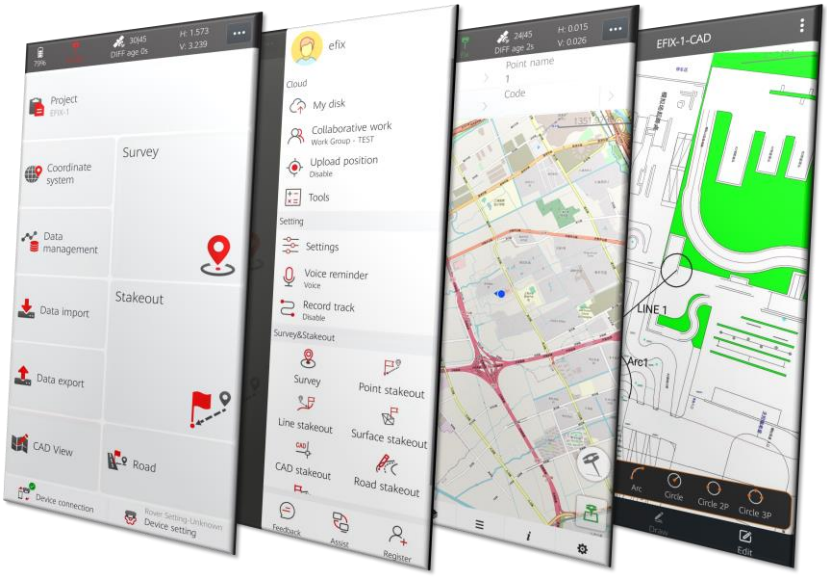
eField *User Guide*

Productivity is the priority



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Building the intelligent world with precise time and space

Table of Contents

Table of Contents 2
1 eField Overview 5
1.1 Software Description 5
1.2 Key Features 6
1.3 Software Interface 8
1.4 Software Installation 11
2 Project 12
2.1 Projects 12
2.1.1 New 12
2.1.2 Delete 28
2.1.3 Open 29
2.1.4 To cloud and From cloud 29
2.1.5 Share and Load 31
2.2 Coordinate system 33
2.2.1 CRS 33
2.2.2 Site calibration 41
2.2.3 Base shift 43
2.3 Data management 44
2.3.1 Points 44
2.3.2 Lines 52
2.3.3 Surfaces 58
2.4 Data import 58
2.4.1 Import 58
2.4.2 Base map 59
2.5 Data export 63
2.5.1 Export 63
2.5.2 Reports 64
2.6 Points 67
2.6.1 Add 67
2.6.2 Query 68
2.6.3 Delete 69
2.6.4 Detail 70
2.6.5 Recycle 71

2.6.6 Coordinate Type 72
2.6.7 Multiple Operation 73
3 Config 74
3.1 Device connection 74
3.2 Device setting 79
3.2.1 Work mode 79
3.2.2 Device information 101
3.2.3 Static settings 103
3.2.3 NMEA output 105
4 Survey 107
4.1 Map 107
4.1.1 Icon details 107
4.1.2 Settings 108
4.1.3 Antenna height 113
4.1.4 Point name 113
4.1.5 Multi-feature measurement 114
4.1.6 Survey methods 117
4.1.7 Layers' manager 125
4.1.8 CAD 126
4.2 Stakeout 129
4.2.1 Display mode 129
4.2.2 Point stakeout 134
4.2.3 Line stakeout 138
4.2.4 Surface stakeout 139
4.2.5 CAD stakeout 140
4.2.6 Settings 149
4.3 Road 153
4.3.1 Road stakeout 153
4.3.2 Road manager 154
4.3.3 Stakeout 175
4.3.4 Settings 177
4.3.5 Stakeout side-slope 178
4.3.6 Where am I 180
4.3.7 Survey cross-section 181
4.3.8 Stakeout report 181

4.3.9 Display the available stations 183
5 Tools 185
5.1 Volume 185
5.2 Inverse 188
5.3 Area 189
5.4 Angle conversion 191
5.5 Parameters Calculation 192
5.6 Point to line dist 194
5.7 Offset 195
5.8 Deflection 195
5.9 Rotation 196
5.10 Intersection 197
5.11 Bisection Angle 198
5.12 Divide Line 199
5.13 Average Value of Points 200
5.14 Grid to Ground 201
6 Register 205

1 eField Overview

1.1 Software Description

Thanks for your interest in eField, it is the latest measuring software based on 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, and road stakeout.

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

Powerful Graphical Surveying: Supports both online OSM/BING/WMS/Google Image map and base map (DXF, SHP, TIF, SIT, KML, KMZ) 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.

1.2 Key Features

Various Base Map Displays

- OSM, BING, Google Image, WMS online maps.
- DXF(including 3D DXF), SHP, TIF, SIT, KML, KMZ offline maps
- JPG

Extensive Import and Export Data Formats

- Import from DXF(including 3D DXF), SHP, KML, KMZ, JPG, CSV, DAT, TXT and CGO formats.
- Export to DXF, SHP, KML, KMZ, RAW, HTML, CSV, DAT, TXT formats.
- Customized import and export contents in CSV, DAT or TXT formats.

Various Types of Measurement

- Supports static, RTK and stop & go measurement.
- 7 methods of point measurement, including topographic point, control point, quick point, continuous point, offset point, eBubble compensated point and corner point.
- Simultaneous stop-and-go 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 stop&go based on real-time kinematic (RTK) mode and static mode can be set at the same time.

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 coordinate system.
- Multiple grid formats are available: GGF, BIN, GRT DAT, DATCZ, GRD, GSF, GRI 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.

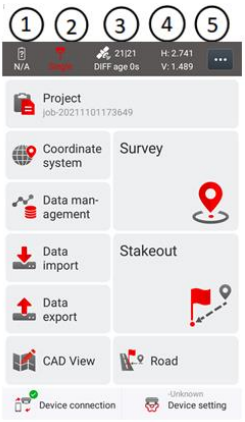
RTCM Transformation Message

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

1.3 Software Interface

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

In **Main interface,** it is consisted of four parts: **Project**, **Survey**, **Config** and **Tools**. Customers can slide to view all menus.



Status Bar:

① This icon shows receiver battery.

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

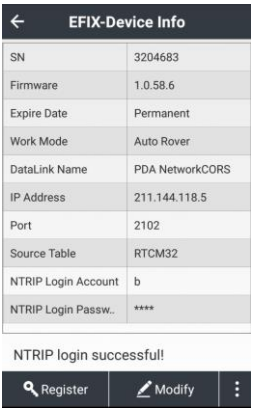
③ This icon shows satellites numbers (N/A), A represents the total number of received satellites, and N represents the number of used satellites. DIFF age means the correction date delay time. It can lead users to **Skyplot** interface.

④ The texts will show current precision, H means horizontal accuracy, V means elevation accuracy.

⑤ The icon will expand more functions.

Device Info: Support to view detail of the current device as shown

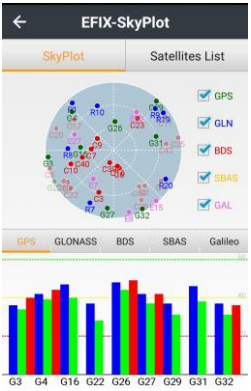
below.



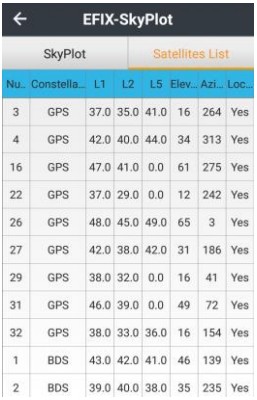
Skyplot: Support to view the current skyplot. Users can see the reference position information of each satellite in current skyplot, and the SNR (L1, L2) which uses bidirectional histogram for display is at the bottom of skyplot. Histogram colors represent different SNR range:

SNR ≤ 20 green;

20 < SNR ≤ 40 blue.



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.



Nu..	Constella...	L1	L2	L5	Elev...	Azi...	Loc...
3	GPS	37.0	35.0	41.0	16	264	Yes
4	GPS	42.0	40.0	44.0	34	313	Yes
16	GPS	47.0	41.0	0.0	61	275	Yes
22	GPS	37.0	29.0	0.0	12	242	Yes
26	GPS	48.0	45.0	49.0	65	3	Yes
27	GPS	42.0	38.0	42.0	31	186	Yes
29	GPS	38.0	32.0	0.0	16	41	Yes
31	GPS	46.0	39.0	0.0	49	72	Yes
32	GPS	38.0	33.0	36.0	16	154	Yes
1	BDS	43.0	42.0	41.0	46	139	Yes
2	BDS	39.0	40.0	38.0	35	235	Yes

1.4 Software Installation

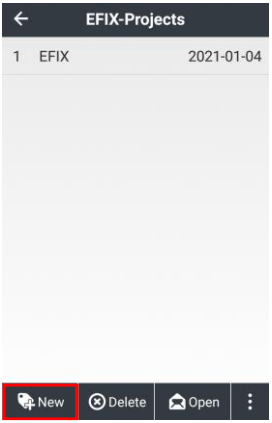
Copy the software (eField.apk) onto Android devices, touch screen to start the installation program. After installation, it will generate eField app on the desktop.

2 Project

2.1 Projects

2.1.1 New

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

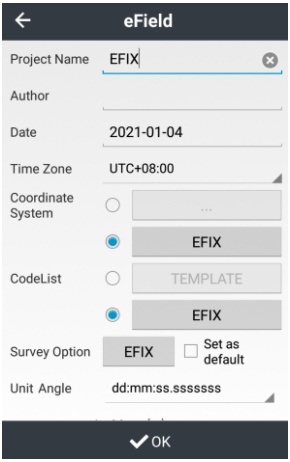


Project Name: Input the project name, backslash (/) is forbidden.

Author: Input the name of the operator.

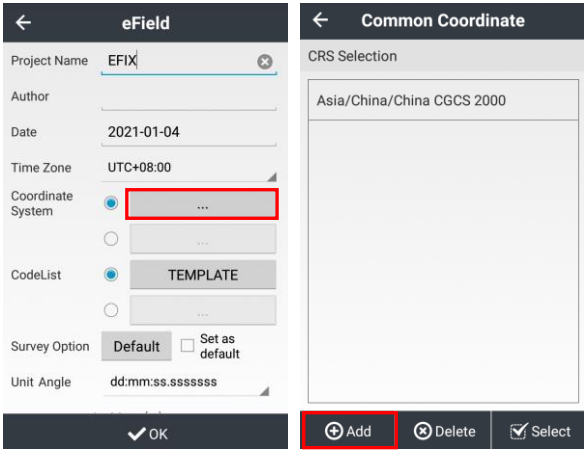
Date: Default time is the local time.

Time Zone: Choose the time zone in drop-down list from UTC-12:00 to UTC+14:00.

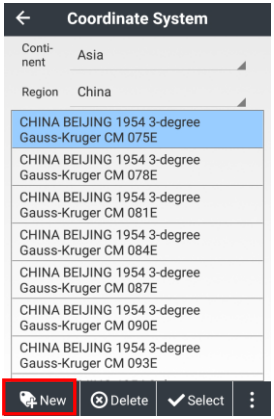


(1) **Coordinate System**:

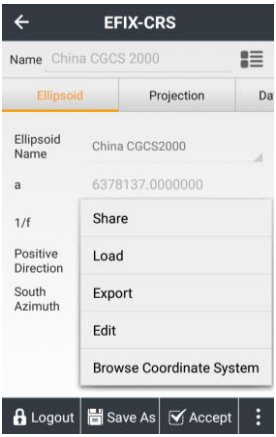
Users can create a new coordinate system or use the template of existing projects. Tick the first box to enter **Common Coordinate** interface, and then users are able to add a new coordinate system by clicking **Add**.



Click **New** to create a new coordinate system.



Users can view the parameters of ellipsoid, projection, datum transformation, plane adjustment and height fitting.



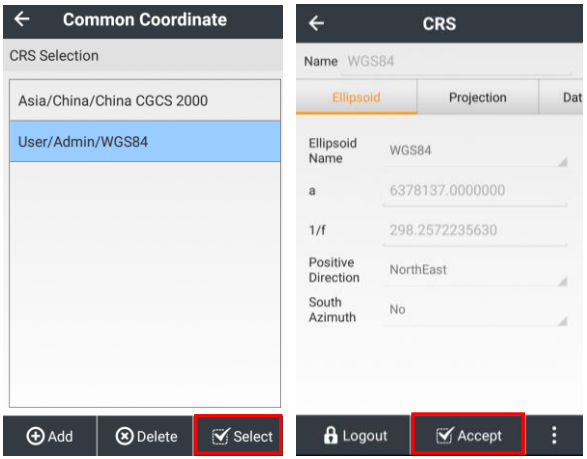
Click **Save** and it will prompt the path where this coordinate system saves.

Go back to **Common Coordinate** interface.

Click **Delete** to delete a coordinate system from the List.

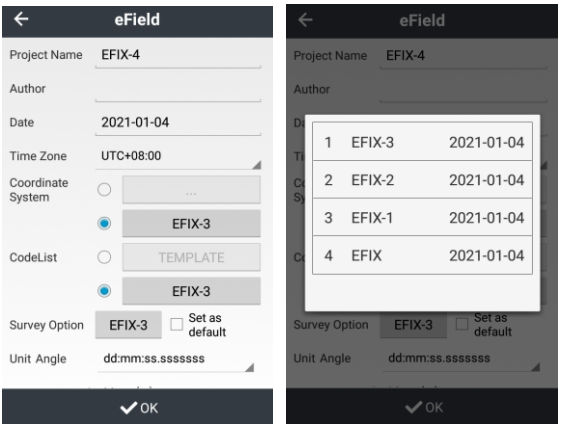
Click **Select**, it'll return to **Coordinate System** interface, and then

click **Accept** to finish CRS configuration.



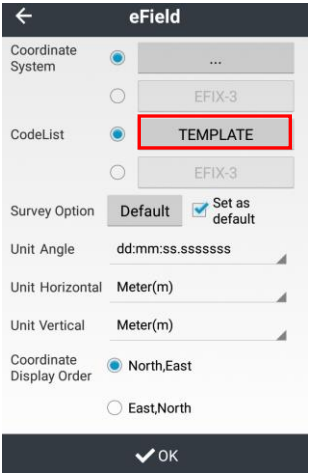
(2) **Project Template**:

Tick the second box to select project template, then it will show a list of historical projects. Users can select one and click **OK** to apply. It's used for applying the transformation parameters for different sites. 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.

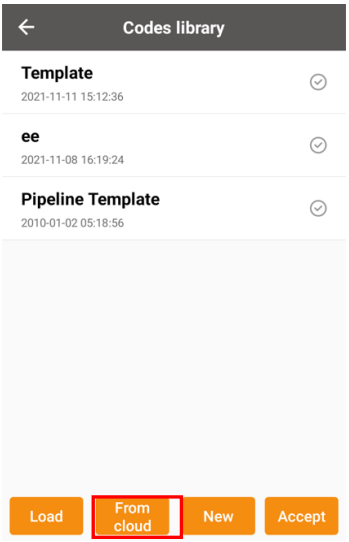
CodeList: Click to view **CodeList** interface.

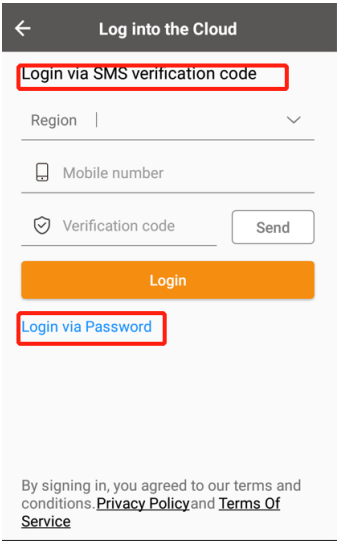


Click **New** to create a new codelist, input file name and click **OK**. (Users also can click **Accept** to accept existing codelist and it will

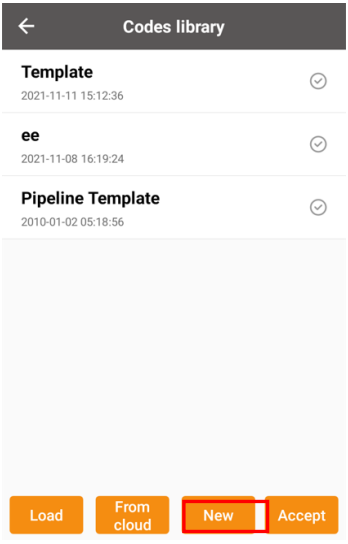
return to previous interface after accepting successfully.)

Firstly, users can import **from cloud** by **SMS verification code** or inputting **Users name, Password** which are generated by **SMS verification code after sign up.**

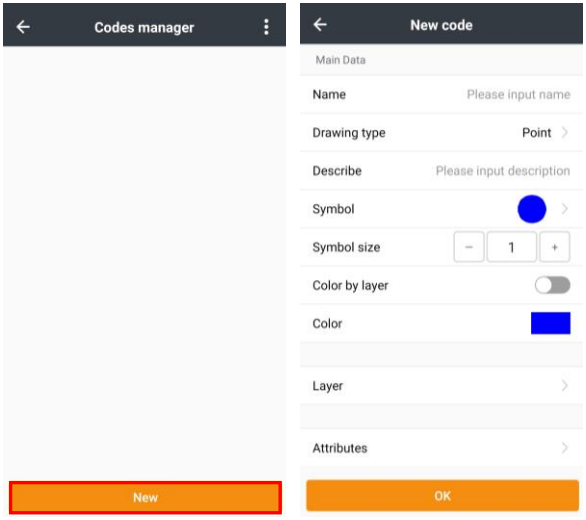


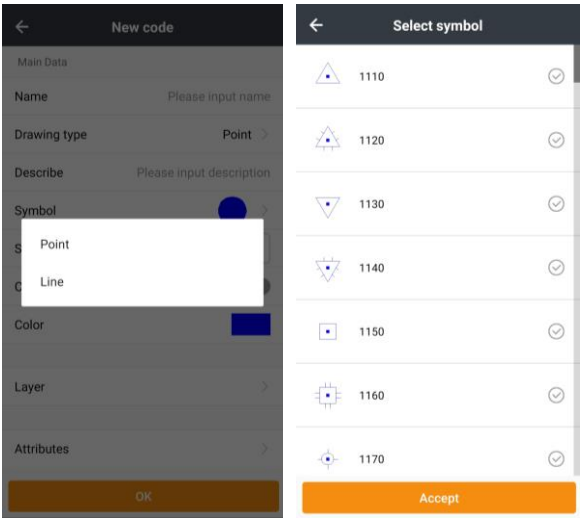


Secondly, click **New** to create a new codelist, input file name and click **OK.**

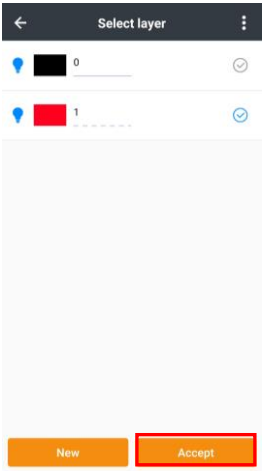


Click **New**, then input new code name, describe, and choose drawing type from Point and Line. Choose Symbol from symbol list and decide the size of it. Users can choose color of the new code and decide if they want to color by layer.

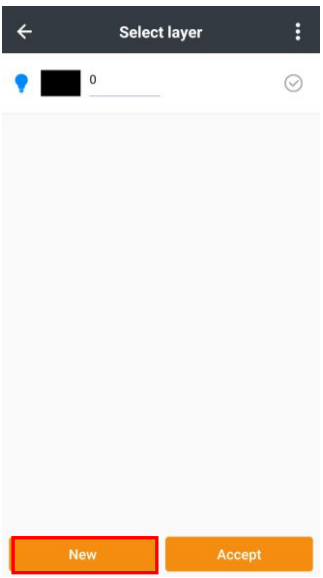




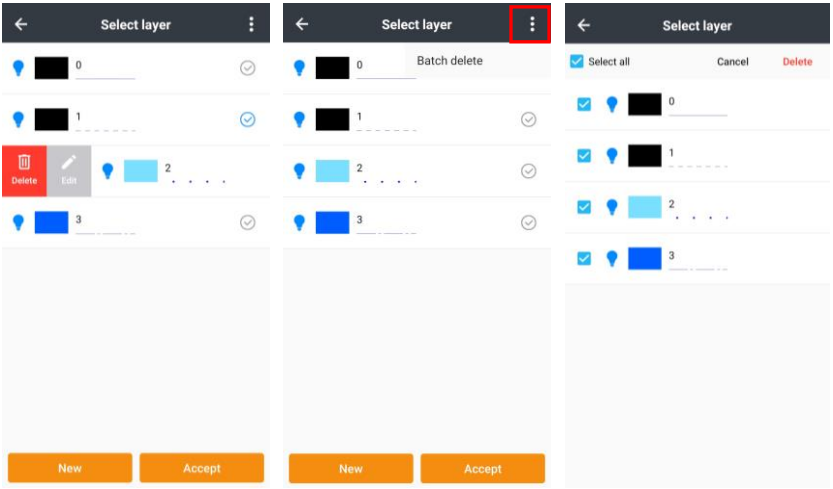
Users can select layer and click **Accept**, then the layer would be chosen.



Also they can create a new layer by clicking **New**, then input the layer name and select color and linetypes. Click **OK**, so the new layer would be created.

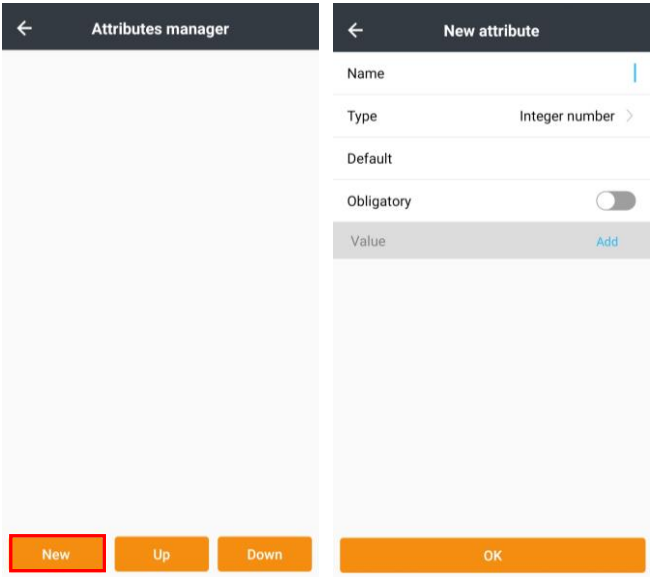


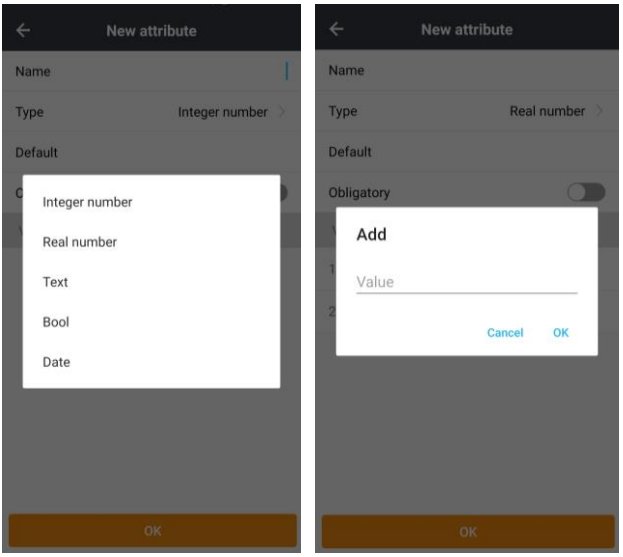
Left slide a layer to **edit** or **delete** it, but **layer 0** cannot be deleted. Users can click the icon on the **upper right** to select a **batch** to delete.

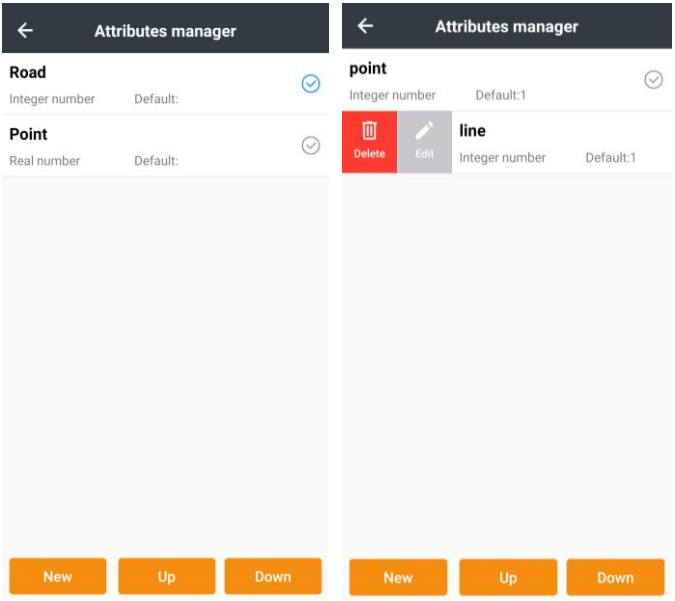


Users can create a new attribute by clicking **New**. Input Name,

default, and select type from pull-down menu. Users can decide if this attribute is obligatory. Click **Add** to add values to the attribute. Then click **OK** to create a code. Up (down respectively) button is to move the selected attribute up (down respectively). Left slide the attribute to **edit** or **delete** it.

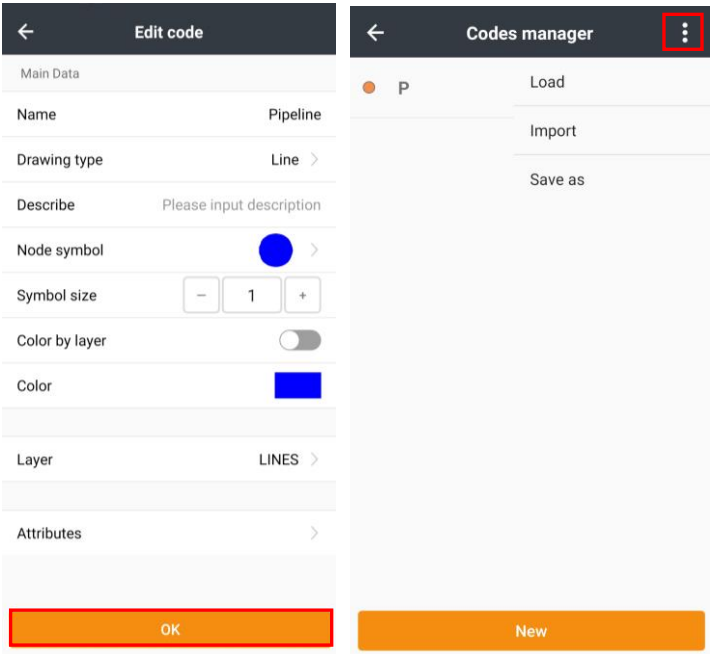




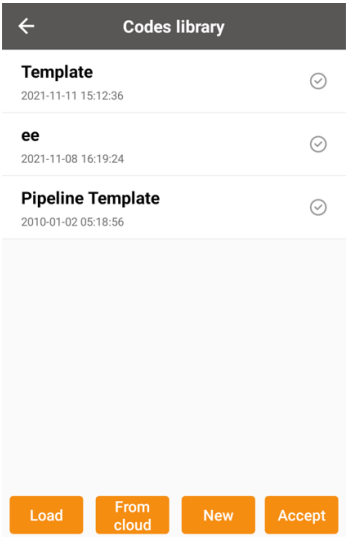


Back to New code interface and click **OK**. The new code would be

saved. Click the icon on the upper right, and users can load, import, and save codes.



Click **load** to load from codes library. The library can be expanded **from cloud** and also users can create **new** library. Select a library and click **Accept**.



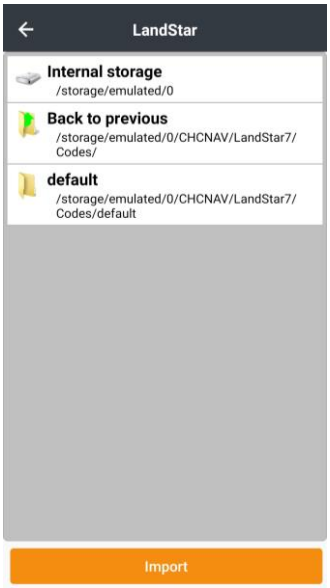
Click **import** and choose a path to import codes. The import function will allow user to import code from excel file. The excel template can be downloaded from the below link:

https://1drv.ms/u/s!AoV9LrLnYKRkrCh-VaoT6I3pakbc?e=BaRtjc

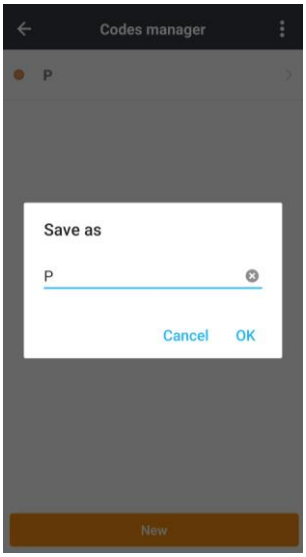
The file definition can be checked as below:

Name	DrawingType	Describe	SymbolID	SymbolSize	IsColorByLay	SymbolColor	LayerName	LayerColor	LineStyle
testCodeNam	0	testDescribe	1	20	0	0	testLayerName	FFFFFF	6
testCodeNam	1	testDescribe		15	0	0	testLayerName2	FFFFFF	8
point	0	pointcode		15	1	FF0000	testLayerName	FF0000	21
line	1	linecode		18	1	FFC125	POINTS	FFC125	7
test1	0	testDescribe	1	20	0	0	testLayerName	FFFFFF	9
test2	1	testDescribe		15	0	0	testLayerName2	FFFFFF	964509
point1	0	pointcode		15	1	FF0000	testLayerName	FF0000	45
line1	1	linecode		18	1	FFC125	POINTS	FFC125	964510
test3	0	testDescribe	1	20	0	0	testLayerName	FFFFFF	37
test4	1	testDescribe		15	0	0	testLayerName2	FFFFFF	28
point2	0	pointcode		15	1	FF0000	testLayerName	FF0000	15
line2	1	linecode		18	1	FFC125	POINTS	FFC125	10

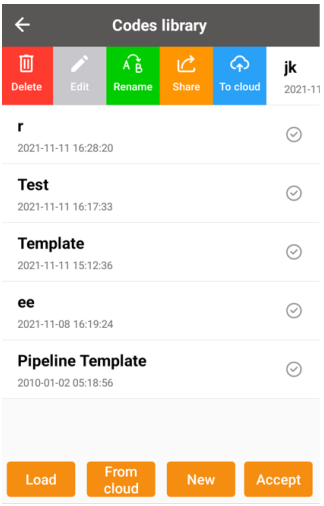
field name	field description	Must to fill?	default value	Note
Name	Code Name	Y	None	
DrawingType	Code drawing type	N	0	0: Point 1: Line
Describe	Code Description	N	None	
SymbolID	Symbol ID	N	907938(Filled circle)	The value of symbolId comes from the list of symbols in the efield.
SymbolSize	Symbol size	N	1	It is recommended that SymbolID be set to 1 when it is 907938 (solid circle) or 907939 (hollow circle), and to 6 (the rest).
IsColorByLayer	The color of the symbols is consistent with the layer which they belong to.	N	0	0: N 1: Y
SymbolColor	Symbol color	N	#0000FF (blue)	Hexadecimal color format
LayerName	layer name	N	POINTS	Default is POINTS layer.
LayerColor	layer color	N	#000000 (black)	If not entered, the layer color of the layer will be set according to the LayerName.
LineStyle	Line Color	N	6	6: solid line, the value of lineStyle comes from the list of line symbols in the efield.



Click **save as** and input a name to save the codes.



Left slide the code to **edit** or **delete** it. In Codes library, left slide to **delete, edit, rename**, and **upload** the codes. Choose a code and click **Accept.**



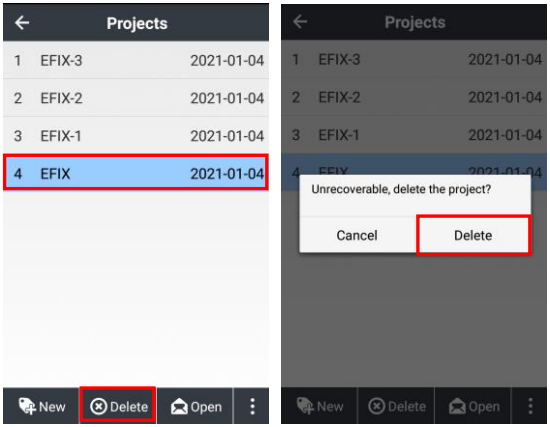
(3) **Survey Option:** Survey parameters will be saved in project automatically, users can apply survey parameters of existing projects when create a new project.

(4) **Unit settings**, **Coordinate display order**, **and Station display**

Note: Starting from version 7.4.0, all the parameters in this page will be saved automatically, and efield will automatically apply the same setting when users create a new project.

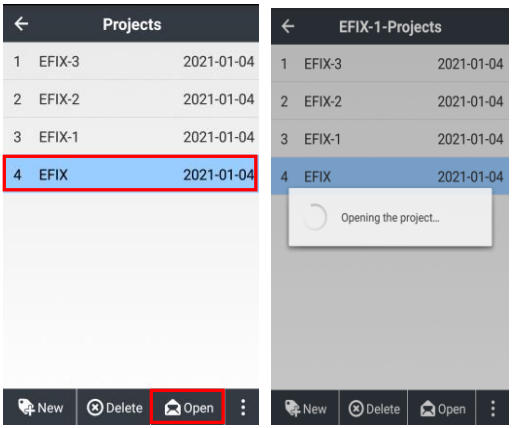
2.1.2 Delete

When users click to delete current project, it will prompt "Cannot Delete Current Project!" to protect current project. While deleting a closed project, it will prompt "Unrecoverable, Delete the Project?" Select **Confirm** to delete the project, or select **Cancel** to cancel deleting.



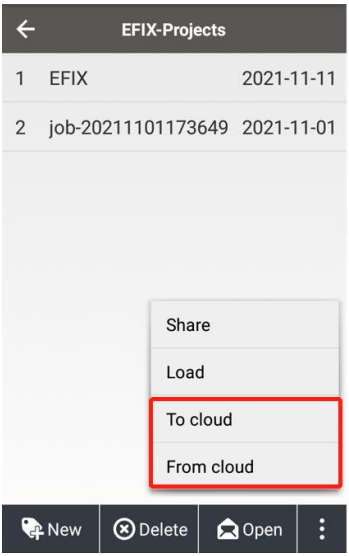
2.1.3 Open

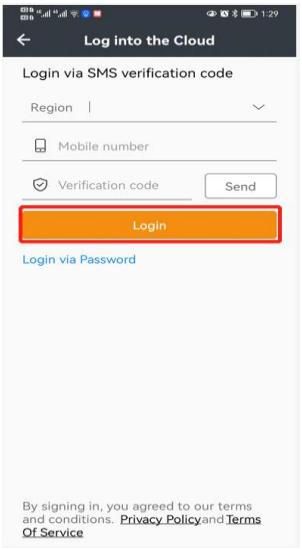
To continue an existing project, users can click **Open** to open previous project.



2.1.4 To cloud and From cloud

Click **To cloud** or **From cloud** to enter the interface of **Cloud**. Enter the **Region，Mobile number，Verification.** Then click **Login**

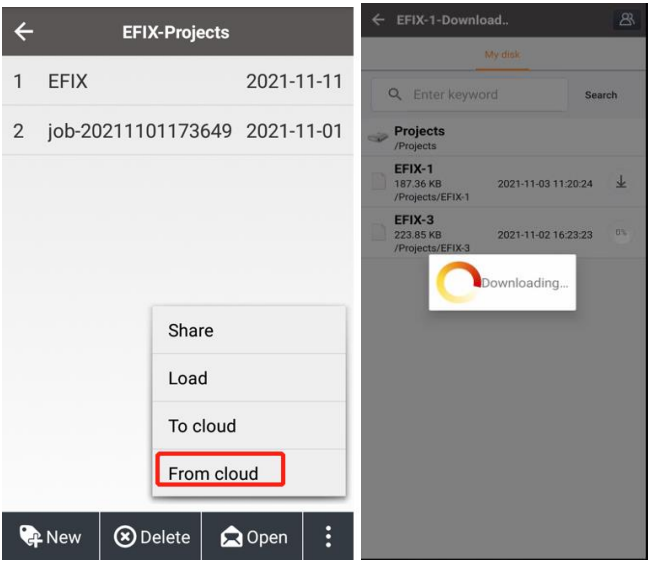




To cloud: Select a project, click **To cloud**, then click the **refresh** to refresh the interface, click **upload** to upload to the cloud sever.

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

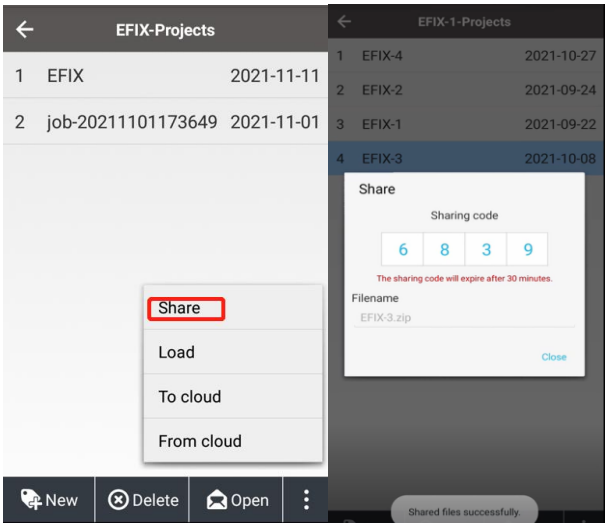
interface. Also you can enter the key words, and click the **search** to find the project you want.

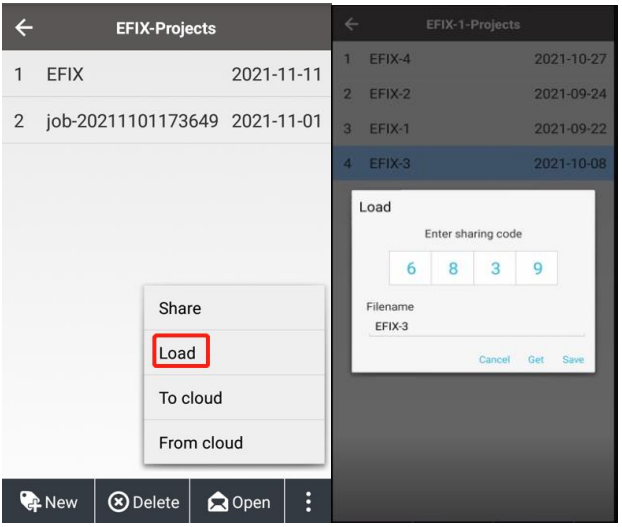


2.1.5 Share and Load

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

Click **Load** and input the sharing code to accept the project.


EFIX-Projects
1 EFIX 2021-11-11
2 job-20211101173649 2021-11-01
Share
Load
To cloud
From cloud
New
Delete
Open
EFIX-1-Projects
1 EFIX-4 2021-10-27
2 EFIX-2 2021-09-24
3 EFIX-1 2021-09-22
4 EFIX-3 2021-10-08
Share
Sharing code
6 8 3 9
The sharing code will expire after 30 minutes.
Filename
EFIX-3.zip
Close
Shared files successfully.


EFIX-Projects
1 EFIX 2021-11-11
2 job-20211101173649 2021-11-01
Share
Load
To cloud
From cloud
New
Delete
Open
EFIX-1-Projects
1 EFIX-4 2021-10-27
2 EFIX-2 2021-09-24
3 EFIX-1 2021-09-22
4 EFIX-3 2021-10-08
Load
Enter sharing code
6 8 3 9
Filename
EFIX-3
Cancel
Get
Save

2.2 Coordinate system

Coordinate System includes CRS, Site calibration and Base shift.

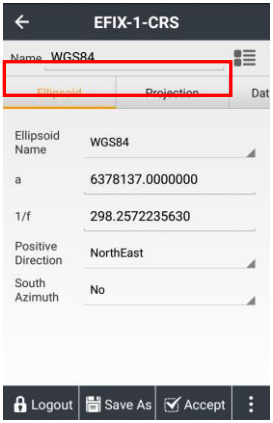
2.2.1 CRS

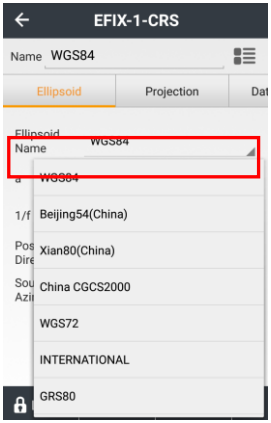
Coordinate System (CRS) offers users some parameters including ellipsoid, projection, datum transformation, plane adjustment and height fitting.

Click **Login** to input a user name and password.
User name is admin, and the initial password is 123456.

Name: Input CRS name, it is required to define CRS name, and the default name is the same as ellipsoid name.

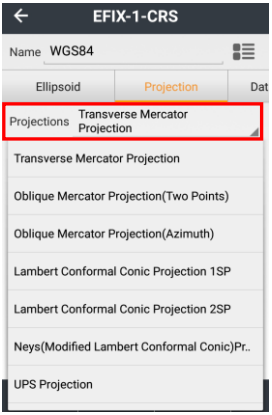
(1) **Ellipsoid**: Includes ellipsoid name, a, 1/f, etc. Users can choose ellipsoid name from pull-down menu (different ellipsoid name is corresponding to different parameters) as well as manually input.



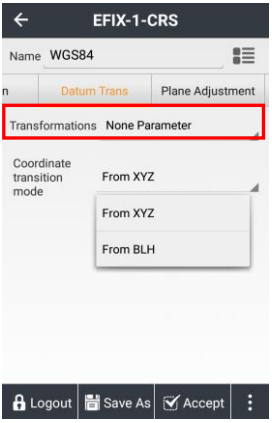


(2) **Projection**: There are some built-in common projection methods of different countries and regions, including Gauss projection, Transverse Mercator projection, UTM projection and so on. And the parameters of the projection model are displayed in the interface. Only the central meridian is needed 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.

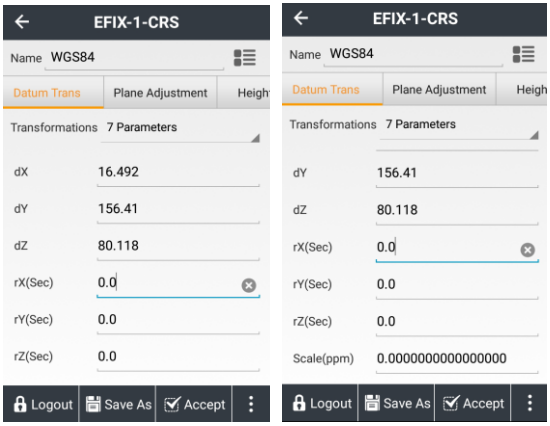
(3) **Datum Trans**: Represents the mathematical model for transformation between two coordinate systems. Datum transformation model includes none parameter, three parameters, seven parameters, seven parameters Bursa, and grid models. Users can input the local 7 parameters directly, no needing the site calibration any more.



(a) None Parameters: Users can choose coordinate transformation mode, from XYZ or from BLH.

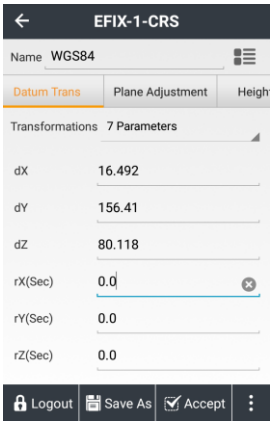


(b) 7 Parameters: Requires at least three known points, and the points can be under the national coordinate system or the coordinate system that existing small rotation from the WGS84 coordinate system. Preferably three or more known points so that eField can check the correctness. The mathematical model 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.



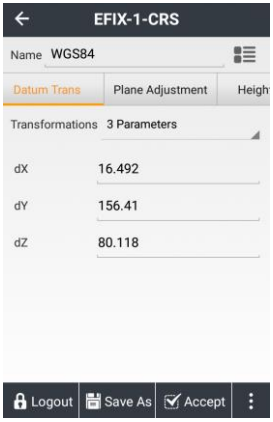
Note: When accuracy of known points is not high, 7 parameters transformation is not recommended.

(c) **7 Parameters Bursa**: Add Bursa modem for 7 parameters.

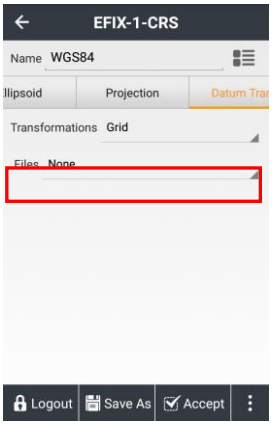


(d) **3 Parameters**: Requires at least one known point, and the points can be under the national coordinate system or the coordinate system that existing small rotation from the WGS84 coordinate system. Preferably two or more points are known so that checking the correctness of the known

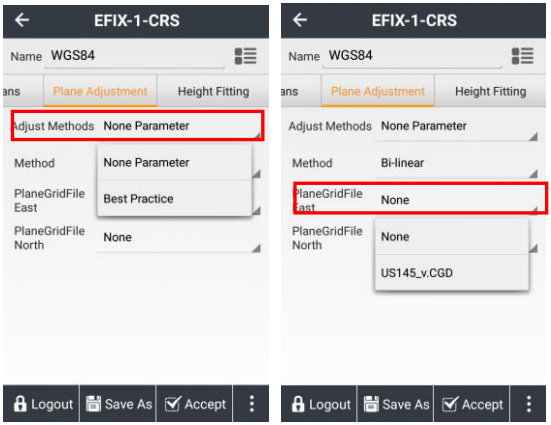
points. This method is suitable small-range work, of which accuracy is determined by the operating range. The larger the operating range users have, the lower the accuracy users get.



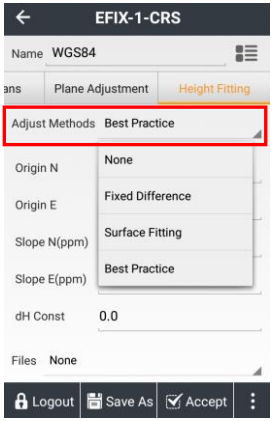
(e) **Grid**: Choose to use grid file for datum transformation (recommend to use CGD file). Please click **eField-Config** to find **Geoid** folder in internal storage of controller, and put grid file in it before using this function. The software currently supports the grid file of CGD/GRD/BYN formats.



(4) **Plane 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 you are logging in successfully. It supports **Best Practice** and **Grid** at present. The software currently supports the grid file of CGD/GRD/BYN 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).



(5) **Height Fitting**: Supports four kinds of algorithms: **None**, **Fixed Difference**, **Surface Fitting** and **Best Practice**, of which **None** is the default one.

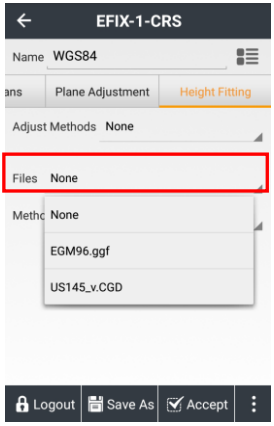


(a) **Fixed Difference**: Need at least one starting point.

(b) **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.

(c) **Best Practice**: Best Practice is the height transformation model of Trimble TGO software.

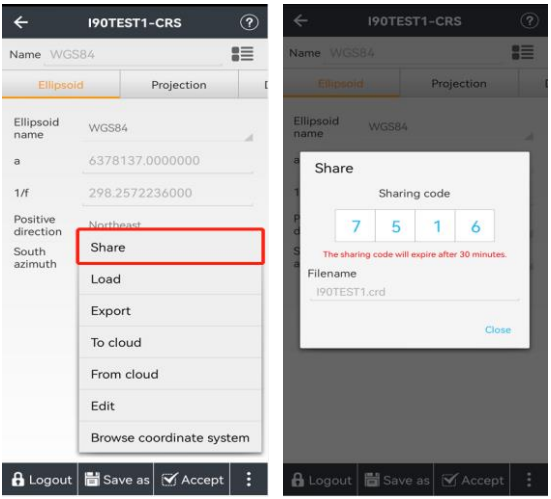
(d) **Geoid Model**: Click to choose the geoid model file when select this method. The software currently supports the geoid model file of CGD/GGF/BIN/GSF/GRD/GRI/BYN/ASC formats. Please click **eField-Config** to find **Geoid** folder in internal storage of controller, and put geoid file in it before using this function (recommend to use CGD file).



(6) **Share** and **Load**:

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

Click **Load** and input the sharing code to accept the project.

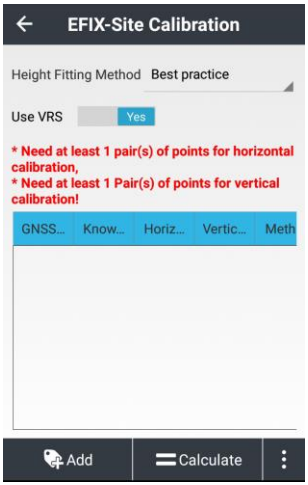


2.2.2 Site calibration

When the correction parameters of application points prompt “abnormal ratio for flat correction” or “residual value is too large”, we suggest check the control point that participate point correction input wrong or not, whether match 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 CAL: Click to enter point calibration interface.

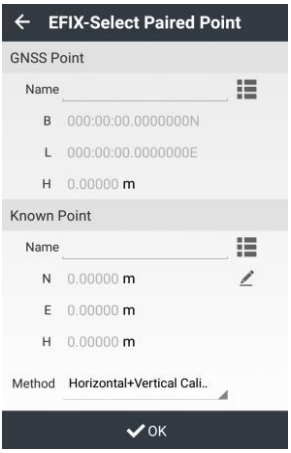


Height Fitting Method: Include fixed difference, surface fitting, best practice. Default plane fitting method is best practice.

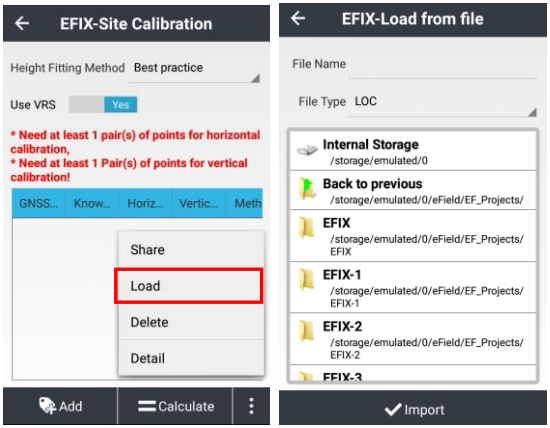
Add: Click to select correspond GNSS points and Known points. Select Horizontal + Vertical Calibration. The best choice is to

choose 3 couples of points based on actual situation.

In the surface of “Select Point Pair”, user can select Known Point or click to input Known Point coordinate.



Calculate: Click to calculate. The software will prompt “plane correction success, height fitting success”. After that click **Application**, the prompt is “Whether replace the current project engineering parameters or not”, select **Yes** will make current calculated correction parameters apply in the coordinate system which can affect into the whole project. Users can log for viewing plane correction and elevation fitting parameters, otherwise parameters are not display.



Click Load from file users can load .loc file and apply in the project.

2.2.3 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.

Base Shift: Click to enter base shift interface. In base shift Interface, click the icon beside GNSS Point to select a current point surveyed at a control point, click the icon beside Known Point to select the corresponding control point. The calculation results would show automatically. Then click **OK**. The software prompts “Apply Shift Parameters or not?” click **Yes**, then the software prompts “Shift base and Related Survey Points, Whether Open Point Library or Not?”. Click **Yes**, 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.

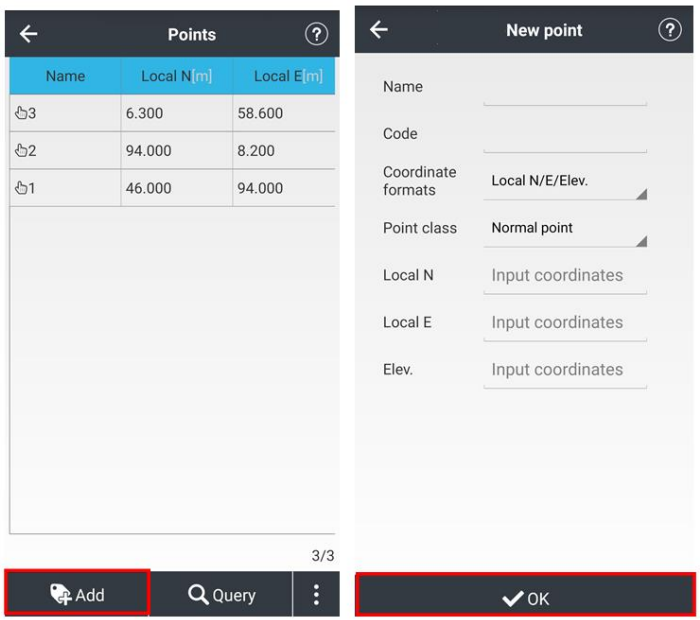
2.3 Data management

2.3.1 Points

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

2.3.1.1 Add

This function can create a new point. Click **Add** to create a point. Creating a point needs some attributes as follows: name, code (input as need), coordinate formats (including: local NEH, local BLH, local XYZ, WGS84 BLH, WGS84 XYZ), point class (including normal point and control point). Then, input the point coordinates that users create.



Click **OK** and the coordinates point will be built.

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.

2.3.1.2 Query

This function can query points by conditions, including name, code, solution of the state, etc. Click to enter **Query** interface.

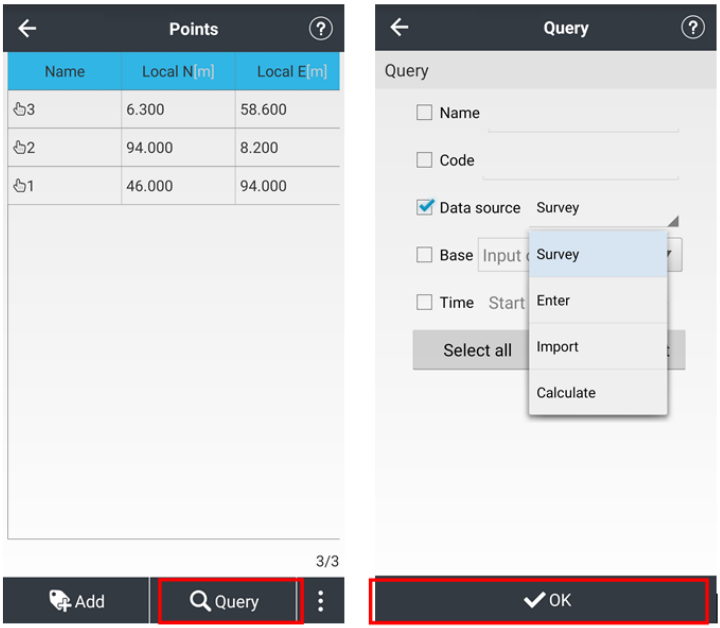
Name: Tick to query points by completely matched with name.

Code: Tick to query points by completely matched with code.

Data Source: Tick to query points by completely matched with data sources, including **Survey**, **Enter**, **Import** and **Calculate**.

Base: Tick to query points by completely matched with base, and then the name of base station will appear in drop-down box.

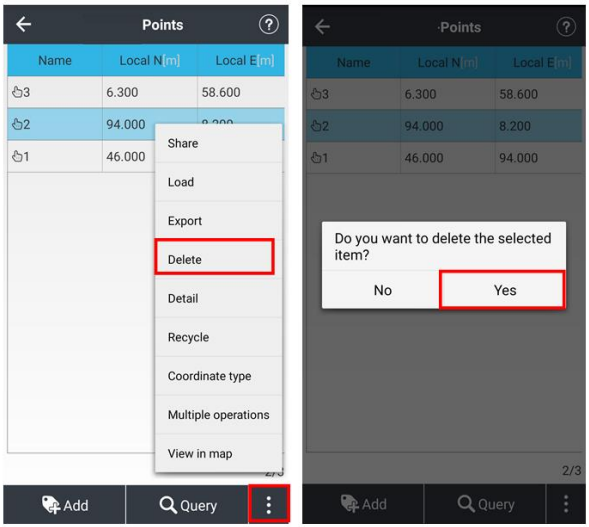
Time: Tick to query points by completely matched with time, users need to set the start time and end time.



Click **OK** to start query.

2.3.1.3 Delete

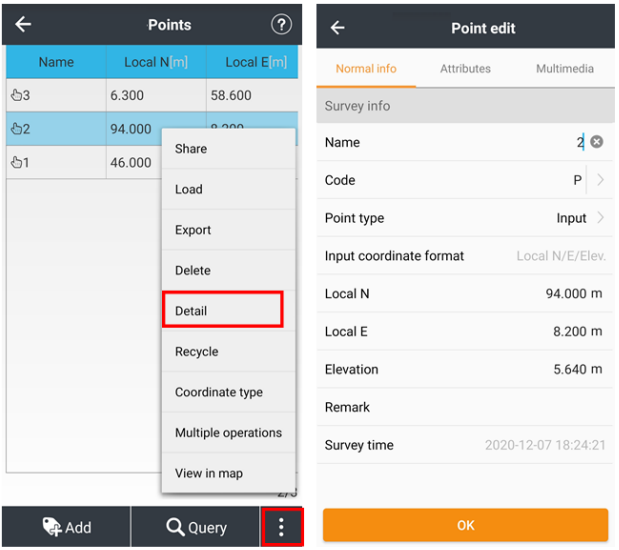
This function can delete points. Click **Delete**, then a dialog box "Delete Selected Data or Not?" will pop up, click **Yes** to delete this record.



Note: When users don't select points before clicking **Delete**, it will pop up a prompt: "Please Select Data First!"

2.3.1.4 Detail

This function can view point detail. Click **Detail** to view detail of the selected point (double-click selected points can also view the detail). Values in black can be modified, and values in gray can't be modified. As for code, users can change point code here, and add more codes one after another by adding a slash between each code. Please noticed that once you changed the code, the measured features will also be changed.



2.3.1.5 Recycle

This function can recycle deleted points. Click **Recycle** to enter **Point Recycler** interface and view deleted points.

Detail: Click to view detail of the selected point.

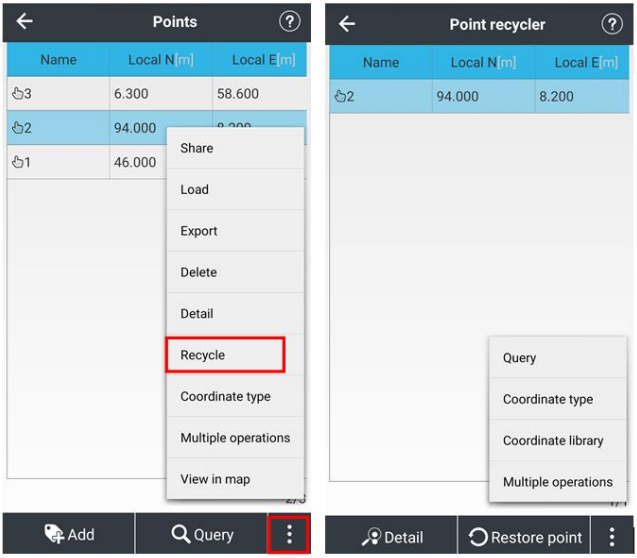
Restore Point: Click to recover deleted points.

Query: Click to query deleted points by condition.

Coordinate Type: Click to set coordinate type of deleted points.

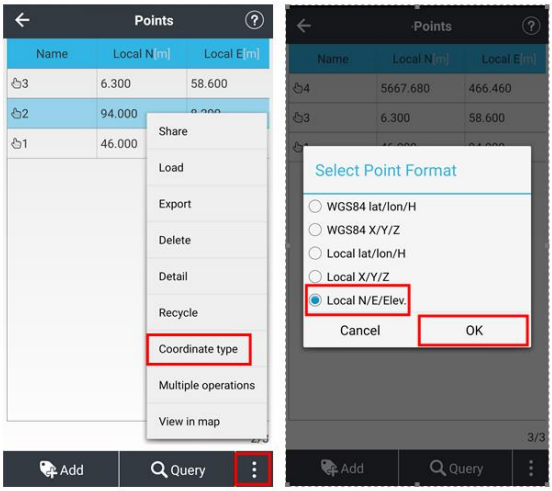
Coordinates Library: Click to view coordinates library.

Multiple Operation: Click to select multiple deleted points.



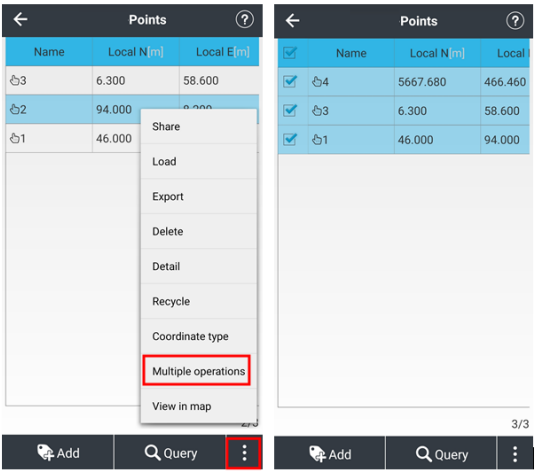
2.3.1.6 Coordinate Type

This function can set coordinate type of points. Click **Coordinate Type** to select point type.



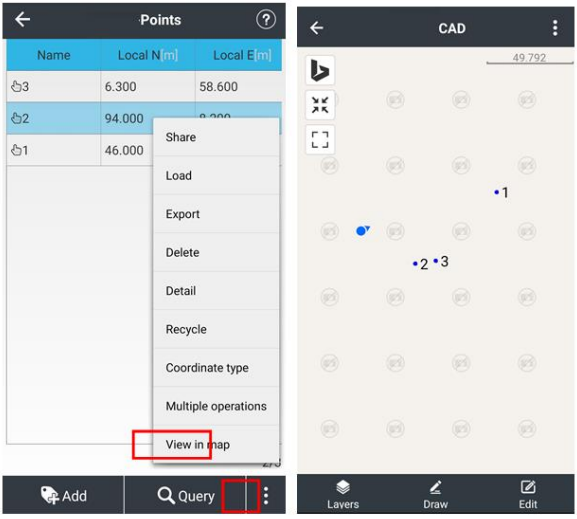
2.3.1.7 Multiple Operation

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



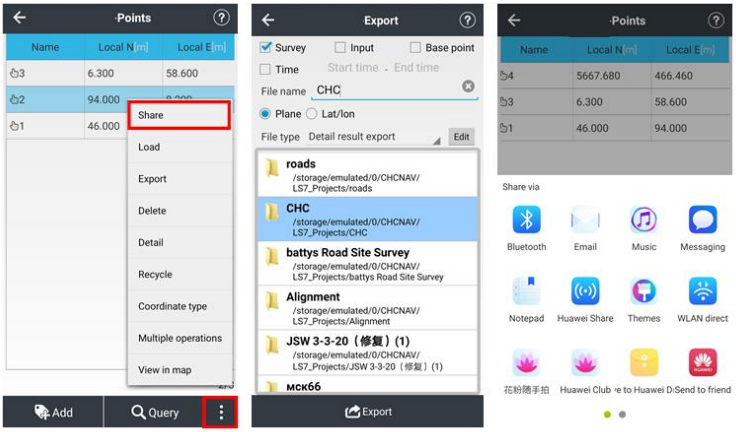
2.3.1.8 View in map

This function can view points in various map. Click **View in map**.



2.3.1.9 Share

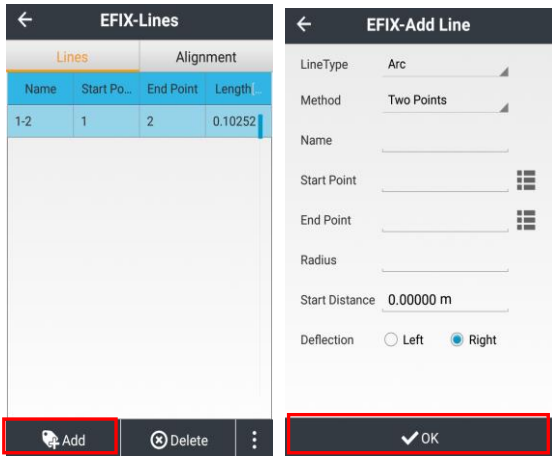
(1) Share: Click **Share** to create a report and share the report to others via common app as Gmail, Whatsapp, Skype, Google Drive and so on.



2.3.2 Lines

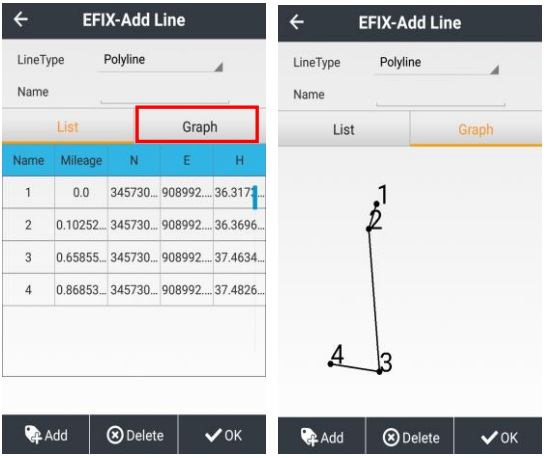
2.3.2.1 Lines

(1) **Add**: Click **Add** to create a line, enter the following new line interface to create a line: **Linetype** (including: line, polyline, circle, arc), **Method** (including **Two Points** and **One Point + Azimuth + Distance**), **Name**, **Start Point**, **End Point**, **Start Distance**.

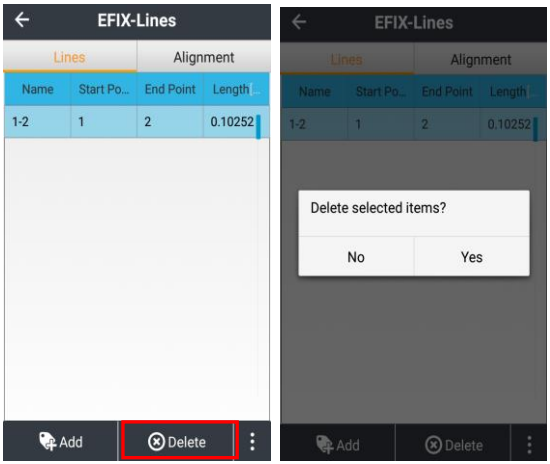


After setting the above values, click **OK,** a line can be created.

When the line type is Polyline, users can click **Graph** to view simplified line graph.

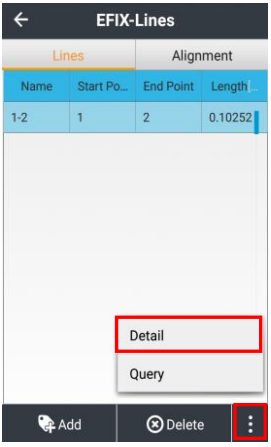


(2) **Delete:** Select one line, click **Delete**, and then it will pop up a dialog box "Delete Selected Data or Not?" Select **Yes**, remove this record; select **No**, do not delete this record.



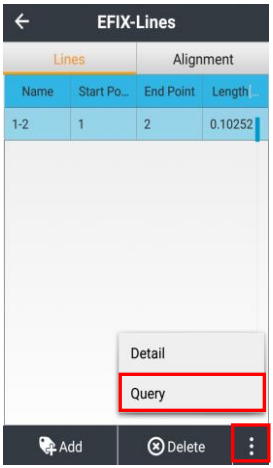
When the line is not selected, click on the **Delete** button will pop up a prompt "Please Select Data First!"

(3) **Detail:** Select **Line**, click **Detail** to view detailed information about the selected line (double-click the selected lines can also check the detail at that line).



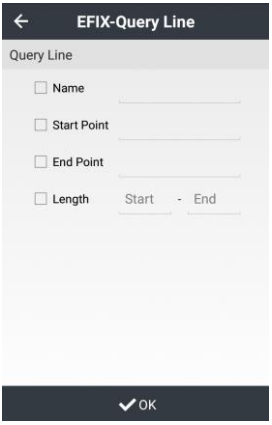
(4) **Query:** Click **Query** to view line query conditions. Line query conditions can be queried by line, name, origin, destination,

and other fields.



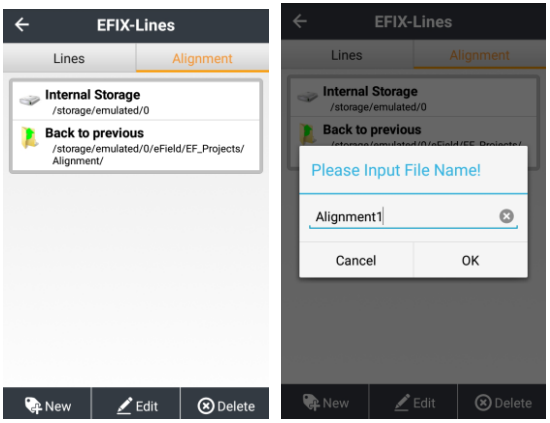
Name: Tick to query lines by completely matched with name.

Start Point: Tick to query lines by completely matched with start point.
End Point: Tick to query lines by completely matched with end point.
Length: Tick to query lines by completely matched with length of the line (enter the start and end values).

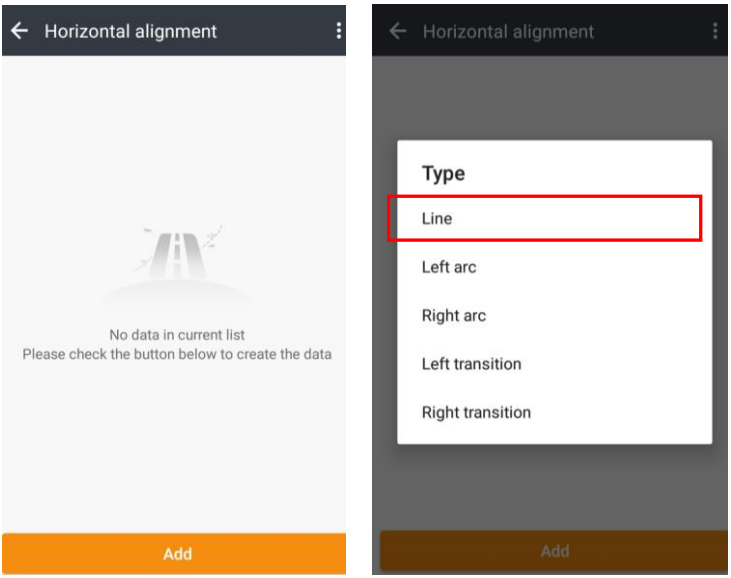


2.3.2.2 Alignment

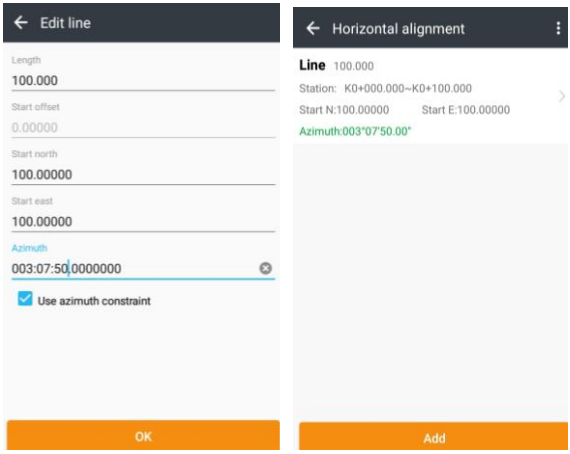
(1) **New:** Click **New** to create a new alignment, and input file name.



Then, users will see **Edit** interface,and click **Add** to choose **Line**



Click **Append** to add line, arc and transition element.



Click **OK** to complete an alignment.

(2) **Edit:** Choose a file and click **Edit** to edit existing alignment.

(3) **Delete:** Choose a file and click **Delete** to delete existing alignment.

2.3.3 Surfaces

Refer to section**Error! Reference source not found. Surface stakeout**.

2.4 Data import

2.4.1 Import

The function can be used for exporting the point coordinates file in specific formats.

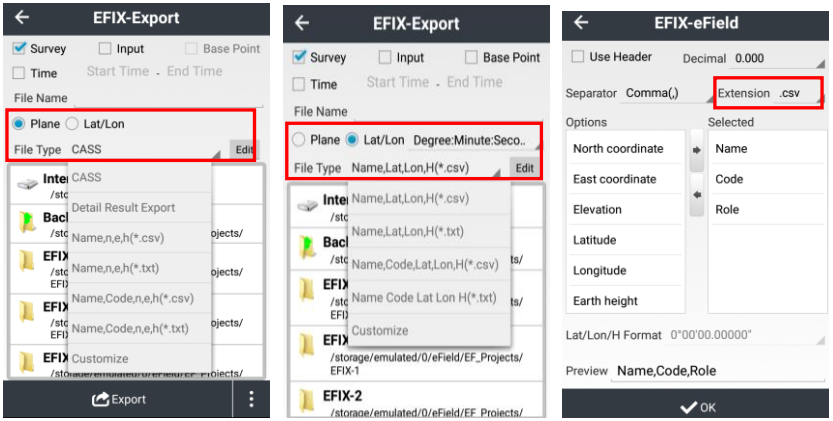
Point Type: Users can choose exporting point types including **Survey Point**, **Input Point** and **Base Point**.

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

Coordinate Type: Plane or Lat/Lon.

File Type: Support CSV, TXT, KML, SHP, DXF and HTML file. 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.)

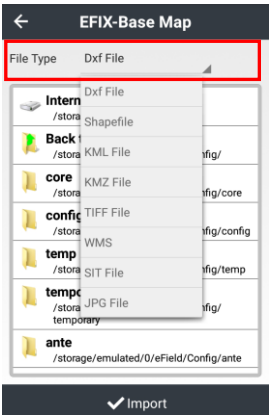
Path: Select the path of export file. Click the folder and it will display a blue select prompt. Then, click **Export** to finish.



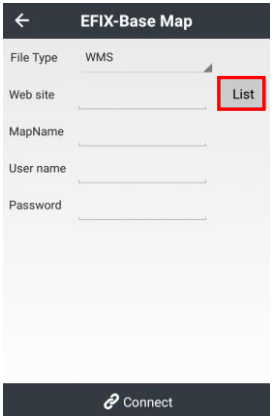
Note: Starting from version 7.4.0, all the parameters in this page will be saved automatically, and eField will automatically apply the same setting when users create a new project.

2.4.2 Base map

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.

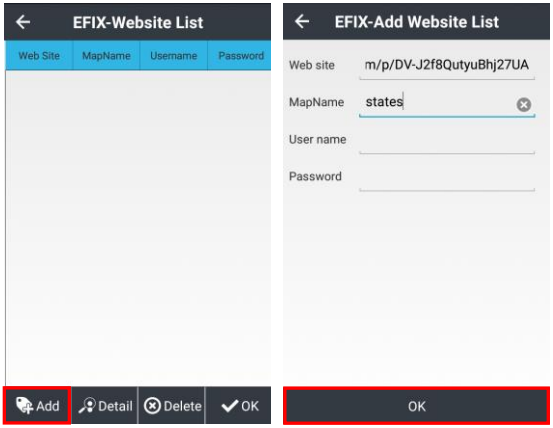


Users can choose WMS for clearer raster map of working area. (Users should have resources first, and EFIX don't provide the resources.)



File Type: WMS.

Website: Input the site address. Users can click **List** and preset website list.



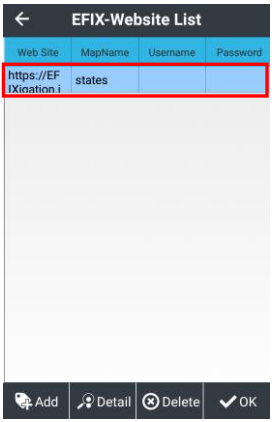
Click **Add**, and then input website, map name, user name and

password.

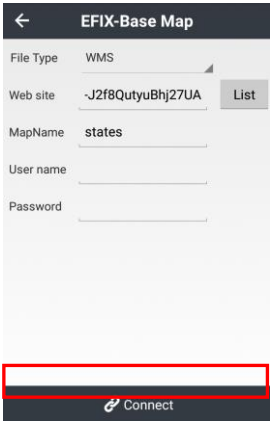
Map name: Customize by users, the name will show on **Display** table of **Setting** interface.

User name/Password: Input when it needs, or users can skip this step.

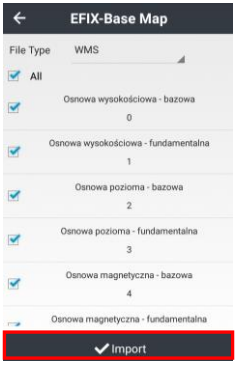
Click **OK** to save website information in list.



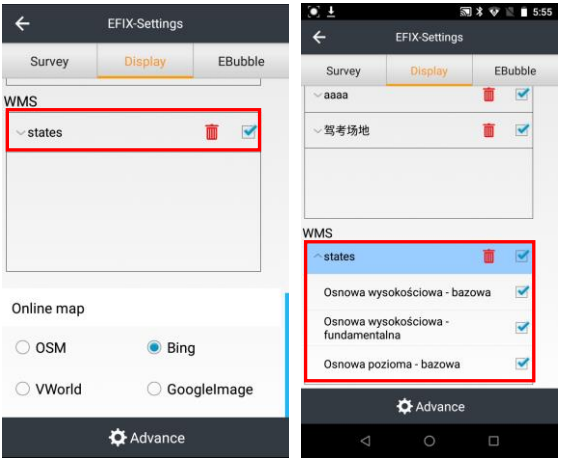
Users can check detail of selected website, as well as delete or apply it. Click **OK** to apply selected website. Users can also input website information in **Base Map** interface, and this website will be saved in **Website List** automatically once connected successfully, so that there is no need to input the same website information each time.



Then click **Connect** to visit the website, choose map content and click **Import** to finish.



Users will see WMS map after switching on online map. To modify the layer display, click **Survey-Map-Settings-Display**, and users can switch on/off map layer display or delete the whole base map.



2.5 Data export

2.5.1 Export

The function can be used for exporting the point coordinates file in specific formats.

Point Type: Users can choose exporting point types including **Survey Point**, **Input Point** and **Base Point**.

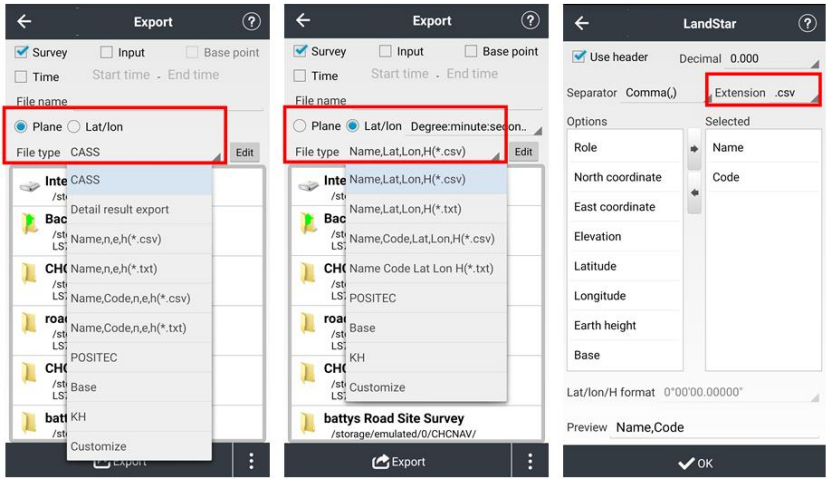
Time: Users can set the start time and the end time for exporting data.

Coordinate Type: Plane or Lat/Lon.

File Type: Support CSV, TXT, KML, SHP, DXF and HTML file. 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.)

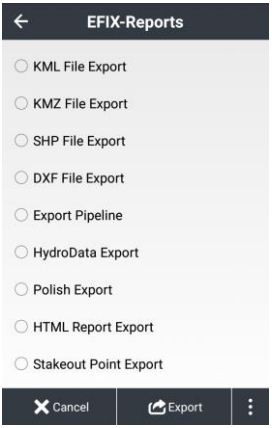
Path: Select the path of export file. Click the folder and it will display a blue select prompt. Then, click **Export** to finish.



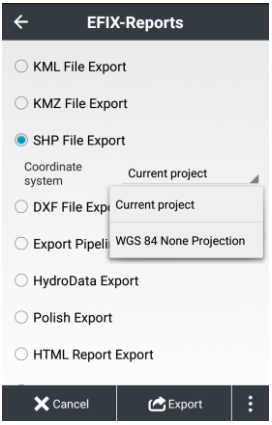
Note: Starting from version 7.4.0, all the parameters in this page will be saved automatically, and eField will automatically apply the same setting when users create a new project.

2.5.2 Reports

This function can export other files, including KML file, KMZ file, SHP file, DXF file, Polish Export, HTML report, stakeout point file, RAW file and attribute file (GIS attributes can be exported into TXT file).

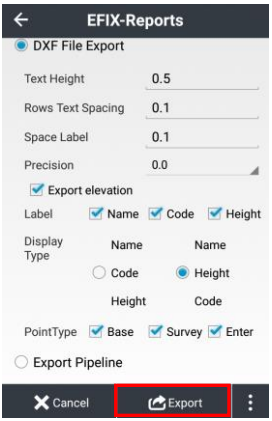


When select **SHP File Export**, the option of " Coordinate system" will pop up.

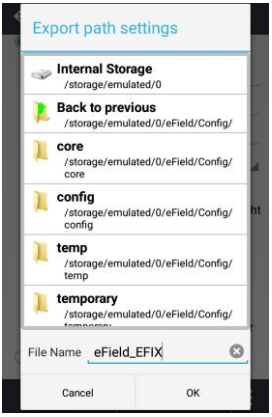


When choose **DXF File Export**, users can set text height, text row spacing, spacing between label and feature, height decimal and label content. Users can also choose label display type after

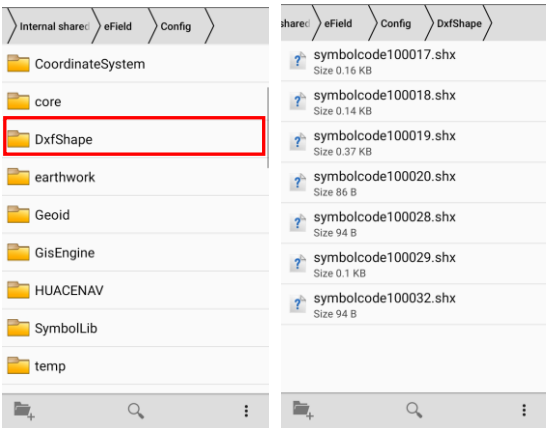
selecting all three labels. The DXF file exported from eField can be used to draw contour lines.



Click **Export**. There will prompt **Export path settings** window, users can choose export path and change the file name.



Note: After exporting DXF file, you can see shape folder (including .dxf and .shx files) in the same root catalogue of DXF file, please copy both DXF file and shape folder to your computer (must be in the same root catalogue), then correct codes of DXF file will display in your computer.

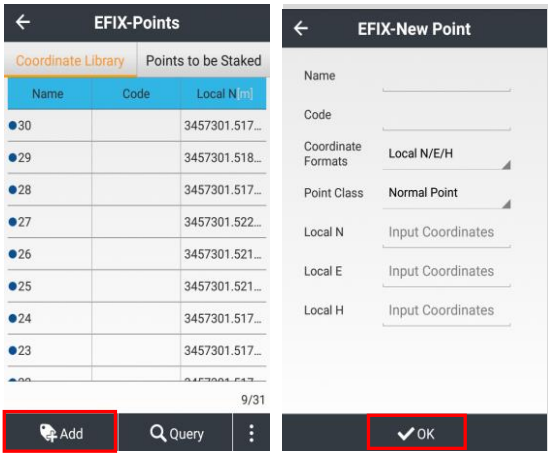


2.6 Points

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

2.6.1 Add

This function can create a new point. Click **Add** to create a point. Creating a point needs some attributes as follows: name, code (input as need), coordinate formats (including: local NEH, local BLH, local XYZ, WGS84 BLH, WGS84 XYZ), point class (including normal point and control point). Then, input the point coordinates that users create.



Click **OK** and the coordinates point will be built.

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.

2.6.2 Query

This function can query points by conditions, including name, code, solution of the state, etc. Click to enter **Query** interface.

Name: Tick to query points by completely matched with name.

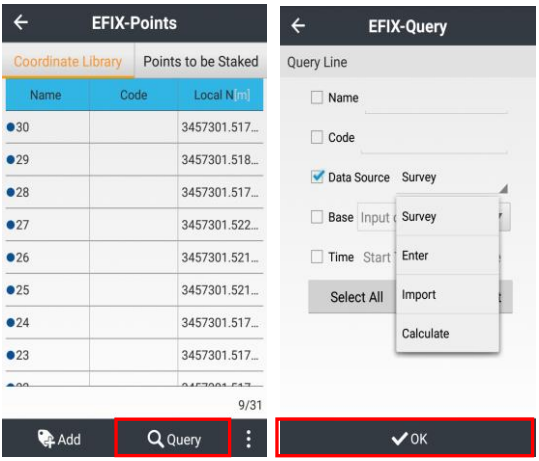
Code: Tick to query points by completely matched with code.

Data Source: Tick to query points by completely matched with data sources, including **Survey**, **Enter**, **Import** and **Calculate**.

Base: Tick to query points by completely matched with base, and then the name of base station will appear in drop-down box.

Time: Tick to query points by completely matched with time, users

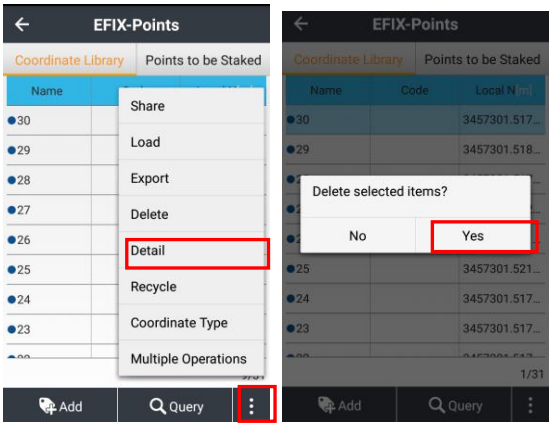
need to set the start time and end time.



Click **OK** to start query.

2.6.3 Delete

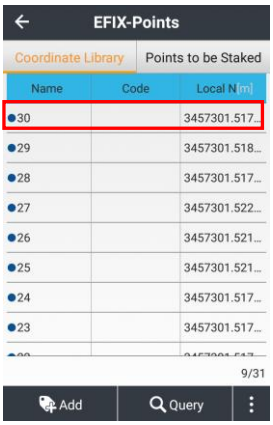
This function can delete points. Click **Delete**, then a dialog box "Delete Selected Data or Not?" will pop up, click **Yes** to delete this record.

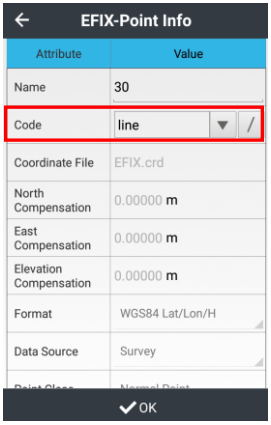


Note: When users don't select points before clicking **Delete**, it will pop up a prompt: "Please Select Data First!"

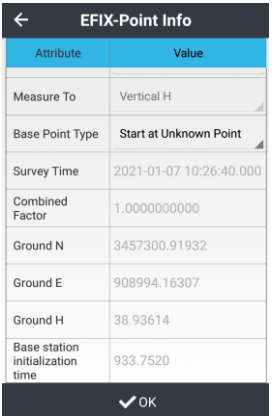
2.6.4 Detail

This function can view point detail. Click **Detail** to view detail of the selected point (double-click selected points can also view the detail). Values in black can be modified, and values in gray can't be modified. As for code, users can change point code here, and add more codes one after another by adding a slash between each code. Please noticed that once you changed the code, the measured features will also be changed.





Combined factor, ground coordinates and base station initialization time will be shown at the bottom of **Point Info** interface.



2.6.5 Recycle

This function can recycle deleted points. Click **Recycle** to enter **Point Recycler** interface and view deleted points.

Detail: Click to view detail of the selected point (double-click selected points can also view the detail).

Restore Point: Click to recover deleted points.

Query: Click to query deleted points by condition.

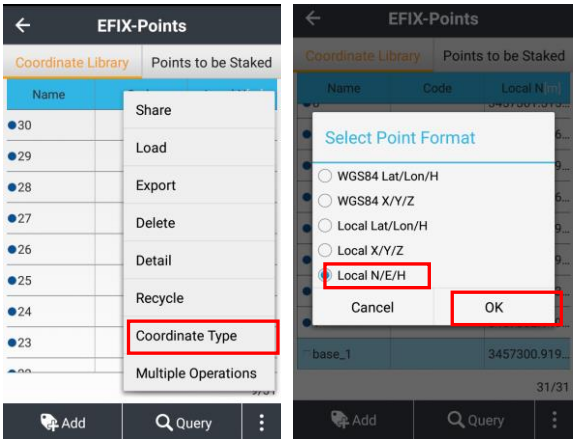
Coordinate Type: Click to set coordinate type of deleted points.

Coordinates Library: Click to view coordinates library.

Multiple Operation: Click to select multiple deleted points.

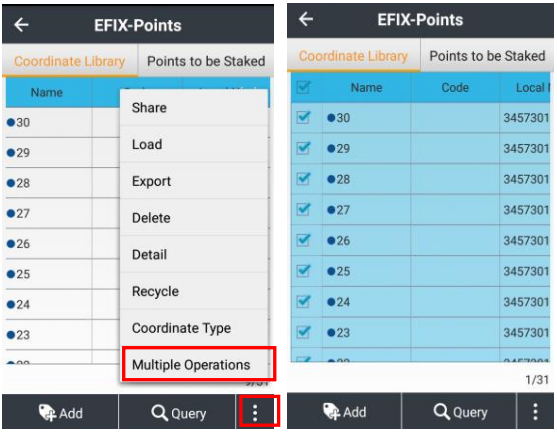
2.6.6 Coordinate Type

This function can set coordinate type of points. Click **Coordinate Type** to select point type.



2.6.7 Multiple Operation

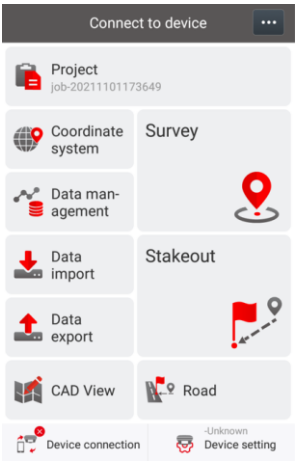
This function can select multiple points. Click **Multiple Operation** to manage not only one item but also multi-items and do operation on multiple points.



3 Config

3.1 Device connection

For device connection.



(1) **GNSS**

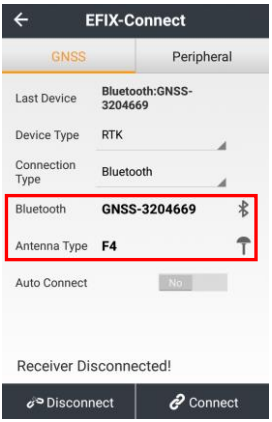
GNSS table is for receiver connection.

Last Device/Current Device: Display last connected device when there is no connection, or display current connected device after connecting successfully.

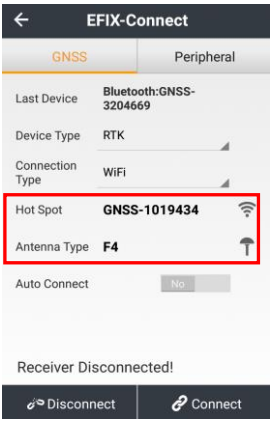
Device Type: **RTK, Local, Other.**

Connection Type: Including the choices of **Bluetooth**, **Wi-Fi** and **Demonstration**. Also users can connect to RTK via **NFC**.
Bluetooth: While using Bluetooth connection (Suitable for GNSS receiver), click **Bluetooth List** to the interface of Bluetooth. Select

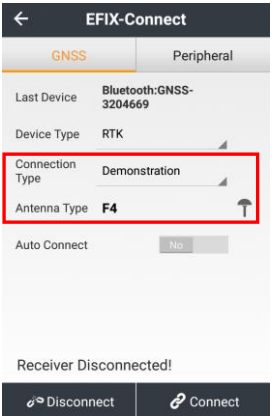
Bluetooth manager, click **Pair new device** to find the device to Pair (Default password is 1234 if it's required to input). When the connection is successful, users will back to connection interface.



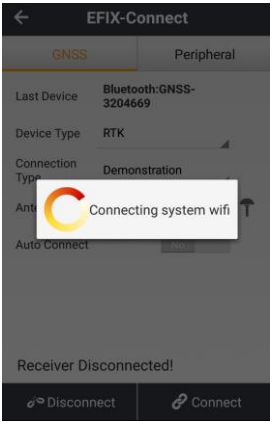
WiFi: While users use **RTK** for device type, connection type supports **WiFi**. Click **Connection List** of hot spots, then it will show users **WLAN** interface. Find the SN of current receiver, input password (if need, the default password is 12345678), then click **Connect**. When the connection is successful, users will back to connection interface.



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

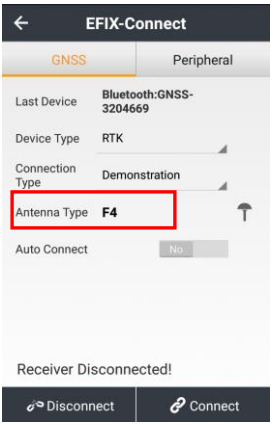


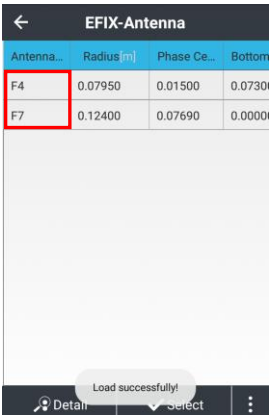
NFC: Turn on NFC function of controller. Put NFC module of controller near to the RTK NFC module. The controller wifi will be switched on automatically and connected to RTK.



Antenna Type: Click **Antenna Type List**, select antenna type (Users can select antenna type of different products in different

manufacturers). Users can handle specific item by clicking **Detail**, **Add**, **Edit**, or **Delete**.





Auto Connect: Switch on, it will connect previous device when users open the software.
Connect: Click to start connection.

Disconnect: Break the current connection.

(2) **Peripheral**

Peripheral table is for peripheral device connection.

Last Device/Current Device: Display last connected device when there is no connection, or display current connected device after connecting successfully.
Device Type: **Laser Rangefinder**.

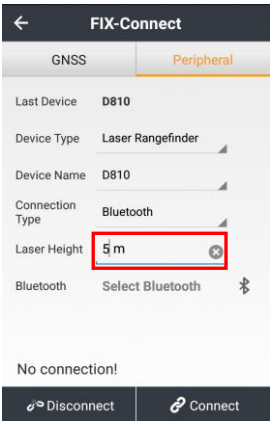
Device Name: Users can find the devices which software supported. Including **D810** (Leica Disto D810 touch), **D510** (Leica Disto D510 touch) and **SNDWay** (SW-S120C).

Connection Type: Including the choices of **Bluetooth** and **Demonstration**.
Bluetooth: While using Bluetooth connection, click **Bluetooth List** to the interface of Bluetooth. Select Bluetooth management, click **Refresh** to find the device to Pair. When the connection is successful, users will back to connection interface.

Note: Some kinds of devices can only be connected to controller with BLE (Bluetooth low energy), such as D810.

Demonstration: Enter demonstration mode, and then users can read demo data while surveying.

Laser Height: When connect to laser rangefinder, users need to input the height of laser rangefinder.



Connect: Click to start connection.

Disconnect: Break the current device connection.

3.2 Device setting

3.2.1 Work mode

Main screen of work mode displays the configuration of the current equipment, including the receiver setting and device operating modes. In most cases, we use the common and specific operation mode to meet the daily trial.

3.2.1.1 External Radio Base

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

RTK: Switch on **Yes**.

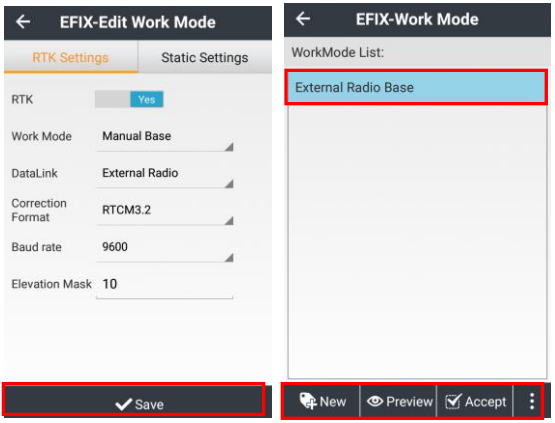
Work Mode: Select Manual Base.

Datalink: Select External Radio.

Correction Format: Select RTCM3.2.

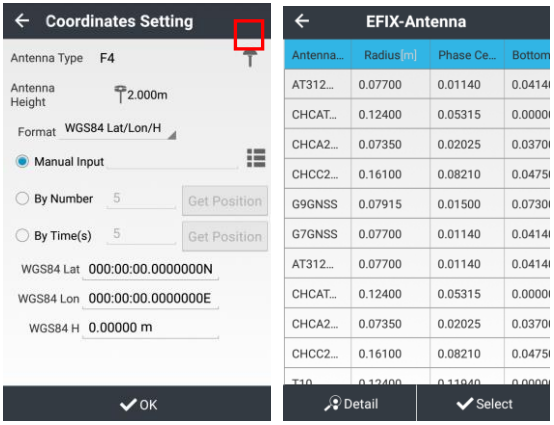
Baudrate: Select 9600.

Elevation Mask: 10.

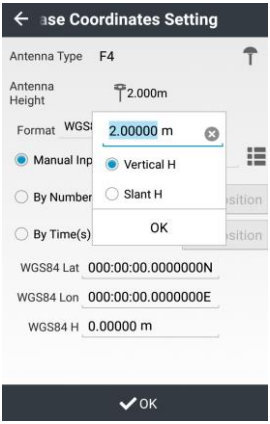


Click **Save**, then the prompt "Please Set a Name for The New Mode" will pop up. Enter the **Name**, and click **OK**. The prompt "Create Mode Successfully" will pop up. Click **OK**, now, the work mode is available in the list. Please select the work mode then click **Accept**, users can see **Base Coordinates Setting** interface.

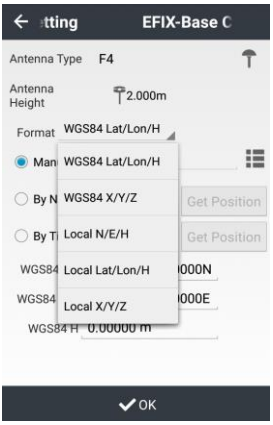
Click antenna icon to choose antenna type.



Input vertical height or slant height.

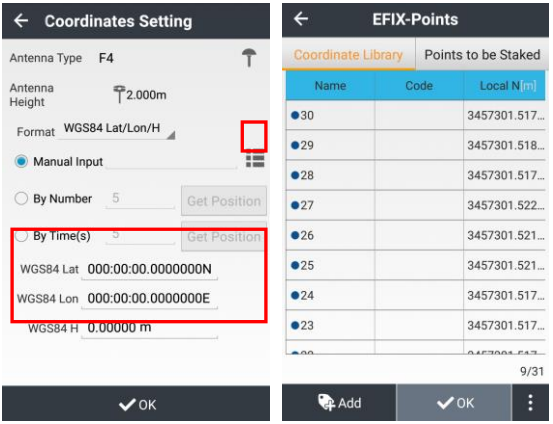


Choose coordinate format.

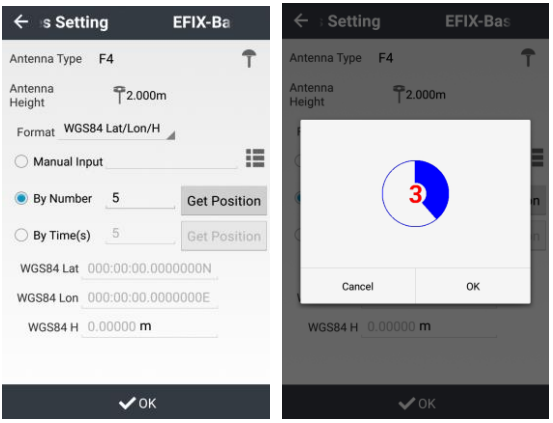


There are three ways to set base coordinates.

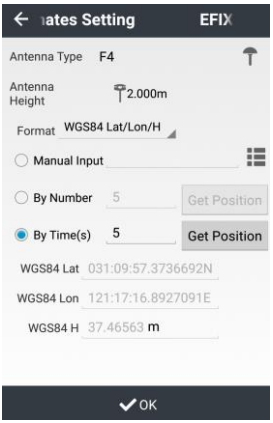
(1) **Manual Input**: Select **Manual Input,** users can manually input base station coordinates or choose in **Points** manager.

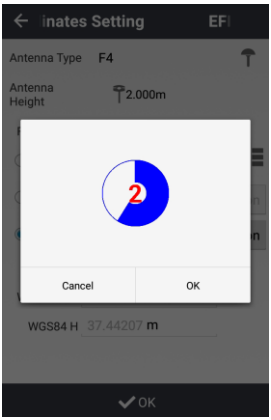


(2) **By Number**: Select **By Number,** set measurement number and click **Get Position**, eField will automatically calculate current base station position.

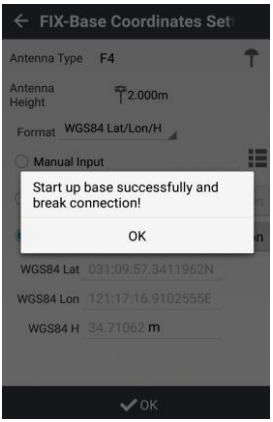


(3) **By Time(s)**: Select **By Time(s),** set measurement time and click **Get Position**, eField will automatically calculate current base station position.





Click **OK** to finish base station setting. When the name, coordinates, antenna height measure method and antenna height of new base station are the same as existed base station, eField will use the existed base station rather than new base station.



Meanwhile, users can change antenna information of base station in **Points** manager. There is no need to worry about the coordinates of rover station when base station information changed, because it will be automatically calculated again once

users refreshed coordinates library.

3.2.1.2 Internal UHF Base

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

RTK: Switch on **Yes**.

Work Mode: Select Manual Base.

Datalink: Select **Internal Radio**, and eField will read radio type of receiver.

Correction Format: Select RTCM3.2.

Protocol: Select Transparent.

Step Value: 25kHz or 12.5kHz, the value depends on the receiver.

Power: Select 1W.

Channel: Select 5.

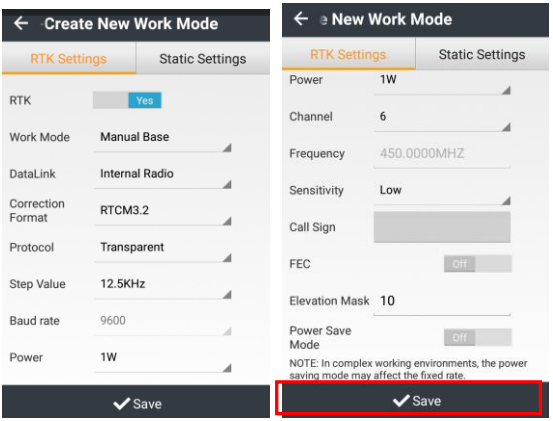
Sensitivity: Low.

Note: Working radius is less than 3km.

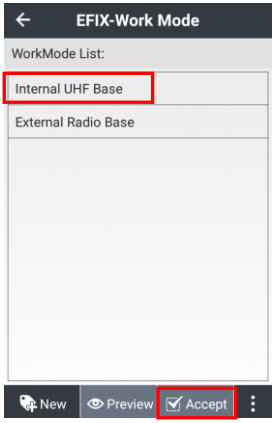
Elevation Mask: 10.

Power Save Mode: This option will appear when the receiver is F4, and the correction format is RTCM3.2 or RTCM3.x.

Click **Save**, then the window "Please Set a Name for The New Mode" will pop up. Enter the **Name**, and click **OK**. The window "Create Mode Successfully" will pop up. Click **OK**.



Now, the work mode is available in the list. Please select the work mode, then click **Accept**, users can see **Base Coordinates Setting** interface (see detail in **3.2.1 External Radio Base**).



3.2.1.3 Internal UHF Rover

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

RTK: Switch on **Yes**.

Work Mode: Select Auto Rover.

Datalink: Select **Radio**, and eField will read radio type of receiver.

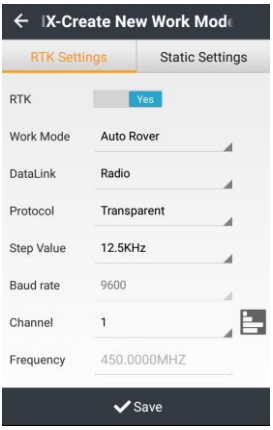
Protocol: Select Transparent.

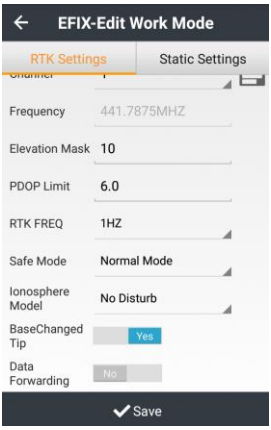
Step Value: 25kHz or 12.5kHz optional, it will only display supported step value of receiver.

Channel: Select 1.

Note: Behind the channel, it is the icon of channel quality detection.

Sensitivity: High.

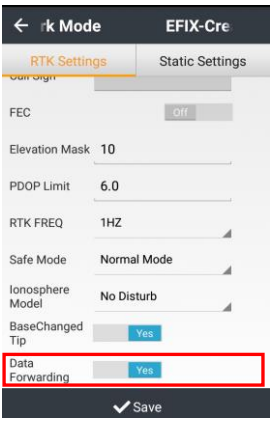


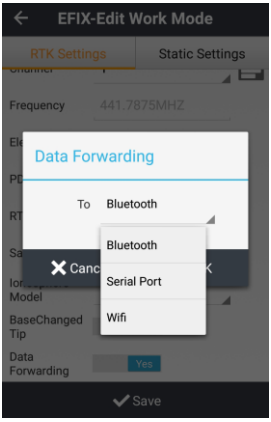


Data Forwarding: Forward data through **Bluetooth**, **Serial Port**, and **WiFi**, so that users can save money and expand operation distance.

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

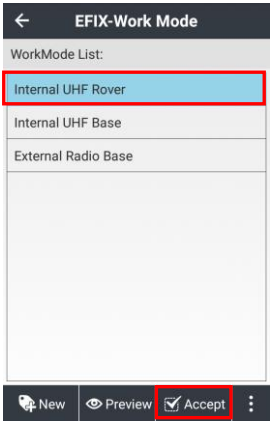
When users choose serial port, correction data in current device will be forwarded to serial port, users can not only connect current device to computer by serial port and view correction data, but also connect current device to external radio.





After setting, please click **Save** to save the work mode.

Click **Save**, then the prompt "Please Set a Name for The New Mode" will pop up. Enter the Name, and click **OK**. Then, the prompt "Create Mode Successfully" will pop up. Click **OK**, now, the work mode is available in the list. Please select the work mode then click **Accept**.



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 from base.

3.2.1.4 Internal GSM Rover (Receiver Network)

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

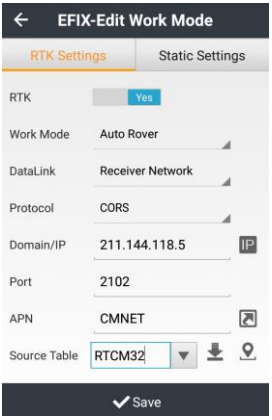
RTK: Switch on **Yes**.

Work Mode: Select Auto Rover.

Datalink: Select Receiver Network.

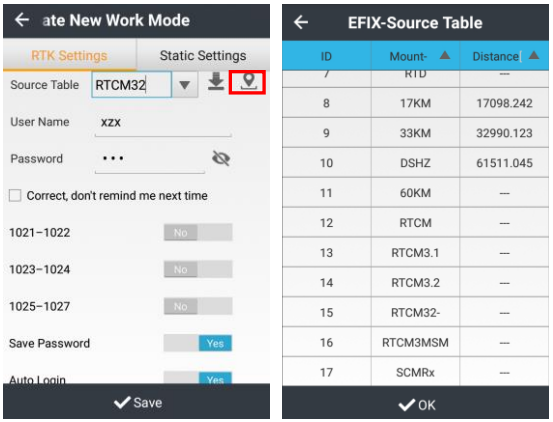
Protocol: Select CORS.

Then, input the corresponding **CORS IP** and **Port**. Users can also click the **APN** set button to set SIM APN.



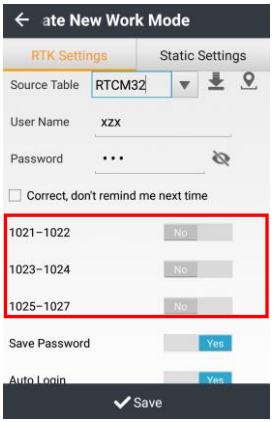
Click **Download** to get the source table. Input the **User Name** and **Password** for user's Ntrip account.

View distance between current position and single station in **Source Table** interface, so that users can choose the closest single station.



Seven message types are defined here in support of the application of coordinate transformations, namely message types 1021 to 1027. Message type 1021 provides the basic transformation parameters for the first three sets, while message

type 1022 provides the information for the fourth set, the Molodenski-Badekas transformation. Message types 1023 and 1024 define the residuals for ellipsoidal and plane grid representations, respectively. Message types 1025, 1026 and 1027 define the parameters that support the Lambert Conic Conformal (LCC2SP) projection, the Oblique Mercator (OM) projection, and others.

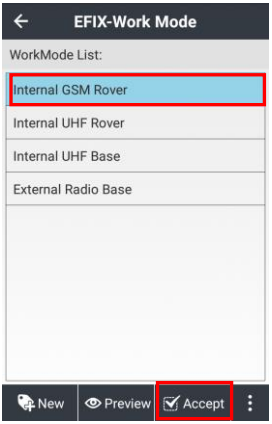


Message Type	Message Name
1021	Helmert / Abridged Molodenski Transformation Parameters
1022	Molodenski-Badekas Transformation Parameters
1023	Residuals, Ellipsoidal Grid Representation
1024	Residuals, Plane Grid Representation

1025	Projection Parameters, Projection Types other than Lambert Conic Conformal (2 SP) and Oblique Mercator
1026	Projection Parameters, Projection Type LCC2SP (Lambert Conic Conformal (2 SP))
1027	Projection Parameters, Projection Type OM (Oblique Mercator)

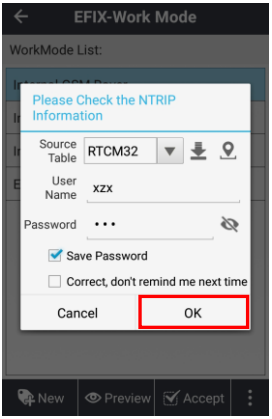
When users use 1021-1027 message types, please ensure that the Ntrip station is sending those messages. (Users should switch on [1021-1022] as long as using RTCM messages, because 1021-1022 messages contain navigation messages.)

After setting other parameters, click **Save**, then the window "Please Set a Name for The New Mode" will pop up. Enter user's **Name**, and click **OK**. Then, the window "Create Mode Successfully" will pop up. Click **OK**, now, the work mode is available in the list. Please select the work mode then click **Accept**.

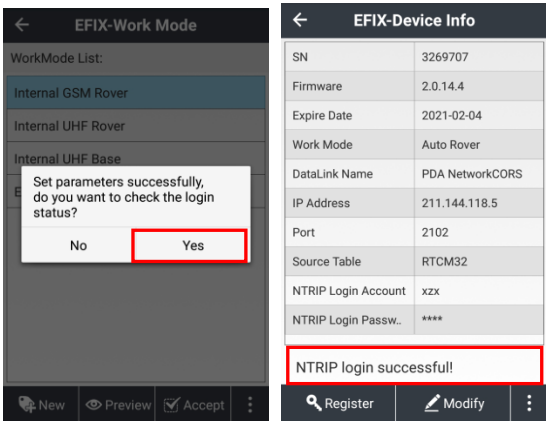


Then, the interface will lead users to check Ntrip information. Users can also select source table or switch other Ntrip account here.

If all the information is correct, please click **OK**.



After accepting successfully, it will pop up “Set parameters successfully, do you want to check the login status?” Click **Yes** to enter **Device Info** interface.



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

For example:

(1) When it prompts “Requesting…”, eField is receiving login messages from the receiver.

(2) When it prompts “No SIM Card!”, users need to input SIM card in receiver first.

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

(4) When it prompts “User name and password error!”, users need to check current user name and password and input 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

from base.

3.2.1.5 DCI (PDA Network)

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

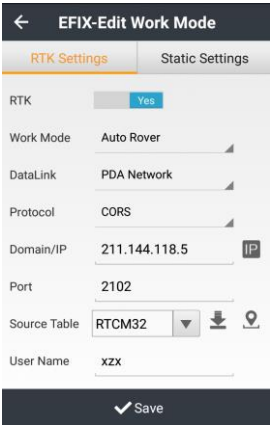
RTK: Switch on **Yes**.

Work Mode: Select Auto Rover.

Datalink: Select PDA Network.

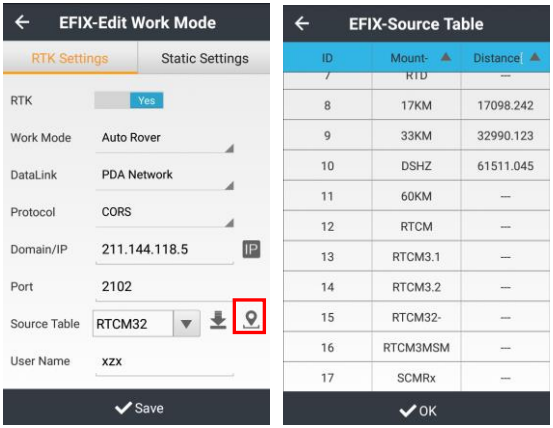
Protocol: Select CORS.

Input the corresponding **CORS IP** and **Port**, then click **Download** to get the source table.

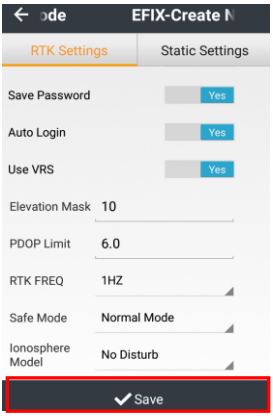


Input the **User Name** and **Password** for user's Ntrip account.

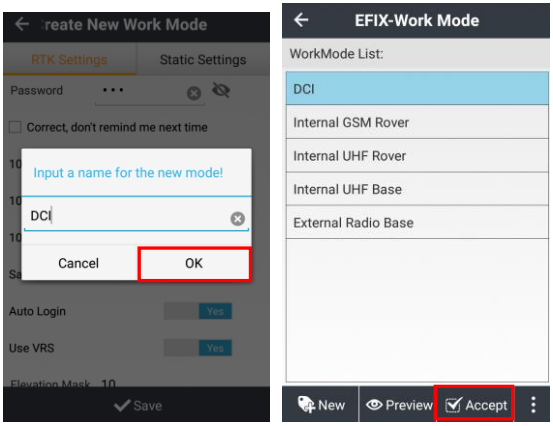
View distance between current position and single station in **Source Table** interface, so that users can choose the closest single station.



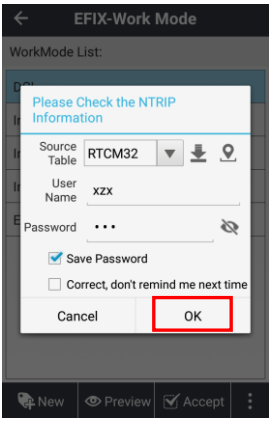
Please see detail about 1021-1027 messages in **3.2.4 Internal GSM Rover**.



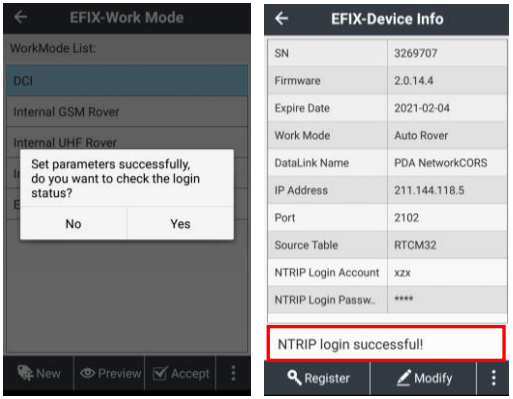
Click **Save**, then the prompt "Please Set a Name for The New Mode" will pop up. Enter work mode name and click **OK**. Now, the work mode is available in the list. Please select the work mode then click **Accept**.



Then, the interface will offer users information about checking Ntrip. You can select source table or switch other Ntrip account here. Click **OK** if all the information is correct.



After accepting successfully, it will pop up "Set parameters successfully, do you want to check the login status?" Click **Yes** to enter **Device Info** interface.

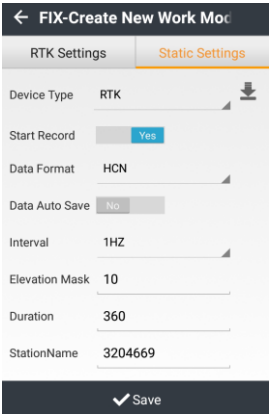


Then the green LED will be flashing and the status will come from **Single** to **Fix**, which means the rover is getting the correction data from base.

3.2.1.6 Static

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

Device Type: Read from receiver automatically, users can also choose it manually. It supports refreshing receiver static setting by clicking the icon behind drop-down menu.



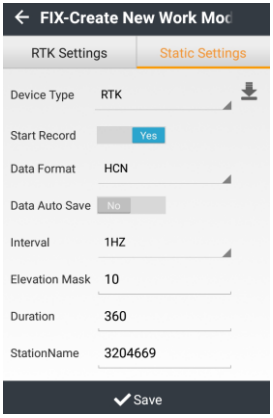
(1) RTK

When users choose **RTK** as device type for connection, users can see **Static Setting** interface as following:

Start Record: Switch on, and it means start record is turned on, otherwise off.

Data Format: Choose **HCN** to record HCN file, or choose **Close** to close it. Users should choose **HCN** data format if want to mark RTK points in static data.

DataAutoSave: Switching on means auto record is turned on, otherwise, is turned off.



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

Elevation Mask: The angle is set for shielding obstruction. The satellites lower than this angle will not be tracked, the default is 0.

Duration: Input duration time as you wish, the default is the SN of connected device.

StationName: Input station name, the default is device SN.

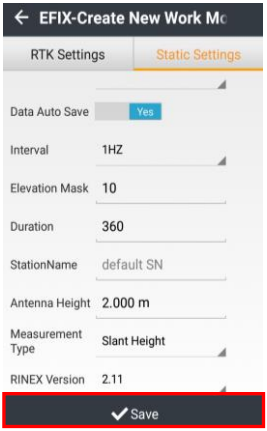
Antenna Height: Input antenna height, the default is 0.

Note: If Measurement Type is Slant Height, antenna height must be above 0.124M.

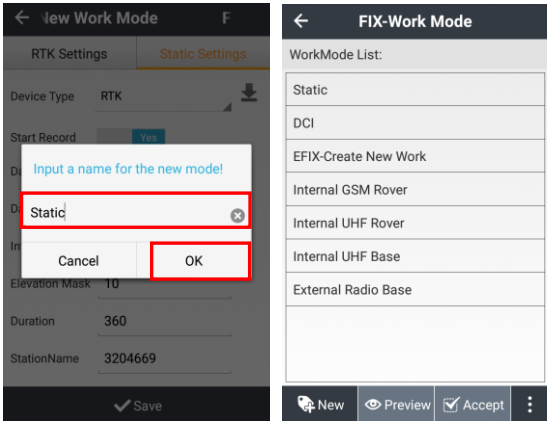
Measurement Type: Including choices of Slant Height, Phase Height, Vertical Height, and the default is Slant Height.

RINEX Version: Choose **2.11/3.02** to record RINEX file, or choose **Close** to close it.

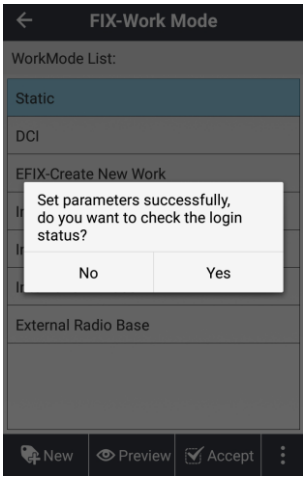
Compress Rinex: Switch on to record compress Rinex file after choosing 2.11/3.02 RINEX storage format, otherwise off.



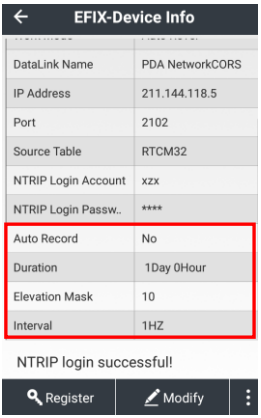
Click **Save**, then the prompt "Please Set a Name for The New Mode" will pop up. Enter work mode name and click **OK**. Now, the work mode is available in the list. Please select the work mode then click **Accept**.



After accepting successfully, it will pop up "Set parameters successfully!" Click **OK** to finish.



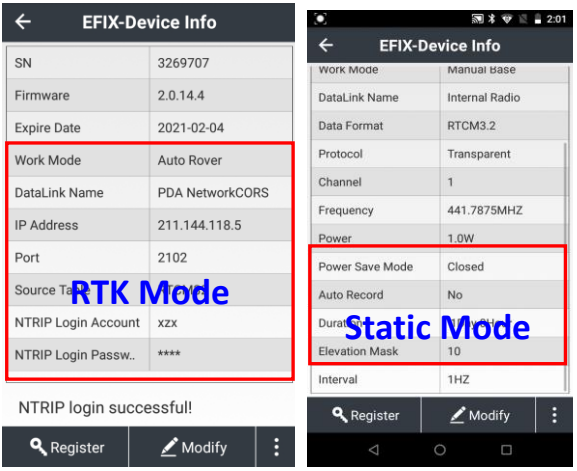
Now, users have already been static recording. However, when RTK and static recording exist at the same time, RTK status will become a priority, including whether automatically record, recording period, mask angle, the sample interval. Click **Info** or **Config - Device Info** to view the current work mode.



Note: Static setting in **Work Mode** is the same as **Static Setting** outside, and the final setting in **Work Mode** or **Static Setting** will take effect.

3.2.2 Device information

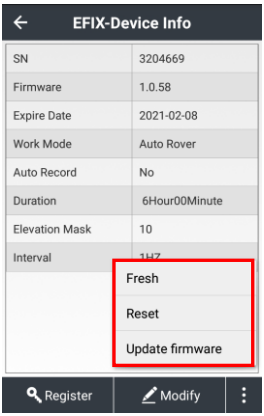
After connecting between controller and receiver, eField will read out the receiver information, such as device type, serial number, expire date, work mode, datalink and so on.



Fresh: Click to get the device information again.

Reset: Click to reset the receiver main board. Then, it will restart the receiver and star search.

Update Firmware: Click and choose firmware to update firmware for receiver, only support updating firmware via WiFi connection.



3.2.3 Static settings

This function can set parameters of static recording, there are two kinds of setting interface corresponding to two kinds of receiver.

(1) **RTK**

When users choose **RTK** as device type for connection, users can see **Static Setting** interface as following:

Start Record: Switch on, and it means start record is turned on, otherwise off.

Data Format: Choose **HCN** to record HCN file, or choose **Close** to close it. Users should choose **HCN** data format if want to mark RTK points in static data.

DataAutoSave: Switching on means auto record is turned on, otherwise, is turned off.

When setting these parameters, click **Get** to obtain default parameters.

Interval: Including choices of 20HZ, 10HZ, 5HZ, 2HZ, 1HZ, 2S, 5S,

10S, 15S, 30S and 1M.

Elevation Mask: The angle is set for shielding obstruction. The satellites lower than this angle will not be tracked, the default is 0.

Duration: Input duration time as you wish, the default is 360.

StationName: Input station name, the default is device SN.

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

Note: If Measurement Type is Slant Height, antenna height must be above 0.124M.

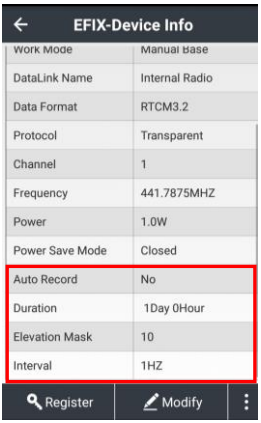
Measurement Type: Including choices of Slant Height, Phase Height, Vertical Height, and the default is Slant Height.

RINEX Version: Choose **2.11/3.02** to record RINEX file, or choose **Close** to close it.

Compress Rinex: Switch on to record compress Rinex file after choosing 2.11/3.02 RINEX storage format, otherwise off.

After setting these parameters, click **Set** to finish static setting.

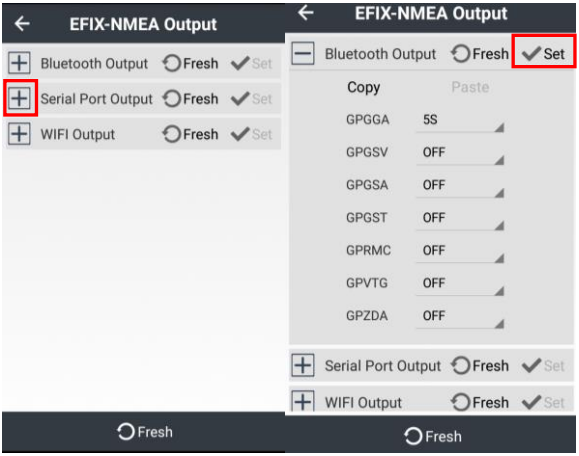
Now, users have already been static recording. However, when RTK and static recording exist at the same time again, RTK status will become a priority, including whether automatically record, recording period, mask angle, the sample interval. Click **Info** or **Config-Device Info** to view the current work mode.



Note: Static setting in **Work Mode** is the same as **Static Setting** outside, and the final setting in **Work Mode** or **Static Setting** will take effect.

3.2.3 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 the 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 sets 9600.

4 Survey

4.1 Map

Main functions:

(1) Users can see the graph with base map, and all the base maps can be displayed.

(2) During measurement, the point, line and surface will be displayed in different color or style (colors of points, lines and surfaces are decided by created new codes).

(3) During measurement, users can select codes for points, lines and surfaces.

(4) During the features (points, lines and surfaces) surveying, if the job of feature surveying is not finished one time, and users want to continue with other features, the previous job of feature surveying will stop temporarily. Users can survey several features simultaneously. It allows to check unfinished tasks as well as current task.

4.1.1 Icon details

icon defines the map type to display.

icon moves the current point in the center of the screen.

icon is the full-screen display button.

icon is the IMU calibration button.

icon is the survey button

icon is the CAD editor button

icon is the layers manager button

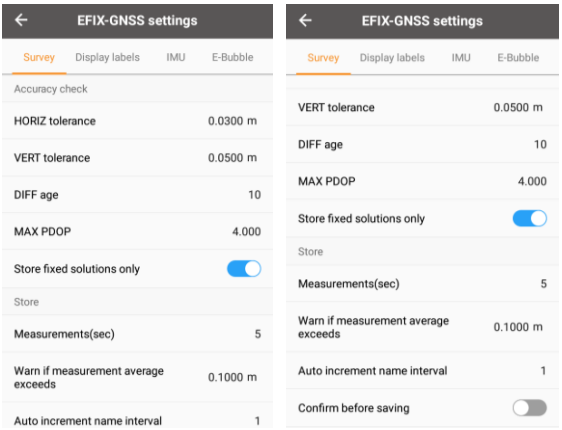
icon is the more survey functions button

icon opens four cells to display. Users could select in each cell what they want to display.

icon opensError! Reference source not found. interface.

4.1.2 Settings

(1) **Survey**: Users can view survey information in this interface.



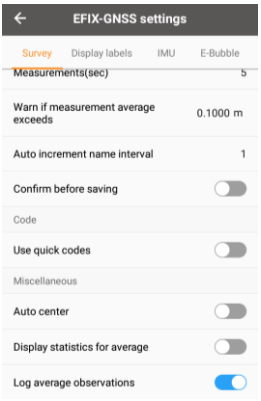
- Accuracy check

Users can modify **H tolerance**, **V tolerance**, **Diff age**, and **Max PDOP** respectively. The defaults of them are 0.030 m, 0.050 m, 5, and 4.000 respectively. Users can decide whether to "**Store only in fixed**" or not.

- Store

Users can modify **Measurements (sec)**, **Warn if measurement average exceeds**, and **Auto increment name interval** respectively. The defaults of them are 5, 0.100, and 1 respectively. Position compromised tolerance will be used when user set observation times to 2 or more. If the horizontal distance from current measure to the 1st measurement >0.1m (depends on user setting), the software will pop up: The rover may be moved.

Users can decide whether to "**Confirm before saving**" or not.



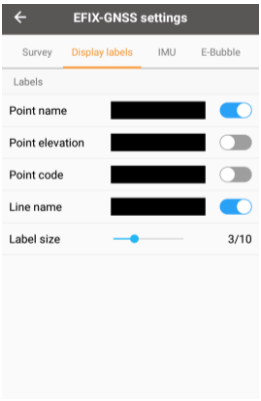
- Code

Users can decide to open "**Use quick codes**" or not.

- Miscellaneous

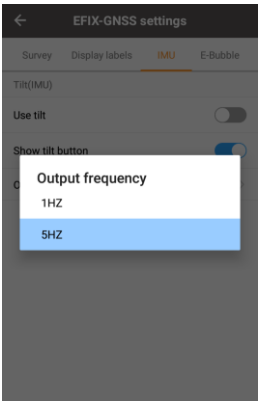
Users can decide to respectively open "**Auto center**", "**Display statistics for average**", "**Log average observations**".

(2) **Display labels**: Users can view display labels information in this interface.



Users can decide whether to display "**Point name**", "**Point elevation**", "**Point code**" and "**Line name**" or not. "**Label size**" can be adjusted from 1 to 10.

(3) **IMU**: Users can view IMU information in this interface.

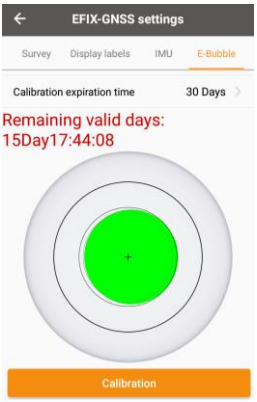


Users can choose to whether "**Use tilt**" and "**Show tilt switch button**" or not. Output frequency can be set to 5 or 1 HZ, and the default is 5 HZ.

(4) **E-Bubble**: Users can view E-Bubble information in this interface.

Note: only F4 has E-Bubble.

View information of receivers with the function of automatic measurement or with tilt sensor.



Click to get the offset info of the receiver. When the offset angle is less than the limit value, users can click OK, and then start E-Bubble calibration.

Note: It needs to keep the bubble centered, and the instrument should be well stable when calibrating.

Users can open "**Show E-Bubble**", "**Tilt warning**" and "**Auto-measure**" buttons or not.

Tilt tolerance: Defines the maximum radius that the receiver can tilt and be considered in tolerance. Input as you wish, and the default is 0.030 m.

E-Bubble sensitivity: The E-Bubble moves 2 mm for the specified sensitivity angle. To decrease sensitivity select a large angle. Input as you wish, and the default is 8 minutes.

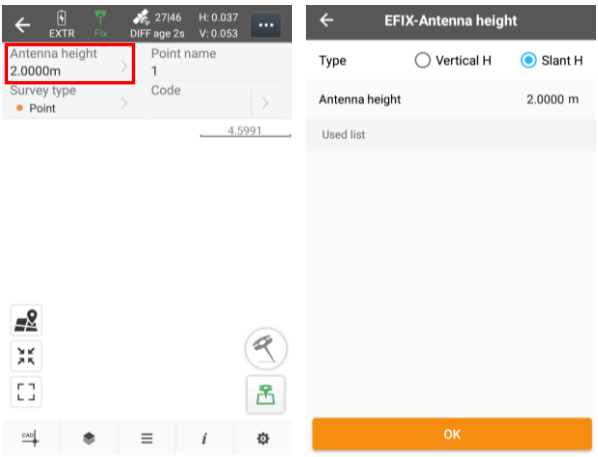
E-Bubble response: Controls the E-Bubble's responsiveness to movement. Low or High.

Calibration expiration time: Displays the time period between calibrations. At the end of the time period the software will prompt

you to recalibrate the E-Bubble. To edit the default value tap the pop-up arrow. Input as you wish, and the default is 30 Days.

4.1.3 Antenna height

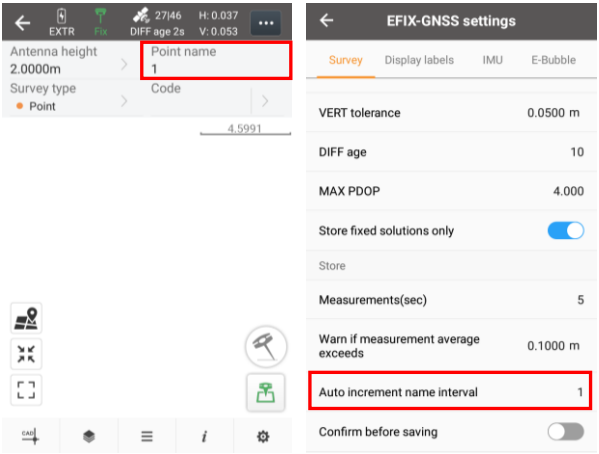
Users can click **Antenna height** to modify the antenna height, then select the **type** of antenna height and input the value. Click **OK**.



Vertical H: The height from ground point to the bottom of receiver. When using range pole, the vertical height is the pole height.
Slant H: The height from the ground point to static measurement tick mark (F4 is the gray rubber ring, F7 is to the auxiliary H.I. tool) of receiver, usually this height is needed when setting up the receiver on a tripod.

4.1.4 Point name

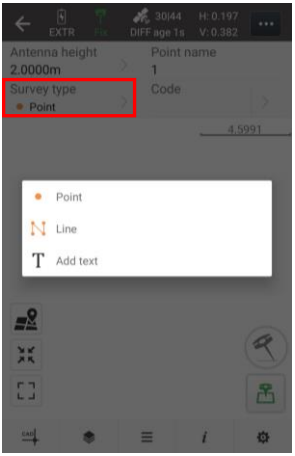
In survey, users could **manually** input the point name or let the system create it **automatically** according to name step size.



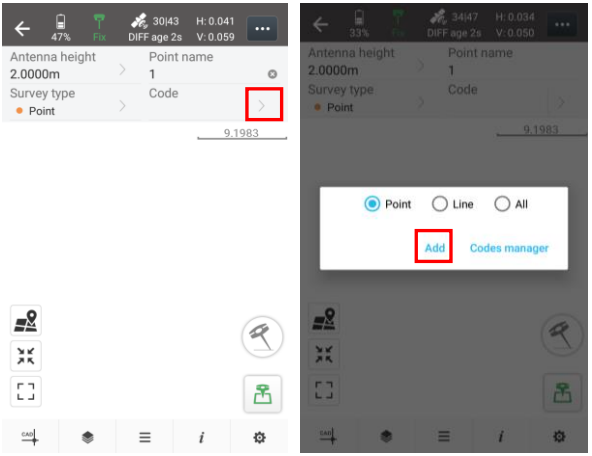
4.1.5 Multi-feature measurement

While user need to do multiple features measurement in one area, users can survey them simultaneously by using multiple types and codes.

Users could select **survey type** between point and line, also add text.

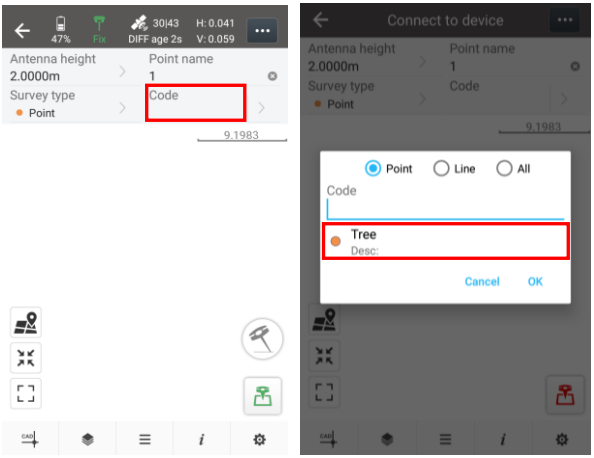


Click the arrow icon, then user can click **Add** to create a new code.



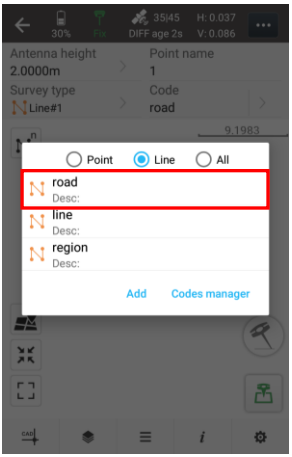
After creating codelist, users can select code in **Map** interface for survey.

Click **Code**, and then select a code in **Code Select** window.



After selecting one code, it will get back to the **Map** interface. Click the arrow and users can add one more code. For more codes,

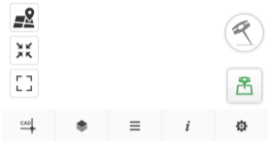
users can click the arrow and add one after another. Here we take point and line as example.



Then, users can start survey multiple features by clicking survey icon.

After surveying, uses can find each line nodes owns their point code as well as the point style of line code. Please remember that eField will save all kinds of point style of each selected code, and the point style belongs to the latest code you add will display at the

top. For example, I add road code at last, so there shows road code at the top; if I add tree code at last, then there will show the tree code at the top.



4.1.6 Survey methods

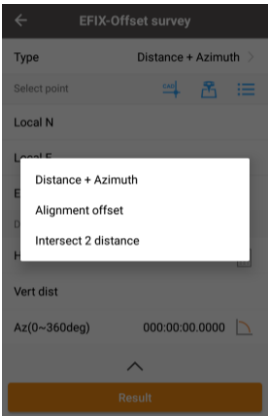
4.1.6.1 Point survey

The antenna height, point name, and code parts are the same as in 4.1.3 – 4.1.5. Here users could also add a **description** of the points.

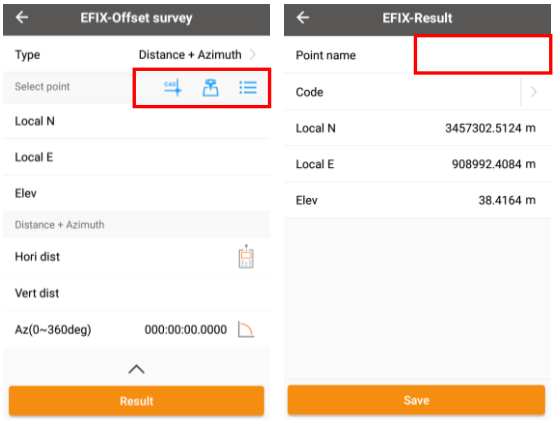
Users could select the coordinates **display mode**.

4.1.6.2 Offset survey

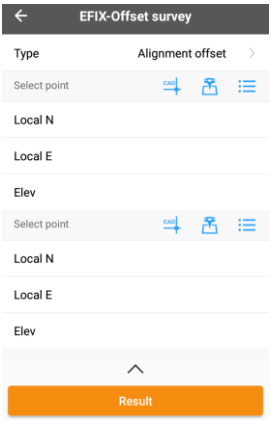
When users cannot reach the target point, this function is helpful. There are three methods for surveying offset point: distance + azimuth, alignment offset, and intersection 2 distances. (Users can measure the current point and any point on the direction of the target point, and get the angle by calculation function on Tools menu.)



(1) **Distance + Azimuth**: Users could **select point** by map snap, instant survey, and point library select. Input **horizontal distance**, **vertical distance** (positive value means the target point is higher than the current point) and **azimuth** between the target point and the current position. The horizontal distance can also be read from laser rangefinder, and corresponding vertical distance can be automatically calculated. Meanwhile, azimuth can be calculated from controller compass, RTK movement or the direction between two points. Later, click **Result** to view target point coordinates and set **point name**. Finally, click **Save**.

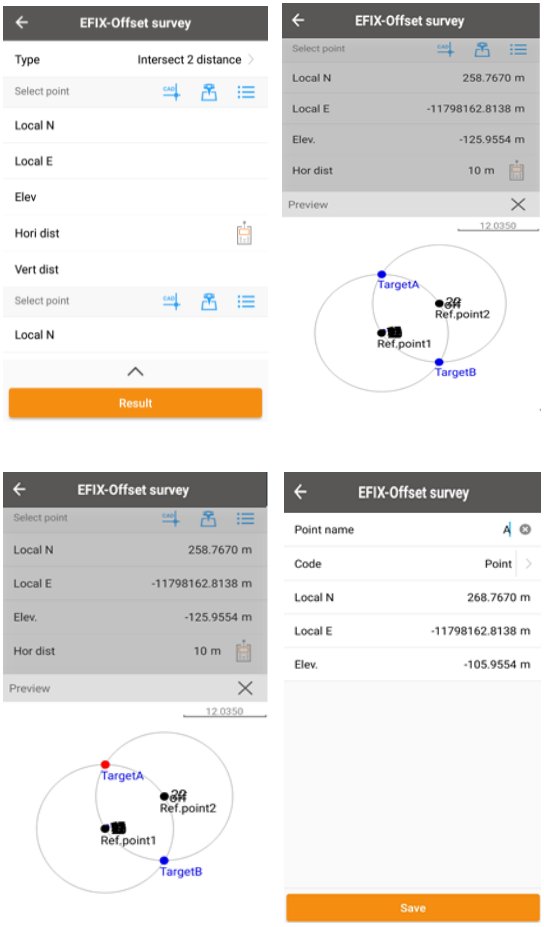


(2) **Alignment offset**: Requires inputting the **horizontal extension** and **offset** distance. Users select two points to form a line.



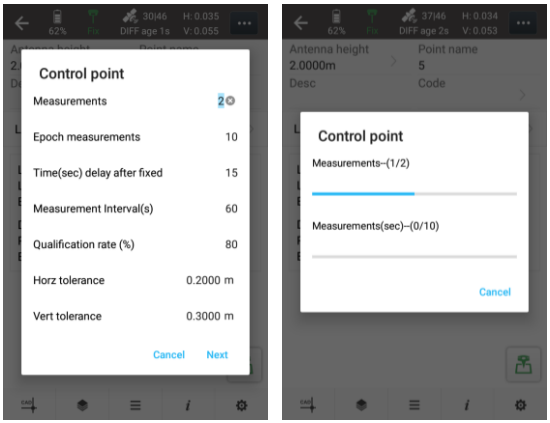
(3) **Intersection 2 distances**: Requires calculating the intersection point of two points. Users should go to one point, click survey icon, read horizontal distance/ vertical distance from laser rangefinder (User can also manually input the vertical distance if necessary). Then, go to the second point, click **Read Point** to get coordinates and click **Read Dist** to read horizontal distance from laser rangefinder. Later, click **Result** to choose target point, A is on the left side and B is on the right (if take Ref.point2 as

reference point). Click the point A or the point B needed, then it would be **red**. Finally, click **Save**.



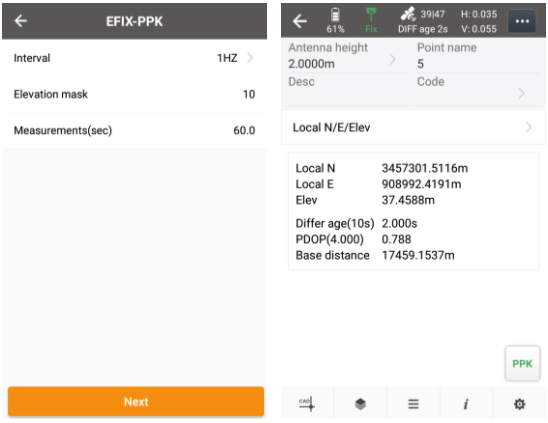
4.1.6.3 Control survey

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



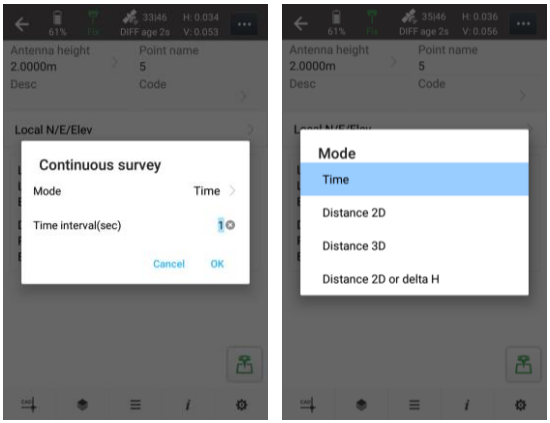
4.1.6.4 PPK survey

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.



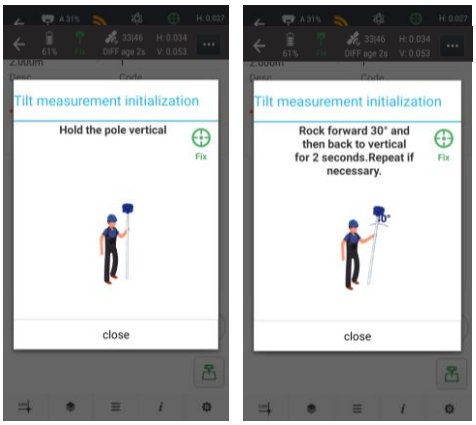
4.1.6.5 Continuous survey

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

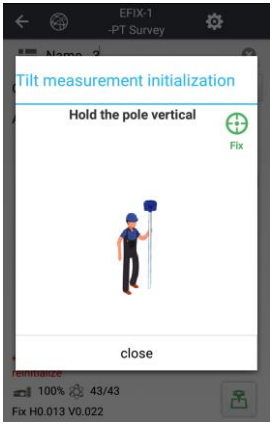


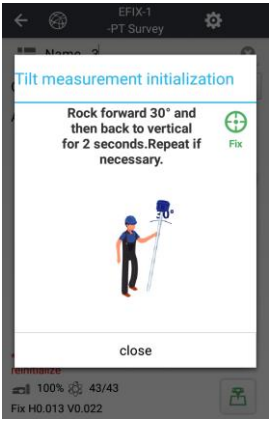
4.1.6.6 IMU survey

F4 and F7 support 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.





Note:

1. At the beginning of initialization, the pole height of the instrument should be the same as that antenna height in the software.

2. In the process of tilt measurement, if the controller shows that "Tilt is not available, please measure in alignment" (red), please shake RTK slightly from left to right or back to front until the reminder disappears.

3. The controller will prompt "Tilt is not available, please measure in alignment" when the receiver is stationary over 30 seconds or the pole hit the ground toughly.

4. The pole cannot be shaken when point is collected.

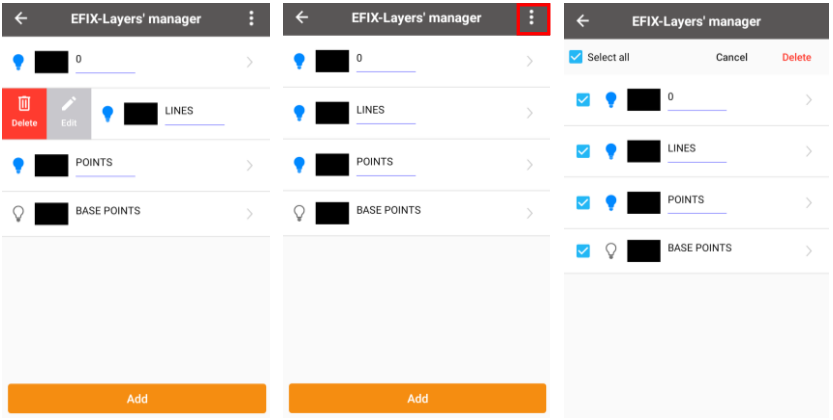
5. Initialization is required:

- when the RTK is turned on every time;
- when IMU module is turned on every time;
- when receiver drops at working;

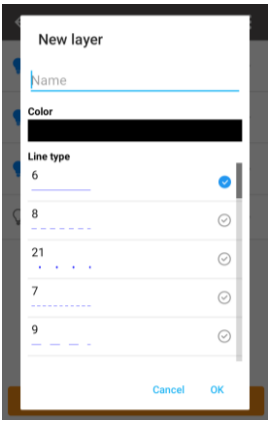
- when the pole is tilted more than 65 degree;
- when the receiver is stationary more than 10 minutes;
- when the RTK rotates too fast on the matching pole (2 rounds per second);
- when the pole hit the ground toughly.

4.1.7 Layers' manager

Left slide a layer to **edit** or **delete** it, but **layer 0** cannot be deleted. Users can click the icon on the **upper right** to select a **batch** to delete.



Users can create a new layer by clicking **Add**, then input the layer name and select color and line types. Click **OK**, so the new layer would be created.

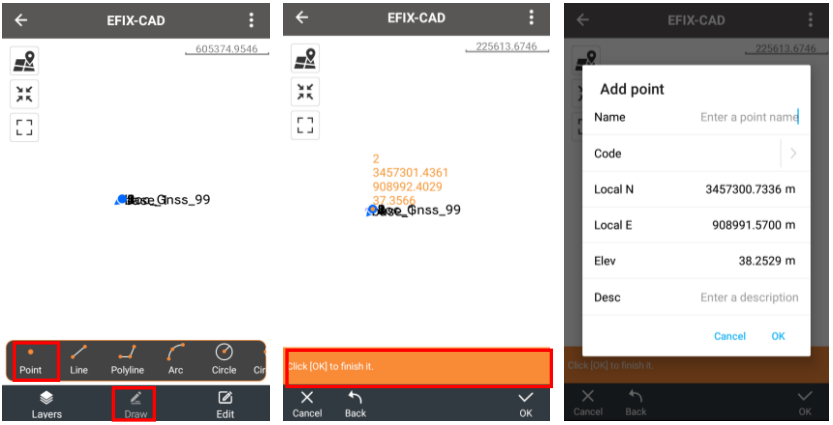


4.1.8 CAD

Users can click **Layers** to open layers manager interface. Click **Draw** (**Edit** respectively) to open **drawing** (**editing** respectively) menu.

4.1.8.1 Draw

Click **point** to select point, then click **Cancel**, **Back**, or **OK** to cancel, redo, or finish drawing. A window would pop up after clicking **OK**. Input point information and click **OK**. Then the old point is covered by the point with new information. For **Line**, **Circle**, **Text**, and etc., the procedure is similar. There would be a tip on the **lower left** indicating next step.



4.1.8.2 Edit

Delete: Click Delete to delete a selected item.

Invert: Select a feature, then users would see an arrow indicating the direction of this feature. Click next, so the direction is inverted. Click OK, then a confirm window pops up. Confirm it so to finish it.

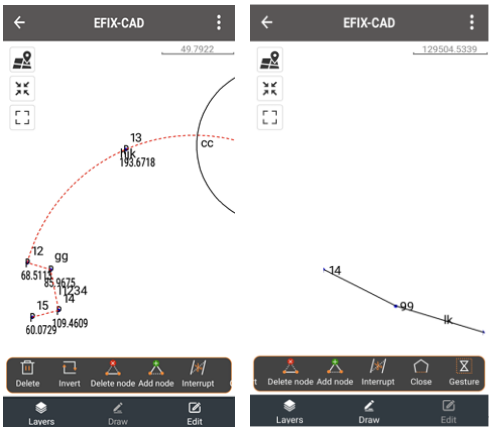
Delete node: Select a polyline, then select a node to delete. A window pops up, then click OK. If no more nodes to delete, click OK. Confirm the requiring window by clicking OK, otherwise continue selecting node.

Add node: Select a polyline, then select a segment (chosen item would be blue). Select a node. If there is no more node to add, click OK and confirm to save, otherwise continue adding.

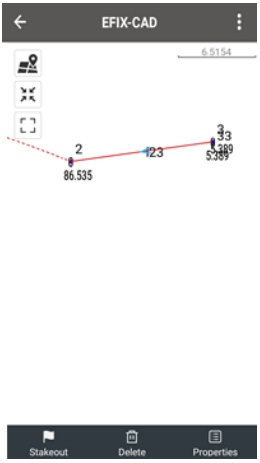
Interrupt: Select a polyline, then select a segment which shall not be the start or end part. Click OK, then name the two individual polylines. Click OK to finish it.

Close: Select a polyline, then click Close. Click OK and confirm it.

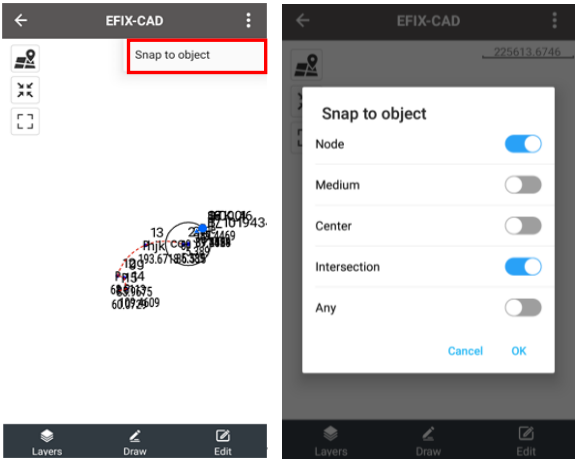
Gesture: Select a polyline, then draw the polyline as users wish. Click OK and confirm it.



Click any item just created, then users could see it becomes **red** and the lower menu contains three other choices: **Stakeout**, **Delete**, and **Properties**.



Click icon on the upper right to open **Snap to object**. Users could turn on any button as they wish. Click **OK** to apply it.



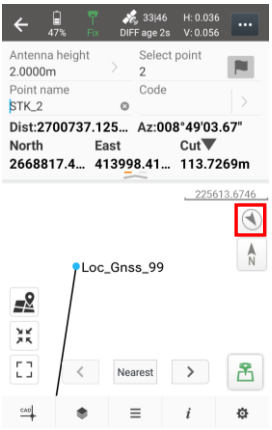
4.2 Stakeout

4.2.1 Display mode

There are two display mode in **Stakeout** view: map mode and compass mode. Map mode is for showing current position and target position, while compass mode is for showing the direction to target.

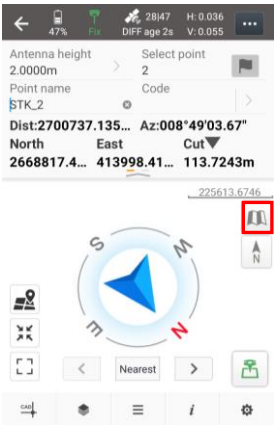
4.2.1.1 Map mode

Default is map mode, users can switch to compass mode by clicking icon. It's better to use map mode when users are **close** to target, then users will see green cross and circle around target which suggests current position is within stakeout tolerance.

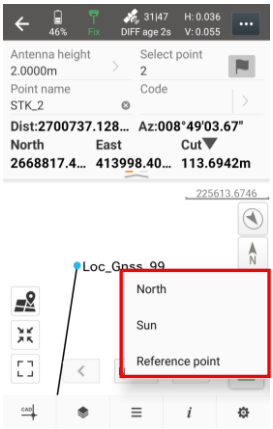


4.2.1.2 Compass mode

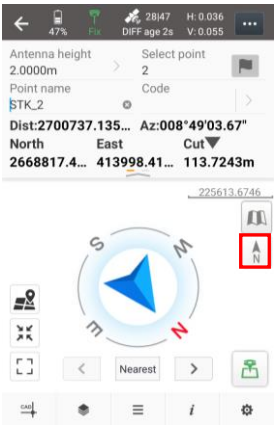
Users can switch to compass mode by clicking icon and switch back to map mode by clicking icon. It's better to use compass mode when users **haven't got close** to target, then users will see the direction to target. There are three methods to calculate the direction: north, sun or reference point.



There are three methods to calculate the direction: north, sun or reference point.

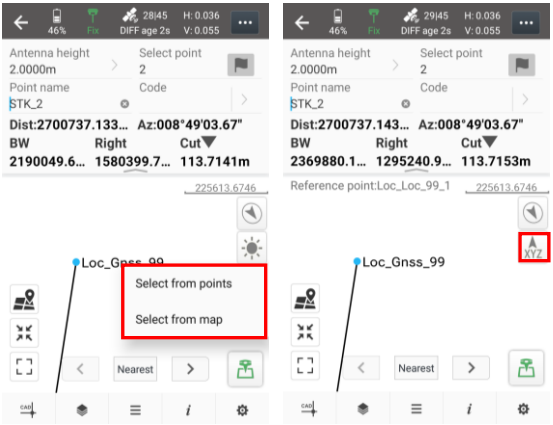


North: Takes north direction as reference direction.

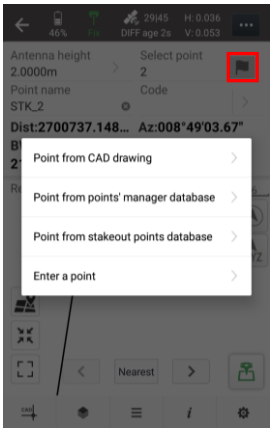


Sun: Takes sun direction as reference direction.

Reference Point: Takes selected point as reference direction, users can select point from **Points** interface or map.



Users can also click icon on the upper right to input stakeout target.



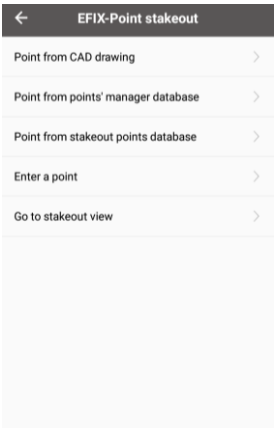
DIST: Refer to the horizontal distance between current position and target point.

AZ: In **point** stakeout, refer to the horizontal azimuth between current position and target point.

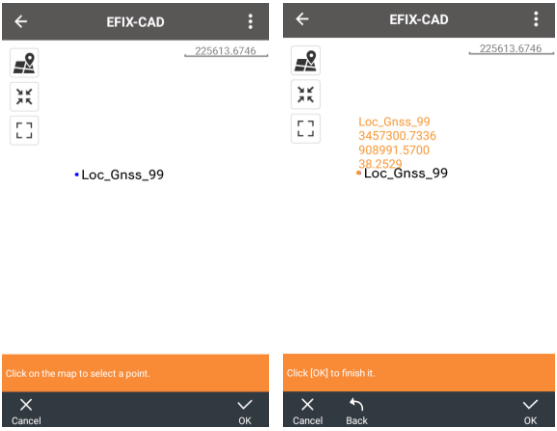
Sta.: In **line** stakeout, refer to station mileage

Text: Text under **Dist** shows forward/backward (**FW**/**BW**), **Left**/**Right, South/North, East/West** and **Cut**/**Fill** value between current position and target point. In **line** stakeout, users can also have **offset** value which would become 0 when users are on the target position and **SP dist** (**EP dist respectively**) which is the distance between current position and start point (end point **respectively**).

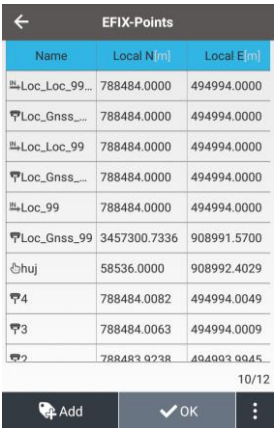
4.2.2 Point stakeout



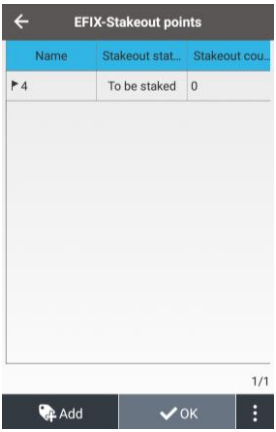
From **CAD**: Click a point from the map and click **OK** to finish it.



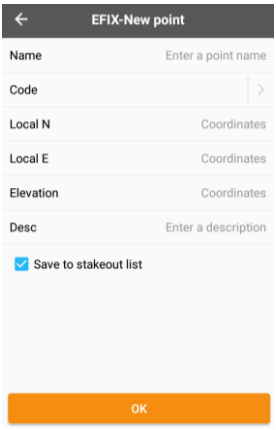
From **points library**: Select a point from points library and click **OK**.



From **stakeout points**: Select a point from stakeout points library and click **OK**.

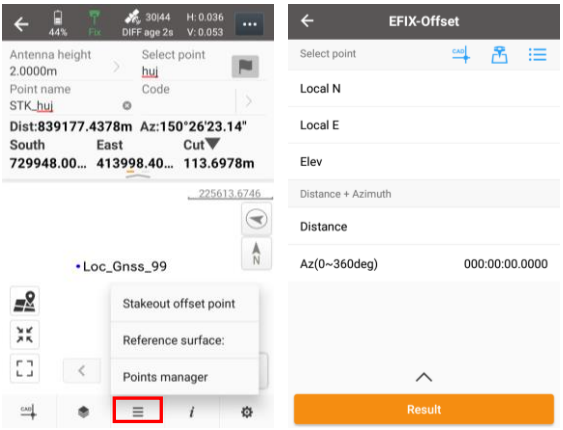


From **manual input**: Users manually input the name, code, and coordinates, then click **OK**.

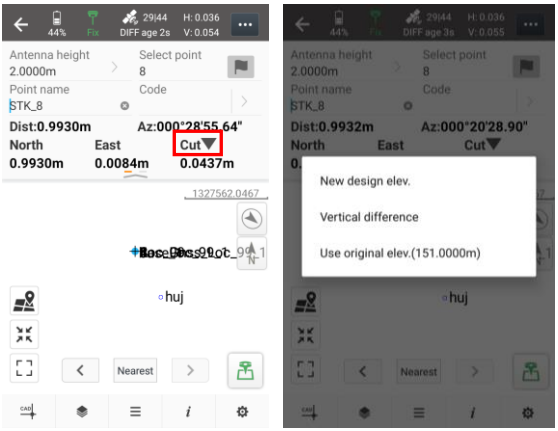


From **the nearest point**: The **nearest** button is to rank points according to distances.

Stakeout **offset point**: Click **multifunctional icon** to open offset point stakeout. Users could manually input coordinates, pick from the map, instant survey, or select from point library. After inputting distance and azimuth, click **Result** then input the **name** of the new point. Click **OK**.



After needed information is input, move as the instructions say and users can switch between map mode and compass mode for convenience. The **fill/cut** icon could be chosen among **new design elevation**, **vertical difference**, and **original elevation**. The vertical difference is the difference between to-stakeout height and the original design height.



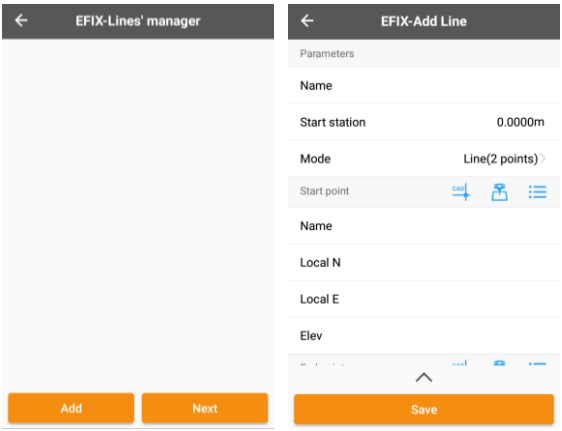
Click multifunctional icon to open **reference surface** interface. Users could create new surface or open an existing one. Click the icon in the

upper right corner to **modify** surfaces.

Click the survey button to stakeout the point

4.2.3 Line stakeout

Line: Users could choose object from line manager or manually input. Then click next.



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.

Move as the instructions say and users can switch between map mode and compass mode for convenience. Click the survey button to stakeout the item.

4.2.4 Surface stakeout

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

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

Click **Add** to add points manually.

Click **Select** to pick points from the points list.

Click **Import** to import the CASS file.

After inputting enough points, click **Save** and come back. Click surface for more operations.

Open surface File: Click to open the surface file. Including HC Triangulation File, DXF file and LandXml File.

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 stakeout icon for staking out.

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

Click to add stakeout point.

Click to enter surface/points manager interface or export a report.

4.2.5 CAD stakeout

Open the software, select the survey module and click [CAD Stakeout] to enter the CAD Stakeout.

When there is no stakeout task, the upper left navigation area displays NEH coordinates by default.

Snap point button

Point Stakeout button, directly input point coordinates

The current position is centered

Full data display of collected data and CAD graphics

Buttons for layer display control

Explode polyline and block

Multifunctional icon

Select the button for the information to be displayed

Set button

Open CAD file button

4.2.5.1 Open cad file

Click icon to open the file manager

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

click **From cloud** to upload the file to be downloaded.

Click **Load** and input the sharing code to accept the project

4.2.5.2 Open cad file

1) Select point to stakeout

After opening the CAD file, directly select the point feature on the view to enter the point stakeout mode, as shown in the figure below, the selected point displays the coordinate information (NEH) on the view.

Navigation information is divided into distance, elevation, forward\backward, left\right, fill\dig; distance, elevation, south\north, east\west, fill\dig.

Distance: the distance between the current point and the stake out point;

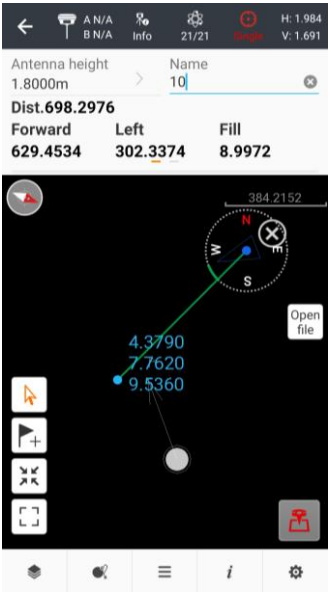
Elevation: current point elevation;

Fill and dig: fill and dig value at the current point;

Note: The Z coordinate of the point constitutes a plane, which is used to calculate the fill and dig value. If the lofted point has no Z value, the display is invalid.

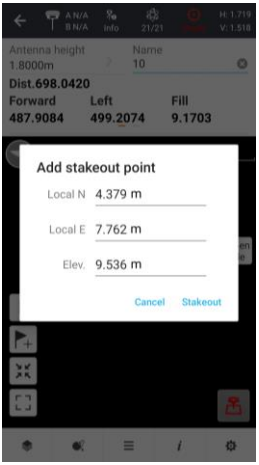
2) Stakeout the capture point

Click and drag the selection tool to capture the endpoint, midpoint, intersection, node, center, and snapped point. After capturing the point on the graph, users automatically enter the point stakeout mode.



3) Input point to stakeout

Click to input the point to stakeout, as shown in the figure below, after entering the coordinates of the point to stake out, enter the point stakeout mode.



4) Block stakeout

After opening the CAD file, select the block figure on the view, stakeout the base point of the block, and display the base point coordinates of the block on the view.

4.2.5.3 Stakeout of Line/Circle/Polyline

Line stakeout supports straight lines, arcs, circles, and polylines. After opening the CAD file, directly select the line on the view to perform line stakeout. As shown in the figure below, the selected line is **highlighted**. By default, the nearest point on the line is staked out.

Navigation information shows real-time mileage, elevation, lateral deviation, fill and dig.

Note: Straight line, starting point and end point form a slope. If any Z coordinate of the starting point or end point is 0, the fill and dig value display is invalid.

Stakeout a circle or arc, the Z coordinate of the center of the circle or

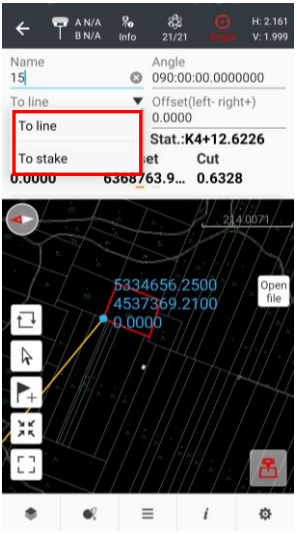
arc forms a plane, and calculate the fill and cut values. If the Z coordinate is 0, the fill and dig value is displayed as invalid.

Lofting multiple line segments, the fill and dig values are displayed as **invalid**.

After entering the line stakeout, you can choose the stakeout method:

To line: any point on the stakeout line, just enter any station;

To stake: users define the start station and station interval like in common line stakeout.



4.2.5.4 Tools

1) Layer control

: Turn the layer on and off. The light bulb icon is the layer switch.

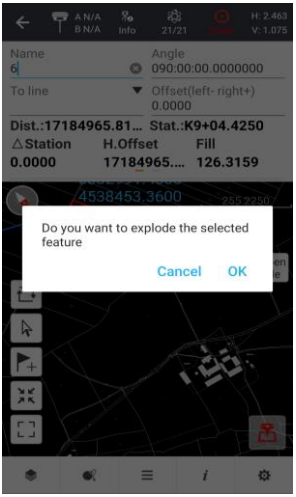
Click this icon to turn the layer on or off cyclically. For the opened layer, all graphic objects on it are visible; for the closed layer , All graphical objects on it will be hidden

: Freeze and unfreeze the layer. The frozen layer can make the objects on the layer invisible. It is used to freeze the layer that does not need to be displayed for a long time, which can speed up the display and regeneration.

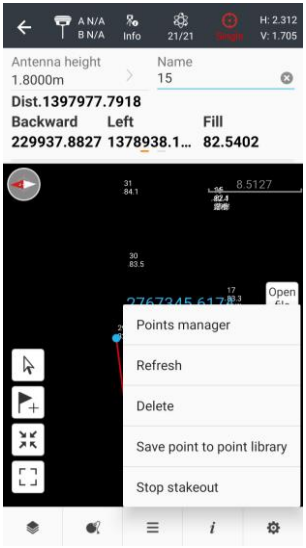
: Lock and unlock the layer. The lock icon is the layer lock switch. Click this icon to cyclically lock or unlock the layer. The layer can be edited only when it is unlocked. Edit any layer.

2) Explode

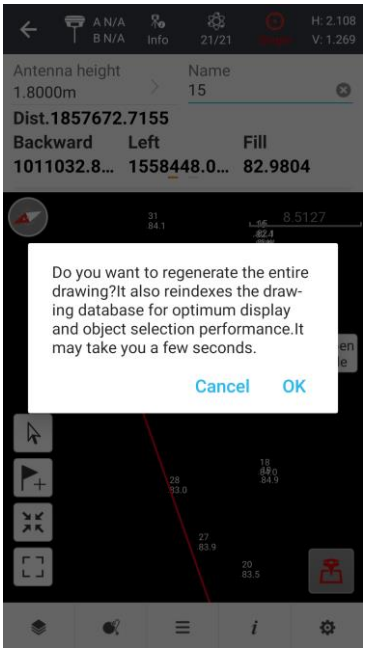
Exploding is the decomposition of a composite object (blocks, polylines) composed of multiple objects into independent objects. Select the polyline or block on the view and click to explode, as shown in the figure below, just confirm.



3) Multifunctional

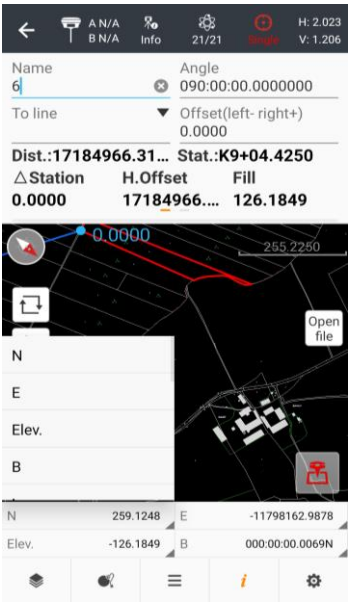


Refresh regenerates the **entire** view. Click Refresh, as shown below, just confirm.



4) Real-time information

Click the real-time information to display the current default information. Click to select the information to be displayed from the information list. Real-time information includes north coordinate, east coordinate, elevation, latitude, longitude, earth height, HDOP, VDOP, PDOP, differential delay, base station distance, base station height difference, top point distance, top point height difference.



4.2.6 Settings

4.2.6.1 Stakeout

- Store

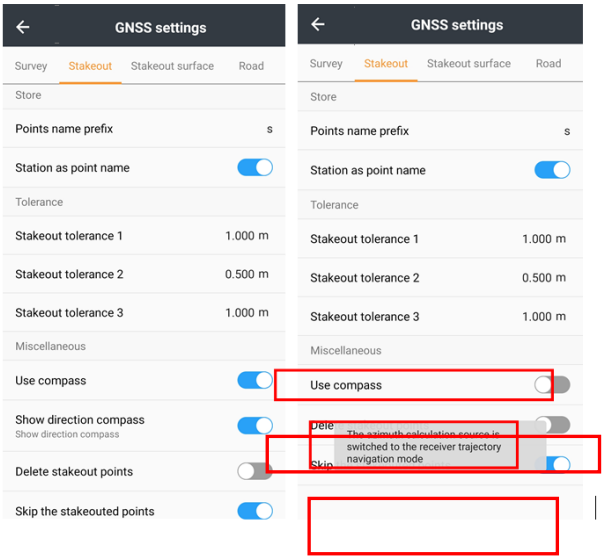
Users can modify '**Points name prefix**' and decide whether to use '**Station as point name**'.

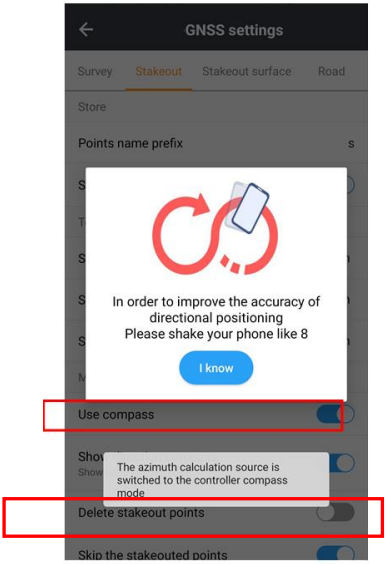
- Tolerance

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 “**Use compass**”, “**Show direction compass**”, “**Delete stakeout points**(delete staked out points from the stakeout list)”, and “**Skip the stakeouted points**” or not. If “**Use compass**” button is closed, “**Show direction compass**” would disappear automatically. When opening “**Use compass**”, please do as the pop-up window says.



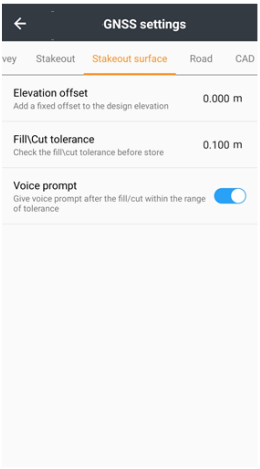


4.2.6.2 Stakeout surface

Users can modify "**Elevation offset**" to add a fixed offset to the design elevation.

Users can modify "**Fill\Cut tolerance**" to check the fill\cut tolerance before store.

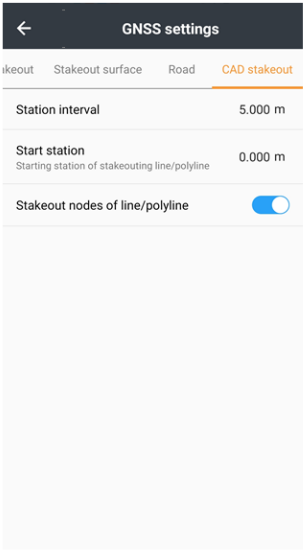
Users can open "**Voice prompt**" to give voice prompt after the fill/cut within the range of tolerance.



4.2.6.3 CAD stakeout

Users can modify "**Station interval**" and "**Start station**".

Users can open "**Stakeout nodes of line/polyline**" or not.



4.3 Road

4.3.1 Road stakeout

EField Roading is a module that allows to create and manage road design data and perform all the necessary stakeout operations without to use 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.

Is 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'** allow 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' allow 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.

4.3.2 Road manager

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

It is possible to list road 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, can only view it.

Define a EFIX road

When defining a road, you create a rodx 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 tempate** 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	If select **Elements** to define the horizontal alignment, you can select the **Element entry**

method	**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, eidt 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 current element isn`t the first one, the value will be calculated automatically.
Start east	Enter the **Start east** to define the line. If current element isn`t the first one, the value will be calculated automatically.
Azimuth	Enter the **Azimuth** to define the line. If current element isn`t the first one, the value will be calculated automatically.
Use azimuth constraint	If 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 current element isn`t the first one, the value will be calculated automatically.
Start east	Enter the **Start east** to define the arc. If 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 current element isn`t the first one, the value will be calculated automatically.
Use azimuth constraint	If 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 current element isn`t the first one, the value will be calculated automatically.
Start east	Enter the **Start east** to define the transition. If 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 current element isn`t the first one, the value will be calculated automatically.
Use azimuth constraint	If 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

PI is a point of intersection that contains curves.

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.

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 current element isn`t the first one, the value will be calculated automatically.
Start east	Enter the **Start east** to define the line. If current element isn`t the first one, the value will be calculated automatically.
End north	Enter the **End north** to define the line. If current element isn`t the first one, the value will be calculated automatically.
End east	Enter the **End east** to define the line. If 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 current element isn`t the first one, the value will be calculated automatically.
Start east	Enter the **Start east** to define the line. If current element isn`t the first one, the value

	will be calculated automatically.
End north	Enter the **End north** to define the line. If current element isn`t the first one, the value will be calculated automatically.
End east	Enter the **End east** to define the line. If 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 define 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 sideslope.

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.

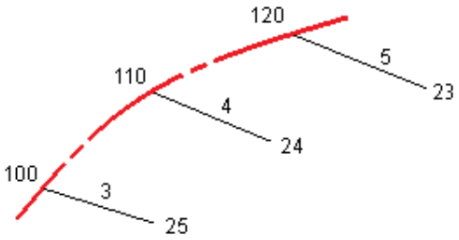
Vertical alignment: Define the changes in the elevation of the road.

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 is 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.

4.3.3 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 graphic view.

Field	Description
Real time station	Automatically calculate the stakeout station according to the current position.
Station	The station of will be stakeouted.

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 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 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.

4.3.4 Settings

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

If users open "**Station as point name**", the real-time station is input as point name, otherwise users should enter station as point name.

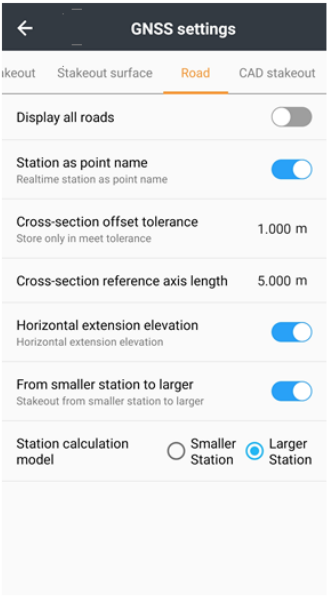
Users can modify "**Cross-section offset tolerance**" and "**Cross-section reference axis length**".

If users close "**Horizontal extension elevation**", "**Horizontal Slope elevation**" would be displayed.

If users close "**From smaller station to large**", please stakeout from

larger station to smaller, otherwise from smaller to larger.

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



4.3.5 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 lastest 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.

4.3.6 Where am I

This function is able to provide much information concerning the current position referring to the selected road.

Basing 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 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.

4.3.7 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 current position and the station of the target.

Cur/Fill: Vertical cut/fill to the design.

4.3.8 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 present 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.

4.3.9 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 is:

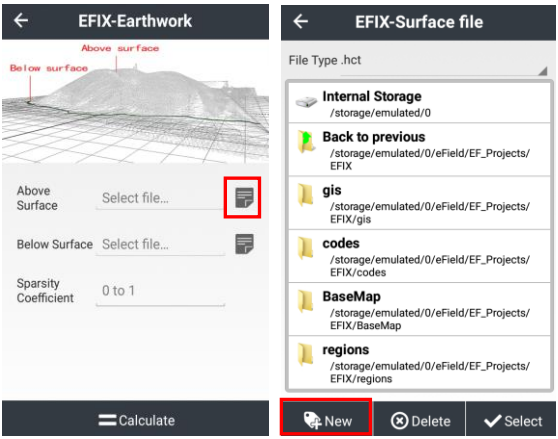
Abbreviation	Meaning
RS	Road start
RE	Road end
CC	Curve to transition
LT	Line to transition
CL	Curve to line
TL	Transition to line
LC	Line to curve
TC	Transition to curve

5 Tools

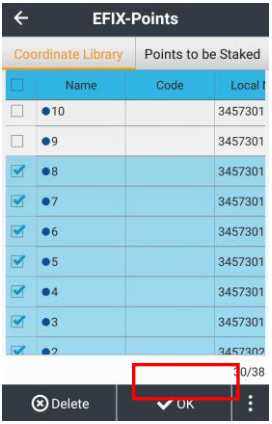
5.1 Volume

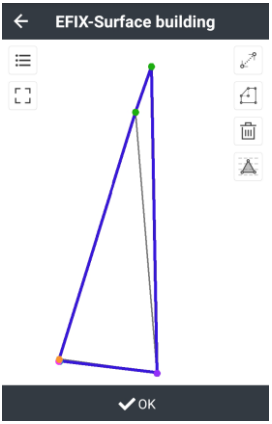
Surface with Height:

Above/Below Surface: Import above surface file. Click import icon to enter **Surface File** interface.



Users can choose surface file or create a new surface file by selecting points. Click **New** to create a new surface file, users can add a new point or select point in **Points**, then click **OK** the interface of “Surface building” will appear.





In this interface users can modify constraint line, boundary, and points of surface.

: Tap to view coordinates of points. Users can also input new points, select more points from points library, or delete points.

: Tap to view full screen.

: Tap to determine the constraint line. Select two constraint points and create a constraint line. Then tap the triangulation networks generating icon. The line created by the constraint points won't be changed after calculating.

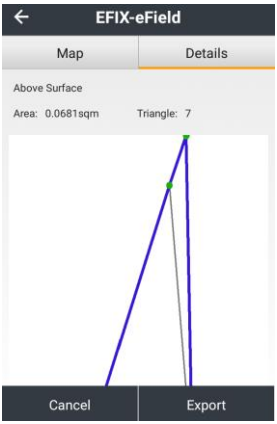
: Tap to modify the boundary. Choose two points to create a new line for determining a new boundary, and then delete the wrong part of the boundary.

: Tap to delete a useless point or wrong part of the boundary. Tap the icon, select a target point or line, and tap **[OK]** to confirm the deletion.

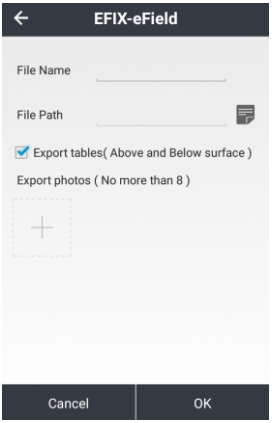
: Tap to generate new triangulation networks.

Sparse Coefficient: Input sparse coefficient of earth, range from 0 to 1.

Finally, click **Calculate** to get result. From the result interface users can select Map or Detail. In the Map interface users can get cut or fill value, in the Detail interface users can know area and triangle of above surface and Below surface.



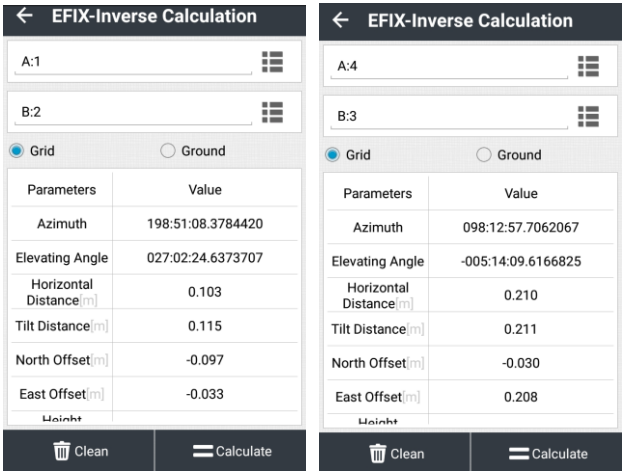
Click Export users can export the result with some photos (less than 8).



5.2 Inverse

Select starting point A and ending point B from point manager, click **OK** to calculate. The results calculated according to grid or

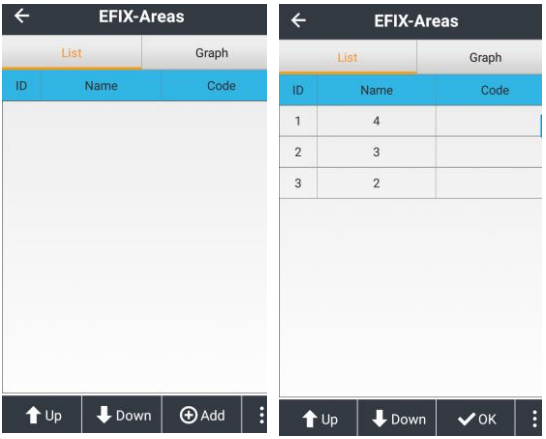
ground surface will be shown in the table. The results contain: azimuth, elevating angle, horizontal distance, tile distance, north offset, east offset, height difference and gradient.



5.3 Area

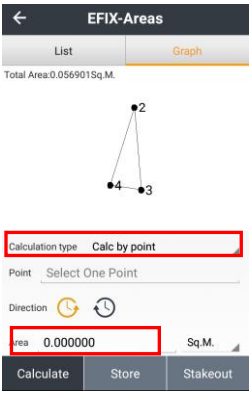
This function is to calculate the area, perimeter of figure, the coordinates that participates resolve are chosen from point management by library chosen. The unit of perimeter is metric and the unit of area supports square meters.
OK: Calculate the perimeter and area of the figure which is composed of points in sequence.
Delete: Delete point.
Select: Add points to the list.

Up/Down: Make selected points move up or down.

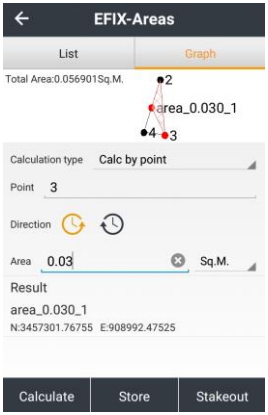


Area Division: Cut the selected area according to the value inputted.

Choose the Calculation type, input the area, should less then the whole selected area.

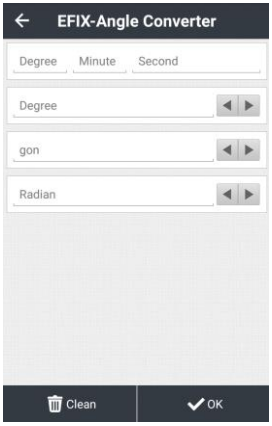


Click Calculate, after that, you can store or stakeout calculated point.



5.4 Angle conversion

Angle converter can convert degrees, minutes, seconds and radians among these 3 types of converter.
Enter a value in degrees, minutes and seconds edit box, click on the **OK** 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.

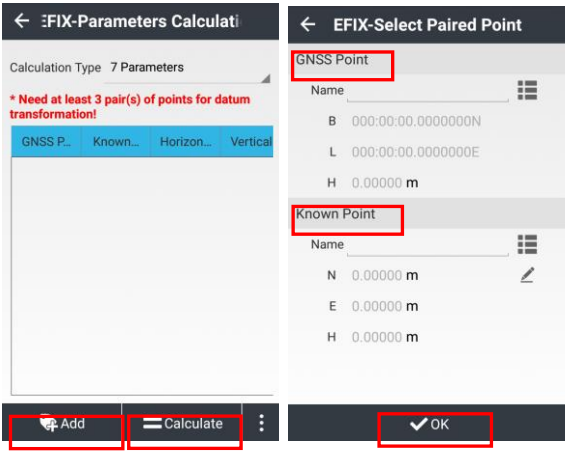


5.5 Parameters Calculation

Calculation Type: Include 7 Parameters and 3 Parameters.

7 Parameters: The application scope of 7 parameters is relatively large, generally larger than 50 km. Users need to know at least three pairs of known point values in local coordinate system and their corresponding WGS-84 coordinates. Only when we get the seven parameters transmitting from WGS coordinate system to local coordinate system, can we start the parameters calculation.

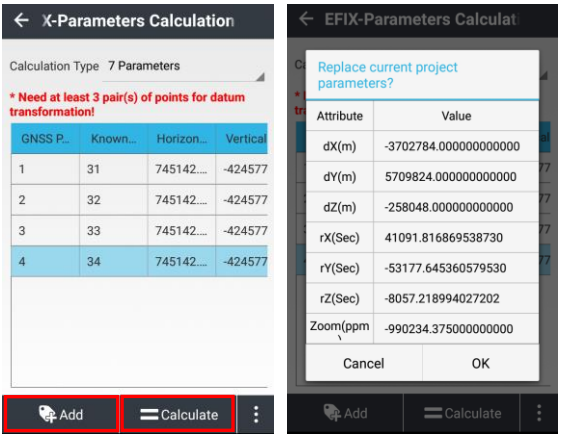
Select Point Pair: Click **Add** to add point pairs and input pairs of GNSS point and known points to calculate 7 parameters. Add WGS-84 coordinates at **GNSS Point** and add plane coordinates at **Known Point**.



Note: Select three corresponding point pairs and add to the interface of parameters calculation.

Calculate: Click to calculate. The results will be popped up automatically. Then click **OK** to apply 7 parameters to the current project.

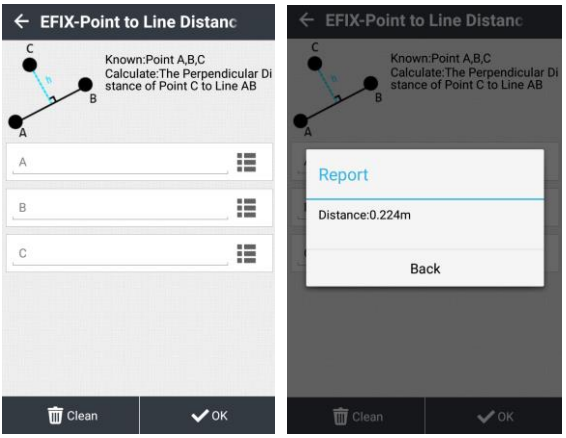
Datum trans: Back to the main menu, click **CRS** to view Datum trans interface and 7 parameters can be viewed. Default datum transformation is 7 parameters. Click **Login**, input name is admin and password is 123456, and then parameters will be unlocked.



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.

5.6 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.

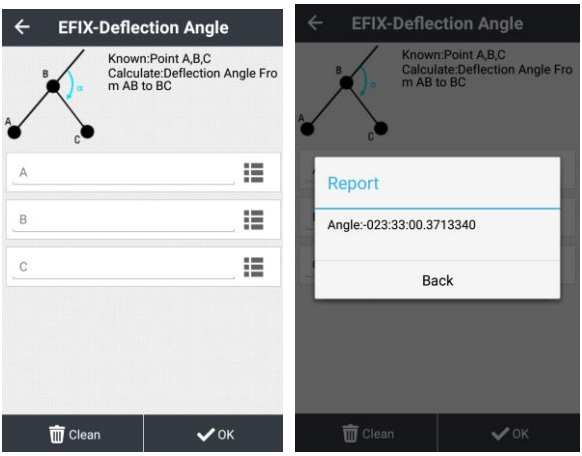


5.7 Offset

Origin (A): Select form **Points**.
Horizontal distance (AP'): Input the horizontal distance.
Perpendicular (PP'): Input the vertical distance.
Azimuth Angle: Input the azimuth angle.
Offset Distance: Click **OK** to display a calculation result screen, enter the point name, and click **OK** to save the calculated point.

5.8 Deflection

Deflection Angle: Click Deflection to calculate deflection angle. Select Point A, B, C, and click **OK**, the angle will be displayed in pop-up interface.



5.9 Rotation

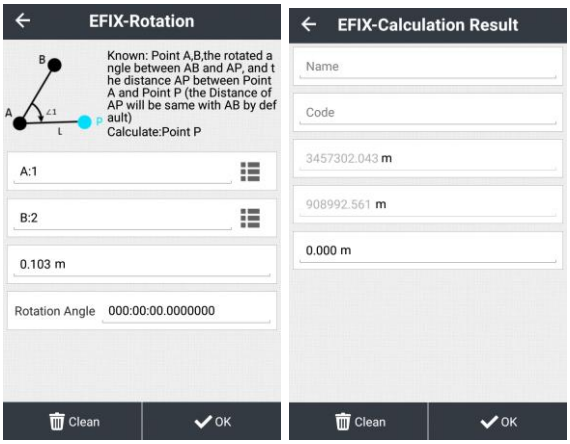
Rotation: Point P is on the line AB which rotates a certain angle. After selecting AB points, the system will calculate the distance between A point and B point as default and this distance as initial value for AP. the value of AP can be negative which means the P point is in the extension line of selected line.

A/B: Select the coordinate of A, B from Library Option.

AP: Initial distance.

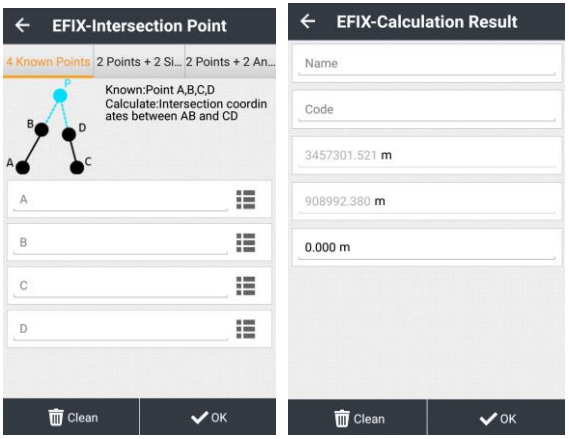
Rotation Angle: Click **OK** will show calculate result.

Calculation Result: Input name and code, and then click **OK** to save this calculated point.

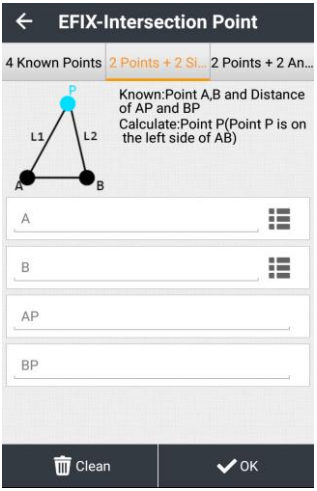


5.10 Intersection

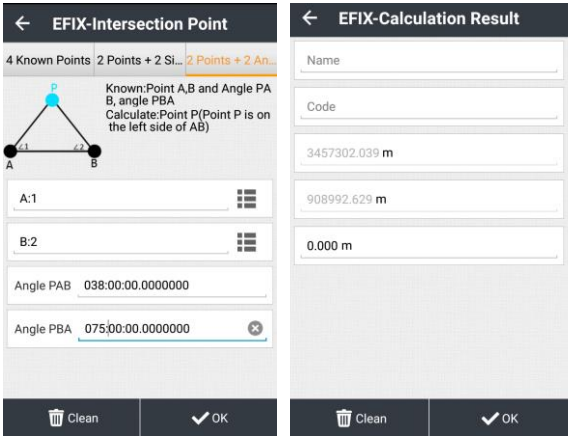
Known Points: Select points from point management, and click **OK** to calculate the intersection P of line AB and line CD.



Points + 2 Sides: Select points A and B from point management. Enter the length of line AP and line B. Click **OK** to calculate. Input a name, and click **OK** to save.



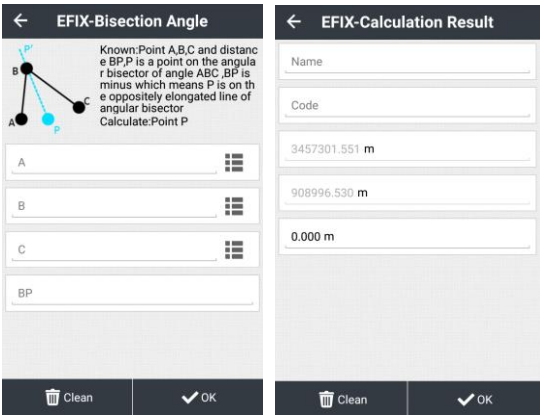
Points + 2 Angles: Calculate intersection P with known points A and B and the inner angle of PAB. Click **OK** to calculate. Input a name, and click **OK** to save.



5.11 Bisection Angle

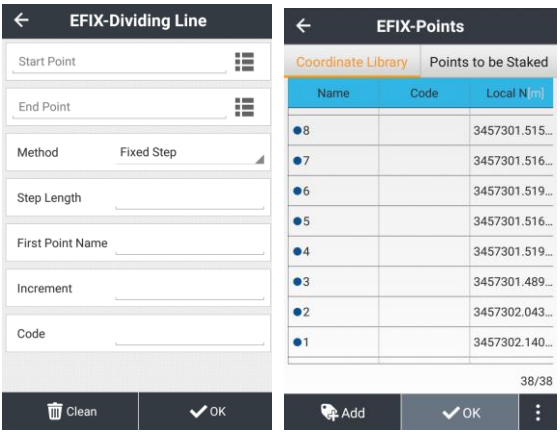
Bisection Angle: Given line BA and BC comes to an angle ABC, P is

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 extension line of the angle bisection line. Click **OK**, the results will show out, input the point name, and click **OK** to save the calculated point.



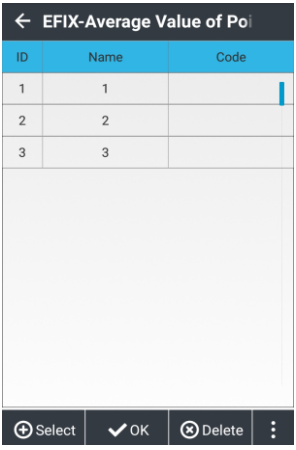
5.12 Divide Line

Divide Line: Select start point and end point from **Points**, select **Method**, Input step and first point name, then click **OK**; it will remind users a successful division. Click **Points** manager to review points.

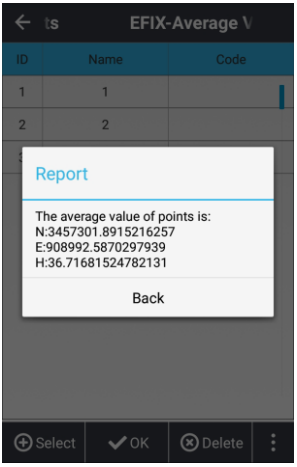


5.13 Average Value of Points

Select: Select points to calculate.

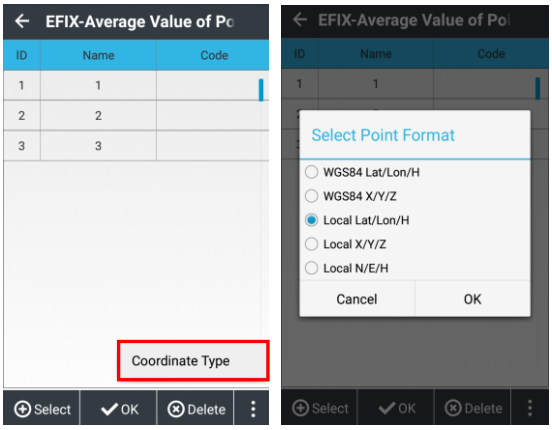


OK: Report the average value of selected points in a prompt window.



Delete: Delete point on the list.

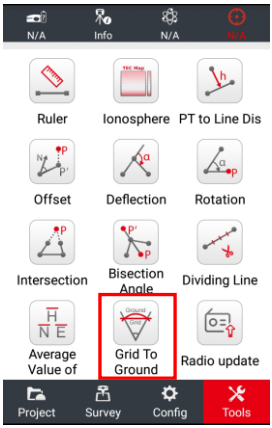
Coordinate Type: Users can set coordinates types of points.



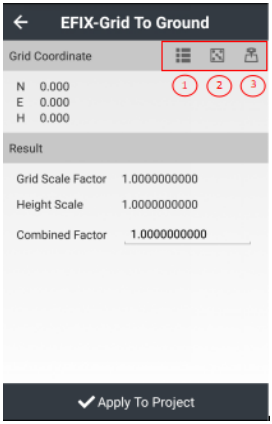
5.14 Grid to Ground

While surveying in the same area, users can get grid coordinates or

ground coordinates with a GPS receiver or a total station, but it is unable to deal with different kinds of coordinates when post-process data. **Grid to Ground** function is used for calculating the combined factor and transform grid coordinates into ground coordinates, so that users can work with both total station and RTK receiver in the same project.

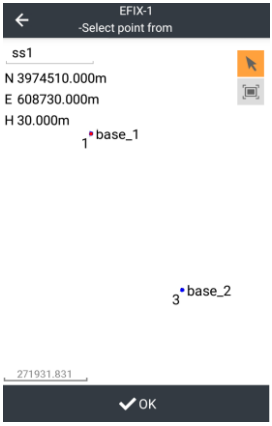


Tap **Grid to** in **Tools** interface. There are three methods to select grid coordinate: from Points, map selection and calculate directly. There needs two points for calculation, the first point coordinates are default as current base station coordinates. Grid scale factor, height scale and combined factor will be calculated after selecting second point coordinates. (Combined factor can also be inputted.)

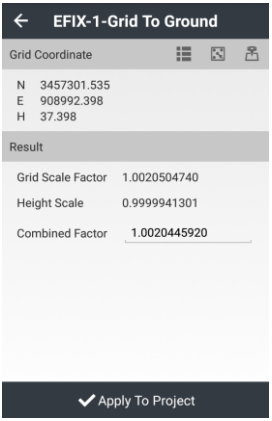


(1) **Points**: See details in **2.7 Points**.

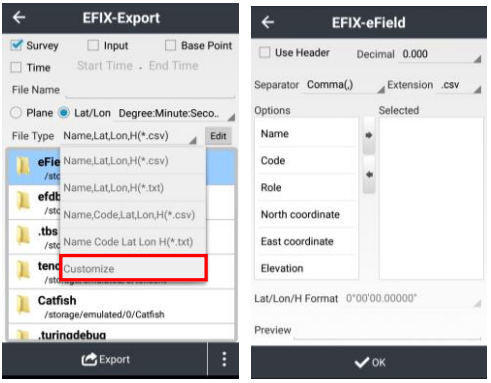
(2) **Map Selection**: Select a point in DXF/SHP base map or measured point.



(3) **Calculation**: Click to calculate the coordinates of current position.



Click **Apply to Project**, and then users will see transformed ground coordinates in point detail. There is no need to apply combined factor when it's 1, because default combined factor is 1 and users can view the ground coordinates in point detail directly. These ground coordinates can also be exported as TXT, DAT or CSV format with customized content.



6 Register

If the software isn't registered, please contact regional sales representative.

Register:

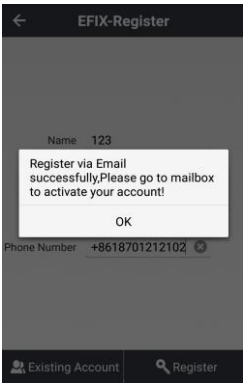
(1) **Register via Email**

Enter the **Config** interface and click **About**. Users will see register status is **Unregistered**, click **Unregistered**. Then users will see a pop-up window: "Please Register via Email!", click **Confirm**.

Then input user information and click **Register** to submit application. Please input your true e-mail address, because we will send "Account activation" mail to this e-mail address.

When users submit application successfully, it will prompt "Register via Email successfully, please go to mail box to activate your account!". Click **OK** and go to mail box, and then users will see "Account activation" mail send by EFIX. Please click the URL to activate your account. After activation of mail account, users can

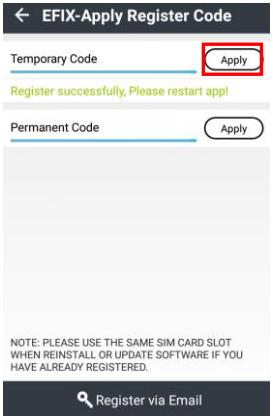
go to **Apply Register Code** interface in eField.



(2) **Apply Register Code**

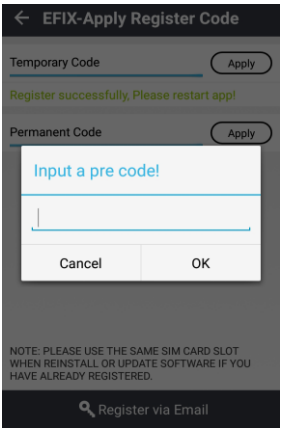
(a) **Temporary usage**

Click **Apply** after **Temporary Code**, and users can apply register code immediately. Then users will see progress bar turns blue and the status reads “Successfully”, please remember to restart eField after registration.

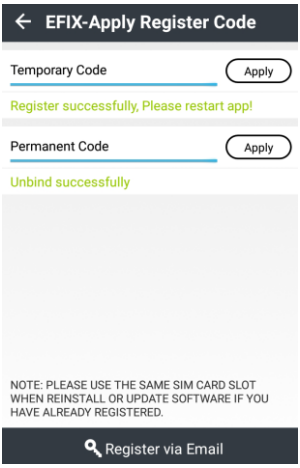


(b) **Permanent usage**

Click **Apply** after **Permanent Code**. Input a pre-code, and click OK. Users should ask regional sales manager or dealer for pre-codes.



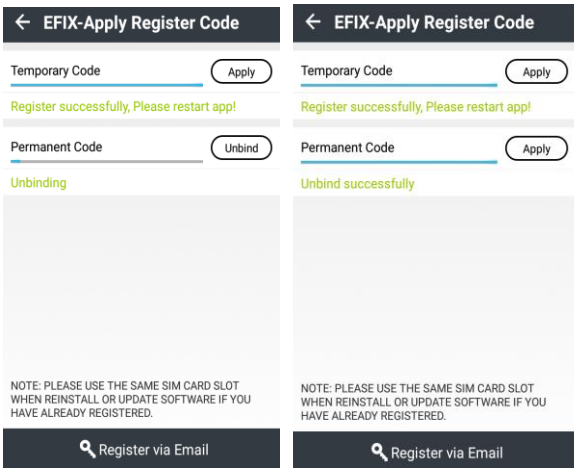
Then users will see progress bar turns blue and the status reads "Successfully", please remember to restart eField after registration.



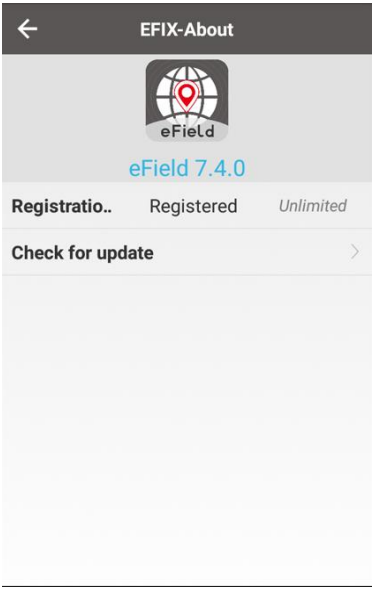
(3) **Unbind Pre-code**

In general, one pre-code is corresponding to only one device. For some special situation, users can use unbind function to unbind the pre-code of current device, then this device will become unregistered status and the pre-code can be used in other device.

Click **Unbind**, and users will see the progress bar turning blue. After the progress bar has turned blue "Unbind successfully" will appear.



Then, users will find the current device becomes unregistered. It means you can use the pre-code in another device now.


EFIX-About
eField
eField 7.4.0
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Registered
Unlimited
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EFIX Geomatcis Co., Ltd.

Shanghai, China

Email : sales@efix-geo.com | support@efix-geo.com

Website: www.efix-geo.com

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