ComNav Technology

User Guide

Surveying Data Collection Software ---Survey Master

Feb 15, 2025

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1 Introduction

Survey Master(SM) is professional Android-based surveying software developed by ComNav Technology. The setup Wizard makes you easily configure the GNSS, and with the User-friendly interface with smart menus, objects and graphics you can collect field data through Topo survey/Auto survey/Area Survey/Feature Survey, Static and PPK, also stake points/lines/arc/CAD. Moreover, Survey Master provides a convenient

way to import/export surveying data.

1.1 Installation environments

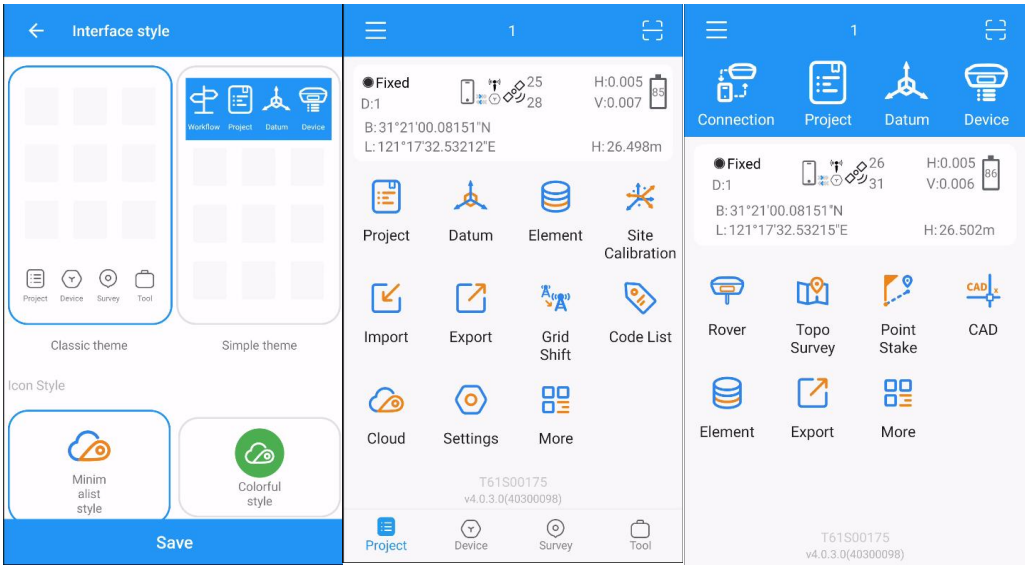
Survey Master can only run in Android operating system, and the android device specification should be at least or better than the ones listed below:

- CPU: core 2.1GHz(currently support ARM cortex only)
- At least 4G RAM
- Android System version: ≥4.2
- Screen: 4.5 inches
- Screen resolution: 960*640
- Hardware: Bluetooth, Wi-Fi/GPRS

1.2 User Interface

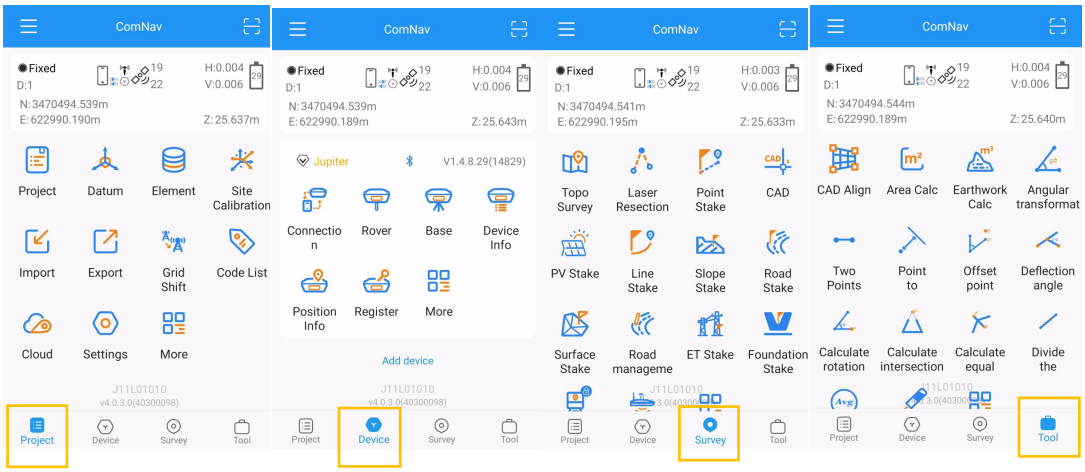
Survey Master has user-friendly interfaces, which provides you a convenient and effective surveying experience. This version has two interface styles: Minimalist and Colorful. You can choose a style what you like in settings.

This version adds a new interface theme and there are two themes you can choose: classic theme and simple theme. You can go to ***Project***->***Settings***->***Set theme*** to set a proper theme.

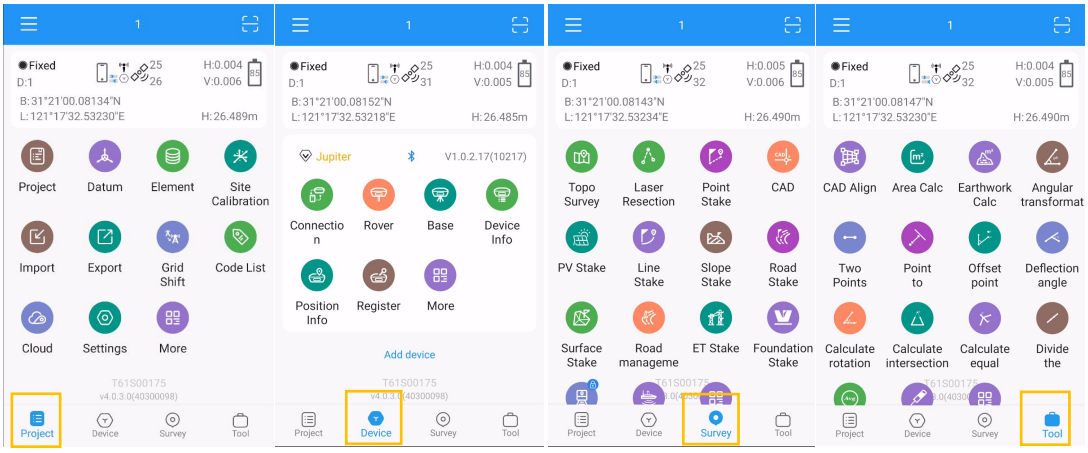


Set theme Classic theme Simple theme

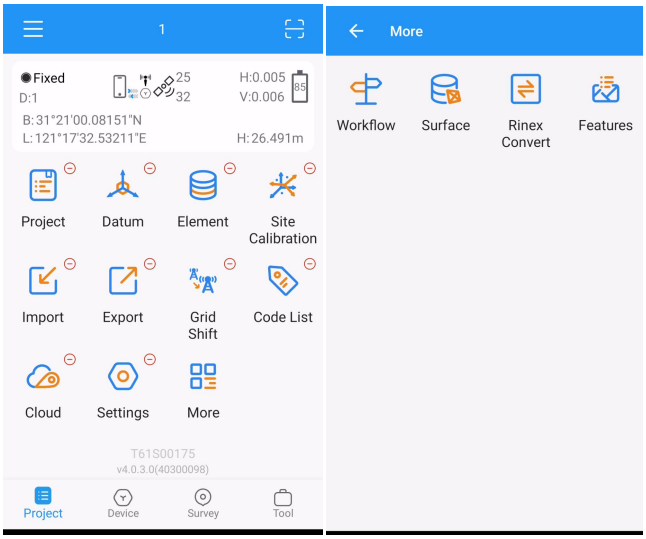
Minimalist style:



Colorful style:

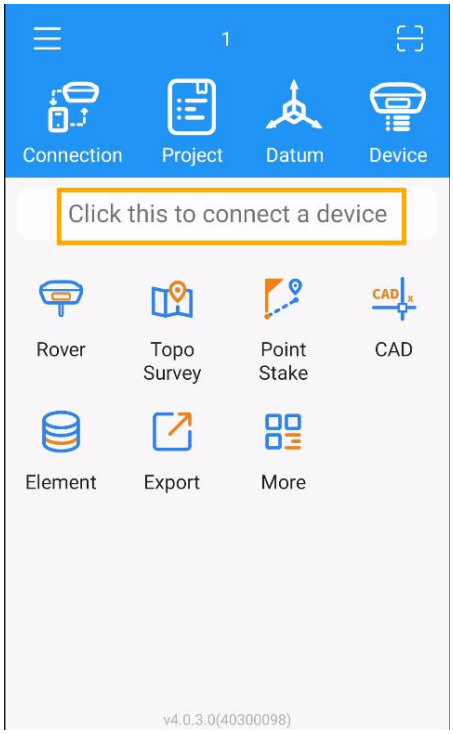


The ***More*** interface stores the uncommon function, you can long press the icon on the main interface and click ⊖ to put the function you will not use frequently. And you can also long press the icon in the ***More*** interface and put the function you use frequently in the main interface. Besides, you can drag the icon to change their order.



For Simple theme, there is only one page, there are some default functions in this page, you can add the functions which you use frequently from ***More*** page.

In the top of the page, there are ***Workflow***, ***Project***, ***Datum***, ***Device***. In the middle of the page,



Click this to connect a device, you can go to ***Device*** to disconnect the current device, if you use ***Simulated Device***, the ***Device*** function can't be used, you need to go to disconnect the device.

Following function instructions are based on Classic theme.

1.2.1 Project interface

The interface mainly includes Project, Coordinate system, Import/Export and Cloud.

- Workflow: Guide the whole workflow
- Project: Build/Open/Delete/Resue a project
- Datum: Select and manage the datum
- Element: Points manage
- Surface: Surfaces manage
- Code list: Manage codes in list, Code List support edit layer and import point symbol by CAD file
- Import: Import points file
- Export: Export Grid Coordinates and Geodetic coordinates (based on WGS84 or Local), stake points/lines and detailed survey points
- Rinex convert: Support to convert cnb file to Rinex format in your controller
- Features: Features manage; check points/lines/polygons what you measured in Feature Survey

- Cloud: Login cloud to backup project, datum, work mode
- Site Calibration: Transfer the WGS84 coordinates to local grid coordinates, support to import Trimble/Topcon Point file (*.txt) format

1.2.2 Device interface

This interface is related to setup the GNSS in RTK mode, and check the receiver information.

- Connection: Connect receiver
- Rover: Setup receiver work as rover
- Base: Setup receiver work as base
- Antenna: Antenna manage; check the information of antenna
- 0183 Output: Configure NMEA output via com port or BT
- External radio: Configure external radio
- Device Info: Show firmware, hardware, status and so on
- Position Info: Show receiver, base station and satellites information
- Register: Check register status
- Static: Log raw data
- Mock Location: Share Survey Master location to controller
- FW upgarde: Update firmware for the receiver whose current firmware supports this function, only supports *.bin format
- Reset RTK: Reset the RTK by this button
- Advanced: Perform some advanced settings on the receiver, including NMEA Output, Remote Assist (User Side), Remote Assist (Support Side), H-Terminal, Debug Data, and Auto record debug data
- Add device: Quickly connect device and automatically start Work mode.

1.2.3 Survey Interface

This interface contains all survey modes, such as the most used function Topo survey, stake and road function.

- Topo survey: Survey points
- Control survey: Record control points
- Detail survey: Show local gird coordinate and LatLon coordinate
- Auto survey: Automatic survey points by time or distance
- Point stake: Stake points
- Line stake: Stake lines
- Stake Arc: Design curves and stake out curves
- Stake CAD: Import dxf or dwg file; choose points/lines to stake

- Area survey: Get area result by survey points
- PPK: Dynamic data collection
- Road design: Design road
- Road stake: Stake road
- Road store: Road elements
- Feature survey: Survey point/line/polygon features
- Surface stake: Stake surfaces

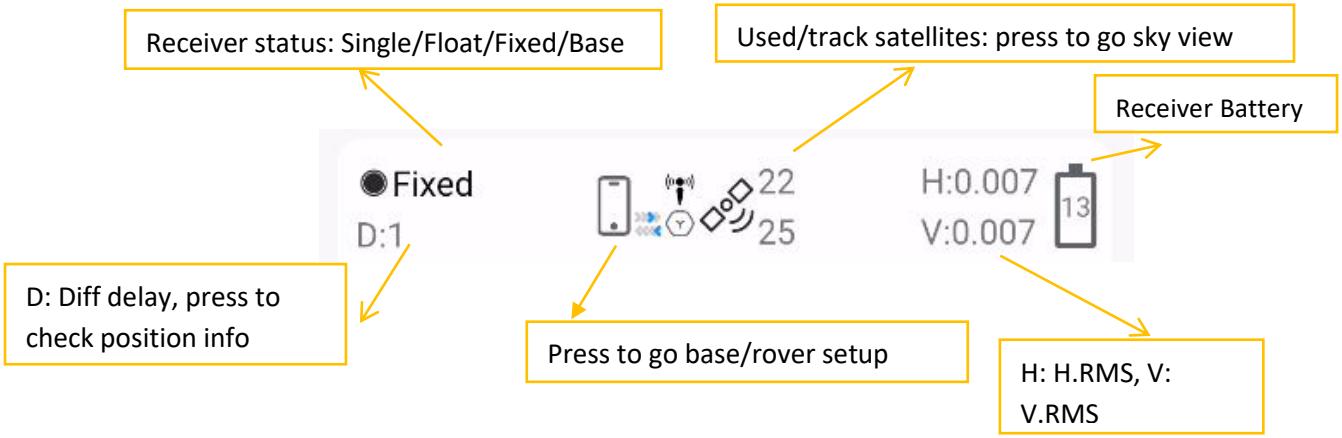
1.2.4 Tool Interface

The interface mainly includes site calibration, grid shift and cogo function.

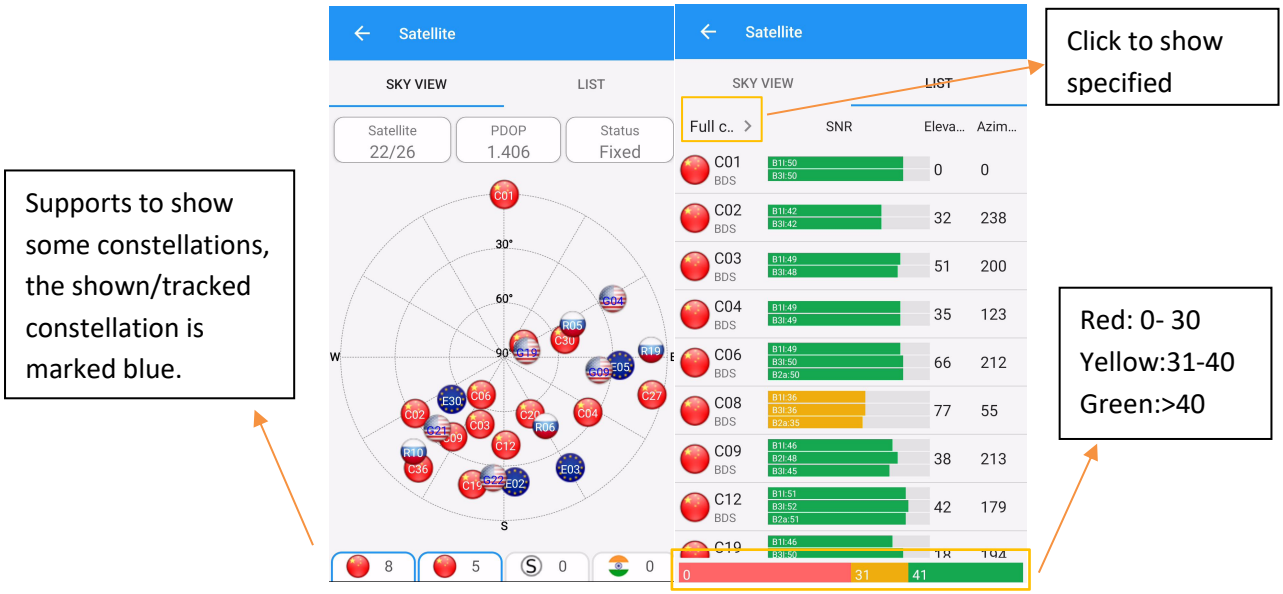
- Grid Shift: Once change Base coordinate during one project, need do this
- Area calc: Used for calculate polygon area by measured points
- Earthwork Calculation: Calculate the earth volume to dig or fill based on surfaces.
- COGO: Calculate points/lines/angle
- FTP: Share controller files to pc wirelessly.
- E-mail: Send files to e-mail.
- Laser Ranging: Laser measuring distance.

1.2.5 Status information

The status bar is showing the receiver status.



- Satellite information
  Support to show Sky view and satellite list.



- Status Bar

The icons and their descriptions are as follows:

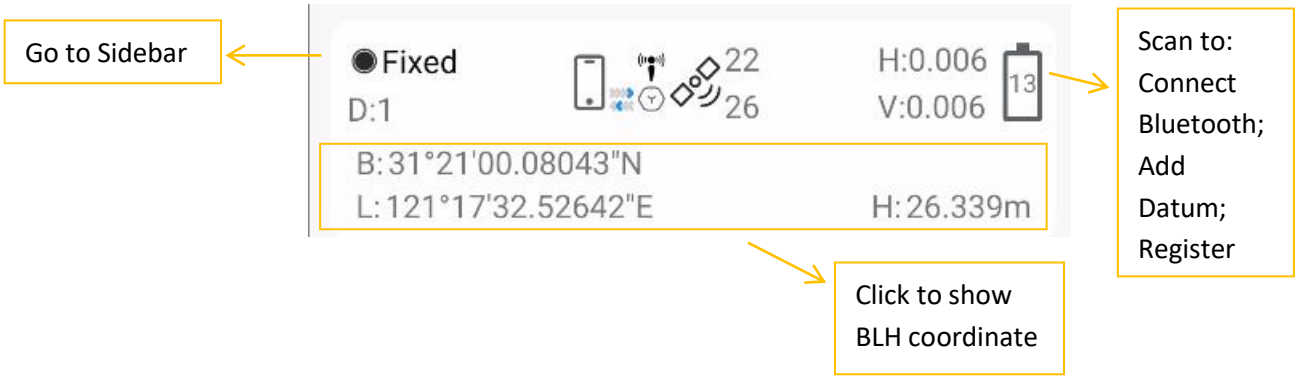
Icon	Description
	Indicates the receiver battery power, calculation method is (A+B)/2, A: battery power of compartment A; B: battery power of compartment B; You can click this icon to check more details. If the battery is changed by external power, you will see the second picture.
 N M	M: number of the satellites tracked; N: number of the satellites used.
	Radio mode
	PDA CORS mode
	Internal GSM mode

The positioning status and their descriptions are as bellows:

Status	Description
Searching	The receiver is searching the satellites.
Single(Red color)	Single positioning solution.
Float (Red color)	The whole week ambiguity is not fixed.
Fixed (Black color)	The whole week ambiguity is fixed, high accuracy.
Base	The base is setup successfully.
D:***	The diff delay, * represent the diff delay value

H: …, V: …	Horizontal RMS, Vertical RMS

Tip: If the status keeps searching when the receiver is outdoors, pls check if the receiver register is expired; or you can try to update the firmware, if these methods cannot solve the issue, pls contact our support.



1.2.6 Settings

You can find the Settings in the Project page, or you can go to sidebar to enter Settings.

Project settings

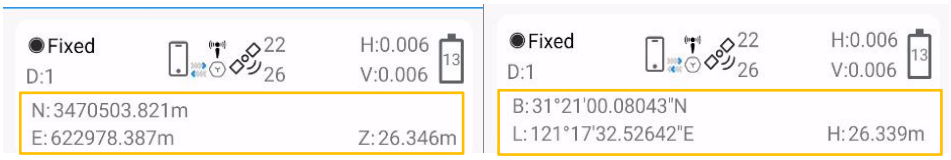
- ***Units and Decimal***: set units and decimal for data.
  Length: supports Meter,International feet, US survey feet
  Angle: supports Degree(°), DD° MM'SS.SSSS, DD:MM:SS.SSSS,Gradian(gon)
  Export decimal: 0.0, 0.00, 0.000, 0.0000, 0.00000
  Lat/Lon: supports DD° MM'SS.SSSS, DD:MM:SS.SSSS, D.DDDDDDDDD
  Area: support m^2 , Square kilometer, Square feet(international), Square feet(US), Acre, Hectare, mu
  Earthwork: support m^3 , Cubic kilometer, Cubic feet(international), Cubic feeet (US)
- ***Coordinate order***: Coordinate display order, you can choose "E, N" or "N, E", this will be used in the main interface coordinate display and other functions which will display coordinate. But this cannot change the coordinate display order of the information bar in the survey and stake interface, whose order can be changed in the ***Information*** settings of survey settings.
- ***Survey***: You can configure settings for Survey, Stake, Road, PPK, CAD, and the Information, for more information, pls refer to Chapter 13.7.
- ***Display settings***: You can configure layer management, point symbol and color, annotation style color, current position icon color and bubble color.

System settings

- ***Keyboard Shortcut***: You can set Volume+ (-) as Null, Measure, Previous point, Next point.
  Null: means no settings, default is null.
  Measure: means to survey the point.
  Previous point: skip to the previous point in the stake functions.

Next point: skip to the next point in the stake functions.

- ***Screen orientation***: Supports Automatic, horizontal screen, vertical screen.
- ***Set theme***: You can set theme for Survey Master, including classic them and simple theme. And set Icon style: Minimalist or Colorful.
- ***Language***: Survey Master now supports 73 languages, including Chinese, English, German, French, Spanish, Danish etc.
- ***Main interface display coordinates***: If you check on this option, then when you connect to a device, the coordinate information will be displayed in the main interface. Default is off.

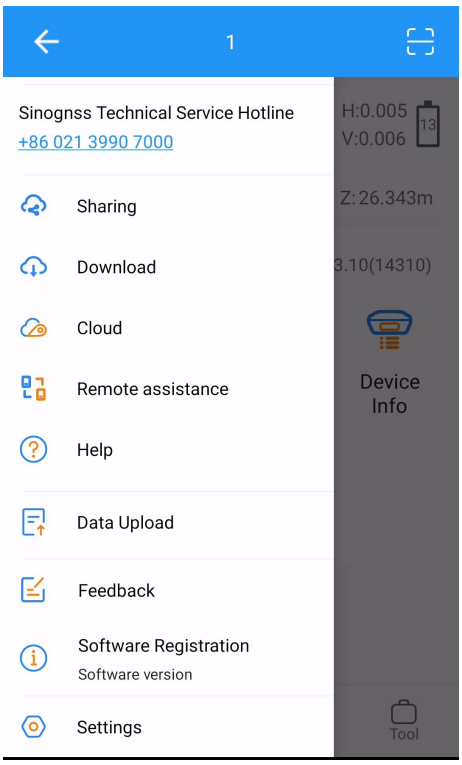


General settings

- ***Auto connect***: If you check on this option, then when your restart the software, it will automatically reconnect the device before restarting the software.
- ***Mock Location***: This function can share the receiver position to third party software, for more information, pls refer to Chapter 13.7.

1.2.7 Sidebar

Click the icon in the upper left corner of the main interface, you will get the sidebar information.



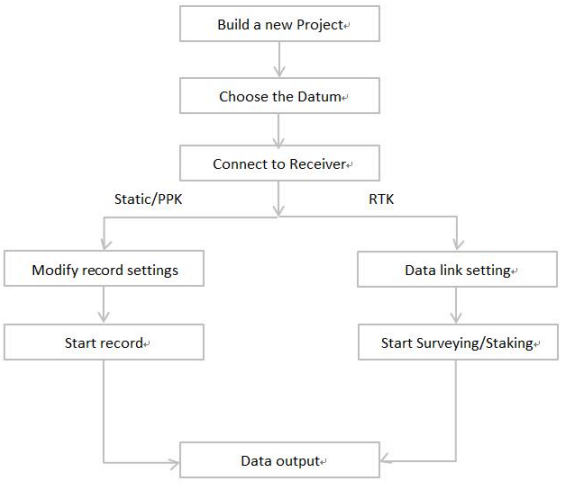
Sinognss Technical Service Hotline: Get support from this hotline.

Sharing: Click this to share the files by QR code or code.

Download: Click this to download files by QR code or code.
Cloud: For more information, pls refer to Chapter 13.1.
Help video: Find some training video of Survey Maser.
Help: Click this to get help document for Survey Master, only supports English language now.
Data Upload: Logs or tasks can be sent back to the cloud.
Feedback: You can send the errors or abnormal features, suggestions for improvement to us in this way.
Software Share: You can use the QR to share the Survey Master to others or share to other software.
Software Registration (Software Version): This shows some information for current version, click version to get Stake log, check software status and register. Pls refer to Chapter 13.11
Settings: For more information, pls refer to Chapter 1.2.6.

1.3 Workflow

This figure shows the workflow of your survey through Survey Master.

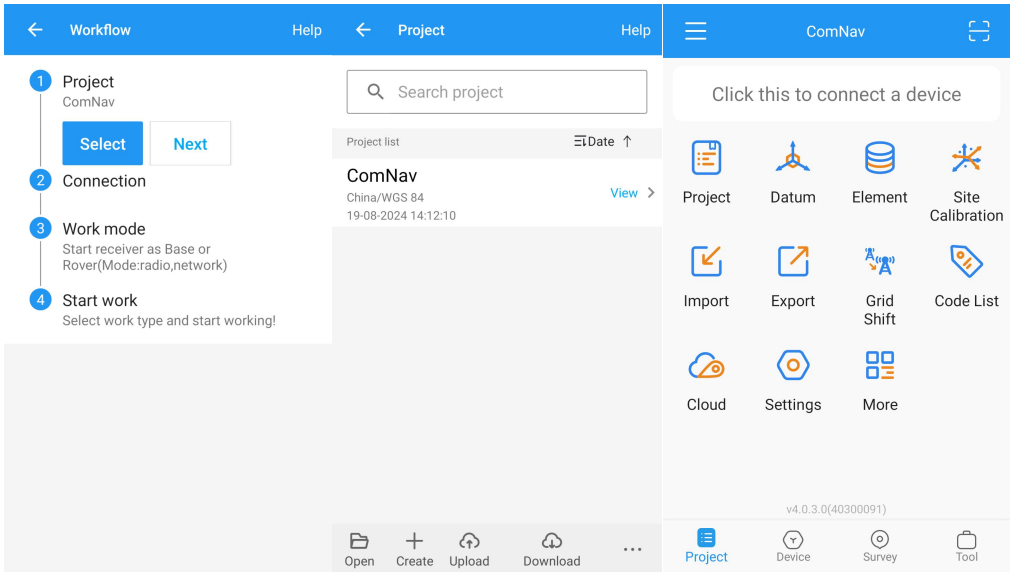


2 Workflow function

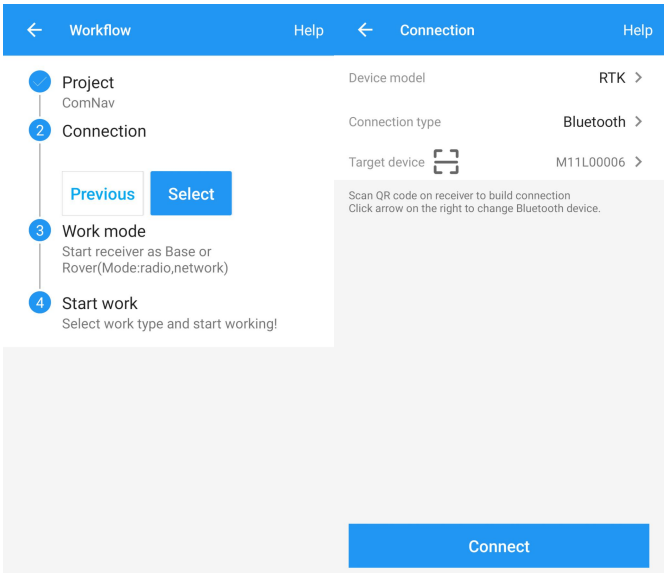
Follow the Wizard, you can quickly learn the general workflow of Survey Master, also you can quick start your survey by this function no matter you are experienced one or new user.

In Project menu, tap Wizard.

First step is for ***Project***, click ***Select*** to go into Project interface to create or select a project. For detailed information, you can refer to chapter 3.

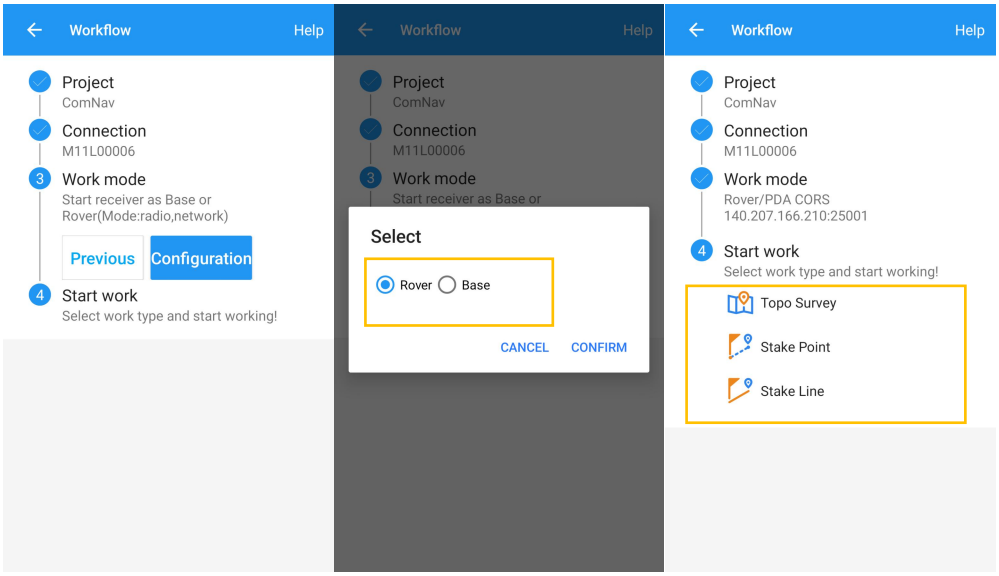


Second step is for ***Bluetooth connection***, click ***Select*** to go into Bluetooth connection interface. For detailed information, you can refer to chapter 4.



Third step is for ***Work mode*** set up, click ***Select*** to go into QuickSetup interface to start your receiver as Base/Rover. For detailed information, you can refer to chapter 5.

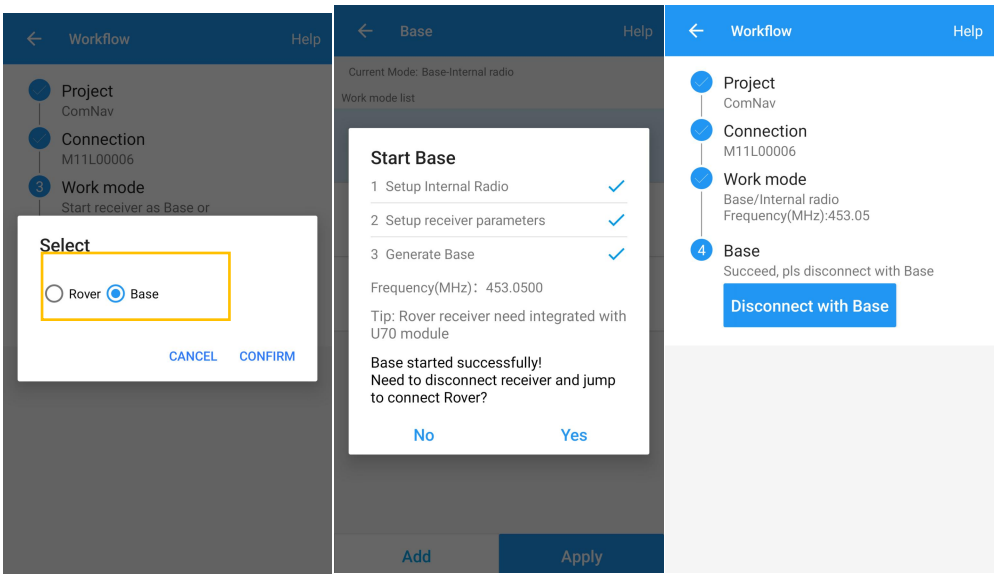
If start your receiver as Rover, then you can start work directly of Topo survey or Stake out.



If start your receiver as Base, after setting Base mode successfully, there will be a Prompt.

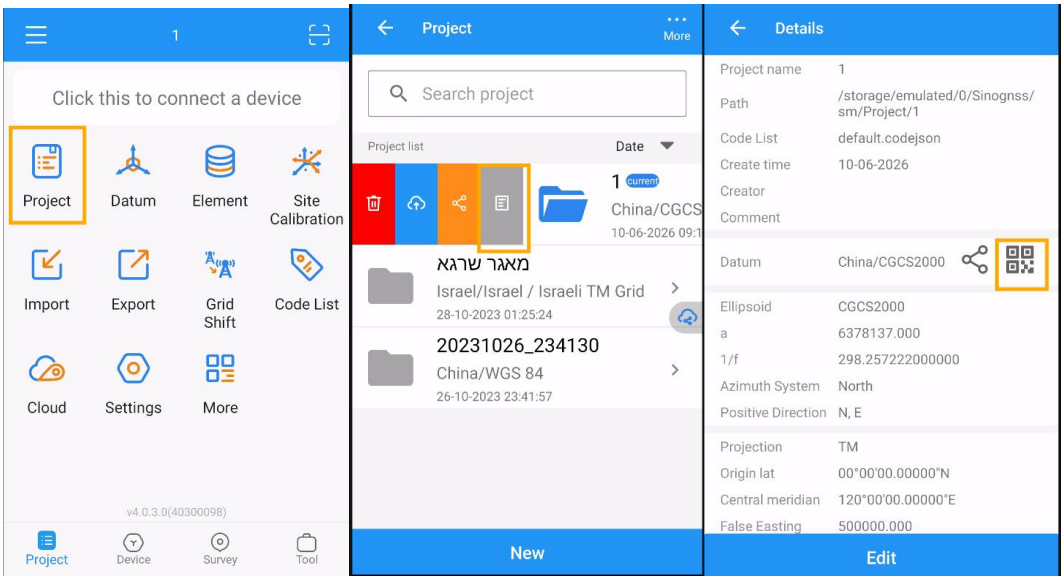
YES: will disconnect with base and go to Connection interface;

NO: will keep connecting with base and go to Workflow interface.



3 Create a new project

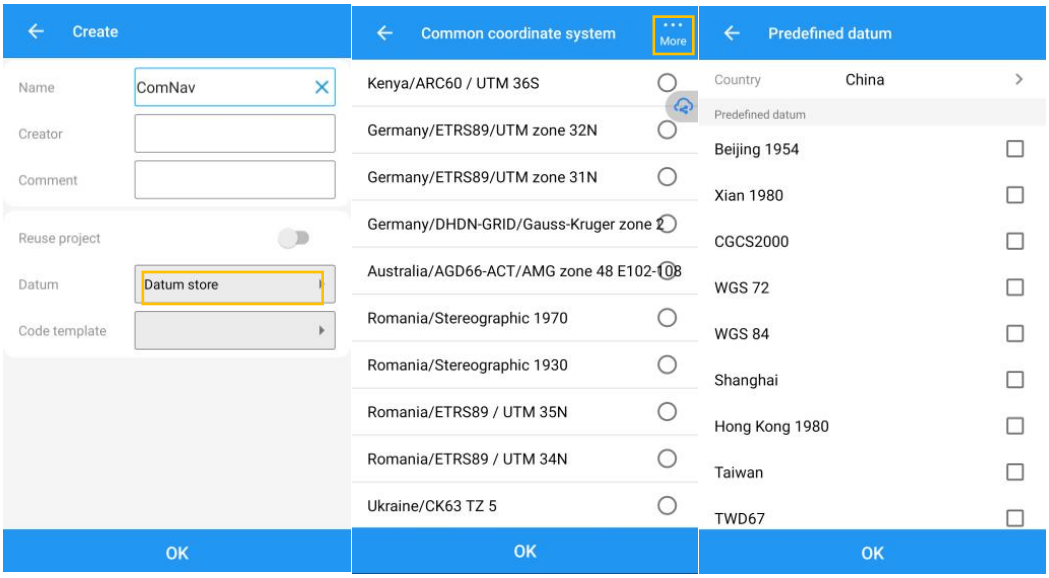
Click ***Project***, set project name and select project datum.



If you want to start work with receiver, you should select one project with datum information. You can click on Project or swipe right on Project to access more options.

In Project interface, you can click new to add a new project or click to open the previous project. It also supports to backup your project file by uploading your Cloud account, and download from it. If you delete the projects accidentally, you can recover them from Recycle Bin.Survey Master supports to order the project by date and name, in order or reverse order.

The project that already exists in the project list, you can click to check the current project details, including Project name, store path, and datum parameters. Click the QR to share your datum information to others. Besides, click ***Edit*** to change the datum parameters, also, you can change in the Datum interface.
You can click to Upload the project file to the cloud.



Reuse project: Disabled by default and can be enabled manually.

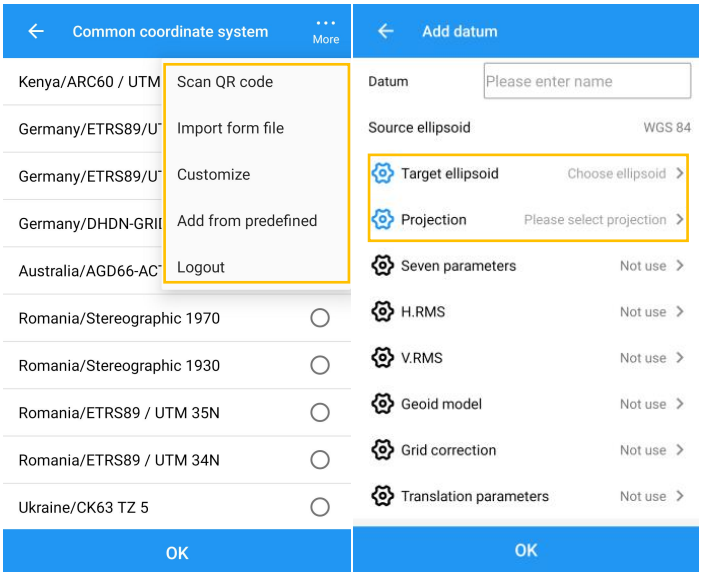
1.Template Project: Defaults to the currently opened project. If no project is open, the first project in the project list will be selected. You can also manually choose a project from the drop-down list.

2.Datum: Inherits the coordinate system of the template project by default and cannot be changed.

3.Code Template and Project Settings are selected by default and can be modified. Control Point, Import Point, and Stake Point are unselected by default and can also be modified.

Datum store:

1. Select Predefined datum: You can select datum directly from the list. Survey Master currently has 74 countries datum and will add more afterwards. You can multi-select Datum in Predefined datum.
2. Create a User defined datum: If you cannot find datum you want in the list, follow instructions below to add one: select Source ellipsoid, Target ellipsoid, Projection for your datum, and even seven parameters, geoid model based on your request.
3. Import form file: support to import Trimble DC and CAL formats in coordinate systems
4. Scan QR code: Support to get the datum from other users.

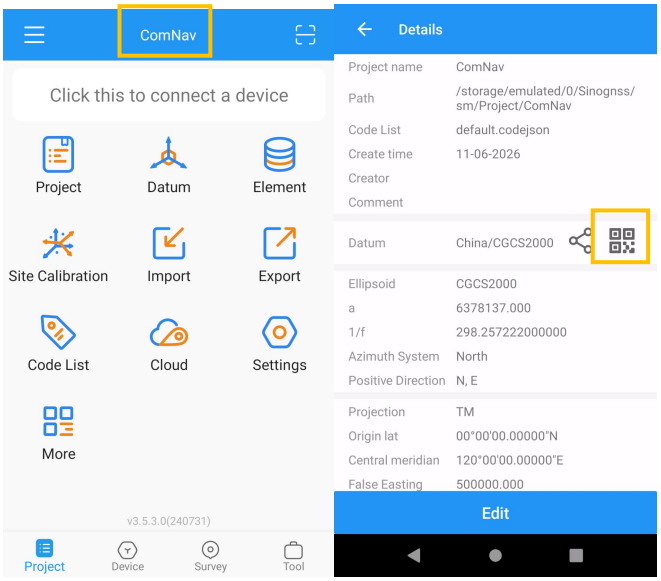


Source ellipsoid: Source ellipsoid is the ellipsoid whose GNSS measured data has no conversion. Generally, the source ellipsoid is WGS84 coordinate, because the coordinate directly obtained by GNSS receiver is WGS84 coordinate.

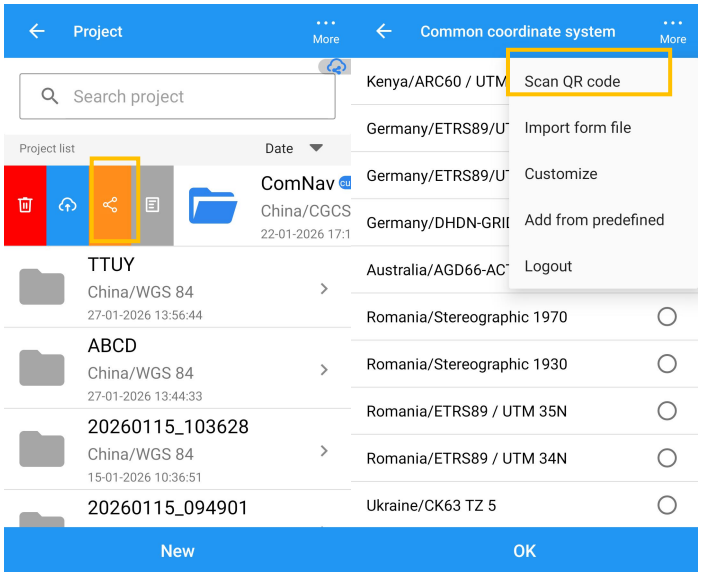
Target ellipsoid: This is the ellipsoid where the coordinates used in the measurement, depending on the actual situation of the coordinates.

*Tip1: if asked username and password for seven parameters, enter **admin** **admin***
*Tip2: For H.RMS and V.RMS, it will show after do **Site Calibration**.*

Share Datum via QR code: press project name, it will generate a QR code about datum parameters. Users can use the Scan function to get the datum.

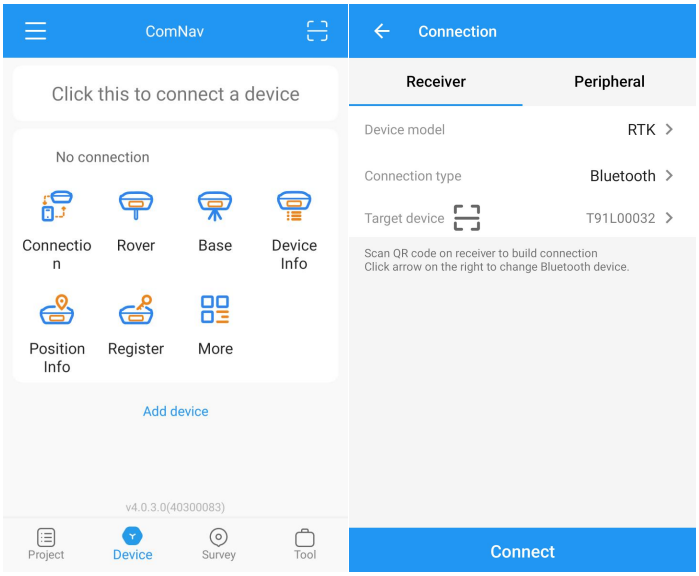


Upload Project/Datum to cloud: sharing project with cloud.



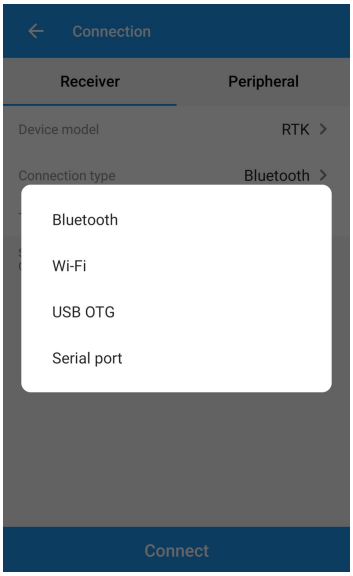
4 Connection

After creating a new project, switch to ***Device***, tap ***Connection***. You can connect Survey Master with ComNav GNSS receivers. Or choose Simulated device/NMEA0183 Device/Android device. And you can choose quick card to connection quickly.

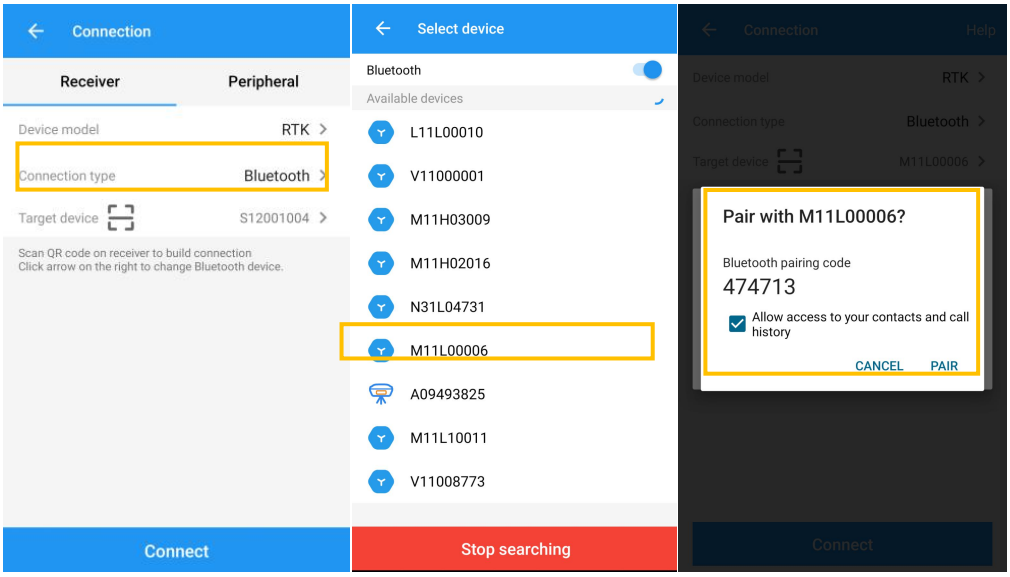


4.1 RTK

There are four connection types: Bluetooth, USB OTG, Serial Port, WiFi.



Bluetooth: After connecting ComNav receiver, you can check some information of receiver (like firmware version) in *Device Info*. And some functions are only available for specified device.

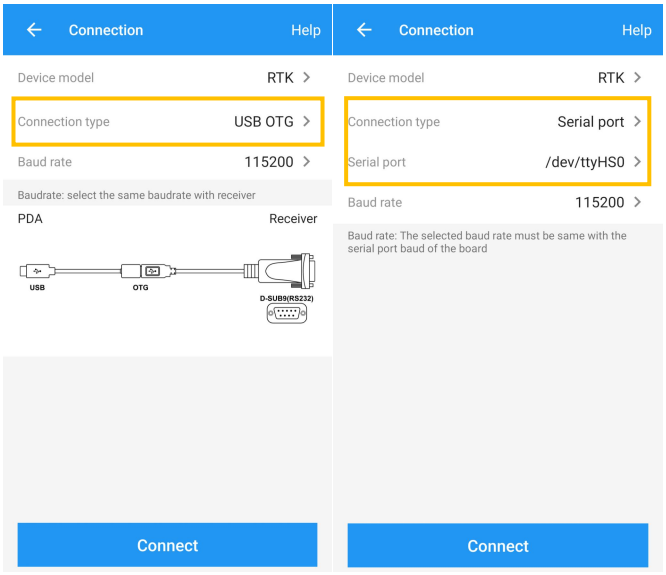


After connected successfully, the bottom will show the positioning status.

Tips: If you failed to connect with receiver through Survey Master, you can just follow prompt info to go into the device Bluetooth setting interface to make sure Bluetooth paired successfully. Sometimes you need restart the receiver or Survey Master.

USB OTG: Using USB, OTG and D-SUB9(RS232) to connect with OEM board.

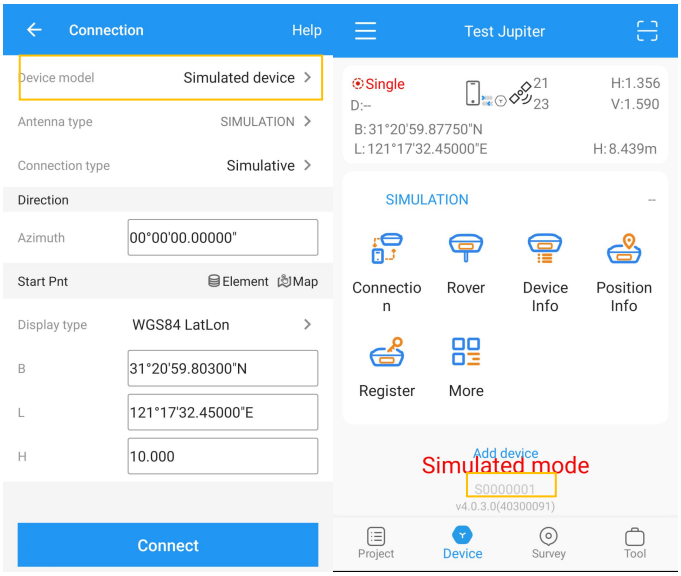
Serial port: Support to connect with Android-based Tablet PC with OEM board inside.



WIFI: Special receiver or special firmware support WIFI connection

4.2 Simulated device

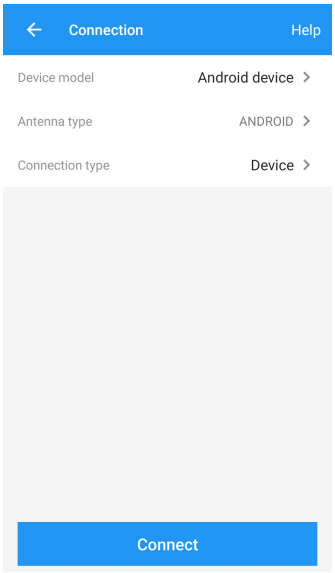
Simulate connecting Survey Master. On this model, some functions will not work.



When the receiver is connected, here will show SN

4.3 Android device

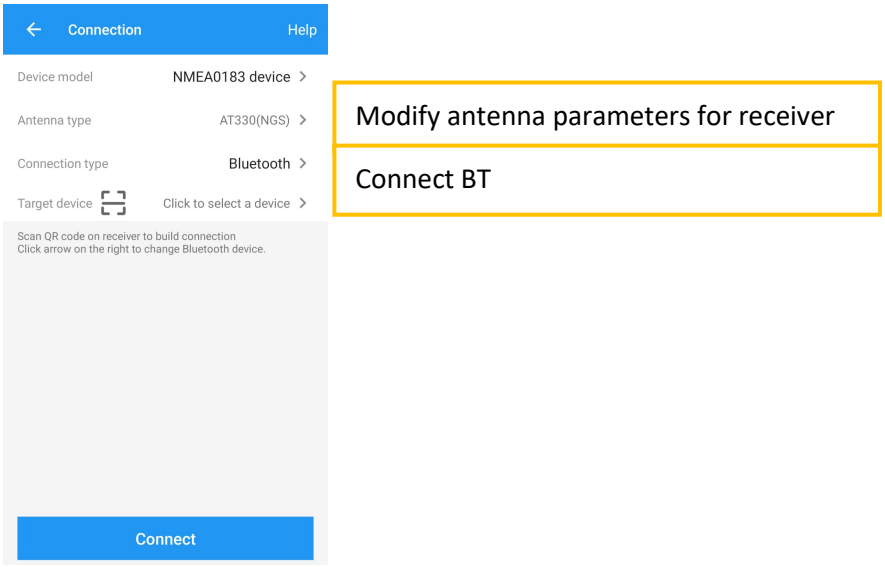
Survey Master can use the controller internal GNSS, which is a good choice for GIS data collection.



4.4 NMEA0183 device

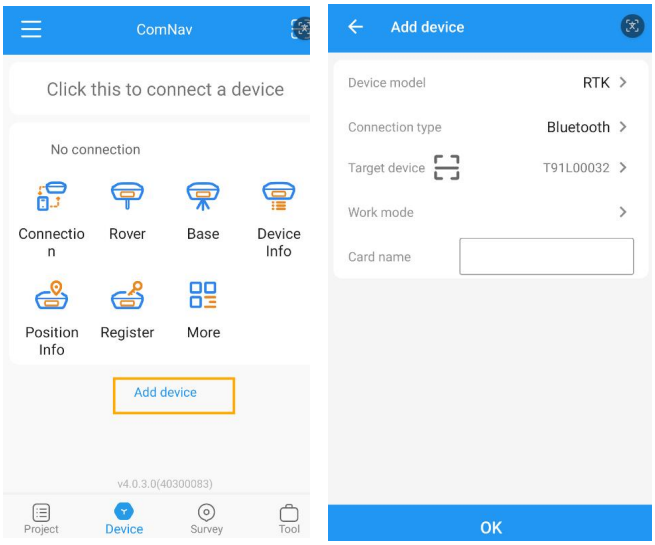
Any other brand receivers which can output NMEA data can connect with Survey Master, in this model, some functions can't be configured, like base settings, and some of the rover settings. If other brand receivers want to work with Survey Master, should do as followings:

1) Configure your receiver on other GNSS software, make sure it can receive differential data and get fixed, meanwhile, output NMEA message: GPGSV, GPGGA, GPZDA and GPGST.
2) Disconnect with other GNSS software, then connect with Survey Master, it should be fixed, and you can do general survey and stake.



4.5 Quick card

After configuring the receiver as a base or rover, you can connect and activate the working mode with one tap, reducing repetitive configuration tasks.



Create Quick card

a) Click ***Add Device*** to enter the page for add device information.

b) The optional Device model, Connection type and Target device are consistent with those on the Connect Device page.

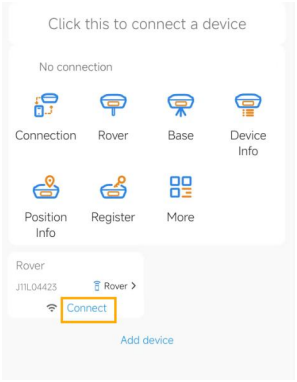
c) The device must be connected when selecting the Work mode.

d) Custom Card name is supported; if not entered, the default device name will be displayed.

Application Method:

a) Before connect the device, you may tap the connection method on the card to switch between Bluetooth and Wi-Fi.

b) Click Connect; once connected, the working mode will start directly.



c) The current working mode and icon are displayed in the upper-right corner of the card. Tap to modify the working mode. If the device is not connected, you will be prompted to connect first before modification.

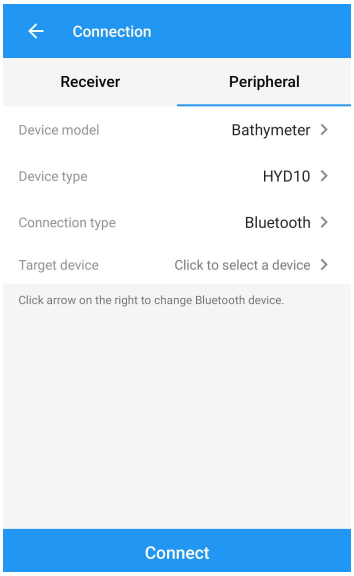
Notes:

Only one card is allowed per device; repeated addition will overwrite the existing one.

The Card name cannot be modified after the card is added. Long press and tap the small red minus icon in the upper-right corner to delete the card.

4.6 HYD10

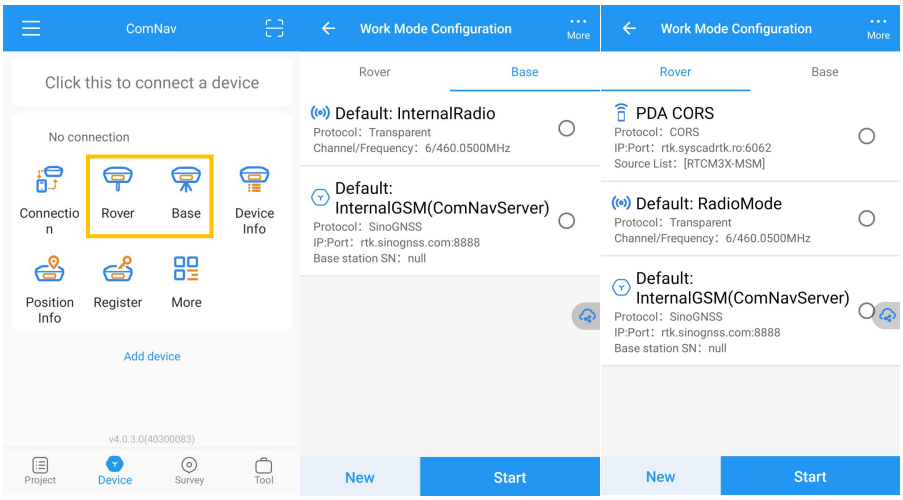
Survey Maste V403 support to connect with Echo sounder(HYD 10)



5 Quick Setup your receiver

In Survey Master, you need only one step to start your receiver: Choose ***work mode-> Apply***.

There are some default work modes, two for Base and three for Rover. Choose one mode and long press, you can check the detailed information. If the default work mode suits for you, you can just click Apply to start your receiver. Usually, you need to add one mode yourself.

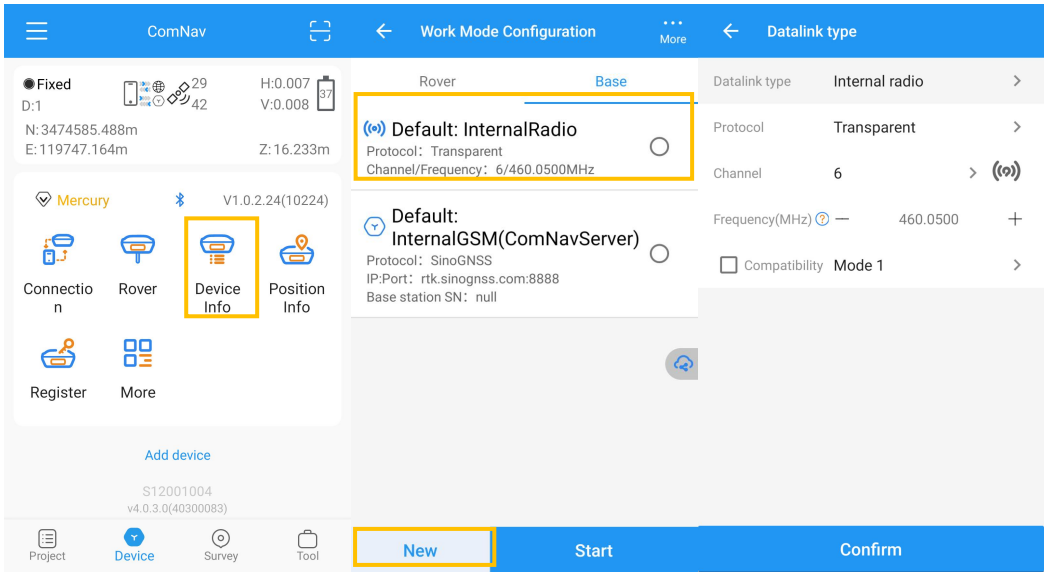


5.1 Start your receiver as Base

5.1.1 Internal Radio mode

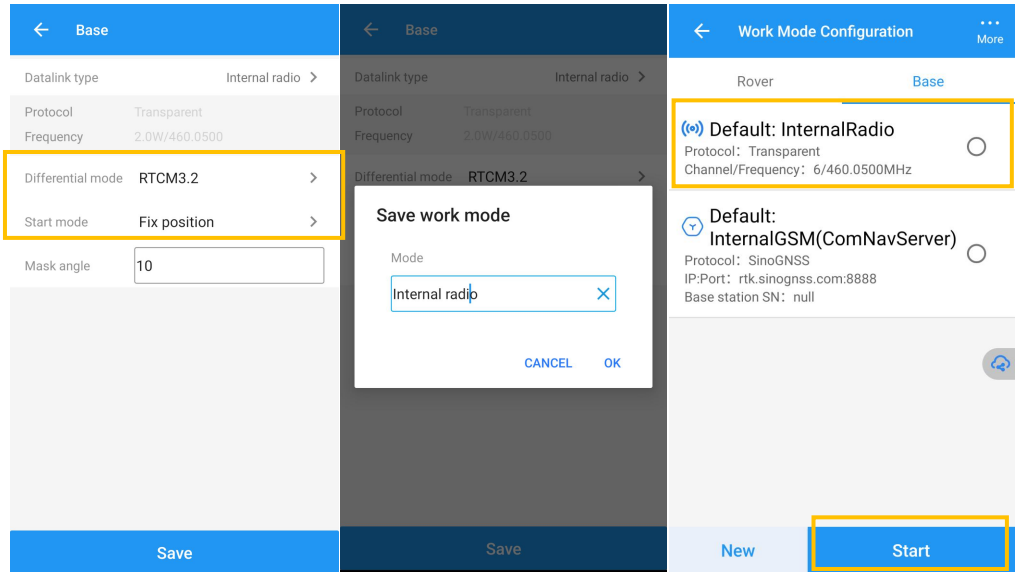
This mode uses internal radio to transmit the correction data from Base to Rover. You need to set Base and Rover with same protocol and frequency.

The following steps give an example of internal radio transmission.



- ***Protocol***: Supports Transparent, MAC, South,TT450s , SNLonglink and SNLonglink+ for Base transmission.(
- ①SNLonglink and SNLonglink+ protocols are only applicable to U70G/U703/U70 model data radios with radio version ⩾ 2.1.5, and GNSS version⩾620L5.
- ② The air baud rate corresponding to the SNLonglink+ protocol only supports 6000.)

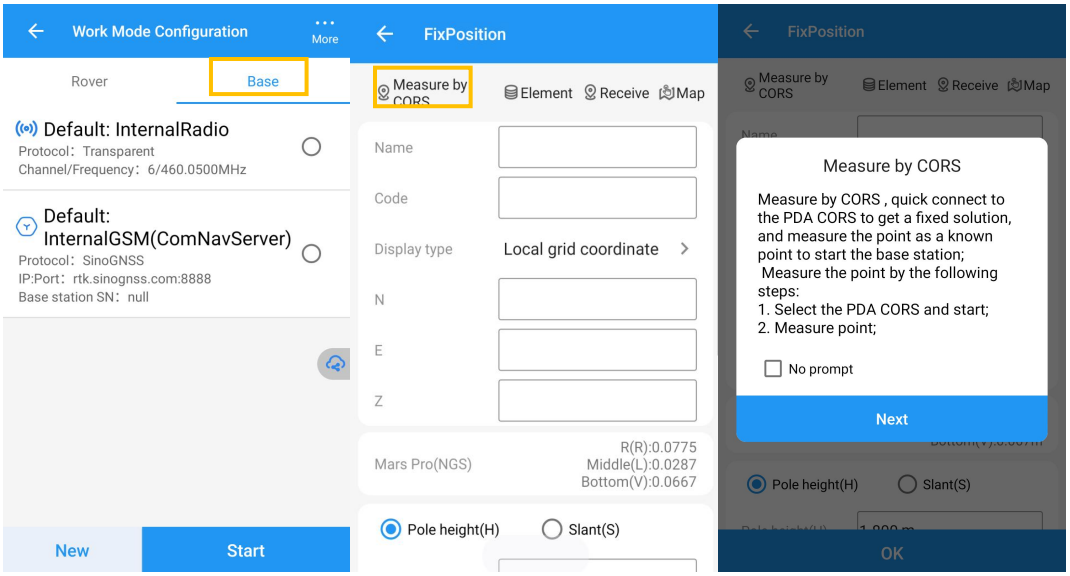
- ***Frequency***: select a channel or customize a frequency, the range of frequency is 410-470 MHz

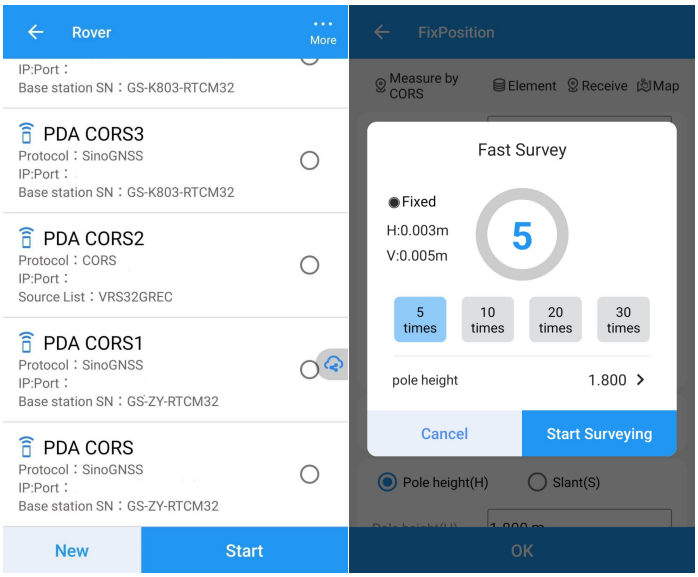


- ***Auto base***: Once you start the Base, the receiver will automatically get current coordinates and broadcast correction data.

Fix position: Once you start the Base, you need enter known coordinate or get a current coordinate.

1.Measure by CORS ; When input base station coordinate, quick connect to the PDA CORS to get a fixed solution, and measure a fixed point by cors as a known point to start the base station.





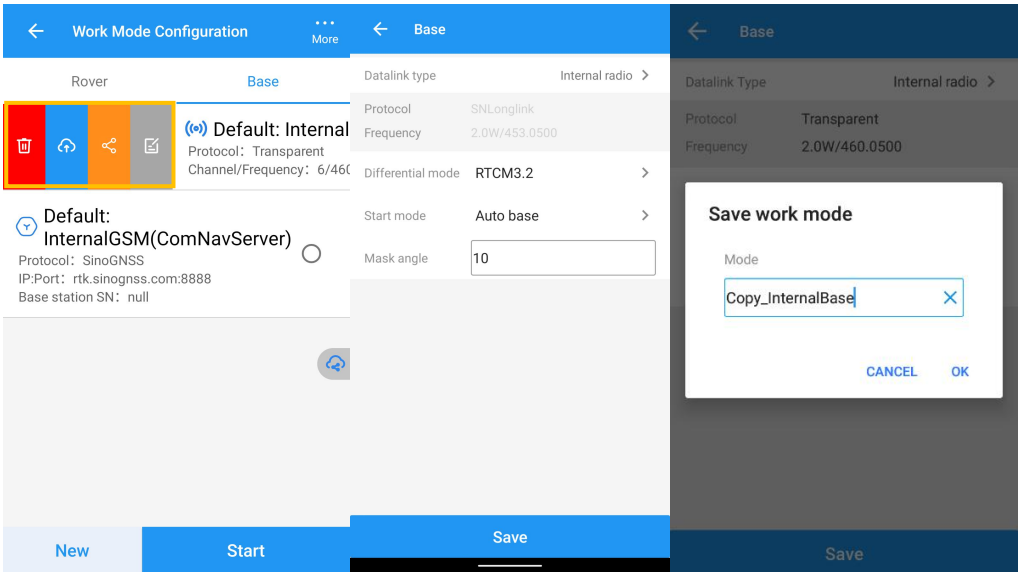
2.Element: Select a known point from Element.

3.Receive: Survey a single point with GNSS.

4.Map: Enter map to select a point.

After start base successfully, there will be a prompt, click ***Yes*** to disconnect the receiver and jump to the connection function or click ***No*** to back to Device interface.

Choose one work mode and long press, then you can do the following functions.



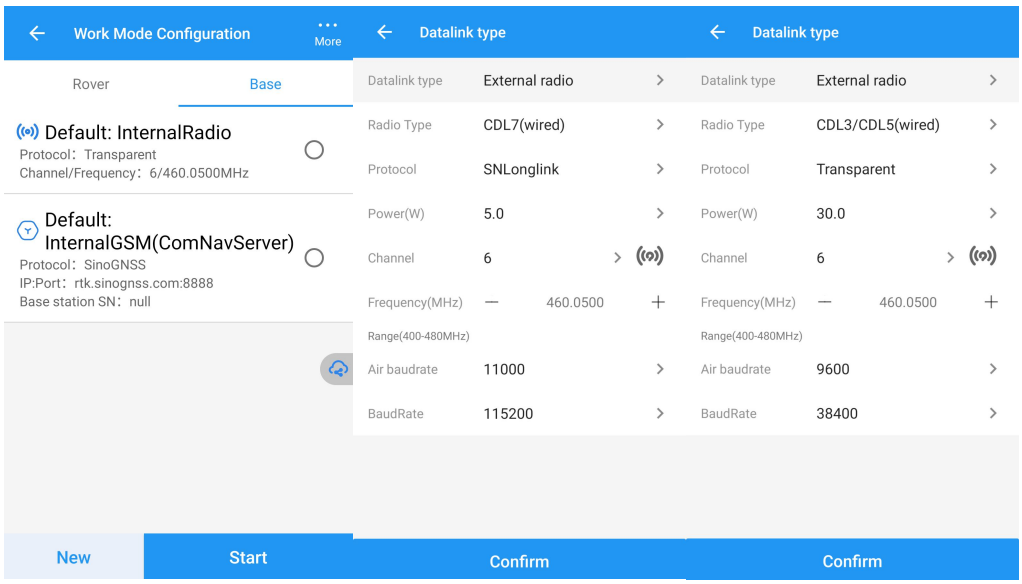
- : If you find that the work mode you added has some error or just want to change based on the current work mode, you can click ***Modify*** button to change it.
- : Share the work mode by sharing code
- : Upload your work modes to Cloud for backup.
- : You can delete the work mode that you don't need.

Tip: and are not available for default work modes.

5.1.2 External Radio mode

This mode uses external radio to transmit the correction data from Base to Rover. You need set Base and Rover with same protocol and frequency.

The steps to start external radio mode is similar with internal radio mode, but you need select the protocol and frequency on the external radio, not on Survey Master.



If you use CDL3/CLD5 external datalink, you need to check on **CDL3/CDL5** button, and the settings are below:

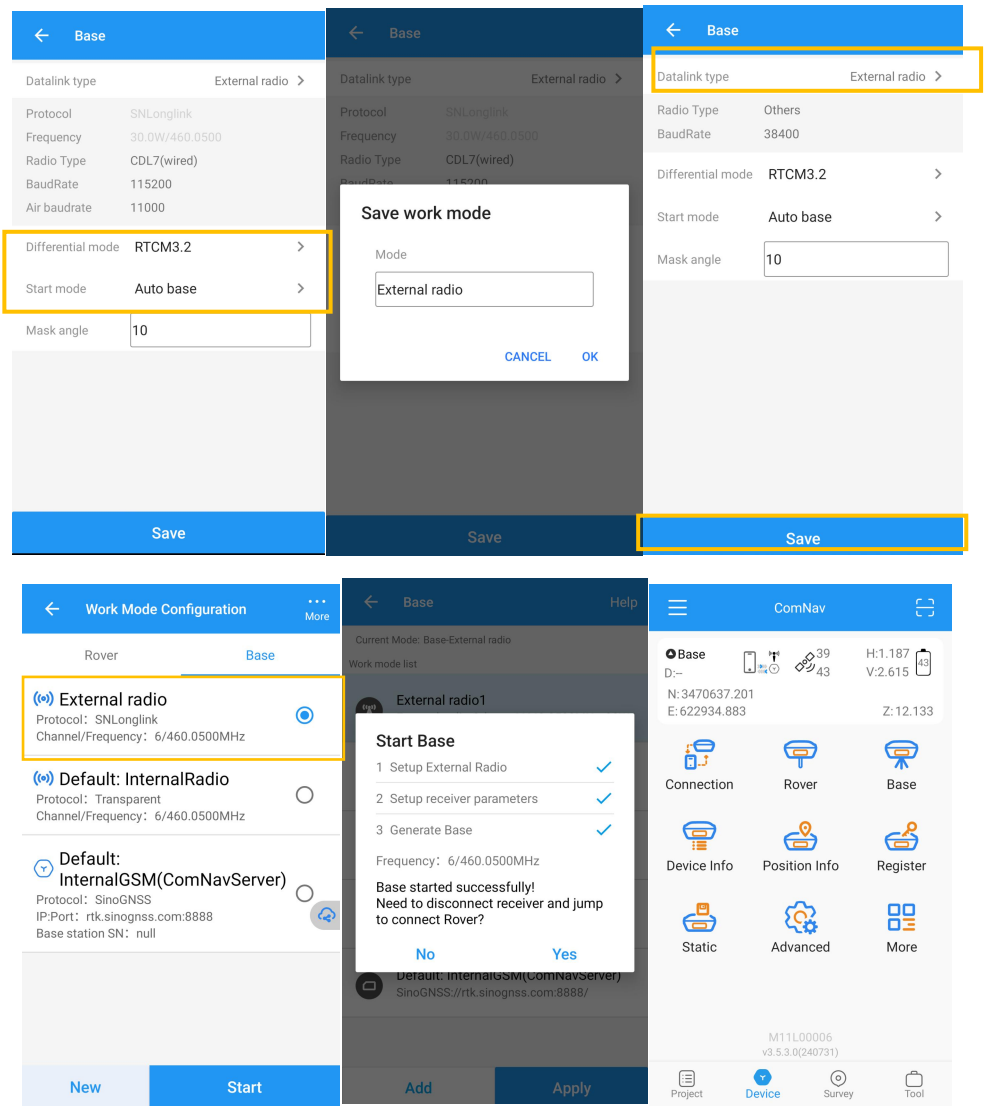
Protocol: Support Transparent, TT450S, MAC and South.
Power: Supports 2w, 5w,10w, 15w, 20w, 30w. The higher power is, the more consumption will be.
Channel: Support to customize, for normal CDL3/CDL5, the minimum frequency interval is 0.05 MHz(50 KHz), you should select the same channel on Survey Master and CDL3/CDL5, for more information, pls refer to CDL5 User Guide.
Air baudrate: For ComNav GNSS receivers, the air baudrate is 9600, if you want to work with ComNav GNSS receivers, pls set it 9600.
Baudrate: This option is to set the baudrate of lemo port, if you set 38400, you need to choose 38400 to connect CRU, or freset the receiver to clear the settings, then the baudrate will restore to 115200.

If you use CDL7 external datalink, you need to check on **CDL7** button, and the settings are below:

Protocol: Only supports Transparent.
Power: Supports 5w, 30w. The higher power is, the more consumption will be.
Channel: Support to customize, for normal CDL7, the minimum frequency interval is 0.0125 MHz(12.5 KHz), you should select the same channel on Survey Master and CDL7.
Air baudrate: For ComNav GNSS receivers integrated with Lora modem, if you choose SNLonglink+, the air baudrate is 6000, if you choose SNLonglink, the air baudrate is 11000.
Baudrate: This option is to set the baudrate of lemo port, if you set 38400, you need to choose 38400 to connect CRU, or freset the receiver to clear the settings, then the baudrate will restore to 115200.

Tips:

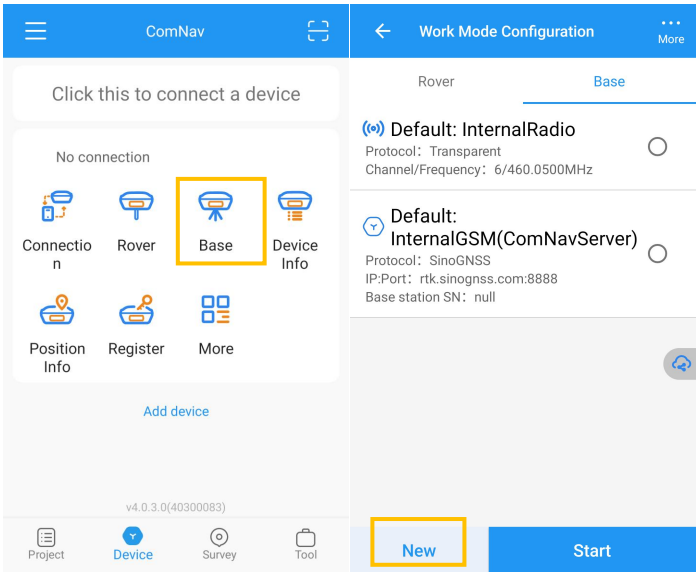
1. *If you want to setup the PDL or other external datalink, you need to check on the **Setup CDL**, and set the protocol, power, frequency and baudrate, then check off the **Setup CDL** button, and click confirm.*
2. *CDL3/CDL5 external datalink can work with the normal receivers, for example, all the K7 platform T seires receivers, and T300/+, T30 E; CDL7 can only work these receivers which is integrated with Lora modem, like N3 receivers and N5 receivers for K8 platform.*

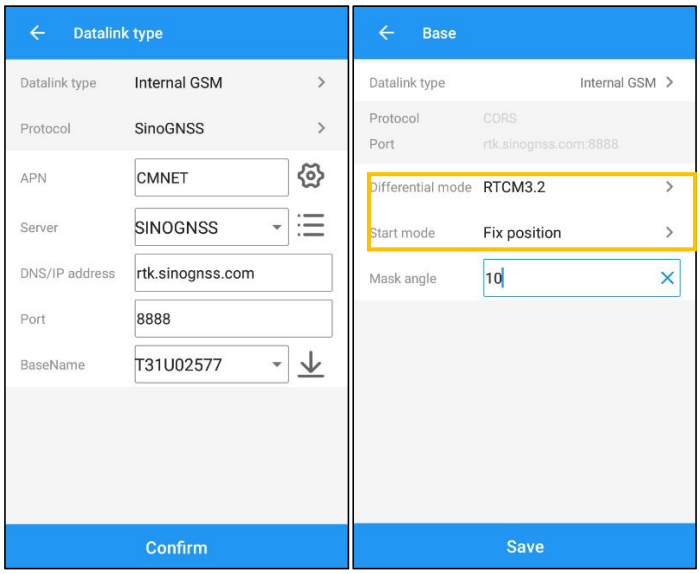


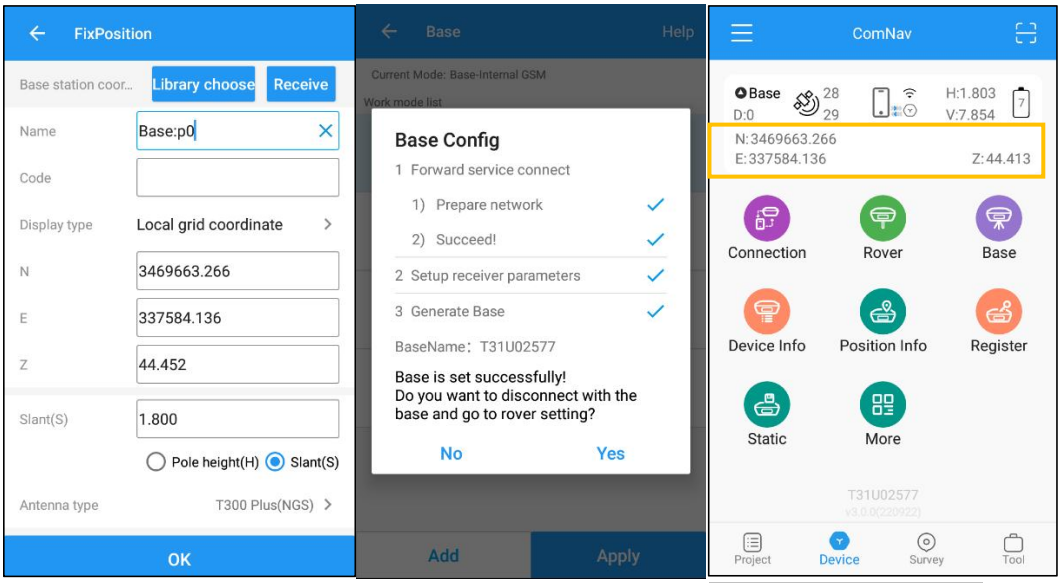
5.1.3 Internal GSM mode

This mode uses GPRS (internet data) to transmit the correction data from Base to Rover. You need insert a SIM card to Base, set the Base to log on server (with static IP address), and the Rover receives the correction data by Ntrip protocol.

The following figures show an example of Base configuration with internal GSM transmission.



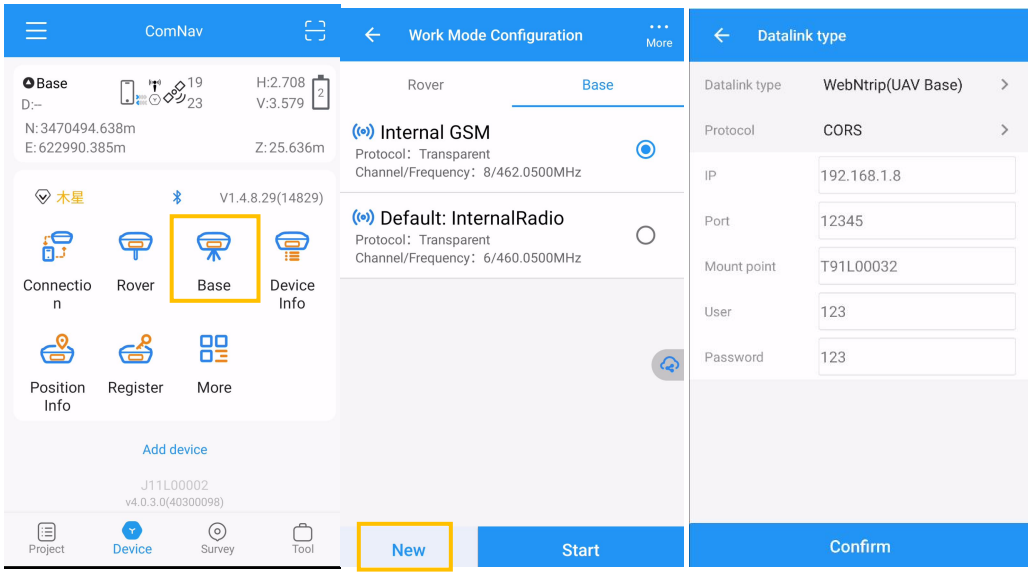




Tip: ComNav Technology provides a free static server address ***rtk.sinognss.com:8888****, anyone can upload CORS data so long as abide by the agreement.*

5.1.4 WebNtrip（UAV Base）

To simplify the workflow for UAV users who often require portable base stations in the field, devices with built-in Wi-Fi (such as T30, N3, N5, etc.) now support a WebNtrip(UAV Base). In this mode, the receiver broadcasts differential data through its own Wi-Fi hotspot, eliminating the need for complex web-based setup and enabling a quick and efficient startup process.



IP Address:192.168.1.8

Port:12345

Mount Point :Device Serial Number (SN)

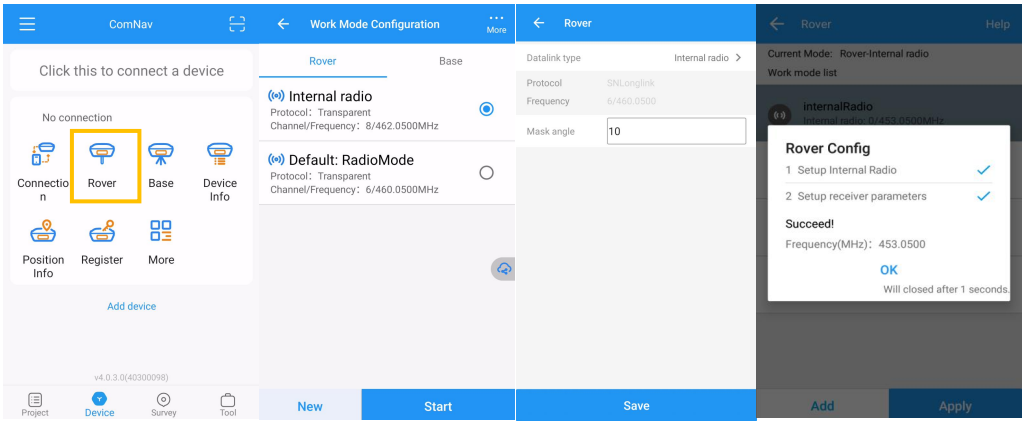
5.2 Start your receiver as Rover

This chapter shows how to start receiver as rover with internal radio, internal GSM and PDA CORS mode.

5.2.1 Internal Radio mode

Select the same protocol and frequency with Base receiver, then the receiver status will turn single to fixed.

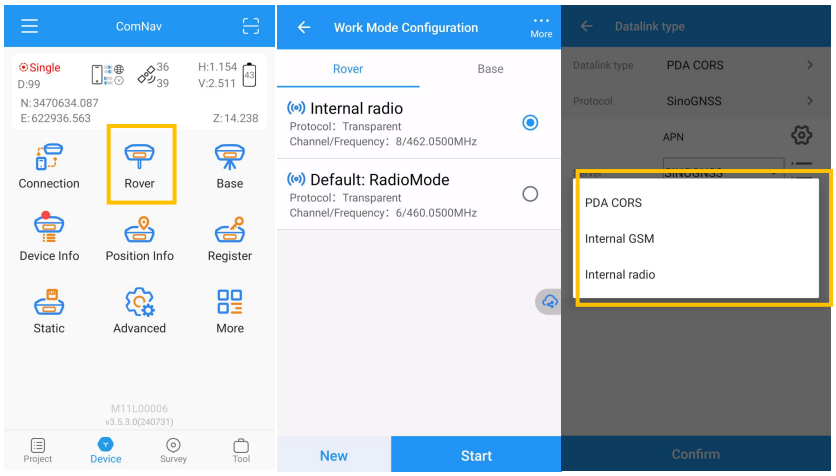
The following steps show an example of internal radio.

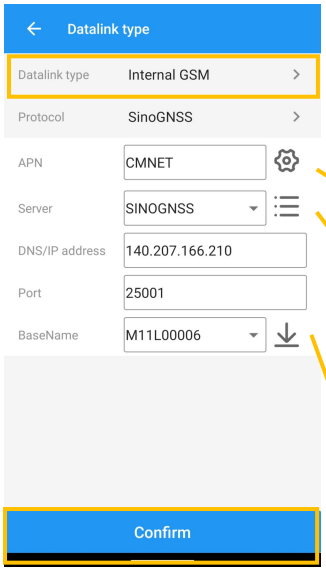


5.2.2 Internal GSM/PDA CORS mode

For internal GSM need insert a SIM card to receiver, for PDA CORS need make sure controller can access to Internet.

You should enter the server ***IP*** and ***Port***. In addition, enter ***User*** (login name) and ***Password*** to get ***Source List***.





Press to modify the APN for SIM card

Add your CORS info to list, press to select

Press to get source list and select mount point.

CORS base station distance sorting. The mount point list is sorted by distance from your current location, from nearest to farthest, so you can quickly find the closest base station from a large list.

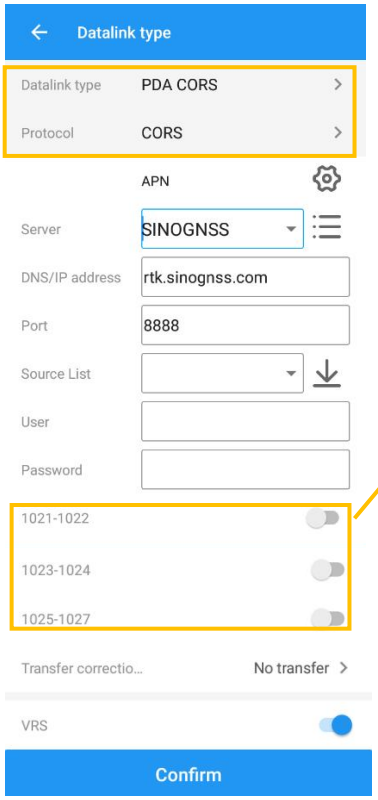
The protocol supports CORS, SinoGNSS, TCP.

SinoGNSS: This is the exclusive Ntrip protocol of ComNav, if you choose this protocol, then you will not be asked to enter the username and password.

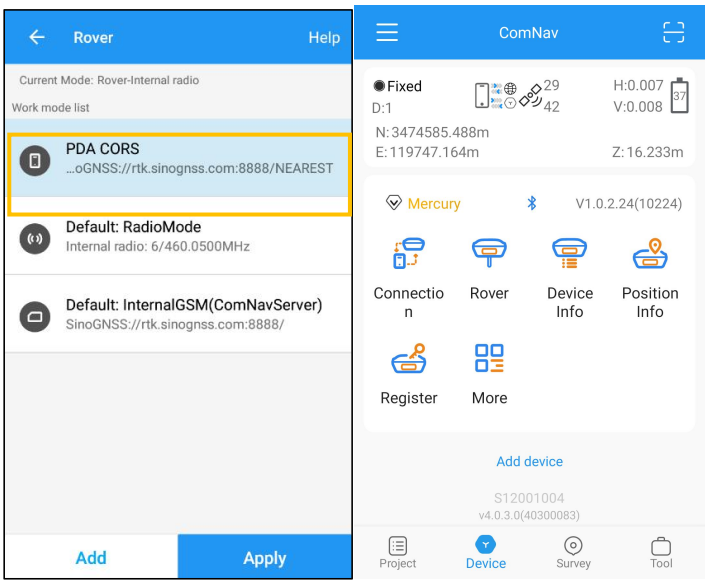
CORS: This is a common Ntrip protocol, you need to set the username and password.

TCP: This is used to directly obtain the corrections transmitted by TCP protocol.

Transfer corrections: This function can only be used for N5 (K7 platform), T30 IMU. You can use this function to transmit the corrections from the base via internal radio, which needs you to install the whip antenna on your current receiver and another rover.



1021-1027 message is only available for PDA CORS mode, the message is used for datum correction for CORS.



Tip: L-Band is only for PPP function, using PPP function can get the station coordinates directly, and there is no limit with the distance of stations, the accuracy can be up to 3-5cm.

6 Survey-field Data collect

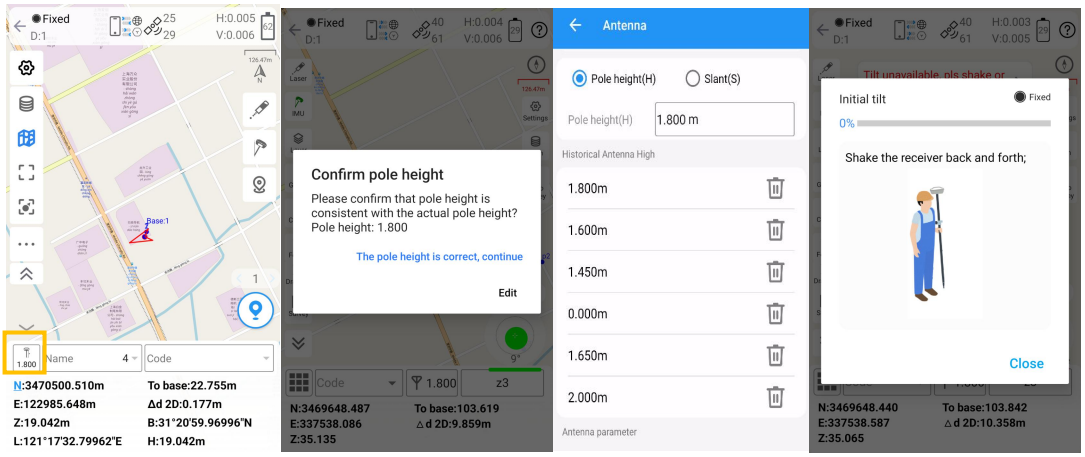
This section describes the basic survey functions of Survey Master, including Topo survey, Control Survey, Auto survey, Area survey, Feature survey and stakeout.

6.1 Topo survey

Click Topo Survey-> enter point name, ->click  to start or stop collecting data.

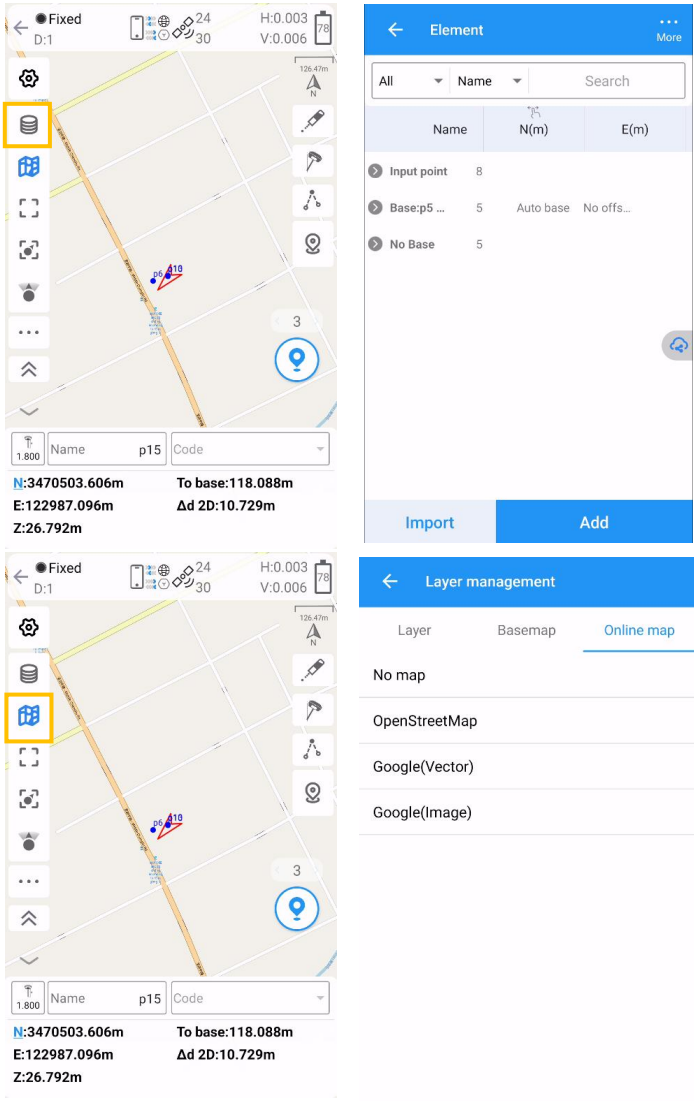
- You can quickly change antenna height in the survey interface.

Pole height list: Direct selection of historically designed pole heights.



- Tap ***Elem*** to check point coordinates.

- Tap ***Layer*** to show the layers: Open street map/Google (Vector)/Google (Image)



: Click this to show the whole points on the interface.

: If the arrow is out of sight on the interface, you can click this to locate the receiver position, then the arrow will be shown on the interface.

: When not turned on, the basemap interface is fixed and in north direction mode; when view following is turned on, the basemap rotates in the user's direction

: Click to enter Settings. Settings can be accessed from any Survey or Stake function.

Survey method: You can only choose survey point

H. RMS: Horizontal Accuracy Limit: A warning will be displayed if the horizontal accuracy exceeds this value.

V.RMS: Vertical Accuracy Limit: A warning will be displayed if the vertical accuracy exceeds this value.

MAX PDOP: Default is 4, and it can be customized.

Fixed: Enabled by default; if unchecked, there will be no accuracy restriction for survey points.

Point stepsize: Default is 1, and it can be customized.

Observed times: Default is 5 times, and it can be customized.

Offset radius: Default is 0.5; a warning will be shown if this value is exceeded, indicating point deviation.

Confirm before saving: If unchecked, survey and stakeout points will be saved to the element automatically. If checked, save point prompt will appear after survey or stake each point, and the point will only be saved to the element after confirmation.When you turn on this one, you can reuse GIS Attributes from previous point when survey,two modes available: reuse from last point or selected specified point. Quickly copy GIS attributes of previous points.

Standing survey: Enable auto survey. In IMU or laser mode, a shortcut button will appear on the survey screen. No manual click is required; points will be survey automatically after staying for 2 seconds.

Duplicate name: If checked, duplicate point names are allowed; if unchecked, point names must be unique.

Use quick code: When enabled, you can set the number of quick code pages. A 3×3 grid will be displayed, and codes can be added by long-pressing for quick survey.

Save photo when use laser: Software auto save photo when use laser camera(Device need support laser camera)

Use code location display description: When enabled, codes are displayed as "Code (Description)". When disabled, only "Code" is shown wherever codes are used.

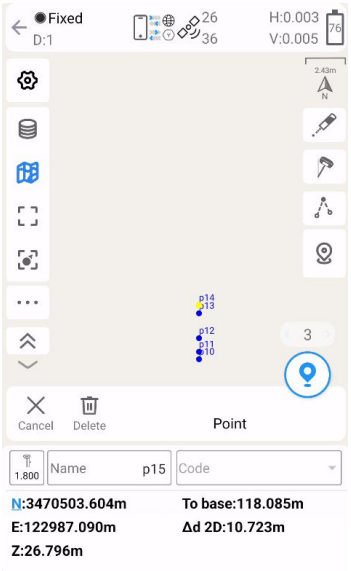
Save PPK data: When enabled, PPK data will be saved.

Point lable: When enabled, point lable can be used for notes during survey and stakeout.

Pos Update Freq: When 1 Hz output, the observation time is 1 second (1 epoch). The default for Topo Survey is 1 Hz, with options of 1 Hz, 2 Hz, 5 Hz, and 10 Hz.

In 4.0.3 version, Survey Master supports to delete the surveyed points on the screen, you can tab the surveyed point on the screen, the point will be highlighted, you can choose to delete it, then it will be deleted on the screen and in Element, you can restore it from the Recycle bin of Element. Also you can modify the point color and size.

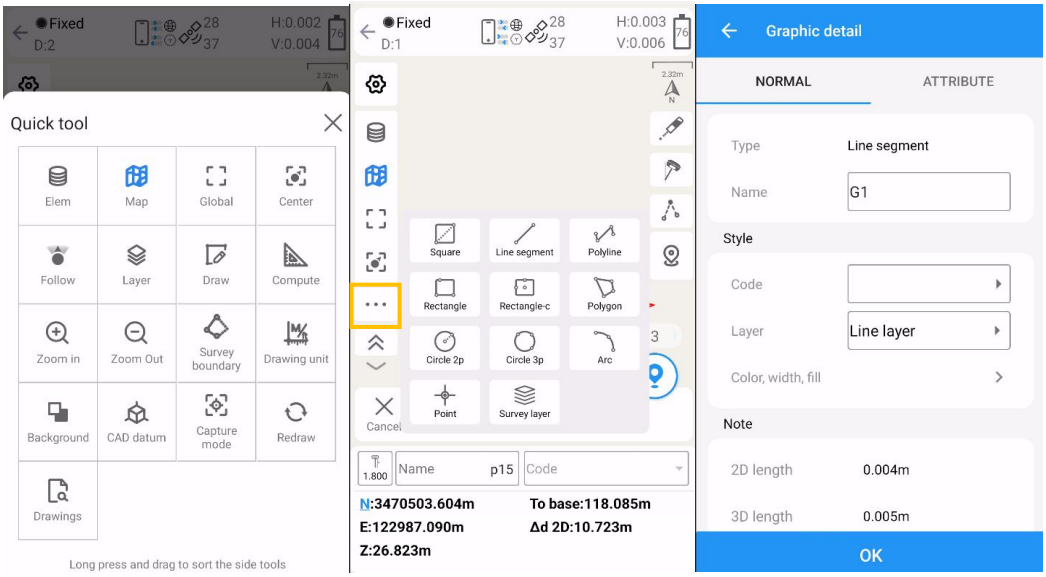
When you tab the surveyed point, then it will enter the edit mode, you can choose another surveyed point, then the previous selected point will cancel the highlight, the current selected point will be highlighted. Click [Delete] to delete point, click [Modify] to edit the point or click [Exit] to exit edit mode.



Choose one point on the screen, when the point is chosen, then it will be highlight on the screen.

Delete: delete this point, it will be deleted on the screen and Element, but you can recover it from the Recycle bin.

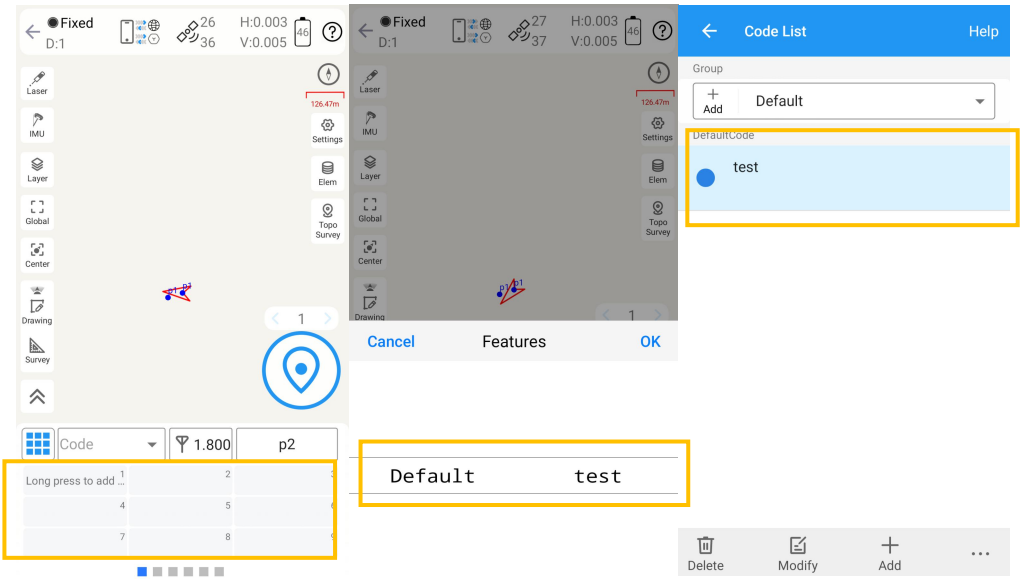
- Graphic survey: Tap the graphic button, the use the surveyed points and follow the guidance on the interface to draw graphics, you can export the graphic survey results as *.dxf format in Export interface. And you also can set up Code and Attribute.



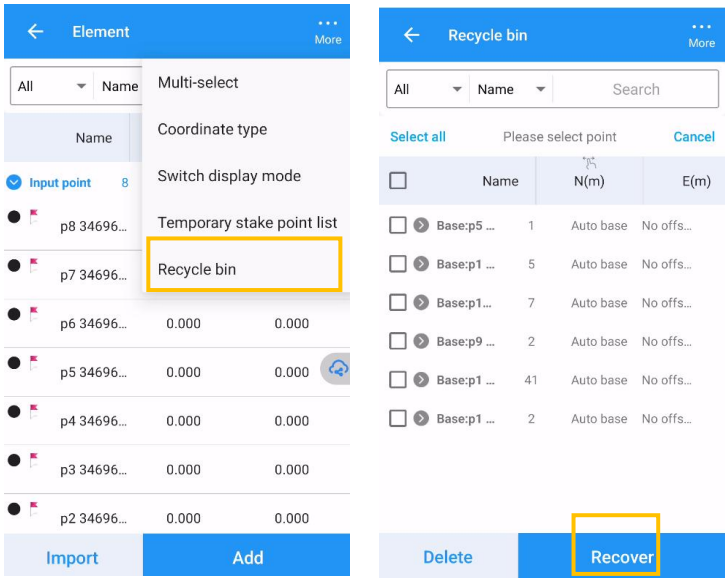
- Fast survey by pressing Code: Tap the code in nine panels, will survey the point

directly.

Tip: Go into code function to modify code list, then you can choose the code what you want to use in nine panels. For detailed information, you can refer to chapter 12.9

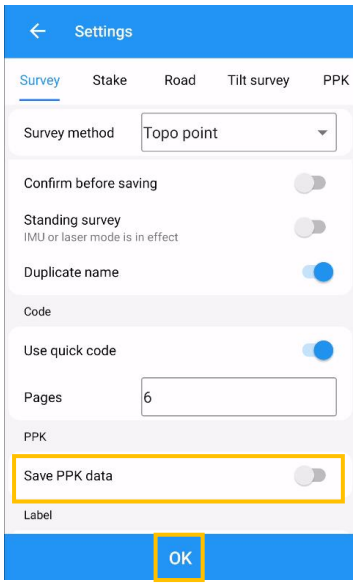


- Recover deleted points in Recycle Bin.



- Save PPK data

In the settings, if you check on ***Save PPK data*** button, then will save PPK data while doing RTK. It is designed for the harsh environment where the receiver is not stable to get fixed. When you back to office, you can post process the PPK data to get a fixed solution.



Tip: There is no button to stop the file recoding, when you reconnect the receiver next time, it will continue last recoding, unless you restart the software, it will stop record.

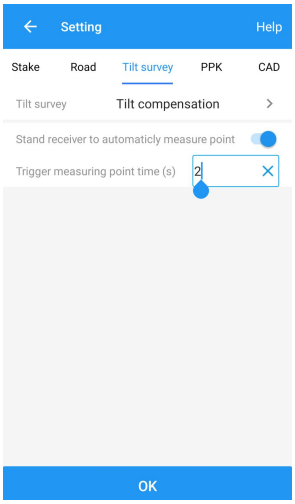
6.1.1 Tilt Calibration

There are three tilt calibrations for ComNav Technology receiver.

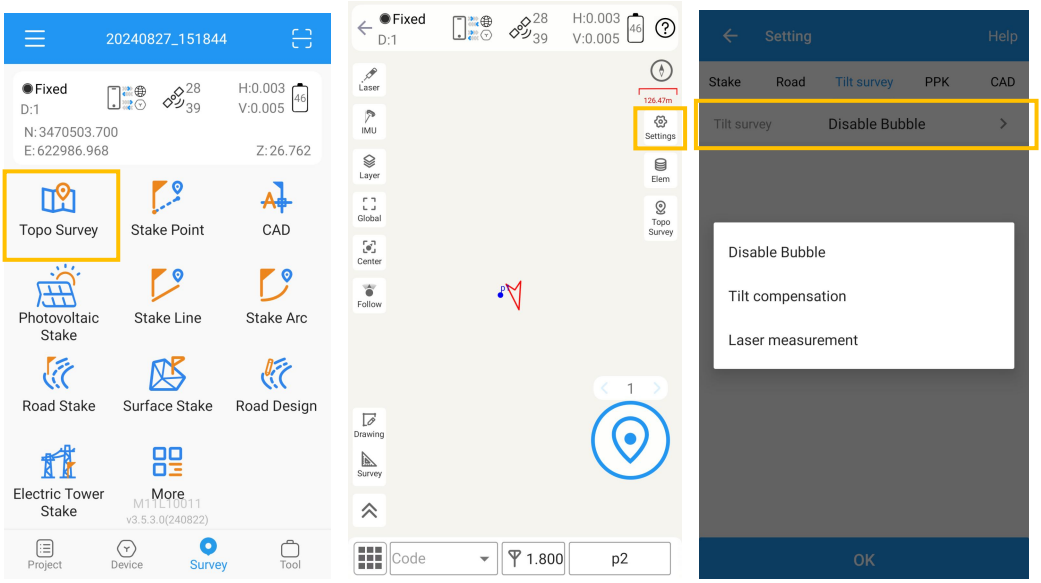
- Magnetometer: T30/T300plus receivers which are based on K7 platform;
- IMU modem: N5 (K7 and K8 platform), N3 (K8 platform) etc.
- Laser receiver: Mars, Mars pro, Venus which are based on k8 platform.

Tilt survey option will appear when receiver supports for tilt survey, it is available for ComNav Technology T30 and T300 Plus GNSS receiver (K7 platform), but T300/G200 does not support tilt survey.

When the pole tilts within 60° , the built-in sensor based tilt measurement system precisely calculates the actual offset according to angle, which can not only meets the requirement of high precision measurement, but also relieves the users from continually checking whether the pole is plumb.



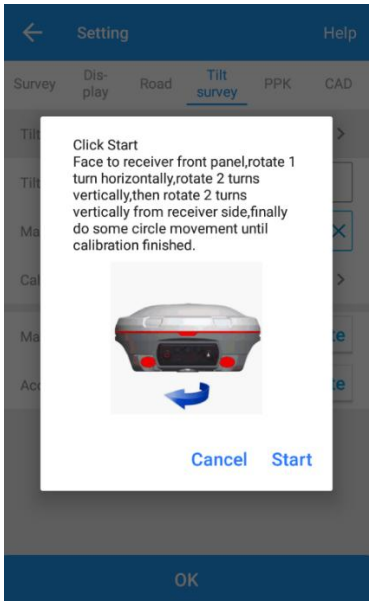
1. Check ***Tilt Survey option***: Go into Topo survey—Settings—***Tilt Survey***



- Tilt tolerance: the value is relevant with the antenna height, if antenna height is 2m, the tilt should be less than 1m (tilt angle should less than 30°)
- Magnetic field strength: default value is 70, You can check current field Magnetic strength: ***Device*** → ***Position Info.*** Please kindly adjust it, the bigger value of magnetic field strength is, the more increase of measure error will be.
- Calibration interval: supports 20 days, 90 days, 180 days, 365 days, if you choose 20 days, it means tilt calibration will expired after 20 days.

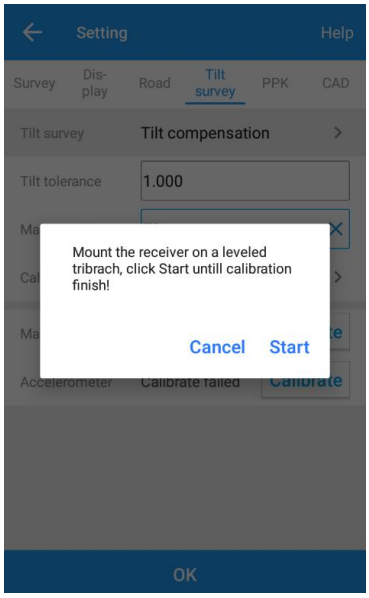
2. ***Calibration***

If calibration expired or you first use the receiver, tap Calibrate and follow the guidance until succeed. During operation, make receiver can search the satellites.



Magnetometer calibration:

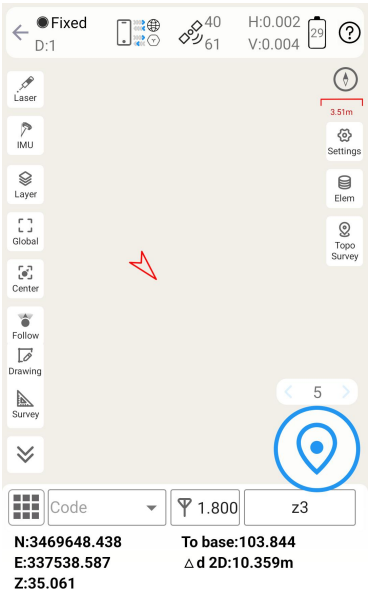
- Operate as the picture shows.



Accelerometer calibration:

- Mount the receiver on a leveled tribrach. Be sure the receiver is definitely in a horizontal state. This step is very important for receiver to get high accuracy.

In survey interface, you can find the bubble and angle value shows the pole you tilt. The angle should be less than 30° , for more accuracy, angle less than 15° will be better.



Tips: In the Tilt Survey, there are three options: Disable Bubble, eBubble, Tilt compensation, Disable Bubble: not use bubble or tilt during surveying;

eBubble: will show bubble only on the survey interface after do magnetometer calibration and accelerometer calibration, this will help you to check the bubble position on the pole, so you can check the bubble on the interface instead of on the pole; but this doesn't use calibration parameters during surveying, so you should keep the bubble centered to get high accuracy.

6.1.2 IMU calibration

All K8 series products that support IMU, with firmware version 1.4.6.02 or above on the EG25 platform, and 1.1.4.11 or above on the EC20 platform, support Auto IMU, You only need to turn on the IMU switch to start using the IMU.

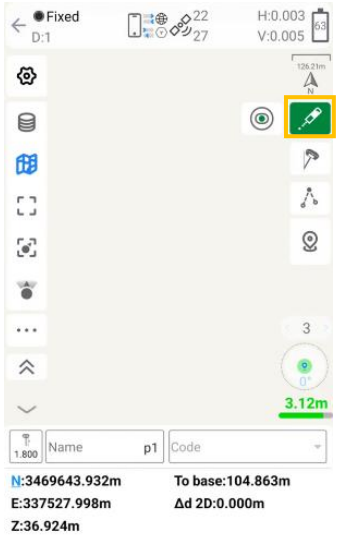
6.1.3 Visual Survey

Currently only Jupiter receivers support Visual Survey function. When using the Visual Survey function, you need to connect the Jupiter receiver to Survey Master via Wi-Fi.

When you use laser survey function, in some special scenarios, such as when the laser distance is too long, it can be difficult to see the location of laser point with the naked eye. By turning on the camera, you can quick find the laser marking point in

the software.

1) First, click laser. Align the target point use the laser.



2) Then click camera. Now you can see the laser point position in the software.





3) The progress bar represents the IMU accuracy: green indicates good accuracy, red indicates poor accuracy. If the progress bar is green but not full, you can shake the receiver to restore full accuracy.

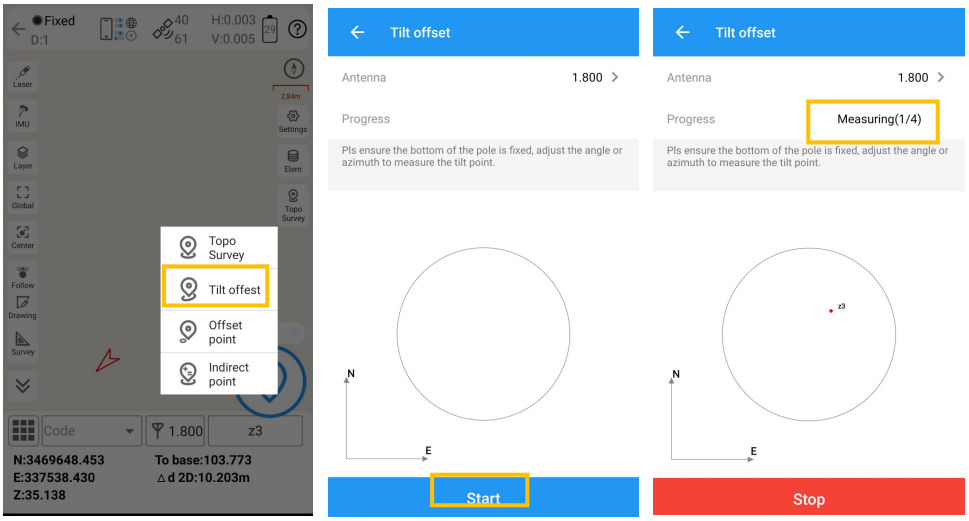


4) Drag Zoom up to zoom in. Drag Zoom down to zoom out.

6.1.4 Tilt offset

Tilt offset function is different with Tilt survey. It is available for ComNav Technology GNSS receiver, Not only T30, T300 Plus, but also T300 and G200.

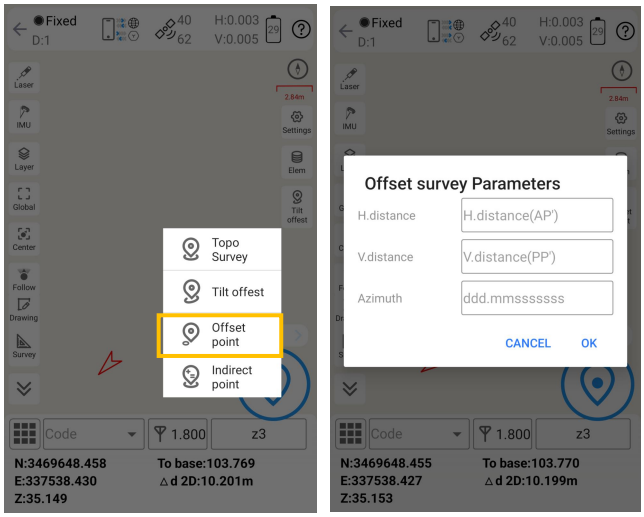
Need you to ensure the bottom of the pole is fixed, and measure 4 points from different angle or azimuth. It will use these 4 points the tilt point.



Tip: We have tested this function, but the accuracy of tilt point is not good and less than tilt survey. We will take our effort to solve this problem. We suggest you to use tilt survey if you have high-precision requirements.

6.1.5 Offset Point

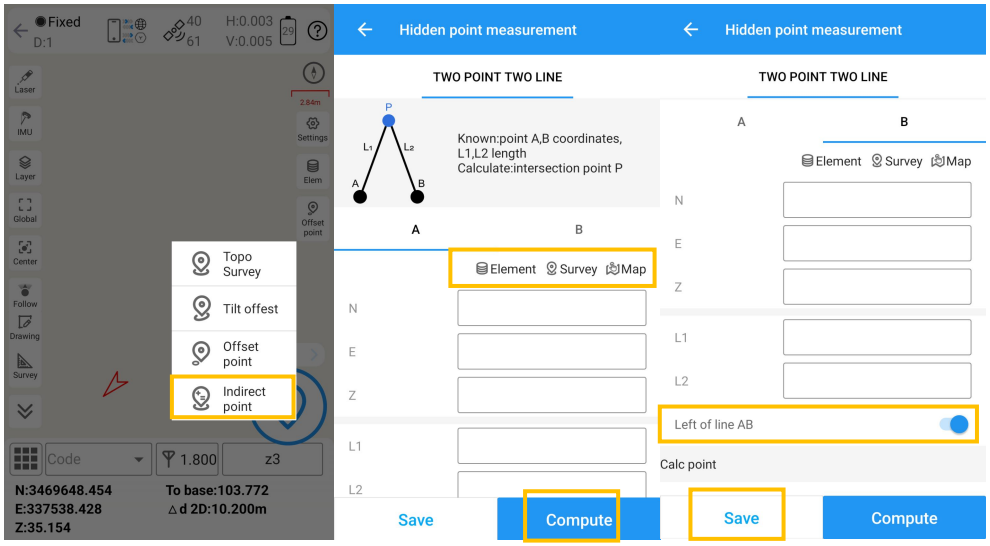
When you measure a point that cannot be approached in the field, you only know the distance and azimuth from the point to the current position, you can use the ***Offset Point*** function to calculate the coordinate of the unknown point, and save the point to the Element.



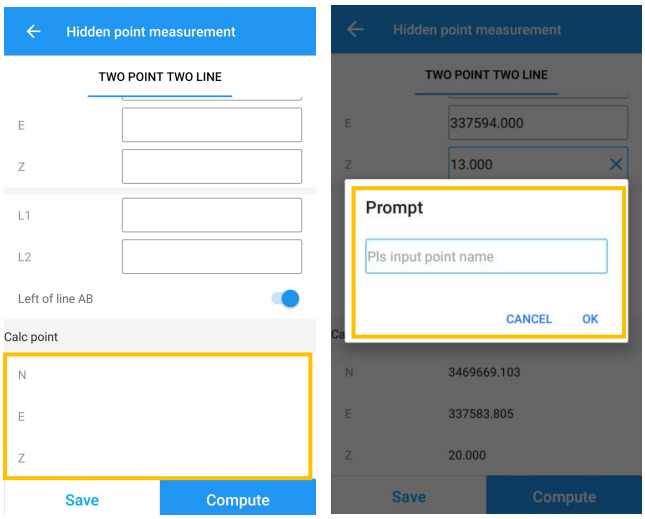
- ***H.distance***: The horizontal distance from unknown point to the current position;
- ***V.distance***: The horizontal distance from unknown point to the current position;
- ***Azimuth***: Taking the current position as the origin, starting from the true north of the current position and clockwise to the angle between the unknown point.

6.1.6 Indirect point

This function is used to calculate the coordinates of a point at a certain distance from the known point A and the known point B.

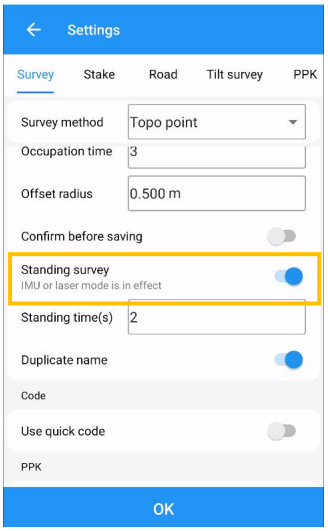


- You can enter the point A and point B coordinate manually, or you can click the to select from ***Element***, or click to survey the point;
- Enter the L1 and L2 for distance from point A to the unknown point P and distance from point B to the point P;
- Determine whether the unknown point is to the left or right of the AB line, and the direction is from A to B.
- Click ***Compute*** to get the unknown point P coordinate, it will be shown under the interface, click ***Save*** to enter the point name and save to the ***Element***.



6.1.7 Standing survey

There is no need to manually click the measurement button in the software, just leave the receiver stationary to automatically measure points.
Active Stand survey to automatically measure point option, and set the trigger point time. By holding still at a point for several seconds, the point can be measured automatically.



6.1.8 Offset laser

The Offset laser function is designed for scenarios where the center of a target cannot be measured directly, but its actual coordinates need to be obtained quickly. By measuring a point on the target surface with the laser and entering a compensation value such as the target radius, thickness, or a fixed height offset, the software automatically calculates and stores the compensated coordinates. This function is particularly useful for surveying trees, utility poles, light poles, pipelines, and other objects with known dimensions.

Click Tool →Offset Laser, includ Distance offset and Elevation offset.

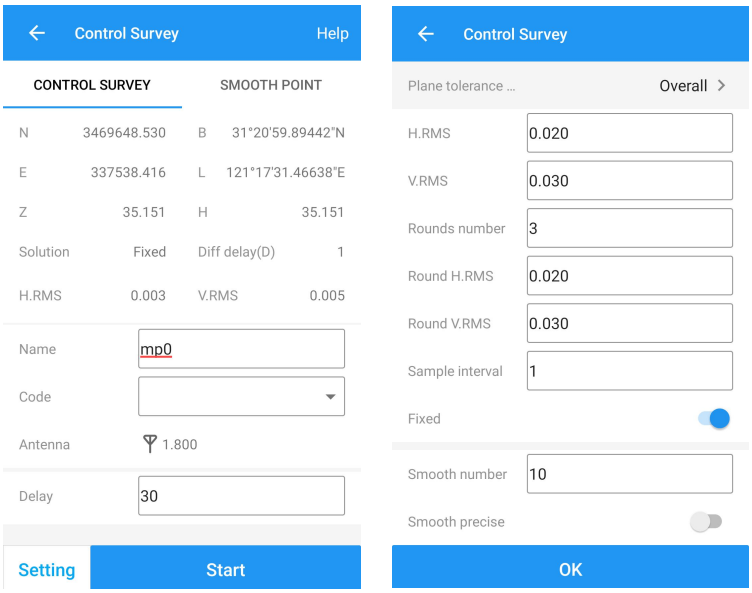
After offset value is entered, the laser length displayed on the survey icon will be extended accordingly. Both the distance offset and elevation offset values are applied once and will be automatically disabled after the point is measured.

This function is only available on devices that support laser and requires the laser to be enabled before use.

6.2 Control survey

Control survey is also called topographic control survey, used for topographic mapping, including horizontal control survey and vertical control survey. Generally, control survey is gradually encrypted between high-level control points.

1. Control survey should be carried out under the control point network.
2. The accuracy of the control points is measured by the median error relative to the adjacent control point.
3. The density of the control points is determined according to the terrain, the instrument and the measurement method used.



Control survey:

1) *Click Survey->Control survey, enter the control survey interface;*
2) *Name: Set a name for the control point;*
3) *Code: Same as Topo survey, set a code for the control point;*
4) *Antenna*: Set antenna height;

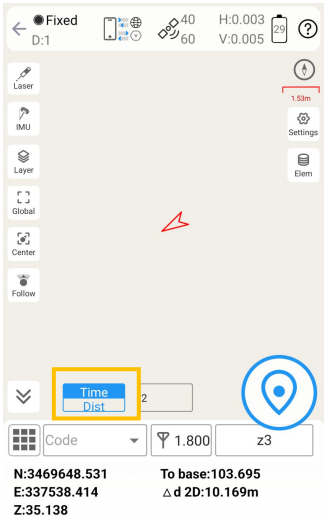
5) *Delay*: Set the delay time between two rounds, and can check the process bar in *Reset*;
6) *Smooth*: This is similar with the occupation time, there are 2 numbers on the behind of the process bar, the first number shows the status of the smooth point collection, the second number shows the total number of the points involved in the smoothing, for example, if you set the smooth number to 10, the receiver will collect 10 times, and take the average of these 10 times results as the smooth point;
7) *Round*: One round will get one smooth point, there are 2 numbers on the behind of the process bar, the first number shows the current measurement round, the second number shows the total number of the measurement round during the control survey, if you set the round number as 3, the receiver will collect 3 smooth points, and take the average of these 3 smooth points as the final result, called control point;
8) *Reset*: During the reset, the receiver will pause the measurement point, after one measurement round, the receiver will undergo a reset before starting next measurement.
9) *Start*: Start Control survey, after smooth, round, reset, the control survey will be completed.
10) *Setting*:
    a) Plane tolerance method: includes overall and each component (dN, dE)
        - Overall: combined dN and dE, and set tolerance for the combination, generally, the combination is square root.
        - Each component (dN, dE): set tolerance for dN and dE respectively.
    b) H.RMS: Plane tolerance of mapping survey, the default is 0.02, unit: meter.
    c) V.RMS: Set height tolerance of mapping survey, the default is 003, unit: meter.
    d) Rounds number: Set the round number, the default is 3.
    e) Round H.RMS: the average plane tolerance of the smooth points between two rounds, the default is 0.02, unit: meter.
    f) Round V.RMS: the average vertical tolerance of the smooth points between two rounds, the default is 0.03, unit: meter.
    g) Sample interval: The staketime interval between two smooth points, the default is 1s.
    h) Fixed: When check on this button, then it won't let you to survey the point if the status is not fixed; When check off this button, you can survey a point even it is not fixed.
    i) Smooth number: The number of smooth point number within a round, the default is 10, and no less than 3.
    j) Smooth precise: Set the tolerance for the smooth measurement within one round, the default is 0.02, unit: meter.
11) SMOOTH POINT:
    a) σ: The error value within one round;
    b) Round: Display the smooth point data in each round in the measurement

process;

12) Export the report: You can export the control report after completing the control survey, for more information, please refer to Chapter 12.2.

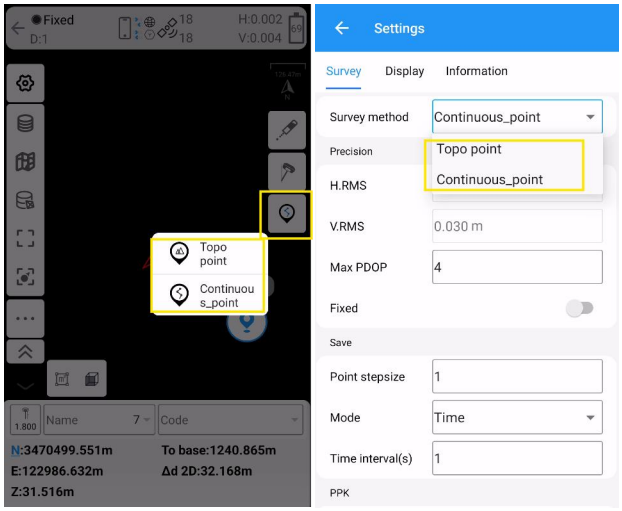
6.3 Auto survey/Area survey/Detail survey

- ***Auto survey***: automatic and continuous survey by Time or Distance.



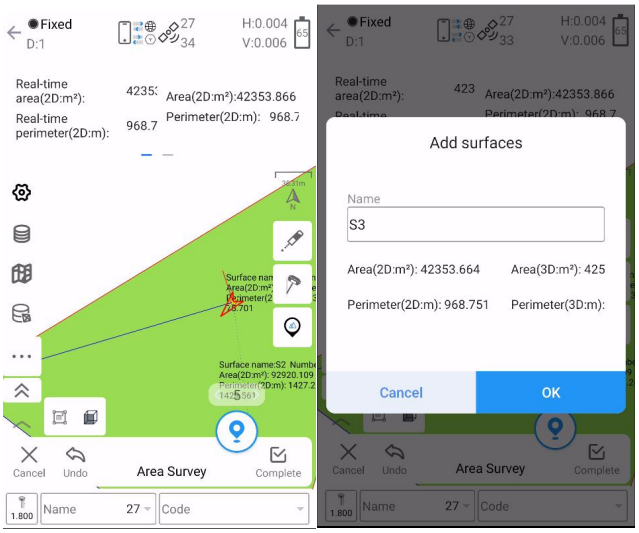
- ***Area survey***: compute area directly after getting points.

Survey method: Topo point is the default. It can be switched to Continuous point (via switching in the Survey interface or in the settings page).



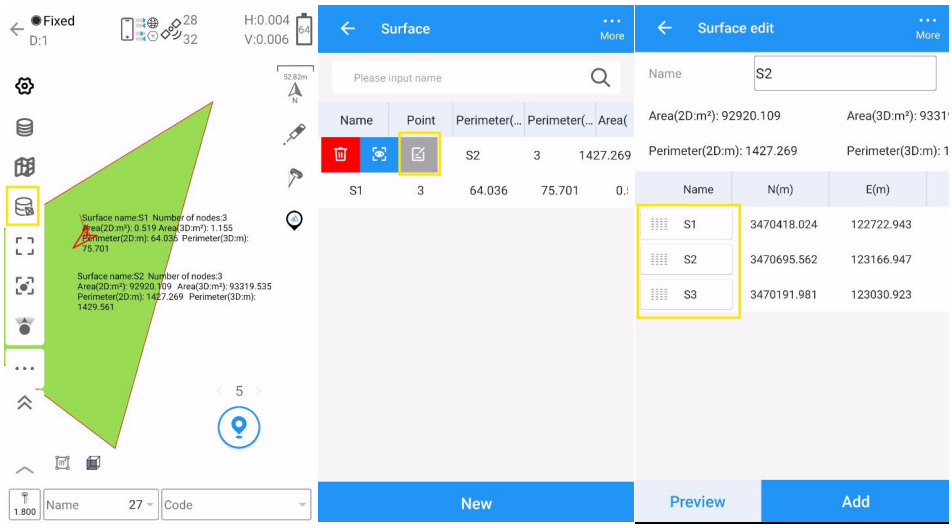
Survey three or more points or select three or more points from the Element. the system will automatically connect them in order to form a closed surface and generate

an area shape. The top information bar on the main interface displays real-time perimeter and real-time area.

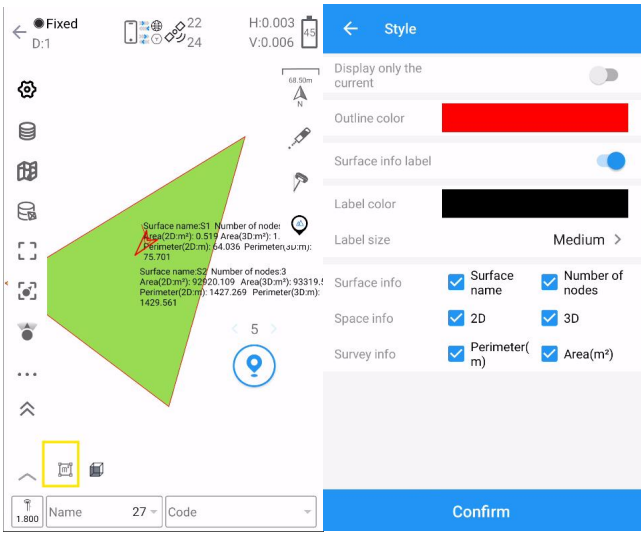


Click Complate, enter the surface name, click OK.

Clice Surface Store→Edit to view the point sequence. Long-press the point name to adjust the order.

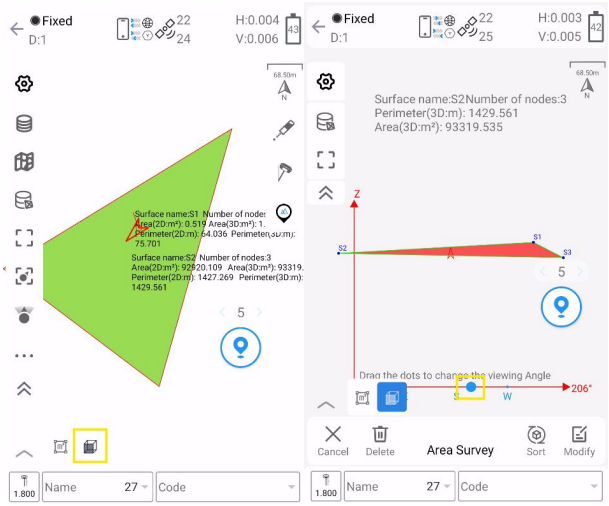


Style: Set up surface display information.

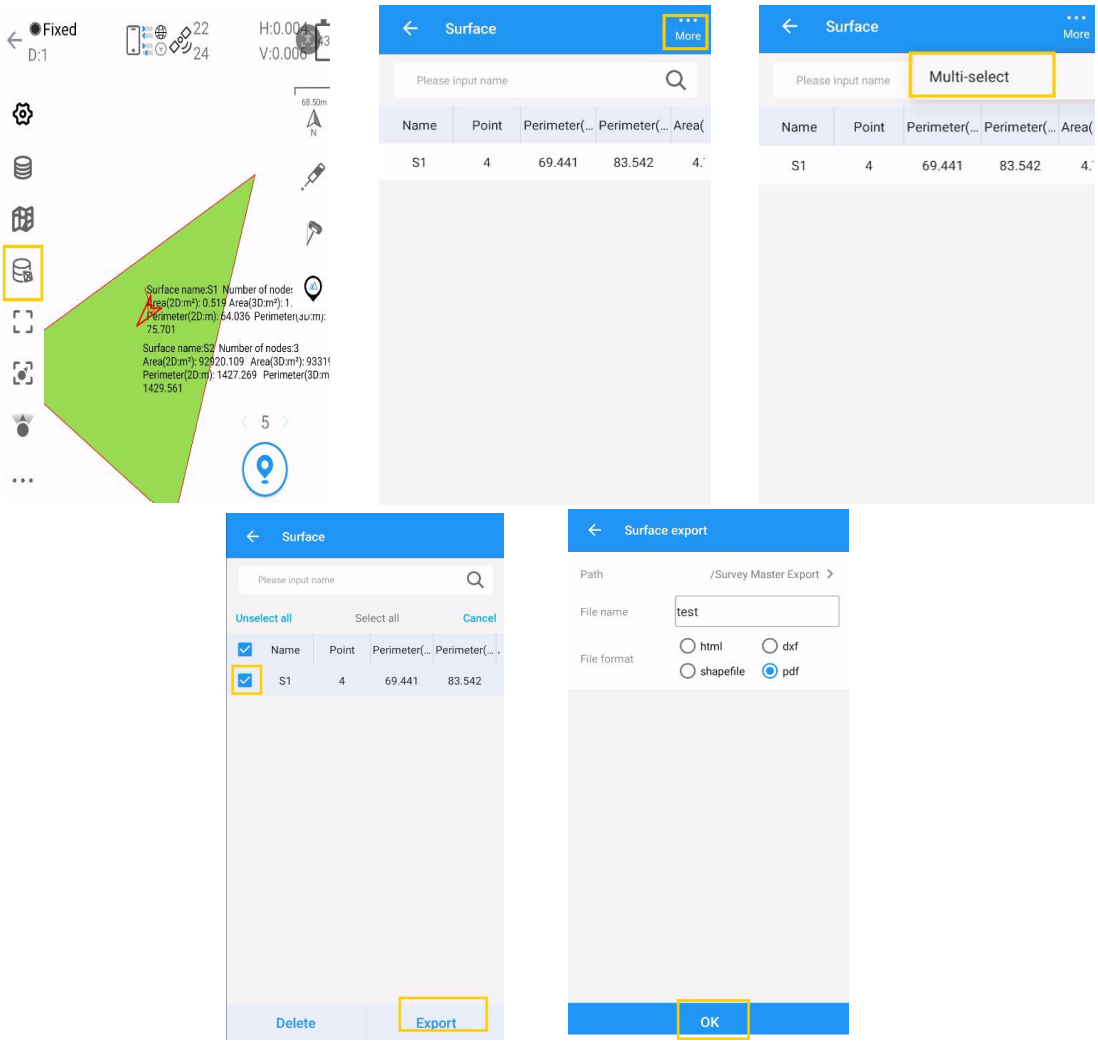


Display only the current: When enabled, only the surface currently being surveyed is displayed on the map. When disabled, all areas are displayed. Disabled by default.
Outline color: Default is red and can be customized.
Surface info Label: Enabled by default. Displays Label color, Lable size, surface information, space information, survey information.
Label color: Defines the color of the surface label and can be customized.
Label size: Defines the font size of the surface label. Available options: Large, Medium, and Small.
Surface info: Surface name: User-defined surface name. Number of node: Number of points that around the surface boundary.
Space Info: 2D: Elevation is not considered. 3D: Elevation is considered.
Survey Info: Perimeter, Area

3D mode: Click to enter 3D Mode, where you can view a 3D representation of the current surface. Drag the model to view its projection from different directions and angles



Surface export: Select a feature and click Export to open the polygon export interface. Export formats supported: HTML, DXF, SHP, PDF.

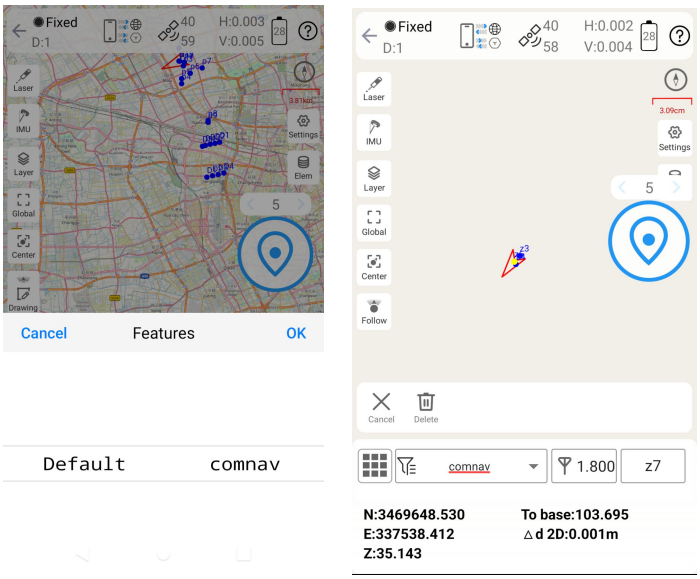


6.4 Feature survey

For feature survey, you can survey points, lines, polygons. After survey the point of line or polygon, you can real-time drawing them into a graph. This can help you see the features clearly. If you use the code that you add, the feature will show the same color and style of the code.

1. Choose the code and go survey:

You can select the code of point, line and polygon to go ***feature Survey***. After measured, the feature will store in ***Features***.



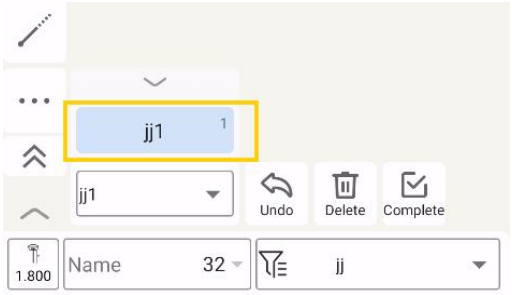
Delete: Delete current surveying feature.

2. Real-time drawing:

Click , it will prompt to complete the line or polygon survey. The line and polygon will show the same color and style of code in the feature survey interface.

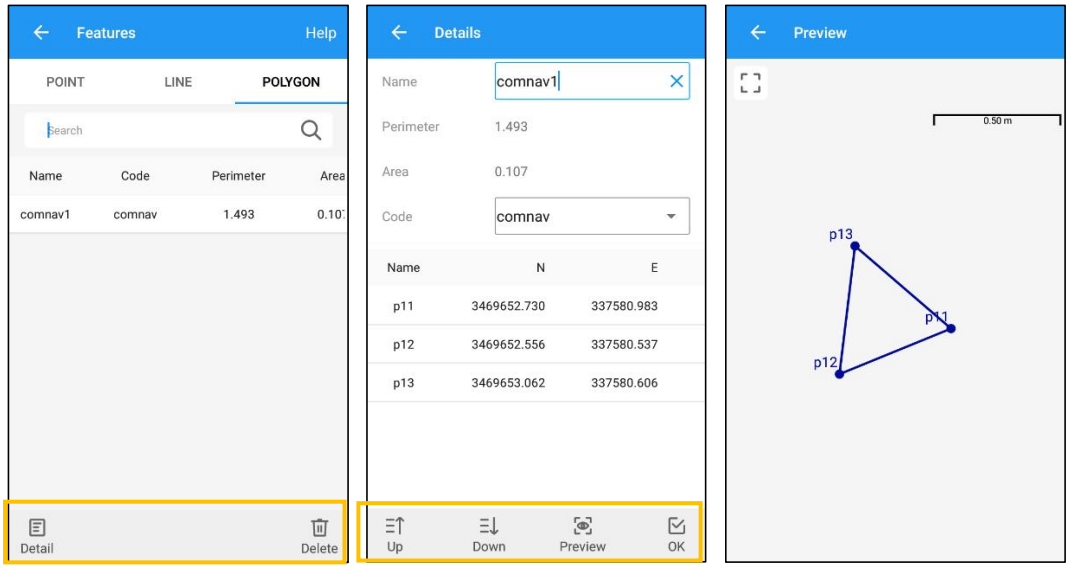
Tip: If you want to draw a line or polygon, you need to survey all the point in the line and polygon. Be sure the points are all the same code. After these, you can automatically draw.

When the current code survey is not completed, switching to another code type allows tapping the Feature name drop-down to view previously measured features, and blue buttom to continue the survey.



3. Check and manage the features:

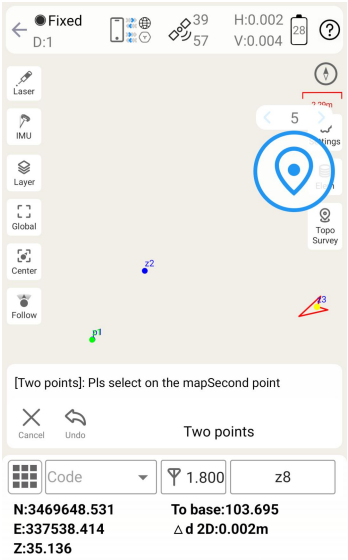
Click ***Features*** in the Project interface, you can delete or see the details of the feature what you selected. Including check the point of feature and preview it.



There are new added functions in Feature Survey.
1.Calculate the distance between two pints.

Click the ***Distance*** icon on the right side of Feature Survey, then the icon will be highlighted. Click ***Distance*** icon again or click ***Exit*** to exit the distance calculation mode.

Follow the instruction on the screen to calculate distance or exit calculation mode choose the first point one the screen,
Second point: choose the second point on the screen, then it will get the distance information between these points you selected.

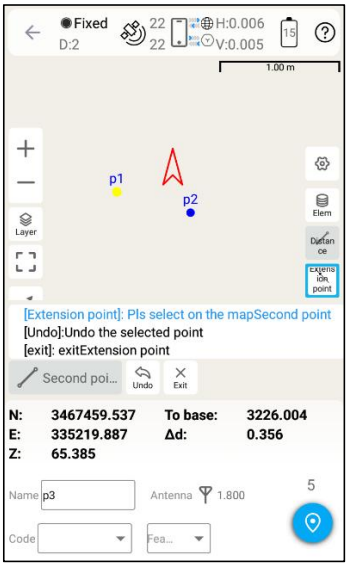


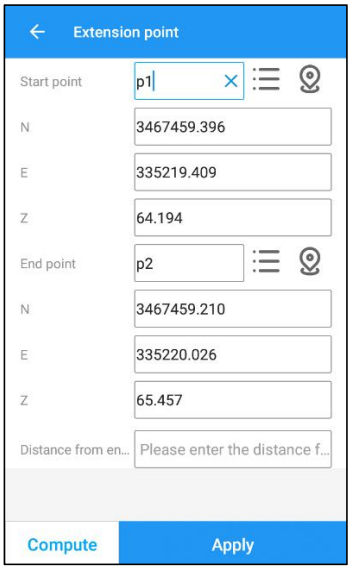
2.Calculate the extension point

When you choose ***Extension point*** icon, you will enter Extension point mode, pls follow the instructions on the screen to finish the calculation. Select the two surveyed points on the map, when select the first point, it will be highlighted, then select the second point on the map, set the distance of the second point, click compute to get the extension point, set the point name and click Apply to save point in Element.

Undo: Undo the selected point, you can choose the first point again.

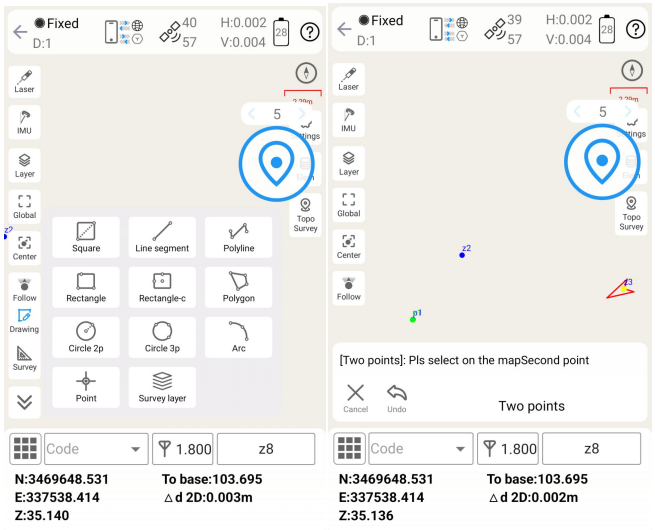
Exit: Exit the Extension point calculation mode.





3.Draw graphics using the existed points

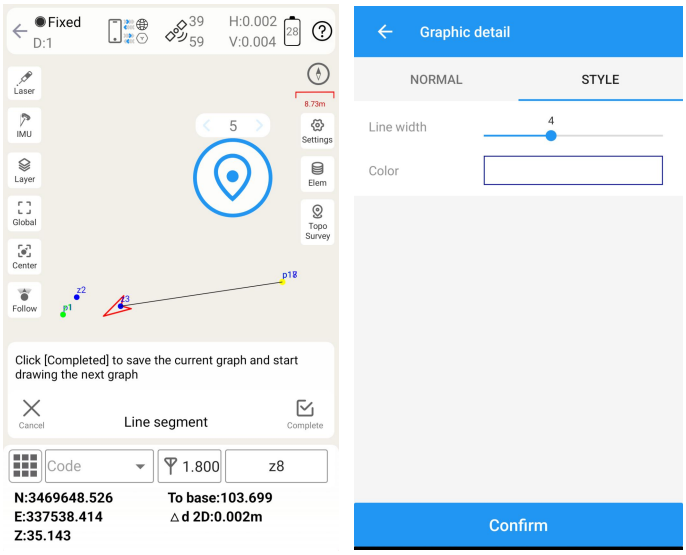
Use the graphics on the left side of Feature Survey, supports to draw line segment, polyline, polygon, circle, rectangle, etc. All these drawings can be exported in the dxf file export.



Completed: Finish the drawing.

Tips:

1. *For line segment, when you choose two points, it will finish one line segment automatically, same with rectangle, circle, square and arc.*
2. *For the polyline and polygon, you need to complete the garphic drawing manually.*
3. *Take the polyline for example, choose the Polyline on the screen, then choose the points on the screen to draw line.*
4. *For these graphics drawn by the user, you can choose them on the screen, then edit their color and type, or delete them.*
5. *Choose one drawing on the screen, this drawing will be highlighted.*

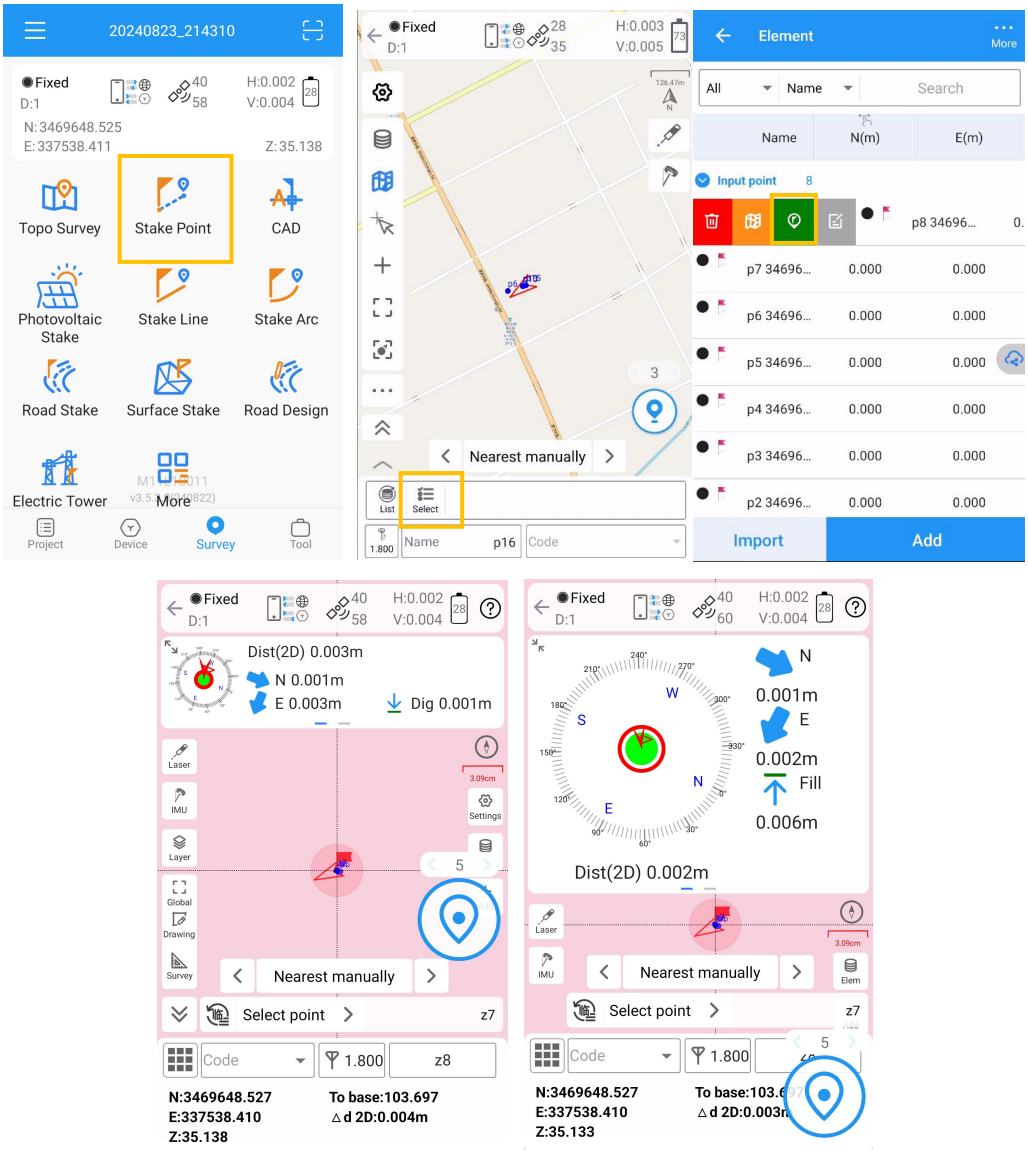


6.5 Stake points/lines

6.5.1 Stake points

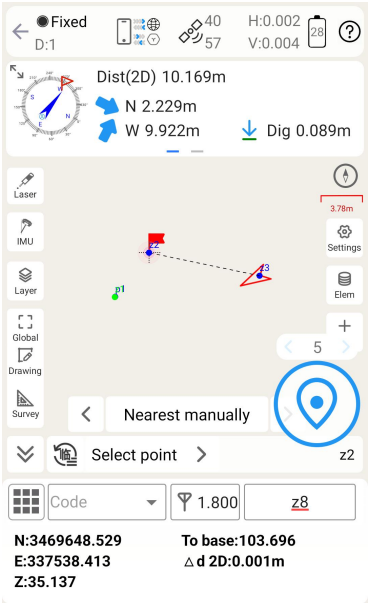
Go into ***Stake point*** interface, click to choose a point and tap ***Stake***. Survey Master

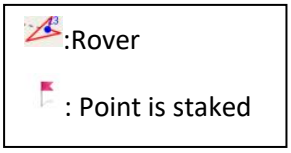
provides a navigatiofn map when staking points/lines. If you are close to the target point enough, it will alarm you based on the alarm range you set.



Various navigation info choices

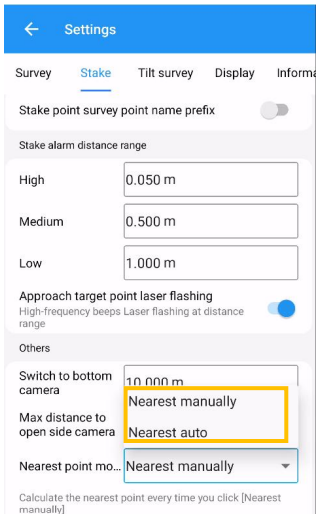
Tip: Survey Master supports to select the point on the screen directly, including the surveyed points and points from the background layer, when you click the point on the map, it will change to this point automatically, so you can stake it. For the points selected from background layer, they will be saved to the Element as the ***Map Selected Point*** *type.*





For N5 receiver, T30 IMU receiver etc, you can use IMU staking function. In the IMU staking, you can open IMU function, and don't need to keep the receiver vertical to the ground, and the tilt angle supports maximum to 60 degrees.

For Mars receiver, Mars pro receiver and Venus receiver, you can use laser staking function. In the laser staking, you can open laser function, and no need to keep the receiver vertical to th ground.



Stake nearest point mode: Nearest manually and Nearest auto.

Nearest manually: Calculate the nearest point every time you click Nearest manually.

Nearest auto: Follow the receiver position to automatically calculate the nearest point and switch.

Elevation: The user can also choose to Input new Design H, Input vertical offset, Use original Design H (default), use a surface file, or Display real-time H.

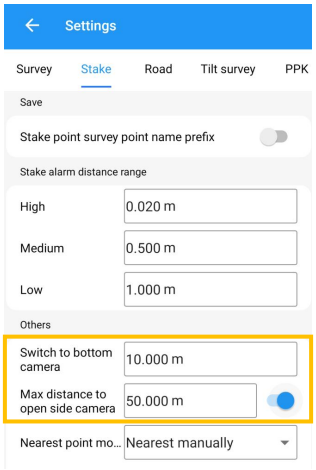
6.5.2 Visual Stake

Currently only Jupiter receivers support Visual Stake function. When using the Visual Stake function, you need to connect the Jupiter receiver to Survey Master via Wi-Fi.

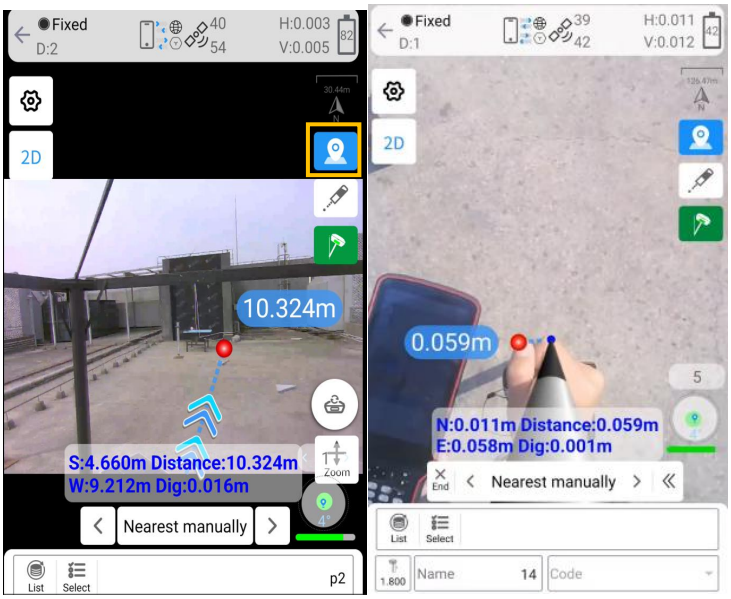
1) Switch to bottom camera : Allows you to set the distance for switching to the button camera during point stakeout, default value is 10 meters.

Max distance to open side camera: Allows you to set the distance for switching to the side camera during point stakeout. It is enabled by default, default value is 50 meters.

Bottom camera and side camera can automatically switch: when the distance from the stake point is more than 10m and less than 50m, the side camera will be turned on automatically. When the distance from the stake point is less than 10 meters, it will automatically switch to the bottom camera.



2) Click on the visual button. After the button turns blue it means that it enters the visual stake mode. Please make the controller and the camera oriented in the same direction. Use the side camera for direction guidance at long distances and the bottom camera for precise positioning at short distances.(It is important to note here that when you use the Visual Stake function, do not turn on the laser.



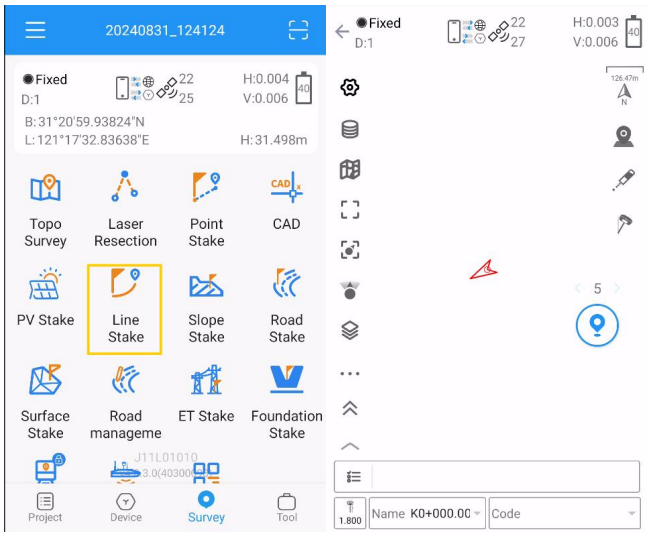
3) Red point: target stake point.

The numbers on the navigation: Distance to target Stake point.

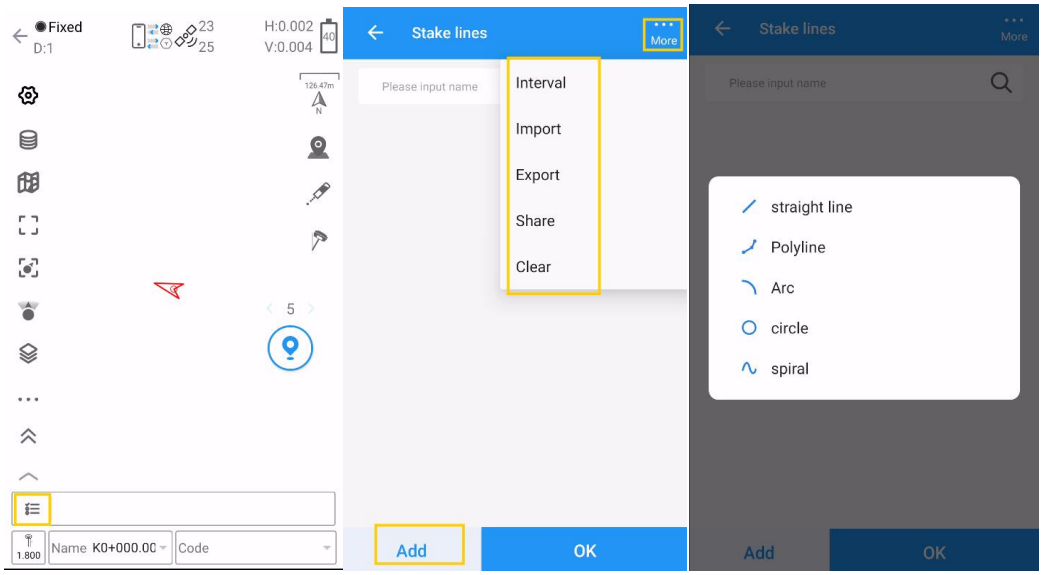
Green circle: indicates an approaching target point.

Virtual pole: Switch to the bottom camera and turn it on automatically.

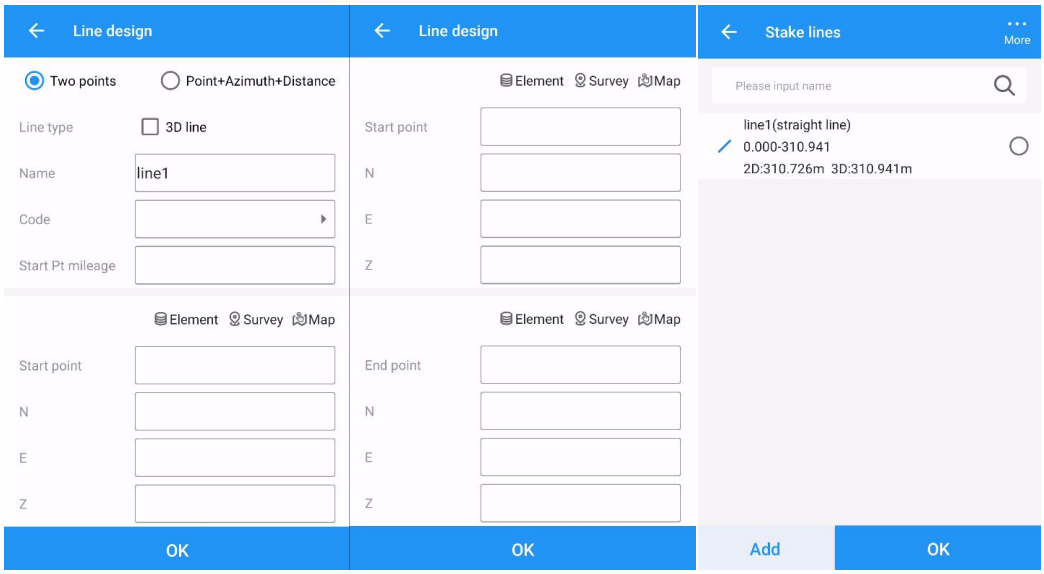
6.5.3 Stake line



Line store



Add Line： support straight line, Polyline, Arc,circle,spiral.



Straight line: support 2 ways, Two points and Point+Azimuth+Distance

Line type: support 2D and 3D line

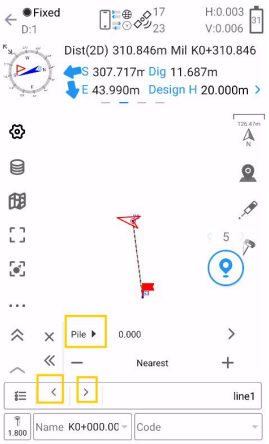
Name: The name of the line. By default, the first line in the project is named Line1, the second Line2, and so on. A custom name can also be entered.

Code: The line code. A custom value can be entered.

Start Point: The starting point of the line. It can be entered manually , selected by tapping Element or select point from map.

End Point: The ending point of the line. It can be entered manually, selected by tapping Element or select point from map.

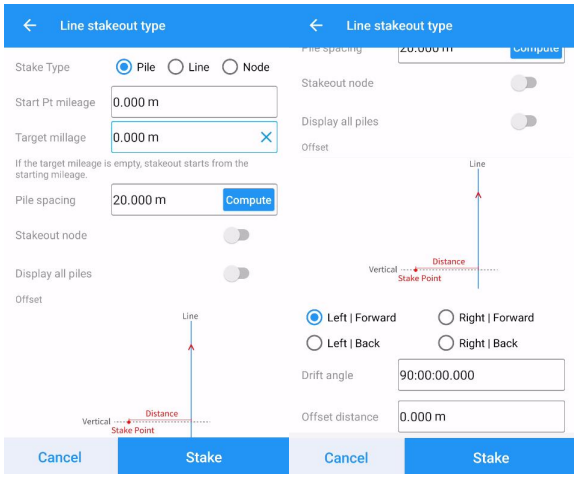
Stake line



Select a line for stake, the system enters Stake Line mode, Stake Pile by default.
Click Stake Mode (Pile) to open the Stake Scenario Setting. Include stake Pile, stake Line and stake Node.
The line name and the currently selected stake scenario are displayed at the bottom of the

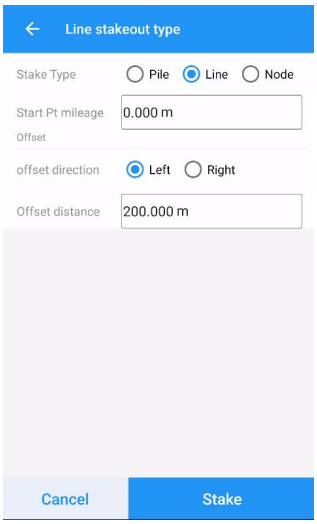
screen. Click “<” or “>”to switch next lines for stake.
You can use camera to stake line, when your receiver has camera, such as jupiter. You can click  to use camera to do visual stake line.

Stake Pile



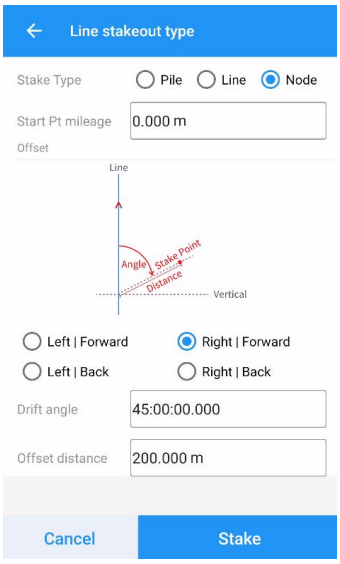
Start Pt mileage: The starting mileage of the line is set to 0 by default.
Target mileage: When a target mileage is entered, stakeout starts from that mileage instead of the start mileage.
Pile spacing: Distance between two Piles. Tap [Compute] to automatically calculate the Pile spacing.
Stakeout node: Enabled: Stake at each node when moving to the previous or next stake.
Disabled (Default): Don’t stake node.
Display all piles: Enabled: Display all piles on the map.Disabled (Default): Display only the current stake pile.
Left: Forward,Back. Right: Forward,Back: Select one of the following options: Left-Forward, Left-Back, Right-Forward, or Right-Back. Left and Right are defined relative to the direction from the line start point to the end point.
Drift angle: Always positive. The deviation direction is determined by the user-selected left/right and forward/back direction.
Offset distance: Length along the specified Drift angle. In the design drawing, arrows indicate left/right (determined from the line start point toward the end point). Only positive values are allowed.
With +/- pile, you can stake the exceed line. Extended line, which is displayed with a dashed line.

Stake Line



Start Pt mileage: Set the start Pt mileage for line to stake.
Offset direction: Set the direction if staking an offset line from the straight line is required.
Offset distance: Set the distance if staking an offset line from the straight line is required.

Stake Node



Start Pt mileage: Set the start Pt mileage for line to stake.
Left: Forward,Back. Right: Forward,Back: Select one of the following options: Left-Forward, Left-Back, Right-Forward, or Right-Back. Left and Right are defined relative to the direction from the line start point to the end point.
Drift angle: Always positive. The deviation direction is determined by the user-selected left/right and forward/back direction.
Offset distance: Length along the specified Drift angle. In the design drawing, arrows indicate left/right (determined from the line start point toward the end point). Only positive values are allowed.

Note: When you choose line in Line Stake, you can Modify line, it support Invert, Dist offset, Element offset, Elevation offset and Prolong.

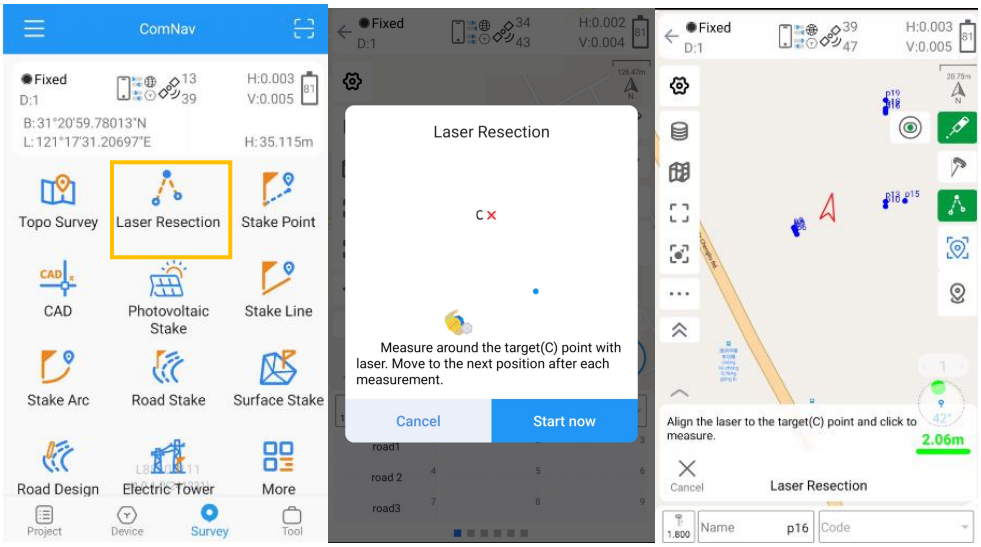


6.6 Laser Resection

Have you ever encountered a situation where the reliability of the measurement results was poor due to a long distance when using Laser RTK to survey points?

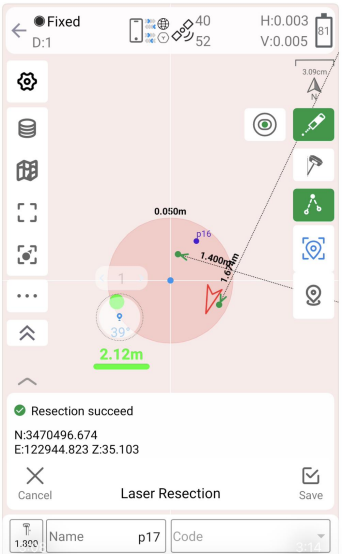
To solve this problem, we have introduced Laser Resection function. By Laser Resection—collecting the same target point from two different positions—and constructing an observation model to eliminate error parameters, the accuracy of laser measurements can be significantly improved.

Connect a device that supports laser, the Laser Resection function will appear in two locations: first, in the survey interface; and second, in the right sidebar of the Topo survey.



Click on the Laser Resection button to automatically turn on the laser and initialize the tilt, after initialization is complete you can click on the survey button to measure points.

Each measurement point should be moved to the next position, unqualified measurement points will not be recorded, at least two points need to be recorded to save the results of the intersection.



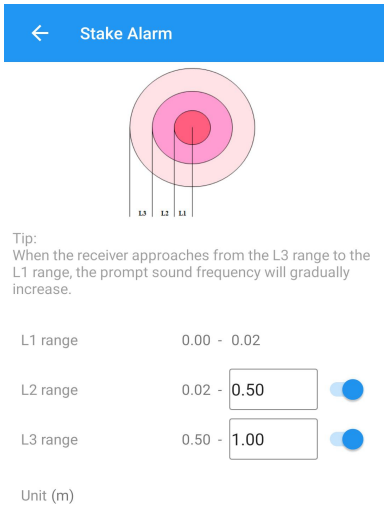
You can view the current accuracy result by checking the accuracy bar of the intersection point below, when the intersection result is not satisfactory, it cannot be saved, you need to continue to measure and improve the accuracy bar to save the measurement result.

6.7 Settings for Survey/Stake

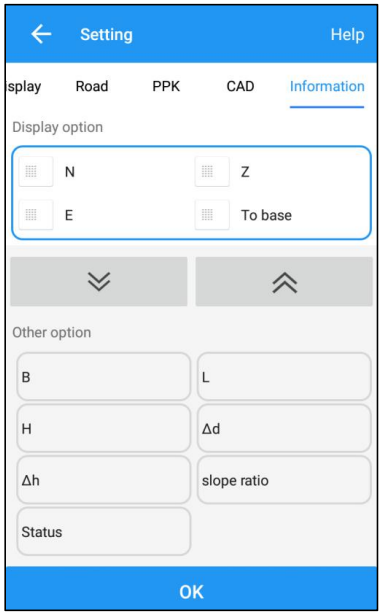
Here show all settings for Topo survey/Auto survey/Area survey

- Fixed: only fixed result can be saved;
- Duplicate name: allow point name same;
- Auto save: save points to ***Element*** directly;
- Code measure: quick measure by nine-panel codes;
- HRMS, VRMS: threshold for points accuracy;
- PDOP: This sets limit for PDOP, when the PDOP beyond this value, it won't allow to survey point;
- Save PPK data: you can save PPK data while doing RTK, and later you can process the PPK data;
- offset radius: point cannot offset bigger than the value during measure;
- Occupation time: measure times for one point;

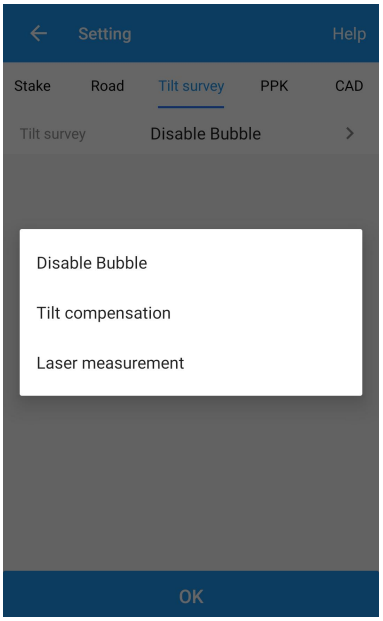
- Point stepsize: for point name;
- Stake alarm: alarm when close to target point
- Frequency: Refresh frequency;
- Stake point survey point name prefix: This is used to set the prefix for the survey point when you srake the point;
- The visual stakeout switching distance:The distance to visual staking can be set, the default is 10m.



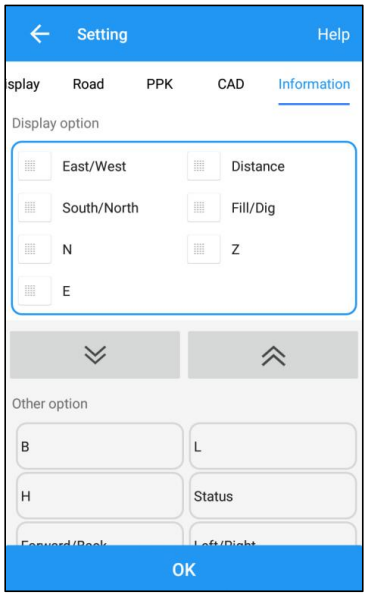
Stake Alarm:
This is used to set the alarm when stake point, it has three classes, when the receiver approaches from the L3 range to the L1 range, the prompt sound frequency will gradually increase.
L1 range is 0.00- 0.02m, when the receiver is in this range, the alarm will sound twice per second. This class is open as default.
L2 range is from 0.02m to the value you set, this value should be bigger than 0.02m, when the receiver is in this range, it will sound once per second. Default is closed.
L3 range is from the value you set in the L2 range, the end value should be bigger than the L2. Default is closed. When the receiver is in this range, it will sound once per two seconds.
You can close L3 range, and when you close L2 range, L3 range will be closed automatically.



These are the settings for information display in survey interface.
Display option: Items which can be shown in the survey interface, 8 items are the most.
Other option: Items which cannot be shown in the survey interface.
N, E, Z: plane coordinates, displayed in a vertical column by default
B, L, H: latitude, longitude, ellipsoid height.
Status: receiver RTK solution status, includes searching, single, float, fixed.
To base: Distance from receiver current position to the base.
Δd: Distance from receiver current position to last surveyed point.
Δh: Height difference from current position to last surveyed point.
Slope ratio: The ratio of vertical distance H to horizontal distance L, between current position to last surveyed point.



- Disable bubble: not use bubble or tilt;
- Tilt compensation: apply compensation during tilt.
- Laser measurement:Measurement with lasers



These are settings for information display in stake interface.

Fill/Dig: The height difference between stake point and current position.

East/West: The direction instruction to the east/west according to stake point and current position.

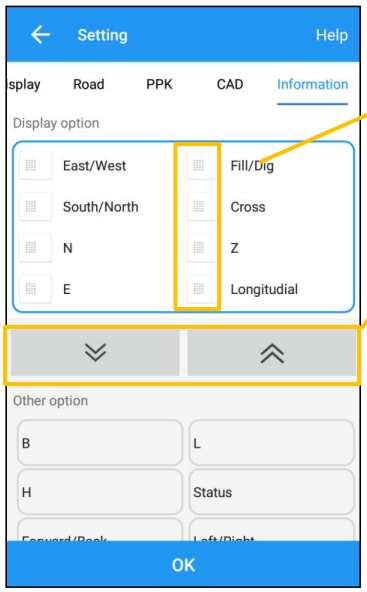
South/North: The direction instruction to the south/north according to stake point and current position.

Forward/Back: The direction instruction to the forward/back according to stake point and current position.

Left/Right: The direction instruction to the left/fight according to stake point and current position.

Distance: The distance from current position to the stake position.

Azimuth: The azimuth between current position and stake point.



Drag the icon to change the items display order

Add the items to display option or remove them to other option

These are the settings for information display in Road Stake and Stake Arc.

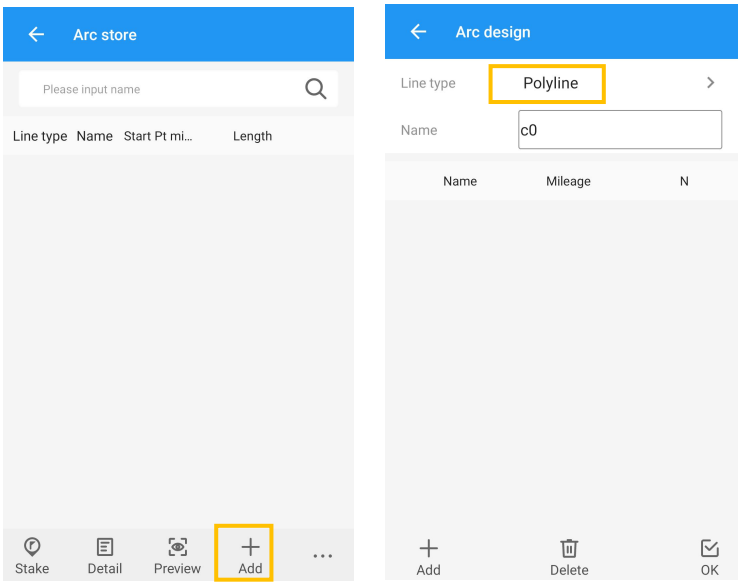
Cross: For road stake, left/right is cross, the cross is negative, which means it is on the left side of the road center line, positive means on the right side of the road center line.

Longitudinal: For road stake, forward/back is Longitudinal deviation, and the longitudinal deviation is negative, which means it is behind the target point, positive means it is front the target point

7 Stake Arc

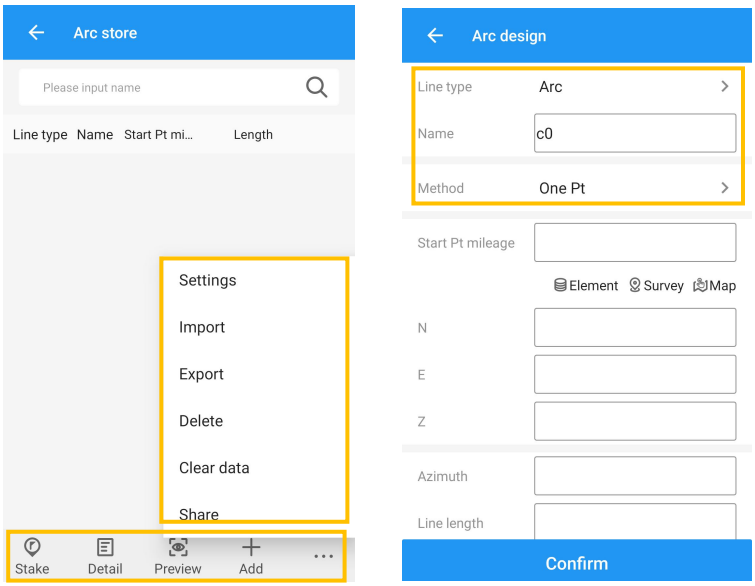
Click ***Stake Arc*** in the Survey interface, you can design your polyline, curve and stake it.

1. Add the polyline:



Tip: Now can only select point from element to add a polyline.

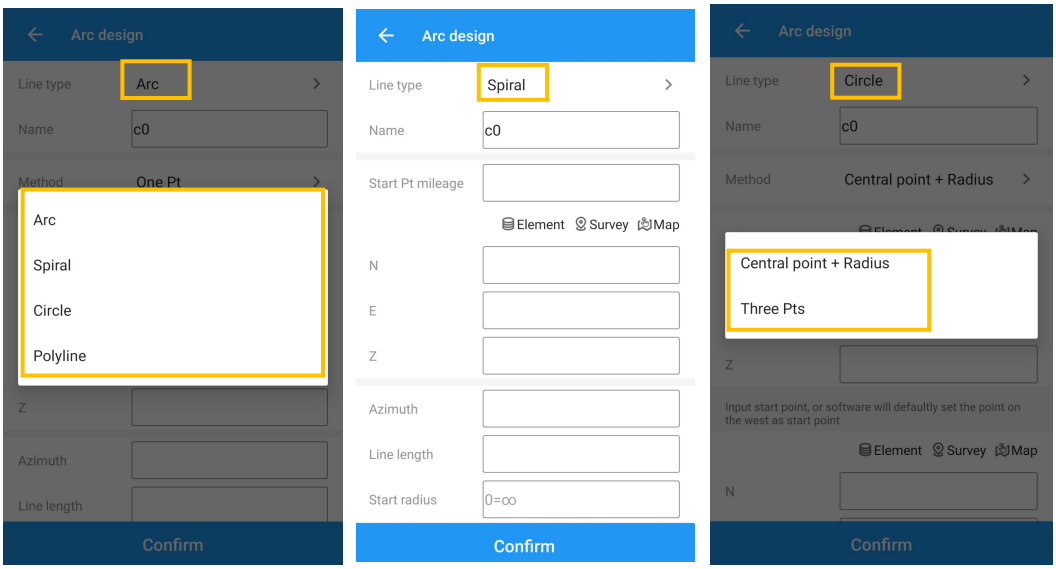
2. Add the curve:



- Stake: Select a curve to stakeout and enter the Stake Arc interface
- Detail: Select a curve to view more details of it
- Settings: Set the distance of spacing
- Preview: preview the selected curve
- Add: add a curve what you need
- More: 1. Import: Import curve data; 2. Export: Export curve data; 3. Delete: Delete the selected line in the line library; 4. Clear data: Clear all data in the line library;

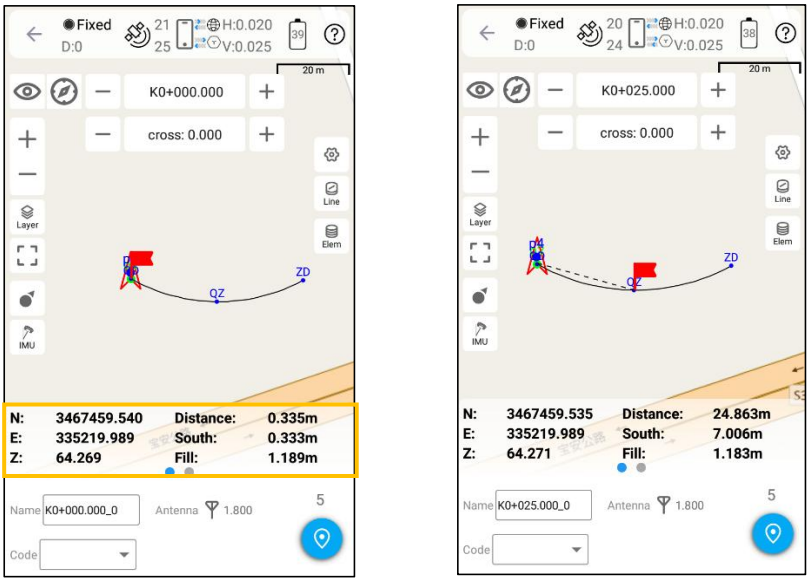
Three types of curve:

When you add a curve, you can add Arc, Spiral, Circle. For arc and circle line type, there are some methods to design it



3. Stake:

Select a polyline or curve in the line library and click ***Stake*** to enter the stake interface.



East/West/North/South: Direction from current to target point.

Distance: Distance between the current and the target point.

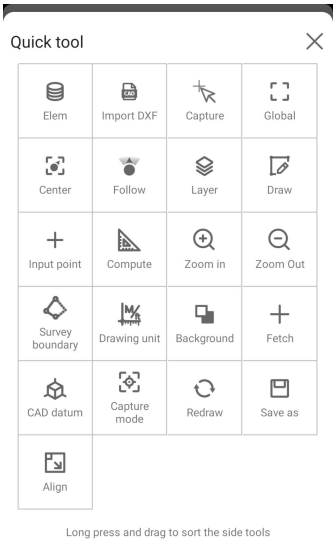
Dig: use dig or fill to represent elevation difference from current to target point.

8 CAD

CAD function support survey and stake point.

- Stake points: *Use arrow to select points*
- *Survey point: Click measure icon to save current coordinate*

8.1 CAD Menu



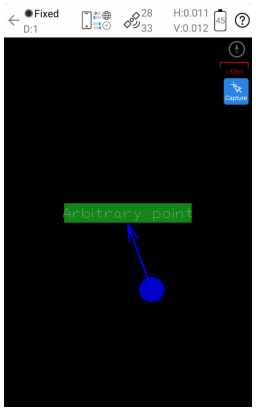
Settings: Go to setup options for Survey, Stake, Road, PPK, CAD, and Information .

Elem: Access to the point library to view measured point information.

Map: You can switch the currently used map or switch to no map. Added Online map function, you can choose OpenStreetMap, Google(Vector),Google(Image) and Vworld.

Import DXF: When you click Import DXF, it will browse all dxf &dwg files in the controller, you can enter the file name and search the file quickly.

Capture: After you check on these items, when the selection tool approached you can capture them easily.



Drawings: Click this button to display the drawing elements in the center of the screen.

Global: Click Global to find drawings quick.

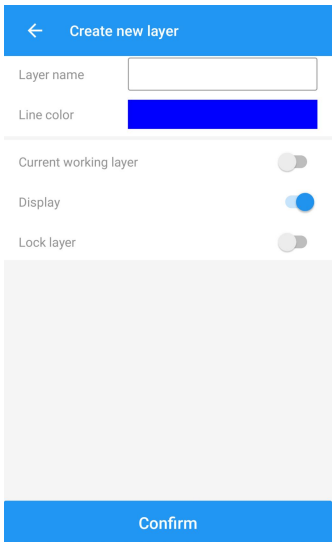
Center: The current position is centered.

Follow: Click to turn on the follow mode, the CAD drawing orientation changes according to the controller orientation.

Input point: Customizable input to add stake points, choose whether to save to the element or not.

Layer:
1.CAD layer:The current working layer of the CAD drawing, whether the layer is visible or not, whether the layer is locked or not and the layer color can be modified.

2.Create new layer: A new layer can be created as a working layer, with a customisable Layer name, Line color, Current working layer, Displayed or not, Lock layer or not.



Draw: For details, check 8.2.

Compute: For details, check 8.3.

Survey boundary: Click on it to enter the Survey boundary settings, you can use the map selection and library selection two ways, set whether to Display survey boundary.

Drawing Unit: Some users use non-metric units when drawing CAD drawings, so when you use Stake CAD, you should select the corresponding unit to stake out, Survey Master supports meter and millimeter.

Background: Edit background color, supports white, black, gray, black is by default, after you change the color, it will not change when you restart the software or switch project.

Zoom in/out:Click to zoom in and out

CAD Datum: In most cases, the user uses the world coordinate system by default. If the user coordinate system is set, for example, for the convenience of drawing, the coordinate system is moved to the plan view of an object. In this case, the user should select User coordinate system in Survey Master.

Fetch: Fetch feature point, you can choose point, circle point and Node.

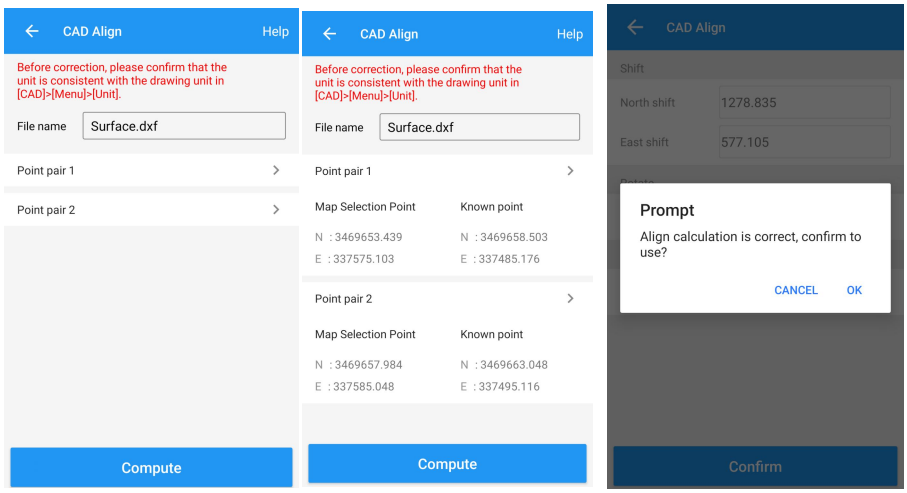
Capture mode: Click the Captuer button to display the type of point currently being captured.

Redraw: When the CAD file is not refreshed at the real time, you can click Redraw to refresh file.

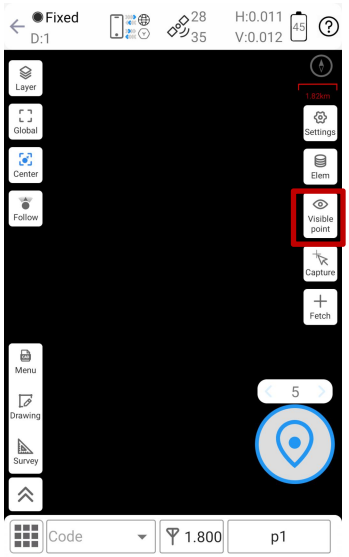
Save as: When you edit the dxf file, you can save the file as a new file.

Align: This is used to calibrate the dxf file coordinate, you need two pairs of the coordinate, we usually use two sets of points on the diagonal.

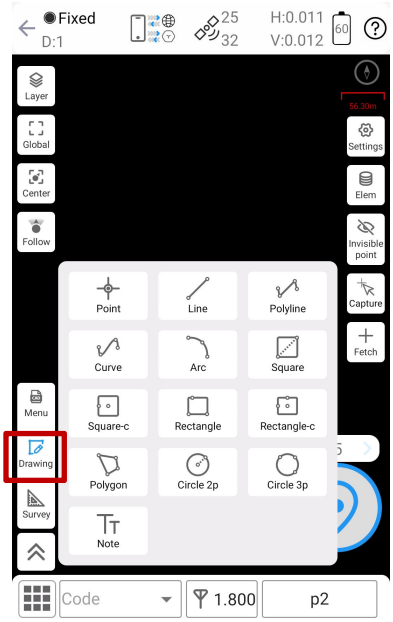
1.Choose the first source point or coordinates on the map;
2.Then click OK to confirm coordinate selection.
3. Enter the first target point coordinate, then click OK to confirm the coordinate.
4. Click Select to choose the second source point or coordinates on the map; then click OK to confirm coordinate selection;
5. Enter the second target point coordinate, then click OK to confirm the coordinate, if the calculation is correct, it will prompt the next tip. You can select the line from the dxf to check if the coordinate is aligned successfully



Invisible point: There are two modes: visible point mode and hidden point mode. In visible point mode, all the points in the CAD interface will be displayed, while in hidden point mode, all the points in the CAD interface will not be displayed.

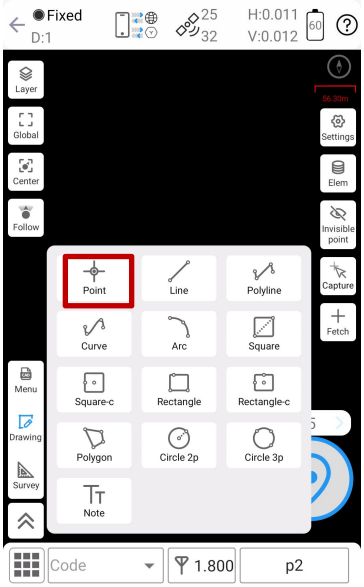


8.2 CAD Drawing



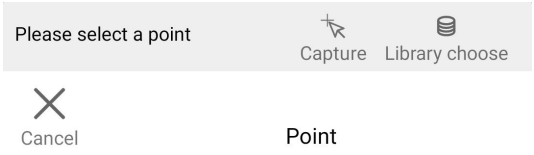
8.2.1 Point

Points can be drawn by clicking on the map, selecting points with the Capture tool, or selecting points from Element, and entering the point name.

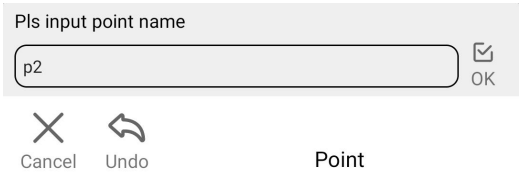


The drawing steps are as follows:

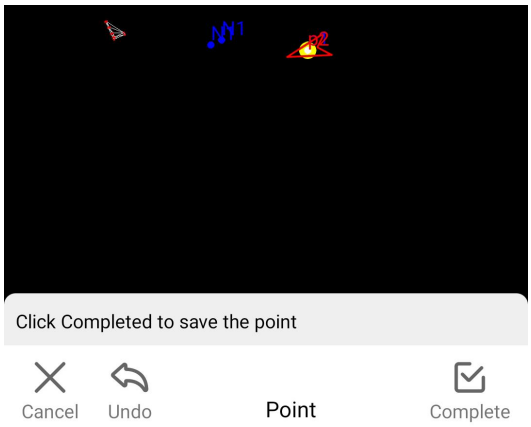
1) You can select points by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected points will be displayed in yellow. Click *Cancel* can exit the point drawing operation.



2) The bottom prompts "Pls input point name". Enter the name of the drawing point. Click *Undo* to return to the previous step.



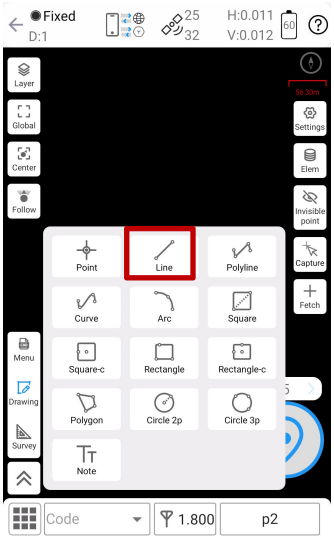
3) Click *OK*, a red point name will appear on the selected point, and the bottom of the interface will prompt "Click Completed to save the point".



4) Click *Completed* to complete the point drawing operation.

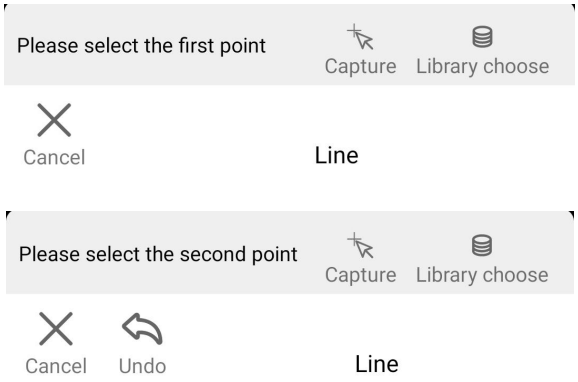
8.2.2 Line

You can select two points by clicking on the map, selecting 2 points with the Capture tool, or selecting 2 points from Element, and automatically connect them to draw a line.

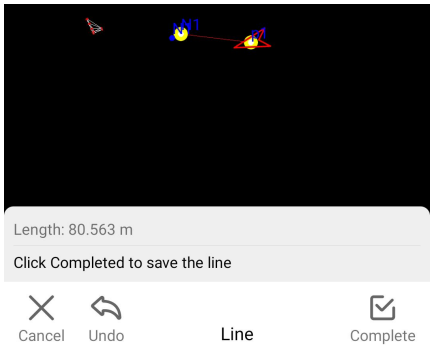


The drawing steps are as follows:

1) Select the first point by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel*, which will exit the drawing mode. Clicking *Undo* will cancel the selected point.



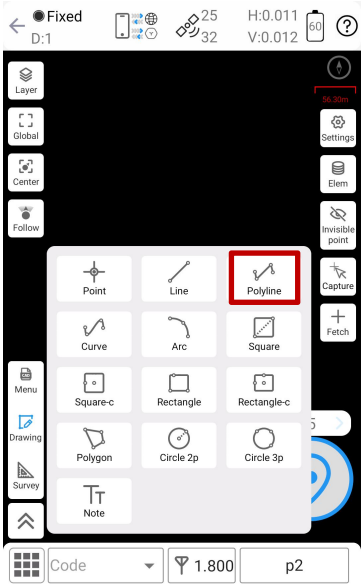
2) After completing the first point, you will be prompted to select the second point, which is the same as the first point. After completing the point selection, you will be prompted below to click *Completed* to save the line.



3) After clicking *Completed*, the line is successfully created.

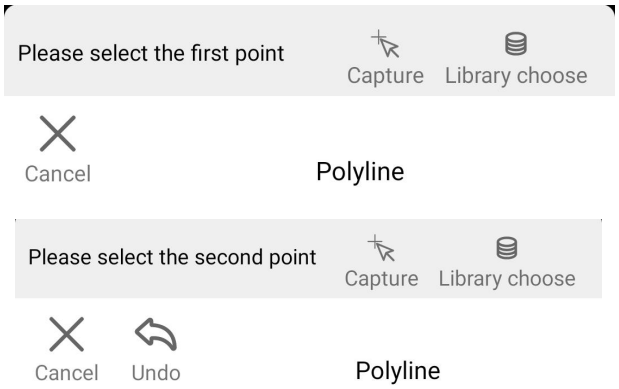
8.2.3 Polyline

You can select multiple points by clicking on the map, selecting points with the Capture tool, or selecting points from Element. They will be automatically connected into polyline in the order of selection.

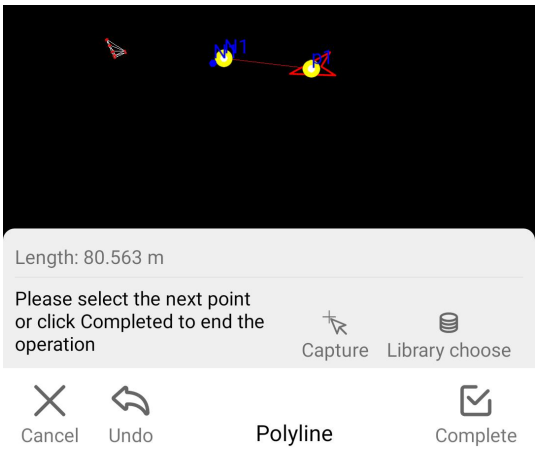


The drawing steps are as follows:

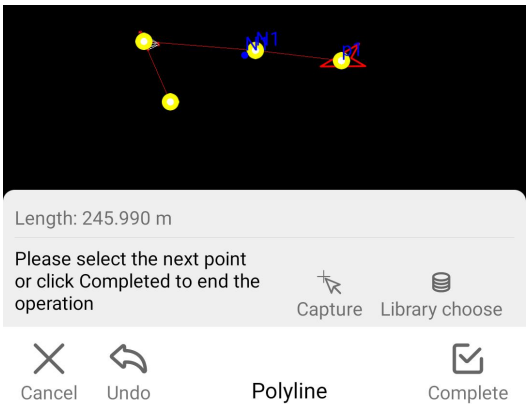
1) Select the first point by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel*, which will exit the drawing mode. Clicking *Undo* will cancel the selected point.



2) After completing the first point, you will be prompted to select the second point, which is the same as the first point and will automatically form a connection with the first point.

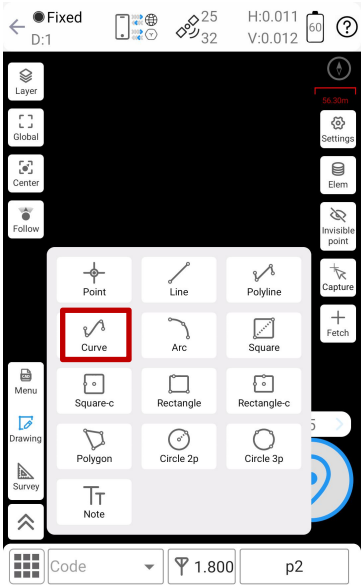


3) After completing the selection of the second point, you will be prompted below to select the next point or click *Completed*. You can continue to select points or click *Completed* to save the polyline.



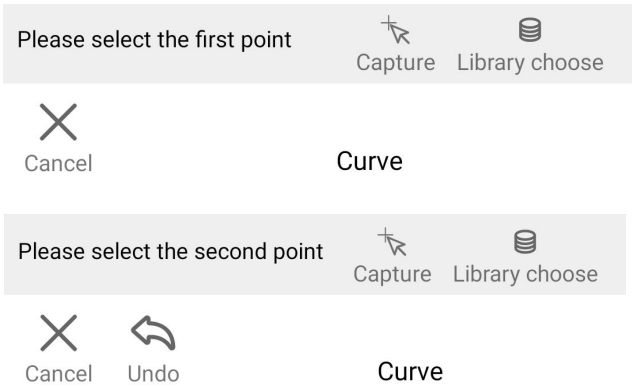
8.2.4 Curve

You can select multiple points by clicking on the map, selecting points with the Capture tool, or selecting points from Element. They will be automatically connected into curve in the order of selection.

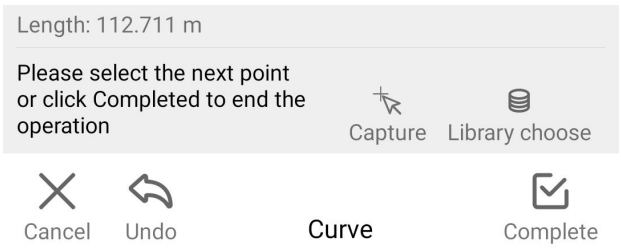


The drawing steps are as follows:

1) Select the first point by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel*, which will exit the drawing mode. Clicking *Undo* will cancel the selected point.

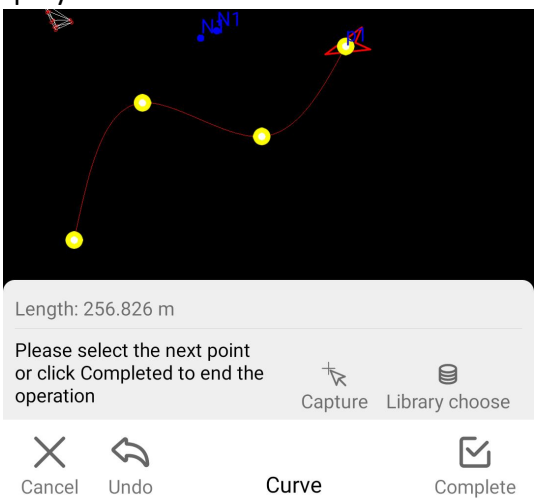


2) After completing the first point, you will be prompted to select the second point, which is the same as the first point and will automatically form a connection with the first point.



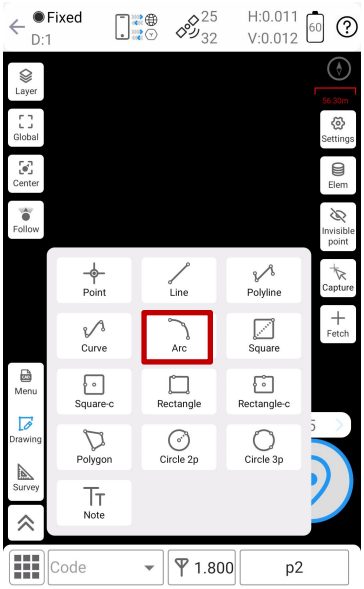
3) After completing the selection of the second point, you will be prompted below to

select the next point or click *Completed*. You can continue to select points or click *Completed* to save the polyline.



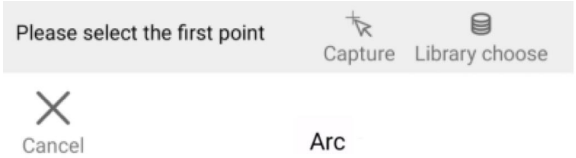
8.2.5 Arc

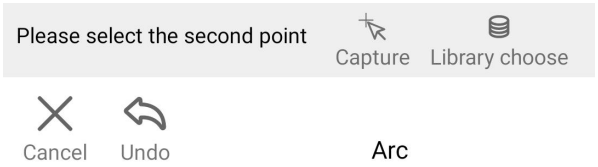
You can select multiple points by clicking on the map, selecting points with the Capture tool, or selecting points from Element. They will be automatically connected into Arc in the order of selection.



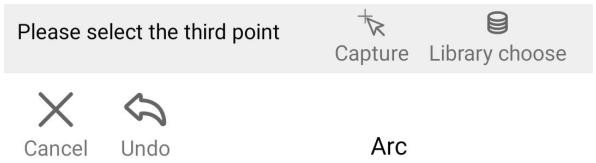
The drawing steps are as follows:

1) Select the first point by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel*, which will exit the drawing mode. Clicking *Undo* will cancel the selected point.

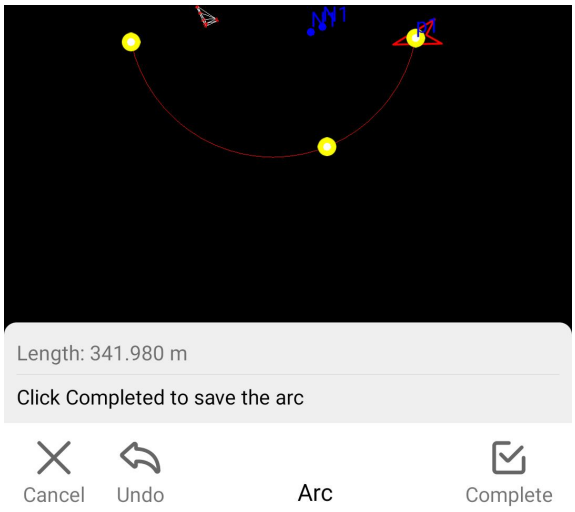




2) After completing the first point, you will be prompted to select the second point, which is the same as the first point.

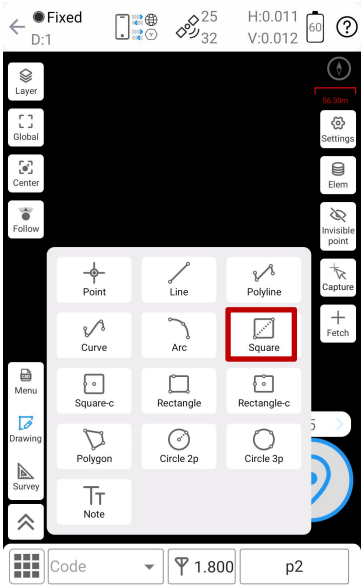


3) After completing the selection of the second point, you will be prompted below to select the third point. After selecting the point, connect it with the first two points to form an arc. Click *Completed* to complete the operation.



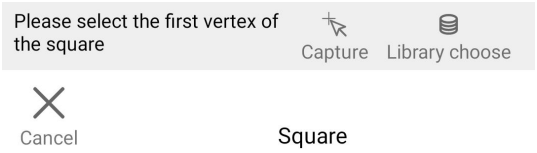
8.2.6 Square

You can select the first vertex and the second vertex of the square to complete the square by clicking on the map, selecting points with the Capture tool, or selecting points from Element.

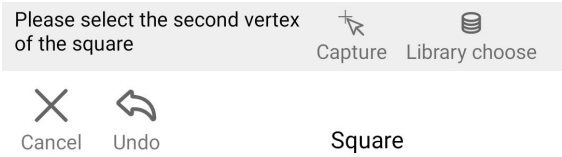


The drawing steps are as follows:

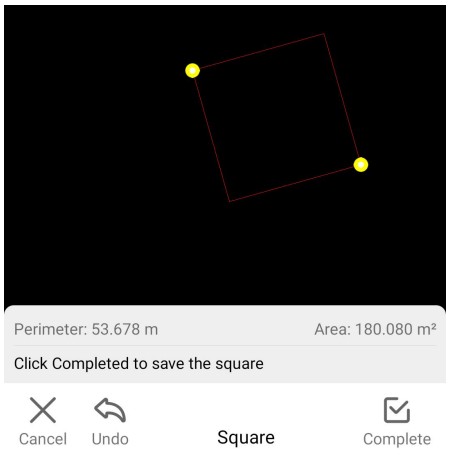
1) Select the first vertex of the square by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel* to exit the drawing mode.



2) After completing the first point selection, select the second vertex by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel* to exit the drawing mode. Click *Undo* will cancel the selected point.

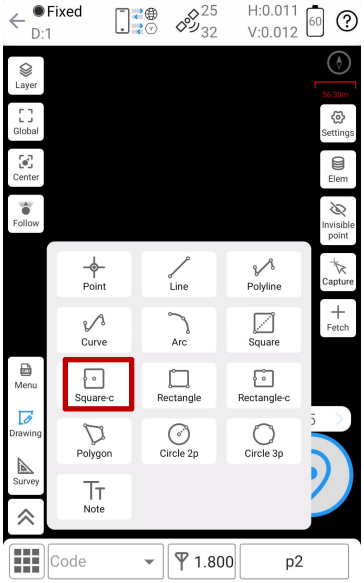


3) After completing the selection of the second vertex, the bottom prompts "Click Completed to save the square". Click *Completed* to complete the square drawing.



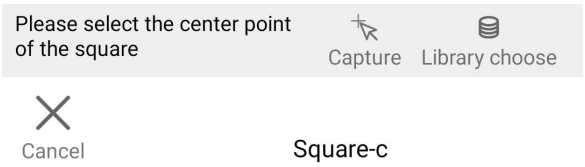
8.2.7 Square-c

You can select the center point and the border points to form a square by clicking on the map, selecting points with the Capture tool, or selecting points from Element.

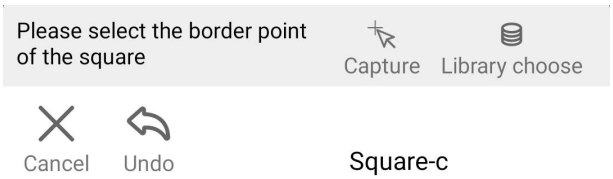


The drawing steps are as follows:

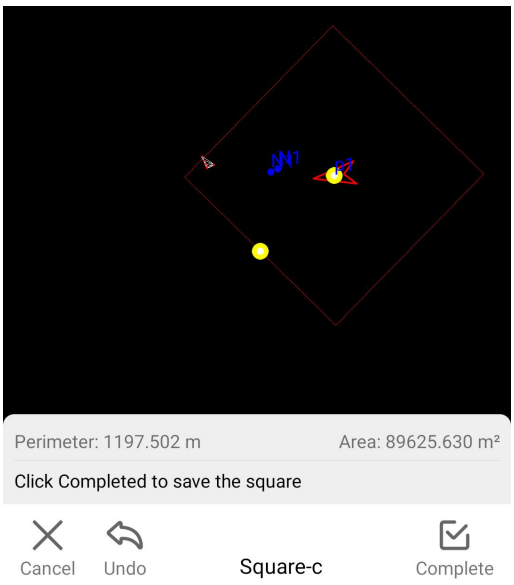
1) Select the center point of the square by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel* to exit the drawing mode.



2) After completing the center point selection, select the square border point by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel* to exit the drawing mode. Click *Undo* will cancel the selected point.

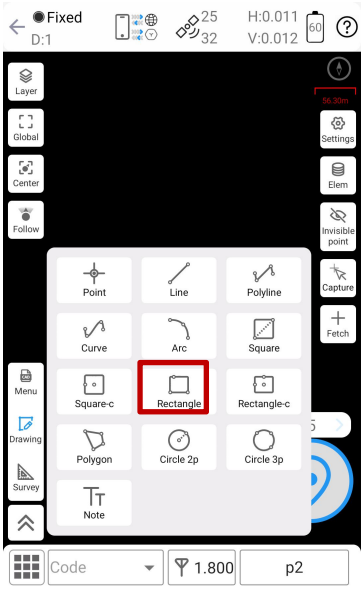


3) After completing the selection of the square border point, the bottom prompts "Click Completed to save the square". Click *Completed* to complete the square drawing.



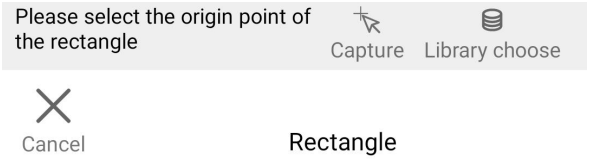
8.2.8 Rectangle

You can select the origin point of the rectangle, the width limit point and the height limit point to complete the rectangle by clicking on the map, selecting points with the Capture tool, or selecting points from Element.



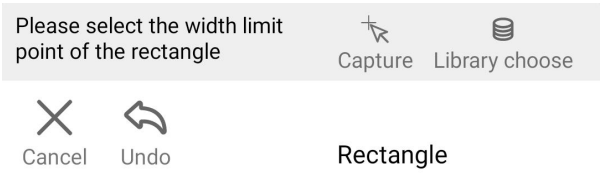
The drawing steps are as follows:

1) Select the origin point of the rectangle by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel* to exit the drawing mode.

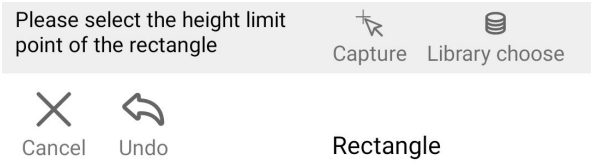


2) After completing the origin point selection, select the width limit point by clicking

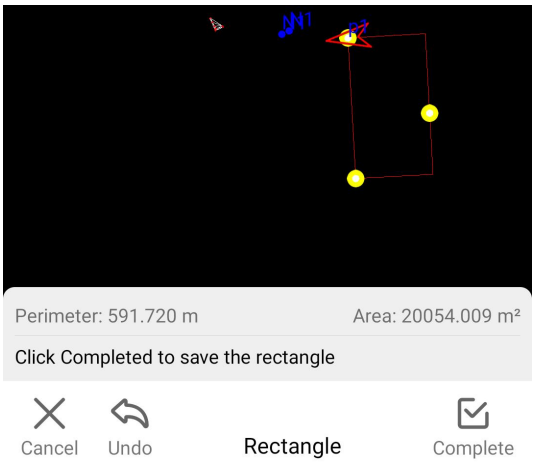
on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel* to exit the drawing mode. Click *Undo* will cancel the selected point.



3) After completing the width limit point selection, select the height limit point by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel* to exit the drawing mode. Click *Undo* will cancel the selected point.

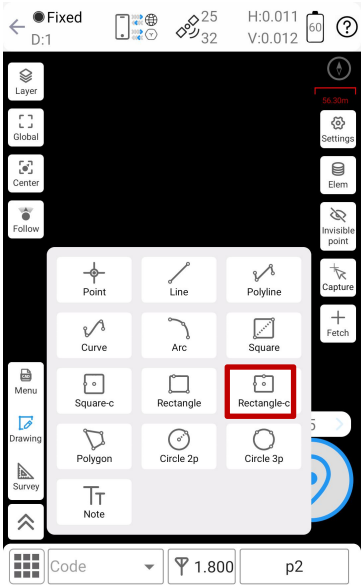


5) After completing the selection of the height limit point, the bottom prompts "Click Completed to save the rectangle". Click *Completed* to complete the rectangle drawing.



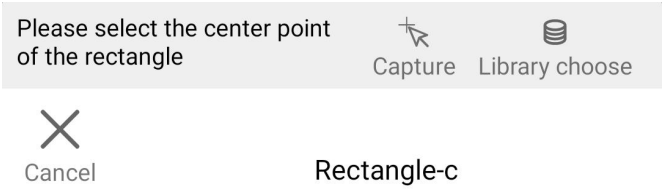
8.2.9 Rectangle-c

You can select the center point of the rectangle, the width limit point and the height limit point to complete the rectangle by clicking on the map, selecting points with the Capture tool, or selecting points from Element.

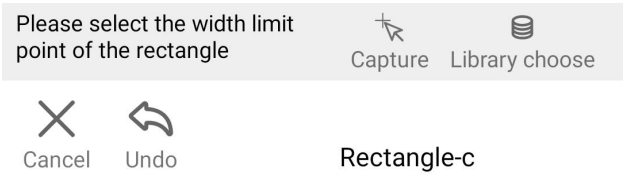


The drawing steps are as follows:

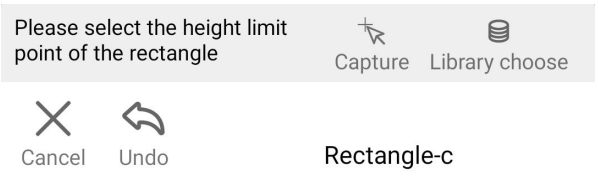
1) Select the center point of the rectangle by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel* to exit the drawing mode.



2) After completing the center point selection, select the width limit point by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel* to exit the drawing mode. Click *Undo* will cancel the selected point.

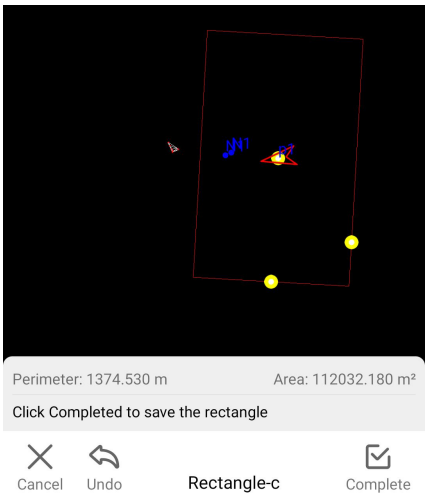


3) After completing the width limit point selection, select the height limit point by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel* to exit the drawing mode. Click *Undo* will cancel the selected point.



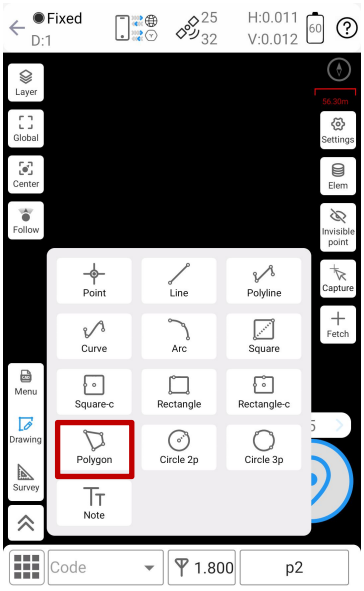
4) After completing the selection of the height limit point, the bottom prompts "Click

Completed to save the rectangle". Click *Completed* to complete the rectangle drawing.



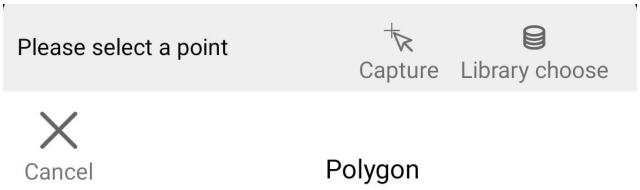
8.2.10 Polygon

You can select multiple points by clicking on the map, selecting points with the Capture tool, or selecting points from Element. They will be automatically connected into polygon in the order of selection.

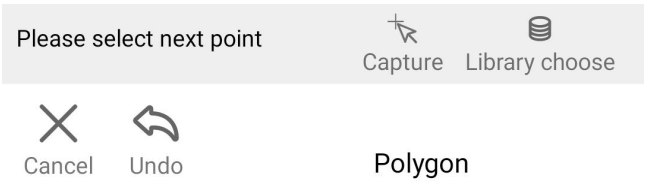


The drawing steps are as follows:

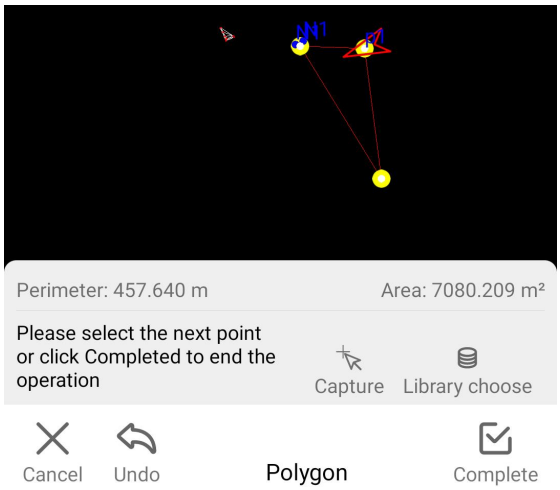
1) Select the first point by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel*, which will exit the drawing mode. Clicking *Undo* will cancel the selected point.



2) After completing the first point, you will be prompted to select the next point, which is the same as the first point and will automatically form a connection with the first point.

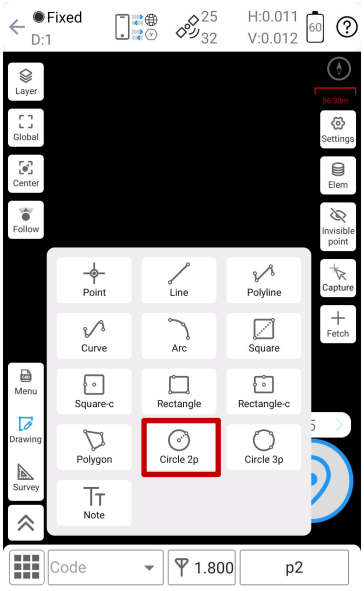


3) Repeat the second step. The bottom prompts "Please select the next point or click Completed to end the operation" Click Completed to complete the drawing of the polygon.



8.2.11 Circle 2p

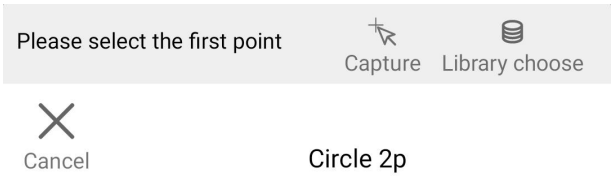
Draw a circle with the distance between two points as the radius by clicking on the map, selecting points with the Capture tool, or selecting points from Element.



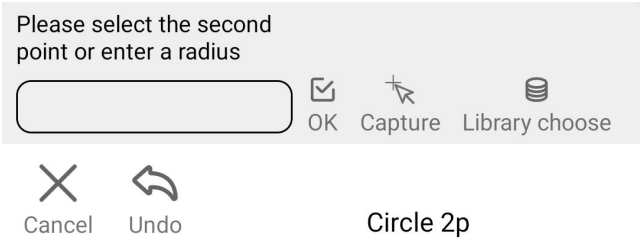
The drawing steps are as follows:

1) Select the center point of the circle by clicking on the map, selecting points with the

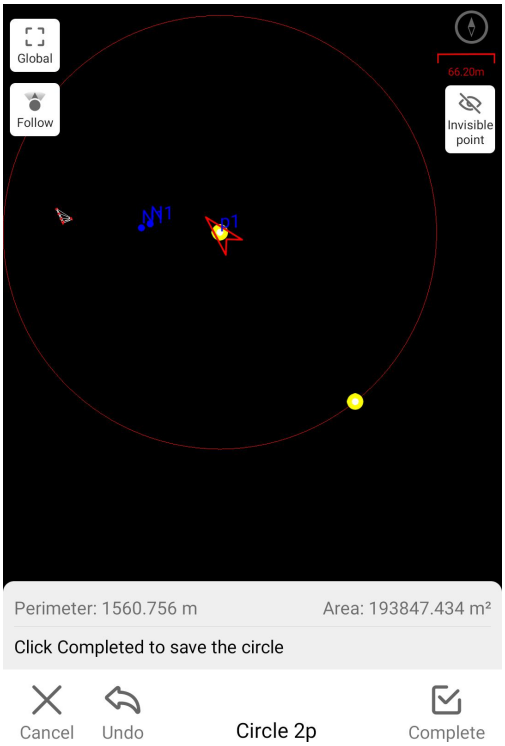
Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel* to exit the drawing mode.



2) After completing the first point selection, enter a radius or select the second point by clicking on the map, selecting points with the Capture tool, or selecting points from Element. You can click *Cancel* to exit the drawing mode. Click *Undo* will cancel the selected point.

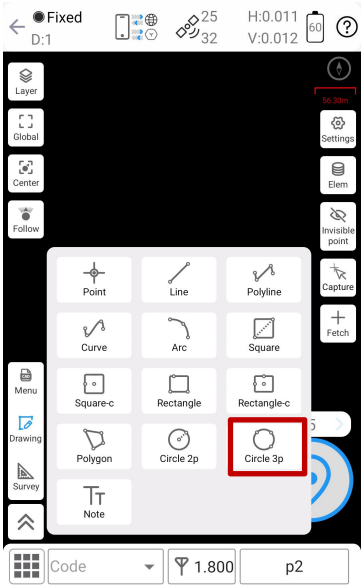


3) After completing the selection of radius, the bottom prompts "Click Completed to save the circle". Click *Completed* to complete the circle drawing.



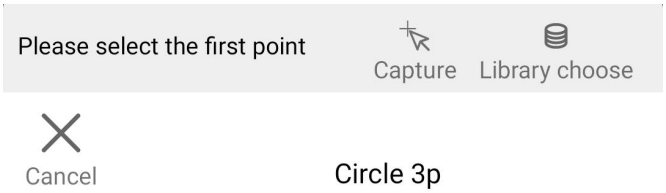
8.2.12 Circle 3p

Draw a circle with 3 points on the circle by clicking on the map, selecting points with the Capture tool, or selecting points from Element.

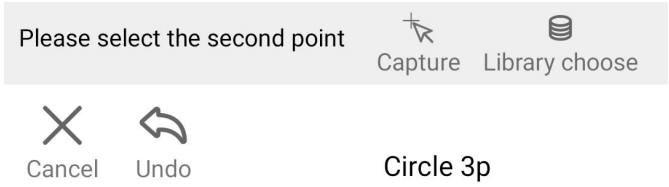


The drawing steps are as follows:

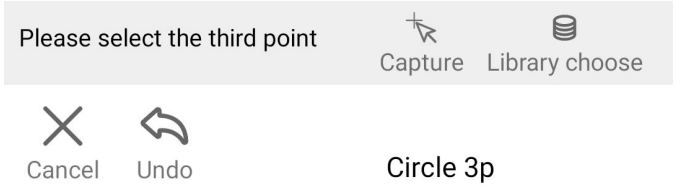
1) Select the first point of the circle by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel* to exit the drawing mode.



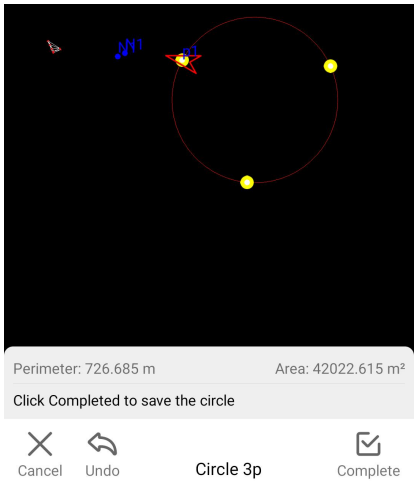
2) After completing the first point selection, select the second point by clicking on the map, selecting points with the Capture tool, or selecting points from Element. You can click *Cancel* to exit the drawing mode. Click *Undo* will cancel the selected point.



3) Repeat the second step and select the second point and the third point.

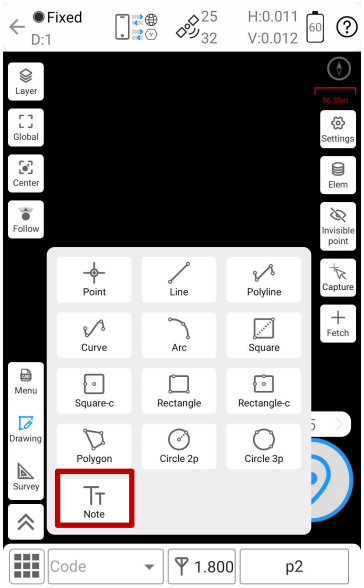


4) After completing the selection of 3 points, the bottom prompts "Click Completed to save the circle". Click *Completed* to complete the circle drawing.



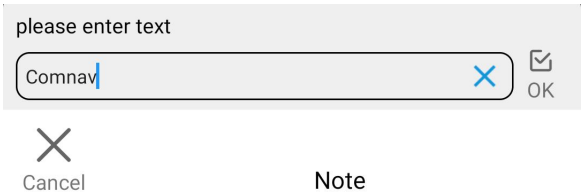
8.2.13 Note

Text can be added to drawings.

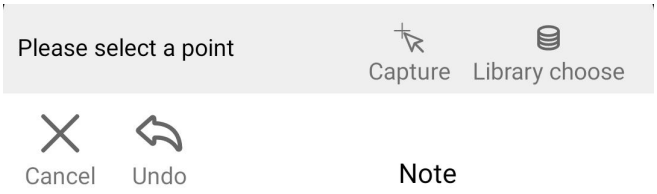


The drawing steps are as follows:

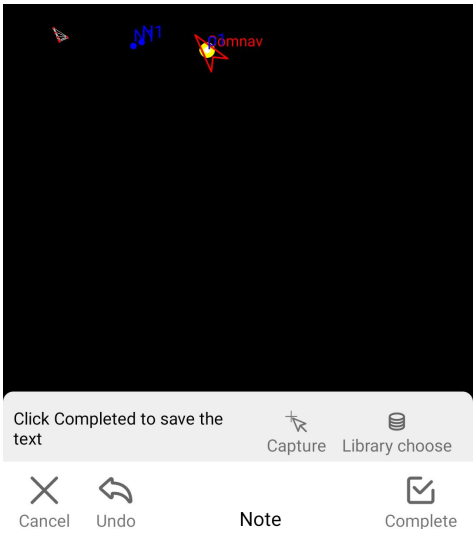
1) Enter text content. Click *OK*.



2) After entering text content, select the point by clicking on the map, selecting points with the Capture tool, or selecting points from Element.



3) After completing the selection of Note point, the bottom prompts "Click Completed to save the test". Click *Completed* to complete the note drawing.

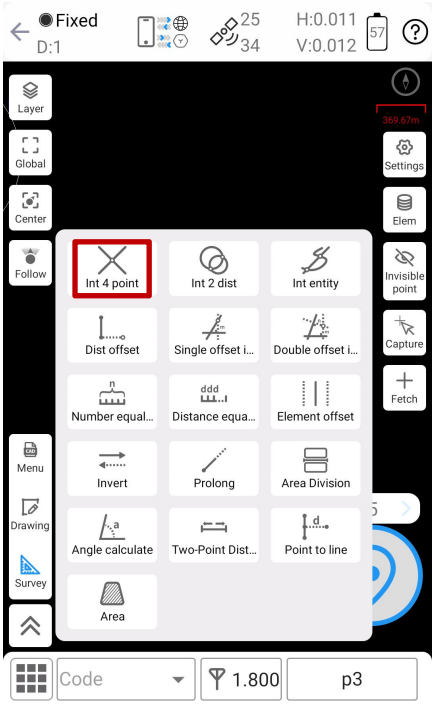


8.3 CAD Compute



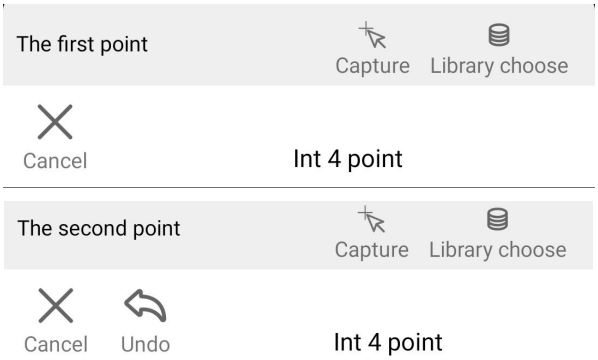
8.3.1 Int 4 point

Select four points to form two lines and then calculate the intersection point of the two lines or their extensions. Click Finish to save the intersection point to Element.

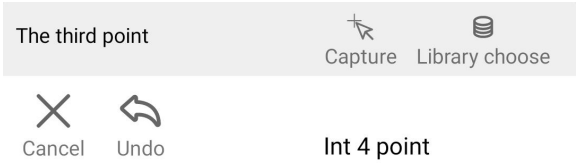


The steps are as follows:

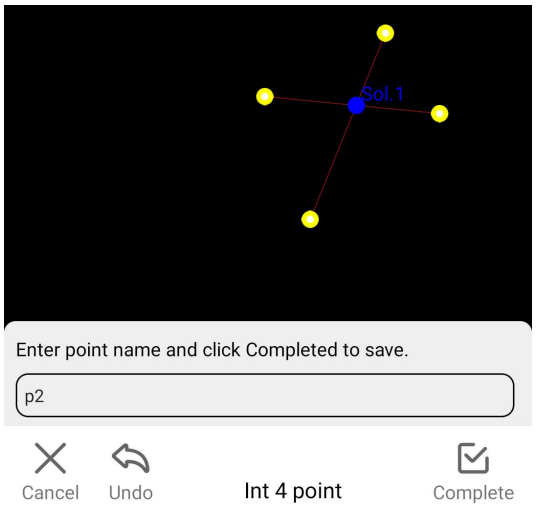
1) Select the first point by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel* and the function will exit.



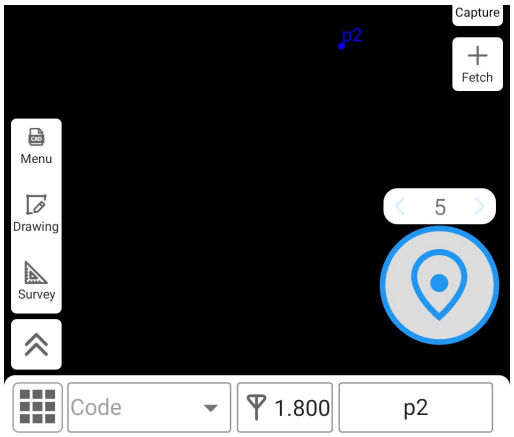
2) The prompt below is to select the second point, which is the same as the first point. After completing the point selection, a line will be automatically formed with the first point.



3) The selection method for the third and fourth points is the same as above. After the point selection is completed, the intersection point of the two lines will be automatically calculated. If there is no intersection between the two lines, an extension of the two lines will be automatically made to find the intersection point.

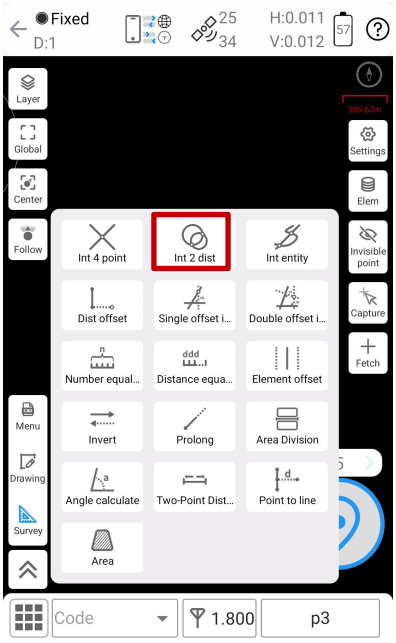


4) After obtaining the intersection point, set the point name. After clicking *Completed*, the point will be saved to Element and displayed on the map.



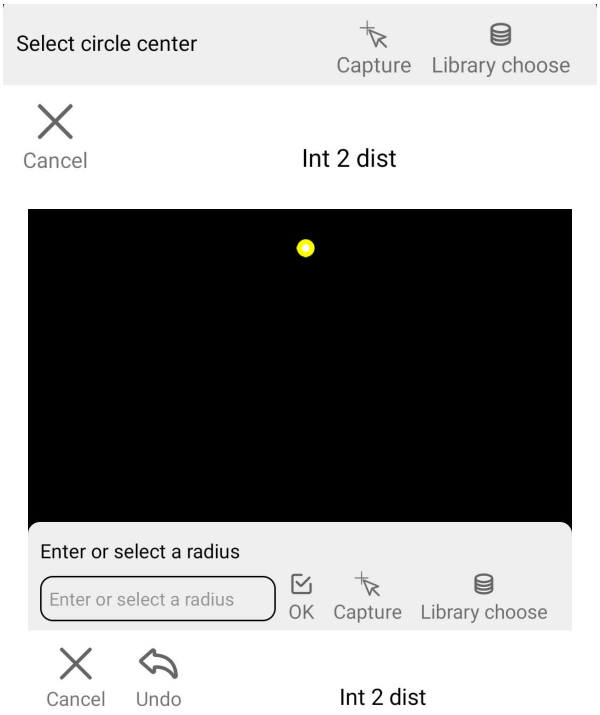
8.3.2 Int 2 dist

Select the center and radius to draw two circles and calculate the intersection point of the two circles. Click Completed to select the intersection point and save it to Element.

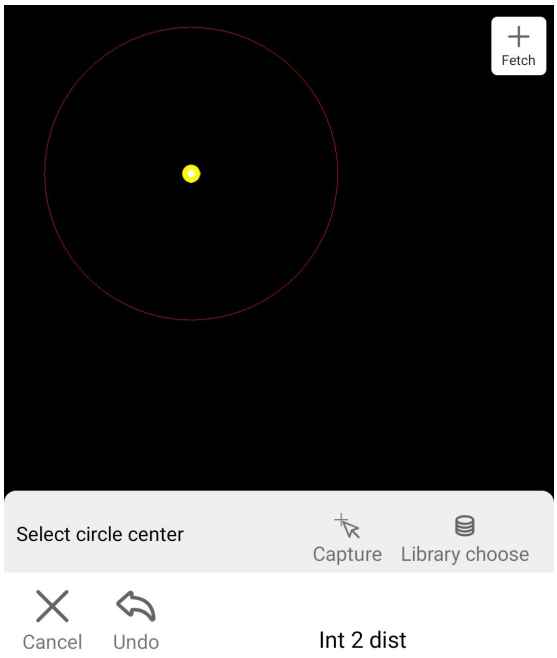


The steps are as follows:

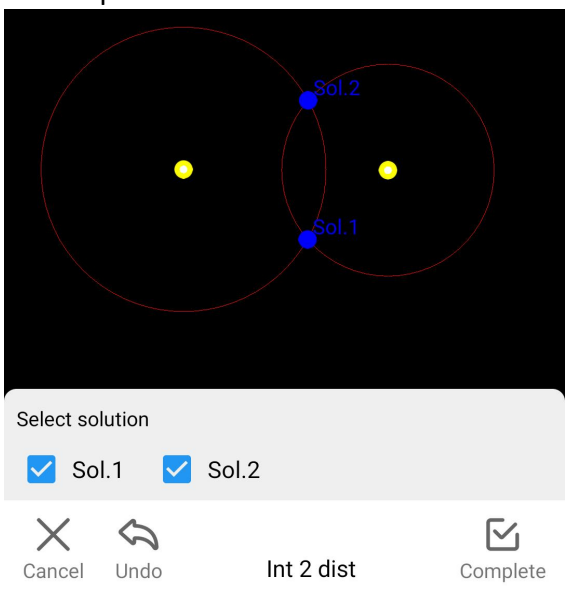
1) Select circle center by clicking on the map, selecting points with the Capture tool, or selecting points from Element. The selected point will be displayed in yellow and will not be saved to Element. You can click *Cancel* and the function will exit.



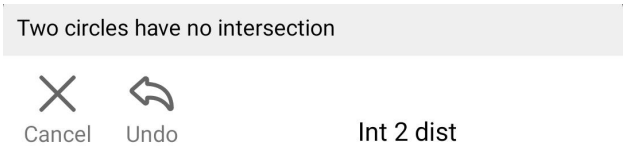
2) After completing the first point selection, enter a radius or select the second point by clicking on the map, selecting points with the Capture tool, or selecting points from Element. After completing the radius selection, a circle will be automatically formed with the first point.



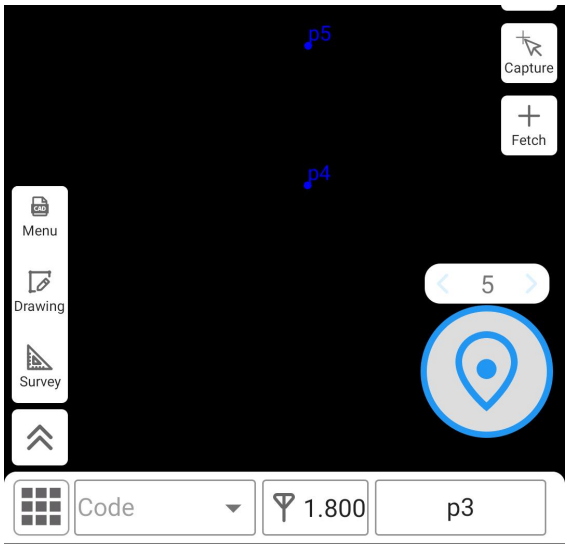
3) The selection method for the second circle is the same as above. After 2 circles completed, the intersection point of the two circles will be automatically calculated.



If there is no intersection between the two circles, the bottom prompts "Two circles have no intersection".

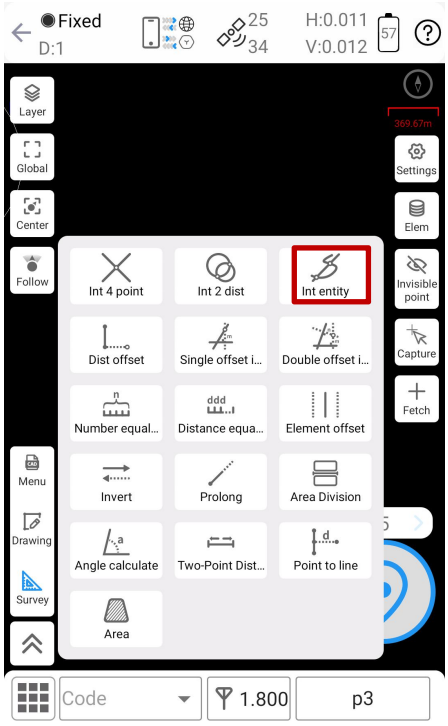


4) After obtaining the intersection point, select the intersection point which you want to save. After clicking *Completed*, the point will be saved to Element and displayed on the map.



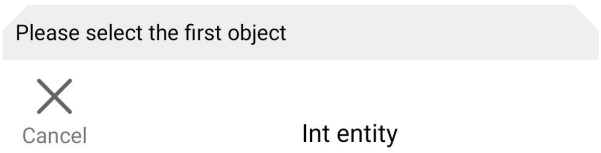
8.3.3 Int entity

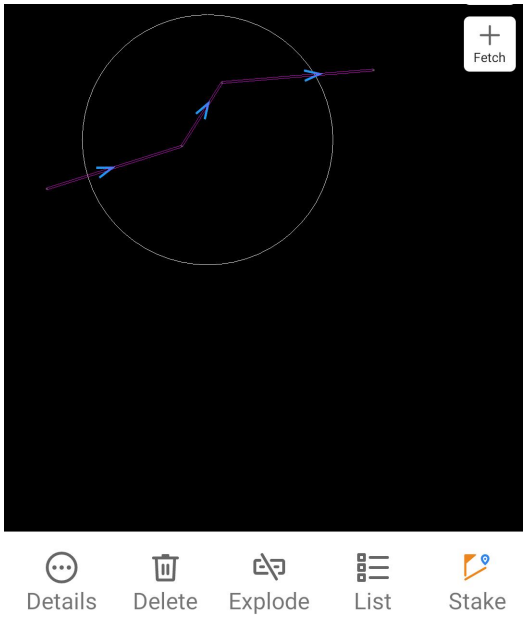
Select 2 objects and calculate the intersection point of these two objects. Click Completed to select the intersection point and save it to Element.



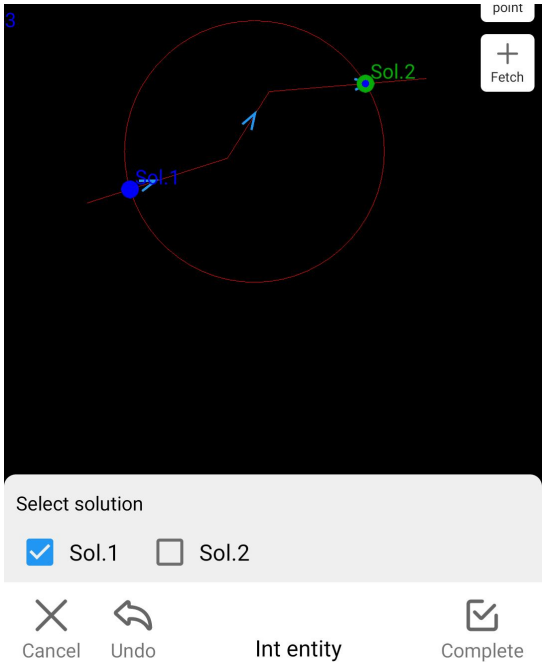
The steps are as follows:

1) Select the first object by clicking on the map. You can click *Cancel* and the function will exit.

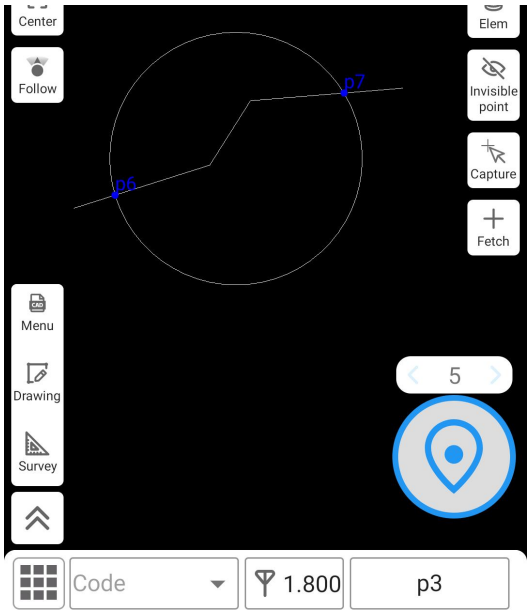




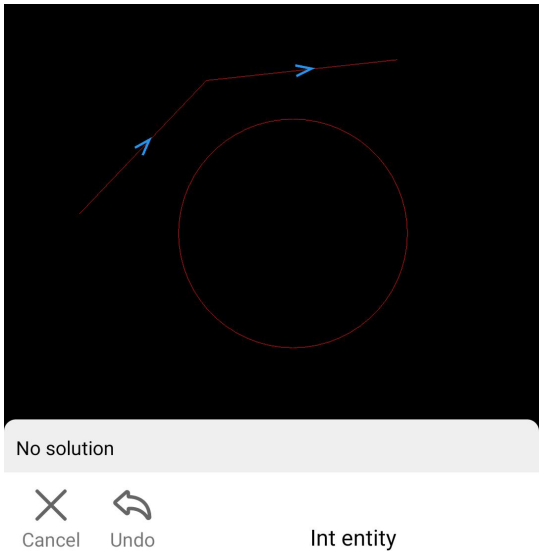
2) After the first object selection, select the second object by clicking on the map. After 2 objects selected, the intersection point of the two objects will be automatically calculated.



3) After obtaining the intersection point, select the intersection point which you want to save. After clicking *Completed*, the point will be saved to Element and displayed on the map.

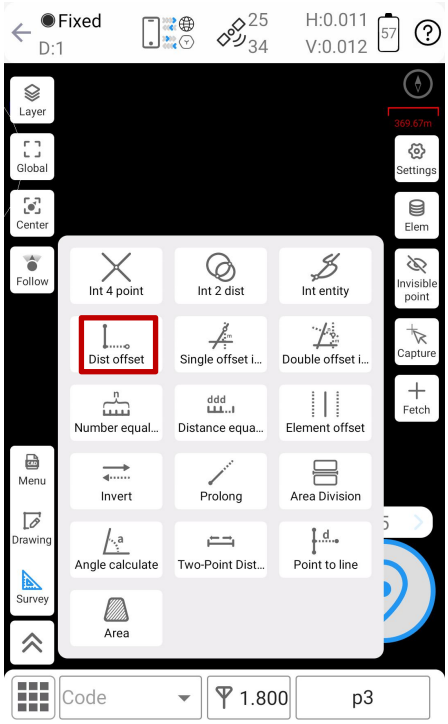


4) If there is no intersection between the two circles, the bottom prompts "No solution".



8.3.4 Dist offset

After selecting the graphic, input the mileage and offset distance to calculate two offset points.

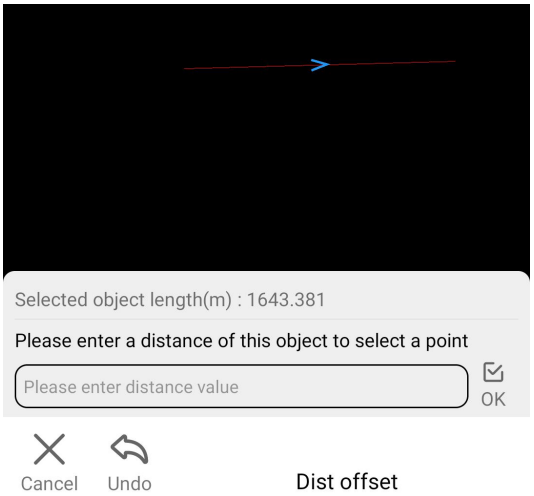


The steps are as follows:

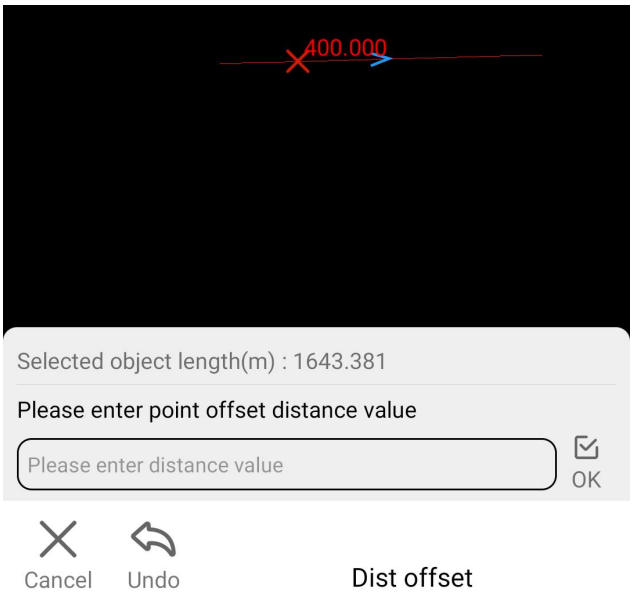
1) Select a graphic by clicking on the map. You can click *Cancel* and the function will exit.



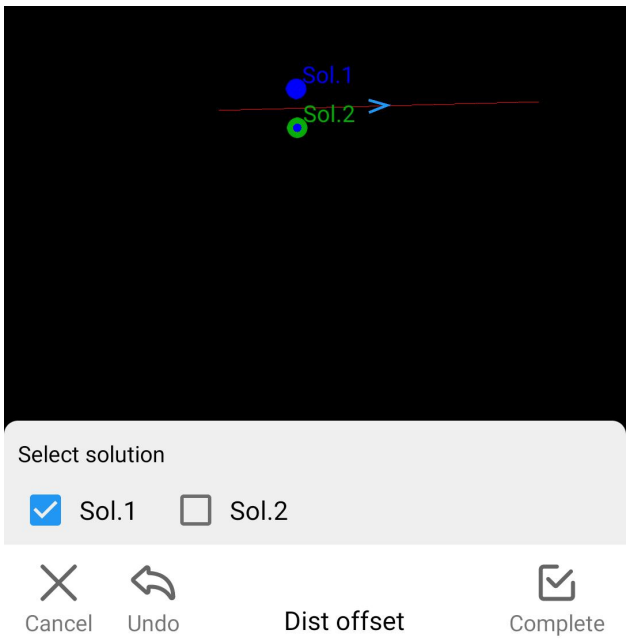
2) After selecting a graphic, the length of the selected graphic is displayed at the bottom. Enter the mileage to start the offset.

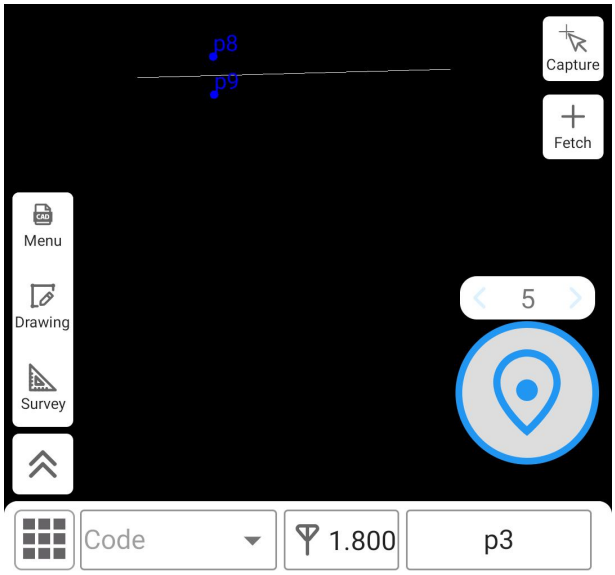


3) After entering a distance, you can see a red mark on the graphic. This red mark is the mileage point which will not save in Element. Then you can enter point offset distance value.



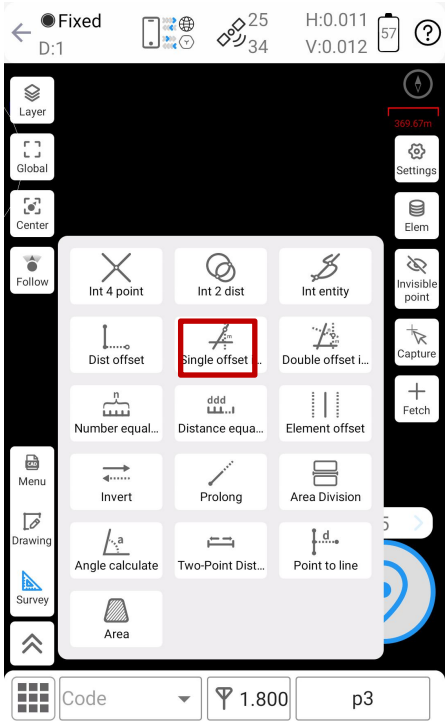
4) After obtaining the offset point, select the offset point which you want to save. After clicking *Completed*, the point will be saved to Element and displayed on the map.





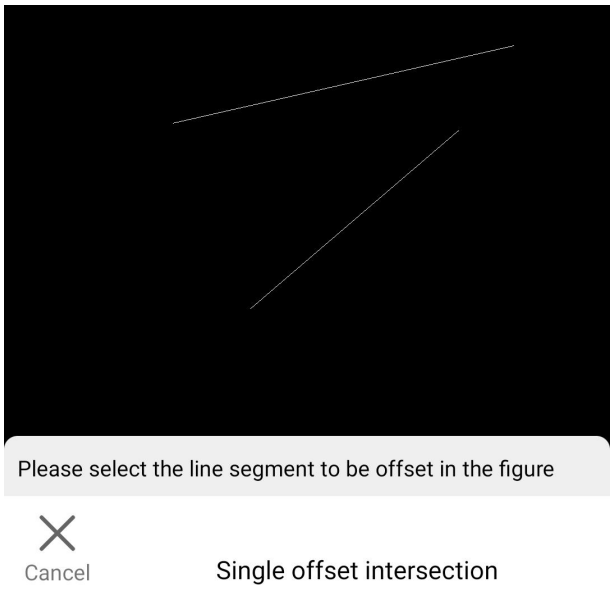
8.3.5 Single offset intersection

Calculate the intersection point of the current line with another line after offset. (i.e. a point on a line that is a certain distance from another line)

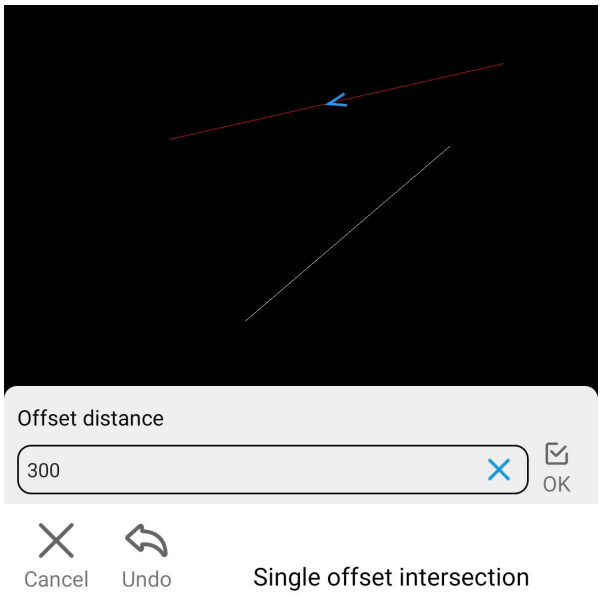


The steps are as follows:

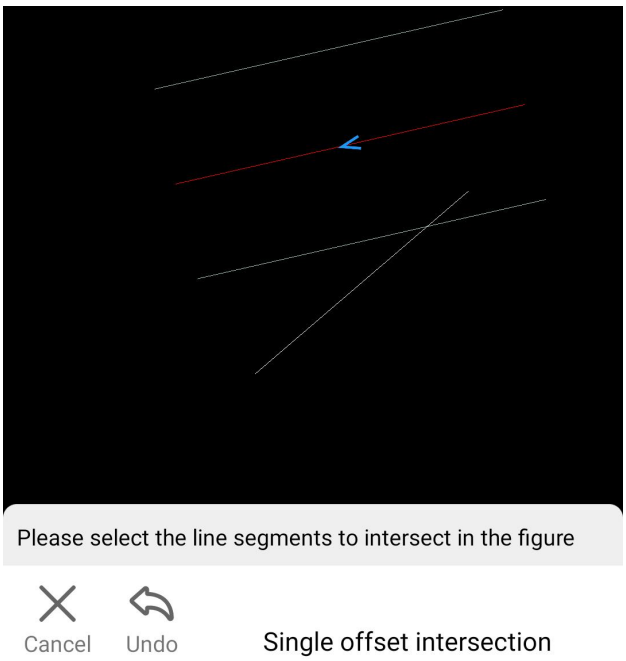
1) Select the line segment to be offset by clicking on the map. You can click *Cancel* and the function will exit.



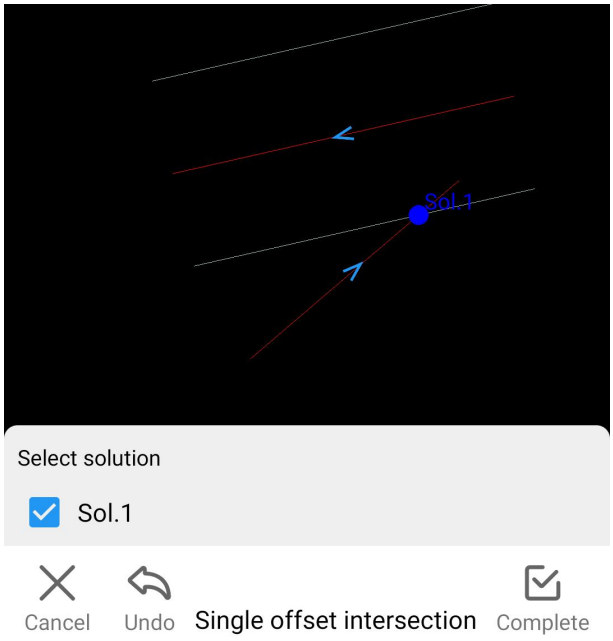
2) After selecting, enter the offset distance of this line. This distance is a certain distance that a point on a line that is from another line.



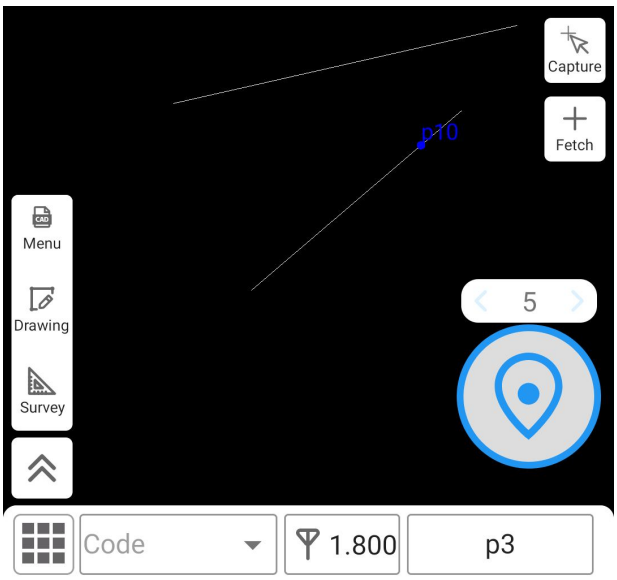
3)After enter an offset value, this line will form two offset lines. But the offset lines are not saved. You can clearly see whether the offset point intersects with other lines, thereby obtaining the offset point on the line.



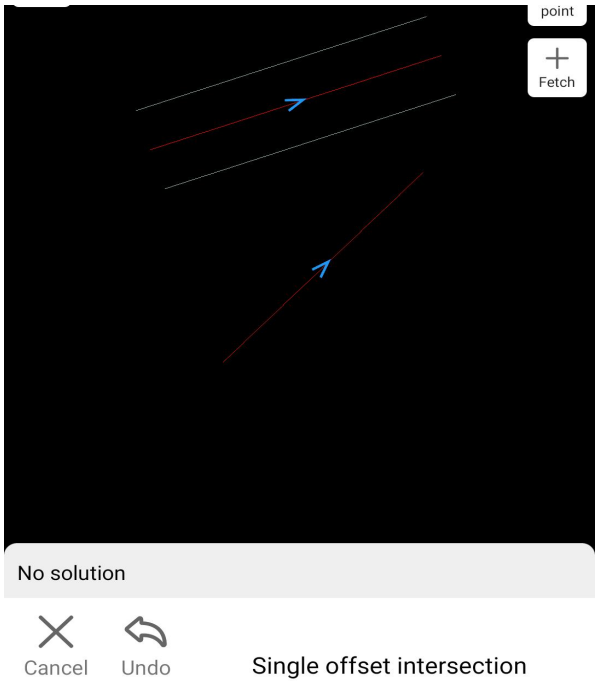
3) Select another line to intersect.



4) After obtaining the intersection point, select the intersection point which you want to save. After clicking *Completed*, the point will be saved to Element and displayed on the map.

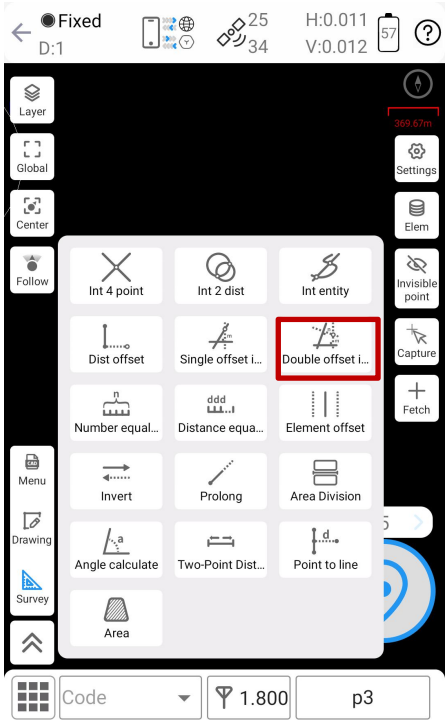


5) If there is no intersection, the bottom prompts "No intersection".



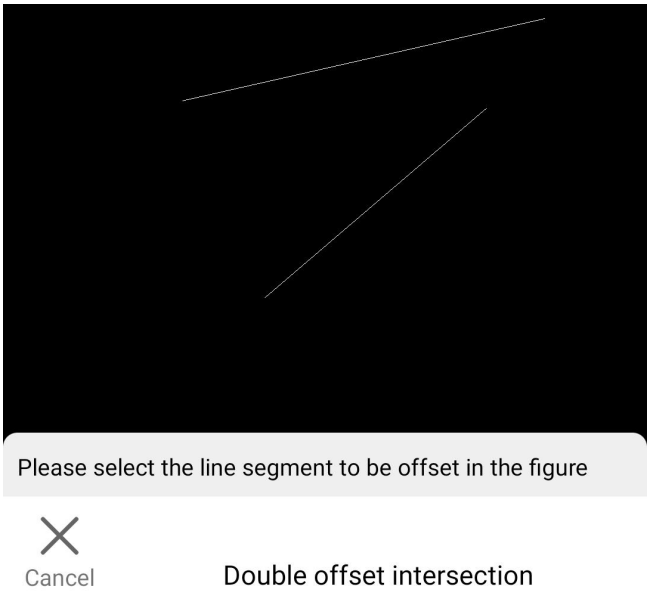
8.3.6 Double offset intersection

Select two lines in turn, enter the offset distance, and generate lines on the left and right sides of the line segment that are translated to the line ends. The intersection of the two parallel lines is obtained and can be saved to the Element. (i.e. Points that are a certain distance from two line segments)

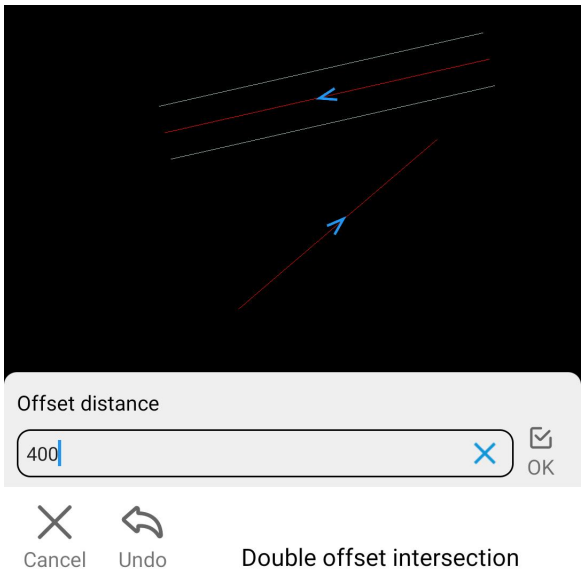


The steps are as follows:

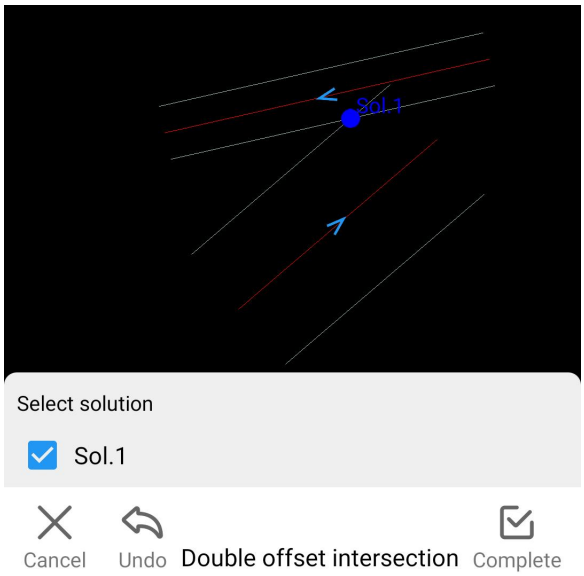
1) Select the line segment to be offset by clicking on the map. You can click *Cancel* and the function will exit.



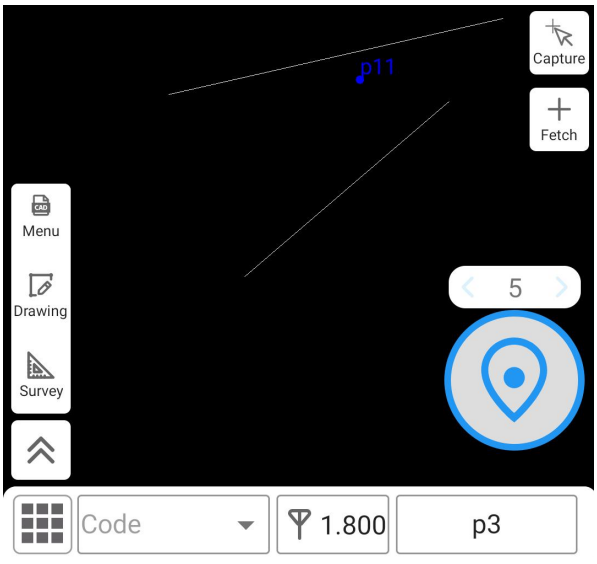
2) After selecting, enter the offset distance of this line.



3)After enter an offset value, this line will form two offset lines. But the offset lines are not saved.

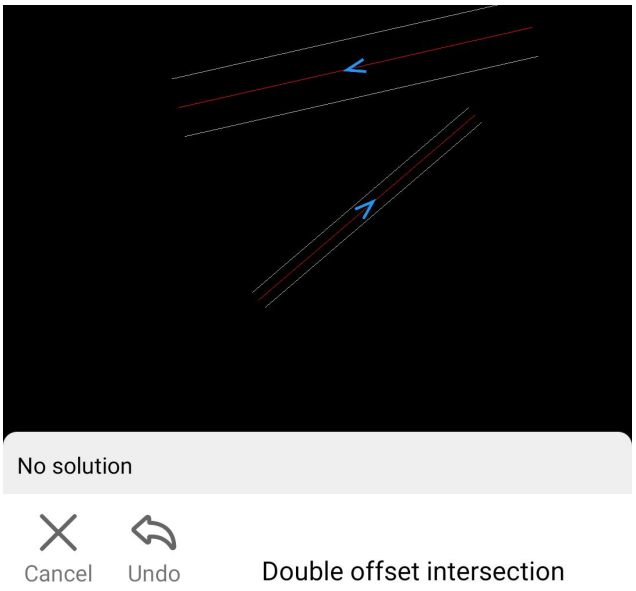


4) The selection method for the second line is the same as above.



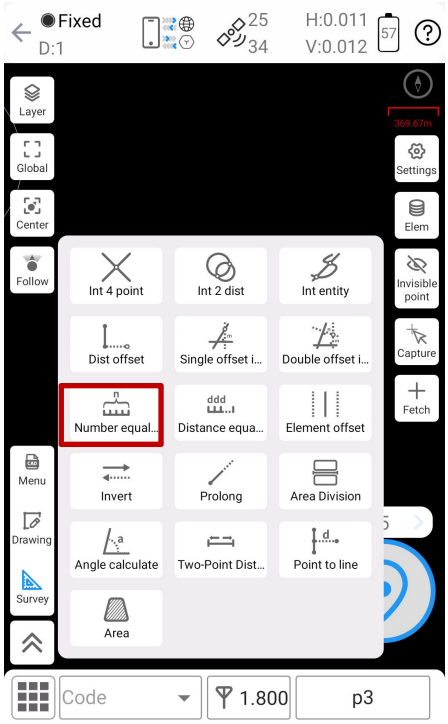
5) After obtaining the intersection point, select the intersection point which you want to save. After clicking *Completed*, the point will be saved to Element and displayed on the map.

6) If there is no intersection, the bottom prompts "No intersection".



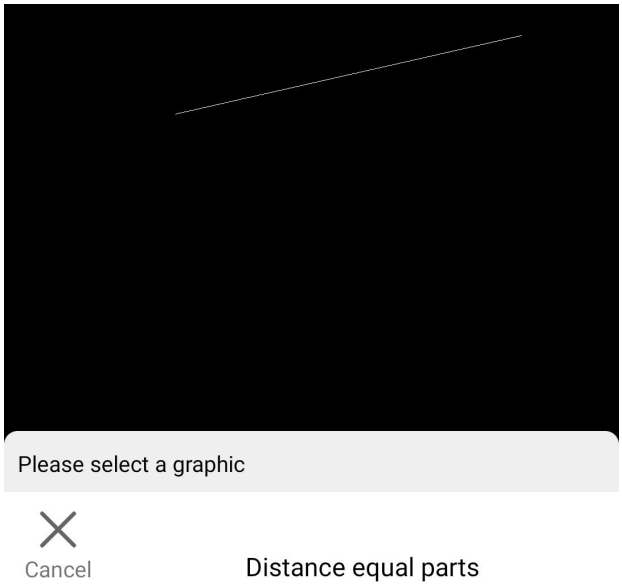
8.3.7 Number equal parts

Select the graphic, enter the number of divisions required, divide the selected graphic into equal parts, generate corresponding points and save them to Element.

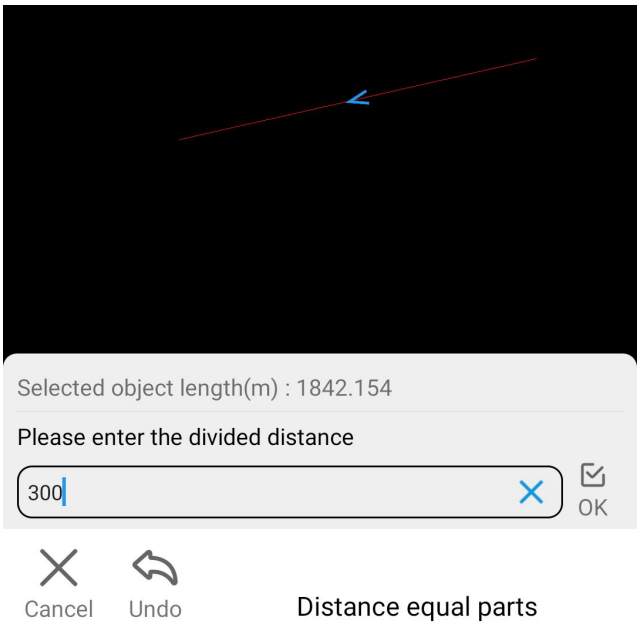


The steps are as follows:

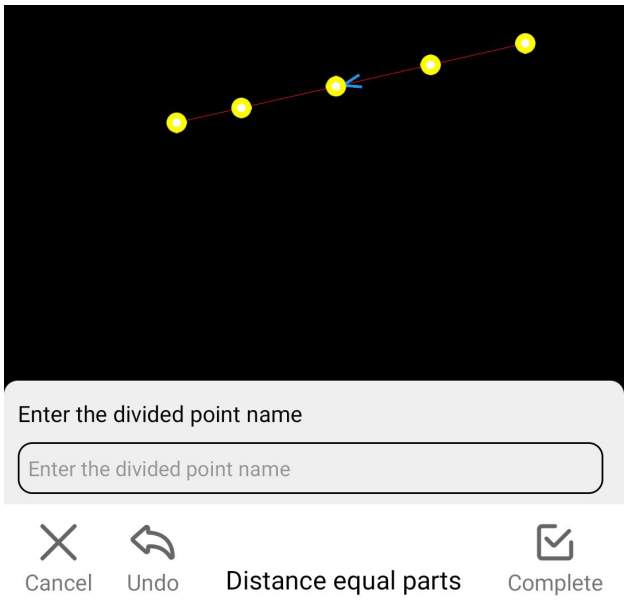
1) Select a graphic by clicking on the map. You can click *Cancel* and the function will exit.



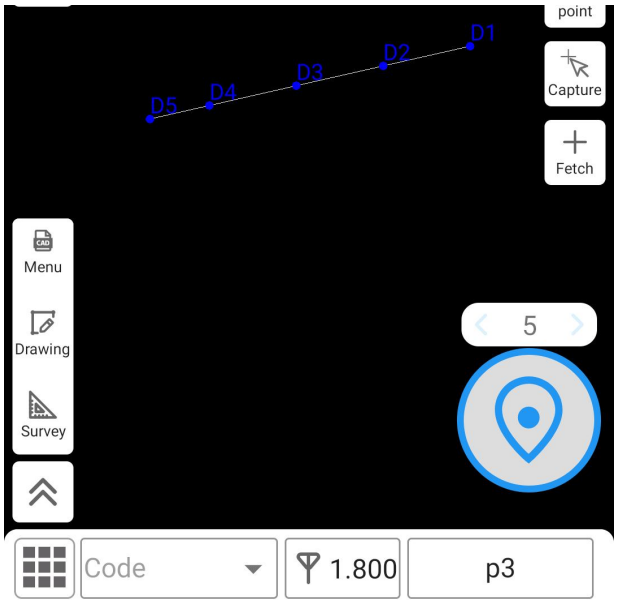
2) After selecting a graphic, the length of the selected graphic is displayed at the bottom. Enter the divided quantity.



3) After entering the divided quantity, you can see marks on the graphic. These marks are the divided point which will save in Element. Then you can enter the divided point name.

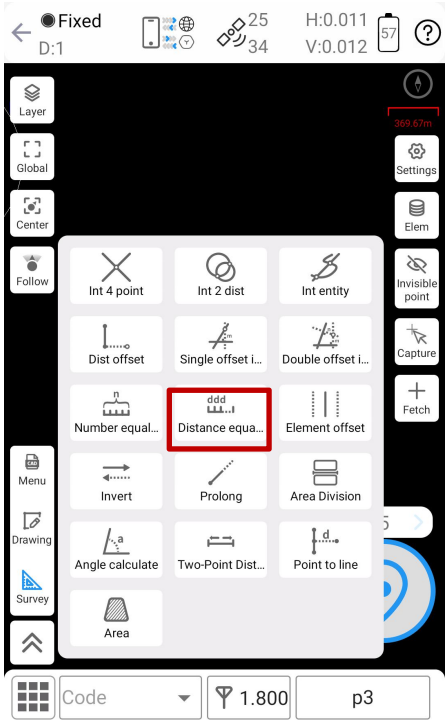


4) After clicking *Completed*, the point will be saved to Element and displayed on the map.



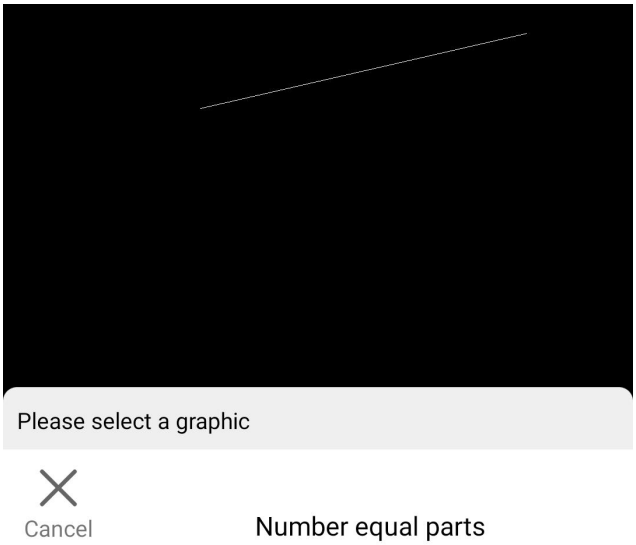
8.3.8 Distance equal parts

Select the graphic, enter the distance to be divided, divide the selected graphic into equal parts, generate corresponding points and save them to Element.

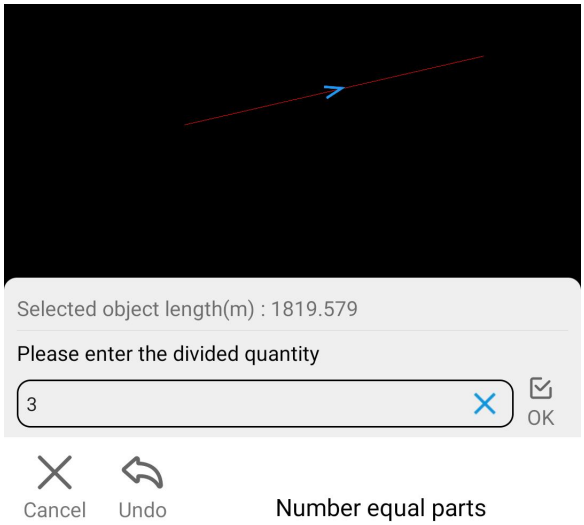


The steps are as follows:

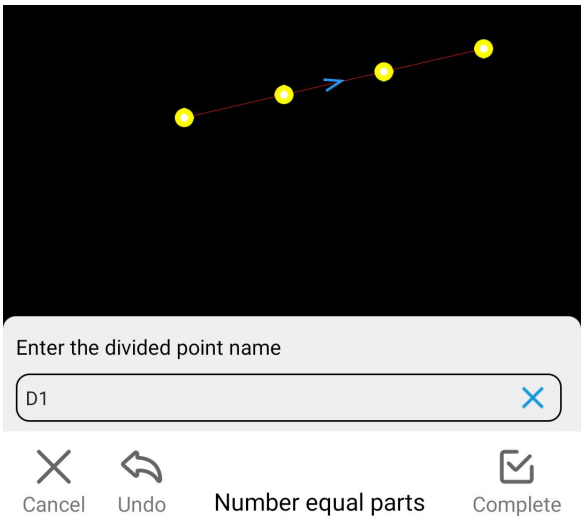
1) Select a graphic by clicking on the map. You can click *Cancel* and the function will exit.



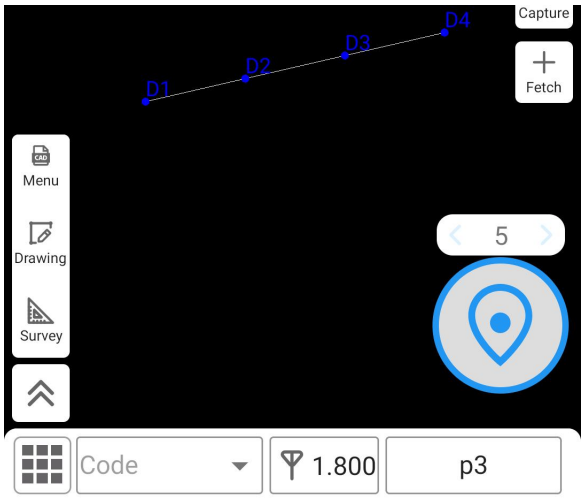
2) After selecting a graphic, the length of the selected graphic is displayed at the bottom. Enter the divided distance.



3) After entering the divided distance, you can see marks on the graphic. These marks are the divided point which will save in Element. Then you can enter the divided point name.

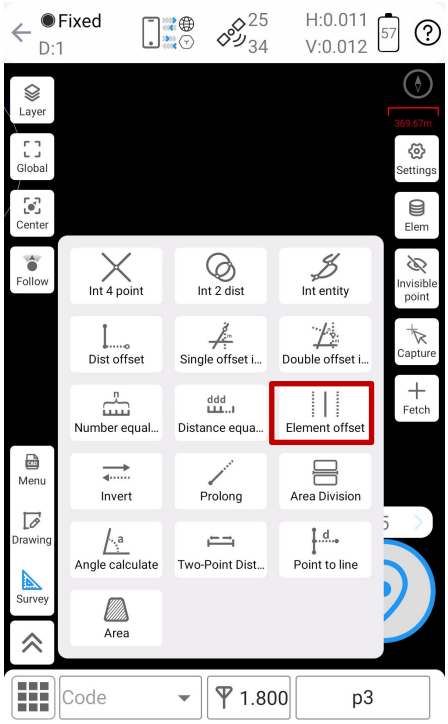


4) After clicking *Completed*, the point will be saved to Element and displayed on the map.



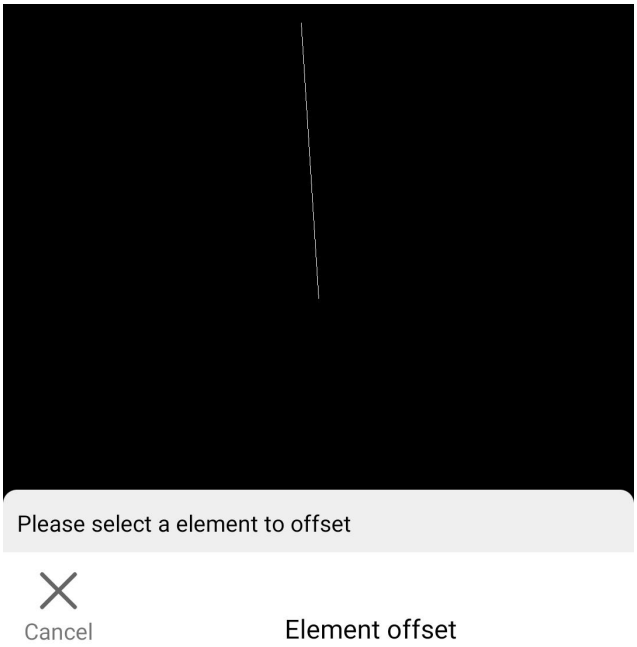
8.3.9 Element offset

Select the element, generate new element parallel to the element.

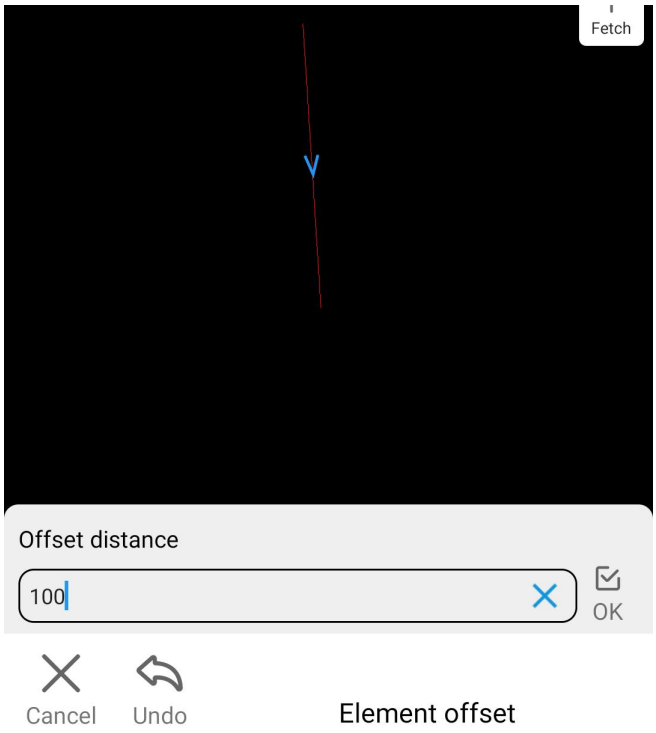


The steps are as follows:

1) Select the element to be offset by clicking on the map. You can click *Cancel* and the function will exit.

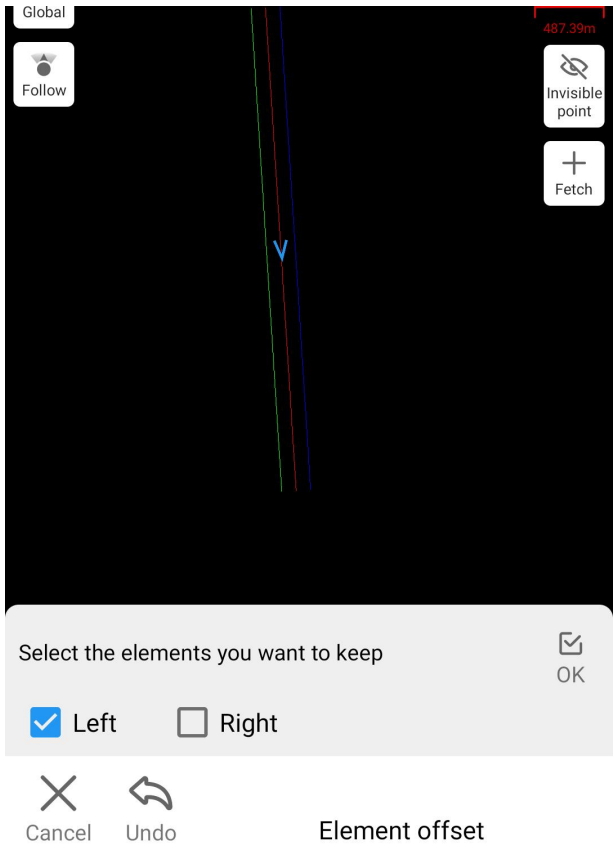


2) After selecting, enter the offset distance.



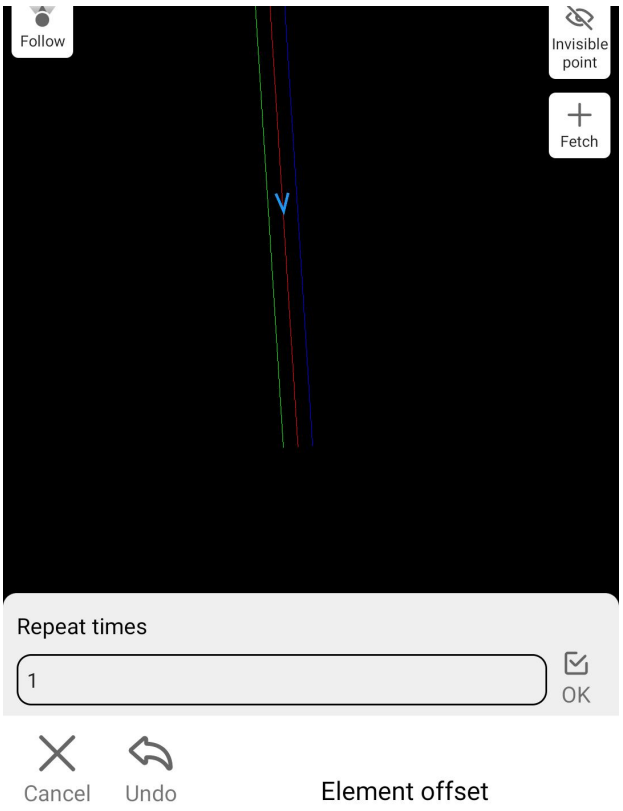
Element offset

3) After enter an offset value, this line will form two offset lines. Select the elements you want to keep.

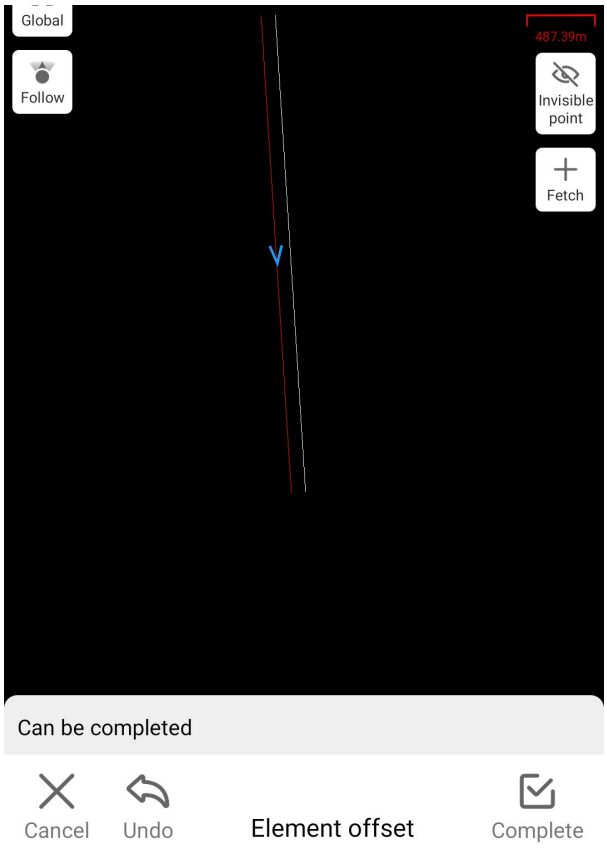


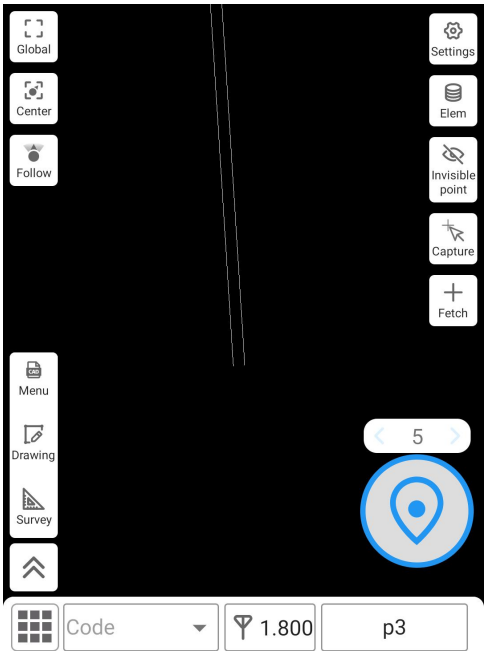
Element offset

4) Then enter the number of times to perform the offset operation.



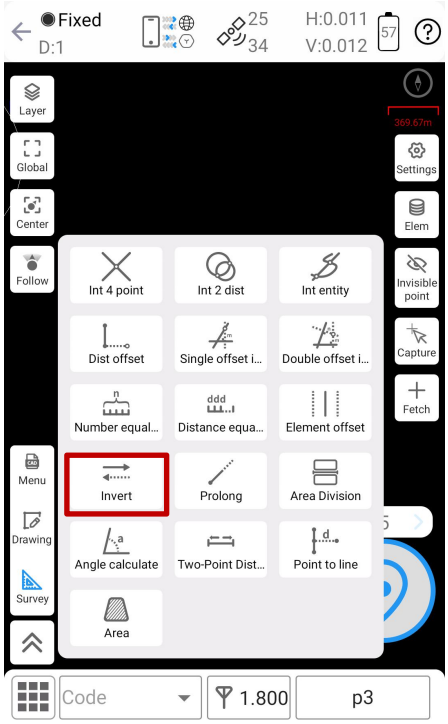
5) After clicking *Completed*, you can get the results.





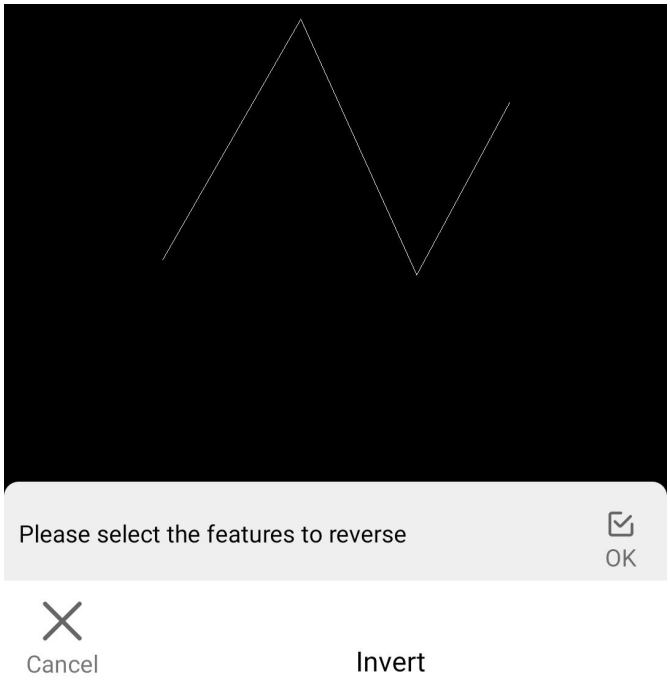
8.3.10 Invert

Select the graph to reverse the progressive direction of the graph's nodes, that is, exchange the starting and end positions of the graph.

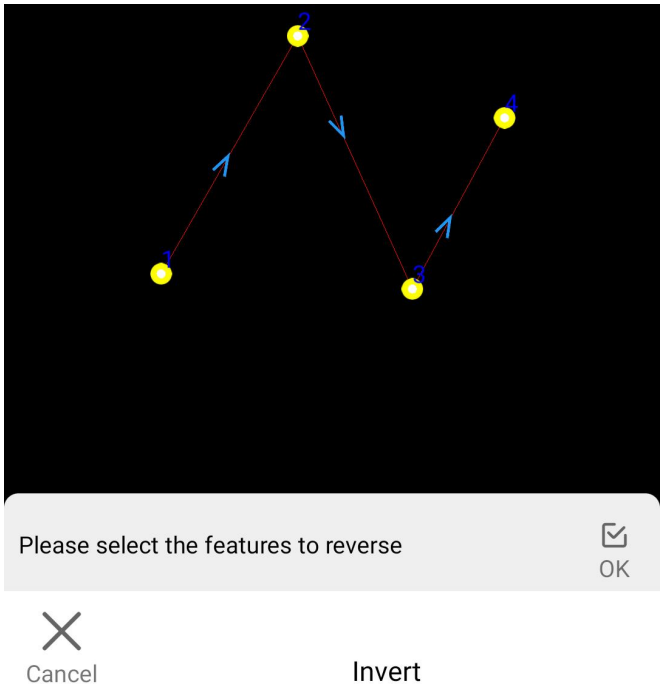


The steps are as follows:

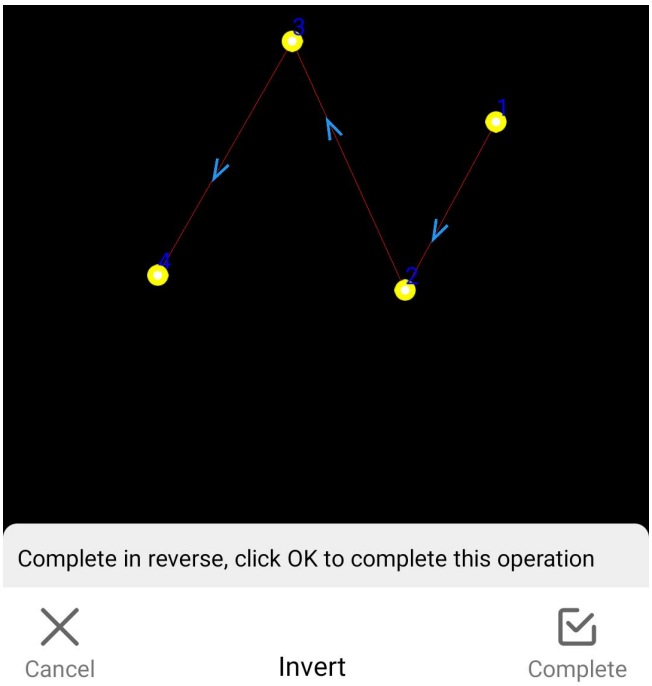
1) Select a graphic by clicking on the map. You can click *Cancel* and the function will exit.



2) Select the graphic to be reversed. The yellow highlight effect of its node is displayed on the selected graphic interface, and the arrow shows the progressive direction of the current graphic.

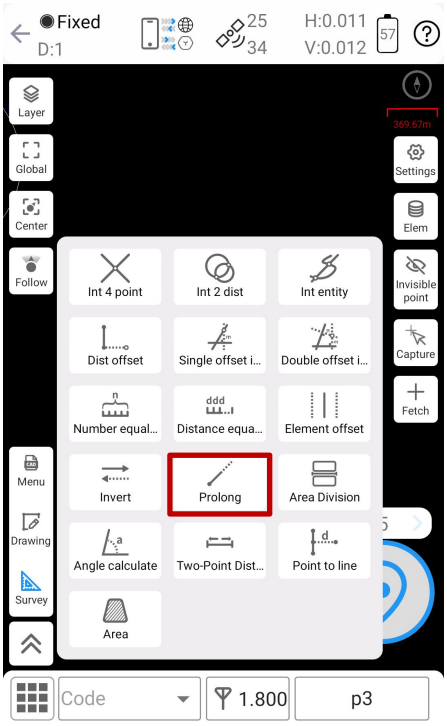


3) After clicking *Completed*, completed in reverse, the graphic progression direction is changed.



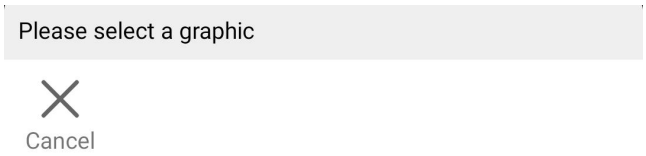
8.3.11 Prolong

Select the graphic, enter the distance to be extended, and it will be extended at the end point of the graphic.

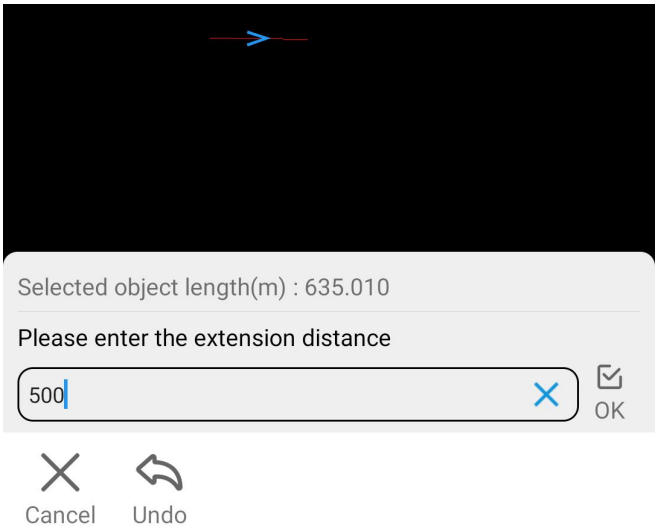


The steps are as follows:

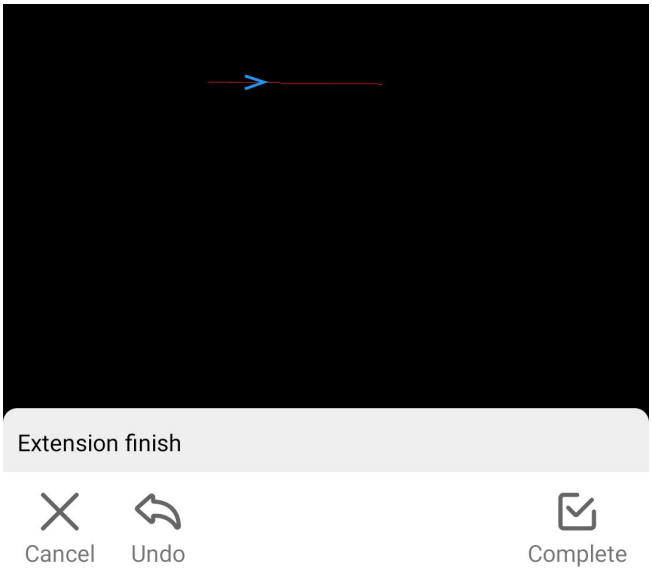
1) Select the graphic that needs to be extended. You can click *Cancel* and the function will exit.



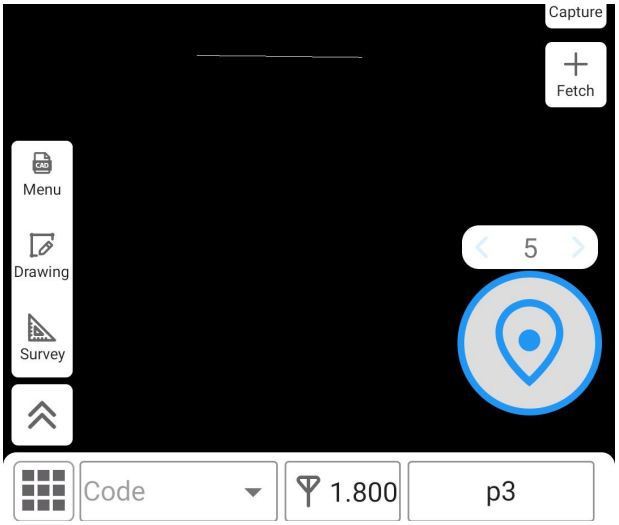
2) The bottom prompts "Please enter the extension distance" and the length of the currently selected graphic is displayed above. Click *Cancel* to exit the function. Click *Undo* to uncheck the graphic and you can reselect it.



3) Enter the extension distance, click *OK* and then extend the graphic at the end point according to the input distance.

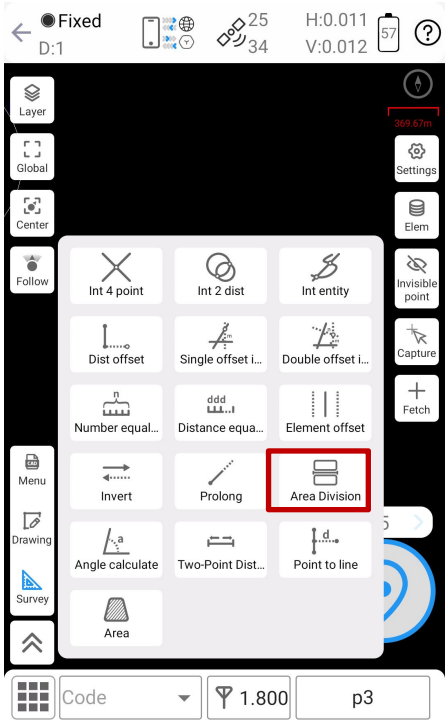


4) After the extension is completed, click *Completed* to save the extension results.



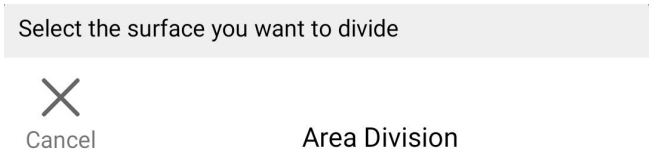
8.3.12 Area Division

Divide and save the intersection points according to the input area.

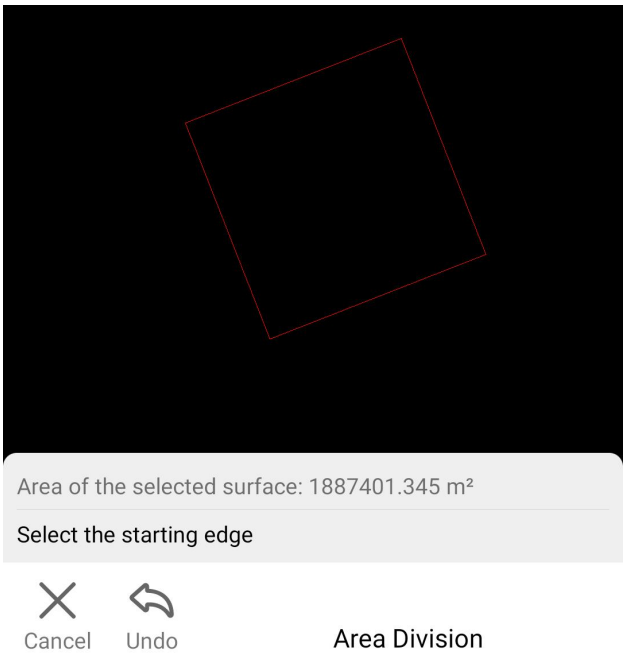


The steps are as follows:

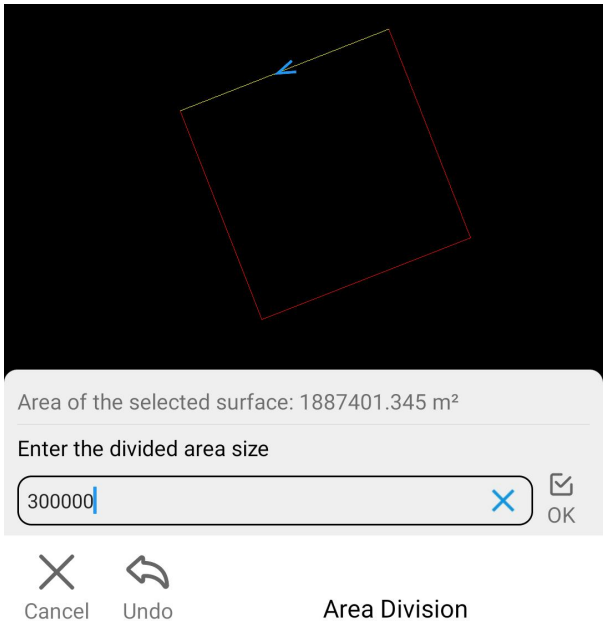
1) Select the surface you want to divide. You can click *Cancel* and the function will exit.



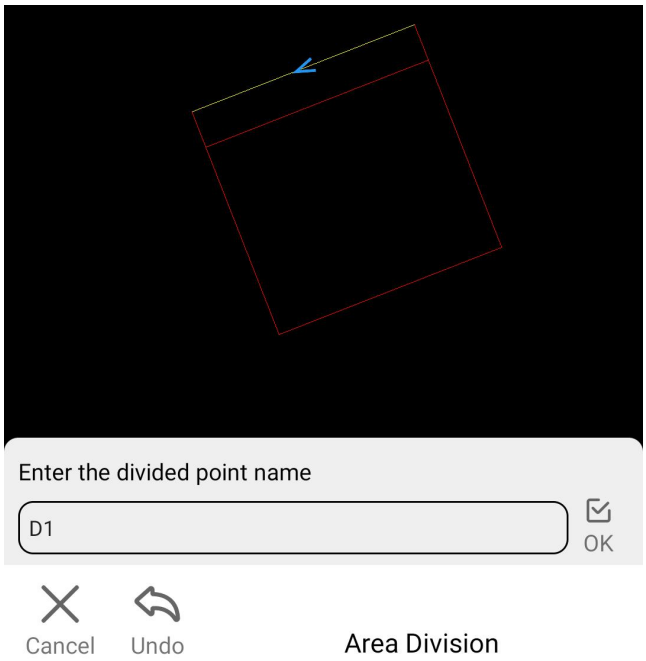
2) The bottom prompts "Select the starting edge" and the area of the currently selected surface is displayed above. Click *Cancel* to exit the function. Click *Undo* to uncheck the surface and you can reselect it.



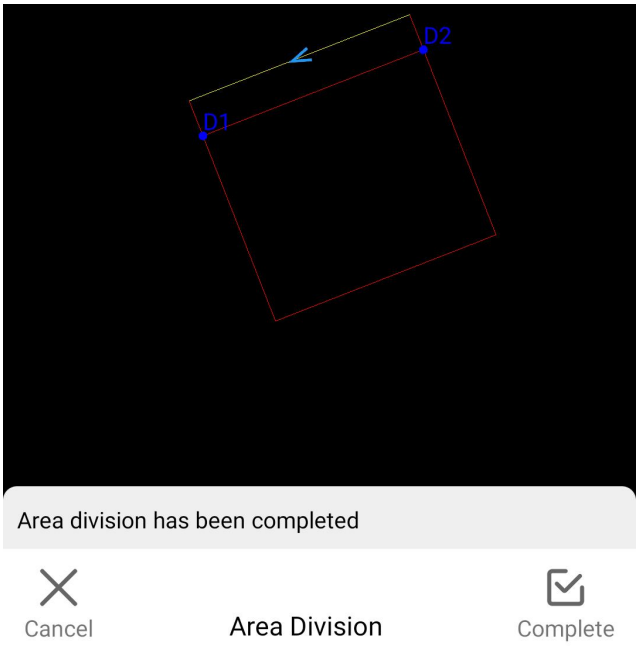
3) Select the starting edge which you want to divide this surface and enter the divided area size.

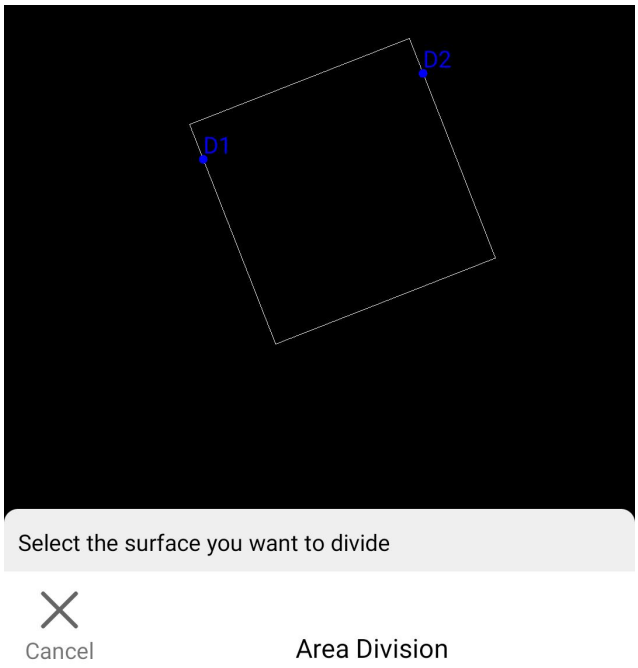


4) After clicking *OK*, the area from the starting edge to the generated dividing line is the area set by the division.

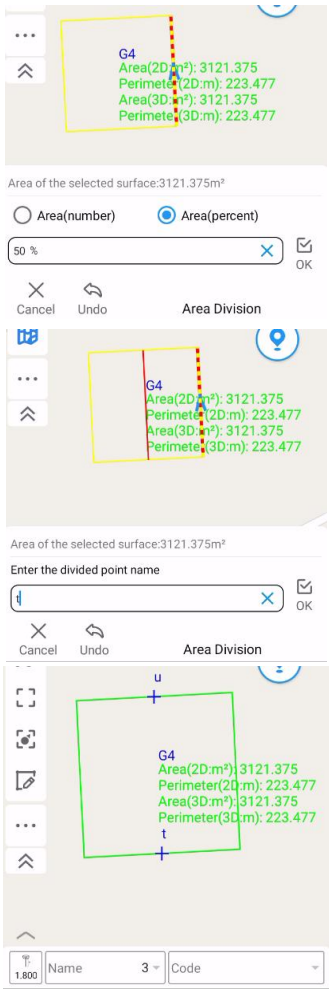


5) Enter the division point name. After clicking *OK*, the area division is completed, the divided points are generated at the intersection of the generated dividing line and the original selected surface, and the points are saved in Element.



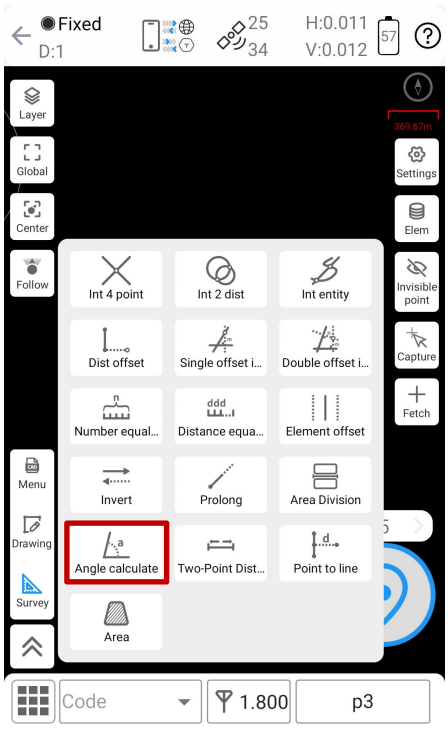


4040 added Area Division support enter percentage.



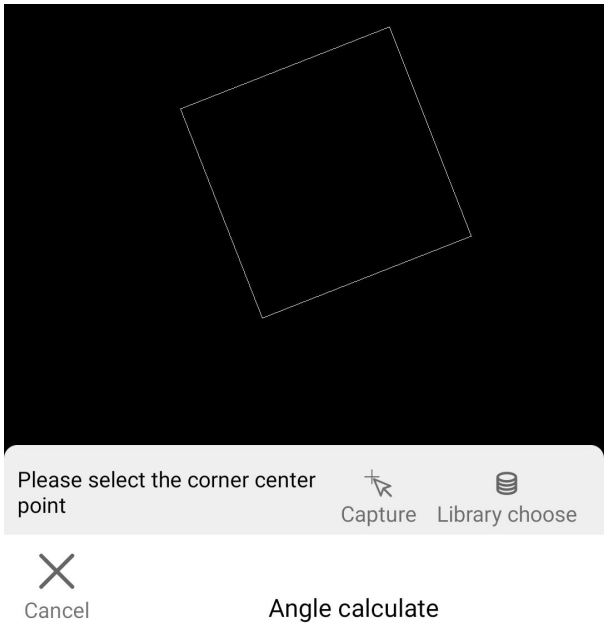
8.3.13 Angle calculate

After selecting three points to form the included angle, the current angle is displayed.

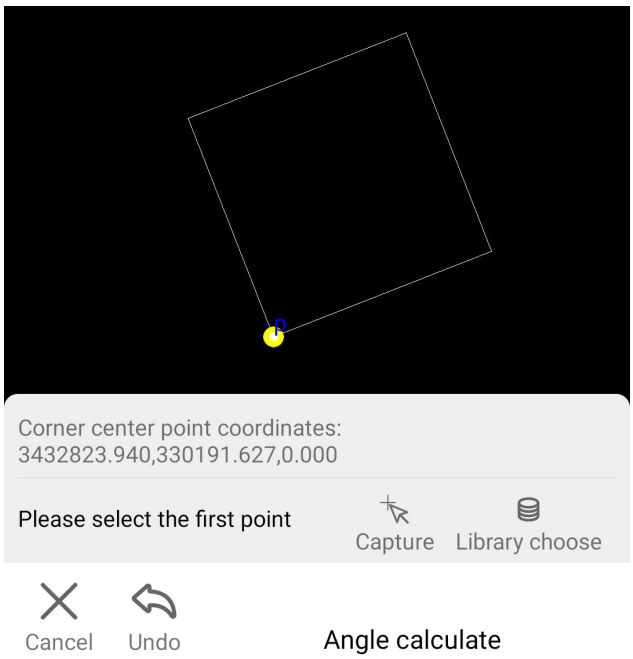


The steps are as follows:

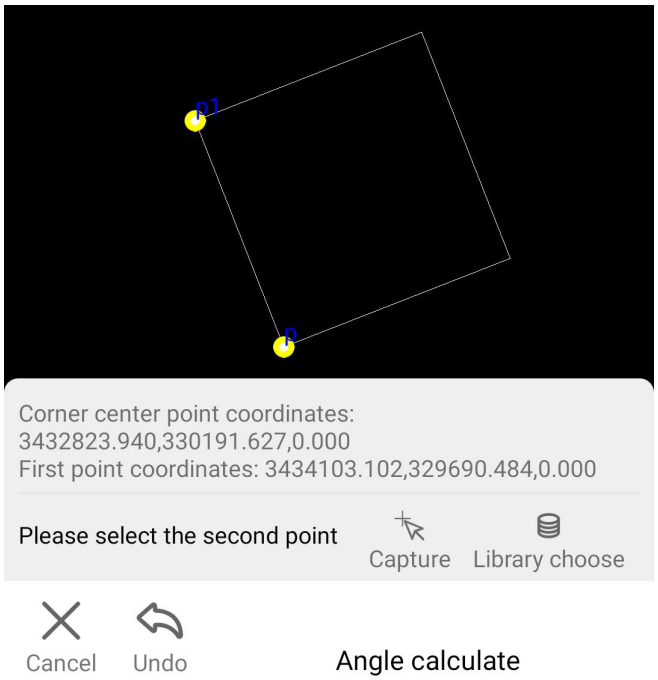
1) Select the corner center by clicking on the map, selecting points with the Capture tool, or selecting points from Element. You can click *Cancel* and the function will exit.



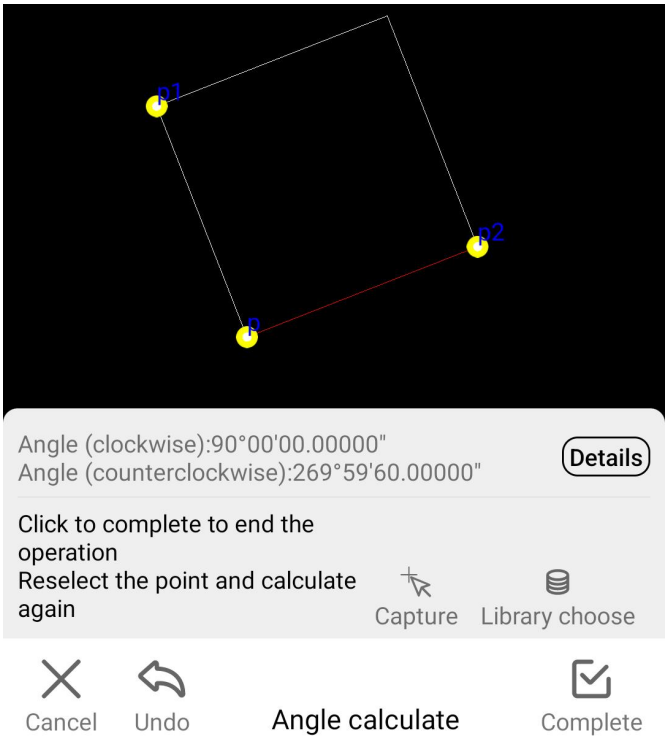
2) After the center point selection, the coordinates of the selected point will be displayed. The bottom prompts "Please enter the first point". Click *Cancel* to exit the function. Click *Undo* to uncheck the point and you can reselect it.



3) After the first point selection, the coordinates of the selected point will be displayed. The center point will be connected to the first point. The bottom prompts "Please enter the second point". Click *Cancel* to exit the function. Click *Undo* to uncheck the point and you can reselect it.

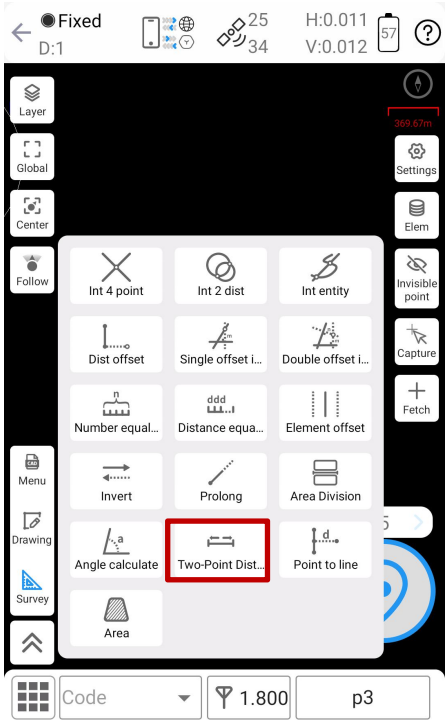


4) After the second point selection, the center point will be connected to the second point. The clockwise and counterclockwise angles of the current included angle will be displayed. You can click *Details* to enter the angle calculate interface to view or modify. The selected points and graphics will not be saved after clicking *Completed*.



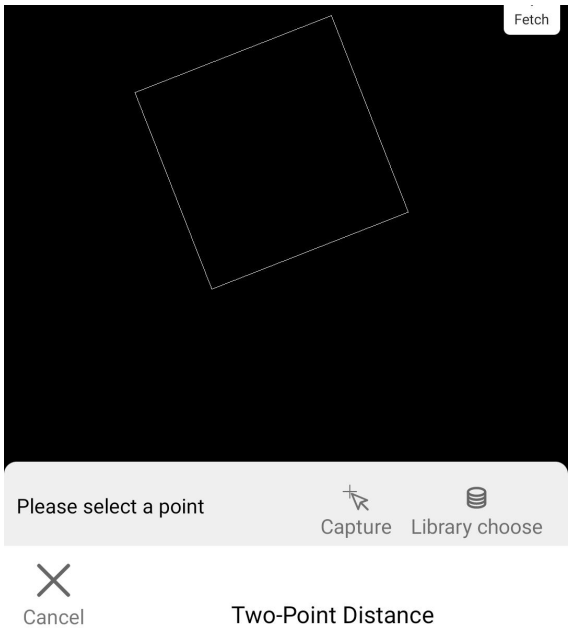
8.3.14 Two-Point Distance

Select two points and automatically calculate the horizontal distance (2D) and slope distance (3D).

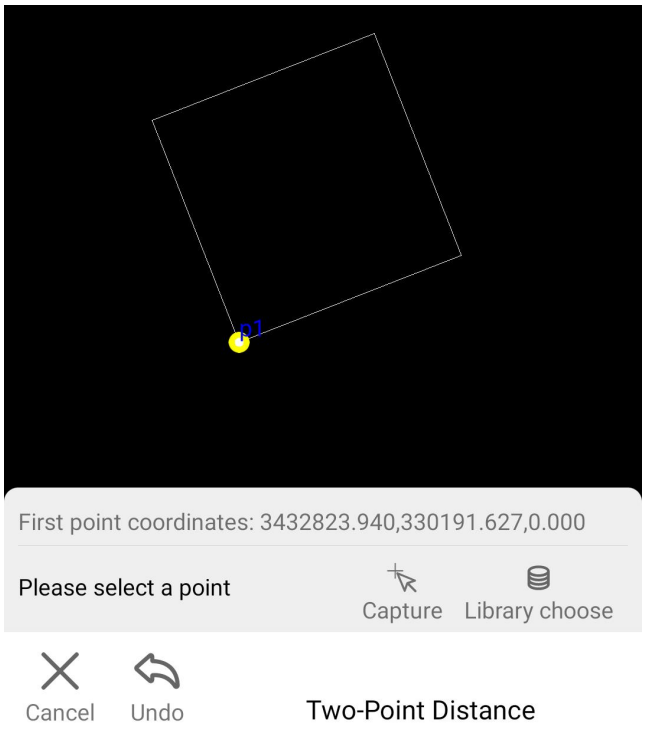


The steps are as follows:

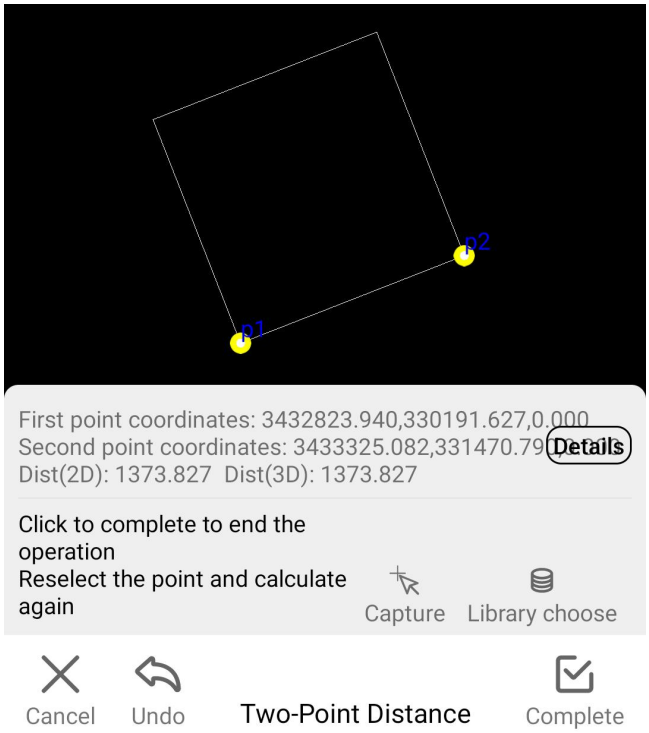
1) Select a point by clicking on the map, selecting points with the Capture tool, or selecting points from Element. You can click *Cancel* and the function will exit.



2) After the first point selection, the coordinates of the selected point will be displayed. The bottom prompts "Please select a point". Click *Cancel* to exit the function. Click *Undo* to uncheck the point and you can reselect it.

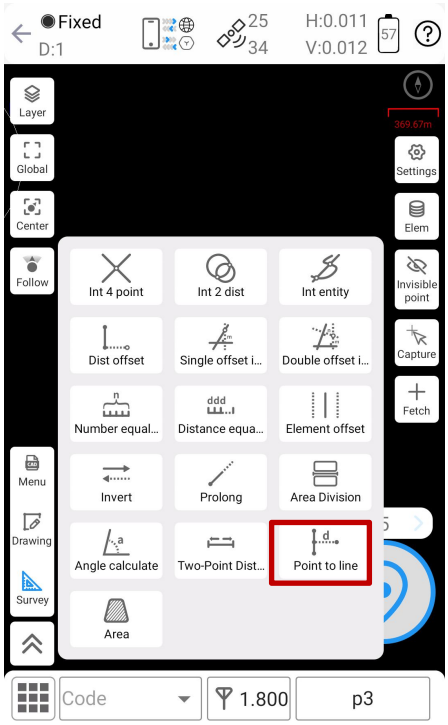


3) After the second point selection, the first point will be connected to the second point. The 2D distance and 3D distance will be displayed. You can click *Details* to enter Two Point interface to view or modify. The selected points and graphics will not be saved after clicking *Completed*.



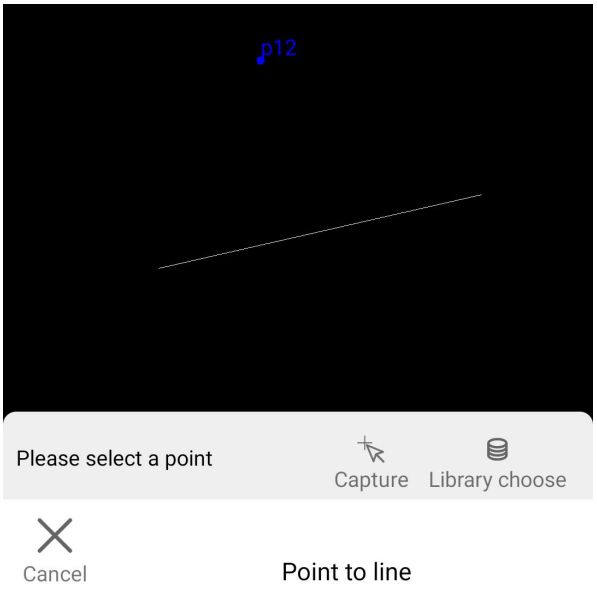
8.3.15 Point to Line

Select a point and a line and calculate the vertical distance from the point to the line.

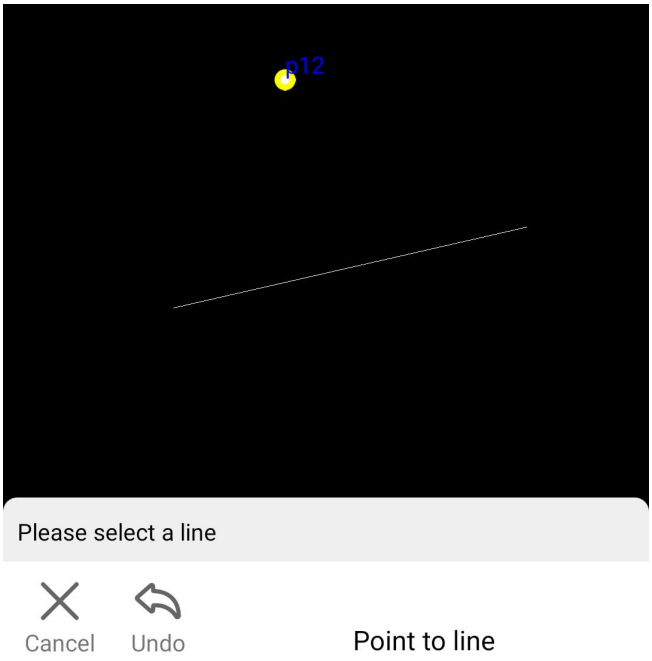


The steps are as follows:

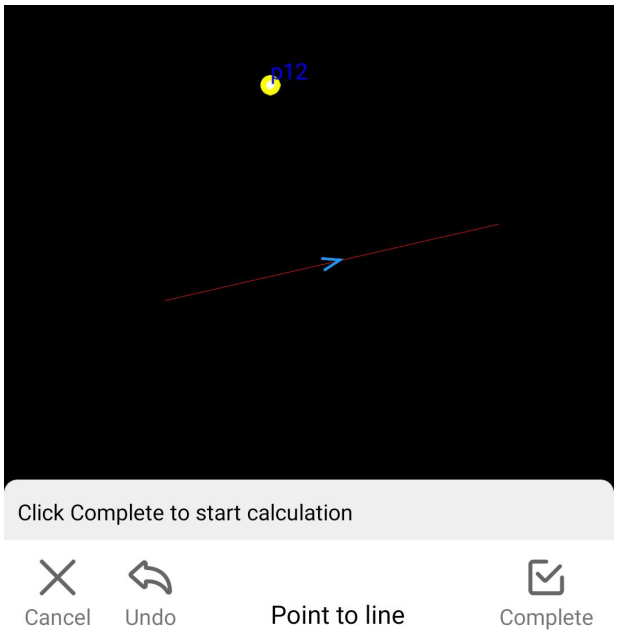
1) Select a point by clicking on the map, selecting points with the Capture tool, or selecting points from Element. You can click *Cancel* and the function will exit.



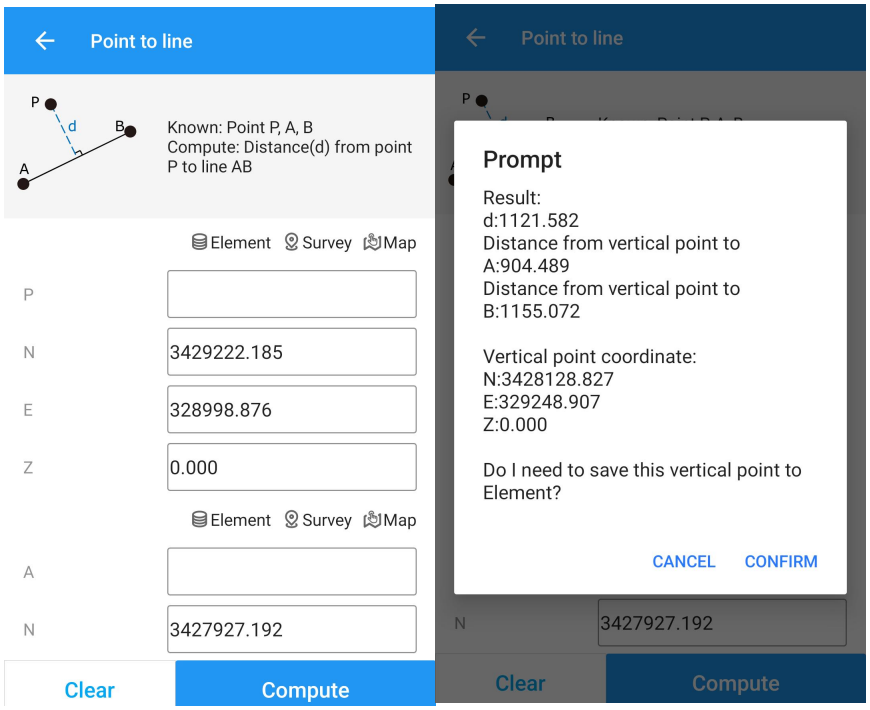
2) After the first point selection, the bottom prompts "Please select a line". Click *Cancel* to exit the function. Click *Undo* to uncheck the point and you can reselect it.



3) After the line selection, the bottom prompts "Click Completed to start calculation". Click *Cancel* to exit the function. Click *Undo* to uncheck the line and you can reselect it.

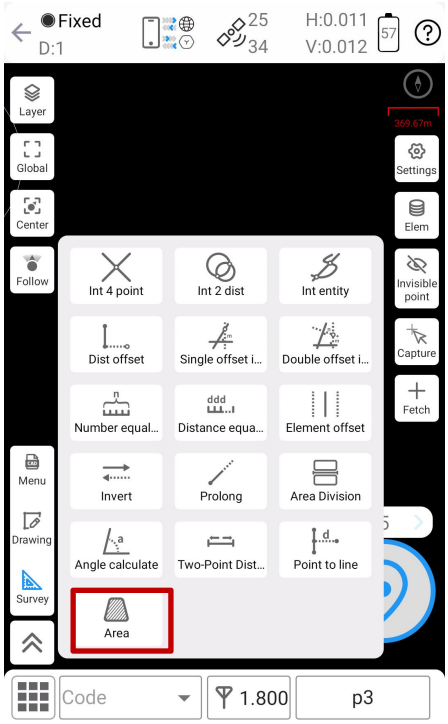


4) After clicking *Completed*, you can enter Point to line interface to view or modify. Click *Compute* you can save this vertical point to Element.



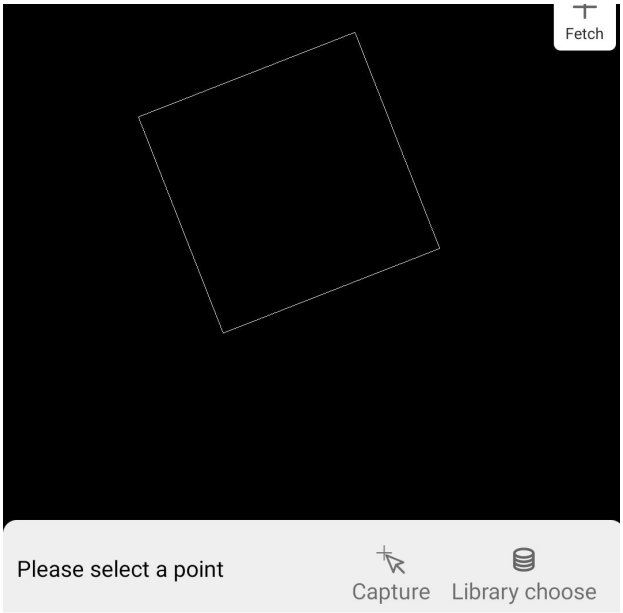
8.3.16 Area

Select the nodes that make up the graph, automatically calculate the area of the graph, and label the value.

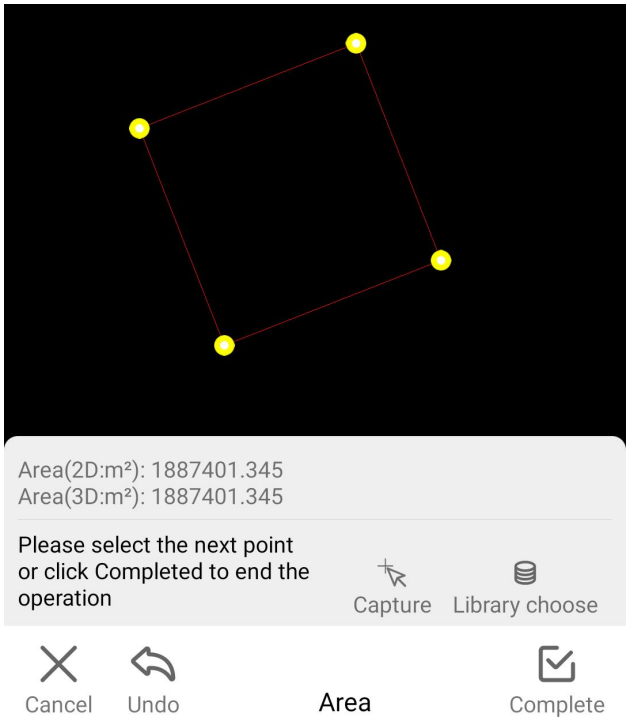


The steps are as follows:

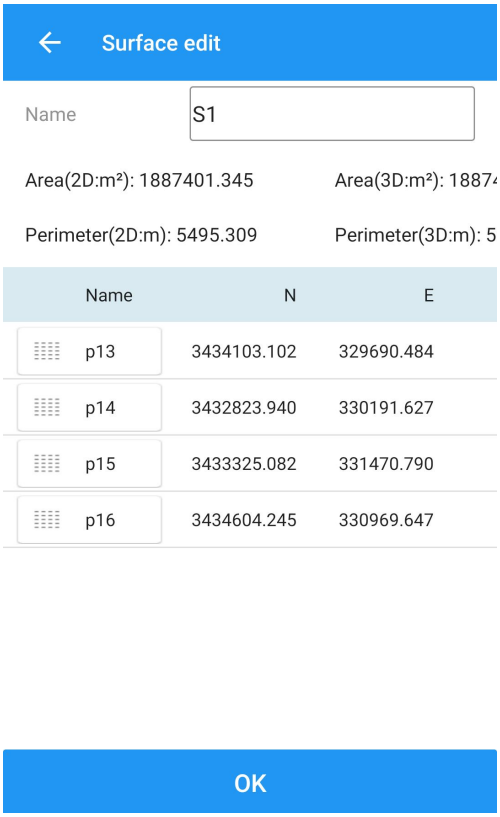
1) Select points by clicking on the map, selecting points with the Capture tool, or selecting points from Element. These points will make up a graph. You can click *Cancel* and the function will exit.



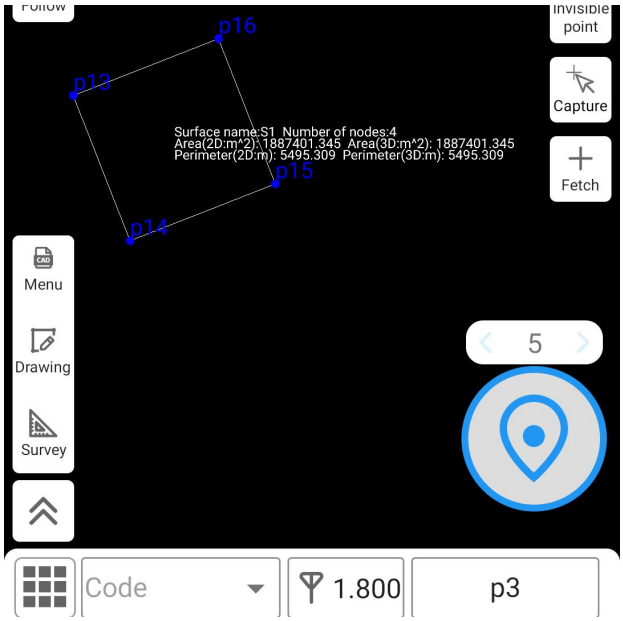
2) After all points selection, the 2D area and 3D area will be displayed. Click *Undo* to uncheck the point and you can reselect it.



3) After Clicking *Completed*, you can enter Surface edit interface to view or modify. Click *Cancel* to exit the function. Click *Undo* to uncheck the line and you can reselect it.

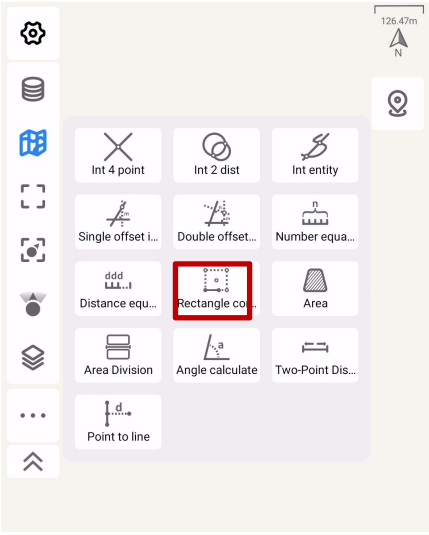


4) After clicking *OK*, the area annotation is displayed in the center of the interface, and the 2D/3D perimeter and area of the graph are displayed. The graph selection points are generated at the nodes and saved to Element.



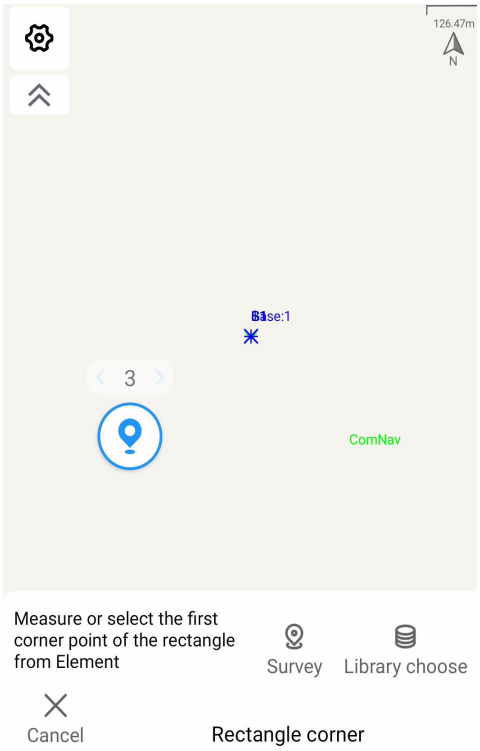
8.3.17 Rectangle corner

First, measure or select the first corner of the rectangle via the point library. Then measure any point on the long side of the rectangle, enter the rectangle's length and width, select the rectangle's position, and tap Complete to generate the rectangle.

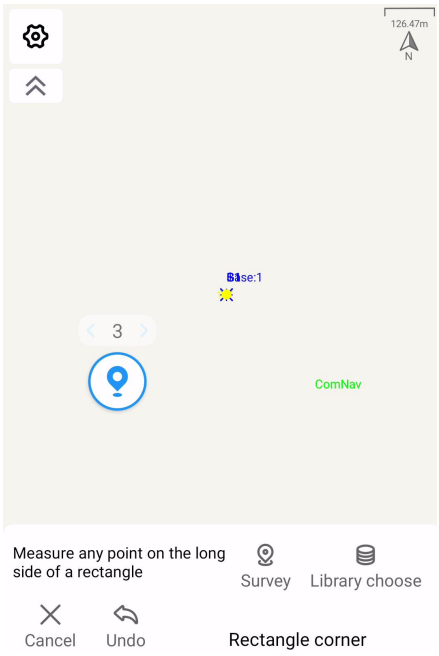


The steps are as follows:

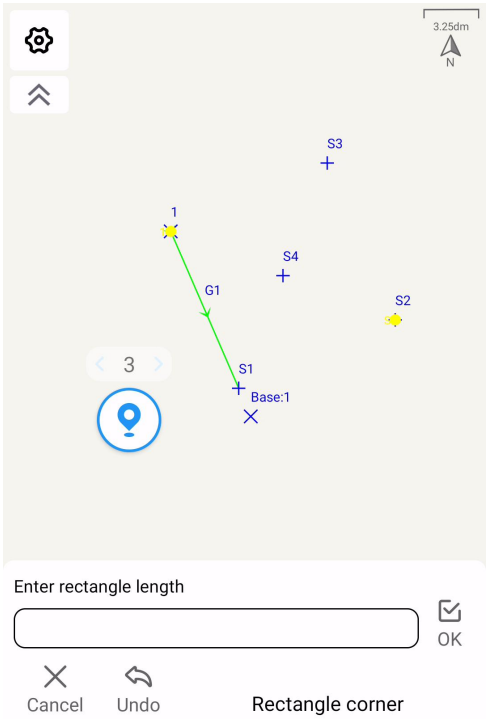
1) Measure or select the first corner of the rectangle via the point library.You can click *Cancel* and the function will exit.



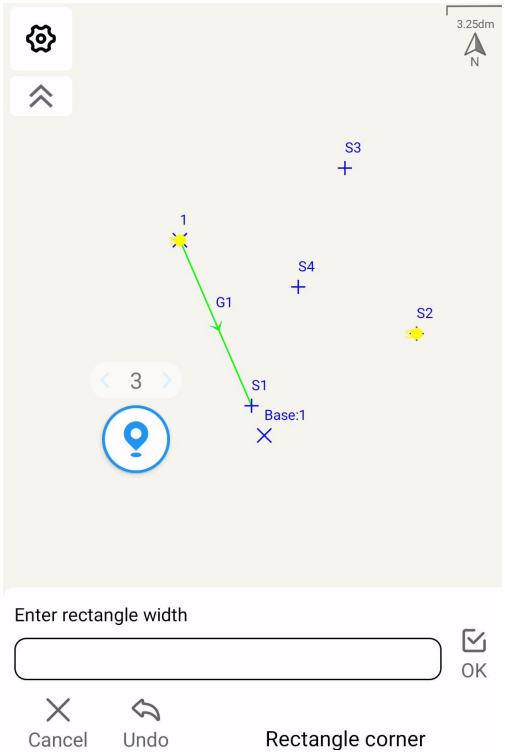
2) After determining the first point,measure or select the point on the long side of the rectangle via the point library.You can click *Cancel* and the function will exit.Click *Undo* to uncheck the line and you can reselect it.



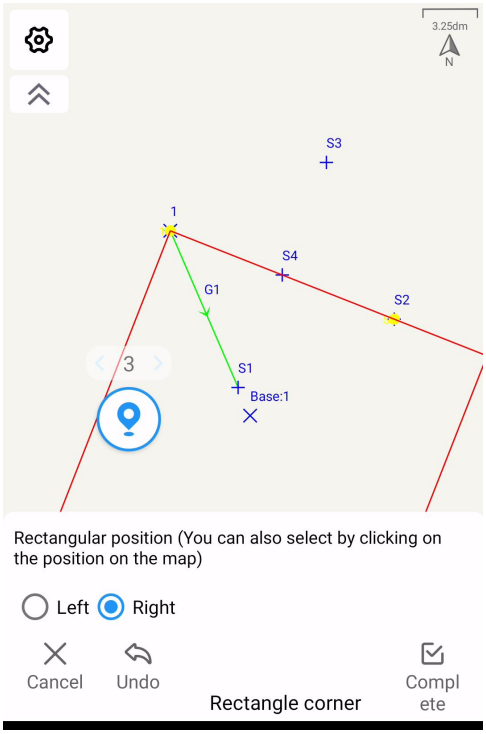
3) After determining the second point,enter the length of the rectangle.You can click *Cancel* and the function will exit.Click *Undo* to uncheck the line and you can reselect it.



4) After setting the length,enter the width of the rectangle.You can click *Cancel* and the function will exit.Click *Undo* to uncheck the line and you can reselect it.



5) After setting the width,select the position of the rectangle: you may choose either left or right.You can click *Cancel* and the function will exit.Click *Undo* to uncheck the line and you can reselect it.

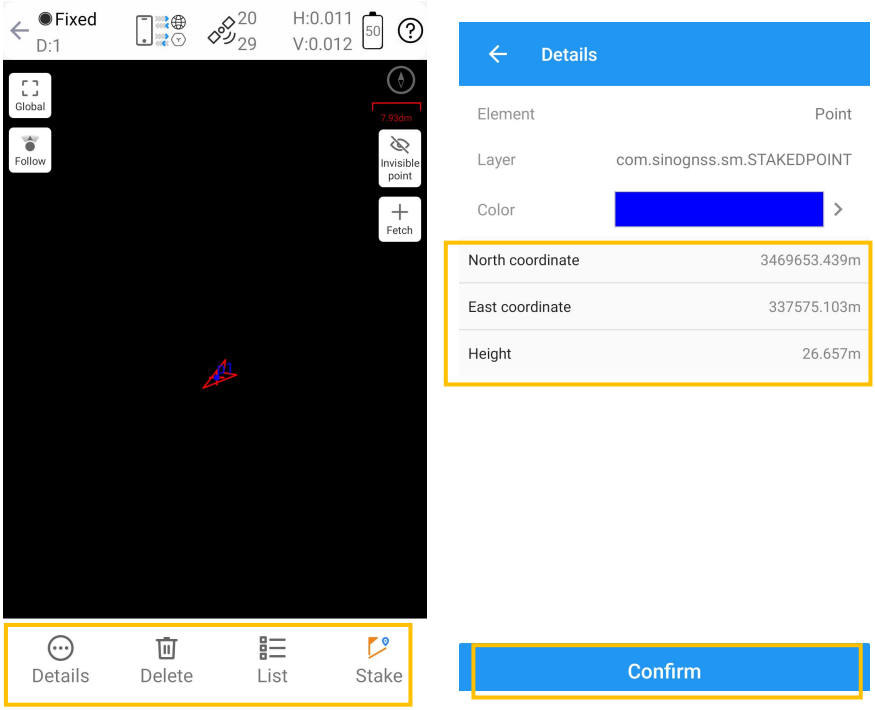


8.4 CAD Stake

When you choose point or line of the CAD file, you can do the followings:

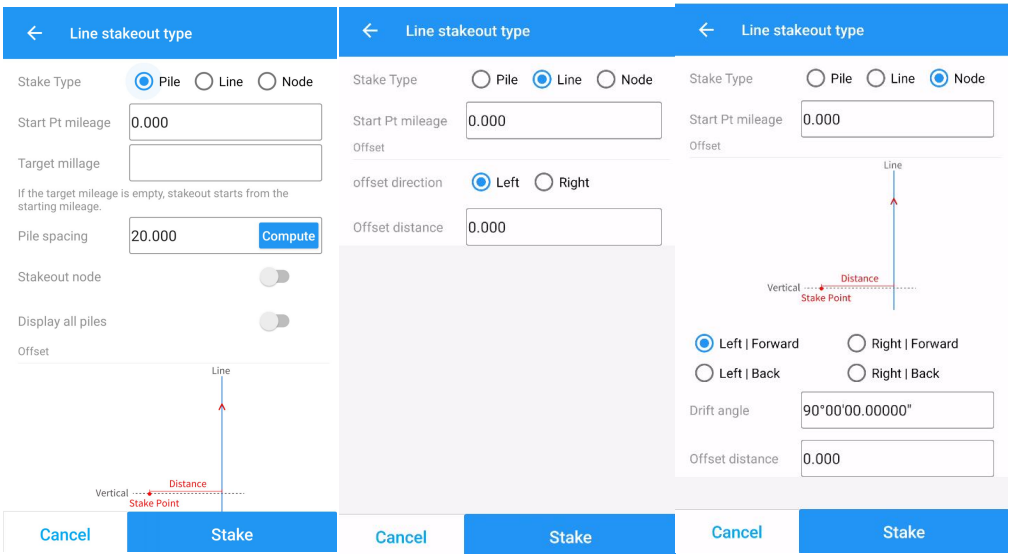
Delete: Delete this point or line, then click ***Save*** to save as a new file. When you exit the Stake CAD, the delete operation will not be saved to this current file.

Details: Check more information of the element what you selected.



List:You can check Element information.

Stake: Choose one point in the list to stake. Or stake lines: Directly select line on the screen to stake, support to stake straight line, ellipse and elliptic arc.



Stake Pile:You can manually set the Start Pt mileage; if left blank, the system will start stakeout from the Start Pt mileage by default. The default Pile spacing is 20, but it can be customized. The *Stakeout node* is off by default; when enabled, all nodes along the alignment will be displayed. The *Display all piles* is also off by default; when enabled, all stake piles along the alignment are shown, and when disabled, only the current stake pile is displayed.

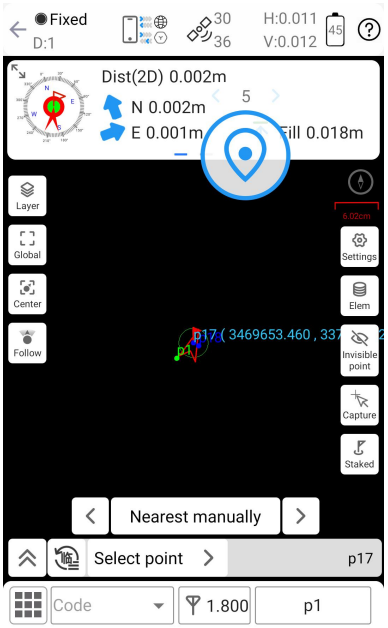
Offset Direction: Four directions are supported — Left|Forward, Left|Back, Right|Forward, and Right|Back. For example, “Left|Forward” means the offset is applied from the current position toward the foot of the perpendicular to the line, and the stakeout proceeds forward along the line with the offset direction to the left front. The default Drift angle is 90°, which can be customized. The default offset distance is 0 and can also be customized.

Stake Line: The Start Pt mileage can be manually set. The default offset direction is Left, which can be changed to Right. The default offset distance is 0, and the offset angle can be customized.

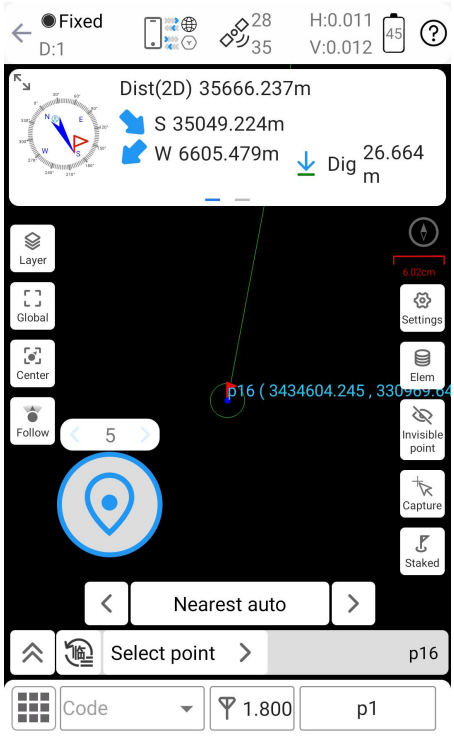
Stake Node:TheStart Pt mileage can be manually set. Four offset directions are available — Left|Forward, Left|Back, Right|Forward, and Right|Back. The default Drift angle is 90°, which can be customized. The default offset distance is 0, and the offset angle can also be customized.

Nearest point mode:

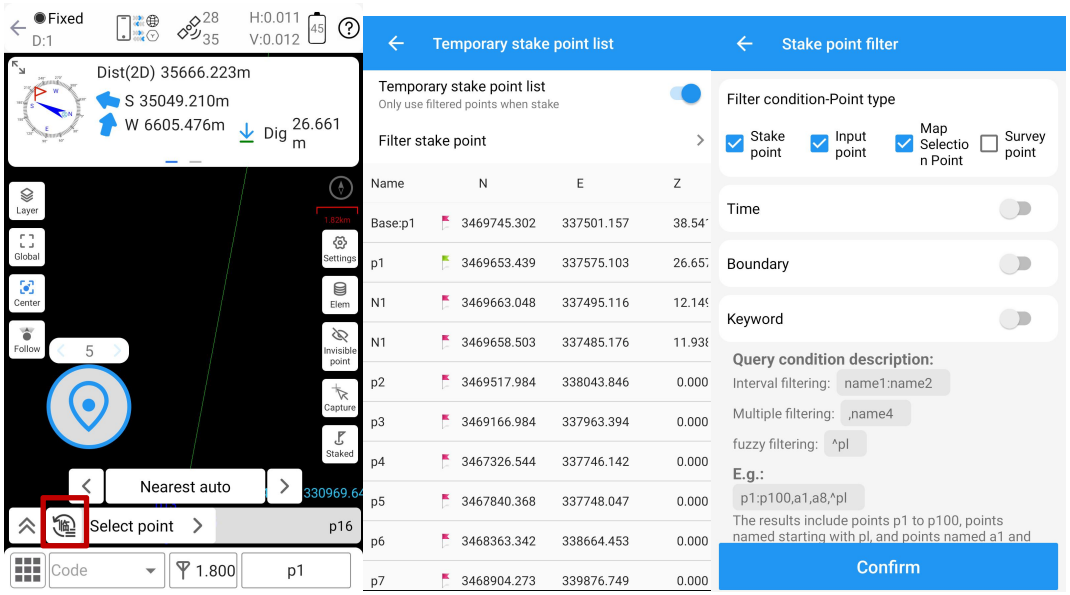
(1) Manual Nearest: Click Manual Nearest once to calculate the nearest unplaced point to the current position.



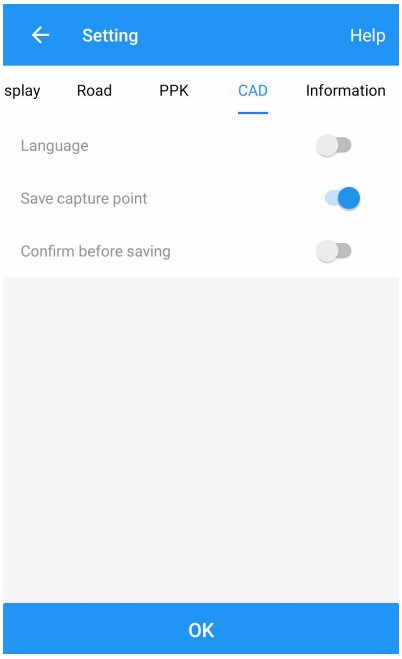
(2) Auto nearest: Automatically select the nearest point for stake, and automatically switch to the next nearest point after point stake completed.



Temporary stake point list: Click to enter the temporary stake point list, the default temporary Stake point list is closed, after opening, the lower part of the display element in all the points, you can filter the stake point.



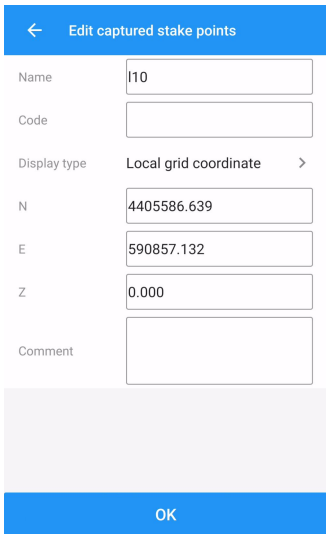
8.5 CAD Setting



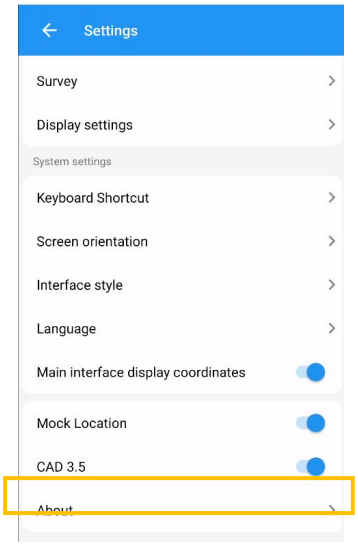
Language: Turn on the button, it can support any language

Save capture point: It is turned off by default. After turning it on, the CAD interface will save the captured points to Element. After turning it off, the captured points only support stake and will not be saved to Element.

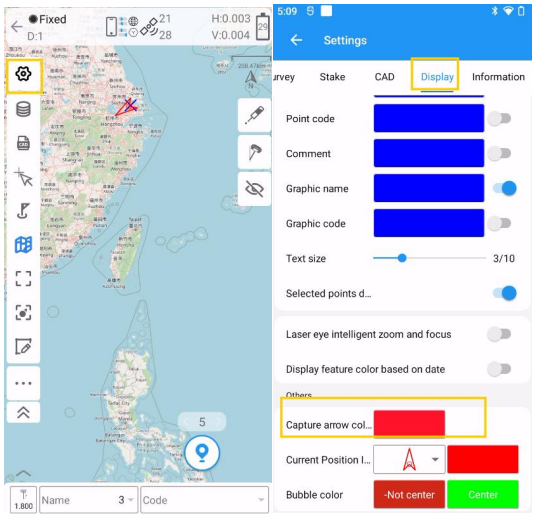
Confirm before saving: It is enabled by default. This option will be displayed when the save capture point function is enabled. After it is enabled, the captured points can be edited. After the editing is completed, click OK to save it to Element. After it is disabled, the captured points can be saved without secondary confirmation.



(CAD3.5 :opened to use the old version of CAD3.5. It is in settings.



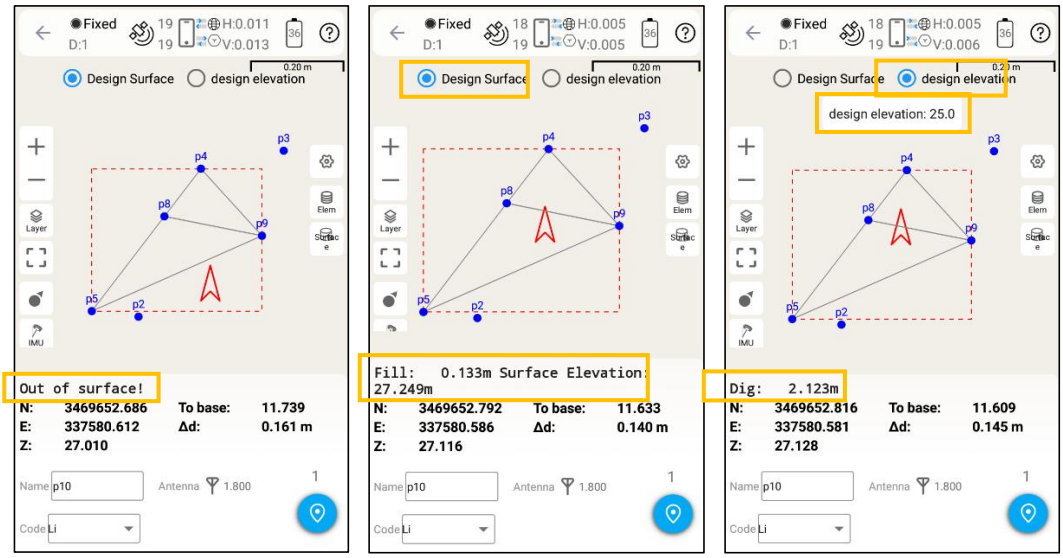
Change capture colar: customizable color for Capture



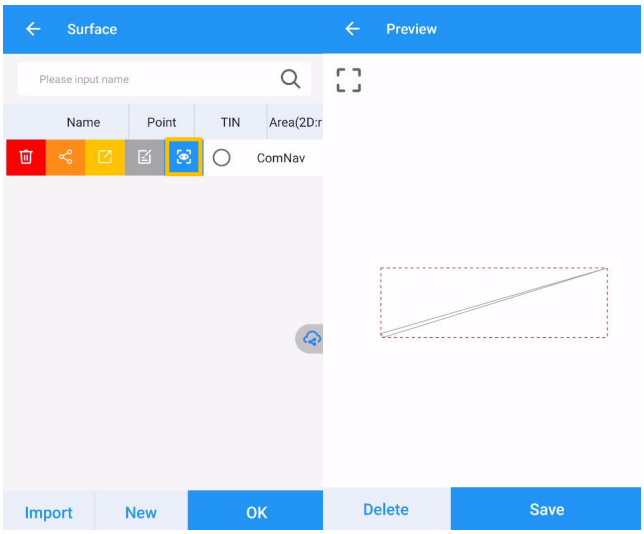
9 Stake Surface

You can stake the elevation using the design surface, then you can choose the fill or excavate according the stake result.

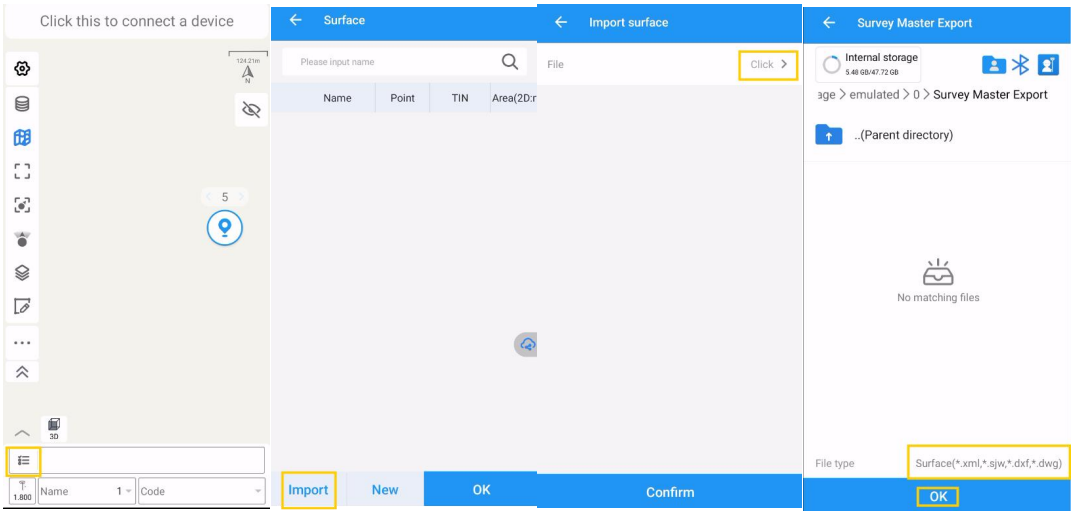
1. Go to ***Survey***->***Surface Stake***, if you don't open a surface before, then it will jump to the ***Surface*** interface;
2. If the current position is not within the range of the design surface, it will show "***Out of Surface!***"; if the current position is within the range of the design surface, it will show the fill or excavation value;
3. There are two methods to stake the elevation, you can use the elevation from the ***Design surface***, or you can use the ***Design elevation*** to get the fill or excavation value;



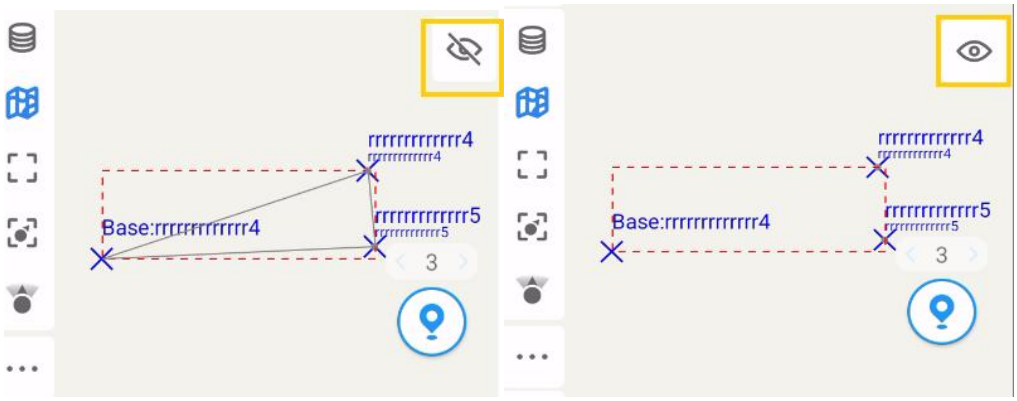
4. Added surface preview mode, you can click to view the surface.



5. Added import DXF/DWG file in surface store

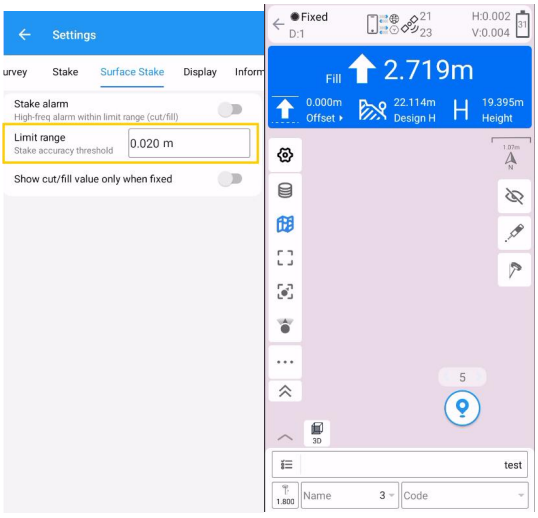


6. You can hide map in Surface Stake.



7. You can set Limit range when stake surface.

Within Limit range → displayed in green
Exceeds cut limit (e.g., 2 cm) → displayed in red
Exceeds fill limit (e.g., 2 cm) → displayed in blue



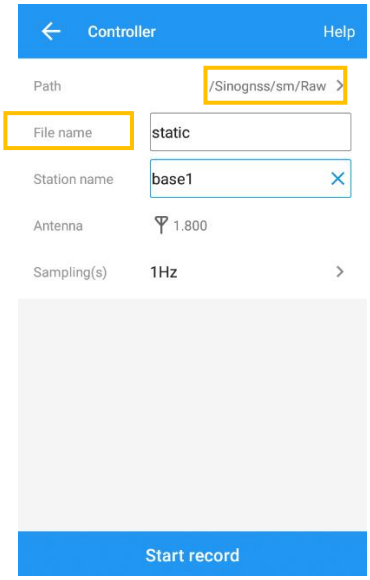
10 Static survey and PPK

Survey Master provides multiple choices of survey methods for users, and the following sections provide a brief introduction of PPK and static survey.

10.1 Static survey

Static survey is commonly applied for control points, which requires millimeter accuracy. After connecting with Bluetooth, you can record static data to your controller or receiver, if your receiver's SN is T31XXXXX or your receiver is K8 receivers (needs firmware supported, the firmware can't be lowered then 1.4.0 OS firmware and 609N5 GNSS firmware),

- Save the static data in controller

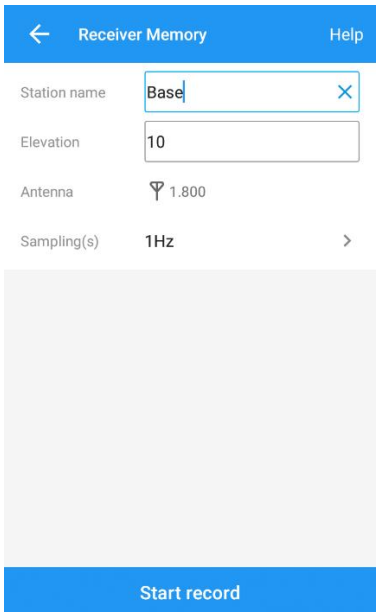


- You can enter File name, Station name, Antenna height, stake-> Click ***Start record***, the recorded raw data will be saved in the corresponding path.
- The raw data is in .cnb format, you can transfer to RINXE format through CRU software.

- Save the static data in the receiver

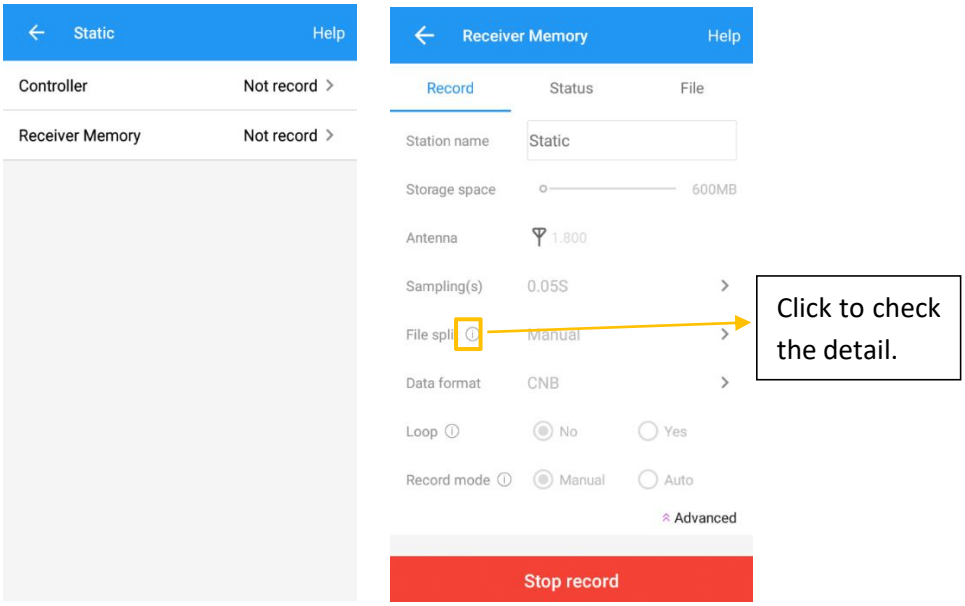
If you want to record static data to receiver memory, you can also control by Survey Master instead of long pressing the static button on receiver, this function is available for T300 GNSS receiver（SN:T31XXXXX） and K8 platform receivers.

1) T300 GNSS receiver（SN:T31XXXXX）



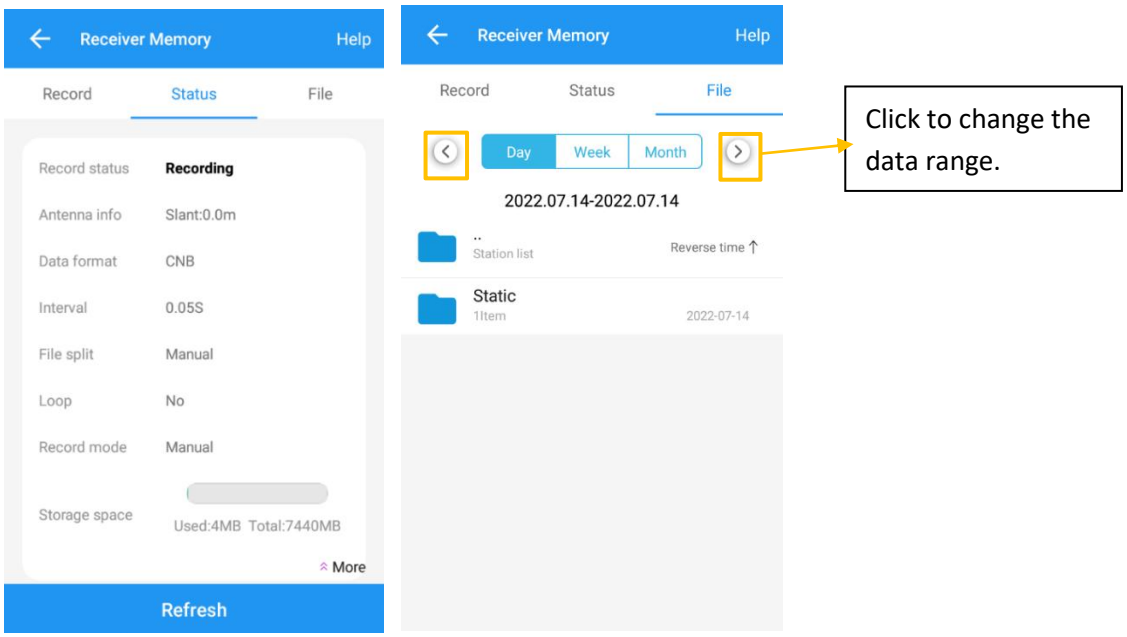
- You can also set parameters to receiver, including station name, elevation, antenna height and stake.
- The raw data is in .cnb format, you can transfer to RINXE format through CRU software.

2) K8 platform receivers

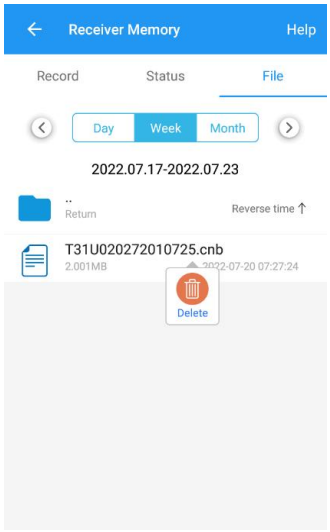


Station name: The static will be stored in this folder,
Record space: Default is 600 MB, this is set record space for the current static file.
Antenna: Set the antenna height and measure type, it will be recorded in the static file.
Sample interval: Choose sample frequency, supports 0.05s, 0.1s, 0.2s, 0.5s, 1s, 2s, 5s, 15s, 30s, 60s.
File split: Choose file split, support every 5\10\15\20\30 minutes or 1\2\4\24 hours to save a file and file split manually, default is manual. If you select 24 as file split, it will create two data file when it occurs to 24 o'clock (UTC Time). One is from start time to 24 o'clock, another is from 0 o'clock to end time.
Data format: Support CNB\ Rinex3.02\Rinex2.10
Loop: When storage is full, Yes means delete earliest data and store continually, No means stop recording

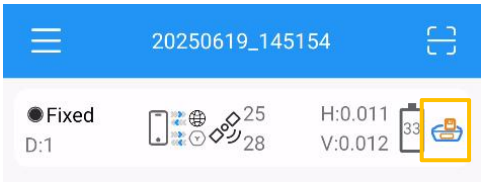
Mode: Support manually and automatically recording mode.



In ***Status*** interface, you can check the static record status, and static settings.
In ***File*** interface, you can check the static files by day/week/month. You will find the folder, and the static data is in the specific folder. Long press the static data, choose to delete the file.



Real-time display of static data storage statu: When in static data storage statu, a static storage icon will appear in the status bar of the main menu interface to remind users that static data is currently being recorded. Tapping it will take you to the static recording interface.

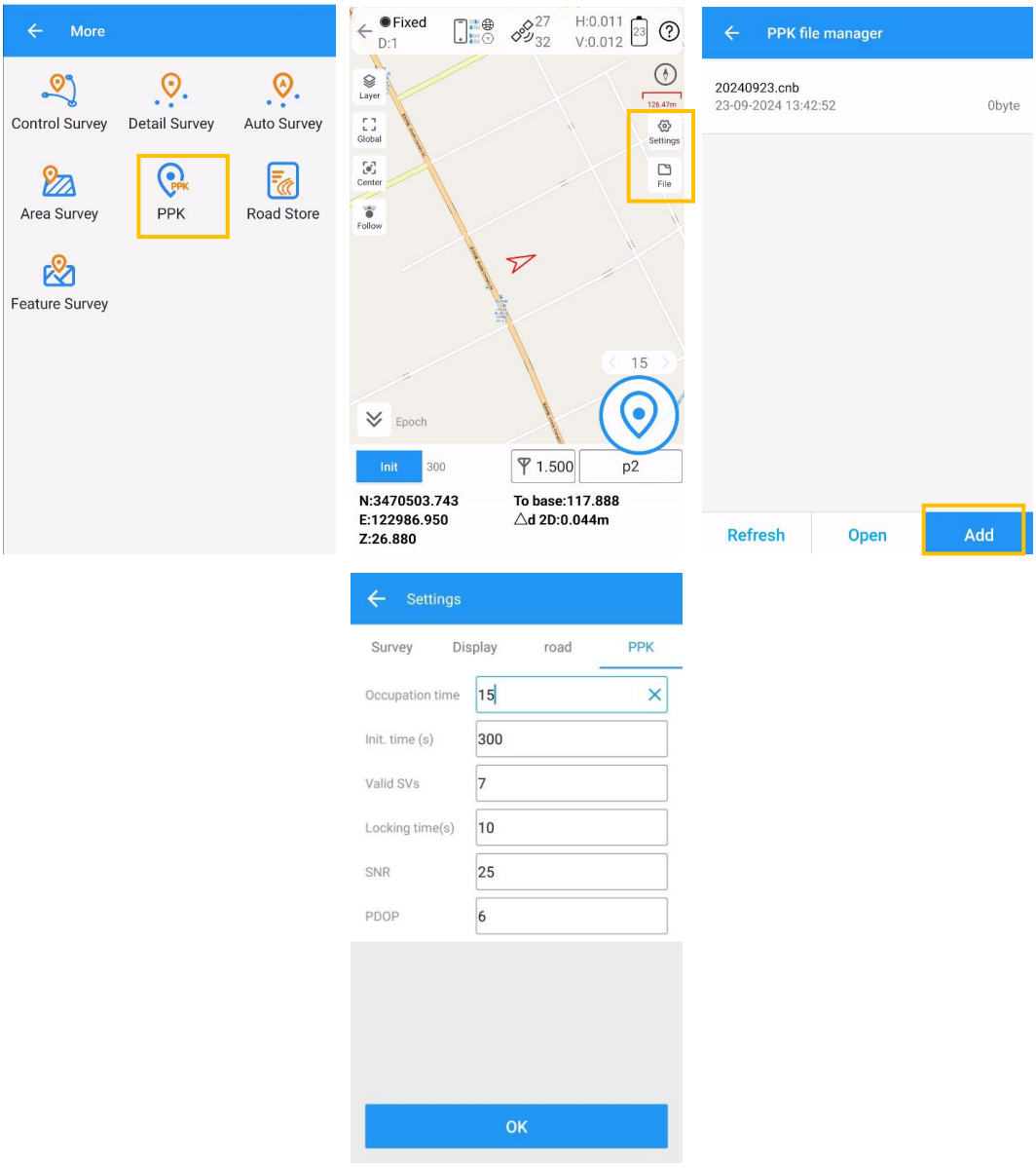


10.2 PPK

PPK (post processing kinetic) is the unique function of survey master, which is used for post-processing dynamic measurements.

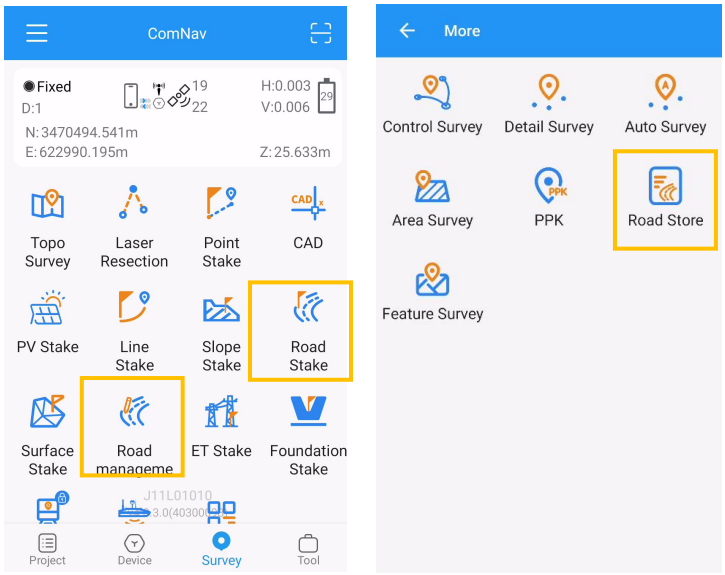
It also needs two receivers to work together, one work as Base to record static data, and another one work as Rover as shown below.

1. Click PPK in survey interface -> Build a PPK file
2. Go ***Settings***, configure PPK based on your requirements
3. To get stable epoch, click Init to initialize -> to start PPK survey



11 Road

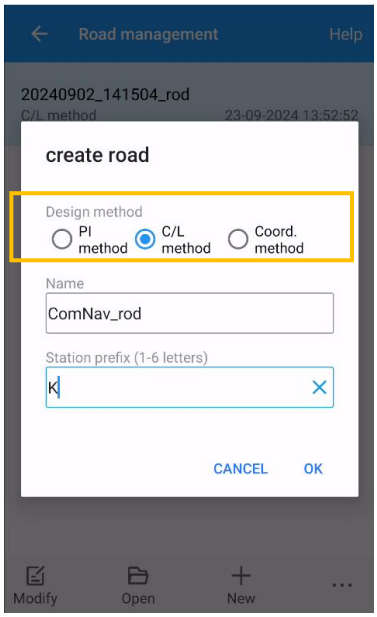
To stake road alignment, first you need design the road, including the horizontal alignment, vertical alignment and cross-section.



11.1 Road Design

Survey Master can use two methods to define an alignment: PI and C/L.

- PI refers to point of intersection, which mainly use point coordinates to define the alignment;
- C/L method is more popular, which use element parameters such as line length to define the alignment.



Click Add to add a new road;

Click Modify to edit the selected road; Click Delete to delete a road file.

Click Open to show the selected road the map interface.

Click … icon to upload/download a road file from cloud.

11.1.1 Broken chainage

Broken chainage refers to the phenomenon of discontinuity of pile numbers caused by local changes or section measurement. There are two main situations, one is that the front stake is larger than the back stake, and the other is that the front stake is smaller than the back stake.

Classification of broken chainage has two types:

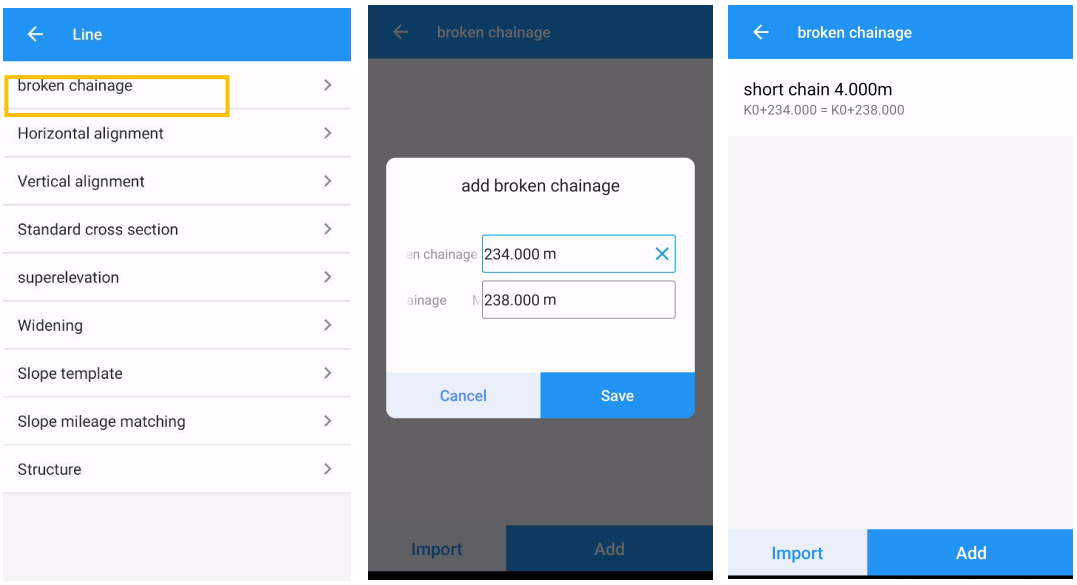
The first type, the front pile number is greater than the back pile number, for example: K112+943.305 = K112+900.001, and there will be duplicate piles. In this case, it is called a long chain. The distance between two long chains is the difference between the two piles, 43.304 meters.

The second type, the front pile is smaller than the back pile, for example: K115+309.227 = K115+320.001, there will be a discontinuity in the stake. This situation is called a short chain, and the distance between two short chains is also the difference between the two piles, 10.774 meters.

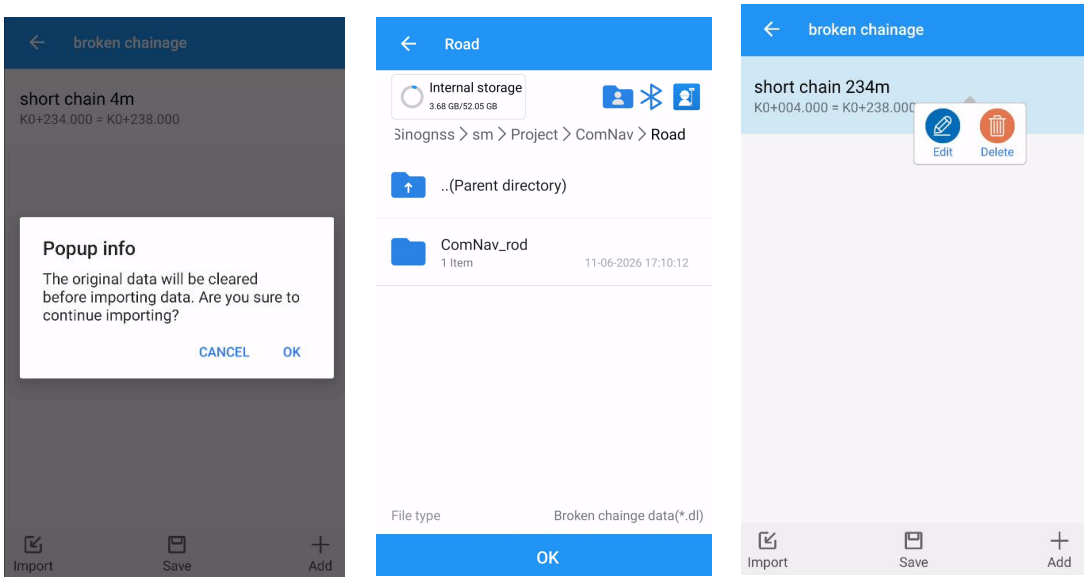
To sum up in a short sentence, it is: if the pile number is repeated, it is a long chain, and if the pile number is broken, it is a short chain.

Survey Master supports long chain, short chain, and supports multiple broken chainages at the same time. It is recommended that the user enter the broken chainage first before entering other parameters to avoid changing the broken chainage later and affect other parameters. Of course, you can also enter the broken link later.

When you enter the broken chainage, it is entered as real number, for example, K1+234.000 = K1+238.000, the mileage before the broken chainage, you need to enter 1234, the mileage after broken chainage, you need to enter 1238; K112+943.305 = K112+900.001, the mileage before the broken chainage, you need to enter 112943.305, the mileage after broken chainage, you need to enter 112900.001.



- ***Import***: Import broken chainage data; If there is already broken chainage data in the list, when you click Import, it will prompt that" The original data will be cleared before importing data. Are you sure to continue importing?"
  a) CANCEL: then the data import will be canceled;
  b) OK: it will clear the existed broken chainage data and jump to the broken chainage data import interface.



Survey Master supports four kinds of broken chainage:

a) Standard broken chainage data(*.dll);
b) Broken chainage data from Road Star software(*.xls);
c) Broken chainage parameters from Surveyor software(*.xls);
d) Broken chainage parameters from Surveyor software(*.txt)

You should choose a type of broken chainage, import data or exit the import interface.

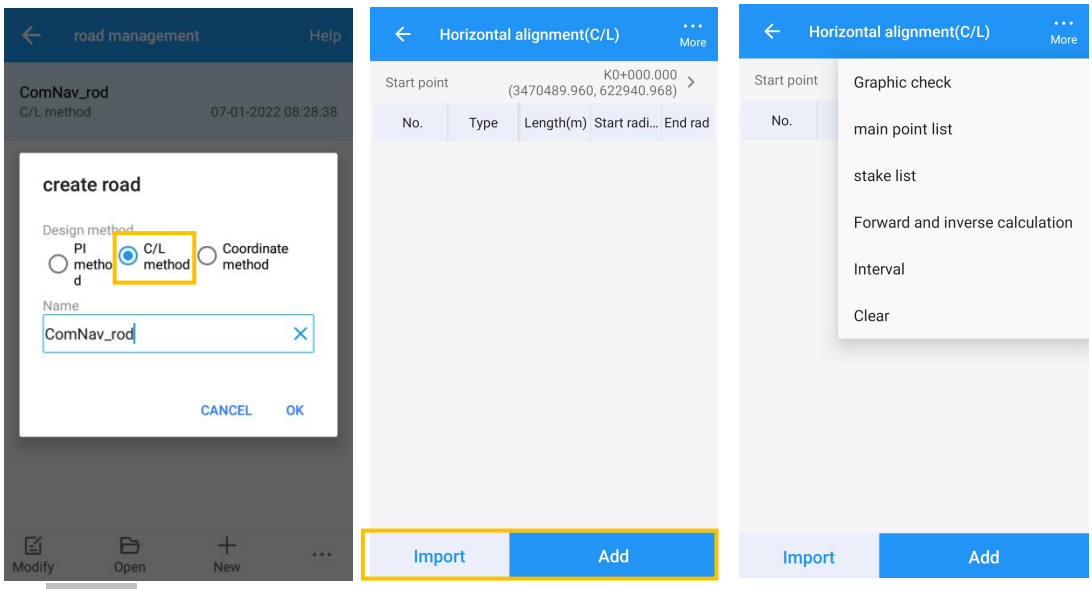
- ***Save***: When you add or modify the chainage, you can click ***Save*** to save the data, the broken chainage data will be saved in the path: Sinognss/sm/Road.
- ***Add***: You need to enter the mileage before broken chaniage and mileage after broken chainage.

- ***Edit/Delete***: You can long press the broken chainage data in the list to edit or delete.

11.1.2 Horizontal Alignment

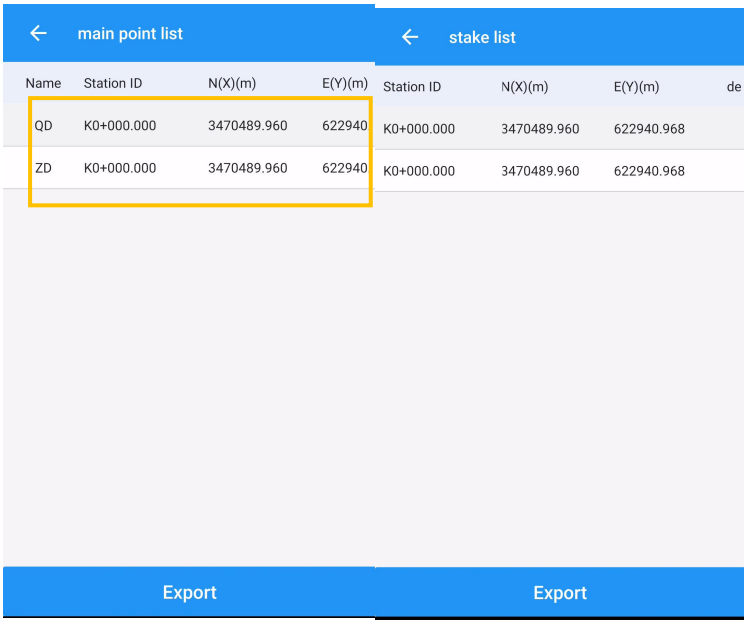
Horizontal alignment contains straight lines, curves and spirals. The following show two methods to edit.

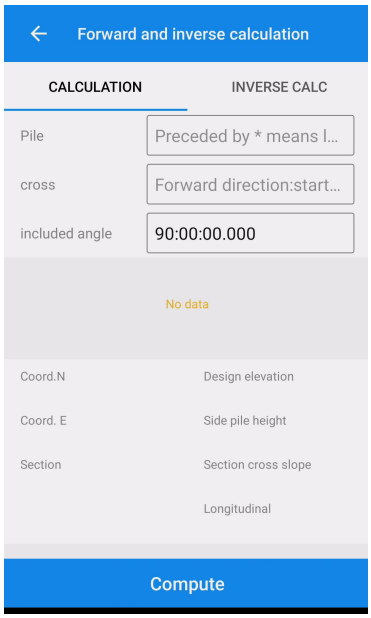
A. Use C/L method to edit alignment: After build C/L method road, go to horizontal alignment.



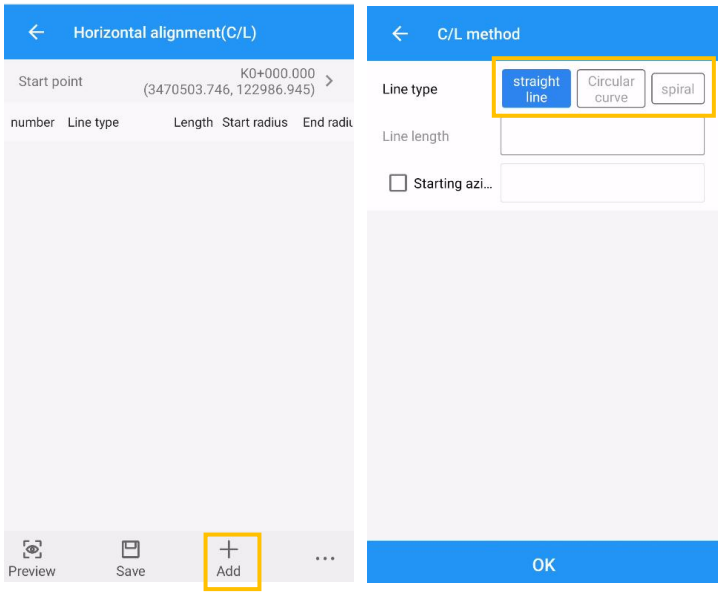
- ***Import***: You can import horizontal alignment file, the C/L method can only import the C/L file, and the PI method can only import the PI method file, the file format is *.pqx.
  a) Standard horizontal alignment(*.pqx);
  b) Horizontal alignment from Surveyor software(*.xls);
  c) Horizontal alignment from Surveyor software(*.txt);

- ***Settings***: Set interval for station, default is 20m;
- ***Save***: Save data after edit;
- ***More***: Clear all data;
- ***Preview***: Preview the road on map, main points (element changed), stake points (based on setting interval) and station check (mileage to point/point to mileage).





- Click  to add alignment element.

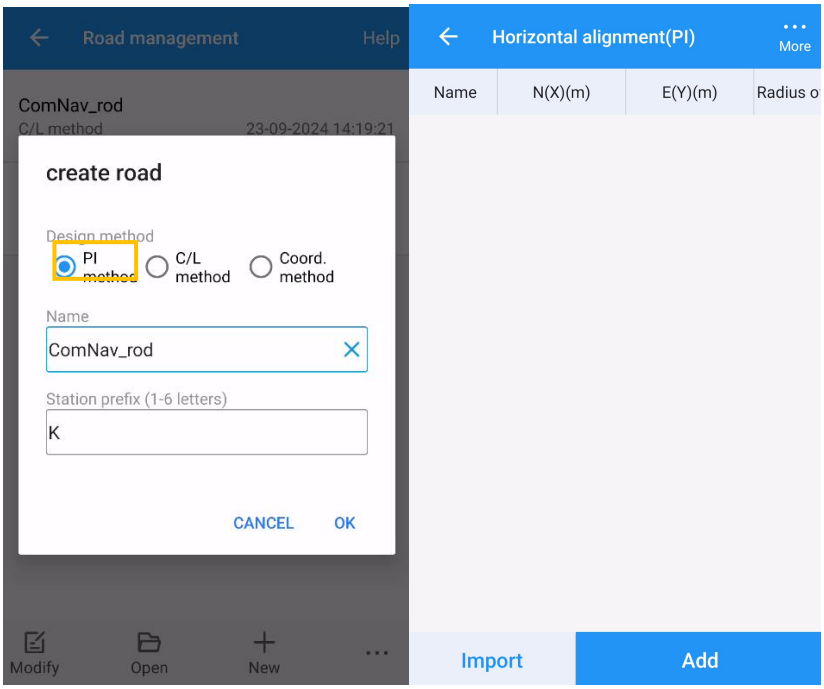


Add Line: enter azimuth and line length.

Add Curve: enter radius, length, and select curve direction (left/right).

Add Spiral: enter start radius, end radius, spiral length and select spiral direction (left/right).

B. Use PI method to edit alignment: After build PI method road, go to horizontal alignment.

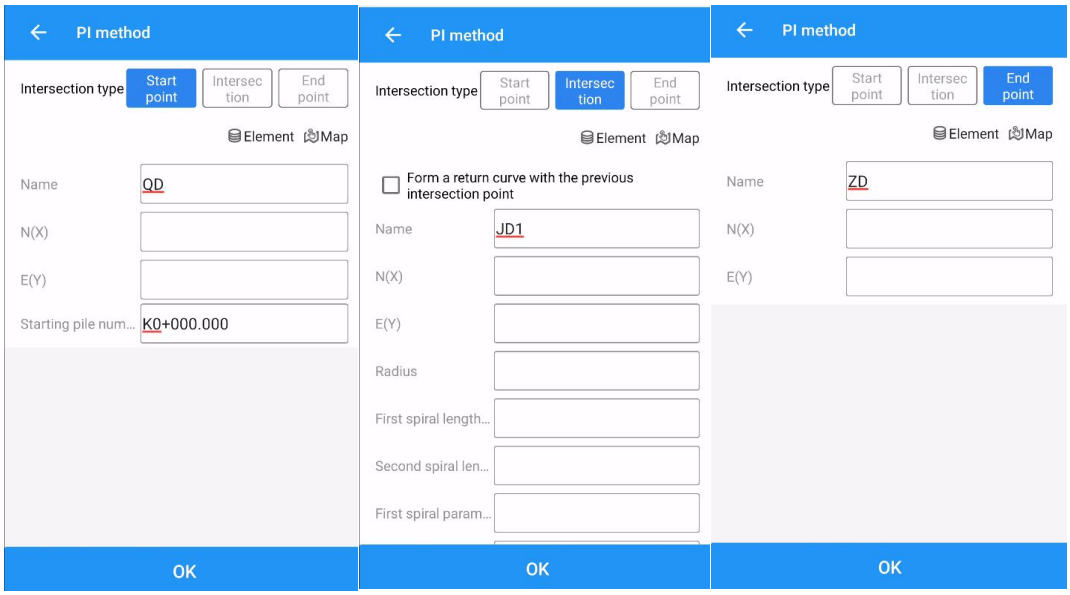


- ***Import***: You can import horizontal alignment file, you can import horizontal alignment file, the C/L method can only import the C/L file, and the PI method can only import the PI method file, the file format is *.pqx, or you can import the straight curve table directly.

  d) Standard horizontal alignment(*.pqx);

e) Horizontal alignment from Surveyor software(*.xls);
f) Horizontal alignment from Surveyor software(*.txt);

- ***Settings***: Set interval for station, default is 20m;
- ***Save***: Save data after edit;
- ***More***: Clear all data;
- ***Preview***: Preview the road on map interface and check stations, refer to C/L method.
- Click Add to add alignment element.



Add Start point: enter start point coordinate and station ID.
Add Intersection:
Add End point: enter end point coordinate.

C. Coordinate method

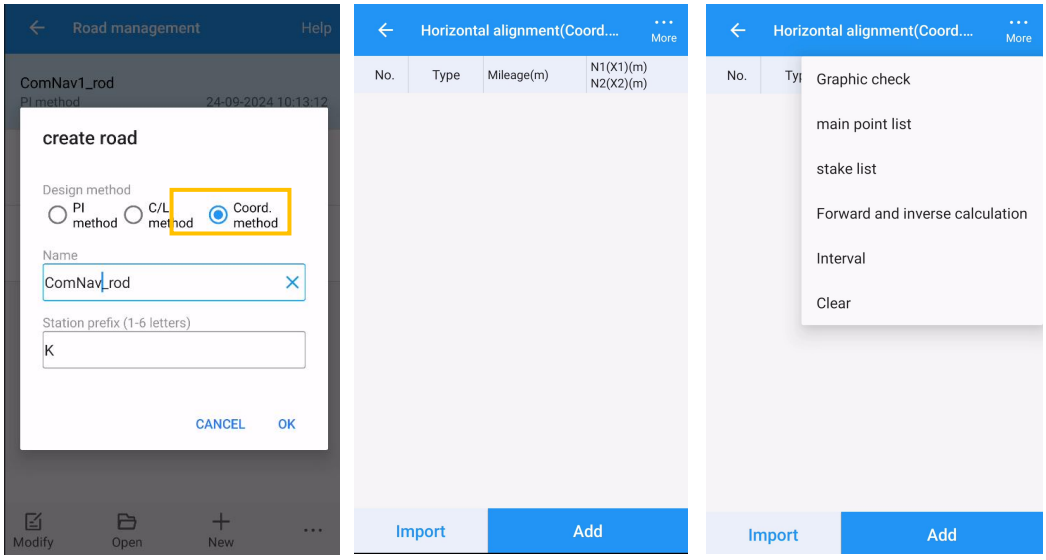
Use Coordinate method to edit alignment: After build Coordinate method road, go to horizontal alignment.

- ***Import***: Import horizontal alignment data. If there is already horizontal alignment data in the list, when you click Import, it will prompt that" The original data will be cleared before importing data. Are you sure to continue importing?"
  a) CANCEL: then the data import will be canceled;
  b) OK: it will clear the existed horizontal alignment data and jump to the horizontal alignment data import interface.

  You can import the following horizontal alignment:

a) Standard horizontal alignment in the coordinate method(*.pqx);

b) Horizontal alignment from Surveyor software(*.xls);
c) Horizontal alignment from Surveyor software(*.txt);

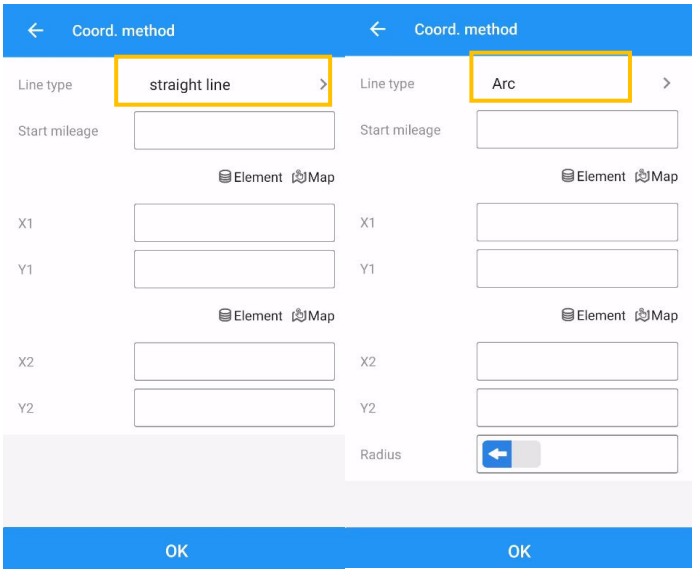


- ***Settings***: Set interval for station, default is 20m;
- ***Save***: Save data after edit;
- ***More***: Clear all data;
- ***Preview***: Preview the road on map interface and check stations, refer to C/L method.

- Click 

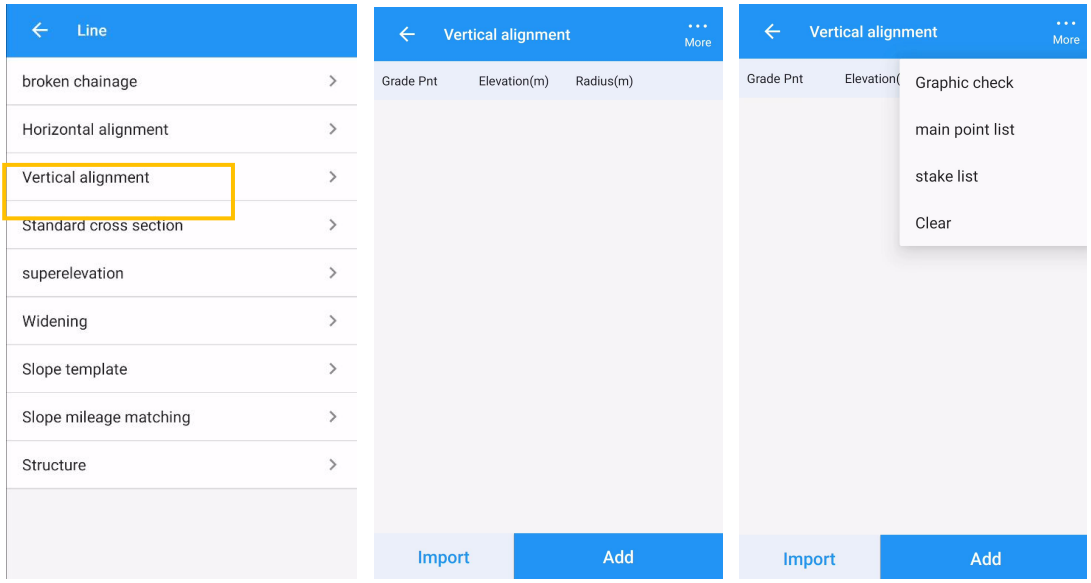
to add alignment element.

1) Straight line: input the start coordinate and end point coordinate, the software automatically calculates the distance;
2) Arc: input the start coordinate, end point coordinate and radius, the software automatically calculates the length of the circular curve;
3) After adding, you need to check that the end of each piece of data must be consistent with the starting station number of the next section (except for broken chainage).



11.1.3 Vertical Alignment

Vertical alignment contains grade breaks.



- ***Import***: You can import vertical alignment file with specific format;

a) Standard vertical alignment(*.pqx);

b) Vertical alignment from Surveyor software(*.xls);

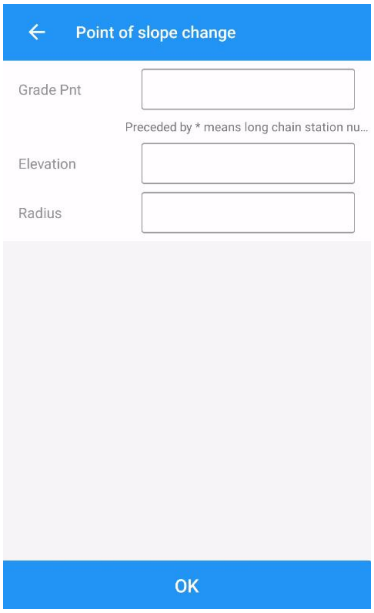
c) Vertical alignment from Surveyor software(*.txt);

d) Vertical section design line from Road Star software(*.xls)

- ***Save***: Save data after edit;
- ***More***: Clear all data;
- ***Preview***: Preview the road on map interface and check main points;

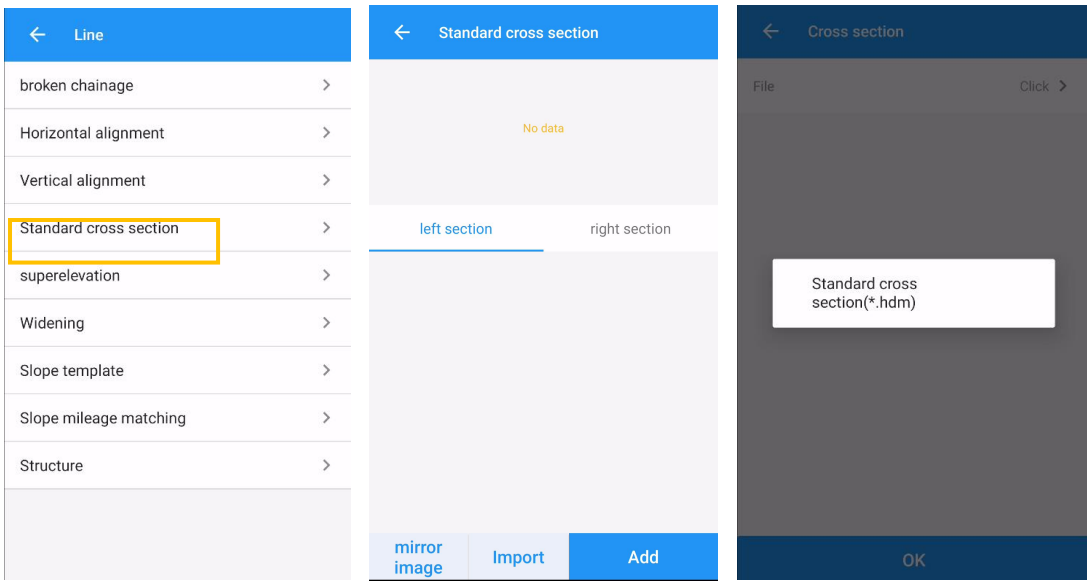
- Click 

to add alignment element, including grade point station, grade point elevation and radius.



11.1.4 Standard Cross Section

Cross section contains horizontal offsets.



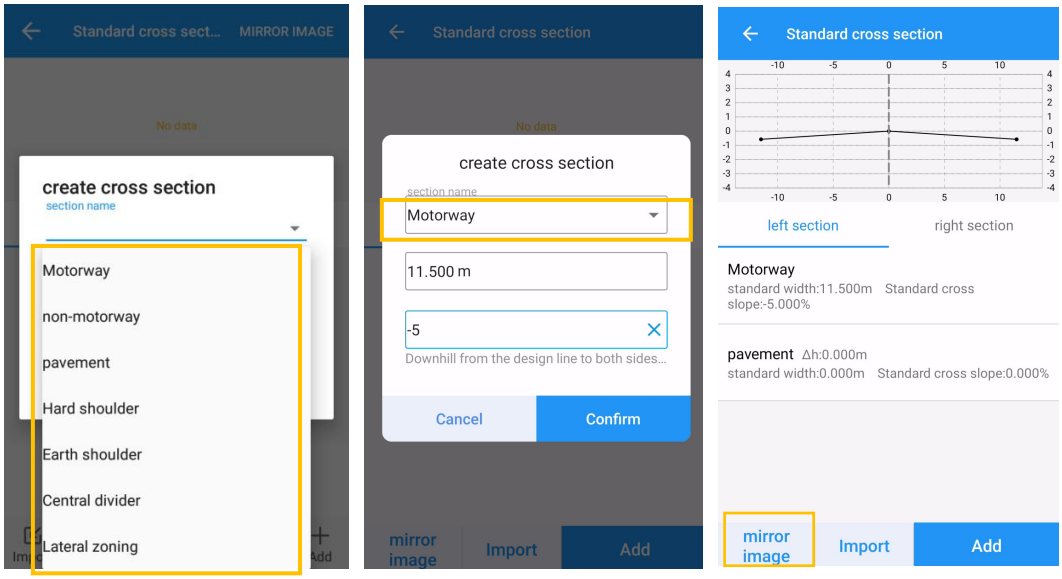
- ***Import***: You can import cross section files. If there is already cross section data in the list, when you click ***Import***, it will prompt that" The original data will be cleared before importing data. Are you sure to continue importing?"
  a) CANCEL: then the data import will be canceled;
  b) OK: it will jump to the cross section import interface, if you import the new data, it will clear the previous cross section data first and then import the new cross section data, but it you don't import the cross section data, the previous data will not be cleared.

Survey Master supports four kinds of cross section data.

d) Standard cross section(*.hdm): This is designed by ComNav, when you add the cross section, this is the default format.
e) Standard cross section from Road Star software(*.xls).
f) Plate superelevation and widening parameters from Surveyor software(*.xls)
g) Plate superelevation and widening parameters from Surveyor software(*.txt)

- ***Apply***: Apply the cross section to the road, the data will be saved in the path: Sinognss/sm/Road.
- ***Delete***: When you click , you can click the corresponding data.
- ***Edit***: Click the cross section data in the list, you can edit the data.
- ***Add***: Click 

to add cross sections: Select a section type, enter section width, slope and height difference, the default cross section data is *.hdm format.



h) Section name: You can choose motorway, non-motorway, pavement, hard shoulder, earth shoulder, central divider, lateral zoning.

i) Standard section width: Enter the current section width, the unit is meters;

j) Cross slope: Enter the cross slope of the current lane, downhill from the design line to both sides, you don't need to enter %.

k) Height difference: Relative to the height difference of the previous lane.

1) Above the previous lane: positive value;

2) Below the previous lane: negative value.

e) Mirror Image: You can design left section and right section respectively. If the left section and right section are symmetrical, you can only design left section or right section, then click Mirror Image, then it will get the same section on the right section or left section.

11.1.5 Super-elevation

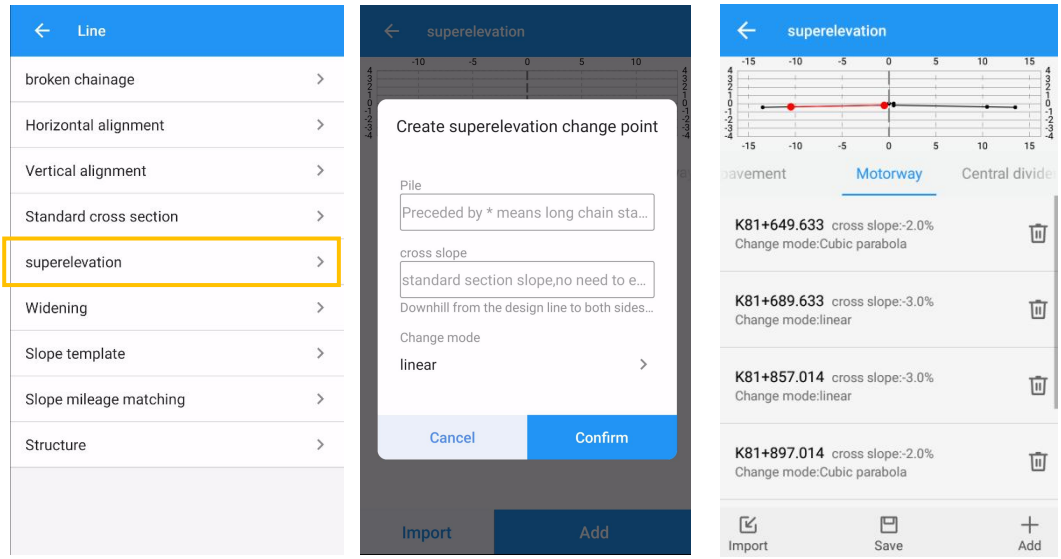
Superelevation means that when the train is running on a circular curve, the lateral force or centrifugal force will cause slippage. In order to offset the centrifugal force generated when the vehicle is running on the circular curve section, it can ensure that the train can be safe, stable, and meet the design speed and economically and comfortably pass the circular curve, the outer side is higher than the inner side one-way cross slope on the cross section of this road section.

- ***Add***:

a) Add the stake mark of the superelevation change point;

b) Add the cross slope of the superelevation change point (standard section slope, no need to enter %, downhill from the design line to both sides, downhill is negative, uphill is positive)

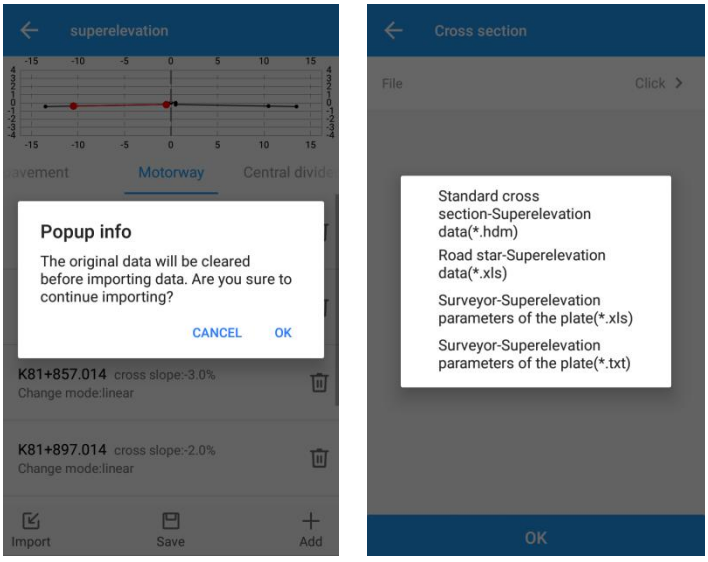
c) Change mode: supports Linear and Cubic parabola.



- ***Import***: If there is superelevation in the list, when you click ***import***, it will prompt that" The original data will be cleared before importing data. Are you sure to continue importing?"
  a) Cancel: Cancel to import superelevation data;
  b)OK: it will clear the existed superelevation data and jump to the superelevation data import interface.

Survey Master supports 4 kinds of superelevation data.

a) Standard corss section-Superelevation data(*.hdm);
b) Superelevation from Road Star software(*.xls).
c) Superelevation parameters of the plate from Surveyor software(*.xls)
d) Superelevation parameters of the plate from Surveyor software(*.txt)



- ***Save***: When you add, edit and delete superelevation data, click ***Save*** button to save the change, the data will be stored in the path Sinognss/sm/Road.
- ***Edit***: Click the data in the list, you can edit the data value.
- ***Delete***: Click  to delete the corresponding data.

Explanations:

- *The superelevation data will be stored in the *.hdm file under the path Sinognss/sm/Road, you can open it with Notebook.*
- *Here is an example of superelevation data.*

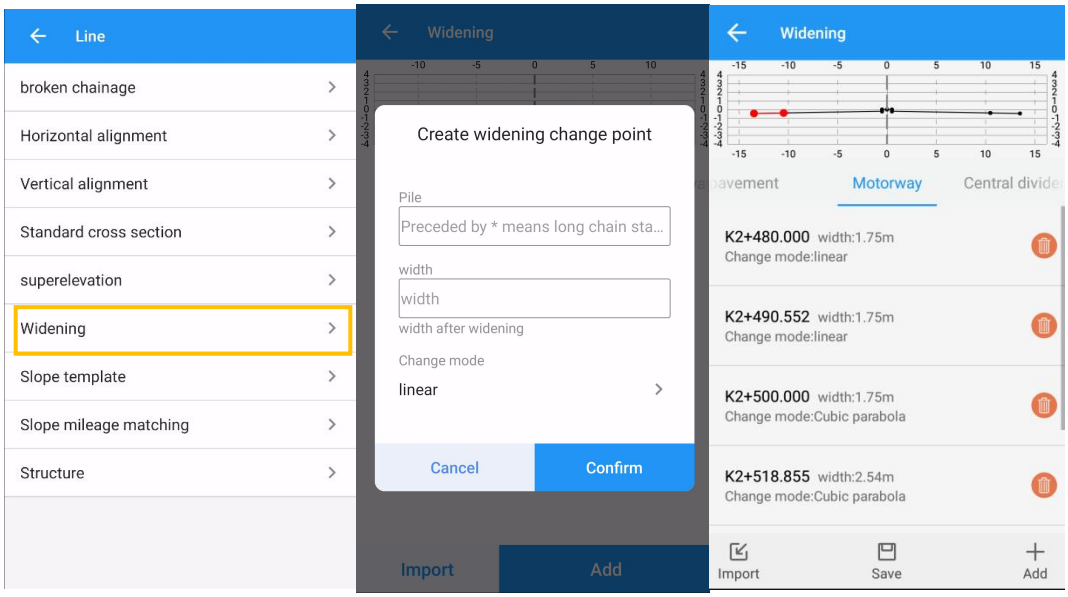
1) *The first column: "0" means that the data in this row is superelevation data, if it is "1", it means that it is widening data.*
2) *The second column: represents the pile of superelevation change point, the order is from the main section in the left section of the standard cross section to the end of other plates on the right plate (i.e. the main plate on the left--other plates on the left--the main plate on the right--other plates on the right);*
3) *The thirs column: the cross slope value of the superelevation change point (From the design line to both sides, downhill is negative, uphill is positive);*
4) *The fourth column: the variation of superelevation, "0" represents linear, "1" represents cubic parabola.*

```
0,Motorway,10.0,-2.0,-0.2
0,K81+649.633,-2.0,1
0,K81+689.633,-3.0,0
0,K81+857.014,-3.0,0
0,K81+897.014,-2.0,1
0,K82+083.777,-2.0,1
0,K82+123.777,-3.0,0
```

11.1.6 Widening

Widening means that when the car is driving on a curve, the driving trajectory of each wheel is different. The radius of the rear wheel on the inner side of the curve is the smallest, and the radius of the front wheel near the outer side of the curve is the largest. This phenomenon is more prominent when the turning radius is small. In order to ensure that cars do not encroach on adjacent lanes when turning, all curved sections with a radius of less than 250m need to be widened.

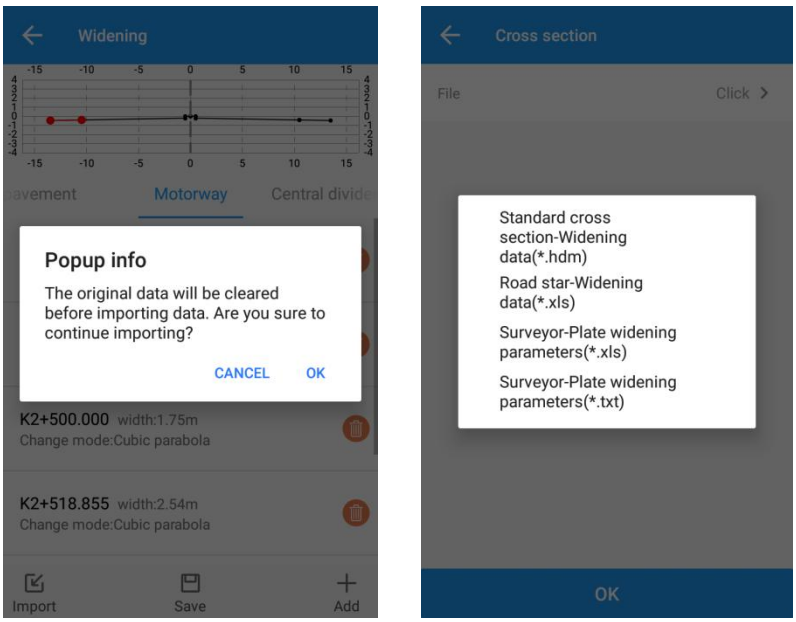
- ***Add***: Find the widening change point and input the widening data.
  a) Add the pile of the widening change point;
  b) Add a width of widening change point;
  c) Variation method: Linear, Cubic parabola, Quadratic parabola;
  1) Linear: Gradually widen in proportion to its length within the scope of the widening transition section, which can be used for second, third and fourth class highways;
  2) Cubic parabola: use high-order parabola within the scope of the widening transition section, suitable for expressways and first-class highways that have certain requirements for road capacity;
  3) Quadratic parabola: use a circle in the widening transition section, suitable for highways and suburban sections of first and second-class highways; bridges, viaducts and other structures; and sections of various safety protection facilities.



- ***Import***: If there is widening data in the list, when you click ***import***, it will prompt that" The original data will be cleared before importing data. Are you sure to continue importing?"
  a) Cancel: Cancel to import widening data;
  b)OK: it will clear the existed widening data and jump to the widening data import interface.

Survey Master supports 4 kinds of superelevation data.

a) Standard corss section-Widening data(*.hdm);
b) Widening data from Road Star software(*.xls).
c) Plate widening parameters from Surveyor software(*.xls)
d)Plate widening parameters from Surveyor software(*.txt)



Explanation:

1. The widening data is stored in a ***.hdm file in the default location and can be

opened with just Notepad.

```
1,K2+480.000,1.75,0
1,K2+490.552,1.75,0
1,K2+500.000,1.75,1
1,K2+518.855,2.54,1
1,K2+520.000,2.61,2
1,K2+529.431,2.65,2
```

The widening data is the same as the superelevation data, divided into four columns
1) The first column: "1" means widening data, if "0" means superelevation data;
2) The second column: the station number of the widening change point, the order is from the main plate in the left plate of the standard cross section to the other plates in the right plate (that is, the main plate on the left--other plates on the left- -The main section on the right--other sections on the right);
3) The third column: the width of the widened change point (the widened width);
4) The fourth column: the widening gradient mode, "0" represents linear, "1" represents cubic parabola, and "2" represents quadratic parabola.

```
0,Central divider,0.5,0.0,0.0
0,Motorway,10.0,-2.0,-0.2
0,K2+480.000,1.5,0
0,K2+490.552,2.56,0
0,K2+500.000,3.0,0
0,K2+518.855,-2.27,0
0,K2+520.000,-2.73,0
0,K2+529.431,-3.0,0
1,K2+480.000,1.75,2
1,K2+490.552,1.75,2
1,K2+500.000,1.75,2
1,K2+518.855,2.54,2
1,K2+520.000,2.61,2
1,K2+529.431,2.65,2
0,pavement,3.0,-2.0,0.0
0,Earth shoulder,0.5,-3.0,0.0
1,Central divider,0.5,0.0,0.0
1,Motorway,10.0,-2.0,-0.2
0,K2+480.000,1.75,0
0,K2+490.552,-1.5,0
0,K2+500.000,-3.0,0
0,K2+518.855,2.27,0
0,K2+520.000,2.73,0
0,K2+529.431,3.0,0
1,K2+480.000,1.75,2
1,K2+490.552,2.38,2
1,K2+500.000,2.65,2
1,K2+518.855,1.86,2
1,K2+520.000,1.79,2
1,K2+529.431,1.75,2
1,pavement,3.0,-2.0,0.0
1,Earth shoulder,0.5,-3.0,0.0
```

Superelevation on the left

Widening on the left

Superelevation on the right

Widening on the right

Tips:

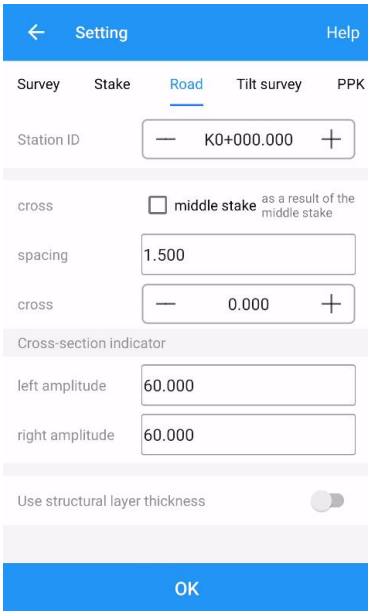
1. Both the widening data and the superelevation data are included in the cross-section data, generally below the superelevation; the order from top to bottom is the left main section superelevation--left main section widening--left The other plates are superelevation--the other plates on the left are widening--the main plate on the right is superelevation--the main plate on the right is widening--the other plates on the right are superelevation--the other plates on the right are widening.

2. The data not framed in the figure are cross-section data.

11.2 Road Stake

11.2.1 Road Settings

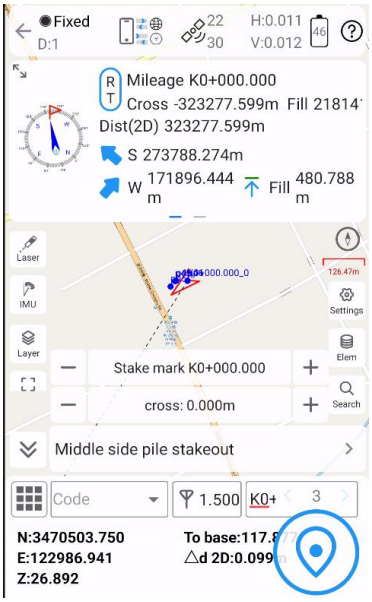
Go Road stake—Settings--Road.



Current mileage stake: if check on the option, means no target station, go whatever mileage show station on centerline;
Station ID: enter the station for current stake;
Middle stake: check on the option refers to save points in stake point list, otherwise save in cross point list;
Spacing/Cross: define the offset value;
Cross section line: define the length for the guideline of right/left cross;

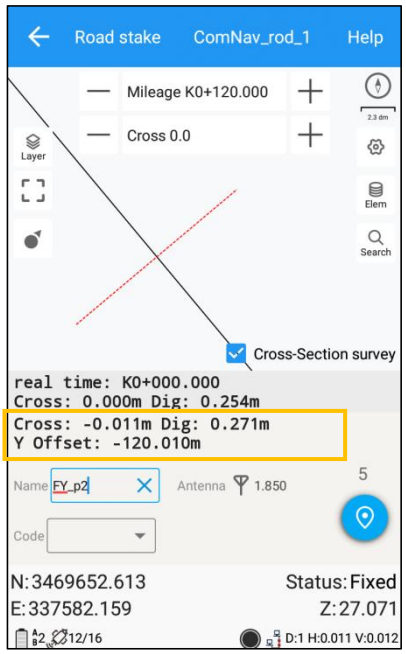
11.2.2 Stake Alignment

Go Road stake, it will auto add the start point of the road to the target stake point, follow the navigation information shown on the map, when go near the target point, the map will show big circle as below, and when the accuracy high enough to stake the point, Survey Master will alarm to let you know, then press measure icon to finish this point stake.



11.2.3 Stake Cross Section

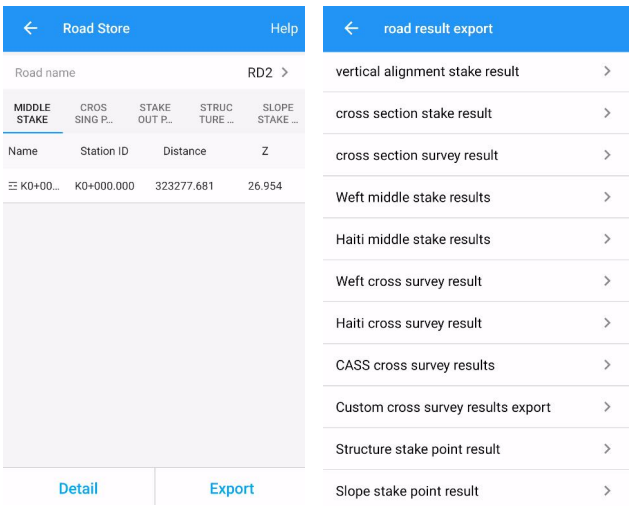
Go Road stake, check Cross section option. The red line shows cross section direction.



Cross: Distance from current to cross section;
Y Offset: Along the alignment the distance from current to cross;
Dig: Elevation difference from current to designed elevation.

11.2.4 Road store

Go Road store to check the stake point and the cross point, export the data as you required.



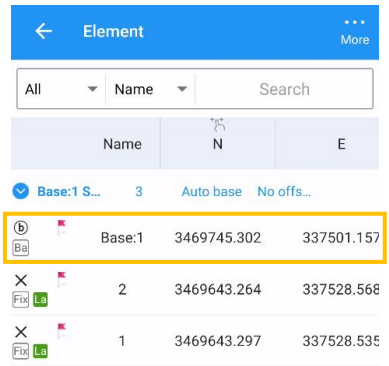
12 Element

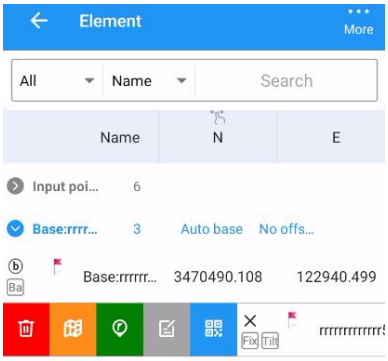
The points, which are surveyed, staked, added, imported, and input from ***Basemap*** (refer to Chapter 12.3), will be stored in ***Element***. The surveyed points will be shown under one base while surveying. Also, no matter where you need to select a point, all the points of the ***Element*** are available.

- Symbol descriptions

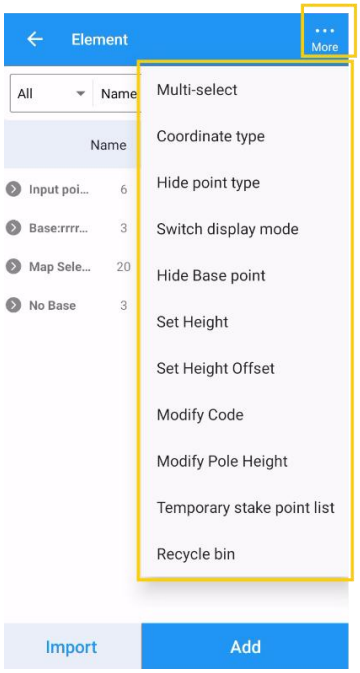
Symbol	Description
Ba	Base point
×	Survey point
→	Auto survey point
•	Input point
▲	Control point
⊙	Stake point
=	Road middle stake point
÷	Road cross point
La	Use laser survey
Tilt	Use IMU survey
G	Point has GIS attribute
Fix	Fixed point
Sin	Single point

- ***Base: 1(Base)***: This shows the coordinate of base station, the base type includes auto base and fix position.



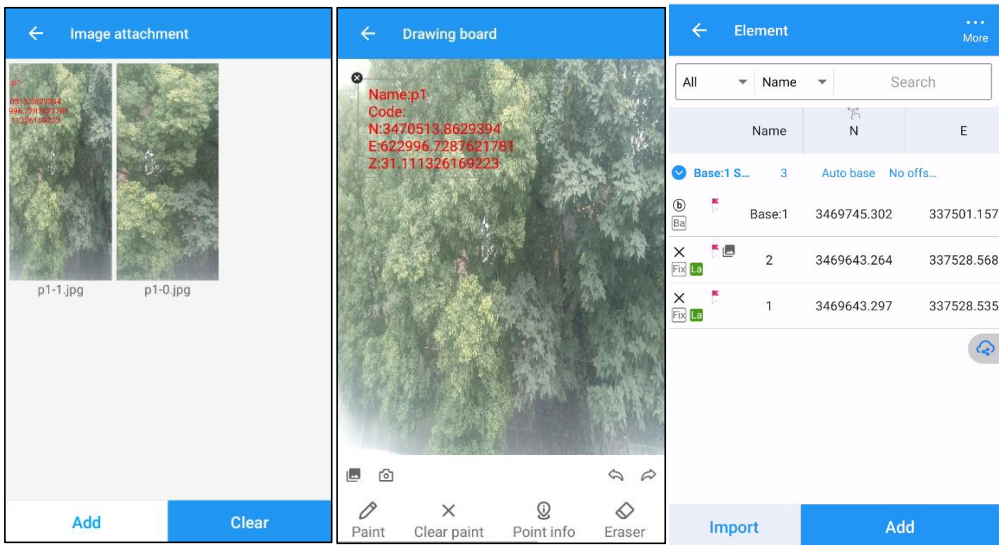


- : Delete point
- : Select one point and click , then go to ***Stake point*** interface to stake point(pls refer to Chapter 6.4).
- : Center the selected point on the map.
- : Select one point and click button, you can check more details about this point,such as Laser length,Tilt angle and so on.
- : Share point coordinates via QR code.Others can get coordinate information by scanning the code for fast point data sharing on site.



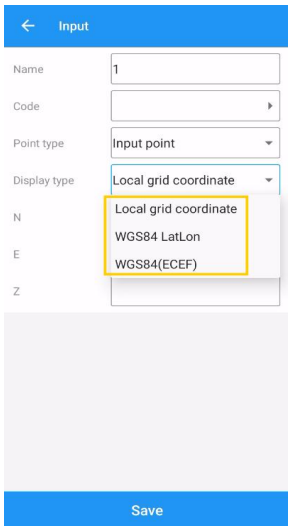
- ***Multi-select:*** Select single point, multiple points or select all for delete or share
- ***Coordinate Type:*** Choose Local grid coordinate or WGS84 coordinate
- ***Hide point type:*** Turn off the current point type display and show all points directly.

- ***Switch display mode:***Adjust the number of lines used to display point attributes; supports single-line display and multi-line display.
- ***Hide Base point***: Hide or show base points in the Element.
- ***Set Height:*** Batch modify height values of points in the Element.
- ***Set Height Offset:*** Apply height offset values for batch height modification of points in the Element. A positive value adds the height offset to the original height; a negative value subtracts the height offset from the original height.
- ***Modify Code:*** Batch modify point codes in the Element. Codes can be selected directly from the code list or entered manually.
- ***Modify Pole Height:*** Batch modify the pole height of measured points in the Element.
- ***Temporary stake point list:*** Click to enter the temporary stake point list, the default temporary Stake point list is closed, after opening, the lower part of the display element in all the points, you can filter the stake point.
- ***Recycle bin:*** Points deleted from the Element will be moved to the Recycle Bin. When you expand the list and select a point, you can choose either Recover or Delete. Choosing Recover will restore the deleted point back to the Element. Choosing Delete will prompt the message: "Do you want to delete the selected points?" If OK, the points will be permanently deleted. If cancel, the operation will be aborted and you will return to the previous screen.
- : ***Image attachment***, you can add the picture for the surveyed point, currently supports multiple pictures for one surveyed point, when you add one picture in ***Image attachment***, you can choose the picture to edit, in the ***Drawing board***, you can add the position info, draw something, add notes for this picture, if you add a picture for one point, it will show picture on the Element list. The picture is stored in the path: Sinognss/sm/project/ specific project/ media.

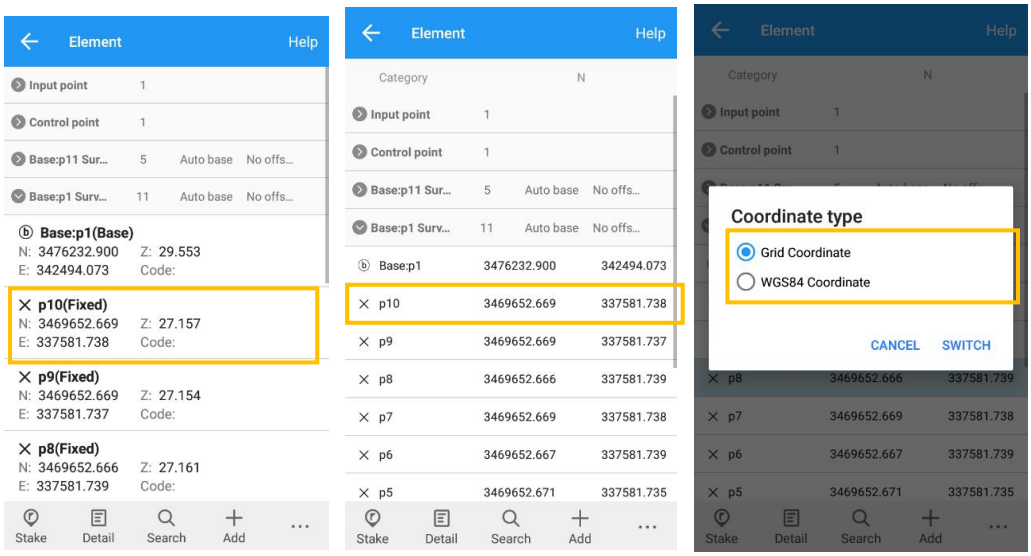


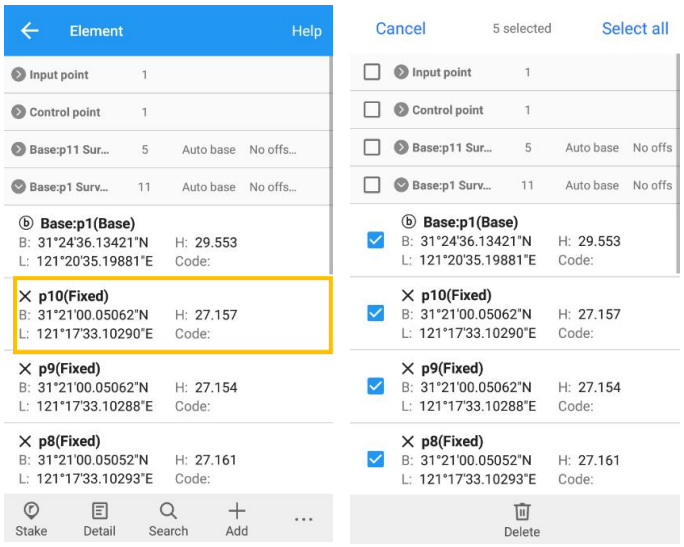
- ***Search***: Click ***Search*** and enter some key words, it will show you the points you need.
- ***Add***: Supports to add Input Point, Control Point and Stake Point, and Display type Supports Local grid coordinate and WGS84 LatLon. And you can enter WGS84(ECEF)

when Add point.



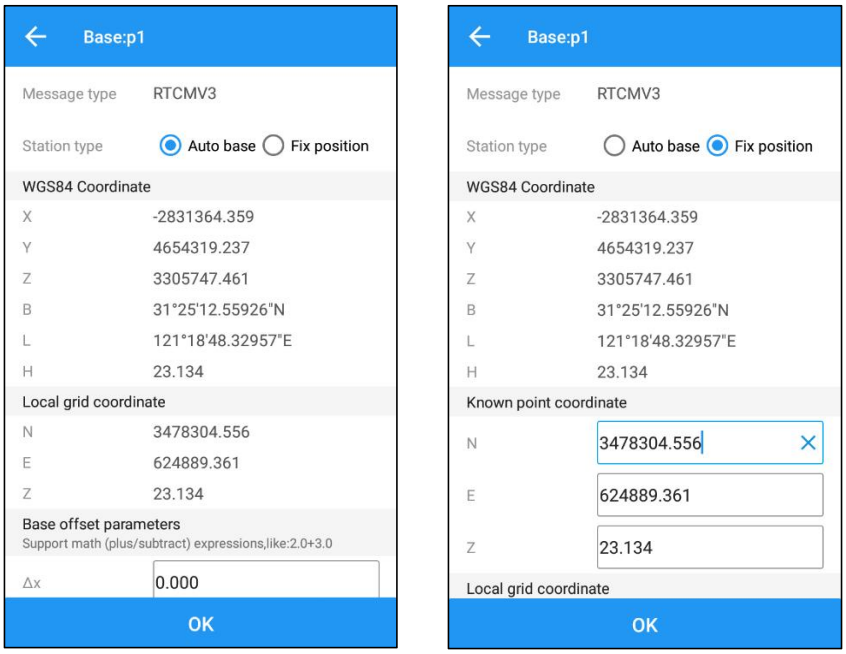
- ***Switch display mode***: There are two display modes of points, the first one can show both Local grid coordinate (NEZ) and WGS84 LatLon coordinate (BLH), you can swipe the screen to check the detail of the point; the second one can only show one form of the coordinate, Local grid coordinate (NEZ) or WGS84 LatLon coordinate (BLH).
- ***Coordinate type***: Support Local grid coordinate (NEZ) and WGS84 LatLon coordinate (BLH), in the form of the second display mode, you can click this to the change coordinate type display.
- ***Multi-select:*** Select one point, then click Multi-select to choose multiple points; in the first display mode, you can also long press the point name to select multiple points.





Click Detail to check the information about the base coordinate.The information includes message type, station type, WGS84 Coordinate, Local grid coordinate, known point coordinate (only Fix position base)and Base offset parameters(only Auto base).

- ***Message type***: differential data type, depends on the differential data transmitted from the base.
- ***Station type***: includes Auto base and Fix position base. If you started Auto base, you can change to Fix position base and enter the Known point coordinate and antenna height; if you started the Fix position base, then it will not be allowed to change to Auto base.



Base offset parameters: If you want to change Auto base coordinate to a control point or a known point, or do some adjustment, you can enter the △x, △y, △h, then the base coordinate will make a adjustment, or you can do grid shift(see Chapter 13.5)

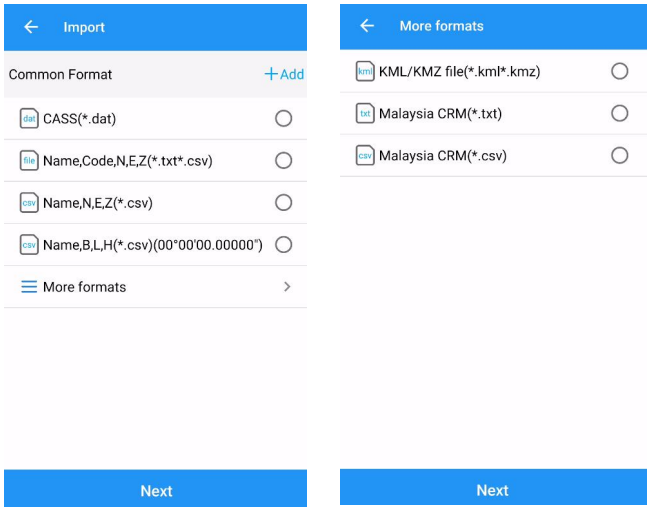
13 Data Export/Import

Survey Master supports to import/export data including grid coordinate, Lat/Lon coordinate with various data format, support import DXF/DWG file and export result of DXF/KML.

13.1 Import points data

Tap ***Import*** in project interface, there are some predefined data formats, click ***More formats*** to get more predefined formats. Besides, you can click ***Add*** to create a User-defined type.

Long press the predefined data format that you don't use often, you can move this format to the More formats page; also, you can move the data format of More formats page to the previous page where stored the formats you usually use.



- Name: Enter the name for the format
- Delimiter: support Comma(,), Space( ), Semicolon(;),Tab()
- File format: (including XLS, XLSX, CASS, CSV, TXT and DAT formats)

Click ***Select all*** to choose all elements, Click ***Clear*** to eliminate all elements selected.

The elements include: code, name, N, E, Z, B, L, H, X RMS, Y RMS, V.RMS, status, start time, occupation time, diff age, base ID, total AntHgt, Antenna height, measure type, antenna name, ending time, comment, RMS, PDOP, HDOP, VDOP, TDOP, GDOP, total SV, used SV, elevation, tilt offset, tilt angle, tilt distance

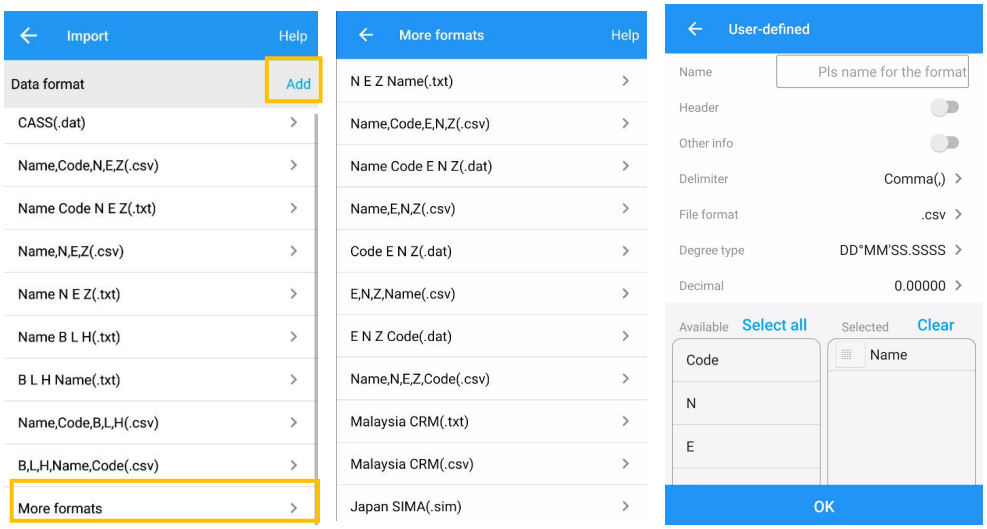
Tip: The format you defined will also be saved to Export interface.

Choose one format to import data.

- The default export path is …*/Sinognss/sm/data*, you can also click ***Upper folder***

to change to any other path where the file is.

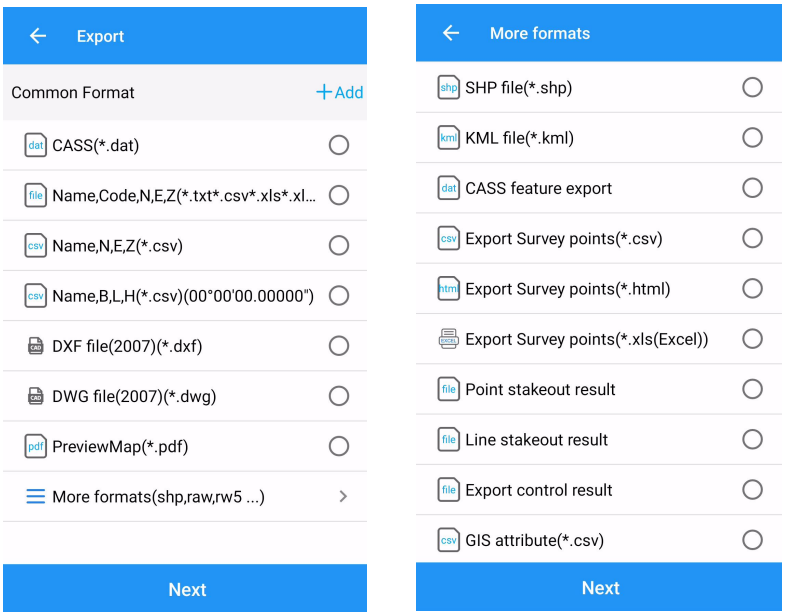
- Point type: support Input point, Control point, Stake point



13.2 Export result

Tap ***Export*** in Project interface to export simple data of survey points. Also, click ***More formats*** to export the survey points with detailed information or other formats like stake points/lines, DXF, SHP, KML, RAW, RW5, HTML, CASS feature result.

Same with Import result, long press the predefined data format to select the interface you want to place.

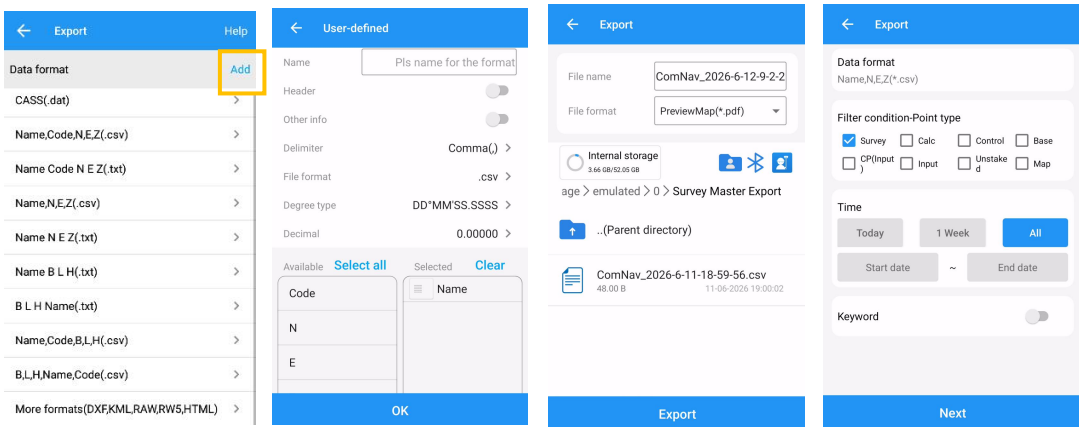


- File format: Support to export DXF, DWG(You can modify point symbol , code symbol and so on, and you can also export Point Label when exporting to DXF/DWG), PDF(Supported export layer by code when export PDF), TXT, SDR, XLS, XLSX, SHP(support PRJ and CPG files in SHP file export,and support to export Draw

point/surface when export SHP file), GIS attribute and KML format

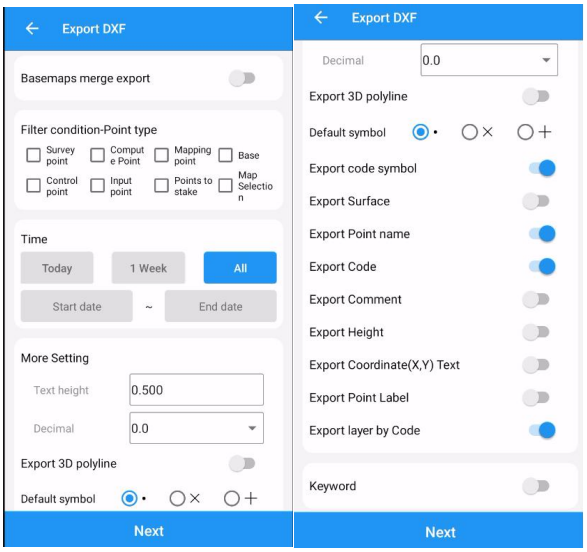
- Select: support Survey point, Compute Point, Control point, Base point, Control(input) point, Input point, Stake point, Map selection point, also, you can set the date, name, code of data to specific export

The default export path is …*/Sinognss/sm/export*, and the previous saved file will be shown below, you can also click ***Upper folder*** to change to any other path.



For the points, lines and polygons you surveyed in Topo survey and Feature survey, you can click ***Export DXF*** to export dxf file, then you can edit them in third party CAD software, or import to ***Basemap*** to check, or import to ***Stake CAD*** to stake.

Choose the data that you want to export including survey point, input point, control point, stake point, base, line and polygon, and the layer properties includes name, code and height, the default text height is 0.5.



13.3 Import layer

Tap the Layer on the Survey , Stake and CAD interfce.

Here users can set the layer: Layer, Basemap, Online map

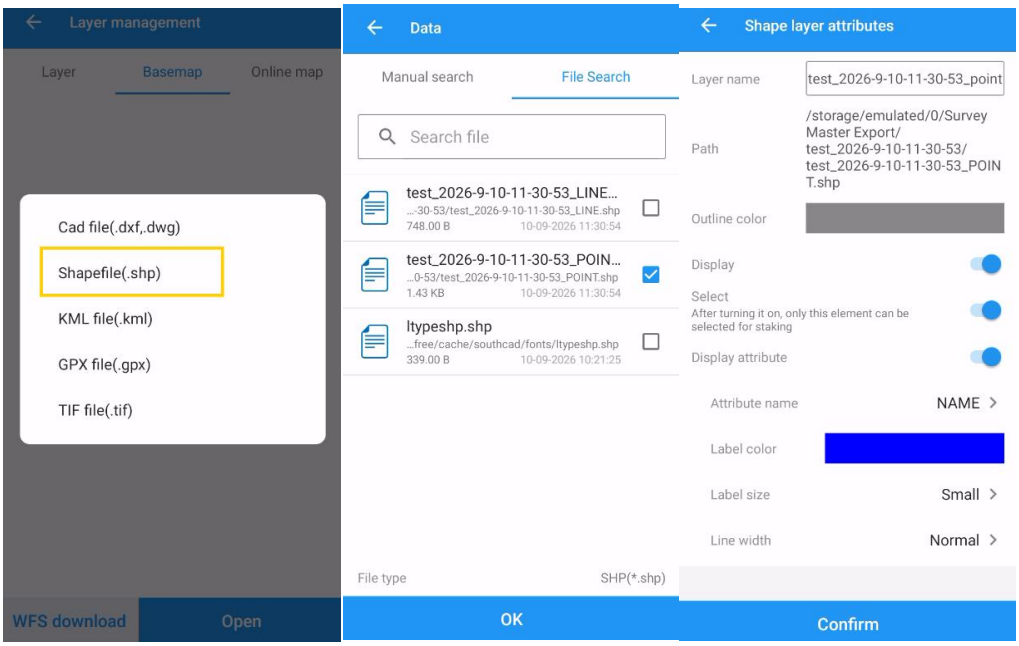
13.3.1 Layer

Edit: You can set up layer name, Colar; Line Wide,Type, Colar,Transparency
Display and no display: Blueis display Layer, Gray is no display Layer
Add: Add new layer

13.3.2 Basemap

Open: Add shapefile(.shp); CAD file(.dxf, .dwg); KML file(.kml); GPX file(.gpx); TIF file(.tif). It will search all file format in your controller, you can enter the file name to find quickly.

Note: When you open shp file, you can modify KML/SHP line information in Basemap.



WFS: WFS support to load and display online vector geographic data, allow you to directly load map sources. You need to obtain a WFS service URL, username, and password in advance. Enter this information into the software and click Get to retrieve the available layers. Then, select the layer you want to use.The controller must have internet to use this feature.
Fetch: Swipe the layer to the right and tap the green icon to enter the Fetch page. You can choose whether to Fetch points to the element and Fetch lines to the line library. By default, the prefixes for points and lines are "M_", but they can be customized as needed.

13.3.3 Online map

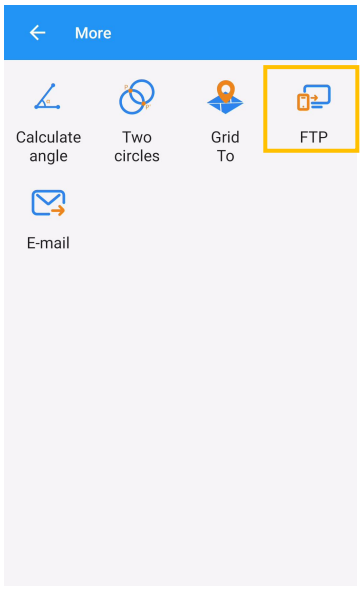
You can switch the currently displayed map or choose no map.

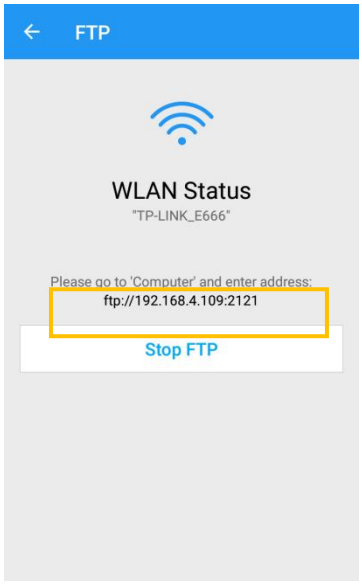
WMS: WMS support to load and display online vector geographic data, allow you to directly load map sources. You need to obtain a WMS service URL, username, and

password in advance. Enter this information into the software and click Get to retrieve the available layers. Then, select the layer you want to use.The controller must have internet to use this feature.

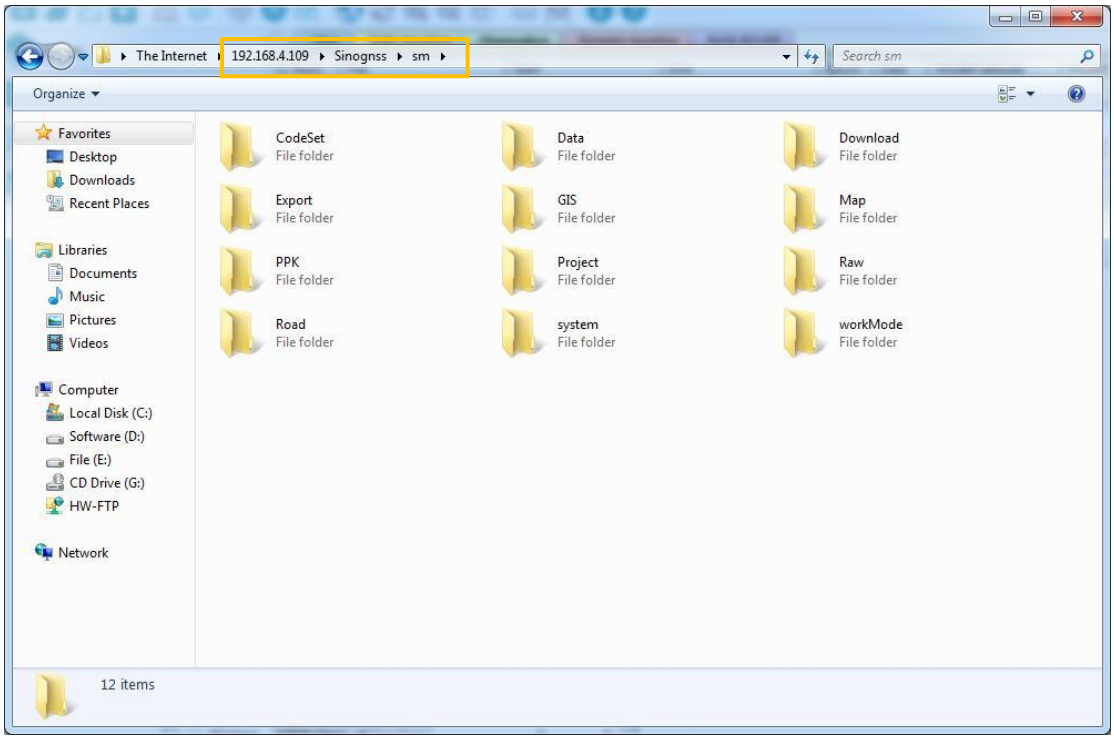
13.4 FTP for data management

This function allows user log in PC to management/download the controller data file. Make sure the controller and PC connect with a same WLAN, go SM start FTP and enter the address on File resource manager or browser, it will show all files on controller.

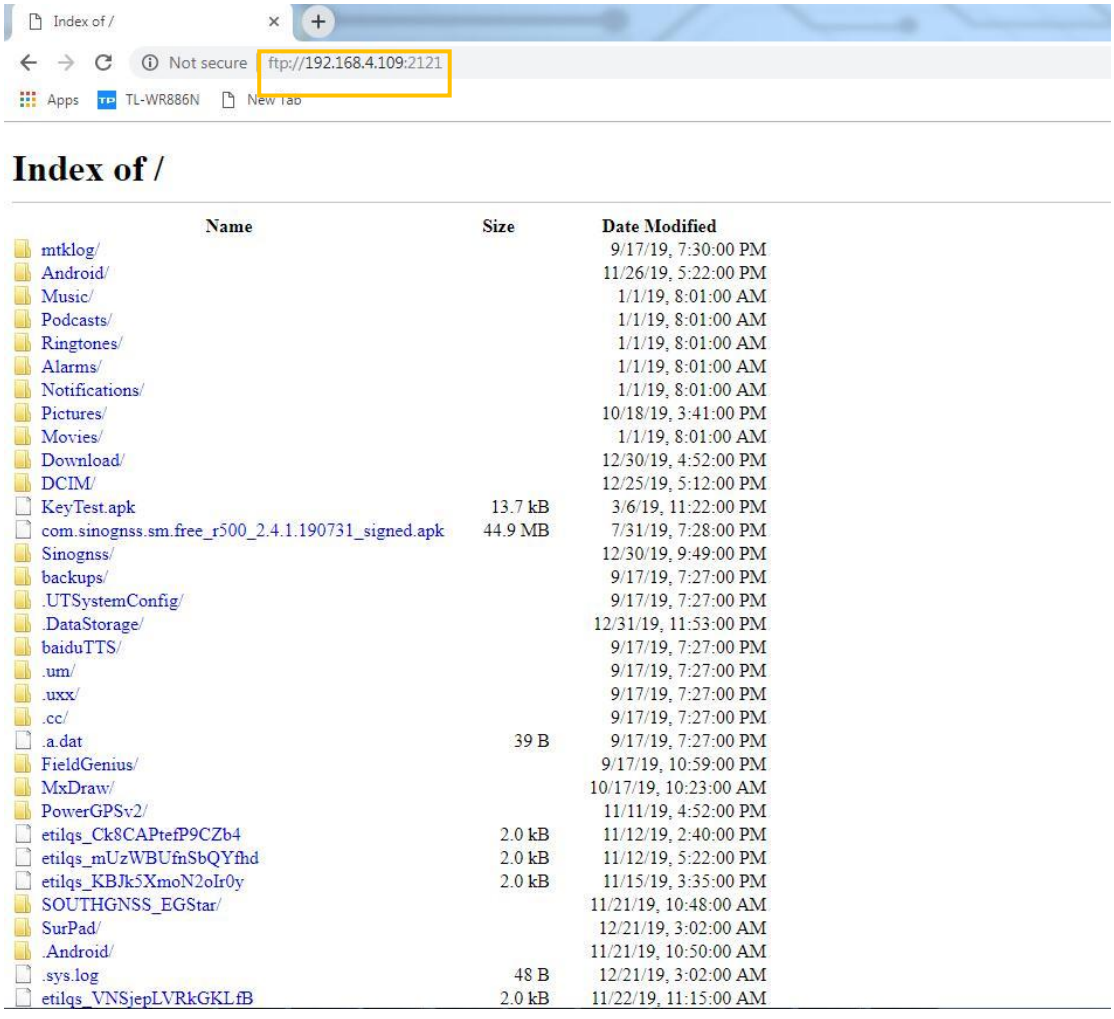




- Enter the ftp address in File resource manager:



- Or enter the ftp address to browser:



14 Frequently used Functions

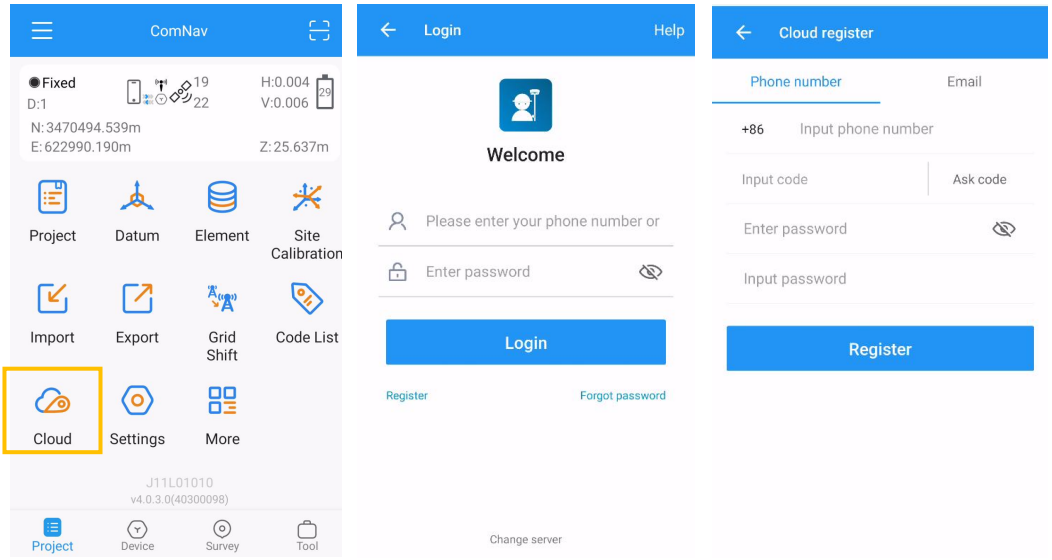
This chapter will show some frequently used functions, including Device Information, Site Calibration, Grid Shift, COGO, NMEA 0183, Code and Receiver Register function.

14.1 Cloud Login/Register

Users can easily register and login an account with phone number all around the world. Once login, users can share data including Project, Datum and work mode any time. For more, the remote assistance function is based on login an account.

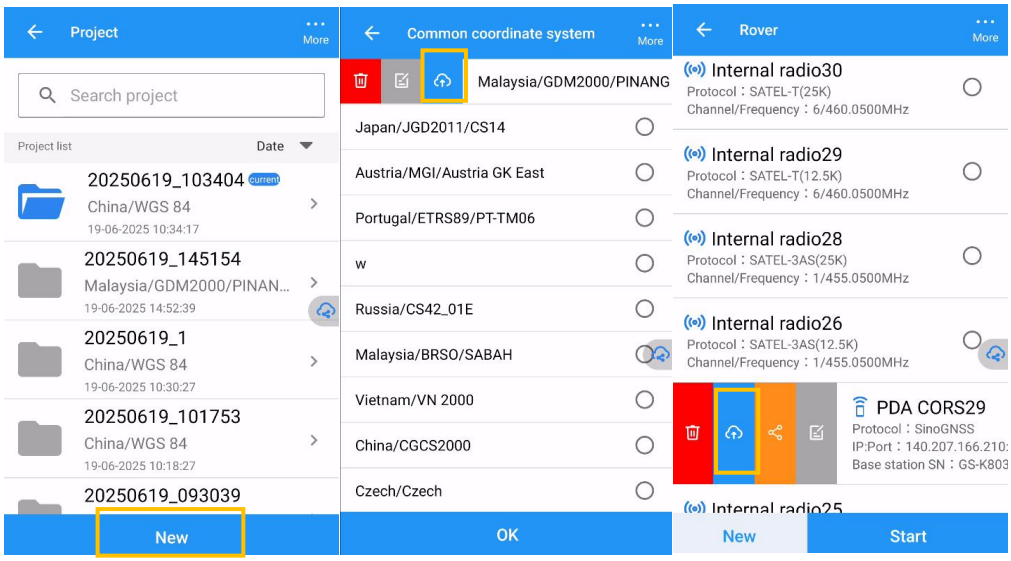
14.1.1 Login/Register

Use phone number and email to register and login.



14.1.2 Cloud upload/download

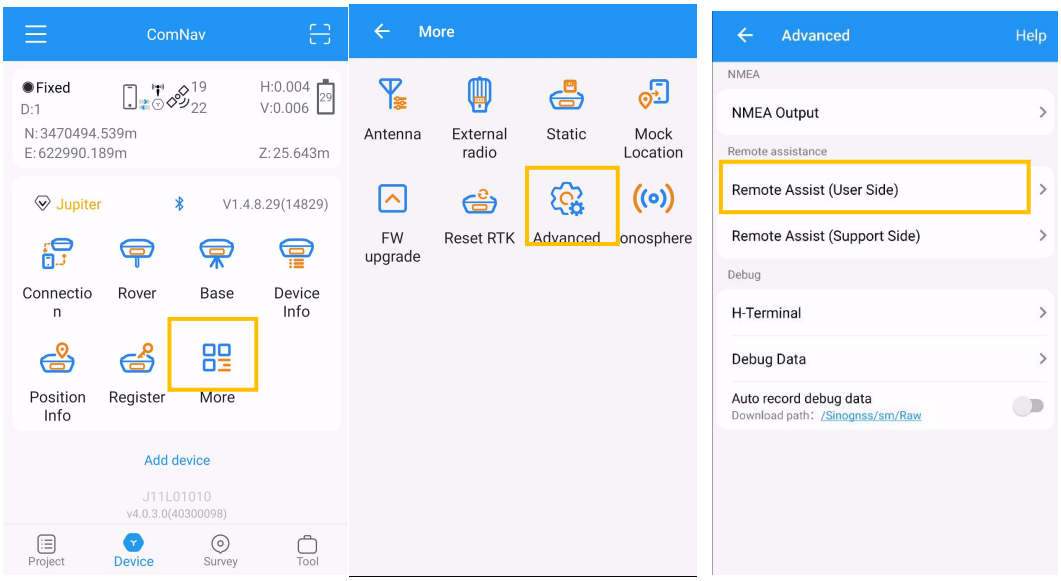
Login the same account, tap upload/download to share project, datum and work mode.

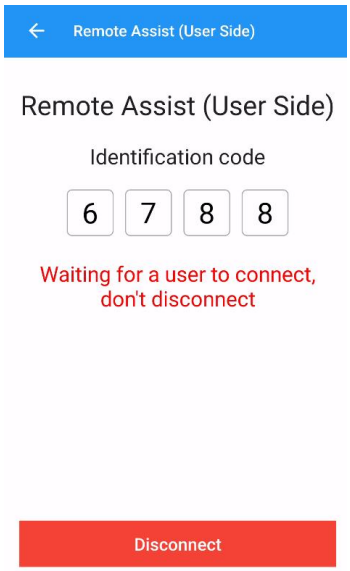


14.1.3 Remote assistance

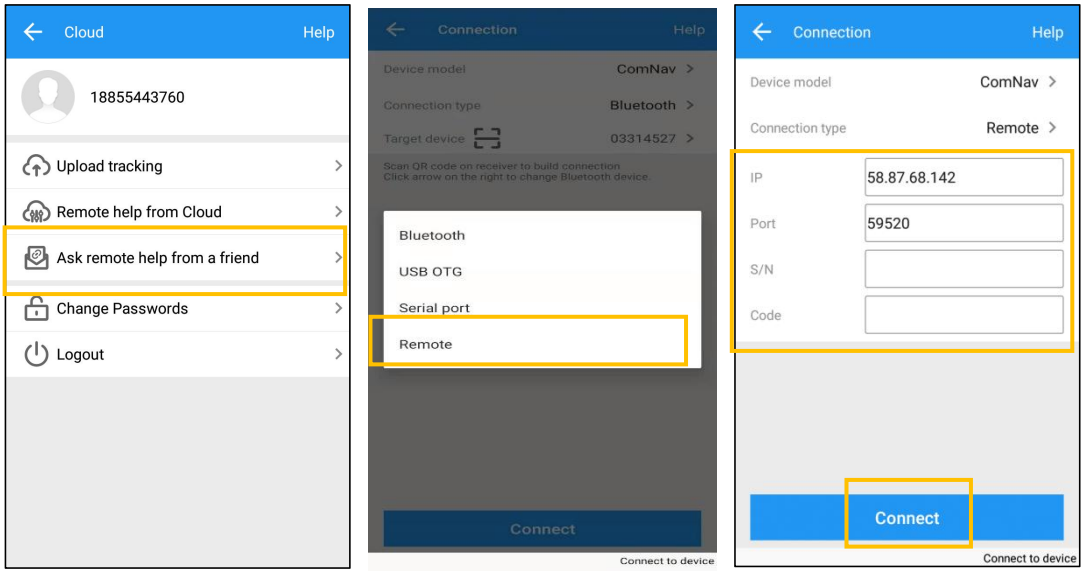
Users who need help need to connect to server as below, then helper in background can help.

Remote help from Cloud. The helper login NaviCloud address to help.



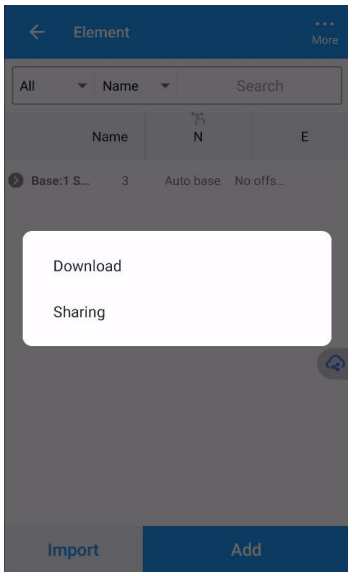


Ask remote from a friend: helper can connect your receiver by Remote connection with Survey Master.



14.1.4 Cloud floating bar

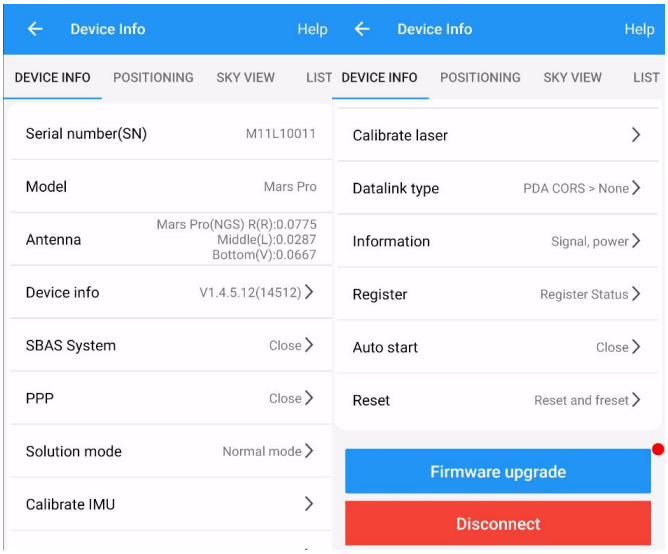
- When entering an interface that supports cloud services, the "Cloud" label will appear and automatically snap to the edge after 1 second.
- The label is draggable. After dragging, it will snap to the right edge of the new position.
- Tapping the label opens a dialog menu showing the available cloud services for the current interface, support sharing or download operations.



14.2 Device Information

Here in the ***Device info***, you can check the device info, positioning information, satellite information, base information.

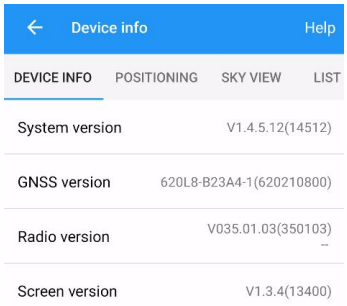
14.2.1 Device Info



Freset: Reset receiver to factory
Restart: Reboot receiver
Firmware update: Choose firmware to update
Disconnect: Disconnect with the receiver

Auto start: Only some receivers supports: T30 IMU and N5 on K7 platform, all K8 receivers
On: receiver will turn on automatically when connecting to external power;
Off: receiver will not turn automatically when connecting to external power.

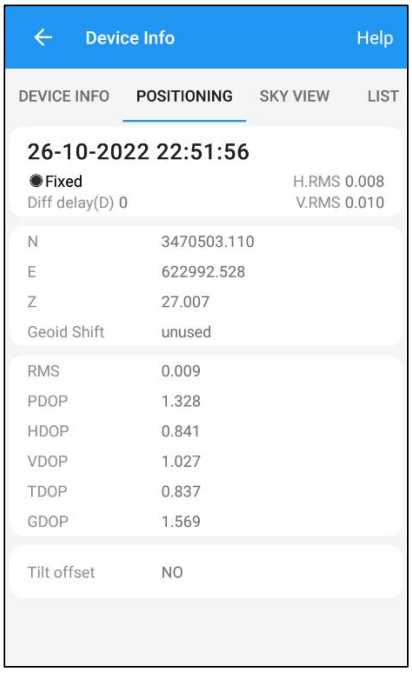
Calibrate IMU: For K8 receivers, when you find the IMU accuracy is not high, and no matter how you calibrate it, it doesn't work, then you can try this way to calibrate IMU, it needs you to rotate pole during calibration.



For K8 receivers:
there are OS firmware, GNSS firmware, radio firmware, and screen firmware (only N5andMars Pro has)

14.2.2 Position information

Tap ***Positioning*** to check the position info.



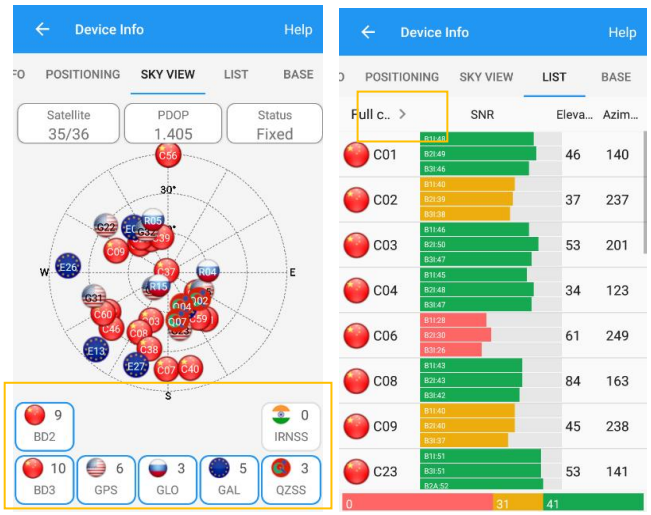
Diff delay: show how long the rover gets differential data from base

Geoid shift: Add EGM model will show the shift value

Tilt offset: Receiver with tilt sensor after calibration will show the magnetic strength value.

14.2.3 Satellite information

Tap ***SATELLITE*** to check the satellites info, including the sky view and satellite list for detailed information.
In addition, you can uncheck to lockout the satellites constellation directly, and if you want lockout some satellites, close the satellites from the list to lockout.

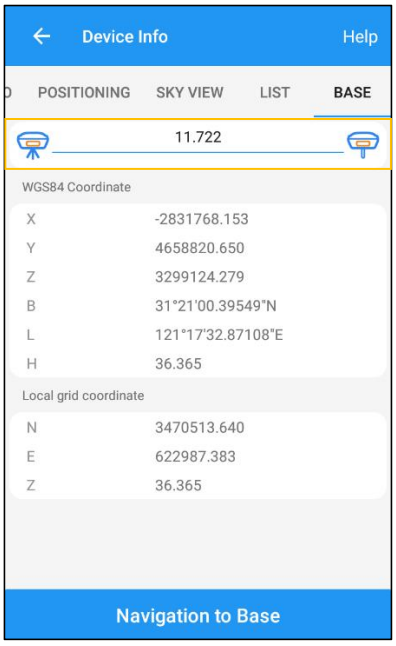


Click to check full constellations or specific constellation satellites

Check every frequency SNR,
Green: SNR > 40
Yellow: 30 < SNR < 40
Red: SNR < 30

14.2.4 Base information

Tap BASE to check the Base info and navigate to Base.

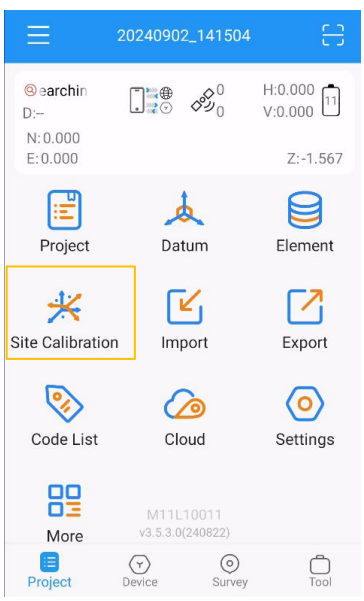


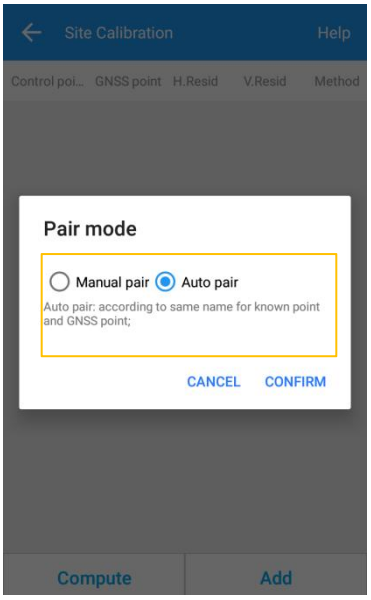
Check Base station coordinate and the distance to Base station

14.3 Site calibration

Site calibration is commonly needed once in one project, and all the points will be collected based on calibrated datum system.

1. Choose manual pair or auto pair.

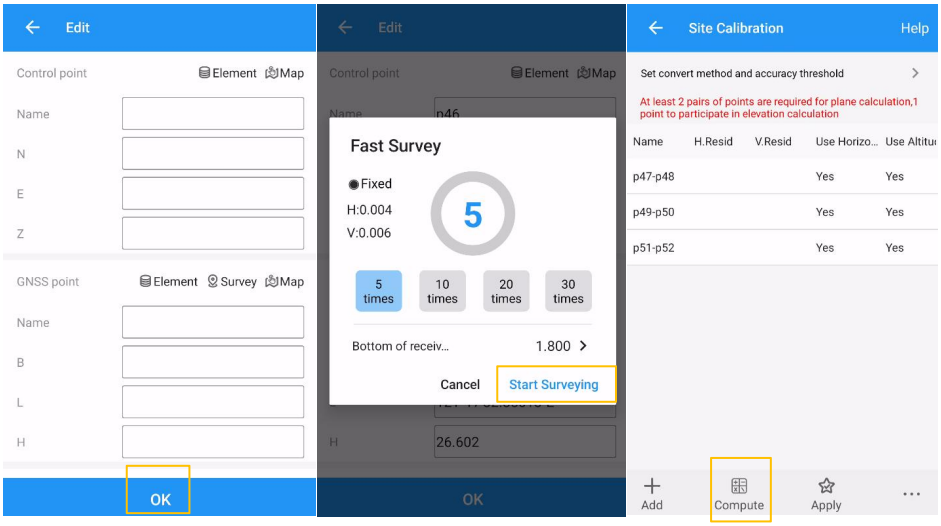


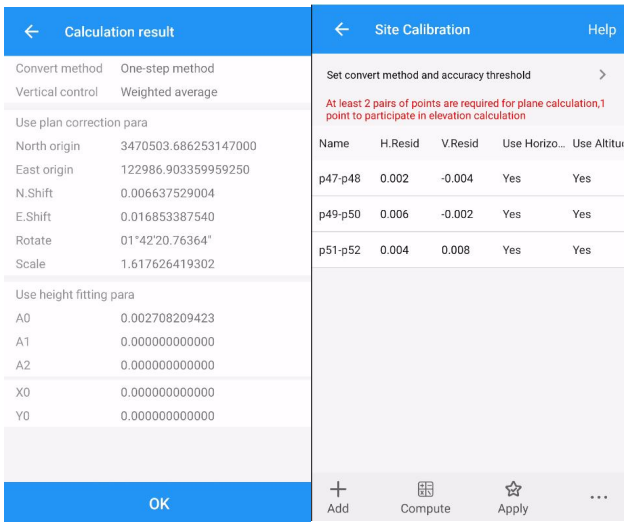


2. If you choose manual pair, you can directly enter at least three groups' point to compute. (for example, take K1,K2,K3 as known points, take A1,A2,A3 as measured points) After click ***Compute*** to calculate, the software will calibrate automatically.

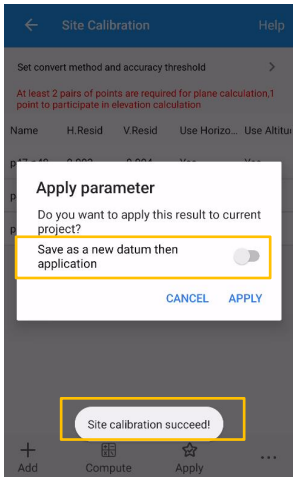
Click to add K1, K2, K3

Click to add A1, A2, A3

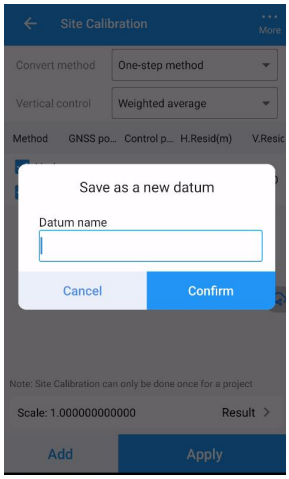




3. If you choose auto pair, it will auto compute according to the same name for known point and measured point. After click ***Compute*** to calculate, the software will calibrate automatically.
4. Click ***Apply*** to confirm to replace datum. The value of H.Resid and V.Resid should meet the requirement (H.Resid $\leqslant$ 0.015m, and V.Resid $\leqslant$ 0.02m).



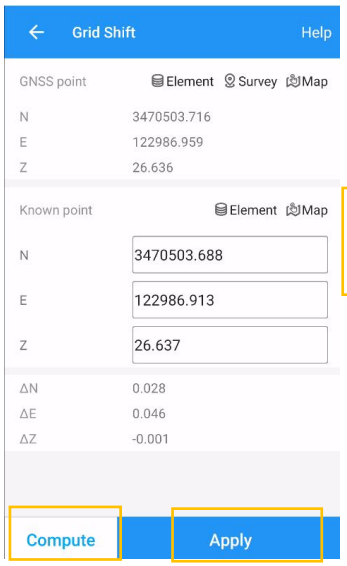
5. It also supports import and export LOC files, which is convenient for customers to use.
6. Turn on Save as a new datum then application, you can save current parameters as a new datum.



14.4 Grid Shift

Grid shift function is applied when you need to change the position of Base station in the same project.

Click ***Grid Shift*** in Tool interface -> add current GNSS point and target known point -> Click ***Compute***-> ***Apply*** to complete grid shift, all rover points will upgrade the coordinate.

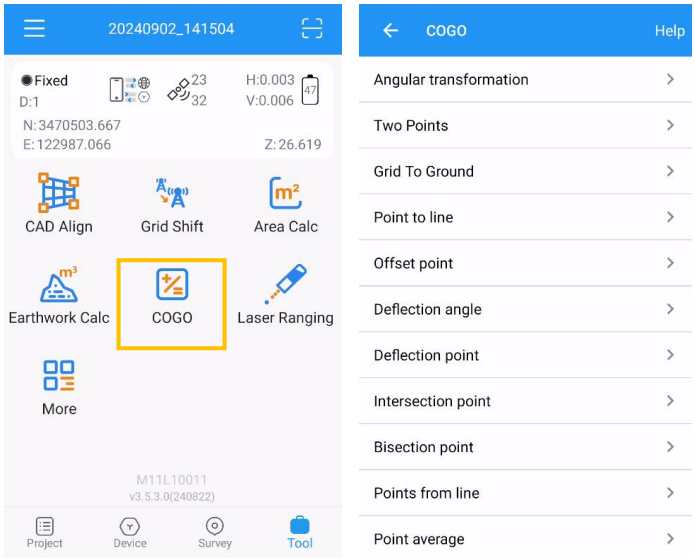


Click to add the point from Gnss point

Click to select the same point from known point

14.5 COGO

With COGO function, you can calculate points/lines/angle directly on field.



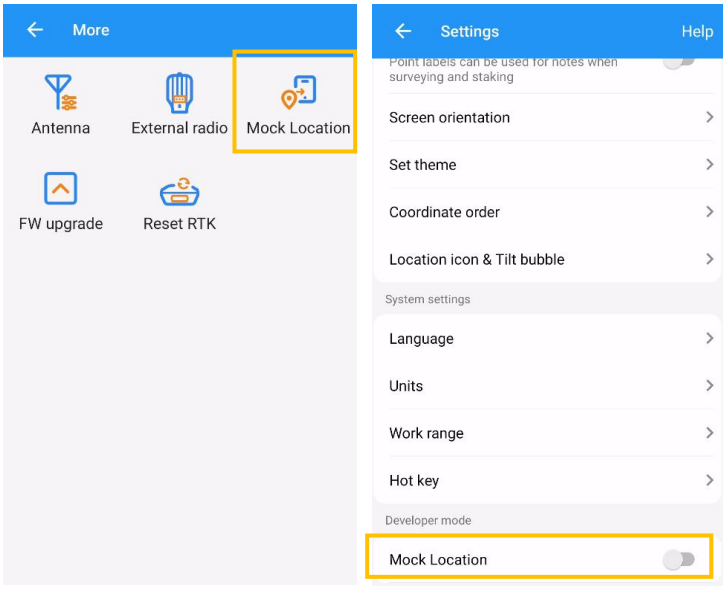
- Angular transformation: Angular type transform;
- Two points: Calculate two points distance;
- Grid To Ground:Calculate grid to ground
- Point to line: Distance from point to one line;
- Offset point: Calculate point with azimuth and distance;
- Deflection angle: Calculate angle of two lines;
- Deflection point: Calculate point with angle and distance;
- Intersection point: Calculate intersection points from two lines;
- Bisection point: Calculate point from angle bisector;
- Points from line: Calculate points on line by distance or segment;
- Point average: Calculate average from points;

14.6 Mock Location

Mock Location is a function for sharing the Survey Master accuracy to your controller/smart phone, so that ComNav receiver can work with third party software. The function is suitable for users who prefer some third-party software rather than Survey Master, then can take ComNav receiver and their own software to conduct work.

Step 1: Enable Mock Location in Survey Master

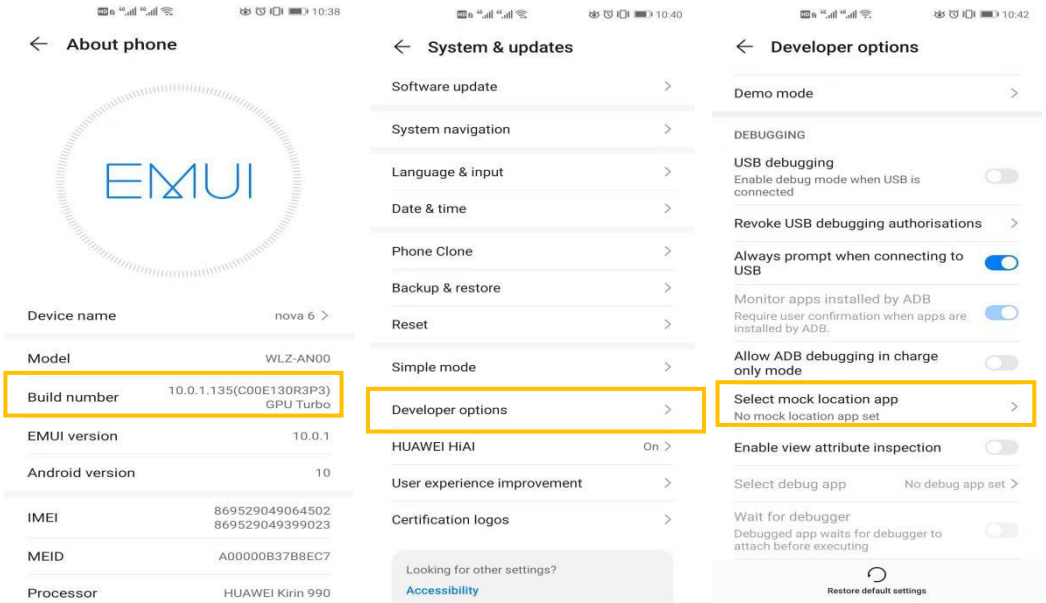
For users who need RTK accuracy, please follow the previous chapters to get RTK fixed firstly, then go Project→Settings, check Mock Location option, and leave Survey Master Software run in background.



Step 2: Enable Mock Location for controller/smart phone

For many Android devices, they can get position from internal GPS/GNSS chip and Wi-Fi network but not accurate (generally less than 10 meters), so you need to enable mock location on to get position from Survey Master.

- Firstly open **Settings** on your controller/smart phone.
- Scroll down to bottom and select **About Phone**.
- Scroll down and find **Build Number option**, click **seven times** on Build Number to make sure you are in developer mode.
- Also in Settings, select **System&updates**, then find **Developer Options** and open it.
- Normally, you just need to enable Allow mock locations on. And in some devices, you need Select mock location app, then select **Survey Master Software**.



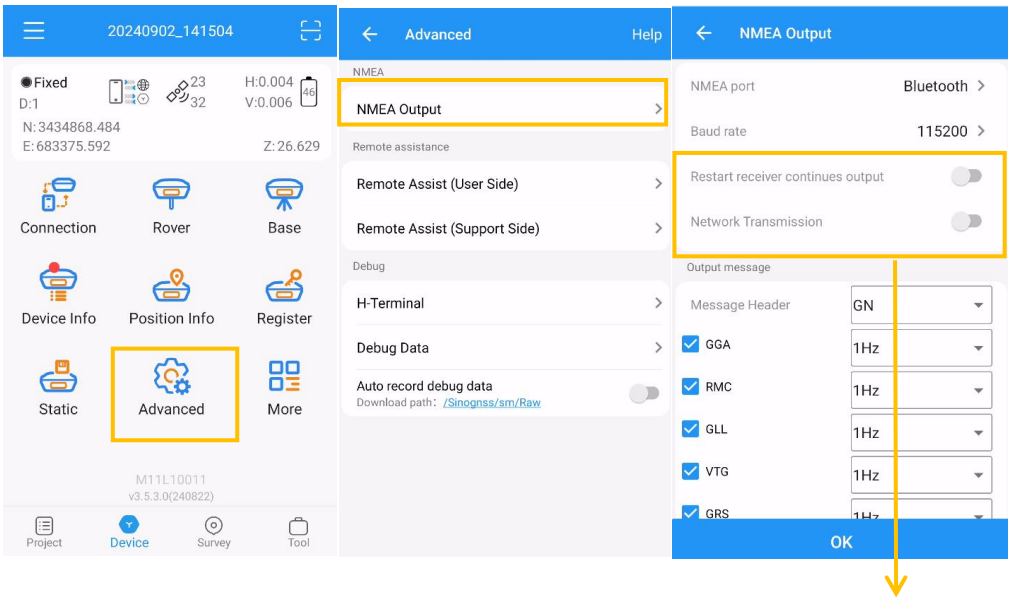
Step 3: Go third party software

14.7 Advanced

14.7.1 NMEA 0183 output

With ***NMEA 0183*** function, you can quickly set to output NMEA data from com1 port or Bluetooth. In fact, this function is same as enter commands “log comX gpXXX ontime X”.

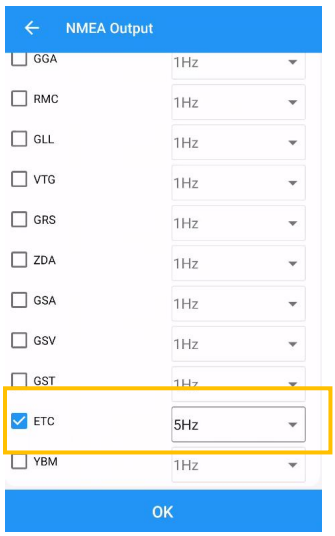
Choose NMEA Port -> Baud -> check commands you want to output.



- This option is same as the command “saveconfig’’, save current configuration.
- Data transfer: for transmit all the BT output to the address.

After configuring the Bluetooth output, do not reconnect the receiver using Survey Master again, as the software sends multiple request messages when establishing the connection, which may interfere with the NMEA output.

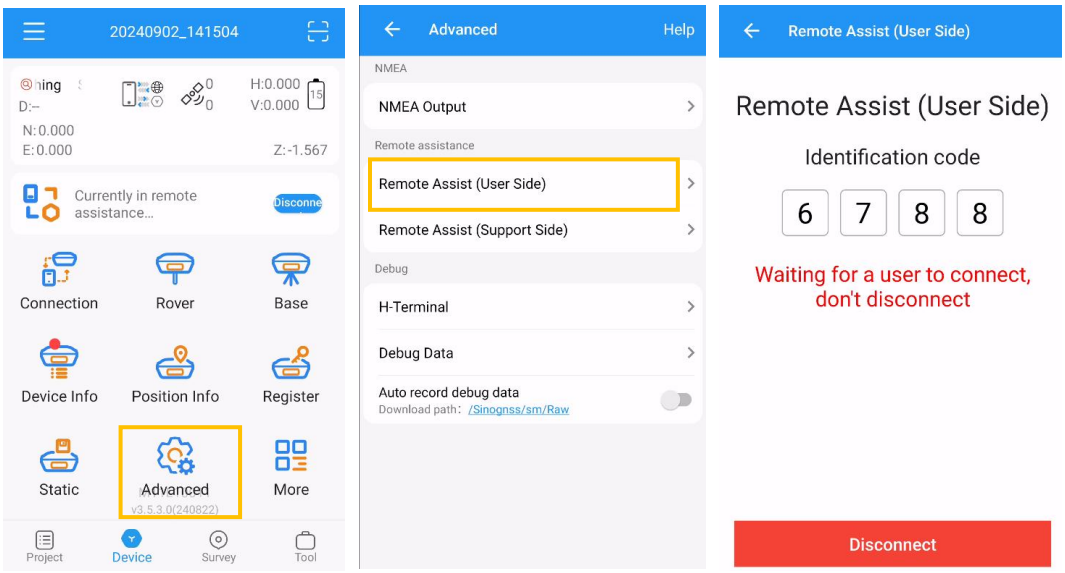
GNETC is a newly added NMEA message used to output tilt compensation data.The EG25 receiver supports ETC starting from firmware version 1.4.7.15 and above. When you want to use GNETC, please choose Bluetooth output.



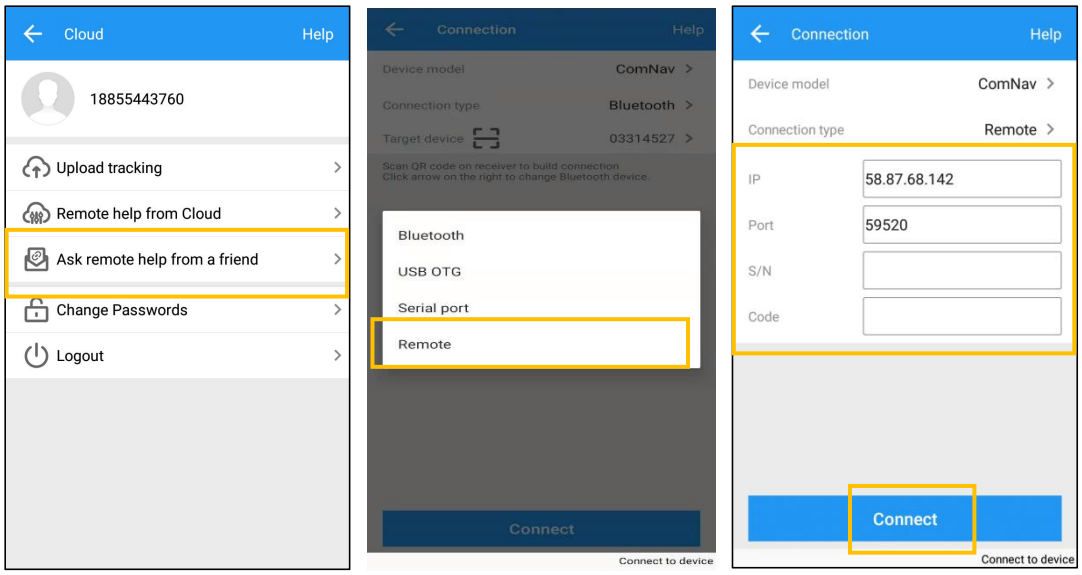
14.7.2 Remote assistance

Users who need help need to connect to server as below, then helper in background can help.

Remote help from Cloud. The helper login NaviCloud address to help.



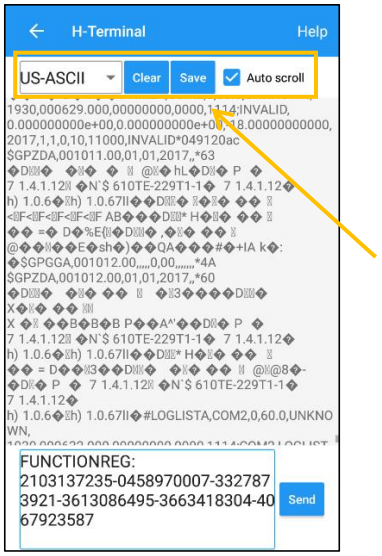
Ask remote from a friend: helper can connect your receiver by Remote connection with Survey Master.



14.7.3 H-Terminal

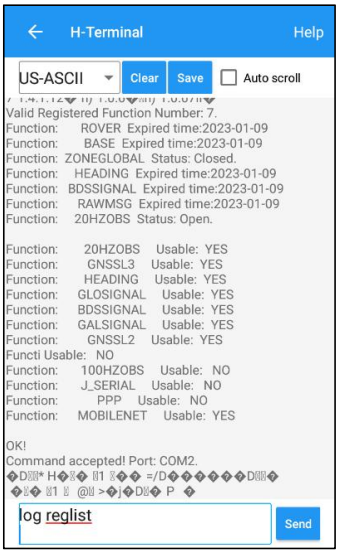
You need copy the whole code, and enter the cursor to next line, then send.
Include the word 'FUNCTIONREG:'

FUNCTIONREG:2091007494-0446840386-3349298772-3600957130-3684843029-2463744780

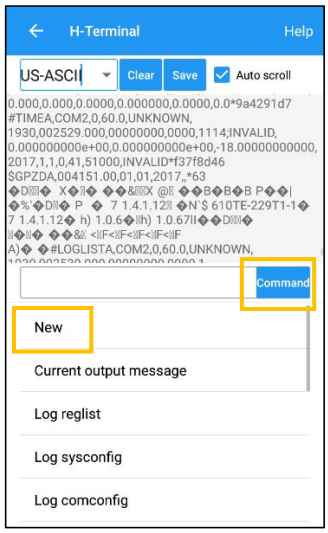


HEX: Hexadecimal output
US-ASCII is based on UTF-8, for users, we use this to send command;
ISO-8859-1: It belongs to the singleton encoding, backwards compatible with ASCII.

Clear: Clear current message output;
Save: Save current message output as a file, format is *cnb.
Auto scroll: Check off this to stop the message scroll



Click ***Command*** to see commands that are used frequently, you can add a new command.



14.7.4 Debug Date

Debug Data: Save data output from BT. When you encounter issues that require check by the R&D team, you can save the Debug Date and provide it to them.

Auto record debug data: By default, this feature is disabled. When enabled, debug data will be automatically saved to the "/Sinognss/sm/Raw" folder. Files older than 7 days will be automatically deleted.

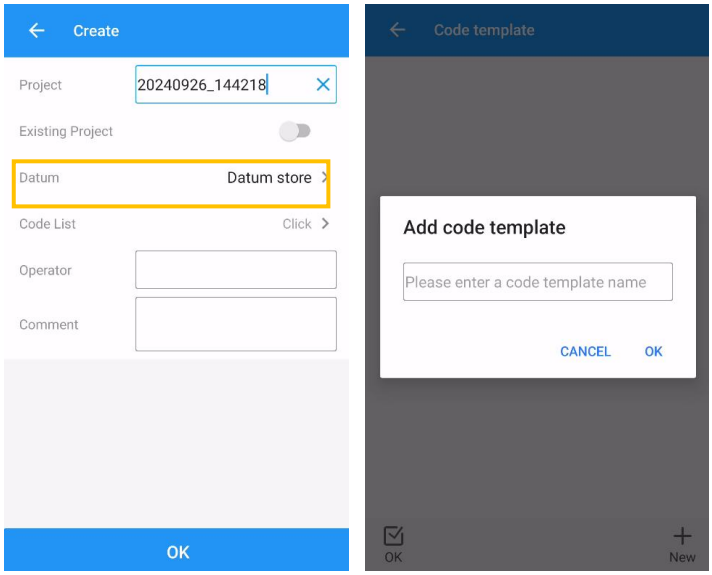
14.8 Code List

This is a function for adding or managing the code. You can add the code for point, line and polygon by grouping. After add a code list what you need, it will be convenient to use ***Topo Survey***, ***Feature Survey*** and nine-panels function. In addition, the description of code is good for you to survey features. In some situation, code will be

easy, so you can select the description to know what you are surveying.

Step 1: Add a code list

If you don't have a code list, you can modify current code list and add the code, if you add a code list before, you can choose this code list when you create a new project.

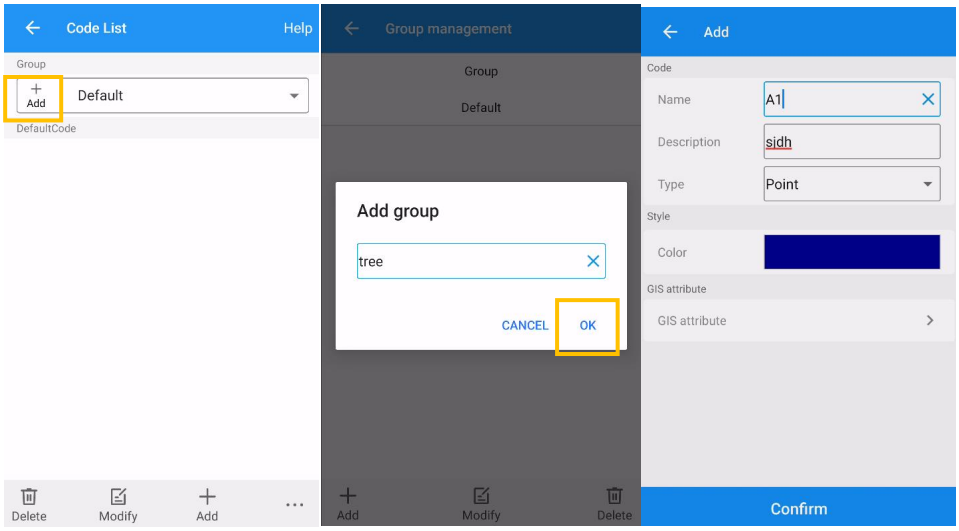


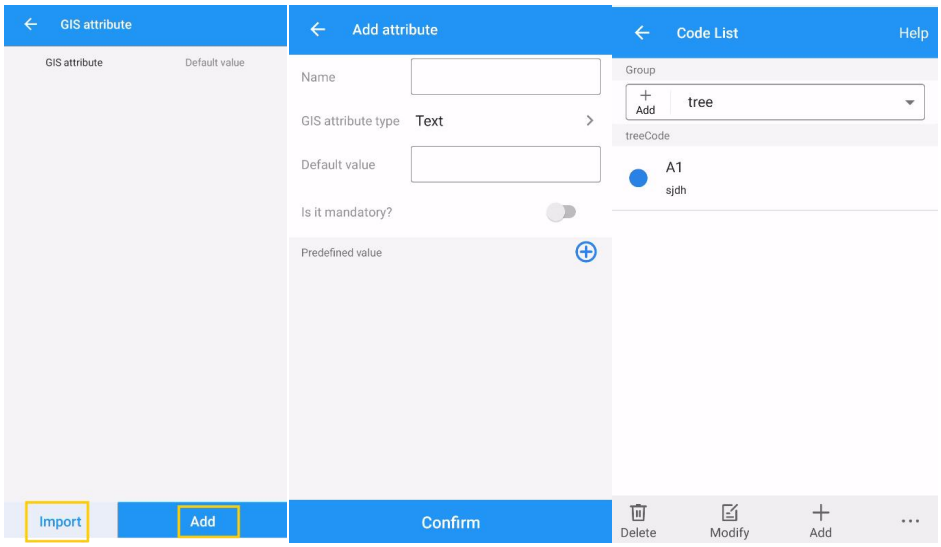
- Modify: You can modify the current code list, supports modify previous code detail and add a new code to it.
- Import: select the TXT code list file which you need to import.
- Add: Add a code list
- Apply: choose one code list to apply to current task code list.
- Delete: delete the code list, you can delete the code list or delete the current task code list.
- Export: Export *.txt file of the code list.

Tip: When you apply the code list to current task code list, it will plus current code list and the new code list. When you delete the current task code list, it will become zero for point/line/polygon, then you can apply a completely new one.

Step 2: Add the code for point, line and polygon by grouping

Click ***Group*** -> Add group, input group name-> Add the code for point, line, polygon-> choose group->Write Name,Description,type, style for the code->Add GIS attribute （You can import shp format file,The software will automatically identify attribute values in the file and display them in the GIS attribute list.).

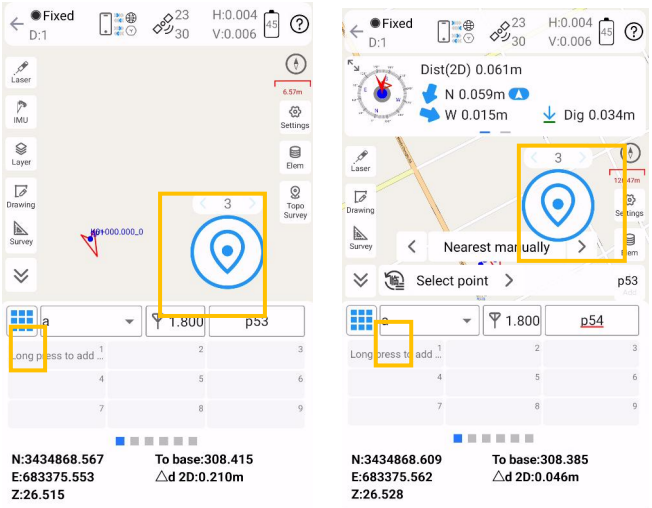




Tips:

1. When you add a group in the point interface, it will not apply in line or polygon interface.

2. You can enter a new code in the Survey and Stake surface, when you survey the point, the code will be stored in the current code list.



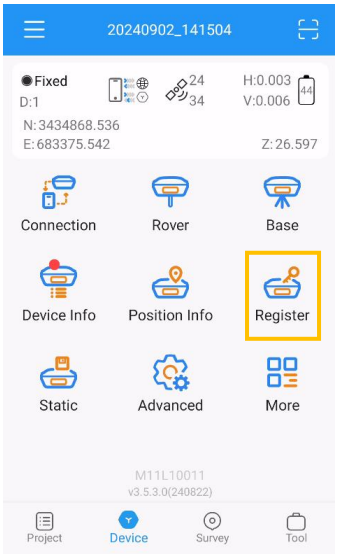
14.9 Register Receiver

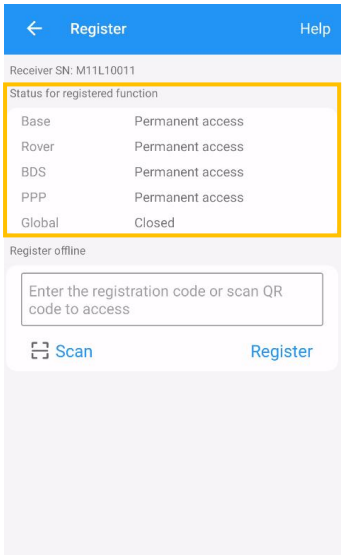
Normally, the register code is like this:
ID:03311982 $$:49-18-76-14-00-00-00-36-21
FUNCTIONREG:2091007494-0446840386-3349298772-3600957130-3684843029-2463744780
Note: The code length is different for different functions.

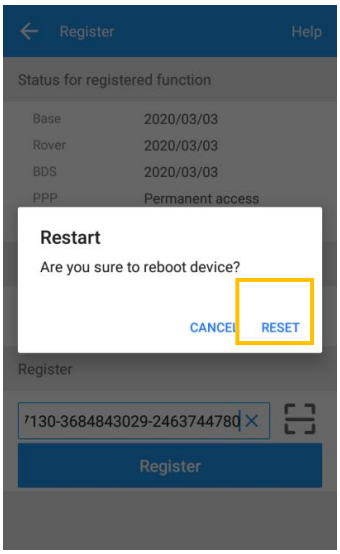
Following shows two methods to register the receiver.

14.9.1 Register Menu

For Register function, you need only enter the number: *2091007494-0446840386-3349298772-3600957130-3684843029-2463744780*







: Get the register code as a QR code, then scan the QR code by the scan button

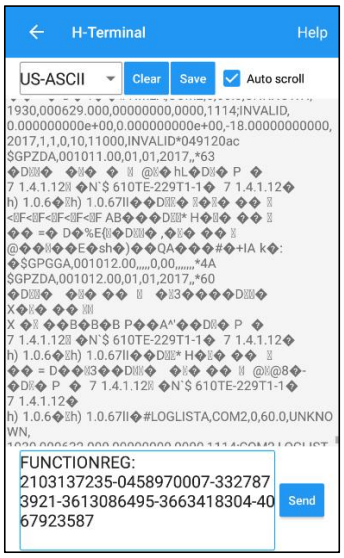
14.9.2 H-Terminal Menu

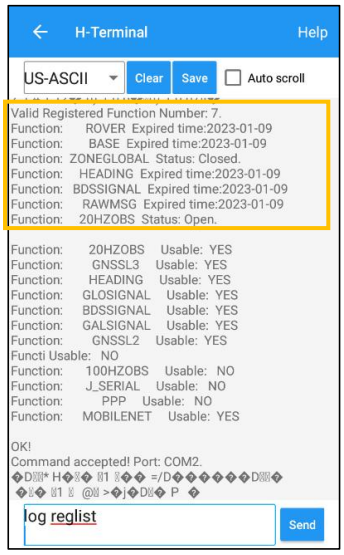
You need copy the whole code, and enter the cursor to next line, then send. Include the word 'FUNCTIONREG:'

FUNCTIONREG:2091007494-0446840386-3349298772-3600957130-3684843029-2463744780

HEX: Hexadecimal output
US-ASCII is based on UTF-8, for users, we use this to send command;
ISO-8859-1: It belongs to the singleton encoding, backwards compatible with ASCII.

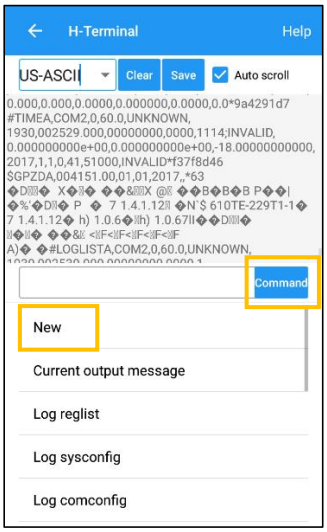
Clear: Clear current message output;
Save: Save current message output as a file, format is *cnb.
Auto scroll: Check off this to stop the message scroll

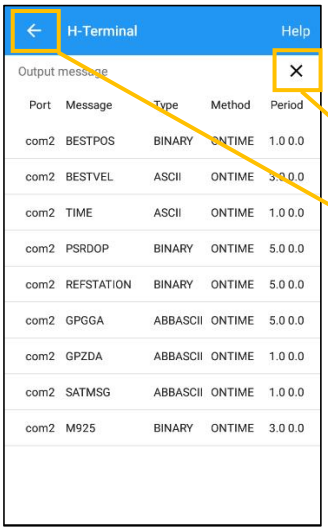




Send command: LOG REGLIST
To check the receiver registration status.

Click ***Command*** to see commands that are used frequently, you can add a new command.





Check current output message

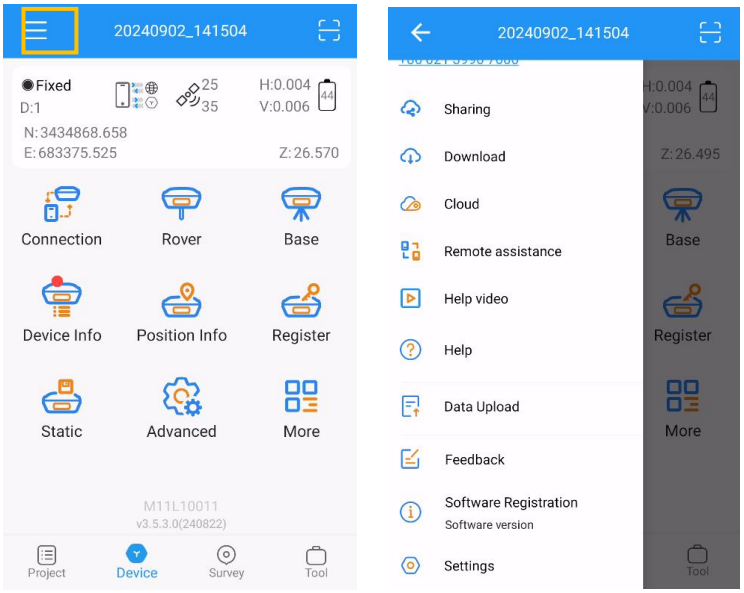
Click to exit current page

Click to exit H-Terminal function

14.10 Register Software

Starting from version 3.5.0, Only ComNav controller users get automatic permanent registration, accessing all features.

Click the icon in the upper left corner of the main interface, you will get the sidebar information. Click *Software Registration*.



If you don't use the ComNav controller, it will show Unregistered.

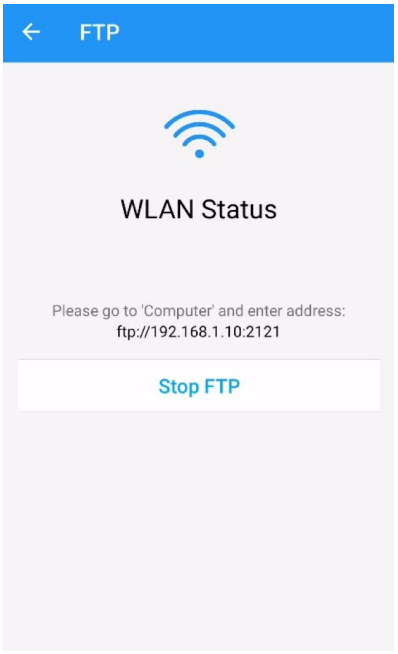
You can click *Free trial* to get a 10-day trial for free. But there is only one trial opportunity.

If you have a registration code, click *Register* to enter or scan registration code. Enter your phone number or email address as a note.

If you need a registration code, pls contact your local dealer or send email to send an email to sales@comnavtech.com.

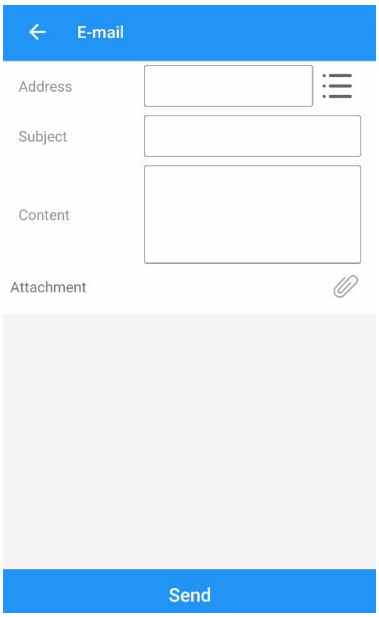
14.11 FTP

FTP: Share controller files to pc wirelessly. Indicates that in Wi-Fi mode, you can access files on the controller/phone/PDA via FTP within the same local network. Click [Run FTP], and the interface will prompt: enter *** in the address bar of "My Computer" to remotely manage the device's files.



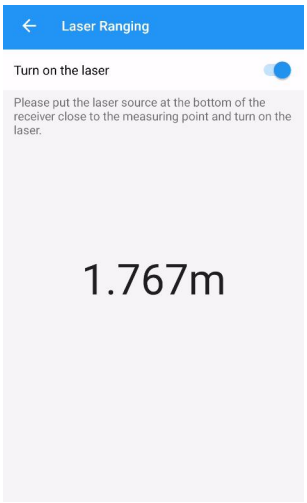
14.12 Email

E-mail: Send files to e-mail. Enter a valid email address, subject, and content. You may choose to add attachment or leave them out. Click "Send" to complete the email sending process. The attachment path is shown in the image below, and you can choose to jump to the specified directory.



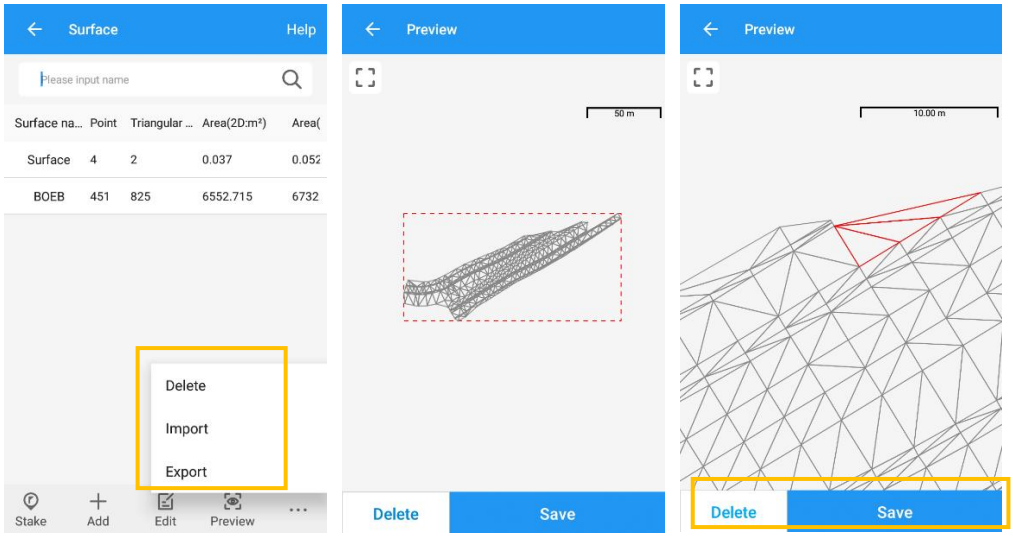
14.13 Laser Ranging

Laser Ranging: Laser measuring distance.The laser ranging function can be used simply by connecting a laser receiver. The distance will be displayed in real time on the screen.



15 Surface

This is a function for adding and managing the surfaces. The surfaces in this Surface library can be staked directly in Stake Surface.



1. ***Search***: Enter the surface name or key words in the search bar to search the corresponding surface;
2. ***Stake***: Select a surface in the table and click Stake to stake the surface, please refer to the Chapter 6.4.3;

3. ***Add*** / ***Edit***

When you add a surface, you need to enter a surface name; Go to the ***Element*** to choose point to form the surface, you can search the point with the key word, or select

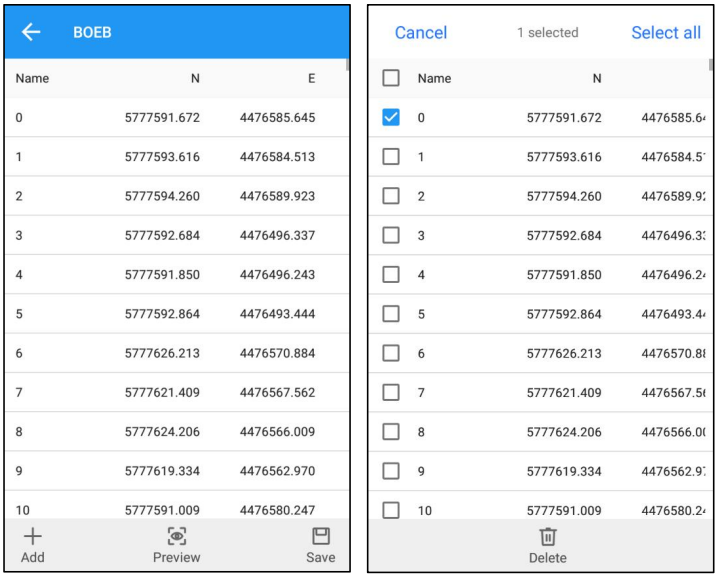
all points. The algorithm to form the surface is Delaunay triangulation, the boundary is defined according to the convex hull algorithm.

After you finished creating the surface, you can preview the surface shape and size, and click ***Save*** to save the surface.

4. ***Preview***: Choose one surface in the table and preview the surface;

a. ***Delete***: Select the line you want to delete, long press the screen and drag your finger to select it, the selected lines will be highlighted, click ***Delete*** to delete the lines, or click on the selected line to uncheck it.

b. ***Save***: Save the edited surface file



7. ***Save***/***Delete***: When you create or edit the surface, you can long press the point on the list, and delete the point from the list, after you create or edit the surface, you can click the ***Save*** to save the creation or edit.

6. ***Delete/Import*** / ***Export***:

Choose one surface in the table and click delete it from the table. Survey Master supports to import the surface in .xml and .sjw format, and supports to export the surface in the .sjw format, the default path is /Sinogns /sm/Export.

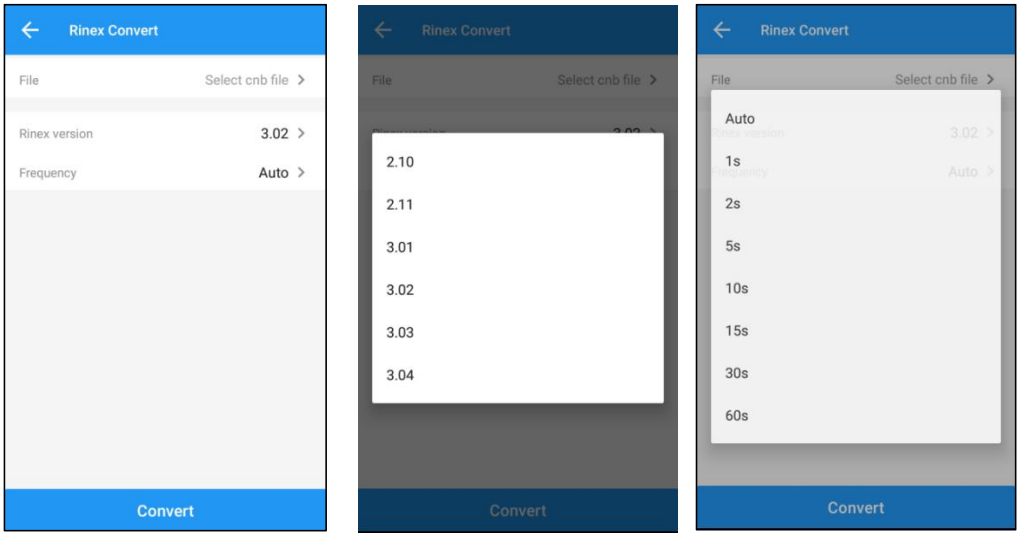
Tip: The surface format suffix should be lower case letters, the .XML file cannot be imported successfully.

16 Rinex Convert

Survey Master supports to convert the static data CNB files to Rinex format, you need to put the CNB files which you want to convert in your controller root first, or you can choose the static data logged by ***Static Survey*** via Survey Master, the default path is /Sinognss/sm/Raw.

The supported Rinex version includes Rinex2.10, Rinex2.11, Rinex3.01, Rinex3.02, Rinex3.03, Rinex3.04; the supported Auto, 1s, 2s, 5s, 10s, 15s, 30s, 60s, Auto means it will be same with the CNB sample interval.

The converted Rinex file will be stored in the same place where the CNB file is, the observation and all ephemeris data will be compressed into one file.



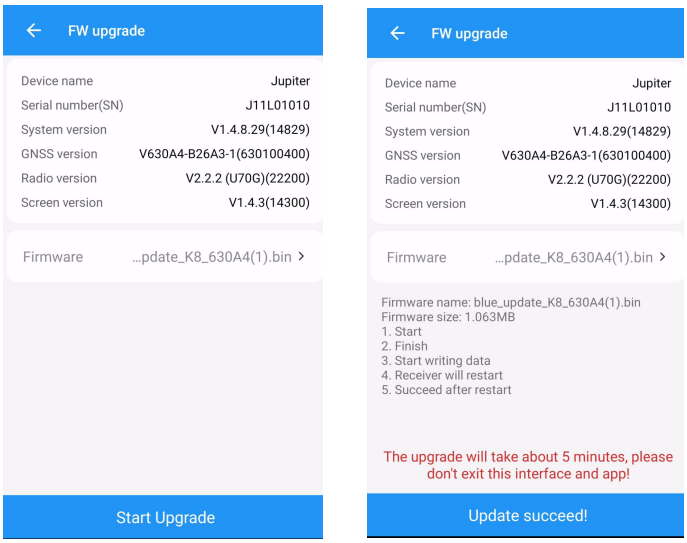
If you have already converted the file, when you converted again, it will pop up that the file name exits and need to change name.

17 FW Update

In Survey Master, you are allowed to update the receiver firmware, but it only supports firmware in *.bin format.

If you want to update the firmware for your receiver, you need to copy the firmware to your controller first, connect your receiver to the Survey Master, then go to the ***Device***->***FW Update***, choose the firmware in your controller folder.

Go to ***Device Info***-> ***Firmware Update***, or click the FW Update on the main interface, go to ***FW update*** interface, click ***Start***, it will take about 10 minutes to finish the update. After you finish the update, you need to restart the receiver.



Tips:

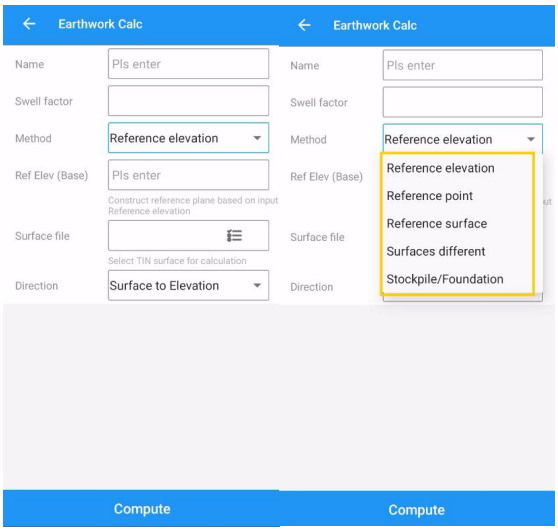
1. Please make sure the power of the controller and receiver more than 30%;

2. Don't power off the receiver or exit software during update!

3. The current receiver hardware and firmware determine whether the FW upgrade function is available. Different receivers have different rules, for more information, please refer to their user guides.

18 Earthwork Calculation

Earthwork volume is one of the main data of the earthwork construction organization design. It is the basis for the organization of labor when manual excavation or the calculation of mechanical shifts and construction period when mechanical construction is used. Earthwork calculations should be as accurate as possible.



Go to ***Earthwork Calc***, enter the Earthwork calculation interface.

Name： Earthwork name.

Swell factor:Earthwork generally has three states:

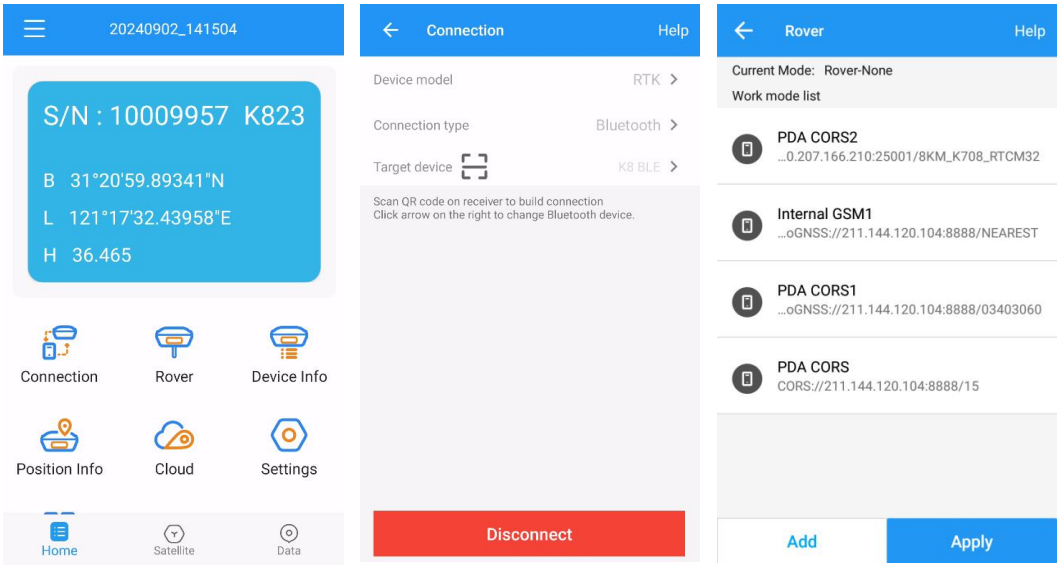
Natural soil — V_{nat}
Loose soil — V_{loose}
Compacted soil — V_{comp}
$V_{loose} > V_{nat} > V_{comp}$
Swell factor = V_{comp}/ V_{nat}or V_{loose} / V_{nat}
That is, the cut & fill volume = calculated cut & fill volume × Swell factor.
Enter the Swell factor according to construction design requirements. If there are no special requirements, enter 1. The value 1 represents natural soil.
Surface file:This surface is the original ground, the target surface for excavation or filling volume, which is stored in the ***Surface*** library, for more information, please refer to Chatper 14;
Direction:Surface to Elevation, Elevation to Surface
Method:
a) Reference elevation:This is the design elevation, it will calculate the excavation or filling volume on the original ground according this elevation
b) Reference point:You can get the reference point from ***Element*** or directly survey a point, it will calculate the excavation or filling volume according to the reference point elevation.
c) Reference surface:This is the design surface, it will calculate the excavation or filling volume between the design surface and the original ground.
d) Surfaces different: Calculate earthwork volume between the triangulated surface data before construction and after construction.
e) Stockpile/Foundation: Calculate earthwork volume of foundation pits or stockpiles.
Compute: Click ***Compute*** to get the excavation or filling information.
Export report: This will export the earthwork calculation report, the format is *. HTML, the default path is Survey Master Export.

19 OEM board interface

This part is used for board testing or developers. This interface will appear when the corresponding board is connected. The following introduction takes the K8 kit as an example.

19.1 OEM board main interface

Connect Device: If you want to switch devices, you can click [Home] → [Connect Device], as shown in Figure 3-2 to connect the device, click “Disconnect” to connect to other devices.
Differential Settings: You can view the current mode and set the current working mode. Currently, only the handbook network working mode setting is supported.



Connect Device: If you want to switch devices, you can click ***Home***→***Connect Device***, and connect the device, click “Disconnect” to connect to other devices.

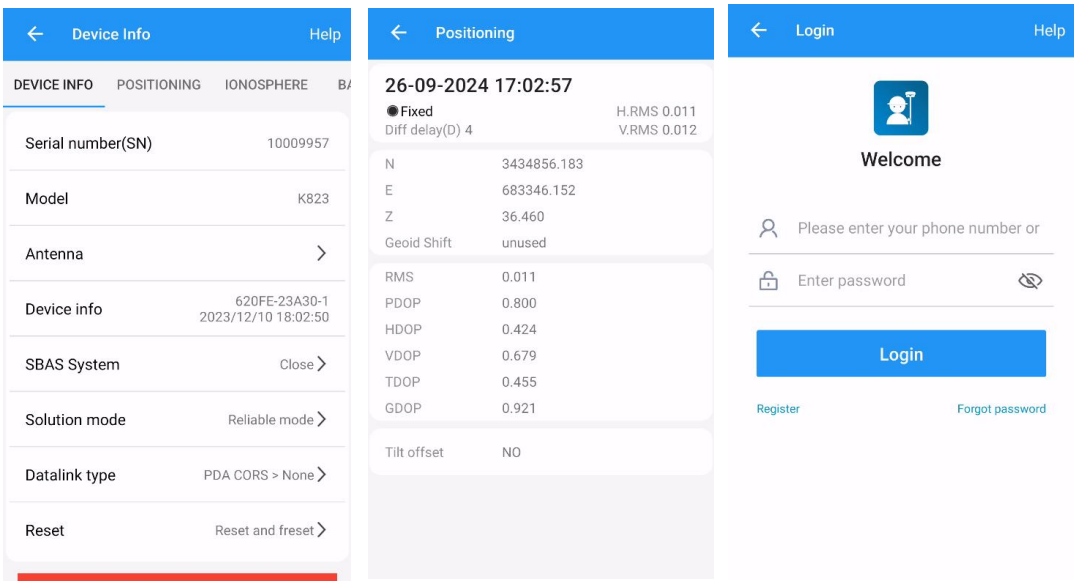
Differential Settings: You can view the current mode and set the current working mode. Currently, only the PDA CORS working mode setting is supported.

Device Information: You can view the device model, S/N, firmware version, data link and other information, click the "Data Link" column to connect or disconnect the working status, or restore the factory settings.

Position Information: View the BLH value, differential status and other values of the current device location, as well as base station information.

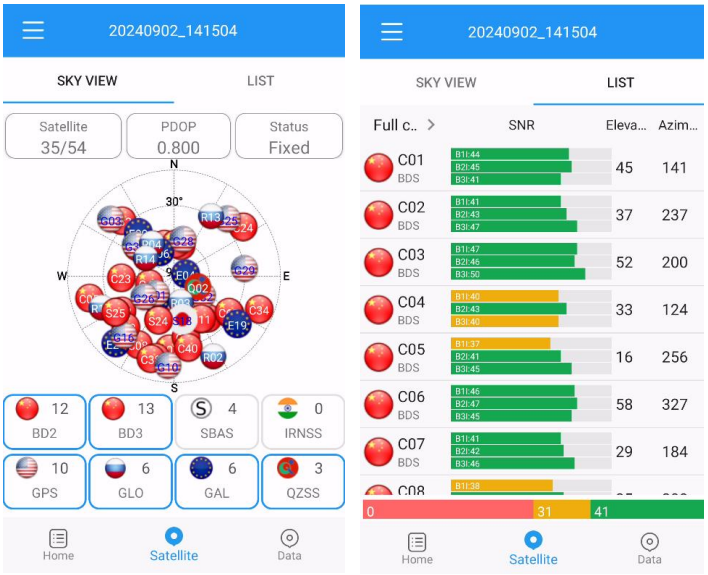
Remote Assistance: After entering the remote assistance interface, log in with the user account and password, and use cloud services.

Settings: After entering the software setting, you can perform operations such as shortcut key setting, sound setting, unit setting and interface style.



19.2 OEM board satellite

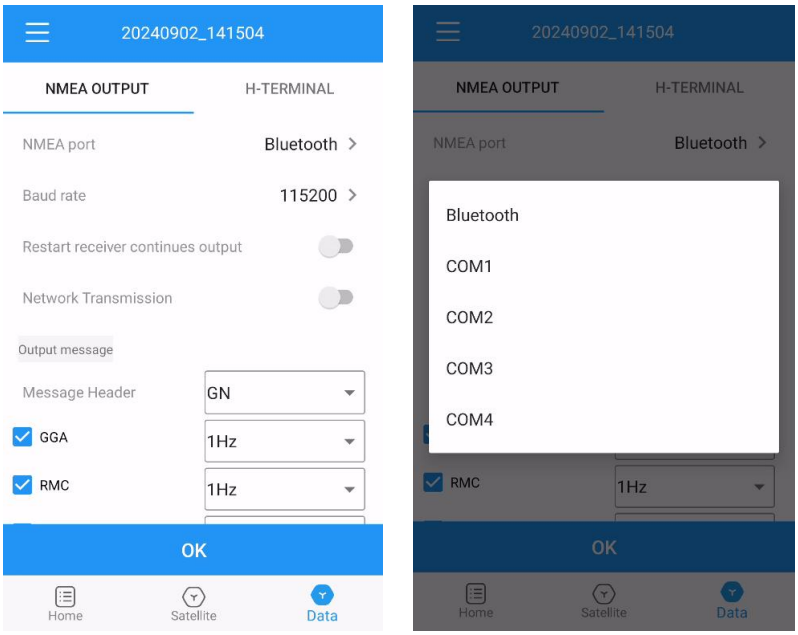
Sky view: GPS, BDS, GLONASS, GALILEO are checked by default, and if a certain type of satellite is blocked, then differential signals are no longer used in satellite solution.
SNR: Displays the current SNR value graph, the middle green line represents the best L1 value, and the red line represents the best L2 value.
List: The displayed contents include serial number, satellite, azimuth, altitude, L1/B1, L2/B2, L5/B3.



19.3 OEM board data

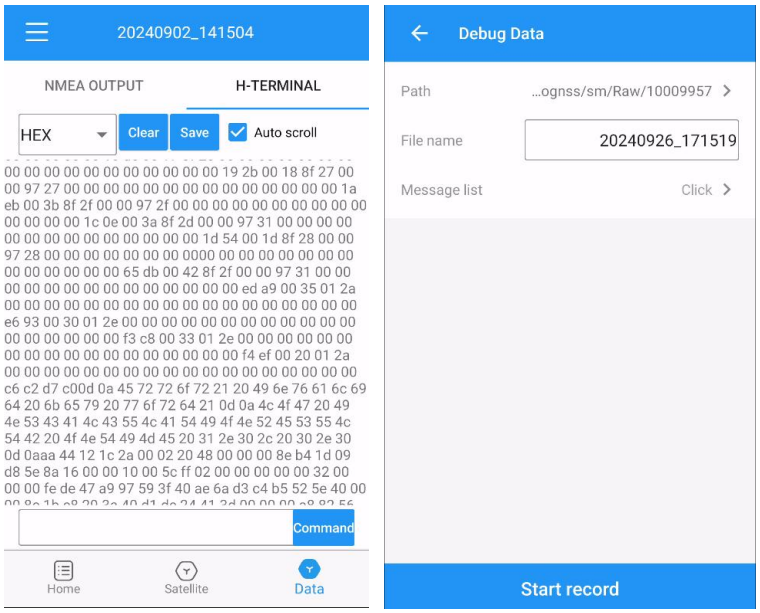
Go to ***Data***->***NMEA***,
1) Output port: default com1, Bluetooth can be selected.
2) Baud rate: default 115200, selectable from: 4800-115200.
3) Restart the receiver to output normally: Indicates that the output settings are saved, and the message is still output after restarting the receiver.
4) Output message: Select all to default to all messages, or select GPGGA, GPRMC, GPGLL, GPVTG, GPGRS….click “OK” to complete.
5) Data forwarding: Enable data forwarding, enter the server and port, and the current receiver message will be forwarded to the server.

Data->***Terminal***: Send commands to the board through the terminal to operate the receiver. When you send commands by inputting relevant commands, the command input has the function of automatic completion. (Whether the command is valid or not depends on whether the current connected hardware supports it).



Data->***Terminal***: Send commands to the board through the terminal to operate the receiver. When you send commands by inputting relevant commands, the command input has the function of automatic completion. (Whether the command is valid or not depends on whether the current connected hardware supports it).

Data->***Terminal***: Click the ***Clear*** button to clear the current interface; click the ***Pause*** button to stop the current interface scrolling; click ***Save*** to store the test data in the custom path. Click the command to pop up the command set, the first line is the new command set, and the rest are the defined command sets.



20 Foundation Stake

Baseline:Users draw a surface (or a line segment) on the map as the initial reference line of the foundation.When the baseline is a line segment, it represents a single slope.

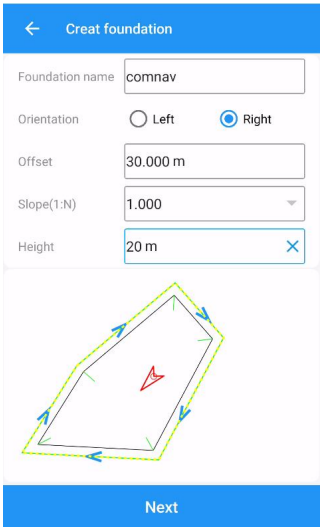
The foundation model is defined by the combination of the foundation reference surface and slope values.
Foundation reference surface: The surface/line formed after offsetting the baseline.
Auxiliary line: The dividing line between the two side slopes. The direction of the auxiliary line indicates the slope orientation.
Excavation line: The boundary line of the foundation reference surface.

Create Foundation

1. Click  to enter the Foundation store.

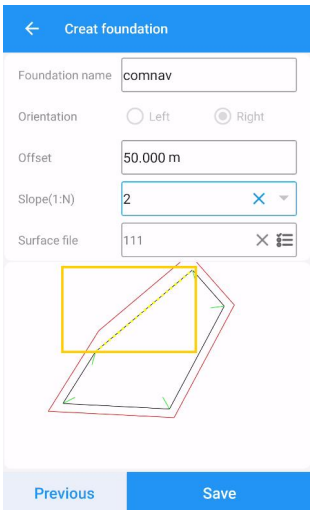
2. Click New to enter the Create Foundation store .

3. The first page is used to define the excavation shape.



(1) . Select a previously created polygon or line.
(2) . Enter the Foundation name, Offset, Slope, Height and Orientation.
(3) . Click Next

4. Enter the second page to edit the Foundation and adjust individual sides:



(1).Select any side of the offset boundary and modify its Offset and Slope.
(2). Select a surface file as the foundation top or bottom surface (optional).
(3) The Foundation name can be edited. The Orientation and Height cannot be edited;Click Previous to return to the previous page if changes are required.

5. After create, click Save to complete the foundation creation

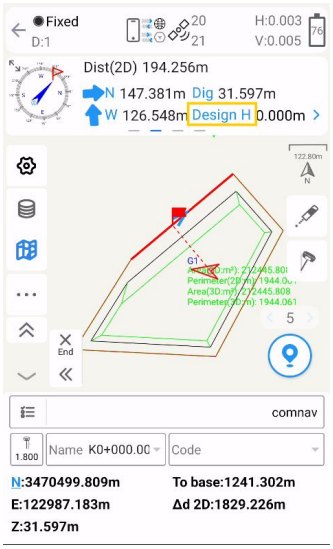
6. Return to the Foundation store, select the foundation, and click Confirm to view the newly created foundation.
(1).For foundations with a selected surface file, display cut/fill volume, area (2D), and area (3D).
(2).For foundations without a selected surface file, display only area (2D).
(3).If the baseline is a line segment, none of the above information is displayed.



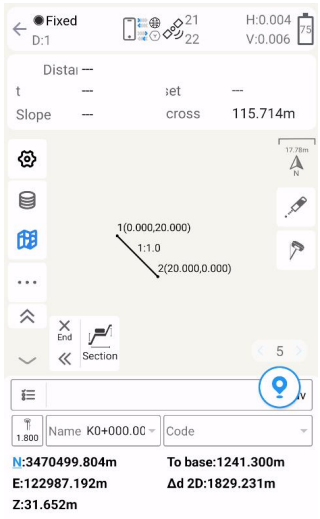
Stake Foundation

1.In the foundation Store, select a foundation and click Confirm to enter the stake interface. The foundation is set to Pending Stake status.

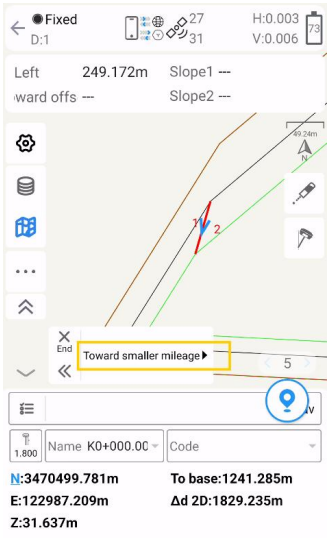
2.Click Baseline to perform line stake. Follow the stake guidance information to complete the operation.Click Design H to modify the design height value for stake.



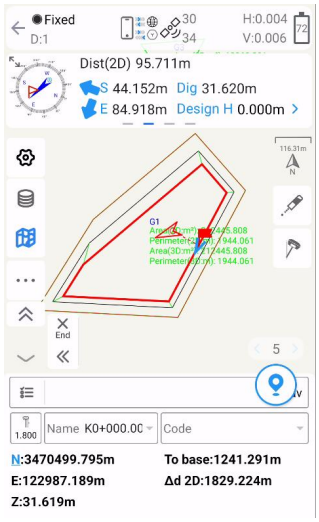
3.Click Foundation reference surface to stake the foundation slope. Follow the stake guidance information. Click Plan View / Section to switch views and check the relationship between the current position and the slope in plan or cross-section.



4.Click Auxiliary Line to stake the slope intersection position. Follow the stake guidance information. Slope 1 is the default direction of the auxiliary line toward the right slope; Slope 2 is toward the left slope.

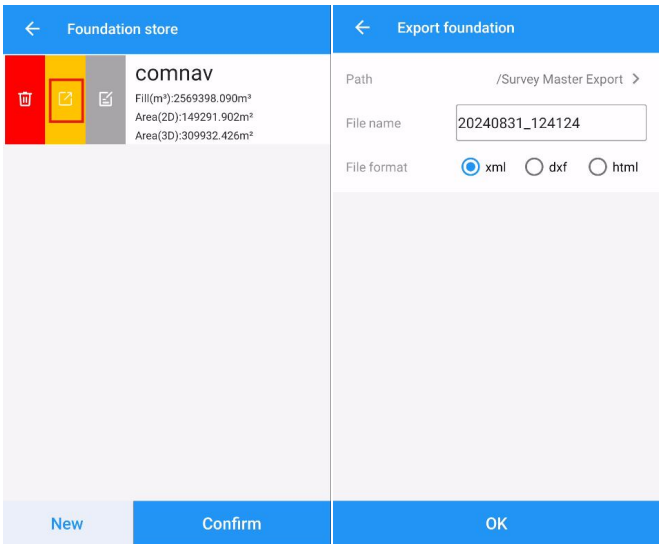


5.Click intersection line of surface file and slope surface to stake the foundation boundary. Follow the stakeout guidance information.



Export foundation

In the Foundation store, swipe left on a foundation and select Export.



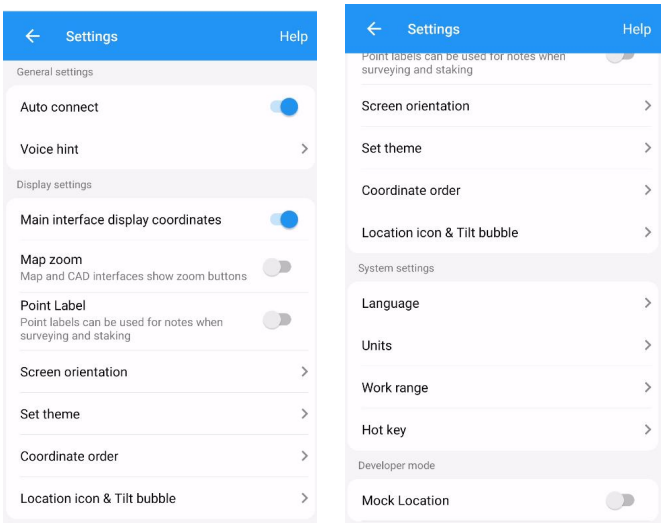
Select the export Path and File name. The default Path is " Survey Master Export ", and the default File name is the project name. Both can be modified manually.

Select the export format:
LandXML: Export the polygon formed by the baseline offset lines.
DXF: Export the top view of the foundation and surface file.
HTML: Exports a foundation report, including the TIN model, cut/fill volumes, 2D/3D area, calculation points, and other related information.

Click OK. When the message "Export Successful" appears, the foundation has been exported successfully.

21 Settings

Go to ***Project***->***Settings***,



- ***Auto connect***: It is used to connect automatically after the Bluetooth is disconnected, and when the software restarts, it will automatically connect to the last receiver mode.
- ***Voice hint***:The engine setting allows the user to choose a suitable voice engine. The voice broadcast is to broadcast the connected equipment and real-time differential status; the sound is to remind when the measurement accuracy of the stakeout does not meet the conditions or when the stakeout reaches the set range.
- ***Main interface display coordinates***:When clicking open, the main interface will display coordinate information; if you choose to close, there is no coordinate information in the main interface.
- ***Screen orientation***:Automatic,Horizontal screen,Vertical screen.
- ***Set theme***:You can switch to choose between minimalist and colourful styles, and the theme can be classic or simple.
- ***Coordinate order***: It can be switched from NE to EN and can be selected according to the user's need to display. After selection, the corresponding coordinate display mode will be displayed in the status bar of the main interface.
- ***Location icon&Tilt bubble***:Used to adjust the colour, shape and tilt bubble colour logo of the map location icon.
- ***Language***: support switching between Chinese, English, French, Turkish, Polish, etc.
- ***Units***: The length unit can be switched between meters or feet; the angle unit can be switched between degrees or degrees, minutes and seconds; there are five kinds of export precision, and the minimum export precision is five digits.
- ***Work range***:Shortcodes and CAD files can be applied globally (shortcodes are the common codes in the Measurement and Displacement screen, and CADs are the files in CAD Displacement).
- ***Hot Key***: You can set the volume key "+" or "-" as the measurement button, the previous point, and the next point.
- ***Mock location***: You can check or uncheck the simulated location. If you check the simulated location, you can view the simulated location information in the device (English version only), for more information, pls refer to Chapter 13.7.

Technical Assistance

If you have any question and cannot find the answer in this manual, please contact us from ComNav Technology Website: *www.comnavtech.com*
or technical support email: *support@comnavtech.com*
Your feedback about this manual will help us improve it with future revisions.