CHC® LandStar 7 User Guide

Geodesical

Revision 1.2
January 2017

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Safety Warnings

The Global Positioning System (GPS) is operated by the U.S. Government, which is solely responsible for the accuracy and maintenance of the GPS network. Accuracy can also be affected by poor satellite geometry and obstructions, like buildings and heavy canopy.

FCC interference statement

CE

This equipment has been designed to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules in the Portable Mode. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference that
may cause undesired operation.

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1 LandStar 7 Overview

1.1 Software Description

Thanks for your interest in LandStar 7 – the most convenient software for positioning. It is the latest measuring software based on Android platform and developed by CHC Technology Co., Ltd.

If you are new to LandStar 7, you will be impressed by its convenient work mode switching, graphic measurement interface, simple operation, friendly user guide, extensive data import/export formats and multiple types of measurement and stakeout methods.

LandStar 7 supports X91/X900 with the firmware version of v8.35 and above, and CHC smart receiver i80 with the firmware version of v1.3.42 and above, as well as GNSS receiver in your Android smartphone and handheld controller. You will enjoy high precision surveying with various types of measurement, as well as abundant import/export data formats.

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1.2 Unique Characteristics

Online register: Online register is now available which needs users to register via E-mail first, users can apply register code after activating E-mail account.

Powerful graphical surveying: Supports both online OSM (Open Street Map) map and other industry standard (DXF, SHP, TIF and SIT file formats, and WMS online base map) as base map while surveying. Selected points in a DXF,or SHP file can be automatically added to the point manager for staking out. Multiple line and polygon features can be measured simultaneously.

Automatic drawings: Multiple line and polygon features can be measured simultaneously, with measuring results are mapped automatically in the field and the perimeters and areas are stored into the features manager.

Extensive data import and export formats: Support CSV, DAT, TXT, DXF, SHP and NCN as the import format, CSV, DAT, TXT, KML, DXF, SHP, RAW,

HTML as the export format. Contents of CSV, DAT, TXT can be customized by users.

Multiple localization methods: Support 3 parameters, 7 parameters, 4 parameters, Geoid shift file (GGF/BIN/GSF/GRD/GRI/ASC/STG/SPB/GBL/ GXY), Grid shift file (GGF/GRD/STG/PXY), RTCM transformation message(1021-1027).

Correction repeater function: Support repeating correction data from RTK network to other rovers via the internal radio modem.

Optional ellipsoid name: Support choosing ellipsoid name from pull-down menu, different ellipsoid name is corresponding to different parameters.

Convenient work mode management: Support presetting of common work modes of base and rover, selecting or switching work modes by one button push. Users will not need additional steps to configure your work mode while surveying. Support simultaneously recording HCN file and RINEX file, users also can input station name and antenna height while surveying.

Various types of measurement: Support points, lines, polygons and PPK measurement. The methods of point measurement include topographic point, control point, quick point, continuous point, offset point, compensation point and corner point. Control point is recommended for high-precision survey, and it now supports i80 receiver with the firmware version of v1.4.24 and above and ARM based receiver of v8.35 and above; corner point is recommended for tilt survey, or somewhere receiver can't be centered.

Quick code display: Tick to show quick code menu in Map interface. Users can slide finger to choose feature type: point, line, and polygon, then click to apply the code.

Multiple types of stakeout: Supports point stakeout, line stakeout, surface stakeout and road stakeout. Users can snap feature point and stakeout on DXF base map or survey point. The snap type including endpoint, midpoint, intersection, perpendicular, center and tangent.

Various GNSS data resources: Support CHC legacy ARM and i80 GNSS

receivers, Android smartphone and handheld controller internal GPS, and many types of peripheral instruments such as generic NMEA0183 receivers.

Three connection types: Support three different connection types, Bluetooth, WIFI and demonstration modes.WIFI mode features fast connection speed, stable performance and longer distance. Demonstration module allows user to input the coordinates and simulate it as the current position.

Smart e-manual: Support embedded e-manual. Users can check the help documentation in the top right corner of the interface and get guide of each function being used.

RAW file recording: Support RAW files. Users can review the operation procedures, configuration parameters and measurement results, as well as transfer RAW files into third party surveying software.

Customizable layer display: Support separate display of points name, code and height, custom of color, size and type of points, lines and polygons, configuration of single or multiple points with height.

Navigation stakeout: Support real-time display of direction, distance and elevation difference between your position and the point to stakeout.

Measurement geofencing: Support series of points as the measurement geofencing. It will remind you once your position goes out of the boundary to ensure user's work being limited in a predetermined area.

Site calibration Quality Control : Support automatic reminders when the error of site calibration results is too large, preventing wrong corrections to be applied.

Landscape mode: Support Landscape mode, designed for tablet devices.

Voice prompt: Support voice prompt when received CORS messages.

Powerful COGO tools: Support calculation of perimeters, areas, transformation parameters, etc. It also has a build-in RPN calculator so that users can do common calculations conveniently in the field.

Real-time global TEC map: Support a built-in global TEC map with updating every 10 minutes to help users to choose the best working time in high

ionospheric activity regions.

1.3 Software Interface

LandStar 7 main interface is divided into four parts: **Project**, **Survey**, **Config** and **Tools**.

Startup Interface: Install at the first time and run the software can directly into the main interface and go to the next slide in turn.

Status Bar:

①This icon will show receiver battery.

②This icon will lead users to device Information interface, this position also will show different icon when users accept different work mode successfully.

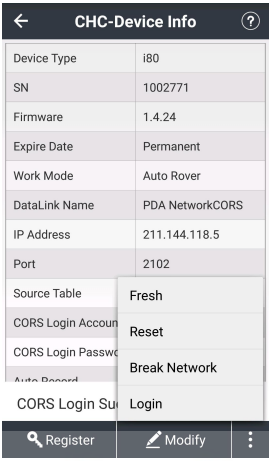
③This icon will lead users to read skyplot information and satellites list. A represents the total number of received satellites; N represents the number of effective solver satellites.

④This icon will lead users to view current position and precision, red means single status, yellow means float status, and green means fixed status. As for precision, **H** means horizontal accuracy, **V** means elevation accuracy; RMS

means the relative error.

⑤This icon will lead users to view e-manual.

Device Information: Users can view the details of the current device as shown below.



Skyplot: Users can view the current skyplot. Then users will see the reference position information of each satellite in current skyplot, while at the bottom of sky map display SNR(L1,L2) which use bidirectional histogram. Histogram colors represent different SNR range:

SNR <=20 green;

20 <SNR <=40 blue.

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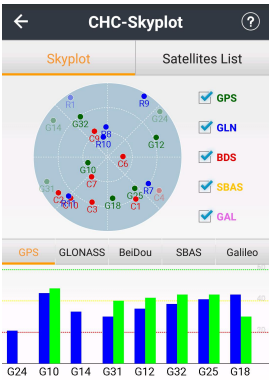
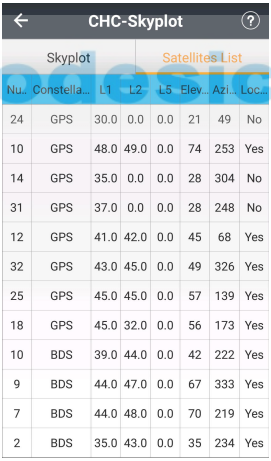
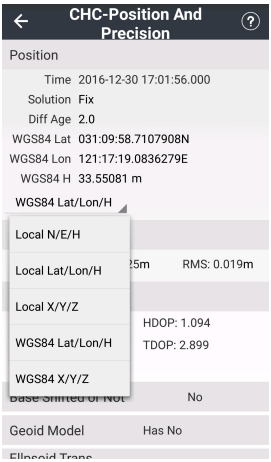


Satellites List: Users can view the current number of each satellite which has been searched, constellation, L1 \ L2 \ L5 SNR, elevation angle, azimuth, and locked status information.



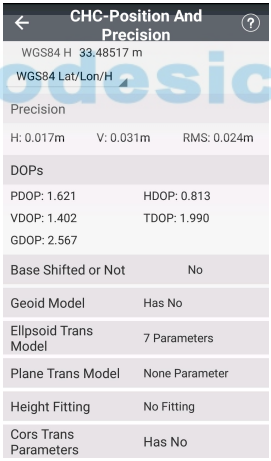
Nu..	Constella...	L1	L2	L5	Elev..	Azi..	Loc...
24	GPS	30.0	0.0	0.0	21	49	No
10	GPS	48.0	49.0	0.0	74	253	Yes
14	GPS	35.0	0.0	0.0	28	304	No
31	GPS	37.0	0.0	0.0	28	248	No
12	GPS	41.0	42.0	0.0	45	68	Yes
32	GPS	43.0	45.0	0.0	49	326	Yes
25	GPS	45.0	45.0	0.0	57	139	Yes
18	GPS	45.0	32.0	0.0	56	173	Yes
10	BDS	39.0	44.0	0.0	42	222	Yes
9	BDS	44.0	47.0	0.0	67	333	Yes
7	BDS	44.0	48.0	0.0	70	219	Yes
2	BDS	35.0	43.0	0.0	35	234	Yes

Position: Users can view GPS time, solver status (single point, floating or fixed), the differential delay age and the current position in WGS84. Users can also change coordinate system in the drop down list (including Local N/E/H, Local Lat/Lon/H, Local X/Y/Z, WGS84 Lat/Lon/H, WGS84 X/Y/Z).



Precision: Users can view horizontal precision, vertical precision and RMS.

DOPs: Users can view current status of the search space satellites precision factors, including PDOP, HDOP, VDOP, TDOP and GDOP.



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1.4 Software Installation

Copy the software (LandStar 7.apk) and help (LandstarHelp.apk) onto Android devices, touch screen to start the installation program. After installation, it will generate LandStar 7 procedures and LandStarHelp on the desktop, open

LandStar 7 software and click the help icon at the top-right corner to view the help file.

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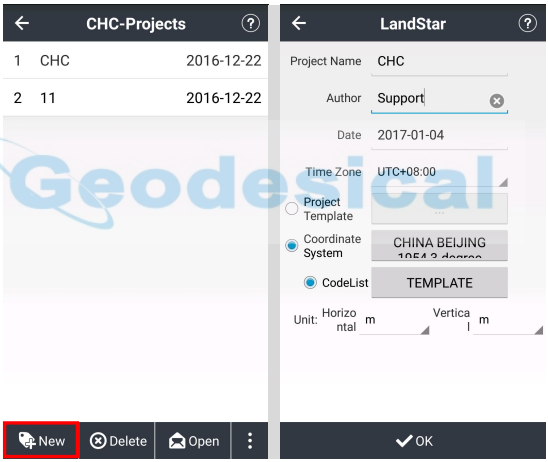
2 Project

2.1 Projects

2.1.1 New

Click **New** to create a new project. When it prompts "Close Current Project and Create a New One?", it means users have already opened a project, and users should close current project to create a new one. After clicking Confirm, it will prompt “Set the Current Project XXX Codelist as Default Codelist Template or Not”, and users should decide whether to cover the codelist of default template with current codelist.



Project Name: Input the project name.

Author: Input the name of the operator.

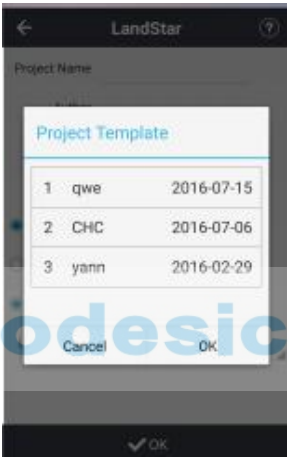
Date: The default time is the local time.

Time zone: It refers to the time zone different from local time and the GPS time which can be selected in the time zone drop-down list from -12 to +14.

(1) Project Template: Select the project template, then it will show a list of historical projects. Users can select one and click **OK** to complete the project

template. It's used for applying the transformation parameters for different sites. For example, there is task A which has finished site calibration, while another task B needs the transformation parameters the same as task A. After inputting a new project name, users can select task A in the project template.

Note: Transformation parameter isn't applied if the new project is created without project template. Project template can also apply all parameters of the existed project.



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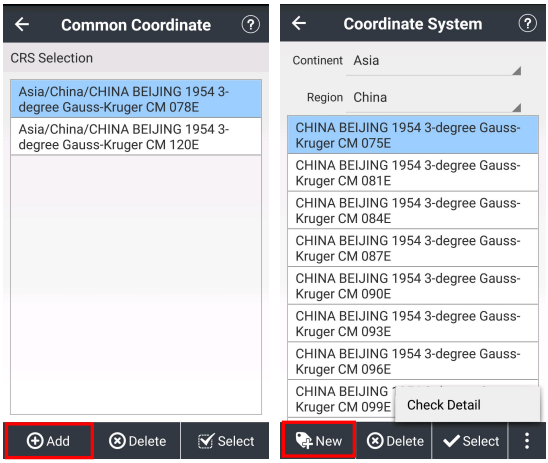
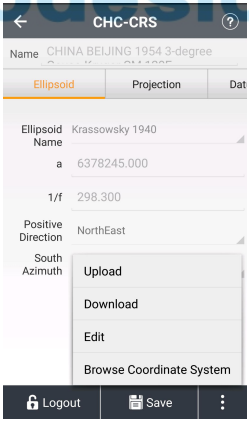
(2) Coordinate System: Users are able to add a new coordinate system after clicking **Add**. Select coordinate system, then the interface of coordinate system management will pop up.



Note: Users can't select another coordinate system when the project template was applied.

Click **New** to add new ellipsoid when it's not listed in the list.

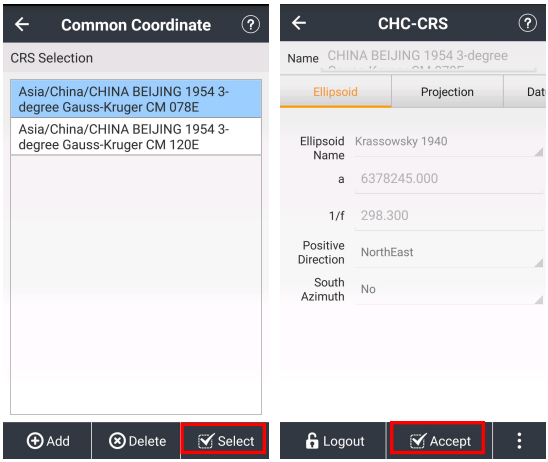
Users can view the parameters of ellipsoid, projection, datum transformation, plane adjustment and height fitting.



Click **Save** and it will prompt the path to save this coordinate system.

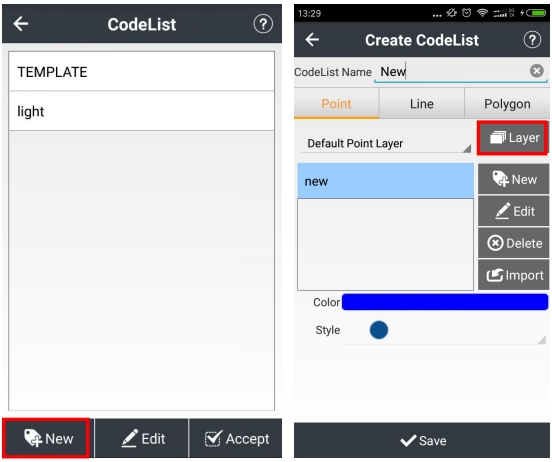
Click **Delete** to delete a coordinate system from the List.

Click **Select**, it'll return to the interface of Coordinate System, and then click Accept to finish CRS configuration.

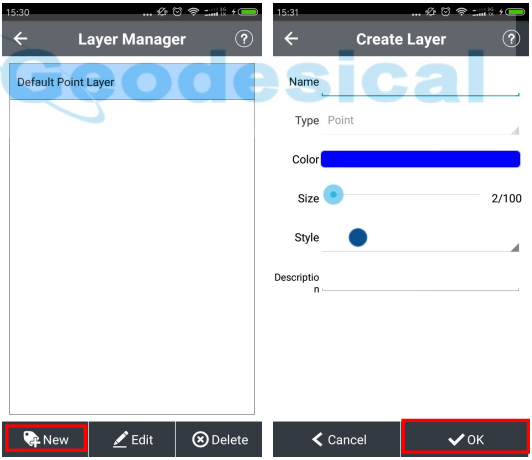


(3) CodeList: Click to view codelist interface.

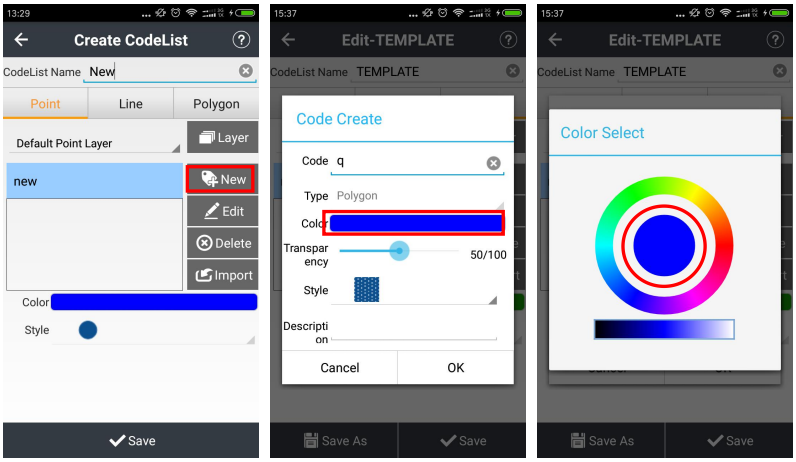
Click **New**, then the interface of **Create CodeList** will pop up. (When users have already created codelist, users can click **Accept** and it will return to previous interface which means code is applied.)



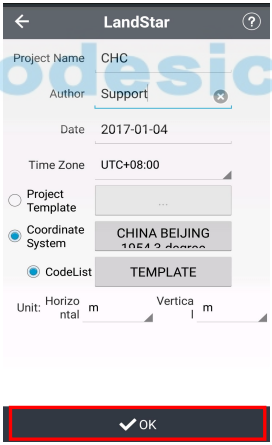
Click **Layer** and enter the interface of **Layer Manager**. Click **New** to enter the interface of **Create Layer**, input layer name and type, select color, size and style, add description. Click **OK** to complete.



Click **New** to enter the interface of new code, input the name of the code. Select code types which includes point-like feature, planar surface features, linear features, and select code color, transparency; style, add description. Click **OK** to finish code creation. (When users have already created a code, users can click **Edit** to edit current new code.)



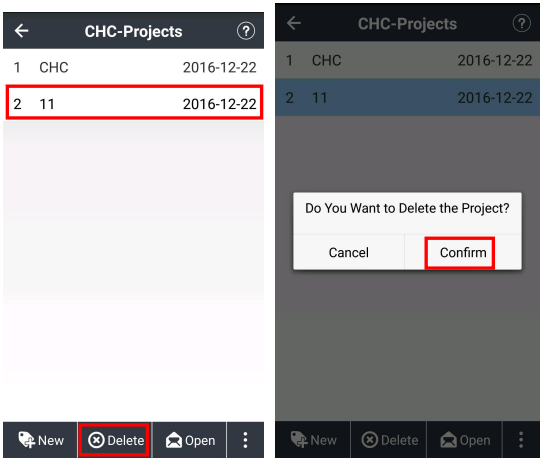
After creating a new coordinate system and codelist, click **OK** to finish the new project creation.



2.1.2 Delete

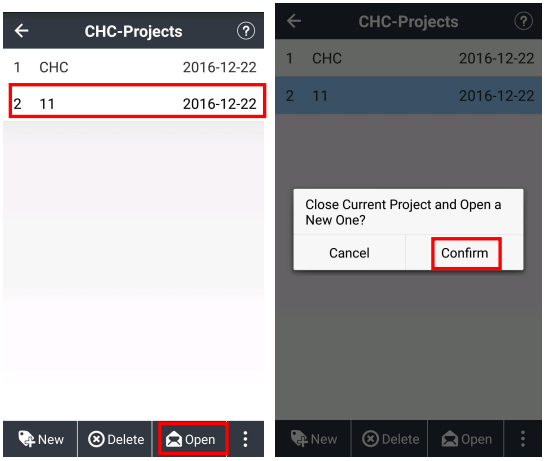
When users want to delete current project, it will prompt "Cannot Delete Current Project!" to protect current project. While deleting a closed project, it will prompt "Do You Want to Delete the Project?" Select **Confirm** to delete

the project. Select **Cancel** to cancel deleting.



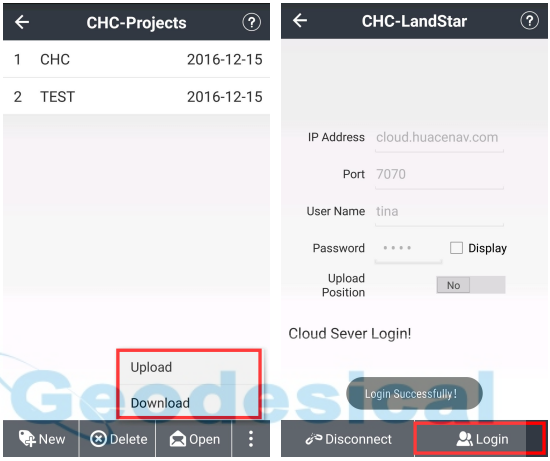
2.1.3 Open

To continue an existed project, users can click **Open** to open previous project. While opening another project, it will prompt "Close Current Project and Open a New One?" Select **Confirm** to open the project XXX. Select **Cancel** to cancel opening.

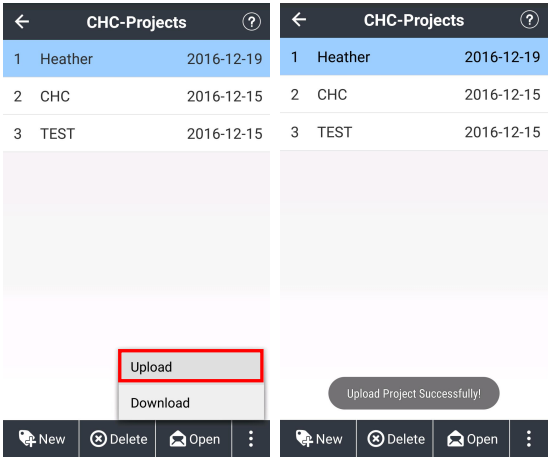


2.1.4 Upload and Download

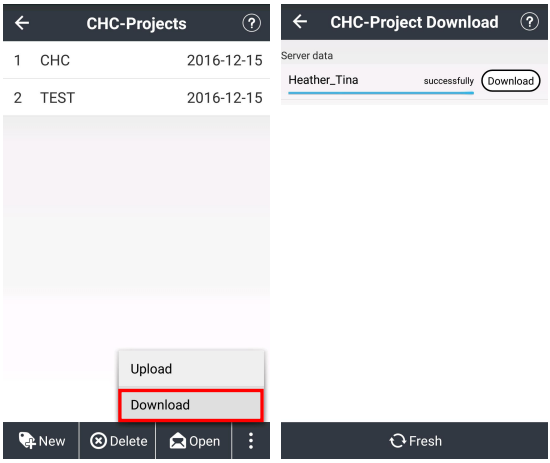
Click **Upload or Download** to enter the interface of **Cloud**. Enter IP address, port, user name and password. Then click **Login** to finish uploading or downloading.



Upload: Select a project, click **Upload**, the project will be uploaded to cloud server.



Download: Select a project, click **Download**, the project will be downloaded to cloud server, and it will be listed in **Projects**.



2.2 CRS

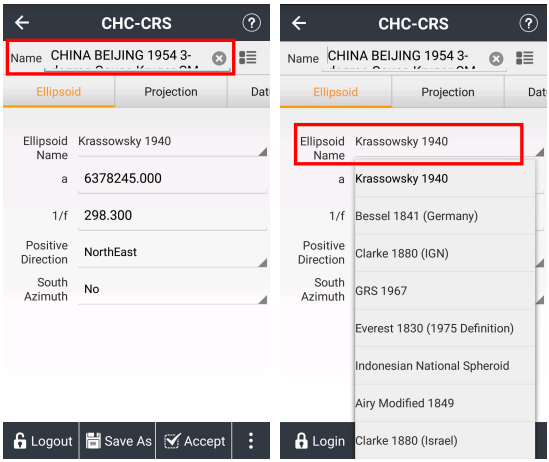
CRS (Coordinate System) offers users some parameters including ellipsoid, projection, datum trans, plane adjustment, height fitting.

Click **Login** to input a user name and password.

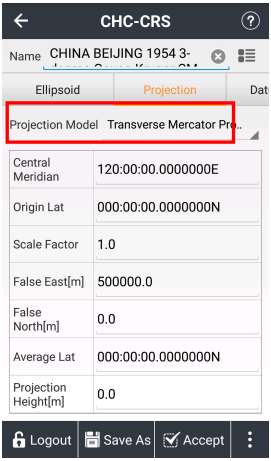
User name is admin, and the initial password is 123456.

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

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

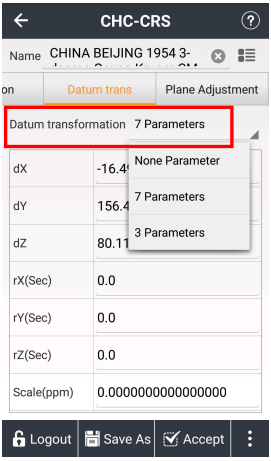


(2) **Projection**: There are some built-in common projection methods of different countries and regions, including Gauss projection, Transverse Mercator projection, UTM projection and so on. And the parameters of the projection model are displayed in the interface. Only the central meridian are needed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

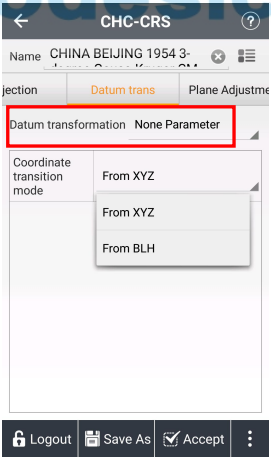


(3) **Datum Trans**: Represents the mathematical model for transformation

between two coordinate systems. Datum transformation model includes none parameter, three parameters, seven parameters models. Users can input the local 7 parameters directly, no needing the site calibration any more.



None Parameters: 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

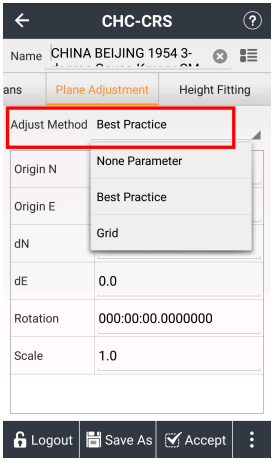
known points so that LandStar 7 can check the correctness. The mathematical model of this method is strict, and it is critical to the precision of the known points. This method is usually used in a wide-range work.

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

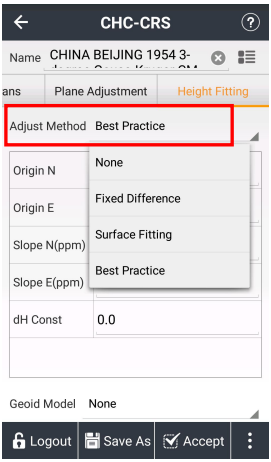
3 parameters: Requires at least one known point, and the points can be under the national coordinate system or the coordinate system that existing small rotation from the WGS84 coordinate system. Preferably two or more points are known so that checking the correctness of the known points. This method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

(4) **Plane Adjustment**: The calibration parameters will be displayed on the interface of the coordinate system parameters after site calibration and application, and users can check them through your login successfully. It supports Best Practice and Grid at present. The software currently supports the grid file of GRD/STG/PXY formats.

Users should put grid files in following path: CHCNAV/LandStar 7/Geoid. Then restart LandStar 7 to apply.



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



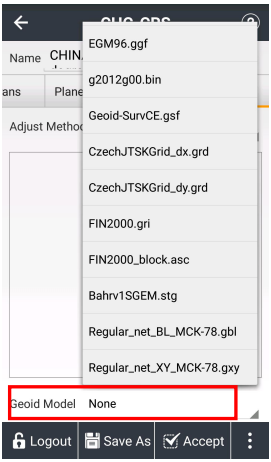
Fixed Difference: Need at least one starting point.

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.

Geoid Model: Click to choose the geoid model file when select this method. The software currently supports the geoid model file of GGF/BIN/GSF/GRD/GRI/ASC/STG/SPB/GBL/GXY formats.

Geodesical



Note: Users should put geoid files in following path: CHCNAV/LandStar 7/Geoid. Then restart LandStar 7 to apply geoid files.

2.3 Import

The function can be used to import the point coordinates from specific formats, and the type of coordinates support plane coordinates and Lat/Lon.

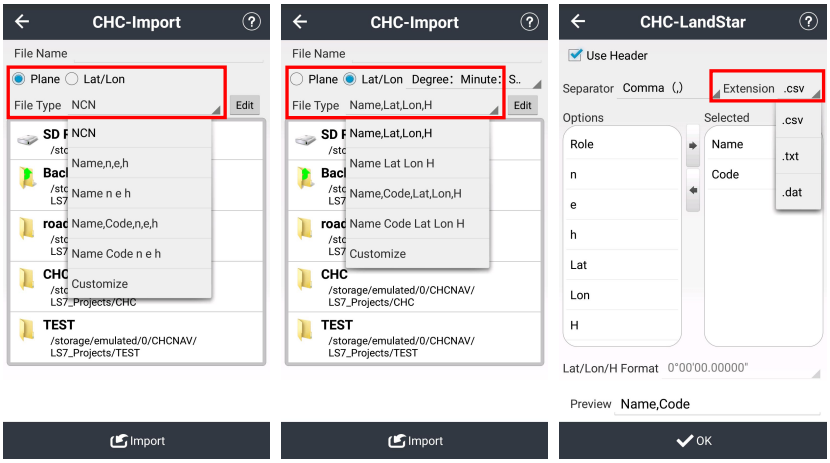
Click **Import** in main interface, and the software will import the known data according to the requirement format in device or SD card.

File Name: Input the file name.

Coordinate System: Plane or Lat/Lon.

File Type: Support CSV, DAT, TXT, DXF, SHP and NCN file. There are several available formats in common use and users can also set the format in **Customize** (Users can customize the import contents while choosing the CSV, DAT and TXT format.)

Path: Select the path of import file. Click the folder and it will display a blue select prompt. Then, click **Import**.



2.4 Export

The function can be used to export the point coordinates to specific formats, and the type of coordinates support plane coordinates and Lat/Lon.

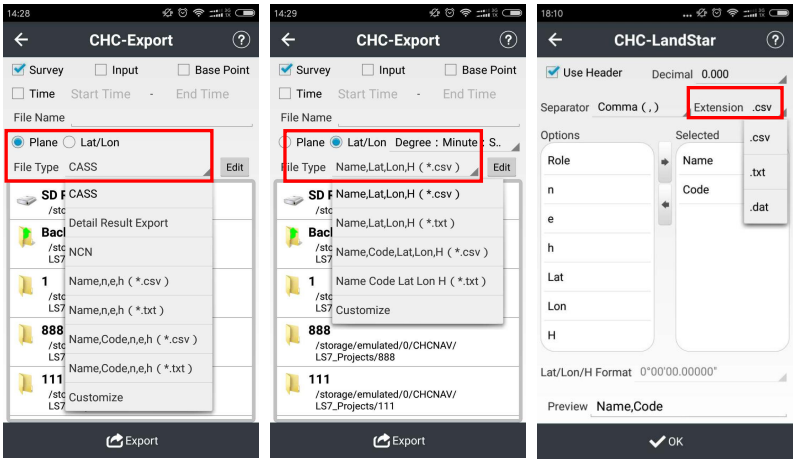
Point Type: Users can choose exported point types including **Survey Point**, **Input Point** and **Base Point**.

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

Coordinate System: Plane or Lat/Lon.

File Type: Support CSV, TXT, KML, SHP, DXF and HTML file. There are several available formats in common sequence that provides users to use and users can also set the format in **Customize** (Users can customize the import contents while choosing the CSV, DAT and TXT format.)

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

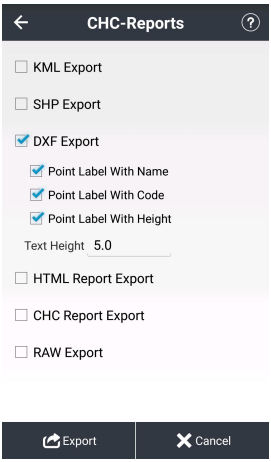


2.5 Reports

The content of other export information include **KML Export**, **SHP Export**, **DXF Export**, **HTML Report Export**, **CHC Report Export**, **RAW Export**.

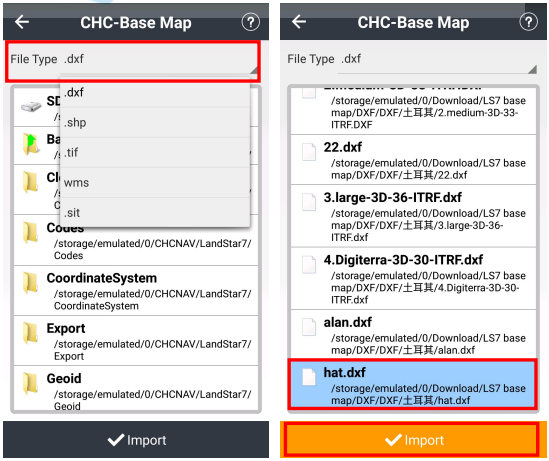
Click **Export**, then it will prompts that "Export successfully!". Report stored path is in the directory where users installed the project, such as CHCNAV / LS7_Projects / project name / report .htm file. Then users can connect handheld controller with computer to view the report file.

Geodesical

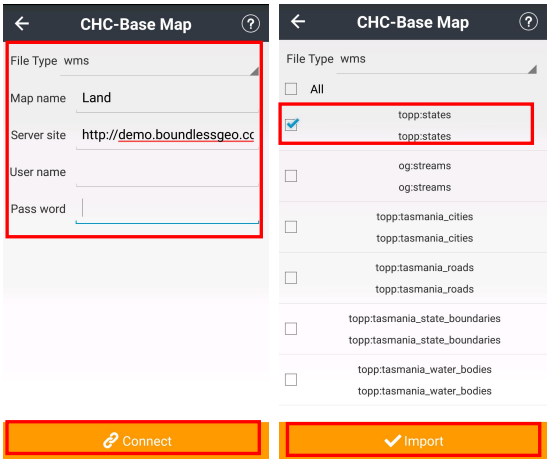


2.6 Base Map

Base map supports five file types namely DXF, SHP, SIT, TIF and WMS, SIT is a compressed type, and WMS is an online base map type. After importing, the points or lines that are in the base map can be displayed, selected or stakeout.



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



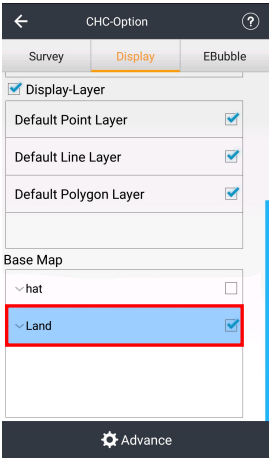
File Type: wms

Map name: Customize by users, the name will show on Survey-Map-Settings -Display.

Server site: Input the site address.

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

To modify the layer display, click **Survey-Map-Settings-Display**. Users should switch on online map to see wms map.



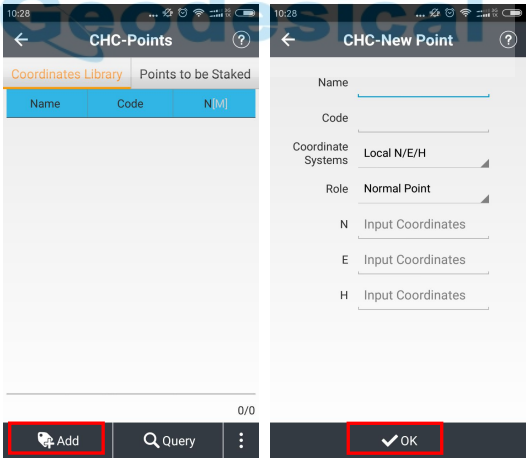
2.7 Points

Points can view the **Coordinates Library**, which includes input point and measuring point, and **Points to be Staked**.

2.7.1 Add

Click **Add** to create a point. Creating a point needs some attributes as follows: name, code, coordinate systems (Including: local NEH, local BLH, local XYZ, WGS84 BLH, WGS84 XYZ coordinates), role (Including Normal Point and Control Point). Then, input the point coordinates that users create, and make sure the code item must be non-mandatory.

Note: When the point that users make have reel number, it will prompt "Projection Error" after adding point. Users can add reel number in "False East' from **CRS-Projection**.



Set the above values, click **OK** and the coordinates point will be built.

2.7.2 Query

Query: The conditions of point can be queried by name, code, solution of the

state etc.

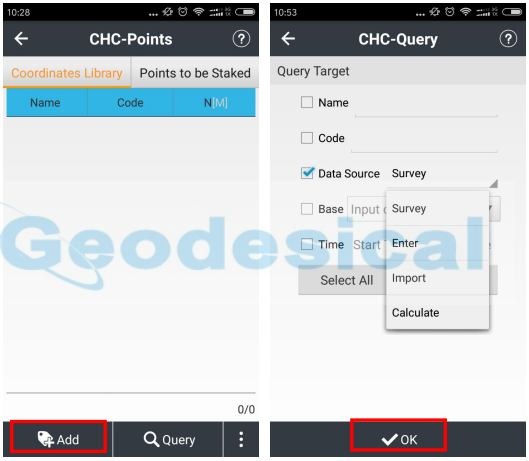
Name: Completely matched or screened name.

Code: Screened by code accurately.

Data Source: Accurately queried by data sources, data sources include: **Survey**, **Enter**, **Import** and **Calculate**.

Base: In Point management which has differential mode can automatically generate base coordinate. Meanwhile, the query target will appear and the name of base station will also appear in drop-down box of base.

Time: You can set the start time and end time for accurately querying.

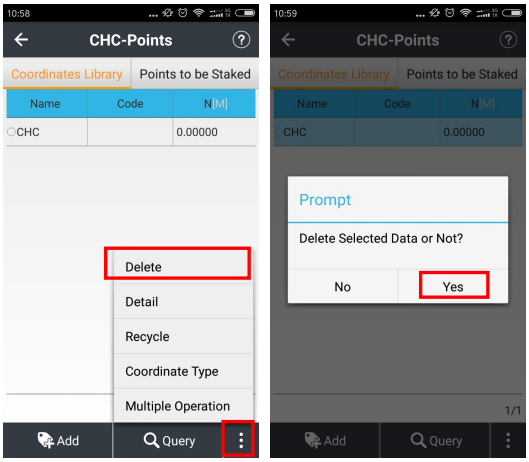


Click **OK** complete query a point.

2.7.3 Delete

Click bottom-right icon and click **Delete**. Then a dialog box “Delete Selected Data or Not?” will pop up. Click **Yes** to delete this record.

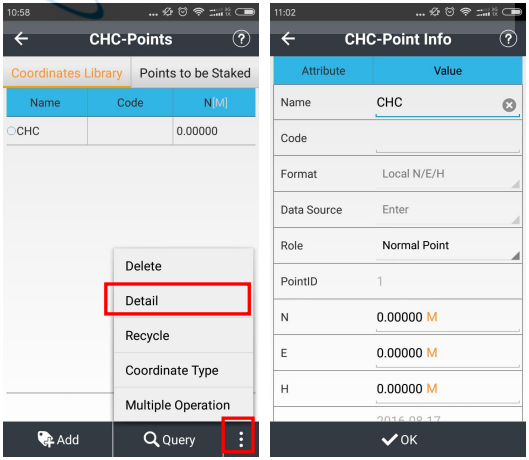
Note: When users don’t select points before clicking **Delete**, it will pop up a prompt: “Please Select Data First!”.



2.7.4 Detail

Click bottom-right icon and select **Details** to view details of the selected point (Double-click selected points can also query the details). The property value can modify except for the values in gray areas.

Geodesical



2.7.5 Recycle

Recycle is used to restore deleted records, and if deleted records do not exist,

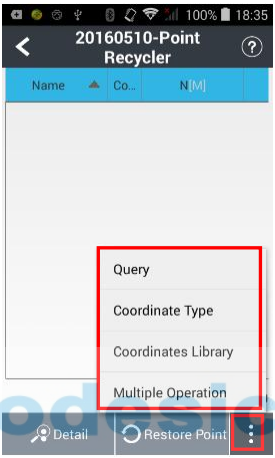
it will prompt "No Record".

Detail: Query details of deleted point coordinate.

Restore Point: Recover coordinates information of deleted points.

Query: Query information of deleted points but cannot query the undelete points.

Coordinate Type: Set coordinates types of recycle points.

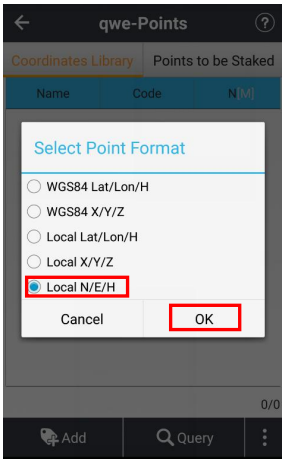


Coordinates Library: Click to view coordinates library.

Multiply Operation: Multiply clear the selected point in the recycle bin.

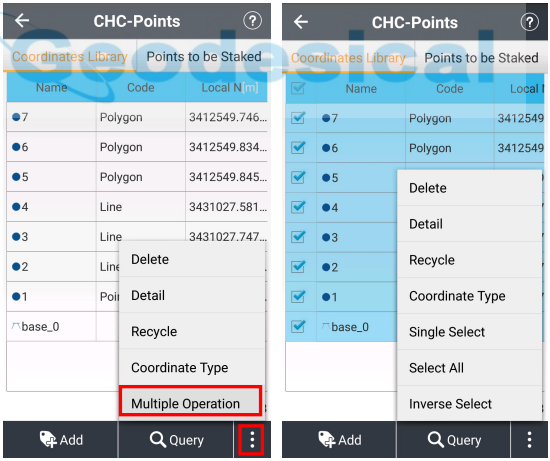
2.7.6 Coordinate Type

Users can set coordinates types of points.



2.7.7 Multiple Operation

Click bottom-right icon and select **Multiple Operation.** Then, users can manage not only one item but also multi-items.

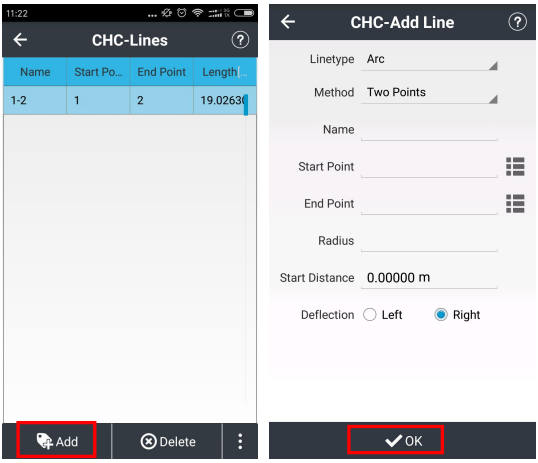


2.8 Lines

2.8.1 Add

Click **Add** to create a line, enter the following new line interface to create a line:

Linetype (Including: Line, Circle, Arc), **Method** (Including Two Points, One Point + Azimuth + Distance), **Name**, **Start Point**, **End Point**, **Start Distance**.

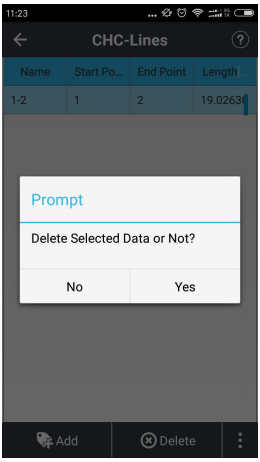


After setting the above values, click **OK,** a line can be built.

2.8.2 Delete

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

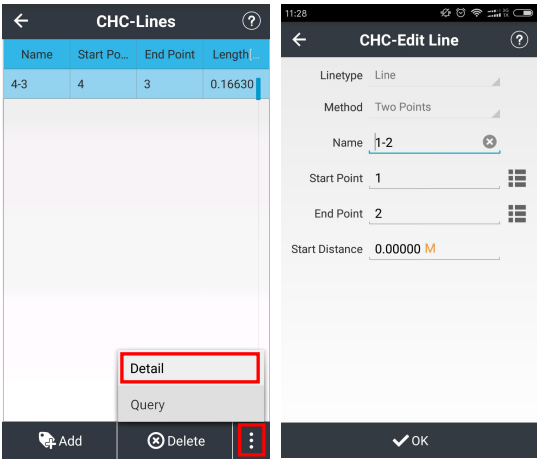
Geodesical



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

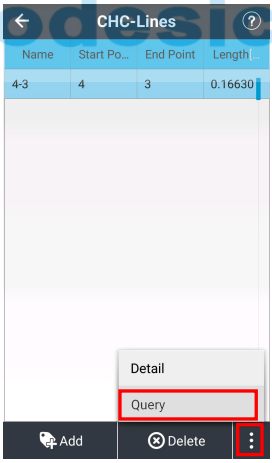
2.8.3 Detail

Select **Line**, click **Detail** to view detailed information about the selected line (double-click the selected points can also check the details at that line). In addition, the gray area indicates the property value of the remaining property values are editable.



2.8.4 Query

Click **Query** to view line query conditions. Line query conditions can be queried by line, name, origin, destination, and other fields.

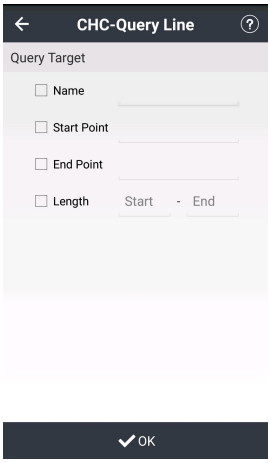


Name: exactly match the query line.

Start point: The starting point of the line can be an exact match queries.

End Point: Through the end of the line can be an exact match queries.

Length: Fully match the query by the length of the line (Enter the start and end values).

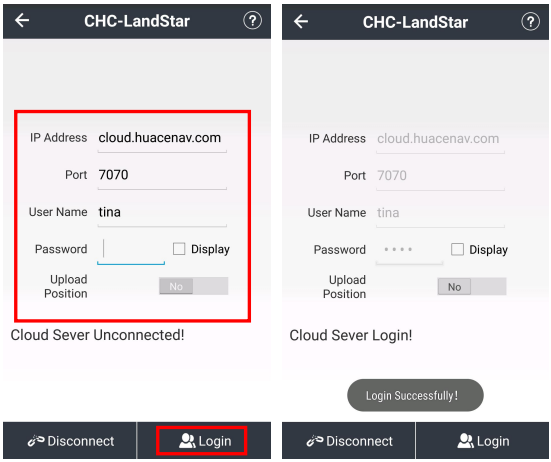


2.9 Features

Click **Features**, then it will display the line or region features which collected in current project. Double click **Map Display**, the collected features will display in Map Display and it can also inquire or delete by Map Display.

2.10 Cloud

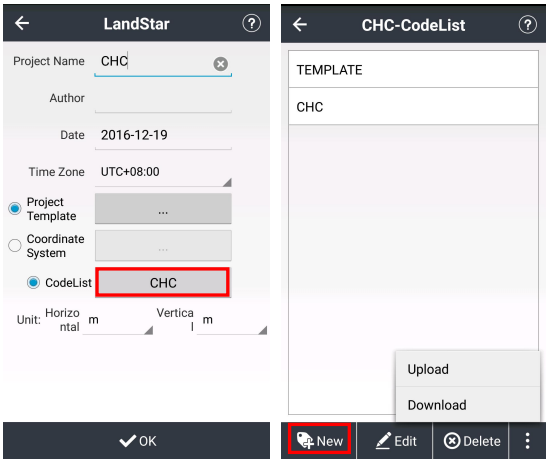
Cloud is the login interface of Cloud, and users can upload or download projects, coordinate systems, work modes, etc. Users can ask local dealer or sales manager for obtaining an account and password to use Cloud. CHC will help customers to build own cloud server (Customer need to provide server and network) if necessary. For more information, please contact local dealer or sales manager.



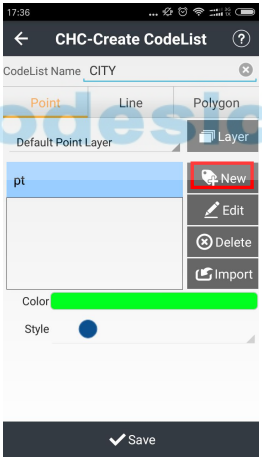
2.11 CodeList

The main function of **CodeList** is to manage codes under the different work conditions. For example, the codes of water management and road survey require different code; if users save these codes in one list, it is not easy to select when users do the field jobs. So it is better to create the different code lists to save the different codes, and users can select the corresponding code list basing on the particular work condition. Create a new group of CodeList, and then click **TEMPLATE** to enter CodeList.

Geodesical



Click **New** to create a new group of CodeList (For example: CITY). It contains three elements: **Point**, **Line** and **Polygon**.



Click **Layer**, later click **New** to create new layers.

Point:

Name: TREE.

Type: Point.

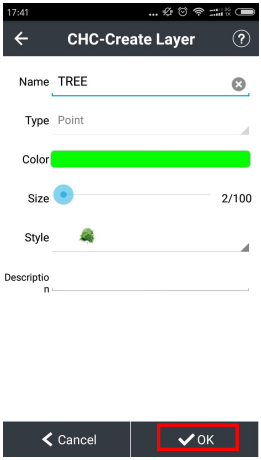
Color: Green.

Size: 2.

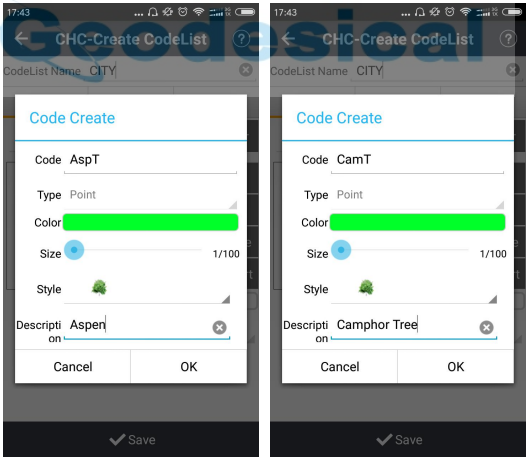
Style: Select from the list.

Remark: Input the description.

Click **OK**.



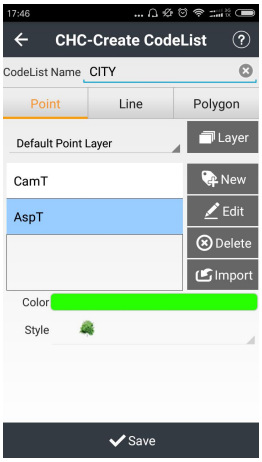
Back to CITY group, click **New** to create new features.



So there are two codes on TREE layer, as shown below:

AspT represents Aspen Tree.

CamT represents Camphor Tree.

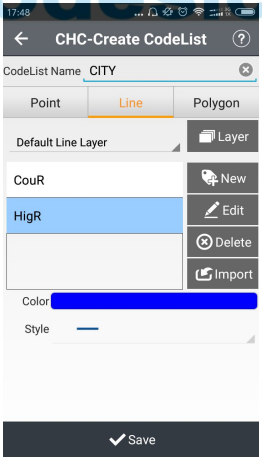


Users can use **Edit** to edit the code, click **Delete** to delete the code, or click **Import** to import the code list.

Line:

CouR represents Country Road.

HigR represents Highway.

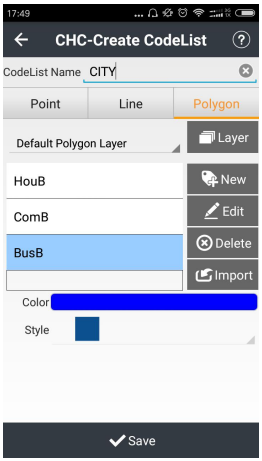


Polygon:

HouB represents House Building.

ComB represents Commercial Building.

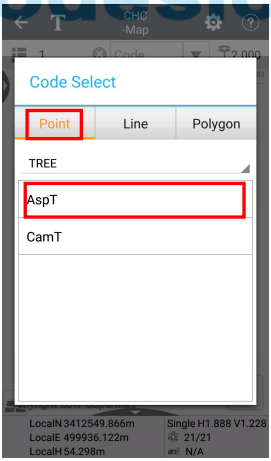
BusB represents Business Building.



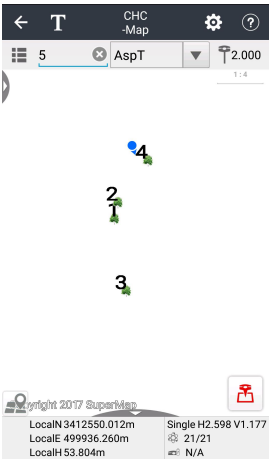
Application of CodeList:

After the creation of CodeList and connection of receiver, users now open **Map**.

Click **Code** to select the features: point, line or polygon.



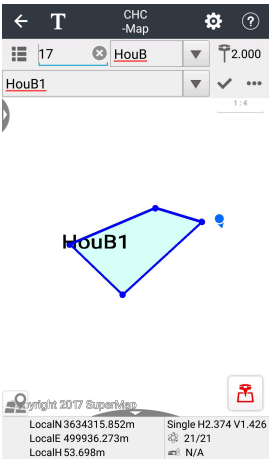
Point survey:



Line Survey:

Click **Tick** to finish a line.

Polygon Survey:



Click **Tick** to finish a polygon.

Or click icon at right to delete, undo or close rectangle.

Geodesical

2.12 PRJ Codes

Click **PRJ Codes**, then users will find the codes currently used. And users can create, edit and delete one code. Users can also input one code from other code lists. If users use the template codes, when users create the new project or open other project, it will ask "Save Current Operation to Codelist or Not?",

click **OK**, the operation to the codes will be saved. The functions of new codes can refer to the CodeList, the functions are only available to the codes in the current task; but if users want to save the functions for the next time, please choose Cancel and the functions will be saved in the **Template** codelist.

Geodesical

3 Config

3.1 Connect

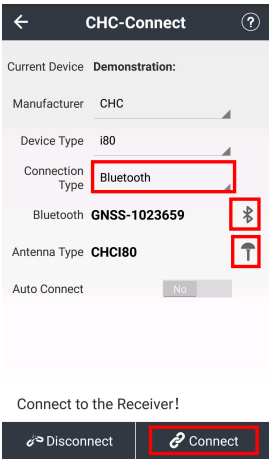
Used for receiver connection.

Manufacturer: Users can choose CHC, JY or CHAMPION.

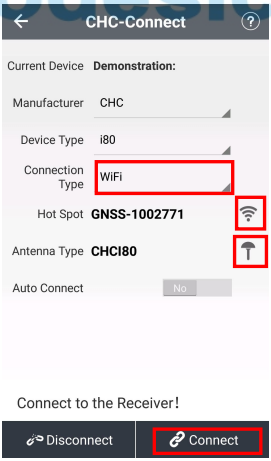
Device Type: CHC includs the choices of **i80**, **X91+/X900+**, **Local**, **Peripheral**.

Connection Type: Including the choices of **Bluetooth**, **WiFi** and **Demonstration**.

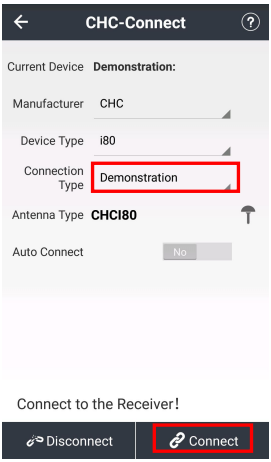
Bluetooth: While using Bluetooth connection (Suitable for i80 and GNSS RTK), click **Bluetooth List** to the interface of Bluetooth. Select Bluetooth management, click **Refresh** to find the device to Pair (Default password is 1234 if it's required to input). When the connection is successful, users will back to connection interface.



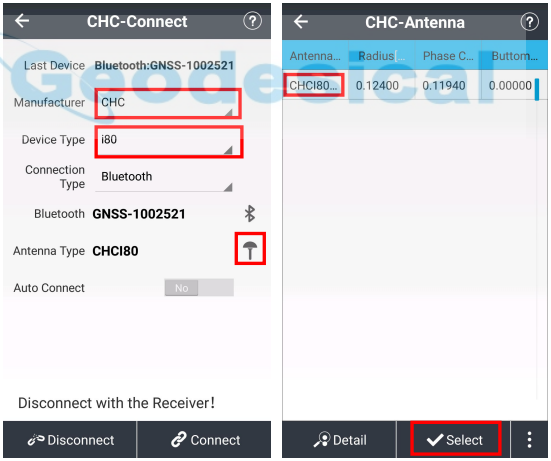
WiFi: While users use Smart GNSS for device type, connection type can select WIFI. Click **Connection List** of Hot Spots, then it will show users WLAN interface. Click **Refresh** to find the SN of current receiver, input password (Default password is 12345678), then click **Connect**. When the connection is successful, users will back to connection interface.



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



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



Auto Connect: Switch on, then, it will connect previous device when users open the software.

Connect: It will display the SN, connection type of current device or prompt "Connection Failed".

Disconnect: Break the current receiver connection.

3.2 Work Mode

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

3.2.1 External Radio Base

Click **New** to create a work mode.

RTK: Switch on.

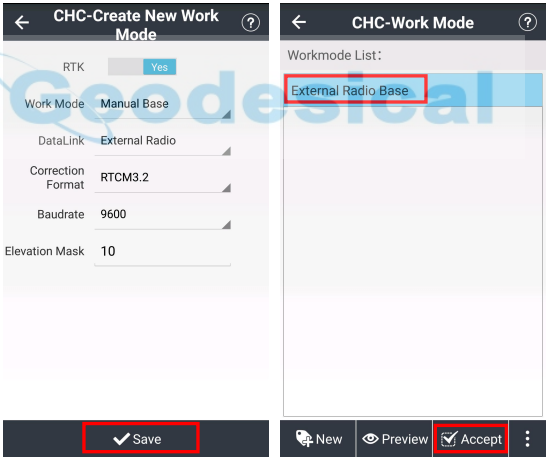
Work Mode: Select **Manual Base**.

Date Link: Select **External Radio**.

Correction Format: Select **RTCM3.2**.

Baudrate: Select 9600.

Elevation Mask: 10.



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

3.2.2 Internal UHF Base

Click **New** to create a work mode.

RTK: Switch on.

Work Mode: Select **Manual Base**.

Date Link: Select **Internal SATEL Radio**.

Correction Format: Select **RTCM3.2**.

Protocol: Select **Transparent**.

Step Value: Select 25kHz.

Baudrate: Select 9600.

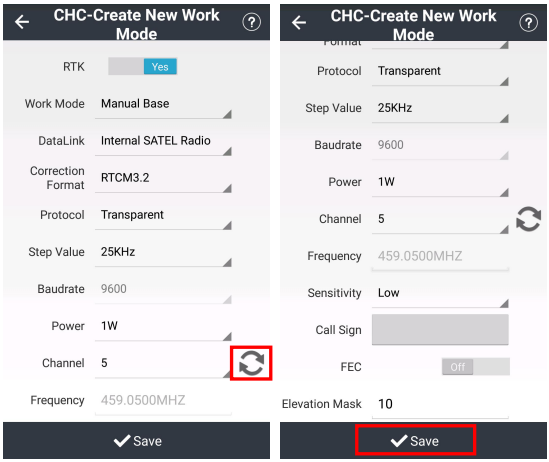
Power: Select 1W.

Channel: Select 5.

Note: Click the fresh button, then, users can update channel and its corresponding frequency. Working radius is less than 3km.

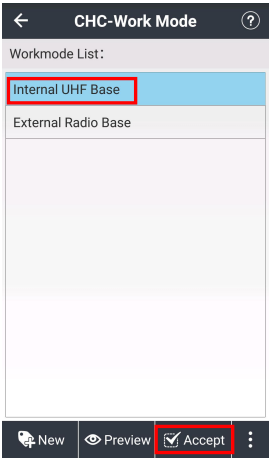
Sensitivity: Select **Low**.

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



Now, the work mode is available in the list. Please select the work mode, then

click **Accept**.



3.2.3 Internal UHF Rover

Click **New** to create a work mode.

RTK: Switch on.

Work Mode: Select **Auto Rover**.

Datalink: Select **SATEL Radio**.

Protocol: Select **Transparent**.

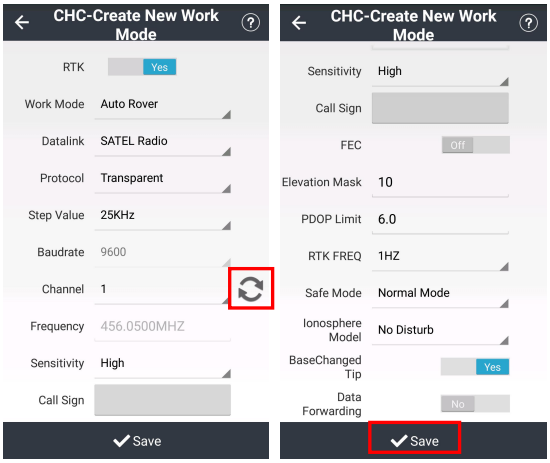
Step Value: Select 25KHz.

Channel: Select 1.

Note: Click the fresh button, then, users can update channel and its corresponding frequency, choose the one users needed.

Sensitivity: Select **High**.

Geodesical



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

Note: Please check the i80 PN number when users select **Datalink**. If the PN ends in 1122, please select **SATEL Radio**; If the PN ends in 5122, please select **CHC Radio**. Click **Save**, then the prompt "Please Set a Name for The New Mode" will pop up. Enter the Name, and click **OK**. Then, the prompt "Create Mode Successfully" will pop up. Click OK, now, the work mode is available in the list. Please select the work mode then click **Accept**.

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

3.2.4 Internal GSM Rover (Receiver Network)

Click **New** to create a work mode.

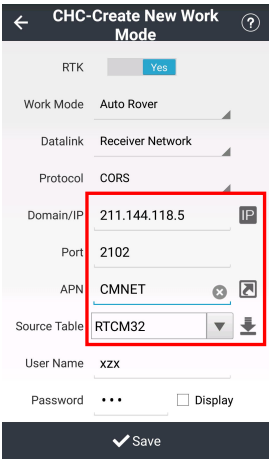
RTK: Switch on.

Work Mode: Select **Auto Rover**.

Datalink: Select **Receiver Network**.

Protocol: Select **CORS**.

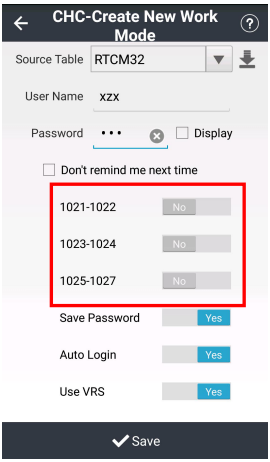
Then, input the corresponding **CORS IP** and **Port**. Users can also click the **APN** set button to set SIM APN.



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

Seven message types are defined here in support of the application of coordinate transformations, namely Message Types 1021 through 1027. Message Type 1021 provides the basic transformation parameters for the first three sets, while Message Type 1022 provides the information for the fourth set, the Molodenski-Badekas transformation. Message Types 1023 and 1024 define the residuals for ellipsoidal and plane grid representations, respectively. Message Types 1025, 1026 and 1027 define the parameters that support the Lambert Conic Conformal (LCC2SP) projection, the Oblique Mercator (OM) projection, and others.

Geodesical

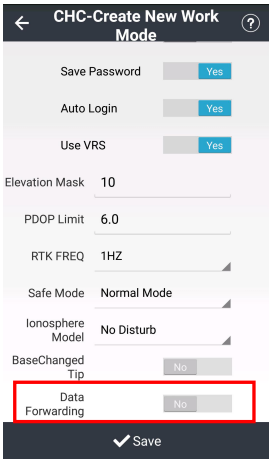


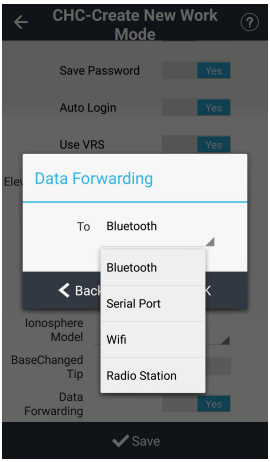
Message Type	Message Name
1021	Helmert / Abridged Molodenski Transformation Parameters
1022	Molodenski-Badekas Transformation Parameters
1023	Residuals, Ellipsoidal Grid Representation
1024	Residuals, Plane Grid Representation
1025	Projection Parameters, Projection Types other than Lambert Conic Conformal (2 SP) and Oblique Mercator
1026	Projection Parameters, Projection Type LCC2SP (Lambert Conic Conformal (2 SP))
1027	Projection Parameters, Projection Type OM (Oblique Mercator)

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

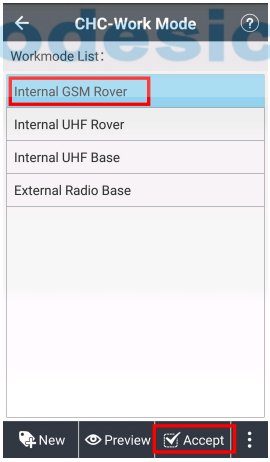
Users can also forward data through Bluetooth, Serial Port, WIFI, and Radio Station.

Geodesical



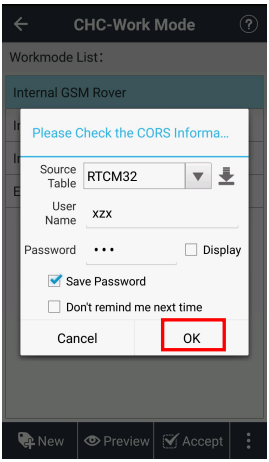


After setting other parameters, click **Save**, then the prompt "Please Set a Name for The New Mode" will pop up. Enter user's **Name**, and click **OK**. Then, the prompt "Create Mode Successfully" will pop up. Click **OK**, now, the work mode is available in the list. Please select the work mode then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



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

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



Then the green LED will flash and the states will come from **Single** to **Fix**, which means the rover is getting the correct data from base.

3.2.5 DCI (PDA Network)

Click **New** to create a work mode.

RTK: Switch on **Yes**.

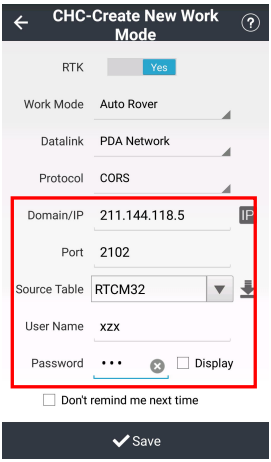
Work Mode: Select **Auto Rover**.

Datalink: Select **Receiver Network**.

Protocol: Select **CORS**.

Then, input the corresponding **CORS IP** and **Port**. Users can also click **Download** to get the source table.

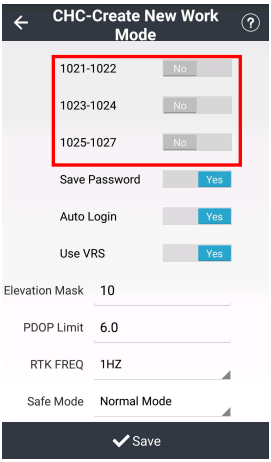
Geodesical



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

Seven message types are defined here in support of the application of coordinate transformations, namely Message Types 1021 through 1027. Message Type 1021 provides the basic transformation parameters for the first three sets, while Message Type 1022 provides the information for the fourth set, the Molodenski-Badekas transformation. Message Types 1023 and 1024 define the residuals for ellipsoidal and plane grid representations, respectively. Message Types 1025, 1026 and 1027 define the parameters that support the Lambert Conic Conformal (LCC2SP) projection, the Oblique Mercator (OM) projection, and others.

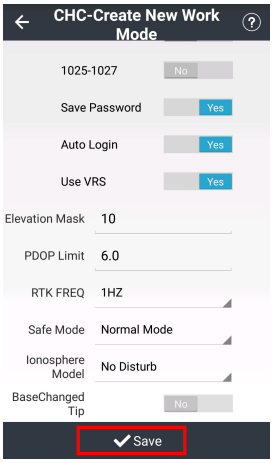
Geodesical



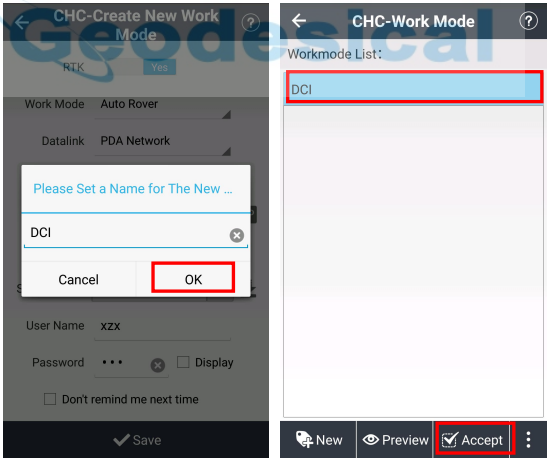
Message Type	Message Name
1021	Helmert / Abridged Molodenski Transformation Parameters
1022	Molodenski-Badekas Transformation Parameters
1023	Residuals, Ellipsoidal Grid Representation
1024	Residuals, Plane Grid Representation
1025	Projection Parameters, Projection Types other than Lambert Conic Conformal (2 SP) and Oblique Mercator
1026	Projection Parameters, Projection Type LCC2SP (Lambert Conic Conformal (2 SP))
1027	Projection Parameters, Projection Type OM (Oblique Mercator)

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

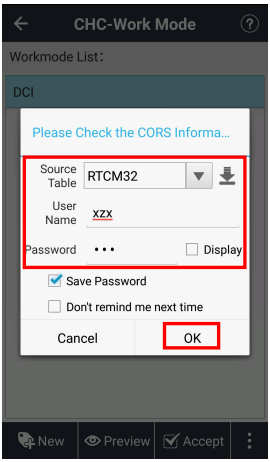
Geodesical



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



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



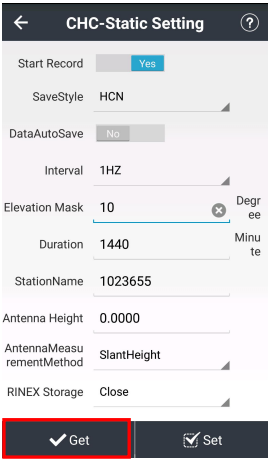
Then the green LED will flash and the states will come from **Single** to **Fix**, which means the rover is getting the correction data from base.

3.3 Static Settings

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

SaveStyle: Choose **HCN** to record HCN file, or choose **Close** to close it.

DataAutoSave: Switch on, and it means auto record is turned on, otherwise off.



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

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

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

Duration: Input duration time as you wish, the default is 1440.

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

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

AntennaMeasurementMethod: Including choices of SlantHeight, PhaseHeight, VerticalHeight, the default is SlantHeight.

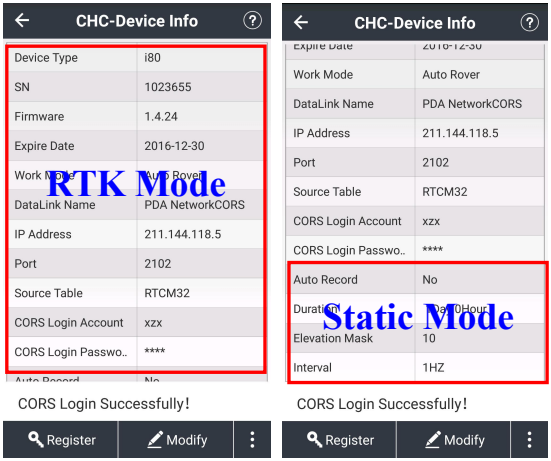
RINEX Storage: Choose **2.11/3.02** to record RINEX file, or choose **Close** to close it.

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

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

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

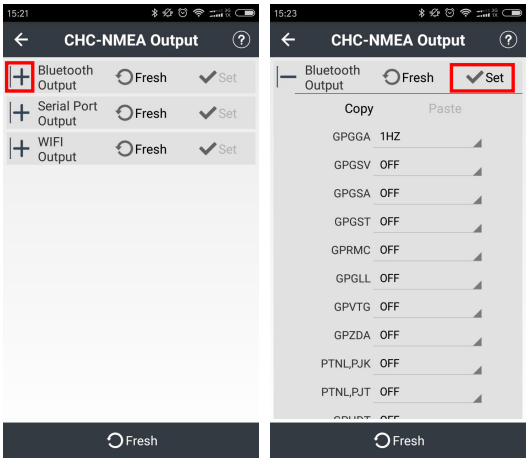
mode.



3.4 NMEA Output

This function is set for making output the NMEA for other external equipments. 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, it needs to click Set, and it is proposed to refresh to confirm no matter the setting is done successfully or not.

If users have done the set of the output mode by Bluetooth, Serial Port or WiFi, users can copy the config and paste it to other output mode when users want to use the same config to another output mod, and it will avoid a repeated config.

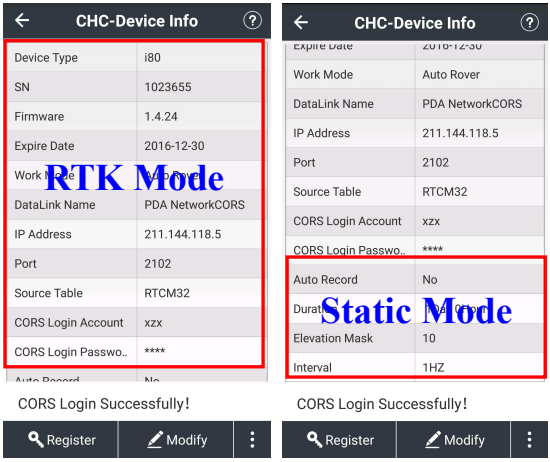


Please ensure Baud rate is 9600 when GPGGA Serial output set is 1HZ based on connecting CHC Receivers.

3.5 Device Info

Geodesical

After connecting between handheld and receiver, Landstar 7 will read out the receiver information, such as device type, serial number, expire date, work mode, data link and so on.



Registration

Click **Register**, it will display the input box to type in the register code. Please contact with regional sales manager or dealer to get the code.

Note: There is no need to enter the - of the register code.

Modify

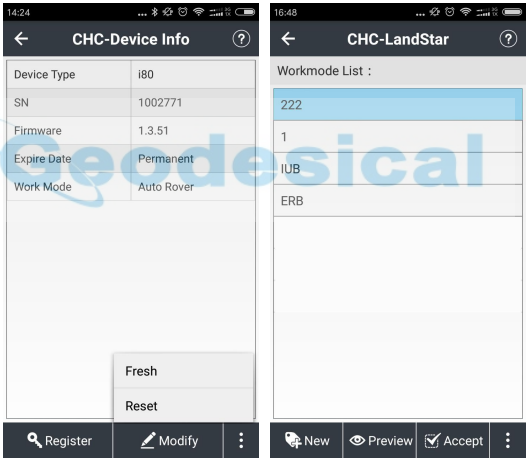
Click **Modify**, it will display the list of the Work Mode to modify the receiver work mode.

Fresh

Click **Fresh**, it will get the device information again.

Reset

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



3.6 Interface

The main function of Interface customization is to determine the display of program interface. The one will appear in the program interface if it is ticked.

3.7 About

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

Users can visit CHC official website by scanning **Website QR Code**.

Users can follow CHC official facebook by scanning **Facebook QR Code**.

Geodesical

4 Survey

4.1 Map

Main functions:

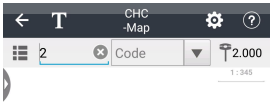
①Users can see the graph with base map, and all the base maps can be displayed.

②During measurement, the point, line and surface will be displayed in different color or style (colors of points, lines and surfaces follow generally the colors chosen when users create the new codes.

③During measurement, users can select the codes for the points, lines and surfaces (on point survey interface, only the codes of points are available).

④During the features surveying (points, lines and surfaces), if the job of feature surveying is not finished one time, and users continue with other features, the previous job of feature surveying will stop temporarily. You can do the surveying of several features at the same time. It allows to check the the task not achieved as well as the task users are doing.

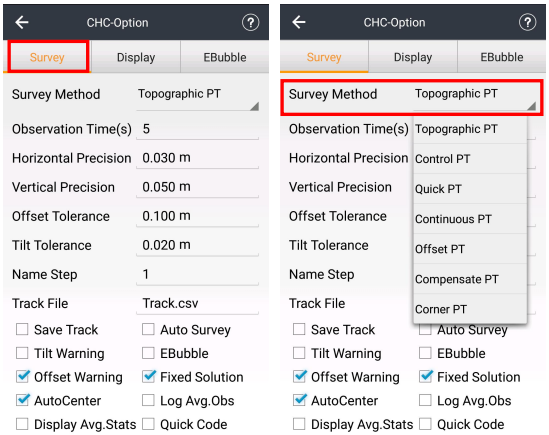
Geodesical



base_11

4.1.1 Option

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



Survey Method: Support topographic point, control point, quick point, continuous point, offset point, compensate point and corner point.

Observation Time: Default observation time of topographic point is 5s, control point is 10s, eccentric point is 1s, compensate point is 5s, etc.

Horizontal Precision & Vertical Precision: Modify as you wish. Such as: default horizontal precision of topographic point is 0.0300m, its vertical precision is 0.0500m; default horizontal precision of quick point is 0.1000m, its vertical precision is 0.2000m.

Horizontal Tolerance & Vertical Tolerance: Modify as you wish. Default is 0.20m/0.30m.

Diff Delay Limitation: Input the limitation of differential delay. Default is 5s.

Repeated times: Input repeated measurement times. Default is 2.

Measurement Interval: Input the interval time of measurement. Default is 60s.

Fixed Delay Limitation: Input the limitation of differential delay. Default is 5s.

Offset Tolerance: Modify as you wish. Default is 0.10m.

Tilt Tolerance: Modify as you wish. Default is 0.020m, and its range is

between 0.001m and 1m.

Name Step: Modify as you wish. Default is 1.

Track File: Input a name for the track.

Save Track: Tick to save track.

Auto Survey: Default is not checked. Tick if users need to do the auto survey, and then the current point survey will stop; if users choose **Continue**, the survey will continue.

Tilt Warning: Make the receiver be tilted when surveying, and users can decide to **Abandon** or **Stop** when it says “The tilt is excessive”.

EBubble: You will see the ebubble on the interface when doing the point staking, if the ebubble is ticked. It will be ticked generally when using the instrument with the function of auto survey.

Offset Warning: Make the receiver offset when surveying and users can decide to **Abandon** or **Stop** when it says “The offset is excessive”.

Fixed Solution: If the fixed solution ticked, then users can measure only when the solution is fixed; please uncheck the fixed solution, if users want to measure even when the solution is single or floating.

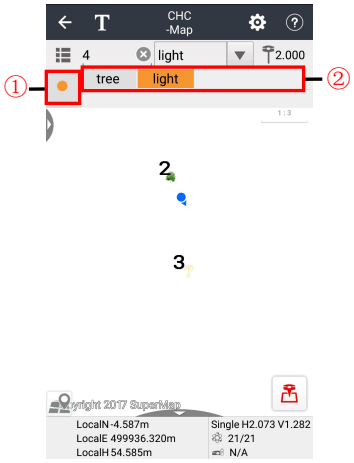
Geodesical

AutoCenter: Your position will automatically display on screen center within 5s while mapping.

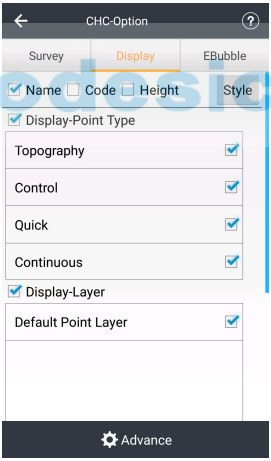
Log Avg.Obs: Log average observation data when observation times >1, the storage path is “CHCNAV / LS7_Projects / project name”.

Display Avg.Stats: Display the stats of average observation data when observation times >1.

Quick Code: Tick to show quick code menu in **Map** interface. ①Users can slide finger to choose feature type: point, line, and polygon. ②Click to apply the code.



(2) **DISPLAY**: Click to modify what to display on the main interface.



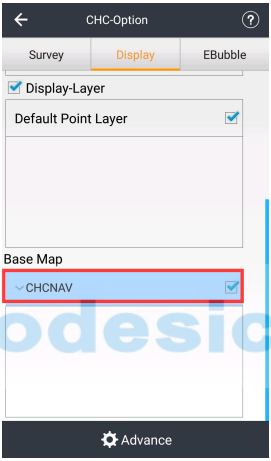
Name/**Code**/**Height**: Select to display on **Map** interface, users can select one item or multi-item. For example, if selecting **Name** and **Code**, users will see point name and code on **Map** interface after measurement.

Display - Point Type: Tick to choose point type to display on **Map** interface.

For example, when users have measured a lot of topography points, control points and quick points, users can tick **Topography** if users only want to see the topography points. Then on **Map** interface, what users can see are the topography points, no control points or quick points.

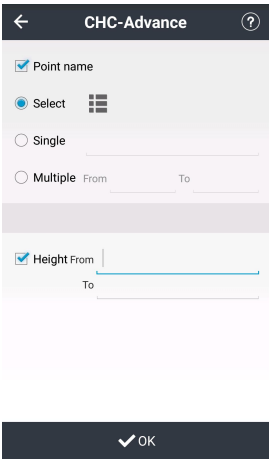
Display - Layer: Display the layers with created new codes, including the layers of points, base map, lines and surfaces.

Base Map: Tick to choose base map to display on **Map** interface. (users should import base map first.)

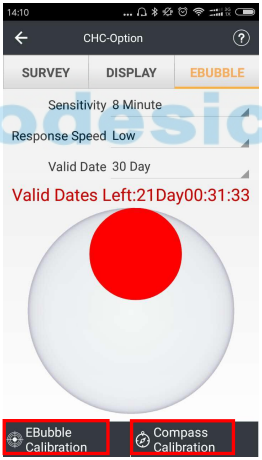


Geodesical

Advance: Configure what else to display by advance selection. Users can filtrate through single point or multiple points or height.



(3) **EBUBBLE**: View information of receivers with the function of automatic measurement or with tilt sensor.



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

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

Compass Calibration: Click to view compass calibration interface, and then

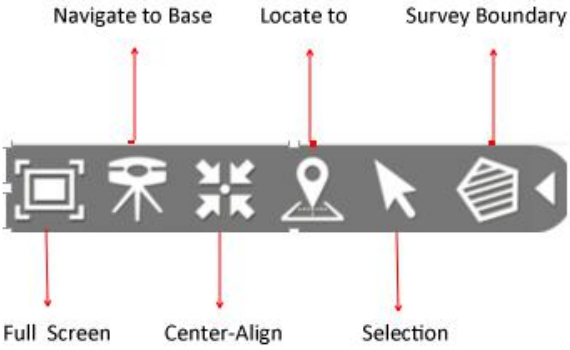
users will read “1) According to the Illustration Slowly Rotating Equipment” and “2) At the Same Time Rotate Yourself Slowly”. Users should keep the i80 receiver level, and make the LCD panel face to yourself. Then do the clockwise rotation for i80 along the X-axis for 360 degrees, and counterclockwise rotation by 360 degrees. It is proposed to finish one rotation in 2s. At the same time users should rotate, and it needs to finish the rotation in 30s. For this kind of calibration, it is proposed to do 2-3 times for all the rotations.

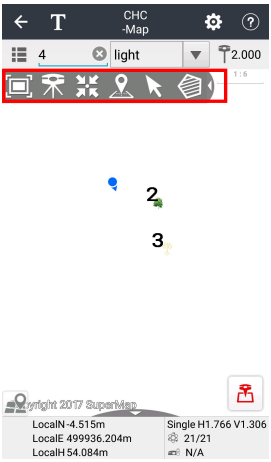
Note: Users should choose a good environment to do the calibration, (In addition to the geomagnetic field, it needs to try to avoid other magnetic interferences) generally there are no large buildings, running cars, power lines, towers and mobile phones in a call around when doing the calibration of the magnetic sensor. If users can’t avoid the condition mentioned, please stay away from the above items when doing the calibration of magnetic sensor.

4.1.2 Symbols

Geodesical

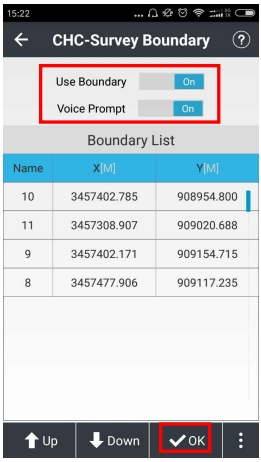
Symbols: Users will view symbols in drop-down menu on the left of interface, and users can slide to open or close the menu.





Locate to: Users can locate to point and set measuring scale as wish.

Survey Boundary: Click to view survey boundary interface, users can select several points to build boundary. Settings of survey boundary are for planning out one job area.



Up: Move the boundary point up.

Down: Move the boundary point down.

Ok: Confirm boundary list.

Select: Select existent points.

New: Manually enter the points that are in the measurement area.

Edit: Edit selected point in boundary list.

Delete: Delete selected point.

Clean: Clean all points.

Use Boundary: Tick to use survey boundary. When receiver is out of the boundary, there will be some red words "Over Survey Boundary!" showed on map interface.

Voice Prompt: Tick to open voice prompt. There will prompt an alarm sound once receiver is out of the boundary.

Note: Survey boundary can be used for the survey, stake, road stake and power stake, etc.

4.2 PT Survey

Antenna: Consist of **Vertical H** and **Slant H**.

Vertical H: The height from ground point to the bottom of receiver. When using range pole, the vertical height is the pole height.

Slant H: The height from the ground point to static measurement tick mark (X91+ is the blue rubber ring, i80 is the receiver bottom) of receiver, usually this height is needed when setting up the receiver on a tripod.

Method: Consist of **Topographic PT**, **Control PT**, **Quick PT**, **Continuous PT**, **Offset PT, Compensate PT** and **Corner PT**.

Control PT: Control survey points will take long time to observe, but it can provide high precision result.

Continuous PT: Continuously survey points automatically according to a preset fixed time period or space distance.

Offset PT: When users cannot reach the target point, this function is helpful. Input the azimuth angle between the target point and the current position (Users can measure the current point and any point on the direction of the target point, and get the angle by calculation function on **Tools** menu), horizontal distance, vertical distance (If the target point is higher than the current point, input a positive value; if lower, input a negative value).

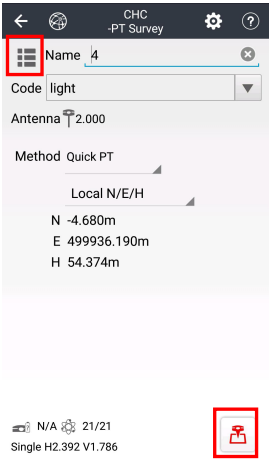
Geodesical

Compensate PT: When the range pole/level is tilted, the survey result will be automatically compensated to normal level condition. The survey result is of the location of the range pole bottom (This function is only available with those RTK receiver with tilt survey function, compass and Ebubble calibration should be done before available).

Corner PT: This is recommended for tilt survey or where receiver can't be centered.

Note: Before surveying, users should set options. Go to Options, set the **Horizontal Precision** to be higher than the value of H, **Vertical Precision** to be higher than the value of V. If the current solution is non-fixed (say float or DGPS or 3D/single point), but users want to go ahead with the point collection procedure, please un-tick **Fixed Solution**. If the rover receiver keeps static, but it reminds movement of the rover receiver (If users find the coordinate is

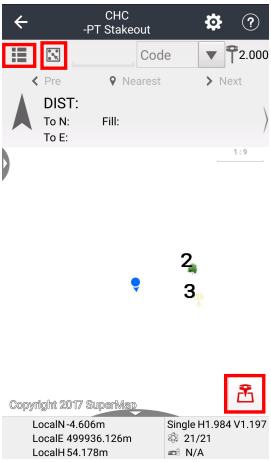
changing a lot while the rover receiver keeps static), this could be caused by site calibration/localization error.



Option: Click to set parameters (See details in 4.1.1). After all parameters set, tap **Measure** (The red icon in down-right corner of interface) to start surveying work.

4.3 PT Stakeout

Before stakeout the points, users need to add some points: Click point library (On the left side of point name) to get into the points library to be stake, click **Add** to select a point. After increase points, select target point then confirm or double-click the target point to start the stakeout.

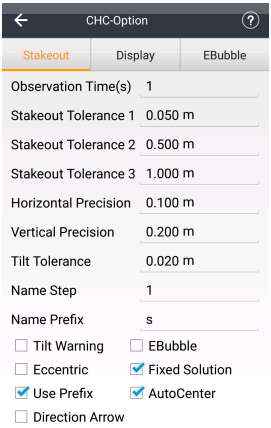


Arrow: Give direction to target point in real time.

Text: Displayed in forward-backward-left-right or east-west-north-south and switched by horizontal slide on text box.

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

Option: Click to set parameters.



Observation Time: Modify as you wish, default observation time is 5s.

Stakeout Tolerance 1/Stakeout Tolerance 2/Stakeout Tolerance 3: Modify

as you wish. Users can set three different tolerance, and then users will see three circles around stakeout point. When users are close to the circle, it will prompt tone (the tone will become rapid as users getting close to stakeout point).

Horizontal Precision & Vertical Precision: Modify as you wish, default horizontal precision is 0.100m, its vertical precision is 0.200m.

Tilt Tolerance: Modify as you wish, default is 0.020m, and its range is between 0.001m and 1m. It will make sense after ticking **Tilt Warning**.

Name Step: Modify as you wish, default is 1.

Name Prefix: Input name prefix, default is s. It will make sense after ticking **Use Prefix**.

Tilt Warning: Make the receiver be tilted when surveying, and users can decide to **Abandon** or **Stop** when it says “The tilt is excessive”.

EBubble: Users will see the ebubble on the interface when doing the point staking, when the ebubble is ticked. It will be ticked generally when using the instrument with the function of auto survey.

Geodesical

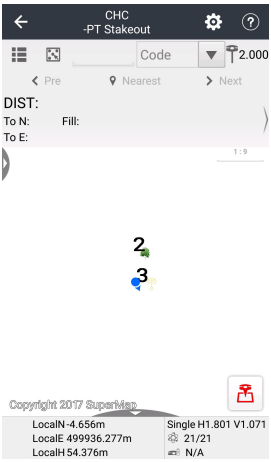
Offset: Tick to stakeout offset point.

Fixed Solution: When the fixed solution ticked, then users can measure only when the solution is fixed; please uncheck the fixed solution, if users want to measure even when the solution is single or floating.

AutoCenter: Your position will automatically display on screen center within 5s while mapping.

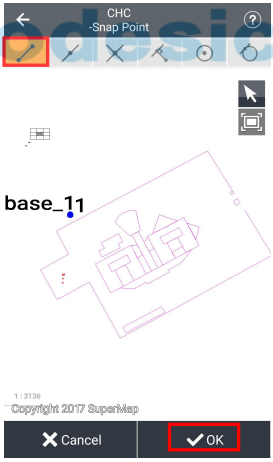
Direction Arrow: Default is ticked, if users don’t want to see arrow in **PT Stakeout** interface, please don’t tick it.

After all parameters set, tap **Survey** (The survey icon in down-right corner of interface) to start surveying work.



Points: Click to select survey points (See details in 2.10).

Snap Point: Users can select feature point both on base map or survey point. The snap type including endpoint, midpoint, intersection, perpendicular, center and tangent.



Note: After setting the proper parameters, the software will calculate the difference between stakeout point and target point. If the difference is under the limit, the software will go to the next point. If not, users need to stake this point again.

4.4 Line Stakeout

Add Line: Configure options in this interface. Including linetype, method, name, start point, end point and start distance. After options set, the new created line will be shown at left side of the **Point Name** in the **Lines**.

Linetype: Include **Line**, **Circle** and **Arc**.

Method: Include **Two Points** and **One Point + Azimuth + Distance**.

Name: Input line name as you wish.

Start/End Point: Select start/end point from **Points**.

Start Distance: Input start distance of line.

Circle Center: Input point as circle center.

Note: When it comes the stakeout of straight line, the default setup is "stake to line" (This time the mileage interface will display "stake to line", lead us to go to a point on the nearest line from the current point. If users want to go back to use other features of stakeout line, users can erase the mileage that users already input.

Geodesical

Arrow: Find the target following the arrow's direction.

Text Indication: There are four indication modes (all shows the distance from the target point), switch the mode, slide left-right in the text box. Like all sides, elevation; all directions, elevation, vertical & horizaontal-biased, mileage, elevation; the distance to starting point, elevation; to the end point, elevation.

Stakeout: Directly input the mileage between "+" "-" signs in the mileage box(if the mileage interval is fix, modify the "stake spacing", and then go to the Line Stakeout's main screen, click "+" "-" to switch sake).

Partial Cross-Staked Point: For example, at the 50 meters mileage point, 5 meters to the right: Click "staking to the line" (after users entering the mileage, display "Stakeout to stake"), offset: 5, angle: 90 °, Mileage: 50.

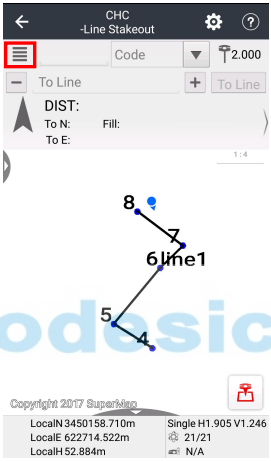
Stakeout Offset Point: For example, at the 60 meters mileage point, 30 degrees to the left, 6 meters. Click "Staking to the line" (After users entering the mileage, display "Stakeout to stake"), offset: 6, angle: 330 °, Mileage: 60.

Slope Ratio: The segment without elevation, use it for the slope with elevation subsection. Divide the line into segments of equal length, to save the time of manually calculating the mileage time of each segment. Click "+" "-" to automatically switch segment point.

Stake Spacing: After the set-up, click "+" "-" automatically to switch the mileage.

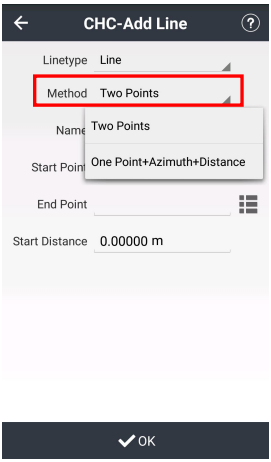
Details Procedure:

Create a new project, more specific operations please check 2.1.



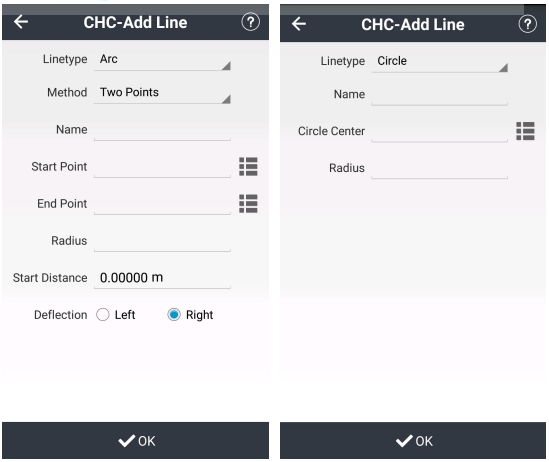
Click list to enter the line library management, users can input the point directly, or users can add customized points from the point management, including three linear types: lines, circles, arcs.

Select straight line, the software provides two modes, namely "two-point" and "one-point + azimuth angle + distance", if users choose "two alignment", extract two coordinates from the library, one is starting point the other one is the end point, enter a starting mileage; If users choose "one point +azimuth angle + distance", users only need to enter one coordinate from the library, enter the line's azimuth, length and starting mileage, and click OK to enter the Stakeout interface.

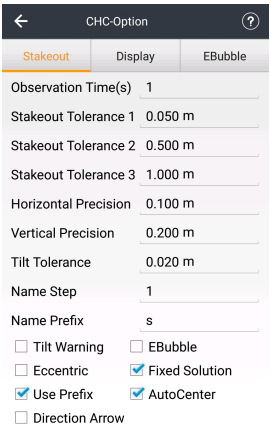


Select the Circle, select the coordinates of the center point from the library, and enter the radius.

Select the Arc Line, "two-point type": Enter the starting point, end point, start mileage, radius, deflection direction; "one point+ azimuth angel+distance", enter the starting point, radius, starting mileage, length, starting azimuth angle, deflection direction.



Option: Click to set parameters.



Observation Time: Modify as you wish, default observation time is 5s.

Stakeout Tolerance 1/Stakeout Tolerance 2/Stakeout Tolerance 3: Modify as you wish. You can set three different tolerance, and then users will see three circles around stakeout point. When users are close to the circle, it will prompt tone (the tone will become rapid as users getting close to stakeout point).

Horizontal Precision & Vertical Precision: Modify as you wish, default horizontal precision is 0.100m, its vertical precision is 0.200m.

Tilt Tolerance: Modify as you wish, default is 0.020m, and its range is between 0.001m and 1m. It will make sense after ticking **Tilt Warning**.

Name Step: Modify as you wish, default is 1.

Name Prefix: Input name prefix, default is s. It will make sense after ticking **Use Prefix**.

Tilt Warning: Make the receiver be tilted when surveying, and users can decide to **Abandon** or **Stop** when it says “The tilt is excessive”.

EBubble: You will see the ebubble on the interface when doing the point staking, if the ebubble is ticked. It will be ticked generally when using the instrument with the function of auto survey.

Offset: Tick to stakeout offset point.

Fixed Solution: If the fixed solution ticked, then users can measure only when the solution is fixed; please uncheck the fixed solution, if users want to measure even when the solution is single or floating.

AutoCenter: Your position will automatically display on screen center within 5s while mapping.

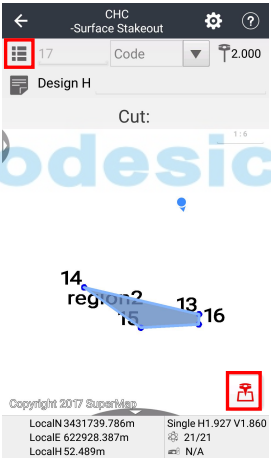
Direction Arrow: Default is ticked, if users don't want to see arrow in **PT Stakeout** interface, please don't tick it.

After users select the line, click measure icon and start stake-out function.

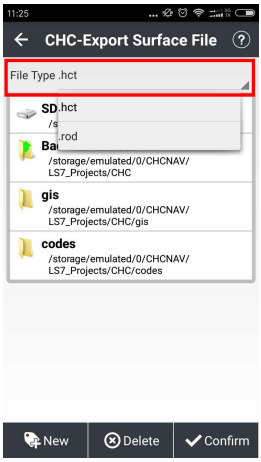
4.5 Surface Stakeout

Arrow: Find the target following the arrow's direction.

Text Indication: Indicate the fill or cut depth.

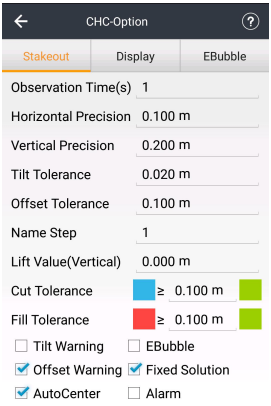


Export Surface File: Click **New** and **Select** to choose measure points from coordinate library.



Note: There are two types of files can choose which are HCT and ROD. Click Ok to give a new name or confirm the created name as below. After uploading points from Coordinate Library, The interface will show the areas which consist by known points and users can see Design height and whether this area need fill , how many cube need to fill or can be shown in the middle of interface. Beside, users can click icon on left to set stakeout information (the light point is users add Cut Tolerance and Fill Tolerance) .

Option: Click to set parameters.



Observation Time: Modify as you wish, default observation time is 5s.

Horizontal Precision & Vertical Precision: Modify as you wish, default horizontal precision is 0.100m, its vertical precision is 0.200m.

Tilt Tolerance: Modify as you wish, default is 0.020m, and its range is between 0.001m and 1m. It will make sense after ticking **Tilt Warning**.

Offset Tolerance: Modify as you wish, default is 0.100m. It will make sense after ticking **Offset Warning**.

Name Step: Modify as you wish, default is 1.

Lift Value: Modify as you wish, default is 0.000m.

Cut Tolerance/Fill Tolerance: Modify as you wish, default is 0.100m.

Tilt Warning: Make the receiver be tilted when surveying, and users can decide to **Abandon** or **Stop** when it says “The tilt is excessive”.

EBubble: You will see the ebubble on the interface when doing the point staking, if the ebubble is ticked. It will be ticked generally when using the instrument with the function of auto survey.

Offset Warning: Make the receiver be offset when surveying, and users can decide to **Abandon** or **Stop** when it says “The offset is excessive”.

Fixed Solution: If the fixed solution ticked, then users can measure only when the solution is fixed; please uncheck the fixed solution, if users want to measure even when the solution is single or floating.

AutoCenter: Your position will automatically display on screen center within 5s while mapping.

Alarm: Tick to alarm when the point is excessive.

4.6 Road

4.6.1 The introduction of Road interface

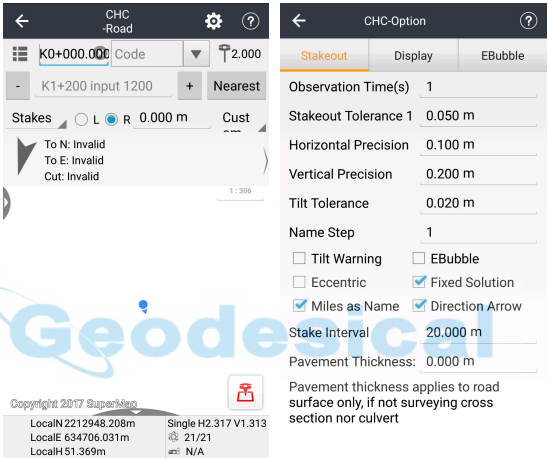
The text introductions of road stakeout divide into three ways:

(1) All around and elevation difference.

(2) Horizontal and vertical offset and elevation difference.

(3) Distance in real time and elevation difference (Calculated by the receiver's location automatically). Three introduction ways can be achieved by sliding text prompt box.

The interface of road stakeout contains three parts which are view area, the navigation text area and button; the current measuring area will display the road, measuring point and current point. There are also some operations of displaying north direction, dynamic scales and buttons for operating view-map.



List: Click to new or open roads, points and export data.

Name: Click to set the point name and it can be set by clicking the mileage or setting as you wish.

Code: Input directly or select the code in the code list.

Blue point: The position of road mileage.

+: Add mileage.

-: Decrease mileage.

Arrow: Display the current position in real-time and the target can be found in the site.

East/South/West/North: Show the target in east (E), south(S), west (W), north (N) (only display two distance messages).

Front/Back/Left/Right: Heading direction is the positive direction (only display two distance messages).

Fill: Indicates current position lower than the design position of the distance and need to fill.

Dig: Represent current position higher than the position of design distance and it need to dig.

Left: Roads along the direction of the left side.

Right: Roads along the direction of the right side.

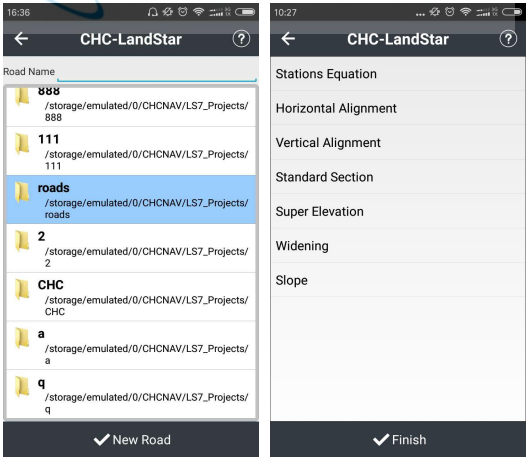
Nearest: To check the nearest stake from current position.

Section: Click the button to use the cross section mode.

Measure: After setting the antenna, it will start to measure.

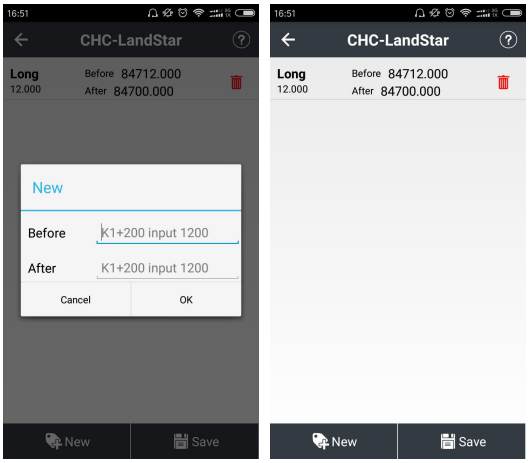
4.6.2 Road

New: Input road name and store path, click **New Road**, and then choose road type, click **Finish**.



Note: Please input parameters up to down in order.

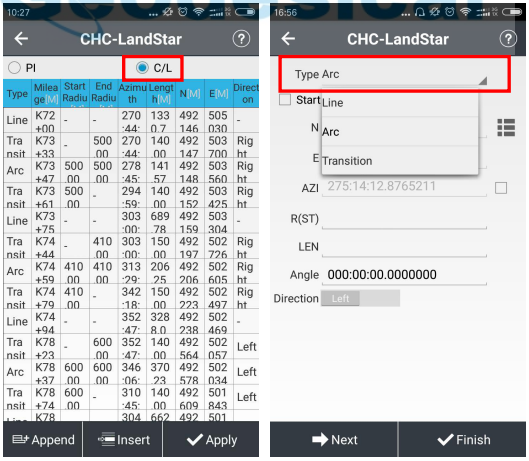
Stations Equation: Click **New** to input before and after mileage, click OK to confirm.



Horizontal Alignment:

(1) **C/L**

Append: Choose type, and input coordinates，etc.



Line: Input azimuth and length.

Arc: Input radius and length, and choose direction.

Transition: Input start radius, end radius and length.

Next: Click until all curve parameters inputted, click **Finish**, and then **Apply**.

Append: Input roads parameters.

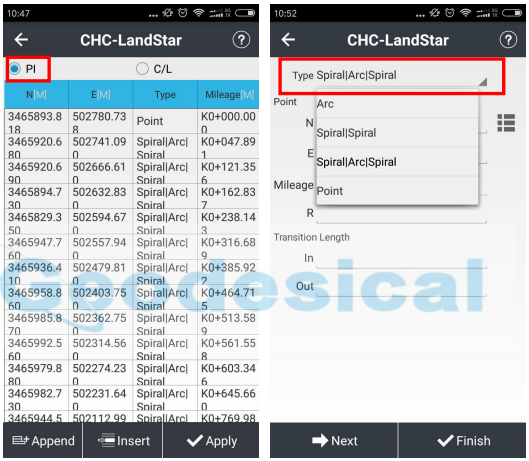
Insert: Insert roads parameters.

Edit: Modify selected roads parameters.

Delete: Delete selected roads parameters

(2) **PI**

Append: Input start coordinate and stake, click next to input curve type and parameters. You can choose curve type at the pull-down list, and input required parameters.



Arc: Input coordinates and radius.

Spiral|Spiral: Input coordinates, in and out transition length.

Spiral|Arc|Spiral: Input coordinates, radius, in and out transition length.

Points: Input coordinates and mileage.

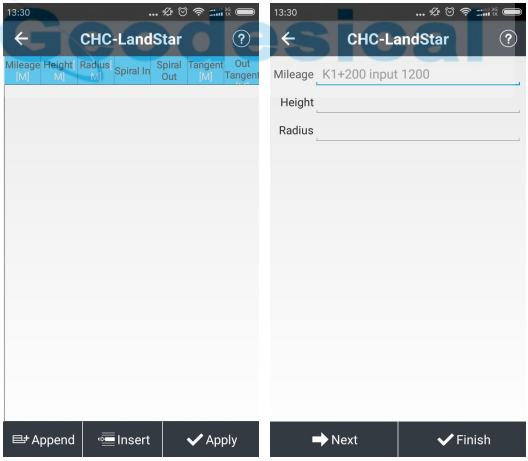
Next: Click until all curve parameters inputted, click **Finish**, and then **Apply**.

Vertical Alignment: Edit vertical alignment, enter the mileage, height and radius (no negative or positive).

Stake Number	Vertical curve						
	Elevation (M)	Convex curve semi-diameter R (M)	Concave curve semi-diameter R (M)	Tangent Length T(M)	External Spur E(M)	Origin Stake Number	Terminal Stake Number
K0+980	545.76	500		22.25	0.50	K0+957.75	K1+002.25
K1+040	547.56		500	17.05	0.26	K1+022.95	K1+057.05
K1+205	562.74	450		13.95	0.22	K1+191.05	K1+218.95
K1+270	564.69		600	24.60	0.50	K1+245.40	K1+294.60

Note: Before entering vertical curve, please enter the flat curve.

New: Click to create a road, and then select **Vertical Alignment**.



The first line: Input mileage, height.

The second line: Input mileage, height, radius.

……

The last line: Input mileage, height.

Apply: Click the icon in down-right corner of interface to complete input.

Standard Section: Click **New**, select section name, standard width, standard slope, click **OK** to complete, and then click **Save**.

Super Elevation: Click **New**, input distance, slope, vary type, click **OK**, and then click **Save**.

Widening: Click **New**, input distance, width, vary type, click **OK**, and then click **Save**.

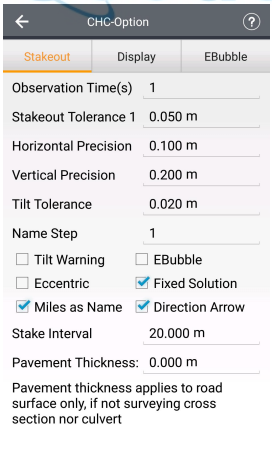
Slope: Click **New**, input slope name, slope type, start mileage, end mileage, click **Confirm and Continue** to input next slope, and then click **Save**.

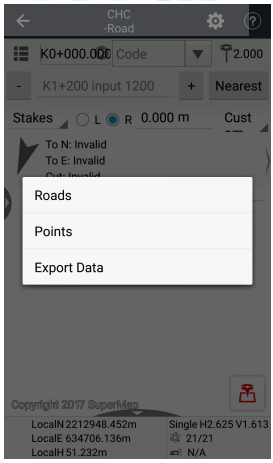
Points: Click to entry points list (Details please refer to 2.7).

Export Data: Click to input file name, select export type and export path.

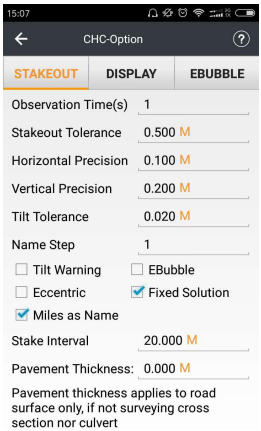
4.6.3 Road Stakeout

Open Road: Click **Survey**, **Road** to enter road stakeout interface. Then open a road file to stakeout.





Setting: Click to set parameters.



Miles as Name: Check this box, the center stake name will used the mileage.

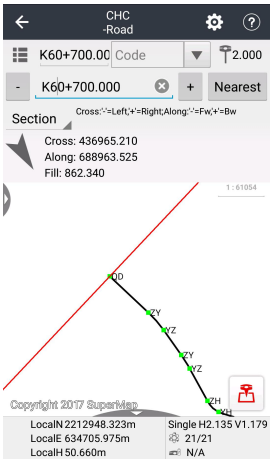
Stakeout Tolerance: Set stakeout tolerance and if tolerance is over the limit, the software will remind that the tolerance is not satisfied.

Stake Interval: The current mileage will increase by the stakeout distance.

Stakes: Enter the mileage in main interface and do the stakeout following prompts. Select left or right then input offset and stake out according to prompts, as shown settings.

Section: When measuring cross section, be sure to measure corresponding center stake, or cannot export the section data. After check the cross section, it will into the cross section measurement mode and a red line will display.

Geodesical



Cross: Distance from the current to cross section.

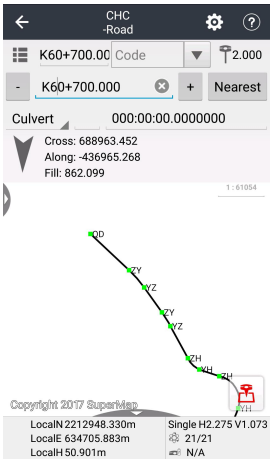
Along: Distance from projection of current position to cross section. **-** Indicates current position is at road.

Fill: Elevation difference between the current position and designed elevation. When collecting cross section, the cross is nearly 0 means the current position; cross is not 0 means the distance from the current position to center stake. Cross is negative means the current position is on the left side of road. Cross is positive means the current position is on the right side.

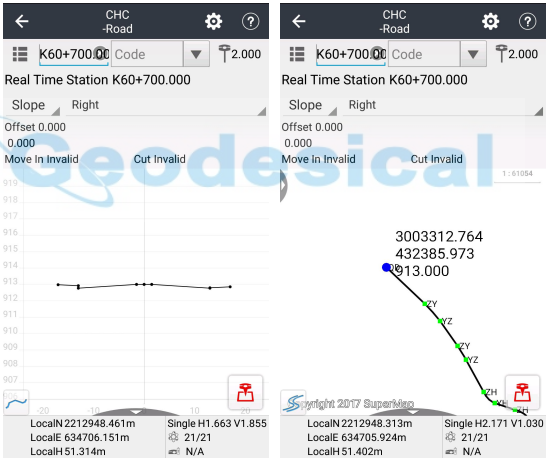
Culvert: Select culvert, input culvert distance and angle, then begin survey.

Angle: Input the angle between culvert direction and highway midline.

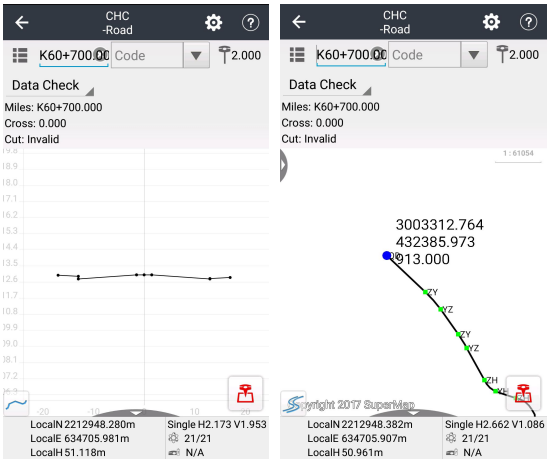
Geodesical



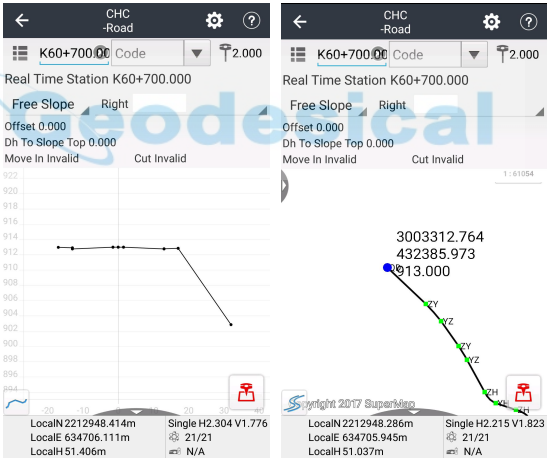
Slope: Display current slope will appear in the main interface.



Data Check: Use receiver to check any position on roads whether it remains deviation.



Free Slope: When meet slope with same type, users can select free slope to avoid duplication input.



4.7 PPK

PPK (post processed kinematic), also Known as dynamic post-processing technology which use carrier phase to Afterward differential processing. The principle of PPK is to simultaneous observing observed quantity of satellite carrier phase for one receiver as base station and at least one receiver as

rover station. After that use Land Star 7 PPK function to linear combination and generate virtual carrier phase observed values, and then determine the relative position of receivers and obtain the rover station coordinates in the local coordinate system from coordinate conversion.

Connect receivers (as base or rover station) and set Static Mode

Connect: Click to set receivers as base station or rover station.

Static Setting: Set static mode.

Note: Start Record button must be Yes, the suggestive value of interval and Elevation Mask should be 1HZ and 13 degree receptively.

Geodesical

Set: Click to set static mode.

Use PPK function: When users finish setting base station (Static mode), it is necessary to set other receiver as rover station which uses PPK function. You can click to set **PPK Obs Time Config** based on satellite numbers. Afterwards, click OK, the PPK function can operate and the time will show in interface which based on the numbers of searching satellites. Beside, we provide auto complete to conveniently save static data without watching the static recording internal time.

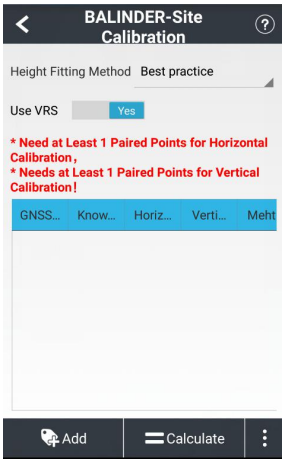
4.8 Site Calibration

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.

Point correction is to calculate the mathematical conversion relationship between WGS-84 and local plane rectangular coordinate system.

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

Site CAL: Click to enter point calibration interface.



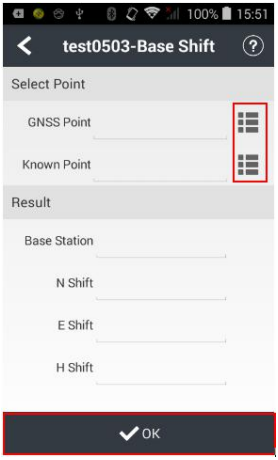
Height Fitting Method: Include fixed difference, surface fitting, best practice. Default plane fitting method is best practice.

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

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

4.9 Base Shift

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



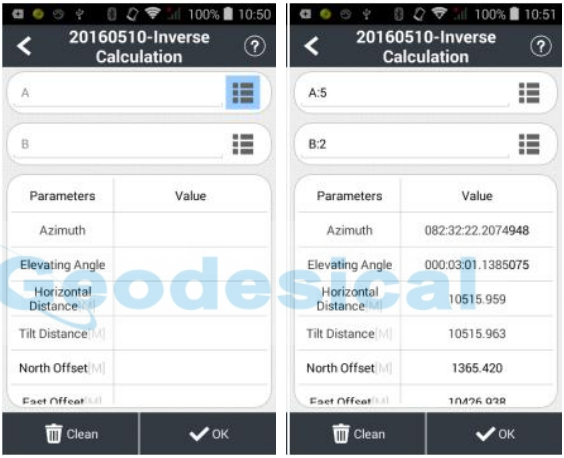
Base Shift: Click to enter base shift interface. In base shift Interface, click the icon beside GNSS Point to select a current point surveyed at a control point, click the icon beside Known Point to select the corresponding control point. The calculation results will show automatically. Then click **OK**. The software prompts “Apply Shift Parameters or not?” click **Yes**, then the software prompts “Shift base and Related Survey Points, Whether Open Point Library or Not?”. Click **Yes**, the point library is opened and the plane coordinates are changed because shift parameters have been applied to all the points surveyed on this base.

Geodesical

5 Tools

5.1 Inverse Calculation

Click list at right side and select starting point A and ending point B from points, click OK to calculate. The results will be shown in the table. The results contain: azimuth, elevating angle, horizontal distance, tile distance, north offset, east offset, height difference and gradient. Click OK can obtain results of inverse calculation.



5.2 Areas

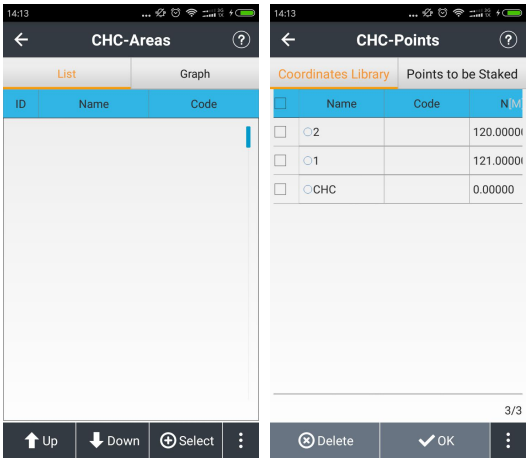
This function is to calculate the area, perimeter of figure, the coordinates that participates resolve are chosen from point management by library chosen. The unit of perimeter is metric and the unit of area supports square meters.

OK: Calculate the perimeter and area of the figure which is composed of points in sequence.

Delete: Delete point.

Select: Add points to the list.

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

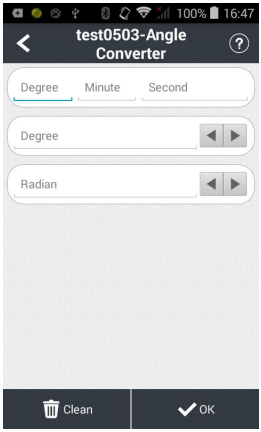


5.3 Angle Converter

Angle converter can convert degrees, minutes, seconds and radians among these 3 types of converter.

Enter a value in degrees, minutes and seconds edit box, click on the **OK** button to calculate the value of the corresponding degrees and radians.

Similarly, it can convert radians to degrees and degrees, minutes and seconds, or converts degrees to radians and the value of every minute.

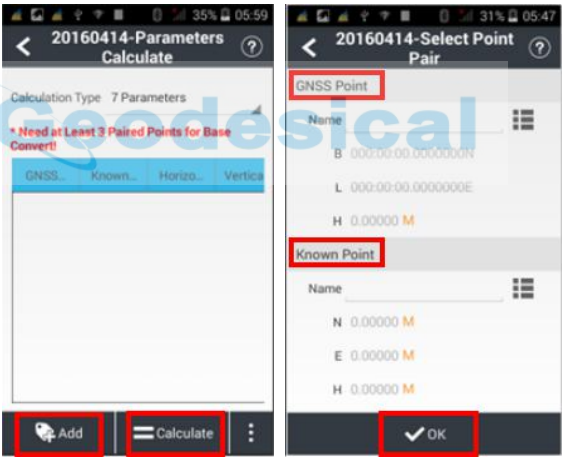


5.4 Parameters Calculate

Calculation Type: Include 7 Parameters and 3 Parameters.

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

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

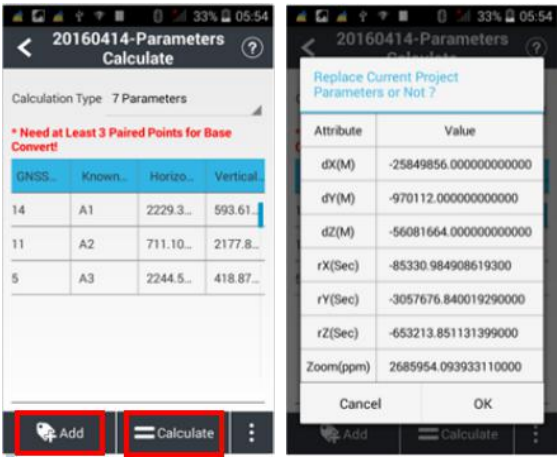


Note: Select three corresponding point pairs and add to the interface of parameters calculation.

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

Datum trans: Back to the main menu, click **CRS** to view Datum trans interface

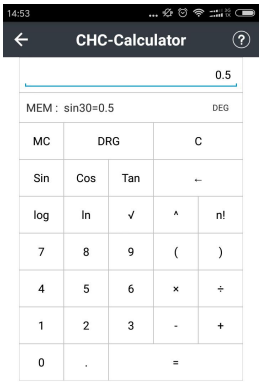
and 7 parameters can be viewed. Default datum transformation is 7 parameters. Click **Login**, input name is admin and password is 123456, and then parameters will be unlocked.



3 parameters: At least one known point pair is requested which is usually used in small scales. The accuracy is up to the operating range, decreasing with the increase of operating distance.

5.5 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. You should click **DRG** to transform input number type into degree (DEG), sin 30(DRG) = 0.5.

Geodesical

←: Back.

log/ln: log10=1.

√: 8√3=2.

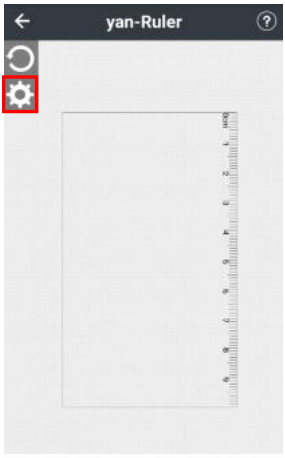
^ : 8^ 2=64.

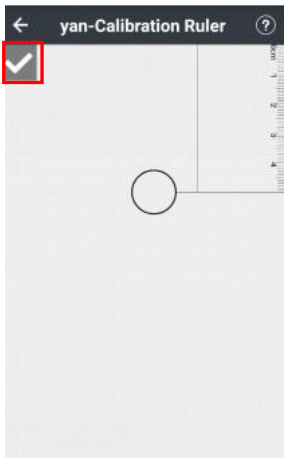
n!: n!3=6.

5.6 Ruler

This function will provide users a ruler to do some simple measurement.

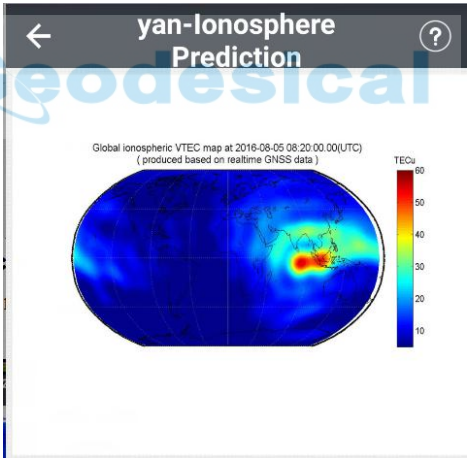
Users can use real ruler to adjust the length of ruler by moving the circle, then click confirm icon.





5.7 Ionosphere Prediction

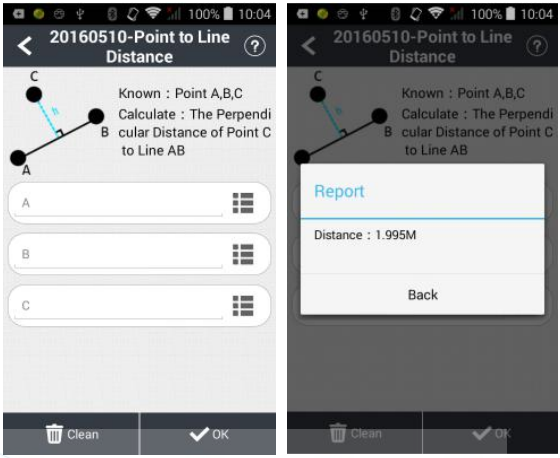
Display ionospheric conditions at present and update every 10 minutes.



Solar storms occurs once every 11-year, along with the period of sun pot activity. The frequency and intensity of ionospheric storm is related to sun pot. When the solar wind swept the Earth, it will change the electromagnetic field, causing geomagnetic storms and ionospheric storm, affect communications, especially short-wave communications, for example GNSS.

5.8 Point to Line Distance

Select points A, B, C from point management and click **OK** to calculate. The result is displayed in a pop-up box, as follows: click **Clean** to clear current data.



5.9 Eccentric Distance

Origin (A): Select form **Points**.

Horizontal distance (AP '): Input the horizontal distance.

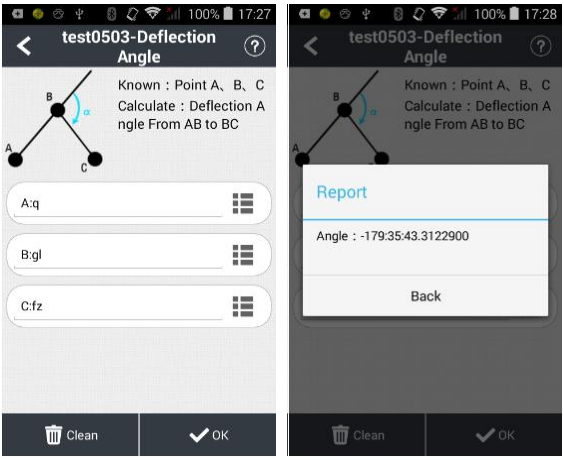
Perpendicular (PP '): Input the vertical distance.

Azimuth Angle: Input the azimuth angle.

Eccentric Distance: Click **OK** to display a calculation result screen, enter the point name, and click **OK** to save the calculated point.

5.10 Deflection Angle

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



5.11 Rotation

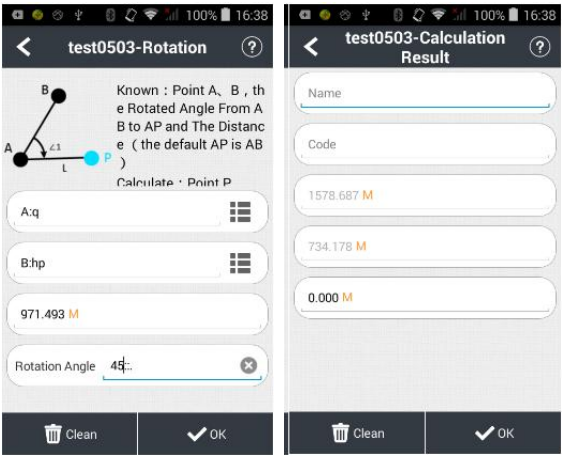
Rotation: **Point P** is on the line AB which rotates a certain angle. After selecting AB points, the system will calculate the distance between A point and B point as default and this distance as initial value for AP. the value of AP can be negative which means the P point is in the extension line of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

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

AP: Initial distance.

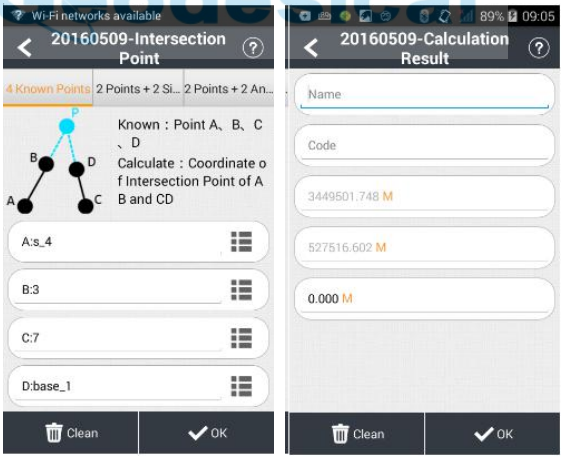
Rotation Angle: Click **OK** will show calculate result.

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

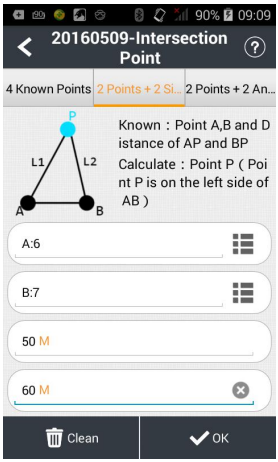


5.12 Intersection Point

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



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

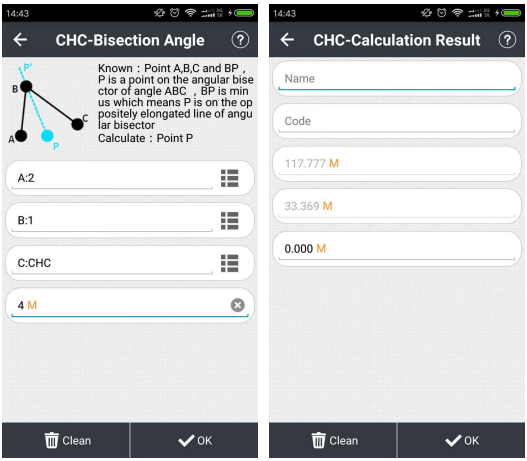


Points + 2 Angles: Calculate intersection P with known points A and B and the inner angle of PAB. Click **OK** to calculate. Input a name, and click **OK** to save.

5.13 Bisection Angle

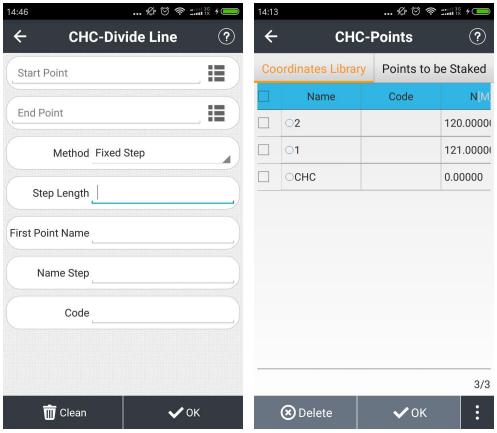
Bisection Angle: Given line BA and BC comes to an angle ABC, P is one point on the angle bisection line, according to the coordinates of Points A, B, C, and the plane distance from Point P to Point B, we can have the coordinate of Point P. If the distance value is negative, it mean Point P is on the oppositely

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



5.14 Divide Line

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



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