eField *User Guide*

Productivity is the priority

Revision 7.7.0.1

Updated December 2025

Easy to Fix, Easy to Master

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1 eField Overview

1.1 Software Description

Thanks for your interest in eField, it is the latest measuring software based on the Android platform and developed by EFIX Geomatics Co., Ltd.

The eField is a full-featured and intuitive field data collection App designed for high precision surveying, engineering, mapping, GIS data collection, road stakeout and pipeline surveying.

Make your work more efficient with App from field-to-finish!

Powerful Graphical Surveying: Supports both online OSM/BING/WMS/V-World/Geoportal/Naver/Google Image map and base map (DXF, DWG, SHP, TIFF, JPG, KML, KMZ, MBTILES, Jmties, WFSDB, Polyline file) while surveying. The powerful editing tools allow you to edit, snap, redraw or interrupt lines for the creation of polylines, polygons, and circles.

User Defined GIS Attributes: During data collection, users can customize attribute fields with media capture (pictures, videos, and voice). The unique multi-code function allows users to survey polylines and polygons simultaneously while sharing the data points to ensure project requirements are met.

Super Packed Road Function: Features include horizontal and vertical alignment, cross-sections with slopes and user defined structures. The enhanced data verification allows users to eliminate costly errors easily. Users can also both manually input or import designed road elements from LandXML files and select polyline from DXF files as the center line to stake out or survey the crossroad.

Easy Pipeline Survey: Makes it simple to survey underground pipelines using integrated data from both the GNSS receiver and the pipeline detector. Users can store high precision and high-quality pipeline coordinates with attributes for exporting into SHP/CSV files.

EFIX Cloud Service:

- Allows for uploading and downloading projects, coordinate systems, work modes, etc.
- Share or download projects, coordinate systems, points, base map, etc. by sharing code
- Remote Assistance Tool

Localization Packages: Allows users to dynamically update the following without updating software:

- Predefined coordinate system files.
- Device connection profile.
- Grid files.
- Online map database file.
- Coordinate system library file.
- Antenna file.
- Software help link files.
- Font files.

1.1. Key Features

Various Base Map Displays

- OSM, BING, Google Image, WMS, V-World, Naver, Geoportal online maps.
- DXF, DWG, SHP, JPG, TIFF, KML, KMZ, MBTILES offline maps

Extensive Import and Export Data Formats

- Import from DXF (including 3D DXF), DWG, SHP, KML, KMZ, JPG, CSV, DAT, XLSX, TXT, TIFF, MBTILES, WFSDB, Polyline file, Jmtiles, Carlson CRD/CRDB and Load from an existing project.
- Export to DWG, DXF, SHP, KML, KMZ, RAW, HTML, CSV, DAT, TXT, XLSX formats, Detailed result, survey reports in HTML and CSV, Point stakeout report, Hydro survey report, Polish, MosGorGeo-Raw, Measurement report, Area report, Slovenia report(.html), Verified survey report, Star*Net report(.dat), Star*Net report (. GPS), Trimble JXL(.jxl), MicroStation format(.txt).
- Customized import and export contents in CSV, DAT, or TXT formats.

Various Types of Measurement

- Supports static, RTK and PPK measurement.
- Five methods of point measurement, including topographic point, control point, quick point, continuous point and offset point.
- Simultaneous PPK and RTK measurement using topographic point or continuous point.

Convenient Work Mode Management

- Presetting common work modes of base and rover, selecting, or switching work modes by one button.
- Convenient to work in PPK based on real-time kinematic (RTK) mode and static mode can be set at the same time.

Various Peripherals Supported

- Pipeline detector, VIVAX-METROTECH vLocPro2.
- Laser rangefinder, Leica Disto 810 touch, Disto 510 touch, and SNDWay SW-S120C, Bosch GLM 50 C, Bosch GLM 120 C.

Standard CGD Correction File

- EFIX own CGD file for grid/geoid correction. Datum grid, plane grid and height geoid files are integrated in one CGD file, and each CGD file name is corresponding to the coordinate system.
- Multiple grid formats are available, GGF, BIN, GRT DAT, DATCZ, GRD, GSF, GRI, STG, GBL, GXY, OSGB, CGD, JASC, GSA, GSB, BYN, GTX, NEGRID, TXT and ASC formats.

User-friendly Stakeout Interface

- Two modes for stakeout, map mode shows the current position and target position, compass mode shows the target direction.
- Users can set North, Sun or point as a reference direction.

Multiple Types of Stakeout

- Point and line stakeout by snapping feature point on DXF base map or survey point.
- Surface and road stakeout.

Correction Repeater Function

- Easily repeating correction data from RTK network or radio mode to other rovers via radio.

RTCM Transformation Message

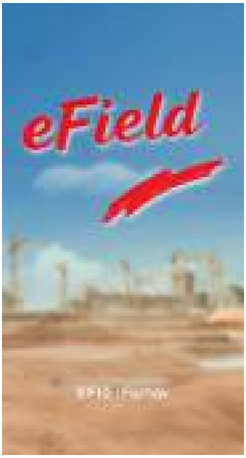
- Using RTCM transformation messages (1021-1027) for datum transformation, projection, automated grid position and geoid adjustments.

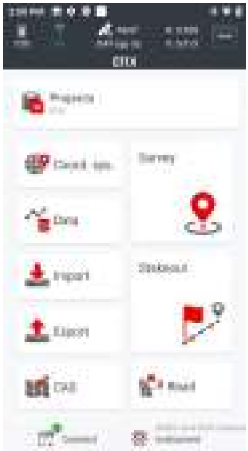
Base Map rotates

- The base map rotates with the direction of the PDA during the surveying process.

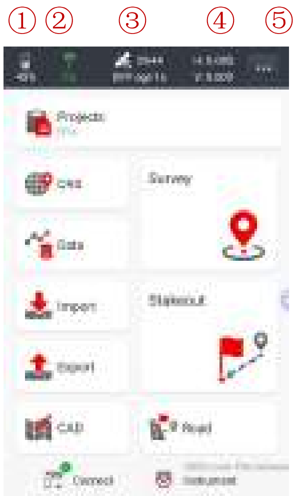
1.2. Software Interface

Startup Interface: Install at the first time and run the software can directly into the main interface.





In the Main **interface,** there are some common functions. Customers can click more to view all menus.



Status Bar:

① This icon shows receiver battery.

② This icon will change to different colors while the receiver is getting different solutions. Red means single status, yellow means float status, and green means fixed status. It can lead users to the Instrument **info** interface.

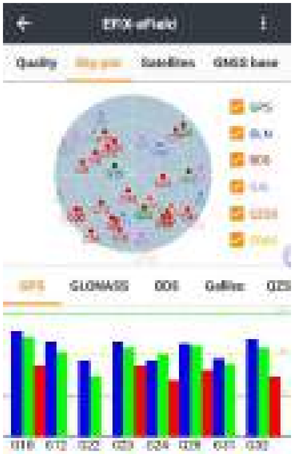
③ This icon shows satellites numbers (N/A), A represents the total number of received satellites, and N represents the number of used satellites. DIFF age means the correction date delay time. It can lead users to **Sky plot** interface.

④ The texts will show current precision, H means horizontal accuracy, V means elevation accuracy, RMS means the relative error. It also can lead users to **Quality** interface. This accuracy is estimated by the receiver, the real accuracy please refer to the known coordinates.

⑤ The icon will expand more functions.

Instrument Info: Support to view detail of the current device as shown below.

Sky plot: Support to view the current sky plot. Users can see the reference position information of each satellite in the current sky plot, and the SNR (L1, L2) which uses bidirectional histogram for display is at the bottom of the sky plot.



Satellites: Support to view the current number of satellites which have been searched, constellation, L1\L2\L5 SNR, elevation angle, azimuth, and locked status.

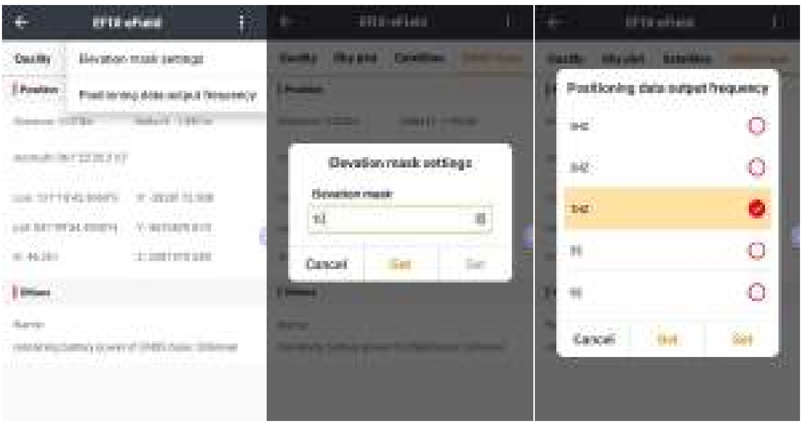
Current position: Support to view GPS time, solution status (single, float or fixed), the differential age and the current position in WGS84. Users can change coordinate type in the drop-down list (including Local N/E/H, Local Lat/Lon/H, Local X/Y/Z, WGS84 Lat/Lon/H, and WGS84 X/Y/Z).

Accuracy: Support to view horizontal precision (H), vertical precision (V) and root mean square error (RMS).

DOPs: Support to view spatial dilution of precision which suggests current satellites searching status, including PDOP, HDOP, VDOP, TDOP and GDOP.

GNSS base: Support to view GNSS base status, coordinates, and the distance to the base station.

More: Click the button on the top-right corner of the interface, the elevation mask and data output frequency setting will show here. Choose Elevation mask setting to set the value and choose Positioning data output frequency to set the RTK update rate.



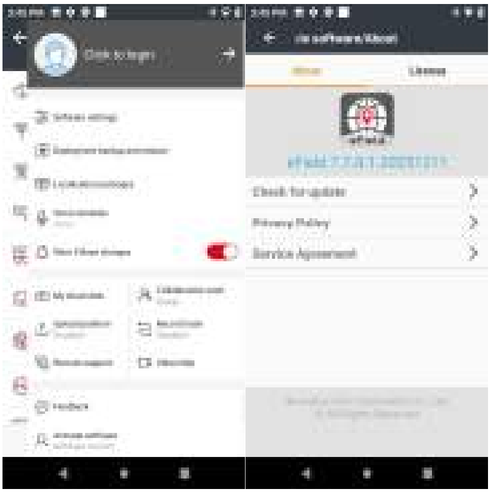
1.3. Software Installation

1.3.1. Install manually

Copy the software (eField.apk) onto Android devices, touch screen to start the installation program. After installation, it will generate the eField app on the desktop, click the icon to run the software. Please get the eField apk file from EFIX local dealers.

1.3.2. Auto update

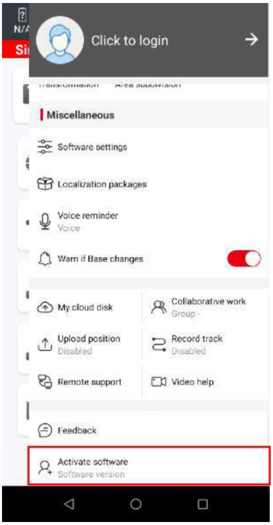
Click **Activate software** and **check for update** to update to the latest version of eField.

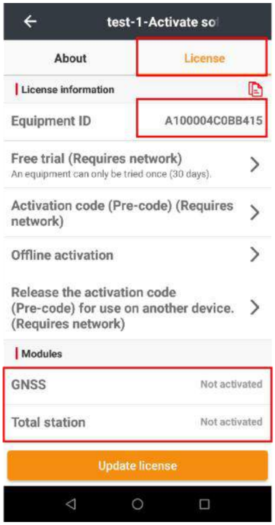


1.4. Register eField

Note: If the software is not registered, please contact regional sales representative.

Enter the **Slide menu** interface and click **Activate software. Users** will see Software version information, click **License**, then users will see Registration information.



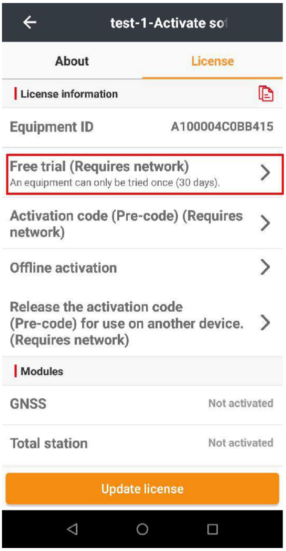


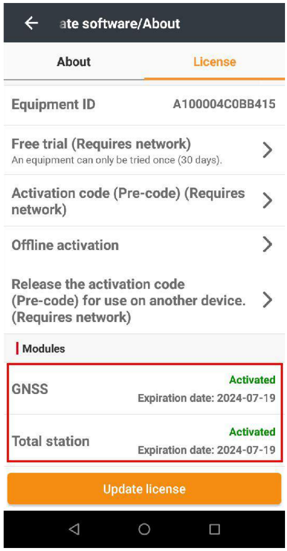
Whether using the FC2 controller or other devices, there will be an Equipment ID, which will be an important part of our query for this device pre-code.

The GNSS function and total station function are independent and can be registered separately.

1.4.1. Free trial (Requires network)

Each device has a Free trial function. If there is an Internet, click Free trial, the software will be registered for 30 days, including GNSS and Total station functions.



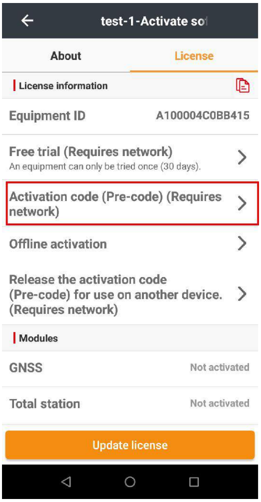


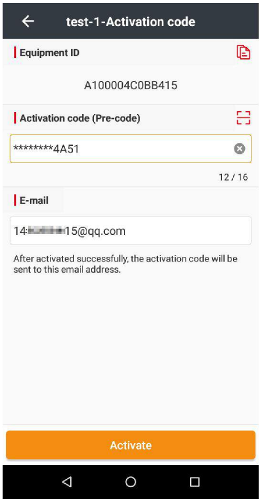
If you still need to use eField after using the free registration, please contact the regional sales manager or dealer to obtain a temporary or permanent registration code. For the registration method, see section 1.5.2 and 1.5.3.

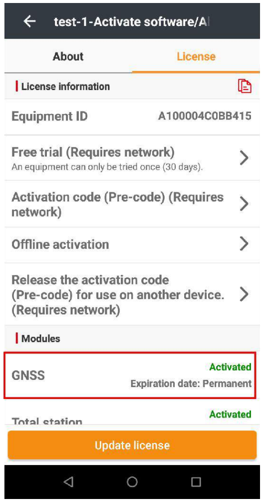
1.4.2. Online Activation

1. Activation code (Pre-code)

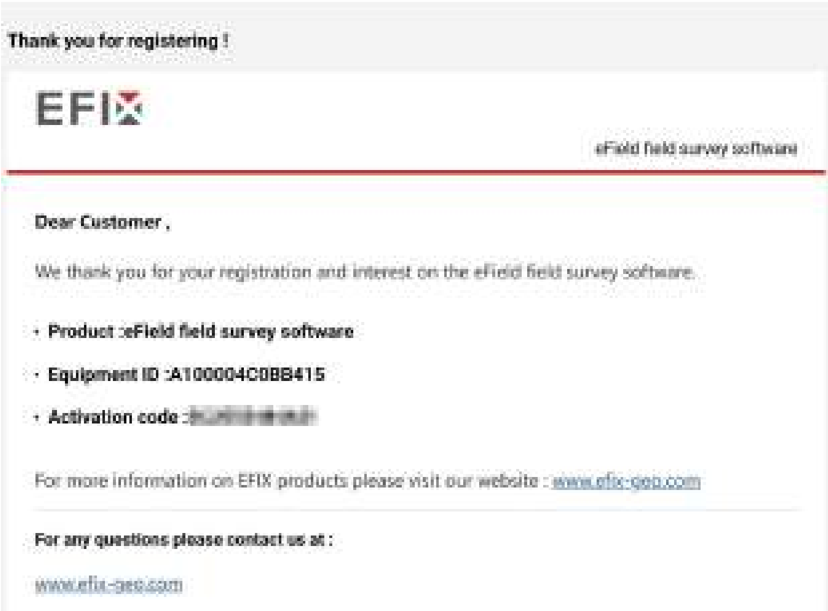
Open the registration interface, click **Activation code (Pre-code)**, enter the existing **pre-code** and **E-mail**, click **Activate**, when users submit the application successfully, it will prompt "Activated successfully".







Note: Please input your true e-mail address, because we will send a "Bind activation code" mail to this e-mail address. Users can view the bound Equipment ID and pre-code in the email, **but do not need to activate it again**.


Thank you for registering !

EFIX

eField field survey software

Dear Customer ,

We thank you for your registration and interest on the eField field survey software.

- **Product :eField field survey software**
- **Equipment ID :A100004C0BB415**
- **Activation code :**

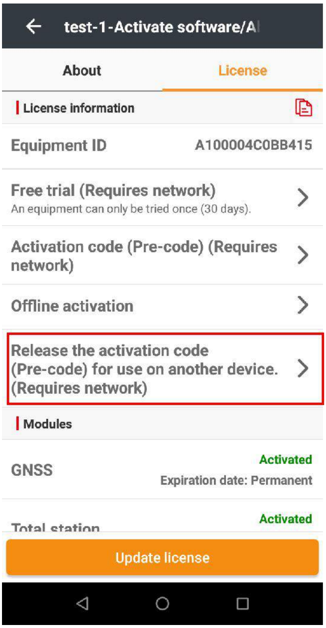
For more information on EFIX products please visit our website : www.efix-geo.com

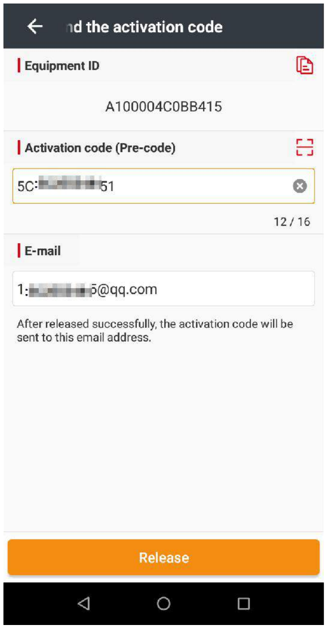
For any questions please contact us at :

www.efix-geo.com

2. Release the activation code (Pre-code) for use on another device

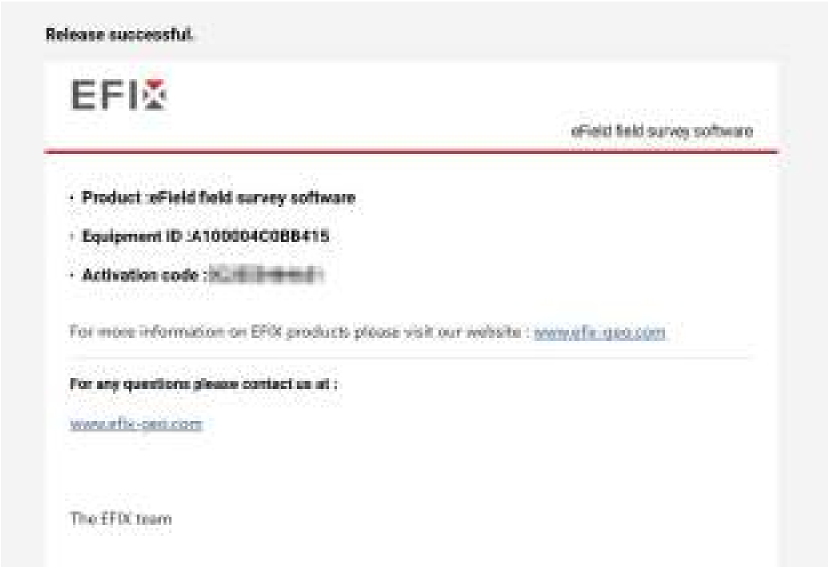
When the user needs to unbind the pre-code bound to use on another device, click **Release the activation code (Pre-code),** enter the pre-code and the same E-mail again, and click **Release,** the pre-code is successfully unbound when the message **"Successfully Released**" is displayed.





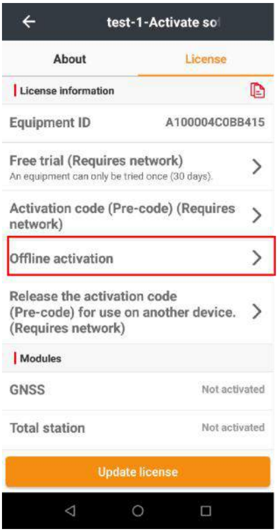
Then, users will find the current device becomes unregistered, and users will receive the email "Release activation code" in the corresponding email. It means you can use the pre-code on another device now.

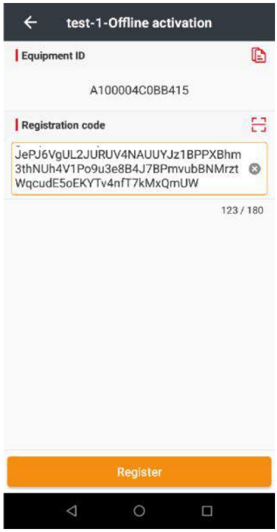
Note: Each permanent code can only be activated five times.



1.4.3. Offline Activation

Offline Activation supports the registration of temporary or per-code in offline state. Click Offline Activation, enter the registration code or click the QR code icon to scan the QR code to get the registration status.



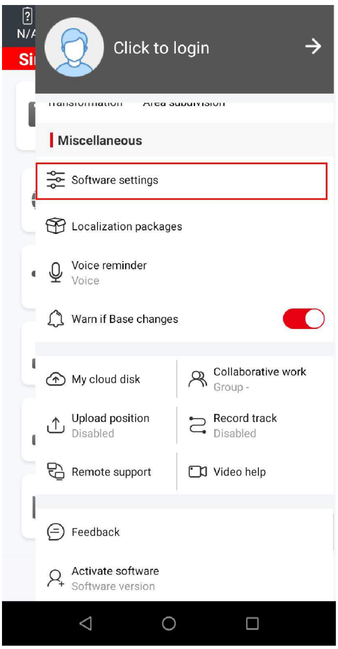


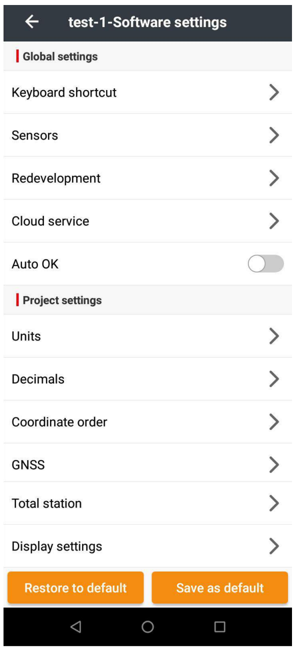
2. eField System settings

From the **Main** menu, click on the **Side bar** button in the upper-right corner. This shortcut button allows quick access to **System settings** from any of the other main menu tabs.

2.1. Software settings

This function is to do some common settings for the software. Click on **Software settings**. The device settings menu is shown:





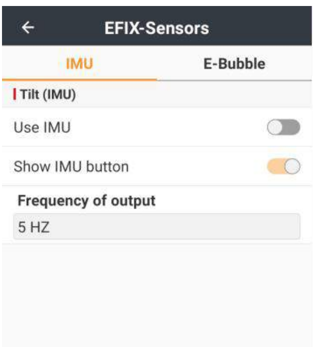
Each of these setting items is described below.

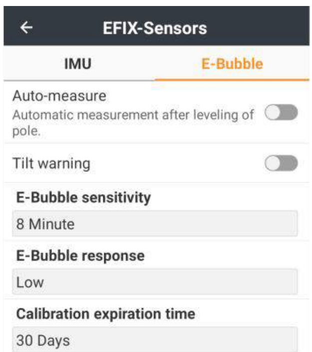
2.1.1. Keyboard shortcut

The user can set different keyboard buttons for **Surveying**, moving to **previous point** or **next point**. The buttons include **NONE**, **Enter\OK**, **Up**, **Down**, **Left** and **Right**.

2.1.2. Sensors

The IMU and E-Bubble can be set up.





2.1.3. Redevelopment

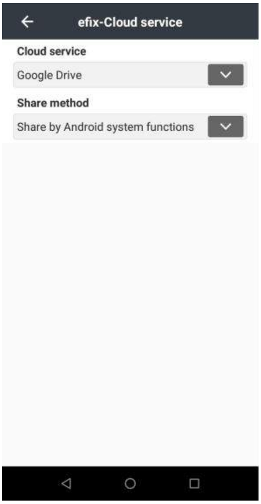
Redevelopment is a way to get coordinates provided by eField software, which mainly has three ways: Pass real-time coordinates via Android broadcast message, Pass real-time coordinates via txt files, and Pass real-time coordinates via QR code, and you can choose the corresponding way to receive coordinates according to the scenarios that do not meet your needs.

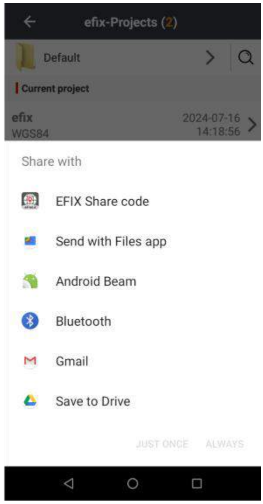
2.1.4. Cloud service

Cloud is the login interface of Cloud service. Users can upload or download projects, coordinate systems, work modes, etc. Users should ask the local dealer or sales manager for obtaining an account and password to use Cloud.

There are two cloud services for sharing files: EFIX Cloud and Google Drive. EFIX Cloud can choose to **share by Android system functions** or **share by sharing code**, while Google

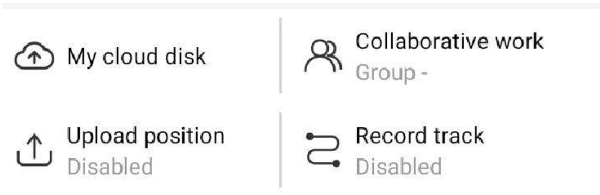
Drive can only **share by Android system functions**. When the user chooses to use Android system functions, other third-party apps on the controller are called when sharing files.



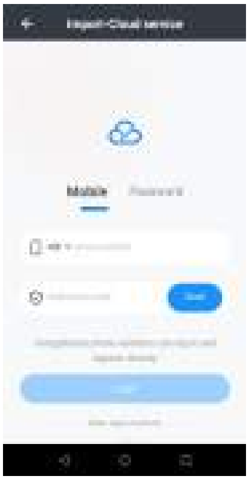


2.1.4.1. EFIX Cloud login

If eField is not currently logged into the EFIX Cloud, clicking on any collaborative function:



It will force a login to the cloud service:



2.1.4.2. Google Drive

Click Google Drive:

Click Sign in with Google, enter the Google Cloud Services account:

Google Cloud mainly provides cloud service related functions, including upload, download:

[Upload]: the data in the software is uploaded to the server.

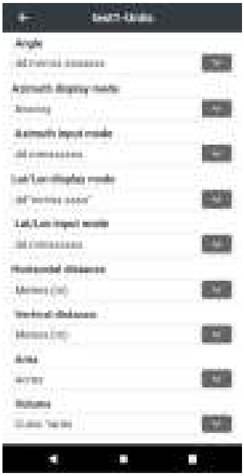
[**Download]**: Download data from the server.

2.1.5. Auto OK/Accept

Enable **Auto OK/Accept** to save hundreds of keystrokes as you use eField. If you meet difficulties with accidental tapping, try disabling **Auto OK/Accept**.

2.1.6. Units

Controls the display, accepted input and units used in eField:



Angle

Sets the display of Angle values:

Azimuth display mode

Set the method for directional display. When set to **Bearing** allows the use of **Quadrant** bearings.

Set to **Bearing** = Quadrant **Bearings** (USA and Canada); **Normal** = **Azimuth**.

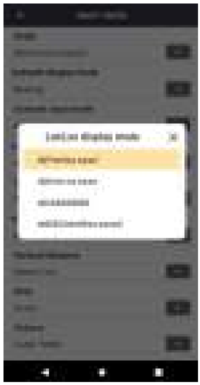
Azimuth input mode

Set the method for directional inputs:

If Azimuth display mode = Bearing, then also accepts Quadrant shortcuts.

Lat/Lon display mode

Set the method for display of Latitude and Longitude:



Lat/Lon input mode

Determines the required entry type for Latitude and Longitude:

Use **dd.mmssssss** (USA), **dd: mm: ss.ssss** requires the inclusion of ':' separators.

Horizontal Distance

Sets the default units for horizontal distance measurements:

Vertical Distance

Sets the default units for vertical distance measurements.

Area unit

Sets the default units for area measurements:

Volume unit

Sets the default units for volume measurements:

Note: the difference between cubic International Feet and cubic US Feet is very small:

10,000.000 cubic Meters

= 353.144.55 cubic USFeet

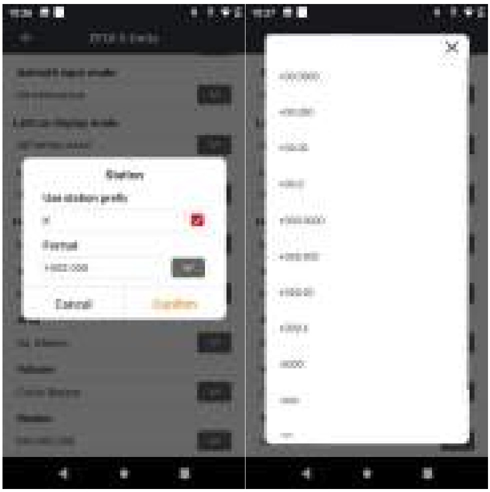
= 13,079.428 cubic USYards

= 353,146.67 cubic iFeet

= 13,079.506 cubic yards

Station

Sets the default display for alignment stationing:

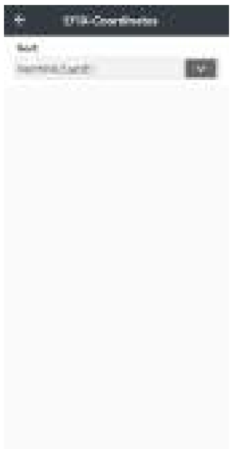


2.1.7. Decimals

Users can set the display precision of **Angle**, **Horizontal distance**, **Vertical distance**, **Area**, **Slope** (%) and **Lat/lon** (dd: mm: ss.sssss) from the respective pull-down menu. And the unit of **Area** is according to **Horizontal distance**. For example, here 4 means four decimal places.

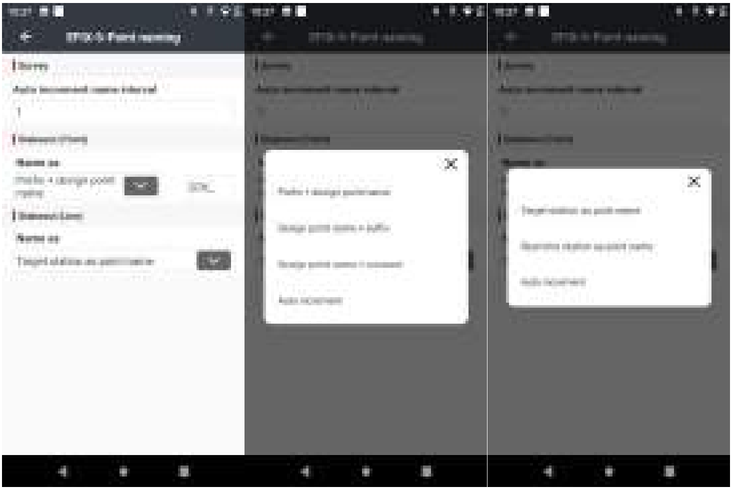
2.1.8. Coordinate order

Users can choose coordinates format between North, East and East, North



2.1.9. Point naming

Users can set the **Auto increment name interval** when surveying, and choose **the name in different formats** when using Point stakeout and Line stakeout.



2.1.10. GNSS

These GNSS settings are also accessible from most of the survey menus by clicking the Setup button. There are separate settings for Topographic point survey, Continuous survey, Control point survey and Verified survey.

The available tabs are dependent on the survey method from where Settings is launched from. Settings are organized on tabs.

2.1.10.1. Survey

2.1.10.1.1. Topographic point survey settings

Topographic points are non-critical GNSS measurements. Typically, speed of acquisition is favored over several long averages with intervening receiver resets that would be measured with the Control or Verified survey methods.

EField has five topographic modes: Topographic, Quick **topographic,**
Control, Continuous and **Tree survey-offset** controlled by the Survey type button on the survey screen.

Horizontal tolerance (HRMS): the highest receiver reported HRMS that is allowed to be stored without user override.

Vertical tolerance (VRMS): the highest receiver reported VRMS that is allowed to be stored without user override.

Diff age: the longest allowed correction latency allowed. Normally the latency will be 1 or 2 seconds for UHF and network servers. Values higher than 10 indicate that the communication link is down.

MAX PDOP: the highest allowed PDOP. Usually PDOP's are less than 2.5, PDOP higher than 3 is worrisome.

Minimum Used SV's: Minimum allowed SV's. Default is 4.

Store fixed solutions only: only allow FIXED RTK solutions. Reject FLOAT, SINGLE and RTD solutions.

Measurements: sets the measurement averaging time in seconds. Typically, 5-seconds for **Topographic** mode and 1-second for **Quick** mode.

Pole stability warning: while measurements epochs are collected, if the horizontal range of measurements exceeds this **Pole movement tolerance (Default is 00.1m)**, the user will be given a warning and the opportunity to escape and not store the measurement.

Confirm before saving: a measurement summary will be shown at the conclusion of averaging. The user can confirm and store or escape without storing the measurement.

Measure when level: If the point coordinate moves within a distance of **Max.movement antenna** after the **Stop time**, the point coordinate is automatically saved. The default setting is to move no more than 00.01m after 2s of stability.

Users can open "**Quick code"** or not and modify the **Quick code pages.**

2.1.10.1.2. Continuous survey settings

Continuous surveying stores measurements continuously based on time interval or distance traveled. This can be useful for storing the center line of a road from a moving vehicle.

Store fixed solutions only: only allow FIXED RTK solutions. Reject FLOAT, SINGLE and RTD solutions.

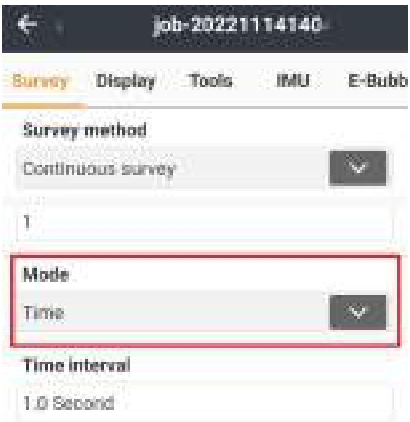
Mode: It can be measured continuously by **time**, **Distance 2D,** and **Distance 3D, Distance 2D or delta H.**

Time: time interval in seconds.

Distance 2D: Horizontal distance of travel.

Distance 3D: 3D distance of travel.

Distance 2D or delta H: 2D horizontal or delta H triggers.



2.1.10.1.3. Control point survey settings

The **Control point survey** takes repeated measurements, averages, resets the receiver between groups, waiting for a new fixed solution. If HRMS/VRMS and group range tolerances are not met, the control survey waits for better conditions.

Number of passing measurements: measurement groups will continue to be collected until this number of groups passes all tolerance settings.

Points per measurement group: the number of multi-epoch averaged points per group.

Number of epochs per point: the number of epochs averaged to make a point in the group.

Per point horizontal range tolerance: the horizontal range of pre point must be less than this tolerance.

Per point vertical range tolerance: the vertical range of pre points must be less than this tolerance.

Group horizontal range tolerance: the horizontal range of multi-epoch points in a group must be less than this tolerance.

Group vertical range tolerance: the vertical range of multi-epoch points in a group must be less than this tolerance.

Epoch maximum Hrms: the receiver reported HRMS must be less than this tolerance for epochs to be accumulated.

Epoch maximum Vrms: the receiver reported VRMS must be less than this tolerance for epochs to be accumulated.

Wait after fixed: the receiver's OEM engine will be reset between each group. The survey will wait for the receiver to fix, plus this additional time for the receiver to settle down. A minimum of 15 seconds is recommended.

Max PDOP: epochs will not be stored if this PDOP is exceeded. Normal PDOP's are less than 2.5, so a setting of 3 may be reasonable.

The control point survey is intended to be used in open canopy on important points. A tripod or bipod **must** be used for a control survey as the measurement acquisition will not finish if the receiver moves during the relatively long acquisition period.

2.1.10.1.4. Quick topographic point survey settings

The Quick mode shares tolerance settings with the Topographic mode, except for the Measurements time..

2.1.10.1.5. Tree survey settings

The settings can directly perform the Tree survey in one step. The parameter Settings are consistent with the Topographic points.

2.1.10.1.6. Laser survey settings

Now only the F8L receiver supports Laser survey.

The settings can directly perform the Laser survey. And users can switch the laser survey mode between **Rapid** and **High accuracy**.

2.1.10.1.7. Common GNSS Survey settings

All the GNSS survey methods share these additional settings.

Log PPK data: write Time Tagging data (the point name) into the static observation file that is being recorded in the receiver's memory.

Show E-Bubble enables the E-Bubble on the display screen. This is only applicable to receivers with an e-Bubble or an IMU.

Automatic photographing: Enabling this option will Automatically take photos by dual cameras after the measurement is complete. See Section 4.6 for details.

2.1.10.2. Stakeout

- Store

Users can decide whether to use "Display **point name, code input box"**.

- Tolerance

Users can modify **"Stakeout tolerance 1, 2, and 3"** respectively. Three different tolerances are available to be set with different degree of urgency sound prompts. The smaller the number is, the smaller the tolerance shall be set.

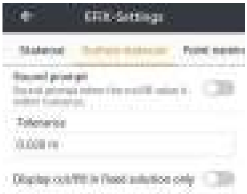
- Miscellaneous

Users can decide to respectively open **"Auto Zoom" , "Use PDA compass" , "Remove staked points from point list after staking" , "Previous/Next skip staked points" , "Stakeout survey points" , "Search the nearest point from the stakeout list only"** and **"Measure when meet tolerance"** or not. When opening "**Use PDA compass"**, please do as the pop-up window says.

2.1.10.3. Surface stakeout

Users can open "**Sound prompt"** to give a sound prompt when the fill/cut is within tolerance.

User can open "**Display cut/fill in fixed solution only"** to only display the value in fixed solution.



2.1.10.4. Road

Users can open "**Display all roads"** or not.

Users can open "**Stakeout centerline node points and design features"** or not.

If users open "**Real time station as a point name"**, the real time station is input as a point name.

If users open "**Target station as a point name"**, users should enter station as a point name.

Users can modify "**Along offset tolerance of cross-section"** , "**Length of cross-section reference axis"** and "**Road thickness"**.

If users close "**From smaller to larger chainage"** , please stakeout from larger chainage to smaller, otherwise from smaller to larger.

Users can choose "**Station calculation method"** between "**Smaller station"** and "**Larger station"**. This function will be used when the software is calculating the mileage from the current receiver position. If the current position has two mileages on the road, display the smaller/larger station.

2.1.10.5. Cross-section survey

Users can open "**Force cross-section at centerline vertexes"** or not.

Users can modify "**Station interval"**, "**Station tolerance of cross-section"** "**Left length of cross-section"** "**Right length of cross-section"** "**Midpoint tolerance of cross-section"**.

If users open "**Real time station as a point name"**, the real-time station is input as a point name.

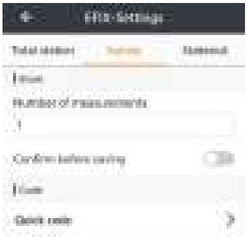
If users open "**Target station as a point name"**, the target station is input as a point name.

2.1.11. Total Station

2.1.11.1. Total station

Users can modify "**Horizontal angle"** "**Vertical angle"** "**Distance"** and "**Elevation"**. The Total station calculates the deviations from the second measurement with the first one. If the deviations exceed the limit, a warning will appear.

2.1.11.2. Survey



Users can modify "**Number of measurements"**.

"**Confirm before saving"** can be closed or open.

Users can choose to "**Quick codes"** or not.

2.1.11.3. Stakeout

"**Display point name, code input box"** can be closed or open.

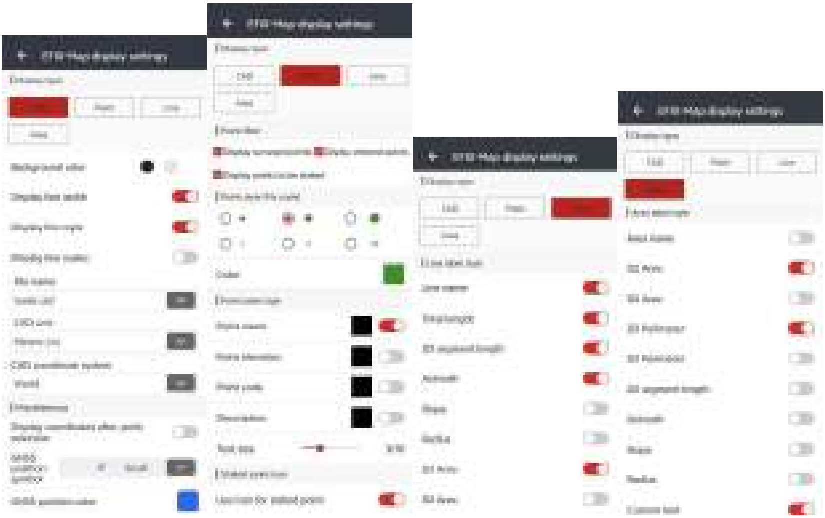
Users can modify "**Distance tolerance"** and "**Elevation tolerance"**.

Users can choose "**Reference TS"** between "**Total station"** and "**Target"**.

Use auto description: controls automatically populated descriptions for staked points.

2.1.12. Map Display settings

These settings are found under "**Map Display settings**":



The **background color** can also be changed to black or white.

Users can choose to open "Display line width" "Display line style" "Display line nodes" or not.

Different layers can be created, and you can choose to display different types of points and change the display of labels.

In eField software, points, lines and surfaces can be displayed and set in layers, including information such as name, length and area. The specific content is shown in the above pictures.

2.1.13. Snap settings

Snap Settings: enable snap modes for picking points, lines, centers. These snaps are used in CAD, storing and staking points from survey menus:

Node: snap to a point.
Endpoint: snap to the end of a line or vertices of a polyline.
Midpoint: snap to the middle of a line segment.
Center: snap to the center of a circle.
Intersection: snap to the intersection of two lines.
Nearest: snap to the nearest point on a line.
Perpendicular: The point at a 90-degree angle.
Quadrant: snap quadrant points.
Tangent point: snap tangent points.
Any: allows snapping to an open location anywhere on the map.

The  tool is useful for picking with the **Any** snap. Click-and-hold on the tool to quickly modify the **Snap**

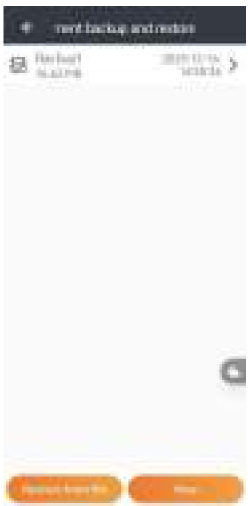
settings. We can also modify the color of the capture arrow.

2.2. Deployment backup and restore

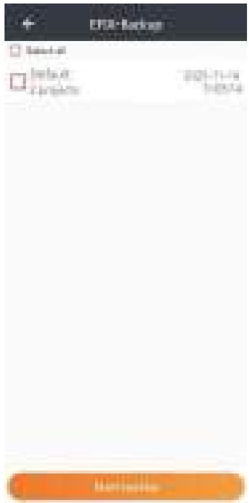
Deployment backup archives all the project groups, projects, all the settings, all Device profiles, menu items positions, all Import and Export profiles, all the GEOIDS, all defaults, all map tiles, all pictures, all the Visual survey jobs, **everything** … to a single compressed file.

This single file can then be moved to a different device and restored.

Click on **Deployment backup and restore**. The **Backup list** of existing deployment backups will be shown:

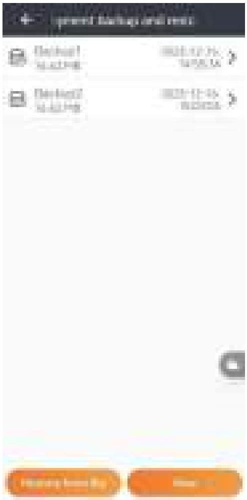


Click New to build a new backup: Give the backup a descriptive **Name**, choose to **Backup application settings**, choose to **Backup projects**, then click **Next**

Check all of the **Project groups** to backup or **Select all** to include all **Project** groups. Finally click **Start backup**:

Depending on the size of the projects, the compression could take a long time (over five minutes.) After the backup completes, it will be listed in the **Backup list**:



Slide the backup entry to the right:

to reveal: Delete, Properties, Cloud, Share, Restore.

If the file to restore is not in the expected location (typically it will be in Download), use the **Restore from file** button to open the backup.

When the backup is complete, the resulting file will be placed in the folder: .\Internal shared storage\system_prj_backup.

The file will have an .zip extension, however it is a standard ZIP compressed file.

[delete]: The backup files on the page are deleted, and the files in the backup directory are deleted

[Properties]: View backup file information. The information cannot be modified

[Upload to the cloud disk]: The software backup file is uploaded to the cloud disk

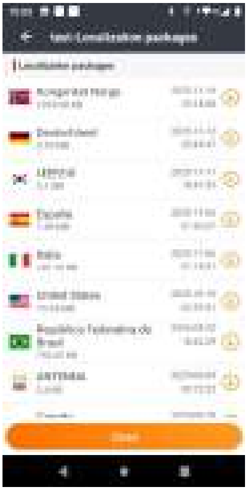
[Share]: Share through third party APP, share through share code

[Restore]: Restore software Settings and projects in backup files

Click on the generated backup file and swipe right to delete or share it.

2.3. Localization packages

Users can download localization packages as needed.



2.4. Audio prompt

Voice reminder for events like **Fix**, **Float**, **Autonomous**, **Connection**, **Disconnection**, **Receiving NTRIP data** can be disabled, announced with a Ding or Voiced:

2.5. Warn if Base changes

Enable to issue a warning if the broadcast position of the current Base changes. This can happen if there are two bases on the same UHF frequency, or if the network generates a new base after a GNSS rover makes a substantial location change.

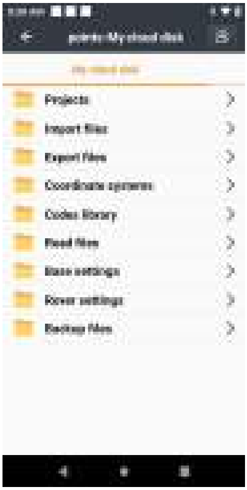
2.6. My Cloud Disk

2.6.1. Collaborative functions in eField

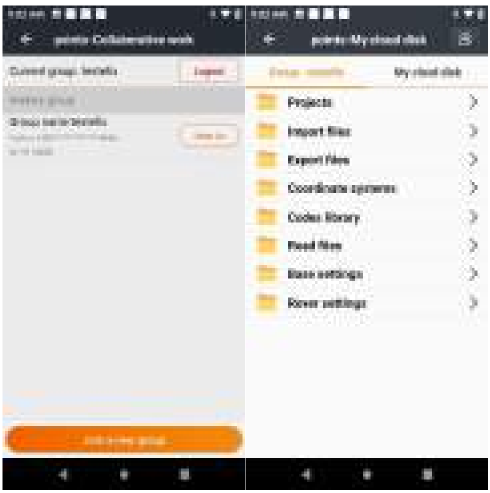
The **EFIX Cloud** is a cloud-based, collaborative work group and storage function. Operation relies on communication with a selectable server based in Europe or Asia. The services are SSL encrypted; however, unencrypted files are stored on the endpoint servers. For this reason, cloud services may not be suitable for confidential work.

2.6.2. Storage

The following predefined storage locations are available from the EFIX Cloud:

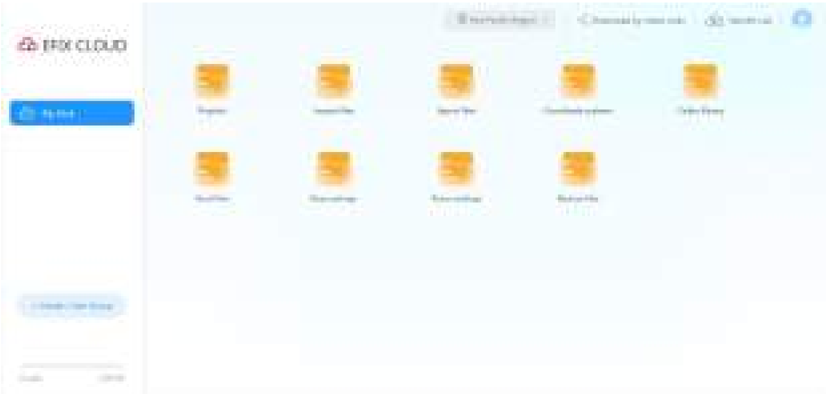


And click the group button, join in the corresponding group, and view the group data.



2.6.3. Web interface to EFIX Cloud

Login to the EFIX Cloud web interface for access to files from a desktop:
https://auth-ap.efix-geo.com/login?client_id=049de2b6e0a6&client_code=cloud-survey-client&redirect=https%3A%2F%2Fcloud.efix-geo.com



2.7. Collaborative work

Once logged into the cloud, **eField Workgroups** can be created or joined.

Workgroups share a common file repository where Projects, Imported files, Exported files, custom Coordinate systems, Code libraries, Roading files, and Base / Rover configuration files can be stored and shared.

Workgroups are assigned a unique **Group ID** by the server when they are created and are protected by a Password:

2.8. Upload position to eField Cloud

Uploads GNSS position **By Distance** or **By Time** to the eField Cloud:

The uploaded position can be viewed in real-time via the web interface. eField must be logged into the EFIX Cloud to use this functionality.

2.9. Record track

Enable to continuously record the GNSS position to the local device:

. CSV file named with the year, month, day, hour, minute:

YYYY-MM-DD HH-MM-SS.csv is created in the project folder:

/storage/emulated/0/EField/Projects/_projectname_/ Each line entry includes:

No., latitude, longitude, H, East, North, elevation, time.

The first line of the file includes a header description of the file contents.

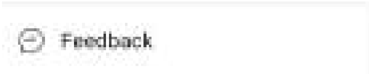
2.10. Video Help

In some regional markets, extensive recorded video collections are available for context video help.

2.11. Remote support

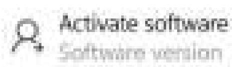
Allows access to the built-in remote support application. Please contact support for remote assistance.

2.12. Feedback



Click on Feedback to send suggestions directly to the eField developers:

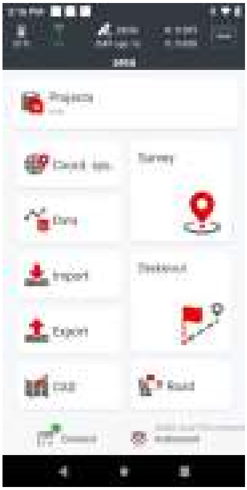
2.13. Activate software / About



Displays the current software version and allows access to the licensing activation and transfer tools.

See **Section 1.5** for registration methods.

2.14. Interface



Status Bar:

This icon shows receiver battery.

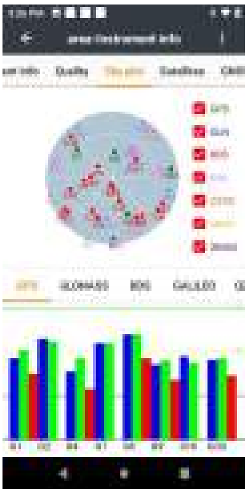

This icon will change to different colors while the receiver is getting different solutions. Red means single status, yellow means float status, and green means fixed status. It can lead users to **Position** and **Precision** interface.

This icon shows satellites numbers (N/A), A represents the total number of received satellites, and N represents the number of effective solver satellites. It can lead users to **Skyplot** interface.

The texts will show current precision, H means horizontal accuracy, V means elevation accuracy, RMS means the relative error. It also can lead users to **Position and Precision** interface. This accuracy is estimated by the receiver, the real accuracy please refer to the known coordinates.

area This icon represents the name of the project, making it more intuitive to see which project it is currently

Skyplot: Support to view the current skyplot. Users can see the reference position information and SNR of L1, L2, and L5 of each satellite in the current skyplot.



Satellites List: Support to view the current number of satellites which have been searched, constellation, L1\L2\L5 SNR, elevation angle, azimuth, and locked status.

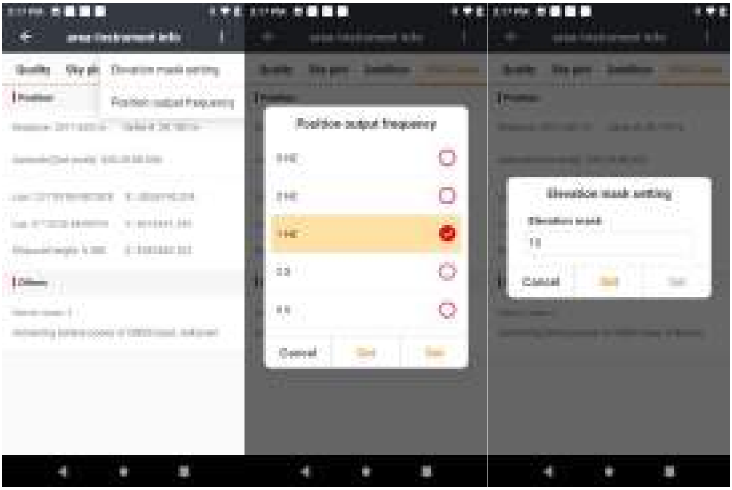
Position: Support to view GPS time, solution status (single, float or fixed), the differential age and the current position in WGS84. Users can change coordinate type in the drop-down list (including Local N/E/H, Local Lat/Lon/H, Local X/Y/Z, WGS84 Lat/Lon/H, and WGS84 X/Y/Z).

Precision: Support to view horizontal precision (H), vertical precision (V) and root mean square error (RMS).

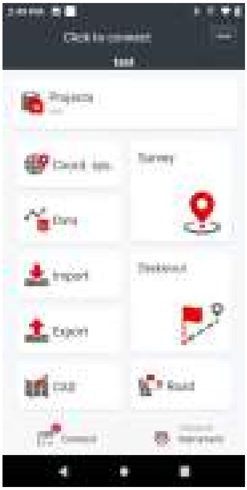
DOPS: Support to view spatial dilution of precision which suggests current satellites searching status, including PDOP, HDOP, VDOP, TDOP and GDOP.

GNSS base: Support to view GNSS base status, coordinates, and the distance to the base station.

Others: Click the button on the right side of the interface, the elevation mask and data output frequency setting will show here. Choose Elevation mask setting to set the value and choose Positioning data output frequency to set the RTK update rate.

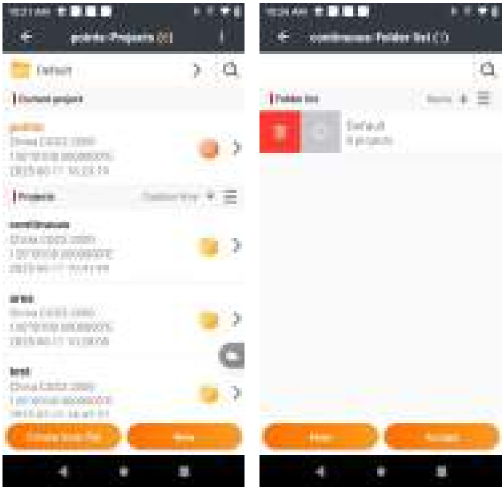


3. Project



3.1. Projects

eField classifies and manages engineering files, providing keyword search for engineering folders and projects, sorting projects by time and sorting project folders by name. When entering the Default folder for the first time, click the Default folder to enter the folder list management interface. You can create or select a folder, as shown below:

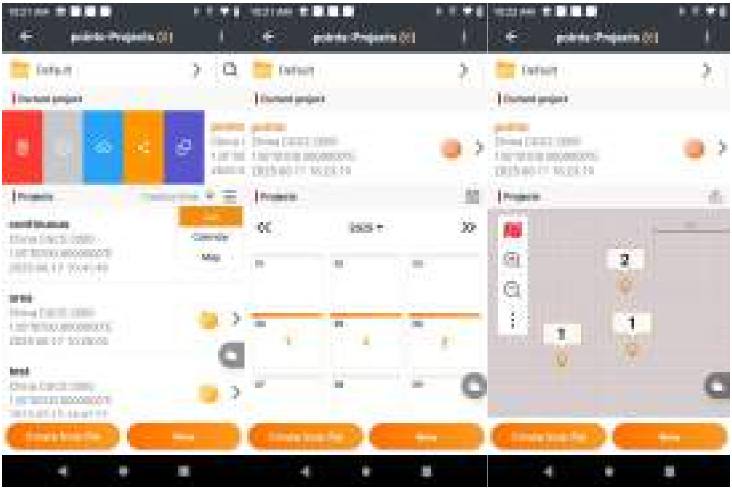


[Search]: Filter display folders by entered keywords

[Details]: View the project folder information and modify the project folder name

[NEW]: Create a new project folder

[Accept]: Accept this project folder



The projects management view can be switched through the buttons in the above picture:

[List View]: Sorted by editing time in descending order by default. Also supports sorting by modification time, editing time, or project name in ascending/descending order

[Calendar View]: Filters and displays project lists by project creation year and month.

[Map View]: Displays project location based on the position of the first measurement point in the project.

3.2. New

Click **New** to create a new project. Users should set coordinate, codeList and other survey parameters.

Name: Input the project name, backslash () is forbidden.

Reference project: choose a reference project and get the parameters automatically, including Coordinate system, Codes library and Projects settings. Control points, Enter, and Stakeout points are optional.

Tick the **Reference project** in Coordinate system to select project template, then it will show a list of historical projects. Users can select one and click OK to apply. For example, there is project A which has finished site calibration, while another project B needs the transformation parameters the same as project A. Then users can select project A in the project template while creating project B.

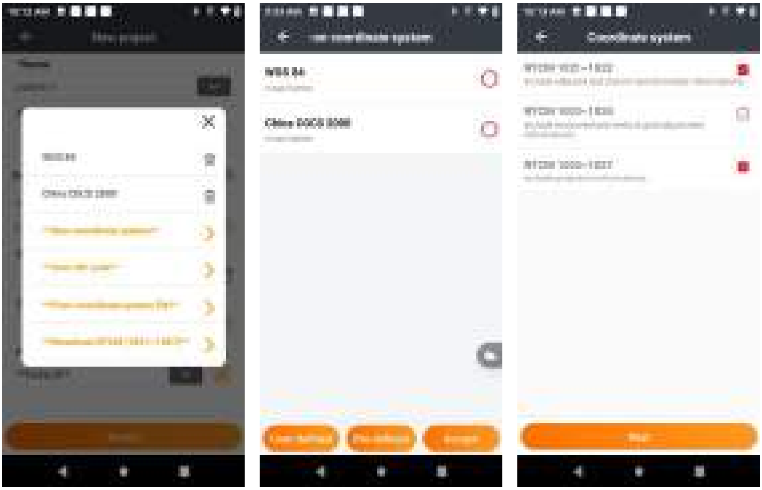
Note: Transformation parameters won't be applied if the new project is created without project template. Project template can apply all CRS parameters of the existing project.

3.2.1. Coordinate System:

The Coordinate system drop down list includes:
Common coordinate systems,
Scan QR code,
Broadcast RTCM (1021~1027),
from Coordinate system file (Supports .dc, .jxl, .cal, .lok, .crd formats),

Custom Coordinate system.

After clicking the edit button next to the Coordinate system, you can enter the list of common coordinate systems and choose between custom coordinate systems and predefined coordinate systems.



[**Common Coordinate Systems]: Coordinate** systems that have been used are recorded in the common coordinate systems list. This allows users to quickly access previously used coordinate systems, improving work efficiency.

[**QR Code Scanning for Coordinate Systems]: scan** a QR code to obtain Coordinate system parameters. After scanning, the parameters are displayed and can be accepted to apply to the current project. The Coordinate system is then added to the frequently used list.

[Import from Coordinate system File]: import Coordinate system parameters from various file formats, including .dc, .jxl, .cal, .lok, and .crd. After successful import, the Coordinate system is added to the frequently used list.

[Broadcast RTCM(1021~1027) Coordinate System]: use the received broadcast parameters as Coordinate system parameters. RTCM data is typically used for differential correction data in satellite positioning systems, suitable for high-precision positioning scenarios.

[defined]: users can define their own Coordinate system parameters. After defining, the parameters are applied to the current project and added to the frequently used list.

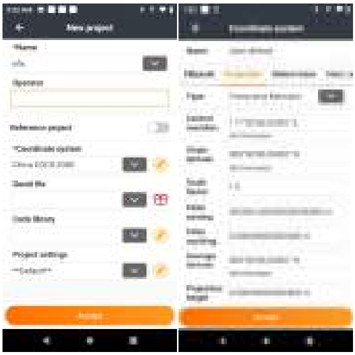
[Predefined Coordinate Systems]: the software provides a list of predefined coordinate systems. Users can select these and apply them to the current project, and they are added to the frequently used list.

[Cloud Services]: Access coordinate systems from cloud services. Users can click the floating button to choose to download coordinate systems via a share code or from a cloud disk.

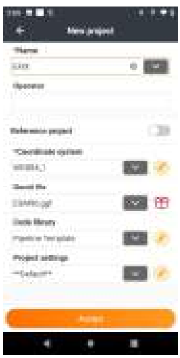
[Accept]: After selecting or defining a coordinate system, clicking the "Accept" button returns the user to the new project interface, where the selected or defined coordinate system is displayed.

[Encrypted Coordinate System]: use the encrypted coordinate system tool to generate an encrypted coordinate system file. When creating a project with an encrypted coordinate system, the software no longer displays the coordinate system parameters or the point correction entry, enhancing security and privacy.

Note: Place the encrypted coordinate system file in the folder EField\Config\CoordinateSystem\Encrypt on the data collector. When the software is restarted, the frequently used coordinate systems list will display the coordinate system option with a lock icon.



[Central Meridian/Band Number]: After selecting a coordinate system, the central meridian or band number of the chosen coordinate system will be displayed. This feature facilitates modification and subsequent use. Any changes made will be saved to the frequently used coordinate systems list.



3.2.2. Geoid File

After selecting a coordinate system, the elevation grid file associated with the chosen coordinate system will be displayed. This feature allows for easy modification and can be left blank if not required. Any changes made will be saved to the frequently used coordinate systems list.

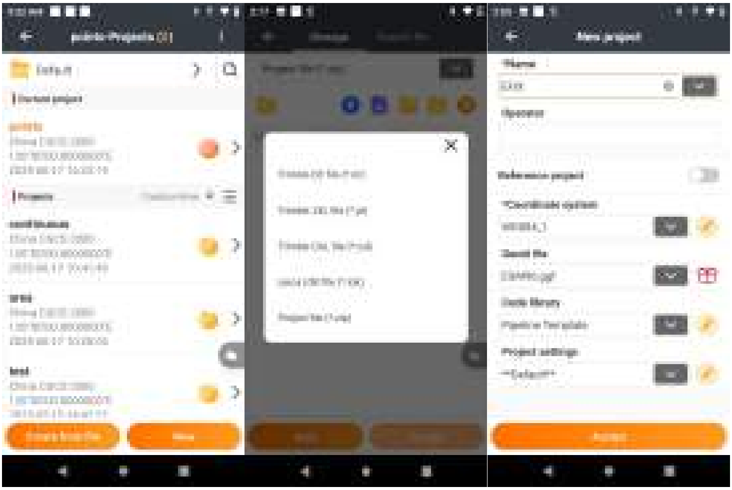
3.2.3. Codes library

Users can import or create new code in the Codes library.

3.2.4. Project settings

User can set Software settings within global settings and project settings. The detailed Settings are described in **Section 2.1**.

3.3. Create project from file



The system supports files in the following formats:
.dc, .jxl, .cal, .lok, and .zip.

After selecting a file, the next step will take you to the New Project page. The name of the project will be automatically set to the name of the selected file. The coordinate system parameters will be parsed from the selected file and applied to the new project. These parameters will also be saved to the list of frequently used coordinate systems. If a .jxl file is selected, you can also import the points contained within the .jxl file while creating the new project.

3.4. Delete

When users enter a project, left slide to delete, upload, share, and open. Click the delete icon, select **Delete** to delete the project, or select **Cancel** to cancel deleting.

Note: In order to avoid user misoperation to delete the project, you must countdown 5s before you can delete it.

After a project is deleted, a compressed backup file with the same name as the original project is generated in the controller file manager. The directory is Files→ system_prj_backup. If you want to use the project again, you need to put the project under the project directory.

3.5. Open

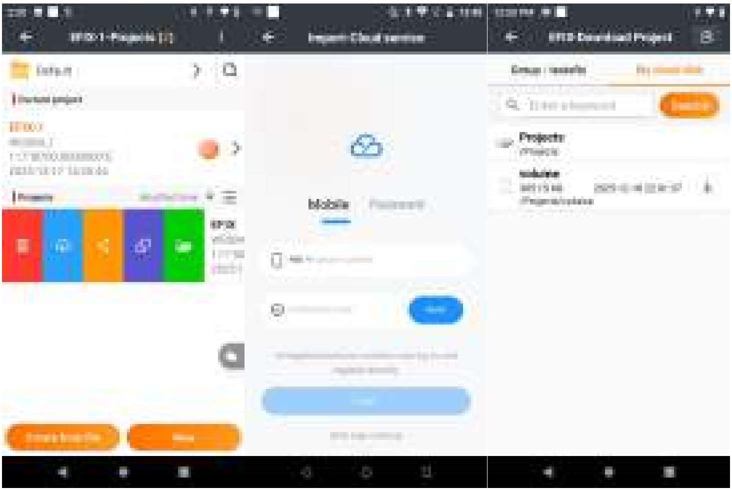
To continue an existing project, users can click the open icon to open the previous project.

The user can edit the currently open project only after the project is opened. They can also copy the project by clicking the button. Select a project and click "Copy" to duplicate it; the copied project will have a default name of "Copy_A" (where "A" is the original project name), a creation time set to the copy time, and all other parameters identical to the original project.

3.6. Upload or download with cloud server

3.6.1. Upload to cloud server

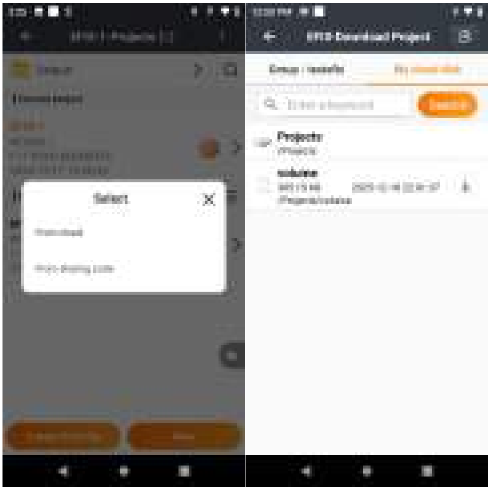
Click **Upload icon** to enter the interface of **Cloud** . Enter the **Region, Mobile number, Verification.** Then click **Login.**



Click **upload** to upload to the cloud server

3.6.2. Download from cloud server.

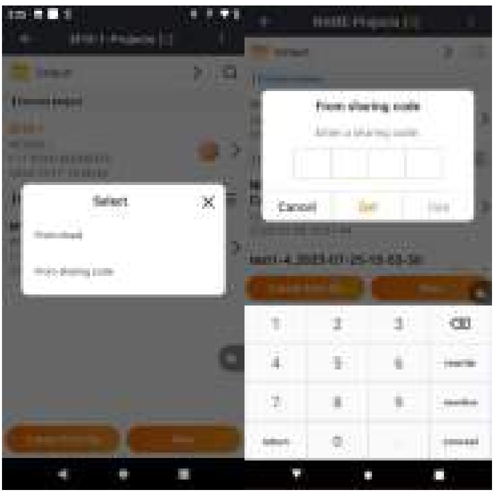
Click on the Cloud Services icon, click from cloud, click the arrow, the project will be downloaded from the cloud server, and it will be listed in the Projects interface. Also, you can enter the key words, and click the **search** to find the project you want.



3.6.3. Share and Load with share code

Click the Share **icon** to generate the sharing code to share the project with others.

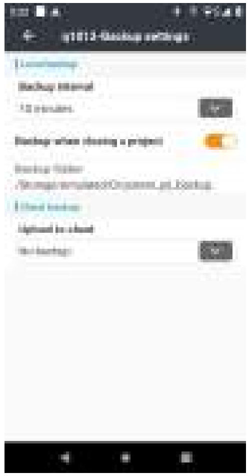
Click on the Cloud Services icon, click **From sharing code** and input the sharing code to accept the project.



3.7. Project backup

In order to avoid project loss, from the project screen, click on the button, Backup Settings to back up the project, which can choose two options: **local backup** and **cloud backup**.

3.7.1. Backup settings

In the local backup, the user can choose whether to automatically back up the project when the project is closed, or you can select the backup interval: no backup, 5 minutes, 10 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, or 3 hours.

The path of the local backup is:

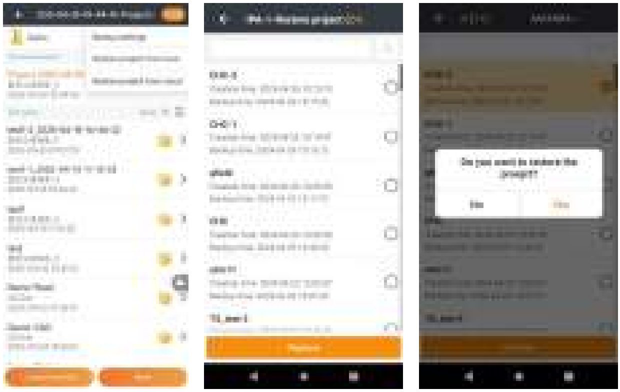
/Storage/emulated/0/system_prj_backup

In cloud backup, the user can choose the backup interval: no backup, 30 minutes, 1 hour, 2 hours, 3 hours, 5 hours, 10 hours, and 24 hours.

3.7.2. Restore project from local

Select **Restore project from Local**, select the project to be recovered, click Restore, the project will be displayed in the project list under the current project folder.



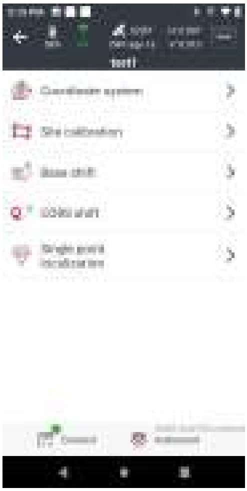
3.7.3. Restore project from cloud

Click Restore project from Cloud, select the project to be recovered, click the download button, after the download is complete, the project will be displayed in the project list.

4. Coord.sys.

Coordinate Reference System (CRS) offers users some parameters including ellipsoid, projection, datum transformation, plane adjustment and height fitting.

The user should open the project first, then click CRS to set the Coordinate system.



4.1. Coordinate system

4.1.1. Ellipsoid

Includes ellipsoid name, a, 1/f, etc. Users can choose ellipsoid name from pull-down menu (different ellipsoid name is corresponding to different parameters) as well as manually input.

4.1.2. Projection

There are some built-in common projection methods of different countries and regions, including Gauss projection, Transverse Mercator projection, UTM projection and so on. And the parameters of the projection model are displayed in the interface. Only the central meridian is needed to change usually, which refers to the central meridian of the plane projection. The average latitude of the survey area needs to be input here for a custom coordinate system, requesting the latitude error less than 30 minutes.

4.1.3. Datum Trans

Represents the mathematical model for transformation between two coordinate systems. The datum transformation model includes **No transformation**, **7-parameters**, **3-parameters**, **seven parameters (strict)**, **Helmert**, **10-parameters**, and **Datum grid**. Users can input the local 7 parameters directly, no needing the site calibration any more.

➢ **No transformation**

Users can choose coordinate transformation mode, from XYZ or from BLH.

➢ 7-Parameters

Requires at least three known points, and the points can be under the national Coordinate system or the Coordinate system that exists a small rotation from the WGS84 Coordinate system. Preferably three or more known points so that eField can check the correctness. The mathematical model of this method is strict, and it is critical to the precision of the known points. This method is usually used in a wide-range work.

Note: When accuracy of known points is not high, 7 parameters transformation is not recommended.

➢ 3-Parameters

Requires at least one known point, and the points can be under the national Coordinate system or the Coordinate system that exists a small rotation from the WGS84 Coordinate system. Preferably two or more points are known so that checking the correctness of the known points. This method is suitable for small-range work, the accuracy of which is determined by the operating range. The larger the operating range users have, the lower the accuracy users get.

➢ 7-Parameters (Strict)

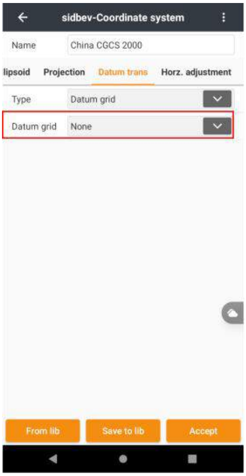
Add Strict modem for 7 parameters.

➢ Helmert

➢ 10-parameters (Molodensky)

➢ Datum Grid

Choose to use grid file for datum transformation (recommend using CGD file). Please click **EField\Config** to find **Geoid** folder in internal storage of controller and put grid file in it before using this function. The software currently supports the grid file of CGD/TXT/GSB/GSA formats.



4.1.4. Horz. Adjustment

The calibration parameters will be displayed on the interface of the coordinate system parameters after site calibration and application, and users can check them when they open the project successfully. It supports **No adjustment**, **Plane** and **Single point localization** at present. The software currently supports the grid file of CGD/GRD/PXY/STG/OSGB/GRT/DAT/DATCZ formats. Please click **EField\Config** to find **Geoid** folder in internal storage of controller and put grid file in it before using this function (recommend to use CGD file).

Copy the file into EField\Config\Geoid folder.

4.1.5. Vert. Adjustment

Supports four kinds of algorithms: **No adjustment**, **Constant adjustment**, **Surface Fitting,** and **Inclined plane**, of which **No adjustment** is the default one.

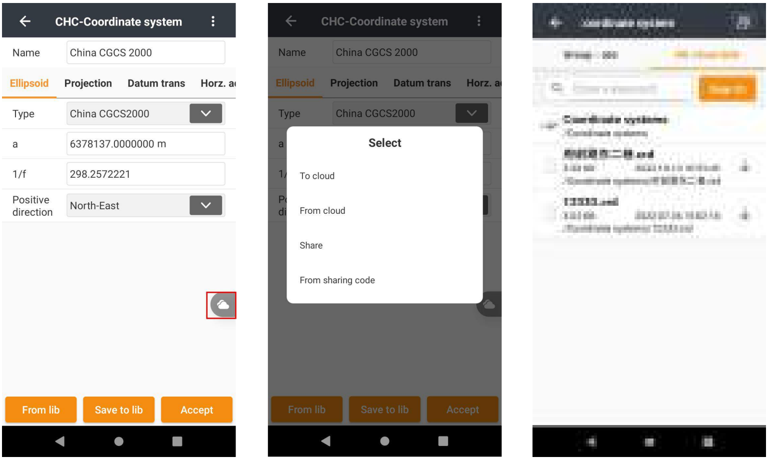
- **Constant adjustment**: Need at least one starting point.
- **Surface fitting**: Generates a best-fit parabola for the abnormal height of many benchmarks. It has high requirements for the starting data, and it may cause divergence of the elevation corrections if the fitting level is too poor. This method needs at least five starting points.
- **Inclined plane**: Inclined plane is the height transformation model of Trimble TGO software.

The software currently supports the geoid model file of CGD/GGF/BIN/GSF/GRD/GRI/BYN/ASC/STG/GBL/GXY/OSGB/TXT/JASC/GSA.GSB/GRT/DAT/DATCZ/GTX.NEGRID formats.

Please click EField\Config to find Geoid folder in internal storage of controller, and put geoid file in **it before using this function (recommend to use CGD file).**

4.1.6. Share or Download

Click on the **Cloud Services icon**, you can upload or download Coordinate system parameters through cloud services or share code.



To cloud: Click To cloud can upload current CRS, click the **refresh** to refresh the interface, click **upload** to upload to the cloud server.

From cloud: click **From cloud**, click the arrow, the CRS will be downloaded from cloud server. Also, you can enter the key words, and click the search to find the CRS you want.

Click **Share** to generate the sharing code to share the CRS with others.

Click **From sharing code** and input the sharing code to accept the CRS.

4.1.7. Other ways to share or download

From the coordinate definition screen, click on the button:

then **Create QR code** to display a QR code:

Which can be scanned by other devices using the **Scan QR code** tool:

Click **Lock** to freeze the coordinate system and password protect it:

Load from file can import coordinate files in the following formats: Trimble DC(.dc), Trimble JXL(.jxl), Trimble CAL(.cal), Leica LOK(.lok), Coordinate system file(.crd).

Export Supports the export of coordinate system parameters in Trimble dc, Trimble cal

4.2. Site calibration

When the correction parameters of application points prompt "abnormal ratio for flat correction" or "residual value is too large", we suggest checking the control point that participates in point correction input is wrong or not, whether it matches the control point or not. If users confirm there is no error, please continue operations.

Assuming there are some known points K1, K2, K3, K4, and find the field position of known points. After that measure corresponding points 1,2,3,4 in the case of the base station does not move.

Site calibration: Click to enter point calibration interface.

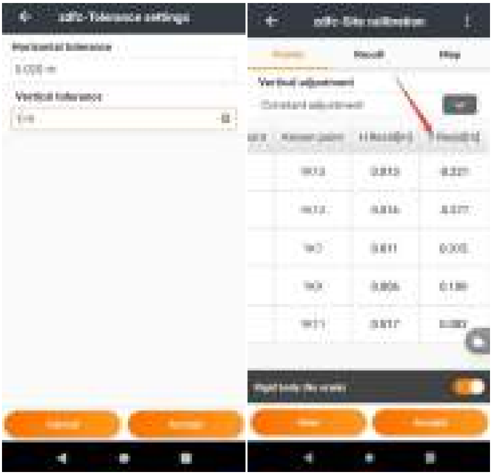
Vert.adjustment Method: Include **Inclined plane**, **Constant adjustment**, **Surface fitting**. Default plane fitting method is **Constant adjustment**.

New: Click to select corresponding GNSS points and Known points. Select **Horizontal + Vertical Calibration**. The best choice is to choose 3 couples of points based on the actual situation.

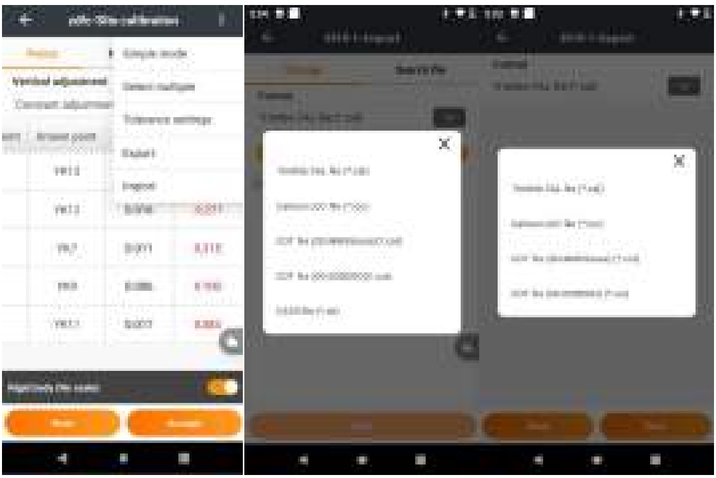
The user can select Known Point or input Known Point coordinate.

Accept: Click **Accept**. The software will prompt "Horz.adjust successfully". After that, click **OK**, it will make the current calculated correction parameters apply in the Coordinate system, which can affect the whole project.

Click **Tolerance settings**, The software defaults to a horizontal limit of 00.02m and a vertical limit of 00.03m. Once these limits are exceeded, they will be marked in red.

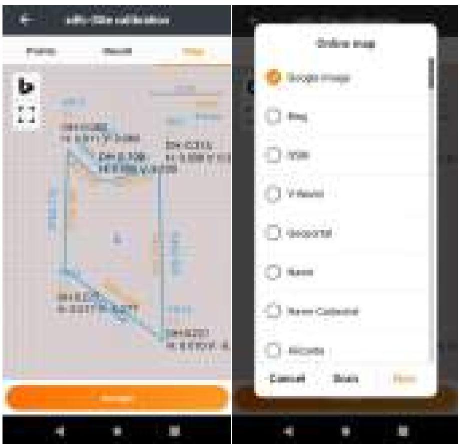


Click **Export/Import**, so users can export . Loc file from current controller/project and import the . Loc file into other controller/project.



Result: Click **Result. Users** can directly see the correction results.

Map: Click **Map. Users** can directly observe the polygon fitting effect formed by the GNSS point and the known points, and can also see the current position of the receiver and check it with the users. And it can overlay the map display.



Rigid body: Turn on the button. Users can set the scale factor to 1 and complete point correction only through translation and rotation.

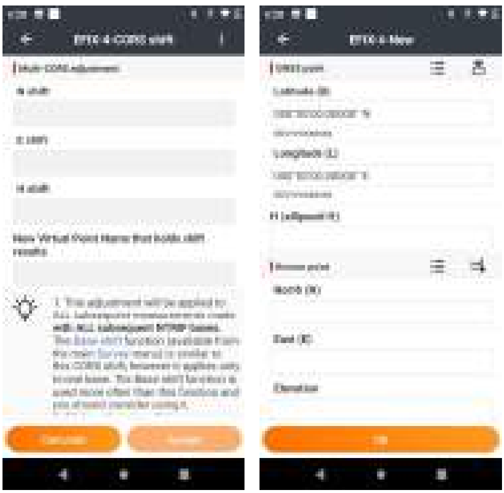
4.3. Base shift

When moving or setting up the base again in **Auto Base** mode, **Base Shift** is required to ensure all the current points are belong to the same Coordinate system as before.

Calculate: Click to enter base shift interface. In Base Shift Interface, click the icon beside Measure Point to select a current point surveyed at a control point, click Next to select the corresponding control point. The calculation results would show automatically. Then click **Accept**. The software prompts "Accept base shift parameters?" click **OK**, then the software prompts "GNSS Base and related points were shifted successfully, open points manager?". Click **OK**, the point library is opened, and the plane coordinates are changed because shift parameters have been applied to all the points surveyed under this base.

4.4. CORS shift

Open the CORS shift interface, click Calculate, add the GNSS point and Known point.



Add the GNSS point

Method 1: Click to measure the coordinates of the control point.

Method 2: Click to select the known point coordinates that were surveyed in advance in the point survey.

Add the known point

Method 1: Click the to select the coordinates of the known point entered before.

Method 2: Enter the coordinates of known points in the current interface.

Method 3: Click and select the point in the drawing.

After the GNSS point and Known point are added, click "OK" to enter the CORS shift interface, display the shift amount and the current CORS shift insertion point, and click "Accept".

CORS shift operation methods include **Guide mode** and **Simple mode**, click to switch modes.

Note: CORS shift only applies to CORS mode to switch between different manufacturer accounts or base station 1+N mode to switch CORS mode.

4.5. Single point localization

Allows projected coordinates at the **Grid** base elevation to be moved up to **Ground** using a **Combined Scale Factor** comprised of a **Projection Grid Scale Factor** and **Ellipsoidal reduction factor** and a **Rotation** about a base **Reference point**. Arbitrary ground coordinates (like 10,000, 10,000) can be associated with the base point. The resulting basis-of-bearings can match the underlying Coordinate system (State Plane Coordinates), align the reference axis with Geodetic (True) North, or be manually set to an arbitrary alignment.

Slide the Use single point localization to the right.

A single menu will be shown:

Define the **Project BNSS Base Point** by picking from CAD with the **CAD** button, making a new measurement at the current position with the **Begin measurement** button, or select an existing GNSS measurement from the **Point list**.

Next enter the **Project Base Local Coordinate** that the receiver should read when placed at the **GNSS Base Point**.

Either type the coordinate in, select a **Known point** from CAD or, select a **Known point** from the **Point List**.

Choose a **Basis of Bearings** from **Geodetic (True North)**, **Grid North** (matches the current Coordinate system projected grid), or **Manual** entry. If manually **Rotation** entry is used, provide extreme precision to match distant coordinates.

Click the **Calculate** button to automatically compute the **Elevation Scale Factor**, the **Grid Scale Factor** at the **GNSS Base Point**, a **Combined Scale** Factor and an appropriate **Rotation**.

Click Accept,

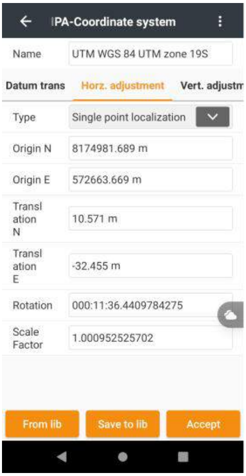
then **Apply** to install the results into the current **Coordinate system**.

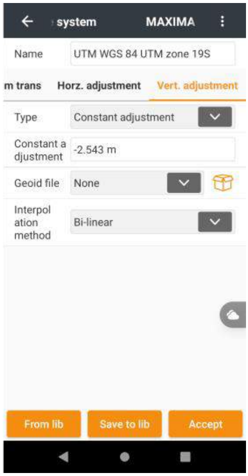
Check-in on the GNSS Base Point using **Stake point**, the receiver's coordinates should exactly match the **Known**

point entry.

The resulting **Horizontal adjustment** will be fully described on the **Coord.sys.** > **Coordinate system** >**Horizontal adjustment** (tab);

The computed Vertical adjustment will be fully described on the **Coord.sys.** >**Coordinate system** > **Vertical adjustment** (tab):





5. Data

5.1. Points

This function can view coordinates library, which includes input point and survey point, and points to be staked.

5.1.1. Import

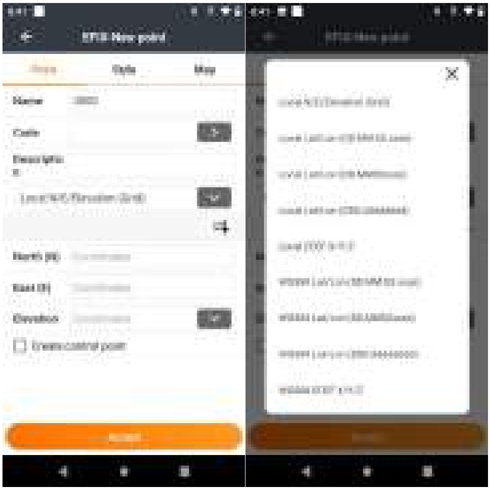
This function can import external points. Click Import to import points, the same as **section 6**

5.1.2. Export

This function can export points, the same as **section 7**

5.1.3. New

This function can create a new point. Click **New** to create a point. Creating a point needs some attributes as follows: **name**, **code** (input as needed), **coordinate formats** and **point class** (including normal point and control point). Then, input the point coordinates that users create, Desc is optional.



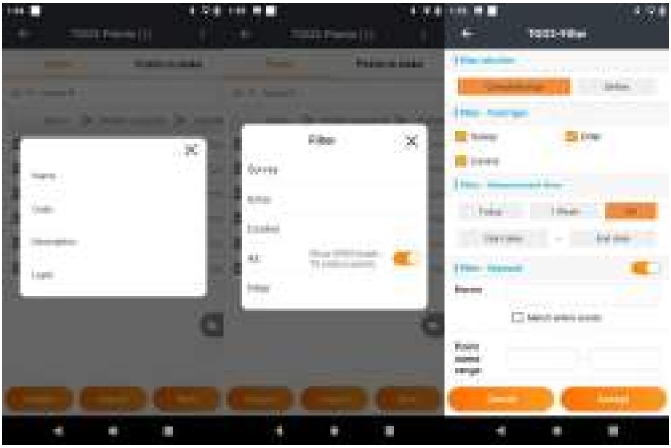
Note: When the point has reel number, it will prompt "Projection Error" after adding point, and users should add reel number in "False East" in **Projection table** of **CRS** interface.

If you choose the **Points to stake, the** function can create new points to stake in 4 different ways.

5.1.4. Search and sort

Point Management supports quick search of points by name, code, remarks, and layer.

Additionally, the filter function allows users to perform custom filtering based on point type, map range, measurement time, and keywords.



5.1.5. Delete

Swipe right on a selected point to perform the following actions: delete, display on map, set out, edit, and copy.
Note: Base points and CORS translation points cannot be deleted

5.1.6. Other Settings

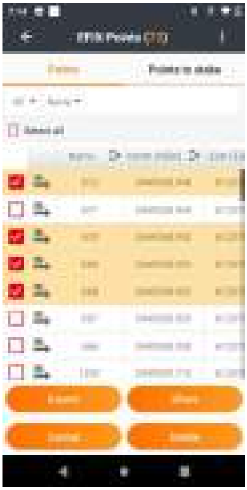
From the points screen, click on the  button:

5.1.6.1. Coordinate type

This function can select different coordinate type. Click Coordinate Type to select point type.

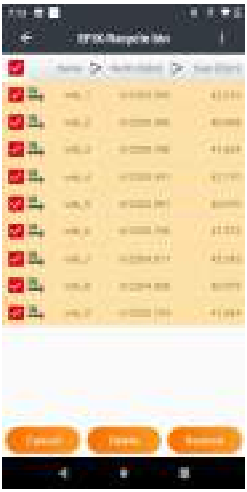
5.1.6.2. Select multiple

This function can select multiple points. Click **Select multiple** to manage not only one item but also multi-items and do operations on multiple points.



5.1.6.3. Recycle bin

This function can restore deleted points. Click **Restore** to recover selected deleted points. Click **Delete** to clear the bin.

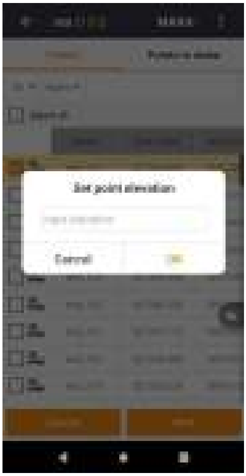


5.1.6.4. Columns configuration

This feature allows users to select the columns as needed to display and change the column order using the **Up** or **Down** buttons.

5.1.6.5. Set point elevation

This function can set the elevation of the point.



5.1.6.6. Adjust point elevations

This function allows users to add or subtract fixed values from the elevation of points in batches.

5.1.6.7. Set code to points

This function can be used for the existing point quick batch set code.

5.1.6.8. Set pole height

This function allows quick batch setting of pole heights for known points.

5.1.6.9. Shift GNSS base

This function can shift the base station after the point position is measured.

5.1.6.10. Hide GNSS base \ TS station points

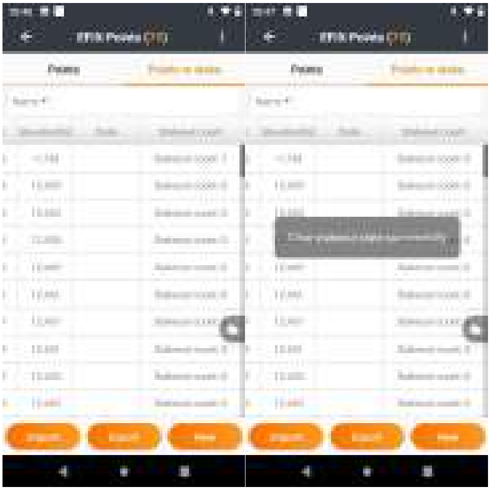
This function can **hide** GNSS\TS station points. Click **Hide GNSS base \ TS station points** to hide them, click **Show GNSS base \ TS station points** to show them.

5.1.6.11. Sort first to top

This function can change the order of the point library.

5.1.6.12. Clear stakeout state

This function resets the stakeout state to 0.

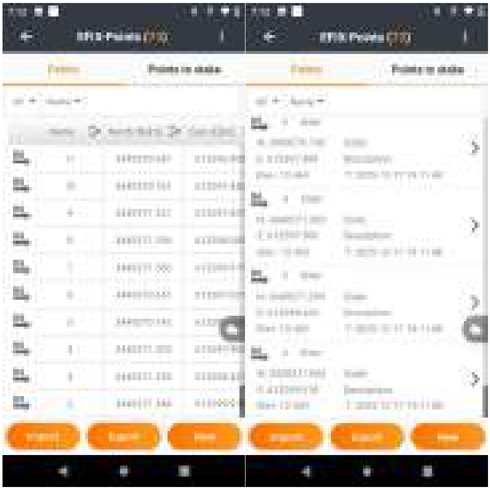


5.1.6.13. Data statistics

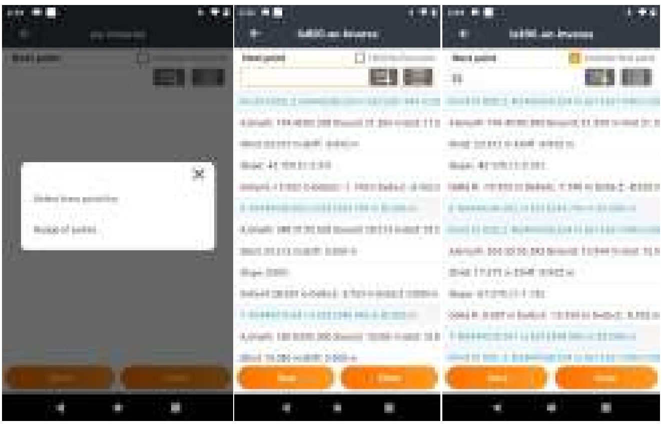
This function can view the different types of points. There are five types, including **total points**, **GNSS base points**, **survey points**, **control points** and **enter points.**

5.1.6.14. Switch list style

This function can switch list style. Click **Switch list style** to change the style.



5.1.6.15. Inverse



After selecting multiple points, the azimuth, horizontal distance, slope distance, gradient, and coordinate differences between the points will be calculated in the order they were selected. If the "Fix First Point" switch is turned on, the azimuth, horizontal distance, slope distance, gradient, and coordinate differences between the first point and the other selected points will be calculated.

5.2. Lines/Arcs

Click **New** to add different types of lines, including Line, Polyline, Arc, Circle and Alignment.

5.2.1. Line

Click **New** to select one type, enter the following new interface to create a line.

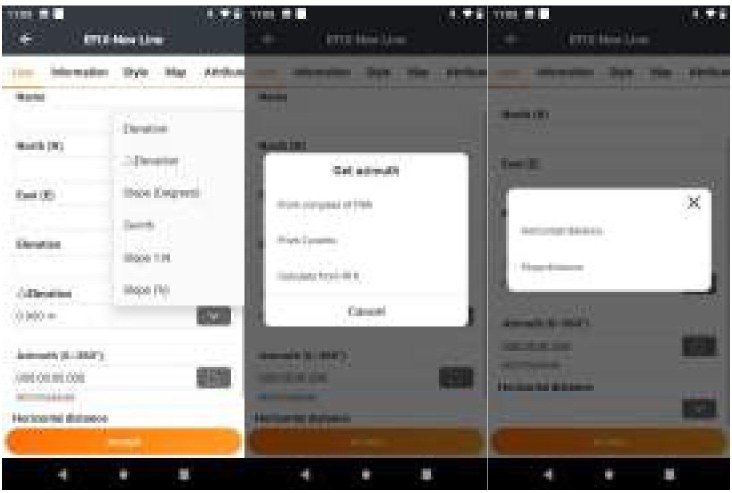
There are two Methods, including **Two Points** and **One Point + Azimuth + Length. Name.**

Two points.

The user should input **Name, North, East, and Elevation**.

One Point + Azimuth + Length. Name.

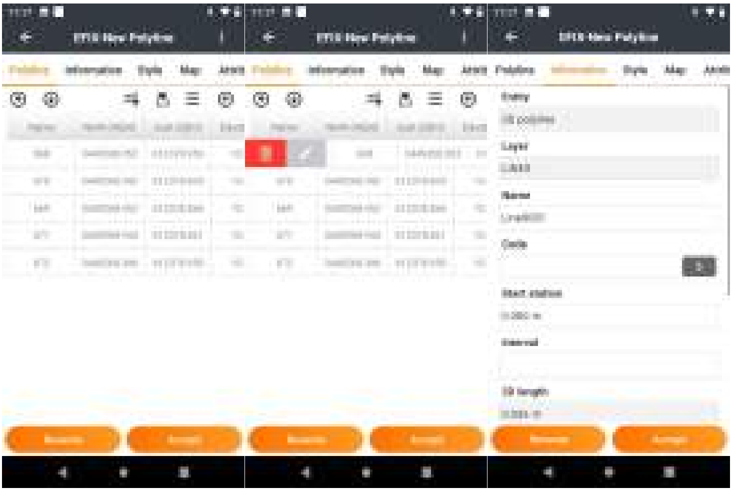
User should input point **Name**, **North, East, and Elevation, and** add the **Δ Elevation / Zenith / Slope (degrees / 1: N / %) , Azimuth , and Horizontal distance.**



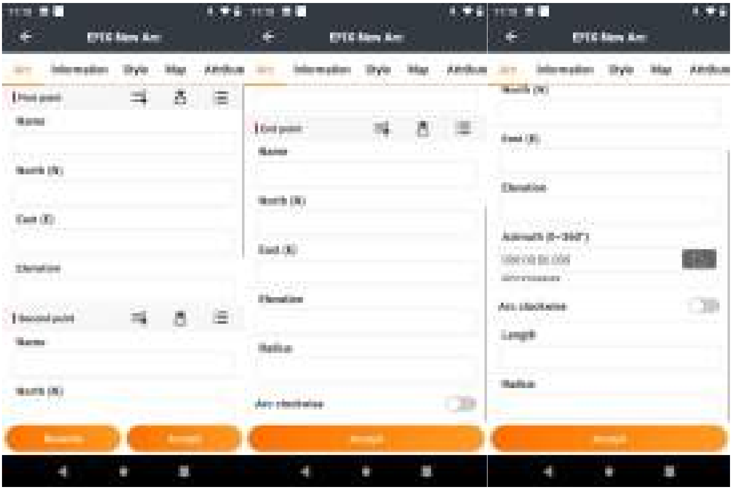
5.2.2. Polyline

Method: Name, node. After entering the above parameters, the line information will be displayed automatically.

Nodes can be added through four methods: graph selection, library selection, measurement, and input. When adding a node, you can check whether it is an arc node. Selecting a list node and swiping right can delete or edit the node.



5.2.3. Arc



Method 1 (3 points): Three points, name, starting point, middle point, and ending point.

Method 2 (2 points + R): Two points + radius, name, starting point, ending point, radius, clockwise: open, close (deflection).

Method 3 (point + azimuth + length + R): Point + azimuth + distance, name, starting point, azimuth, clockwise: open, close (deflection), radius, length.

5.2.4. Circle

Method 1 (3 points): Three points, starting point, midpoint, ending point

Method 2 (Point + R): Center point + radius, name, center point, radius

5.2.5. Extract from map

Support creating lines by selecting methods from the graph

When creating a new line, you can switch to Style, Information, Properties, Map, Properties, Multimedia Tab Settings or view the layer where the line is located, as well as the line style (line type, color, line width), line code, starting mileage, multimedia, properties and other information.

After setting the above values, click [Save], and a line can be built

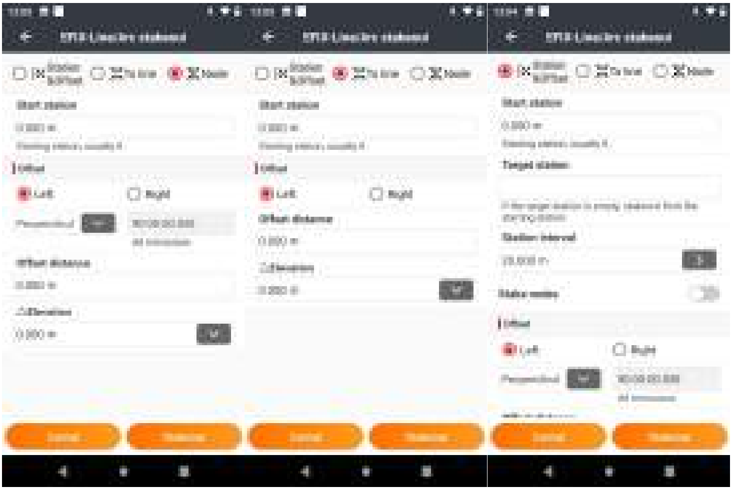
5.2.6. Delete

Select one line, right slide to click **Delete**, and then it will pop up a dialog box "Delete Selected item?" Select **OK,** remove this record; select **Cancel**, do not delete this record.

Also, the user can click the flag button to stakeout the selected line.

5.2.7. Stakeout:

Select the line, click on the right-slide menu **Stakeout** and choose a method (Station & Offset **/ To line / Node)** to stakeout, and then it will directly jump to the Line/Arc stakeout.

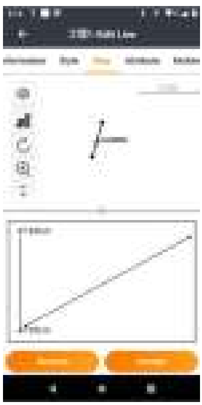


5.2.8. Information

Select Line, click **Edit** to view detailed information about the selected line. Except for the attribute values represented by the gray area, the rest of the attribute values are editable.

5.2.9. Map

All the lines in the line list are displayed on the map by default. You can view the floor plan and section view of the currently selected line by swiping right on the option **Map Display**.



5.2.10. More operations

In the "More" section at the top right corner, there are Select multiple and columns configuration items.

5.3. Areas

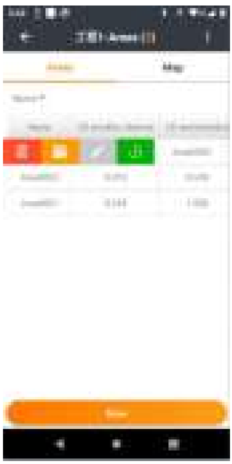
"Areas Management" is used to uniformly manage the created areas and the captured areas.

5.3.1. New Areas

Click the "**New**" button to enter the area creation interface. The nodes of the area can be added through four methods: graphical selection, library selection, survey, and input. The order of the nodes can be adjusted using the "Move Up" and "Move Down" buttons. By selecting an existing node in the list and performing a right-swipe operation, you can delete or edit the node. As shown in the figure below.

5.3.2. Delete-Areas

When an area is selected, click and swipe right to "Delete", a confirmation dialog box will pop up saying "Delete selected item(s)?". If you choose "Yes", the area will be deleted; if you choose "No", the area will not be deleted.



5.3.3. Continue the survey-Areas

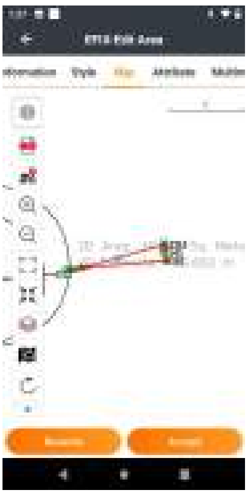
When an area is selected, click and swipe right to "**Continue survey**", and enter the **Area survey** mode. The closed area will automatically open, allowing you to continue surveying the area.

5.3.4. Information

When an area is selected, click and swipe right to "**Edit**". You can then switch between different tabs to view the detailed information of the selected area (or double-click on the selected line to query its detailed information). Except for the property values indicated in the gray area, all other property values are editable.

5.3.5. Map-Areas

All areas in the face list are displayed on the map by default. You can swipe right to select the **"Map Display**" option to view the plan view of the currently selected area.



5.4. Surfaces

These are two separate functions:

Surfaces:

On the Surface management, open or create a new surface.

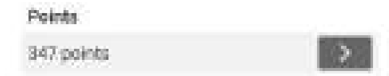
5.4.1. New Surfaces

Click **New**, enter the name, and click points to select the points that make up the face file.

choose "Select from point list", "Select from map" or search by "Range of points". The following uses "Select from point list" as an example.

The point library supports **Import** and **Add** new points, or the user can manually select the existing points, and directly click **Select all** to select all points.

Select **OK** and the total number of points will be displayed.



If there are Breaklines lines and Boundaries lines can be selected to add.

"Breaklines" refers to a line that represents a change in elevation or slope.

It is used to describe the shape and contour of the land. And is an important parameter in land surveying and mapping. When conducting a survey, the surveyor will use the

Breakline to represent the shape and features of the land, and then use it to calculate the area, volume, and other parameters of the land.

"Boundaries" refer to the limits or boundaries of a property or other area being surveyed.

In style, the user can modify the face style and color. The default is Wireframe and layer color.

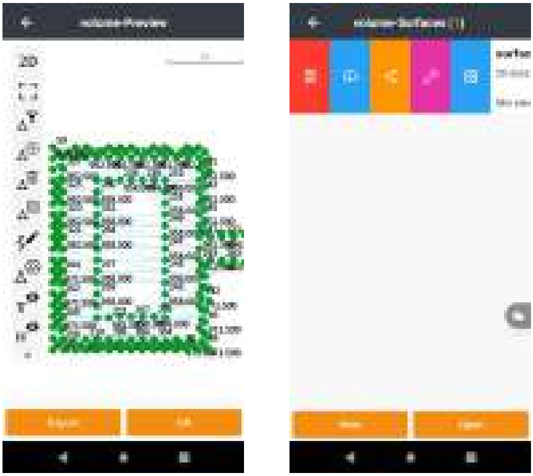
[Wireframe]: Displays a Wireframe made up of lines.

[Shade]: Displays the filled triangulation net.

[Layer color]: Displays the color of the layer.

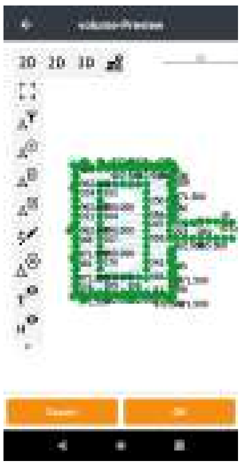
[User-defined color]: Displays user-defined colors.

Click **OK** to jump to the surface preview screen, where you can **preview**, **edit** and export the face file.



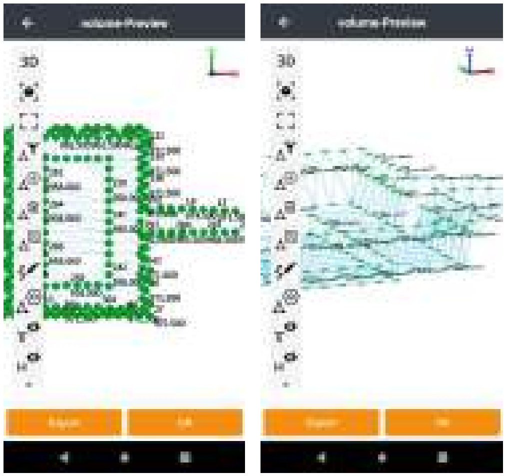
: Preview different dimensions, including 2D, 3D and online map preview, switch by the toolbar.

2D: 2D preview on the opposite side.

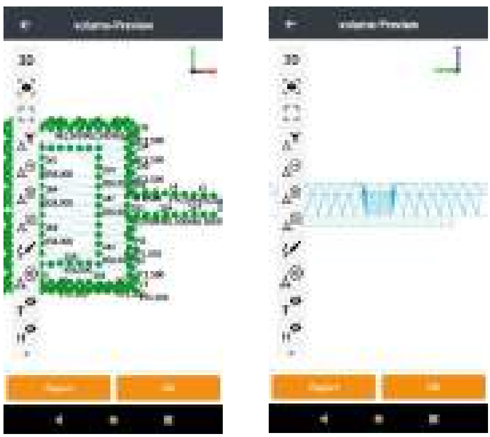


3D: 3D stereo preview on the opposite side.

hold the rotation angle with one finger, rotate left and right or up and down, and zoom with two fingers.



After selecting 3D, click the [Visual Angle] button to switch between different perspectives.



Online map: choose the online map with the software, scan the QR code of the online map, you can also add the online map.

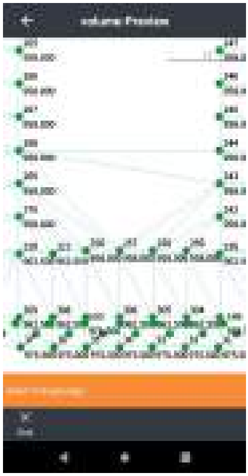
Full graph: Center displays all data on the project.

Filtration: The generated triangulation net can be filtered by minimum Angle and side length multiple. The default minimum Angle is 10, and the minimum change multiple is 10 times.

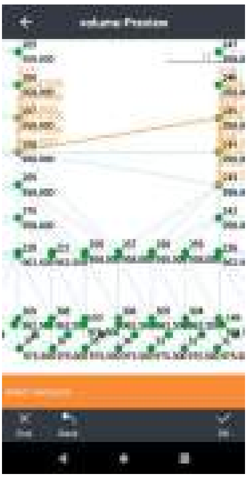
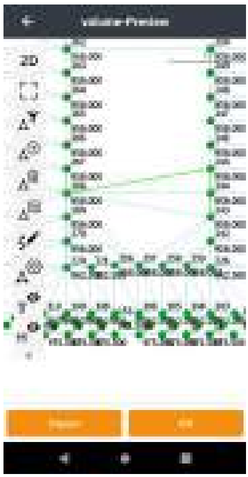
Add: Add the triangulation net by picking points coordinates on the graph.

Delete: Select triangulation net on the surface to delete.

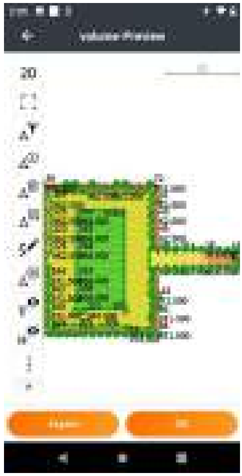
Recombination: Select the triangulation net to be reorganized and form a new triangulation net.

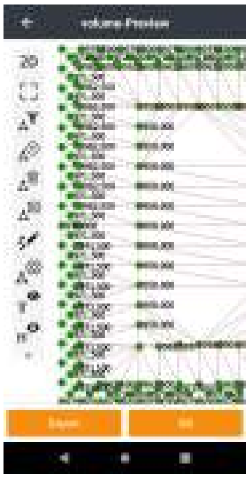
Draw: Plot by picking coordinates on the surface.

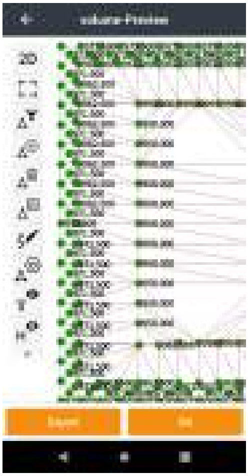
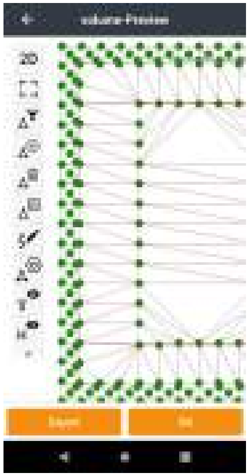
Style: make style edits and changes.



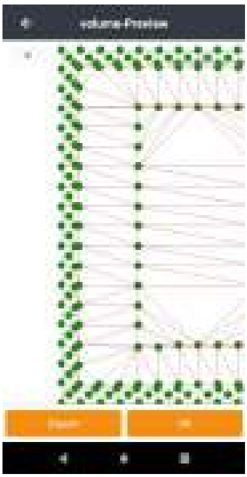
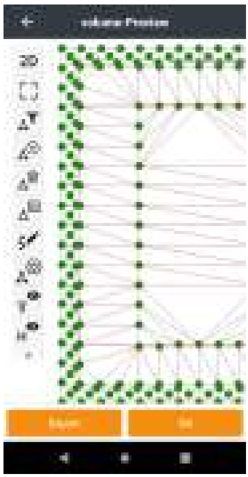
Hide/Display Name: Hide or display the name of the point.



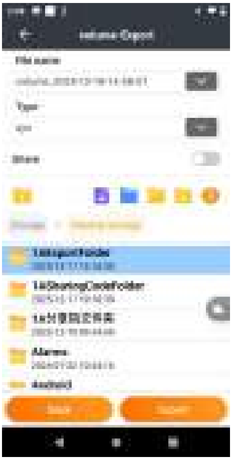
Hide/Display elevation: Hide or display the elevation of a point.

Click fold the toolbar to hide it; Click expand the toolbar.

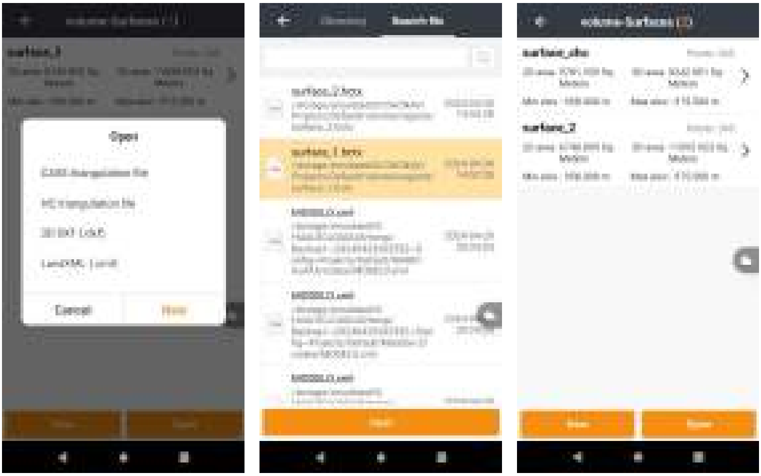
Click Export to export the created face file. The default export folder is **/1AExportFolder**. File name can be changed, support the export of .sjw, .dxf, .dat and .xml format files.

5.4.2. Open-Surfaces

Click **open**, the software supports importing surface file formats as follows: **CASS triangulation file**, **HC triangulation file**, **3D DXF(.dxf)**, **LandXML(.xml)**.

Click open to open the already created surface. Taking opening HC triangulation file as an example, click next, select the file to be opened, click open, name the file, and click OK to see that the file has been imported into Surfaces.



Click the cloud icon, it can also be imported through a cloud service.

5.4.3. Edit-Surfaces

Select the surface to be operated and row right, user can **delete**, **upload cloud**, **share**, **style change**, **preview.**

5.5. Codes

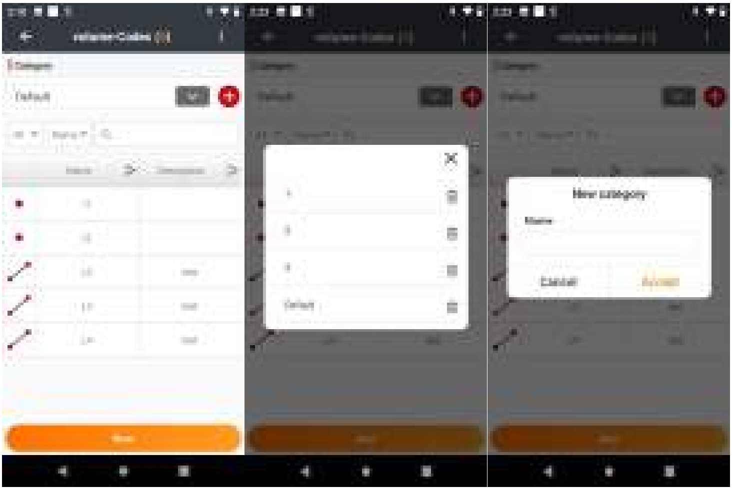
5.5.1. Code Category

In code management, there is a **default** Default category by default. It supports switching, deleting, and creating new code categories.

Switch: Click the drop down arrow next to the group to select another group.

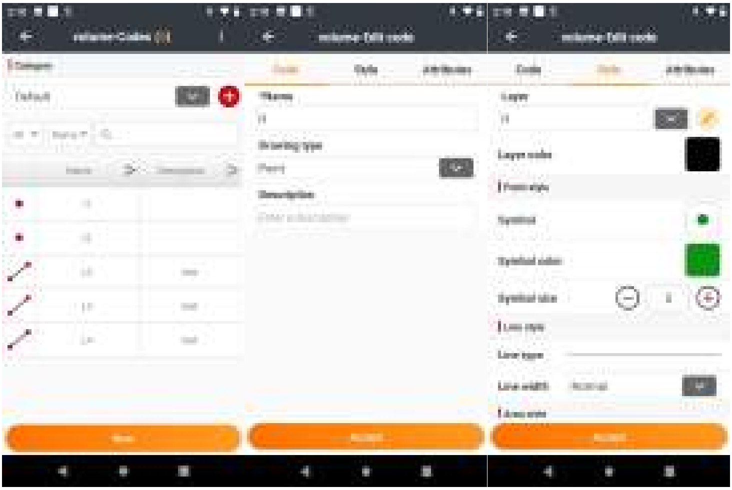
Delete: Click the delete button to remove the currently displayed code group.

Create New category: Click the plus button next to the category to create a new code category.



5.5.2. Code

The code list section provides search functionality by code name and description for quick code lookup. It uses code type symbols to distinguish between point and line codes, and codes with attributes are marked with an "A" icon. You can create, delete, and edit codes within the current code group.



"New": Create a new code within the current code group. You can customize the code name, type, and description. You can also select a mapping layer (where features measured with this code will be stored) and associate field attributes with the code.

"Delete": Select a code and swipe right to choose "Delete" to remove the selected code.

"Edit": Modify the code, including its name, type, description, layer and layer style, and manage fields.

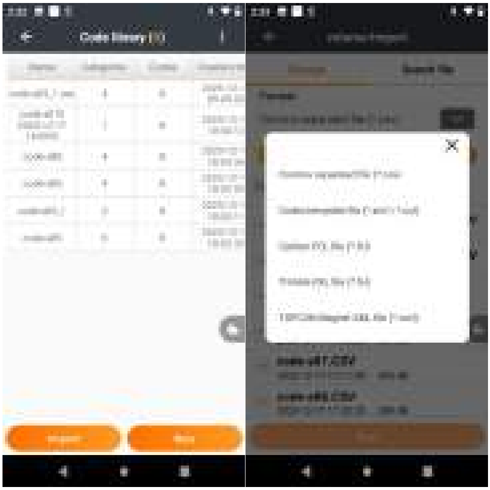
5.5.3. More

The code management system provides additional options, including **Multi-select, import from code library, load from file, save code library, upload to cloud, and share.**

Multi-select: Supports batch deletion of codes. You can use the search function to find the codes you want to delete and then select multiple codes for deletion.
Import from code library: Import existing code templates from the code template library.
Load from file: Import codes from files in .csv, .xml, .cxl, .fcl, .fxl, .mxl formats.
Save code library: Save the current project's codes as a code template to the code template management for easy use in future projects.
Upload to cloud: Save the current project's codes as a cxl file and upload them to the cloud.
Share: Save the current project's codes as a cxl file and share them via share codes or third-party applications

5.6. Code library

The main function of the Code **library** is to manage codes under different work conditions. If users save codes in one list, it is not easy to distinguish. So, it is better to create different code lists for saving different codes, and users can select the corresponding code list based on the particular work condition.



Enter the Code Template Management, where the list displays all the code templates. The software comes with a pipeline measurement code template by default. It supports "Import" and "Create New" code templates.

Import: The supported code template formats include: **.csv, .xml, .cxl, .fcl, .fxl, .mxl**

The following is the template format in .csv.

[illegible]	1	0	test	[illegible]	10	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	2	1	test	[illegible]	0	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

field name	field description	Must to fill?	default value	Note
Name	Code Name	Y	None	
Category Name	Category Name	N	Default	
Drawing Type	Code drawing type	N	0	0: Point 1: Line
Describe	Code Description	N	None	
Symbol ID	Symbol ID	N	907938 (Filled circle)	The value of symbol ID comes from the list of symbols in the efield.
Symbol Size	Symbol size	N	3	Range from 1 to 30; It is recommended that Symbol ID be set to 1 when it is 907938 (solid circle) or 907939 (hollow circle), and to 6 (the rest).
Layer Name	layer name	N	POINTS	Default is POINTS layer.
Layer Color	layer color	N	#000000 (black)	If not entered, the layer color of the layer will be set according to the LayerName.
Line type	Line Color	N	CONTINUOUS	CONTINUOUS: solid line, the value of lineStyle comes from the list of line symbols in the efield.
Symbol color	Symbol color	N	#0f9115 (bright green)	
Line width	Line width	N	Normal	Normal, Thin, Bold

Fill color	Fill color	N	None	
Transparency (0~100)	Transparency	N	0	

The Code Template Management provides the following functions: "**Delete**", "**Upload to Cloud** ", **"Share**", "**Edit**", and "**Multi-select**".

"**Delete**": Deletes the selected code template.

"**Upload to Cloud** ": Uploads the selected code template in cxl format to the cloud disk.

"**Share**": Allows sharing the code template in cxl format via third-party applications or through a share code.

"**Rename**": Rename the code name.

"**Edit**": Edits the selected code template. You can modify the template name, and add, modify, or delete code groups and codes within the template.

"**Multi-select**": Click the "**More**" button in the upper right corner and select "**Multi-select**" to delete multiple code templates in bulk

5.7. Layers

Layer management is used to manage all layers in a project, including **work layers**, **map files**, and **online maps**.

5.7.1. Work layers

The work layer is used to save the results obtained from measurement, layout, and drawing. Operations such as "**New**", "**Delete**", **"Edit**", and "**Show/Hide**" can be performed on the working layer. The work layer can be obtained automatically or manually.

5.7.1.1. Add layer

5.7.1.1.1. Automatic Addition

➢ Default Layer – 0:
This is the layer automatically added when a project is created. It cannot be deleted, and its name cannot be changed during editing.

➢ Default Layer – Points (POINTS):

This layer is used by default to save points without codes. It is automatically added when the first point without a code is generated in the project

➢ Default Layer – Lines (LINES):

This layer is used by default to save lines and surfaces without codes. It is automatically added when the first line or surface without a code is generated in the project.

➢ Default Layer – Base Points (BASE POINTS):

This layer is used by default to save base points. It is automatically added after measurement or layout operations. The visibility of this layer is hidden by default

➢ Code Layer (code):

When a new code is created and the layer option in the style is set to "Create via Code," or when a code is directly entered during measurement, a layer with the same name as the code is automatically added. This layer is used to save the targets corresponding to the code.

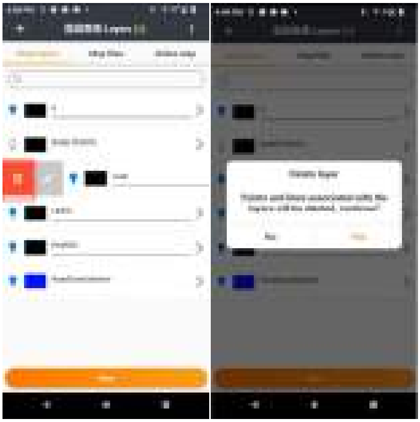
➢ Road Cross-Section Layer (Road Cross Section):
This layer is automatically added when performing road layout and cross-section data collection. It is used to save cross-section data points, and its name cannot be modified.

5.7.1.1.2. Manual Addition - "New"

Enter Layer Management, click "**New**". In the Layer tab, enter a name and click "**Accept**" to create a new layer. When creating a new layer, you can also switch to the **Style** tab to set the layer's color, line width, fill color, transparency, and line type.

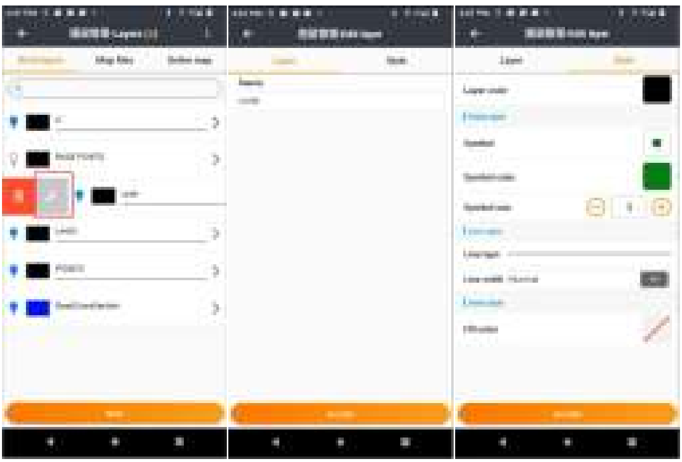
5.7.1.2. Delete Layer

Swipe right on the layer to delete it. After clicking "Delete", a prompt box will appear asking whether to proceed.



5.7.1.3. Edit Layer

Swipe right on the layer to edit it. After clicking "**Edit**", you will enter the edit interface, where you can modify the name, layer color, line width, fill color, transparency, and line type.



5.7.1.4. Control Layer Visibility

Click the light bulb icon on the left side of the layer to change its visibility. When the icon is filled with blue, the layer is visible; when the icon is empty, the layer is hidden

5.7.1.5. More

Click the "**More**" button in the upper right corner, and then click "Multi-select" to perform batch deletion of layers

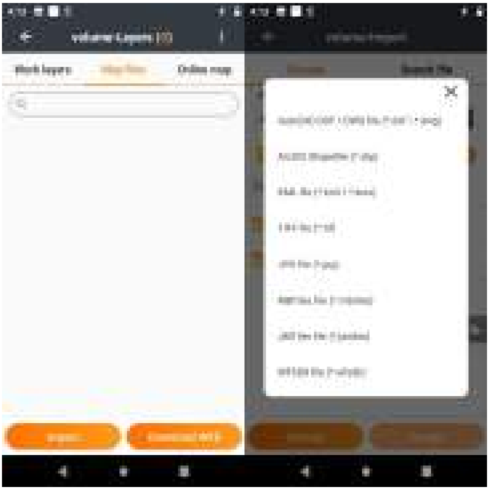
5.7.2. Map files

The map files support the following operations: "**Import**", "**Delete**", "**Map**", "**Visibility**", and "**WFS Download**". Additionally, vector base maps can be "**Corrected**" and have their "**Attributes**" edited, while raster maps can have their "**Transparency**" adjusted.

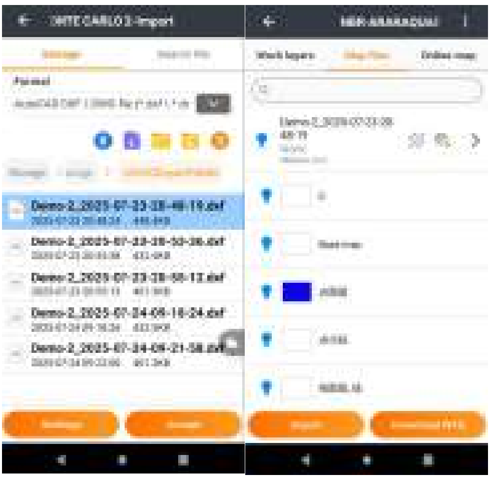
5.7.2.1. Import

Used to import base map files. Supported file formats include **DXF/DWG, SHP, KML/KMZ, TIF, JPG, Mbtiles, Jmtiles, Wfsdb.**

➢ Click "Import" to enter the import interface.



- Select the format of the base map to be imported
- Click "Next", select the base maps to be imported (multiple selections are allowed by default), click "Accept", and complete the import.



When importing AutoCAD DXF/DWG Files (*.dwg, *.dxf) format, click "Settings" to enter the advanced settings interface:

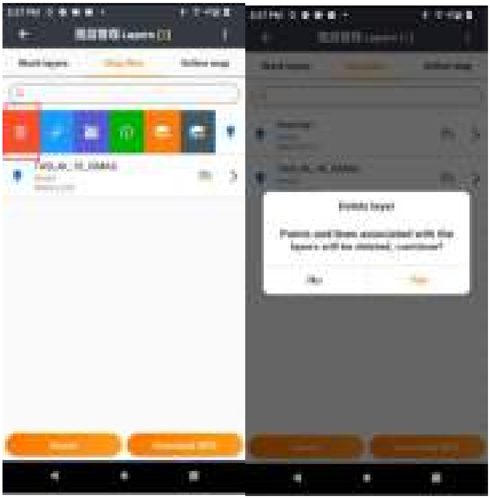
1) Import point entities, Import blocks as points, Import lines/polyline/arc nodes as points

2) Import point types (input points, control points, stakeout points)

3) The import methods include Append, which allows opening multiple base maps simultaneously, and Overwrite, which deletes the original base map and opens the newly selected one.

5.7.2.2. Delete

Used for removing the map files



5.7.2.3. Map

Used for viewing the base map

5.7.2.4. Calibration

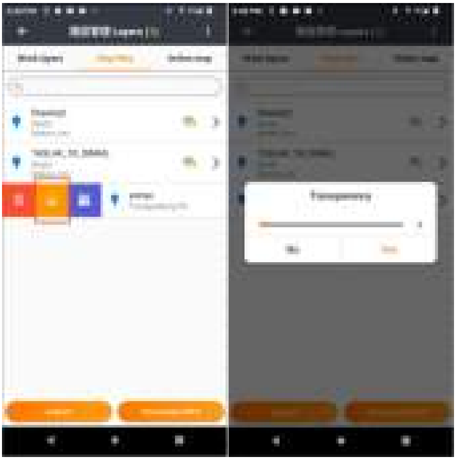
Used for calibrating the base map, applicable to vector base maps

5.7.2.5. Properties

Used for viewing and editing the attributes of the base map, applicable to vector base maps.

5.7.2.6. Transparency

Used for adjusting the transparency of the base map, applicable to raster base maps.



5.7.2.7. Visibility

Used to control the visibility state of the base map

- Vector Base Map

Click the light bulb icon on the left side of the base map to control the visibility of the entire base map.

Click the expand button on the right side of the base map. Then click the light bulb icon on the left side of each layer to individually control the visibility of each layer.

➢ Raster Base Map

Click the light bulb icon on the left side of the base map to control the visibility of the entire base map.

Swipe right on the layer, and click "Show All"/"Hide All" to quickly control the visibility of all sub-layers in batch.

5.7.2.8. WFS Download

Used for downloading WFS base maps

5.7.2.9. More-Multi-select

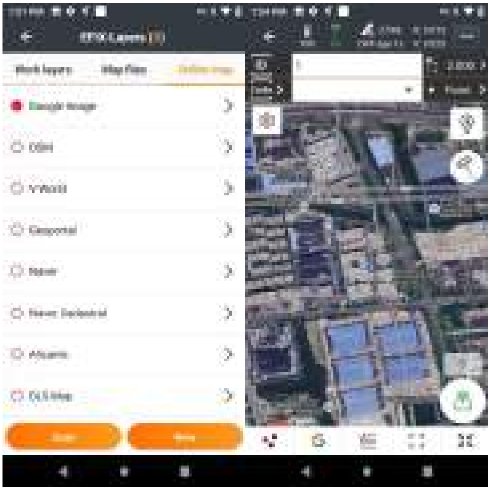
Used for batch deletion of layers.

5.7.3. Online map

The operations that can be performed on the online map include [display], [**Calibration**], **[Download]**, **[Scan]** to add base maps, and **[Add WMS]**.

5.7.3.1. Display of Online Base Map

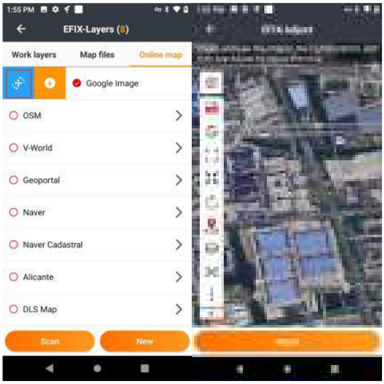
Select the online base map (only single selection is allowed), and enter the Map survey interface, where the selected online base map will appear.



5.7.3.2. Calibration

Used to calibrate the position of the current point on the online base map

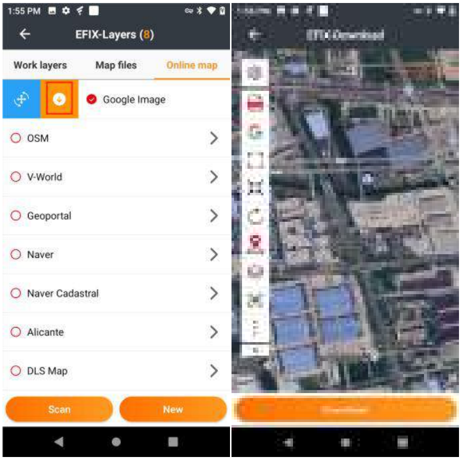
- Swipe right on the online base map, and click **Calibrate** to enter the online base map calibration interface.



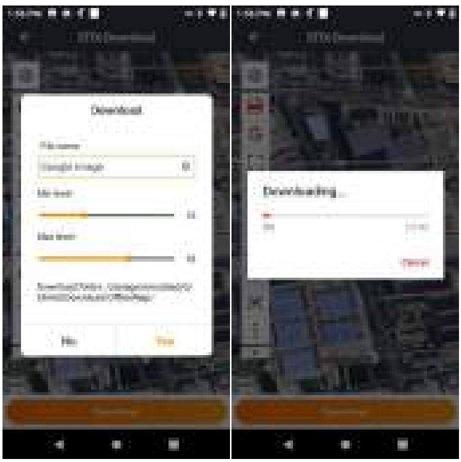
- Drag the base map to adjust the current position cursor to the correct location, then click Calibrate. Check the north and east offsets (which can be modified), and click Confirm to complete the calibration. After the calibration is completed, a Clear button will appear in the lower right corner. If clicked, it will clear the calibration results.

5.7.3.3. Download

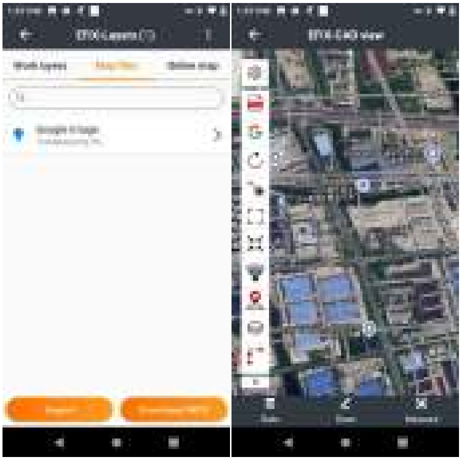
Used for downloading the online map



Drag and zoom the base map to select the range of the online base map you want to download (the range displayed on the screen), and then click **Download**. Confirm the file name, maximum level, and minimum level, and then click **OK** to start the download.

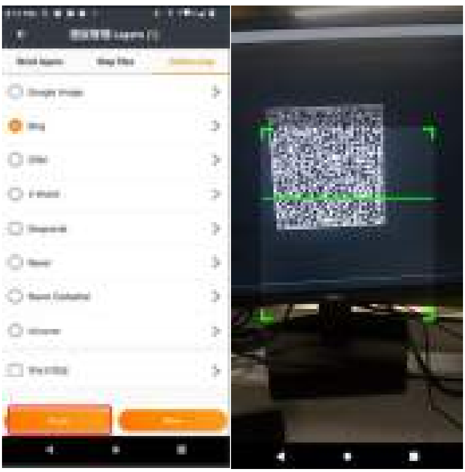


After the download is complete, the base map interface will display the corresponding downloaded online base map. Swipe right to check and confirm that the download is correct.



5.7.3.4. Scan

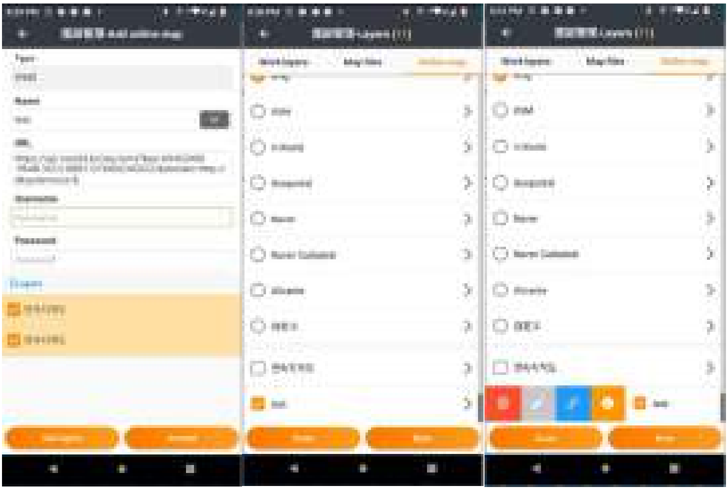
Used to add online base maps



5.7.3.5. Add WMS

Used to add WMS base maps.

Click the "**New**" button in the lower right corner to enter the WMS addition interface. Enter the name, URL, username, and password, then click Get Layers. After selecting the desired layer, click Save. The corresponding WMS will appear below the online base map. You can swipe right to perform actions such as deletion, editing, calibration, and downloading.



5.8. Images

The function can be used to **process** and **edit** images from **Vision Survey.**

6. Import

The data import function has been consolidated into a unified entry point to facilitate the import of various data formats

If the data collector supports OTG/SD card functionality, users can directly select files from the external storage connected via OTG during the import process.

Additionally, an innovative import workflow has been adopted, where users first select the type of file and the specific file to be imported, and then choose the file format. When importing text files containing points or points to be set out, the system features a format-checking function. If any erroneous data is detected, users can directly modify it and proceed with the import.

6.1. Points/Points to stakeout Import

6.1.1. Step 1

Select the Import File Format: A variety of file formats are available to meet the needs of most customers.

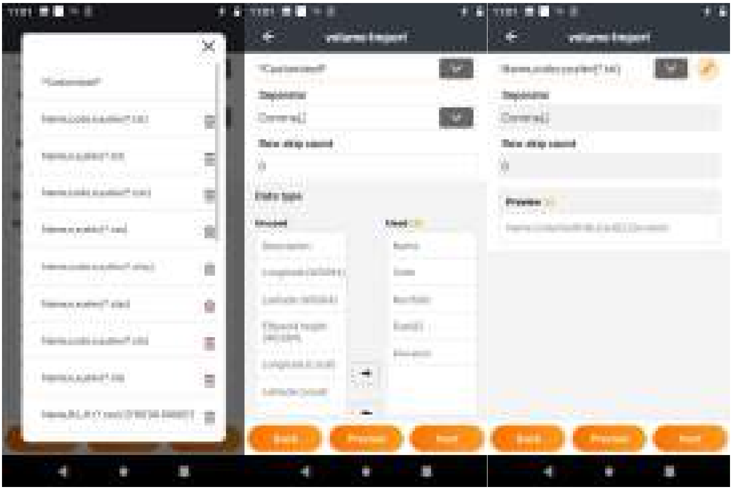
6.1.2. Step 2

select the Path and Data File for Import: When selecting a directory for import or export, system directories that start with a "." will be automatically filtered out. Folders are sorted in numerical and alphabetical order, and shortcut directories are displayed at the top (such as Bluetooth, Downloads, Sharing Code Folder, Export Folder, Current Project Folder, as shown in the figure below). After selecting the file to be imported, click Next.

6.1.3. Step 3

Select the layer for the imported points and check whether to create control points. By default, this option is unchecked to import points as regular input points. The option to create control points is not available for points to be set out.

Cloud Service: Click the floating cloud service button to choose cloud disk download or share code download. You can import files from the cloud disk or download files via share code for import.
Text File Import Parameters: After selecting a "Coordinates file" format, you can further choose predefined data formats or custom data formats.
Preview: After selecting the corresponding format for the imported file data, you can use the Preview function to verify the accuracy of the imported data.

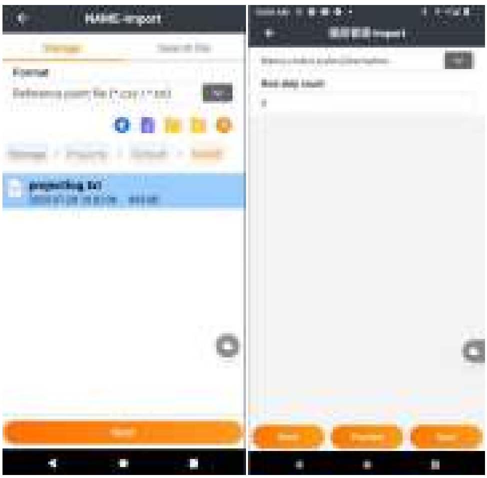


6.2. Reference map files Import

Format: Currently supported formats include DXF/DWG, SHP, KML/KMZ, and XML. Control the visibility of different layers under **Map Survey** > **Tools** > **Layer Management**.

6.3. Reference point files Import

Format: Supports importing points from CSV files in a fixed format as reference point types, and verifies the accuracy of the imported data using the Preview function.



6.4. Lines/Arcs Import

Format: Currently supports formats such as LNS, PXY, and KOF.

6.5. Codes/Code library Import

Format: Currently supports formats including CSV, XML, CXL, FCL, FXL, and MXL.

6.6. Background images Import

Format: Currently supports formats such as TIF, JPG, MBTILES, JMTILES, and WFSDB.

6.7. Coordinate system Import

Format: Currently supports formats including DC, JXL, CAL, LOK, and CRD.

6.8. Site calibration Import

Format: Currently supports formats such as CAL, LOC, COT, and TXT.

7. Export

The function can be used for exporting the data files in different types.

7.1. Points+Survey report

Format: Support TXT, CSV, DAT, XLS, XLSX. There are several available formats in common sequence that provides users to use and users can also set the format in **Customize** (users can customize the import contents while choosing the CSV, DAT and TXT format.)

Map selection: Users can filter points on the Map through complete or custom ranges.

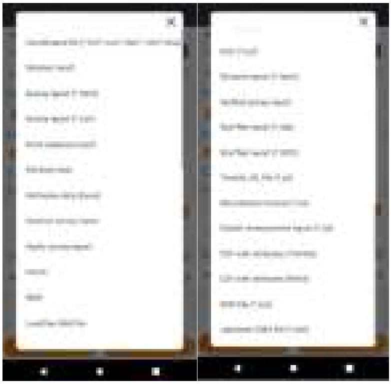
Filter-Type: Users can choose exporting point types including **Survey Point**, **Enter Point, Control Point** and **Base Point**.

Filter-Measurement Time: Users can set the start time and the end time for exporting data.

Filter-Keyword: Users can filter and export points based on **Name, Point name range, Height range, code.description, GNSS Base or layer.**

Report: Support Detailed result, Survey report(HTML), Survey report(CSV), Point stakeout result, Attribute data, Attribute data(Excel), Pipeline survey report, Hydro survey report, Polish, MosGorGeo-Raw, Measurement report, Area report, Slovenia report(.html), Verified survey report, Star*Net report(.dat), Star*Net report (. GPS), Trimble JXL(.jxl), MicroStation format(.txt), and RAW data and so on.

Only when users create a project with PIPELINE TEMPLATE and survey pipeline data can users export pipeline file successfully.

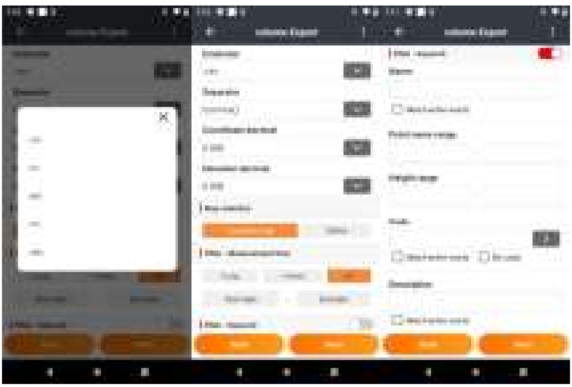


7.2. Points to stakeout

Map selection: Users can filter points on the Map through the complete or custom ranges.

Filter-Measurement Time: Users can set the start time and the end time for exporting data.

Filter-Keyword: Users can filter and export points based on **Name, Point name range, Height range, code.description or layer.**



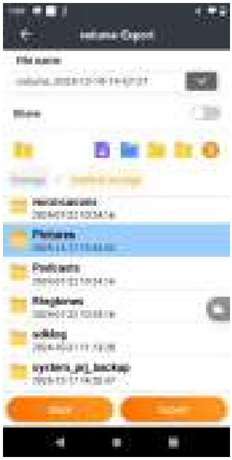
7.3. Map files (All surveyed data)

Format: Support DXF, DWG, SHP, KML, KMZ, XML,

Filter: Users can filter data by layer. You can also filter various types of data according to your own needs, including points, lines, surfaces, and areas. Also, it supports export data including base map.

Custom: After clicking "NEXT", you can enter the selection interface, which includes information such as symbol types and labels.

Path: Select the path of the export file. Click the folder and it will display a blue select prompt. Then, click **Export** to finish.

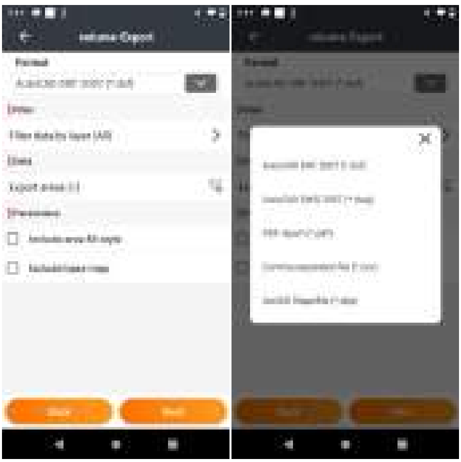


7.4. Areas

Format: Support DXF, DWG, SHP, CSV, PDF;

Filter: Users can filter data by layer;

Parameters: Users can choose whether the exported data includes the fill style or the base map

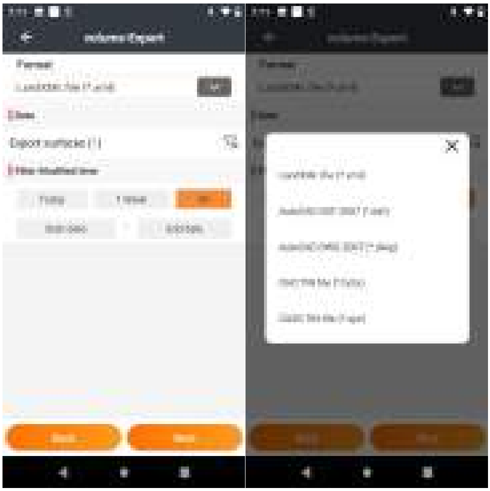


7.5. Surfaces

Format: Support DXF, DWG, SHP, CSV, PDF;

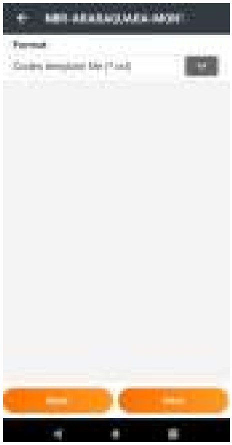
Filter: Users can filter data by layer;

Parameters: Users can choose whether the exported data includes the fill style or the base map



7.6. Codes/Codes library

Format: Support cxl ;



7.7. Coordinate system

Format: Support dc, cal, crd, QR code;

7.8. Site calibration

Format: Support DC, CAL, LOC, COT file;

8. Config

8.1. Connect

For connect.

8.1.1. GNSS

GNSS table is for receiver connection.

Brand: Users can choose **EFIX, XMAP, SPRITE, FarNav.**

Type: includes: **RTK, Internal Android device location, Others (NMEA0183), Simulation.**

Simulation: Enter simulation mode, and then users can use or test all the functions of this software. Meanwhile, the function can simulate position by inputting coordinates.

Model: EFIX RTK includes: **C8, F8L, F8, eBASE, F4, F7, F7+, F6, C3, C5.**

Contact type: Including the choices of **Bluetooth** and **WiFi.**

Antenna Type: Click **Antenna Type List**, select antenna type (Users can select antenna type of different products from different manufacturers). Users can handle specific item by clicking **Add**.

Target: While using Bluetooth connection, click **Search** to the interface of Bluetooth. Select Bluetooth management, click **Refresh** to find the device to Pair (Default password is 1234 if it's required to input). When the pair is successful, just turn back to the connection interface. Then click **Connect**. When the connection is successful, users will back to the main interface. While users use **WiFi** connection. Click **Search**, then it will show users the WLAN interface. Click **Refresh** to find the SN of the current receiver, input password (Default password is 12345678), then click to connect the target. When the connection is successful, just turn back to the connection interface. Then click **Connect**. When the connection is successful, users will back to the config interface.

Connect: Click to start connection.

Disconnect: Break the current connection.

8.1.2. Total station

Total station table is for total station connection.

Brand: Leica, Topcon, CHC, Geomax, Sokkia, Nikon, Simulation

Model: Leica: TPS1200+/100, TS11/13/15/16/30/02/06/09

Topcon: GT Series, PS Series

CHC: CTS-112R4

Geomax: Zoom75/Zoom95

Sokkia: iX Series, iM Series

Nikon: Nivo Series, DTM Series, NPL Series, NPR Series

Target: While using Bluetooth connection, click **Search** to the interface of Bluetooth. Select Bluetooth management, click **Refresh** to find the device to Pair (Default password is 1234 if it's required to input). When the pair is successful, just turn back to the connection interface. Then click **Connect**. When the connection is successful, users will back to the config interface.

Connect: Click to start connection.

Disconnect: Break the current connection.

8.1.3. Peripheral

The peripheral table is for peripheral device connection.

Type: Including the choices of **Laser Rangefinder, Pipeline Detector.**

Model:

Laser rangefinder: Including the choices of **D810, D510, D5, SNDWay, Bosch GLM 50 C, Bosch GLM 120 C** and **Simulation.**

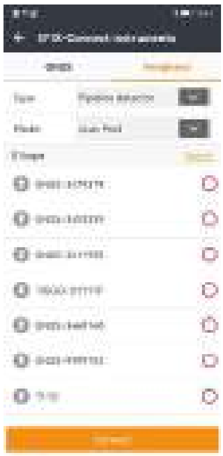
Pipeline Detector: Including the choices of **vLoc Pro2** and **Simulation**.

Simulation: Enter simulation mode, and then users can use or test all the functions of this software. Meanwhile, the function can simulate position by inputting coordinates.

Target: While using Bluetooth connection, click **Search** to the interface of Bluetooth. Select Bluetooth management, click **Refresh** to find the device to Pair (Default password is 1234 if it's required to input). When the pair is successful, just turn back to the connection interface. Then click **Connect**. When the connection is successful, users will back to the config interface.

Connect: Click to start connection.

Disconnect: Break the current device connection.



8.2. Instrument

8.2.1. One-Click fixed

Just select the region and Access Point, click Start-up to get the differential signal to reach a fixed solution.

8.2.2. GNSS rover

The main screen of the GNSS rover displays the configuration of the current equipment, including the receiver settings and device operating modes. In most cases, we use the common and specific operation mode to meet the daily trial.

8.2.2.1. NTRIP model

Click **New** to create a work mode and choose **NTRIP** table.

Name: Enter a name for this work mode.

Network: Choose a model for supplying internet. Include **PDA network** and **Receiver network**.

Domain/IP: input the corresponding **Ntrip IP.**

Port: input the corresponding **Port.**

Select a server: you could add a server and save it. Next time you can choose it in this interface.

Get Mountpoint: get the **Mount point**.

Mount point: choose a **Mount point** you need

Username: The name of user's NTRIP account.

Password: The password of user's NTRIP account.

Automatically connect to CORS (NTRIP): Automatically connect to CORS (NTRIP) when the device is connected.

Save: just save this work mode.

Save&Accept: save and apply this work mode.

If you click Save&Accept, it will pop up "Accept successfully, check details?" Click **OK** to enter the Instrument **Info** interface.

Users can see whether NTRIP login successfully and the reason why login failed.

For example:

(1) When it prompts "Requesting...", the software is receiving login messages from the receiver.

(2) When it prompts "No SIM Card!", users need to insert a SIM card into the receiver first.

(3) When it prompts "3G Module is Dialing, Please Wait...", users need to wait till the 3G module dials up successfully. If users wait for a long time and still can't login successfully, users need to check the status of the 3G module and activate the 3G module dialing up function.

(4) When it prompts "User name and password error!", users need to check the current user name and password and

input the correct one.

Then the green LED will be flashing and the status will come from **Single to Fix, which means the rover is getting the correction data.**

8.2.2.2. APIS model

Click **New** to create a work mode and choose **APIS** table.

Name: Enter a name for this work mode.

Network: Choose a model for supplying internet. Include **PDA network** and **Receiver network**.

Domain/IP: input the corresponding **APIS IP.**

Port: input the corresponding **Port.**

Select a server: choose a server. Or you could add a server and save it. Next time you can choose it in this interface.

GNSS base SN: Enter the serial number of base receiver.

Save: just save this work mode.

Save&Accept: save and apply this work mode.

Then the green LED will be flashing and the status will come from **Single** to **Fix**, which means the rover is getting the correction data.

8.2.2.3. Radio model

Click **New** to create a work mode and choose **Radio** table.

Name: Enter a name for this work mode.

Protocol: Select a protocol. Include EFIX, Transparent, TT450.

Step Value: 25kHz or 120.5 kHz optional, it will only display the supported step value of the receiver.

Baud: 9600 or 19200.

Channel: different channels will show different frequencies. And also can be customized.

Frequency: normally can't be changed and if you choose **User defined**, you can change it.

Transfer differential data: Forward data through **Bluetooth**, **Serial Port**, and **WiFi**, so that users can save money and expand operation distance.

When users choose Bluetooth/WiFi, correction data in the current device will be forwarded to Bluetooth/WiFi, so that other devices can receive the correction data by connecting the Bluetooth/WiFi of the current device.

When users choose serial port, correction data in the current device will be forwarded to the serial port. Users can not only connect the current device to the computer by serial port and view correction data, but also connect the current device to an external radio.

Save: just save this work mode.

Save & Accept: save and apply this work mode.

Then the green LED will be flashing and the status will come from **Single** to **Fix**, which means the rover is getting the correction data.

8.2.2.4. TCP model

Click **New** to create a work mode and choose **TCP** table.

Name: Enter a name for this work mode.

Network: Choose a model for supplying internet. Include **PDA network** and **Receiver network**.

Domain/IP: input the corresponding **IP.**

Port: input the corresponding **Port.**

Select a server: you could add a server and save it. Next time you can choose it in this interface.

Save: just save this work mode.

Save & Accept: save and apply this work mode.

Then the green LED will be flashing and the status will come from **Single** to **Fix**, which means the rover is getting the correction data.

8.2.2.5. PPP

Click **New** to create a work mode and choose **PPP** table.

Name: Enter a name for this work mode.

Save: just save this work mode.

Save & Accept: save and apply this work mode.

8.2.2.6. From cloud

Click an icon like **"cloud"** and then select **From cloud** to into cloud interface.

From cloud: Select a project, click the arrow, the project will be downloaded from the cloud server, and it will be listed in the Projects interface.

8.2.2.7. From sharing code

Click an icon like **"cloud"** and then select **From sharing code** to into cloud interface.

Cancel: cancel this operation.

Get: input the sharing code to get the project.

Use: click **use** to use this project.

8.2.3. GNSS base

The main screen of the GNSS base displays the configuration of the current equipment, including the receiver settings and device operating modes. In most cases, we use the common and specific operation mode to meet the daily trial.

8.2.3.1. Internal radio model

Click **New** to create a work mode and choose **Internal radio** table.

Name: Enter a name for this work mode.

Differential format: Select AUTO.

Protocol: Select Transparent.

Step Value: 25kHz or 120.5kHz, the value depends on the receiver.

Baud: 9600 or 19200.

Transmitting power: Select the radio power of the base receiver.

Channel: different channel will show different frequency. And also can be customized.

Frequency: normally can't be changed and if you choose **User defined**, you can change it.

Elevation mask: 10.

GNSS static recording : ON or OFF.

Start on a known position: ON or OFF. When you click accept, you will come into an interface to input the information.

Save: just save this work mode.

Save & Accept: save and apply this work mode.

8.2.3.2. External radio model

Click **New** to create a work mode and choose **External radio** table.

Differential format: Select AUTO.

Baud: 9600 or 115200.

Elevation mask: 10.

Start on a known point: ON or OFF. When you click accept, you will come into an interface to input the information.

GNSS static recording : ON or OFF.

Save: just save this work mode.

Save & Accept: save and apply this work mode.

8.2.3.3. Receiver network model

Click **New** to create a work mode and choose **Receiver network** table.

Name: Enter a name for this work mode.

Differential format: Select AUTO.

APN: Just set the APN parameters.

Select a server: choose a server.

Elevation Mask: The angle is set for shielding obstruction. The satellites lower than this angle will not be tracked, the default is 10.

Star on a known position: ON or OFF. When you click accept, you will come into an interface to input the information.

GNSS static recording : ON or OFF.

8.2.3.4. Receiver network + external radio model

Click **New** to create a work mode and choose **Receiver network + external radio** table.

Name: Enter a name for this work mode.

Differential format: Select RTCM 3.2.

Select a server: choose a server.

Elevation Mask: The angle is set for shielding obstruction. The satellites lower than this angle will not be tracked, the default is 10.

Star on a known position: ON or OFF. When you click accept, you will come into an interface to input the information.

GNSS static recording : ON or OFF.

8.2.3.5. UAV base

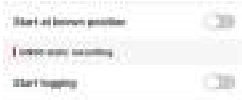
The EFIX GNSS RTK can serve as a base station to work seamlessly with DJI drones. The method is mainly suitable for areas with poor network or no CORS service.

Note: The UAV mode must use WiFi connection to the receiver.

Click **New** to create a work mode and choose **UAV base** .

The settings have been configured in eField, just follow the default. Just remember the default settings, differential format: RTCM3.2, IP: 192.168.2.1, Port: 12345, Mountpoint: 123, username: 123, password: 123, select Save & Accept.

Also choose "Start at known position" "Start logging" according to needs.



After all the above settings are done, we can turn on the DJI M300's remote control, and then turn on the M300 to set.

When we can see the latitude, longitude and accuracy values displayed under the custom network RTK, it means the drone has received the differential data.

8.2.4. Instrument info

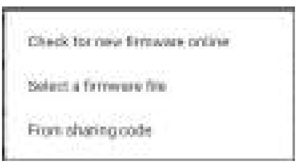
After connecting between controller and receiver, the software will read out the receiver information, such as device type, serial number, expire date, work mode, datalink and so on.

Click the button, switch to the Activate instrument screen.

The main function of the Activate **instrument** is to activate the receiver.

Activation code: input the register code and click **Activated**. If you need the code, please contact the regional sales manager or dealer.

Click the button, upgrade the host firmware and board firmware in three ways:



Click the button:

Retrack all satellites: Click to retrack all satellites in 2 methods.
Fast: Force retrack all satellites.
Slow: Clear ephemeris, cycle GNSS board power

Disconnect PDA Network: Click to break network when you accept PDA network mode. Then, receiver will not receive NTRIP/APIS messages.

Re login: Disconnect login mode and restart.

8.2.5. GNSS static recording

Start logging: click it to get right to edit the settings.

Automatically log when the receiver is turned on: if you choose this function, it will automatically record the static data when it turns on.

Date format: select ECN or RINEX. The RINEX data includes 2.11 and 3.0x.

Interval: Including choices of 20HXZ, 10HZ, 5HZ, 2HZ, 1HZ, 2S, 5S, 10S, 15S, 30S and 1M.

Session duration (mins): Input duration time as you wish, the default is 1440.

Station name: Input station name, the default is the SN of connected device.

Antenna Height: Input antenna height, the default is 0.

Pole height measurement method: Including choices of Slant Height, Antenna phase center, Vertical Height, and the default is Slant Height.

Elevation Mask: The angle is set for shielding obstruction. The satellites lower than this angle will not be tracked, the default is 10.

8.2.6. NMEA Output

This function is set for outputting NMEA messages for other external equipment. GNSS RTK can use Bluetooth, Port to connect receiver; smart RTK can use Bluetooth, port or WiFi to connect receiver. When the config is modified, users need to click Set to confirm the setting is done successfully.

When users finish setting of one output mode, users can copy the setting parameters and paste it to other output mode if users want to apply the same setting parameters to another output mode.

When users use EFIX receivers and set GPGGA output via serial port as 1Hz, please make sure that baud rate is set to 9600.

8.2.7. Elevation mask setting

Press **Get** to retrieve the current **Elevation mask setting** from the connected receiver. Modify, then click set to send to the receiver.

8.2.8. Position output frequency

Press **Get** to retrieve the current **Position output frequency** from the connected receiver. Modify, then click set to send to the receiver. This is the coordinate update rate from the OEM GNSS board and may not be supported for all equipment.

8.2.9. Retrack all satellites

Click **Fast** to force retrack all satellites.

Click **Slow** to clear ephemeris and cycle GNSS board power.

A reset may be beneficial when verifying solutions under heavy canopy and this sequence is automatically applied during the Control survey methods.

8.2.10. NFC/Wi-Fi

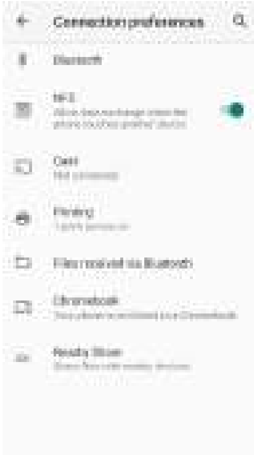
NFC, also known as short-range wireless communication, is a short-range high-frequency wireless communication technology, allowing electronic Non contact point-to-point data transmission (within 10 cm) is carried out between devices to exchange data.

Here, NFC has three functions: 1. WiFi, Bluetooth connection; 2. modify WiFi password. 3. software start function.

(1) Turn on NFC function

Use the NFC function of the Android controller to make a detailed description

Click [settings] - [more...], and then open NFC. Some phones the NFC is switched on by default.



(2) Connecting the receiver

After the NFC function is turned on, lean the NFC function area on the back of the controller against the NFC logo of the receiver and touch it gently.

At this time, the system will automatically open the Bluetooth or WiFi of the controller to start the connection. If the connection is successful, there will be a sound prompt.

If the controller is the first time to connect to the receiver via Bluetooth / WiFi, just click you need to enter the Bluetooth / WiFi password.

Pair the connection manually, after that no need to input again. Connection method defaults to last time.

(3) Change WiFi password

Turn on NFC / WiFi, you can change the WiFi password of the current device and follow the prompts below.

8.2.11. Upgrade

Upgrade firmware: click and choose firmware to update firmware for receiver, only support updating firmware via WiFi connection.

Upgrade GNSS board firmware: click and choose firmware to update firmware for receiver, only support updating firmware via WiFi connection.

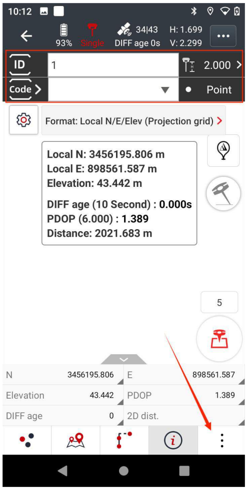
Software version: click to check for update.

9. Survey

9.1. Survey

9.1.1. Interface of the Survey

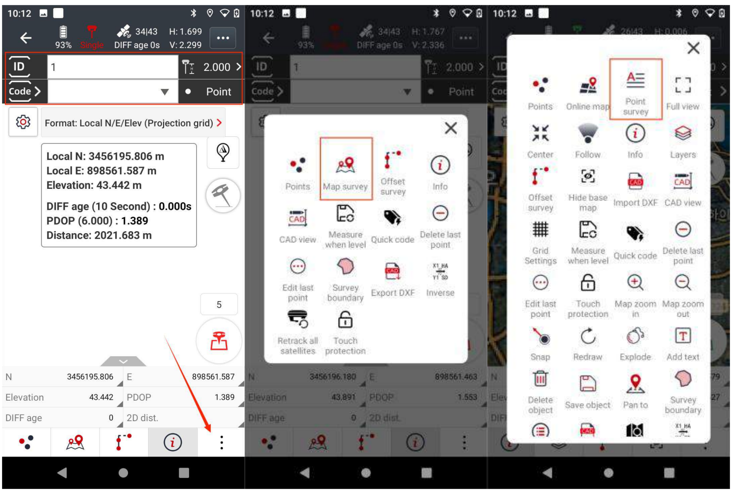
There are antenna height, point name, and code on the top of the interface. Here users could also add a **description** of the points (Code).



Clicking opens the Antenna height menu:

The Antenna height menu keeps the 10 most-recently-used antenna heights so that you can quickly switch between standard pole heights.

Clicking opens the **detailed toolbar, which** allows to switch between **point survey** and **map survey**:

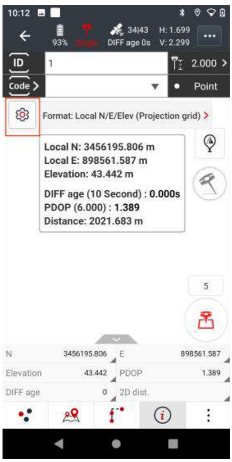


9.1.2. Point Survey

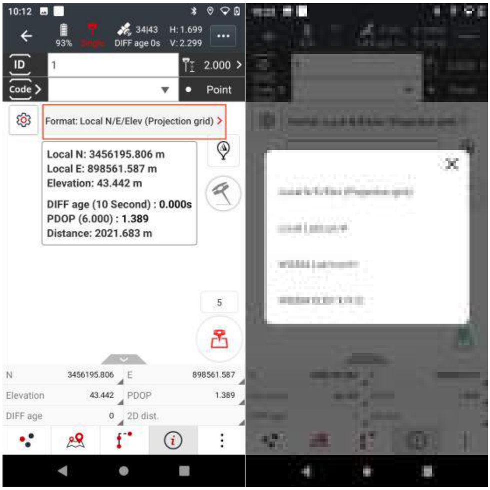
9.1.2.1. Interface of the Point Survey

Users could select change the **settings** in the survey of point.

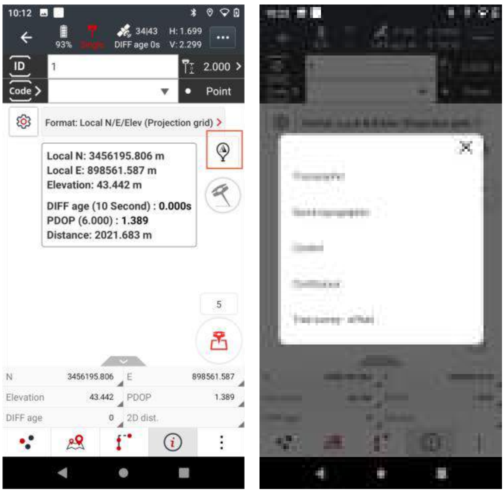
Users could select change the **settings** in the survey of point.



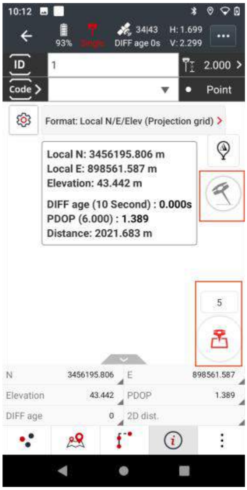
Users can also change the **format** of points.



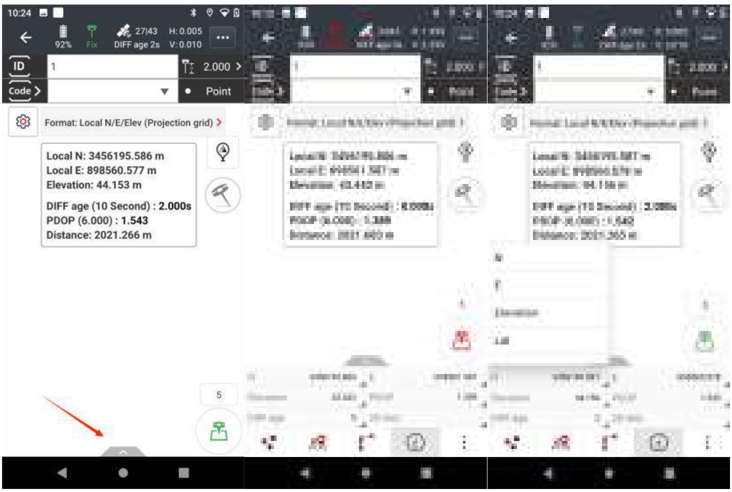
Users can also change the different way of surveying the point.



Users can locate where they are using this button.



Drag this thing up, you can change the display of the point parameters.



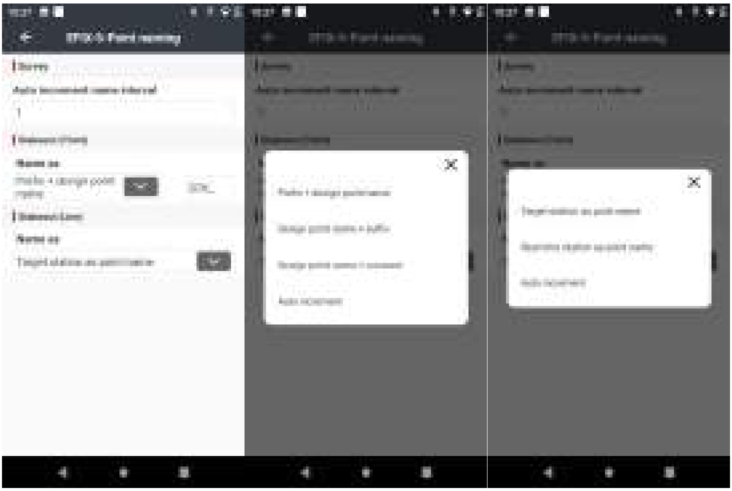
9.1.2.2. Settings

9.1.2.2.1. Survey

The settings are the same as **2.1.10**

9.1.2.2.2. Point naming

Users can set the **Auto increment name interval** when surveying, and choose **the name in different formats** when using Point stakeout and Line stakeout.



9.1.2.2.3. Display

Any display options will be in this interface.

Display Settings are detailed in **2.1.12.**

9.1.2.2.4. Snap

Users can choose the type of capture point and also set the color of the capture arrow.

Snap Settings are detailed in **2.1.13.**

9.1.2.2.5. Tools

Select and unselect different items, then put it on the left side of the point survey interface.

CAD View: Open this data base in the CAD view.

Points: At this manager, you can import, export and add points you want. Also, we can choose the points you want to stake.

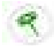
Offset Survey: Choose your reference point, generate new points according to your offset, azimuth, or the way two points meet

Map Survey: Open this points base in the map survey interface, so you can change the auto center or the follow mode.

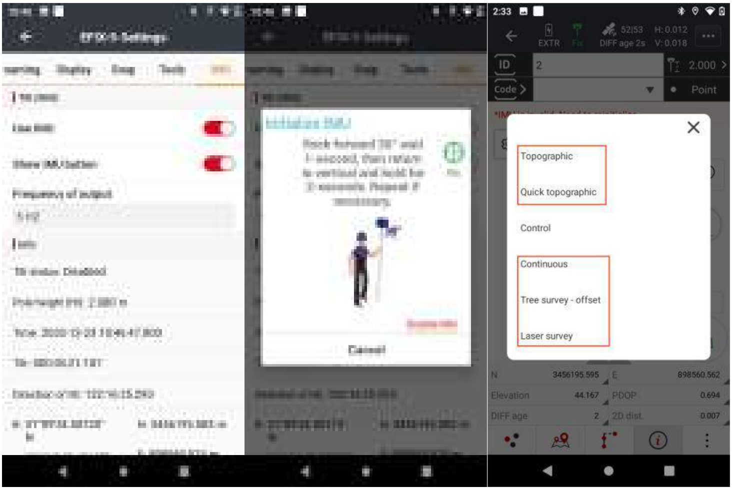
9.1.2.2.6. IMU

You can choose to use the IMU or not and can activate the IMU button and choose to show the button or not. If you want other frequency, you can also change the outputs option.

9.1.2.3. IMU Survey

Click  to activate tilt measurement.

Do as the instructions say.



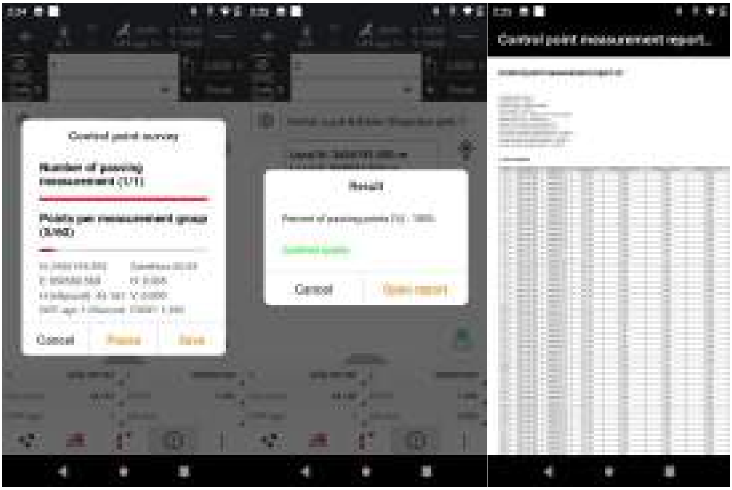
 icon would appear when the initialization is successful.

Click survey icon  to begin survey.

The IMU can be used in the **Topographic, Quick topographic, Continuous, Tree survey-offset** and **Laser survey.**

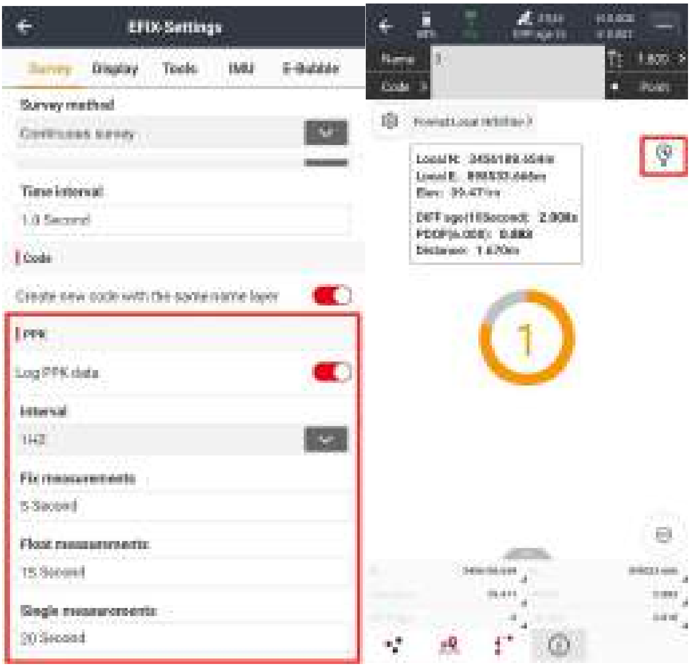
9.1.2.4. Control survey

Control points would take a long time to observe, but it could provide high precision results. Users could adjust parameters for the survey and click **Next** to start the control survey. After measuring is finished, users could check its attributes, then click **OK** to finish.



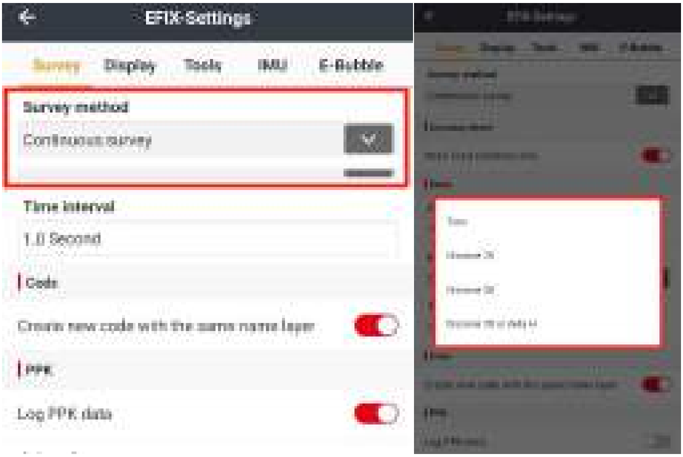
9.1.2.5. PPK survey

Users could choose **Interval**, **Elevation mask**, and **Observation time** as they wish. Click **Next** to enter PPK mode. Click PPK icon to start PPK measure.



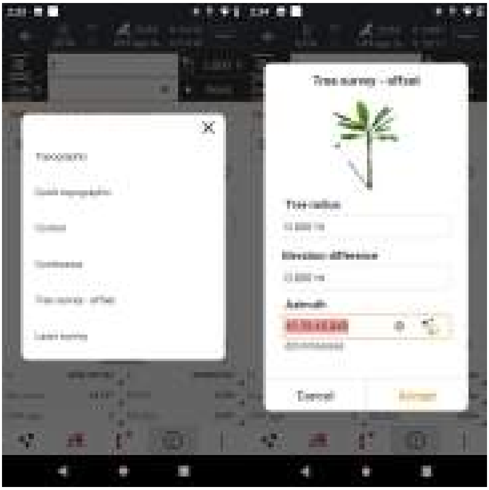
9.1.2.6. Continuous survey

Continuous survey automatically accords to a preset fixed **time period** or **space distance**. There are four modes to select.



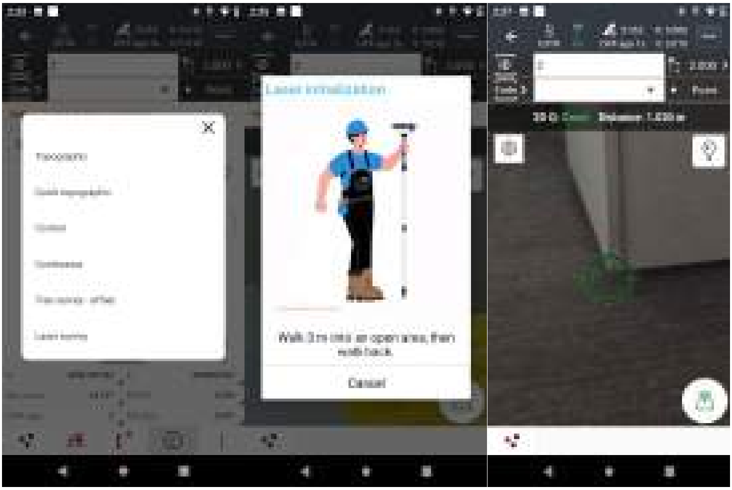
9.1.2.7. Tree survey - offset

Users are aware of the horizontal offset and elevation offset, and can complete the offset survey in one step without having to jump to the offset survey.



9.1.2.8. Laser survey

Now only F8L receiver supports Laser survey.

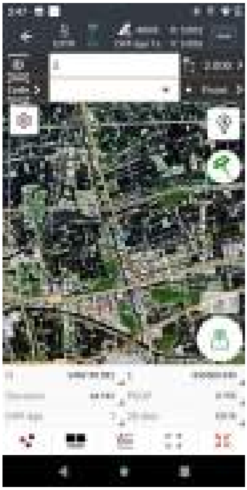


9.1.3. Map survey

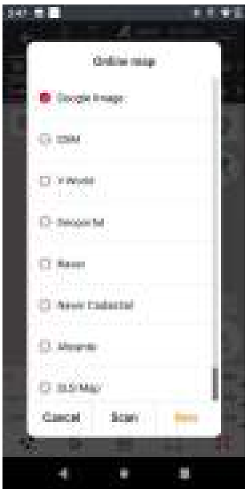
Map Survey allows users to survey with a base map. The base map can be online maps or maps imported by users.

This function can import base maps in five types, including DXF, SHP, KML, KMZ, SIT, TIFF and WMS. SIT is a compressed type, and WMS is an online base map type. After importing, the points or lines in the base map can be displayed, selected, and staked out.

Users can choose WMS/WFS for a clearer raster or vector map of the working area .



To use an **online map** as base map, click on the **map** icon on the left. You can choose the preset maps, or you can add a map supporting WMS or WFS by clicking on the **plus** icon in the top right.



Users can import base maps of different formats in layers

[ID]: The default name can be used, or enter it yourself.

[Code]: Click the code to enter the code management, select the code from the code management, or directly from the drop-down list (the code and the survey type interact with each other in the drop-down list, survey type when the point is selected, only the point code is displayed in the drop-down list, and when the line is selected, it is automatically switched to the line code)

[Survey type]: **Map Survey** provides **point** and **line** survey with an optional background map. After selecting the line, the collected points will be automatically connected into lines.

[Survey Method]: Click to switch survey method within Topographic , Quick topographic, Control, Continuous, Tree survey -offset , Laser survey.

9.1.3.1. Point survey

Survey type select the **point**, enter the ID, code, select the survey method, modify the antenna parameters, etc., click measurement.

9.1.3.2. Line survey

Points and lines will be displayed in different colors or styles (the color of points and lines is mainly based on the color selected when creating a new code, which can be referred to as "Project" - "Code").

[Polyline]: Support polyline, arc, multi-point arc, spline curve, one point circle, three-point circle, square, square center, rectangle, rectangle center.

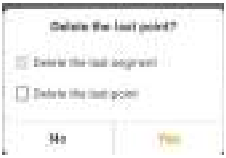
[Lines]: Enter the line segment editing page.

[Close]: When the number of points on the polyline is greater than 2, the line supports closure.

[Break drawing]: Break the measurement from the current line and proceed to the next task.

[Invert]: Swap the start and end of a line segment.

[Rollback]: delete a line or delete a line and points on it.



9.1.3.2.1. Multiple line types

Polyline is a line formed by connecting the collected points in turn.

The **arc** is automatically generated by collecting three points.

Multi-point arc is a quasi-synthetic arc by collecting multiple points.

The **spline curve** is a pseudo-synthetic curve for collecting multiple points.

One-point **circle** is the center of a circle plus any point on the circle.

Three-point circle is a circle generated by any three points on the collection circle.

The square is obtained by collecting two points on the opposite side of the square.

The square **center** is to collect the center point of the square (that is, the intersection point of the diagonal) and then collect the center point of any side of the square to find the side length to generate a square.

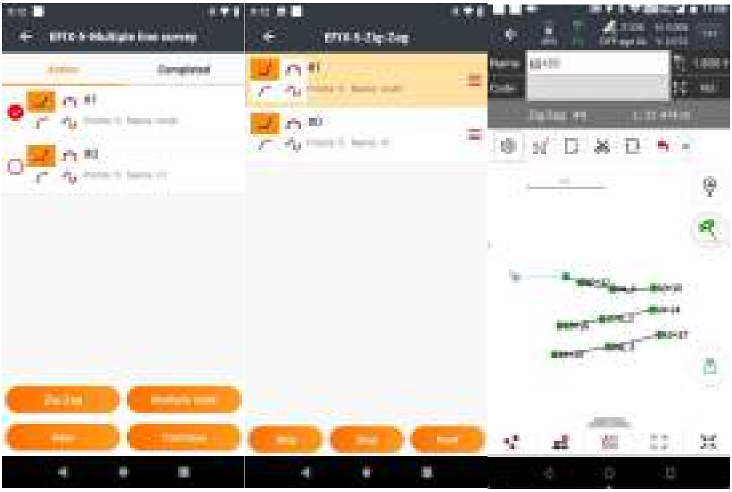
Rectangle is to collect 2 points as the wide edge of the rectangle, and then collect any point (including the point on the extension line), the vertical distance between the point and the wide edge is the length of the rectangle height to generate the rectangle.

The **rectangle center** is to first collect the center point of the rectangle (the point where the diagonal intersects), then collect the center point of any side of the high side to find the length of the wide side, and finally collect any point of the wide side (including the point on the extension line) to find the length of the high side to generate the rectangle.

9.1.3.2.2. Zig-Zag survey

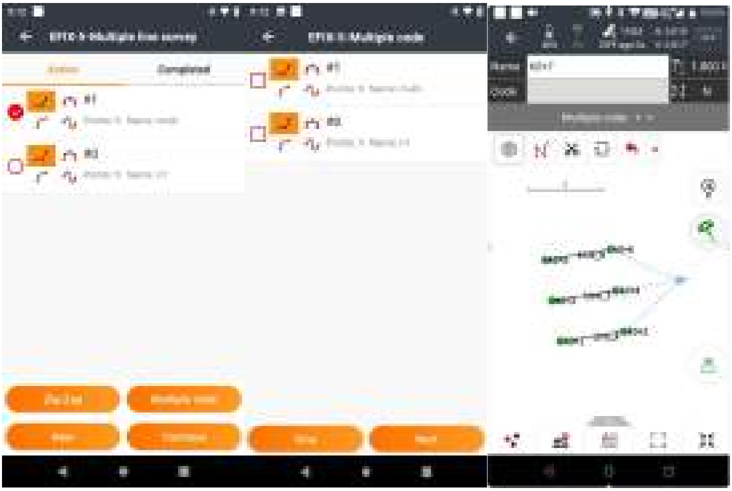
On the multiwire screen, click Zip-Zag, the Zip-Zag survey screen is displayed (the line type can be changed also), click Next, the survey will be made in this order: Line 1 - line 2 - line 3 - line 3 - line 2 - line 1 - line 1 - line 2 - line 3, etc.

Select the corresponding icon, the line type can be changed to: polyline, arc, multi-point arc, spline curve.



9.1.3.2.3. Multiple code survey

On the multiwire screen, click Multiple code, the Multiple code survey screen is displayed (the line type can be changed also), select the line segment that needs to be measured at the same time, click Next to jump to the measurement interface, and the point where the receiver is located will be connected with the selected line segment at the same time. After measurement, the points will be displayed together on the selected line.



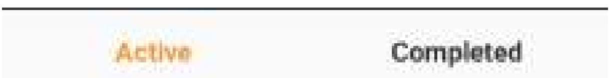
9.1.3.2.4. New and Continue

Click **New** to new a line.

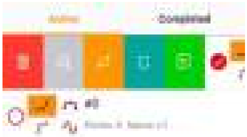
Select an existing line, Click **Continue** to Continue surveying the line.

When measuring features (including points, lines, and surfaces), if the current feature is not measured at one time and another feature is measured, the software will automatically suspend the current unfinished feature.

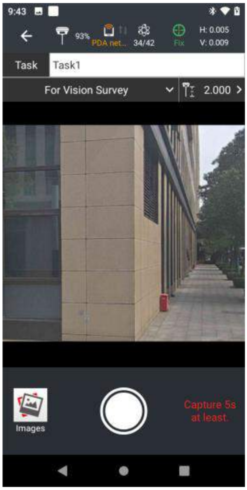
In multi wire Management, users can view the Active lines and Completed lines.



Select line and swipe right, it also supports deletion, renaming, inversion, closing, and completion.



9.2. Vision survey



Click the button on the top-left corner to choose the mode between **For Vision Survey** and **For 3D Modeling**.

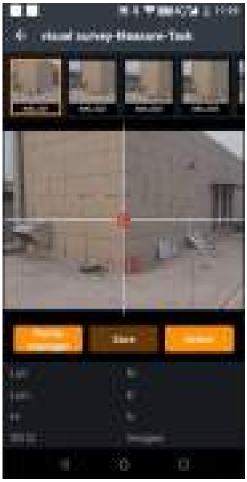
And check whether the height of the antenna is consistent with the height of the pole.

9.2.1. For Vision Survey

9.2.1.1. How to use the Vision Survey

Click t**he Start icon** and keep the camera facing the target point and shoot around the target point.

After shooting, click **the Start icon** to stop. And Click **Confirm** to process.



By moving and zooming the selected picture, make the cross mark aim at the target point to be surveyed.

In order to improve the accuracy of the thorn point coordinates, the same point can **be selected in multiple pictures**.

And then, click **Save** to save the target point coordinates.

9.2.1.2. Notes

1. Currently supported receivers for vision survey: F8, C8.
2. When Vision survey, the connection method must be WIFI.
3. Ensure that the Vision RTK is carried out in open and unobstructed locations to obtain a stable fixed solution.

4. Try to capture a visually rich scene by adjusting the shooting angle and distance to include diverse textures and lines.

5. Avoid capturing dynamic objects with changing light and shadows, such as reflective glass, water surfaces, moving objects, cars, or pedestrians.

6. Aim to shoot in well-lit conditions and avoid shooting in low light, strong light, or against the light.

7. Maximize the line of sight between the target points and the shooting route, minimizing any obstructions in between.

8. Maintain a consistent walking speed while shooting, ensuring that the video duration is not less than 5 seconds.

9. The horizontal distance (in the walking direction) should be greater than 4 meters, and the vertical distance (in the direction of the target) should be greater than 2 meters. It is preferably within 15 meters in the vertical direction.

10. The suggested shooting route can refer to the diagram below, which includes straight walking or circular shooting.

11. Localization calculation is relatively slow, with approximately 1 minute of calculation time for 10 seconds of data and around 5 minutes for 60 seconds of data.

12. It is possible to perform post-processing by opening the image gallery in the office and conducting subsequent calculations.

9.2.2. For 3D Modeling

9.2.2.1. How to use 3D Modeling

Click t**he Start icon** and keep the camera facing the target and capture the video. You can also repeat this until you get the whole thing.

Click **the Start icon** to stop.

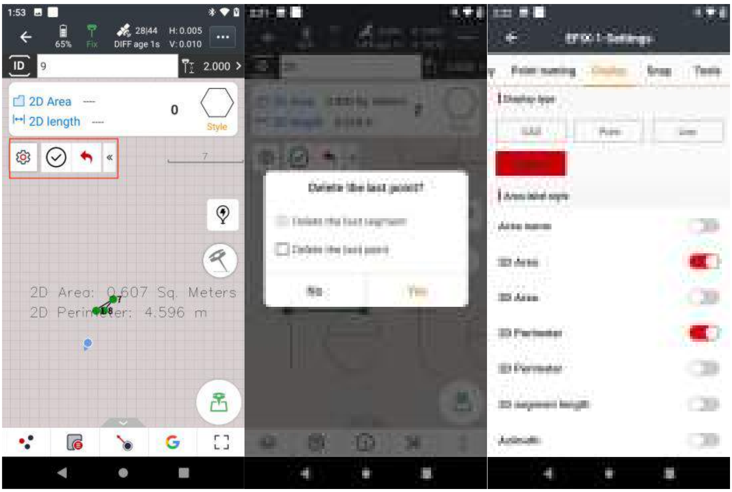
9.2.2.2. Notes

1. Currently supported receivers for vision survey: F8, C8.
2. When Vision survey, the connection method must be WIFI.
3. The shooting scene should be chosen in a relatively open location to obtain stable fixed solutions.
4. The field of view and scenery can be adjusted by adjusting the shooting angle and distance, making the texture lines of the shooting field more rich.
5. Avoid shooting objects with dynamic changes in light and shadow in the field of view. Such as reflective glass, reflective water surfaces, floating objects, moving cars or pedestrians.
6. Try to shoot in good lighting conditions, avoiding shooting in low light, strong light, or backlight.

7. Try to maximize the visibility between the target point and the shooting route, avoiding any obstruction in the middle.

8. Data export: open the controller's "Files" menu, and you can find the observed image data in the following file path:
"EField \ EF_Projects \ Project_Folder \ Image Task \ Task_Folder"

9.3. Area survey



Click the measurement interface to open the area calculation.

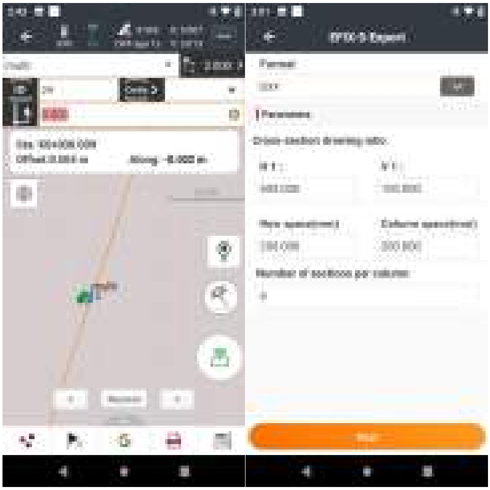
Measure turning points sequentially. You can also click the delete button  to **delete the last segment and the last point.**

After the measurement is completed, click Finish .

The graph will automatically close and the area and side lengths can be found.

Click the settings to adjust the **Area label style**.

9.4. Cross-section survey



Choose the line on the top-left corner. And 3 buttons are below: "Last", "Nearest" and "Nearest". You can change the cross sections by clicking these buttons.

You can enter the mileage of the cross-section you want to survey.

The orange line perpendicular to the line is the cross-section line for the target mileage.

Follow the direction of the line until the "Along" deviation becomes 0.

If the "offset" shows a negative number, indicating that the current position is on the left side of the road's forward direction, and a positive number is on the right side.

If you want to export the cross-section data. You can find the export button in the toolbar.

10. Stakeout

10.1. Point Stakeout

First, we need to open a project or create a project before we start the point stakeout.

In this case, we will use a CAD file as simple.

From the points **library**: Select a point from the points library, you can also add a point manually, or import/export the point file in this faction.

From **Stakeout points**: Select a point from the stakeout points library.

Online map: Users can choose the online map which they want to use as background.

Enter a point: Users manually input the name, code, and coordinates, then click **Stakeout**.

ATUO nearest point: The **ATUO nearest** button is to rank points according to distances.

Full view: Users can view the full map.

Center: Users can click it once to make the map always heading north, click it twice the map will rotate in the direction of PDA, click it three times the Auto centering will be turned off.

Snap: Users can choose a point on the map by the arrow.

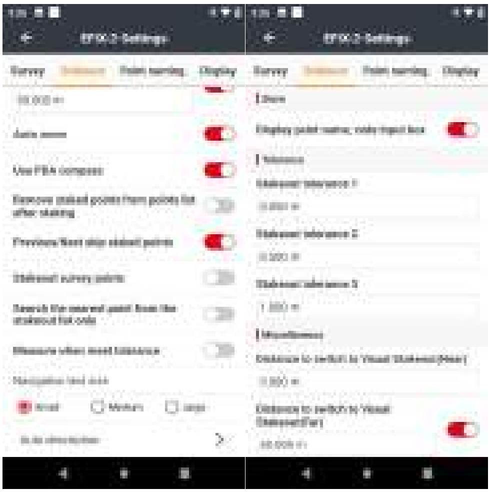
Click the compass icon will show distance and direction to the point.

Click the survey button to stakeout the point.

User can set the Antenna height in Antenna height.

Click **Settings** icon to open the settings.

Stakeout settings: Users can change the store settings, the tolerance settings and the miscellaneous settings in this part.



Tools

The **Tools** setting includes all the tools, selected and unselected.

Info: Click to show or hide the information on the stakeout interface.

Offset stakeout point: Users could manually input coordinates, pick from the map, instant survey, or select from point library. After inputting different parameters, click **Result** then input the **name** of the new point. Click **OK**.

Hide / Show base map: Click to hide or show base map.

Import DXF: Users can import the DXF files from memories.

Layers: Users can show/hide the layers.

Touch protection: Click to use the touch protection. And click the button to disable the touch protection.

Map Zoom in/out: User can zoom in/out the map by these two tools.

CAD View : Users can edit the CAD map in this tool.

Grid Settings: Generate a grid based on the selected origin, azimuth, horizontal spacing, vertical spacing, and color.

Redraw : User can regenerate the drawing. Click **OK** to redraw the map.

Explode: Users can break a compound object into its component objects. Click OK to explode the selected object. It's the same command in AUTO CAD.

Add text: Users can add text to where they tap the screen.

Save/Delete object: Users can save or delete the chosen object.

Pan to: Users can locate the screen center manually.

Survey boundary: Click to set the survey boundary.

Attributes: Click to show the Properties.

Export DXF: Click to export DXF.

Find map: Click to find the map if you don't know where the base map is.

Inverse: Through the function, users can calculate and obtain **Azimuth, Ground, Grid, CSF, SDist, EDiff, Slope, Delta N, Delta E, Delta Z.**

Retrack all satellites: Click to retrack all satellites in 2 methods.
Fast: Force retrack all satellites.
Slow: Clear ephemeris, cycle GNSS board power.

10.2. Line/Arc Stakeout

Line: Users could choose an object from the map or manually input the point on the line.

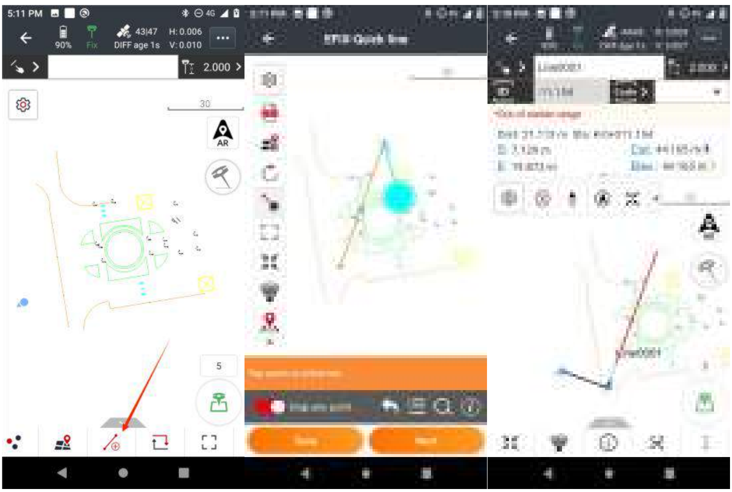
Stake: Click the stake button can choose the way we stake out the line. In this mode, users can stake out the line stake by stake. Users can also change the parameters, Start station, Station interval and the offset settings.

To line: Users can stakeout any point on the line in this mode. Users can also change the Start station and the Offset distance.

Node: The system will automatically choose the feature point of the polygon or the line. Such as the center of the circle, the corner of the polygon and the line.

Invert: Click the button will switch the start and end point of the line.

Quick Line : Select points from the point library to form a polyline. Then, use this polyline in the line layout function for layout purposes.



Polyline: Users input the name of the polyline, start station distance, select points. Click Next.

Arc: Users input the arc name, start station distance. Select the arc mode and input values as the mode needs. Click Next.

Circle: Users input the circle name. Select the circle mode and input values as the mode needs. Click Next.

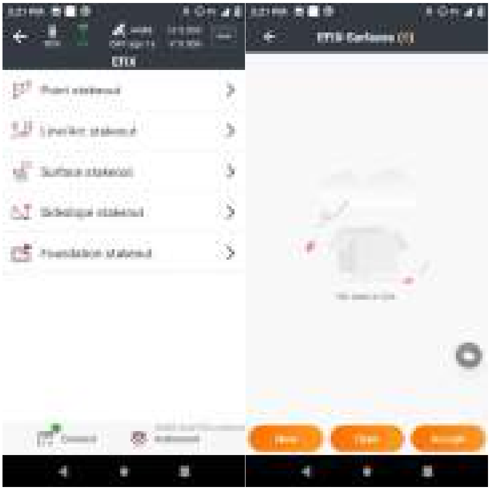
Alignment: Users input the name, start station distance. Choose horizontal or vertical alignment item. Click Next.

Stakeout of point on line: Click **multifunctional icon** to open to-the-line function. Set horizontal offset, then click Stakeout.

Stakeout of station&offset: Click **multifunctional icon** to open Stakeout of station&offset function. Set start station distance, station interval distance, azimuth, and horizontal offset, then click Stakeout.

10.3. Surface stakeout

Click the surface icon, the **surface library** will pop up automatically.



Click **new** then input the surface file name, Click **OK** to continue. For detailed operations.

In stakeout interface, find the target following the arrow's direction. The text indicates the design height, current height, fill or cut depth when receiver is in the surface area. Click stakeout icon to stakeout.

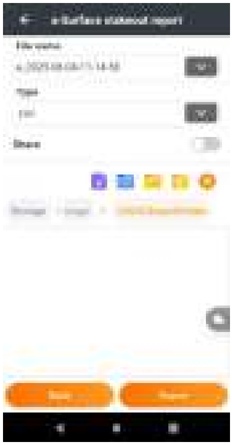
Stakeout: Find the right position and click the stakeout icon for staking out.

 icon is to show the points data base.

icon is to load the online map.

The icon is to show real-time fill or cut information.

icon is to export the stakeout file, support csv, txt, and dat file.



icon is to the CAD view function.

10.4. Sideslope stakeout

First, choose a polyline on the map as the baseline.

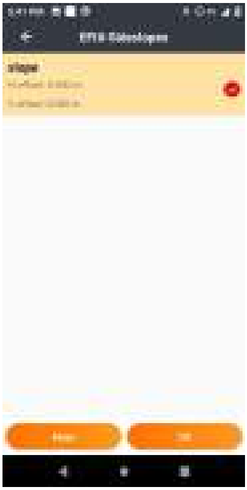
Click the rectangular box on the top-left corner to select a sideslope.

Click New. If the start of the slope does not meet the edge of the roadbed, the H offset and V offset need to be entered correspondingly.

Click Add to add a string of the sideslope.

When we choose the string, it will be highlighted in red.

Then we choose the sideslope we created just now.

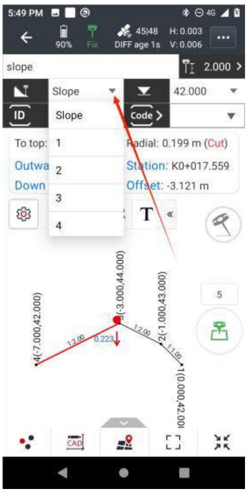


Click and we can change the view.

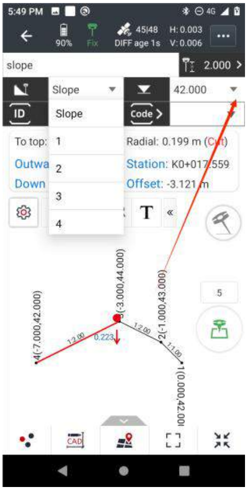
Click we can change the left or right sideslope.

Click T we can change whether some information is displayed or not.

Choose the dropdown list we can choose the target as we need.



Choose the dropdown list we can modify the design elevation.



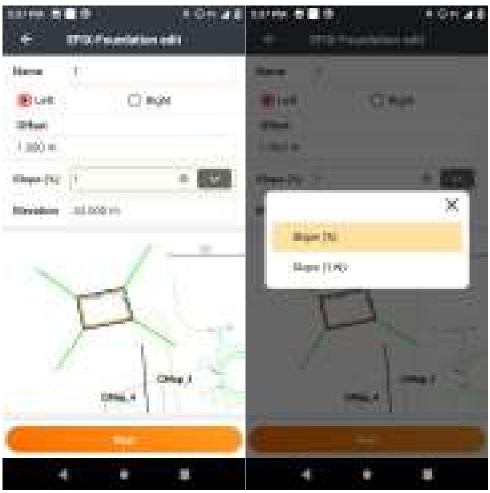
The screen will show us the direction and the distance we need to move.

When we move to the target we can click the survey icon to stakeout the sideslope. (This video is for demonstration so we didn't move to the target)

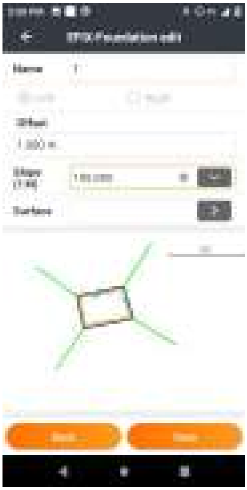
10.5. Foundation stakeout

Click Foundation icon, click new to create a foundation.

Users enter the name, select the sideline, enter the offset (left represents the left offset of the line direction, right represents the right offset of the line direction), slope, elevation, etc.



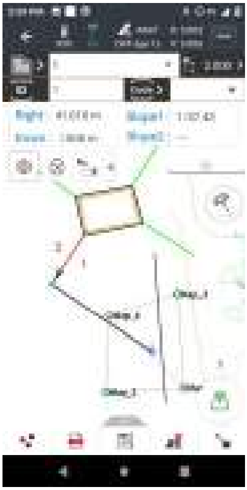
Select the surface file (this step is not necessary, can get the foundation surface intersects with the excavation line.)



After the new foundation pit is built, then stakeout the excavation line. Find the excavation line and stakeout according to the prompt information.

Also, click the icon, Switching cross-section diagram for stakeout.

Select the green auxiliary line for stakeout.



10.6. Visual Stakeout

If the current device is a visual receiver like the F8, an AR (Augmented Reality) button will be shown on the map screen. Click on this button to enter the AR mode.

Your data collector must be connected to the receiver by 5 GHz Wi-Fi (not Bluetooth or 2.4 GHz Wi-Fi) for the Visual survey and Stakeout functions to work.

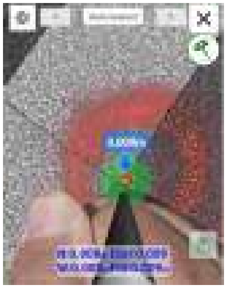
In **Options** on the **Stakeout** tab, under miscellaneous there are **Distance to switch to Visual Stakeout (Near)** and **Distance to switch to Visual Stakeout (Far)** settings. Setting the **Near** distance to 10 to 50 m is reasonable. Setting the **Far** distance between 10 and 50 m or more is probably reasonable. Your settings may depend on onsite terrain and personal preferences.

If you are further than the **Far** distance, eField will show the map screen with optional map backgrounds. If you are between the **Near** and **Far** distance, **eField** will show the front-facing camera. Once you reach the near distance from the stakeout point, the bottom-facing camera will be shown. As you move closer to the point being staked, the view will automatically zoom in to better show the target point on the ground.

A virtual pole is overlayed on the image (usually on top of the data collector bracket and your hand.) The number of blue arrows is proportional to the distance to the target.

The distance, cut fill along with the ΔX, ΔY or forward/left/right (depending on the panel settings on the map screen) are updated continuously.

When you are within the staking tolerance, a green target will be shown centered under the pole tip:



Click on **Start measurement** button to measure a new point at the current location. Click on **Close** (top right corner) to return to standard non-visual **Point stakeout**. Click on the **Back** button (top left corner) to return directly to the **Main menu**.

11. CAD View

Open the software, select the CAD view module to view the CAD file.

11.1. Open CAD file

Click icon to open the file manager

select the file to be opened, and then click **open**.

Click and choose **From cloud** to upload the file to be downloaded.

Click and choose **From sharing code** and input the sharing code to accept the project

11.2. Slide bars

Click ⋮ to show all tool bars.

Online map: Users can choose the online map which they want to use as background.

Redraw : User can regenerate the drawing. Click **OK** to redraw the map.

Snap: Users can choose a point on the map by the arrow.

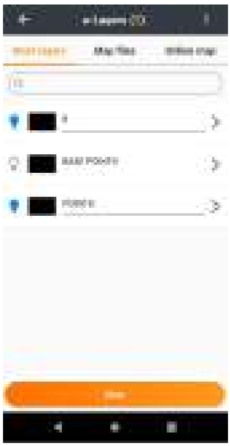
Full view: Users can view the full map.

Center: Users can click it once to make the map always heading north, click it twice the map will rotate in the direction of PDA, click it three times the Auto centering will be turned off.

Follow: Users can click it to make the base map rotate in accordance with the orientation of the controller.

Pan to: Users can locate the screen center manually.

Layers: Users can show/hide the layers.



Off set survey: Users could manually input coordinates, pick from the map, instant survey, or select from point library. After inputting different parameters, click **Result** then input the **name** of the new point. Click **OK**.

Survey boundary: Click to set the survey boundary.

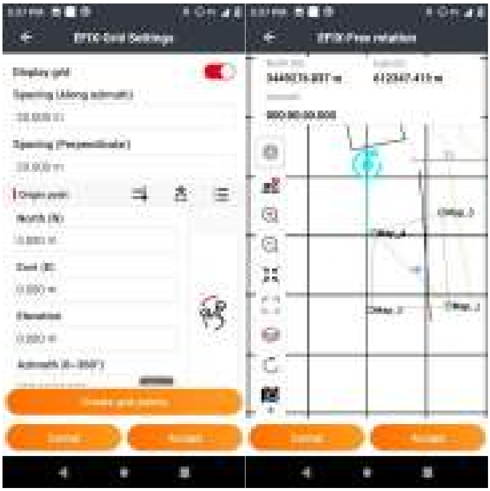
Find map: Click to find the map if you don't know where the base map is.

Hide / Show base map: Click to hide or show base map.

Hide / Show data: Click to hide or show data.

Map Zoom in/out: User can zoom in/out the map by these two tools.

Grid Settings: Generate a grid based on the selected origin, azimuth, horizontal spacing, vertical spacing, and color.



11.3. Tools

There are three modules at the bottom of the interface: **Data, Draw, Measure**

11.3.1. Data

Delete: Select an object or an area and delete them from the CAD file.

Export DXF: Export the CAD file in DXF format, and can choose the Filter type of Survey, Enter, Control, Base.

Layers: Layer display control.

Off other layers: Display the currently selected layer

Layer off: Close the currently displayed layer

Save point: Quickly extract the coordinates of point blocks

Explode: Supports full drawing explosion

Join: Support merging line segments

11.3.2. Draw

Supports point, line, polyline, arc, best fit arc, circle, 2-point circle, 3-point circle, square, square center, rect, rect center, spline, layout and text annotations.

11.3.3. Edit

Users can edit the points or lines when users select them.

Invert: Change the start and end points (direction) of a line.

Close: Automatically close a polyline.

Lengthen: Extend the line at the end point.

Dist & Offset: Generate parallel lines.

Dist&Offset: Generate point through distance and offset.

Explode: Disassemble a feature.

Elevation: Set CAD elevation by object and nodes.

Break: Break the closed shape.

Break at point: Break the line into two lines through a point.

Subdivide: Nodes can be generated according to a fixed length and fixed number of segments.

Delete/Add node: Adjust the nodes that make up the polyline.

Reconnect nodes: Change the connection order of the polyline.

11.3.4. Measure

Can select the points and measure their distance, angle, area and inverse

Inverse: Calculate the distance by capturing any two points.

Mult-Inv: Capture multiple points continuously to calculate the distance between multiple points.

Angle: Measure the angle by rotating clockwise in the order of capture.

Area: Measure the area formed by any polygon.

11.4. Stakeout

Select a point or line on the cad. The stakeout button will appear below. Click to switch to cad stakeout.

It is the same as Point stakeout and Line/Arc stakeout.

12. Road

12.1. Road stakeout

eField Roading is a module that allows to create and manage road design data and perform all the necessary stakeout operations without using point coordinates but by using original design data. The user is free to stakeout and to have road design information at any stations.

Road design data can be created or be imported from LandXML format and the complete design can be managed directly on the controller; it is possible to manage more than one axis at the same time and all design data are displayed in the plan view and cross-section view.

It is possible to work in two different ways:

Cross-sections at specific stations: in this case, at any stations the interpolated cross-section is calculated.

Cross-sections templates: one or more cross-section template can be applied along the center line; cross-section template can be fully customized by the user by defining the cross-section shape and also additional information as superelevations and widenings.

It is possible to stakeout the road design data and sideslopes at any station and with any offset; the point to stakeout can be easily specified on the cross-section view and your current position is displayed in two different views: plan, cross-sections.

A useful command called '**Where am I' allows you** to have all design information about your current position along the road: station, H offset, H alignment, V alignment, Design elevation, Elevation, elevation difference from design elevation and from current surface, Cross slope.

A command called 'Survey cross-section' allows you to measure cross-section points at any stations.

It is possible to stakeout road design data and use a tridimensional design model (surface) as reference for the elevations.

12.2. Road manager

The road manager is the control panel of all the data of the road project. They list all the axes that have been loaded; the road definition can be imported from LandXML format.

It is possible to list roads in two different ways:

Select: in this case you can select a road to stakeout.

Edit: when you click a road, the **Delete**, **Edit** and **Property** menus appear, enabling you to delete or edit the road definition, or to edit the properties of the road.

You can switch between **Select** and **Edit** modes via the **Modify** menu at the top right.

TIP

If the road is imported through a LandXML file, you can't edit the definition of the road, you can only view it.

Define a road

When defining a road, you create a roadx file and add elements to complete the road definition.

The **station equations** define station values for an alignment.

The **horizontal alignment** defines a line that runs along the center of the road.

The **vertical alignment** defines the changes in the elevation of the road.

The **cross-section template** defines a cross section of the road at a point across the road to define how wide it is at different points.

The cross-section template must be defined only for the right side of the section but the definition can also be used for the left side.

Add a template for each change in width. The template may consist of any number of strings.

Add **cross-section template positions** to assign the appropriate template at different stations along the road.

Add **superelevation and widening** to add extra slope and widening on curves in a road design to assist vehicles negotiating the curves.

The **sideslope template** defines the shape and the characteristics of the section to be applied along a track; through the composition of simple linear elements it's also possible to define shapes of complex sections.

The sideslope template must be defined only for the right side of the section but the definition can also be used for the left side.

Add **sideslope template positions** to assign the appropriate template at different stations along the road.

Field	Description
Name	Enter the **Name** to define the road.
Horizontal alignment entry method	Select the **Horizontal alignment entry** method to define the horizontal alignment: **Elements, PI, Coordinates**.
Element entry method	If select **Elements** to define the horizontal alignment, you can select the **Element entry method**: **Length**, **End station**
Elevation rotation axis position	Enter the distance of the point of rotation referring to the central axis.
Start station	Enter the **Start station** to define the road.

Key int the station equations

Use **Station equations** when the horizontal alignment has changed but you wish to remain the original station values.

Field	Description
Ahead	Enter a station value to define the equation.
Back	Enter a station value to define the equation.

TIP

If the Ahead station value is greater than the Backside station value, this equation is an Overlap. If the Ahead station value is less than the Backside station value, this equation is a Gap.

Key in the horizontal alignment

To define the horizontal alignment you can use the:

Elements entry method

Points of intersection (PI) entry method

Coordinates entry method

> **TIP**
>
> To change the entry method for the road, edit the properties of the road. However, once you have entered two or more elements definition the horizontal or vertical alignment definition, the entry method can't be changed.

Elements entry method

As you add each element to the alignment, fill out the fields required for the selected element type.

Line elements

To add a line to the alignment, select **Line** in the **Type** menu:

Field	Description
Length	Enter the **Length** to define the line.
Start offset	Enter the perpendicular offset of the starting coordinate of the current element and the ending coordinate of the previous element.
Start north	Enter the **Start north** to define the line. If the current element isn't the first one, the value will be calculated automatically.

Start east	Enter the **Start east** to define the line. If the current element isn't the first one, the value will be calculated automatically.
Azimuth	Enter the **Azimuth** to define the line. If the current element isn't the first one, the value will be calculated automatically.
Use azimuth constraint	If you check it, you can enter **Azimuth** instead of the automatically computed value.

Left arc\Right arc elements

To add an arc to the alignment, select **Left arc\Right arc** in the **Type** menu:

Field	Description
Length	Enter the **Length** to define the arc.
Start offset	Enter the perpendicular offset of the starting coordinate of the current element and the ending coordinate of the previous element.
Start north	Enter the **Start north** to define the arc. If the current element isn't the first one, the value will be calculated automatically.

Start east	Enter the **Start east** to define the arc. If the current element isn't the first one, the value will be calculated automatically.
Radius	Enter the **Radius** to define the arc.
Azimuth	Enter the **Azimuth** to define the arc. If the current element isn't the first one, the value will be calculated automatically.
Use azimuth constraint	If you check it, you can enter **Azimuth** instead of the automatically computed value.

Left transition\Right transition elements

To add a transition to the alignment, select **Left transition\Right transition** in the **Type** menu:

Field	Description
Length	Enter the **Length** to define the transition.
Start offset	Enter the perpendicular offset of the starting coordinate of the current element and the ending coordinate of the previous element.

Start north	Enter the **Start north** to define the transition. If the current element isn't the first one, the value will be calculated automatically.
Start east	Enter the **Start east** to define the transition. If the current element isn't the first one, the value will be calculated automatically.
Start radius	Enter the **Start Radius** of the transition to define the transition. For **Entry Transition**, the **Start Radius** is usually infinite.
End radius	Enter the **End Radius** of the transition to define the transition. For **Exit Transition**, the **End Radius** is usually infinite.
Azimuth	Enter the **Azimuth** to define the arc. If the current element isn't the first one, the value will be calculated automatically.
Use azimuth constraint	If you check it, you can enter **Azimuth** instead of the automatically computed value.

Points of intersection (PI) entry method

To add an element to the alignment, select **PI Type**:

PI without curve

PI Without Curve is a point of intersection that doesn't contain curves.

Field	Description
Name	Enter the **Name** to define the point of intersection.
North	Enter the N**orth** to define the point of intersection.
East	Enter the **East** to define the point of intersection.

TIP

The start point and end point of the alignment must be PI without curve.

PI

Field	Description
Virtual PI	Define a curve with a corner greater than 180 with the previous PI.
Name	Enter the **Name** to define the point of intersection.
Radius	Enter the **Radius** to define the point of intersection, if the **PI** contains an arc.
North	Enter the N**orth** to define the point of intersection.
East	Enter the **East** to define the point of intersection.
Transition length in	Enter the **Transition Length In** to define the point of intersection, if the PI contains an **Entry Transition**.
Transition length out	Enter the **Transition Length Out** to define the point of intersection, if the PI contains an **Exit Transition**.

Transition start radius in	Enter the **Transition Start Radius In** to define the point of intersection, if the **Entry Transition** is incomplete. If a negative number is entered, it will be used as a parameter to calculate the length of the transition.
Transition end radius out	Enter the **Transition End Radius Out** to define the point of intersection, if the **Exit Transition** is incomplete. If a negative number is entered, it will be used as a parameter to calculate the length of the transition.

PI is a point of intersection that contains curves.

TIP

The type of transition supported by the software is clothoid spiral. The clothoid spiral is defined by the length of the spiral and the radius of the adjoining arc. If $A^2 = R*L$, the clothoid spiral is complete, otherwise it is incomplete. If the entry transition is incomplete, you need to enter the start radius. If the exit transition is incomplete, you need to enter the end radius.

Coordinates entry method

As you add each element to the alignment, fill out the fields required for the selected element type.

Line elements

To add a line to the alignment, select **Line** in the **Type** menu:

Field	Description
Start north	Enter the **Start north** to define the line. If the current element isn't the first one, the value will be calculated automatically.
Start east	Enter the **Start east** to define the line. If the current element isn't the first one, the value will be calculated automatically.
End north	Enter the **End north** to define the line. If the current element isn't the first one, the value will be calculated automatically.
End east	Enter the **End east** to define the line. If the current element isn't the first one, the value will be calculated automatically.

Left arc/Right arc elements

To add an arc to the alignment, select **Left arc\Right arc** in the **Type** menu:

Field	Description
Start north	Enter the **Start north** to define the line. If the current element isn't the first one, the value will be calculated automatically.
Start east	Enter the **Start east** to define the line. If the current element isn't the first one, the value will be calculated automatically.
End north	Enter the **End north** to define the line. If the current element isn't the first one, the value will be calculated automatically.
End east	Enter the **End east** to define the line. If the current element isn't the first one, the value will be calculated automatically.
Radius	Enter the **Radius** to define the arc.

Key in the vertical alignment

If you created the road definition by keying in the horizontal alignment, the elevations of those items are used to define the vertical alignment as a series of **Point** elements.

As you add each element to the vertical alignment, fill out the fields required for the selected element type.

Point elements

To add a point to the vertical alignment, select **Point** in the **Type** menu:

Field	Description
Station	Enter the **Station** to define the vertical point of intersection.
Elevation	Enter the **Elevation** to define the vertical point of intersection.

Symmetric parabola

To add a symmetric parabola to the vertical alignment, select **Symmetric Parabola** in the Type menu:

Field	Description
Station	Enter the **Station** to define the vertical point of intersection.
Elevation	Enter the **Elevation** to define the vertical point of intersection.
Radius	Enter the **Radius** to define the vertical point of intersection.

TIP

The start point and end point of the vertical alignment must be Point.

Key in the cross-section templates

The cross-section template defines the shape and the characteristics of the section to be applied along a track; through the composition of simple linear elements it's also possible to define models of complex sections that may be subject to superelevations and widenings in curves. Strings typically define the shoulder, edge of the pavement, curb, and similar features that make up a road.

Each element is defined by the **Name**, **Slope**, **Width** and **Vertical offset** referring to the previous element:

Field	Description
Name	Enter the **Name** to define the element of the cross-section.
Slope	Enter the **Slope** to define the element of the cross-section. From the central axis to the side axis, positive values represent uphill and negative values represent downhill.
Width	Enter the **Width** to define the element of the cross-section.
Vertical offset	Enter the **Vertical offset** referring to the previous element of the cross-section.

Key in the cross-section template positions

After adding cross-section templates, you must specify the station at which the Roads software starts to apply each template. A template is applied from that point to the station where the next template is applied.

Field	Description
Station	Enter the **Station** to define the cross-section template position. The station is the start point of the cross-section template will be applied.
Left template	Enter the **Left template** to define the cross-section template position.
Right template	Enter the **Right template** to define the cross-section template position.

TIP

If the cross-section definition changes, you need to reedit the cross-section template positions.

Cross-section template position examples

Add a template for each change in cross-section strings number.

This example explains how positioning of templates and use of widenings can be used to control a road definition:

Key in the superelevations

Superelevation values are applied at the start station, and values are then interpolated from that point to the station where the next superelevation values are applied.

Each element of the cross-section can apply a superelevation value.

The software supports the following superelevation interpolated types.

Linear

Cubic parabola

Field	Description
Station	The start station where the superelevation value is applied.
Primitive slope(%)	The original slope value of the current element of the cross-section.
Superelevation(%)	Enter the **Superelevation** to the selected element.

Key in the widenings

Widening values are applied at the start station, and values are then interpolated from that point to the station where the next widening values are applied.

Each element of the cross-section can apply a widening value.

The software supports the following widening interpolated types:

Linear

Cubic parabola

Quartic parabola

Field	Description
Station	The start station where the widening value is applied.
Primitive width	The original width value of the current element of the cross-section.
Widening	Enter the **Widening** to the selected element.

Key in the sideslope templates

The sideslope template defines the shape and the characteristics of the sideslope to be applied along a track; through the composition of simple linear elements it's also possible to define models of complex sideslopes.

Each element is defined by the **Name**, **Slope**, **Width**:

Field	Description
Name	Enter the **Name** to define the element of the sideslope.
Slope	Enter the **Slope** to define the element of the sideslope. The shape of the sideslope is relative to the left/right side axis point at a certain station. From the side axis to the direction away from the center axis, positive values represent uphill and negative values represent downhill.
Width	Enter the **Width** to define the element of the cross-section.

Key in the sideslope template positions

After adding sideslope templates, you can specify the station at which the Roads software starts to apply each template. A template is applied within a range specified by the start station and end station.

The software supports the following sideslope transition types:

No gradient: The same sideslope template is used for this range.

Gradient: A start template is applied at the start station and an end template is applied at the end station. The values defining each element are then interpolated linearly from the start station to the end station. The start and end template must have the same number of elements.

Field	Description
Start station	The station that the sideslope template begin to be applied.
End station	The station that the sideslope template stop to be applied.
Transition method	The transition type from the start sideslope template to the end sideslope template.
Start template	Define a sideslope shape at the starting of the range.
End template	Define a sideslooe shape at the ending of the range.

Import road definition from LandXML format

LandXML road file can contain one or more alignments with associated road definition information.

Select the LandXML file to import. All axes will be loaded and visualized in the list.

The software can obtain the following road components from a LandXML file:

Station equations: Define station values for an alignment.

Horizontal alignment: Define a line that runs along the center of the road.

Vertical alignment: Define the changes in the elevation of the road.

Cross-section: Define how wide it is at different points across the road. The cross-section may consist of any number of strings.

String interpolation

The cross-sections are computed by determining where the cross-section line, formed at right angles to the alignment cuts the strings associated with the alignment. For interpolated stations, the offset and elevation values for the position on an associated string are interpolated from the offset and elevation values of the previous and next positions on that string. This ensures the integrity of the design, especially on tight curves.

See the following example, where the cross section at station

100 has a string offset from the alignment by 3 and an elevation of 25. The next cross section at station 120 has a string offset by 5 and an elevation of 23. The position on the string for the interpolated station 110 is interpolated as shown to give an offset of 4 and an elevation of 24.

> **TIP**
>
> No interpolation occurs between cross-sections with an unequal number of strings.

12.3. Stakeout

Stakeout of a road axis is quite similar to stakeout an element by station and offset.

According to the entered station it's interpolated and visualized the corresponding cross-section. On the calculated section, specify the distance from the center line; it's possible to select the vertex also from the graphic view.

Field	Description
Real time station	Automatically calculate the stakeout station according to the current position.
Station	The station will be staked out.
Station interval	
Mode	The mode of offset value, right angle offset or skew offset.
Cross-section surface	Select the vertex from graphic view.
Offset	Define a point at a right angle to the alignment. It's possible to add an additional offset for construction.
Elevation	The elevation of the target; It's possible to add an additional vertical offset for subgrade.
Azimuth	Skew direction, a delta from the alignment tangent clockwise.
Length	The offset along the skew.

The stakeout panel contains the information to get the target point.

The last part of the panel can show the following information:

Dist.: The distance from the current position to the target.

Stat.: The station of the current position.

Forward/Backward: Navigation information from current position to the target.

Left/Right: Navigation information from current position to the target.

H. Offset: The distance from the current position to the alignment.

Delta station: The difference between the station of the current position and the station of the target.

Cur/Fill: Vertical cut/fill to the design.

Stakeout relative to a DTM

You can display the cut/fill to a digital terrain model (DTM) during stakeout, where the horizontal navigation is relative to the road but the displayed cut/fill delta value is from your current position to a selected DTM.

12.4. Where am I?

This function is able to provide a lot of information concerning the current position referring to the selected road.

Based on the position, they are visualized the following information:

Field	Description
Station	Station in which you are located.
H Offset	Distance from the center line of the current road.
H alignment	Element of the planimetric track.
V alignment	Element of the altimetry track.
Design elev.	Design elevation in which you are located.
Elev.	Elevation in which you are located.
Cut/Fill	Elevation difference.
Cross slope	Cross slope in which you are located.

12.5. Stakeout side-slope

The procedure allows to perform the calculation and the stakeout of the point of intersection of the project side-slope with the existing terrain; the position is calculated on the basis of a slope of project and referring to a station and to a distance (offset) on the outermost of the cross-section.

Field	Description
Match the template according to the station	Automatically select a sideslope template based on the current position and the sideslope template positions.
Station	The station of the current position.
Template	The sideslope template of automatic or manual selection.
Target	The stakeout target, feature points of the sideslope or the slopes.

The side panel contains the information to get the point of intersection; The latest information reports the current value of the slope and the direction to take, on the perpendicular to the reference element, to achieve the value of project slope.

The last part of the panel can show the following information:

Stat.: The station of the current position.

H Offset: The distance from the current position to the alignment.

Inward/Outward: Away from or near the centerline.

Down/Up: Vertical cut/fill to the design.

Cur/Fill: Perpendicular cut/fill to the design.

12.6. Survey cross-section

The procedure allows to perform the measurement along a cross-section. During the cross-section measurement, a red auxiliary line will be created. The cross-section data measured can be used to calculate the volume.

Field	Description
current	Get the station of current position.
Station	The station of the current position.

The cross-section survey panel contains the information to measure cross-section points.

The last part of the panel can show the following information:

Stat.: The station of the current position.

CL offset: The distance from the current position to the alignment.

Delete station: The difference between the station of the current position and the station of the target.

Cur/Fill: Vertical cut/fill to the design.

12.7. Stakeout report

Use the **Report export** function in the software to generate a report from survey data. Use the report to transfer data from the field to your client or the office for further processing with office software.

A table presents the list of all the stakeout points with differences, in distances and elevations, between the design coordinate and the stakeout coordinate.

The file format is:

Field	Description
Point name	The name of the measured point.
Target N	The northing coordinate of the target.
Target E	The easting coordinate of the target.
Target elevation	The elevation of the target.
Target station	The station of the target.
Target H Offset	The H Offset the target.
Measured N	The northing coordinate of the measured point.
Measured E	The easting coordinate of the measured point.
Measured elevation	The elevation of the measured point.
Measured station	The station of the measured point.

Measured H Offset	The H Offset of the measured point.
Delta station	The difference between the design station and the stakeout station.
Delta H Offset	The difference between the design H Offset and the stakeout H Offset.
Delta elevation	The difference between the design elevation and the stakeout elevation.
Cross-section offset	Horizontal offset relative to the cross-section.
Time	The time of the measuring point.

12.8. Display the available stations

Some key stations defined by the horizontal alignment will display on the screen. The station abbreviations used in the Roads software are:

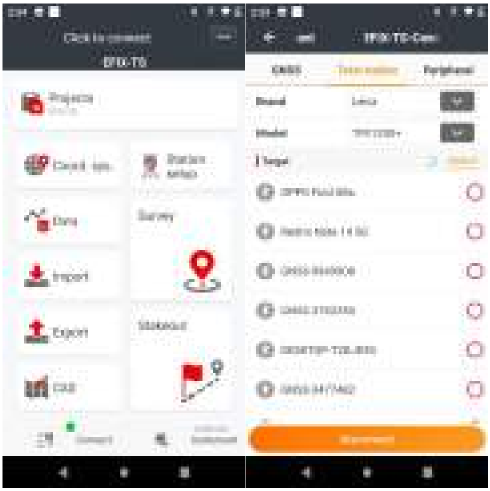
Abbreviation	Meaning
RS	Road starts
RE	Road end
CC	Curve to transition
LT	Line to transition
CL	Curve to line
TL	Transition to line
LC	Line to curve
TC	Transition to curve

13. Total station (TS)

13.1. TS -- Config

13.1.1. Connect to instruments

For controller to connecting total station.



Detailed steps:

1) Select equipment brands: equipment brands include Leica, Topcon, CHC, Geomax, Sokkia, Nikon and Simulation mode.

2) Select equipment model:

Model: Leica: TPS1200+/100, TS11/13/15/16/30/02/06/09

Topcon: GT Series, PS Series

CHC: CTS-112R4

Geomax: Zoom75/Zoom95

Sokkia: iX Series, iM Series

Nikon: Nivo Series, DTM Series, NPL Series, NPR Series

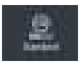
3) Select the device Bluetooth number: Below the target device: click to select the total station Bluetooth number to be connected.

4) Click [Connection], the connection success or failure has the relevant prompt information, and display the current device Bluetooth number.

[Disconnect]: After the device is successfully connected, the disconnected button is displayed below the connection interface.

13.1.2. TS settings

:Whether to lock the prism.

:Change the survey mode (standard / fast / continuous).

:Automated settings (none / ATR search / Power search).

:Search for a prism to the left.

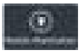
:Specifies an in-window search.

:Search for a prism to the right.

:When the remote control total station is rotated at the total station or the prism pole.

:Turn on the total station guide light.

:Turn on the total station laser.

:Turn on the total station cross-wire lighting.

:Turn the tilt compensation on / off.

:View the compensation accuracy and control the laser below.

13.1.3. TS rotate

:Total station lens is rotated to the horizontal direction.

:Turn the total station to the absolute azimuth.

:Control the left or right turn relative to the current azimuth position.

:After setting the station, control the total station to the stakeout point.

:Control the total station forward inverted mirror switch.

:Control the total station for a left turn of 90°.

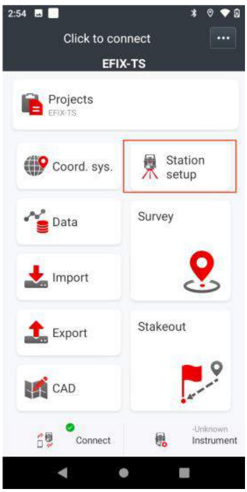
:Control the total station for a right turn of 90°.

:Control the total station for a right turn of 180°.

:Control the total station to rotate to the general direction of the controller.

13.2. TS setup

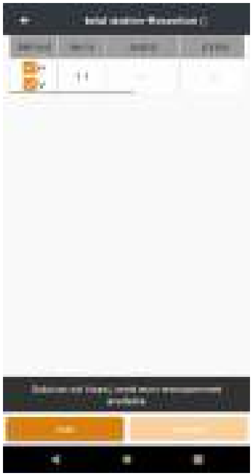
Clicking Station setup, you can enter the station setup interface. There are three kinds of station setup methods: Resection (Free station), Backsight to known point, Backsight by azimuth.



13.2.1. Resection (Free station)

1) Enter the station name and instrument height and click Next.

2) Add known points and perform Resection (Free station).



3) Repeat step 2, measure at least two known points.

4) Complete station setup.

13.2.2. Backsight to known point

1) Select the known point as the setting station and enter the instrument height.

2) Select the known point for the backsight survey.

3) Complete station setup.

13.2.3. Backsight by azimuth

1) Select the known point as the setting station and enter the instrument height.

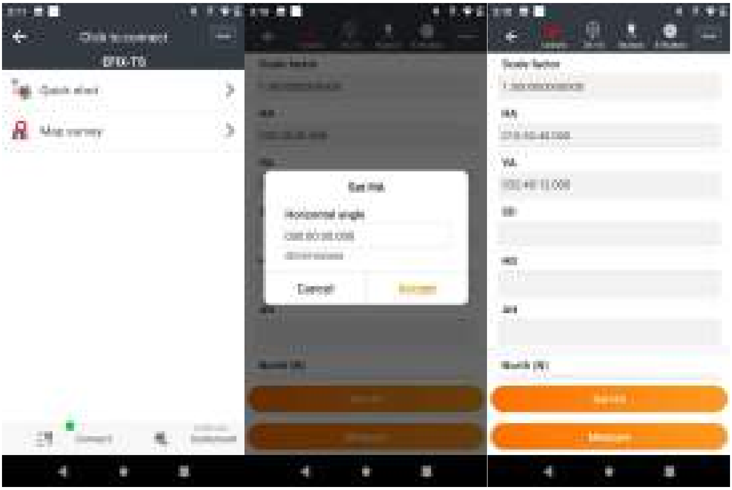
2) Enter the backsight azimuth to perform the backsight survey.

3) Complete station setup.

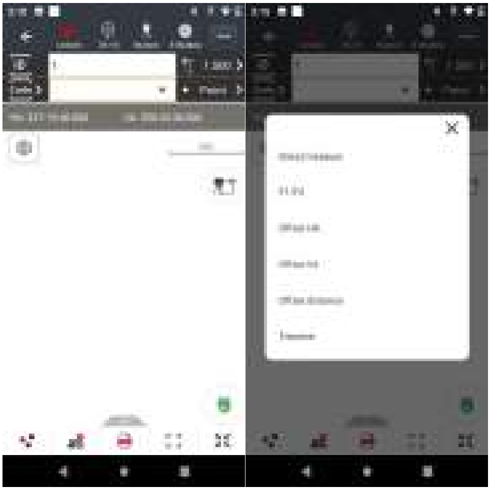
13.3. TS -- Survey

The interface is the same with GNSS survey. Users could set target height, point name, survey type, code, and others like before. Click **measure** icon to start measure.

Use **Quick shot**, and Set HA to Measure.



Click **Map survey**,which is similar to RTK.



[Survey Method]: Click to switch Direct measure, F1/F2, Offset HA, Offset VA, Offset distance and Traverse.

13.4. TS -- Stakeout

13.4.1. Point Stakeout

13.4.1.1. Add the point to stakeout

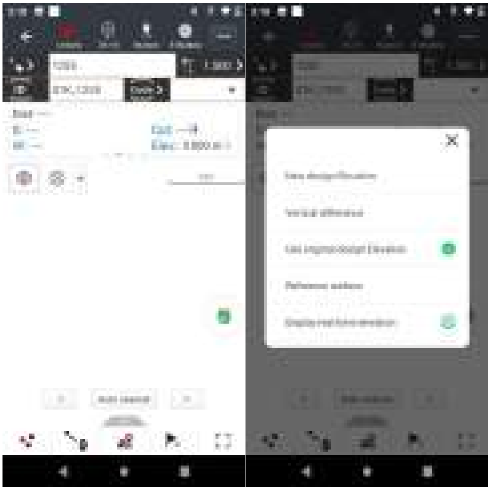
Method 1: Click (upper left corner) to enter the points library and the stakeout points library to be displayed. After importing points or adding points (or points already exist in the library), directly select the target point in the points library or the stakeout points library to be displayed, and click OK to start the stakeout.

Method 2: Select the points directly on the view, or snap the points, and start stakeout.

Method 3: users manually input the name, code,coordinates and description of the new point. Click OK.

13.4.1.2. Point stakeout

The point out interface is shown in the figure below:



Navigation bar:

[**Arrow**]: The arrow points to the direction of the target point in real time, and the target point can be found by pressing the direction indicated by the arrow.

[**Distance**]: Means the plane distance between the current position and the target point.

[**Navigation information**]: can display the front, behind, right and left, east, south, west and north, slide in the horizontal direction on the text box.

 : the direction of travel is the positive direction (related to

the quadrant, only indicates two distances each time), indicated by the up and down, left and right arrows;

S:
E: :With the current location of the user, describe the target point in the east E m, south S m, west W m, north N m (related to the quadrant, only two distances each time);

Cut/Fill: Filling indicates the distance that the current position is lower than the actual position, need to fill, cutting indicates the distance that the current position is higher than the actual position, need to dig (the arrow after the filling value indicates filling up and digging down).

D.Elev: The designed high of target point, click ">", display as follows, set the designed high.

<: After clicking, display the previous task of the current staking task in the current staking list.

>: After clicking, display the next task of the current staking task in the current staking list.

Auto nearest: Click and automatically select the nearest point and stakeout.

Note: At the upper point / next point, the current staking point is in the coordinate library, so click the next point to display the next point of the current staking point in the coordinate library (excluding the measurement point and base station point).

13.4.1.3. Settings

The stakeout interface can set the point name prefix, distance limit, elevation limit, reference direction, etc. The specific setting should be determined according to the actual engineering situation.

Display point name,code input box: When staking, whether to display point name,code input box.

Distance tolerance: Horizontal staking accuracy, beyond which the accuracy software will indicate a large staking deviation.

Elevation tolerance: Level staking accuracy, beyond which the software will indicate large staking deviation.

Reference TS: Whether the direction of the total station is toward the total station or the prism.

Turn to stakeout point: It is closed by default. After opening, the total station will automatically rotate to the direction of the staking point.

Auto description: When opened, the staking point will automatically note the set content.

13.4.1.4. View, coordinate display area

Support selection and snap functions, select the points of the imported base map, and support nodes, end point, midpoint, center, intersection point, nearest point, and any point picking, display coordinates and can be staked. Specific operation: click the corresponding function, select the corresponding ground on the map, you can determine a capture point.

13.4.1.5. Tools

→Tools, can custom-defined tool.Point staking tool, the default tool appears as follows:

: Point library.Select a point from points library ,you can also add a point manually， or import/export the point file in this faction.

: Turn towards target.In the stakeout setting, you can choose whether to open and the way to open it.

: Online map. Users can choose the online map which they want to use as background.

: Enter a point. Users manually input the name, code, and coordinates,then click Stakeout.

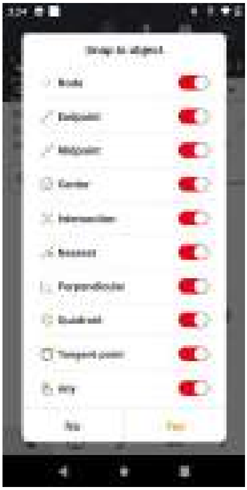
: Full view. Users can view the full map.

: Users can click it once to make the map always heading north, click it twice the map will rotate in the direction of PDA, click it three time the Auto centering will be turned off.

: After clicking, the current position points unchanged (due north), and the object on the view changes according to

the direction of the controller.

: Support selection and snap functions, select points on the imported DXF map, and support nodes, endpoint, midpoint, center, intersection, nearest point, and any point picking. Long press the snap tool to display the snap configuration.



 : Click into the offset stakeout, support distance + azimuth, alignment offset, turned angle + distance and Δ N+ Δ E+Δ H.

13.4.1.6. Start stakeout

After setting the parameters correctly, measure the difference between the coordinates of the staked points and the designed coordinates. If the difference is within the required range, continue to set out other points; otherwise, stakeout again and calibrate the point.

13.4.1.7. Frequently asked questions:

1) Whether the setting out meets the accuracy.

The staking accuracy is limited to the stakeout setting option (upper left pinion icon).When the setting out to the distance and vertical limit difference, it can be measured normally.When the staking accuracy measurement is not satisfied, it indicates that "Stakeout offset is very large".If the measurement does not indicate "Stakeout offset is very large", it indicates that the current staking point has met the accuracy requirements.After the point stakeout is completed, you can see whether the staking points meet the limit difference in the point to stake library.

2) The target point should be nearby, but very far from the prompt.

①Input the wrong coordinates when doing the station setup.②The X \ Y input to the target point is reversed.③The coordinates were entered incorrectly.

3) How to export the lofting results.

Project→Export→Other formats→Point stakeout result.

13.4.2. Line Stakeout

Line/Arc stakeout supports line, polyline, arc, circle,alignment and select from map. Enter the Line/Arc stakeout, click , you can select the line in the lines/arcs management or add a new line to stakeout, or select the line on the map to directly stakeout.

13.4.2.1. Line/Arc stakeout method

1) Station&Offset

Piles or offset piles on the sample line according to pile spacing.

Start station: Set the starting mileage of the line.

Target station: Set the staking mileage.

Station interval: The point automatically switch the mileage according to the set distance.

Stake nodes: When opened, the node will not skip when clicking the pile.

Offset distance: Facing the mileage increasing direction, the current point is the vertical distance of the line segment. Enter offset, can stakeout offset point. You can also change the angle, with the default vertical 90°. When selected as ahead/behind can change the angle.

For example:

①Stakeout horizontal deviation point: Set 5 meters to the right at 50 meters.

Offset distance: 5, Angle: 90°

②stakeout offset point: At the mileage of 60 meters, the right left off 30 degrees, off 6 meters.

Offset distance: 6, select Right, select Ahead, Angle: 30°.

ΔElevation: Difference in elevation from the midline. You can also choose Elevation, Slope(Degrees), Zenith, Slope 1:N, Slope(%),etc., used to calculate the elevation of the offset point.

2) **To line**

Stakeout to the line, the current position of the pile on the line.

Start station: Set the starting mileage of the line.

Offset distance: Facing the mileage increasing direction, the current point is the vertical distance of the line segment. Enter offset, can stakeout offset point. You can also change the angle, with the default vertical 90°. When selected as ahead/behind can change the angle.

ΔElevation: Difference in elevation from the midline. You can also choose Elevation, Slope(Degrees), Zenith, Slope 1:N, Slope(%),etc., used to calculate the elevation of the offset point.

3) **Node**

Nodes on the staking line (N1, N2...).

Start station: Set the starting mileage of the line.

Offset distance: Facing the mileage increasing direction, the current point is the vertical distance of the line segment. Enter offset, can stakeout offset point. You can also change the angle, with the default vertical 90°. When selected as ahead/behind can change the angle.

ΔElevation: Difference in elevation from the midline. You can also choose Elevation, Slope(Degrees), Zenith, Slope 1:N, Slope(%),etc., used to calculate the elevation of the offset point.

13.4.2.2. View display

Support the function of line selection on the map, select the line on the imported base map for staking, support the selection of polyline, arc, circle, curve, etc.

Specific operation: click the corresponding function, select the corresponding line on the map, and then stakeout.

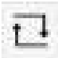
13.4.2.3. Tools

→Tools, can custom-defined tool.Lines/Arcs staking tool, the default tool appears as follows:

: Point library.Select a point from points library ,you can also add a point manually，or import/export the point file in this faction.

: Turn towards target.In the stakeout setting, you can choose whether to open and the way to open it.

: Online map. Users can choose the online map which they want to use as background.

: Click the button will switch the start and end point off the line.

: Full view. Users can view the full map.

: Users can click it once to make the map always heading north, click it twice the map will rotate in the direction of PDA, click it three time the Auto centering will be turned off.

: After clicking, the current position points unchanged (due north), and the object on the view changes according to the direction of the controller.

13.4.2.4. Start stakeout

After setting the parameters correctly, measure the difference between the coordinates of the staked lines/arcs and the designed coordinates. If the difference is within the required range, continue to stakeout other points of the lines/arcs; otherwise, stakeout again and calibrate the point.

13.4.3. Surface stakeout

13.4.3.1. Surface stakeout interface

Open the software, select the Survey, click [Surface stakeout] and enter the staking interface.

When there is no surface staking file, click [Surface stakeout] -the upper left corner , enter the surface management interface to create or open the surface file, select the surface file, and click [Accept].

Main interface sidebar setting and tool introduction:

: Guarantee the total station, survey setting, stakeout setting, road, display and tools, which can enable general parameters and road related parameters to be set. For the specific parameters, please see the software interface.Add the Unselected tools to the Selected options.

: Enter the points and the points to stakeout, and you can view the point information.

: Choose the online map with the software, scan the QR code of the online map, you can also add the online map.

: Show real-time fill or cut information.

: Export the stakeout file, support csv, txt, and dat file.

: Users can view the full map.

: Positioning real-time zoom in the center, can switch to

follow, can close the center.

: Users can click it once to make the map always heading north, click it twice the map will rotate in the direction of PDA, click it three time the Auto centering will be turned off.

: Click to jump to modify the layer option.

Real-time location information is displayed at the bottom:

Choose to display Sta.name, Sta.N, Sta.E, Sta.Elev, Sta.HI, HA, VA, HD, SD, 2D dist, 3D dist and ΔElev.

13.4.3.2. Surface management

1) New

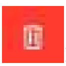
Select **New**, enter the surface name, choose to select from point list, map, or range of points to build a surface file.

2) Open

Open the surface file and support the CASS triangular file (.sjw), HC triangle network file (.hct), 3D DXF file and LandXML files. Click **Open**, **Next**, select the surface file to open, select **Open**.

3) Other functions

In addition to the above functions, click on the surface file and slide right for more operations:

: Delete the selected surface file.

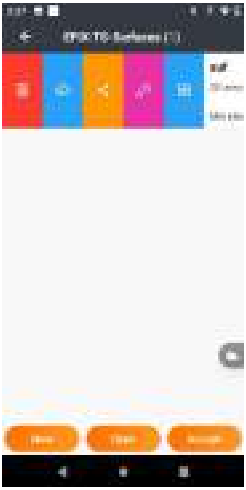
: Manually upload the surface files to the cloud disk for preservation

: Share the surface files through the 4-bit share code, and

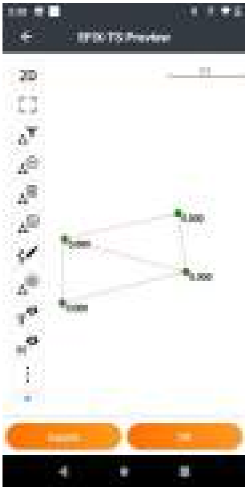
the share code is valid for half an hour.

: Click to set the style and color of the surface file.

: Preview the surface file, but also can modify the surface file.



4) Preview



: 2D, 3D and online map.

: Users can view the full map.

 : The generated triangulation net can be filtered by minimum Angle and side length multiple. The default minimum Angle is 10°, and the minimum change multiple is 10 times.

: Add the triangulation net by picking points coordinates on the graph.

: Select triangulation net on the surface to delete.

: Select the triangulation net to be reorganized and form a new triangulation net.

: Plot by picking coordinates on the surface.

: Make style edits and changes.

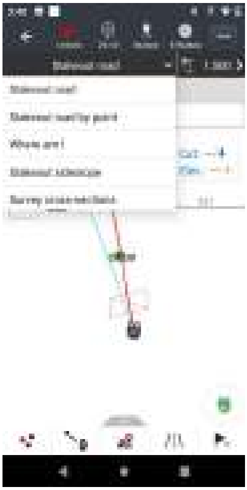
: Hide or display the name of the point.

: Hide or display the elevation of a point.

13.4.3.3. Stakeout

After creating or opening the surface file, select the display surface and adjust the prism rod height on the screen display interface. The navigation bar displays elevation value, design high, and fill/cut value.

13.4.4. Road stakeout



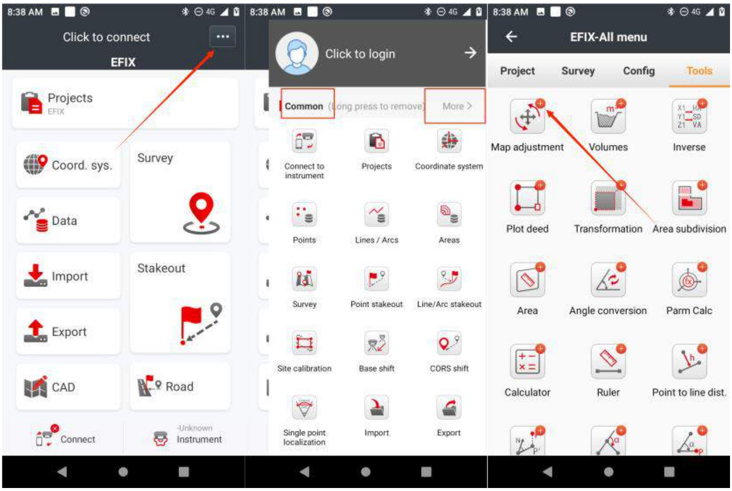
It is the same as the version **12.Road**

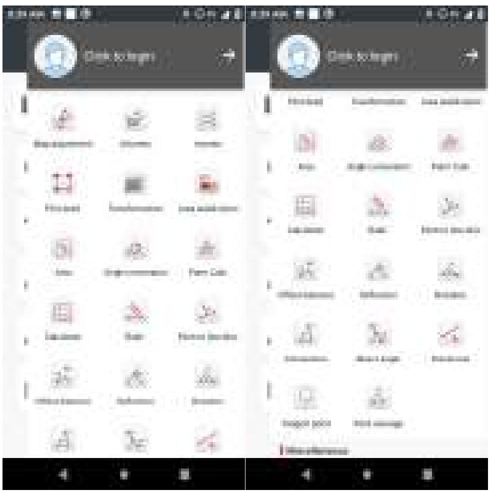
14. Tools

Click the button in the top-right corner.

Click **More** to add tools to the Common **toolbar.**

Now you can use these tools.





14.1. Map adjustment

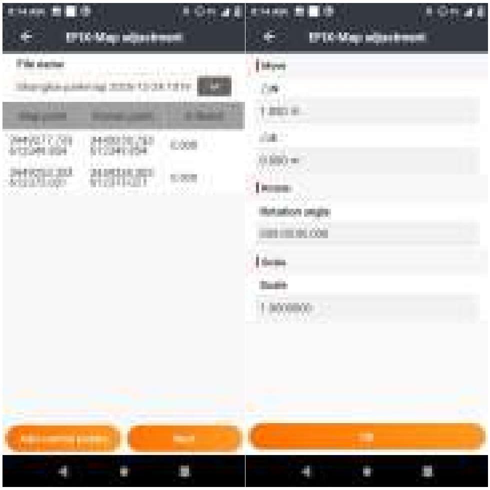
Add: Click add to add Map point and Known point (point pair).

Map point: Choose point on base map.

Known point: Choose point on base map, points, or survey directly.

Click OK & Next to add next point pair; click **OK** to finish adding points.

After adding all the point pairs, click **OK** and there will show **H. Resid**. The smaller the residual is, the better the accuracy is.



Click **Next** to calculate the translation, the rotation, and the scale. It shows how the base map moved. Finally click **OK** to apply.

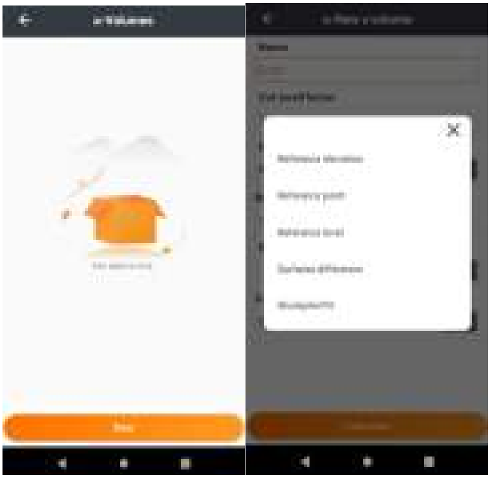
14.2. Volumes

There are five calculation methods for volumes, including reference elevation, reference point, reference level, Surfaces difference and Stockpile/Pit. The calculation method should be selected based on the actual situation. When calculating, surface files need to be provided (before creating a new task, the.sjw and.hct files should be opened through surface management).

First, click "New", enter the name, and select the calculation method

Cut swell factor: Input cut swell factor, range from 0 to 1.

Different methods have different reference elevations. Determine it based on the actual situation. Finally, select the surface reference file. Finally, click **Calculate** to get result.



Click **Export** users can export the result.

14.3. Inverse

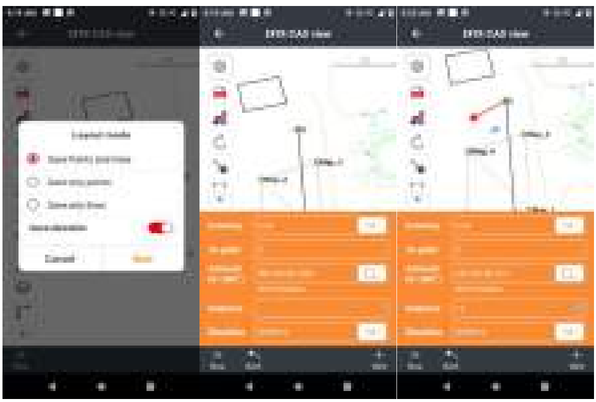
Select starting point A and ending point B from point manager, click **Calculate** to calculate. The results calculated according to grid or ground surface will be shown in the table. The results contain: azimuth, vertical angle, horizontal distance, slope distance, offset N, offset E, offset H and slope.

Support batch selection, it is also possible to fix one point and calculate the information of multiple other points and the fixed point.

14.4. Plot deed

It is a method that derives another point and connects it into a line or arc based on a known point, by setting the azimuth, distance, and elevation difference between two points.

First, select the type you want to save. Then, select a starting point. Enter the corresponding parameters, and the next point will be automatically generated and connected to form a line.



Click on "NEW" to keep adding new points.

14.5. Transformation

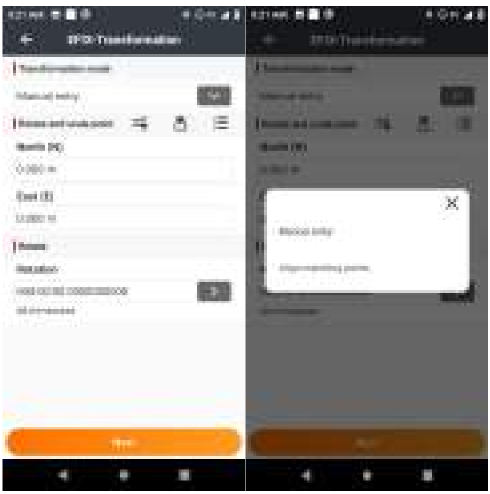
Transformation is essentially site calibration that reduces the scope of the target. Site calibration is calibrated for the entire project, but transformation is calibrated for the selected target.

14.5.1. Entrance

There are two ways of **Transformation mode**: Manual entry and Align matching points. The default is Manual entry.

Manual entry: Calibration is performed by inputting calibration parameters.

Align matching points: The calibration parameters are obtained through the selected point pair and then corrected, which is the same as point correction.



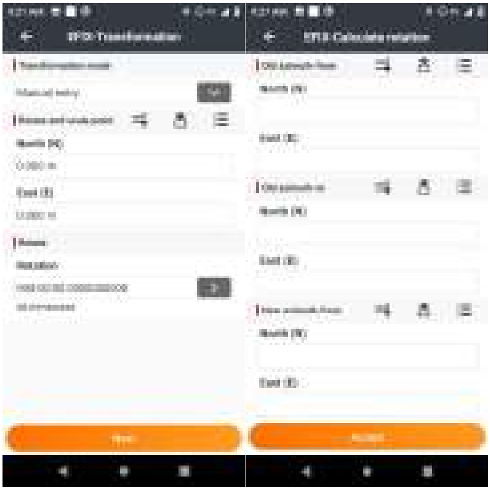
14.5.2. Manual entry

14.5.2.1. Input rotation

Enter the **rotate and scale point** and **rotation**, both of which default to 0.

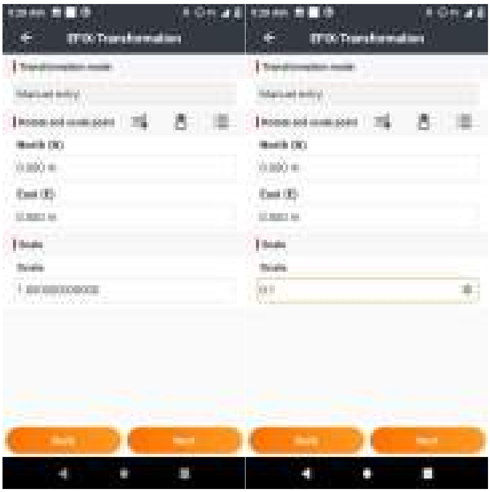
The rotate and scale point can be obtained by direct input, Map, Survey, and Select.

The rotation angle can be obtained by direct input and calculation. The calculation page is shown in the figure.



14.5.2.2. Input scale

Enter the scale, the **rotate and scale point** coordinates default to the point entered earlier but can be modified. Enter the scale, which defaults to 1.



14.5.2.3. Input translate

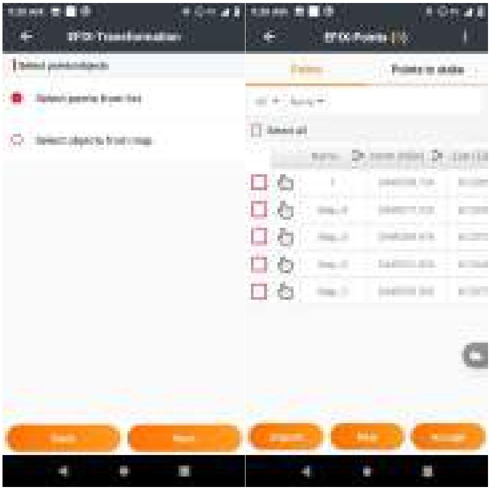
Enter the amount of translation, which defaults to 0.

The amount of translation can be obtained by direct input and calculation. The calculation page is shown in the figure.

14.5.2.4. Select translation target - points or objects

There are two ways to select the translation target: **select points from list** and **select objects from map**.

Select points from list can only select points.



Select objects from map can select points, lines, and surfaces. There are two options for selecting a map: **Select** and **Select area**. **Select area** is used by default.

14.5.2.5. Set save options

There are two save options, **Overwrite objects** and **save as new objects**. The default is **Overwrite objects.**

Select **save as new objects.** The default prefix is **T_**, which can be modified.

Click Next, and a prompt box will pop up for the conversion result, recording the number of points and lines involved (the surface is classified as lines when recording).

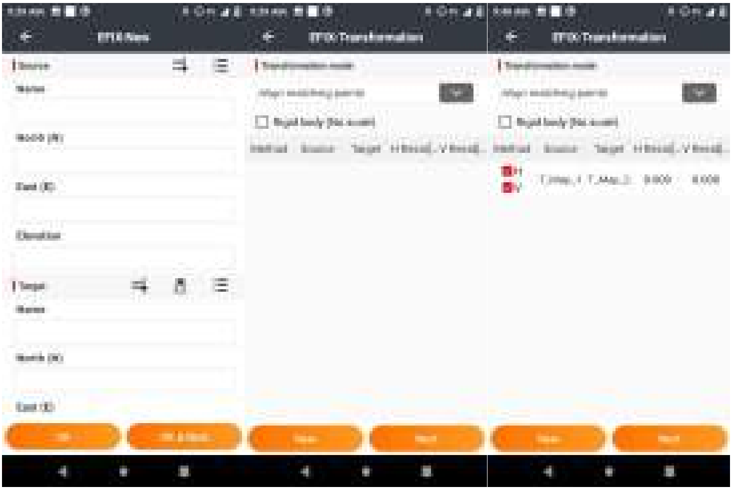
14.5.2.6. View translation results

Enter the point list and CAD view to check the **translation** results. You can find that the **translation** results are correct.

14.5.3. Align matching points

14.5.3.1. Select point pair

Point pairs can be obtained by direct input, map selection, survey, and list selection.



14.5.3.2. Check calibration parameter

The corrected parameters can be viewed after selecting the point pair calculation. (The height difference can be freely modified).

14.5.3.3. Select translation target

There are two ways to select the translation target: **select points from list** and **select objects from map**. Same as Manual entry.

14.5.3.4. Set save options

There are two save options, **Overwrite objects** and **save as new objects**. The default is **Overwrite objects.**

Click Next, and a prompt box will pop up for the conversion result, recording the number of points.

14.5.3.5. View translation results

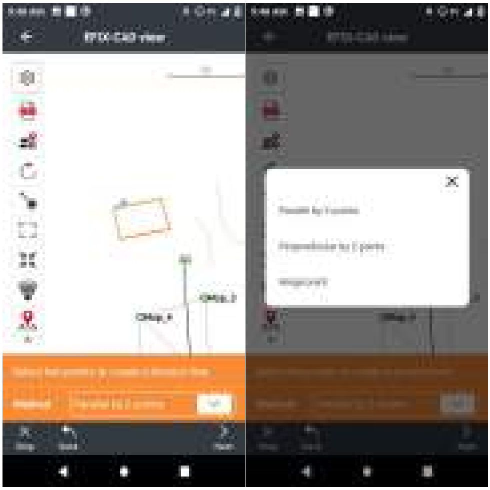
Enter the point list to check the **translation** result. You can find that the **translation** result is correct, and the original point is overwritten.

14.6. Area subdivision

Area subdivision means that the area of a closed figure is segmented by a straight line in different ways.

1. Select the closed multisegment line to be processed, the area will be displayed below, click Next

2. There are three kinds of subdivision methods: parallel by 2 points, perpendicular by 2 points, and Hinge point.



Parallel by 2 points: Two points are selected according to the prompt, and the software divides the area by a straight line parallel to these two points.

Perpendicular by 2 points: The perpendicular lines connecting the two points divide the area equally.

Hinge point: Select a point according to the prompt, and the software evenly divides the area with a straight line fixed across the point.

3. Click Next, the area can be divided according to the area Value and Percentage.

Select the Value, enter the Area (value), click calculate, and the dividing line will be divided according to the input data.

Select the percentage, enter the percentage, click calculate, and the dividing line will be divided according to the input data

4. Click Next, generate area division point according to dividing lines.

Click Add to add the division point to the point manage.

Click Stakeout to stakeout the division point.

14.7. Area

This function is to calculate the area, perimeter of a figure, the coordinates that participate in the resolution are chosen from point management by library chosen. The unit of perimeter is metric, and the unit of area is square meters.

New: Enter coordinate, select from library or map to add points to the list.

Up/Down: Make selected points move up or down.

Right slide: Right slide to delete point or check the details of the point.

OK: Calculate the perimeter and area of the figure which is composed of points in sequence.


Export: Support direct export of graphics

Map: Show the shape of the graphic

14.8. Angle Conversion

Angle conversion can convert degrees, minutes, seconds and radians among these 3 types of conversion.

Enter a value in degrees, minutes and seconds edit box, click on the **Calculate** button to calculate the value of the corresponding degrees and radians.

Similarly, it can convert radians to degrees and degrees, minutes and seconds, or converts degrees to radians and the value of every minute.

14.9. Parameter Calculation (Parm Calc)

Calculation Type: Include 7 Parameters, 7 Parameters (strict) and 3 Parameters.

7 Parameters/(strict): The application scope of 7 Parameters/(strict) is relatively large, generally larger than 50 km. Users need to know at least three/four pairs of known point values in local coordinate system and their corresponding WGS-84 coordinates. Only when we get the 7 parameters transmitting from WGS coordinate system to local coordinate system, can we start the parameter calculation.

3 parameters: At least one known point pair is requested which is usually used in small scales. The accuracy is up to the operating range, decreasing with the increase of operating distance.

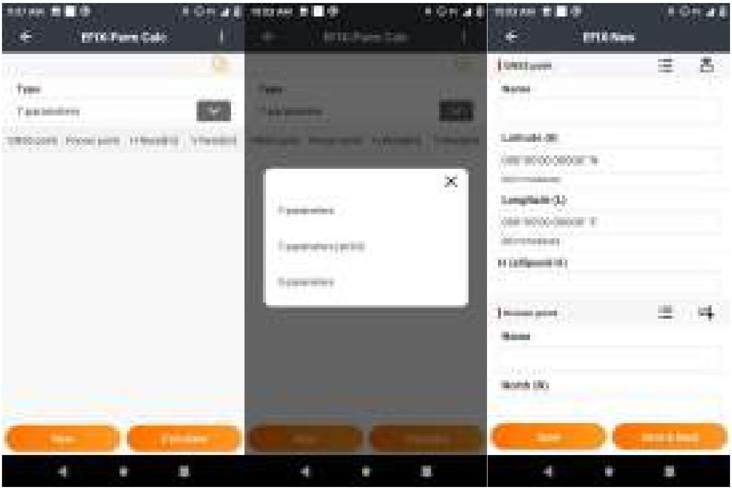
Mode: We can choose **Guide mode** or **Simple mode** to add point pairs based on different situations.

Select Point Pair: Click **Add** to add point pairs and input pairs of GNSS points and known points to calculate parameters. Add WGS-84 coordinates at **GNSS Point** and add plane coordinates at **Known Point**.

GNSS Point: Select from library, survey or enter manually to add GNSS points.

Known Point: Select from library, map or just enter manually to add known points.

Note: Select corresponding point pairs and add to the interface of parameter calculation.

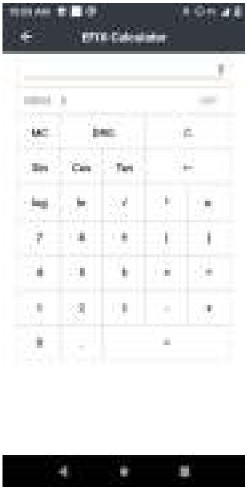


Calculate: Click to calculate. The results will be popped up automatically. Then click **OK** to apply the parameters to the current project.

Datum trans: Back to the main menu, click **CRS** to view Datum trans interface and the parameters can be viewed. Click more, you can choose to lock the parameters and the default password is 123456, which can also be changed. And we can also click unlock to edit parameters.

14.10. Calculator

Use for simple mathematical calculations.



MC: Clear historical.

DRG: Transform input number type (Degree or rad).

C: Clear current record.

Sin/Cos/Tan: Calculate sin/cos/tan value. Users should click **DRG** to transform input number type into degree (DEG), sin 30(DRG) = 0.5.

←: Back.

log/ln: log10=1.   **√**: 8√3=2.

^ : 8^ 2=64.   **n!**: n!3=6.

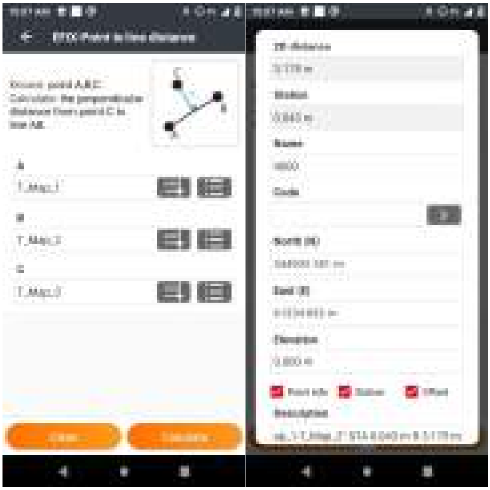
14.11. Ruler

This function will provide users with a ruler to do some simple measurement.

Users can use a real ruler to adjust the length of the ruler by moving the circle, then click the confirm icon.

14.12. Point to Line Dist

Select points A, B, C from point management and click **OK** to calculate. The result is displayed in a pop-up box, as follows: click **Clean** to clear current data.



14.13. Offset Distance

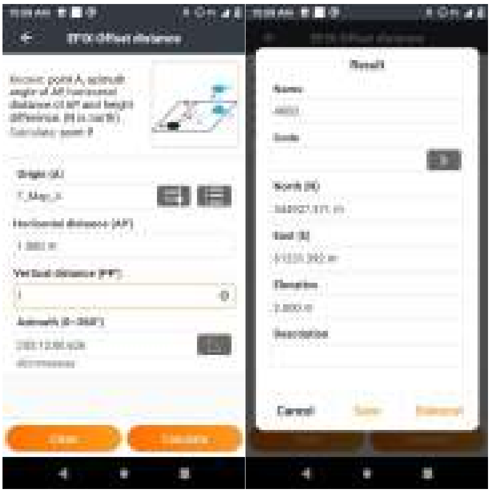
Origin (A): Select from **Points**.

Horizontal distance (AP'): Input the horizontal distance.

Vertical distance (PP'): Input the vertical distance.

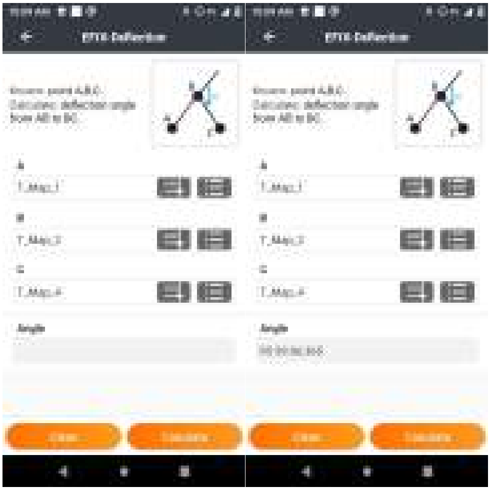
Azimuth Angle: Input the azimuth angle.

Calculate: Click **Calculate** to display a calculation result interface, enter the point name, and click **OK** to save the calculated point.



14.14. Deflection

Deflection: Click **Deflection** to calculate deflection angle. Select Point A, B, C, and click **OK**, the angle will be displayed in the pop-up interface.



14.15. Rotation

Rotation: Point P is on the line AB which rotates a certain angle. After selecting AB points, the system will calculate the distance between point A and point B as default and this distance as the initial value for AP.

A/B: Select the coordinate of A, B from **Points**.

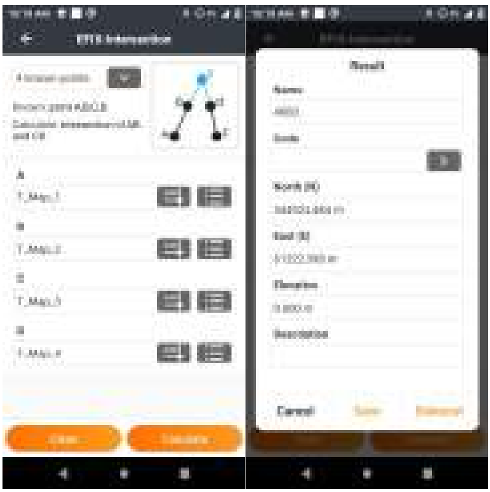
AP: Distance from point A to point P.

Rotation Angle: The rotated angle between AB and AP.

Calculation Result: Click **Calculate** to get the result. Input name and then click **OK** to save this calculated point.

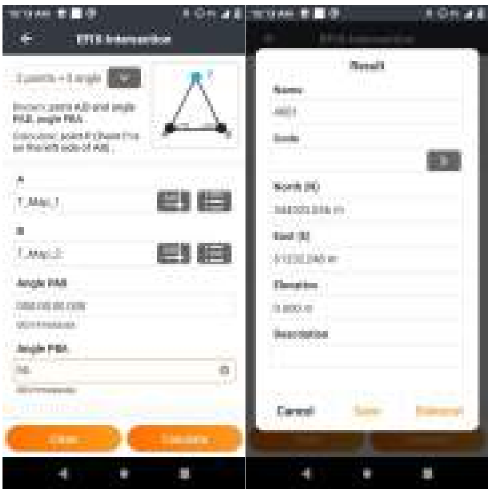
14.16. Intersection

4 Known Points: Select points from point management and click **Calculate** to calculate the intersection P of line AB and line CD.

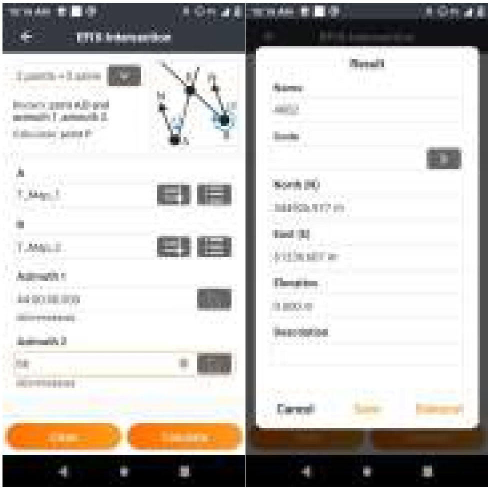


Distance - : Select points A and B from point management. Enter the length of line AP and line BP. Click **Calculate** to calculate. Input a name and click **OK** to save.

Points + 2 Angles: Calculate intersection P with known points A and B and the inner angle of PAB. Click **Calculate** to calculate. Input a name and click **OK** to save.

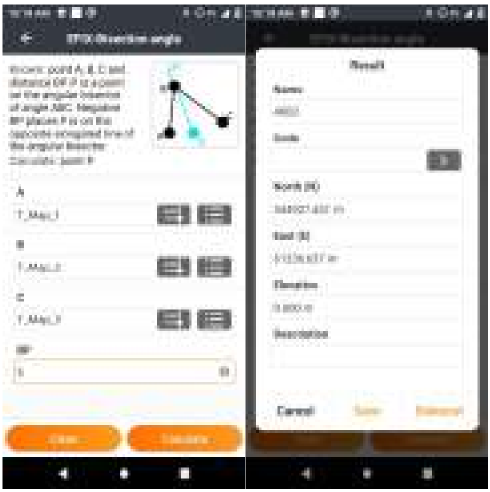


Points + 2 azimuths: Calculate intersection P with known points A and B and the inner azimuths. Click **Calculate** to calculate. Input a name and click **OK** to save.



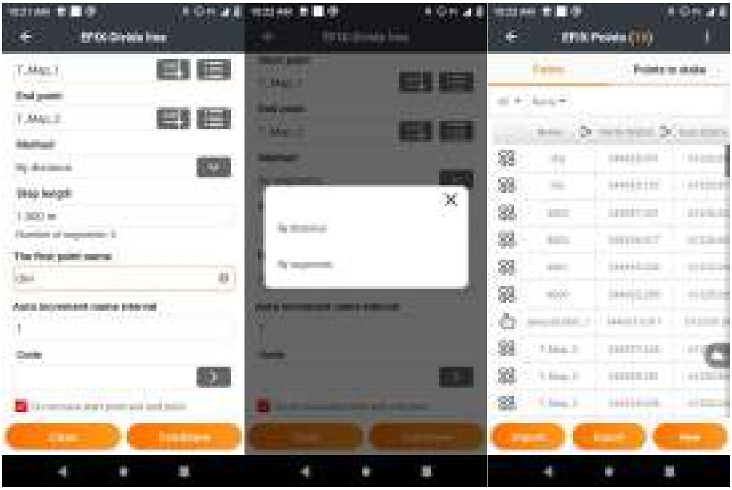
14.17. Bisect Angle

Bisection Angle: Given line BA and BC comes to an angle ABC, P is one point on the angle bisection line, according to the coordinates of Points A, B, C, and the plane distance from Point P to Point B, we can have the coordinate of Point P. If the distance value is negative, it means Point P is on the oppositely extended line of the angle bisection line. Click **Calculate**, the results will show out, input the point name, and click **OK** to save the calculated point.



14.18. Divide Line

Dividing Line: Select start point and end point from **Points**, select **Method**, Input step length, first point name and name interval, then click **Calc&Save**; it will remind users of a successful division. Click **Points** manager to review points.

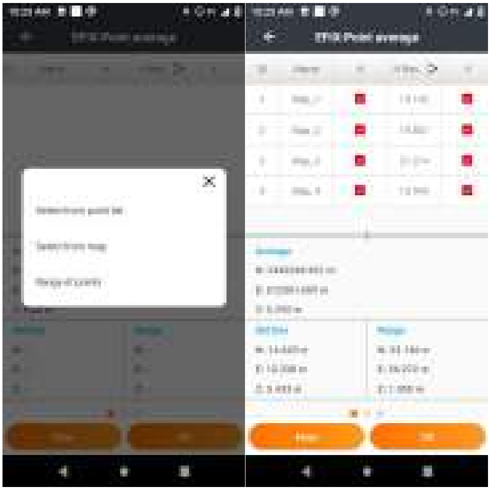


14.19. Tangent point

Click on "Tangent Point", select a point in the graph (not within the selected circle), then select another circle, and place the generated point to the tangent point of the circle (the tangent point closer to the direction of the finger click when the selected circle is generated first). You can choose to layout, save, save and layout this tangent point.

14.20. Point average

Select: Select points to calculate.



OK: Report the average value of selected points in calculation result interface.

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