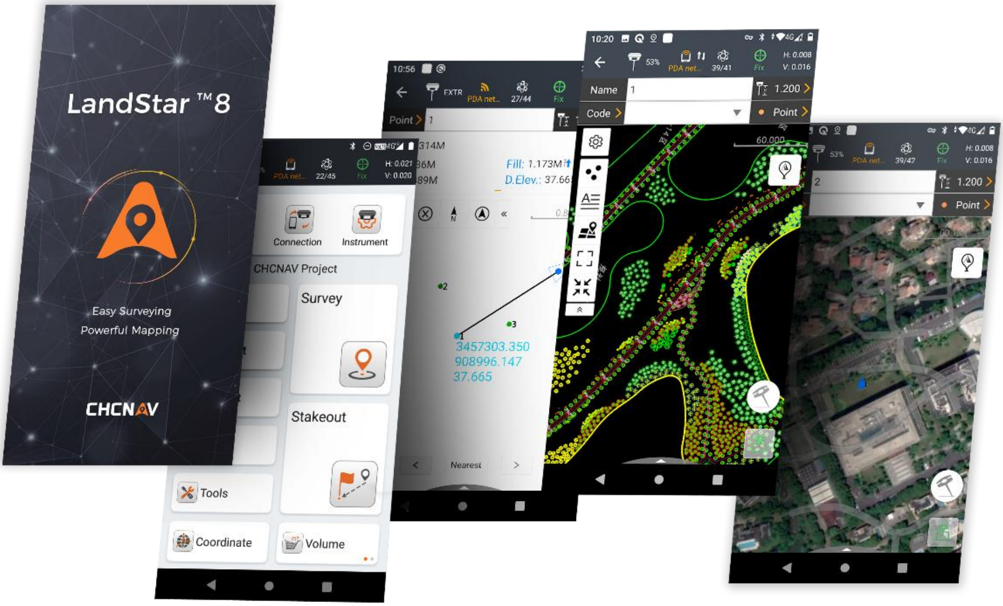
CHCNAV LandStar 8.1

User Guide



Revision 8.1

December 2024

Make your work more efficient

Warning

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Contents

1 LandStar Overview

1.1 Software Description

Thanks for your interest in LandStar, It is the latest measuring software based on Android platform and developed by Shanghai Huace Navigation Technology Ltd.

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

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

Powerful Graphical Surveying: Supports both online OSM/BING/WMS/V-World/Geoportal/Naver/Google Image map and base map (DXF, DWG, SHP, TIF, JPG, KML, KMZ, MBTILES) 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/DWG files as the center line to stake out or survey the cross road.

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

Integrated Hydro Survey: Based on current marine surveying and mapping market, it integrates positioning, routing, navigation, sounding and data export all in one using data from both GNSS receiver and echo sounder. Users can get high precision and high-quality coordinates, depth, seabed elevation, surface elevation and QA for exporting into CSV files.

CHCNAV Cloud Service: Allows for uploading and downloading projects, coordinate systems, work modes, code lists and files.

Localization Packages: Allows you to dynamic updates the followings without updating your software:

1. Predefined coordinate system files.
2. Device connection profile.
3. Grid files.
4. Online map database file.
5. Coordinate system library file.
6. Antenna file.
7. Software help link files.
8. Font files.

1.2 Key Features

One-button Switching Dual Styles

- Simple Style, designed for the entry-level surveyors, with all basic function in one screen.
- Classic Style, designed for professional surveyors, with more functions showing in different tables based on the frequently-used work flow.

Various Base Map Displays

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

Extensive Import and Export Data Formats

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

- Customized import and export contents in CSV, DAT or TXT formats.

Various Types of Measurement

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

Various Peripherals Supported

- Pipeline detector, VIVAX-METROTECH vLoc Pro2.
- Laser rangefinder, Leica Disto 810 touch, Disto 510 touch, and SNDWay SW-S120C, Bosch GLM 50 C, Bosch GLM 120 C.
- Echosounder, Hydrolite DFX, Hydrolite TM, NMEA DPT, NMEA DBT.

Convenient Work Mode Management

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

Standard CGD Correction File

- CHCNAV 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 avaliable, GGF, BIN, GRT DAT, DATCZ, GRD, GSF, GRI, STG, GBL, GXY, OSGB, CGD, JASC, GSA, GSB, BYN, GTX, NEGRID, TXT and ASC formats.

User-friendly Stakeout Interface

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

Multiple Types of Stakeout

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

Correction Repeater Function

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

RTCM Transformation Message

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

Base Map rotates

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

1.3 Software Installation

Method 1: Copy the software (LandStar 8.1.apk) onto Android devices, touch screen to start the installation program. After installation, it will generate LandStar app on the desktop, click the icon to run the software. Please get the LandStar apk file from CHCNAV local dealers.

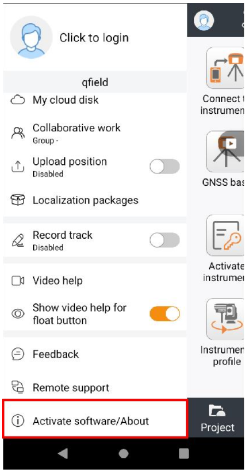
Method 2: Download CHCNAV Installation Manager from Google Play Store and then upgrade to LandStar via CHCNAV Installation Manager.

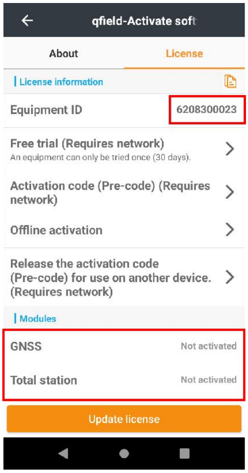
Method 3: Go to About interface, tap Check for Update, the LandStar version will pop up, tap Update Now to update the software to the latest version.

1.4 Register LandStar

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

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



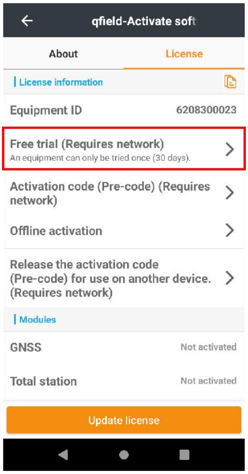


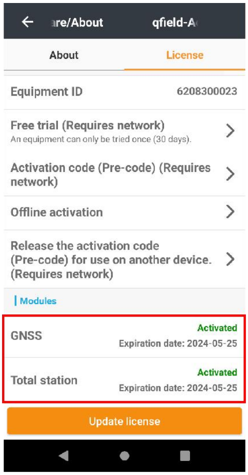
Whether using the HCE600 controller or other devices, there will be a Equipment ID, which will be an important part of our query for this device pre-code.

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

1.4.1 Free trial (Requires network)

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



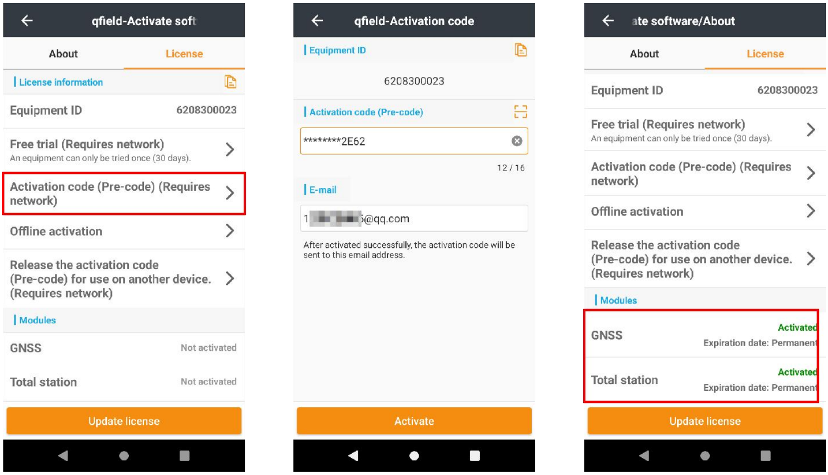


If you still need to use LandStar after using the free registration, please contact the regional sales manager or dealer to obtain a temporary or permanent registration code. For the registration method, See section 1.4.2 and 1.4.3.

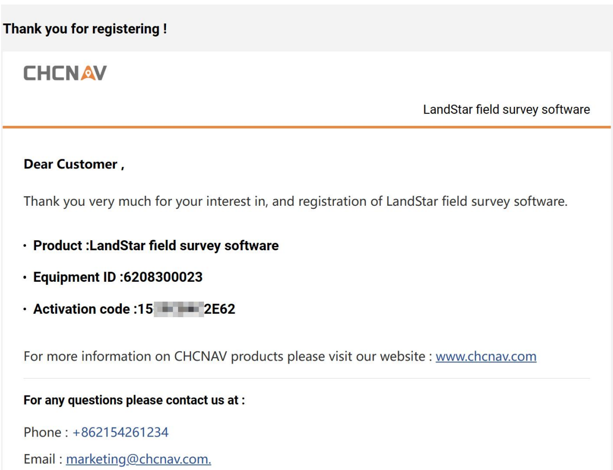
1.4.2 Online Activaton

1.Activation code(Pre-code)

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



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



Thank you for registering !

LandStar field survey software

Dear Customer ,

Thank you very much for your interest in, and registration of LandStar field survey software.

- **Product :LandStar field survey software**
- **Equipment ID :6208300023**
- **Activation code :15[redacted]2E62**

For more information on CHCNAV products please visit our website : www.chcnav.com

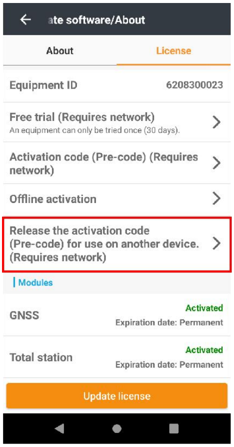
For any questions please contact us at :

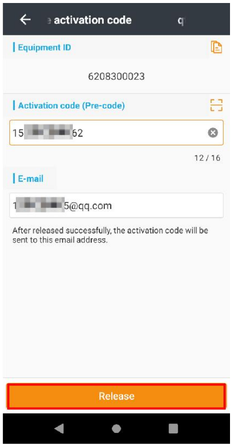
Phone : +862154261234

Email : marketing@chcnav.com.

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

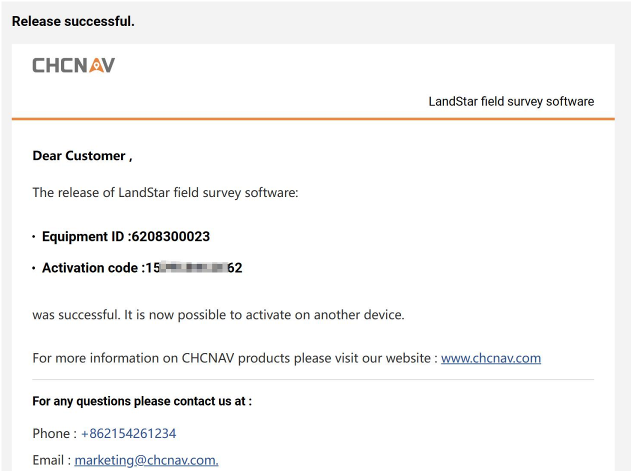
When the user needs to unbind the pre-code bound to use on another device, click **Release the acrivaton code(Pre-code),** enter the pre-code and the same E-mail again, and click **Release,** the pre-code is successfully unbound when the message **"Successfully Released"** is displayed.





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

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


Release successful.

LandStar field survey software

Dear Customer ,

The release of LandStar field survey software:

- **Equipment ID :6208300023**
- **Activation code :15[redacted]62**

was successful. It is now possible to activate on another device.

For more information on CHCNAV products please visit our website : www.chcnav.com

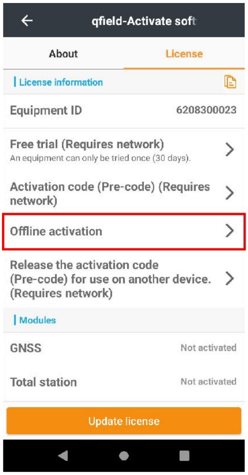
For any questions please contact us at :

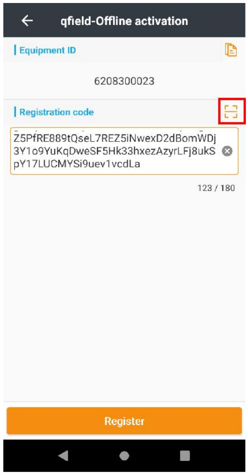
Phone : +862154261234

Email : marketing@chcnav.com.

1.4.3 Offline Activaton

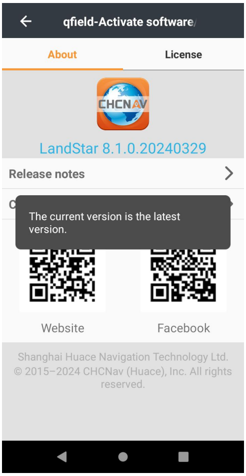
Offline Activaton supports the registration of temporary or per-code in offline state. Click Offline Activaton, enter the registration code or click the QR code icon to scan the QR code to get the registration status.





1.5 Automatic updates

Enter the **Slide menu** and click **Activate software/About**. Users see "**Check for update**" bar, then click it. If there is **no** newer version, a small window "**The current version is the latest version!**" pops up in the middle. If there is a maker '**NEW**', users would come into an update interface. Click '**UPDATE NOW**', then the system would download the package and update itself.



1.6 LandStar Program folders

LandStar stores program data in two places on the Android device. The primary folders are:

\Internal shared storage\CHCNAV

\Internal shared storage\system_prj_backup

Within these folders there are several addition folders: \Internal shared storage\CHCNAV:

\Cache: OEM, Mainboard firmware for GNSS devices

\Config: Fonts, Codes, Geoids, Prisms, Working modes, Coordinate systems

\Download: files downloaded from the Cloud

\Projects: Projects, each project is stored in a folder

Projects can be continuously backed up to the folder:

\Internal shared storage\system_prj_backup

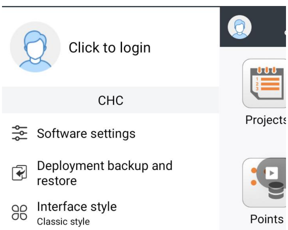
Within this folder there will be a separate folder for each job. Within the job folder there may be multiple ZIP files containing snapshots of the job. These previous versions can be restored from the **Project menu**.

2 LandStar System Settings

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

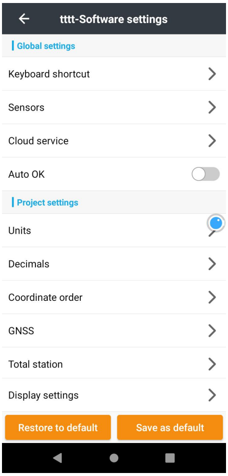
The **Tool tray** **Quick access** button also directly opens the **Sidebar** allowing access to **System settings** without leaving most survey menus.

The **System settings** panel provides access to **Software settings** (a sub-set of the **System settings**), interface styles and program defaults:



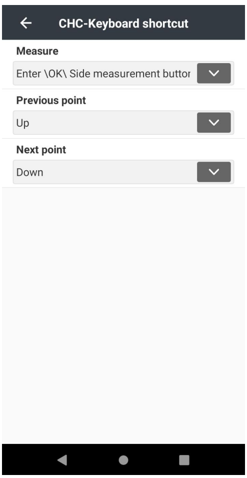
2.1 Software settings

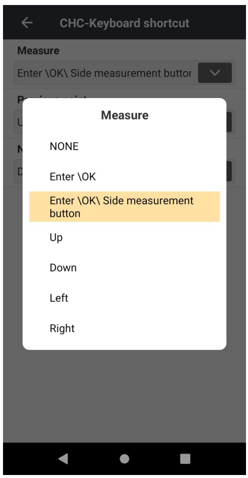
Click on **Software settings**. The device settings menu is shown:



Each of these setting items is described below.

2.1.1 Keyboard shortcut

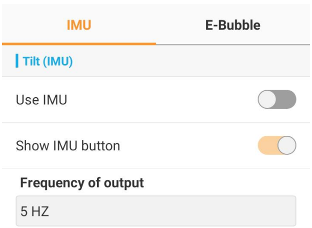


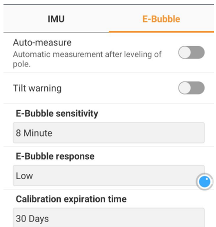


If a device has hardware buttons, functions can be assigned to them. The assignable buttons: **Previous point**, and **Next point** buttons. There are six options, Enter\OK, Enter\OK\Side measurement button, Up, Down, Left, Right.

2.1.2 Sensors

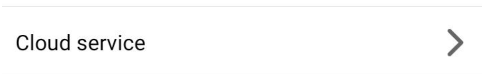
The IMU and E-Bubble can be set up.



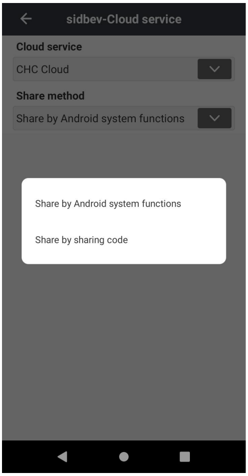


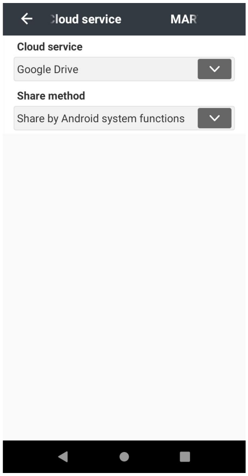
2.1.3 Cloud service

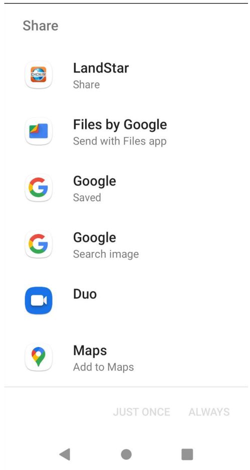
Cloud is the login interface of Cloud service. Users can upload or download projects, coordinate systems, work modes, etc. Users should ask local dealer or sales manager for obtaining an account and password to use Cloud.



There are two Cloud service sharing files: CHC Cloud and Google Drive. CHC Cloud can choose to share by Android system functions or share code, while Google Drive can only share by Android system functions. When the user chooses to use Android system functions, other third-party apps on the controller are called when sharing files.

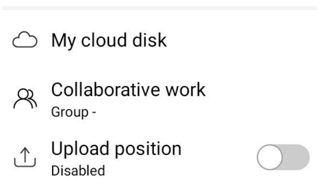




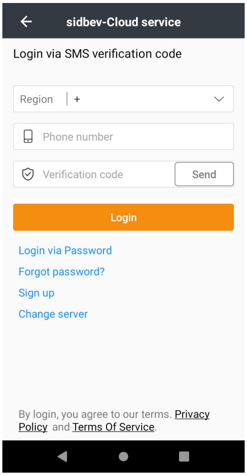


2.1.3.1 CHC Cloud login

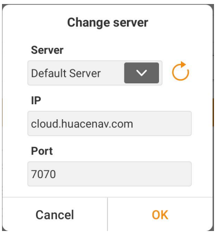
If LandStar is not currently logged into the CHC Cloud, clicking on any collaborative function:



will force a login to the cloud service:



Click on Change server:

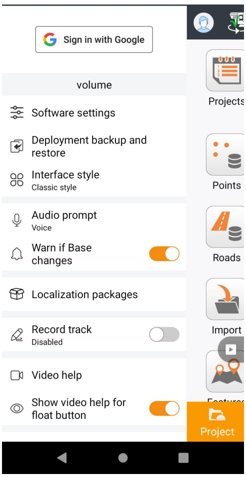


Change the server to the European server. Then click OK. Click to **Login** and use **Cloud services**.

2.1.3.2 Google Drive

Click Google Drive:

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



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

【**Upload**】: the data in the software is uploaded to the server.

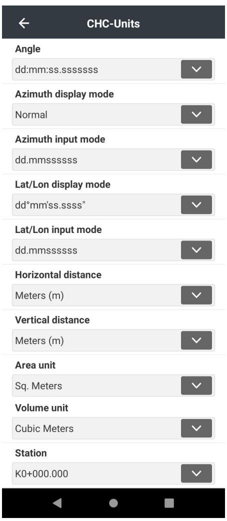
【**Download**】: Download data from the server.

2.1.4 Auto Ok

Enable **Auto Ok** to save hundreds of keystrokes as you use LandStar. If you meet difficulties with accidental tapping, try disabling **Auto Ok**.

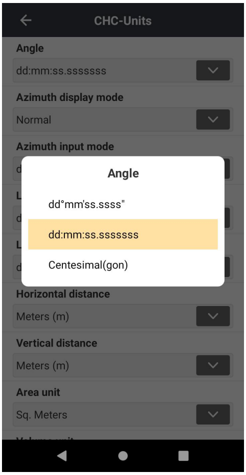
2.1.5 Units

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



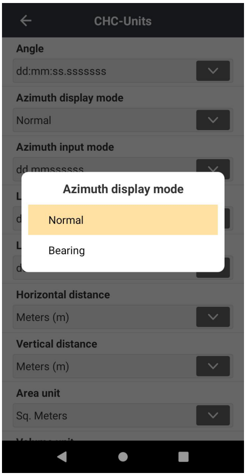
Angle

Sets the display of Angle values:



Azimuth display mode

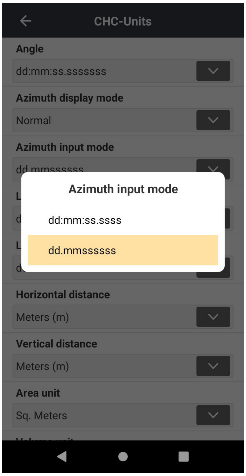
Set the method for directional display. When set to **Bearing** allows the use of **Quadrant** bearings.



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

Azimuth input mode

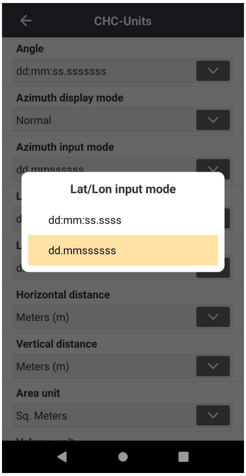
Set the method for directional inputs:



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

Lat/Lon input mode

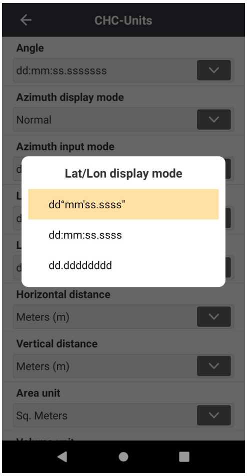
Determines the required entry type for Latitude and Longitude:



Use **dd.mmssssss** (USA), **DD:MM:SS.ssss** requires the inclusion of ':' separators.

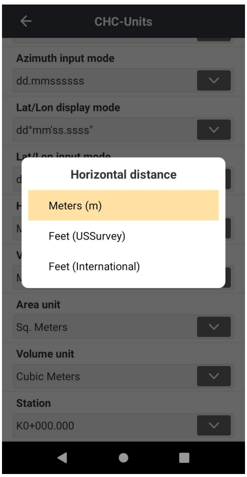
Lat/Lon display mode

Set the method for display of Latitude and Longitude:



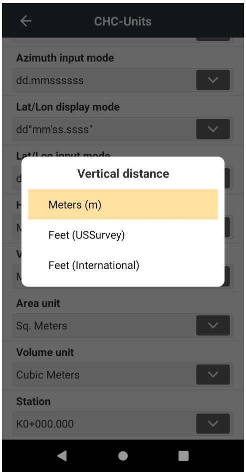
Horizontal Distance

Sets the default units for horizontal distance measurements:



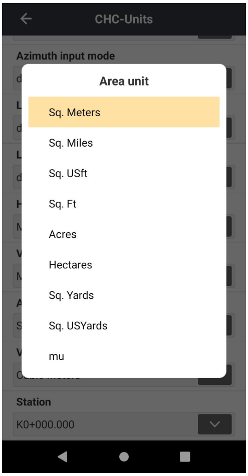
Vertical Distance

Sets the default units for vertical distance measurements.



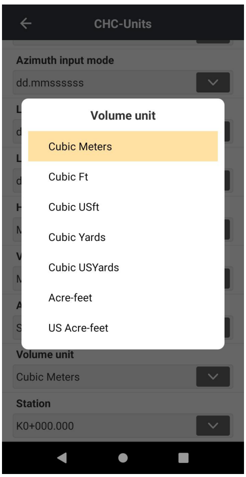
Area unit

Sets the default units for area measurements:



Volume unit

Sets the default units for volume measurements:



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

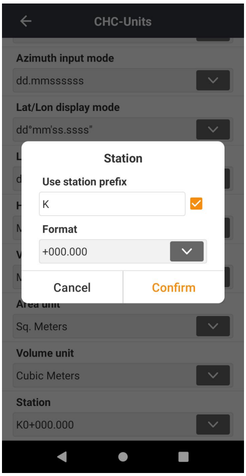
10,000.000 cubic Meters =353.144.55 cubic USFeet=13,079.428 cubic USYards

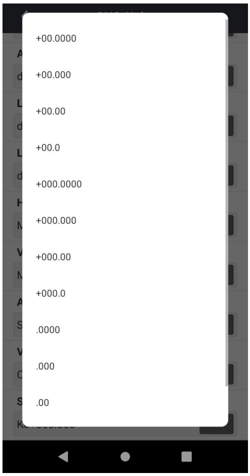
=353,146.67 cubic iFeet

=13,079.506 cubic iYards

Station

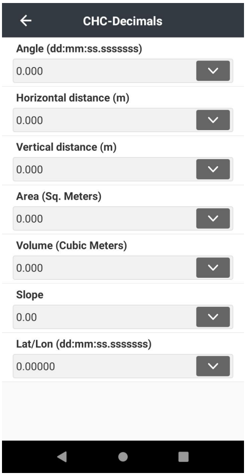
Sets the default display for alignment stationing:





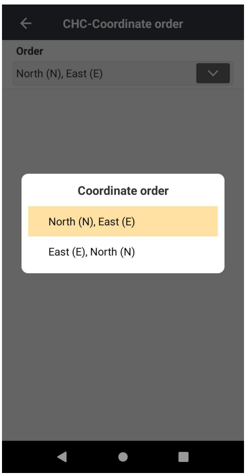
2.1.6 Decimals

These settings control the number of decimal places used to display values. The settings shown above should be reasonable for most applications.



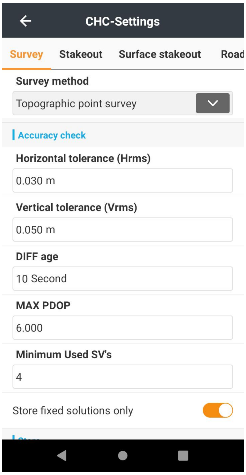
2.1.7 Coordinates

Set the **Coordinate order** to **North, East**.



2.1.8 GNSS settings

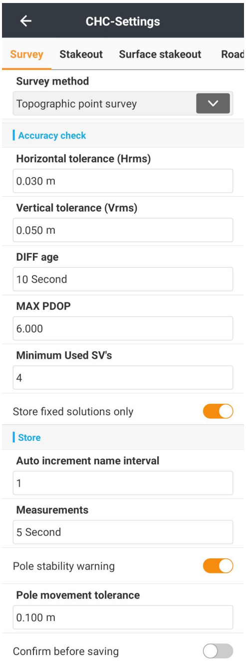
These **GNSS settings** are also accessible from most of the survey menus by clicking the **Setup** button. There are separate settings for **Topographic point survey**, **Continuous survey**, **Control point survey** and **Verified survey**.



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

2.1.8.1 Survey

Topographic point survey settings



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

LandStar has two topographic modes: **Quick** and **Topographic** controlled by the **Survey type** button on the survey screen. The **Quick** mode shares tolerance settings with the **Topographic** mode, except for the **Measurements** time.

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

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

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

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

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

Store fixed solutions only: only allow FIXED RTK solutions. Reject FLOAT, DGPS and Autonomous solutions.

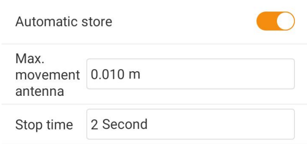
Auto increment name interval: after a topographic measurement is made, the point name increments by this value. Usually, 1 or 10.

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

Pole stability warning: while measurements epochs are collected, if the horizontal range of measurements exceeds this **Pole movement tolerance (Default is 0.1m)**, the user will be given a warning and the opportunity to escape and not store the measurement.

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

Automatic store: If the point coordinate moves within a distance of **Max.movement antenna** after the **Stop time**, the point coordinate is automatically saved. The default setting is to move no more than 0.01m after 2s of stability.



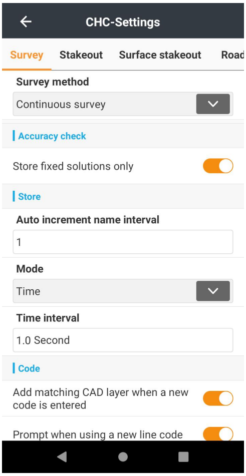
Users can open “**Use quick codes**” or not and modify the **Quick code pages.**

Users can open “Prompt when using a new line code” “Show average report after measure” “Log epoch coordinate” or not.

Users can modify “Geometry factor”.

Continuous survey settings

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



Store fixed solutions only: only allow FIXED RTK solutions. Reject FLOAT, DGPS and Autonomous solutions.

Auto increment name interval: after a topographic measurement is made, the point name increments by this value. Usually, 1 is used for continuous surveying.

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

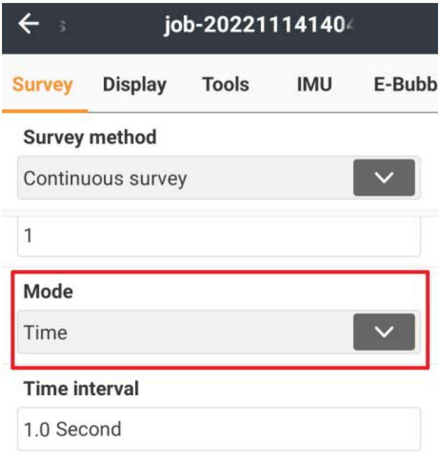
Time: time interval in seconds.

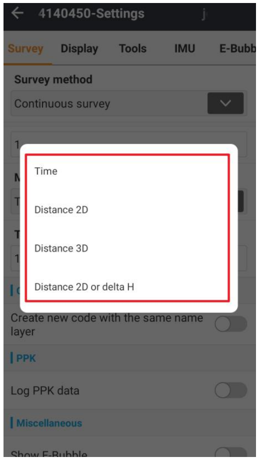
Distance 2D: Horizontal distance of travel.

Distance 3D: 3D distance of travel.

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

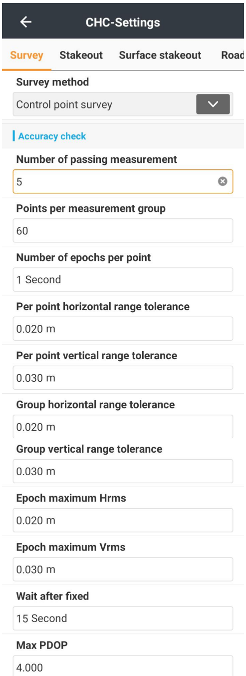
Users can open "Prompt when using a new line code" or not.





Control point survey settings

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



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

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

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

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

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

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

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

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

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

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

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

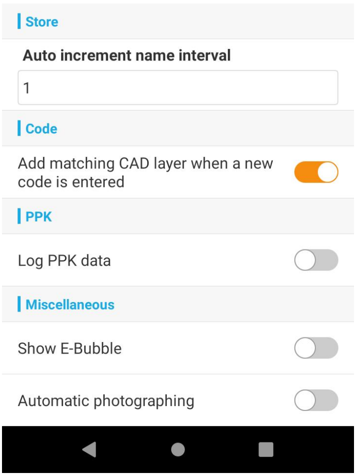
Control point survey is intended to be used in open canopy on important points. A tripod or bipod **must** be used for a control survey as the measurement acquisition will not finish if the receiver moves during the relatively long acquisition period.

Verified point survey is like the **Control point survey**, except the **Verified survey** will continue to run when tolerances are not met and points can be observed during multiple sessions, on multiple days. The **Verified survey** allows the user to reject averaged groups after collection, while **Control survey** requires that all groups meeting the tolerance limits be included in the results.

A measurement group is comprised of several point averages that are themselves averaged epochs.

3.Common GNSS Survey settings

All the GNSS Survey methods share these additional settings.



Auto increment name interval: after a topographic measurement is made, the point name increments by this value. Usually, 1 or 10.

Add matching CAD layer when a new code is entered: if the user types in a new code and stores a measurement with the code, enabling this option will matches the layers on the CAD.

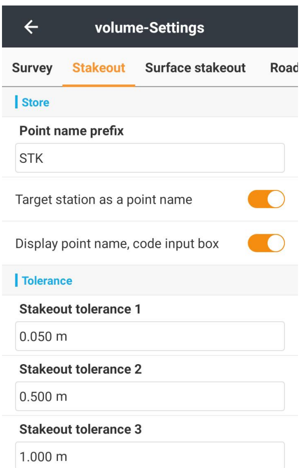
Log PPK data: write Time Tagging data (the point name) into the static observation file that is being recorded in the receiver's memory.

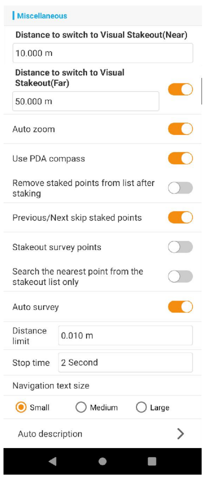
Show E-Bubble enables the E-Bubble on the display screen. This is only applicable to receivers with an e-Bubble or an IMU.

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

2.1.8.2 Stakeout

The settings on the **Stakeout** tab of **GNSS** settings control the operation of the stakeout screens: **Point stakeout**, **Line/Arc stakeout**.

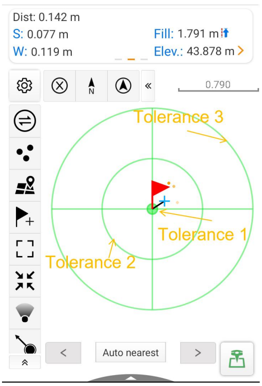




Point name prefix: prepended to the staked point name. For example, when staking a point name 1001, the stored measurement after staking the default name for the new point will be “STK1001”.

Target station as a point name: if staking a line or polyline, use the station along the line as the point name: “K1+12.345”.

Stakeout tolerance 1, 2, 3: 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. There are three circles displayed around the staked point:



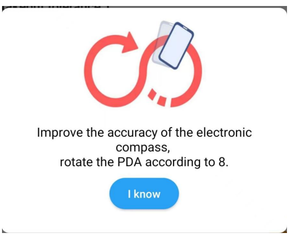
The outside ring is tolerance 3, the middle ring is tolerance 2 and the solid inside ring is tolerance 1. When storing a staked measurement, if the current position is outside of the center ring (tolerance 1) a warning message is displayed.

Distance to switch to Visual Stakeout (Near): using a receiver with visual stakeout cameras (for example the i93), when staking a feature, when closer than the **Near** tolerance, visual stakeout will automatically switch to the bottom camera on the receiver.

Distance to switch to Visual Stakeout (Far): using a receiver with visual stakeout cameras (for example the i93), when staking a feature, when within the **Far** tolerance, but further than the **Near** tolerance, visual stakeout will automatically switch to the forward-facing camera on the receiver.

Auto zoom: the map image will automatically zoom in closer as the measurement approaches the staked point.

Use PDA compass: uses the internal compass of the PDA (tablet) to compute the direction to the target point when enabled. If disabled, use the GPS track to determine the direction to the target point. When opening "**Use PDA compass**", please do as the pop-up window says.



Remove staked points from list after staking: When staking points, it is possible to stake from the **Points to stake** list, which is the right-hand column of the **Point list**:

Enable **Remove staked points from list after staking** to automatically remove points from the **Points to stake** list so that they are only staked once.

Previous/Next skip staked points: all the points in the **Point list** have an internal *Staked* attribute. When you stake a point, the point is marked as *staked*. Enabling this option will skip *staked* points when using the **Next**, **Last** and **Auto nearest** buttons: < Auto nearest > user can still select *staked* points by manually typing in the point name or selecting from the **Point list**.

Stakeout survey points: when disabled only points in the **Points to stake** may be staked. When enabled all points are eligible for staking.

Search for the nearest point from the stakeout list only: when enabled, only points in the **Points to stake** list are considered when looking for the nearest point. Disable to consider all known points.

Auto survey: The point coordinates have been within the limit of difference, and the stop time is not moved, will be automatically stakeout. The default is to stay still for 2 seconds within 0.01 m.

Navigation text size: select the smallest size that is comfortable to read, this will maximize the remaining screen available for map display.

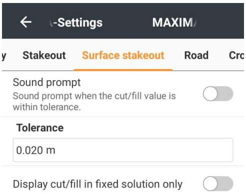
Auto description: controls automatically populated descriptions for staked points. See **Section 4.7** for details.

2.1.8.3 Surface stakeout

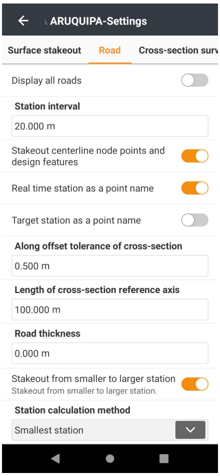
Users can open "**Sound prompt**" to give voice prompt after the fill/cut within the range of tolerance.

Users can modify "**Tolerance**" to check tolerance value before store.

Users can open “**Display cut/fill in fixed solution only**” or not.



2.1.8.4 Road



Users can open “**Display all roads**” or not.

Users can set “**Station interval**”, the default is 20.000 meters.

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

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

If users open “**Target station as point name**”, the target station is input as point name.

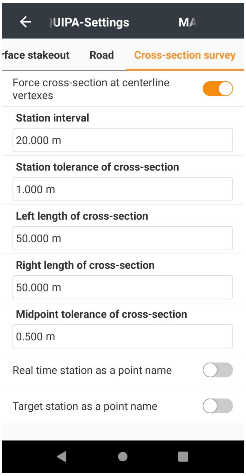
Users can modify “**Along offset tolerance of cross-section**” and “**Length of cross-section reference axis**”.

Users can modify “**Road thickness**”.

If users close “**From smaller to larger station**”, please stakeout from larger station to smaller, otherwise from smaller to larger.

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

2.1.8.5 Cross-section survey



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

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

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

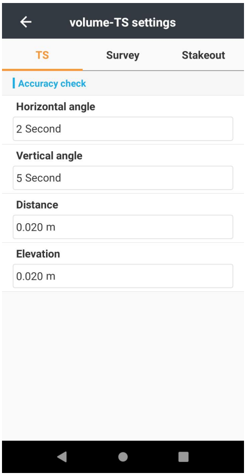
If users open “**Target station as point name**”, the target station is input as point name.

2.1.9 TS settings

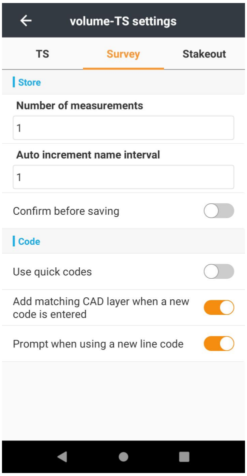
2.1.9.1 TS

Users can modify “**Horizontal angle**” “**Vertical angle**” “**Distance**” and

"**Elevation**". The TS calculates the deviations from the second measurement with the first one. If the deviations exceed the limit, a warning will appear.



2.1.9.2 Survey



Users can modify “**Number of measurements**” and “**Auto increment name interval**”.

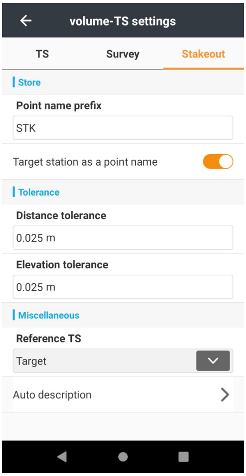
“**Confirm before saving**” can be closed or open.

Users can choose to “**Use quick codes**” or not.

Users can choose to “**Add matching CAD layer when a new code is entered**” or not.

Users can choose to “**Prompt when using a new line code**” or not.

2.1.9.3 Stakeout



Users can modify “**Points name prefix**”.

Users can choose to “**Target station as a point name**” or not.

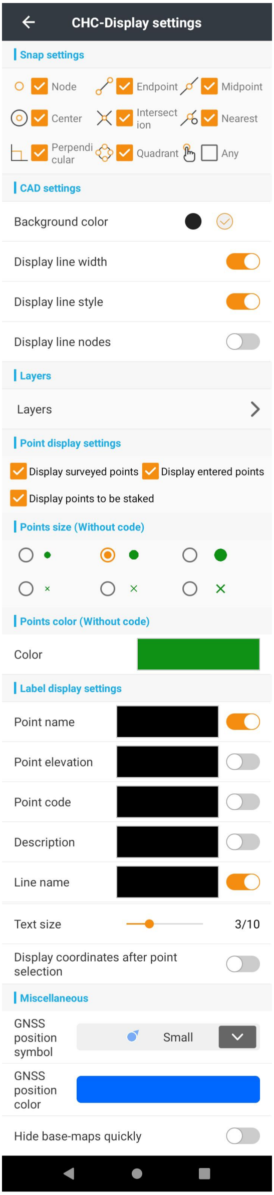
Users can modify “**Distance tolerance**” and “**Elevation tolerance**”.

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

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

2.1.10 Display settings

These settings are found under Software settings: **Display settings**:


CHC-Display settings
Snap settings
Node
Endpoint
Midpoint
Center
Intersection
Nearest
Perpendicular
Quadrant
Any
CAD settings
Background color
Display line width
Display line style
Display line nodes
Layers
Layers
Point display settings
Display surveyed points
Display entered points
Display points to be staked
Points size (Without code)
Points color (Without code)
Color
Label display settings
Point name
Point elevation
Point code
Description
Line name
Text size
3/10
Display coordinates after point selection
Miscellaneous
GNSS position symbol
Small
GNSS position color
Hide base-maps quickly

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

Node: snap to a point

Endpoint: snap to the end of a line or vertices of a polyline.

Midpoint: snap to the middle of a line segment.

Center: snap to the center of a circle.

Intersection: snap to the intersection of two lines.

Nearest: snap to the nearest point on a line.

Perpendicular: The point at a 90-degree angle.

Quadrant: snap quadrant points.

Any: allows snapping to an open location anywhere on the map.

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

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

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

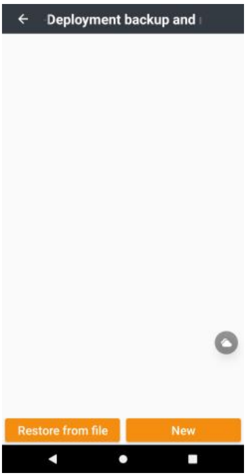
Different layers can be created, and you can choose to display different type of points and change the display of labels.

2.2 Deployment backup and restore

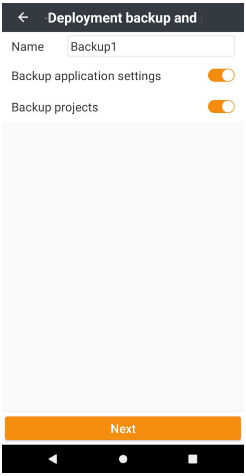
Deployment backup archives all the project groups, projects, all the settings, all Device profiles, menu items positions, all Import and Export profiles, all the GEOIDS, all defaults, all map tiles, all pictures, all the Visual survey jobs, **everything**… to a single compressed file.

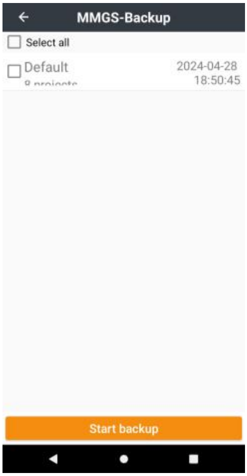
This single file can then be moved to a different device and restored.

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



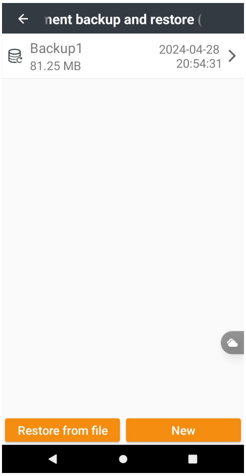
Click New to build a new backup: Give the backup a descriptive **Name**, choose to **Backup application settings**, choose to **Backup projects**, then click **Next**



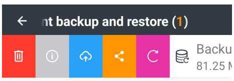


Check all of the **Project groups** to backup or **Select all** to include all **Project** groups. Finally click **Start backup**:

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



Slide the backup entry to the right:



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

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

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

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

【delete】： The backup files on the page are deleted, and the files in the backup directory are deleted

【Stats】：View backup file information. The information cannot be modified

【Upload to the cloud disk】： The software backup file is uploaded to the cloud disk

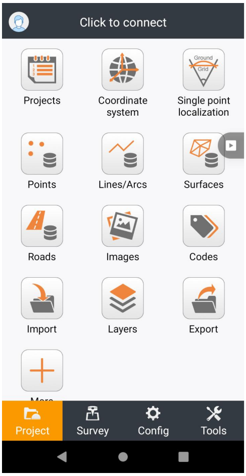
【Share】：Share through third party APP, share through share code

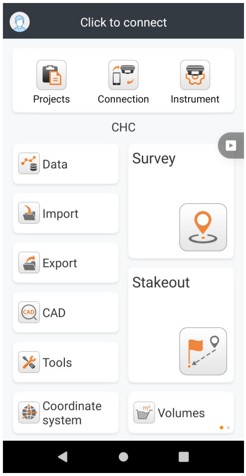
【recover】： Restore software Settings and projects in backup files

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

2.3 Interface style

LandStar has **Classic** and **Simple** interface meus styles:



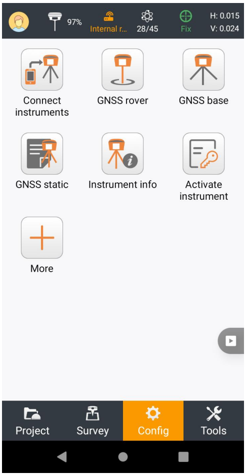


The **Classic style** has 4 tabs: **Project**, **Survey**, **Config** and **Tools**.

Menu buttons can be hidden under the  **More** button.

The **Simple style** has one primary menu which expands primary functions to lists of functions.

This **User Manual** shows only the **Classic style** interface.



Status Bar:

This icon shows receiver battery.

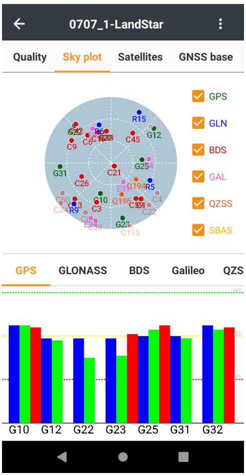
This icon will change as different work modes accepted successfully, with white arrows to show receiving differential data successfully. It can lead users to **Device** Info interface.

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

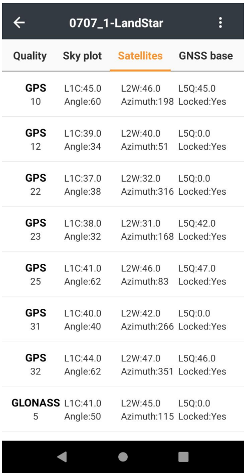
This icon will change to different colors while receiver is getting different solutions, red means single status, yellow means float status, and green means fixed status. It can lead users to **Position** and **Precision** interface.

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

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



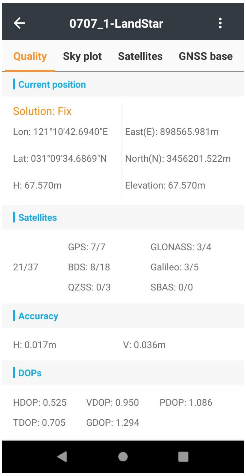
Satellites List: Support to view the current number of satellites which have been searched, constellation, L1\L2\L5 SNR, elevation angle, azimuth, and locked status.



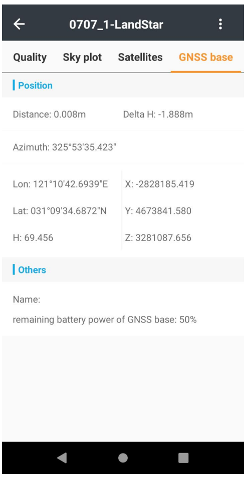
Position: Support to view GPS time, solution status (single, float or fixed), the differential age and the current position in WGS84. Users can change coordinate type in the drop-down list (including Local N/E/H, Local Lat/Lon/H, Local X/Y/Z, WGS84 Lat/Lon/H, and WGS84 X/Y/Z).

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

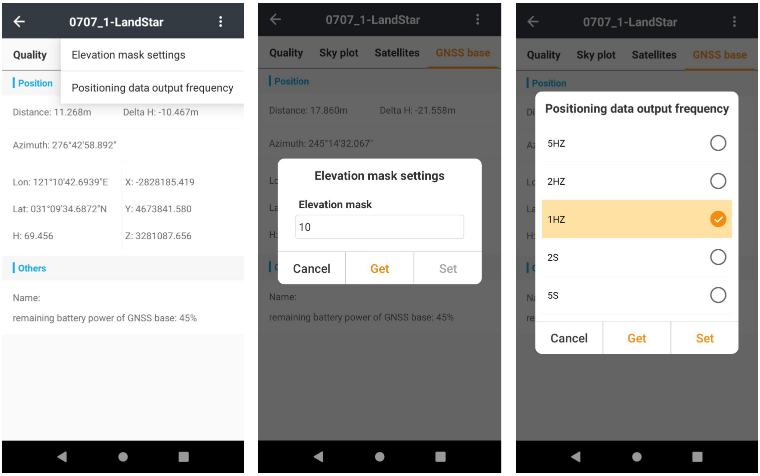
DOPs: Support to view spatial dilution of precision which suggests current satellites searching status, including PDOP, HDOP, VDOP, TDOP and GDOP.



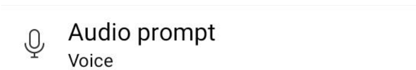
GNSS base: Support to view GNSS base status, coordinates, and the distance to the base station.



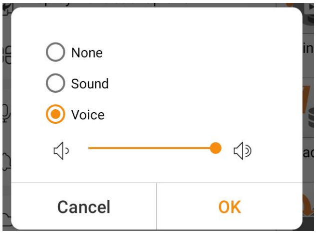
Others: Click the button on the right side of the interface, the elevation mask and data output frequency setting will show here. Choose Elevation mask setting to set the value and choose Positioning data output frequency to set the RTK update rate.



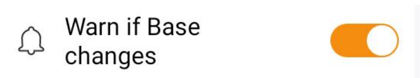
2.4 Audio prompt



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

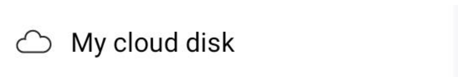


2.5 Warn if Base changes



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

2.6 My cloud disk

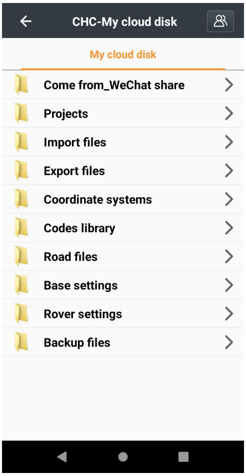


2.6.1 Collaborative functions in LandStar

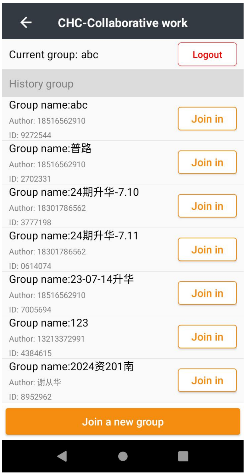
The **CHC Cloud** is a cloud based, collaborative work group and storage function. Operation relies on communication with a selectable server based in Europe or Asia. The services are SSL encrypted; however unencrypted files are stored on the endpoint servers. For this reason, cloud services may not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

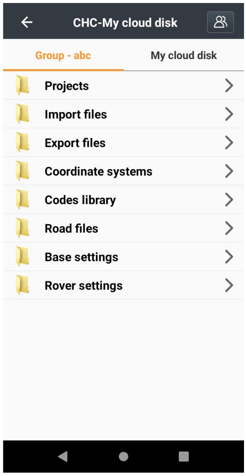
2.6.2 Storage

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



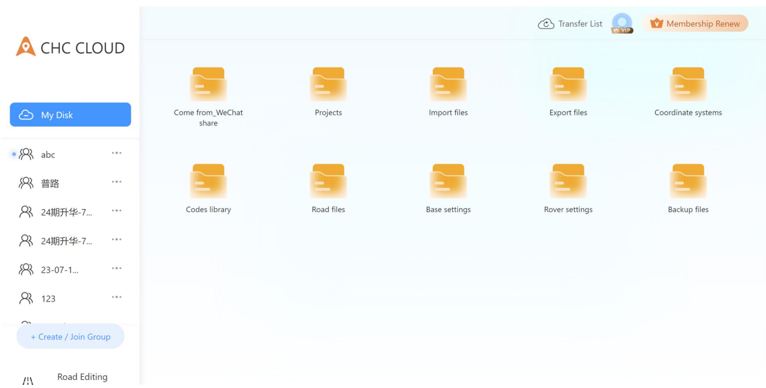
And click the group button, join in the corresponding group, and view the group data.



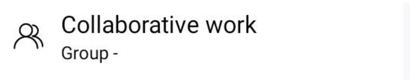


2.6.3 Web interface to CHC Cloud

Login to the CHC Cloud web interface for access to files from a desktop:



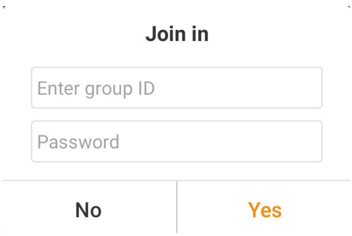
2.7 Collaborative work



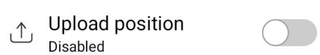
Once logged into the cloud, **LandStar Workgroups** can be created or joined.

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

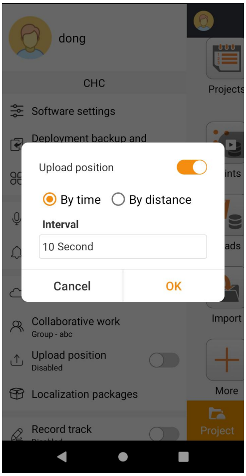
Workgroups are assigned a unique **Group ID** by the server when they are created and are protected by a Password:



2.8 Upload position to CHC Cloud



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

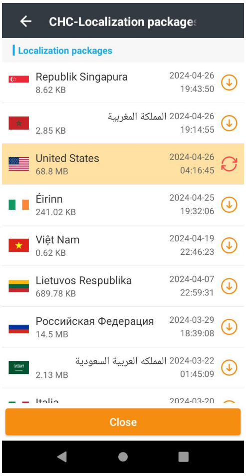


The uploaded position can be viewed in real-time via the web interface. LandStar must be logged into the CHC Cloud to use this functionality.

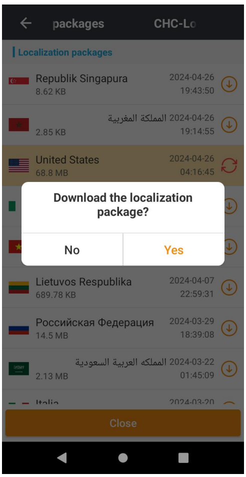
2.9 Localization packages

Localization packages

Localization packages can hold region specific Geoids, profiles, and projections.



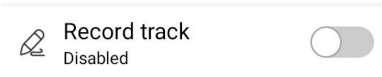
Click on the Download button, then confirm YES:



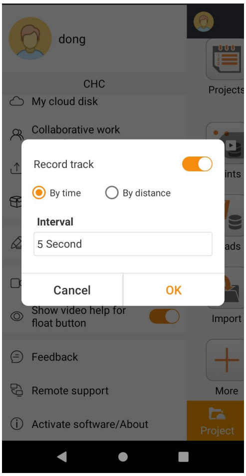
Depending on the speed of the internet connection it could take a while for the download to complete:

When the download is complete, the package file will automatically be decompressed and installed.

2.10 Record track



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



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

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

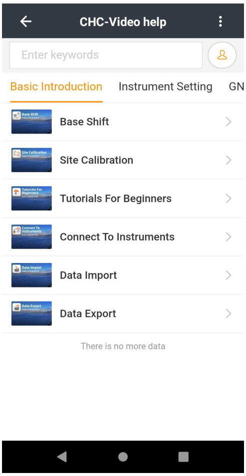
/storage/emulated/0/CHCNAV/Projects/_projectname_/ Each line entry includes:

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

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

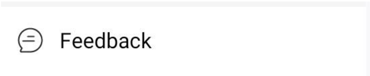
2.11 Video Help and show video help button

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

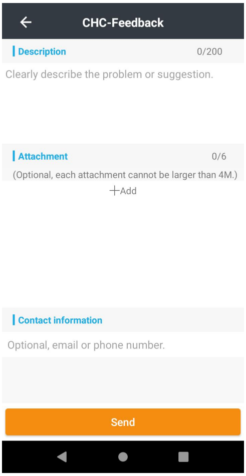


When **Show video help for float button** is enabled, one of these icons will be shown on most screens:

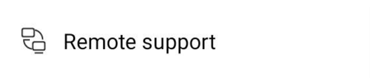
2.12 Feedback



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



2.13 Remote support



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

2.14 Activate software / About

ⓘ Activate software/About

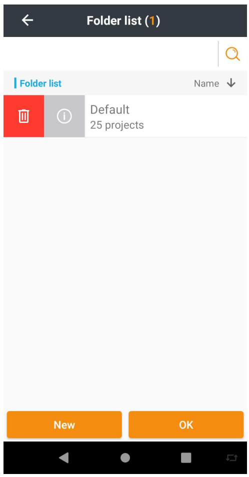
Displays the current software version and allows access to the licensing activation and transfer tools.

See **Section 1.4** for registration methods.

3 Project

3.1 Projects

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



【Search】: Filter display folders by entered keywords

【Details】: View the project folder information and modify the project folder name

【NEW】:Create a new project folder

【OK】:Accept this project folder

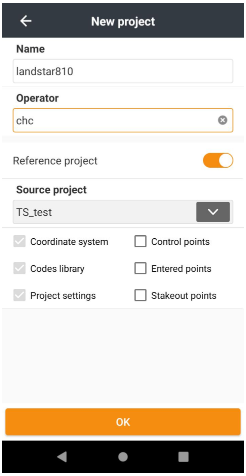
3.1.1 New

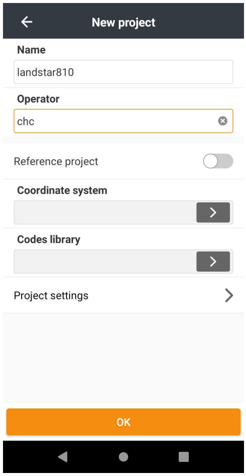
Click **New** to create a new project, users should set coordinate, code List and other survey parameters.

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

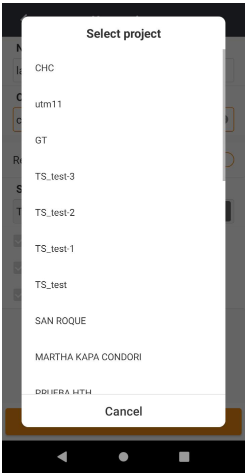
Time Zone: Choose the time zone in drop-down list from UTC-12:00 to UTC+14:00.

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





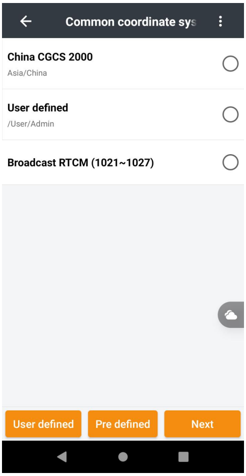
Tick the **Reference project** in Coordinate System to select project template, then it will show a list of historical projects. Users can select one and click OK to apply. For example, there is project A which has finished site calibration, while another project B needs the transformation parameters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

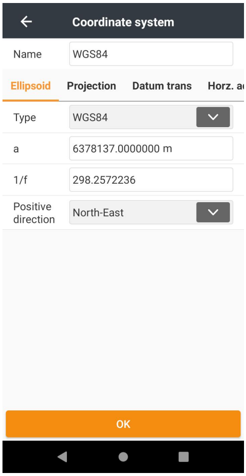


Note: Transformation parameters won't be applied if the new project is created without project template. Project template can apply all CRS parameters of the existing project.

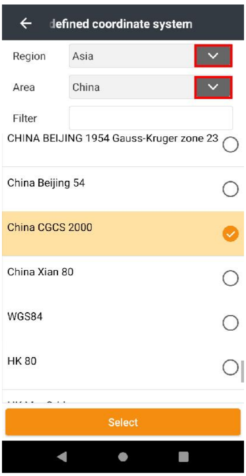
Coordinate System

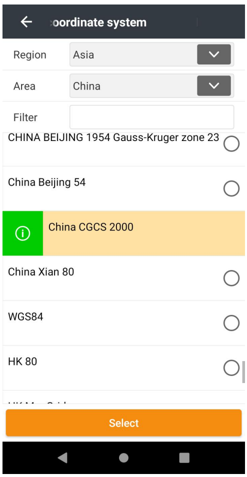
Users can create a new coordinate system or use the template of existing projects. Click **User defined** to create a new coordinate system.



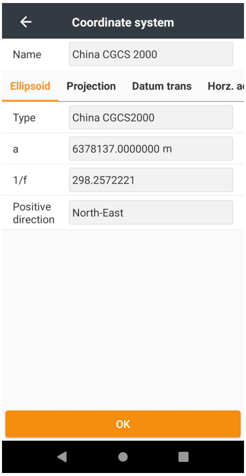


Set the right parameters according to the surveying area, and then click Save to finish CRS configuration.

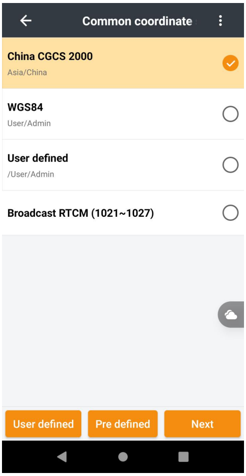




Click **Pre defined** to enter **Common Coordinate** interface, and then users are able to add a new coordinate system by clicking **Selecting**. Slide right and click the green button to check the coordinate system information.

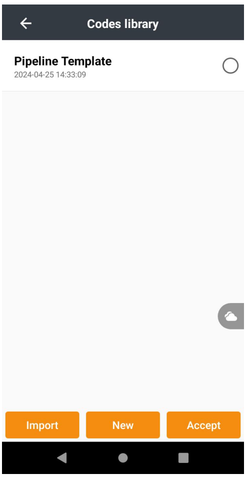


Users can view the parameters of ellipsoid, projection, datum transformation, Horz. adjustment and Vert. adjustment. Click **OK,** it'll return to **Coordinate System** interface, and then click **Select** to finish CRS configuration.



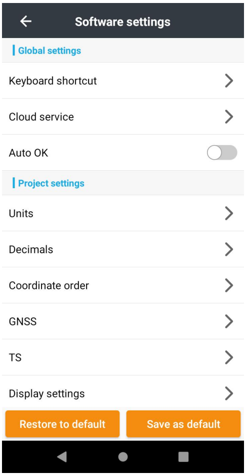
Codes library

Users can import or create new code in the Codes library, which is explained in detail in **Section 3.9**.



Project settings

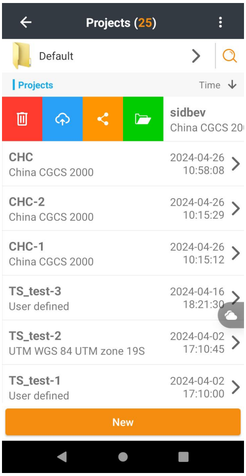
User can set global settings and project settings. The detailed Settings are described in **Section 2.1**.

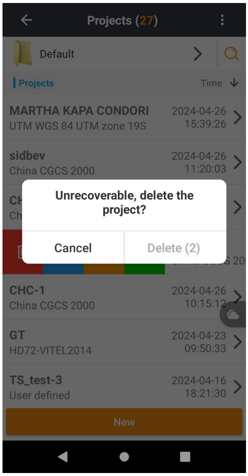


3.1.2 Delete

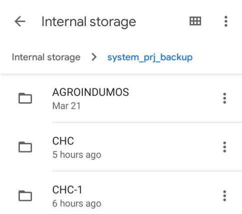
When users enter project, left slide to delete, upload, share, and open. Click delete icon, select **Delete** to delete the project, or select **Cancel** to cancel deleting.

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



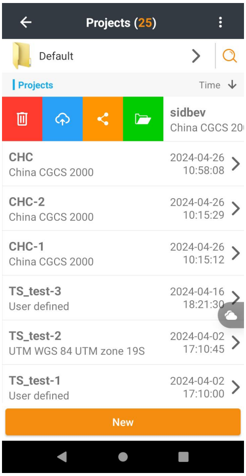


After a project is deleted, a compressed backup file with the same name as the original project is generated in the controller file manager. The directory is Files→ system_prj_backup. If you want to use the project again, you need to put the project under the project directory.

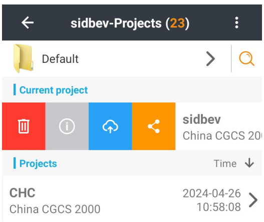


3.1.3 Open

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



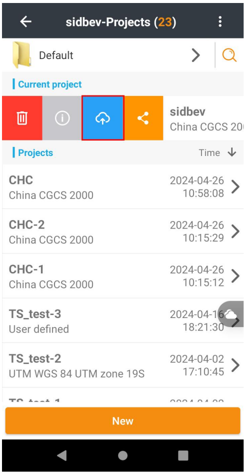
The user can edit the currently open project only after the project is opened.

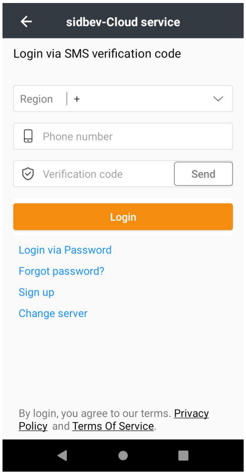


3.1.4 Upload or download with cloud sever

1.Upload to cloud sever

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

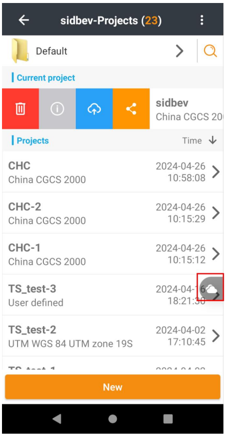


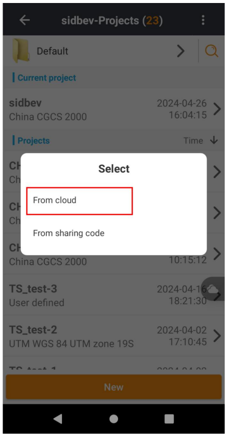


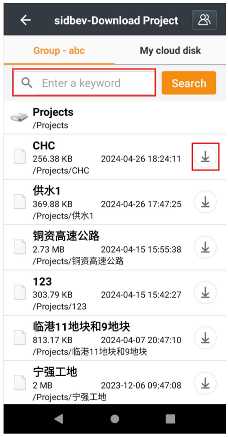
Click **upload** to upload to the cloud sever.

2.Download from cloud sever.

Click on the Cloud Services icon, click from cloud, 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.

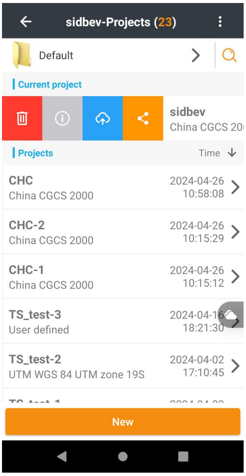


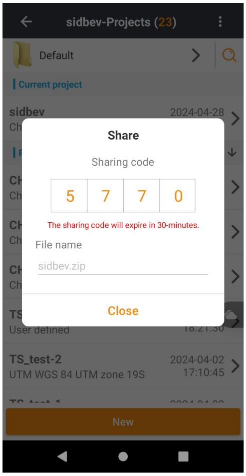




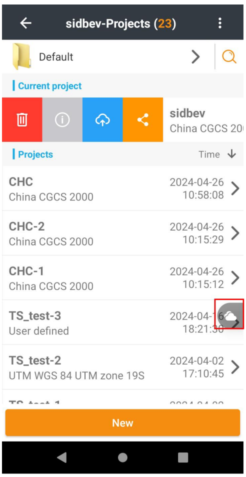
3.1.5 Share and Load with share code

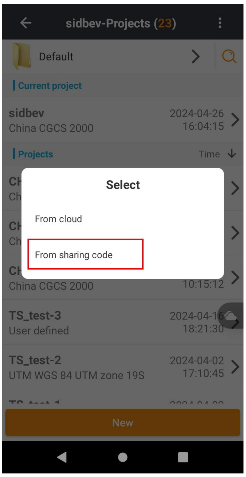
Click **Share icon**  to generate the sharing code to share the project to others.

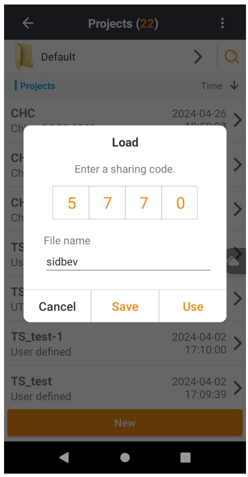




Click on the Cloud Services icon, click **From sharing code** and input the sharing code to accept the project.



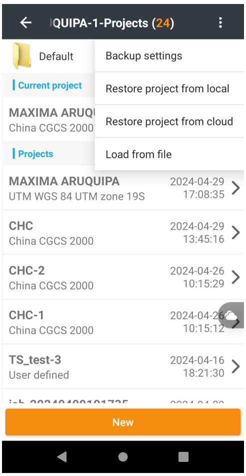


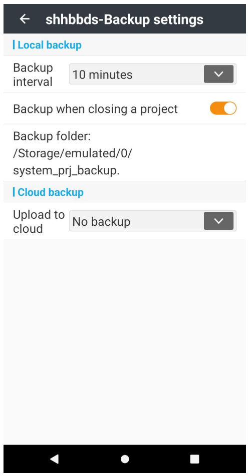


3.1.6 Project backup

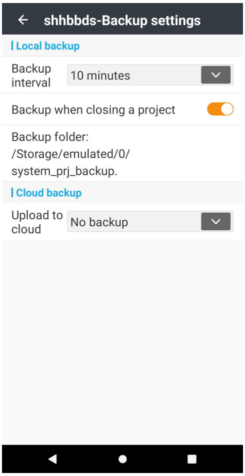
In order to avoid project loss, from the project screen, click on the button, Backup Settings to back up the project, which can choose two options: **local backup** and **cloud backup**.

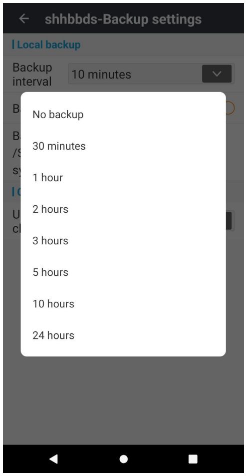
1.Backup settings





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

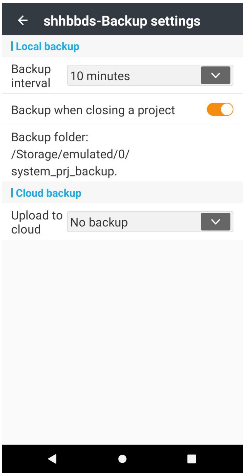


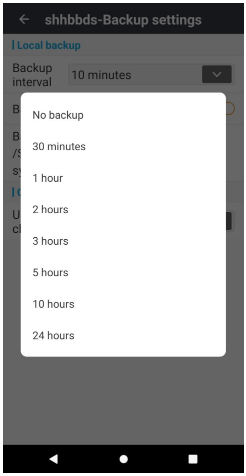


The path of the local backup is:

/Storage/emulated/0/system_prj_backup

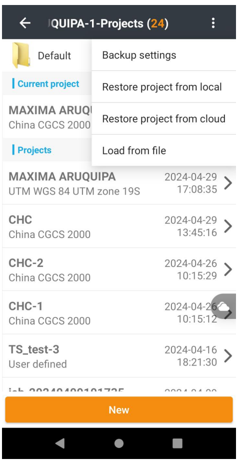
In cloud backup, user can choose the backup interval: no backup, 30 minutes, 1 hour, 2 hours, 3 hours, 5 hours, 10 hours, and 24 hours.

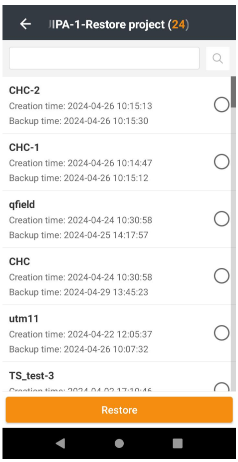


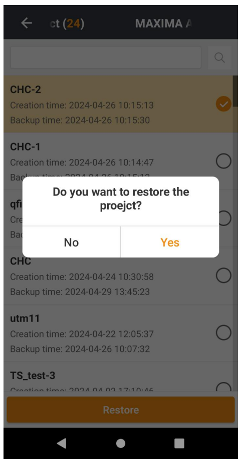


2.Restore project from local

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

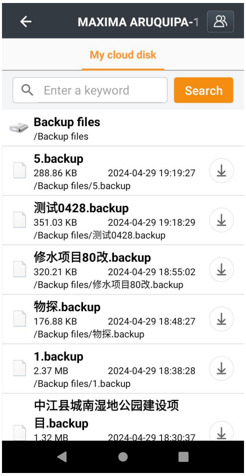






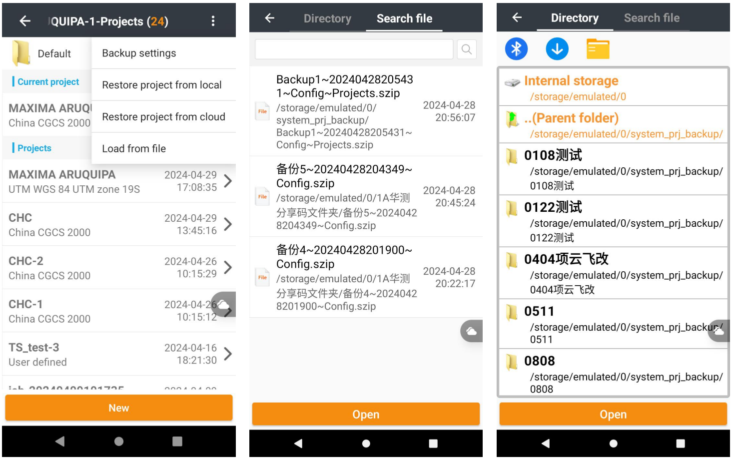
3.Restore project from cloud

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



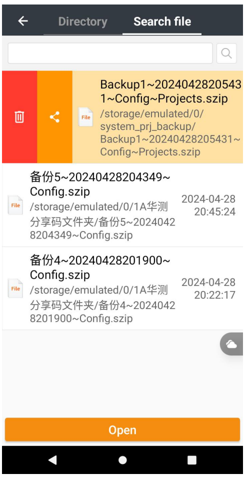
4.Import from a file

Click Import from File, user can choose to search by directory and file search.



5.File upload

Select Import from File, select File Search, click the file to be upload, swipe from left to right, and click Share.



3.2 CRS

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

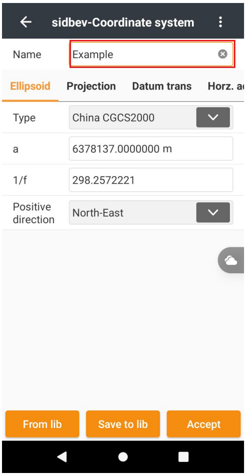
User should open the project first, then click CRS to set the coordinate system.

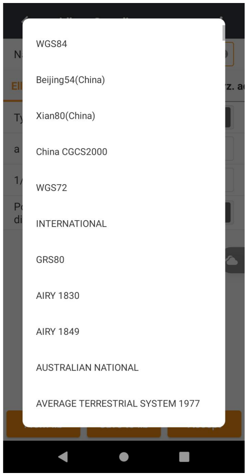
Name: Input CRS name, it's not required to define CRS name like LS7.

3.2.1 Coordinate system

3.2.1.1 Ellipsoid

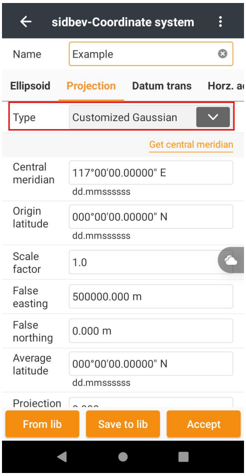
Includes ellipsoid name, a, 1/f, etc. Users can choose ellipsoid name from pull-down menu (different ellipsoid name is corresponding to different parameters) as well as manually input.





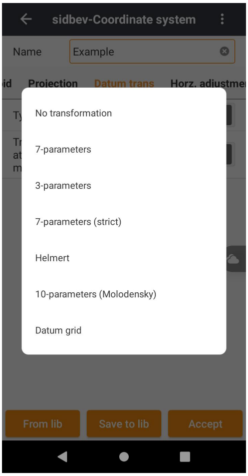
3.2.1.2 Projection

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



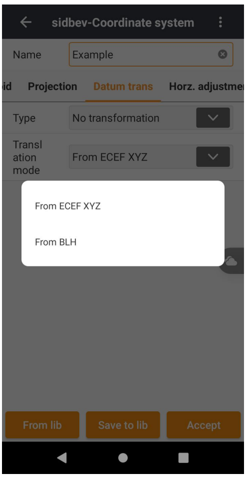
3.2.1.3 Datum Trans

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



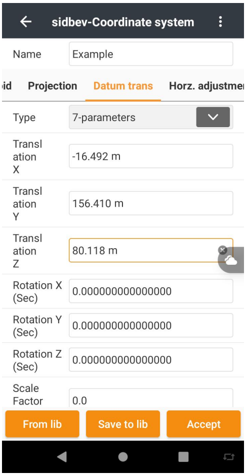
➢ No transformation

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



7-Parameters

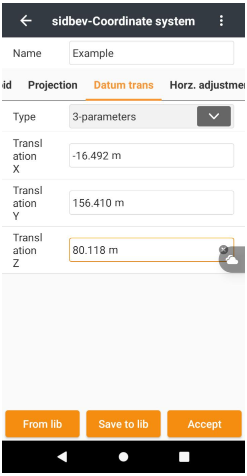
Requires at least three known points, and the points can be under the national coordinate system or the coordinate system that existing small rotation from the WGS84 coordinate system. Preferably three or more known points so that LandStar can check the correctness. The mathematical model of this method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



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

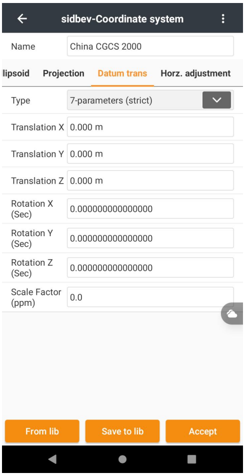
3-Parameters

Requires at least one known point, and the points can be under the national coordinate system or the coordinate system that 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.

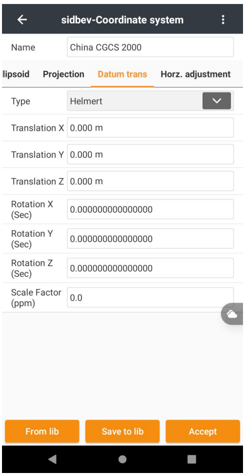


➢ **7-Parameters (Strict)**

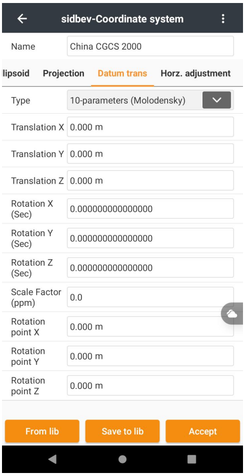
Add Strict modem for 7 parameters.



➢ Helmert

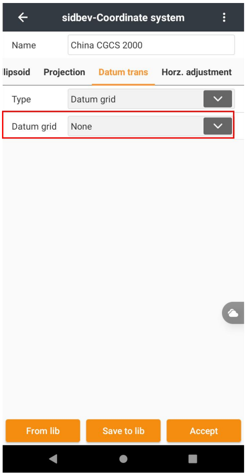


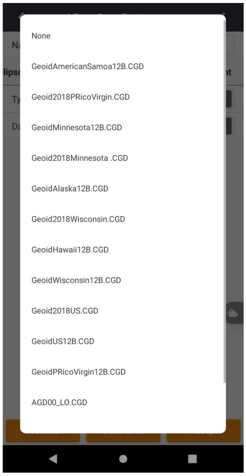
➢ 10-parameters (Molodensky)



- **Datum Grid**

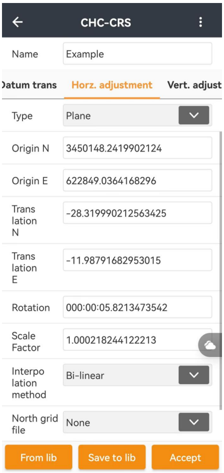
Choose to use grid file for datum transformation (recommend using CGD file). Please click **CHCNAV-LandStar** to find **Geoid** folder in internal storage of controller and put grid file in it before using this function. The software currently supports the grid file of CGD/TXT/GSB/GSA formats.





3.2.1.4 Horz. Adjustment

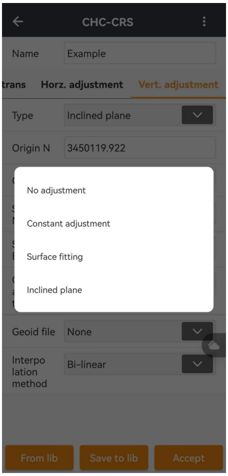
The calibration parameters will be displayed on the interface of the coordinate system parameters after site calibration and application, and users can check them when they open the project successfully. It supports **No adjustment**, **Plane** and **Single point localization** at present. The software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



Copy the file into CHCNAV\LandStar\Geoid folder.

3.2.1.5 Vert. Adjustment

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



- **Constant adjustment**: Need at least one starting point.

- **Surface Fitting**: Generates a best-fit parabola for the abnormal height of many benchmarks. It has high requirements for the starting data, and it may cause divergence of the elevation corrections if the fitting level is too poor. This method needs at least five starting points.

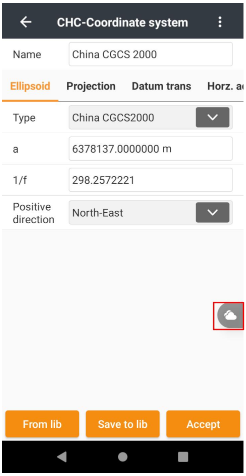
- **Best Practice**: Best Practice is the height transformation model of Trimble TGO software.

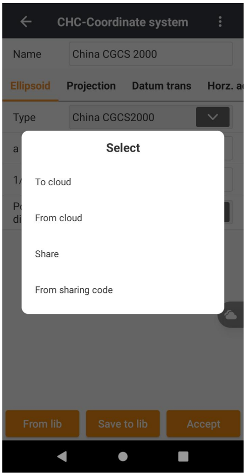
The software currently supports the geoid model file of CGD/GGF/BIN/GSF/GRD/GRI/BYN/ASC/STG/GBL/GXY/OSGB/TXT/JASC /GSA.GSB/GRT/DAT/DATCZ/GTX.NEGRID formats.

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

3.2.2 Share or Download

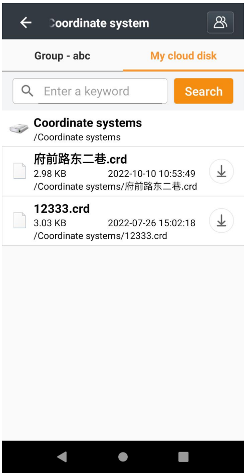
Click on the **Cloud Services icon** , can upload or download coordinate system parameters through cloud services or share code.





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

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

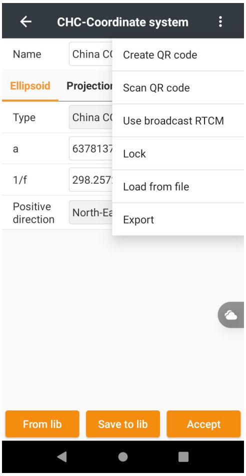


Click **Share** to generate the sharing code to share the CRS to others.

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

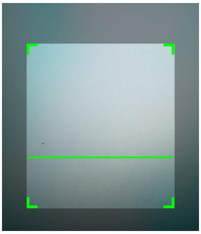
3.2.3 Other ways to share or download

From the coordinate definition screen, click on the ⋮ button:

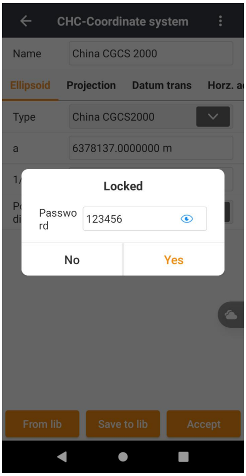


then **Create QR code** to display a QR code:

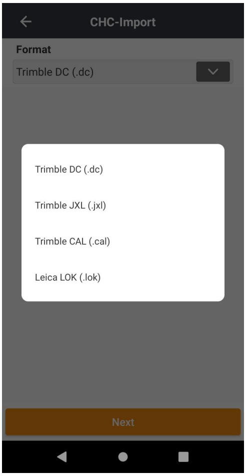
Which can be scanned by other devices using the **Scan QR code** tool:



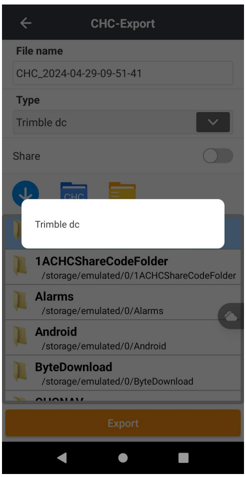
Click **Lock** to freeze the coordinate system and password protect it:



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



Export Supports the export of coordinate system parameters in Trimble dc.

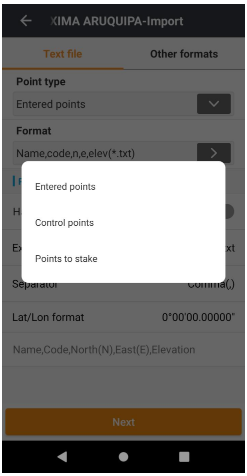


3.3 Import

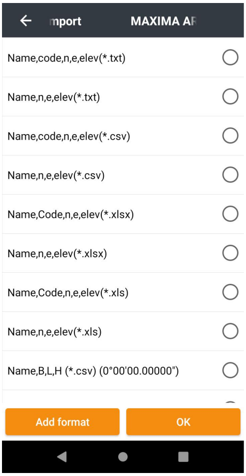
The function can be used for importing the point coordinates file in specific formats.

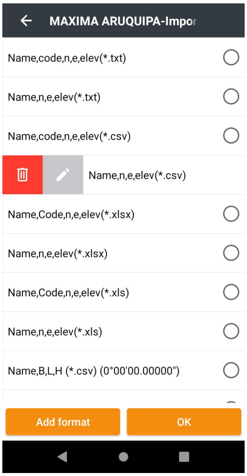
Click **Import** in main interface, and the software will import the existing data according to the requirement format in device or SD card.

Point type: user can select the point type: Entered points, Control points, and Points to stake.

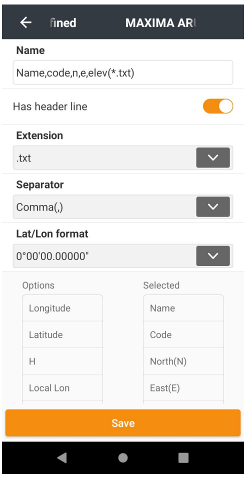


Format: user can select the target type from DAT, TXT, CSV, XLSX, and XLS.

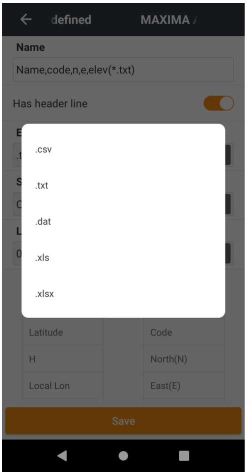


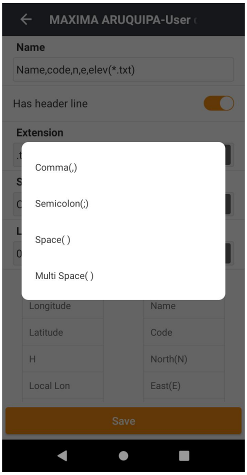


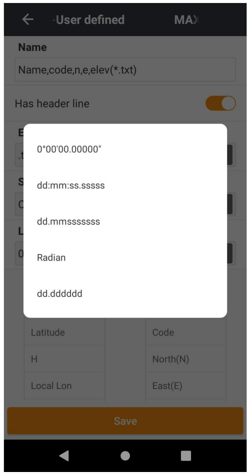
If the data contains table header, use header should be set by right slide menu.



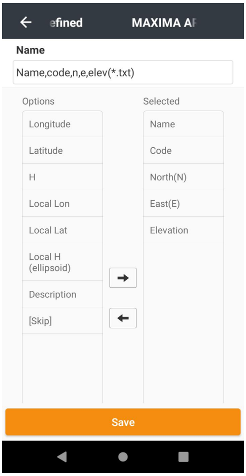
Click the edit button, enter the user defined interface. use header should be set by right slide menu. Choose the extension, separator, and lat/lon format.



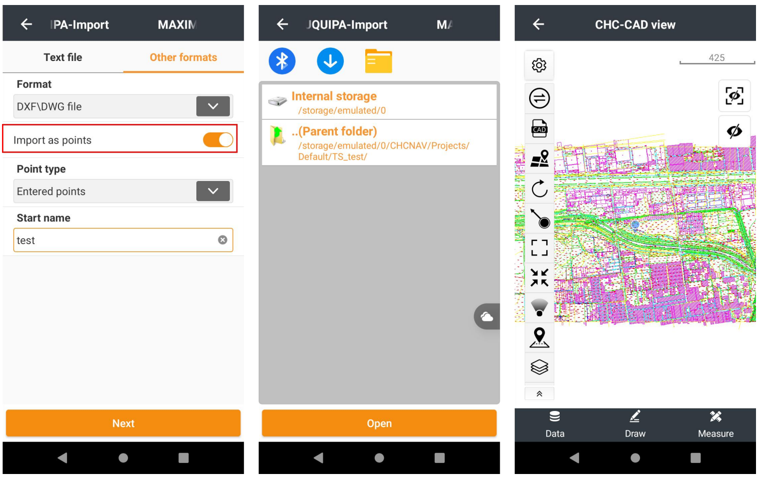




As for header, click the option to add the selected contents, and click selected contents to cancel the options. Click the arrow, add or cancel all the options at one time. After finishing settings, turn on the use header.



Other formats: Support DXF\DWG, SHP, KML\KMZ, TIFF, MBTILES, Jmtiles, WFSDB, JPG, POLYLINE (*.lns), Carlson CRD\CRDB file format. Users can change the format into points by selecting the function.



Select point type from Enter point, Control point and Points to be staked. Set the name, then click next to choose the imported file.

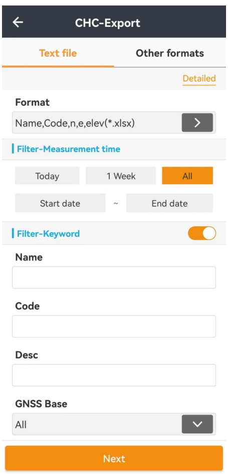
Note: LandStar will automatically apply the same setting when users create a new project.

3.4 Export

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

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

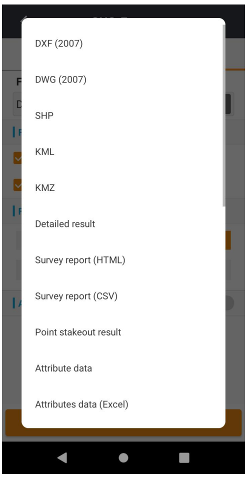
Filter-Measurement Time: Users can set the start time and the end time for exporting data.



Format: Support DAT, TXT, CSV, XLSX, XLS. 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.)

Other format: Support DXF, DWG, SHP, KML, KMZ, Detailed result, Survey report(HTML), Survey report(CSV), Point stakeout result, Attribute data, Attribute data(Excel), Pipeline survey report, Hydro survey report, Polish, MosGorGeo-Raw, Measurement report, Area report, Slovenia report(.html), Verified survey report, Star*Net report(.dat), Star*Net report(.GPS), Trimble JXL(.jxl), MicorStation format(.txt), and RAW data, it will be detailed in Section 3.4.1.

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

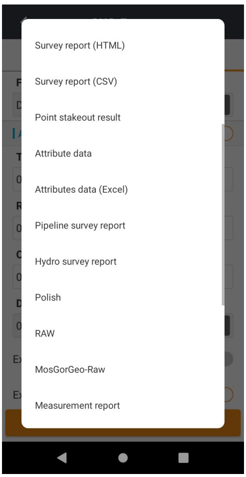


Note: LandStar will automatically apply the same setting when users create a new project.

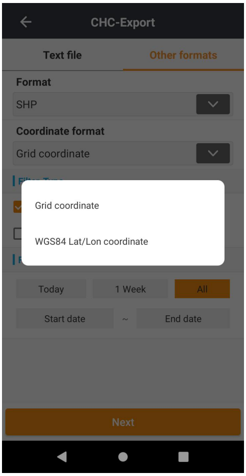
3.4.1 Reports

This function can export other files, including KML file, KMZ file, SHP file, DXF file, Pipeline survey report, Hydro survey report, Polish, Survey report(HTML), Point stakeout result, Detailed result, Survey report(CSV), Attribute data, Attribute data(Excel), MosGorGeo-Raw, Measurement report, Area report, Slovenia report(.html), Verified survey report, Star*Net report(.dat), Star*Net report(.GPS), Trimble JXL(.jxl), MicorStation format(.txt), andRAW file.

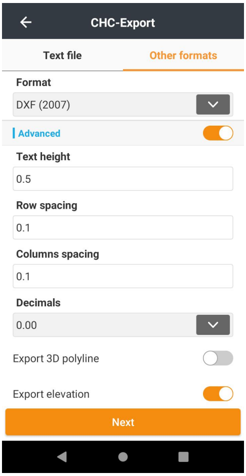
Only when users create project with **PIPELINE TEMPLATE** and survey pipeline data can users export pipeline file successfully.



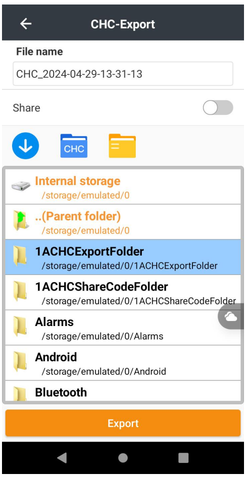
When select **SHP File Export**, the option of “ Coordinate system” will appear.



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 LandStar can be used to draw contour lines.



Click **Next**. There will prompt **Export** 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.

3.5 Points

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

3.5.1 Import

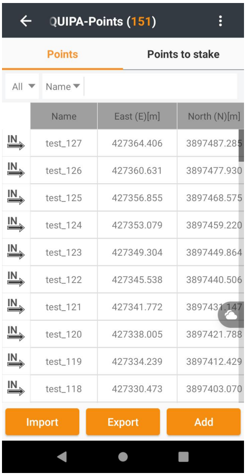
This function can import external point. Click **Import** to import points, the same as **section 3.3.**

3.5.2 Export

This function can export points, the same as **section 3.4**.

3.5.3 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), type (including enter and control point), and coordinate formats:

Local E/N/Elev (Projection grid),

Local Lat/Lon (dd:mm:ss.ssss),

Local Lat/Lon (dd.mmssssss),

Local Lat/Lon (dd.dddddddd),

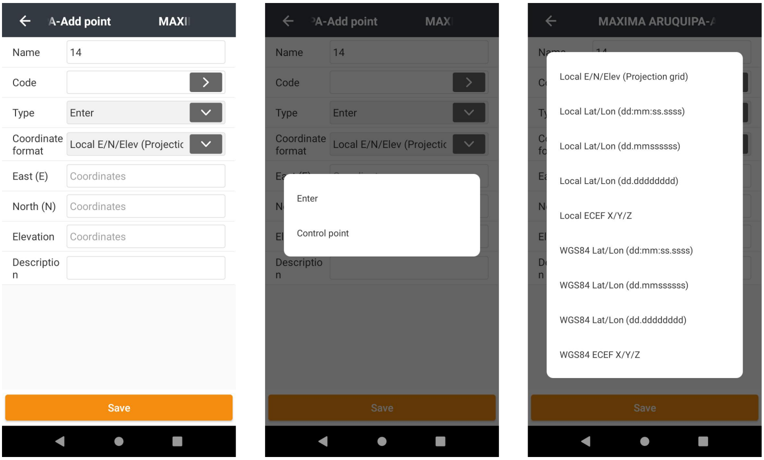
Local ECEF X/Y/Z, WGS84 Lat/Lon (dd:mm:ss.ssss),

WGS84 Lat/Lon (dd.mmssssss),

WGS84 Lat/Lon (dd.dddddddd),

WGS84 ECEF X/Y/Z).

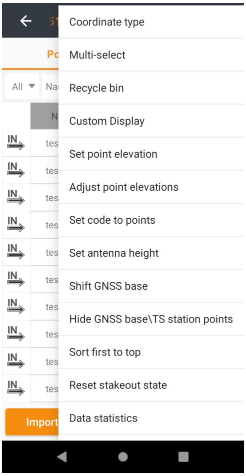
Then, input the point coordinates that users create, Description is optional.



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

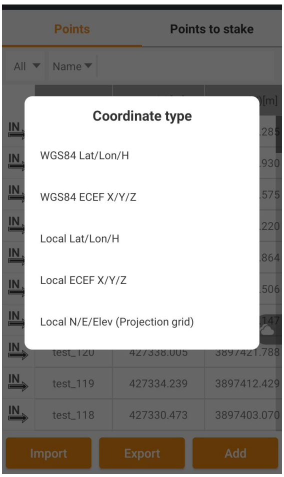
3.5.4 Other Settings

From the points screen, click on the button:



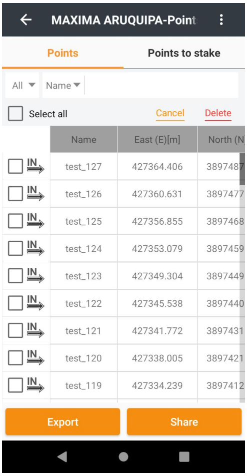
3.5.4.1 Coordinate type

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



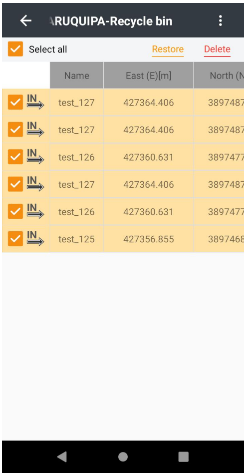
3.5.4.2 Multiple-select

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.



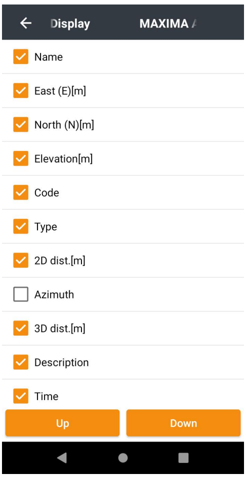
3.5.4.3 Recycle Bin

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



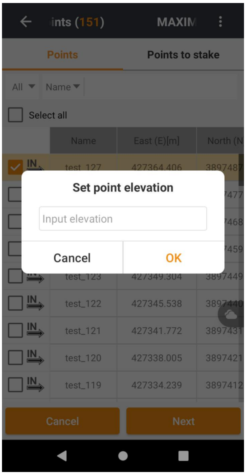
3.5.4.4 Custom Display

This feature controls what is displayed in point management.



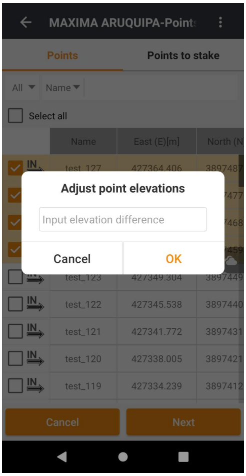
3.5.4.5 Set point elevation

This function can set the elevation of the point.



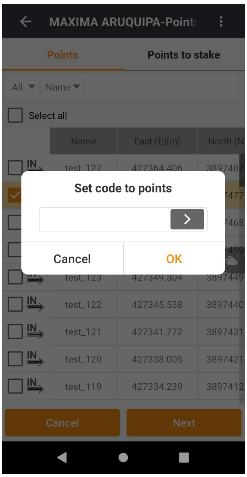
3.5.4.6 Adjust point elevations

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



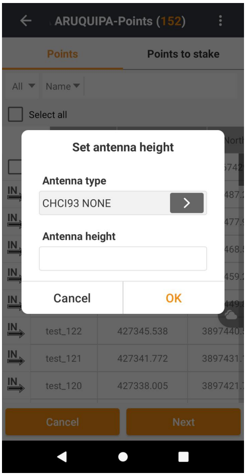
3.5.4.7 Set code to points

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



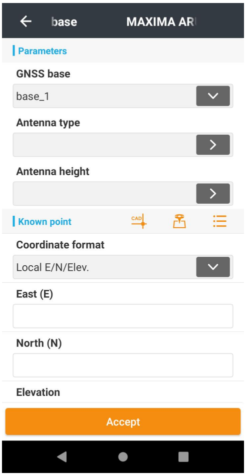
3.5.4.8 Set antenna height

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



3.5.4.9 Shift GNSS base

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



3.5.4.10 Hide GNSS base points

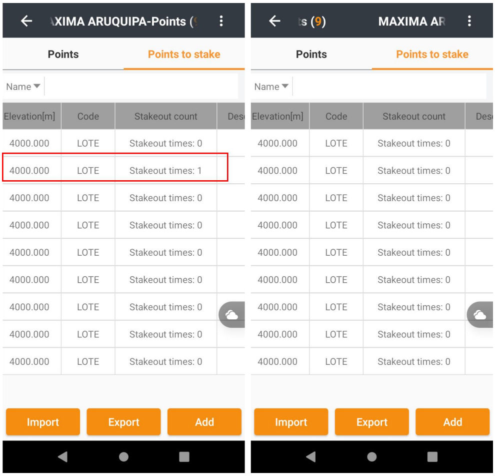
This function can **Hide** GNSS points. Click **Hide GNSS base points** to hide them, click **Show GNSS base points** to show them.

3.5.4.11 Sort first to top

This function can change the order of the point library.

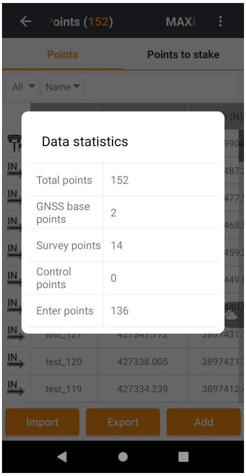
3.5.4.12 Reset stakeout state

This function resets the stakeout state to 0.



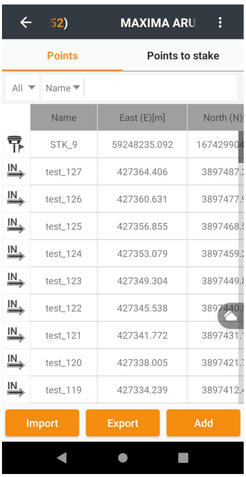
3.5.4.13 Data statistics

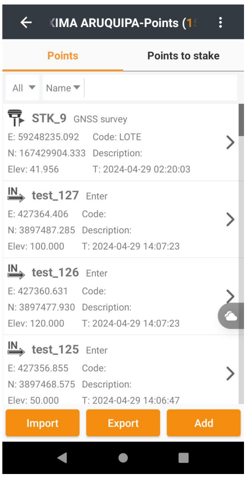
This function can view the different type of points. There are five types, including total points, GNSS base points, survey points, control points and enter points.



3.5.4.14 Switch list style

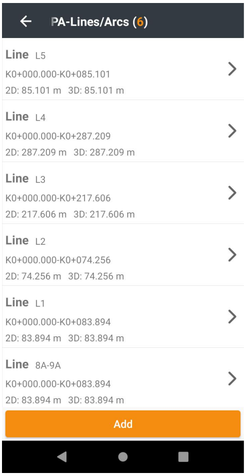
This function can **Switch** list style. Click **Switch list style** to change the style.

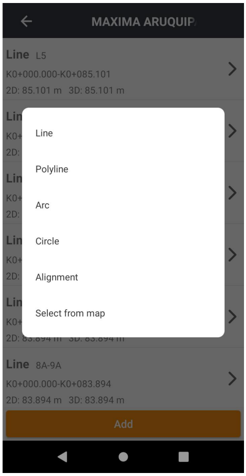




3.6 Lines

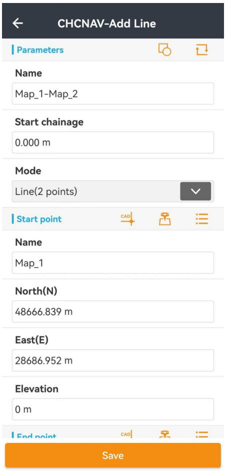
Click Add to add different types of lines, including Line, Polyline, Arc, Circle and Alignment.

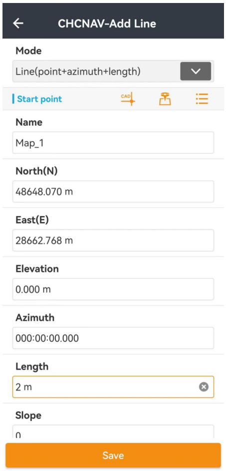




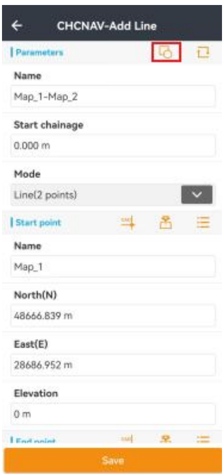
1. **Add**: Click **Add** to select one type, enter the following new interface to create a line.

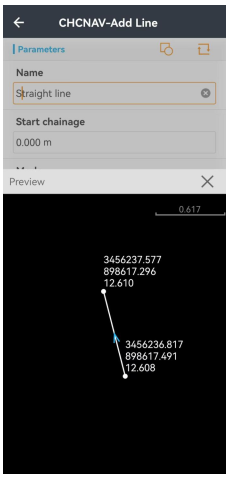
There are two **Methods** including **Two Points** and **One Point + Azimuth + Length. Name**, **Start Point**, **End Point**, **Start Distance**. Two points, user should input **Name, North, East, and Elevation**. The other way, user should input **Name**, **North, East, Elevation, Azimuth, Length and Slope.**

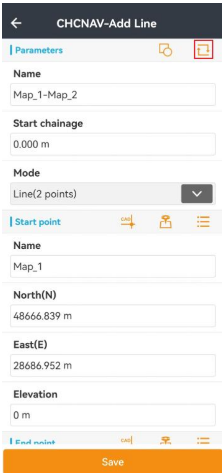


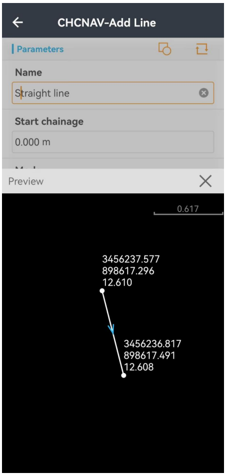


After setting the above values, click **Save**, a line can be created. Users can check the graph by clicking the rectangle button and inverse the direction by clicking the arrow button.

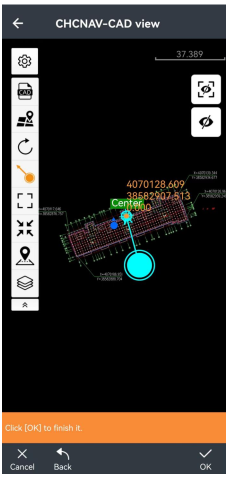


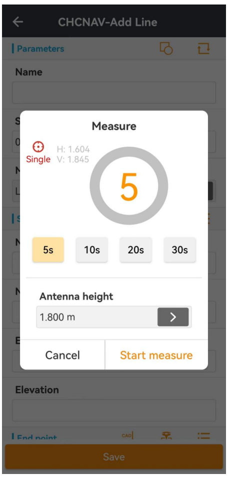


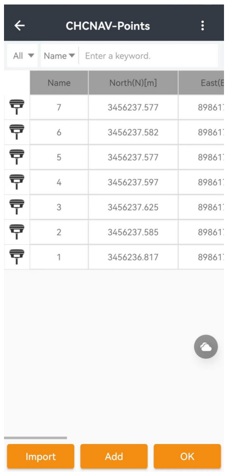




And there are 3 methods to select one point, including from CAD, from point survey and from point lists.

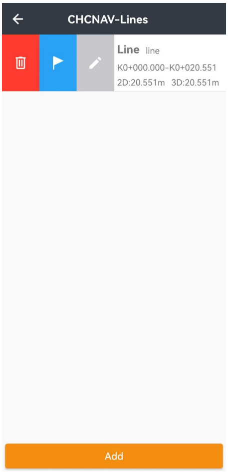


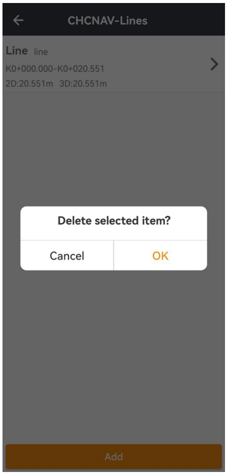




2. **Delete**: Select one line, right slide to click **Delete**, and then it will

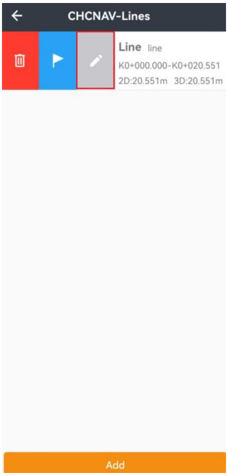
pop up a dialog box "Delete Selected item?" Select **OK,** remove this record; select **Cancel**, do not delete this record.

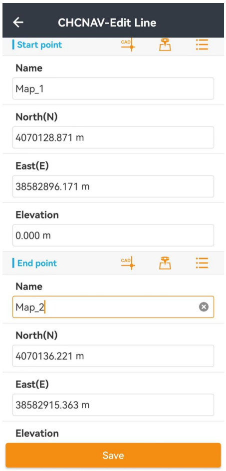




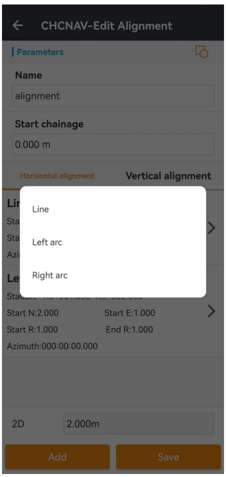
Also, user can click the flag button to stakeout the selected line.

3. **Detail**: Select Line, click Edit to view detailed information about the selected line.

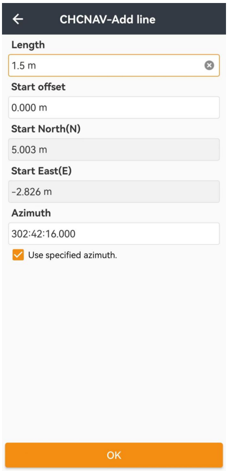


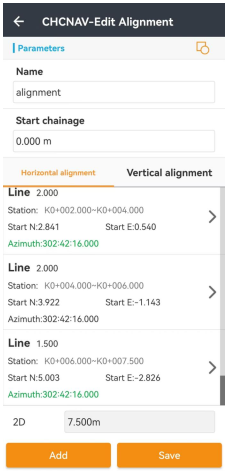


As for alignment, user can click Add to create Line, Left arc and Right arc.

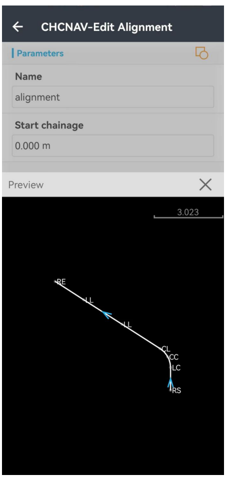


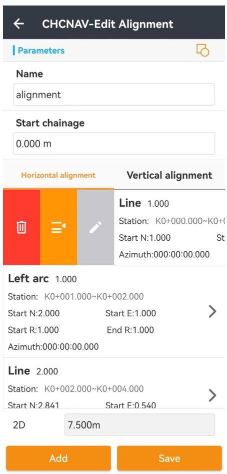
Input Length, Start offset, Start North, Start East and Azimuth if using specified azimuth. Click OK to finish add.





Click rectangle icon on the upper right to see the graph.



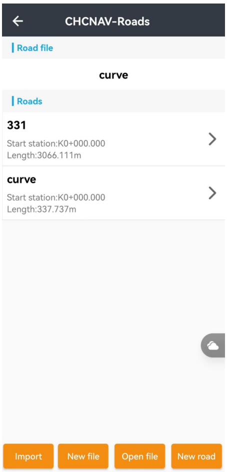


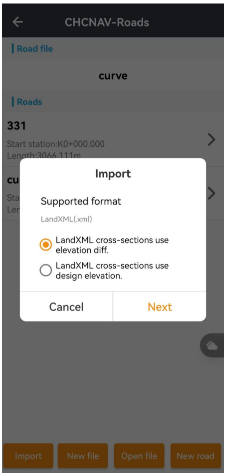
4. **Edit:** Choose a file and right slide to click **Edit** to edit existing alignment.

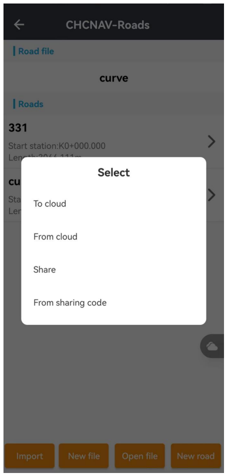
5. **Delete**: Choose a file and right slide to click **Delete** to delete existing alignment

3.7 Roads

The function is to create road project, user can import from cloud and internal storage.







This function 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.

Note: If the road is imported through a LandXML file, you cannot edit the definition of the road, can only view it.

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

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

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

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

Key int the station equations

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

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

Note: 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

Note: 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.

Note: 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.

Note: 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 is not the first one, the value will be calculated automatically.
Start east	Enter the **Start east** to define the line. If current element is not the first one, the value will be calculated automatically.
End north	Enter the **End north** to define the line. If current element is not the first one, the value will be calculated automatically.
End east	Enter the **End east** to define the line. If current element is not 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.

Note: 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 superelevation 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.

Note: 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 superelevation

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 sideslope 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.

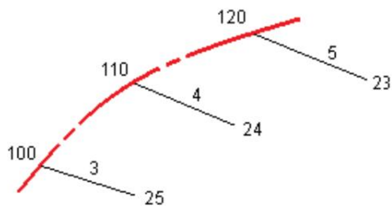
Vertical alignment: Define the changes in the elevation of the road.

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.

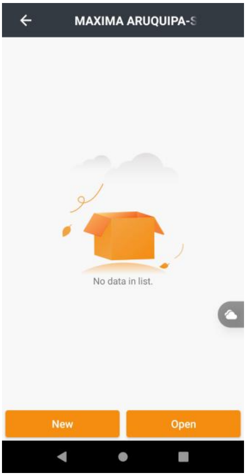
See the following example, where the cross section at station 100 has a string offset from the alignment by 3 and an elevation of 25. The next cross section at station 120 has a string offset by 5 and an elevation of 23. The position on the string for the interpolated station 110 is interpolated as shown to give an offset of 4 and an elevation of 24.



Note: No interpolation occurs between cross-sections with an unequal number of strings.

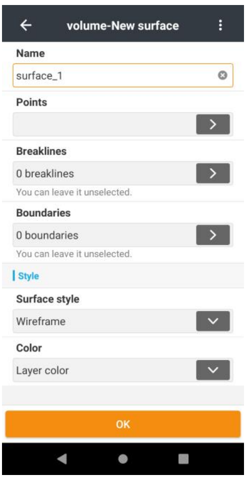
3.8 Surfaces

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

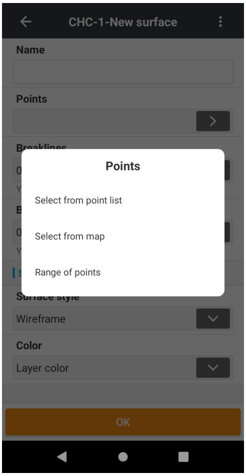


3.8.1 New

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

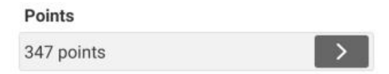


choose “Select from point list”, “Select from map” or search by "Range of points”. The following uses “Select from point list” as an example.



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

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

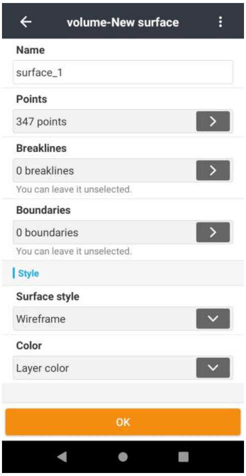


If there are Breakline lines and Boundaries lines can be selected to add.

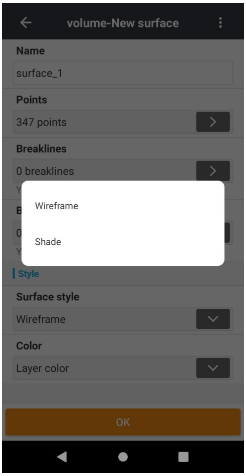
" Breakline" refers to a line that represents a change in elevation or slope.

It is used to describe the shape and contour of the land. And is an important parameter in land surveying and mapping. When conducting a survey, the surveyor will use the Breakline to represent the shape and features of the land, and then use it to calculate the area, volume, and other parameters of the land.

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

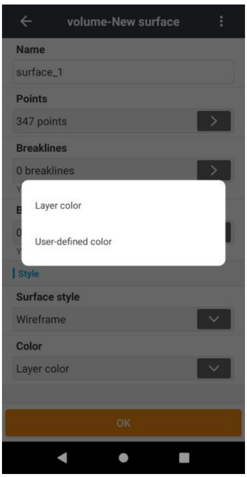


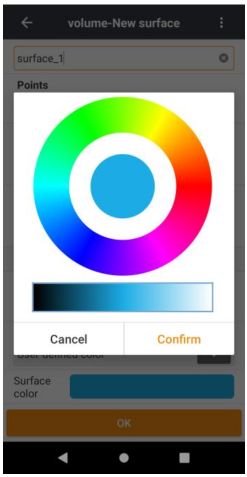
In style, user can modify the face style and color. The default is Wireframe and layer color.



【Wireframe】: Displays a Wireframe made up of lines.

【Shade】: Displays the filled triangulation net.

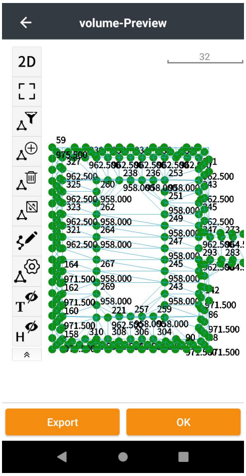


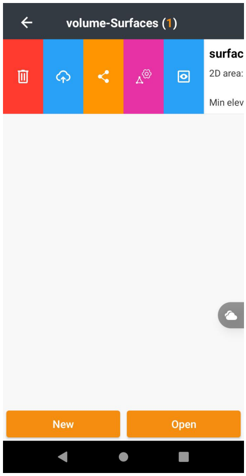


【Layer color】: Displays the color of the layer.

【User-defined color】: Displays user-defined colors.

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

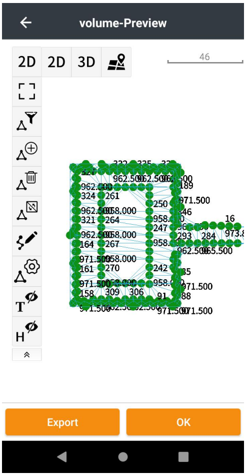




7.3.1 2D

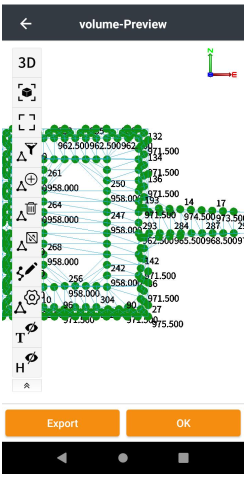
2D: Preview different dimensions, including 2D, 3D and online map preview 2D 3D, switch by the toolbar.

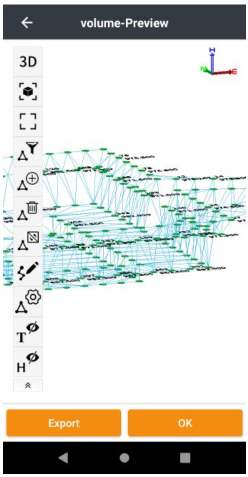
2D: 2D preview on the opposite side.



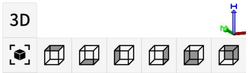
3D: 3D stereo preview on the opposite side.

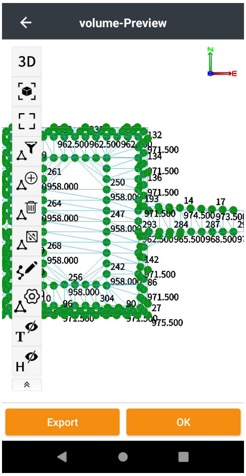
hold the rotation Angle with one finger, rotate left and right or up and down, and zoom with two fingers.

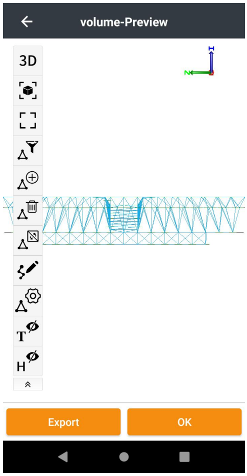




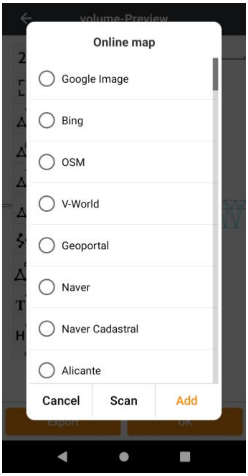
After selecting 3D, click 【Visual Angle】 button to switch between different perspectives.

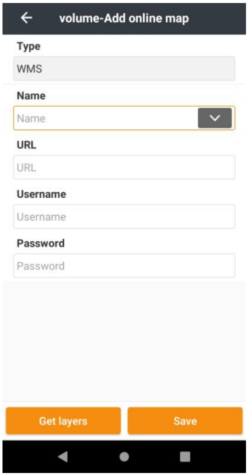






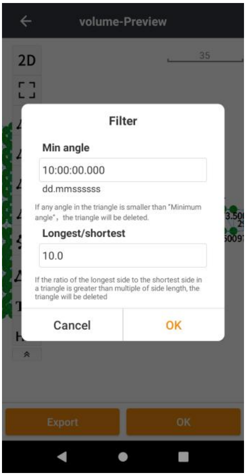
Online map: choose the online map with the software, scan the QR code of the online map, you can also add the online map.



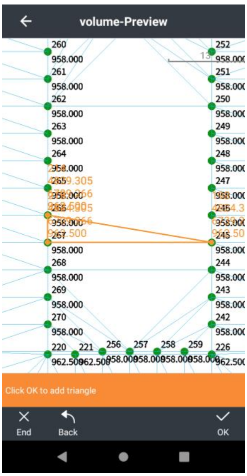


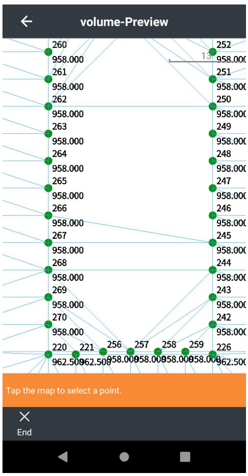
Full graph: Center displays all data on the project.

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

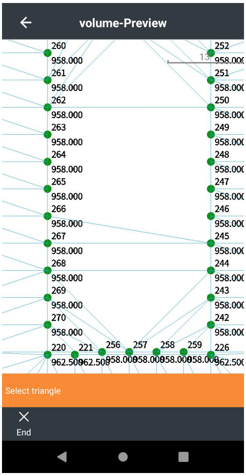


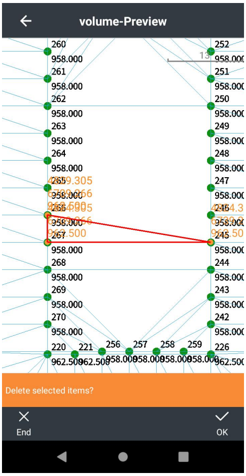
 Add: Add the triangulation net by picking points coordinates on the graph.

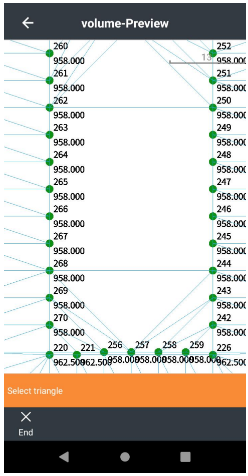




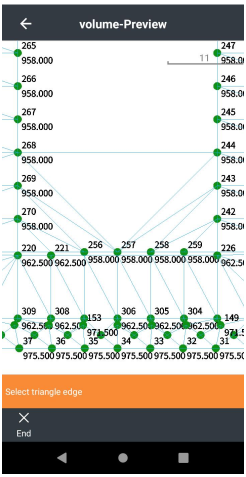
Delete: Select triangulation net on the surface to delete.

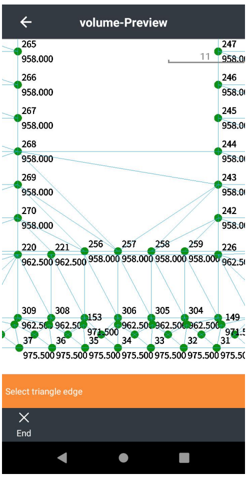




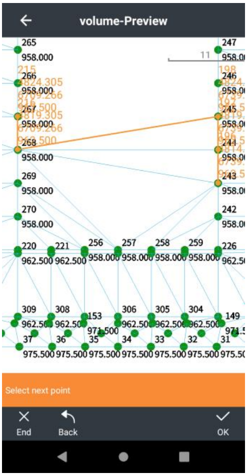


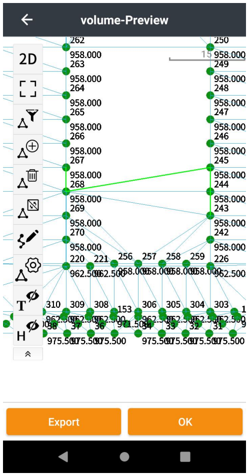
Recombination: Select the triangulation net to be reorganized and form a new triangulation net.



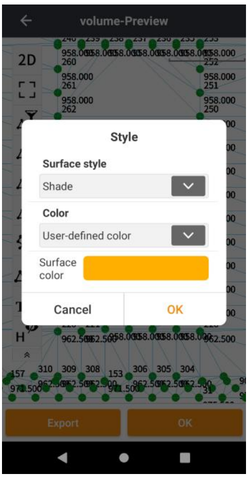


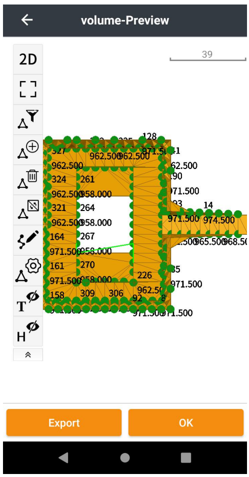
Draw: Plot by picking coordinates on the surface.



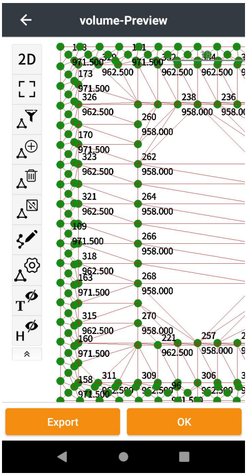


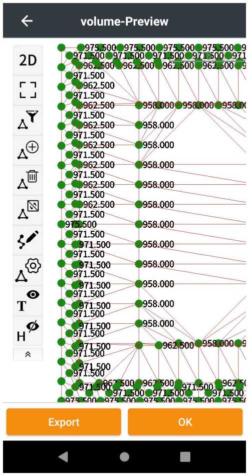
Style: make style edits and changes.



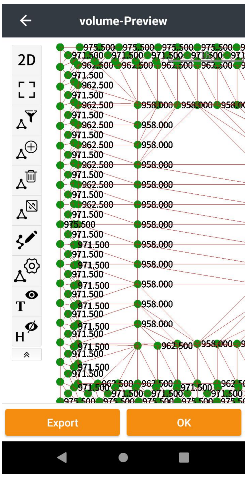


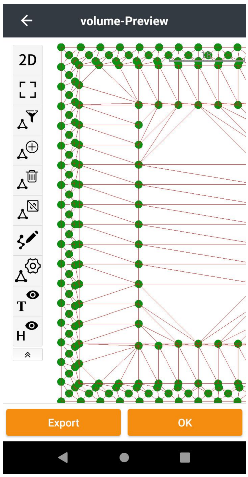
Hide/Display Name: Hide or display the name of the point.



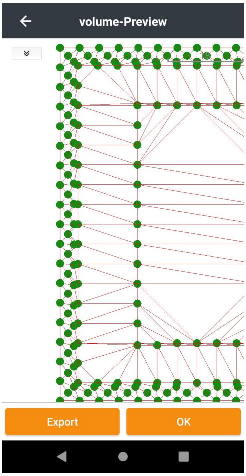


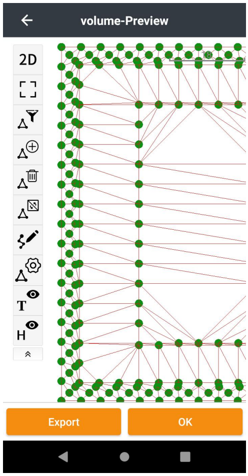
Hide/Display elevation: Hide or display the elevation of a point.



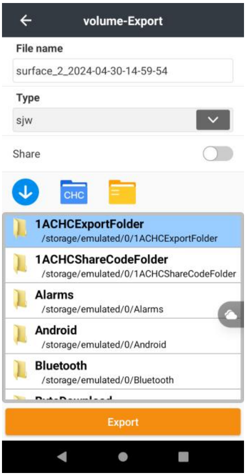


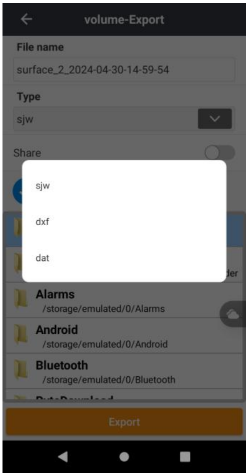
Click fold the toolbar to hide it; Click expand the toolbar.





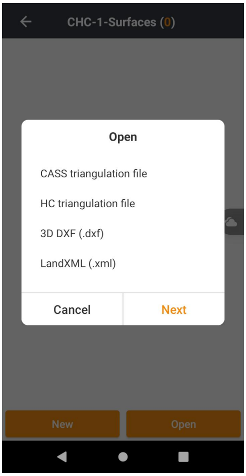
Click Export to export the created face file, the default export folder is /1ACHCExportFolder. File name can be changed, support the export of .sjw, .dxf, .dat format files.



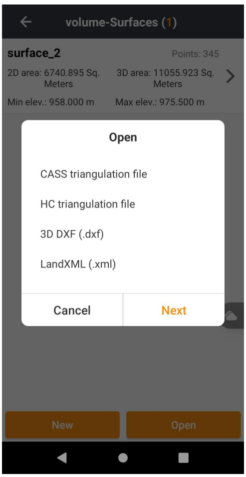


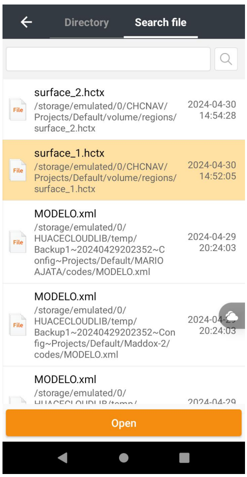
3.8.2 Open

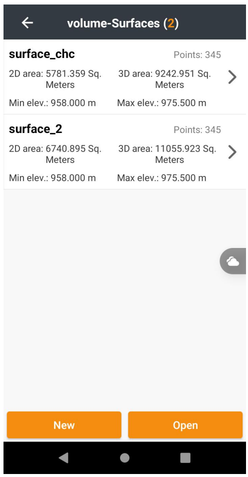
Click open, the software supports importing surface file formats as follows: CASS triangulation file, HC triangulation file, 3D DXF(.dxf), LandXML(.xml).



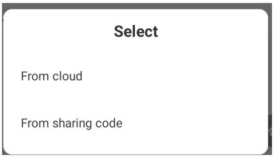
Click open to open the already created surface. Taking opening HC triangulation file as an example, click next, select the file to be opened, click open, name the file, and click OK to see that the file has been imported into Surfaces.





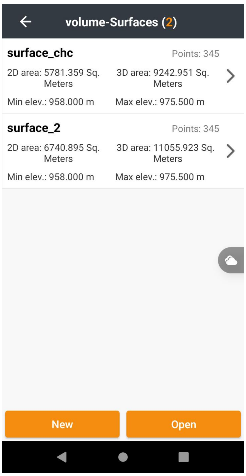


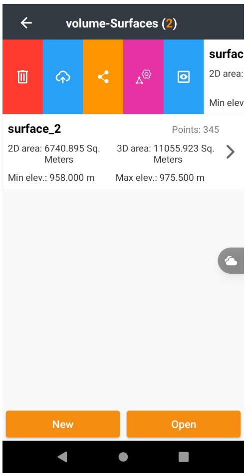
Click cloud icon, it can also be imported through a cloud service.



3.8.3 Edit

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

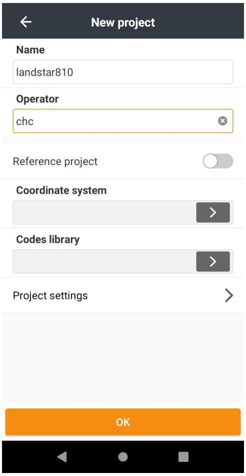


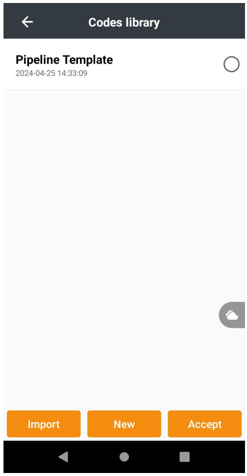


3.9 Codes

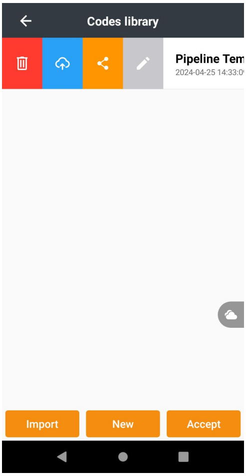
The main function of **CodeList** is to manage codes under the different work conditions. If users save codes in one list, it is not easy to distinguish. So, it is better to create different codelist for saving different codes, and users can select the corresponding codelist based on the particular work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

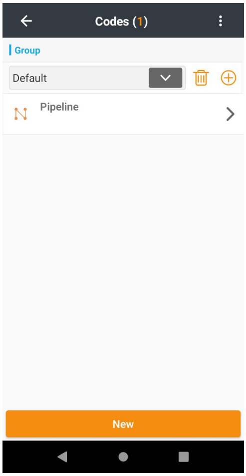
Click **Codes library**, users will see only one line code named “Pipeline”. Please don’t create other code, because user-created code in **PIPELINE TEMPLATE** is void.



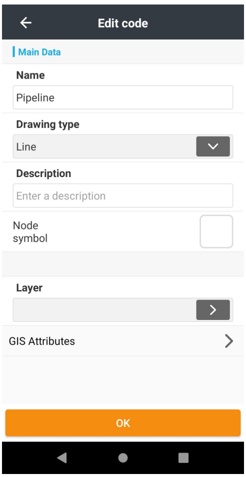


For high precision underground pipeline measurement, please remember to choose **PIPELINE TEMPLATE**, otherwise, users can’t see **Pipeline** icon in **Survey** menu.

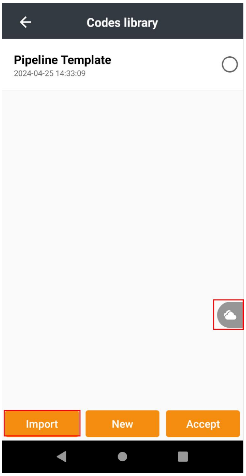


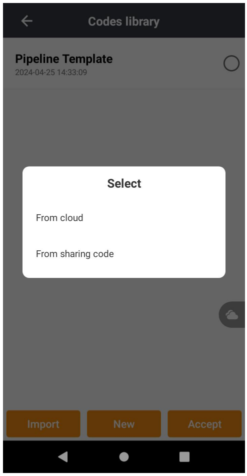


Choose **Pipeline** and click **Edit**, and then users can do as in general template.

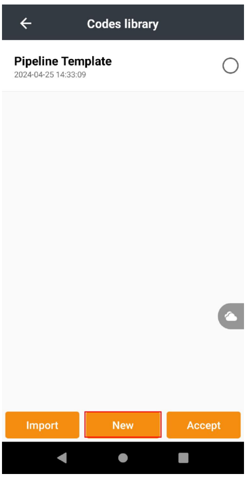


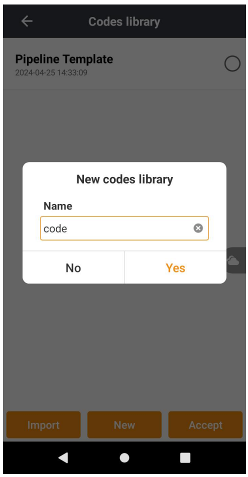
If users need to use other code templates, can choose to import or download from the sharing code and cloud services.



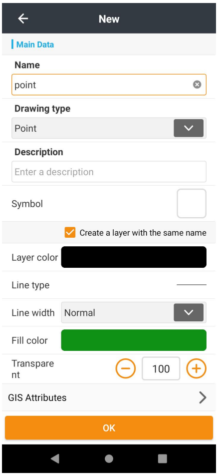


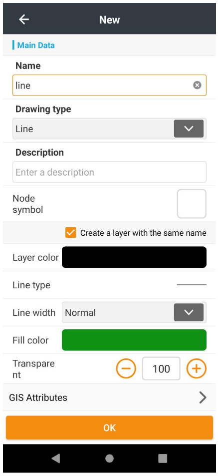
Of course, users can also create new code templates in the software. click **New** to create a new codelist, input file name and click **Yes**.

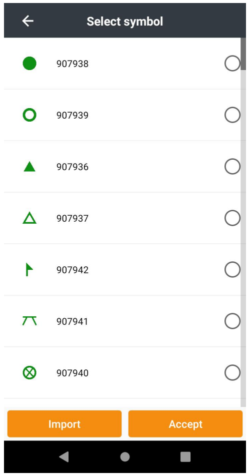




And then, the user can then create a new code layer in this interface. Click **New**, then input new code name, description, and choose drawing type from Point and Line. Choose Symbol from symbol list and decide the size of it.

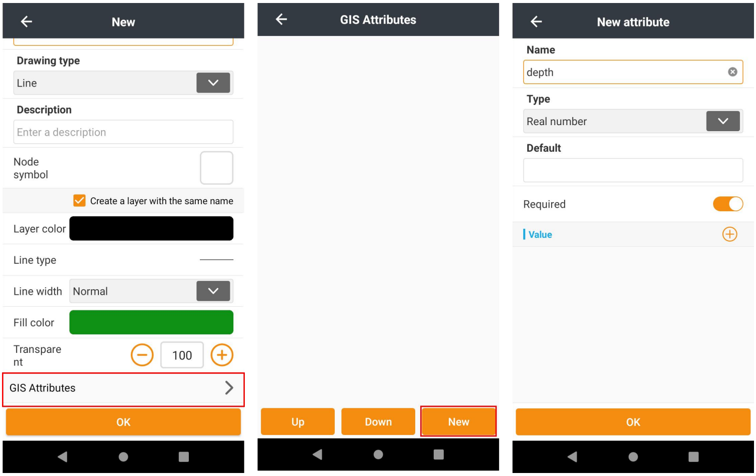






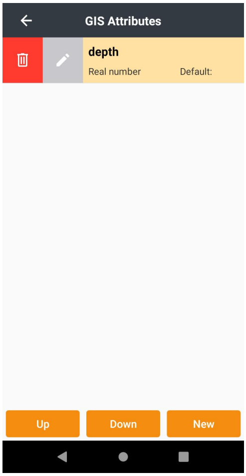
Users can choose color of the new code and decide if they want to color by layer. The Settings such as line type, line width, and fill color can be customized according to requirements.

Users can create a new GIS attribute in GIS Attributes by clicking **New**. Input Name, default, and select type from pull-down menu.



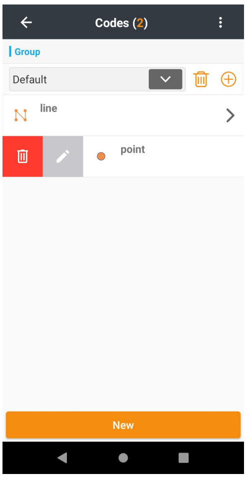
Users can decide if this attribute is obligatory. Click **Add** ⊕ to add values to the attribute. Then click **OK** to create a code.

Up (down respectively) button is to move the selected attribute up (down respectively). Left slide the attribute to **edit** or **delete** it.

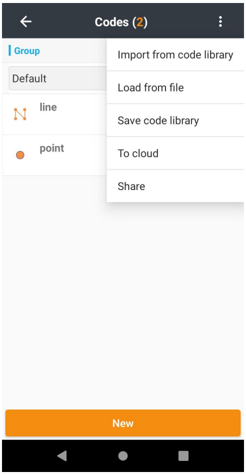


The user can select the layer and click **OK**, and the layer will be created successfully.

Right slide a layer to **edit** or **delete** it.

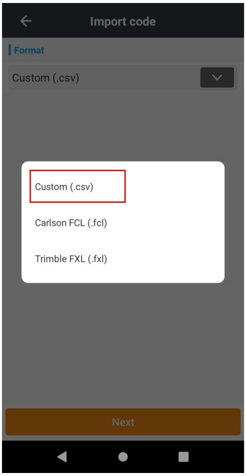


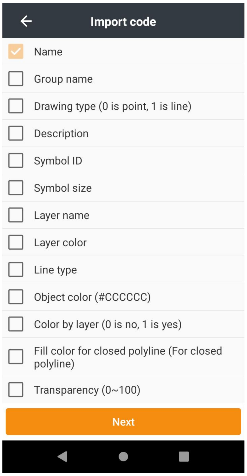
Click the icon on the upper right, and users can load, import, save codes share the codes by cloud or share code.



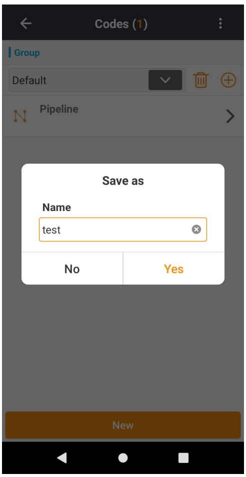
Click **Import from code library** and select the existing code template and the new template will be replaced. Also selecting the Import feature will allow the user to import code from the file.

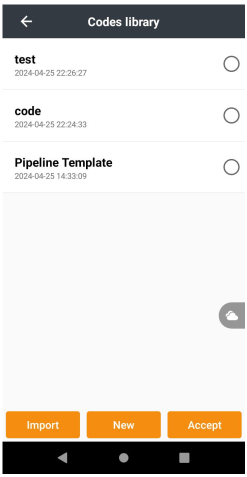
Click Load from file to import code files in three formats: Custion(.csv), Carlson FCL(.fCL), Trimble fxl (.fXL). If Custion(.csv) is selected, clicking next will bring up a number of options, which can be selected depending on the format of the code file.



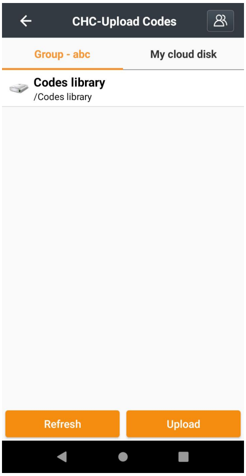


Click Save code library to save the existing code as a template and then continue editing the current template.

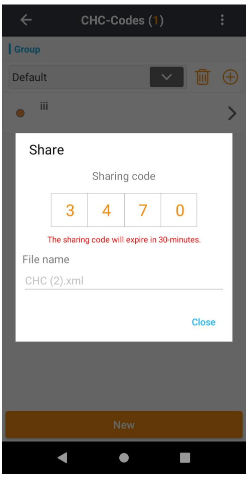




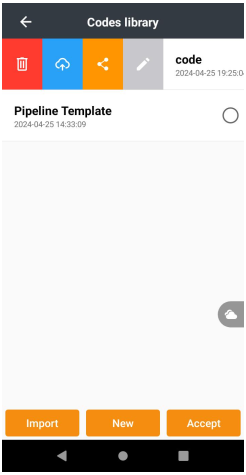
Click To cloud, users can use cloud services to quickly share code templates to the cloud and download on the cloud server.



If you select share, you can use the Share code tool to share the code template and obtain the code on the PC.



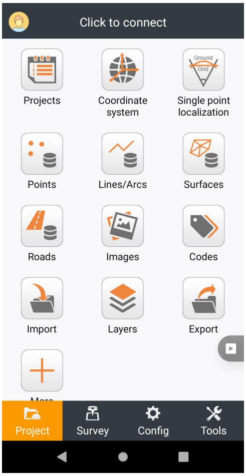
In Codes library, light slide to **delete**, **upload**, **share**, and **edit** the codes. Choose a code and click **Accept**.



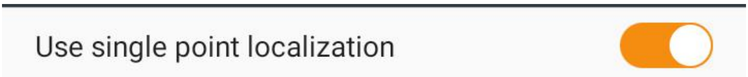
3.10 Single point localization

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

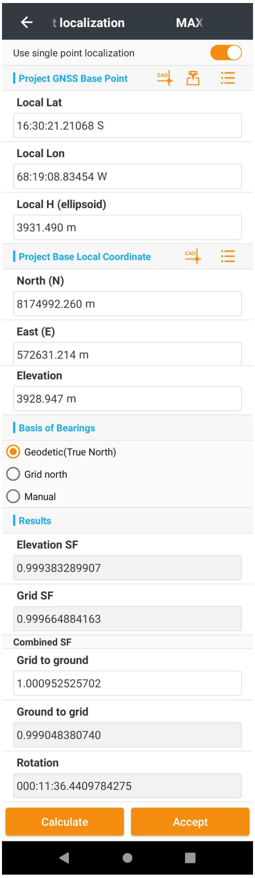
Begin from the **Project** (tab) > **Projects** button:



Slide the Use single point localization to the right:



A single menu will be shown:



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

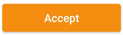
Next enter the **Project Base Local Coordinate** that the receiver should read when placed at the **GNSS Base Point**. Either type the coordinate in, select a **Known point** from CAD or, select a **Known point** from the

Point List.

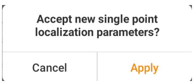
Choose a **Basis of Bearings** from **Geodetic (True North)**, **Grid North** (matches the current Coordinate system projected grid), or **Manual** entry. If manually **Rotation** entry is used, provide extreme precision to match distant coordinates.

Click the 

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

Click 

Accept,

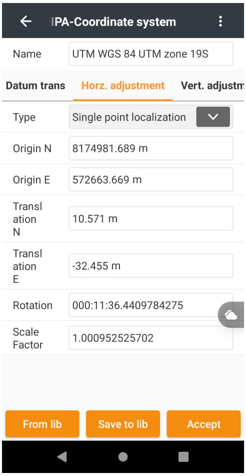


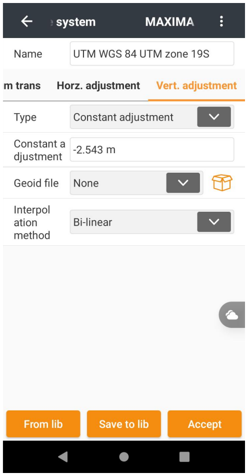
then **Apply** to install the results into the current **Coordinate system**.

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

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

the computed Vertical adjustment will be fully described on the **Project** > **Coordinate system** > **Vertical adjustment** (tab):


IPA-Coordinate system
Name
UTM WGS 84 UTM zone 19S
Datum trans
Horz. adjustment
Vert. adjustm
Type
Single point localization
Origin N
8174981.689 m
Origin E
572663.669 m
Translation N
10.571 m
Translation E
-32.455 m
Rotation
000:11:36.4409784275
Scale Factor
1.000952525702
From lib
Save to lib
Accept


system
MAXIMA
Name
UTM WGS 84 UTM zone 19S
m trans
Horz. adjustment
Vert. adjustment
Type
Constant adjustment
Constant adjustment
-2.543 m
Geoid file
None
Interpolation method
Bi-linear
From lib
Save to lib
Accept

4 Survey

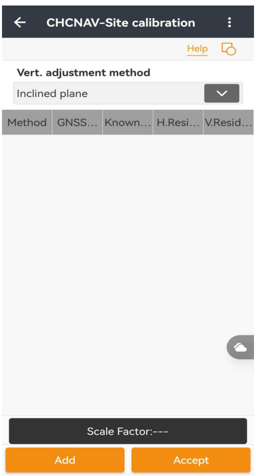
4.1 Site CAL, Base shift and CORS shift

4.1.1 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.

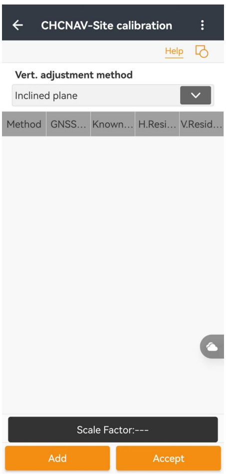
Site calibration: Click to enter point calibration interface.

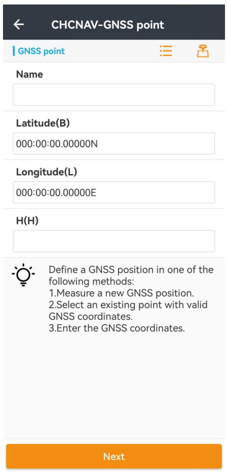


Vert.adjustment Method: Include Inclined plane, Constant adjustment, Surface fitting. Default plane fitting method is Inclined plane.

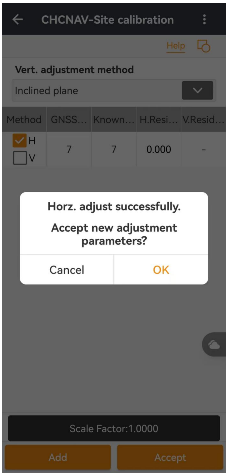
Add: Click to select correspond GNSS points and Known points. Select **Horizontal + Vertical Calibration**. The best choice is to choose 3 couples of points based on actual situation.

user can select Known Point or input Known Point coordinate. Then click **NEXT** until all necessary points have been selected.

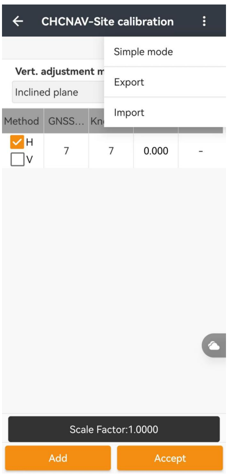


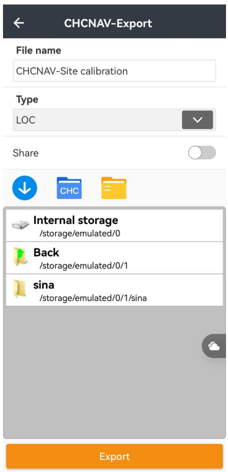


Calculate: Click **Calculate**. The software will prompt "Horz.adjust successfully". After that click **OK**, it will make current calculated correction parameters apply in the coordinate system which can affect into the whole project.



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

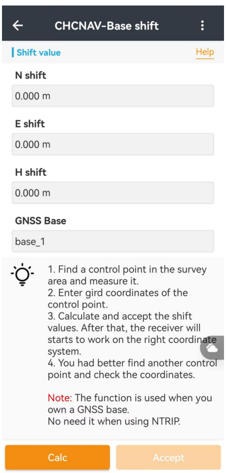




4.1.2 Base shift

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.

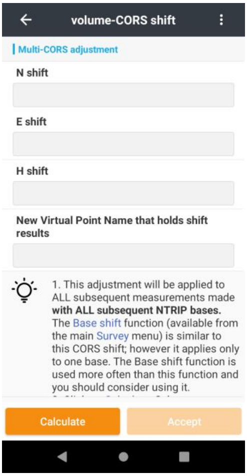
Calc: Click to enter base shift interface. In base shift Interface, click the icon beside Measure Point to select a current point surveyed at a control point, click Next to select the corresponding control point. The calculation results would show automatically. Then click **Accept**. The software prompts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

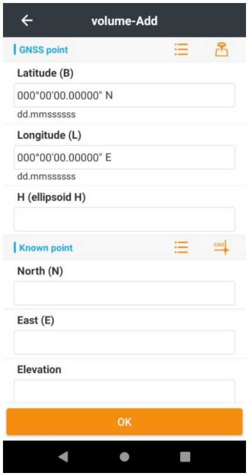


4.1.3 CORS shift

Survey→ click CORS shift ;

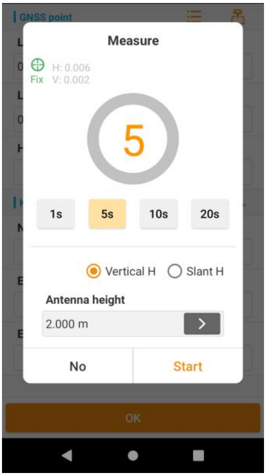
Open the CORS shift interface, click Calculate, add the GNSS point and Known point.





Add the GNSS point

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

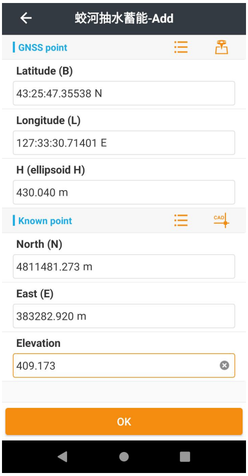


Method 2: Click to select the known point coordinates that were surveyed in advance in the point survey.

Add the known point

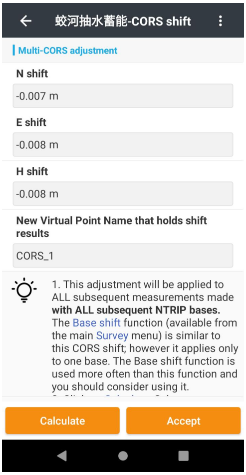
Method 1: Click the ☰ to select the coordinates of the known point entered before.

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



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

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



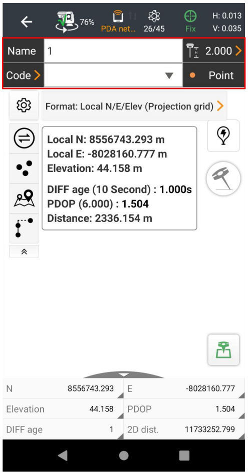
CORS shift operation methods include Guide mode and Simple mode, click to switch modes.

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

4.2 Survey of points

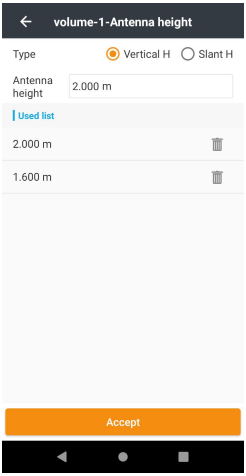
4.2.1 Interface of the Point Survey

Enter the Name, code, select the survey method, modify the antenna parameters, etc., click measurement.



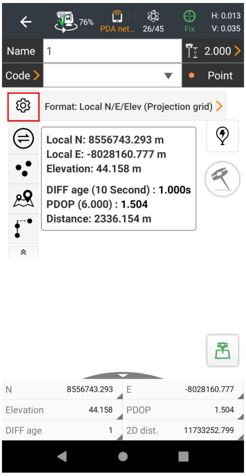
Clicking 

opens the Antenna height menu:

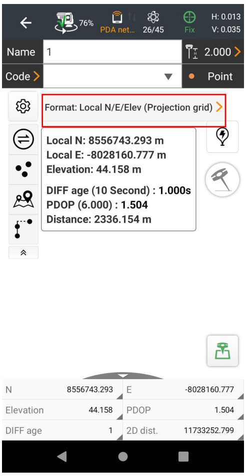


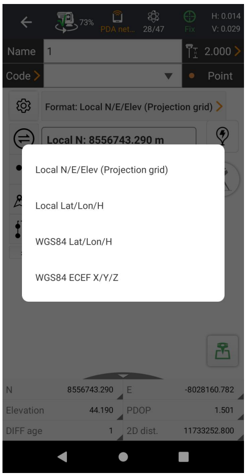
The Antenna height menu keeps the 10 most-recently-used antenna heights so that you can quickly switch between standard pole heights.

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

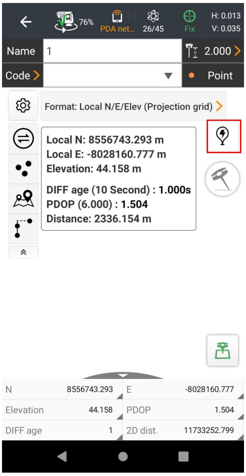


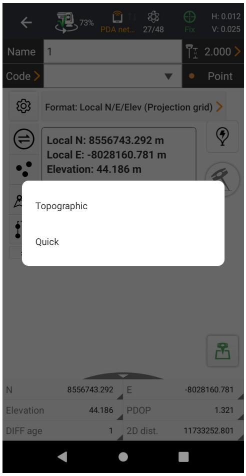
User can also change the **format** of points.



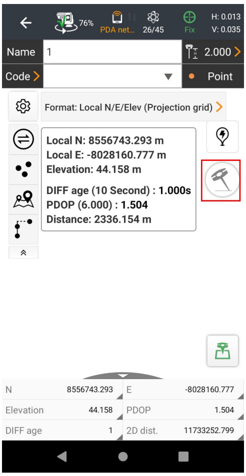


Users can also change the different way of surveying the point.



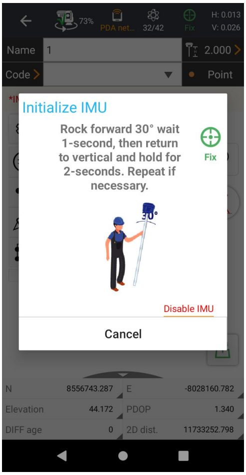


Click **IMU icon** to activate tilt measurement.



There are three types of IMU ICONS: Close  , Successful initialization , Unavailable state .

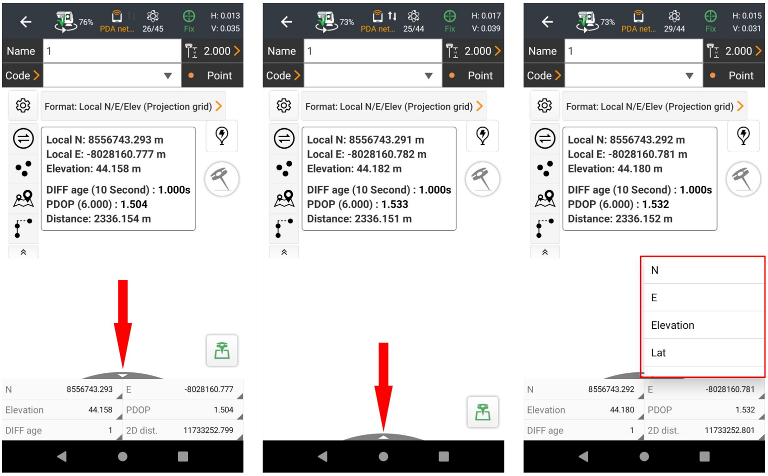
In the closed state, click the icon, the initialization is displayed, and follow the prompts to perform operations.



 icon would appear when the initialization is successful. Click survey icon  to begin survey.

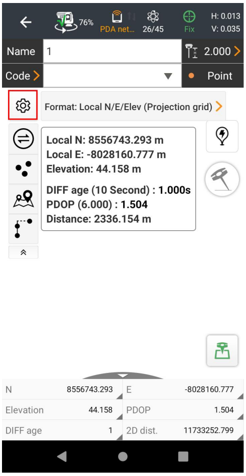
You can also select **Disable IMU** to disable the imu.

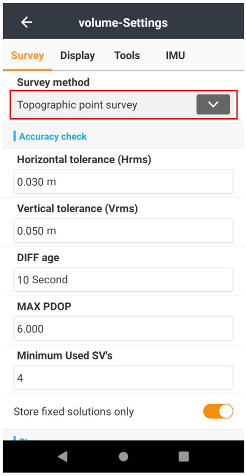
Drag this thing up, you can change the display of the point parameters.

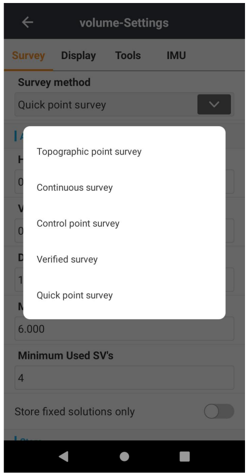


4.2.2 Settings

When we want to change the detailed settings of the point survey, you can click this button.







1. **Survey**

When doing the survey job, you can choose three different survey methods: Topographic point survey, Continuous survey and the Control point survey.

The setting parameters of different measurement methods are described in **Section 2.1.8.1**.

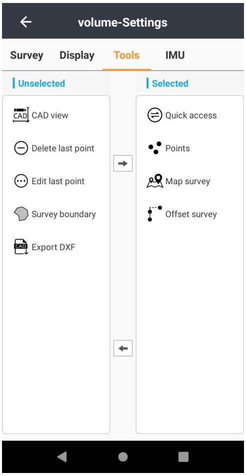
2. **Display**

Any display options will be in this interface.

Display Settings are detailed in **Section 2.1.10.**

3. **Tools**

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



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

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

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

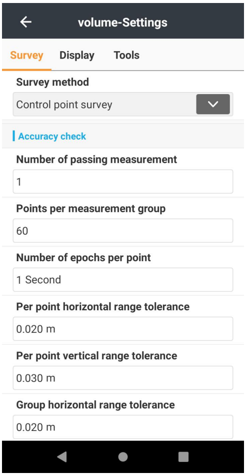
Map Survey: Open this points base in the map survey interface, so you can change the auto center or the follow mode.

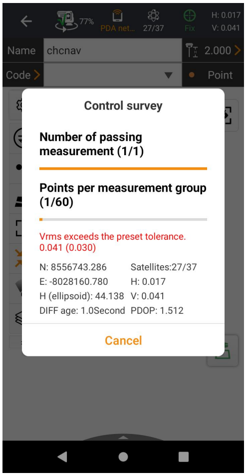
4. **IMU**

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

4.2.3 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.

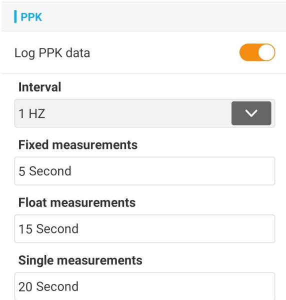




4.2.4 PPK survey

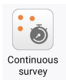
Click PPK icon to start PPK measure. When the PPK measurement is turned on, the static measurement is automatically turned on.

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

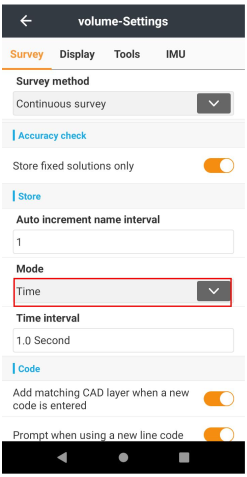


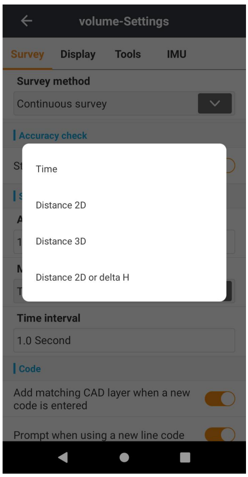
4.2.5 Continuous survey

Available from the **Survey** (tab), **Continuous survey** button:



Click setting icon , select the corresponding measurement mode:

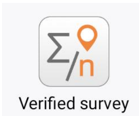




Then return to the continuous measurement interface, click the measurement  icon to measure.

4.2.6 Verified survey

Available from the **Survey** (tab), **Verified survey** button:



The **Verified survey** tool automates acquiring multiple groups-of-averages, automatically resetting the GNSS engine between groups, performing statistical and graphical analysis of the results to reject bad-FIX and average good-FIXED measurements.

The intended use of the **Verified survey** tool is to acquire very reliable coordinates under extremely heavy canopy where the receiver is **expected** to encounter many bad fixes.

The **Verified survey** function differs from the **Control survey** function:

Control survey is intended for use in open canopy where there will never be a 'bad FIX'.

Control survey does not allow post collection group selection. If a bad-FIX is encountered, the entire control point must be recollected.

Verified survey is intended for use in heavy canopy where many bad FIXs are expected.

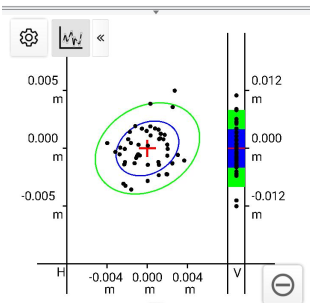
Verified survey will automatically pause if the constellation quality degrades or a bad-FIX is encountered. **Control survey** will stop and abort if the tolerance conditions are not met.

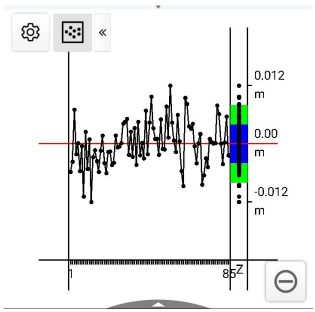
Verified survey makes it easy to add additional groups later, perhaps over several days.

Verified survey allows inspection and post inclusion/rejection of groups.

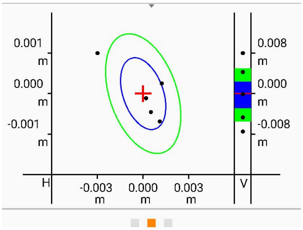
Time	H	H Res[m]	Hrms[m]	V	V Res[m]	Vrms[m]	PDOP	Antenna height[m]
2024-05-06 18:11:53	✓	0.004	0.012	✓	0.009	0.023	1.209	2.000
2024-05-06 18:11:54	✓	0.006	0.012	✓	0.007	0.023	1.209	2.000
2024-05-06 18:11:55	✓	0.003	0.012	✓	0.009	0.022	1.209	2.000
2024-05-06 18:11:56	✓	0.002	0.012	✓	0.009	0.021	1.209	2.000

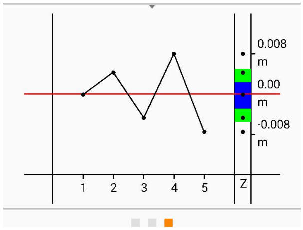
Verified survey generates real-time horizontal and vertical plots that show acquisition progress.





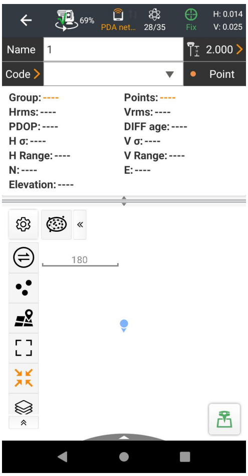
Plots are also available for post analysis of the included measurement groups.





4.2.6.1 Verified survey operation

Click the button on the main survey menu:



The **Verified survey** screen has a group summary area:

Group: 3/5	Points: 42/100
Hrms: 0.011 m	Vrms: 0.021 m
PDOP: 1.212	DIFF age: 1 Second
H σ: 0.003 m	V σ: 0.009 m
H Range: 0.015 m	V Range: 0.043 m
N: 3449265.477 m	E: 612364.483 m
Elevation: 44.188 m	

The drag bar at the bottom of the summary area can be moved up and down as needed to view the entire summary.

The **Group** shows **current group** / **initial number of groups**. The **current group** will be larger than the **initial number of groups** if you decide to collect additional measurements after the initial collection.

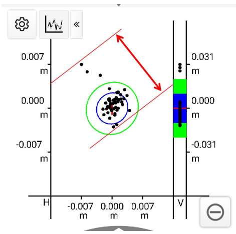
Points is the **current number of points** / **target point count**, for the current group.

Hrms Vrms are the current horizontal and vertical estimated errors reported by the receiver. **PDOP** is the current Position Dilution-of-Precision reported by the receiver.

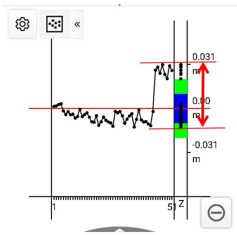
DIFF age is the correction latency (the number of seconds since a valid correction was received by the receiver) reported by the receiver. Typically, it will be less than 3-seconds.

H σ is the standard deviation of all the included horizontal epochs taken for the current point name. **V σ** is the standard deviation of all the included vertical epochs taken for the current point name.

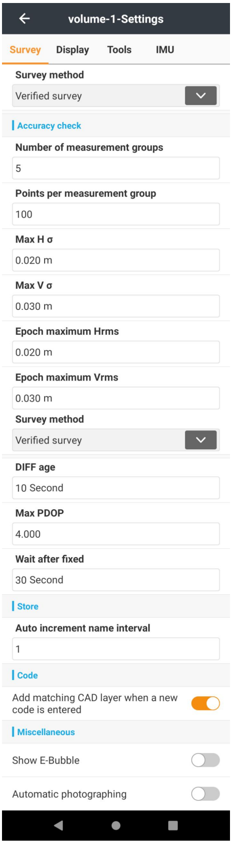
H Range is the horizontal range of included measurements taken for the current point name:



V Range is the vertical range of included measurements taken for the current point name:



When you first enter the **Verified survey**, first click the  Options button, **Survey settings** will be shown:



Nominal **Number of measurement groups** to acquire. Each group is separated by a GNSS engine reset and the **Wait after fixed** time.

Each group will include **Point per measurement group** epochs.

If the receiver reports a Hrms value higher than the **Epoch maximum Hrms**, collection will wait for a lower Hrms.

If the receiver reports a Vrms value higher than the **Epoch**

maximum Vrms, collection will wait for a lower Vrms.

DIFF age is the maximum correction latency allowed before collection is paused. Typically, GNSS measurements with higher differential age have lower accuracy.

Max PDOP is the maximum Position Dilution-of-Precision allowed before collection is paused.

Between each measurement group, the GNSS engine is reset. This forces the receiver to completely reacquire a new position. After the receiver reacquires satellite tracking, resolves ambiguities, receives corrections, and computes a FIXED solution, group collection waits an additional **Wait after fixed** time before starting to acquire epochs. This is intended to allow the receiver to further stabilize to a more accurate value.

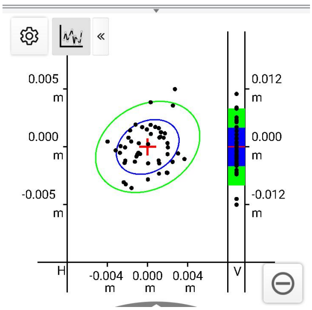
Note: **Show E-Bubble**: enables the E-Bubble on the display screen. This is only applicable to receivers with an **E-Bubble** or an **IMU** like the i50, i80, i70. The **E-bubble** is not related to the IMU which is forced inactive for **Verified survey**.

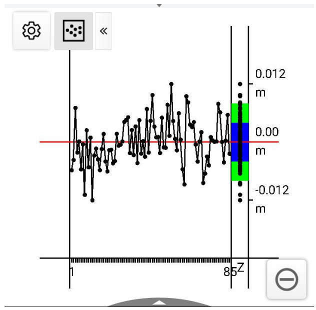
After configuring the **Verified survey** specific settings, enter (or accept the default) **Point name** and

The receiver IMU is always disabled for Verified survey, it is important to carefully level the receiver. Finally click the **Begin survey** button to start acquiring measurement epochs. The **Verified survey** will start following the rules established in settings:

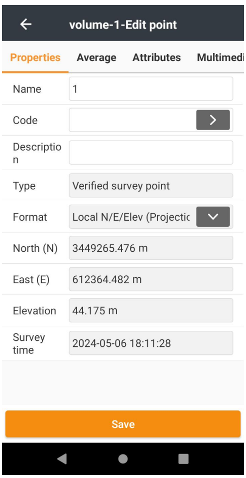
Hrms: 0.011 m Vrms: 0.021 m
PDOP: 1.212 DIFF age: 1 Second
H σ: 0.003 m V σ: 0.009 m
H Range: 0.015 m V Range: 0.043 m
N: 3449265.477 m E: 612364.483 m
Elevation: 44.188 m

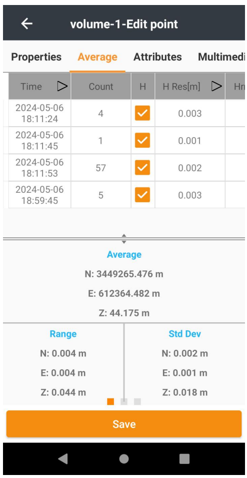
Click the button while points are collected to display scatter plots for the horizontal and vertical measurements:





At the conclusion of the last automatic group, click the Edit last point button to display the results of the **Verified survey**:





Select the 2nd tab **Average** to view the results of each collected group.

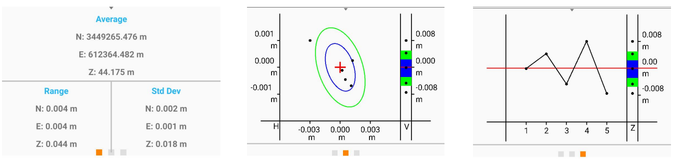
Drag the top section right and left to reveal the report columns for the measurement groups:

Time ▷	H	H Res[m] ▷	Hrms[m] ▷	V	V Res[m] ▷	Vrms[m] ▷	PDOP ▷	Antenna height[m]
2024-05-06 18:11:53	✓	0.004	0.012	✓	0.009	0.023	1.209	2.000
2024-05-06 18:11:54	✓	0.006	0.012	✓	0.007	0.023	1.209	2.000
2024-05-06 18:11:55	✓	0.003	0.012	✓	0.009	0.022	1.209	2.000
2024-05-06 18:11:56	✓	0.002	0.012	✓	0.009	0.021	1.209	2.000

Enable and disable group contributions to the average by checking and unchecking the H and V.

Use the **H Res** and **V Res** values to find bad FIXes and remove them from the final computed-point. Sort the groups by clicking on the sort icon ▷ at the top of each column.

The bottom portion of the Average tab has three panels. You can switch between them by swiping left and right:

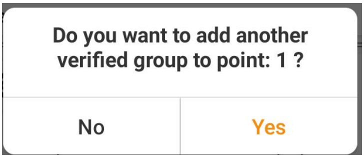


These panels reflect only the included ✓ measurement groups, they automatically update as groups are included and excluded.

4.2.6.2 Adding additional measurement groups to a Verified survey

After a **Verified survey** operation successfully stores a result into the **Point list**, you can add additional measurement groups.

Reoccupy the mark, then return to the **Verified survey** screen and either type in the same Point name, then click on Begin or click on an existing Verified survey point. LandStar will verify that you want to add to the existing point:



If you have already collected the **Number of measurement groups** specified in the **Verified survey** options but would like to automatically collect several additional observation groups, return to **Options** and set the **Number of measurement groups** to the new desired total.

When you click on **Begin** automatic group collection will continue until the new desired number of groups has been reached.

4.2.6.3 Point Names

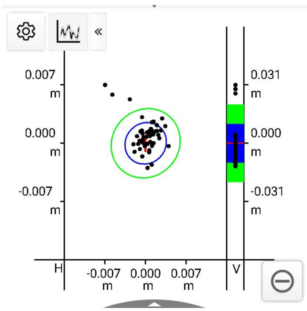
Verified survey points groups are collected and organized by **Point Name. The Point Name** Name 1 **box: holds the name for** the group that will be collected when the **Start measurement** button is pressed.

Unlike other survey modes, the Name does not automatically increment, this facilitates collecting additional groups into an existing averaged point.

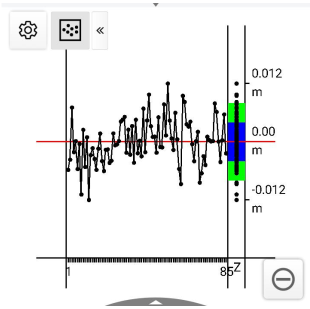
4.2.6.4 Real-time plot

While groups are being collected it is possible to display real-time result plots. These plots show all the enabled measurement epochs. (You can disable groups in the Edit Point, Average tab.)

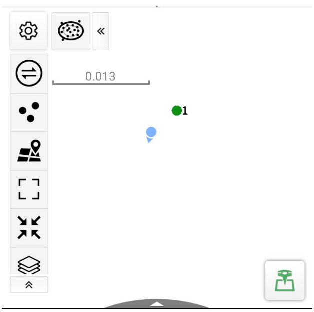
When showing the map screen, clicking the  button will switch to the combined horizontal and vertical scatter plots:



Clicking the  button will switch to the vertical timeline plot:



Clicking the  button will return to the point display map:



On these plots, the blue ellipse and background are 1-sigma, and the green ellipse and background are 2-sigma indicators.

4.2.6.5 Start / stop measurements

Click the **Start measurement** button to begin acquiring epochs for the next group.

 **Begin measurements**

After measurements have started, the button changes to:

Stop measurements

Clicking **Stop measurements** aborts the current measurement group after a confirmation.

4.2.6.6 Back

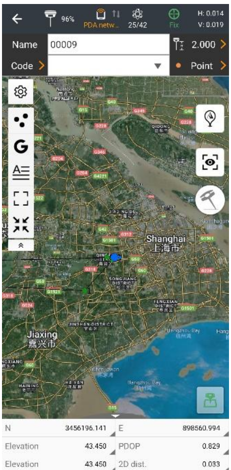
Clicking on the **Back** button returns to the **Main Survey** menu.

4.3 Map survey

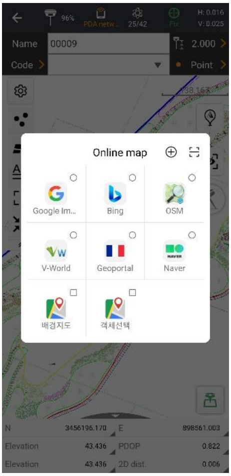
Map survey allows users to survey with a base map. The base map can be online maps or maps imported by users.

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

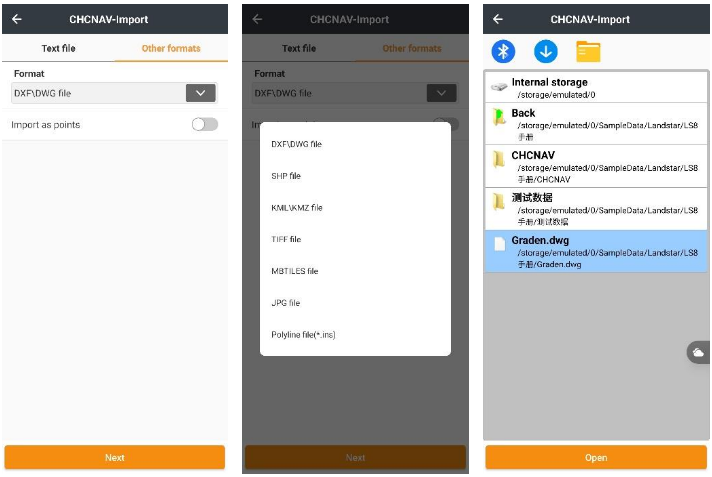
Users can choose WMS/WFS for clearer raster or vector map of working area .



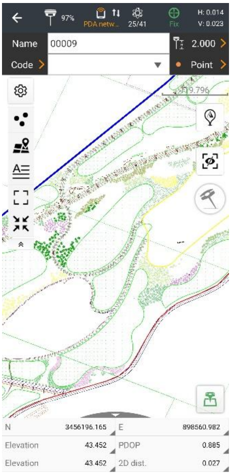
To use an **online map** as base map, click on the **map** icon on the left. You can choose the preset maps, or you can add a map supporting WMS or WFS by clicking on the **plus** icon in the top right.



To **import user-defined map**, go to the main menu and enter **Import** in the Project page. Choose **Other formats** and tap the selectbox under **Format** to choose a format matching your map file. After that, click **Next,** find your file and **Open** it.



Go back to Map survey and you can check the imported map.



Name 【Name】: The default name can be used, or enter it yourself.

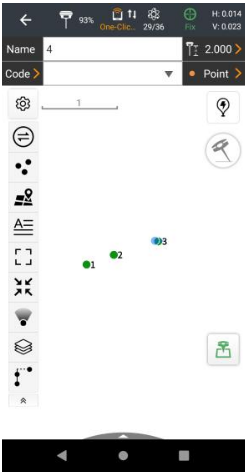
Code 【Code】: Click the code to enter the code management, select the code from the code management, or directly from the drop-down list (the code and the survey type interact with each other in the drop-down list, survey type when the point is selected, only the point code is displayed in the drop-down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

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

【Survey Method】: Click to switch Topographic point, Quick point.

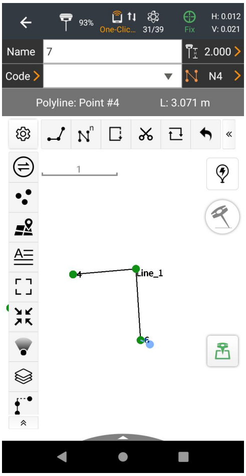
4.3.1 Point survey

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



4.3.2 Line survey

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



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

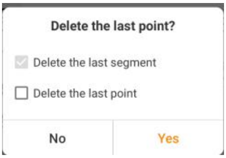
【Lines】:Enter The line segment editing page.

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

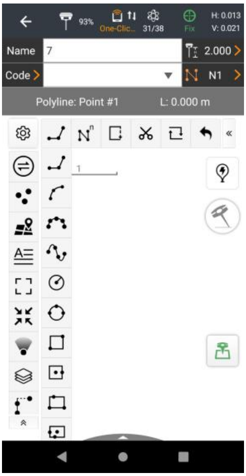
【Break drawing 】: Break the measurement from the current line and proceed to the next task.

【Invert】: Swap the start and end of a line segment.

【Rollback】:delete a line or delete a line and points on it.



1.Multiple line types



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

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

 **Multi-point arc** is a quasi-synthetic arc by collecting multiple

points.

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

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

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

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

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

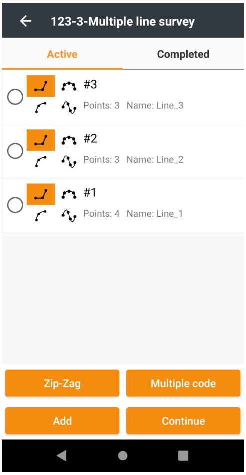
Rectangle is to collect 2 points as the wide edge of the rectangle, and then collect any point (including the point on the extension line), the vertical distance between the point and the wide edge is the length of the rectangle height to generate the rectangle.

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

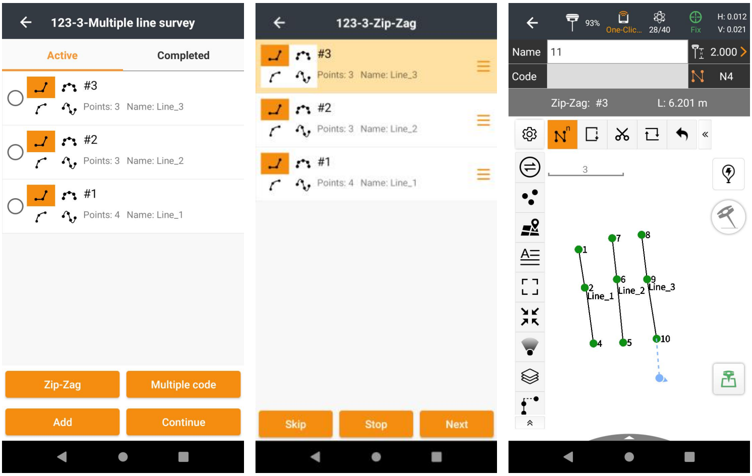
Select the corresponding icon, the line type can be changed to:

polyline, arc, multi-point arc, spline curve.

2.Zip-Zag survey

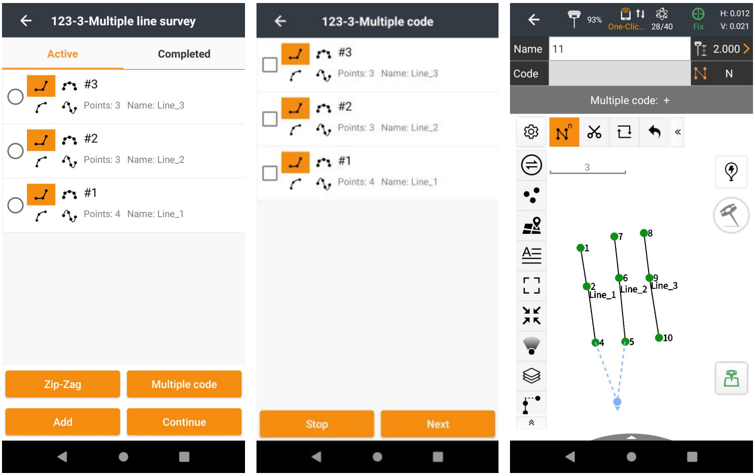


On the multiwire screen, click Zip-Zag, the Zip-Zag survey screen is displayed (the line type can be changed also), click Next, survey will be made in this order: Line 1 - line 2 - line 3 - line 3 - line 2 - line 1 - line 1 - line 2 - line 3, etc.



3.Multiple code survey

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



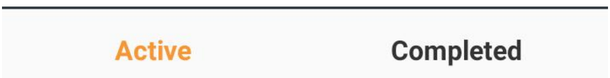
4.Add and Continue

Click **Add** to new a line.

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

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

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



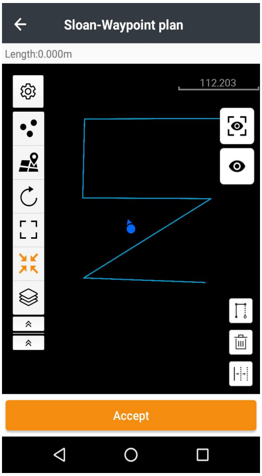
Select line and swipe right, it also supports  deletion, renaming, inversion, closing, and completion.

4.4 GNSS Survey of hydro survey

Hydro survey is used for detecting the height of water surface and underwater terrain. User can design the route of echo sounder and get the value of depth, seabed elevation, surface elevation.

Waypoint plan

Click Waypoint plan in the main interface, then user can pre-define the survey route.



: Draw route line icon.

: Delete route line icon.

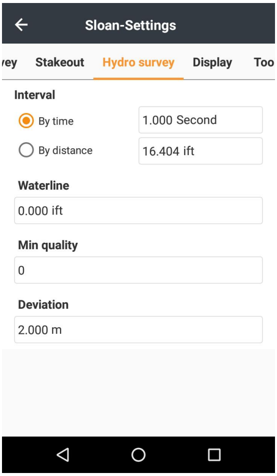
: Draw parallel lines icon.

: locate to current position icon.

: Full screen view icon.

Setting

Click in the main interface, user can set the parameters.



Interval: There are two types of hydro survey methods: **By time** and **By Distance**.

Pole height: The vertical or slant height of receiver.

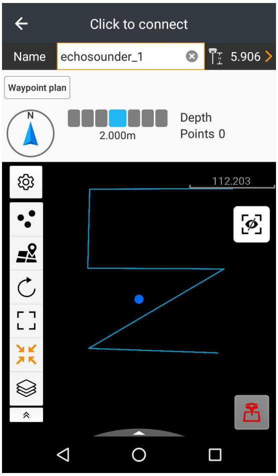
Waterline: The depth of the boat draught.

Min quality: Used to filter low-quality data. When the quality coefficient is lower than the **Min quality**, LandStar won't store points. The quality value comes from the echo sounder, value goes from 0 to 100.

Deviation: Set the deviation limit from the designed route line.

Survey

During the survey user click  to start a survey. Tap  to stop the survey.



Compass: The direction of the ship sailing.

: The position and distance of the ship in the direction of the preset route.

Depth: The real-time value of depth.

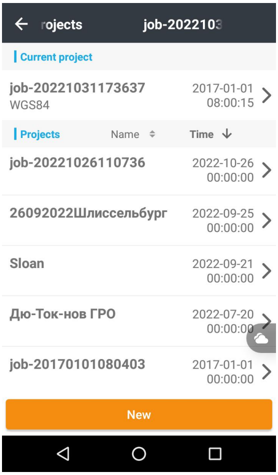
Points: The number of points that have been collected.

Click point library to manage the collected points. User can query, delete, and check the detail of every point.

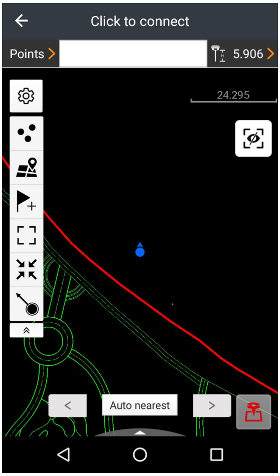
4.5 GNSS Stakeout

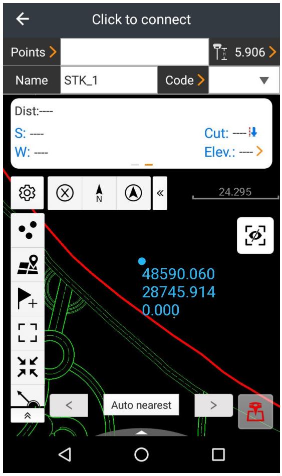
4.5.1 Point Stakeout

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

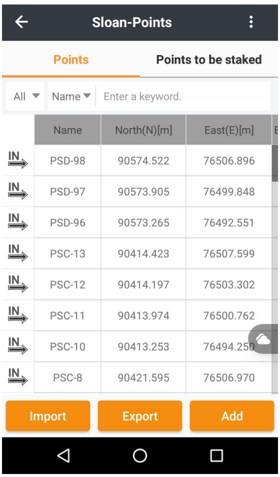


In this case, we will use a CAD file as simple.

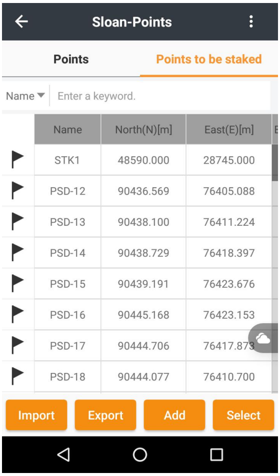




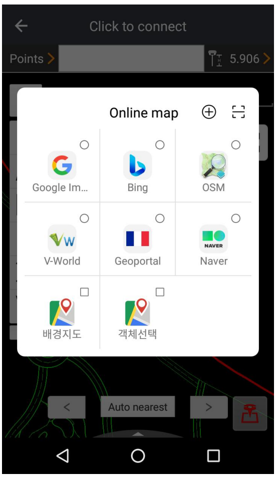
From **points library**: Select a point from points library ,you can also add a point manually， or import/export the point file in this faction .



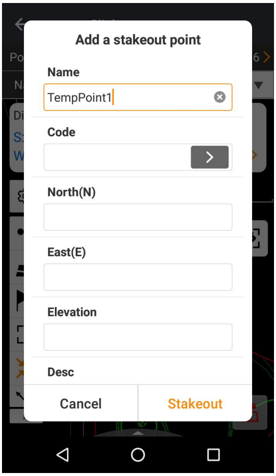
From **Stakeout points**: Select a point from stakeout points library.



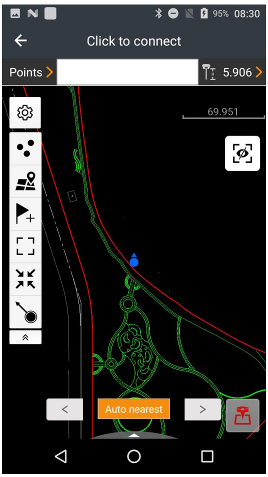
Online map: Users can choose the online map which they want to use as background.



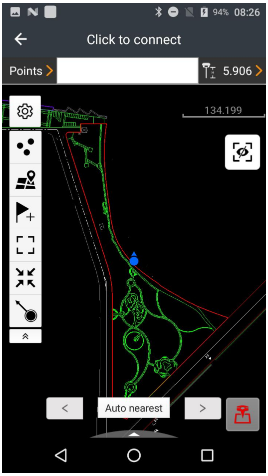
Enter a point: Users manually input the name, code, and coordinates, then click **Stakeout**.



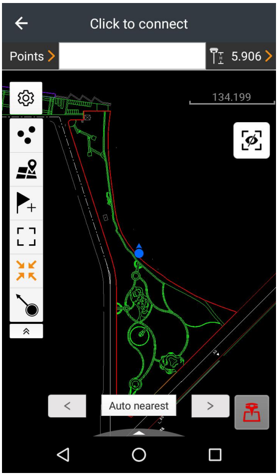
ATUO nearest point: The **ATUO nearest** button is to rank points according to distances.

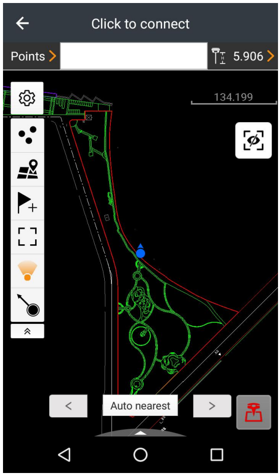


Full view: Users can view the full map.

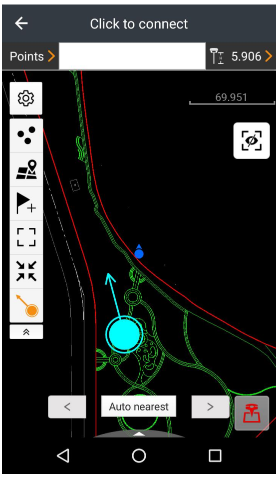


Center: Users can click it once to make the map always heading north, click it twice the map will rotate in the direction of PDA, click it three time the Auto centering will be turned off.



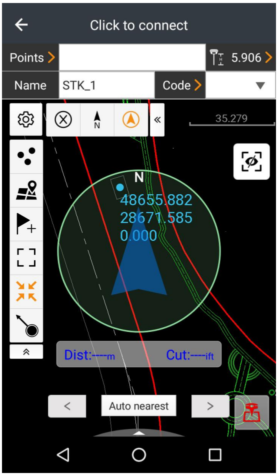


Snap:Users can choose a point from the map by the arrow.

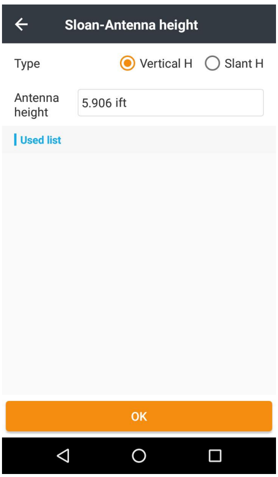


Click the compass icon will show distance and direction to the point.

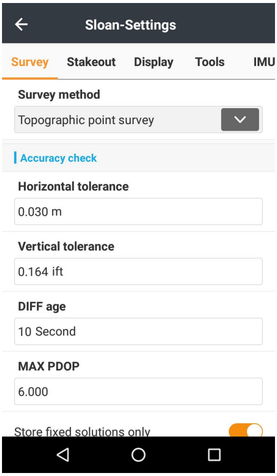
Click the survey button to stakeout the point.



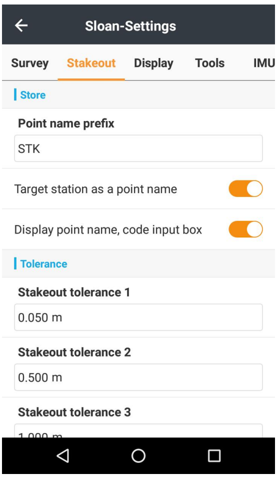
User can set the Antenna height in Antenna height.

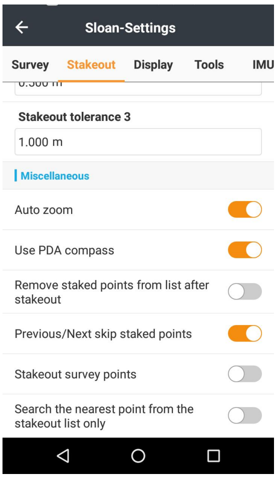


Click **Settings** icon to open the settings.



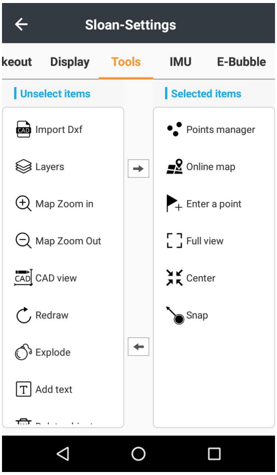
Stakeout settings： Users can change the store settings, the tolerance settings and the miscellaneous settings in this part.

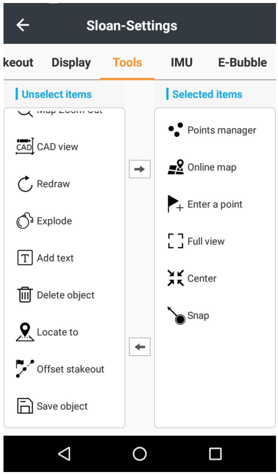




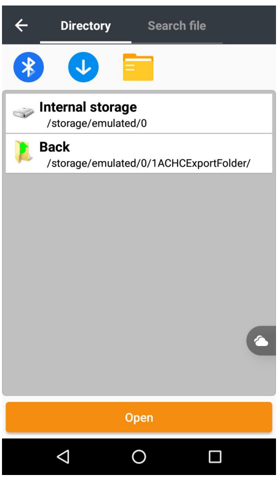
Tools

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

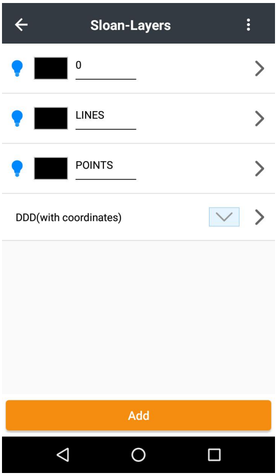




Import DXF: Users can import the DXF flies from memories.

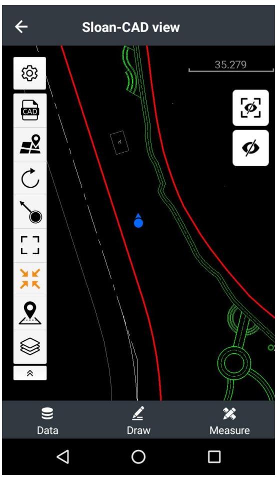


Layers: Users can show/hide the layers.

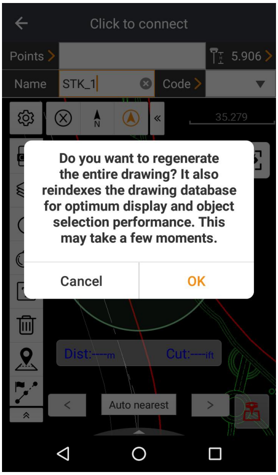


Map Zoom in/out: User can zoom in/out the map by these two tools.

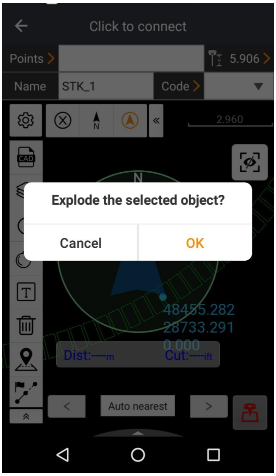
CAD View ： Users can edit the CAD map in this tool.



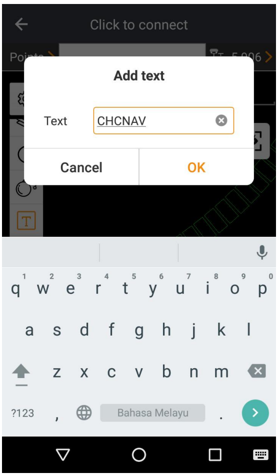
Redraw： User can regenerate the drawing. Click **OK** to redraw the map.

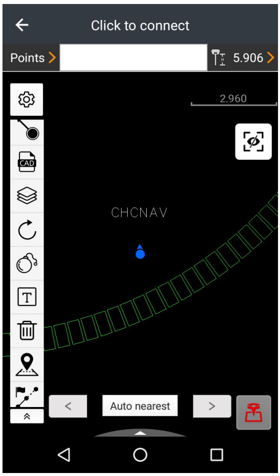


Explode: Users can break a compound object into its component objects. Click OK to explode the selected object. It's the same command in AUTO CAD.

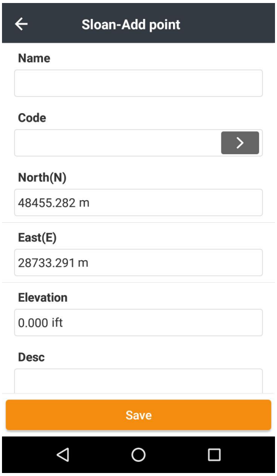


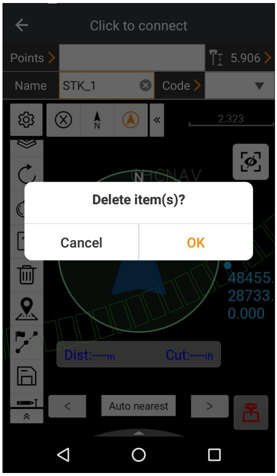
Add text: Users can add text to where they tap the screen.



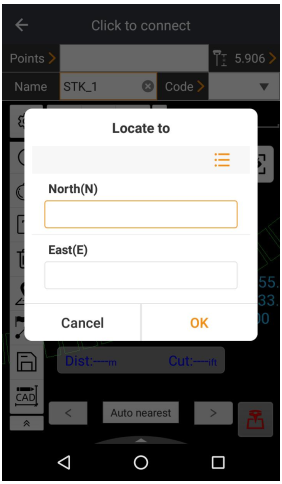


Save/Delete object: User can save or delete the chosen object.

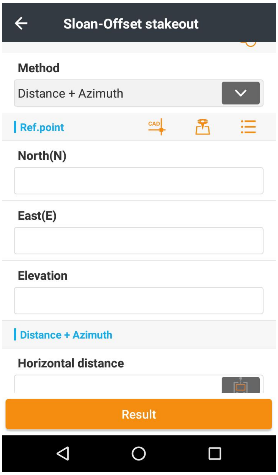


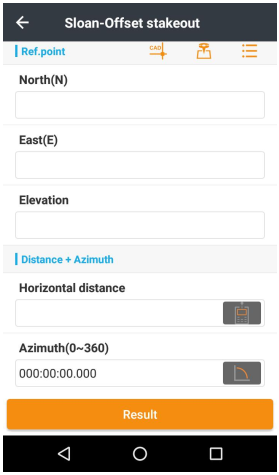


Locate to: Users can locate the screen center manually.

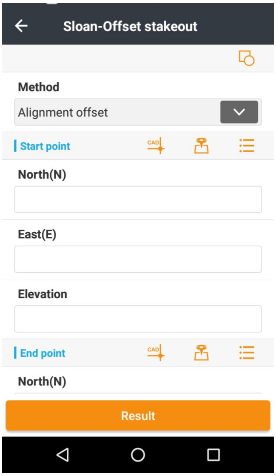


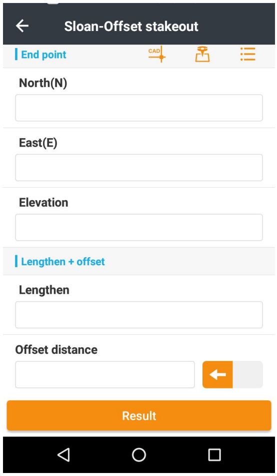
Off set stakeout point: Users could manually input coordinates, pick from the map, instant survey, or select from point library. After inputting distance and azimuth, click **Result** then input the **name** of the new point. Click **OK**.



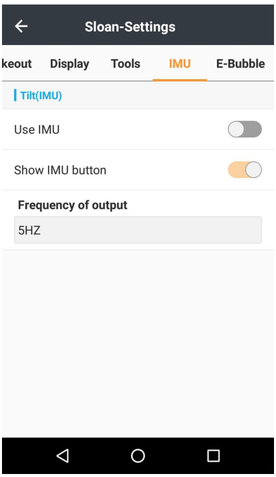


Users can also choose the Alignment offset function to stakeout point by entering lengthen and offset distance.

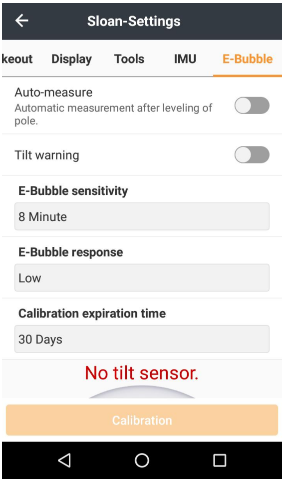




IMU ： Users can change the IMU settings. (The device must have the title sensor)

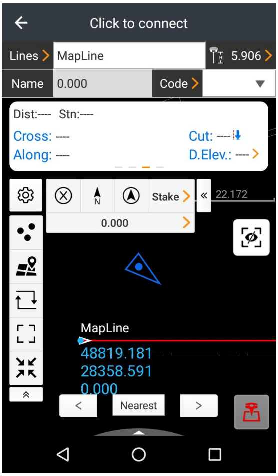


E-bubble ： Users can change the E-bubble settings. (The device must have the title sensor)

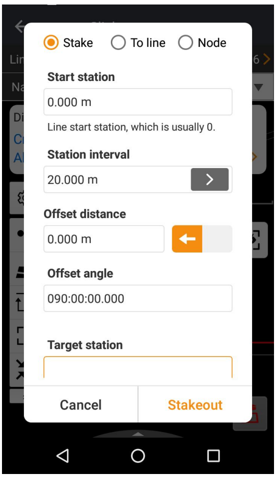


4.5.2 Line Stakeout

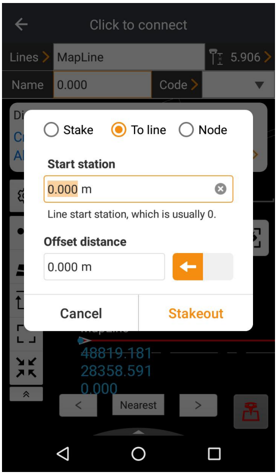
Line: Users could choose object from the map or manually input the point on line.



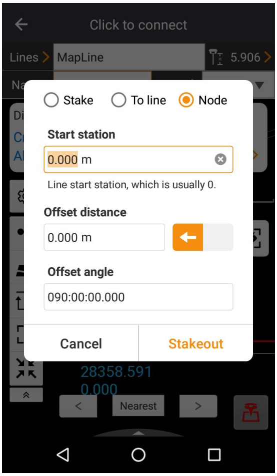
Stake: Click the stake button can choose the way how we stakeout the line. In this mode, users can stakeout the line stake by stake. User also can change the parameters, Start station, Station interval and the offset settings.



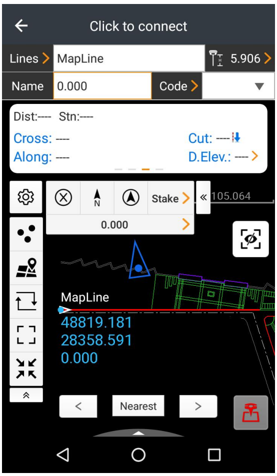
To line: Users can stakeout any point on the line in this mode. Users can also change the Start station and the Offset distance.

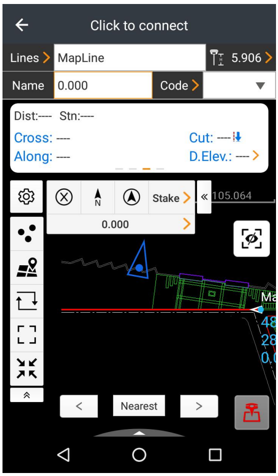


Node: The system will automatically choose the feature point of the polygon or the line. Such as the center of the circle, the corner of the polygon and the line.

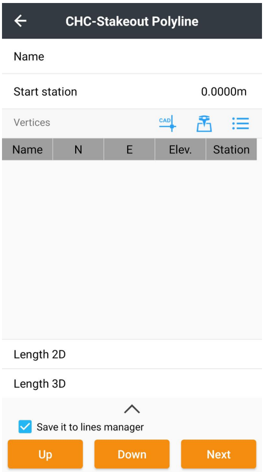


Invert: Click the button will switch the start and end point off the line.

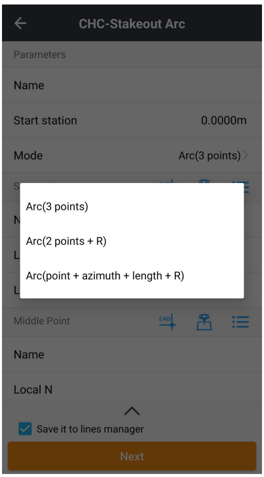




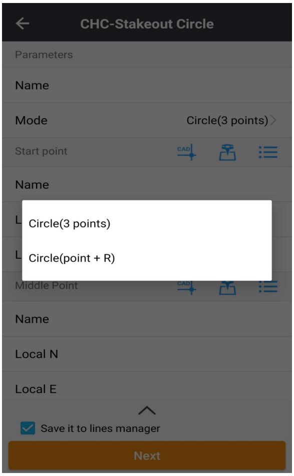
Polyline: Users input the name of the polyline, start station distance, select points. Click Next.



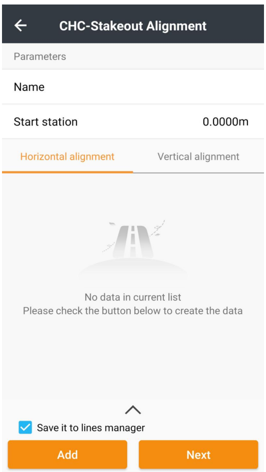
Arc: Users input the arc name, start station distance. Select the arc mode and input values as the mode needs. Click Next.

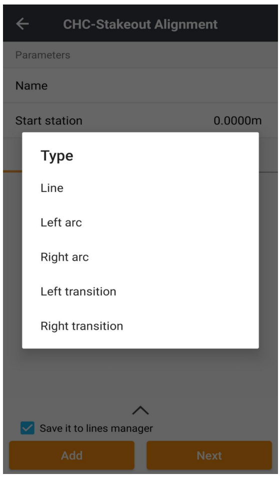


Circle: Users input the circle name. Select the circle mode and input values as the mode needs. Click Next.

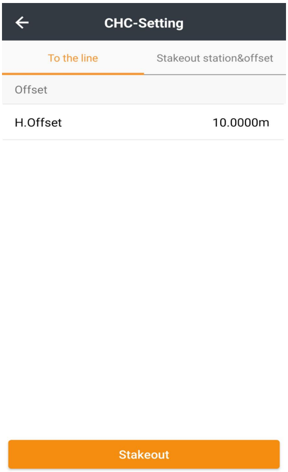


Alignment: Users input the name, start station distance. Choose horizontal or vertical alignment item. Click Next.

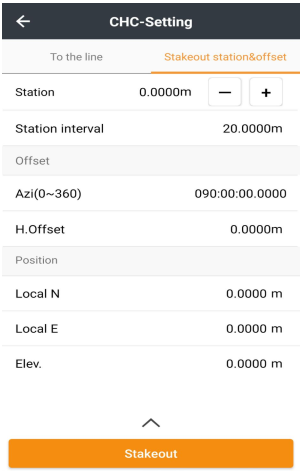




Stakeout of point on line: Click **multifunctional icon** to open to-the-line function. Set horizontal offset, then click Stakeout.



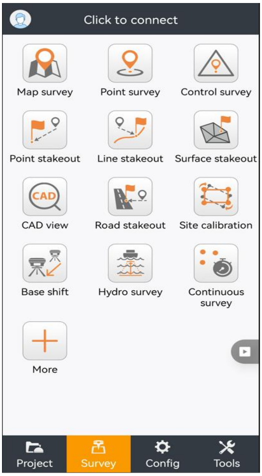
Stakeout of station&offset: Click **multifunctional icon** to open Stakeout of station&offset function. Set start station distance, station interval distance, azimuth, and horizontal offset, then click Stakeout.

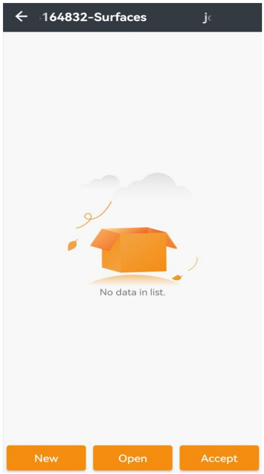


Move as the instructions say and users can switch between map mode and compass mode for convenience. Click the survey button to stakeout the item.

4.5.3 Stakeout of surface

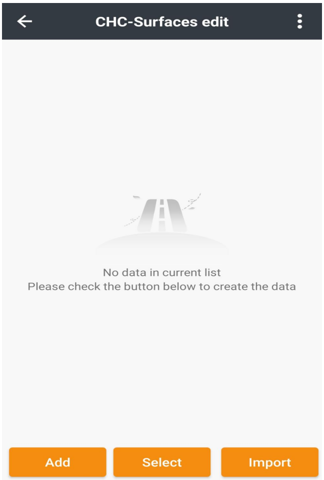
Click **surface** icon, the **surface library** will pop up automatically.



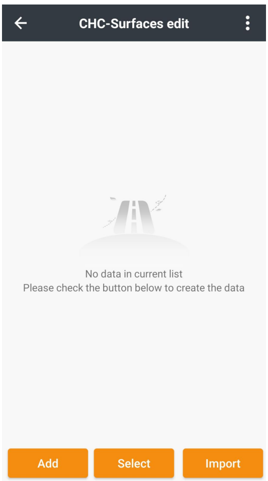


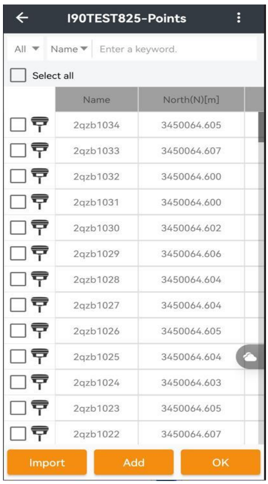
Click **new** then input the surface file name, Click **OK** to continue.

Click **Add** to add points manually.

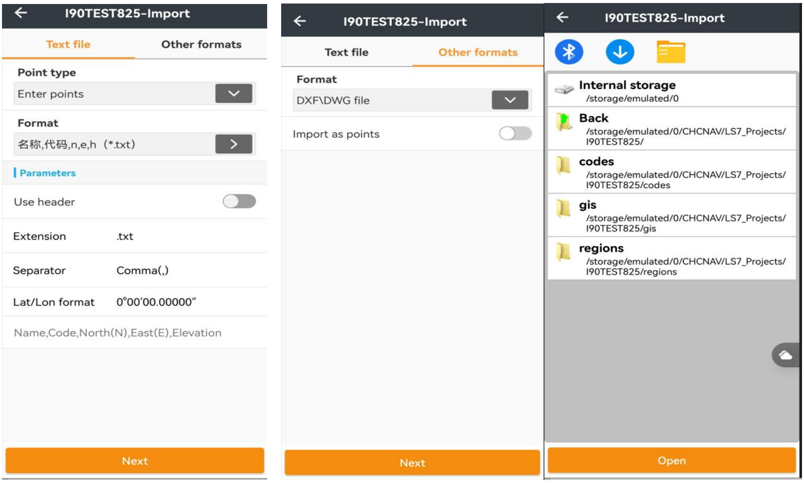


Click **Select** to pick points from the points list.

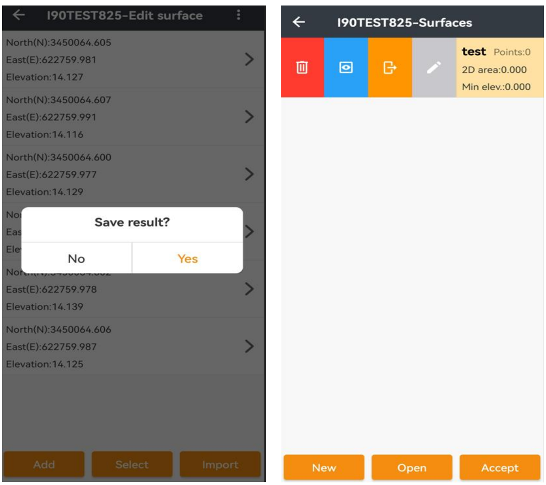




Click **Import** to import the Text file or other formats file.

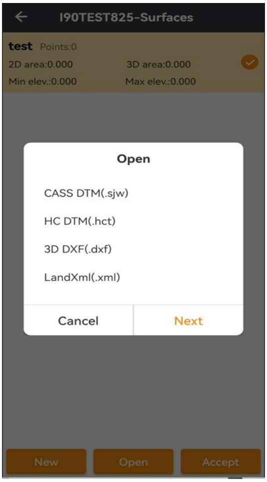


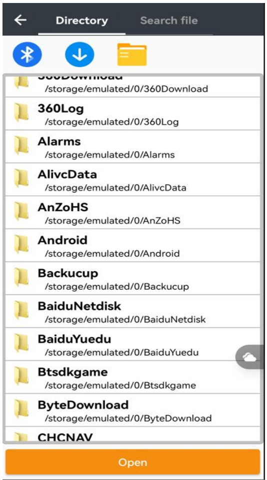
After inputting enough points, click **Save** and come back. Left slide surface for more operations.



Open surface File: Click to open the surface file. Including CASS DTM

File, HC DTM File, 3D DXF file and LandXml File.



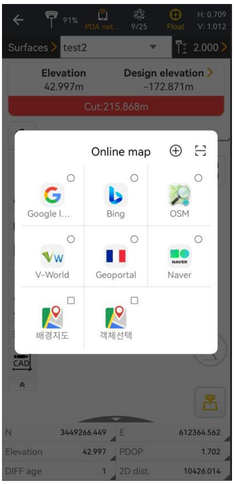


In stakeout interface, find the target following the arrow's direction. The text indicates the design height, current height, fill or cut depth when receiver is in the surface area. Click stakeout icon to stakeout.

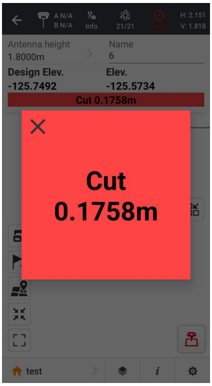
Stakeout: Find the right position and click stakeout icon for staking out.

 icon is to show the points data base.

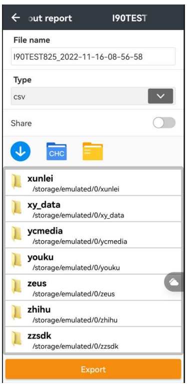
 icon is to load the online map.



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



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



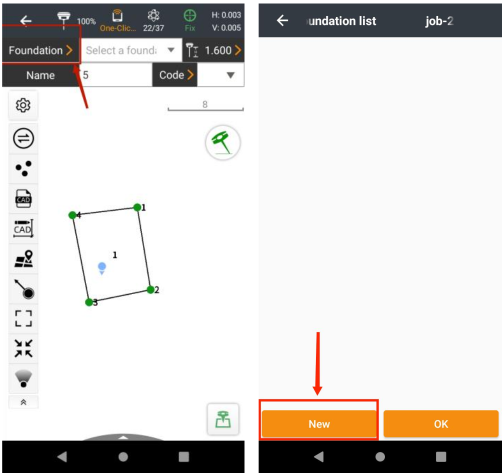
 icon is to the CAD view function. Refer to section 3.13 CAD view.

4.5.4 Foundation stakeout

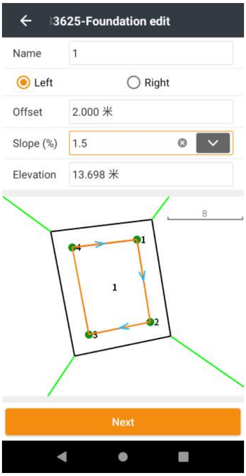
1. Click Foundation stakeout.

2. Click 

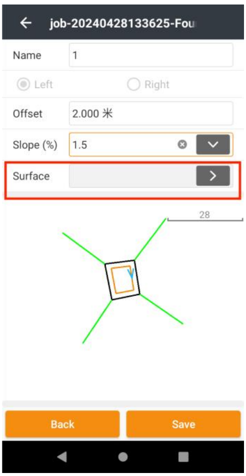
Foundation icon, click new to create a foundation.

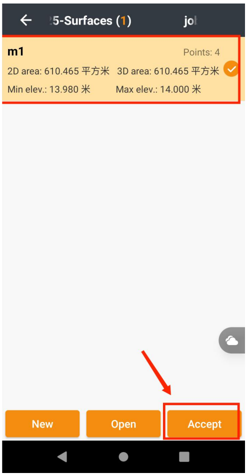


3. Users enter the name, select the side line, enter the offset (left represents the left offset of the line direction, right represents the right offset of the line direction), slope, elevation, etc.



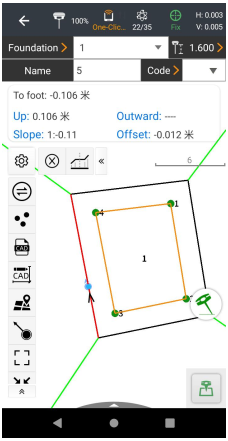
4. Select the surface file (this step is not necessary, can get the foundation surface intersects with the excavation line.



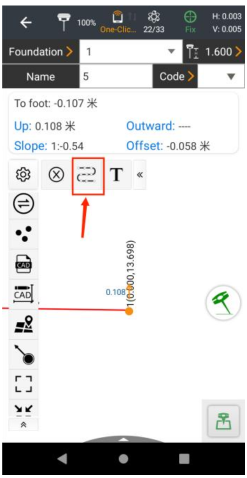


5. After the new foundation pit is built, then stakeout the

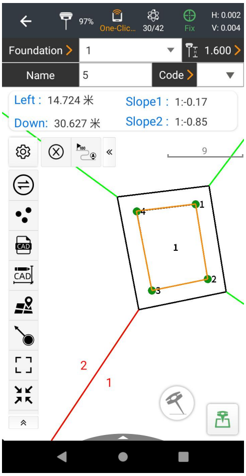
excavation line. Find the excavation line and stakeout according to the prompt information.

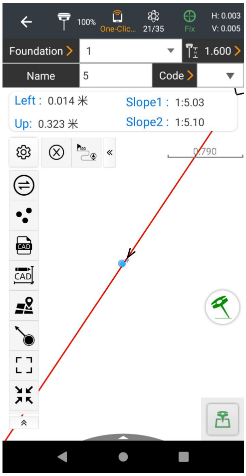


Also, click icon, Switching cross-section diagram for stakeout.



6. Select the green auxiliary line for stakeout.





4.5.5 Visual Stakeout

If the current device is a visual receiver like the CHC i93, an AR (Augmented Reality) button will be shown on the map screen. Click on this button to enter the AR mode.

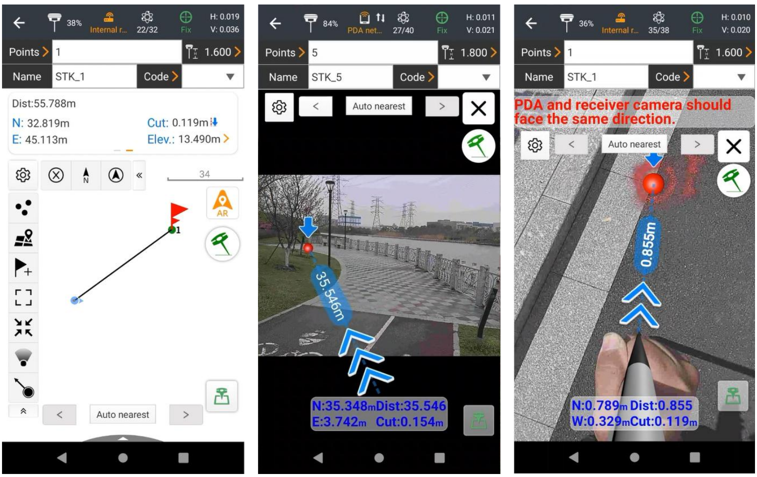
Once activated the AR button will change color: to indicate activation.

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

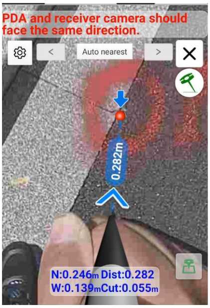
In **Options** on the **Stakeout** tab, under miscellaneous there are **Distance to switch to Visual Stakeout (Near)** and **Distance to switch to**

Visual Stakeout (Far) settings. Setting the **Near** distance to 10 to 50 m is reasonable. Setting the **Far** distance between 10 and 50m or more is probably reasonable. Your settings may depend onsite terrain and personal preferences.

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

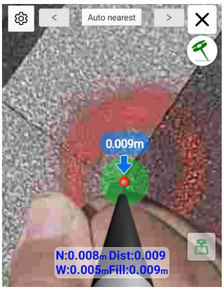


A virtual pole is overlayed on the image (usually on top of the data collector bracket and your hand.) The number of blue arrows is proportional to the distance to the target.



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

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



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

4.6 Road

4.6.1 Road stakeout

LandStar 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.

4.6.2 roads 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.

Note: If the road is imported through a LandXML file, you cannot edit the definition of the road, can only view it.

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

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

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

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

Key int the station equations

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

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

Note: 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

Note: To change the entry method for the road, edit the properties of the road. However, once you have entered two or more elements definition the horizontal or vertical alignment definition, the entry method cannot 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 is not the first one, the value will be calculated automatically.
Start east	Enter the **Start east** to define the line. If current element is not the first one, the value will be calculated automatically.
Azimuth	Enter the **Azimuth** to define the line. If current element is not 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 **North** to define the point of intersection.
East	Enter the **East** to define the point of intersection.

Note: 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 **North** 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.

Note: 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.

Note: 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.

Note: 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.

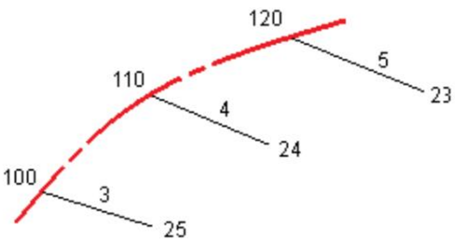
Vertical alignment: Define the changes in the elevation of the road.

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.



Note: No interpolation occurs between cross-sections with an unequal number of strings.

4.6.3 Stakeout road

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.
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.

4.6.4 Stakeout side-slope

The procedure allows to perform the calculation and the stakeout of the point of intersection of the project side-slope with the existing terrain; the position is calculated on the basis of a slope of project and referring to a station and to a distance(offset) on the outermost of the cross-section.

Field	Description
Match the template according to the station	Automatically select a sideslope template based on the current position and the sideslope template positions.
Station	The station of the current position.
Template	The sideslope template of automatic or manual selection.
Target	The stakeout target, feature points of the sideslope or the slopes.

The side panel contains the information to get the point of intersection; The latest information reports the current value of the slope and the direction to take on the perpendicular to the reference element, to achieve the value of project slope.

The last part of the panel can show the following information:

Stat.: The station of the current position.

H Offset: The distance from the current position to the alignment.

Inward/Outward: Away from or near the centerline.

Down/Up: Vertical cut/fill to the design.

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

4.6.5 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.

4.6.6 Survey cross-section

The procedure allows to perform the measurement along a cross-section. During the cross-section measurement, a red auxiliary line will be created. The cross-section data measured can be used to calculate the volume.

Field	Description
current	Get the station of current position.
Station	The station of the current position.

The cross-section survey panel contains the information to measure cross-section points.

The last part of the panel can show the following information:

Stat.: The station of the current position.

CL offset: The distance from the current position to the alignment.

Delete station: The difference between the station of current position and the station of the target.

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

4.6.7 Stakeout report

Use the **Report export** function in the software to generate a report from survey data. Use the report to transfer data from the field to your client or the office for further processing with office software.

A table 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.

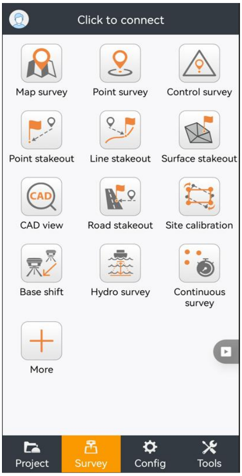
4.6.8 Display the available stations

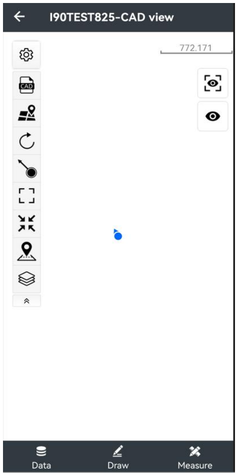
Some key stations defined by the horizontal alignment will display on the screen. The station abbreviations used in the Roads software is:

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

4.7 CAD View

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





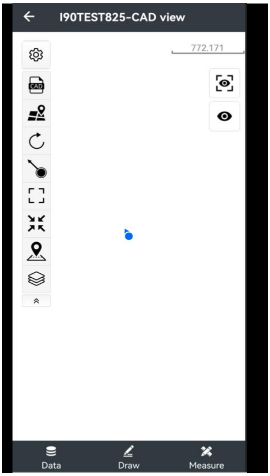
4.7.1 Open CAD file

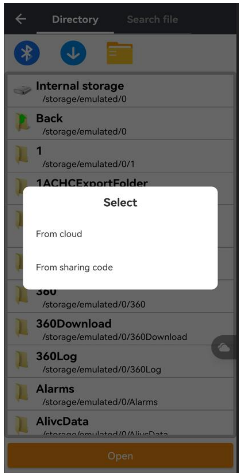
Click  icon to open the file manager

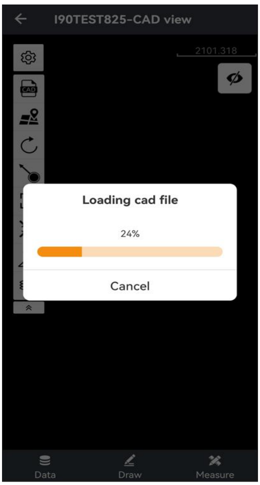
select the file to be opened, and then click **open**.

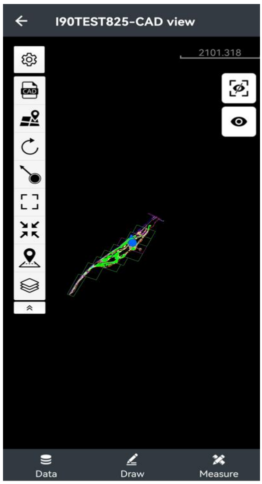
click  and choose **From cloud** to upload the file to be downloaded.

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





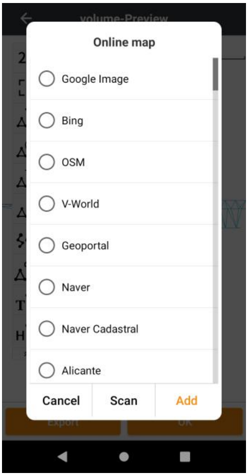


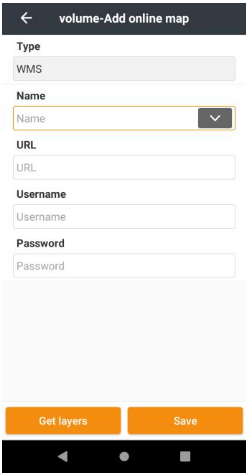


4.7.2 Slide bars

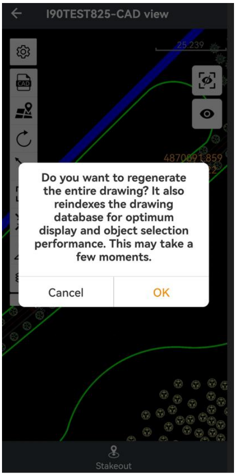
1. Online map

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

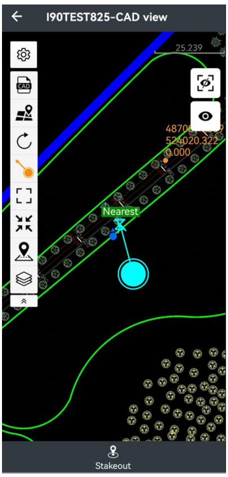




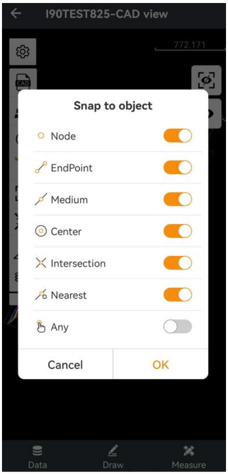
2. Refresh the CAD file



3.  **Snap to object**



And you can long press the button to modify the snap settings.

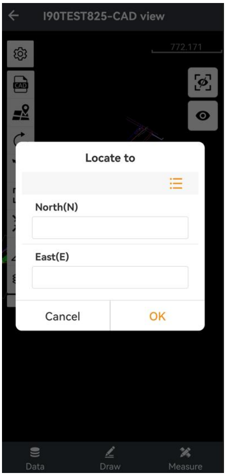


After snap a object you can click Stakeout this button to jump to stakeout function.

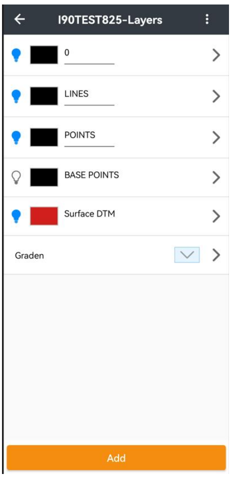
4. Full data display of collected data and CAD graphics

5. The current position is centered

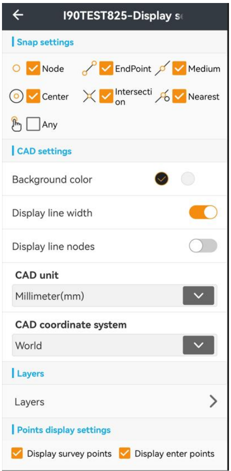
6. Point Stakeout button, directly input point coordinates



7.  Buttons for layer display control



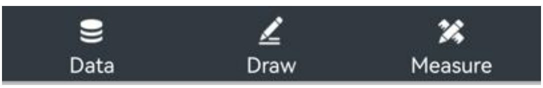
8.  Set button



You can set the **Snap settings, CAD settings, Layers, Points display settings, Labels display settings**.

4.7.3 Tools

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



1. Data

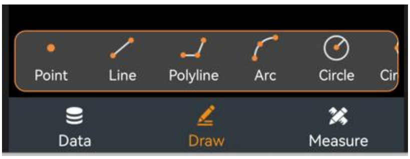
: Select an object or an area and delete them from the CAD file.

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

: Layer display control.

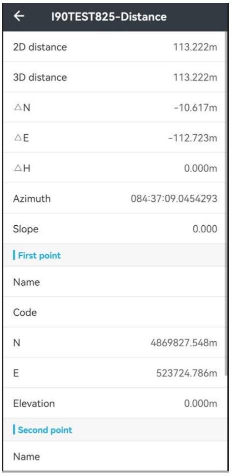
2． Draw

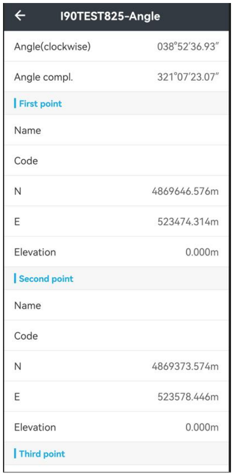
Can draw the Point, Line, Polyline, Arc, Circle, Circle 2points, Circle 3points, Text,



3． Measure

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





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

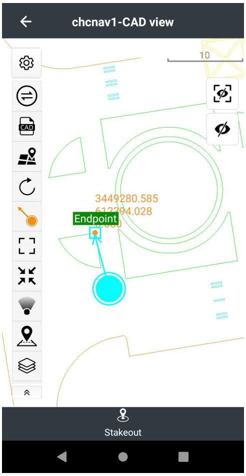
Select the button for the information to be displayed

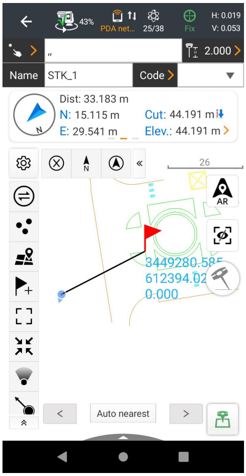
Set button

Open CAD file button

4.7.4 Stakeout

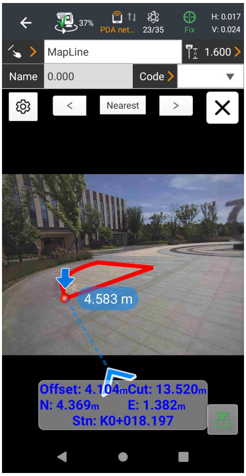
Select a point or line on the cad. The stakeout button will appear below. Click to switch to cad stakeout.





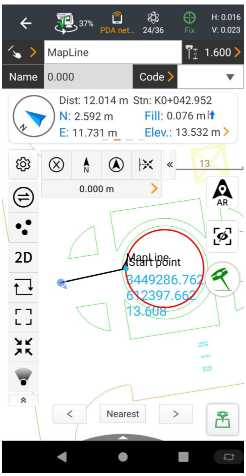
The operations are the same as in **section 4.5.1 and 4.5.2.**

If the current device is a visual receiver like the CHC i93, an AR (Augmented Reality) button will be shown on the map screen. Click on this button to enter the AR mode.

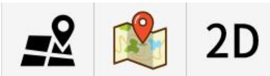


Points or lines can be stakeout in this way.

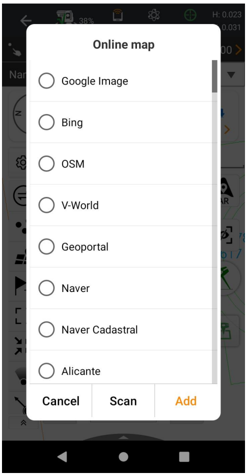
Click this button, you can exit the Visual Stakeout to use the conventional stakeout function.

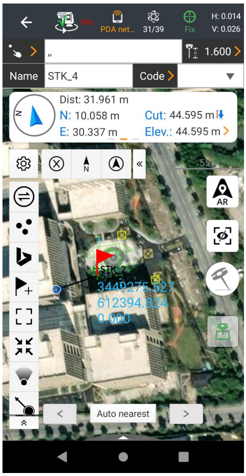


And click  this button, you can add the online map, and change to use **Conventional CAD Visual Navigation** or **CAD AR Visual Stakeout**.



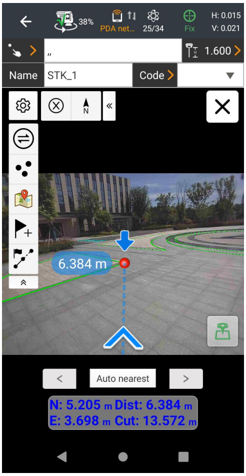
Click  this button, add online map in different formats.

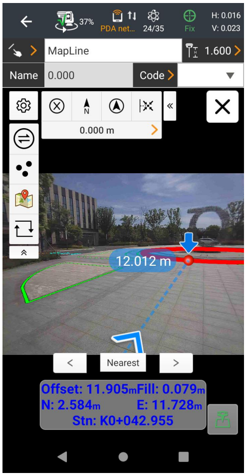




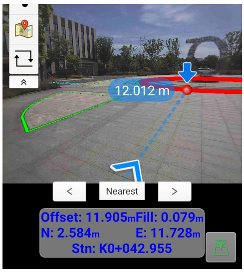
Click  this button, it will switch to use **CAD AR Visual Stakeout.**

When using visual stakeout, the software displays all the contents of the CAD on the screen and displays the selected target to be stakeout in red.



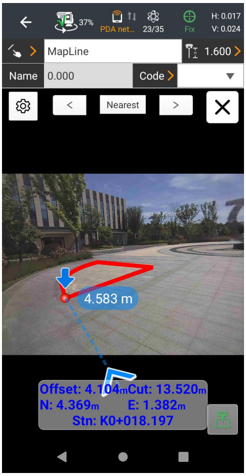


Other points or lines can be selected at any time for stakeout.



Click on  this icon to switch to 2D another one, for **Conventional CAD Visual Navigation.**

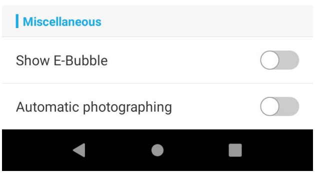
In this mode, open the Visual stakeout button, the screen will only show the selected point or line in red, the other content will not be displayed.



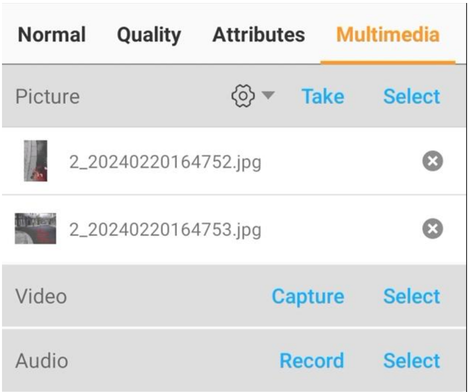
Of course, opening the **CAD AR Visual Stakeout** provides a great convenience for your work, you can use this function to view the whole contents of the CAD while using visual stakeout, and compare the local terrain.

4.8 Automatic photographing

There is an **Automatic photographing** switch in the Settings of each measurement stakeout page (except visual survey and continuous survey), which is turned off by default.



Enabling this option will Automatically take photos by dual cameras after the measurement is complete, the photos taken by the receiver camera are added to the multimedia.

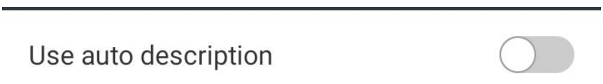


4.9 Auto description for staked points

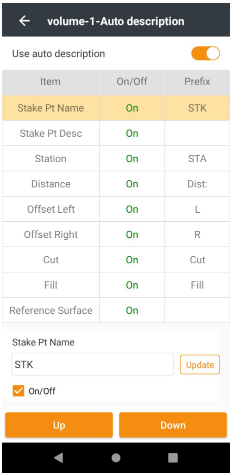
When you stake a point, the description of the new staked point can be automatically populated, or it can be left blank for the operator to manually fill out.

To control the **Auto description**, go to **Software settings** > **GNSS** > **Stakeout** (tab) > **Auto description >**

Click on the **>** button:



Move the slider to the right to enable **Automatic descriptions**:



Highlight an **Item** line, then use the **Up** and **Down** buttons to change the order of items.

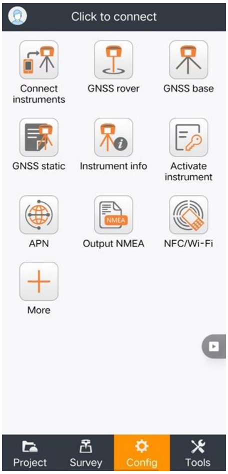
Highlight an **Item** line, then use the entry box at the bottom to modify the **Prefix**, click the **Update** button to commit change.

The **On/Off** checkbox enables / disables the highlighted item.

5 Config

5.1 Connect

For device connection.



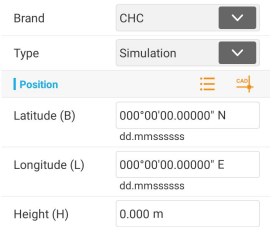
5.1.1 GNSS

GNSS table is for receiver connection.

Brand: Users can choose CHC, JY, CHAMPION, Prince, ELMIZ, HORIZON, ComNav, Topomap Positioning System, iGage, eGPS Solutions, Datronix, GeoGenie.

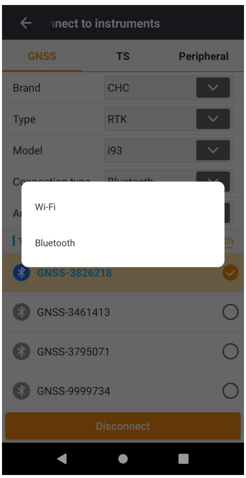
Type includes: **RTK, Internal Android device location, Others (NMEA0183), Simulation**.

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



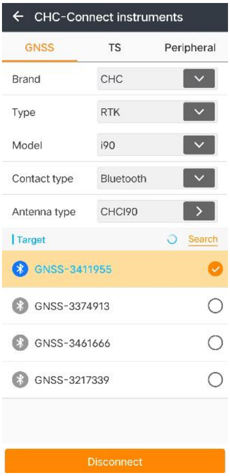
Model: CHCNAV includes: i93, **i90, i80, i89, i83, i80, i70,i73, i73+, i50, M6, E91, E90, iBase, X6, X91+, X900+, M5.**

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

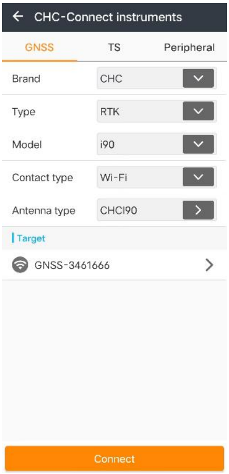


Antenna Type: Click **Antenna Type List**, select antenna type (Users can select antenna type of different products in different manufacturers). Users can handle specific item by clicking **Add**.

Target: While using Bluetooth connection (Suitable for i80 and GNSS receiver), click **Search** to the interface of Bluetooth. Select Bluetooth management, click **Refresh** to find the device to Pair (Default password is 1234 if it's required to input). When the pair is successful, just turn back to the connection interface. Then click **Connect**. When the connection is successful, users will back to config interface.



While users use **WiFi** connection. Click **Search**, then it will show users **WLAN** interface. Click **Refresh** to find the SN of current receiver, input password (Default password is 12345678), then click to connect the target. When the connection is successful, just turn back to the connection interface. Then click **Connect**. When the connection is successful, users will back to config interface.



Connect: Click to start connection.

Disconnect: Break the current connection.

5.1.2 TS

TS table is for total station connection.

Brand: Leica, Topon, CHC, Geomax, Sokkia, Simulation

Model: Leica: TPS1200+, TS11, TS30, TS15, TS15

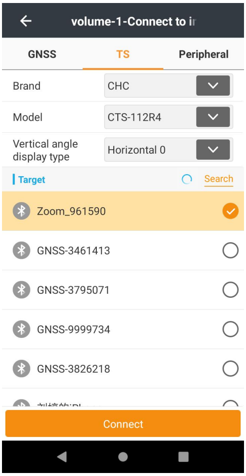
Topon: GT1200/600

CHC: CTS-112R4

Geomax: Zoom75/Zoom95

Sokkia: iX 1201

Target: While using Bluetooth connection (Suitable for i80 and GNSS receiver), click **Search** to the interface of Bluetooth. Select Bluetooth management, click **Refresh** to find the device to Pair (Default password is 1234 if it's required to input). When the pair is successful, just turn back to the connection interface. Then click **Connect**. When the connection is successful, users will back to config interface.



Connect: Click to start connection.

Disconnect: Break the current connection.

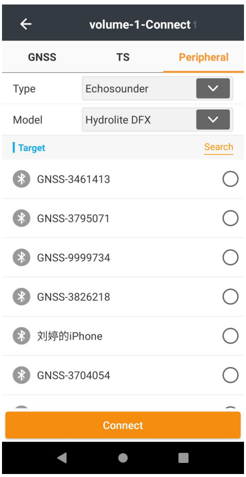
5.1.3 Peripheral

Peripheral table is for peripheral device connection.

Device Type: Including the choices of **Pipeline Detector, Laser Rangefinder, and Echo Sounder**.

Model: Including the choices of **vLoc Pro2** and **Simulation**.

Target: While using Bluetooth connection (Suitable for i80 and GNSS receiver), click **Search** to the interface of Bluetooth. Select Bluetooth management, click **Refresh** to find the device to Pair (Default password is 1234 if it's required to input). When the pair is successful, just turn back to the connection interface. Then click **Connect**. When the connection is successful, users will back to config interface.



Connect: Click to start connection.

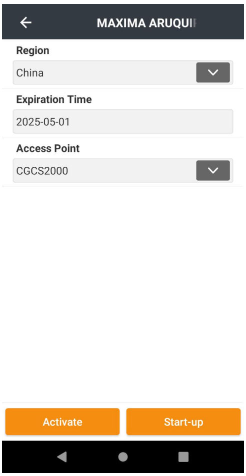
Disconnect: Break the current device connection.

Various Peripherals Supported

- Pipeline detector, VIVAX-METROTECH vLoc Pro2.
- Laser rangefinder, Leica Disto 810 touch, Disto 510 touch, and SNDWay SW-S120C, Bosch GLM 50 C, Bosch GLM 120 C.
- Echosounder, Hydrolite DFX, Hydrolite TM, NMEA DPT, NMEA DBT.

5.2 One-Click fixed

As of April 30, 2024, only China and India support this feature.



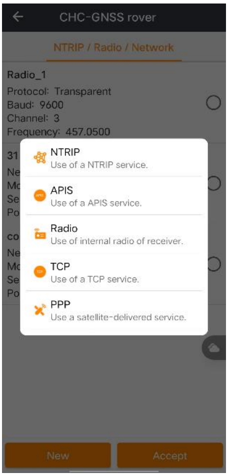
Just select the region and Access Point, click Start-up to get the differential signal to reach a fixed solution.

5.3 GNSS rover

Main screen of GNSS rover 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.

5.3.1 NTRIP model

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



Name: Enter a name for this work mode.

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

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

Port: input the corresponding **Port.**

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

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

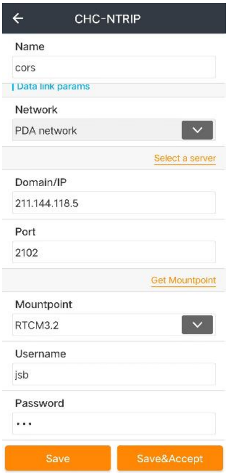
Mount point: choose a **Mount point** you need

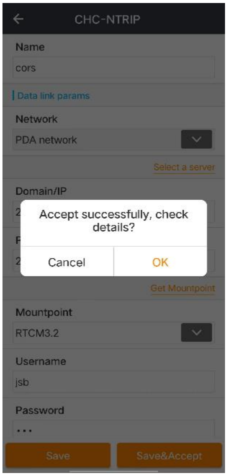
Username: The name of user's Ntrip account.

Password: The password of user's Ntrip account.

Save: just save this work mode.

Save&Accept: save and apply this work mode.





If you click Save&Accept, it will pop up “Accept successfully, check detials?” Click **OK** to enter **Instrument Info** interface.

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

For example:

1. When it prompts “Requesting…”, LandStar 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.

5.3.2 APIS model

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

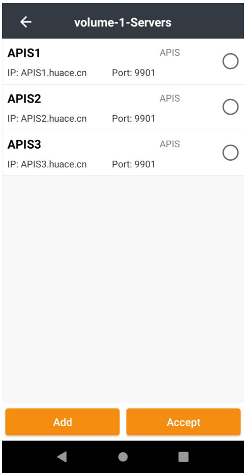
Name: Enter a name for this work mode.

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

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

Port: input the corresponding **Port.**

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



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

Save: just save this work mode.

Save&Accept: save and apply this work mode.

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

5.3.3 Radio model

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

Name: Enter a name for this work mode.

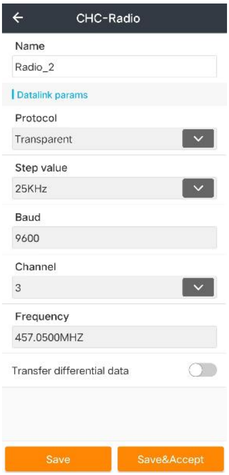
Protocol: Select a protocol. Include CHC, Transparent, TT450.

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

Baud: 9600 or 19200.

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

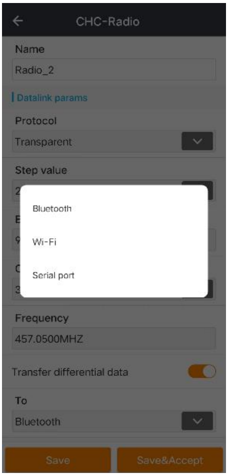
Frequency: normally can't be changed and if you choose **User defined**, you can change it.



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

When users choose Bluetooth/WiFi, correction data in 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.



Save: just save this work mode.

Save&Accept: save and apply this work mode.

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

5.3.4 TCP model

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

Name: Enter a name for this work mode.

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

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

Port: input the corresponding **Port.**

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

Save: just save this work mode.

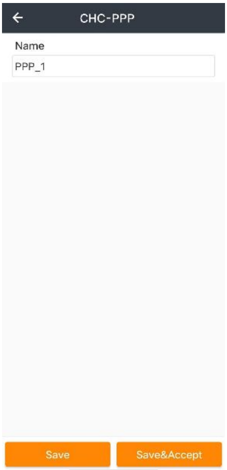
Save&Accept: save and apply this work mode.

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

5.3.5 PPP (Precise Point Positioning)

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

Name: Enter a name for this work mode.



Save: just save this work mode.

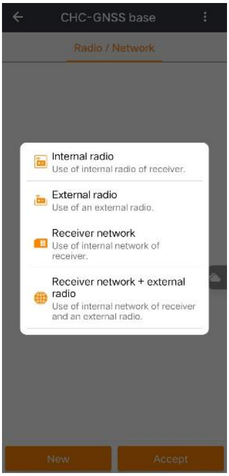
Save&Accept: save and apply this work mode.

5.4 GNSS base

Main screen of GNSS base 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.

5.4.1 Internal radio model

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



Name: Enter a name for this work mode.

Differential format: Select RTCM3.2.

Protocol: Select Transparent.

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

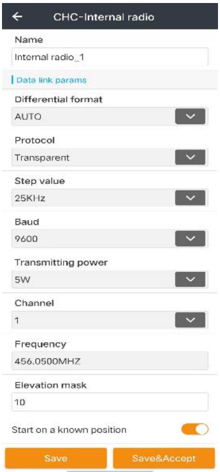
Baud: 9600 or 19200.

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

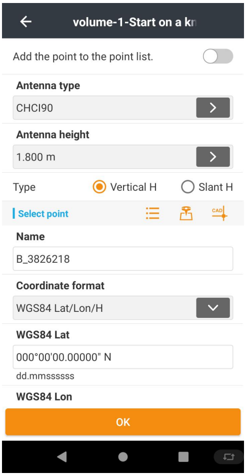
Channel: different channel will show different frequency. And also can be customized.

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

Elevation mask: 10.



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



Save: just save this work mode.

Save&Accept: save and apply this work mode.

5.4.2 External radio model

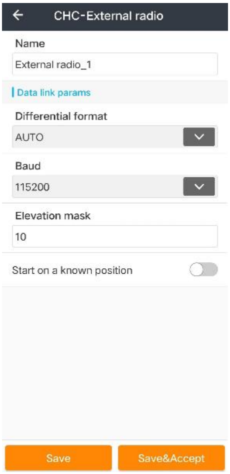
Click **New** to create a work mode and choose **External radio** table.

Differential format: Select RTCM3.2.

Baud: 9600 or 19200.

Elevation mask: 10.

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



Save: just save this work mode.

Save&Accept: save and apply this work mode.

5.4.3 Receiver network model

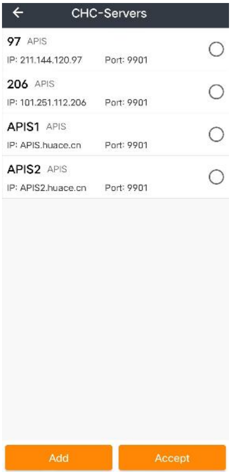
Click **New** to create a work mode and choose **Receiver network** table.

Name: Enter a name for this work mode.

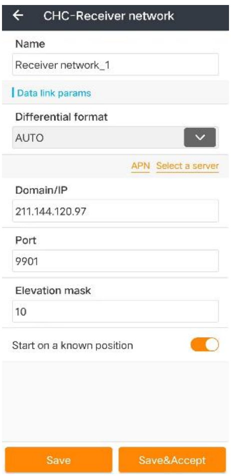
Differential format: Select RTCM3.2.

APN: APN setting, you can see more details in **4.9**.

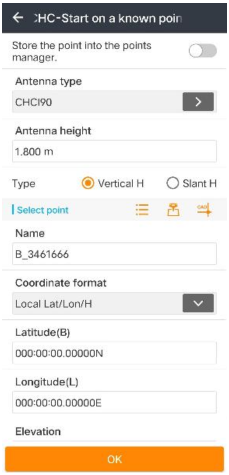
Select a server: choose a server.



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



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



5.4.4 Receiver network + external radio model

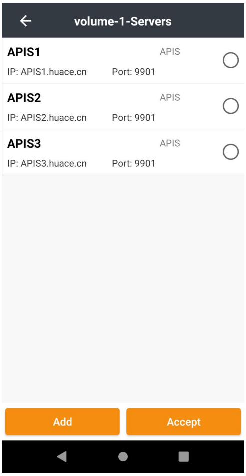
Click **New** to create a work mode and choose **Receiver network + external radio** table.

Name: Enter a name for this work mode.

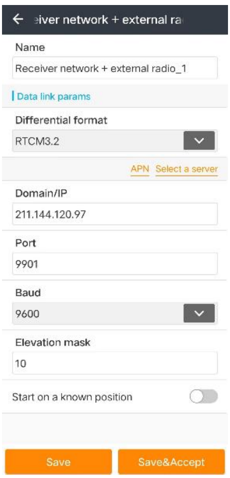
Differential format: Select RTCM3.2.

APN: APN setting, you can see more details in **4.9**.

Select a server: choose a server.



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



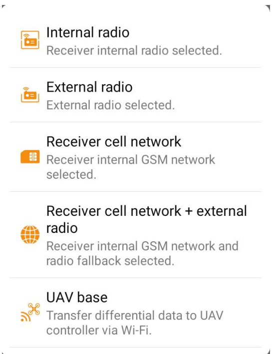
Star on a known position: ON or OFF. When you click accept, you will come into an interface to input the information.

5.4.5 UAV base

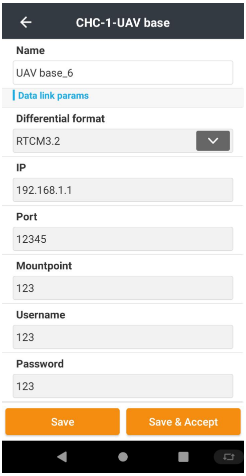
The CHCNAV GNSS RTK can serve as a base station to work seamlessly with DJI drones, The method is mainly suitable for areas with poor network or no CORS service.

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

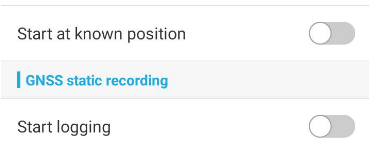
Click **New** to create a work mode and choose **UAV base** .



The settings have been configured in LandStar, just follow the default. Just remember the default settings, differential format: RTCM3.2, IP: 192.168.1.1, Port: 12345, Mountpoint: 123, username: 123, password: 123, select Save & Accept.



Also choose “Start at known position” ”Start logging” according to needs.



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

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

5.5 GNSS static recording

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

Date format: select HCN.

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

Interval: Including choices of 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 10.

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

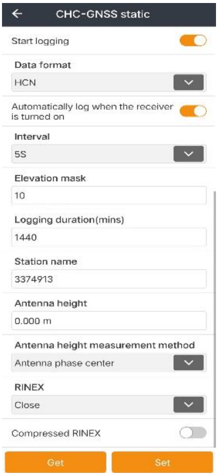
Station name: Input station name, the default is the SN of connected device.

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

Antenna phase center: Including choices of Slant Height, Phase Height, Vertical Height, and the default is Slant Height.

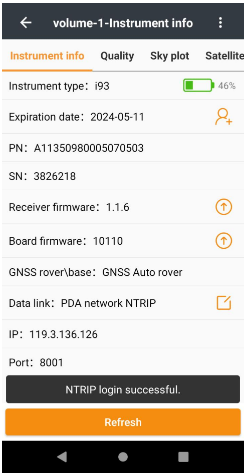
RINEX: Choose the type of RINEX data, includes 2.11,3.0x or choose close.

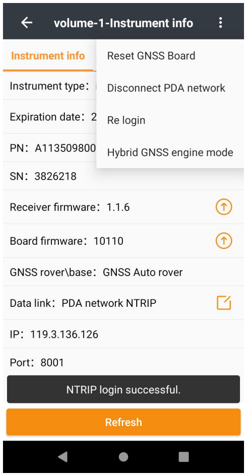
Compressed RINEX: choose to compress or not.


CHC-GNSS static
Start logging
Data format
HCN
Automatically log when the receiver is turned on
Interval
5S
Elevation mask
10
Logging duration(mins)
1440
Station name
3374913
Antenna height
0.000 m
Antenna height measurement method
Antenna phase center
RINEX
Close
Compressed RINEX
Get
Set

5.6 Instrument info

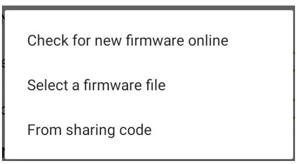
After connecting between controller and receiver, LandStar will read out the receiver information, such as device type, serial number, expire date, work mode, datalink and so on.





Click button, switch to the Activate instrument screen.

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



Click the button:

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

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

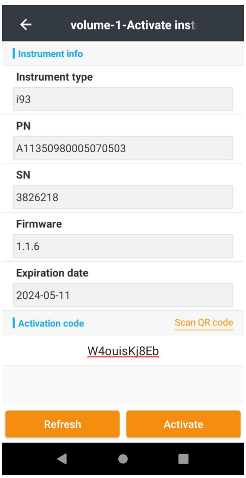
Re login: Disconnect login mode and restart.

Hybrid GNSS engine mode: Displays the current RTK working mode.

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

5.7 Activate instrument

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



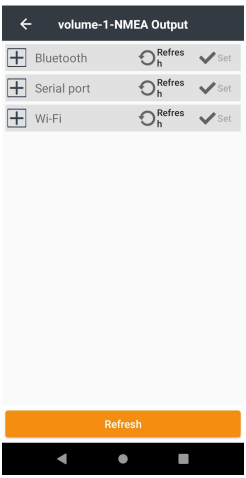
Activation code: input the register code and click **Activated**. If you need the code please contact with regional sales manager or dealer.

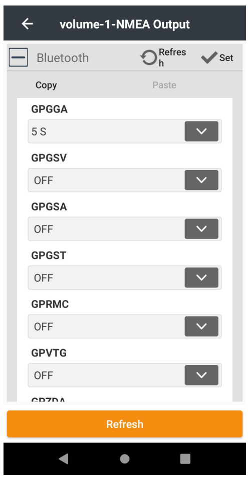
5.8 Advanced

5.8.1 Output NEMA

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.

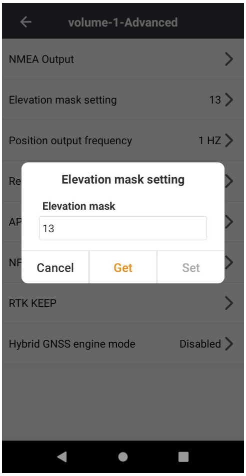




When users use CHCNAV receivers and set GPGGA output via serial port as 1Hz, please make sure that baud rate sets 9600.

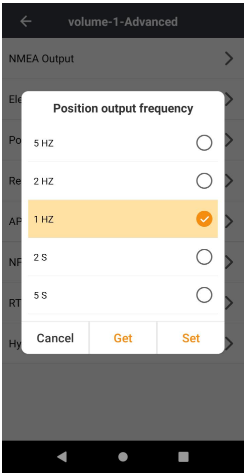
5.8.2 Elevation mask setting

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



5.8.3 Position output frequency

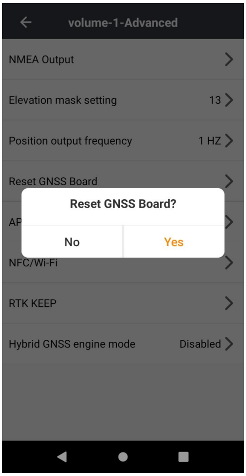
Press **Get** to retrieve the current **Position output frequency** from the connected receiver. Modify, then click set to send to the receiver. This is the coordinate update rate from the OEM GNSS board and may not be supported for all equipment.



5.8.4 Reset GNSS Board

Click **Yes** to clear the GNSS board's ephemeris and then reset the GNSS Board. This forces a full reacquisition of signals and position.

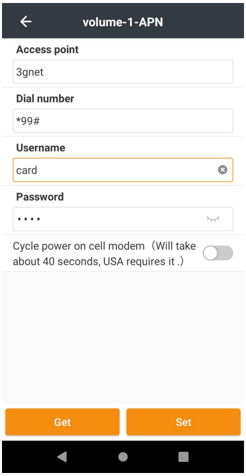
A reset may be beneficial when verifying solutions under heavy canopy and this sequence is automatically applied during the **Verified** and **Control survey** methods.



5.8.5 APN

Click **Get** to get the information and click **Set** to apply. But in some area, maybe you need to input the information manually.

This option allows you to change the cellular modem **APN** (Access Point Name), **Dialing number** string, SIM **Username** and SIM **Password**:

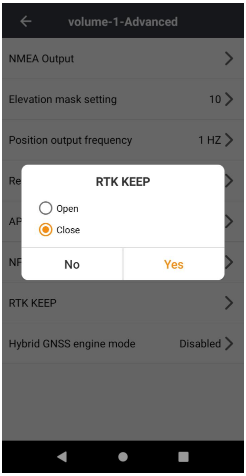


5.8.6 NFC/Wi-Fi

Set up the receiver's NFC and WiFi functions, refer to Section 5.9 for details.

5.8.7 RTK keep

If you lose the connection of the differential signal and the receiver will keep fixed mode about 10 minutes.



5.9 NCF/Wi-Fi

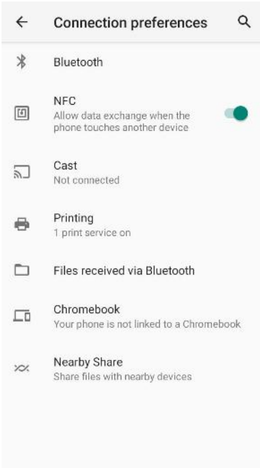
NFC, also known as short-range wireless communication, is a short-range high-frequency wireless communication technology, allowing electronic non-contact point-to-point data transmission (within 10 cm) is carried out between devices to exchange data.

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

1. Turn on NFC function

Use the NFC function of hce600 Android to make a detailed description.

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



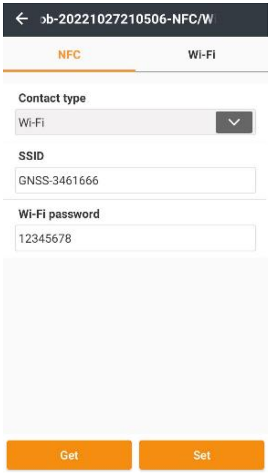
2. Connecting the receiver

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

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

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

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



3. Change WiFi password

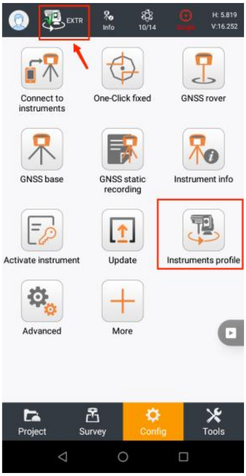
Turn on NFC / WiFi, you can change the WiFi password of the current device and follow the prompts below.

5.10 Instruments profile

The essence of instrument configuration is to combine the original instrument connection and working mode settings, making it convenient for users to complete instrument configuration with just one click.

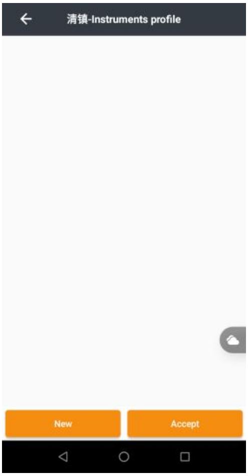
5.10.1 Entry method

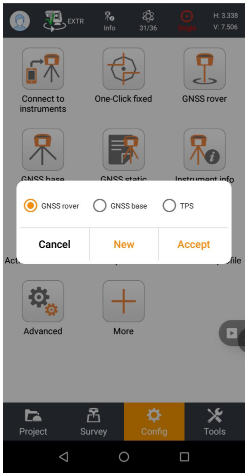
There are two ways to enter the instrument configuration: entering the nine-grid interface and the title bar icon. The status of the two is synchronized, and the entrance to the nine grid is displayed/hidden, and the corresponding title bar entrance is also displayed/hidden. The entrance to the Nine Palace Grid is hidden by default and can be found in the Configuration - More section.



Note: If both version A and version B have instrument configuration functionality, version A displays the instrument configuration entry. Upgrading to version B will keep the instrument configuration entry displayed, otherwise it will be hidden.

Entering the instrument configuration from the entrance of nine grid, all configuration files are in one list, while the list in the title bar entrance is divided into mobile stations and base stations. The functions of the two entrances are basically the same. Next, we will use the Nine Palace Grid entrance to introduce the functions.

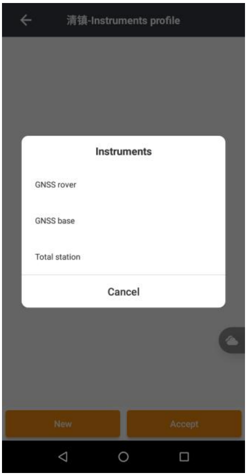




Note: The display status of the instrument configuration entrance in the simple style and classic style is synchronized. The display status of the instrument configuration entrance on the interface after connecting the RTK is not synchronized with the display status of the instrument configuration entrance on the interface after connecting the total station. The nine grids of the two interfaces are independent of each other.

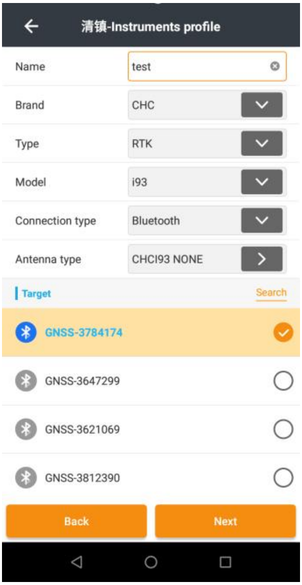
5.10.2 New

When creating a new configuration file, first select the type of configuration: mobile station, base station, or total station.



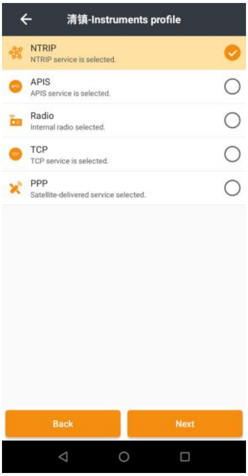
1.Mobile Station

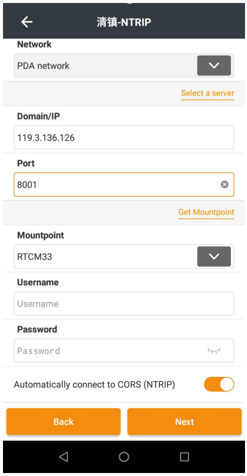
Firstly, select the input configuration file name, select the manufacturer, device type, model, connection method, antenna type, and target device. This page is basically consistent with the separate RTK connection page.



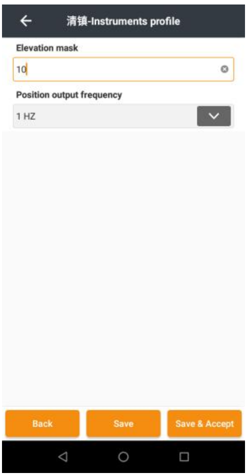
Note: When editing a configuration file, clicking on the 'Return' button in the upper left corner means abandoning editing and returning directly to the list; the previous step in the lower left corner means returning to the previous interface.

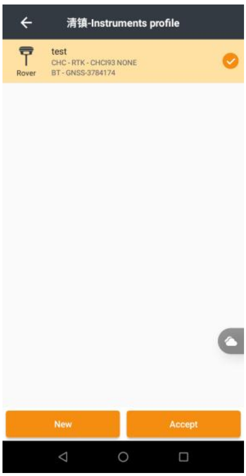
Click Next, select the corresponding working mode, and fill in the relevant parameters. Taking CORS working mode as an example, this page is basically the same as the separate mobile station working mode setting page.





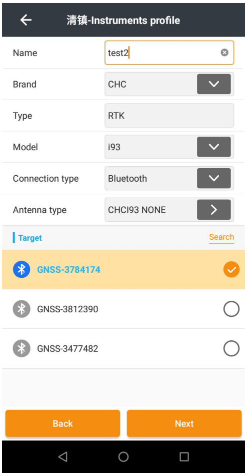
Click Next, set the height cutoff angle and output frequency, save or save and apply, and the corresponding configuration file will be added to the list.

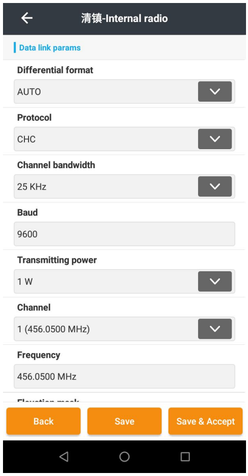




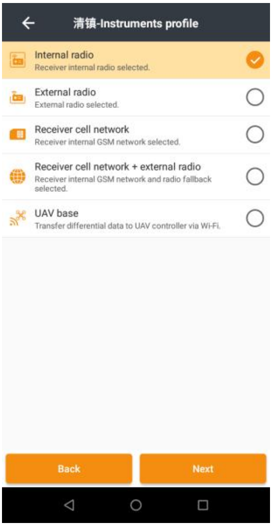
2.base station

Select the input configuration file name, select the manufacturer, device type, model, connection method, antenna type, and target device. This page is basically consistent with the separate RTK connection page.

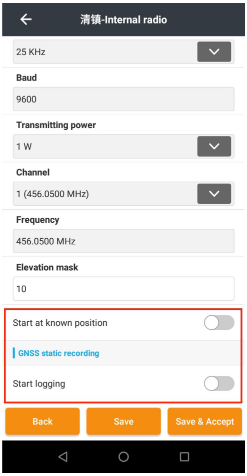


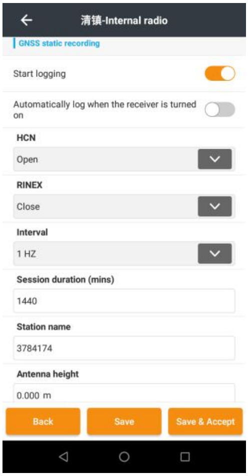


Click Next, select the corresponding working mode, and fill in the relevant parameters. Taking the built-in radio station working mode as an example, this page is basically the same as the separate base station working mode setting page.



When setting the working mode of the base station, you can also set **known point start** and **static measurement**. Turn on the static setting switch, and there will be additional static parameters that can be set below.

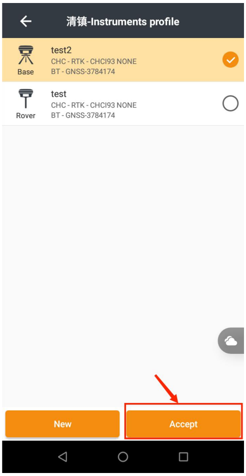


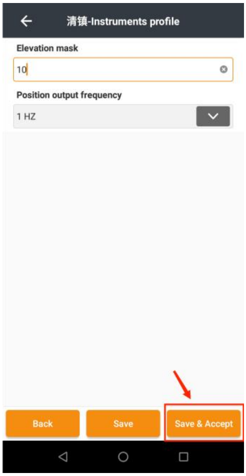


Save or **Save and Apply**, corresponding configuration files will be added to the list.

5.10.3 Application

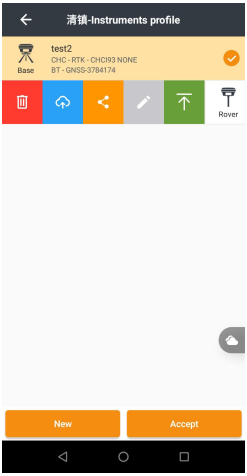
Applications can be directly applied by clicking **Accept** in the instrument configuration list, or by clicking **Save and Apply** during editing. After application, the software will connect to the target device of the configuration file and set the corresponding working mode.





5.10.4 Edit

Right swipe on the configuration file to edit it. From left to right, the options are **Delete**, **Upload**, **Share**, **Edit**, and **Top**.

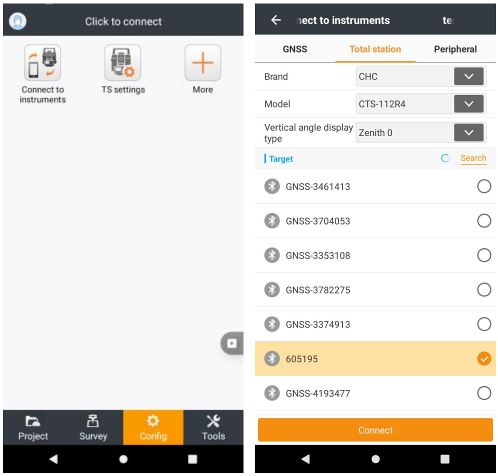

清镇-Instruments profile
test2
CHC - RTK - CHCI93 NONE
BT - GNSS-3784174
Base
Rover
New
Accept

6 Total station

6.1 TS -- Config

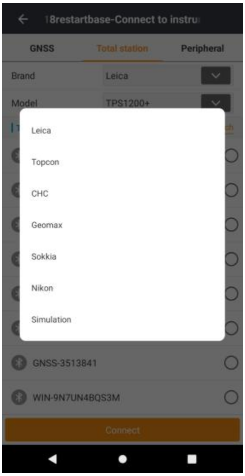
6.1.1 Connect to instruments

For controller to connecting total station.



Detailed steps:

1) Select equipment brands: equipment brands include Leica, Topcon, CHC, Geomax, Sokkia, Nikon and Simulation mode.



2) Select equipment model:

Leica: TPS1200 +, TS30, TS15, TS11, TS16, TS13, TS02/06/09, TPS100 Series(TC400/600/800/900);

Topcon: GT Series, PS Series;

CHC: CTS-112R4;

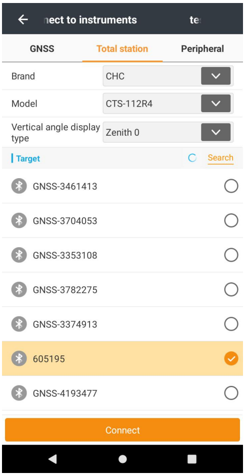
Geomax: Zoom75/Zoom95;

Sokkia: iX Series, iM Series;

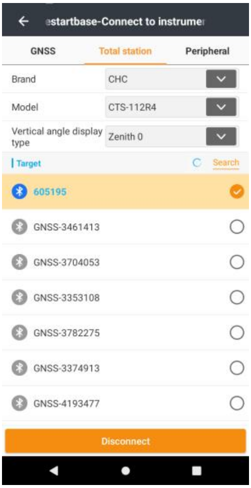
Nikon: Nivo Series,DTM Series, NPL Series, NPR Series.

3) Select the device Bluetooth number: Below the target device: click to select the total station Bluetooth number to be connected.

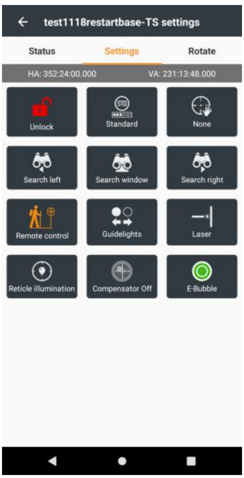
4) Click [Connection], the connection success or failure has the relevant prompt information, and display the current device Bluetooth number.



[Disconnect]: After the device is successfully connected, the disconnected button is displayed below the connection interface.

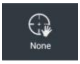


6.1.2 TS settings

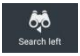


:Whether to lock the prism.

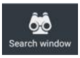
:Change the survey mode (standard / fast / continuous).



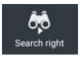
:Automated settings (none / ATR search / Power search).



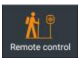
:Search for a prism to the left.



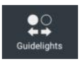
:Specifies an in-window search.



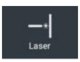
:Search for a prism to the right.



:When the remote control total station is rotated at the total station or the prism pole.

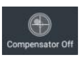


:Turn on the total station guide light.

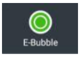


:Turn on the total station laser.

:Turn on the total station cross-wire lighting.



:Turn the tilt compensation on / off.



:View the compensation accuracy and control the laser below.

6.1.3 TS rotate

:Total station lens is rotated to the horizontal direction.

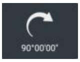
:Turn the total station to the absolute azimuth.

:Control the left or right turn relative to the current azimuth position.

:After setting the station, control the total station to the stakeout point.

:Control the total station forward inverted mirror switch.

:Control the total station for a left turn of 90° .



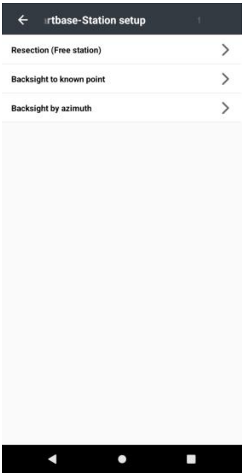
:Control the total station for a right turn of 90° .

:Control the total station for a right turn of 180° .

:Control the total station to rotate to the general direction of the controller.

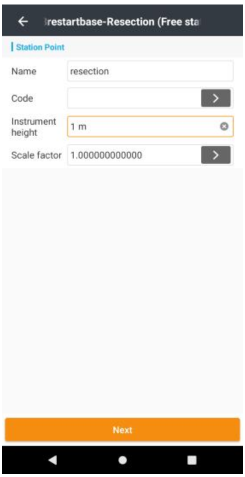
6.2 TS setup

Clicking , you can enter the station setup interface. There are three kinds of station setup methods: Resection (Free station), Backsight to known point, Backsight by azimuth.

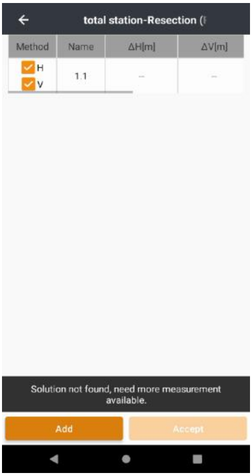


6.2.1 Resection (Free station)

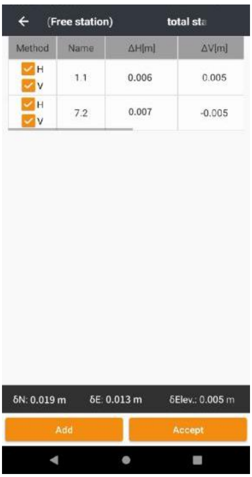
1) Enter the station name and instrument height and click Next.



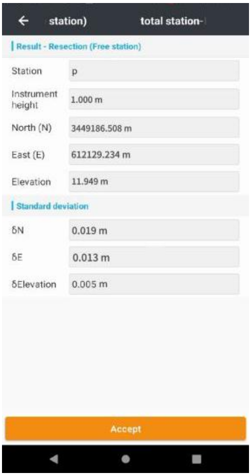
2) Add known points and perform Resection (Free station).



3) Repeat step 2, measure at least two known points.

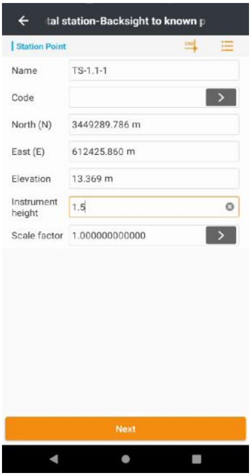


4) Complete station setup.

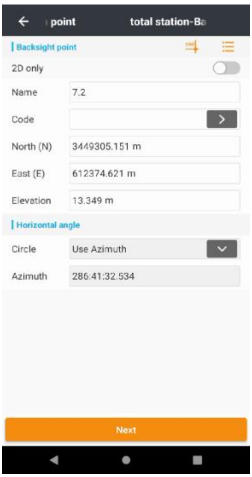


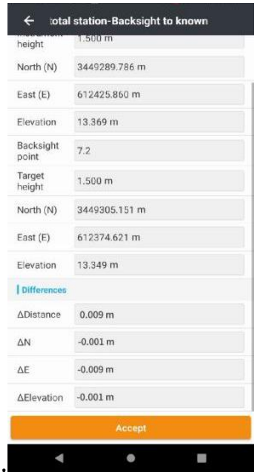
6.2.2 Backsight to known point

1) Select the known point as the setting station and enter the instrument height.



2) Select the known point for the backsight survey.

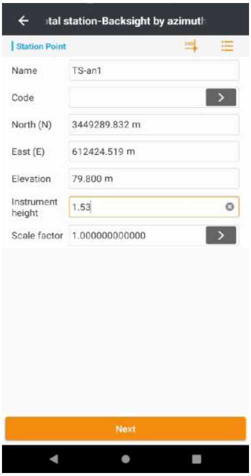




3) Complete station setup.

6.2.3 Backsight by azimuth

1) Select the known point as the setting station and enter the instrument height.

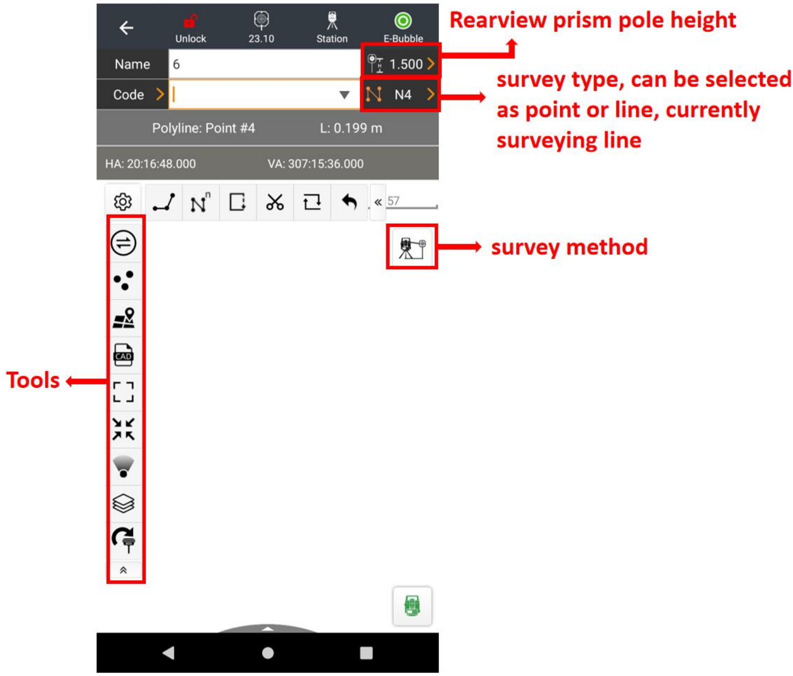


2) Enter the backsight azimuth to perform the backsight survey.

3) Complete station setup.

6.3 TS -- Survey of points

The interface is the same with GNSS survey. Users could set target height, point name, survey type, code, and others like before. Click **measure** icon to start measure.



[Survey Method]: Click to switch Direct measure, F1/F2, Offset HA, Offset VA, Offset distance and Traverse.

6.4 TS -- Stakeout

6.4.1 Point Stakeout

6.4.1.1 Add the point to stakeout

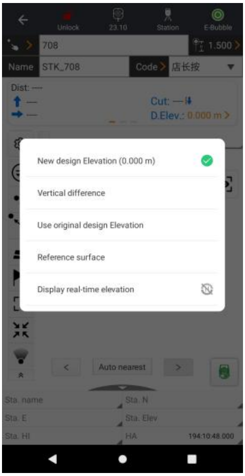
Method 1: Click  (upper left corner) to enter the points library and the stakeout points library to be displayed. After importing points or adding points (or points already exist in the library), directly select the target point in the points library or the stakeout points library to be displayed, and click OK to start the stakeout.

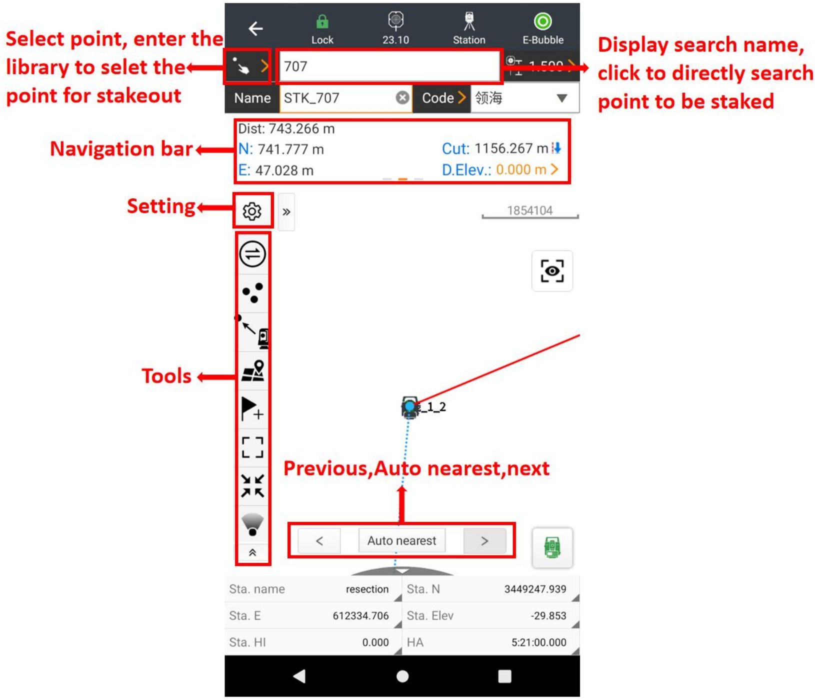
Method 2: Select the points directly on the view, or snap the points, and start stakeout.

Method 3: users manually input the name, code, coordinates and description of the new point. Click OK.

6.4.1.2 Point stakeout

The point out interface is shown in the figure below:


Unlock
23.10
Station
E-Bubble
708
1.500
Name
STK_708
Code
店长按
Dist: ---
Cut: ---
D.Elev.: 0.000 m
New design Elevation (0.000 m)
Vertical difference
Use original design Elevation
Reference surface
Display real-time elevation
Auto nearest
Sta. name
Sta. N
Sta. E
Sta. Elev
Sta. HI
HA
194:10:48.000



Navigation bar:

[**Arrow**]: The arrow points to the direction of the target point in real time, and the target point can be found by pressing the direction indicated by the arrow.

[**Distance**]: Means the plane distance between the current position and the target point.

[**Navigation information**]: can display the front, behind, right and left, east, south, west and north, slide in the horizontal direction on the text box.

 : the direction of travel is the positive direction (related to the quadrant, only indicates two distances each time), indicated by the up and down, left and right arrows;

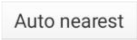
S:
E: :With the current location of the user, describe the target point in the east E m, south S m, west W m, north N m (related to the quadrant, only two distances each time);

Cut/Fill: Filling indicates the distance that the current position is lower than the actual position, need to fill, cutting indicates the distance that the current position is higher than the actual position, need to dig (the arrow after the filling value indicates filling up and digging down).

D.Elev.: The designed high of target point, click ">", display as follows, set the designed high.

< : After clicking, display the previous task of the current staking task in the current staking list.

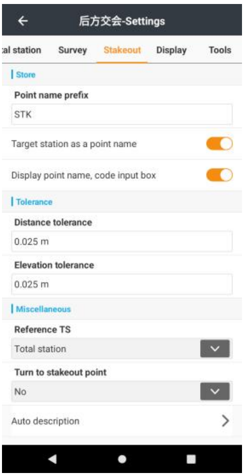
> : After clicking, display the next task of the current staking task in the current staking list.



: Click and automatically select the nearest point and stakeout.

Note: At the upper point / next point, the current staking point is in the coordinate library, so click the next point to display the next point of the current staking point in the coordinate library (excluding the measurement point and base station point).

6.4.1.3 Settings



The stakeout interface can set the point name prefix, distance limit, elevation limit, reference direction, etc. The specific setting should be determined according to the actual engineering situation.

Point name prefix: Prepended to the staked point name. For example, when staking a point name 1001, the stored measurement after staking the default name for the new point will be “STK1001”.

Target station as a point name: If staking a line or polyline, use the station along the line as the point name: “K1+12.345”.

Display point name,code input box: When staking, whether to display point name,code input box.

Distance tolerance: Horizontal staking accuracy, beyond which the accuracy software will indicate a large staking deviation.

Elevation tolerance: Level staking accuracy, beyond which the software will indicate large staking deviation.

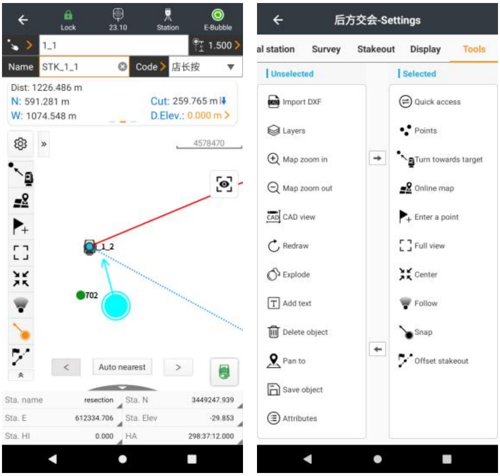
Reference TS: Whether the direction of the total station is toward the total station or the prism.

Turn to stakeout point: It is closed by default. After opening, the total station will automatically rotate to the direction of the staking point.

Auto description: When opened, the staking point will automatically note the set content.

6.4.1.4 View, coordinate display area

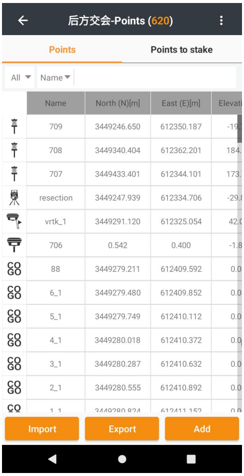
Support selection and snap functions, select the points of the imported base map, and support nodes, end point, midpoint, center, intersection point, nearest point, and any point picking, display coordinates and can be staked. Specific operation: click the corresponding function, select the corresponding ground on the map, you can determine a capture point.



6.4.1.5 Tools

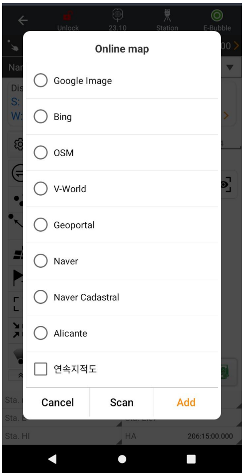
→Tools, can custom-defined tool.Point staking tool, the default tool appears as follows:

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

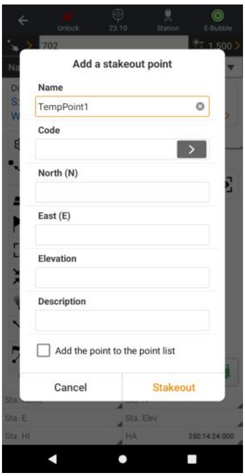


: Turn towards target.In the stakeout setting, you can choose whether to open and the way to open it.

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

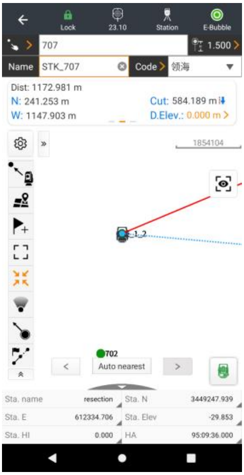


 : Enter a point. Users manually input the name, code, and coordinates,then click Stakeout.

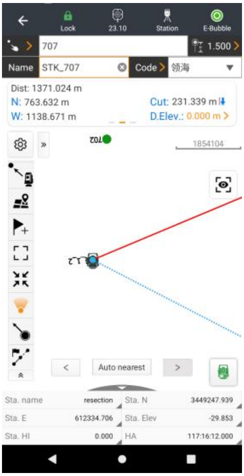


: Full view. Users can view the full map.

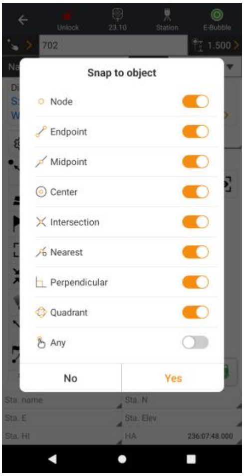
: Users can click it once to make the map always heading north, click it twice the map will rotate in the direction of PDA, click it three time the Auto centering will be turned off.



: After clicking, the current position points unchanged (due north), and the object on the view changes according to the direction of the controller.



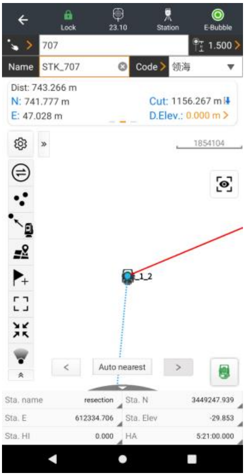
 : Support selection and snap functions, select points on the imported DXF map, and support nodes, endpoint, midpoint, center, intersection, nearest point, and any point picking. Long press the snap tool to display the snap configuration.



 : Click into the offset stakeout, support distance + azimuth, alignment offset, turned angle + distance and $\Delta X + \Delta Y + \Delta Z$.

6.4.1.6 Start stakeout

After setting the parameters correctly, measure the difference between the coordinates of the staked points and the designed coordinates. If the difference is within the required range, continue to set out other points; otherwise, stakeout again and calibrate the point.



Frequently asked questions:

1) Whether the setting out meets the accuracy.

The staking accuracy is limited to the stakeout setting option (upper left pinion icon).When the setting out to the distance and vertical limit difference, it can be measured normally.When the staking accuracy measurement is not satisfied, it indicates that "Stakeout offset is very large".If the measurement does not indicate "Stakeout offset is very large", it indicates that the current staking point has met the accuracy requirements.After the point stakeout is completed, you can see whether the staking points meet the limit difference in the point to stake library.

2) The target point should be nearby, but very far from the prompt.

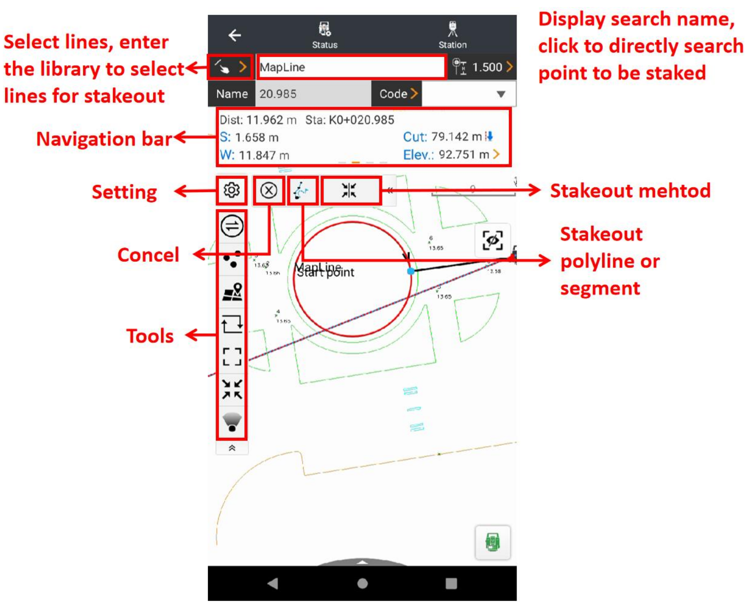
①Input the wrong coordinates when doing the station setup.②The X \ Y input to the target point is reversed. ③ The coordinates were entered incorrectly.

3) How to export the lofting results.

Project→Export→Other formats→Point stakeout result.

6.4.2 Line Stakeout

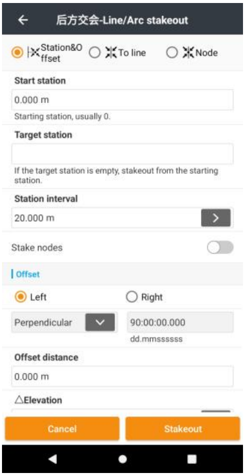
Line/Arc stakeout supports line, polyline, arc, circle,alignment and select from map. Enter the Line/Arc stakeout, click  , you can select the line in the lines/arcs management or add a new line to stakeout, or select the line on the map to directly stakeout.



6.4.2.1 Line/Arc stakeout method

1) Station&Offset

Piles or offset piles on the sample line according to pile spacing.



Start station: Set the starting mileage of the line.

Target station: Set the staking mileage.

Station interval: The point automatically switch the mileage according to the set distance.

Stake nodes: When opened, the node will not skip when clicking the pile.

Offset distance: Facing the mileage increasing direction, the current point is the vertical distance of the line segment. Enter offset, can stakeout offset point. You can also change the angle, with the default vertical 90° . When selected as ahead/behind can change the angle.

For example:

①Stakeout horizontal deviation point: Set 5 meters to the right at 50 meters.

Offset distance: 5, Angle: 90°

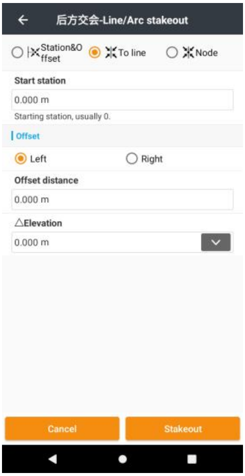
②stakeout offset point: At the mileage of 60 meters, the right left off 30 degrees, off 6 meters.

Offset distance: 6, select Right, select Ahead, Angle: 30° .

Δ **Elevation**: Difference in elevation from the midline. You can also choose Elevation, Slope(Degrees), Zenith, Slope 1:N, Slope(%),etc., used to calculate the elevation of the offset point.

2) **To line**

Stakeout to the line, the current position of the pile on the line.



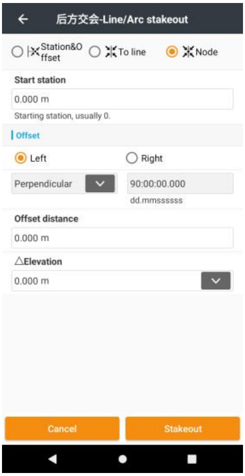
Start station: Set the starting mileage of the line.

Offset distance: Facing the mileage increasing direction, the current point is the vertical distance of the line segment. Enter offset, can stakeout offset point. You can also change the angle, with the default vertical 90° . When selected as ahead/behind can change the angle.

Δ **Elevation**: Difference in elevation from the midline. You can also choose Elevation, Slope(Degrees), Zenith, Slope 1:N, Slope(%),etc., used to calculate the elevation of the offset point.

3) **Node**

Nodes on the staking line (N1, N2...).



Start station: Set the starting mileage of the line.

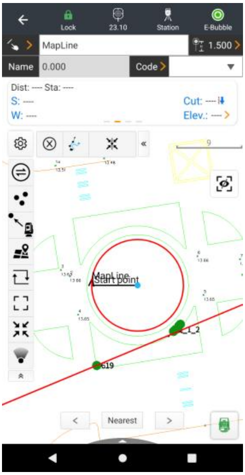
Offset distance: Facing the mileage increasing direction, the current point is the vertical distance of the line segment. Enter offset, can stakeout offset point. You can also change the angle, with the default vertical 90° . When selected as ahead/behind can change the angle.

Δ **Elevation**: Difference in elevation from the midline. You can also choose Elevation, Slope(Degrees), Zenith, Slope 1:N, Slope(%),etc., used to calculate the elevation of the offset point.

6.4.2.2 View display

Support the function of line selection on the map, select the line on the imported base map for staking, support the selection of polyline, arc, circle, curve, etc.

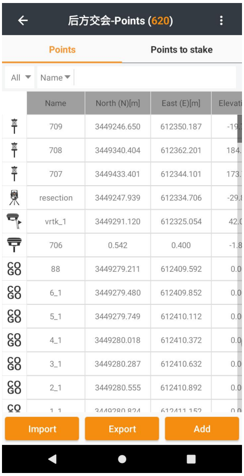
Specific operation: click the corresponding function, select the corresponding line on the map, and then stakeout.



6.4.2.3 Tools

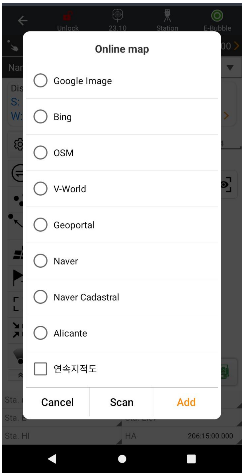
→Tools, can custom-defined tool.Lines/Arcs staking tool, the default tool appears as follows:

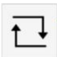
: Point library.Select a point from points library ,you can also add a point manually， or import/export the point file in this faction.

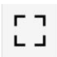


: Turn towards target.In the stakeout setting, you can choose whether to open and the way to open it.

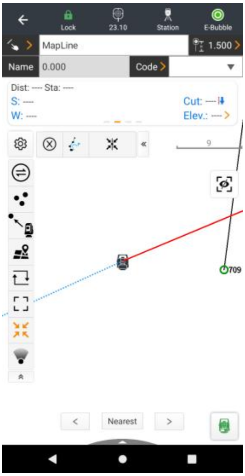
: Online map. Users can choose the online map which they want to use as background.



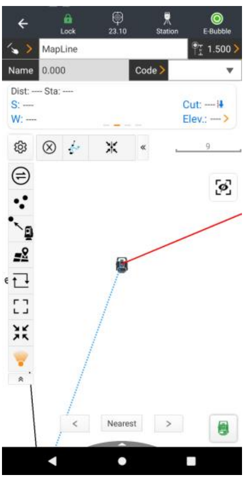
: Click the button will switch the start and end point off the line.

: Full view. Users can view the full map.

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



: After clicking, the current position points unchanged (due north), and the object on the view changes according to the direction of the controller.



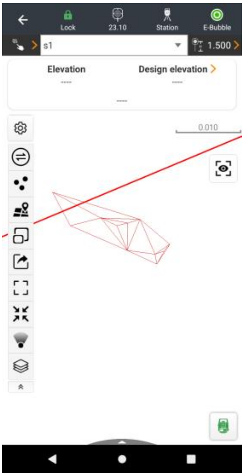
6.4.2.4 Start stakeout

After setting the parameters correctly, measure the difference between the coordinates of the staked lines/arcs and the designed coordinates. If the difference is within the required range, continue to stakeout other points of the lines/arcs; otherwise, stakeout again and calibrate the point.

6.4.3 Surface stakeout

6.4.3.1 Surface stakeout interface

Open the software, select the Survey, click [Surface stakeout] and enter the staking interface.



When there is no surface staking file, click [Surface stakeout] -the upper left corner , enter the surface management interface to create or open the surface file, select the surface file, and click [Accept].

Main interface sidebar setting and tool introduction:

: Guarantee the total station, survey setting, stakeout setting, road, display and tools, which can enable general parameters and road related parameters to be set. For the specific parameters, please see the software interface.Add the Unselected tools to the Selected options.

: Enter the points and the points to stakeout, and you can view

the point information.

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

: Show real-time fill or cut information.

: Export the stakeout file, support csv, txt, and dat file.

: Users can view the full map.

: Positioning real-time zoom in the center, can switch to follow, can close the center.

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

: Click to jump to modify the layer option.

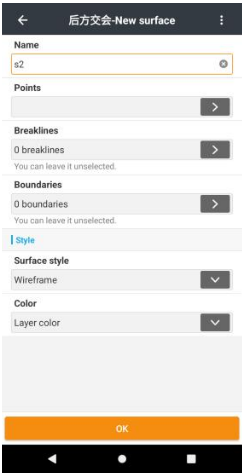
Real-time location information is displayed at the bottom:

Choose to display Sta.name, Sta.N, Sta.E, Sta.Elev, Sta.HI, HA, VA, HD, SD, 2D dist, 3D dist and △Elev.

6.4.3.2 Surface management

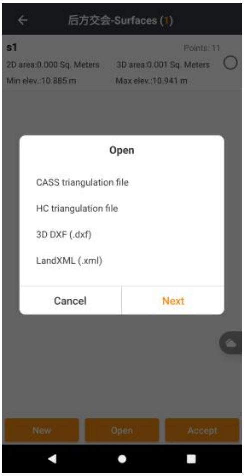
1) New

Select **New**, enter the surface name, choose to select from point list, map, or range of points to build a surface file.



2) Open

Open the surface file and support the CASS triangular file (.sjw), HC triangle network file (.hct), 3D DXF file and LandXML files. Click **Open**, **Next**, select the surface file to open, select **Open**.



3) Other functions

In addition to the above functions, click on the surface file and slide right for more operations:

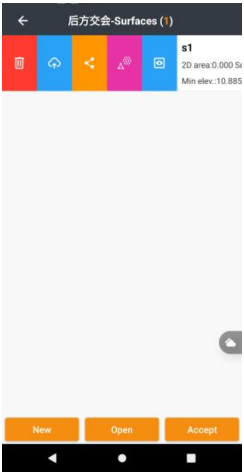
: Delete the selected surface file.

: Manually upload the surface files to the cloud disk for preservation

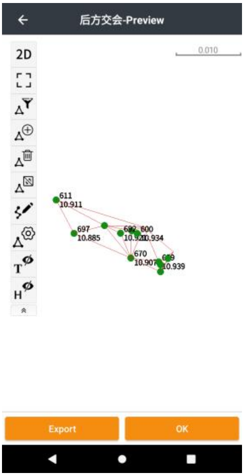
: Share the surface files through the 4-bit share code, and the share code is valid for half an hour.

: Click to set the style and color of the surface file.

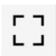
: Preview the surface file, but also can modify the surface file.



6.4.3.3 Preview



: 2D, 3D and online map.

: Users can view the full map.

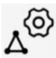
: The generated triangulation net can be filtered by minimum Angle and side length multiple. The default minimum Angle is 10°, and the minimum change multiple is 10 times.

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

: Select triangulation net on the surface to delete.

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

: Plot by picking coordinates on the surface.

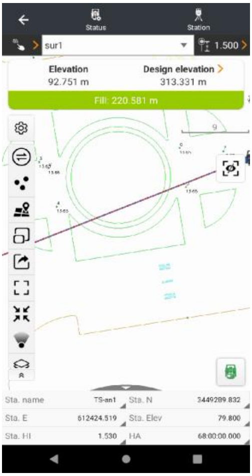
: Make style edits and changes.

: Hide or display the name of the point.

: Hide or display the elevation of a point.

6.4.3.4 Stakeout

After creating or opening the surface file, select the display surface and adjust the prism rod height on the screen display interface. The navigation bar displays elevation value, design high, and fill/cut value.

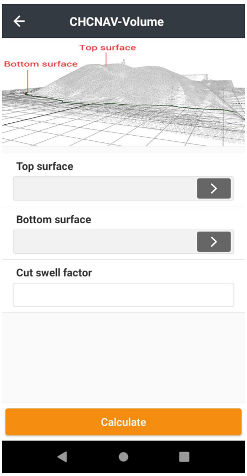

Status
Station
sur1
1.500
Elevation
92.751 m
Design elevation
313.331 m
Fill: 220.581 m
Sta. name
TS-an1
Sta. N
3449289.832
Sta. E
512424.519
Sta. Elev
79.800
Sta. HI
1.530
HA
68:00:00.000

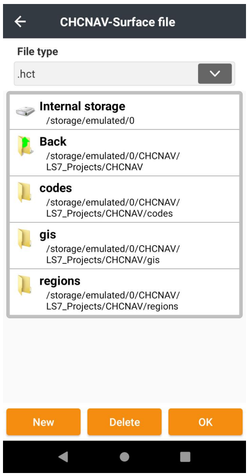
7 Tools

7.1 Volume

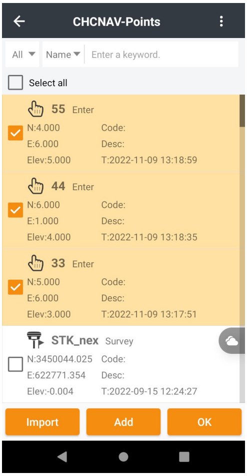
Surface with Height:

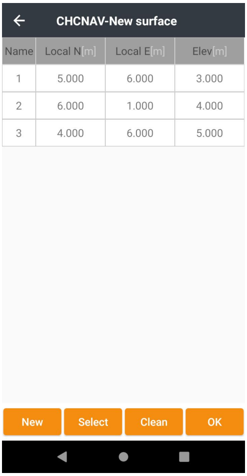
Top/Bottom Surface: Import above surface file. Click import icon to enter **Surface File** interface.

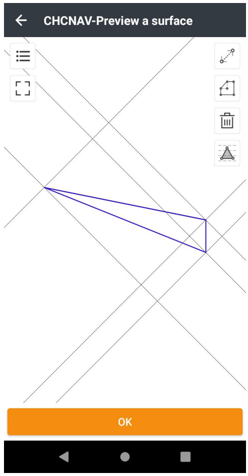




Users can choose surface file or create a new surface file by selecting points. Click **New** to create a new surface file, users can add a new point or select point in **Points**, then click **OK** to preview the surface.







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.

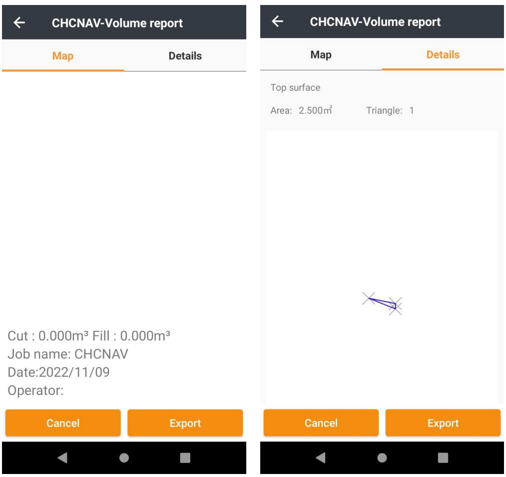
: Tap to modify the boundary. Choose two points to create a new line for determining a new boundary, and then delete the wrong part of the boundary.

: 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.

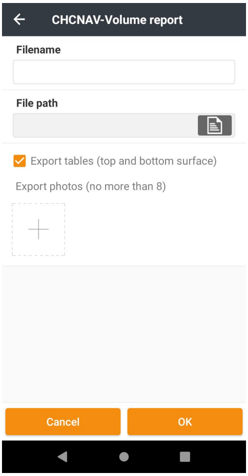
: Tap to generate new triangulation networks.

Cut swell factor: Input cut swell factor, 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 top surface and bottom surface.

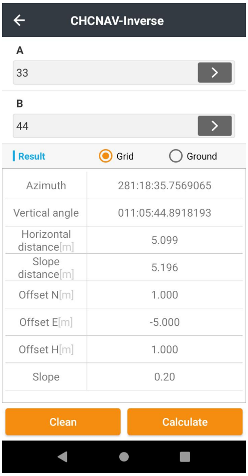


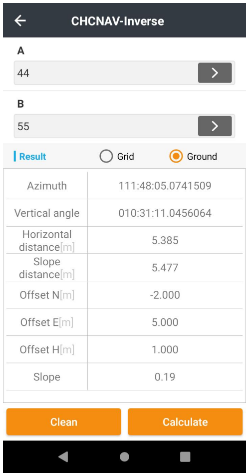
Click **Export** users can export the result with some photos (no more than 8).



7.2 Inverse

Select starting point A and ending point B from point manager, click **Calculate** to calculate. The results calculated according to grid or ground surface will be shown in the table. The results contain: azimuth, vertical angle, horizontal distance, slope distance, offset N, offset E, offset H and slope.





7.3 Areas

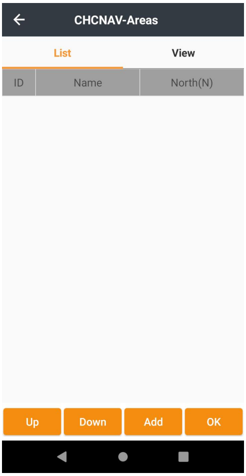
This function is to calculate the area, perimeter of figure, the coordinates that participates resolve are chosen from point management by library chosen. The unit of perimeter is metric, and the unit of area supports square meters.

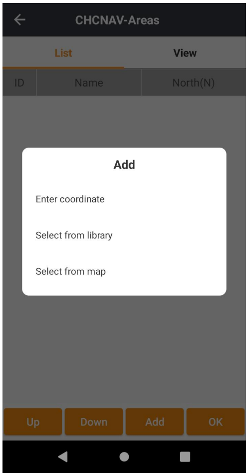
Add: Enter coordinate, select from library or map to add points to the list.

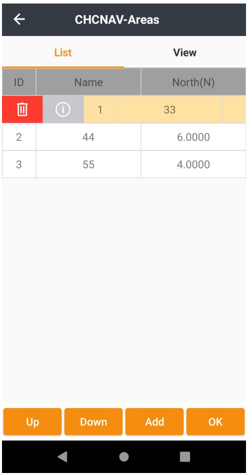
Up/Down: Make selected points move up or down.

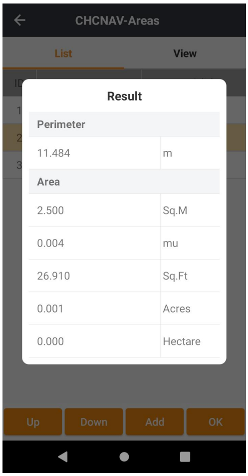
Right slide: Right slide to delete point or check the details of the point.

OK: Calculate the perimeter and area of the figure which is composed of points in sequence.



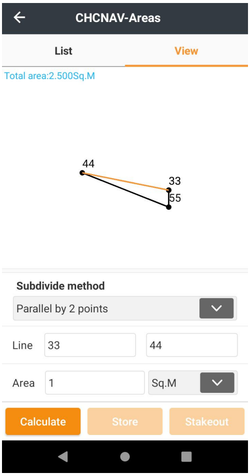




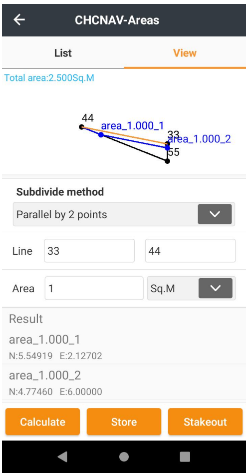


Area Division: Cut the selected area according to the value inputted.

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



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

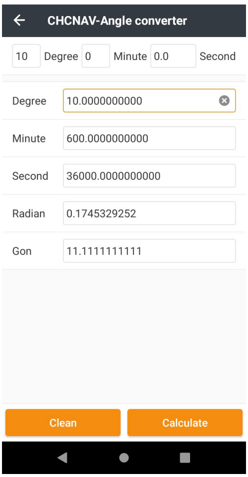


7.4 Angle Conversion

Angle conversion can convert degrees, minutes, seconds and radians among these 3 types of conversion.

Enter a value in degrees, minutes and seconds edit box, click on the **Calculate** button to calculate the value of the corresponding degrees and radians.

Similarly, it can convert radians to degrees and degrees, minutes and seconds, or converts degrees to radians and the value of every minute.



7.5 Parameter Calculation

Calculation Type: Include 7 Parameters, 7 Parameters(strict) and 3 Parameters.

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

3 parameters: At least one known point pair is requested which is usually used in small scales. The accuracy is up to the operating range, decreasing with the increase of operating distance.

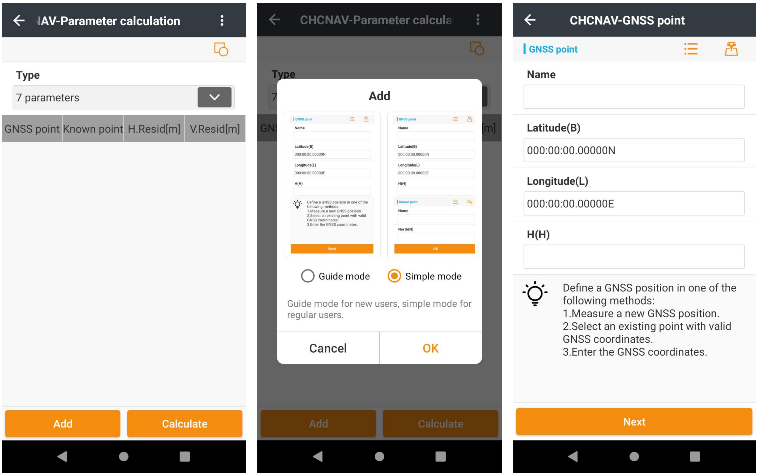
Mode: We can choose **Guide mode** or **Simple mode** to add point pairs based on different situations.

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

GNSS Point: Select from library, survey or enter manually to add GNSS points.

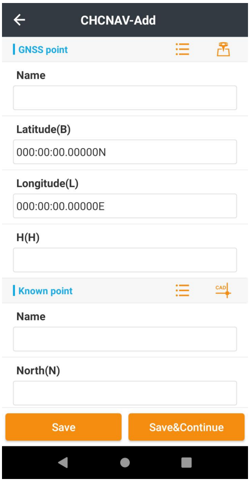
Known Point: Select from library, map or just enter manually to add known points.

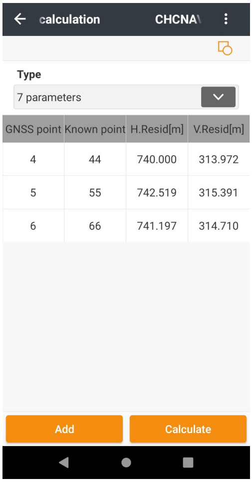
Note: Select corresponding point pairs and add to the interface of parameter calculation.

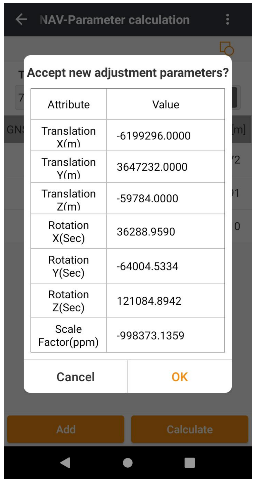


Calculate: Click to calculate. The results will be popped up automatically. Then click **OK** to apply the parameters to the current project.

Datum trans: Back to the main menu, click **CRS** to view Datum trans interface and the parameters can be viewed. Click more, you can choose to lock the parameters and the default password is 123456, which can also be changed. And we can also click unlock to edit parameters.







7.6 Calculator

Use for simple mathematical calculations.

MC: Clear historical.

DRG: Transform input number type (Degree or rad).

C: Clear current record.

Sin/Cos/Tan: Calculate sin/cos/tan value. Users should click **DRG** to transform input number type into degree (DEG), sin 30(DRG) = 0.5.

⬅: Back.

log/ln: log10=1.

√: 8√3=2.

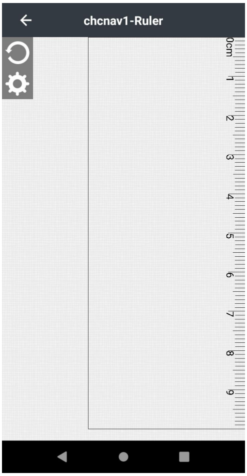
^ : 8^2=64.

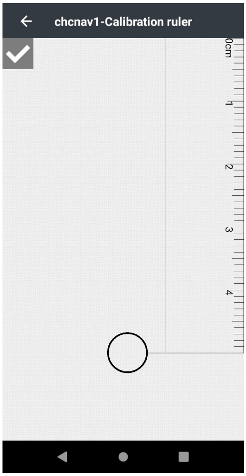
n!: n!3=6.

7.7 Ruler

This function will provide users a ruler to do some simple measurement.

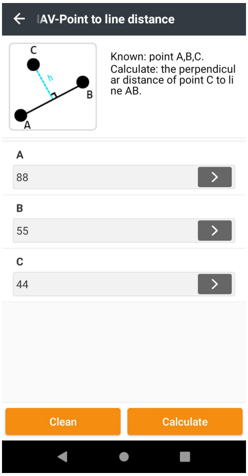
Users can use real ruler to adjust the length of ruler by moving the circle, then click confirm icon.

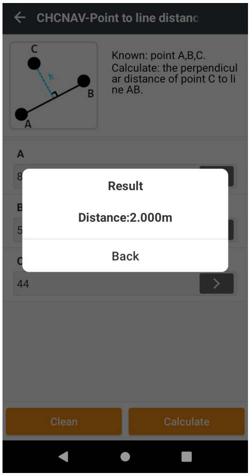




7.8 Point to Line Dist

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.





7.9 Offset Distance

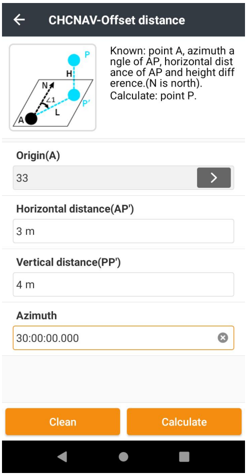
Origin (A): Select form **Points**.

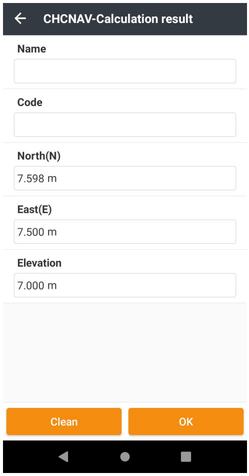
Horizontal distance (AP'): Input the horizontal distance.

Vertical distance (PP'): Input the vertical distance.

Azimuth Angle: Input the azimuth angle.

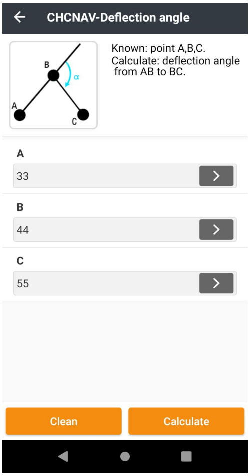
Calculate: Click **Calculate** to display a calculation result interface, enter the point name, and click **OK** to save the calculated point.





7.10 Deflection

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



7.11 Rotation

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

A/B: Select the coordinate of A, B from **Points**.

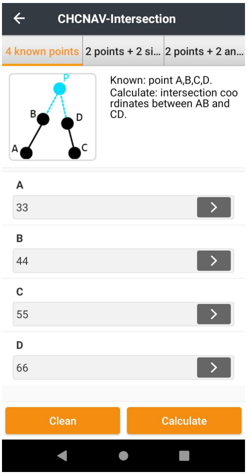
AP: Distance from point A to point P.

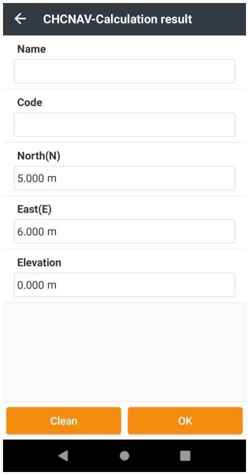
Rotation Angle: The rotated angle between AB and AP.

Calculation Result: Click **Calculate** to get the result. Input name and then click **OK** to save this calculated point.

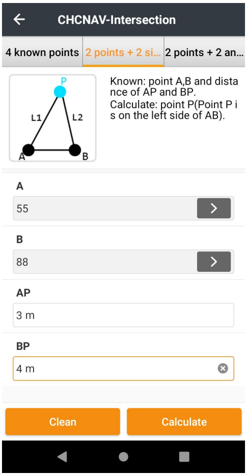
7.12 Intersection Point

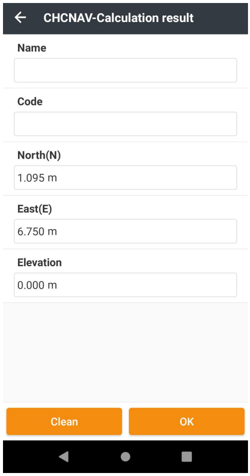
Known Points: Select points from point management and click **Calculate** to calculate the intersection P of line AB and line CD.



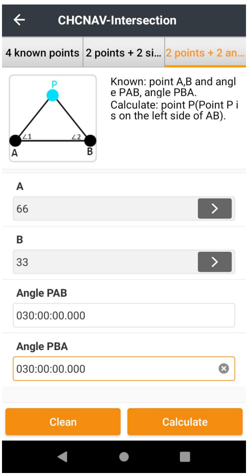


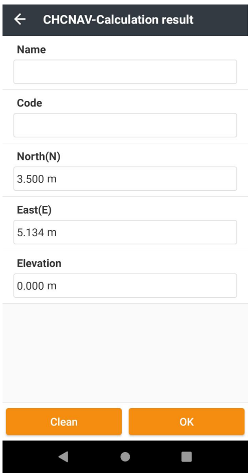
Points + 2 Sides: Select points A and B from point management. Enter the length of line AP and line BP. Click **Calculate** to calculate. Input a name and click **OK** to save.





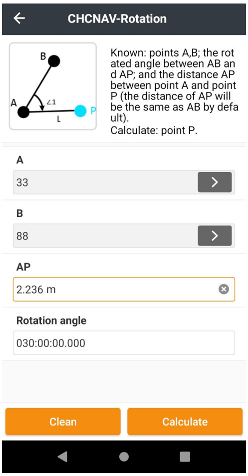
Points + 2 Angles: Calculate intersection P with known points A and B and the inner angle of PAB. Click **Calculate** to calculate. Input a name and click **OK** to save.

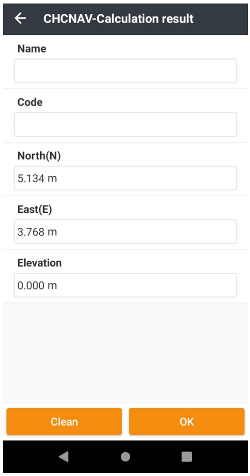




7.13 Bisection Angle

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 **Calculate**, the results will show out, input the point name, and click **OK** to save the calculated point.

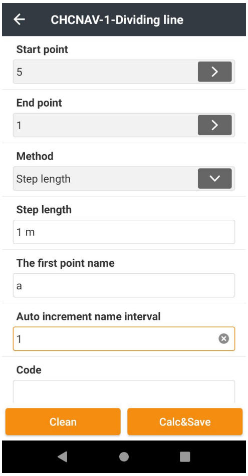


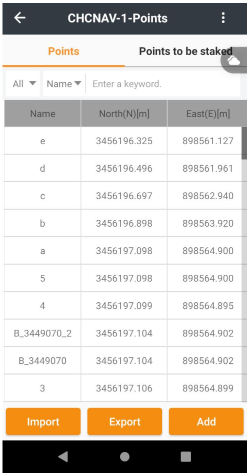


7.14 Dividing Line

Dividing Line: Select start point and end point from **Points**, select **Method**, Input step length, first point name and name interval, then click **Calc&Save**; it will remind users a successful division. Click **Points**

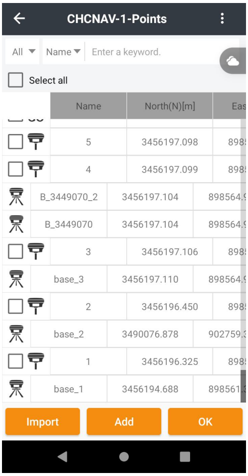
manager to review points.

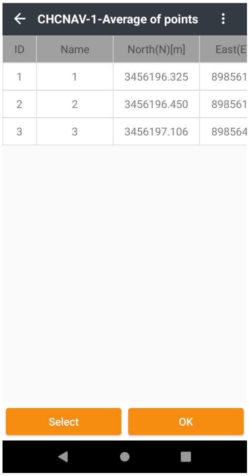




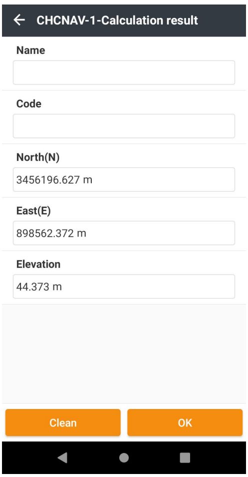
7.15 Average Value of Points

Select: Select points to calculate.

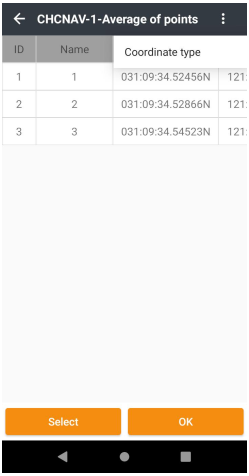


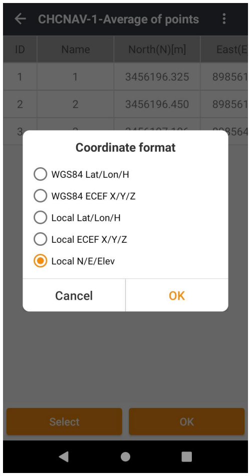


OK: Report the average value of selected points in calculation result interface.



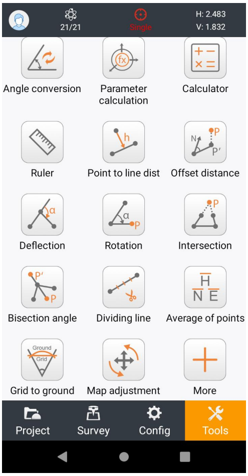
Coordinate Type: Users can set coordinate types of points.





7.16 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.



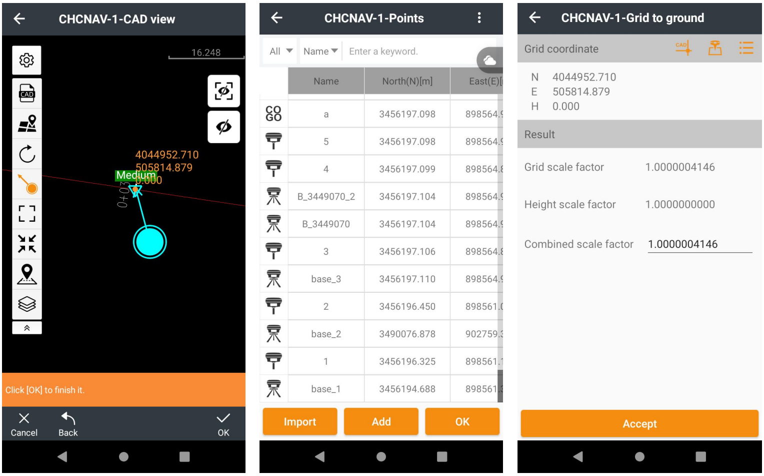
Tap **Grid to ground** in **Tools** interface. There are three methods to select grid coordinate: from Points, map selection and calculate directly. There needs two points for calculation, the first point coordinates are default as current base station coordinates. Grid scale factor, height scale and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

3 ways to choose points:

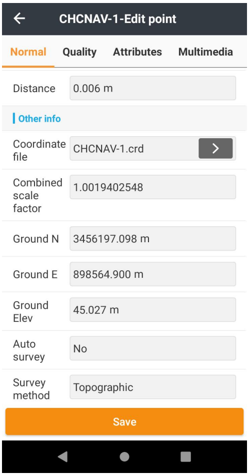
(1) **Map Selection**: Select a point in base map or measured point.

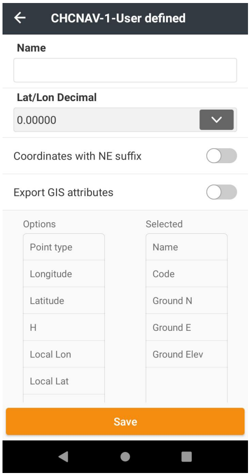
(2) **Survey**: Click to get the current position.

(3) **Points**: Click to choose points in points list.



Click **Accept**, 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.





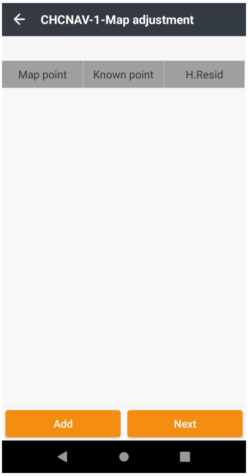
7.17 Map adjustment

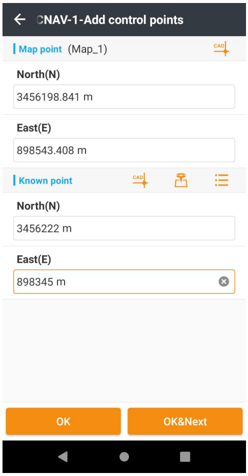
Add: Click add to add Map point and Known point (point pair).

Map point: Choose point on base map.

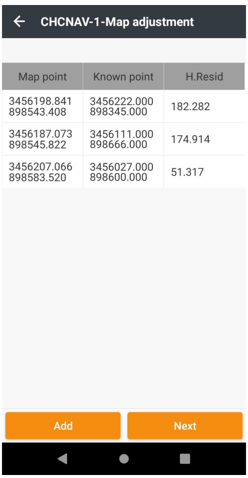
Known point: Choose point on base map, points, or survey directly.

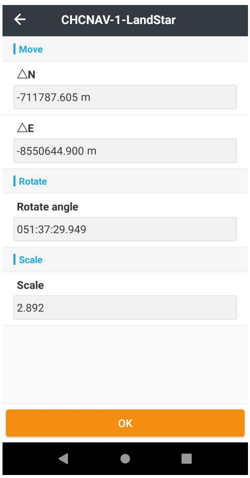
Click **OK&Next** to add next point pair; click **OK** to finish adding points.





After adding all point pairs, click **OK** and there will show **H.Resid**. The smaller the residual is, the better the accuracy is.





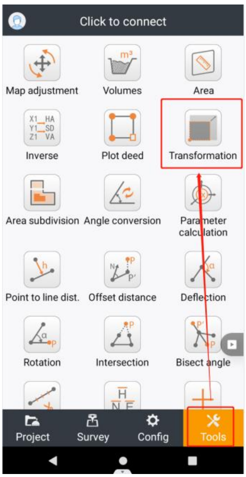
Click **Next** to calculate the translation, the rotation, and the scale. It shows how the base map moved. Finally click **OK** to apply.

7.18 Transformation

Transformation is essentially site calibration that reduces the scope of the target. Site calibration is calibrated for the entire project, but transformation is calibrated for the selected target.

7.18.1 Entrance

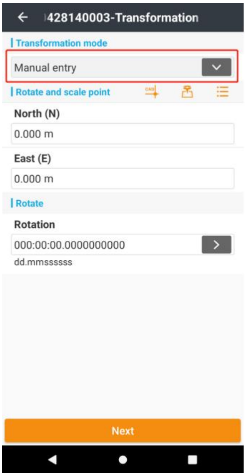
The entry to transformation is Tools-Transformation, which is displayed by default.

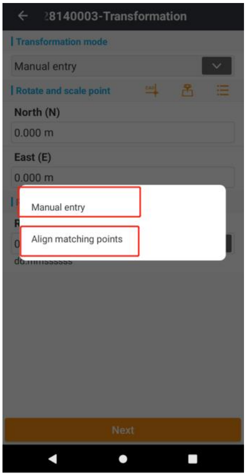


There are two ways of Transformation: Manual entry and Align matching points. The default is Manual entry.

Manual entry: Calibration is performed by input calibration parameters.

Align matching points： The calibration parameters are obtained through the selected point pair and then corrected, which is the same as point correction.

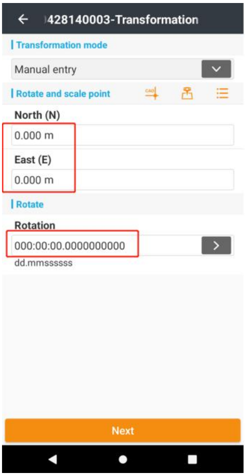




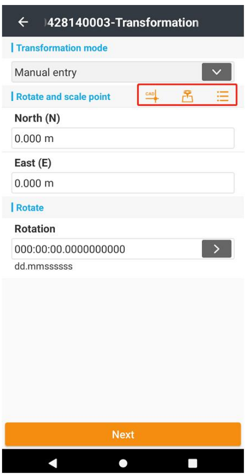
7.18.2 Manual entry

1.Input rotation

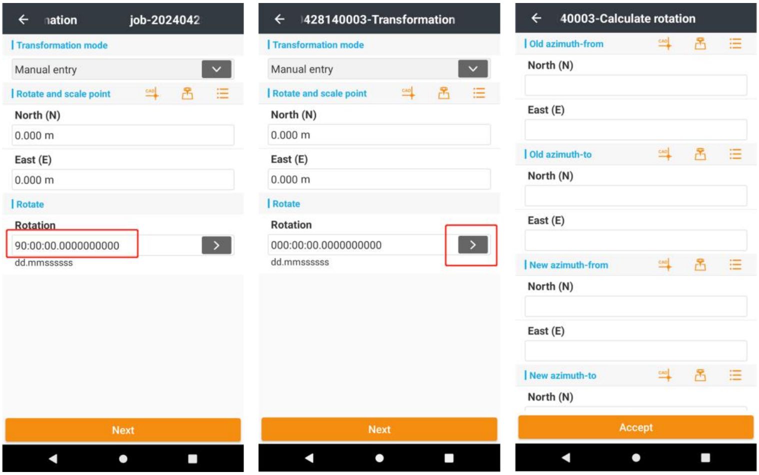
Enter the **rotate and scale point** and **rotation**, both of which default to 0.



The rotate and scale point can be obtained by direct input, Map, Survey, and Select.

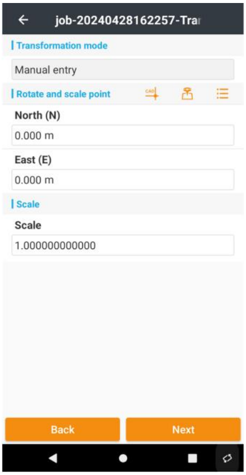


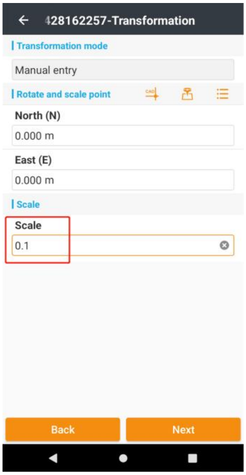
The rotation Angle can be obtained by direct input and calculation. The calculation page is shown in the figure.



2.Input scale

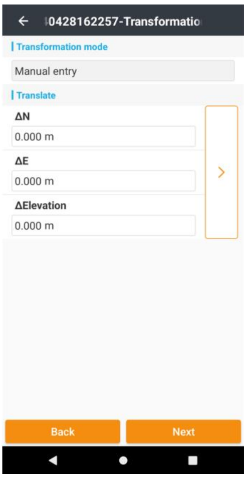
Enter the scale, the **rotate and scale point** coordinates default to the point entered earlier but can be modified. Enter the scale, which defaults to 1.



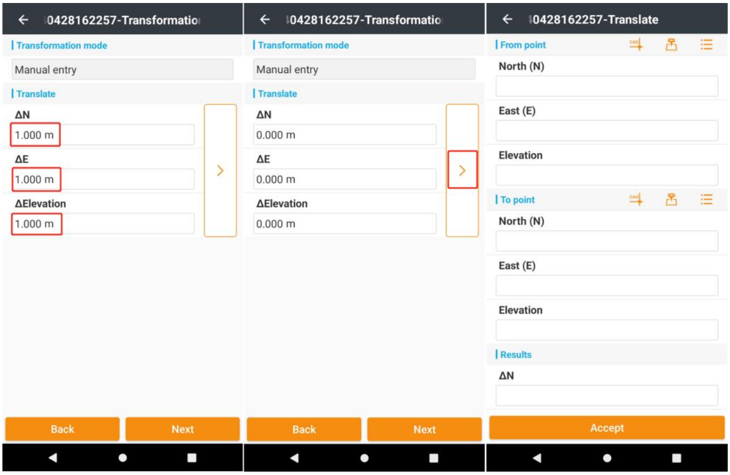


3.Input translate

Enter the amount of translation, which defaults to 0.



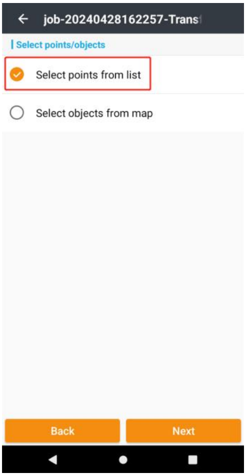
The amount of translation can be obtained by direct input and calculation. The calculation page is shown in the figure.

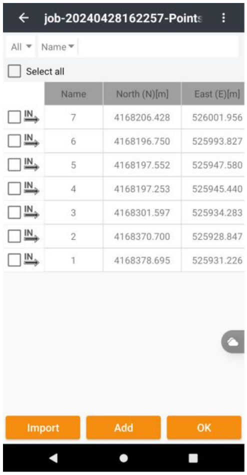


4.Select translation target - points or objects

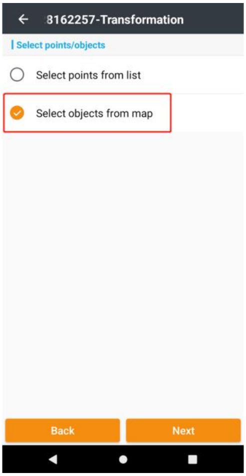
There are two ways to select the translation target: **select points from list** and **select objects from map**.

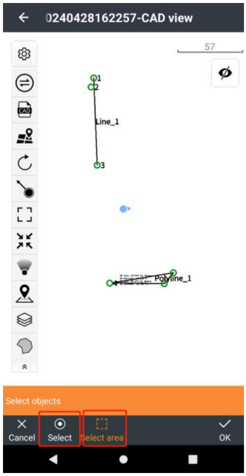
Select points from list can only select points.

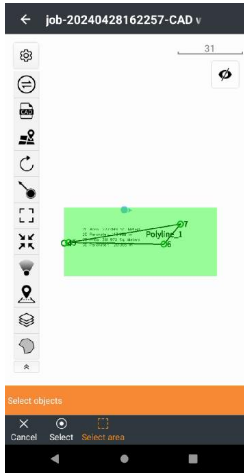




Select objects from map can select points, lines, and surfaces. There are two options for selecting a map: **Select** and **Select area**. **Select area** is used by default.

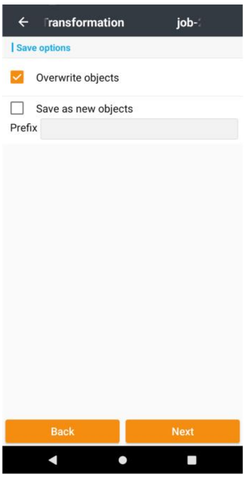




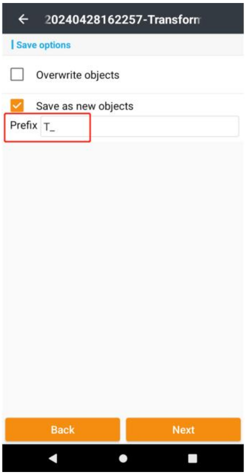


5.Set save options

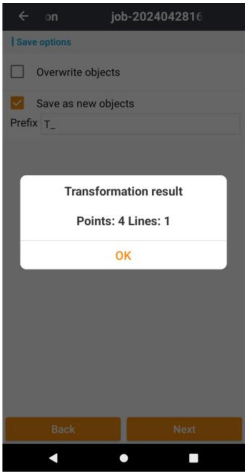
There are two save options, **Overwrite objects** and **save as new objects**. The default is **Overwrite objects.**



Select **save as new objects.** The default prefix is **T_**, which can be modified.

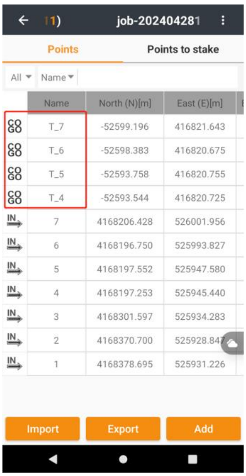


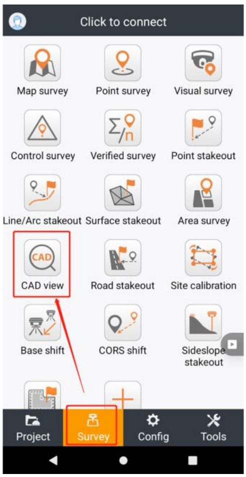
Click Next, and a prompt box will pop up for the conversion result, recording the number of points and lines involved (the surface is classified as lines when recording).

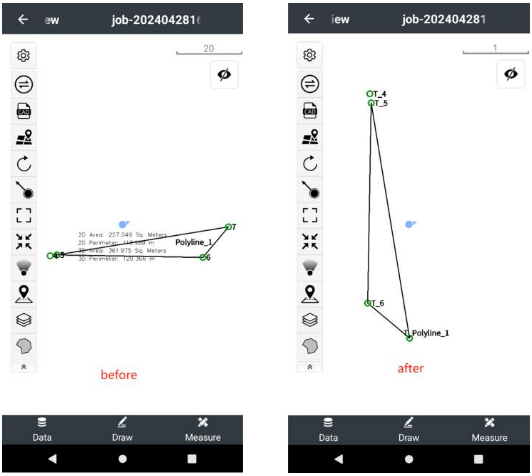


6.View translation results

Enter the point list and CAD view to check the **translation** results, you can find that the **translation** results are correct.



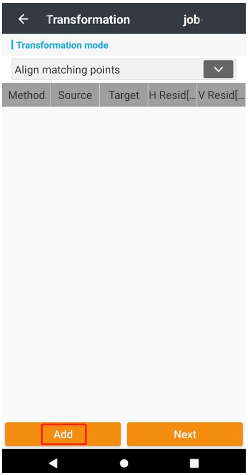


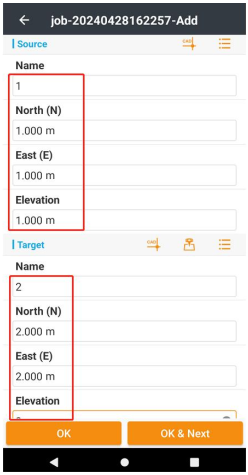


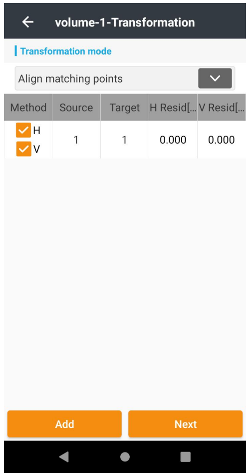
7.18.3 Align matching points

1.Select point pair

Point pairs can be obtained by direct input, map selection, survey, and list selection.

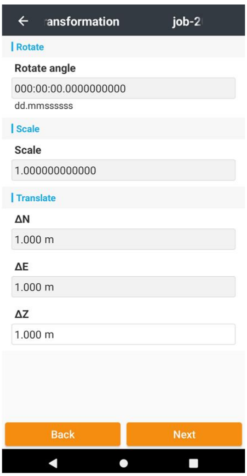






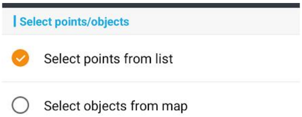
2.Check calibration parameter

The corrected parameters can be viewed after selecting the point pair calculation. (The height difference can be freely modified).



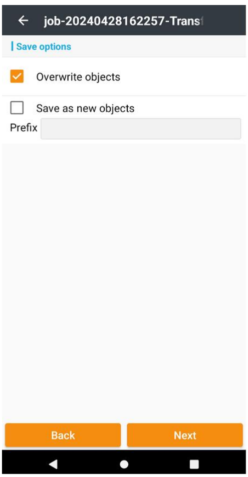
3.**Select translation target**

There are two ways to select the translation target: **select points from list** and **select objects from map**. Same as Manual entry.

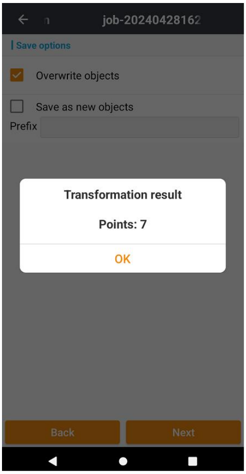


4.Set save options

There are two save options, **Overwrite objects** and **save as new objects**. The default is **Overwrite objects.**

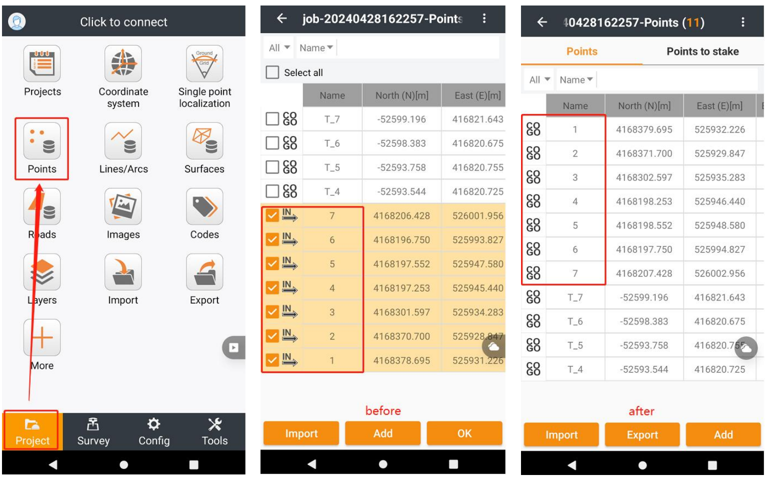


Click Next, and a prompt box will pop up for the conversion result, recording the number of points.



5.View translation results

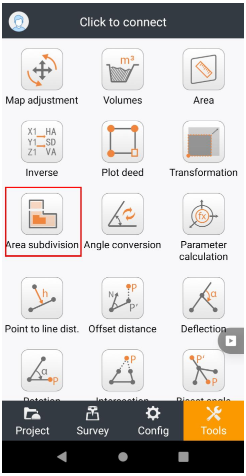
Enter the point list to check the **translation** result, you can find that the **translation** result is correct, and the original point is overwritten.



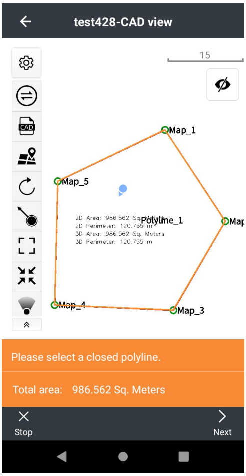
7.19 Area subdivision

Area subdivision means that the area of a closed figure is segmented by a straight line in different ways.

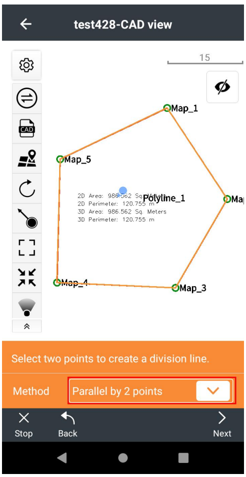
1.Tool interface, select area subdivision

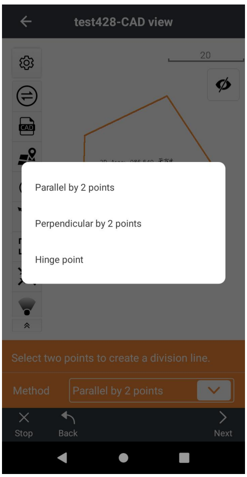


2. Select the closed multisegment line to be processed, the area will be displayed below, click Next

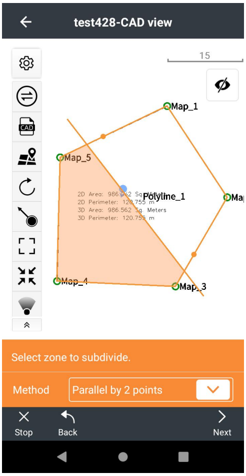


3.There are three kinds of subdivision methods: **parallel by 2 points**, **perpendicular by 2 points**, and **Hinge point**.

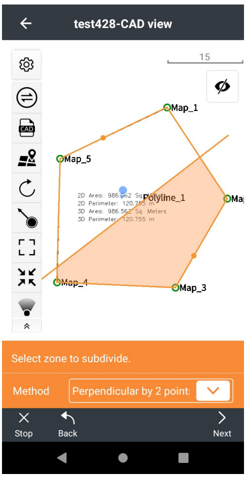




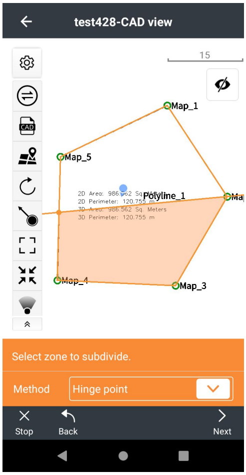
Parallel by 2 points: Two points are selected according to the prompt, and the software divides the area by a straight line parallel to these two points



Perpendicular by 2 points: The perpendicular lines connecting the two points divide the area equally.

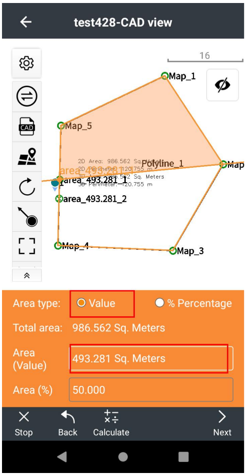


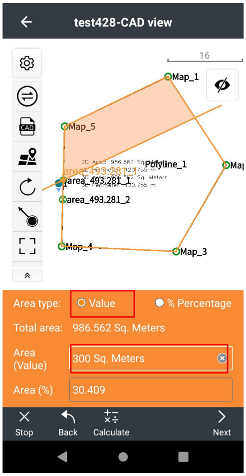
Hinge point: Select a point according to the prompt, and the software evenly divides the area with a straight line fixed across the point.



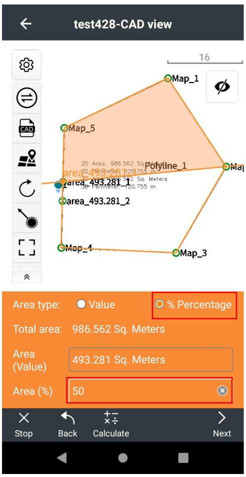
4.Click **Next**, the area can be divided according to the area **Value** and **Percentage**.

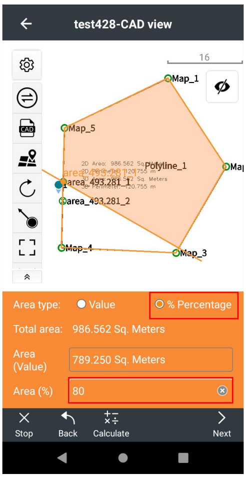
Select the **Value**, enter the **Area(value)**, click **calculate**, and the dividing line will be divided according to the input data.



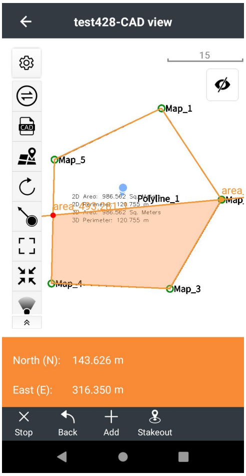


Select the **percentage**, enter the **percentage**, click calculate, and the dividing line will be divided according to the input data

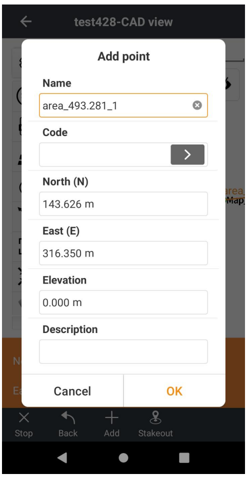




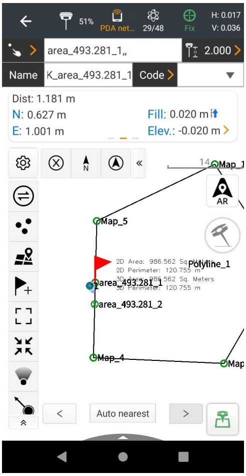
5.Click **Next**, generate area division point according to dividing lines.



Click **Add** to add the division point to the point manage.



Click **Stakeout** to stakeout the division point.


51%
PDA net...
29/48
Fix
H: 0.017
V: 0.036
area_493.281_1,,
2.000
Name
K_area_493.281_1
Code
Dist: 1.181 m
N: 0.627 m
E: 1.001 m
Fill: 0.020 m
Elev.: -0.020 m
Map_1
AR
Map_5
Polyline_1
area_493.281_1
area_493.281_2
Map_4
Auto nearest

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