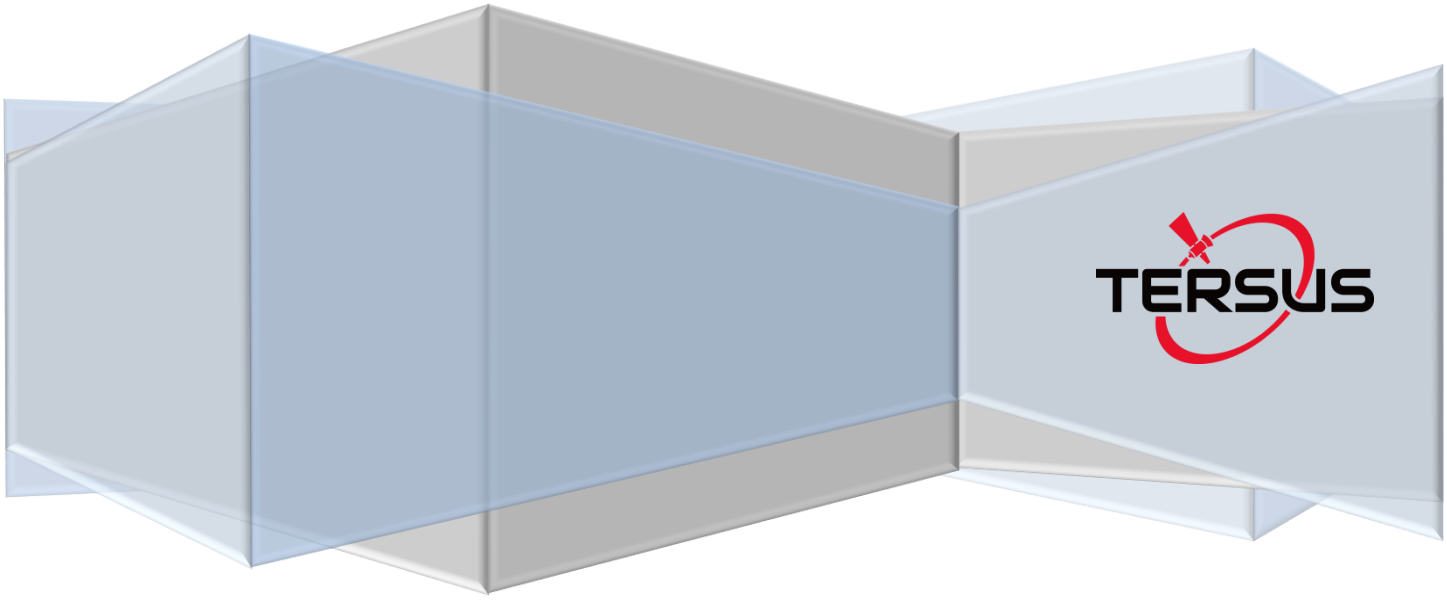
User Manual

Version V1.0-20180808

User Manual
For Nuwa App



Revision History

Revision	Description	Date	Owner
1.0	Issued for Release	2018/08/08	LC

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- Main Interface
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1.1 Introduction

Nuwa is a survey application software based on Android OS (Operating System), designed by and all rights reserved to Tersus Inc. Nuwa is simple, easy to use and has friendly UI (User Interface). It's designed to work with David GNSS receiver specifically, read https://www.tersus-gnss.com/product/david-receiver for more information about David GNSS Receiver.

Main features of Nuwa App:

- All the base/rover configuration can be completed by one click
- Supporting user-defined coordinate system
- Supporting several import/export file formats
- With Nuwa, a David receiver can work as a NTRIP server and upload RTK corrections in real time.
- Supporting text and graphics interface, providing a variety of options; with convenient data sharing capabilities;
- Support for new release detection and online upgrades.

1.2 Installation

Copy the .apk file to an Android device, click it to start installation. The Nuwa icon will be on the desktop after it is installed successfully.

1.3 Main Interface

Nuwa has four main functional groups: Project, Device, Survey and Tools.

While Nuwa is running, slide left or right on the screen to enter other functional groups.

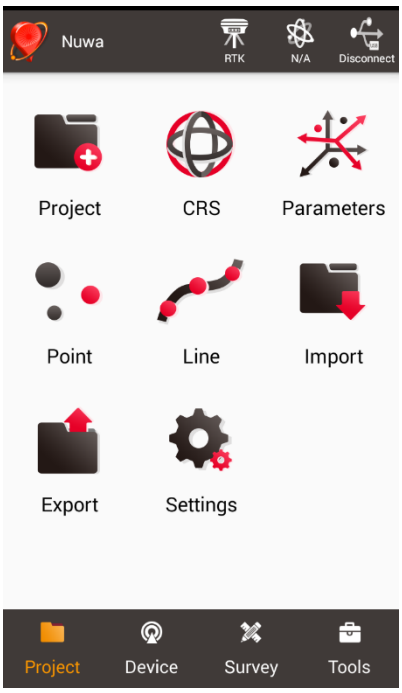

Figure 1.1 Nuwa Main Interface

- Status Bar

[

]: Project Information, the current project is displayed.

[

]: Device information, click it to check more detail about the David connected.

[

]: Satellites status, N/A indicates Not Available, satellite positioning status includes: Single, Float and Fixed.

[

]: Connection status, can be Connect, Connecting or Disconnect.

- Menu area

List all the menu items in the current functional group.

- Tabs Bar

Four functional groups: Project, Device, Survey and Tools.

2. Project

- Project
- CRS (CooRdinate System)
- Parameters
- Point
- Line
- Import
- Export
- Settings

2.1 Project

This section is used to create a new project, open/delete/edit an existed project.

2.1.1 New

A new project is necessary to manage all the data. Click [Project] - > [New] to go to the following interface.

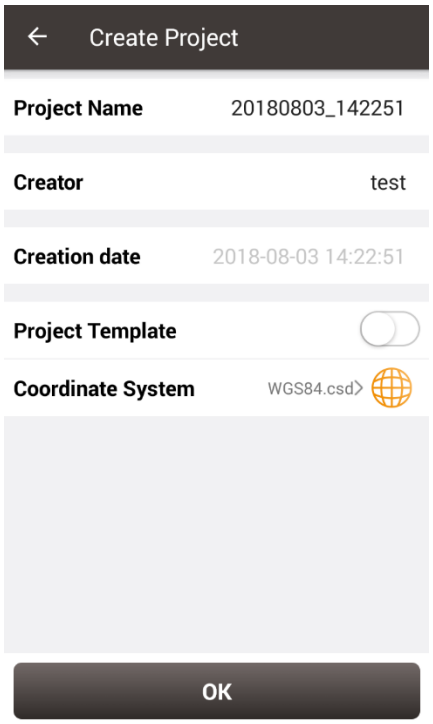

Figure 2.1 Create Project interface

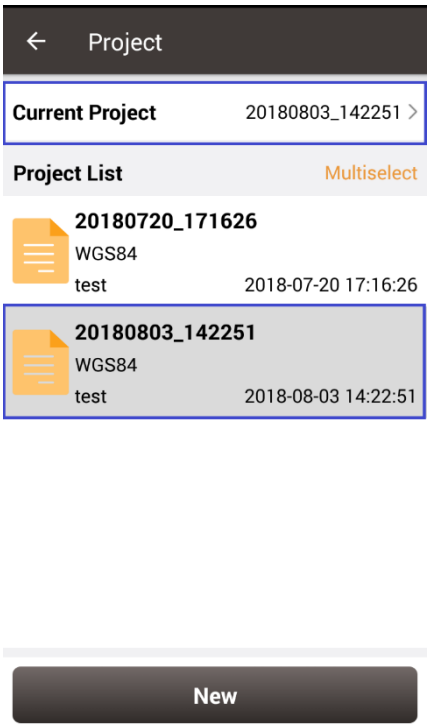

Figure 2.2 New project created

[Project Name]: input the project name

[Creator]: input the name of the operator

[Project Template]: use an existed project settings

[Coordinate System]: configure a new coordinate system

After a project is created, this project is displayed in the Current Project. Refer to section 2.1.4 for more details about project property.

2.1.2 Open

If there is need to operate in an existed project, find it in the project list and click it. Nuwa prompts to open the project, click [OK].

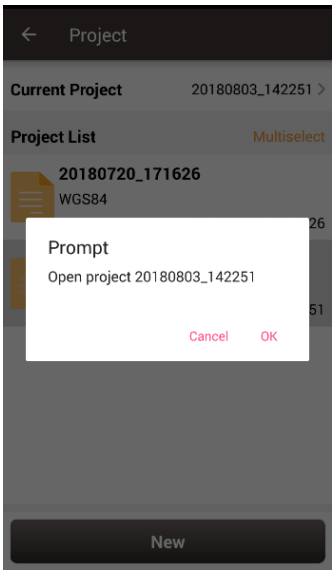

Figure 2.3 Open an existed project

2.1.3 Delete

Click [Multiselect] at the right side of Project List, select (single select, inverse select or select all) projects to be deleted. After the projects are selected, click [Delete] button to delete them. Nuwa prompts to confirm, click [OK] to complete the deletion.

Note: The current Project cannot be deleted in Nuwa app.

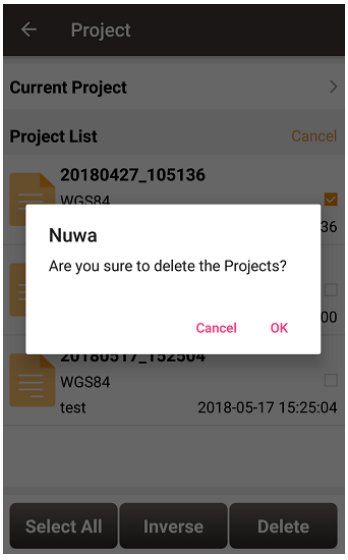

Figure 2.4 Delete Project

2.1.4 Edit Project Property

If a project is opened, the coordinate system can be edited, including ellipsoid, projection method and coordination transformation.

Click the [Current Project] to enter Project Property interface. Click [Edit] to input the ellipsoid parameters, projection type and coordination transformation, refer to section 2.2.2 for details.

Click [Share] to share the project parameters with others.

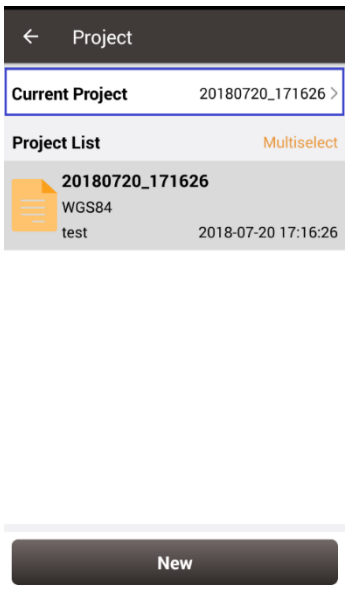

Figure 2.5 Project List

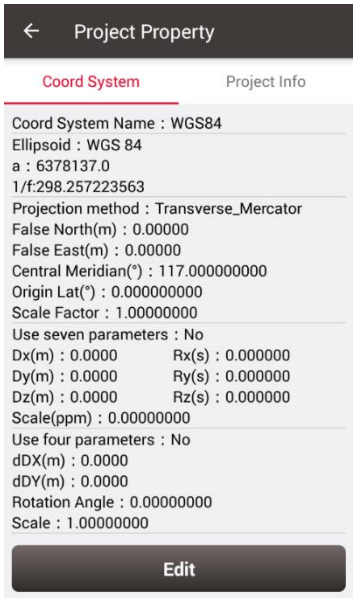

Figure 2.6 Project Property

Figure 2.7 Share Project Info

2.2 CRS (CooRdinate System)

Nuwa app supports user-defined coordinate system. A user-defined coordinate system can be saved as a template. A CRS can be created, edited and deleted in the CRS management interface.

2.2.1 New CRS

When a new CRS is created, input the coordinate system name, select the right ellipsoid, the projection type and CRS transformation type, refer to the following screenshots:

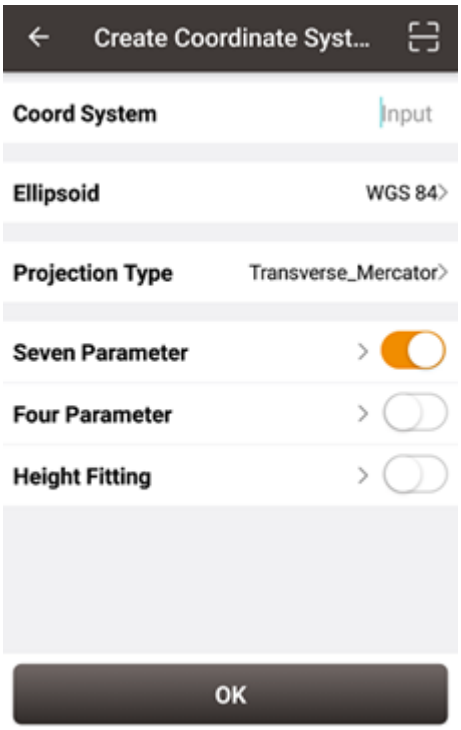

Figure 2.8 Create a new CRS

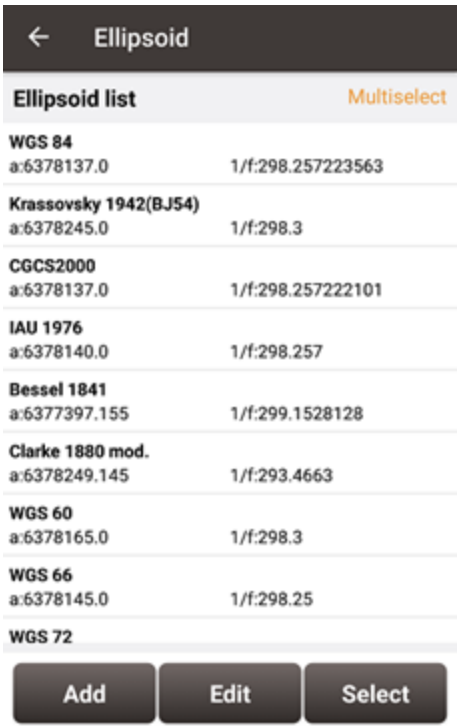

Figure 2.9 Ellipsoid list

[Ellipsoid]: Select the correct ellipsoid parameters, including ellipsoid name, semi-major axis, inverse flattening, etc. There is no need to configure semi-major axis, inverse flattening by further steps.

Note: The default ellipsoid is WGS84

[Projection Type]: Including transverse Mercator projection, UTM projection, Lambert conformal conic projection 1SP, Lambert conformal conic projection 2SP, and etc. Origin latitude, central meridian and other parameters can also be configured in Projection interface.

[Seven Parameter]: Datum transformation is necessary when the source ellipsoid is different from the target ellipsoid. Axis shift, rotation and scale would be introduced in the datum transformation. Bursa-wolf seven-parameter model is used by Nuwa for datum transformation. At least three known points are necessary for accurate transformation. Only X/Y/Z shifts are required if low accuracy transformation is needed, other parameters can adopt the default values.

[Four Parameter]: For the transformation between two planes. X/Y axis shift, rotation and scale are necessary to be input.

[Height Fitting]: currently three algorithms are supported: fixed difference correction, plane fitting and surface fitting.

Click the corresponding items to complete the configuration, refer to the following three screenshots:

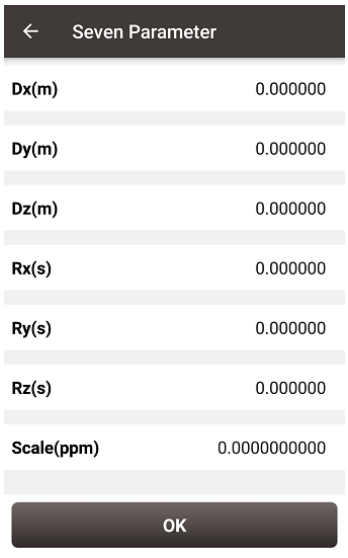

Figure 2.10 Seven Parameter

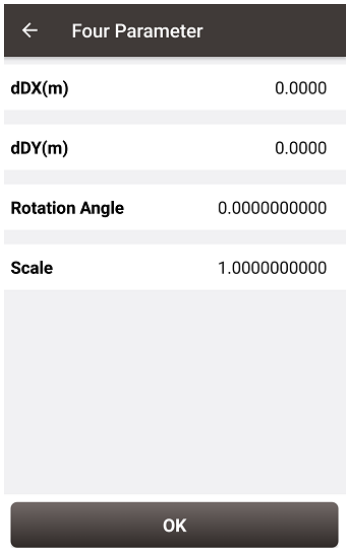

Figure 2.11 Four Parameter

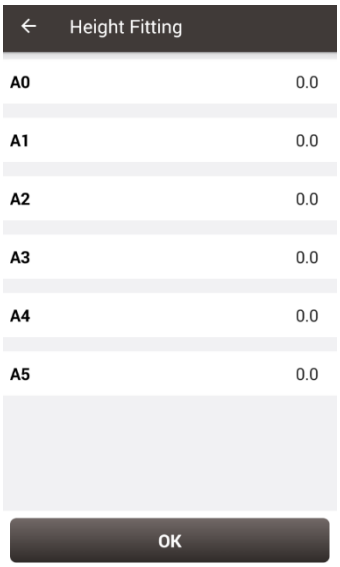

Figure 2.12 Height Fitting

2.2.2 Edit CRS

Click an existed CRS to enter the Edit Coordinate System interface, refer to the following screenshot:

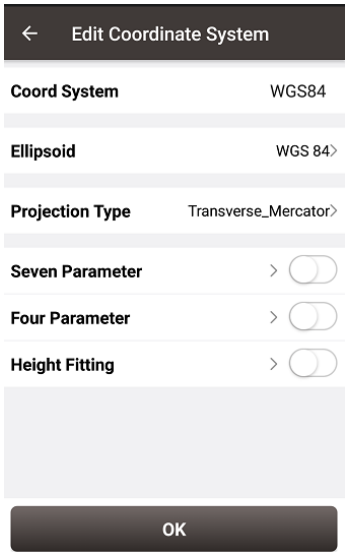

Figure 2.13 Edit Coordinate System

2.2.3 Delete CRS

The current CRS cannot be deleted. Click [Multiselect] to select the CRS to be deleted and click [Delete] to finish the deletion.

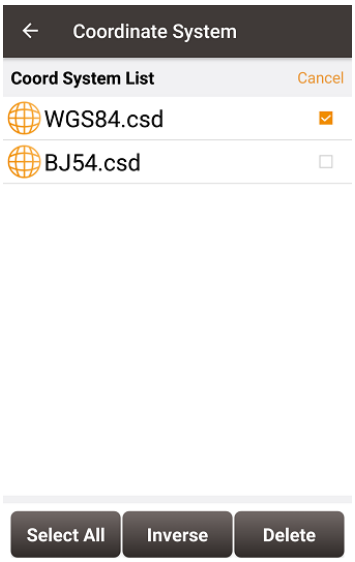

Figure 2.14 Delete CRS

2.3 Parameters

Seven Parameter and Three Parameter methods are introduced in this section.

Seven Parameter: this method can cover long distance range, generally more than 50 km. At least three known points are required in local datum and in WGS-84 system before calculating.

Three Parameter: at least one known point is required. This method can cover short distance range; the accuracy is determined by working area and decreased with the distance.

The following is an example of Seven Parameter. Click [Project] -> [Parameters] to enter the following interfaces.

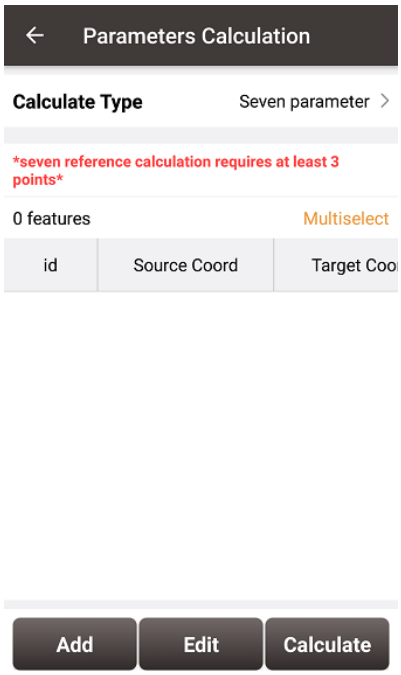

Figure 2.15 Parameters Calculation

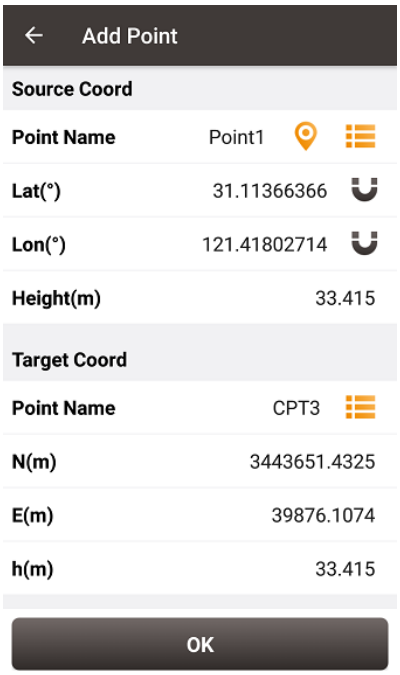

Figure 2.16 Add Point for calculation

Select seven parameter for Calculate Type, click [Add] on the bottom left to input the known points. For the Source Coordinate, input Latitude, Longitude and Height by manual input, collected from a David receiver or selected from the control point list. For the Target Coordinate, input the local values from manual input or selected from the control point list.

- Manual input

Input the point position according to the format required. The latitude/longitude format can be changed by clicking the U icon on the right.

- Control Point

Click [ ] to load control points. Control points can be added by clicking [Add] in the Control Point interface.

- Smooth Acquisition

Click [ ] to start smooth acquisition through David receiver.

After points are added, click [Calculate] on the bottom right to do the parameter transformation. The result is shown as below screenshot:

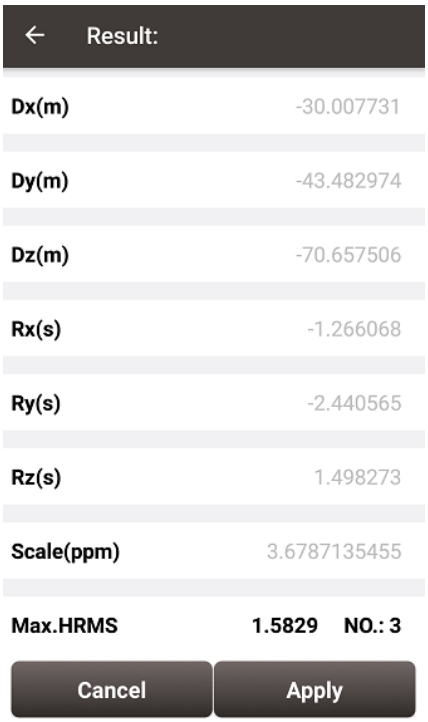

Figure 2.17 Parameters Calculation Result interface

2.4 Point

Point library includes survey point library, control point library and stakeout point library. Points can be added into a library. Editing, searching and checking detail information can be done under this Point interface.

A point can be imported into the control point library or the stakeout point library. In the point library interface, slide in the left or right direction to check the point information, such as coordinates, collection time, and etc.

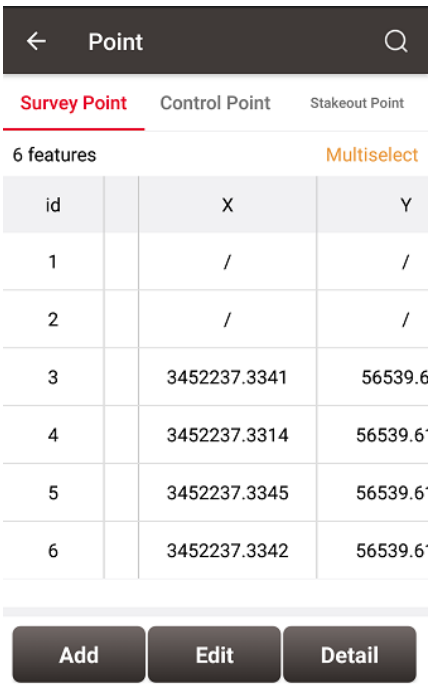

Figure 2.18 Point Interface

Control point library are used as examples in the sections below:

2.4.1 Add Point

Under the Control Point interface, click [Add] to enter the Add Control Point interface. Choose the coordinate type, input the point name and the coordinate values, or click the upper right icon to import the survey point directly.

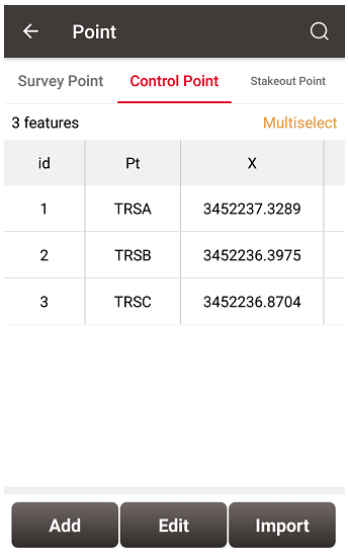

Figure 2.19 Control Point interface

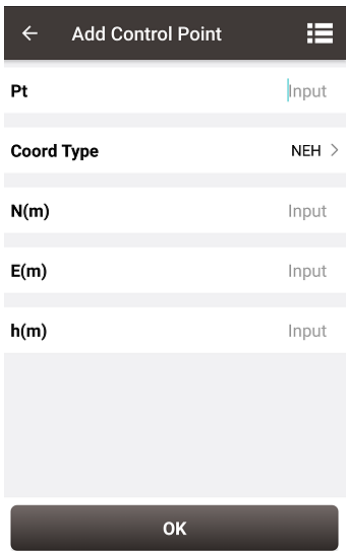

Figure 2.20 Add Control Point

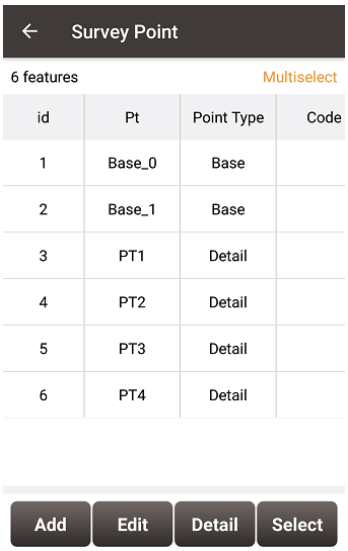

Figure 2.21 Import Survey Point

2.4.2 Search Point

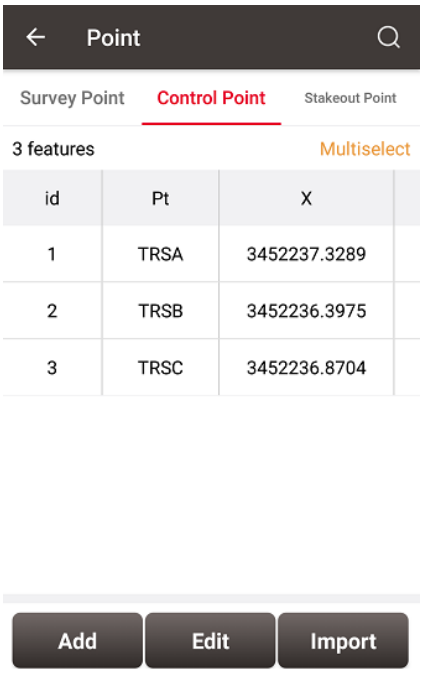

Figure 2.22 Control Point interface

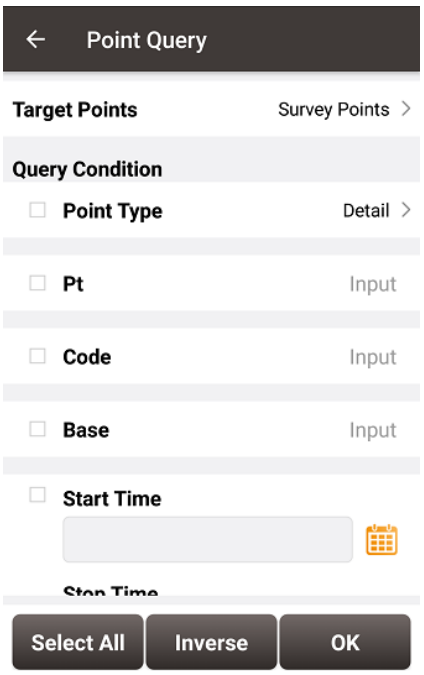

Figure 2.23 Point Query interface

Click the up-right icon to enter Point Query interface which is shown in the Figure 2.23 above. Target Points can be survey points, control points or stakeout points. Query

condition details are as follows:

[Point Type]: Detail, continuous, input point, calculate or base.

[Pt]: Point name to be queried.

[Code]: Code number.

[Base]: The name of the base.

[Start/Stop Time]: Start and stop time of the points

Click [OK] to search all the points meeting the query conditions.

2.4.3 Edit Point

Choose the points to be edited, and click [Edit] to enter the Edit interface.

Note: There is an exception that in the Survey Point tab, only the code info can be edited apart from the manual input points.

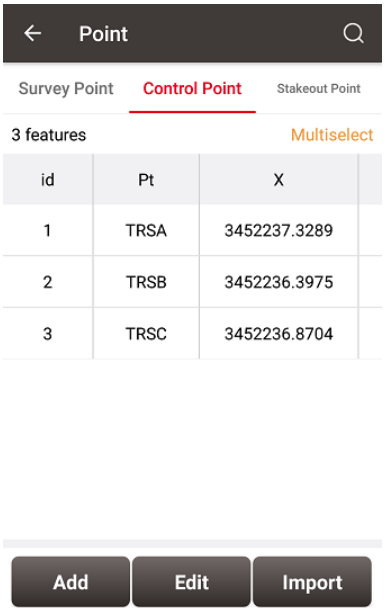

Figure 2.24 Control Point interface

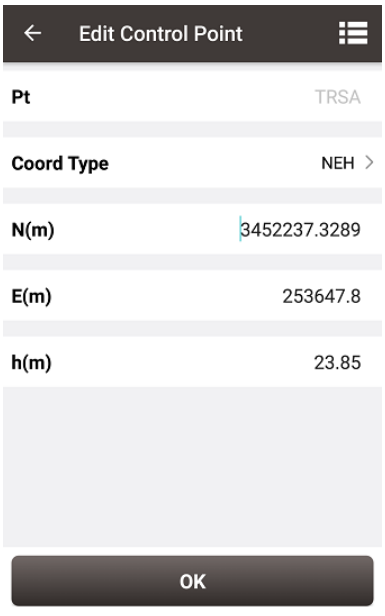

Figure 2.25 Edit Control Point interface

2.4.4 Import Point

Click [Import] at the bottom right corner, select a customized format in the pop-up list, thereafter select file format and file path to import points.

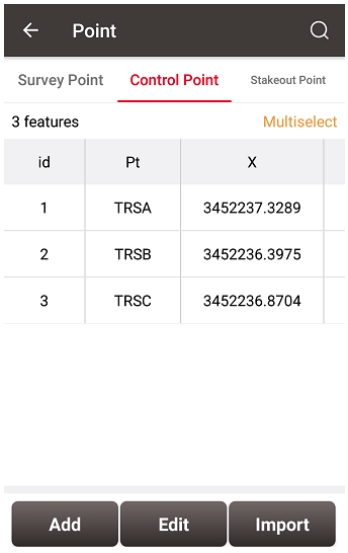

Figure 2.26 Control Point interface

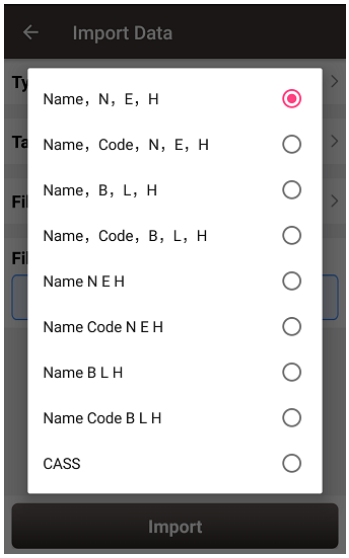

Figure 2.27 Format list

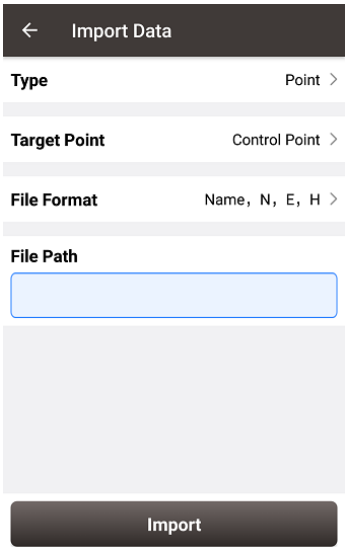

Figure 2.28 Import Data info

2.4.5 Delete Point

Click [Multiselect] in the point interface to enter the following interface. Select the points to be deleted and click [Delete] to complete the deletion.

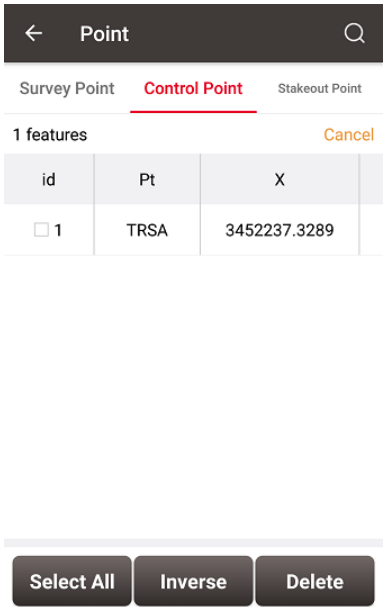

Figure 2.29 Delete Point interface

2.5 Line

New lines can be added, existed lines can be searched, edited and deleted.

2.5.1 Add Line

Click [Project] - > [Line] to enter the line interface. Click [Add] to enter the following two interface for Add Line

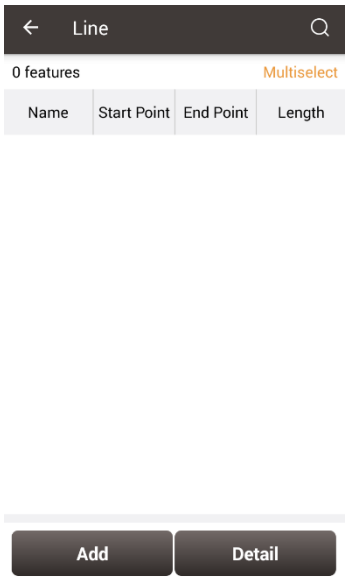

Figure 2.30 Line interface

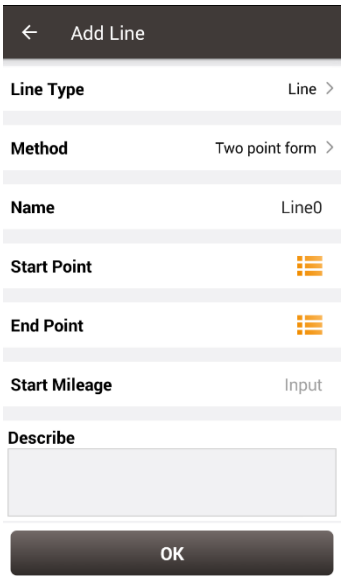

Figure 2.31 Add Line method 1

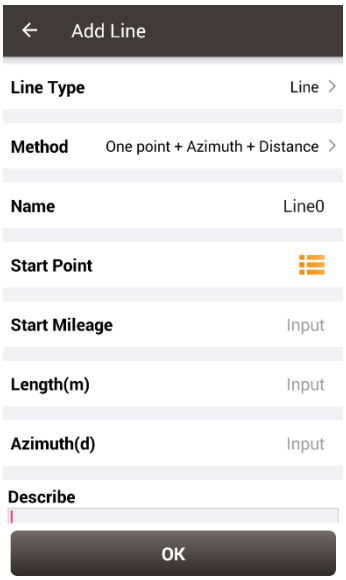

Figure 2.32 Add Line method 2

Two methods are used to add a line: Two Points and One point + Azimuth +Distance.

- Two Points:

Input the name of the line, then click to import the start point and end point.

- One point + Azimuth + Distance

Input the name of the line, then click to import the start point from a point library.

Input the other information for the line.

2.5.2 Search Line

Click the icon at the up-right corner, the line query interface is shown as below. Input the search items and tick the item, click [OK] to search the line.

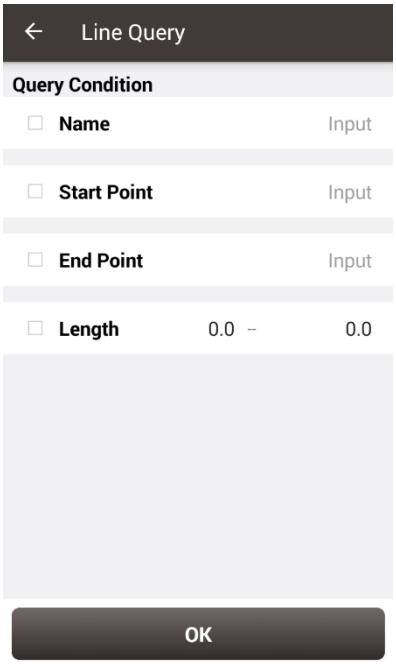

Figure 2.33 Line Query interface

2.5.3 Edit Line

In the Line interface, select the line to be edited. Then click [Detail] to enter the edit page, more details about edit refer to section 2.5.1 Add Line.

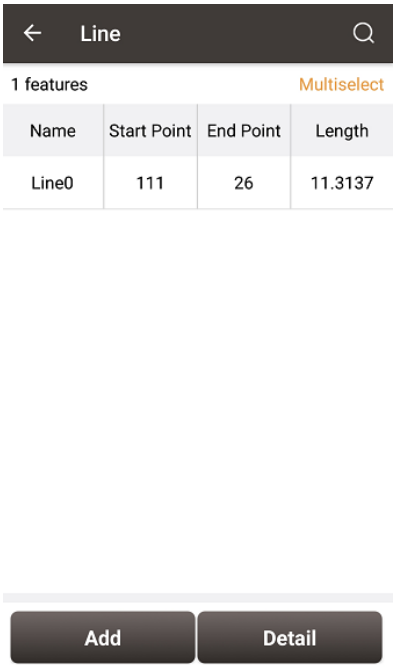

Figure 2.34 Line interface

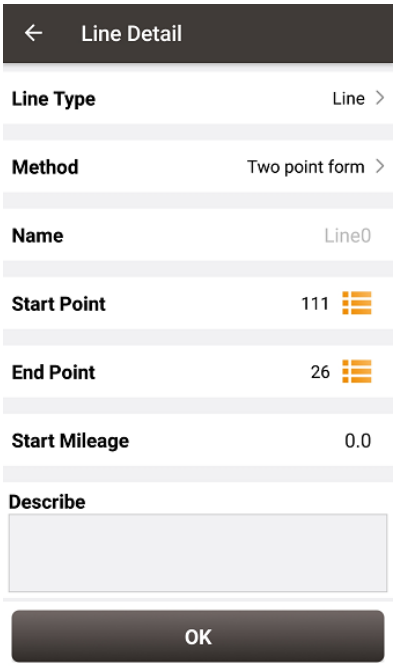

Figure 2.35 Line Detail interface

2.5.4 Delete Line

In the Line interface, click [Multiselect] to enter the following interface. Tick the line to be deleted, then click [Delete] to complete deletion.

Figure 2.36 Line interface

Figure 2.37 Tick the line to be deleted

2.6 Import

There are two types of import: Coordinate Import and Other Import. Coordinate import is to import files with .csv and .dat format. Other Import is to import files with .dxf and .shp format. Currently .dxf and .shp files are not supported.

2.6.1 Coordinate Import

Under the Coordinate Import interface, select Type, Target Point library to be added, Data Format, File Format and the file path where the file is located, click [Import] to complete the import.

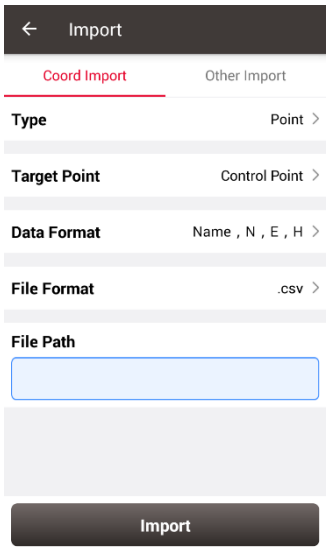

Figure 2.38 Import interface

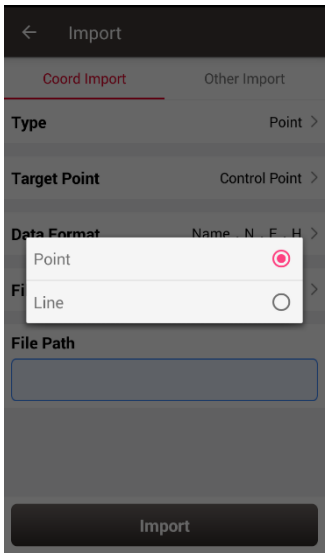

Figure 2.39 Import Type

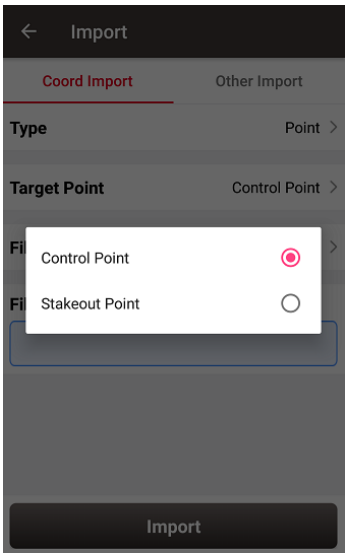

Figure 2.40 Target Point Library

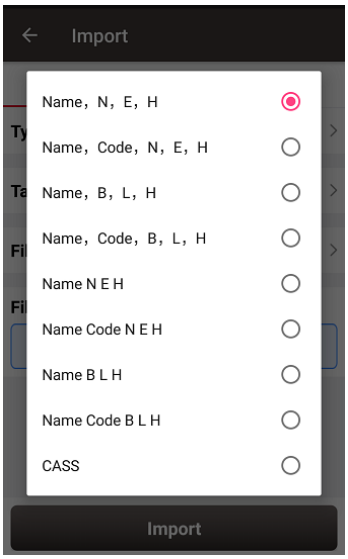

Figure 2.41 Data Format options

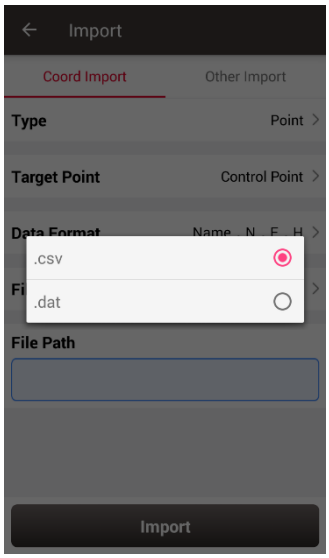

Figure 2.42 File Format options

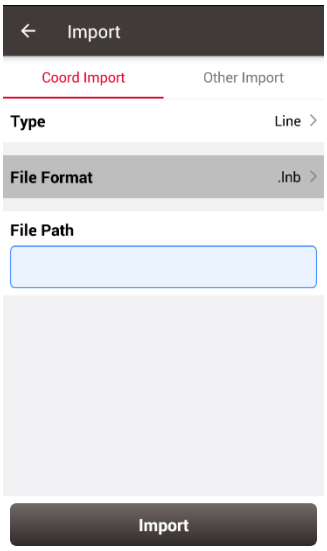

Figure 2.43 Import Line interface

2.6.2 Other Import

Under the Other Import interface, select the file type and the file path, click [Import] to import the file. Currently this function is not support and is to be developed.

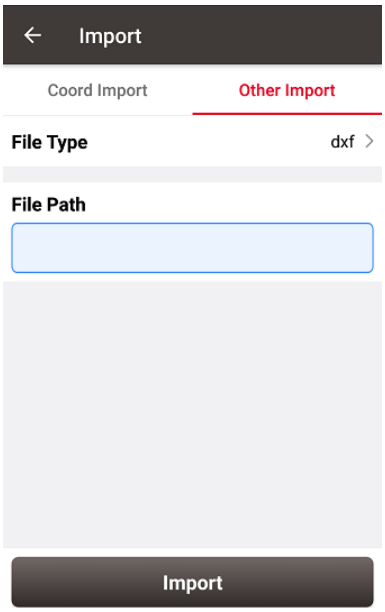

Figure 2.44 Other Import interface

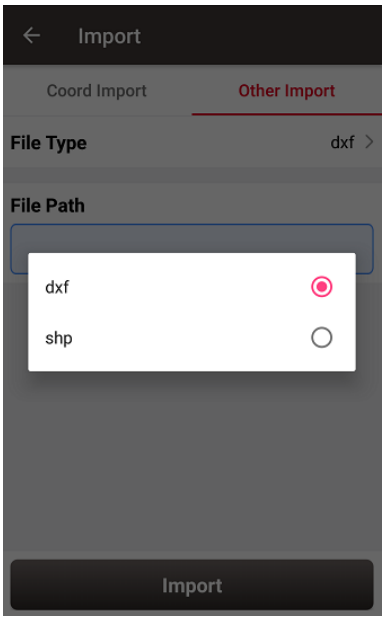

Figure 2.45 File Type for other import

2.7 Export

Correspondingly there are two types of export: Coordinate Export and Other Export. Coordinate Export is to export .csv files, Other Export is to export files with .kml, .shp and .dxf format.

2.7.1 Coordinate Export

Under the Coordinate Export interface, select Point Type, Date range and Data Format, ensure the File Name and Storage Path is correct, thereafter click [Export] to complete the export. For Data Format, there is a list of options provided to select, and a user-defined format can be created.

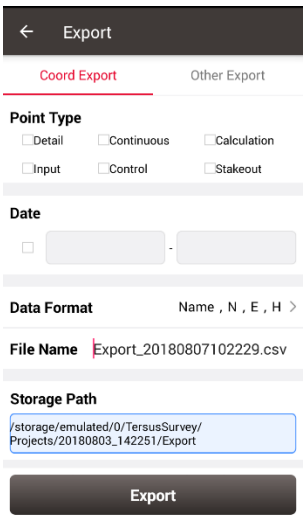

Figure 2.46 Export Interface

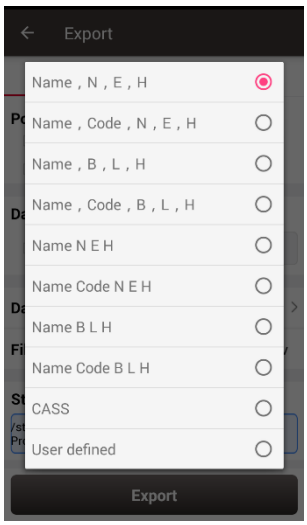

Figure 2.47 Data Format options

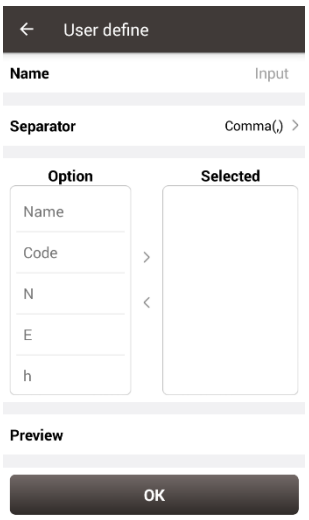

Figure 2.48 User defined data

2.7.2 Other Export

Under the Other Export interface, file format can be KML, SHP or DXF. Type in the export file name and click [Export] to complete the file export.

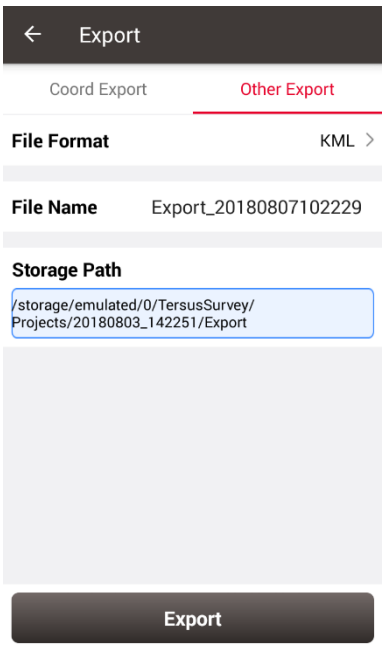

Figure 2.49 Other Export interface

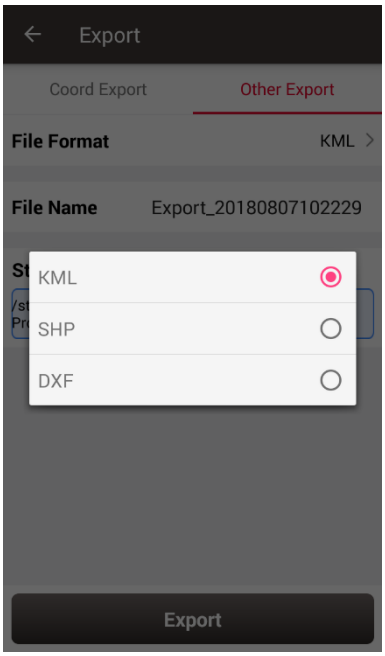

Figure 2.50 File Format for other export

2.8 Settings

Settings interface is shown as below, the function descriptions is as follows.

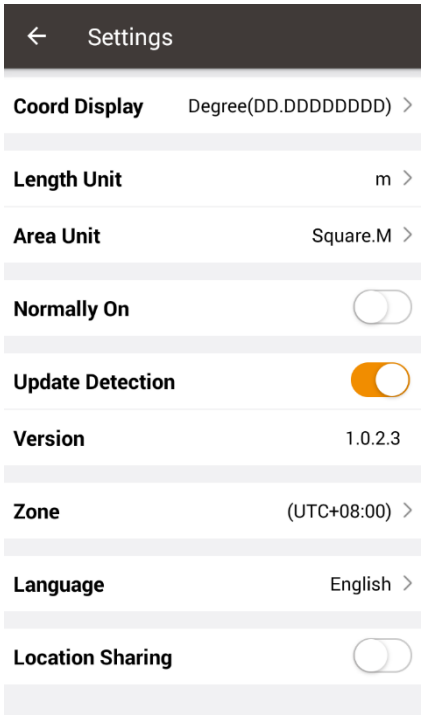

Figure 2.51 Settings interface

[Coord Display]: can be selected from degree (DD.DDDDDDDDD), DM (DD:MM.MMMM) or DMS (DD:MM:SS.SS).

[Length Unit]: can be selected from Km, meter, Inch or Feet.

[Area Unit]: can be selected from Mu, Square Km, Square Meter, Hectare and Acre.

[Normally On]: the screen would be always on if it is enabled.

[Update Detection]: Auto update detection is on if it is enabled.

[Version]: the current version of the Nuwa app.

[Zone]: select the time zone according to the current position.

[Language]: support Auto, Chinese, English, French, Spanish, German, Portuguese, Italian, Russian, Japanese, Korean, Malay, Arabic, Thai, and Turkish.

[Location Sharing]: the location would be shared with other apps if it is enabled.

3. Device

- Connect
- Data Terminal
- Base
- Rover
- Device Info
- Demo

3.1 Connect

There are two ways to enter the Connect interface: Click [Device] -> [Connect] or click [

] on the up right corner in the status bar. Screenshots and descriptions are as follows.

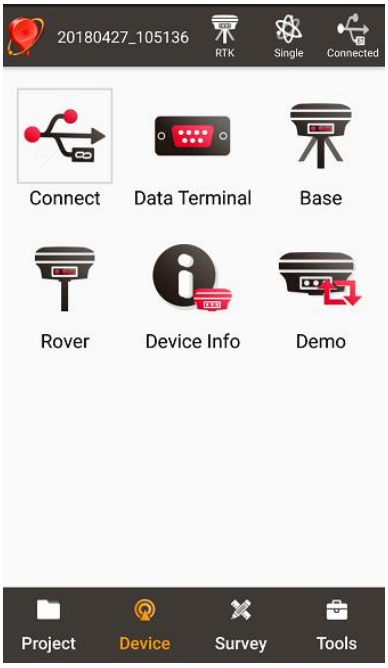

Figure 3.1 Device functional group

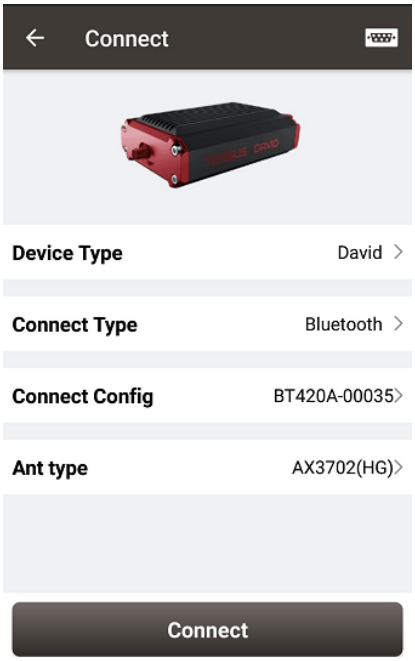

Figure 3.2 Connect interface

[Device Type]: can be selected from David or NeoRTK2[1].

[Connect Type]: can be selected from USB or Bluetooth

[Connect Config]: shows the device name to be connected

[Ant type]: can be selected from the antenna list, the default is AX3702 (HG). An antenna with user-defined parameters can be used.

Note 1: currently only David is supported. Check with Tersus technical support if more details are needed.

3.2 Data Terminal

In the data terminal interface, the output loggings can be monitored. The data is output in hex format. Click [Paused] to pause the output logging. Click [Clear] to clear the screen. The data can be saved in a txt file. Click [Commands] to output common NMEA loggings.

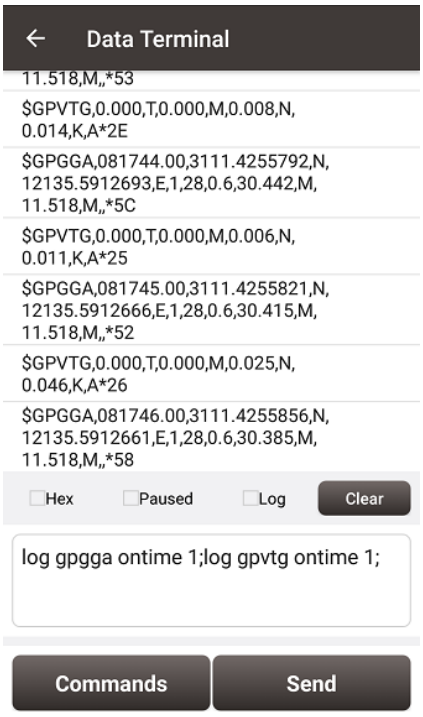

Figure 3.3 Data Terminal interface

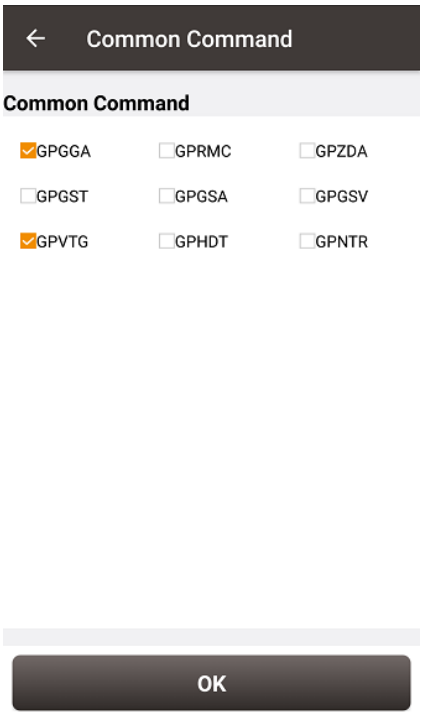

Figure 3.4 Common Command

3.3 Base

Four default base configurations are provided as in the base main interface. Click [New] to create a new base configuration. Select a configuration file in the Work Mode List and click [Detail] to edit the base configuration. Click [Start] to complete the base configuration.

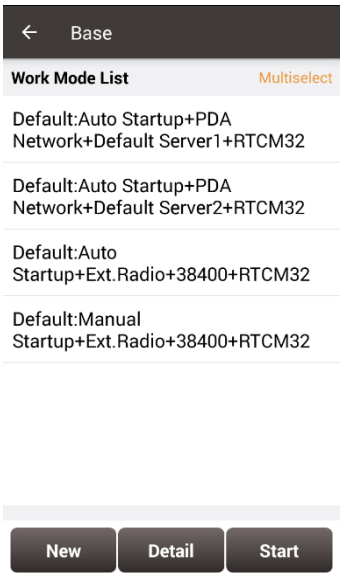

Figure 3.5 Base interface

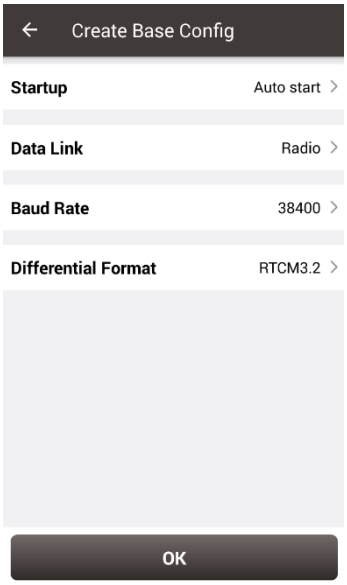

Figure 3.6 Create Base Configuration

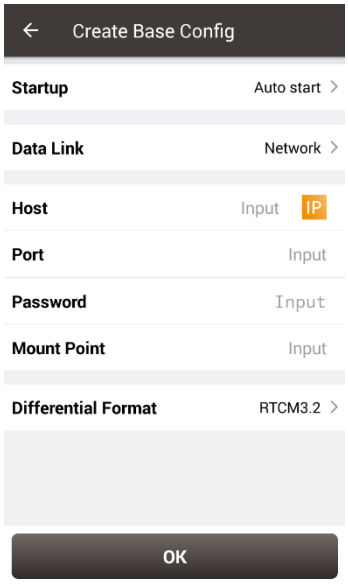

Figure 3.7 Auto start - Network

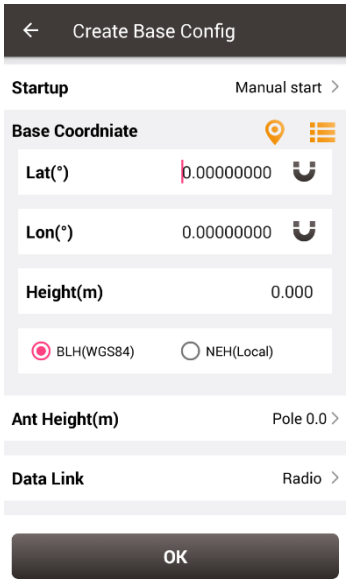

Figure 3.8 Manual start - Radio

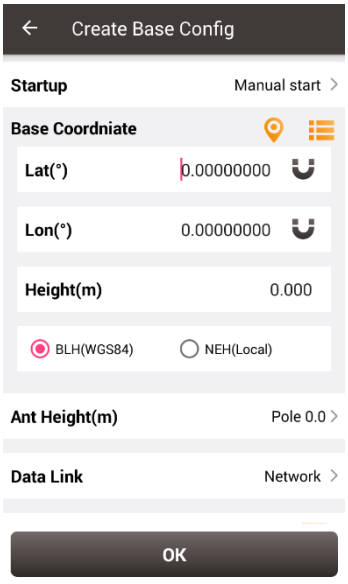

Figure 3.9 Manual Start - Network

The base configuration includes: startup mode, data link, antenna height, differential format and differential format. The details are described as below:

[Startup]: auto start or manual start

- Auto start: the position of the base is achieved automatically.

- Manual start: position points are achieved by averaging collection, loaded from a point library or input manually.

[Ant Height]: antenna type is vertical, slant or pole, antenna height is input manually.

[Data Link]: radio or network

- Radio: the corrections are output / input to / from an external radio, baud rate should be selected accordingly.
- Network: the corrections are uploaded / downloaded to / from a NTRIP host. The IP address, port, password and mount point of the host should be input manually.

[Differential Format]: CMR, CMR+, RTCM2.3 and RTCM3.2 are supported.

3.4 Rover

Three default rover configurations are provided in the Rover main interface. Click [New] to create a new configuration. Select a configuration file in the Work Mode List and click [Detail] to edit the rover configuration. Click [Start] to complete the rover configuration.

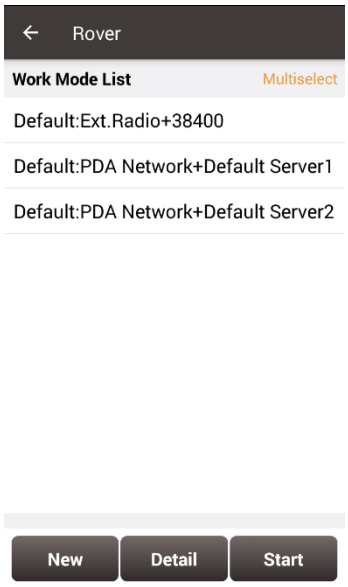

Figure 3.10 Rover interface

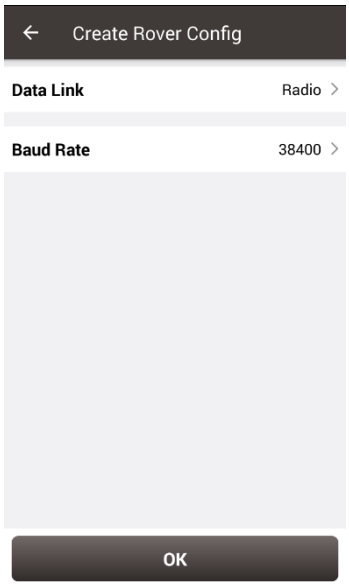

Figure 3.11 Create Rover Configuration - Radio

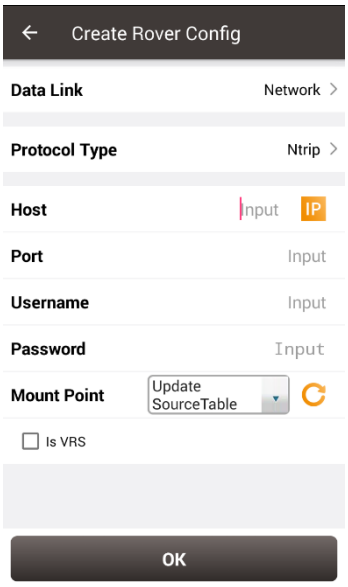

Figure 3.12 Create Rover Configuration - Network

3.5 Device Info

Under the Device functional group, click [Device Info] to check the detailed information about the device connected. Click [Reset] or [Register] to complete related operations

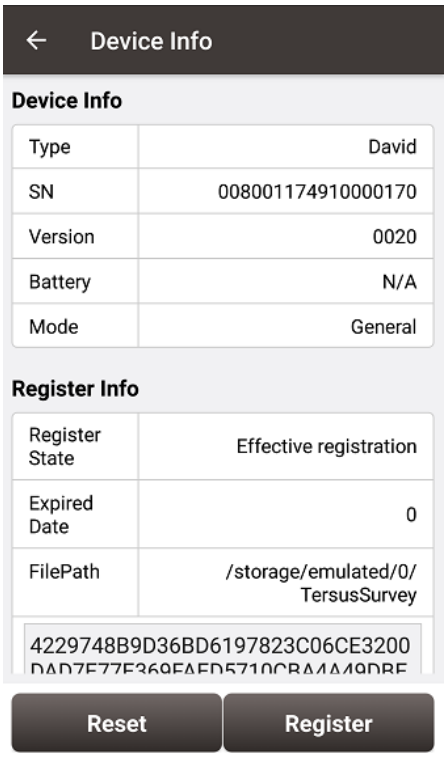

Figure 3.13 Device Info interface

3.6 Demo

This module is to be developed.

4. Survey

- Point Survey
- Point Stakeout
- Line Stakeout
- Static Survey
- Point Correction
- Survey Config
- Base Shift

4.1 Point Survey

The main interface of Point Survey includes: status bar, background map, tools and information.

Figure 4.1 Point Survey – Drawing mode

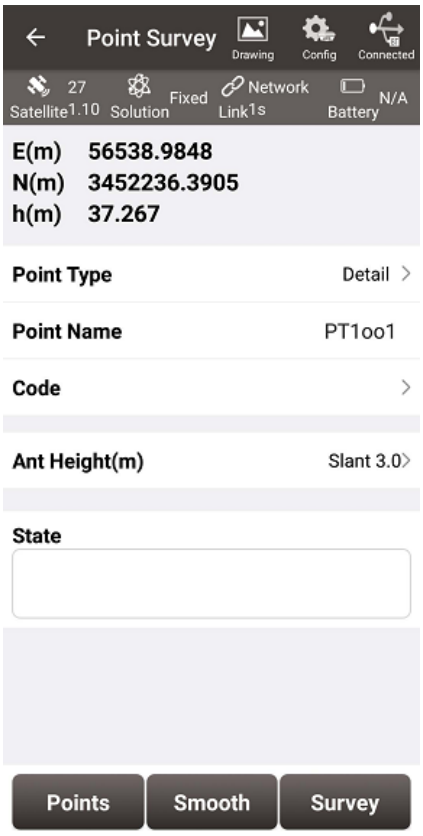

Figure 4.2 Point Survey – Text mode

- Status Bar

[Text]: the main interface is shown in text mode or drawing mode, click this icon to switch between the two modes.

[Config]: Survey Configuration, refer to section 4.6 for more details.

[Connected]: connection status with a David receiver, refer to Connect for more details.

[29 Satellite 1.10]: number of satellite traced, e.g., 29 means 29 satellites are tracked, and 1.10 indicates the PDOP value.

[Solution Fixed]: satellite position type, includes Single, Float and Fixed.

[

]: the upper right word indicates the data link type: radio or network; the lower right time is the latency of the data link.

[

]: indicates the remaining battery power of David receiver.

- Background Map

[]: edit the survey point library.

[]: click it to switch among none, OSM online map and Google online map.

[]: zoom in the map.

[]: zoom out the map.

[]: zoom with the current location at the center.

[]: place all the points in one view.

- Tools

After survey points are collected, information in blue color is displayed at the up left corner. There are two methods to collect survey points:

[]: Auto collect, refer to section 4.6.1 Comm Config for more details.

[]: Manual collect

- Information Bar

Six information items are displayed, each can be chosen from the 18 items in the following screenshots.

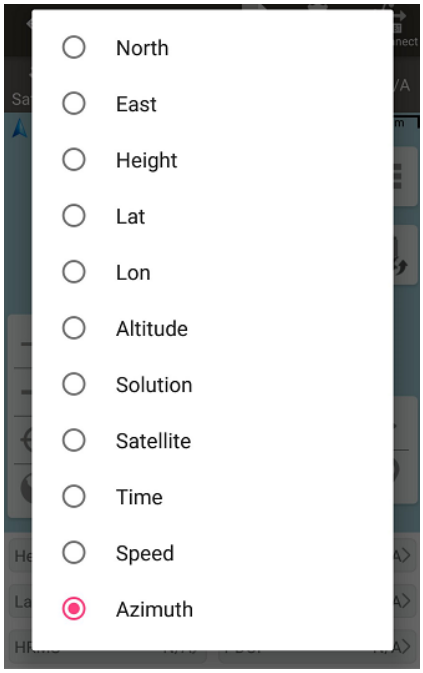

Figure 4.3 Information option list – part 1

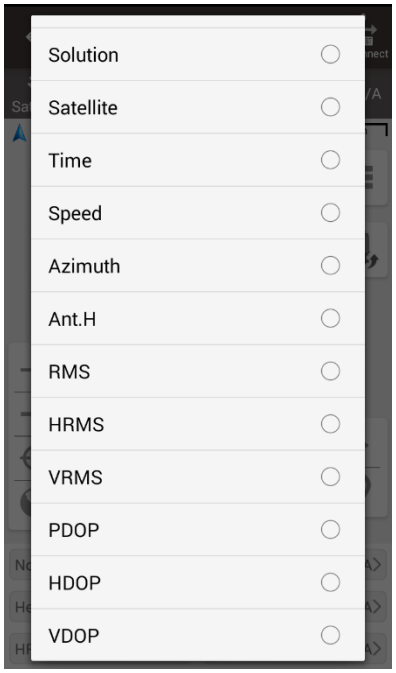

Figure 4.4 Information option list – part 2

4.2 Point Stakeout

Figure 4.5 Point Stakeout interface

The above screenshot is the main interface of point stakeout, which is similar to that of point survey. The main steps are as follows:

- Add stakeout point: click to enter the stakeout point library, refer to section 2.4 for point library management.
- Select the point to be stakeout: select the point, then click [Select].
- The offset between the current point and the target point is displayed on the screen. The arrow icons and are used to browse the stakeout points in the library.

4.3 Line Stakeout

Figure 4.6 Line Stakeout interface

The above screenshot is the main interface of line stakeout, which is similar to that of point survey. The main steps are as follows:

- Click to enter line stakeout library. Refer to section 0 for editing line library.
- Select the stakeout line, click [Select].
- The offset between the current point and the target point is displayed on the screen. The arrow icons and are used to browse the stakeout lines in the library.

4.4 Static Survey

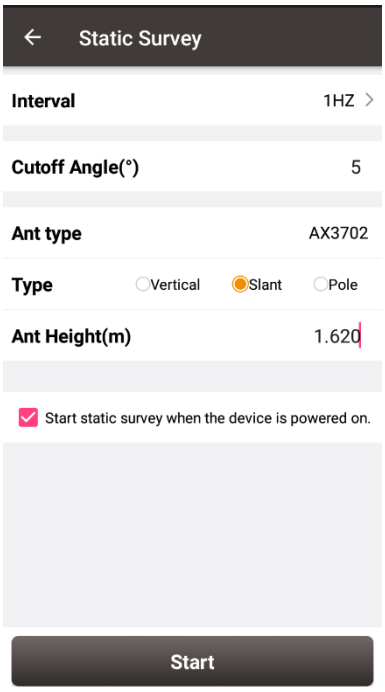

Figure 4.7 Static Survey interface

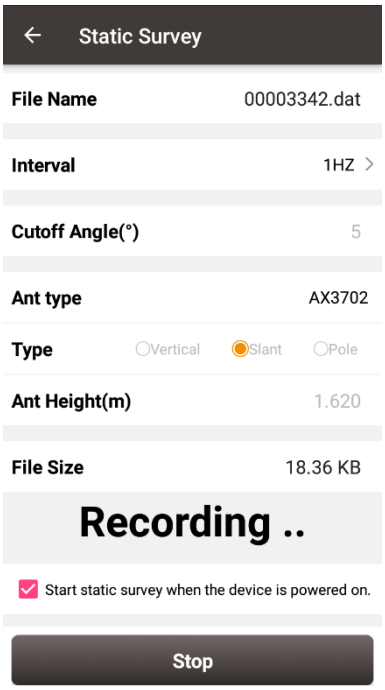

Figure 4.8 Static data recording

[Interval]: selected from 20HZ, 10HZ, 5HZ, 1HZ, etc. The max rate is determined by the device connected.

[Cutoff Angle]: the cut off angle.

[Ant Type]: the antenna type.

[Type]: selected from vertical, slant or pole.

[Ant Height]: the height of the antenna.

After all the parameters are confirmed, click [Start] to start data collection.

4.5 Point Correction

The point correction is to find the mathematical conversion relationship (transition parameter) between WGS-84 and the local plane Cartesian coordinate system. There are three calculation types: four-parameter, height-fitting, and four-parameter + height-fitting.

There are three methods for height-fitting: fixed difference correction, plane fitting and surface fitting.

4.5.1 Four Parameter

At least two paired points are needed for Four Parameter type. Click [Add] to input the original coordinate values and the target coordinate values. Refer to section 2.4 about how to add points in the library.

4.5.2 Height Fitting

The number of points is different when different height fitting methods are used, the details are as follows:

Fixed Difference Correction: at least one paired point is needed.

Plane Fitting: at least three paired points are needed.

Surface Fitting: at least six paired points are needed.

Refer to section 2.4 about how to add points in the library.

4.5.3 Four Parameter + Height Fitting

The number of points is different when different height fitting methods are used, the details are as follows:

Fixed Difference Correction: at least two paired points for local parameter calculation and one paired point for fixed difference are needed.

Plane Fitting: at least two paired points for local parameter calculation and three paired points for plane fitting are needed.

Surface Fitting: at least two paired points for local parameter calculation and six paired points for surface fitting are needed.

Refer to section 2.4 about how to add points in the library.

4.6 Survey Config

During data collection, restrictions are given to solution type and HRMS limits, hence only the data meeting the restrictions can be saved. More details are as follows:

4.6.1 Comm Config

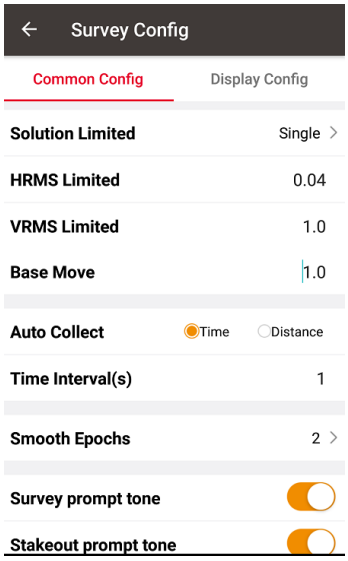

Figure 4.9 Survey Config – Common Config

[Solution Limited]: includes Single, DGPS, SBAS, Float and Fixed. The solution accuracy (from high to low) is: Fixed > Float > SBAS > DGPS > Single.

[HRMS Limited]: horizontal RMS limit. Data would not be collected if its HRMS is greater than this limit.

[VRMS Limited]: vertical RMS limit. Data would not be collected if its VRMS is greater than this limit.

[Base Move]: If the base moves over this limit, the data collection would not be finished.

[Auto Collect]: data can be collected according to Time or Distance.

If Time is selected, ensure to input the time interval.

If Distance is selected, ensure to input the distance interval.

[Smooth Epochs]: smooth epoch can be 2, 3, 5 or 10 seconds.

[Survey Prompt Tone]: can be enable or disabled.

[Stakeout Prompt Tone]: can be enable or disabled.

[Stakeout Prompt Type]: can be North and South direction or Forward and Backward.

[Ant Type]: Antenna parameters.

[Type]: height type, can be vertical, slant or pole.

[Ant Height]: value of the antenna height.

4.6.2 Display Config

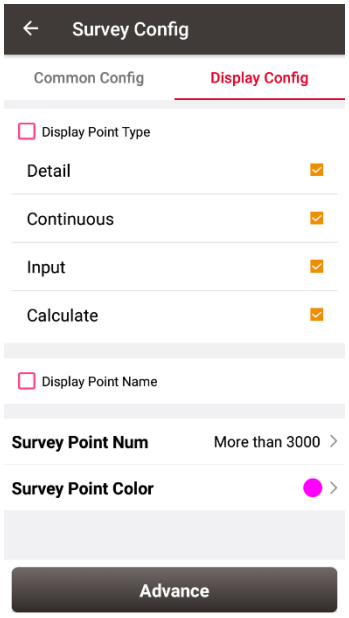

Figure 4.10 Survey Config – Display Config

Figure 4.11 Survey Point Color

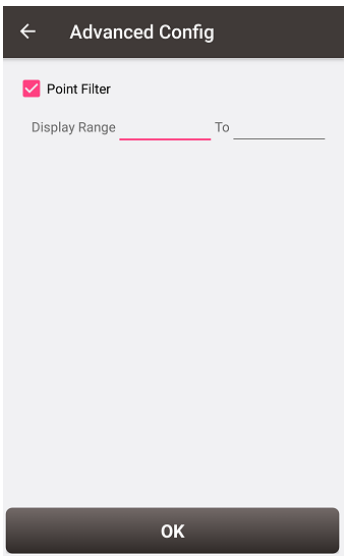

Figure 4.12 Advanced Config for Display Config

Select the Display Point Type and Display Point Name according to the application. Select Survey Point Number: more than 3000 or under 3000. Click [Survey Point Color] to select a color on the outer ring for the survey points and click the inner pie to confirm the color. Click [Advance] to filter the displayed points.

4.7 Base Shift

When the base is moved or re-configured in auto start mode, base shift should be done to ensure the points collected after the base is moved have the same accuracy as those points before the base is moved. The steps are as follows:

Click [Base Shift] to enter the following interface, click the list icon on the right of GNSS Point and Known Point to select a known point. The base shift is calculated automatically. The shift is applied to all the points to be surveyed.

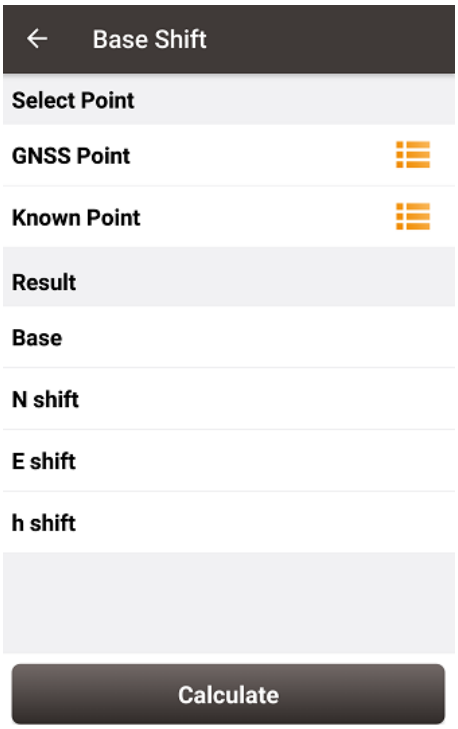

Figure 4.13 Base Shift interface

5. Tools

- Area Perimeter
- Distance Calculation
- Offset Point
- Rotation Point
- Two Points Intersection
- Four Points Intersection
- Azimuth
- Intersection Angle

5.1 Area Perimeter

This tool is used to calculate area and perimeter. The points can be imported from the point library by clicking the list icon on the upper right corner. The unit is meter for perimeter and square meter for area.

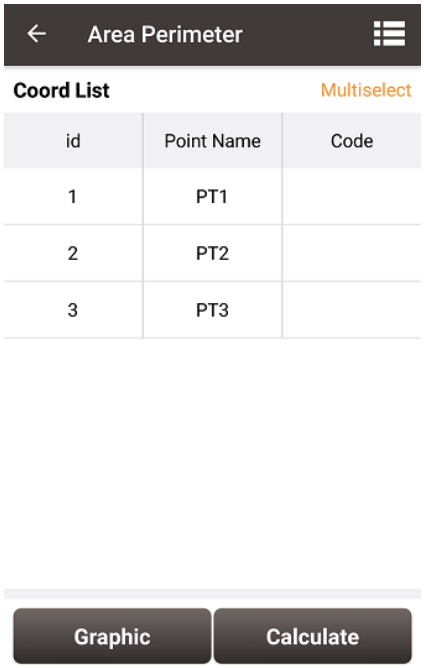

Figure 5.1 Area Perimeter interface

[Graphic]: shows the closed polygon formed by the points.

[Calculate]: calculates the area and perimeter of the closed polygon.

[Multiselect]: enters point edit interface to inverse or delete.

5.2 Distance Calculation

There are two kinds of distance calculation: point to point, and point to line. The points can be imported from the point library.

5.2.1 Point to Point Distance

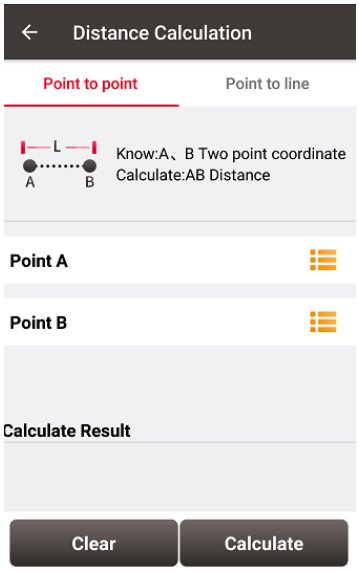

Figure 5.2 Distance Calculation – Point to Point

Import point A and point B from the point library.

[Calculate]: calculate the distance between the two points.

[Clear]: clear the result.

5.2.2 Point to Line Distance

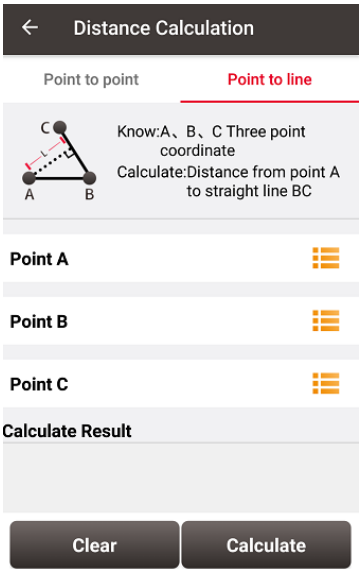

Figure 5.3 Distance Calculation – Point to Line

Import a point from the library to calculate the distance from point A to line BC.

[Calculate]: calculate the distance.

[Clear]: clear the result.

5.3 Offset Point

Given point A, AP's horizontal length L and height H, calculate the coordinate of P. The steps are as follows:

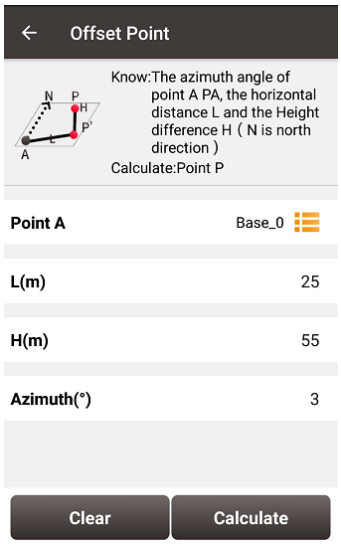

Figure 5.4 Offset Point interface

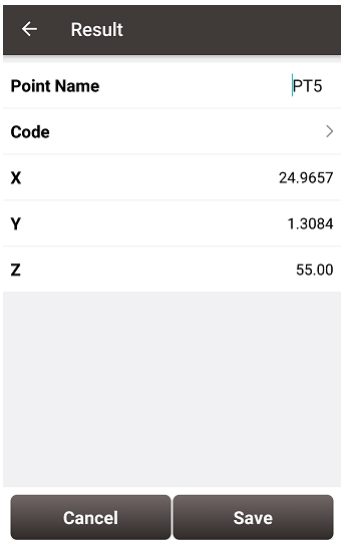

Figure 5.5 Offset Point calculation result

[Calculate]: calculate the coordinate of point P.

[Clear]: clear the current result.

5.4 Rotation Point

Given the coordinates of point A, B and the rotation angle (clockwise), calculate the coordinate of point B after rotation.

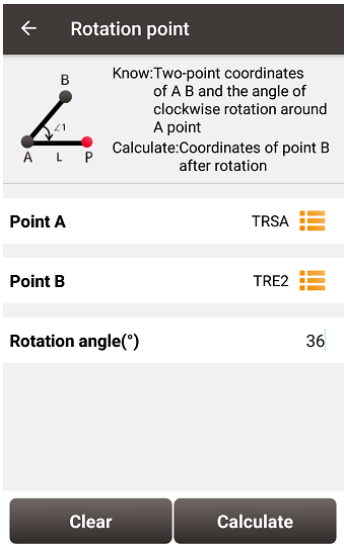

Figure 5.6 Rotation Point interface

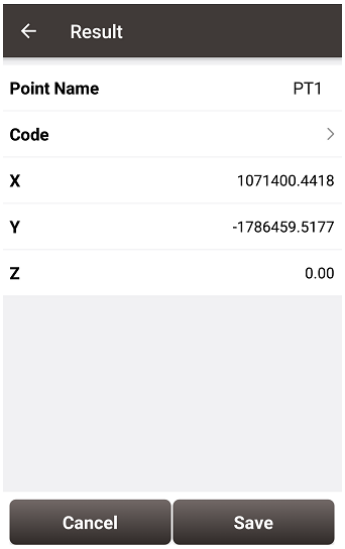

Figure 5.7 Rotation Point Calculation result

[Calculate]: calculate the coordinate of point B after rotation.

[Clear]: clear the result.

5.5 Two Points Intersection

There are two types of models listed below:

- Model 1: Given the coordinates of point A and B, the angle α between line AB and AP, the angle β between line AB and AP, calculate the coordinate of point P.
- Model 2: Given the coordinates of point A and B, the length of line AB and PB, calculate the coordinate of point P.

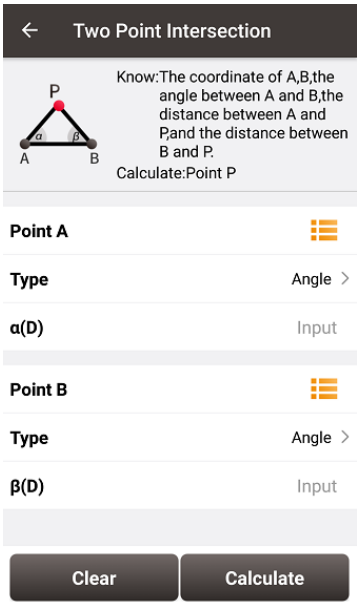

Figure 5.8 Two Point Intersection – Angle

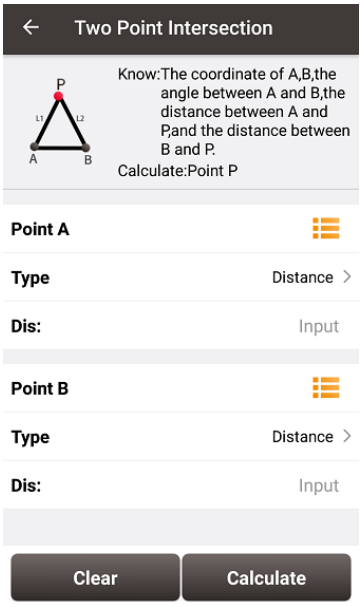

Figure 5.9 Two Point Intersection – Distance

[Calculate]: calculate the coordinate of the intersection P.

[Clear]: clear the result.

5.6 Four Points Intersection

Given line AB and CD, calculate the coordinate of the intersection point P.

Figure 5.10 Four Point Intersection interface

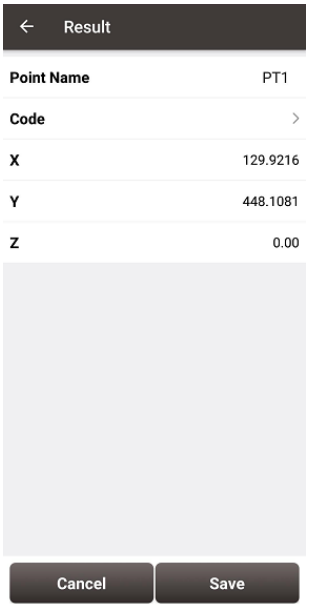

Figure 5.11 Four Point Intersection result

[Calculate]: calculate the coordinate of the intersection P.

[Clear]: clear the result.

5.7 Azimuth

Given the coordinates of point A and B, calculate the heading angle of line AB.

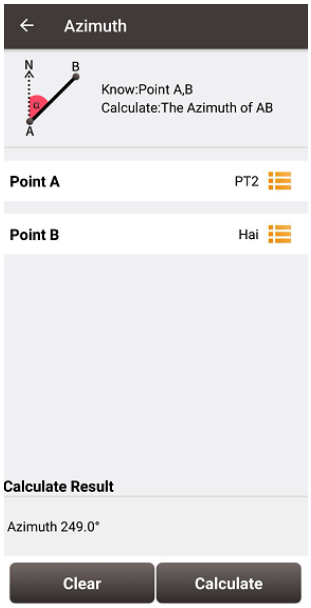

Figure 5.12 Azimuth calculation interface

[Calculate]: calculate the heading of line AB.

[Clear]: clear the result.

5.8 Intersection Angle

Given the coordinates of point A, B and C, calculate the angle ∠ABC

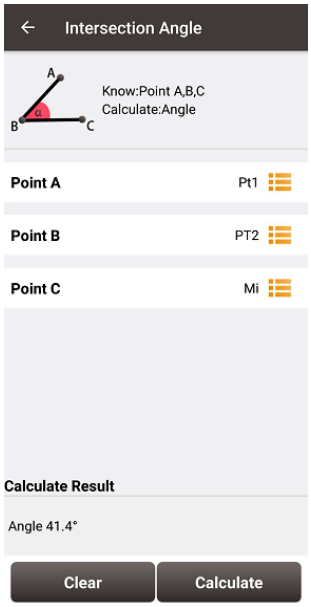

Figure 5.13 Intersection Angle calculation

[Calculate]: calculate the angle ∠ABC.

[Clear]: clear the result.

6. Technical Appendix

6.1 Quick Start

1. Create a new project

Go to [Project] -> [Project], click [New], input the project name, select a CRS or edit with a template CRS, click [OK] to create a project.

2. Connect a device

Go to [Device] -> [Connect], select the device type, connect type, connect config and antenna type, and click [Connect]. Click 

in the status bar can also connect to the device.

3. Configure the base and the rover

A base transmits RTK corrections to an external radio or to network. The position of the base must be input manually or auto start. Nuwa supports RTK uploading to a NTRIP host, which brings convenience for a number of applications.

A rover receives RTK corrections from an external radio or from network. NTRIP and TCP protocols are supported if corrections are received from network.

All the configuration can be managed, such as created, edited and deleted in Nuwa App. A device can be configured to work as a base or as a rover.

4. Point Correction and Base Shift

The point correction is to find the mathematical conversion relationship (transition parameter) between WGS-84 and the local plane Cartesian coordinate system. There are three calculation types: four-parameter, height-fitting, and four-parameter + height-fitting.

There are three methods for height fitting: Fixed Difference Correction, Plane Fitting and Surface Fitting.

In Auto Start mode, if a base is moved or re-installed, Base Shift is necessary to make the points have the same coordinates before and after the power cycle. Main steps:
Go to [Survey] -> [Base Shift], select GNSS points and known points, click [Calculate], the offsets parameters are calculated automatically. The user can apply the parameters on the points to be surveyed. Base Shift also influence coordinates value of other points with this base.

Steps 5 - 8 are action points in fields, select one or more in fields.

5. Point Survey

Go to [Survey] -> [Point Survey] to enter survey interface, which can be in text mode or drawing mode. The main difference between the two modes is whether the drawing is displayed. The configuration refers to section 4.6.1 Comm Config for more details.

Two collection modes: Auto Collect and Manual Collect, refer to section Point Survey for details. All the detailed information about the survey points can be checked in the survey point library.

6. Point Stakeout

Go to [Survey] -> [Point Stakeout] to enter point stakeout interface. Stakeout points must be saved in the stakeout point library before. Select the points to be stakeout and find the target point according to the prompt information by Nuwa, refer to sectionn Point Stakeout for details.

7. Line Stakeout

Go to [Survey] -> [Line Stakeout] to enter line stakeout interface. Stakeout lines muse be saved in the stakeout line library. Select the lines to be stakeout and find all the points on the target line according to the prompt information by Nuwa, refer to section Line Stakeout for details.

8. Static Survey

Go to [Survey] -> [Static Survey] to enter static survey interface. Select the parameters, such as interval, cut off angle, antenna parameters and click [Start], refer to section Static Survey for details.

9. Export

Go to [Project] -> [Export] to enter export interface. Four file formats are supported: csv, dxf, shp and kml. The data to be exported can be filtered by point type and collection time. Click [Start] after all the options are filled.

10. Import

Go to [Project] -> [Import] to enter import interface, which can be divided into Coordinate Import and Other Import.

Coordinate import is to import points in a CSV file, mainly to import points to a library.

Other import is to import the DXF or SHP files for the background. Click [File Path] to input the file directory.

6.2 Static Data Process with David

6.2.1 Preparation

- A David receiver
- A 2pin-USB power cable
- A COMM2-7pin-USB & DB9 data cable
- A USB Type A male to USB Type A male cable or a USB type A male to DB9 male cable
- A power bank
- A computer running TersusDownload tool

Figure 6.1 Preparation for Static Data Process

After the static survey in fields is completed, connect the David receiver to the computer

according to the following figure and power on the David receiver.

The USB port is mapped to a serial port (COM9 in the following example) in the computer, which can be checked in the Device Manager.

Figure 6.2 Connections of David, computer and power bank

6.2.2 File Downloading

Open the TersusDownload on the computer:

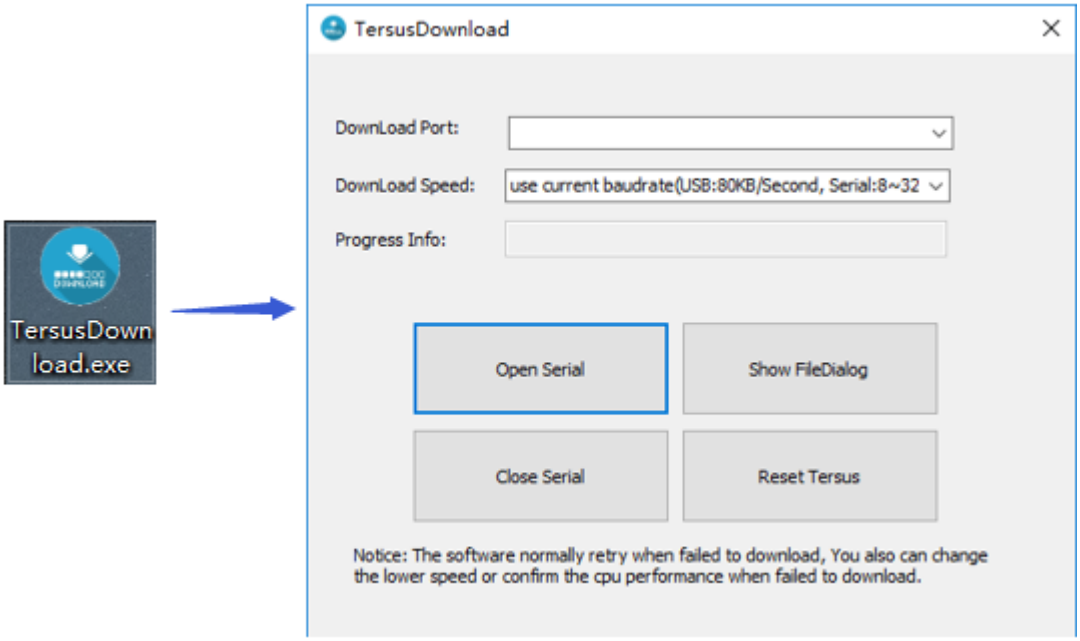

Figure 6.3 TersusDownload interface

Select the serial port to communicate with the David receiver

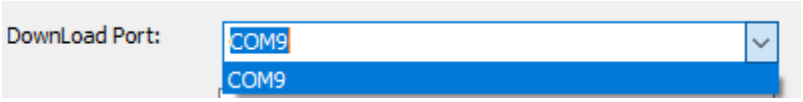

Figure 6.4 Download Port options

Select the download speed (the example is using USB port). Select the baud rate if a serial port is used to download the file.

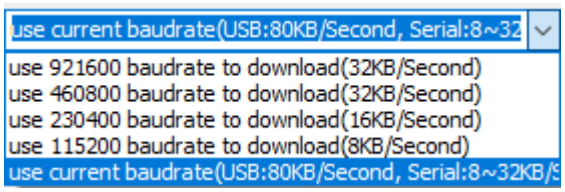

Figure 6.5 Download speed options

Click [Open Serial] in Figure 6.3, all the files on the eMMC card of David receiver would be read and shown in the following figure:

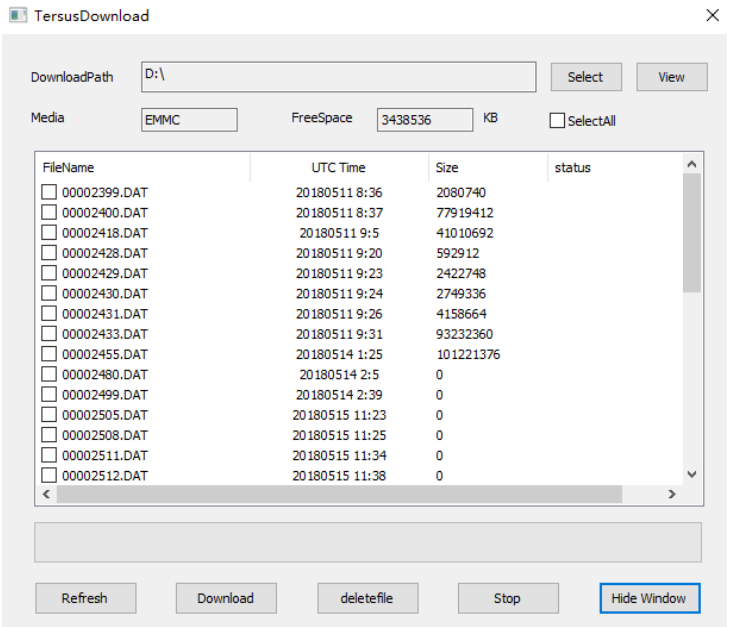

Figure 6.6 Files read on eMMC of David

Select the DownloadPath, select the files to be downloaded, click [Download] to start downloading:

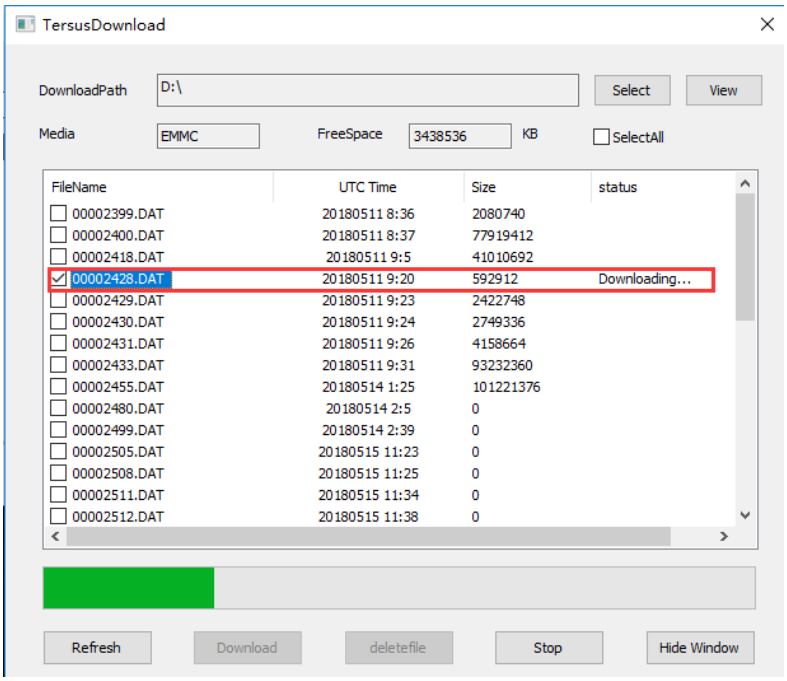

Figure 6.7 File selected is downloading

6.2.3 Convert (Rinex)

Open TersusRinexConverter tool:

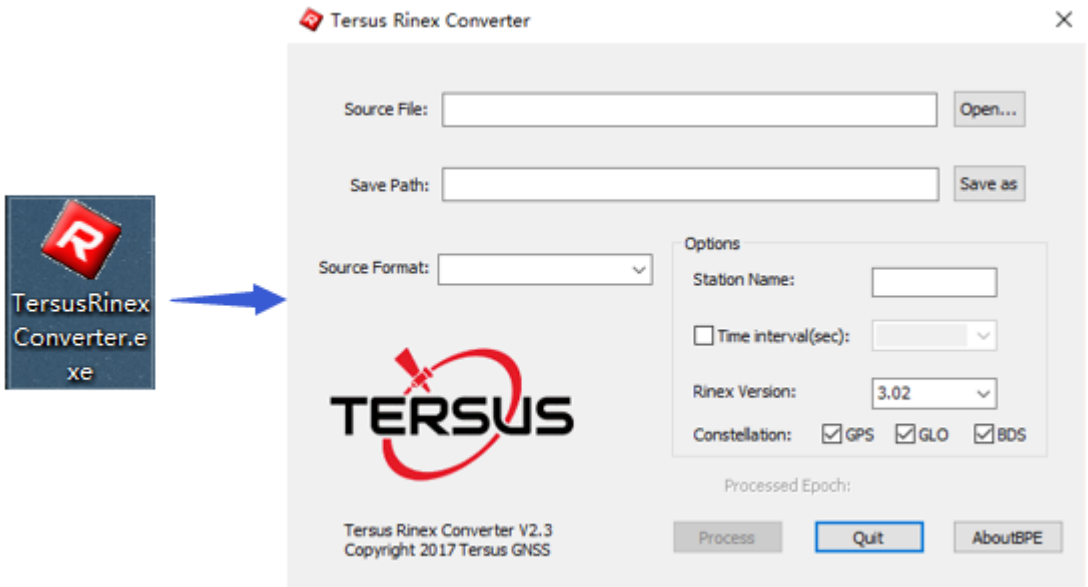

Figure 6.8 TersusRinexConverter interface

Click [Open] on the right side of the Source File, load the downloaded file, select [Precise BX306\316] for the Source Format. Give the Station Name if needed.

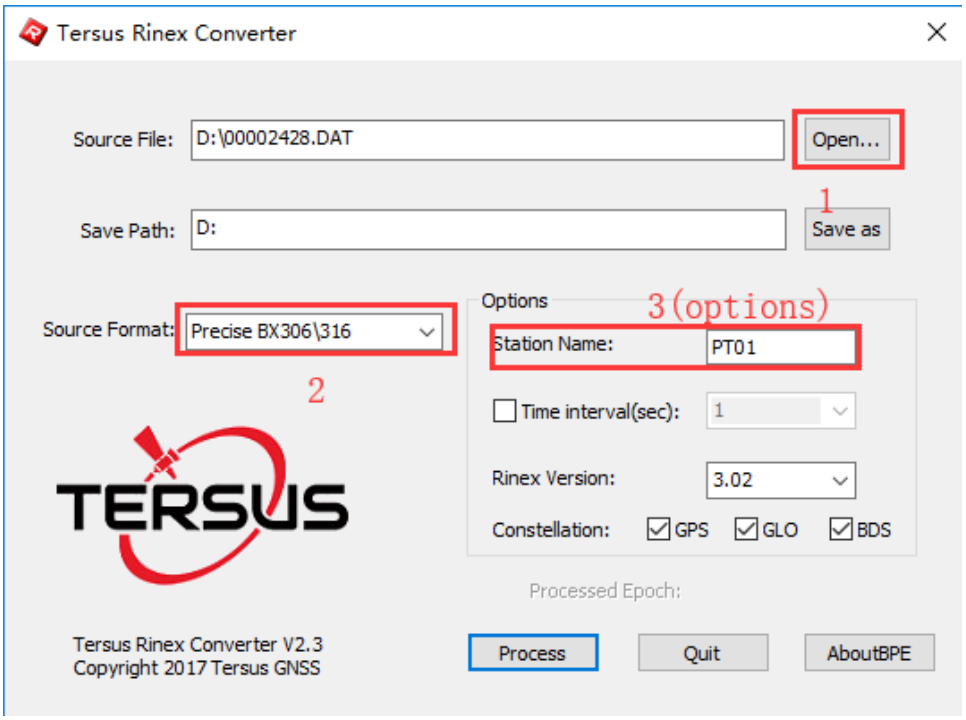

Figure 6.9 Process of converting source file to rinex file

Click [Process] to create Rinex file.

Follow the same steps as above to create all the Rinex files needed.

6.2.4 Data Post Processing

Open TERSUS Geo Office software:

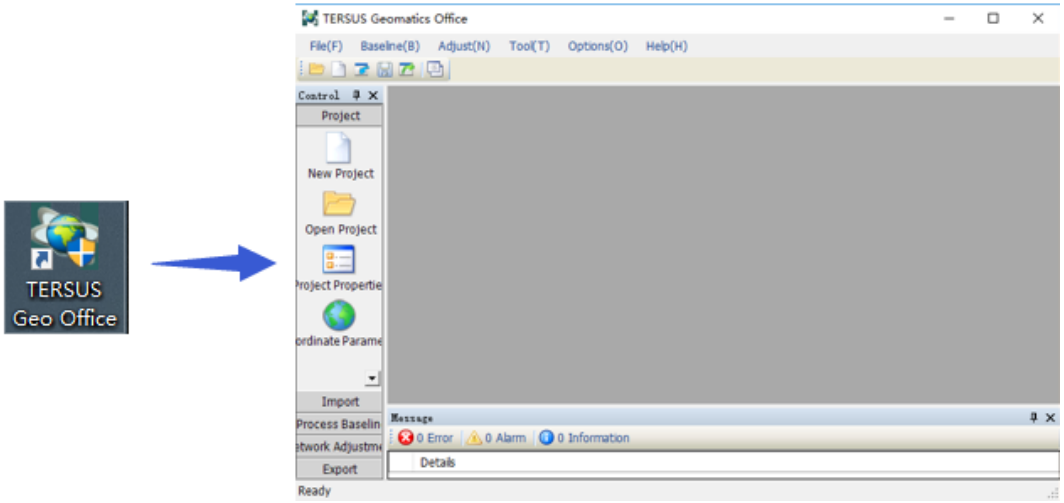

Figure 6.10 TERSUS Geomatics Office interface

After a project is created, click [Import] -> [Import Files]

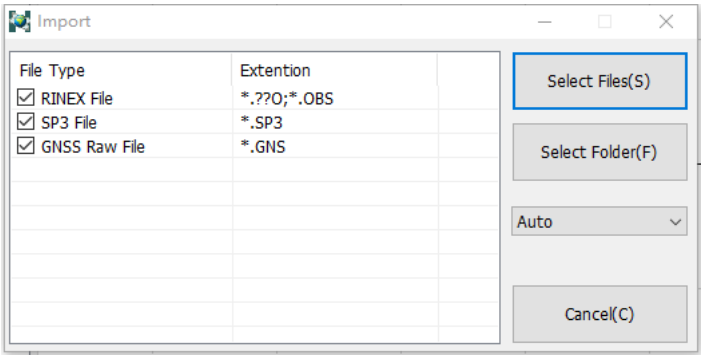

Figure 6.11 Import Files in TERSUS Geo Office

Click [Select Files] to load the Rinex files created in section 6.2.3.

Refer to the user manual of Tersus Geo Office for more details on data post processing.

6.3 Point Correction

1. [Project] -> [New], input a Project Name, select the proper CRS system.
2. [Device] -> [Connect], connect to the David receiver.

Figure 6.12 Create a new project

Figure 6.13 Connect to a David receiver

3. [Device] -> [Rover], configure this David as a rover and ensure the rover can get fixed solution.

Figure 6.14 Configure David as a rover

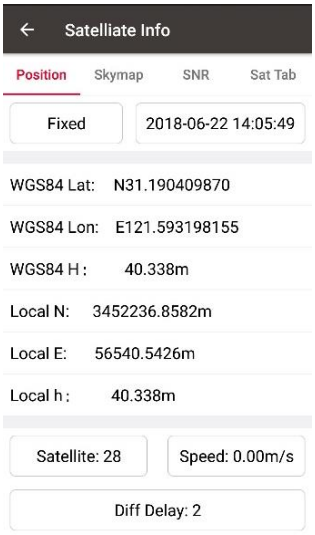

Figure 6.15 Satellite Information

4. [Survey] -> [Survey Config], input the correct antenna height.
5. [Survey] -> [Point correction], select the proper method to calculate. The following example is using four parameter method.

Figure 6.16 Survey Configuration

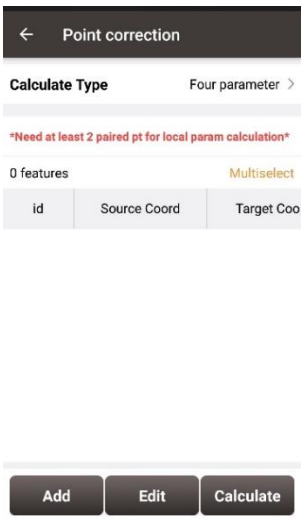

Figure 6.17 Point Correction interface

6. Click [Add], input the point name for the Source Coordinate. Select a point with known WGS-84 coordinates, or survey the point directly. Input the known coordinate in the local CRS for the Target Coordinate.
7. Click [OK].
8. Add the 2nd point with the same procedure as the 1st point.

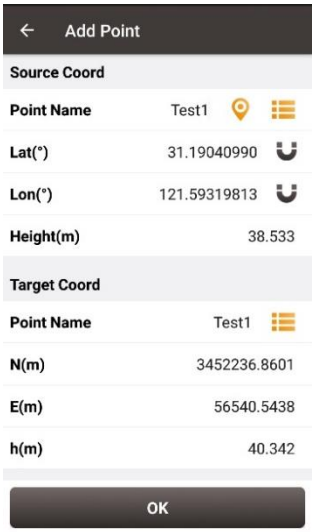

Figure 6.18 Add Point for Point Correction

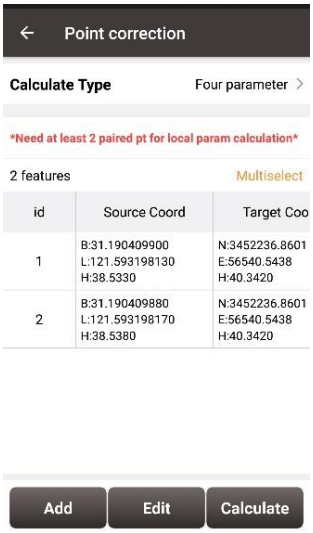

Figure 6.19 Two points added for point correction

9. Click [Calculate] and check the calculation result.
10. Click [Apply] to add the parameters to the project.

Figure 6.20 Calculation result for point correction

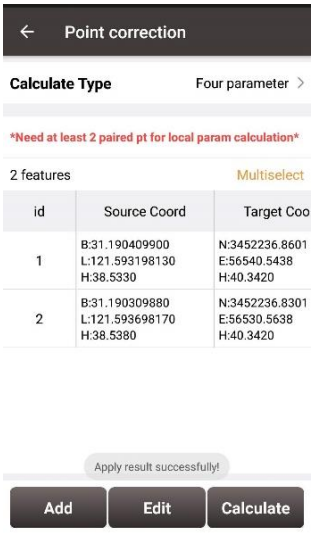

Figure 6.21 Apply result to the project

7. Terminology

Abbreviation	Definition
CRS	Coordinate System
GNSS	Global Navigation Satellite System
OS	Operating System
PDOP	Position Dilution of Precision
RINEX	Receiver Independent Exchange format
RMS	Root Mean Squares
RTCM	Radio Technical Commission for Maritime Services
RTK	Real-Time Kinematic
UI	User Interface
UTM Projection	Universal Transverse Mercator Projection