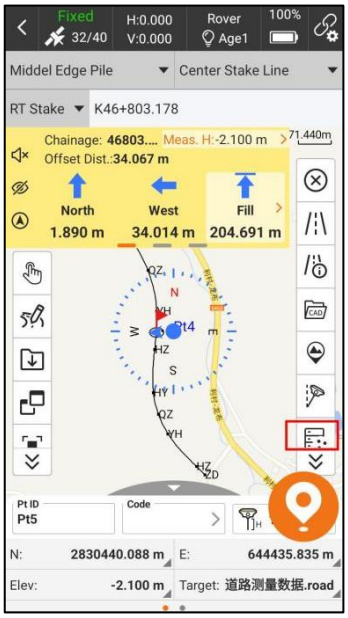
Offset: Manually input offset or select outer road sections to set offset distance.

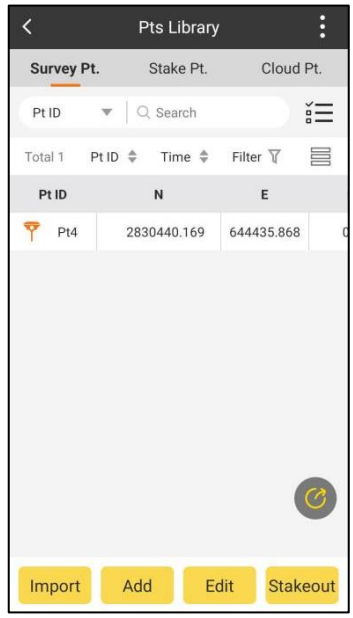


Real-time parameter information is displayed on the top card of the stakeout interface.



Collected data can be viewed and exported via the Point Library on the right.





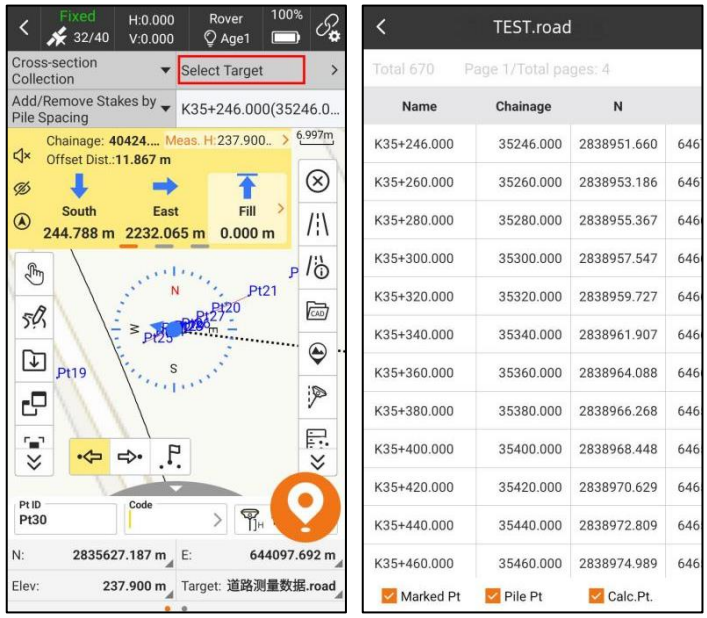
6-11-2 Cross-Section Collection

Enter the road stakeout interface, select the target road, and click Cross-Section Collection at the top left corner.

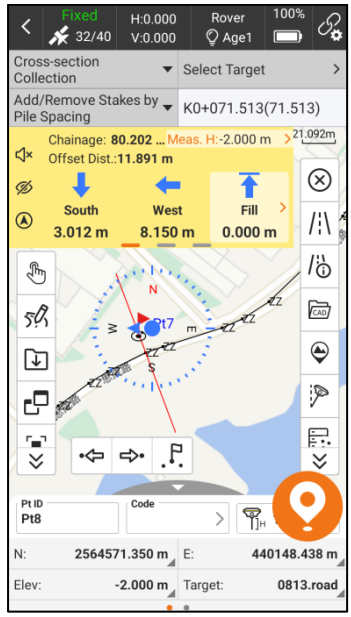




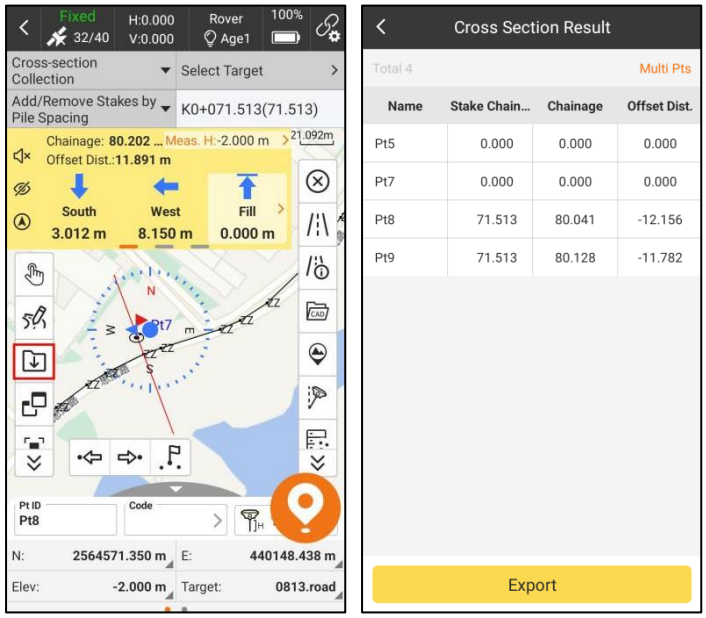
Select the mileage for cross-section stakeout.



The red straight line in the interface represents the normal extension line of the cross-section, which can be customized in settings.Core parameters: Vertical distance (distance from current point to cross-section normal) and offset distance (nearest distance from current point to the route). Collect coordinates at positions with elevation changes according to actual conditions.



Collected data can be viewed and exported via the Result button on the left.



Route Stakeout Parameter Settings (Click Options):

Display Settings: Customize displayed content including road marker points and additional stake points.

Cross-Section Normal Extension Length: Set the extension length of cross-section normal lines.

Mileage Limit: Set the start and end mileage for stakeout. Offset and mileage will not be calculated for points beyond the range, with out-of-range prompts. This function solves projection errors at sharp route corners.

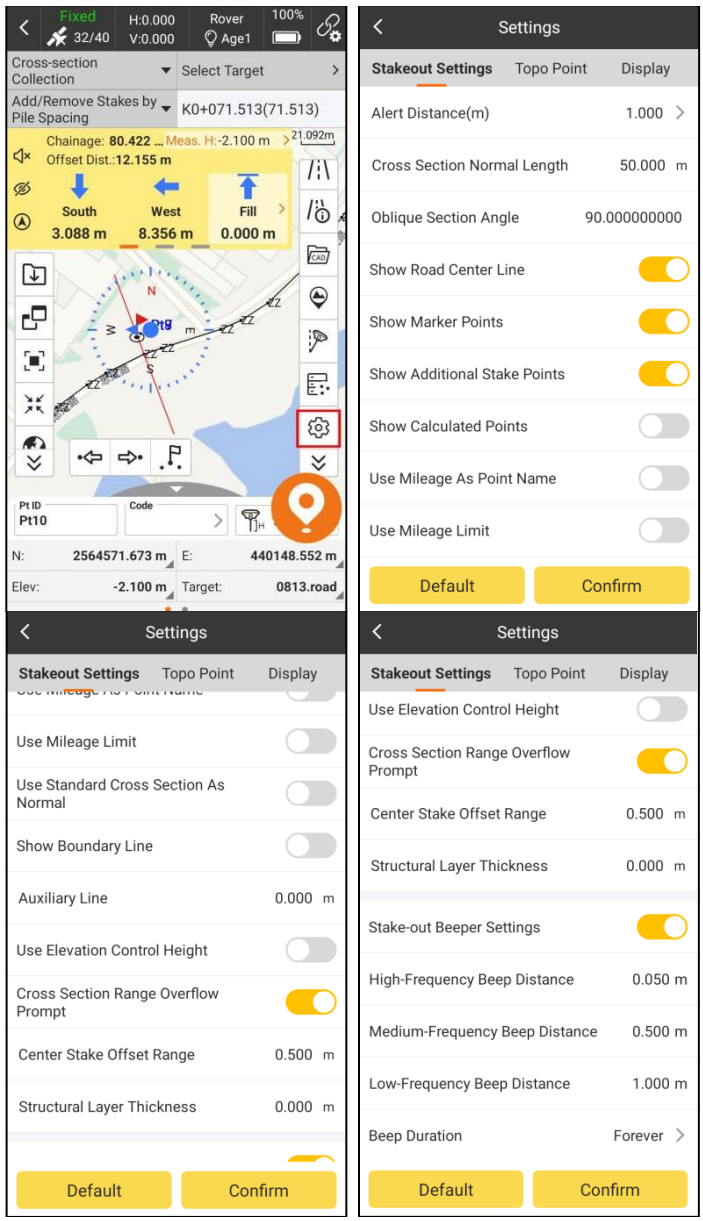
Boundary Line Display: Show the width from centerline to hard shoulder.

Standard Cross-Section Normal: Take the standard cross-section width as the normal line length.

Auxiliary Line: Display offset lines based on road centerline with customizable distance for reference.

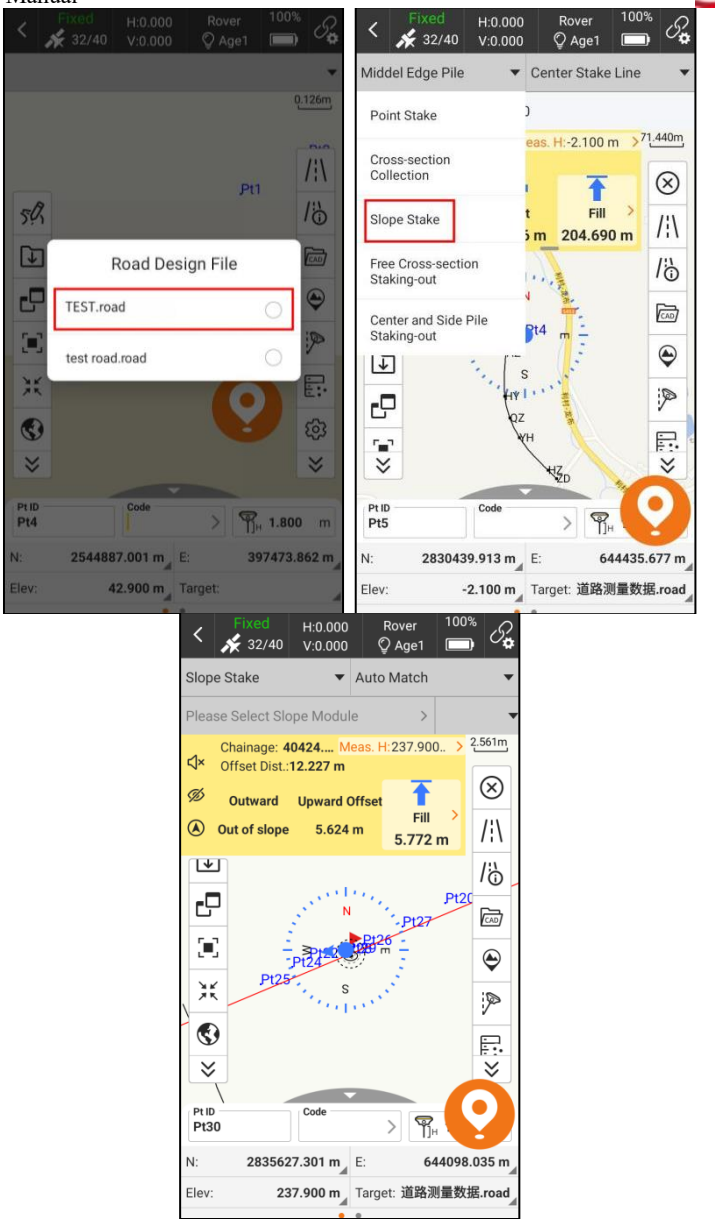
Out-of-Range Prompt: Enable/disable prompt for cross-section collection out of range.

Structural Layer Thickness: Set the thickness of road structural layers.

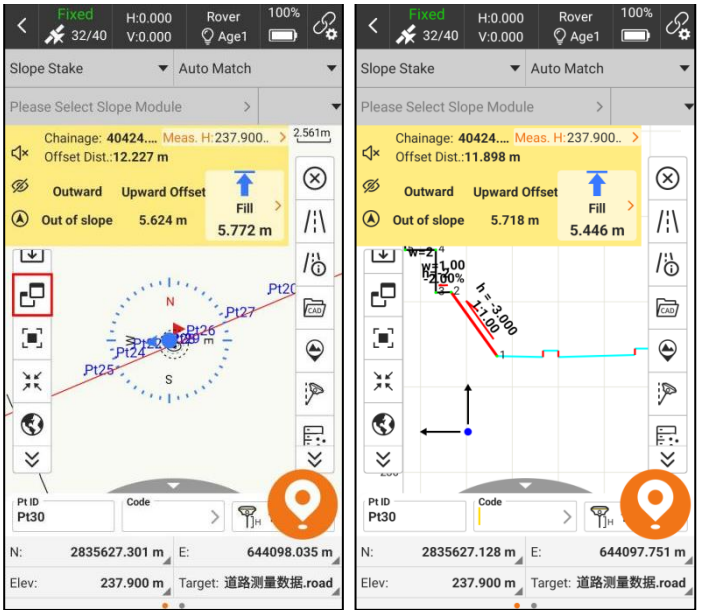


6-11-3 Slope Stake

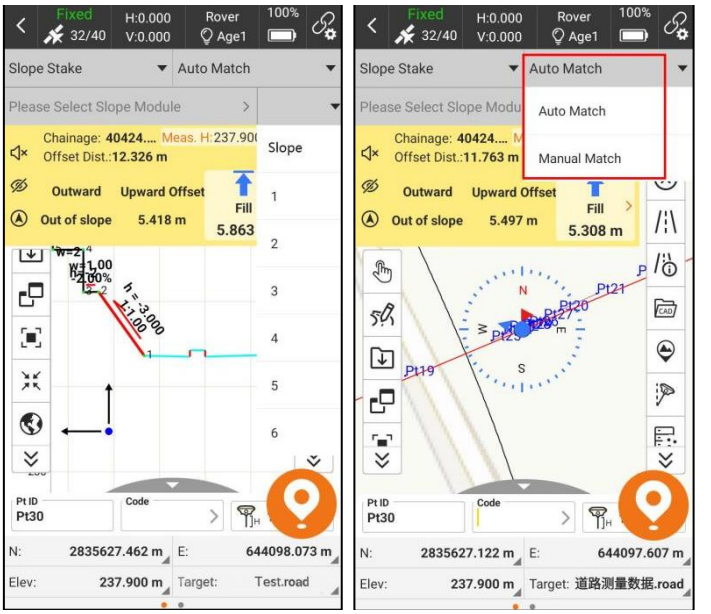
Enter the road stakeout interface and select the target road (slope data must be preset for the selected mileage in road design).


Fixed
32/40
H:0.000
V:0.000
Rover
Age1
100%
Road Design File
TEST.road
test road.road
Pt ID
Pt4
Code
1.800 m
N:
2544887.001 m
E:
397473.862 m
Elev:
42.900 m
Target:
Middel Edge Pile
Center Stake Line
Point Stake
Cross-section Collection
Slope Stake
Free Cross-section Staking-out
Center and Side Pile Staking-out
Fill
204.690 m
Pt ID
Pt5
N:
2830439.913 m
E:
644435.677 m
Elev:
-2.100 m
Target:
道路测量数据.road
Slope Stake
Auto Match
Please Select Slope Module
Chainage: 40424....
Meas. H:237.900..
Offset Dist.:12.227 m
Outward
Upward Offset
Out of slope
5.624 m
Fill
5.772 m
Pt ID
Pt30
N:
2835627.301 m
E:
644098.035 m
Elev:
237.900 m
Target:
道路测量数据.road

Select Slope Stake at the top left corner, switch the view from plane view to profile view via the view switch button.

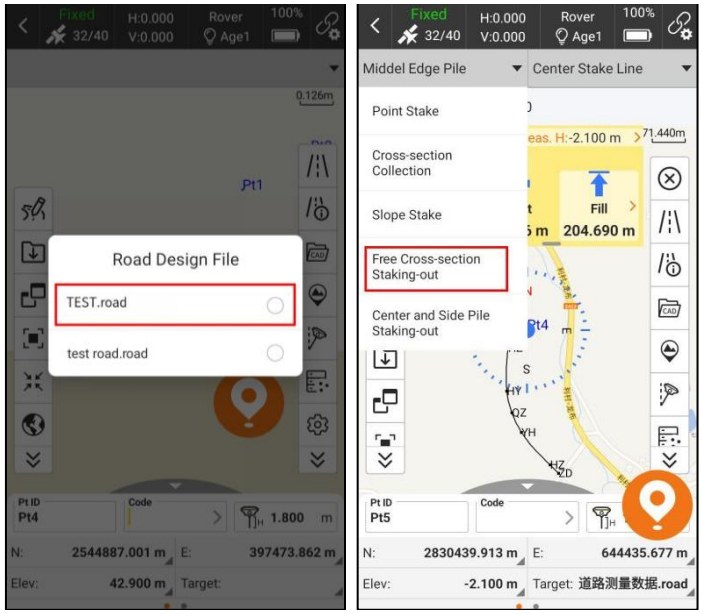


Select slope feature points or slope surfaces to start stakeout, and switch between automatic matching and manual matching modes.

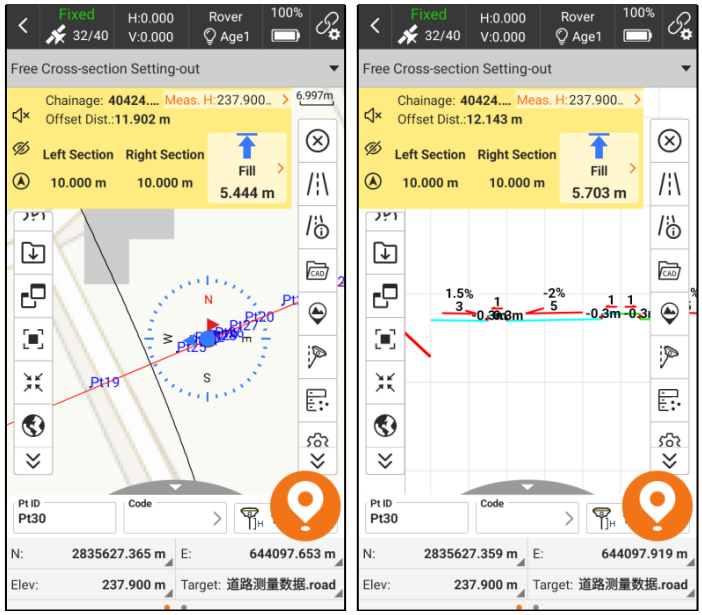


6-11-4 Free Cross-Section Staking-out

Enter the road stakeout interface, select the target road, and choose Free Cross-Section Staking-out at the top left corner.



Stake out any position within the subgrade range to check the height difference (fill/cut value) of the current position. Switch stakeout view modes via the Toggle button.

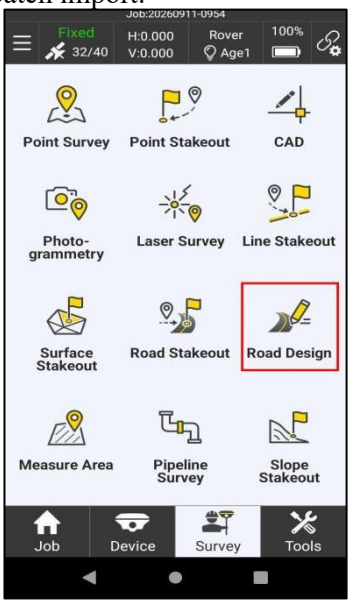


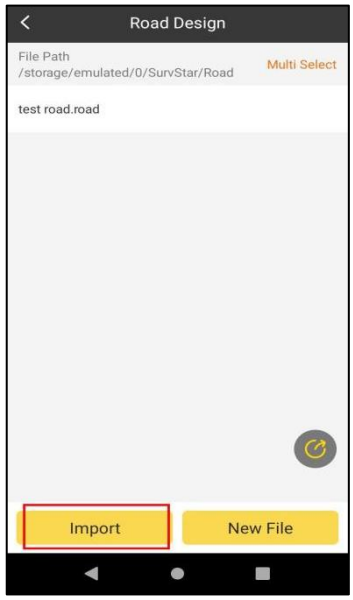
6-12 Road Design

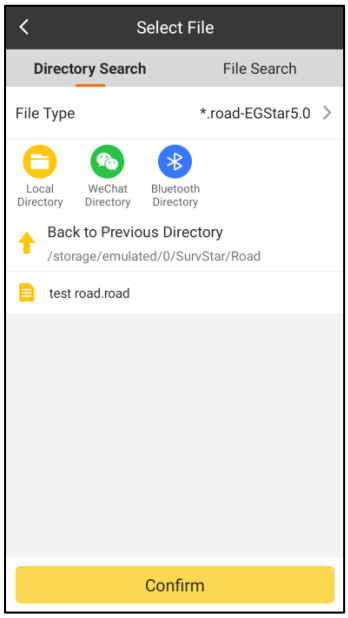
The Road Design function is a graphical road design tool. Users input required route parameters following system prompts. The software automatically calculates route point coordinates and generates the road alignment graphics.

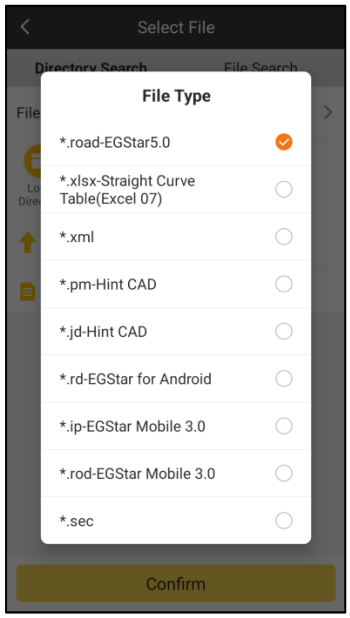
The Road Design menu includes: Curve Design, Vertical Section, Standard Section, Super Elevation, Widen The Road, Side Slope and other core functions.

The system supports the import of straight curve tables, multiple types of road design files, and multi-path batch import.







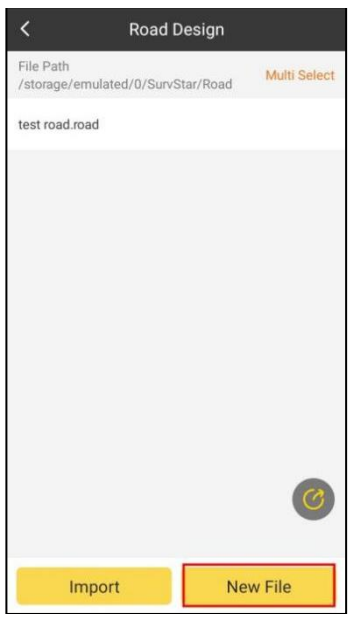


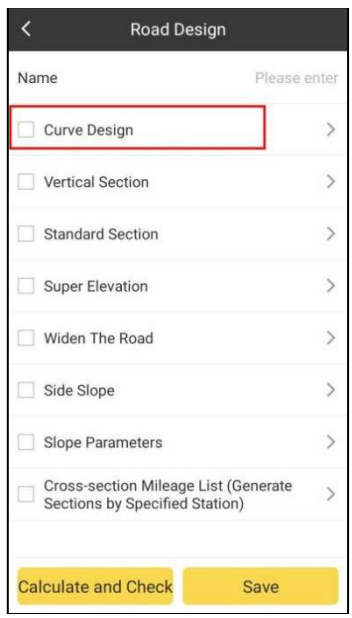
6-12-1 Curve Design

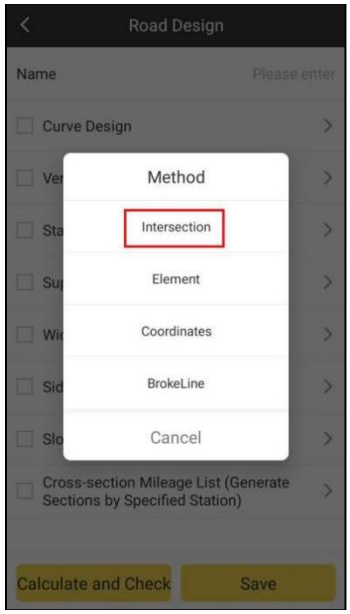
6-12-1-1. Intersection Point Method

The intersection point method is a widely adopted road design method at present. Users only need to input the coordinates of route curve intersection points, as well as the corresponding transition curve length, radius, mileage and other information of the route. The software will generate the coordinates of key feature points, additional stake points and route points, and display intuitive graphics, facilitating route stakeout and surveying work.

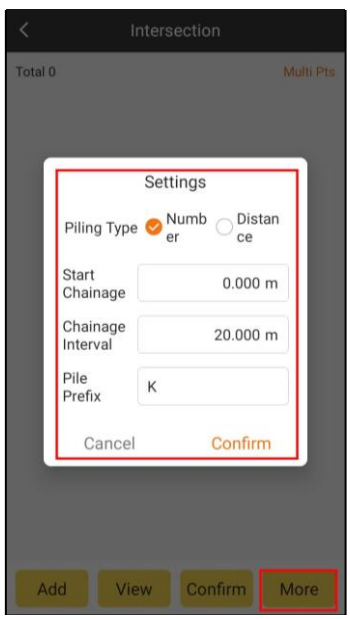
The specific operation steps are as follows: New File — Horizontal Curve Design — Intersection Point Method to enter the intersection point design interface.



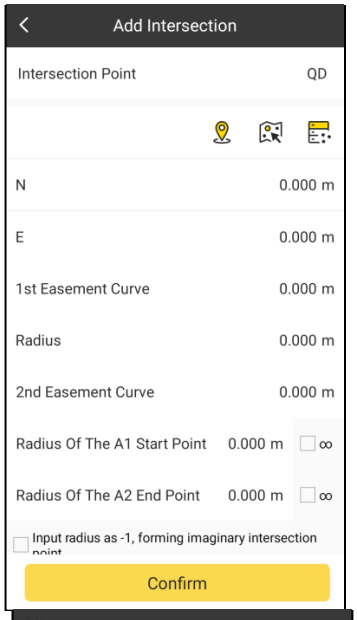


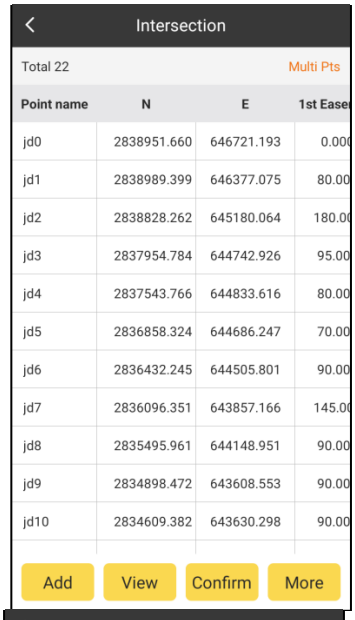


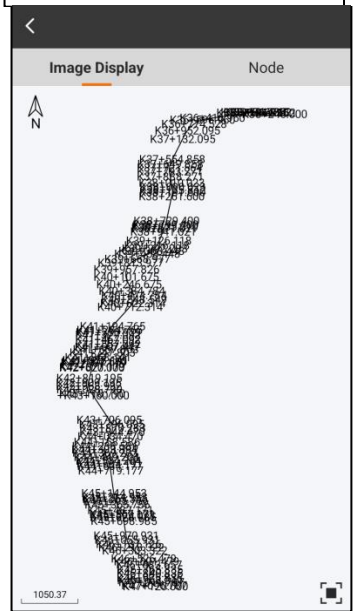
1)After entering the intersection point design interface, click More-Settings at the bottom right corner to set the starting mileage, mileage interval and stake number prefix. "Full stake number" and "Full stake distance" are two coordinate generation modes; "Starting Mileage" refers to the mileage of the starting point; "Mileage Interval" means the interval for generating route point coordinates.

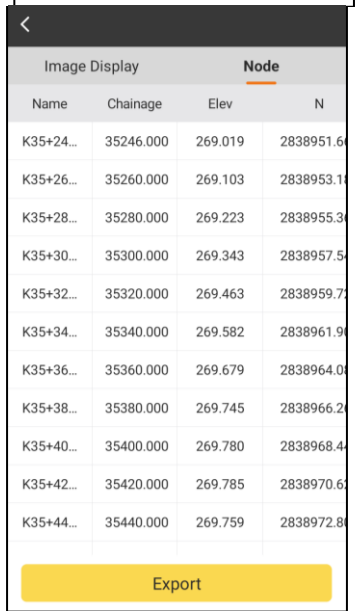


2) After completing the road design, click View to check whether the calculated stake-by-stake mileage and coordinates are consistent with the stake coordinate table provided by the design institute.







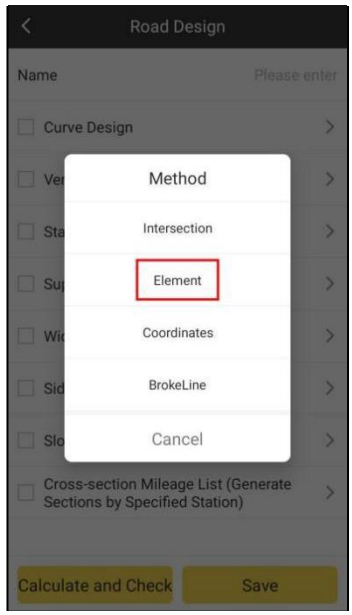


6-12-1-2. Element Method

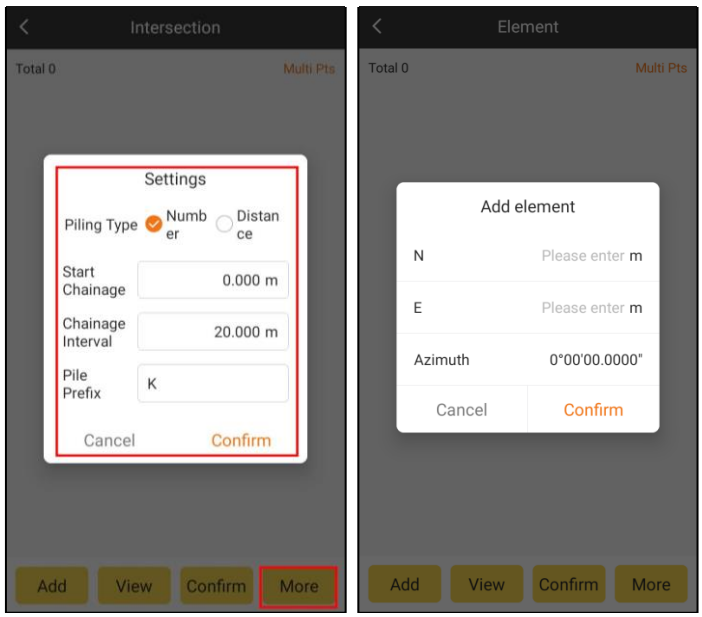
The element method is a conventional road design method. It divides the road route into basic road elements (points, straight lines, transition curves, circular curves, etc.), and combines these basic elements one by one according to specified rules to form a complete road route.

Operation steps:

1) Create a new file, select Horizontal Curve Design and Element Method to enter the element method design interface.



2) Click More-Settings at the top right corner to set the starting mileage, mileage interval and stake number prefix, then add a starting point by inputting the north coordinate, east coordinate and initial azimuth angle.

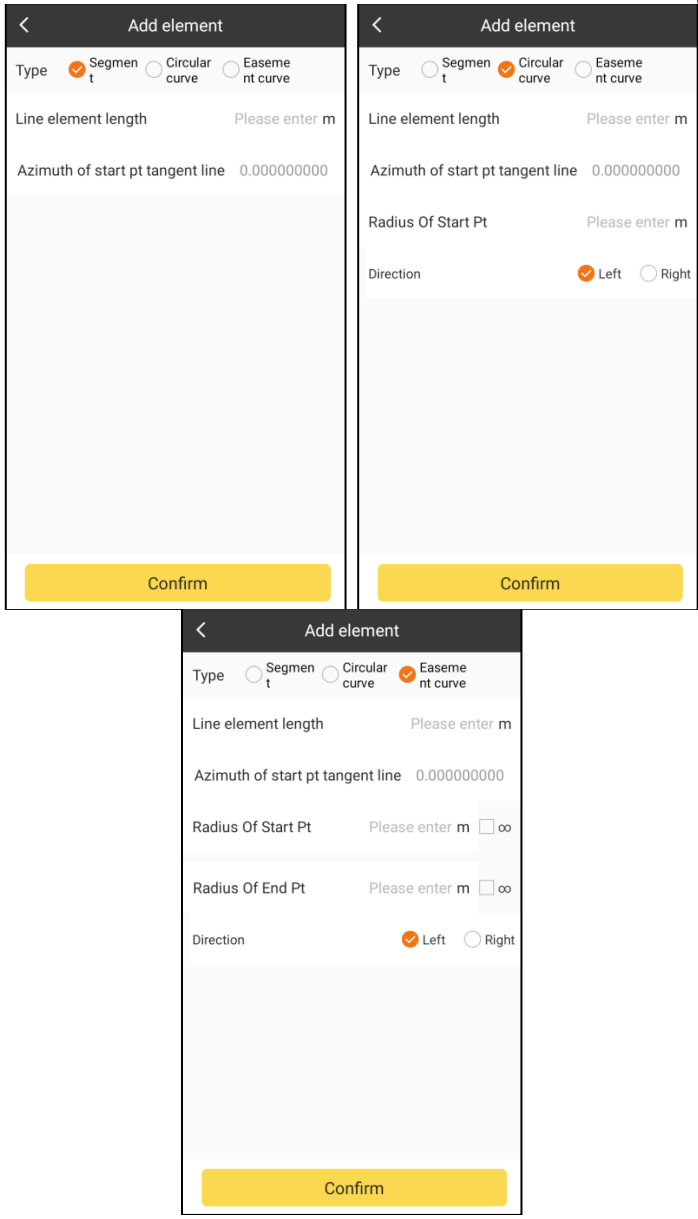


3)After adding the starting point, click Add continuously, and select to add "Line Segment", "Transition Curve" or "Circular Curve" according to design requirements.

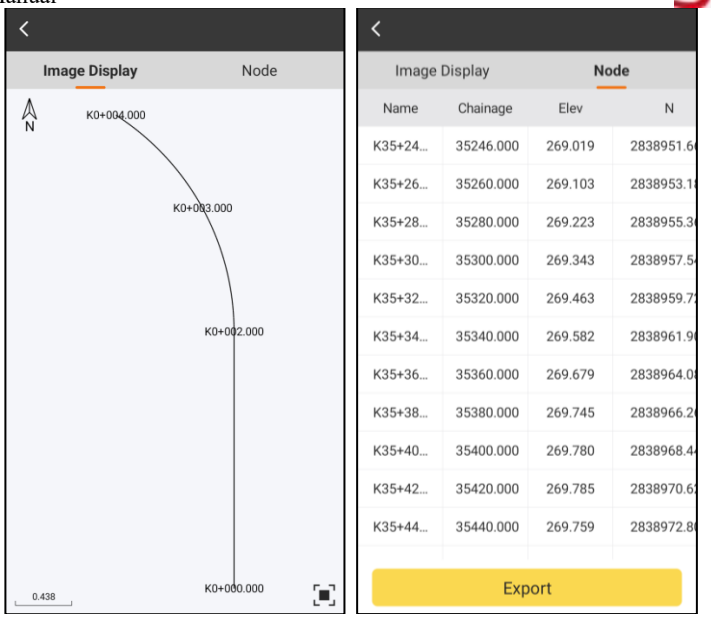
Line Segment: Only input the segment length is required. In case of straight line connected to another straight line, the azimuth angle of the second straight line shall be input additionally.

Transition Curve: Four parameters are required: transition curve length, starting radius, ending radius and deflection direction.

Circular Curve: Three parameters are required: circular curve length, circular curve radius and deflection direction.



4)After data input, click View. The software will automatically calculate and generate the road graph and stake-by-stake coordinates. Verify whether the generated stake mileage and coordinates match the stake coordinate table provided by the design institute.

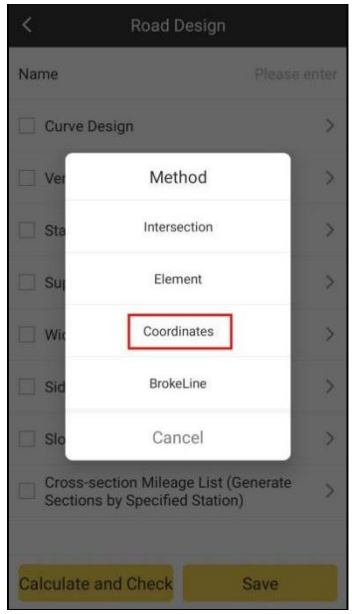


6-12-1-3. Coordinate Method

Some road routes consist of straight lines and circular curves with non-tangent connections. For example, the azimuth angle of a straight line is 130°, while the starting azimuth angle of the connected circular curve is 140°. Such roads are complicated to design by the element method and intersection point method. Therefore, the coordinate method is developed as a simple and special horizontal curve design method for such scenarios.

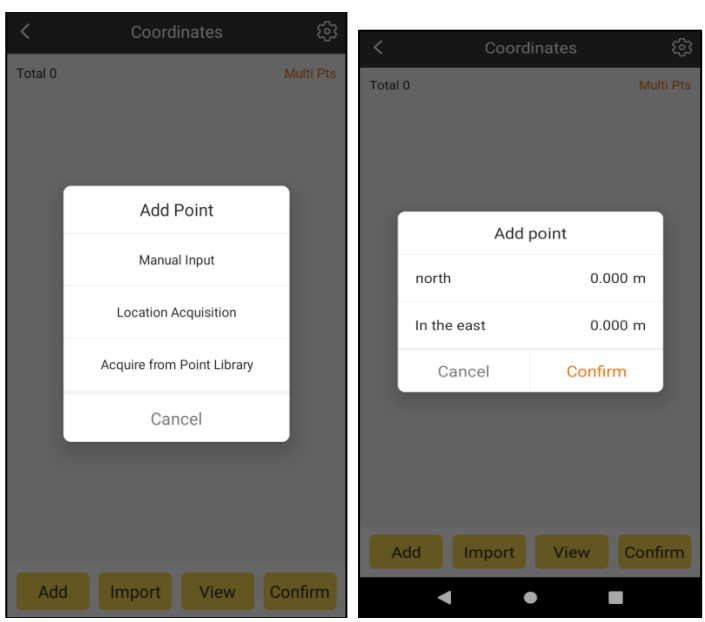
Operation steps:

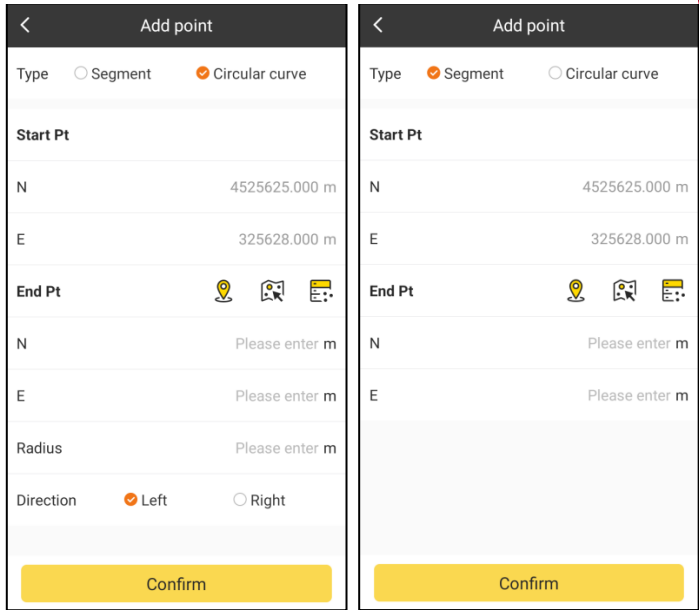
1) Create a new file, select Horizontal Curve Design and Coordinate Method to enter the coordinate method design interface.



2) Click More-Settings at the top right corner to set the starting mileage, mileage interval and stake number prefix, then add a starting point by inputting north and east coordinates.

3) Input all coordinate points in sequence and click View. The software will automatically calculate and generate the road graph and stake-by-stake coordinates. Check the consistency between the generated data and the official design stake coordinate table.

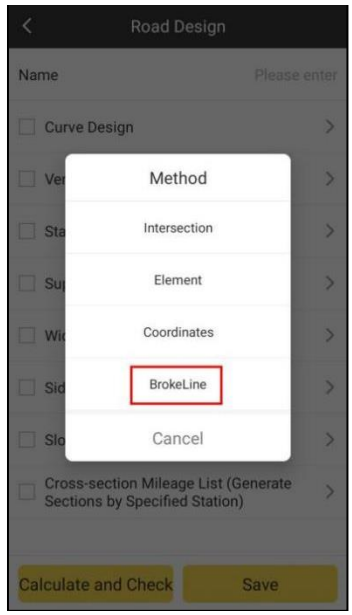




6-12-1-4. Polyline Method

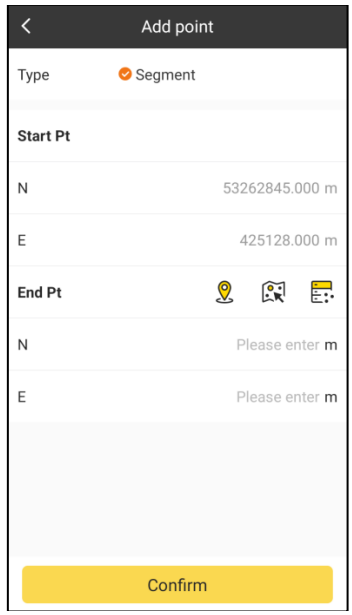
Operation steps:

1) Create a new file, select Horizontal Curve Design and Polyline Method to enter the polyline method design interface.



2) Click the More-Settings button at the top right corner to set the starting mileage, mileage interval and stake number prefix.

3) Input all coordinate points in sequence and click View to verify the generated stake-by-stake mileage and coordinates against the official design table.



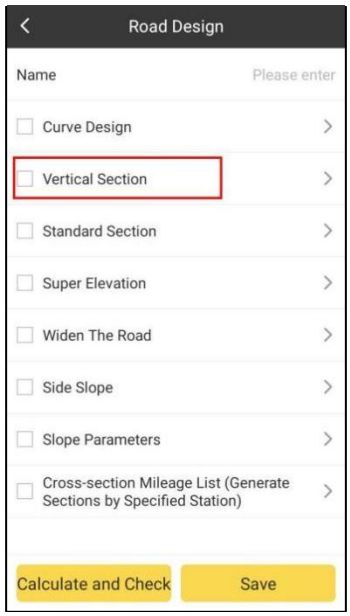
6-12-2 Vertical Curve Design

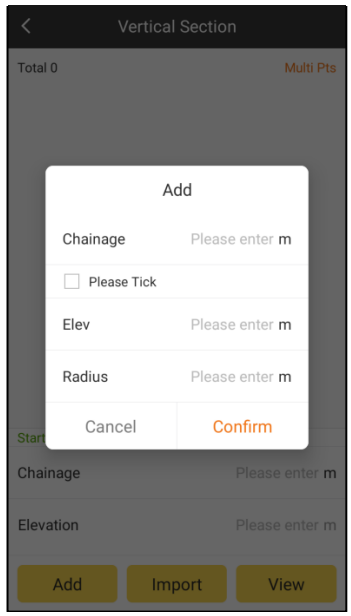
Vertical curves are applied at the turning points of two longitudinal road slopes to smooth driving. Two vertical curve shapes are available: parabola and circular curve. According to specifications, quadratic parabola is the standard vertical curve shape; circular curves are nearly identical to quadratic parabolas in practical engineering applications.

Concept: The longitudinal section is obtained by vertically cutting along the road centerline. Vertical curve design is used to calculate the elevation data of the road centerline. The data input is simple: only three parameters of each grade change point are required: mileage, elevation and radius. The software automatically calculates the slope ratio, which can be used to judge the correctness of input data. Users can also verify the calculated elevation by inputting specified mileage values.

In SurvStar , vertical curve design is usually carried out after horizontal curve design based on the vertical curve table. The specific steps are as follows:

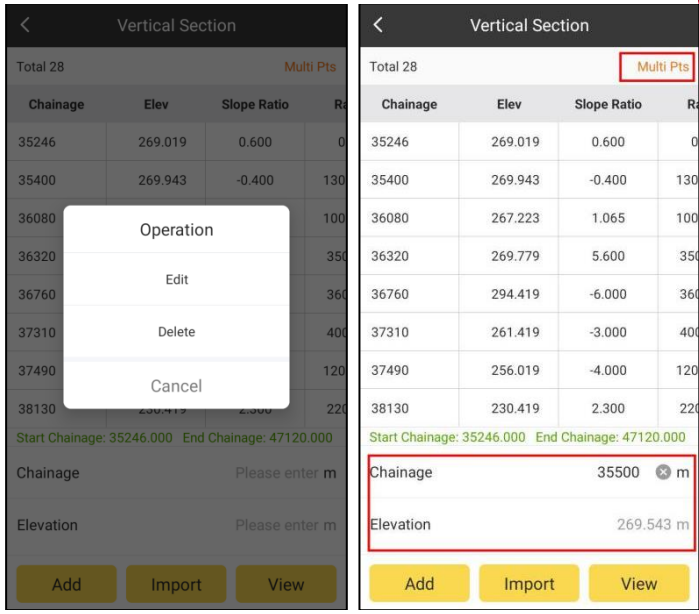
Open SurvStar - Survey - Road Design - New File - Vertical Curve Design - Add. Input the mileage, elevation and radius in sequence. Add subsequent grade change points until all vertical curve data are completely input.



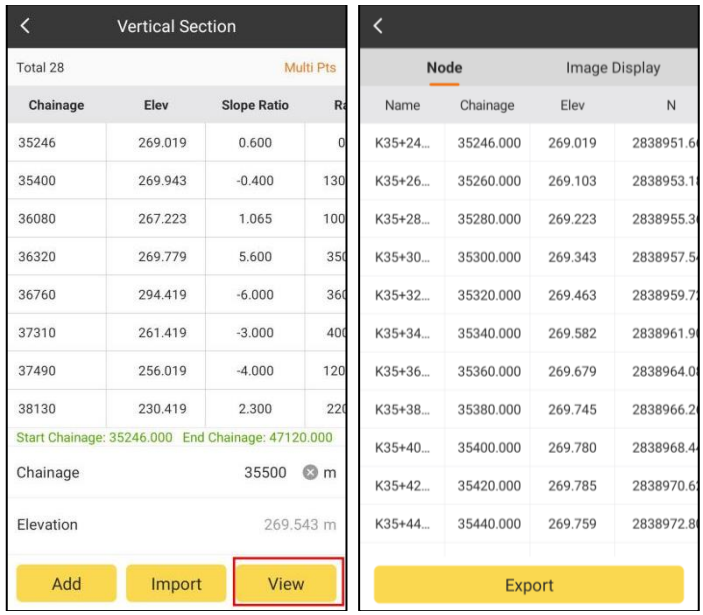


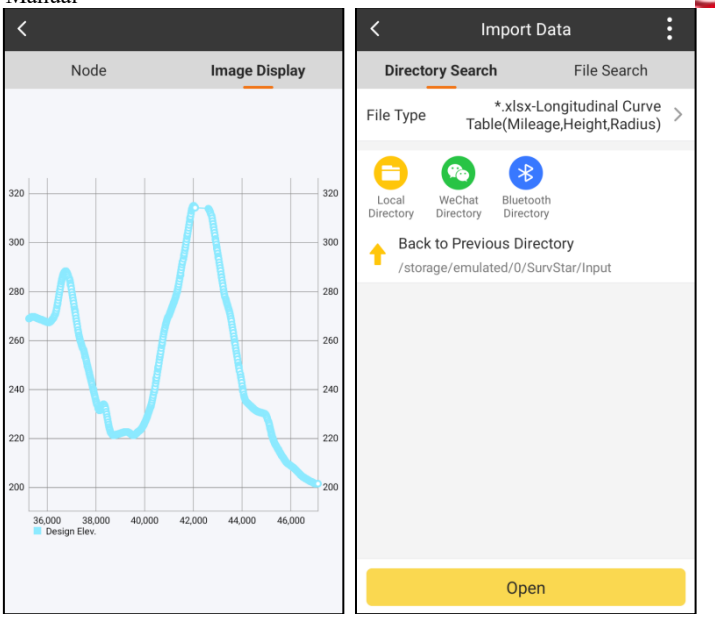
In the vertical curve design interface, users can edit or delete existing grade change vertical curves by selecting the corresponding mileage data. The multi-select function at the top right corner supports batch deletion of vertical curve data.

Users can input mileage values to check the corresponding calculated elevation.



Click View to check vertical curve results, which are displayed in two forms: stake-by-stake coordinates and graphical view. Vertical curve data can be exported as centerline mileage CSV files with customizable file names.



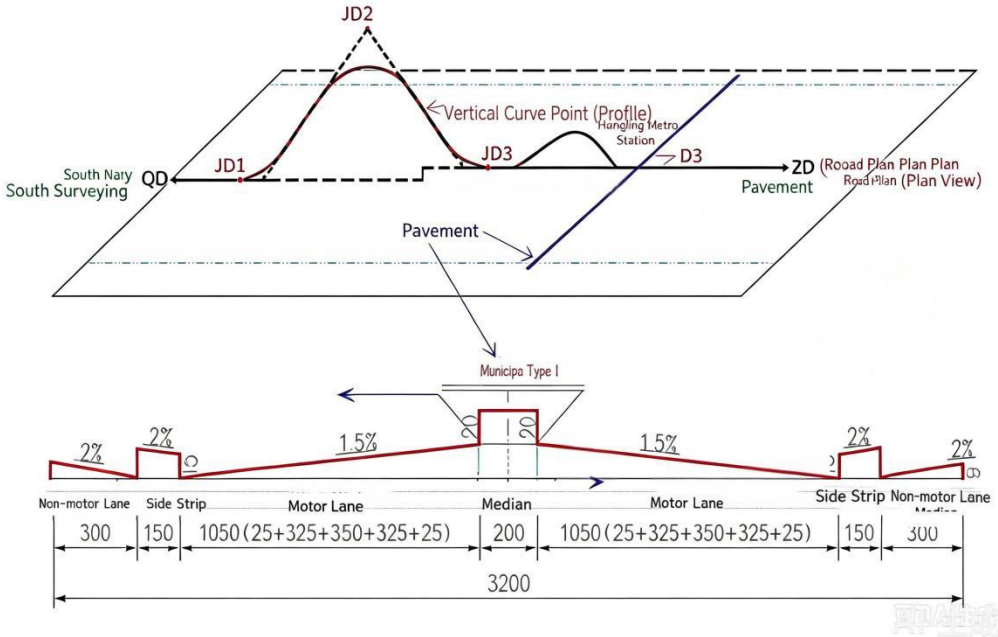


6-12-3 Standard Cross-Section

Concept: A cross-section is a section perpendicular to the road centerline. The standard cross-section enables the acquisition of design elevations for any point within the road scope. The components of highway and urban road cross-sections are different.

Highway cross-section components: carriageway (pavement), road shoulder, side ditch, slope, green belt, median divider, retaining wall, etc.

Urban road cross-section components: carriageway (pavement), sidewalk, curb, green belt, divider, etc. Retaining walls are added for high embankments and deep cuttings. Standard cross-sections support symmetrical and asymmetrical layout according to terrain conditions.

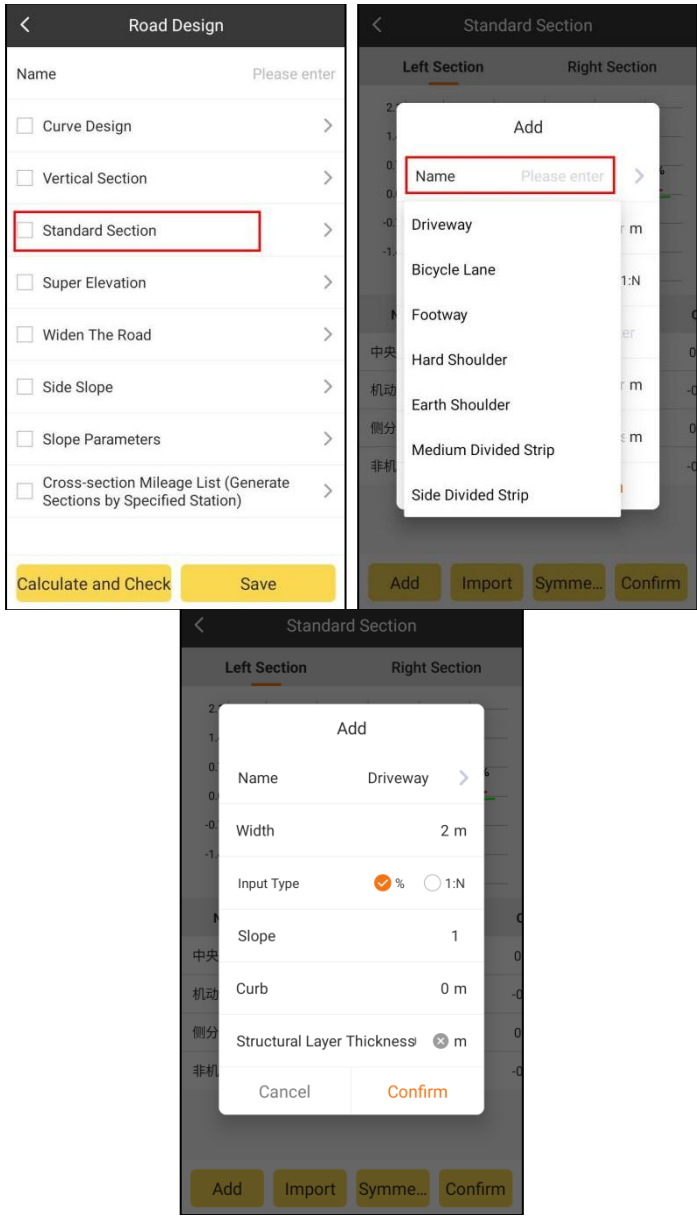


Standard Cross-Section Data Input Rules

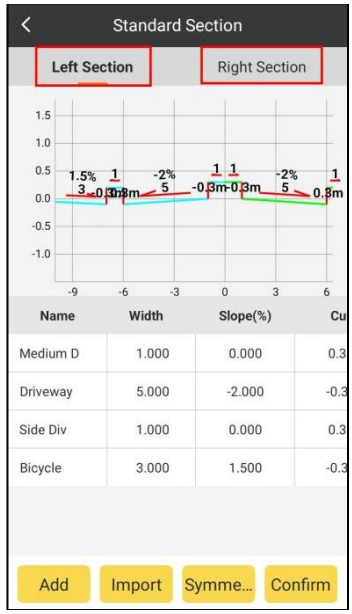
Input parameters include: Name (carriageway, sidewalk, etc.), Width, Cross Slope (calculated outward from the road centerline; upward slope is positive, downward slope is negative; slope ratio 1:2 equals 50% slope value, input 2 for 1:N format or 50 for percentage format), and Curb Height (height difference with the previous pavement section; positive for higher, negative for lower).

Example: A curb height of 0.3m for the median divider means the median divider is 0.3m higher than the centerline. The left cross-section can be input normally, and the right cross-section can copy all left-section attributes via the Symmetry function.

Road cross-section design steps: Click Standard Cross-Section - Add. Select the section name (motor vehicle lane, non-motor vehicle lane, sidewalk, etc.) in the pop-up window. Input width, select input type, and fill in cross slope and curb parameters (input 0 if there is no height difference between adjacent sections). Click Confirm to complete the setup.



Users can edit or delete existing cross-section data by selecting the target section. Confirm after completing the design of left and right cross-sections.



6-12-4 Super Elevation

Road super elevation refers to the outer-high inner-low pavement design at road bends, which offsets centrifugal force and prevents vehicle deviation during high-speed turning. The super elevation cross slope is generally adjusted within 1.5%~6%, complying with highway and urban road route design specifications.

Operation steps after completing standard cross-section design:

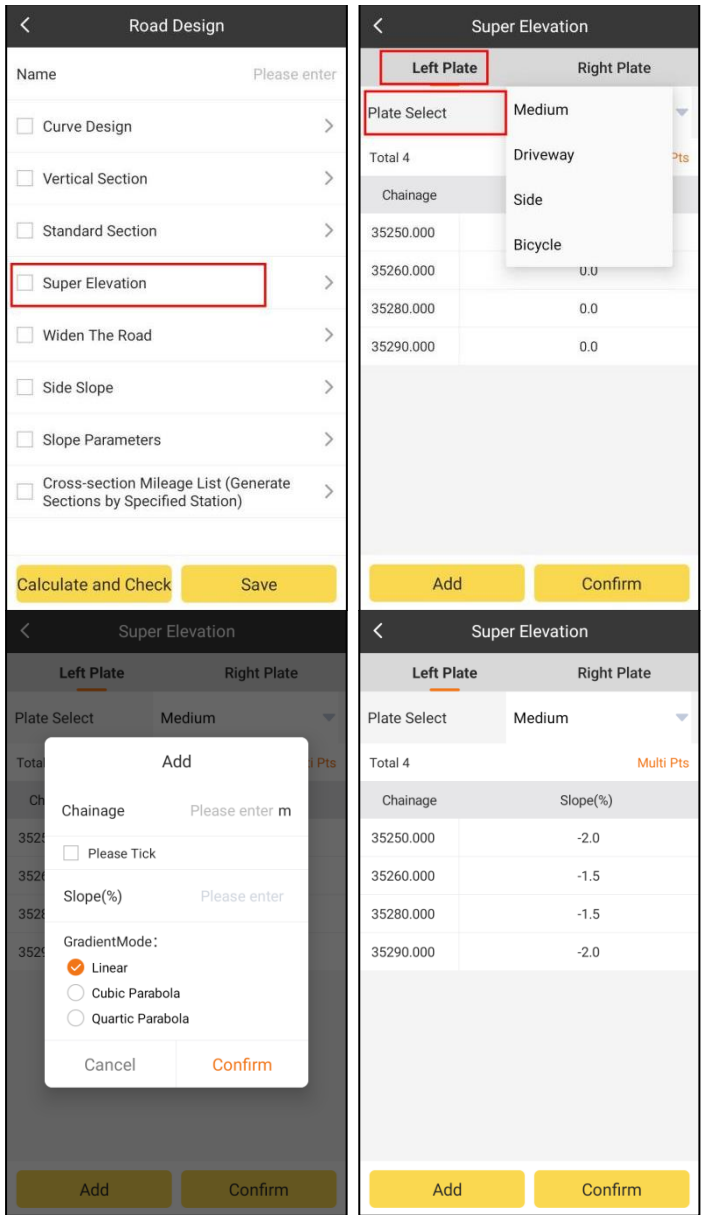
1. Click super elevation to enter the setting interface.

2. Select the left or right cross-section requiring super elevation, choose the corresponding pavement section (e.g., motor vehicle lane), and click Add.

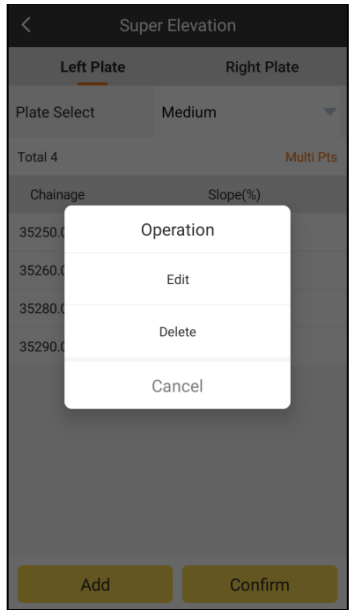
3. Input the super elevation mileage range, cross slope and transition mode in the add window, then click Confirm.

4. A complete super elevation setting requires four key sections: transition start mileage, transition end mileage, constant super elevation start mileage and constant super elevation end mileage.

Example: At mileage 35250, the cross slope of the left motor vehicle lane is -2%, linearly transitioning to -1.5% at mileage 35260; the -1.5% cross slope remains constant from mileage 35260 to 35280, and transitions back to -2% from mileage 35280 to 35290 to complete the super elevation section.



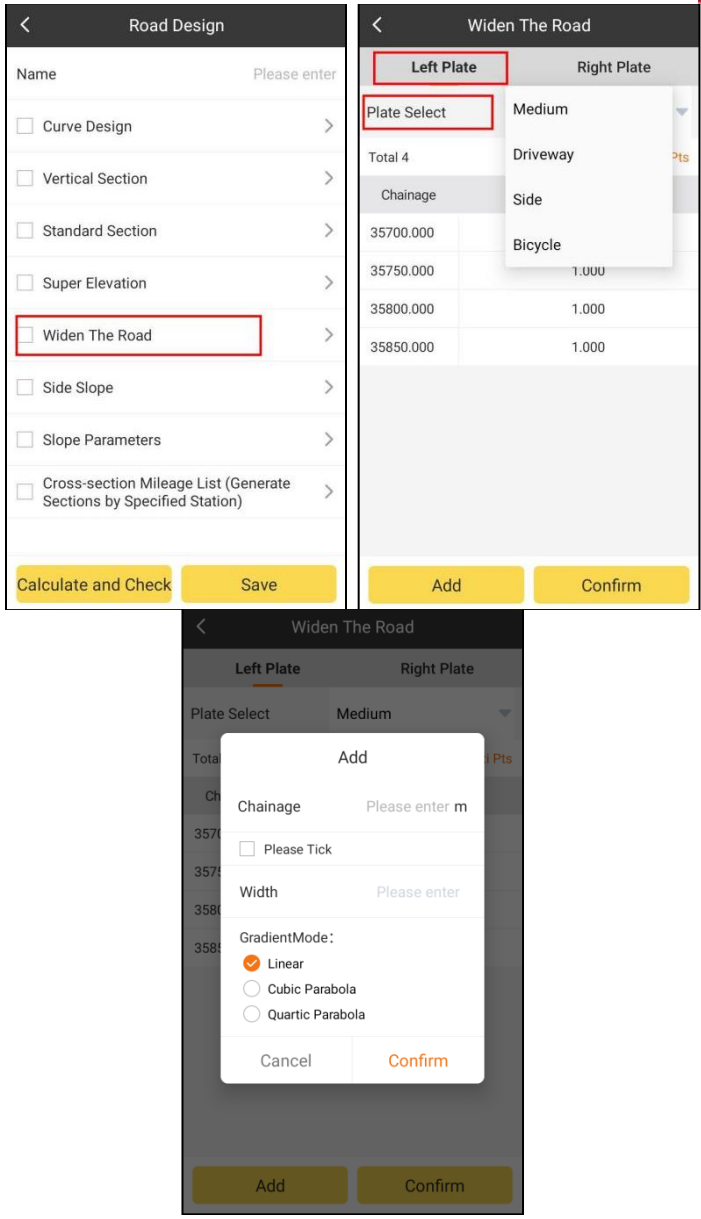
Existing super elevation data can be edited or deleted by selection.



6-12-5 Widen The Road

Vehicles have different wheel tracks when driving on curves: the inner rear wheel has the minimum turning radius, while the outer front wheel has the maximum turning radius. This phenomenon is prominent for curves with small turning radii. To prevent lane occupation during turning, curve sections with a radius less than 250m shall be widened.

Operation steps after standard cross-section design: Click widen the road to enter the setting interface. Select the left or right cross-section and the target pavement section to be widened (e.g., left non-motor vehicle lane). Click Add, input the corresponding mileage range, widen the road width and transition mode, then click Confirm.



Standard widen the road Rules

(1) Mileage 0~35700: Fixed width of 3m (standard median divider width);

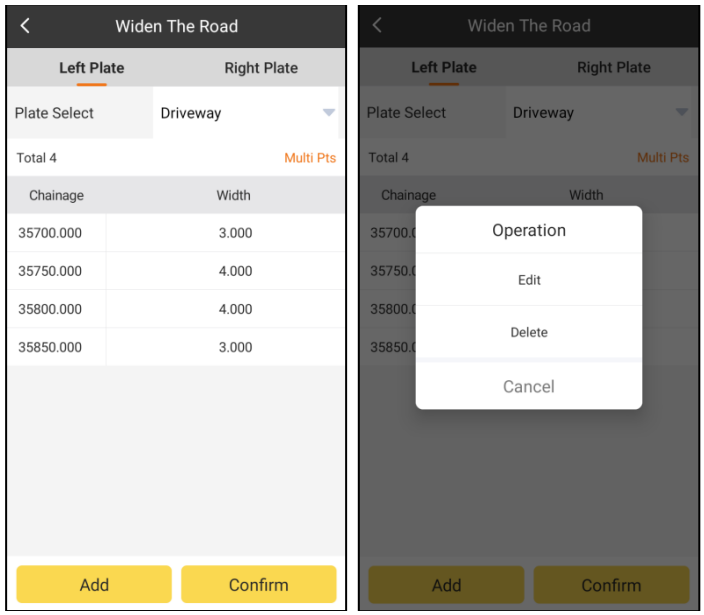
(2) Mileage 35700~35750: Width linearly increases from 3m to 4m;

(3) Mileage 35750~35800: Fixed width of 4m;

(4) Mileage 35800~35850: Width linearly decreases from 4m to 3m;

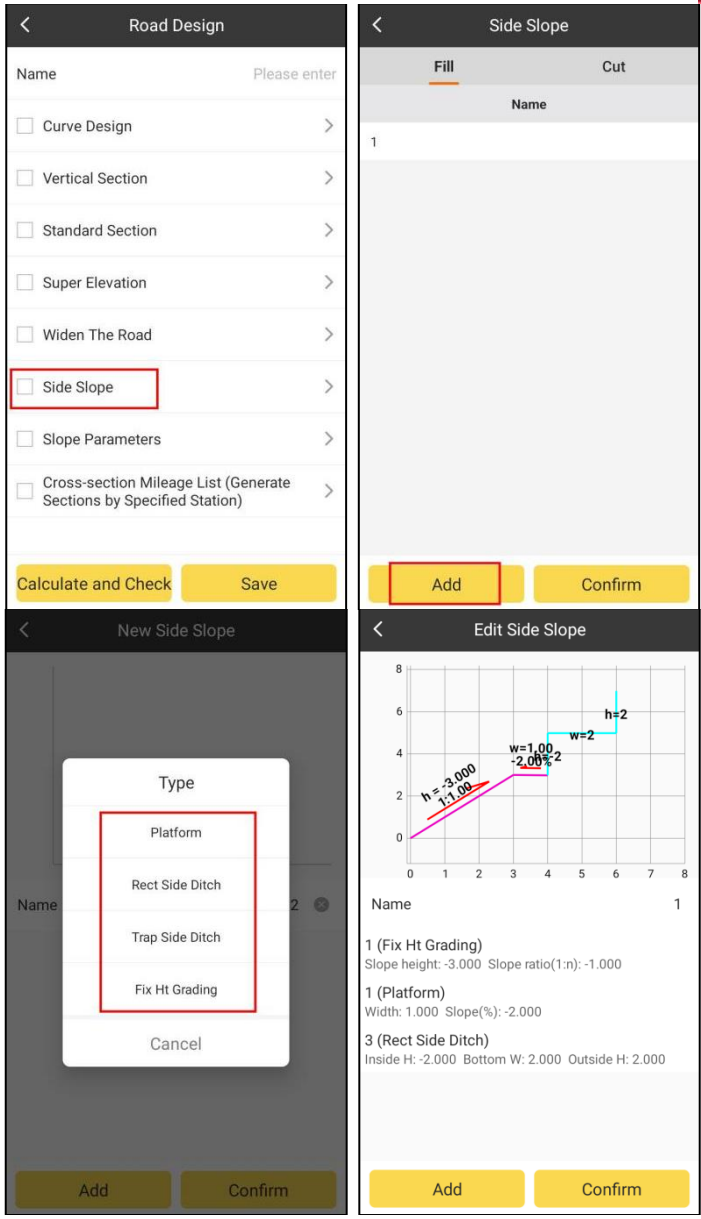
(5) Mileage after 35850: Fixed width of 3m (standard median divider width).

The whole widen the road section forms a closed transition curve. Existing widen the road data supports editing and deletion operations.



6-12-6 Side Slope

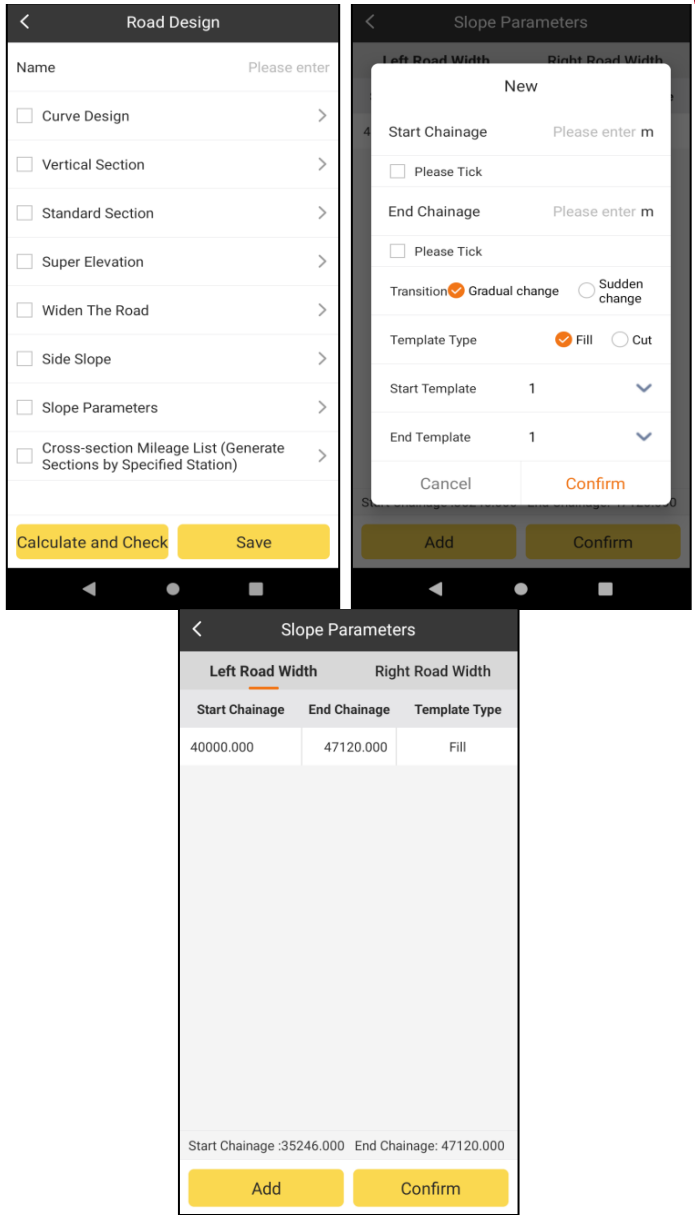
Slope refers to the inclined surface constructed on both sides of the road subgrade to ensure subgrade stability. The side slope supports adding various slope types and unified library management to meet different construction scenario requirements.



6-12-7 Slope Parameters

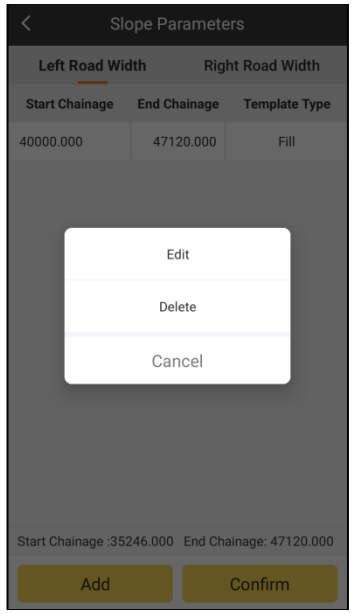
In the slope parameter interface, users can manually add, edit and delete slope parameters.

Add: Click Add in the slope parameter interface to enter the detailed editing page. Select left/right road width, set the start and end mileage of slope parameters, transition mode, and start/end slope template types, then click Confirm to add new slope parameters.



Edit: Select existing slope parameter data, click Edit to modify parameters, and save by confirming.

Delete: Select target slope parameters, click Delete and confirm to remove the data.



6-13 GIS Survey

GIS survey can define the required feature attribute database and collect shape data containing various required feature attributes, which is convenient for post-processing of GIS data in the later stage.

1.For the new project, we need to import or input a feature manage database. Click  and enter to feature manager page. We can also click the layer bar to enter to it.

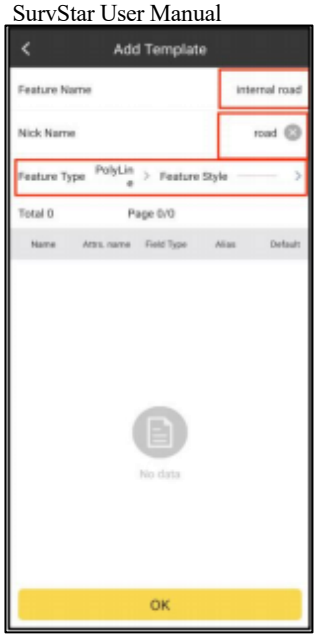


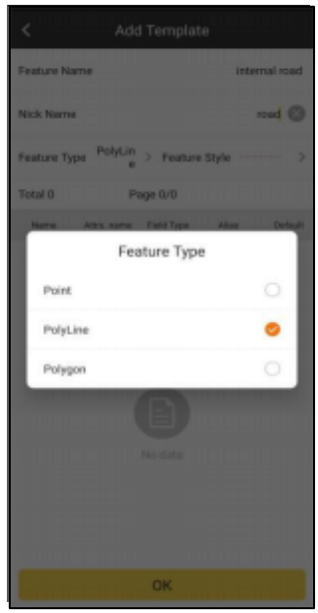
2.In feature manager, we can add, edit, delete, import and export the features.

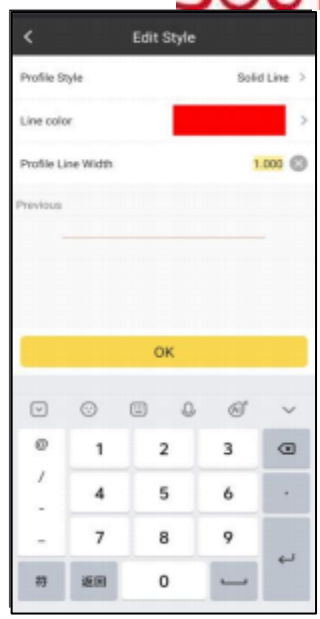


Add:

Click Add input the feature name and nick name, choose the feature type (Point/PolyLine/Polygon) and set the feature style, then click OK.





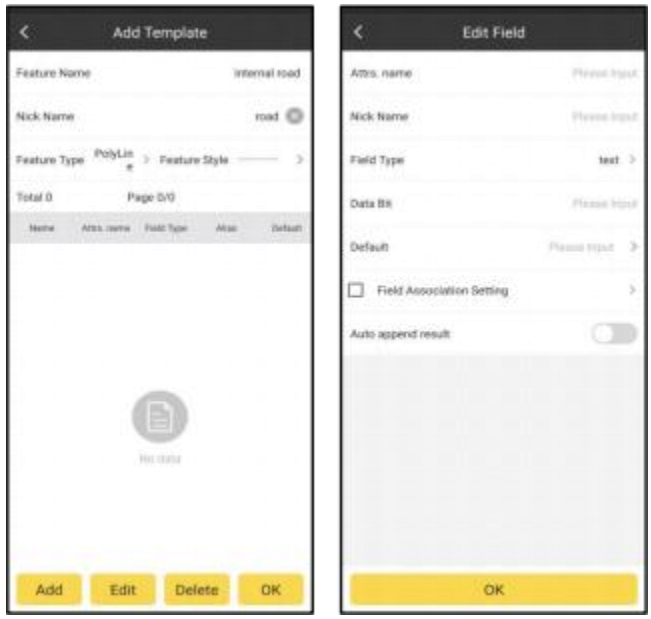


Then we need to add the attribute of it, click Add. Input the Attributes Name, Nick name, Field Type and click OK. If the input of the attributes finished, click OK.

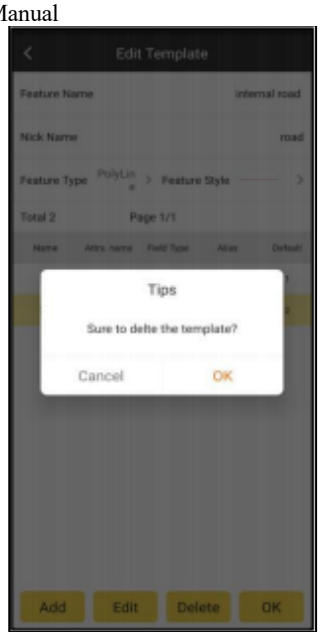




Edit: Select any feature, click Edit, then we can edit it.



Delete: Select any feature, click Delete, then we can delete it.





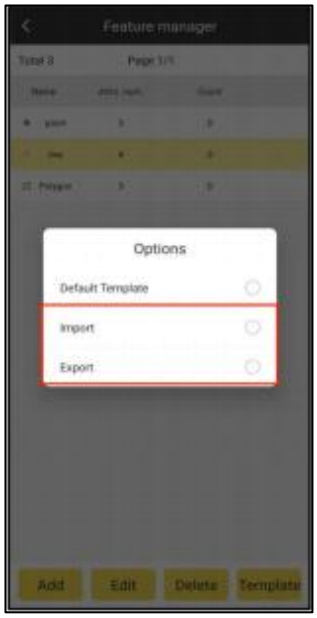
Default Template:

Click Template and click Default Template , there will load the default template to it. It has three features: Point, Line and Polygon.



Import/Export Template:

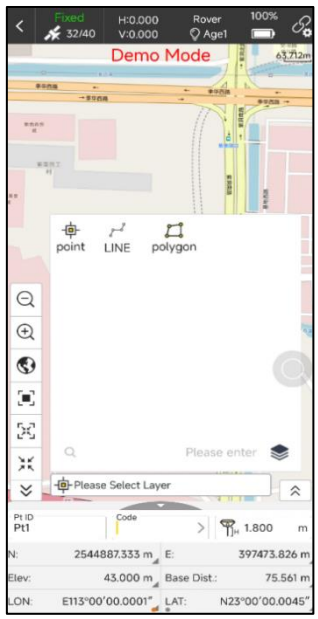
Click Template and click Import /Export , there will load the default template to it. It has three features: Point, Line and Polygon.







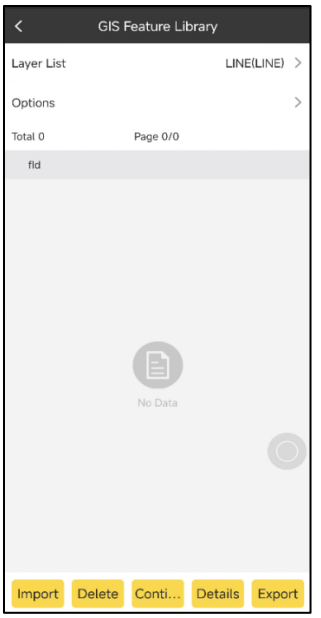
3. After the feature manager completed, we can use it by clicking the below layer bar. Select the feature and then we can start GIS survey.

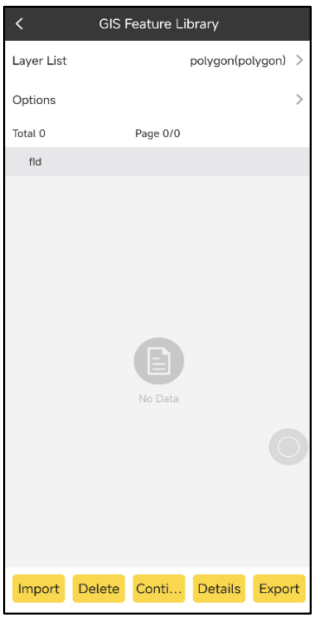


4. And then we can select a layer start to do GIS survey.

: Click this, we can edit the attributes of current feature.

5. We can check and manage the shape in Geometry Database. Clic and enter to GIS Feature Library. In GIS Feature Library, it can import/export shape file(*.shp), delete and continue to survey the feature.

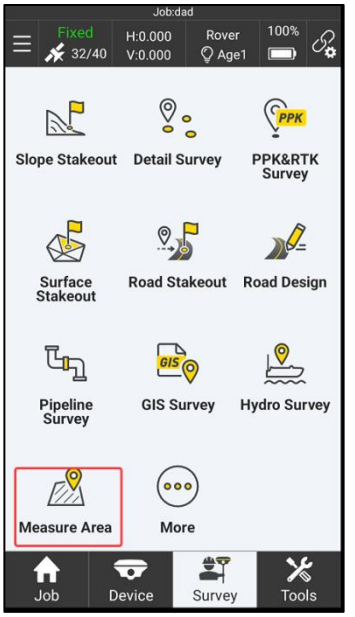


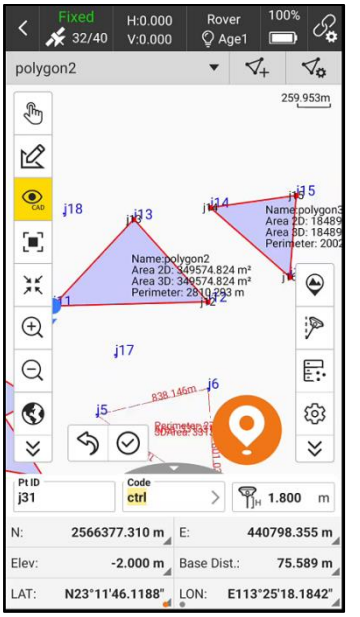


6-14 Sea Survey

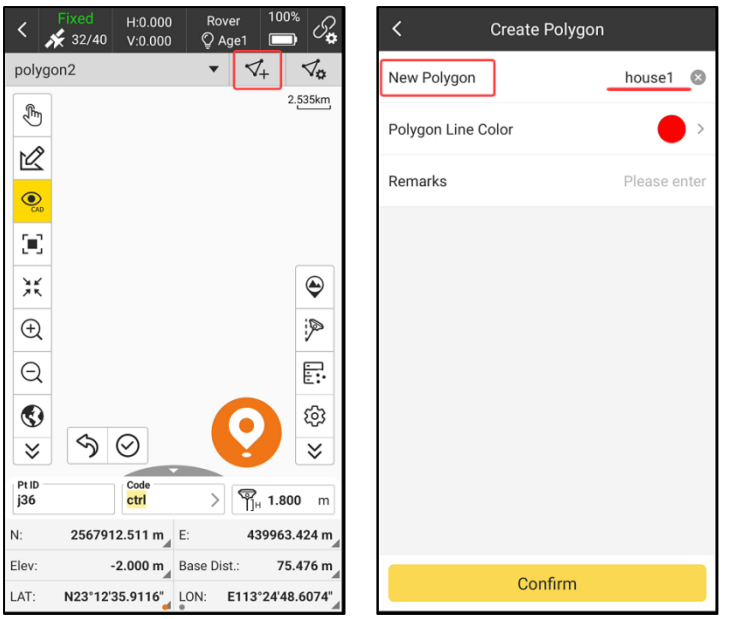
This function is being improved and tested.

6-15 Measure Area



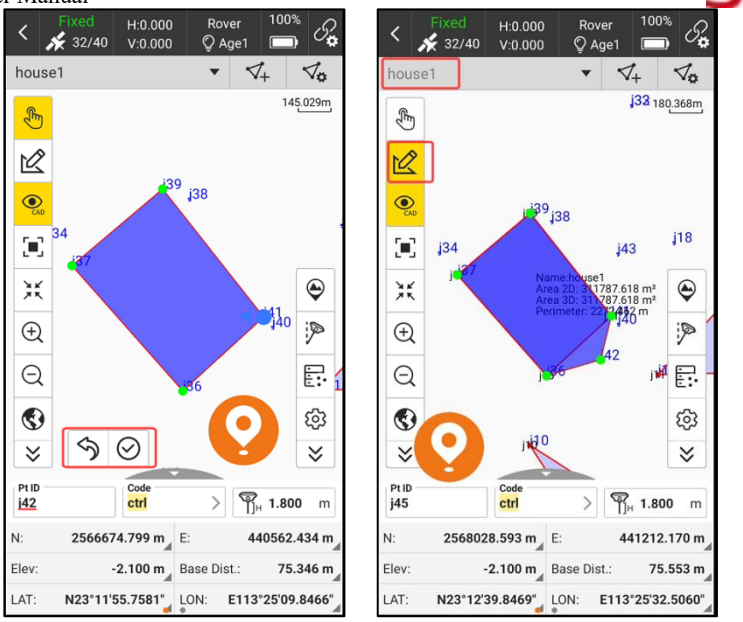


Measure area is mainly used for measure a polygon and calculate its the side length, area and perimeters.



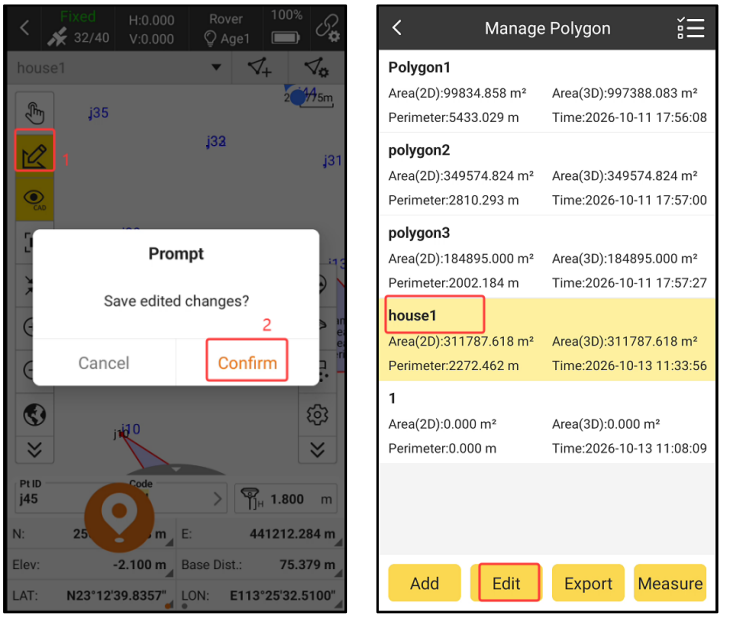
How to create a polygon and measure its area, perimeters and side length?

Click  to add a polygon and give a name and remarks.



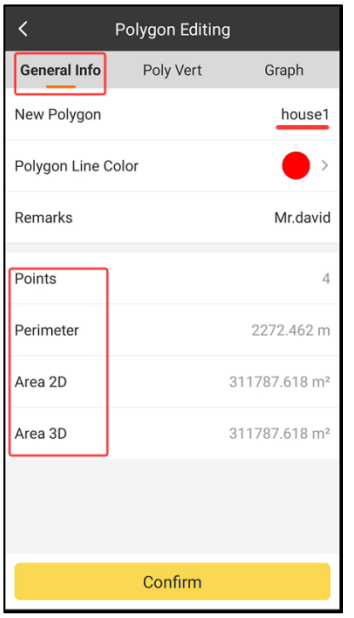
Click ⊘ to complete the measurement for a polygon as above.

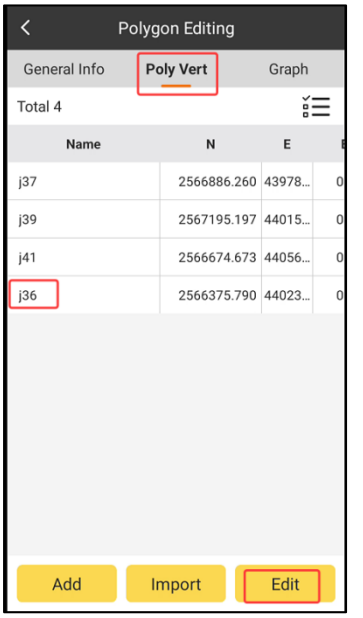
If there is something wrong with the polygon's vertex, you can choose this polygon, then edit it. By using your finger to re-select the points in your need , a polygon will be edit. Above shows we re-select some points (j36-j37-j39-j41-j42) to re-form the polygon house1.

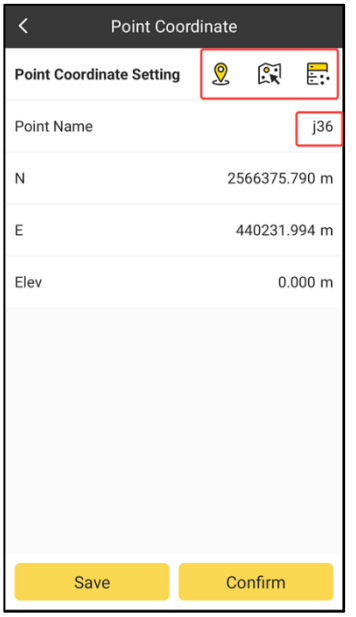


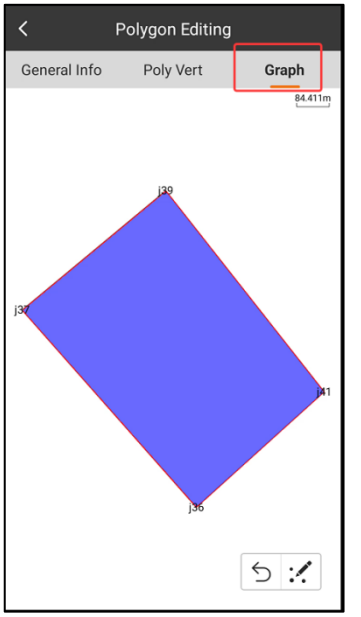
After editing you need to click on button to save the change for selected polygon house1 as above.

Click on  we can check all polygon in lists, select a polygon and click on Edit.



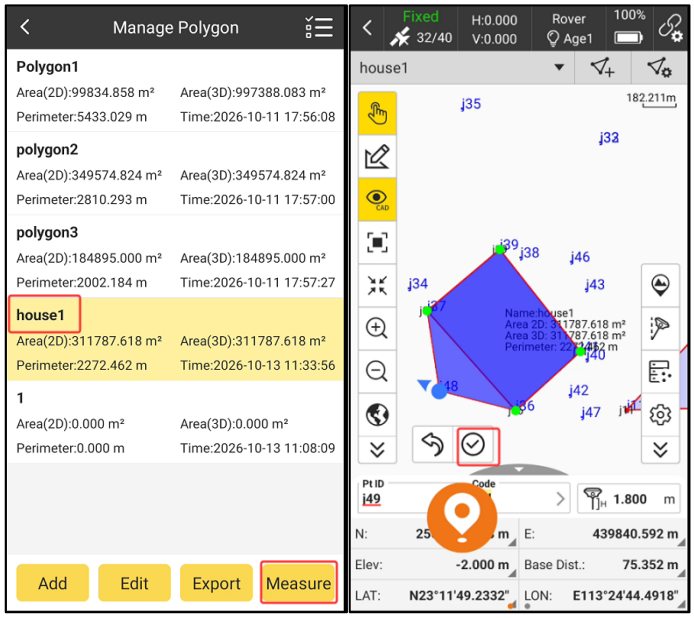






If we want to use another point to replace j36 vertex, we can measure a new point or select a point from map or point libray as above.

By clicking graphic the selected polygon will be displayed as above.

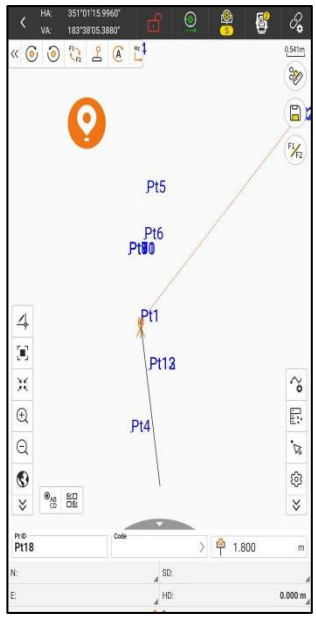


If you find a polygon (house1) is not complete, you can click on Measure button and continue to measure more points to complete this polygon as above.

Chapter 7 Survey – Total Station

7-1 Point Survey

Click Survey->Point Survey to enter this interface.





: Displays information about the current angle of the device.


: APR(Automatic Prism Recognition) and Track (Prism tracking) On/ Off.


: Selection of different measurement targets, measurement modes and whether the laser pointer is switched on or off.


:Lock status (To show the status of locking prism)


:E-bubble and Setting button

:Selection of different device connection

:Set Horizontal angle :Joystick(Manual/Auto)

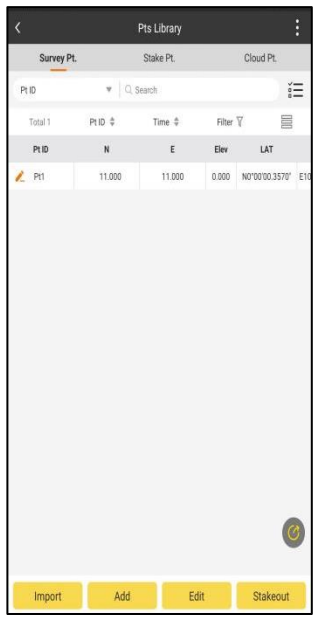
:Change face :Power search(clockwise)

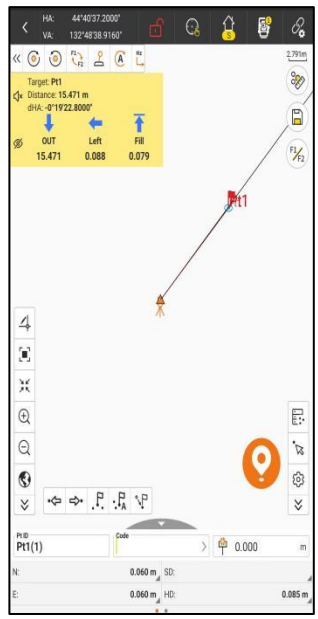
:Point Turn/Angle Turn :Power search(anti-clockwise)

Note:The meaning of other icons is explained in Chapter 6-1

7-2 Point Stakeout

Point stakeout is the process of inputting target coordinate in software and stakeout in field. By clicking this, we will enter to points database. Select any point, and click OK. Then we will enter to the point stakeout page.





Arrows in left bar describe as follows:

To Forward/Backward: distance that receiver needs to move Forward/Backward from current position to stakeout point. To Forward arrow shows up and to

Backward arrow shows down.

To Left/Right: distance that receiver needs to move Left / Right from current position to stakeout point. To Left arrow shows left and to Right arrow shows right.

Fill/Dig: dig in stakeout point position. If the value is positive, perform excavation; if not, perform fill. If current height is higher than stakeout point arrow shows down. If current height is higher than stakeout point arrow shows up.

：open/close stakeout voice prompt.

：hide or show left arrow bar.

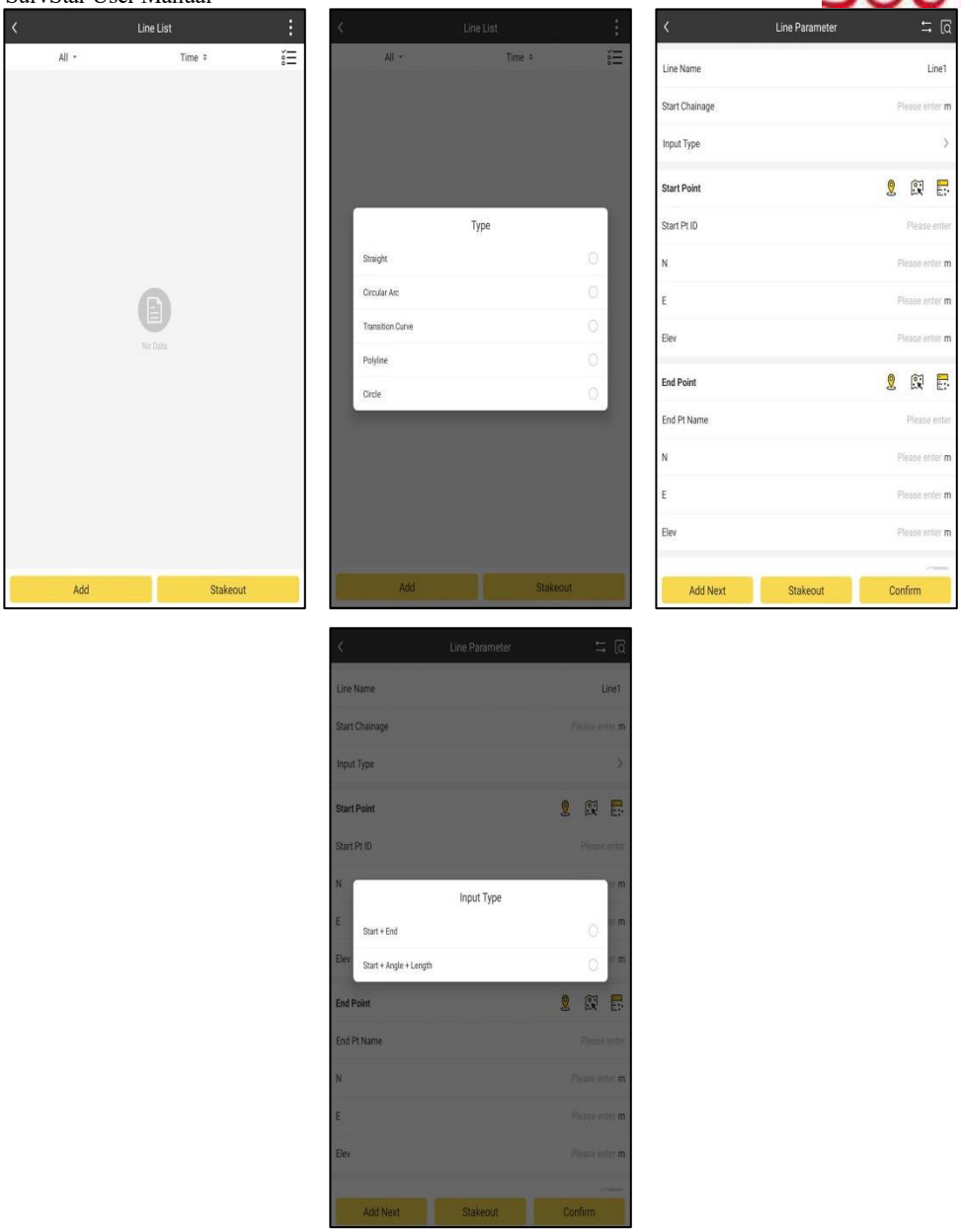
Point stakeout steps:

1. Select a point to stakeout in the points database, then click OK to enter points stakeout page. Red flag is target stake point. Circle is current position of receiver. Arrow is direction indicator, indicating the direction of current receiver. When the arrow direction is same with the direction to the target point, please move in this direction, then you can reach the target point.
2. According to left status bar, move from the current point to the stakeout point, and excavate or fill the soil according to the height difference of the elevation.
3. When current point is within prompt range, there will be three concentric circles, which indicate it enters precise stakeout.
4. After you reach the stakeout point, please stake it.

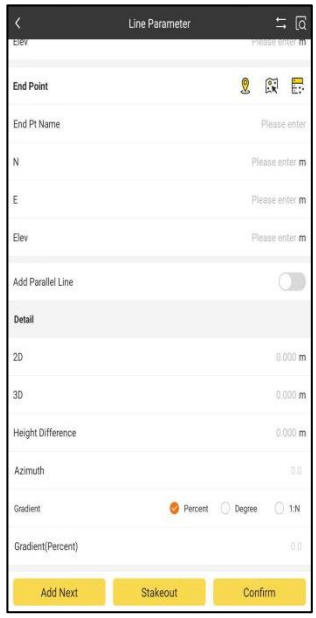
7-3 Line Stakeout

Line stakeout is the stakeout of designed line, including line mileage, left and right offset and elevation control within line. By clicking this, we will enter to Line List.

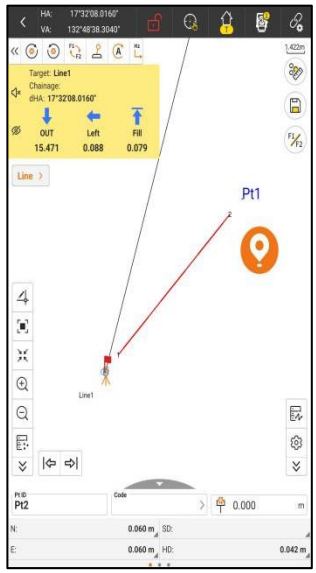
Click "Add" to select the type.：straight、circular arc、transition curve、polyline、circle. And we can designed line with Line Name, Start Chainage,the Start Point, End Point and Detail . We can also import line file(*.SL).



Select any line, and click OK. We can set the settings of stake, it including Chain Pile Stake On/Off, Auto Stake Nearest Point On/Off, Mileage, Range, Calculating Method and Stake interval. Click OK.



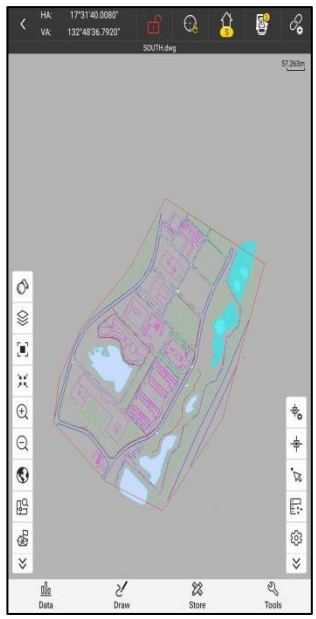
Then we will enter to the line stakeout page.



It can set line stakeout settings, including Prompt Distance, Reference Direction (Forward, North); settings for Topo Point, Inform and Tool Bar are the same as that of Point Survey. Click Default settings and it can restore the changed settings.

7-4 CAD Stakeout

CAD is mainly used to stakeout lines in the existing CAD graphics. By clicking this, we can enter to the CAD page.



：CAD Layer.

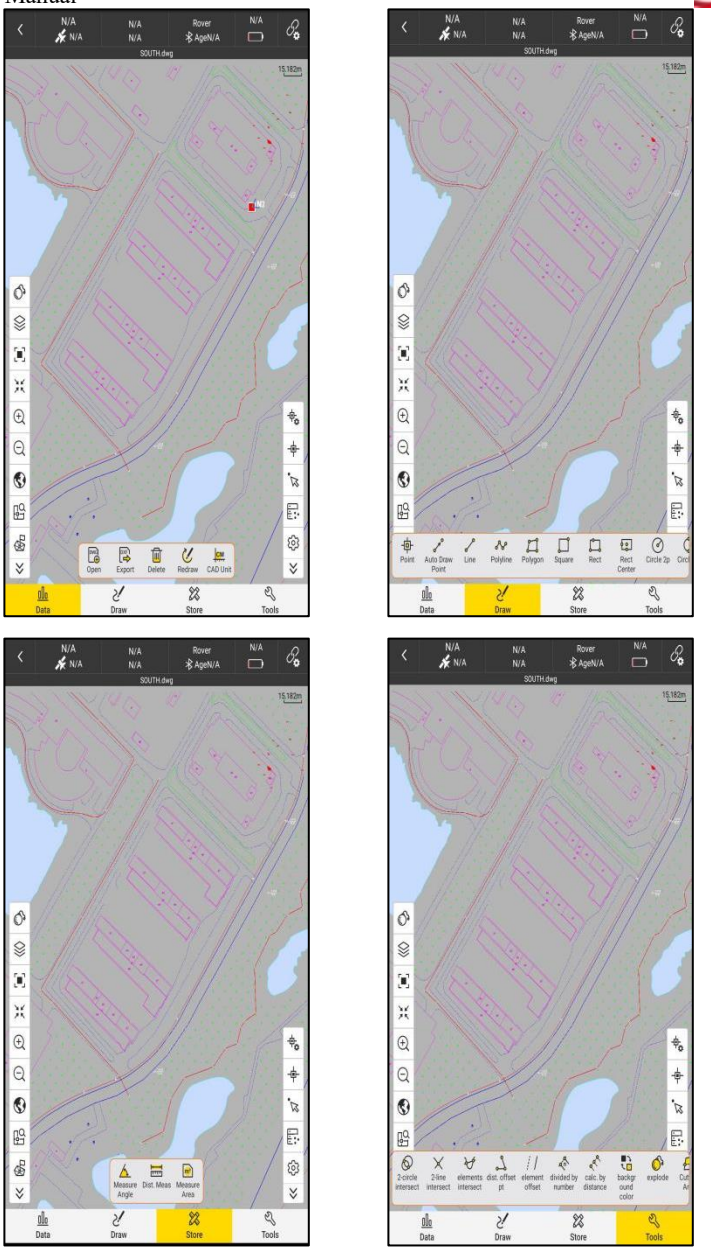
We can manage and check the CAD layer by clicking this icon



：Import CAD file(*.dxf/*.dwg).

：By clicking this, there will be an arrow when touch and hold to move on the screen. The place indicated by the arrow is the place of the target point. It can also show the coordinates of this point in the top of the page.

:Select target line.

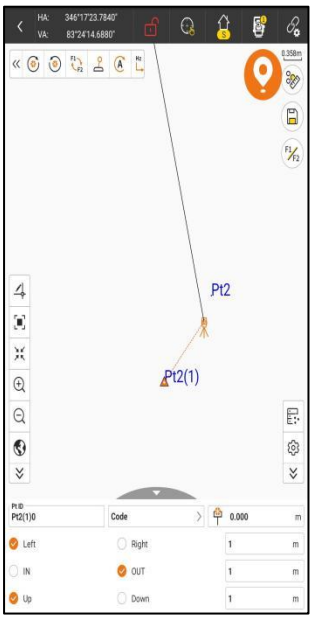


There are four modules in CAD stakeout.Click Data to open or export the dxf, dwg,ifc,xml,pdf file.Click Draw ,there are multiple ways to render graphics. .Click Store ,Measure Angle、Dist Meas and Measure Area. Click Tools ,there are many practical tools available.

7-5 Dist Offset

The distance offset calculates from measurement or coordinates with longitudinal,

parallel offset and height differences of the target point relative to the known point.

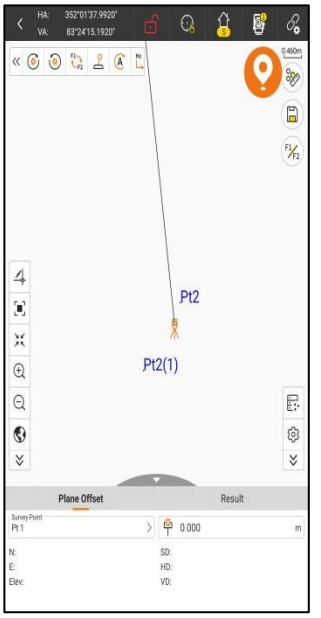


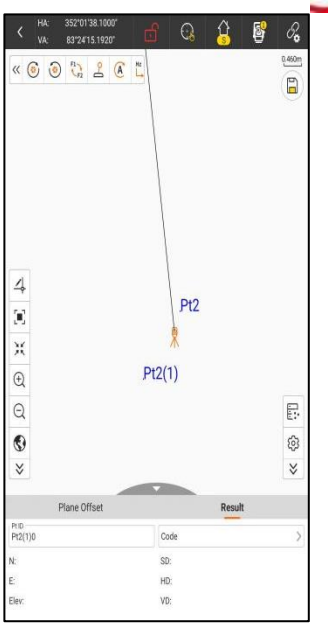


Click Dist Offset to into this interface.Input lateral, longitudinal and altitude offset.Click result , measure and calculate the offset coordinates.

7-6 Plane Offset

This function calculates the points which cannot be measured directly.

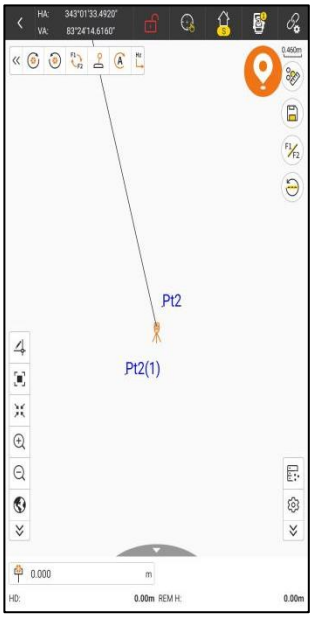




Click Plane Offset to into this interface. Measure three points in the same plane. In the software, it will turn to result interface automatically. Rotate the telescope, aim at the unreachable point in this plane.Click save to save the coordinate.

7-7 REM

When the target is hard to reach or hang in the air, for example, the electric cables, REM (Remote Height) can help you measure the point.



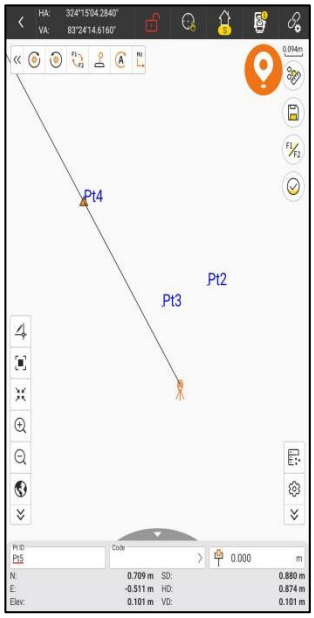
Click REM to into this interface. Before measuring, set a prism vertically under the target. Input target height and measure. Rotate the telescope to the target.It will show the REM Ht automatically.

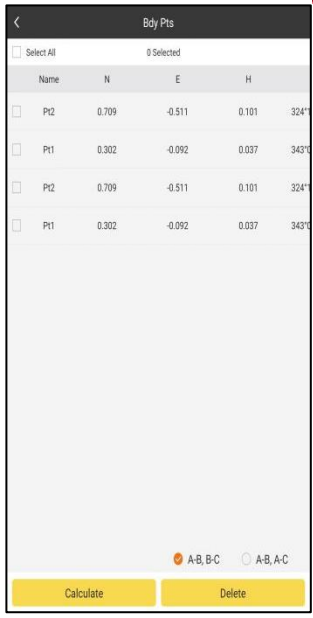
7-8 MLM

MLM, is mainly used to compute the HD/VD/ SD/azimuth between two points.

1.MLM Radial(A-B, A-C) , lock the start point

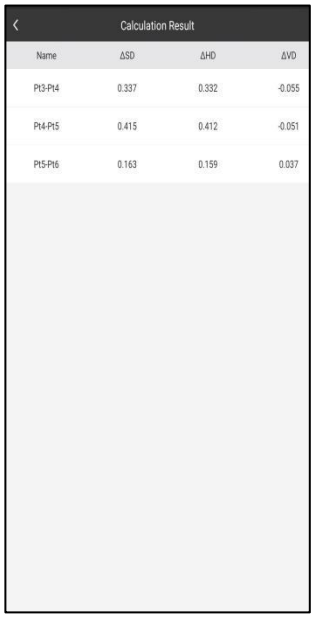
2.MLM Cont. (A-B, B-C) , unlock the start point.



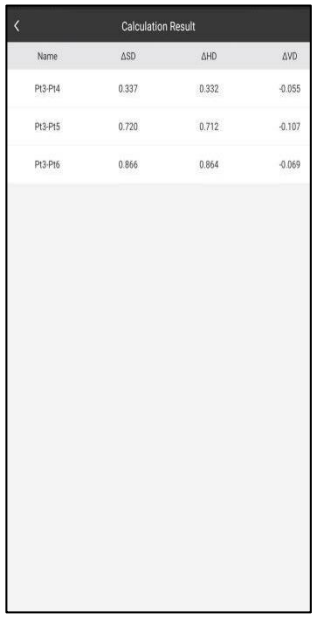


Click MLM to into this interface.Measure points that need to be measured.

Click  to into the second interface where points and calculate methods can be selected. After selecting points and calculate method, click Calculate to get the result.



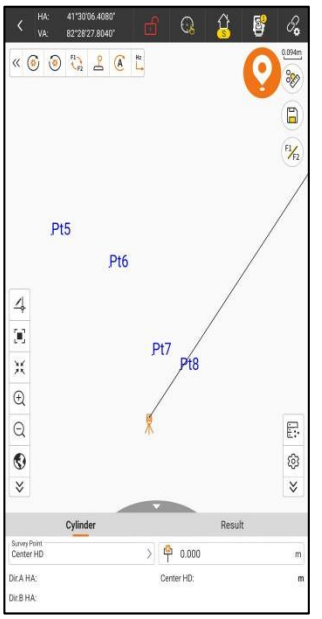
(A-B, B-C)



(A-B, A-C)

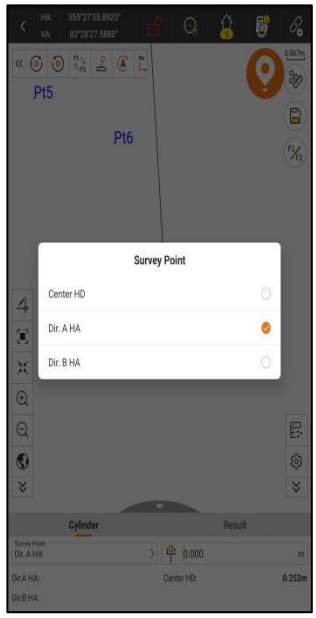
7-9 Cylinder Center

Cylinder Center is widely used in measuring a hidden point that is not directly visible, for example the center of column as picture shown. Measure the left and right edge of column. Then measure the center point in surface.



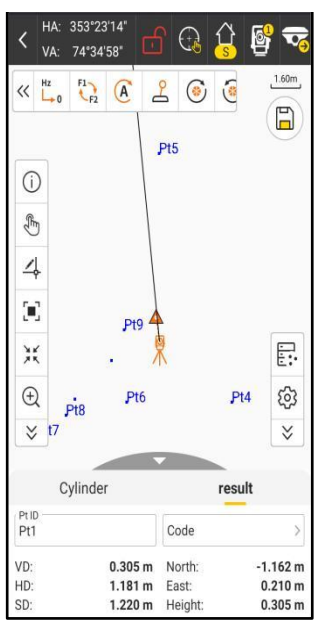
Click Cylinder Center to into this interface. Measure three parameters separately.







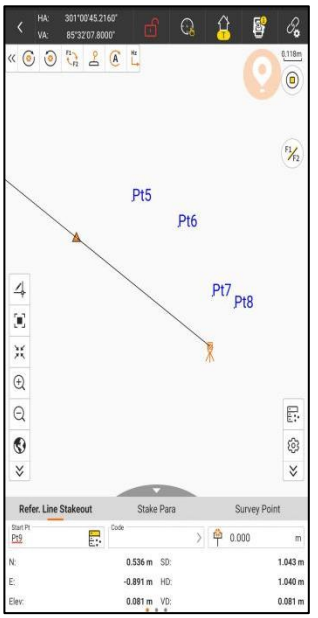
If there is no special requirement, after measuring the first parameter, it will automatically jump to measure the second parameter. Measurement parameters can be selected manually.

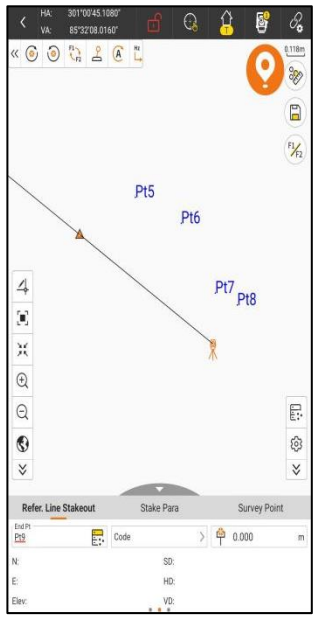


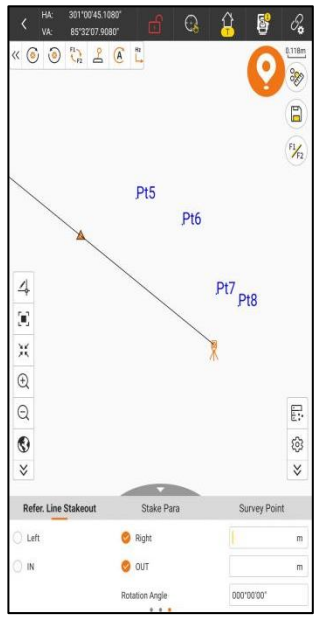
After measuring three parameters, it will turn to result interface automatically.

7-10 Refer.Line Stakeout

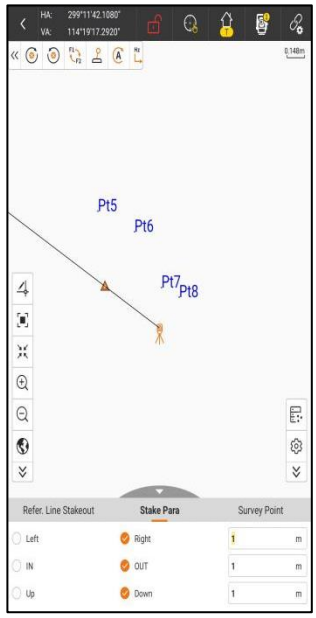
Reference Line application can be used to stake out or measure points relative to a line. The points are staked from a reference line (shifted from a baseline), and the related offset. The reference line can be offset either longitudinally or latitudinally to the baseline (defined by two known points), or be rotated around the first base point as required.



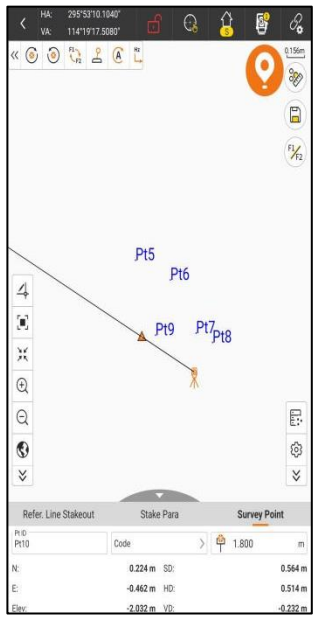




Click Refer.Line Stakeout to into this interface.There are three page to confirm the line. Measure the start point and end point, and set up the distance and the rotation of the line.Steps: Aim to the start point and measure,then pull left to into next measure page.Aim to the end point and measure, then pull left to into next setting page.Set up the distance and rotation angle.



Set up the parameters about lateral, longitudinal and altitude offset.



Turn into the interface of the staking out.

7-11 Refer.Arc Stakeout

The reference arc is used for measuring and staking where the axis is an arc. The arc is determined by the center of the circle plus the radius, or the center of the circle plus a point on the circle, or three points on the circle where the arc is located. The direction of the reference arc is the same as the clockwise direction. The offset of the reference arc is determined according to the plumb line between the measurement release point and the reference arc, and the mileage is determined according to the direction of the reference arc.Stake out an arc by center/start point, start point/end point/radius and the others factors.

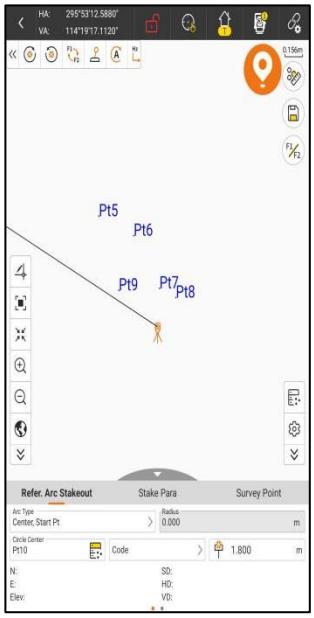


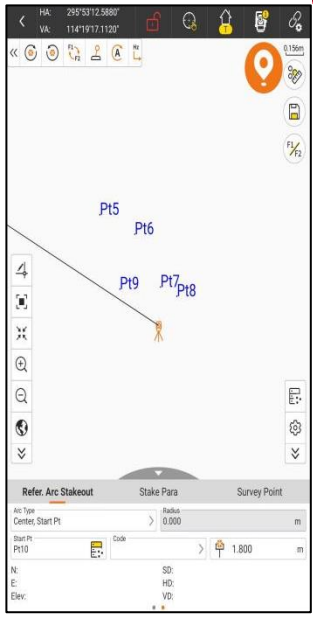
Click Refer.Arc Stakeout to into this interface. There are three methods to select.

1.Center point and start point

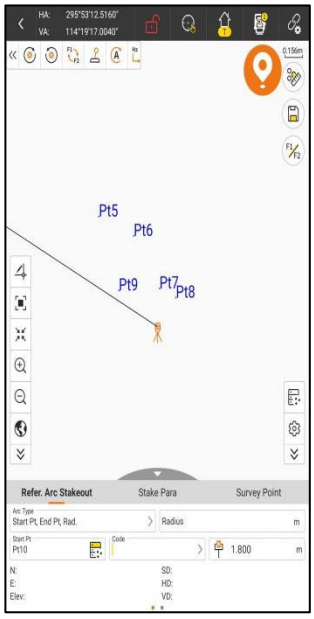
2.Start point, end point and radius

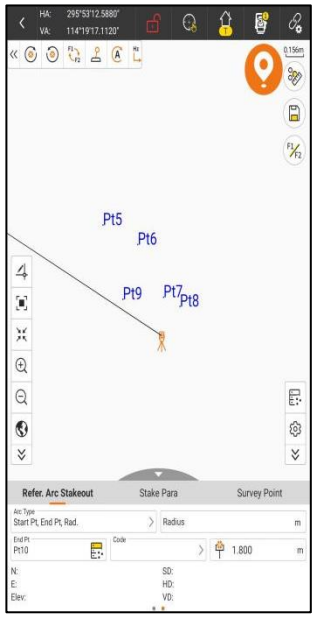
3.Start point, end point and point on Arc.



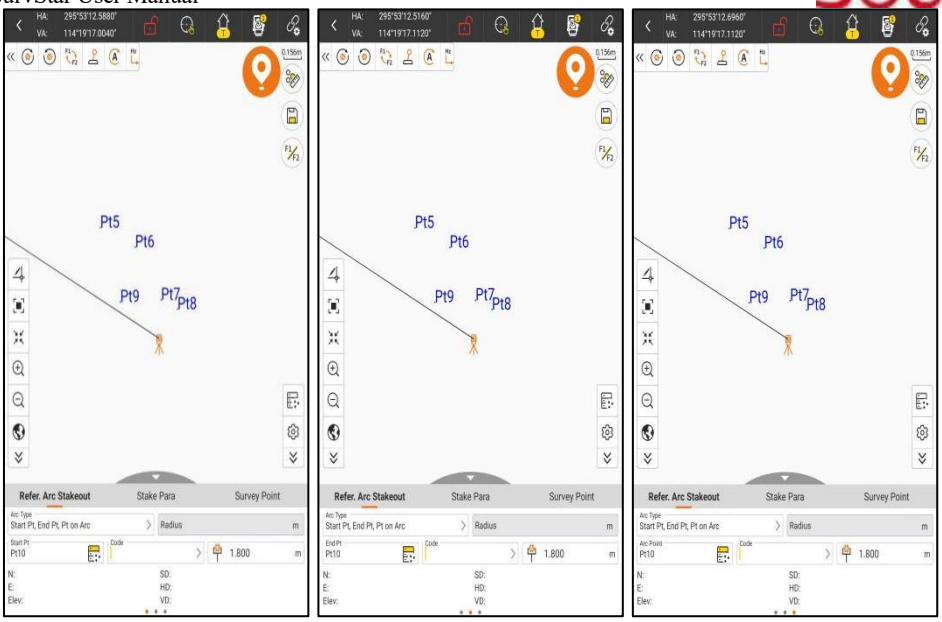


Method 1:measure center point and start point.



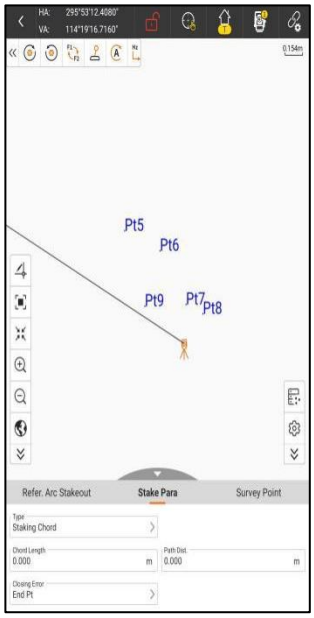


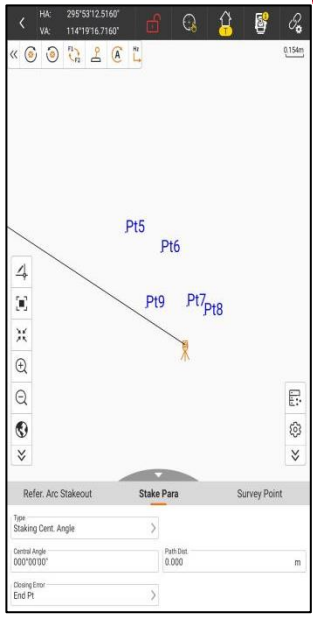
Method 2: measure the start point,end point and input radius.



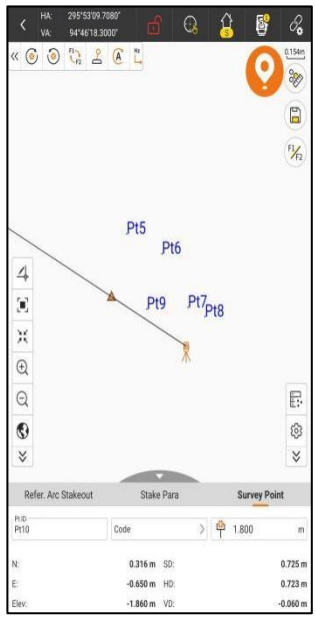
Method 3: measure the start point, end point and arc point and input radius.







Set up the stake parameters

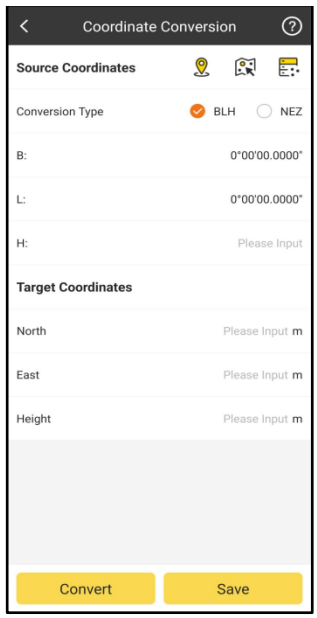


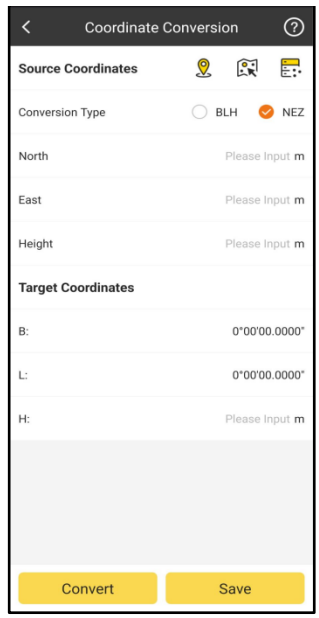
Turn into the interface of staking out.

Chapter 8 Tools

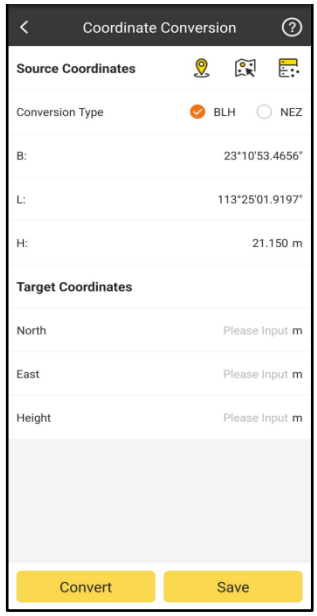
8-1 Coordinate Converter

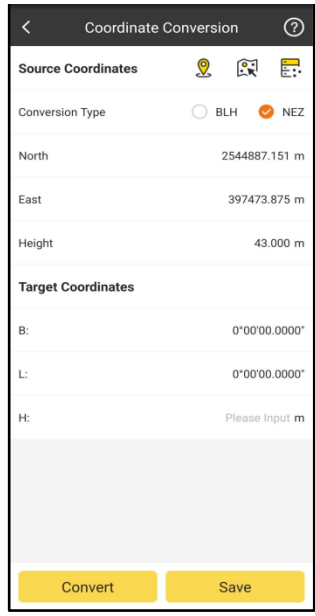
By clicking this, we can convert coordinate from BLH to NEH or from NEH to BLH in the current Job parameters. We need to select the Conversion Type firstly.



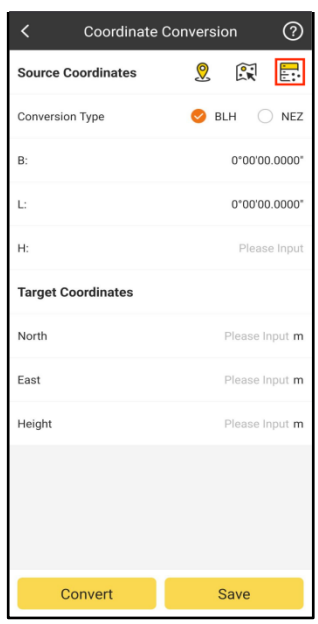


We can input coordinate directly.

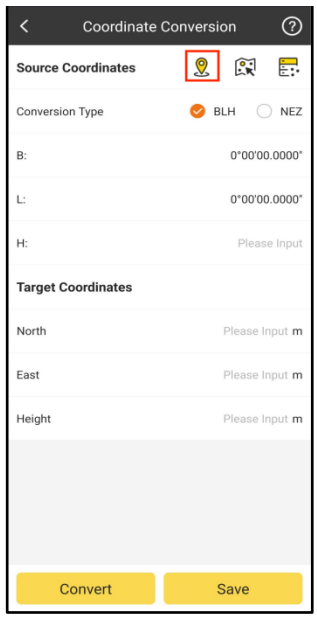


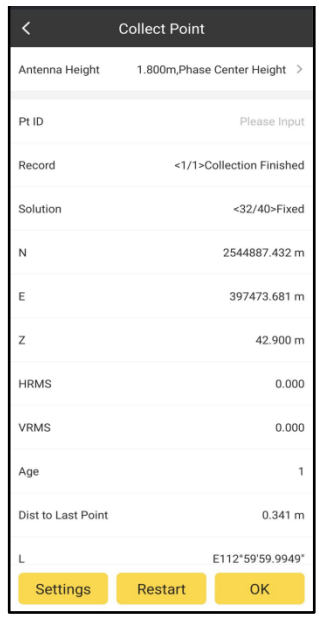


If we have the surveyed point in database, we can click the icon in the right of the Source Coordinates bar. And select a point. Click OK. Then the BLH or NEH will input automatically

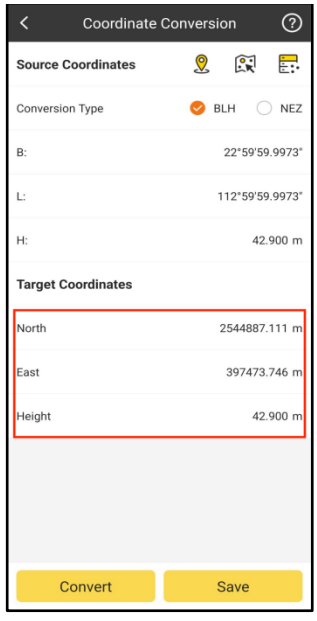


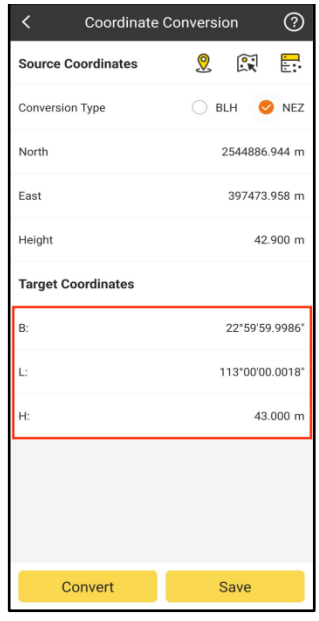
We can also put the device in the point and collect the coordinate in site. Click the icon the right of the Source Coordinates bar. And click OK to collect it.



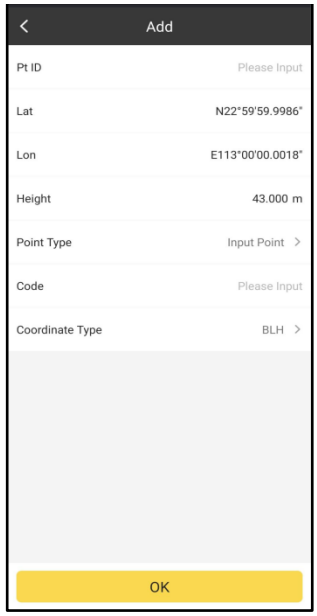


Click convert and the target coordinates will be calculated and shown in the below bars.



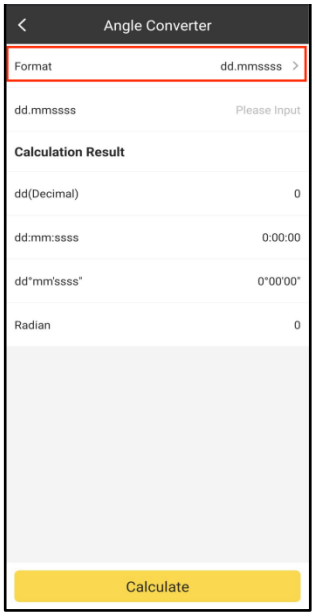


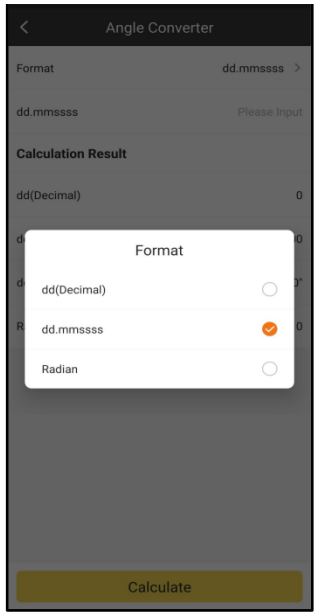
We can click Save to add the calculated coordinate to the point database.

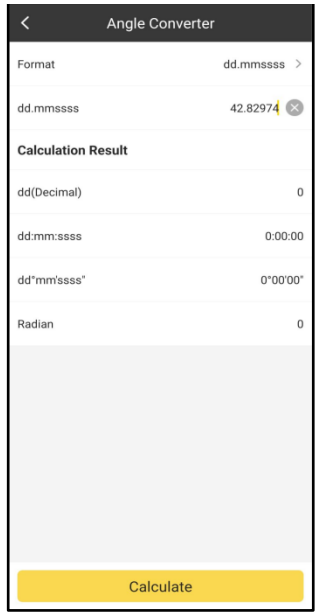


8-2 Angle Converter

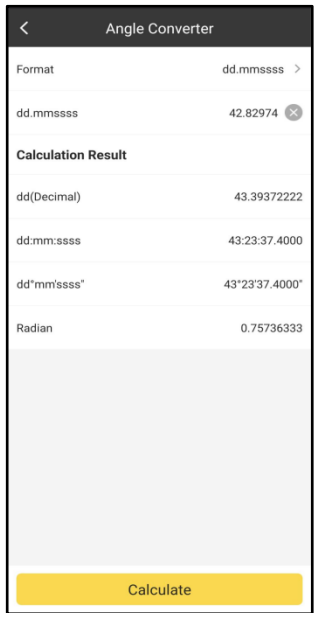
We can convert the angle format in this function. Select the input format and input the angle.





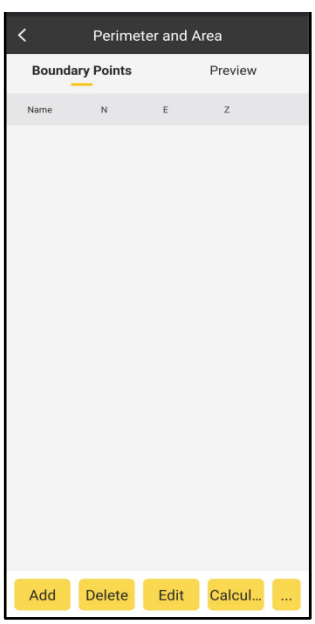


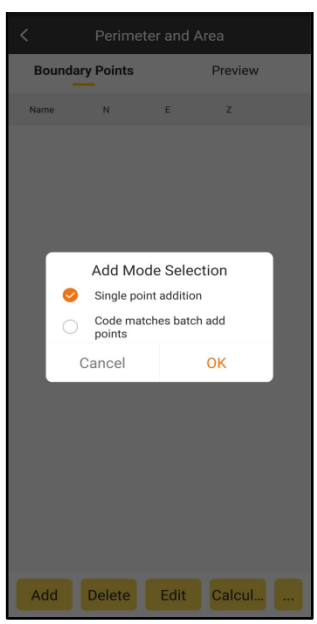
Click Calculate .Then it will be converted to other formats



8-3 Perimeter and Area

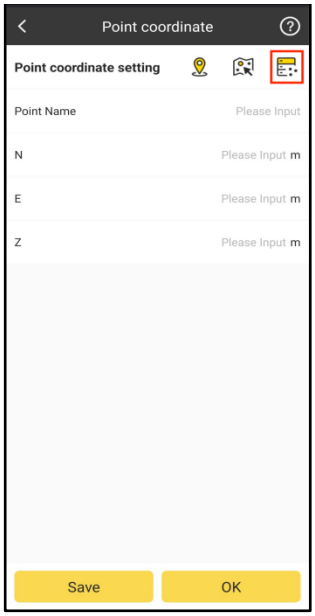
We can use the coordinate of the points to calculate the perimeter and area. Click Add We can input the point directly.

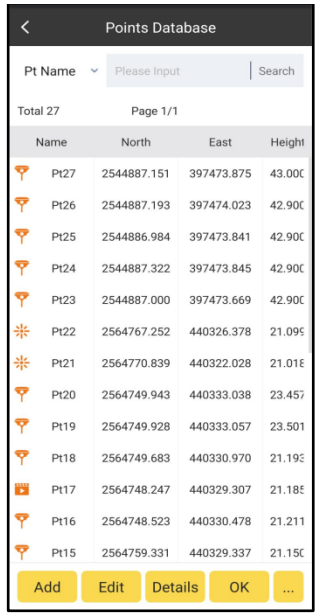






If we have the surveyed point in database, we can click the icon in the right of the Point





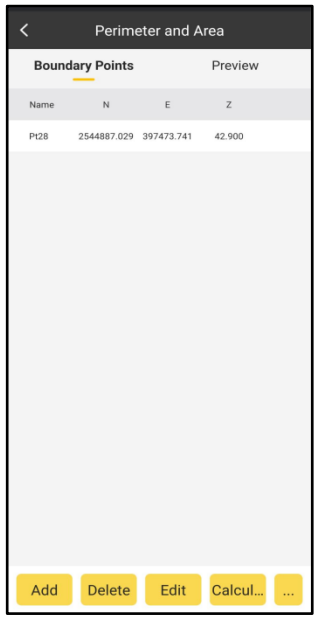


We can also put the device in the point and collect the coordinate in site. Click the icon in the right of the Point coordinate setting bar. And click OK to Collect it.



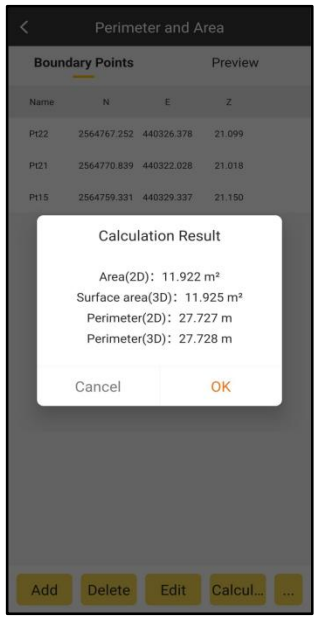
Click OK

. And the point will add to point list.

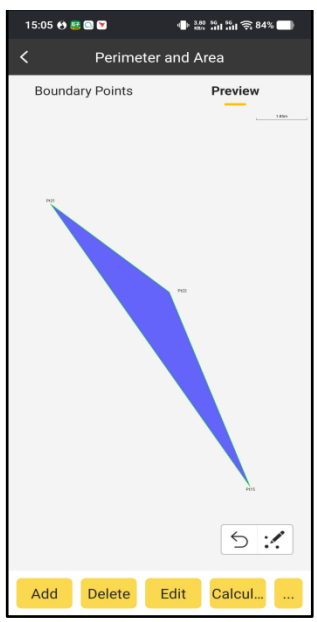


We can delete or edit a point after selecting it and then click Delete or Edit.

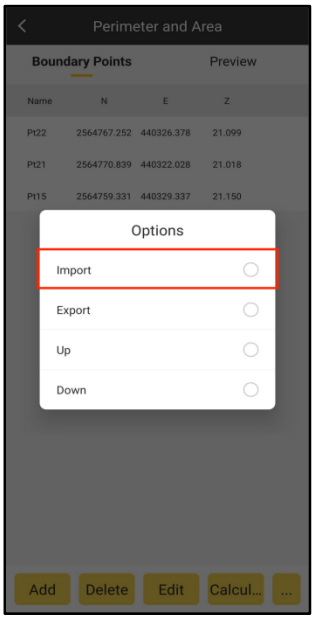
When we finished the input of the points, then we click Calculate and there will show theresult of perimeter and area.

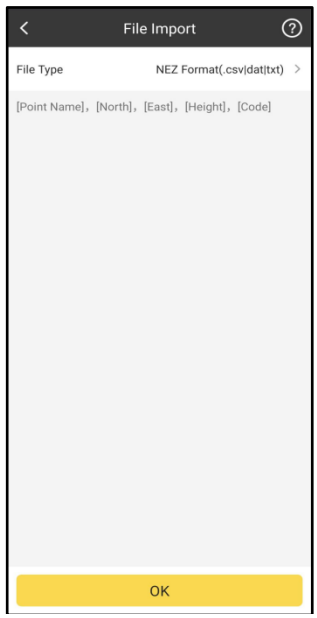


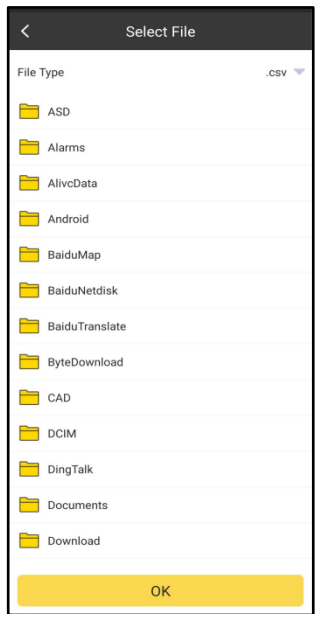
We can check the shape of the polygon by click the Preview



Click ... and click import . Select the file type: NEH Format(*.csv|dat|txt) or Cass Format(*.dat). Click OK. Select file path and click the file. Click

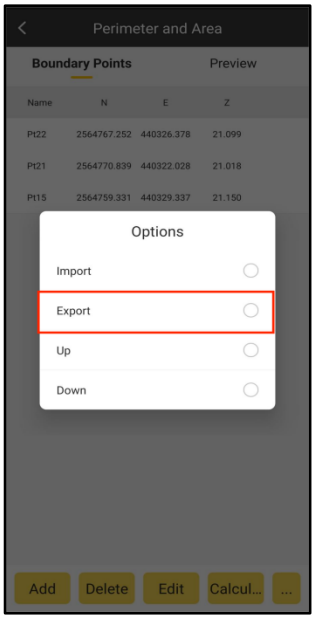


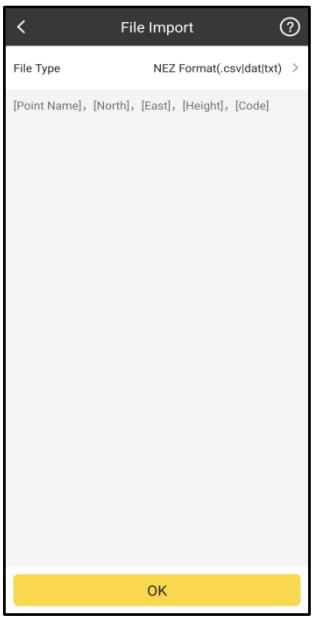




Export:

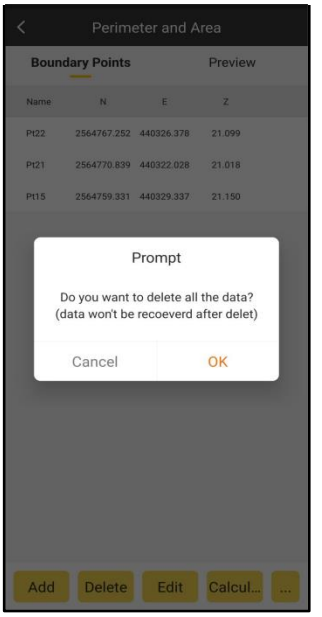
Click ... and Click Export . Select the file type: NEH Format(*.csv|dat|txt) or Cass Format(*.dat). Click OK . Select file path. Click OK





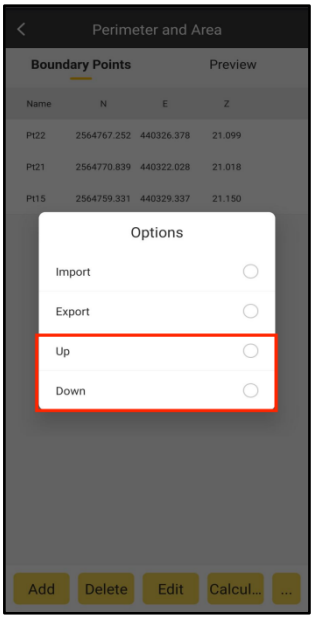
Delete Selected data:

Click Delete.Click OK.



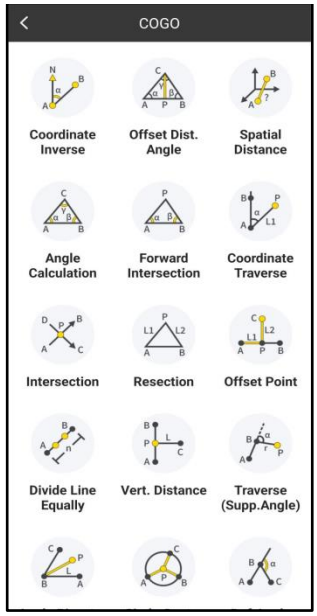
Up/Down Point:

Select a point, click ... and click up / down. Then the selected point will move up/down.



8-4 COGO

Click COGO to enter to this page. According to the known coordinates, it can figure out position relations between point and point as well as between point and line. It includes Coordinate inverse calculation, Point line calculation, Vector, Two Lines Angle and other calculation, which will be introduced in the following.



The following three icons in COGO Calculation mean:

: Collect current coordinate.

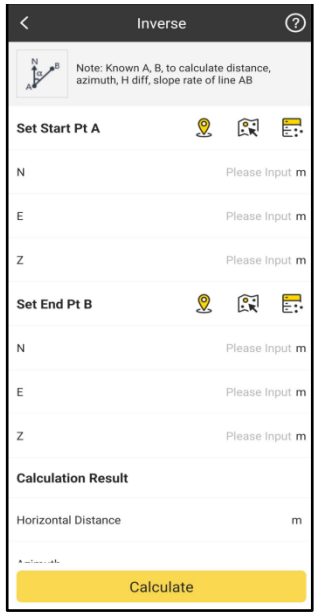
: Points Database.

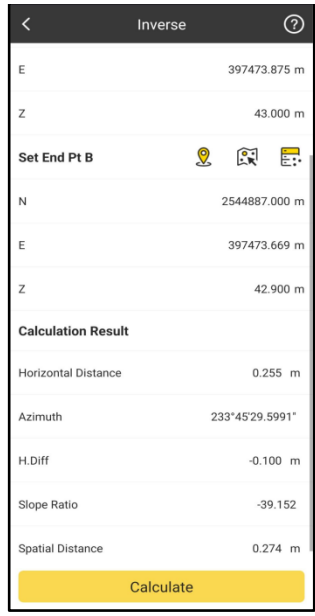
There are three ways to set points: 1. Extract coordinates from Points Database; 2. Collect current GPS coordinates; 3. directly input values of Northing, Easting and Elevation.

Calculation result in COGO calculation can be stored in Points Database with Click Save.

8-4-1 Coordinate Inverse

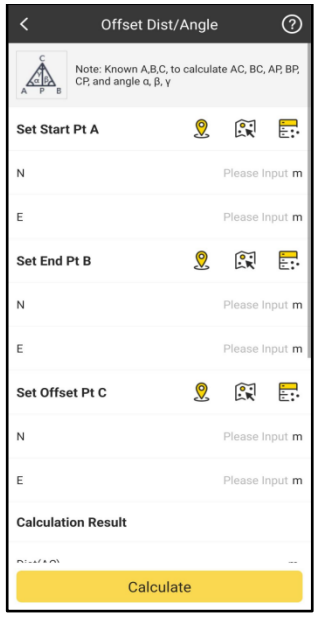
Set Start Point A and End Point B, and click Calculate to calculate the Horizontal Distance,Azimuth, H Difference, Slope Ratio and Slope Distance.

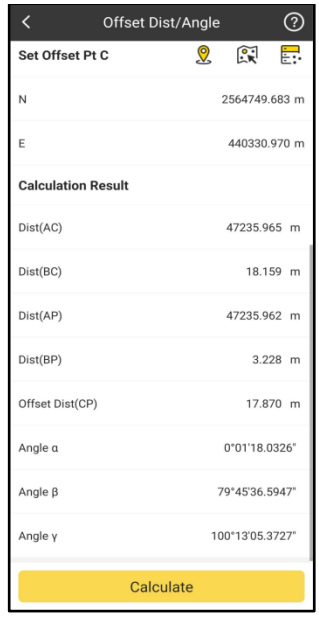




8-4-2 Offset Distance/Angle

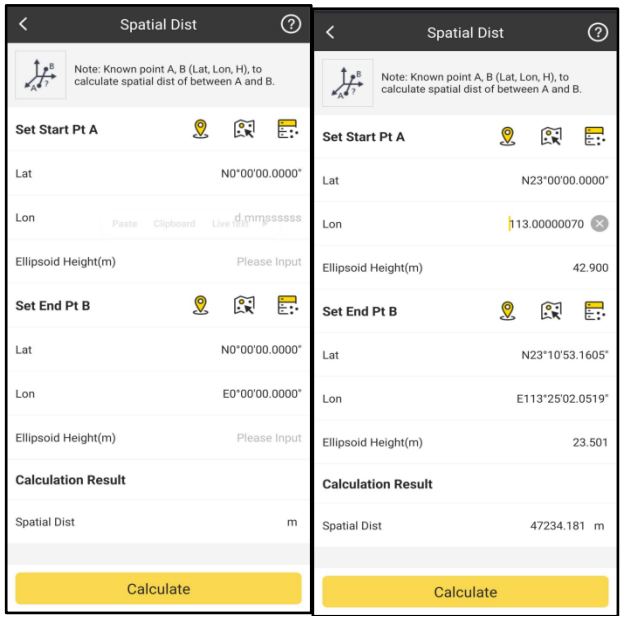
Set Start Point A, End Point B and Offset Point C, and then click Calculate to calculate the Distance(AC), Distance(BC), Distance(AP), Distance(BP), Offset Distance(CP), Offset Angle and Corner Angle.





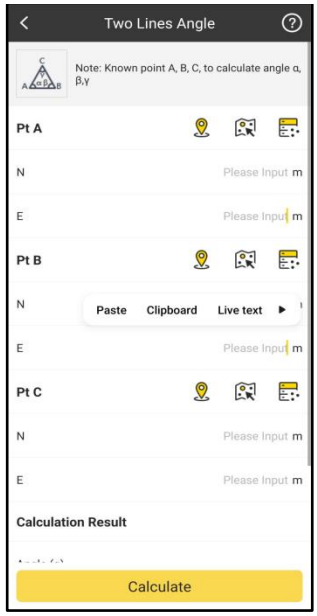
8-4-3 Spatial Distance

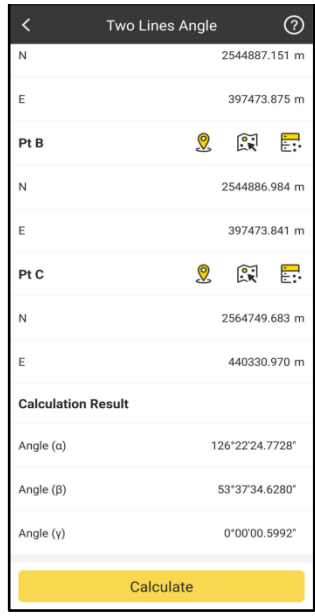
Set Start Point A and End Point B, and then click Calculate to calculate the Spatial Distance.



8-4-4 Angle Calculation

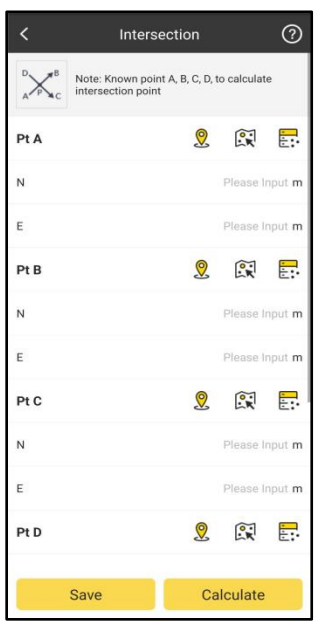
Set Point A, Point B and Point C, and then click Calculate to calculate the Angle ABC, BAC and ACB.

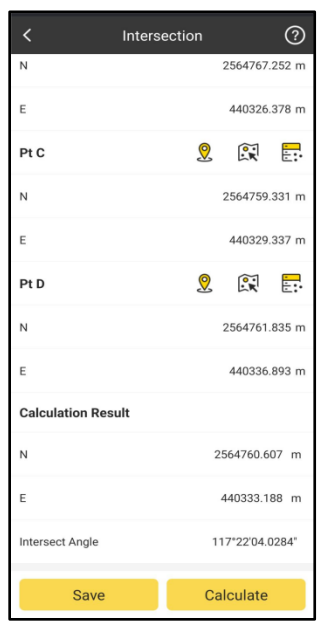




8-4-5 Intersection

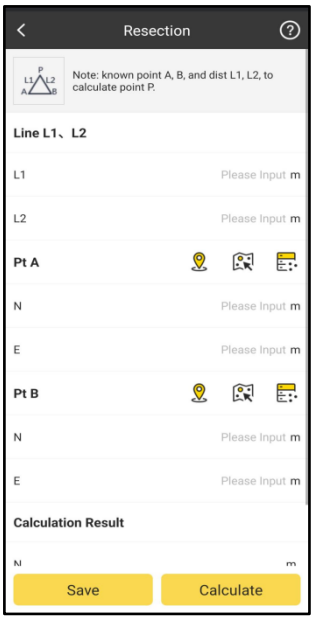
Set Point A, Point B, Point C and Point D, and then press Calculate to calculate the intersection coordinates and intersect angle.

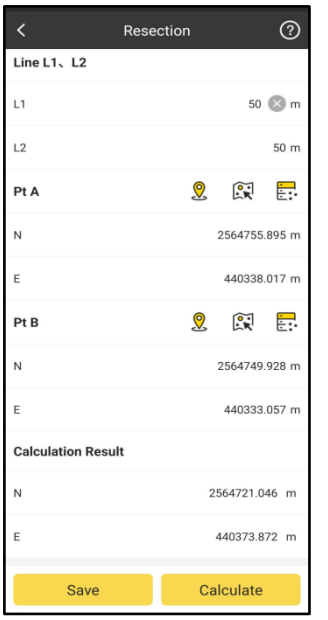




8-4-6 Resection

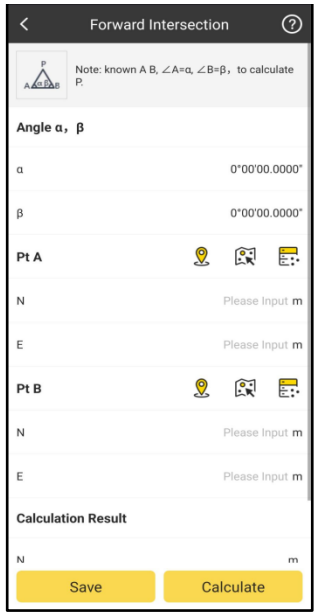
Set Line L1, L2, Point A and Point B, and then click Calculate to calculate the point coordinates.

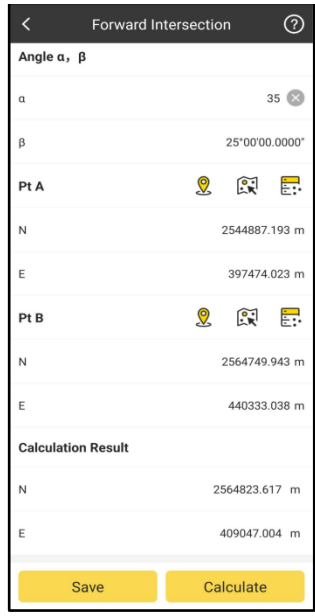




8-4-7 Forward Intersection

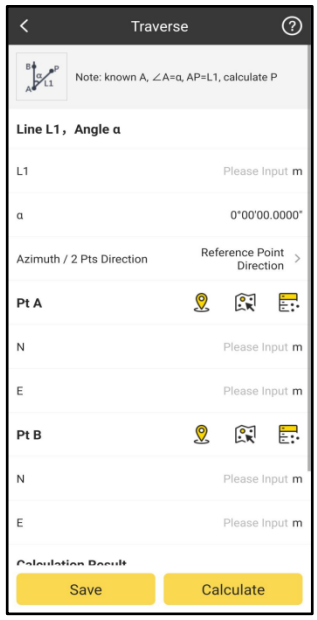
Set Angle α, β, Point A and Point B, and then click Calculate to calculate the intersection point coordinates.

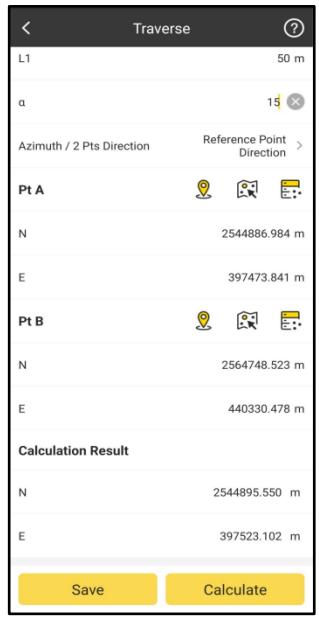




8-4-8 Coordinate Traverse

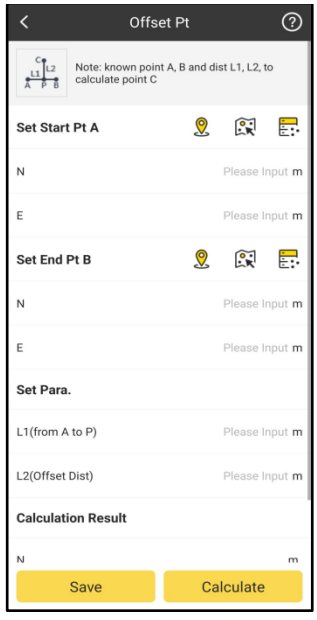
Set Line L1, Angle α, Point A and Point B, and then click Calculate to calculate the traverse point coordinates.

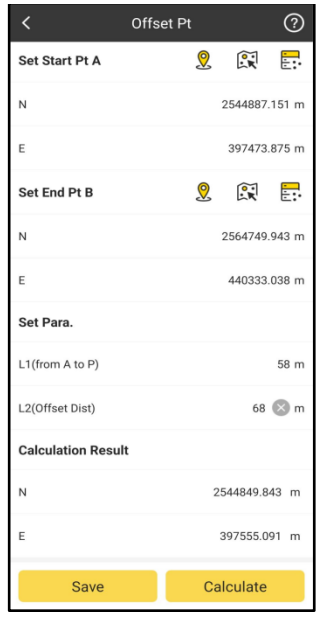




8-4-9 Offset Point

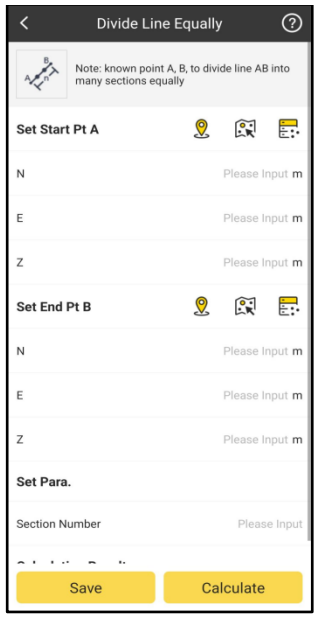
Set Start Point A, End Points B, Line L1(from A to P), Line L2(Offset Distance), and then click Calculate to calculate the offset point coordinates.





8-4-10 Divide Line Equally

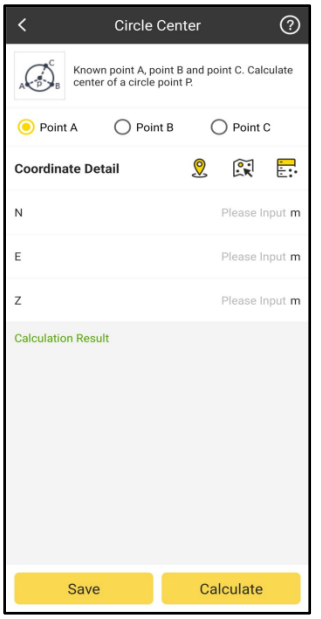
Set Start Point A, End Point B, and Section Number, and then click to Calculate equally divided points' coordinates.

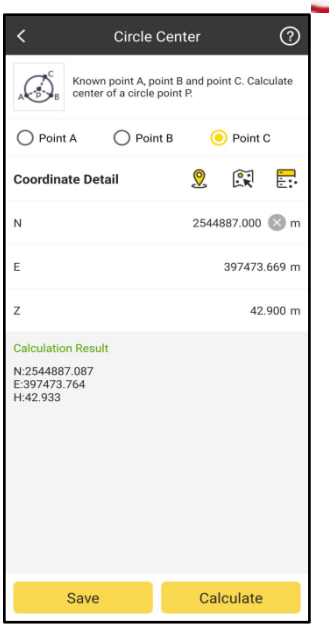


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8-4-11 Circle Center

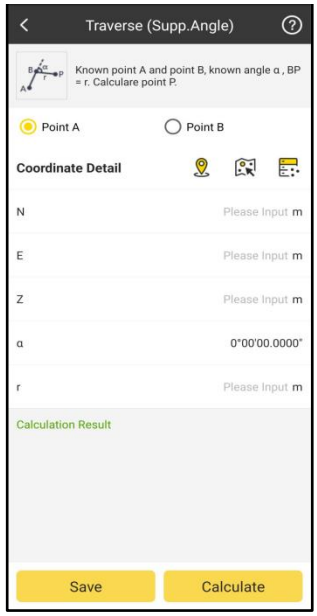
Set Point A, Point B, and Point C, and then click to calculate Coordinates of the circle center.

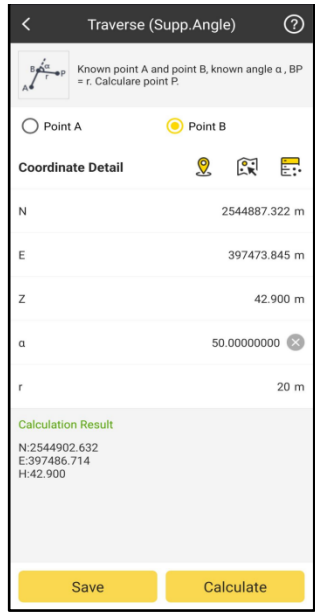




8-4-12 Traverse Calculation(2 Pts direction)

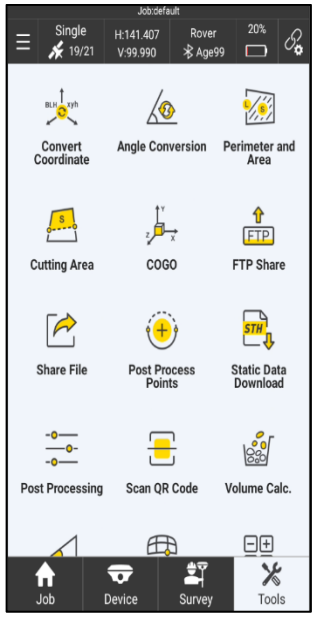
Set Point A, Point B, Angle α and Line r, and then click to calculate the point coordinates.

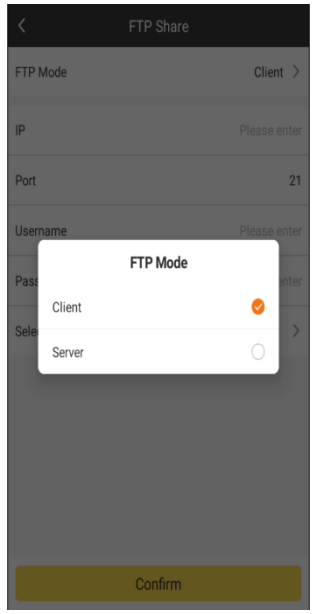




8-5 FTP Share

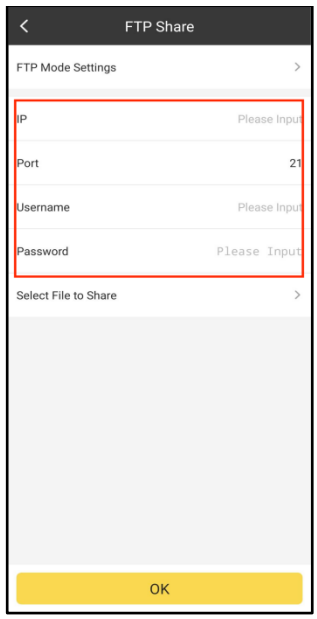
In FTP Share, we can share files using FTP. And there are two FTP modes, by Client and by Server.



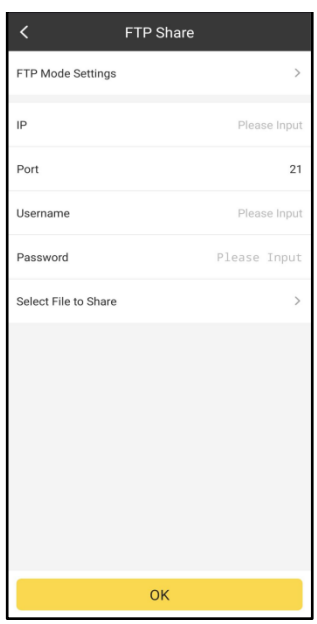


Client Mode: Upload files to FTP server.

We need to have a FTP server, and input IP, Username and Password to access the server.



And then we can Select File to Share to upload files to the FTP server.

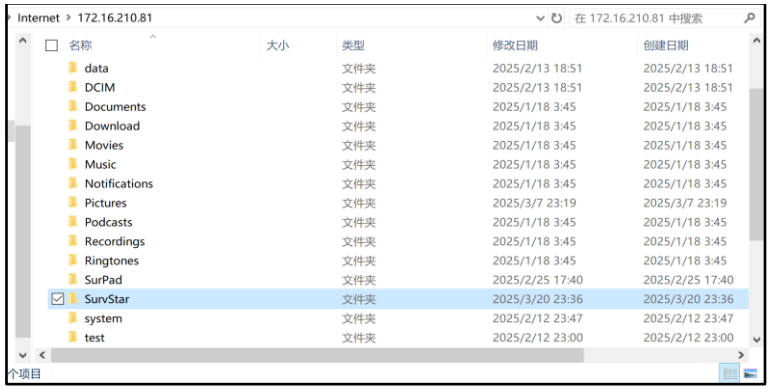


Server Mode: Make android device as FTP server

Another device must be in the same LAN of android device install Survstar. By activating this mode, we can access to the android phone internal memory by FTP:// android device LAN IP:2121.

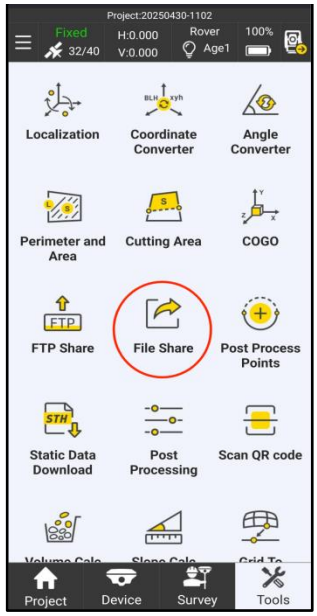


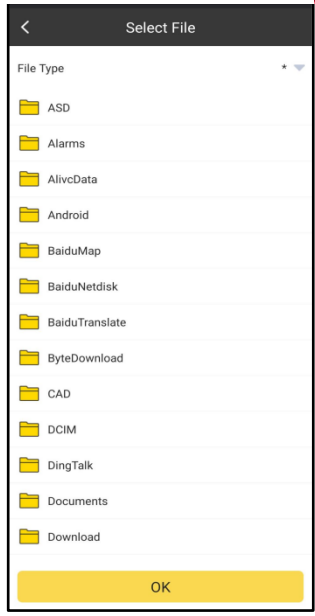




8-6 File Share

shared file and click OK, then we can share the selected file.

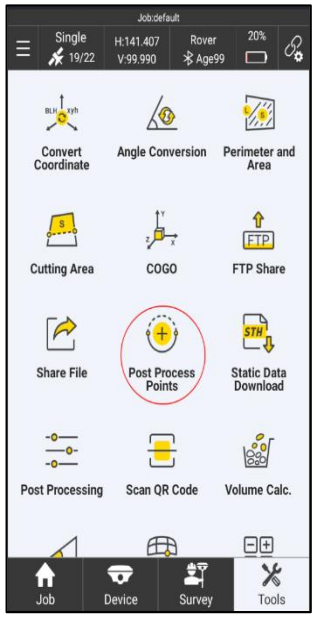


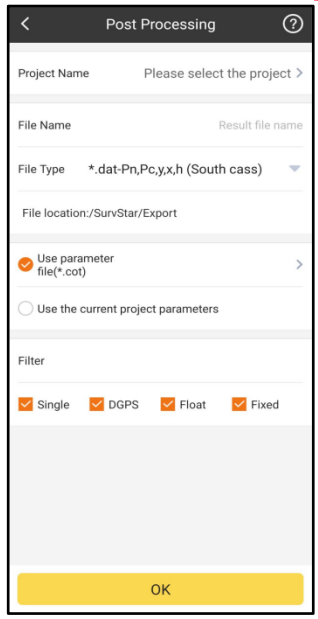


By clicking this, we can share the data file to the other app or the other device. Select the

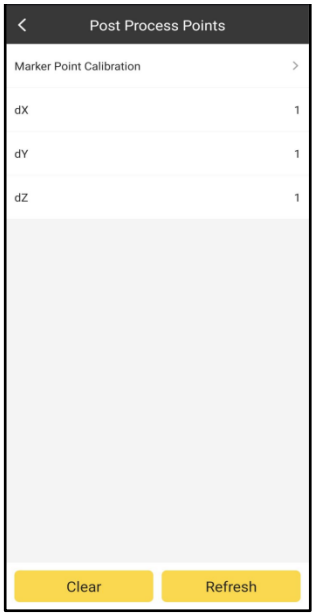
8-7 Post-Process Points

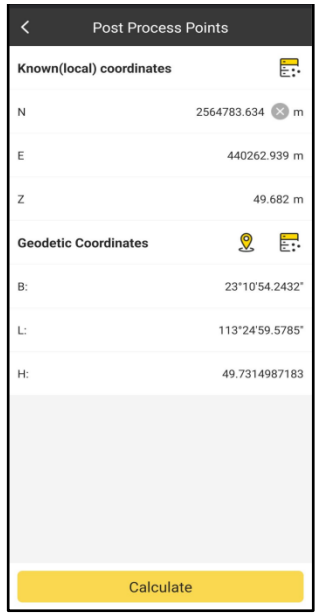
In this section, we can make single point calibration for all collected points. If we know offsets in X, Y and H, we can input offset values directly.

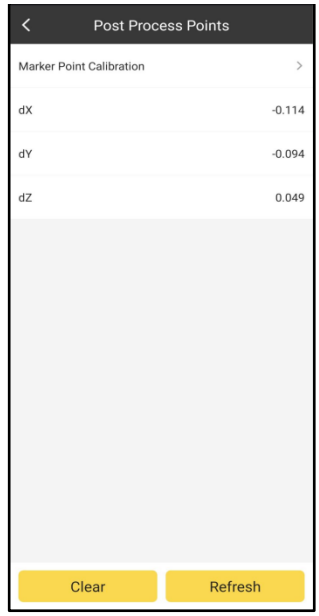




We can also click Marker Point Calibration to calculate the offset parameters.







Then click Refresh, select the base to be calibrated, click Refresh. Then select the Starting Time and the Ended Time, then the surveyed point in that period will be calibrated.

