

CHC® LandStar 7 User Guide



Revision 1.0
September 2016



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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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*LandStar 7 Quick Start Guide –
Revision 1.0 September 2016*



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

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



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 **Geodesical**

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 v8.33 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.

1.2 Unique Characteristics

Powerful graphical surveying: Support both online OSM (Open Street Map) map and offline map (DXF and SHP file) as the base map while surveying. Selected points in a DXF or SHP file can be automatically added to the points manager for staking out.

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 and Grid shift file (GGF)[BIN, GRD, GSF, GRI and ASC geoid and grid shift file formats will available soon.], RTCM transformation message(1021-1027).

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

Convenient work mode management: Support presetting of common work modes of base and rover, selecting or switching work modes by one button push. You will not need additional steps to configure your work mode 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 and compensation point.

Multiple types of stakeout: Support point stakeout, line stakeout, surface stakeout and road stakeout.

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. You 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. You 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.

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

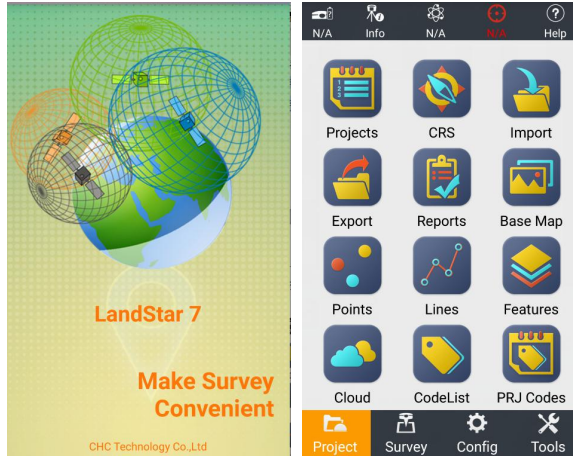
Real-time global TEC map: Support a built-in global TEC map with updating every 10 minutes to help you to choose the best working time in high ionospheric activity regions.

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.

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Status Bar



: This icon will show receiver battery.



: This icon will lead you to device Information interface.



: This icon will read skyplot information and satellites list. **A** represents the total number of received satellites; **N** represents the number of effective solver satellites.



: This icon will lead you to view position and precision of single status.



: This icon will lead you to view position and precision of float status.



: This icon will lead you to view position and precision of fixed status.

Precision : **H** means horizontal accuracy, **V** means elevation accuracy; RMS means the relative error.

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

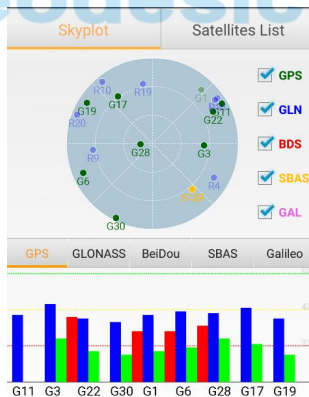
Device Type	i80
SN	1002771
GPS Firmware	1.3.42
Expire Date	Permanent
Work Mode	Auto Rover
DataLink Name	Internal Radio
Protocol	Transparent
Channel	6
Frequency	

Fresh
 Reset
 Switchoff Radio

Register
Modify
⋮

Skyplot: You can view the current skyplot. Then you can see the reference position information of the 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.



Satellite List: You can view the current number of each satellite which has been searched, satellite systems, L1 \ L2 \ L5 SNR, elevation, azimuth, locking and other information.

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Skyplot		Satellites List					
Nu.	Constella...	L1	L2	L5	Elev.	Azi.	Loc...
11	GPS	37.0	0.0	0.0	21	60	Yes
3	GPS	42.0	24.0	36.0	53	92	Yes
22	GPS	35.0	19.0	0.0	37	62	Yes
30	GPS	33.0	14.0	26.0	15	206	Yes
1	GPS	35.0	17.0	28.0	32	42	No
6	GPS	38.0	19.0	30.0	29	247	Yes
28	GPS	38.0	25.0	0.0	82	267	Yes
17	GPS	41.0	20.0	0.0	47	324	Yes
19	GPS	35.0	16.0	0.0	26	302	Yes
18	GLONASS	30.0	28.0	0.0	23	55	No
4	GLONASS	38.0	38.0	0.0	35	119	No

Position: You can view GPS time, solver status (single point, floating or fixed), the differential delay and the current position in WGS84. You 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: You can view horizontal precision, vertical precision and RMS.

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

Position		
Time	2016-07-09 15:50:22.000	
Solution	Single	
Diff Age	7.0	
Lat	031:09:58.6287318N	
Lon	121:17:18.7879625E	
H	47.07329 M	
WGS84 Lat/Lon/H		
Precision		
H: 1.250M	V: 1.671M	RMS: 1.419M
DOPs		
PDOP: 2.514	HDOP: 1.542	
VDOP: 1.986	TDOP: 1.493	
GDOP: 2.924		
Base		
Point Name	base 2	

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 install successfully, it will generate LandStar 7 procedures and LandStar 7.Help icon on the desktop, open the LS7 software and click the help icon at the top-right corner to view the help file.

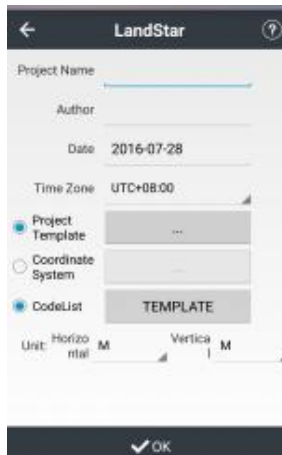
2 Project

2.1 Projects

2.1.1 New

While creating a new project, clicking **Yes** if it prompts “Set the Current Project XXX Code list as Default Code list Template or not”. Then, you will cover the code list of default template with current code when closing a project.

Note: The prompt "Close Current Project and Create a New One" will pop up if you had projects in the list before. Clicking Confirm means you are allowed to another new project.



The screenshot shows the 'LandStar' application interface for creating a new project. The form includes the following fields and options:

- Project Name:** A text input field.
- Author:** A text input field.
- Date:** A date picker set to 2016-07-28.
- Time Zone:** A dropdown menu set to UTC+08:00.
- Project Template:** A radio button option that is selected, with a dropdown menu showing '...'. Below it is a button labeled 'TEMPLATE'.
- Coordinate System:** A radio button option that is not selected, with a dropdown menu showing '...'. Below it is a button labeled 'TEMPLATE'.
- CodeList:** A radio button option that is selected, with a dropdown menu showing '...'. Below it is a button labeled 'TEMPLATE'.
- Unit:** A dropdown menu with 'Horizo' and 'Vertica' options, each followed by 'M'.

At the bottom of the screen, there is a dark bar with a white checkmark and the text 'OK'.

Project Name: Input the project name.

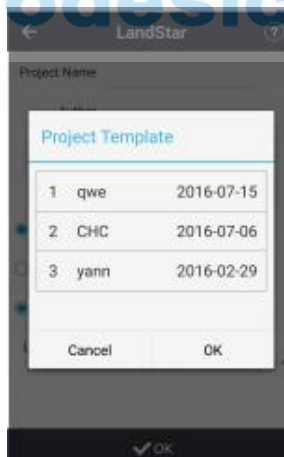
Author: Input the name of the operator.

Date: The default time is the local time.

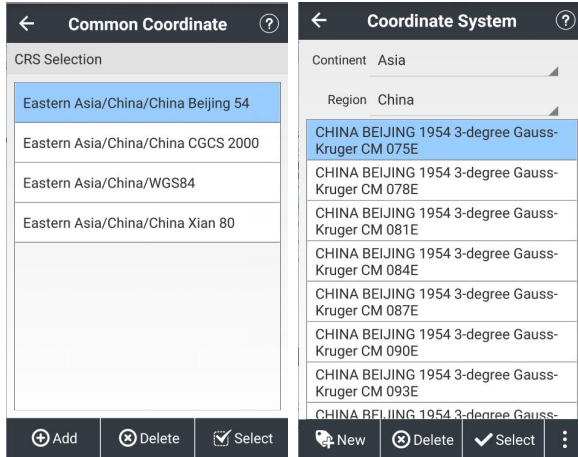
Time zone: It refers to the time zone different from local time and the GPS time which can be selected in the time zone drop-down list from -12 to +14.

Project Template: Select the project template, then it will show you a list of historical projects. You 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. When you input a new project name in Projects, you can select task A in the project template.

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



Coordinate System: You 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: You 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.

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

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

You can view the parameters of datum transformation or plane adjustment.

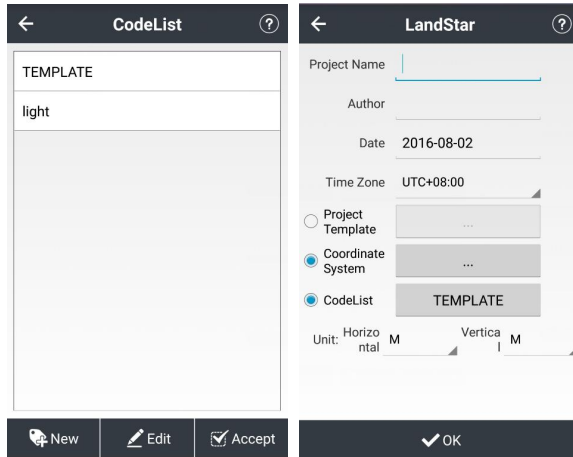
Click **Save** and it will prompt the path to save this coordinate system.

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

After clicking **Select**, it'll return to the interface of coordinate system management interface, which means ellipsoid is applied.

CodeList: Click to view codelist interface.

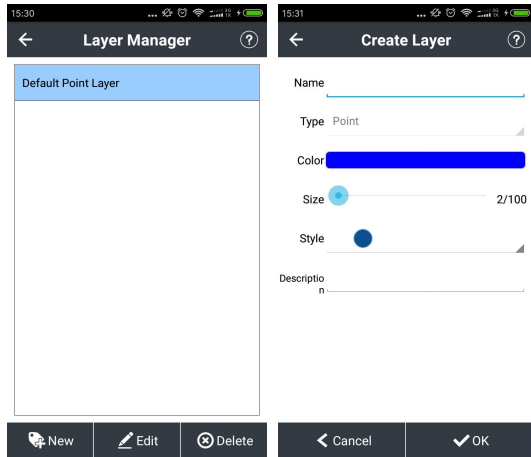
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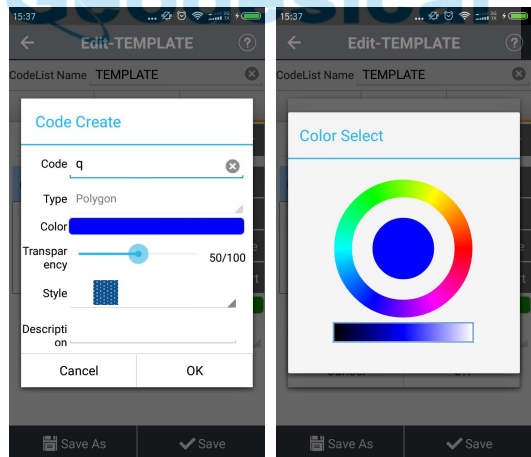
Click **New**, then the interface of code list will pop up.



Click **Layer** and enter the interface of layer. Click **New** to enter the interface of new layers, 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.



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

Click **Edit** to edit current new code.

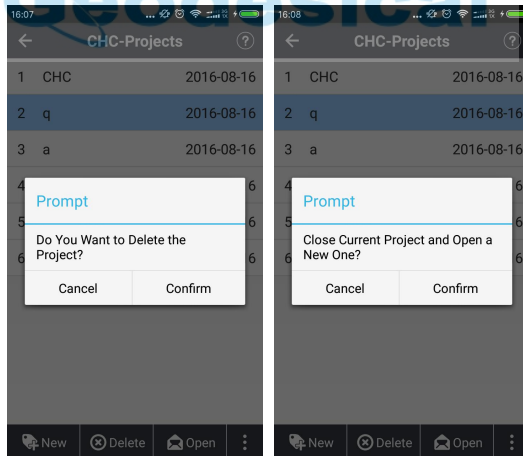
Click **Accept** and it will return to previous interface which means code is applied.

2.1.2 Delete

When you want to delete an opened project, it will prompt "Cannot Delete Current Project." to protect opened project. While deleting a closed project, it will pop up a dialog box "Do You Want to Delete the Project?" Select **Confirm** to delete the project file. Select **Cancel** to cancel delete.

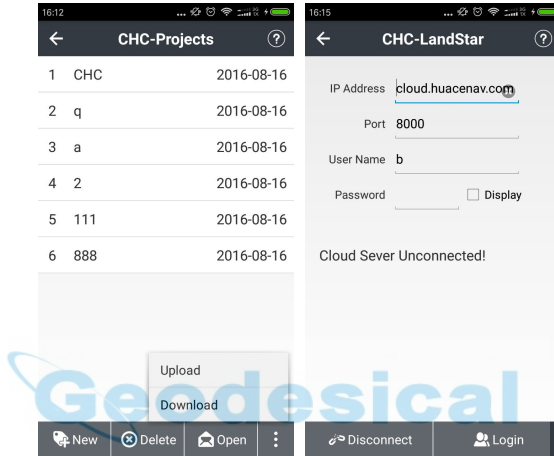
2.1.3 Open

To continue an existed project, you 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 open.



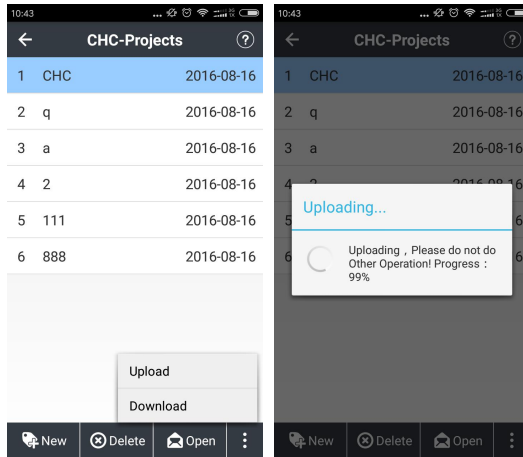
2.1.4 Upload and Download

Click **Upload** or **Download** to enter the interface of Cloud services. Enter IP address, Port, User Name and Password. Then click **Login** to finish upload or download.



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 listed in the project management.

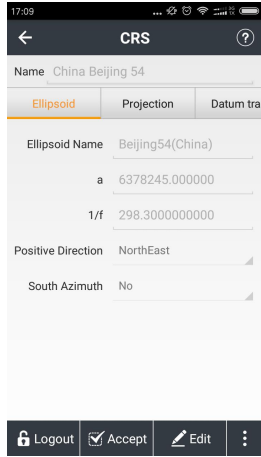


2.2 CRS

CRS offers you some parameters including ellipsoid, projection, datum trans, plane adjustment, height fitting.

Ellipsoid: Includes Ellipsoid Name, a, 1/f, etc.

Coordinate system name is required to define the coordinate system name, and it is recommended to use the project name as the coordinate system name.



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.

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Projection Model	
Central Meridian	117:00:00.0000000E
Origin Lat	000:00:00.0000000N
Scale Factor	1
False East	500000
False North	0
Average Lat	000:00:00.0000000N
Projection Height	0

Datum Trans: Represents the mathematical model for transformation between two coordinate systems. Datum transformation model includes none parameter, three parameters, seven parameters models. You can input the local seven parameters directly if they have, no needing the site calibration any more.

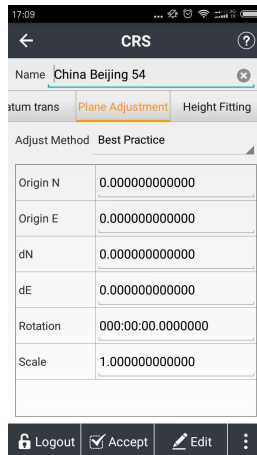
Datum transformation	
dX	0.000000000000
dY	0.000000000000
dZ	0.000000000000
rX(Sec)	0.000000000000
rY(Sec)	0.000000000000
rZ(Sec)	0.000000000000
Scale(ppm)	0.000000000000

7 parameters: Requires having three known points at least, and the points can

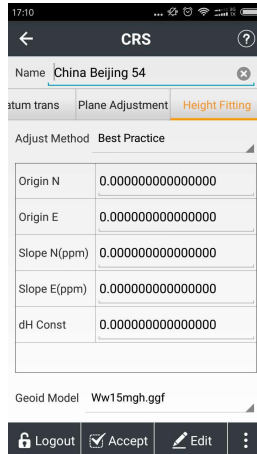
be under the national coordinate system or the coordinate system that existing small rotation from the WGS84 coordinate system. Preferably three or more points are known so that checking the correctness of the known points. The mathematical model of this method is strict, and therefore it is critical to the precision of the known points. This method is usually used in a wide-range work. When known point accuracy is not high, seven parameters transformation is not recommended.

3 parameters: Requires having having one known point at least, 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, the lower the accuracy.

Plane Adjustment: The calibration parameters will be displayed on the interface of the coordinate system parameters after site calibration and application, and you can check them through your login successfully. This icon supports Best Practice and Grid at present.



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



Fixed Difference: Need at least one starting point, and support GGF file.

Plane Fitting: Generate a best-fit plane for the abnormal height of many benchmarks. It equates the fixed difference method when the fitted plane is parallel to the horizontal plane. This method needs at least three starting points.

Surface Fitting: Generates a best-fit para bolide for the abnormal height of many benchmarks. It has high requirements for the starting data. 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. It includes five parameters, North origin (Origin N), East origin (Origin E), North slope, East slope and elevation constant.

Geoid model: Click to choose the geoid model file if select this method. The software currently supports the geoid model file of GGF format.

2.3 Import

It is no doubt that inputting a large amount of known points to data controller is always wasting time and easy to make mistakes. Click **Import** in main interface, and the software will import the known data according to the requirement format in device or SD card.

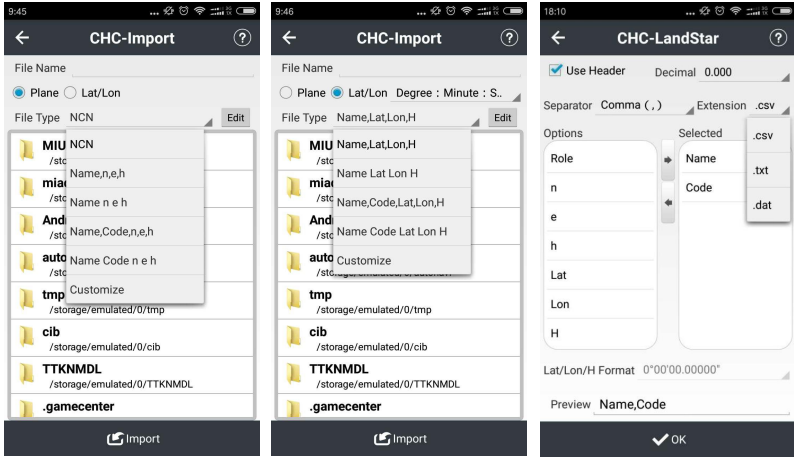
File Name: Input the file name.

Coordinate System: Plane or Lat/Lon.

File Type: TXT file or CSV file. There are several available formats in common use and users can also set the format in custom.

Customize: You can also 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: You can choose exported point types including **Survey Point**, **Input Point** and **Base Point**.

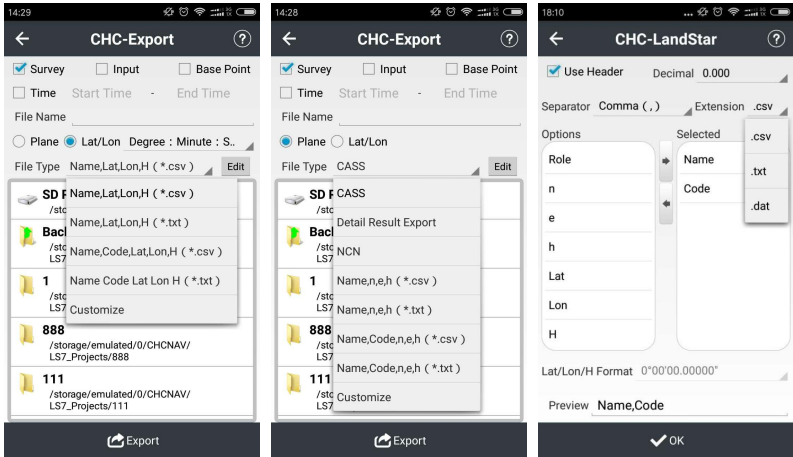
Time: You can set the start time and the end time for exporting data.

Coordinate System: Plane or Lat/Lon.

File Type: TXT file or CSV file. There are several available formats in common sequence that provides you to use and you can also set the format in custom.

Customize: You can also customize the import contents while choosing the format including CSV, DAT and TXT.

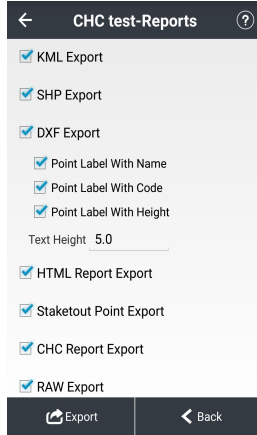
Path: Select the path of export file. Click the folder and it will display a blue select prompt. Then, click **Export**.



2.5 Reports

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

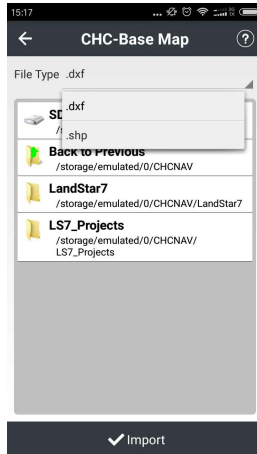
Click **Export**, then it will suggest that "Export successfully!". Paths report stored in the directory where you installed the program, such as CHCNAV / LS7_Projects / project name / report .htm file, handheld controller and computer connections, copy the file to the computer, double-click the file to see the report file.



2.6 Base Map

Base map mainly import the required map to software. Now it supports two formats namely DXF and SHP. After importing, the points or lines that are in the base map can be displayed, selected or stakeout.

To modify the layer display, click **Survey-Map-Settings-Display**.



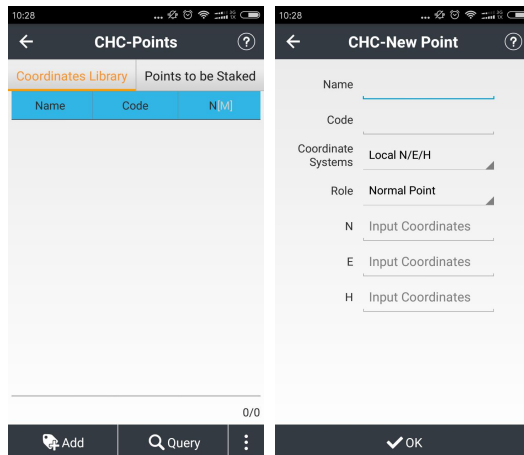
2.7 Points

Points can view the input point, the measuring point and the coordinate of the point 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 coordinate that you create, and make sure the code item must be non-mandatory.

Note: If the point that you make have reel number, the prompt “Projection Error” will appear after adding point. We 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.

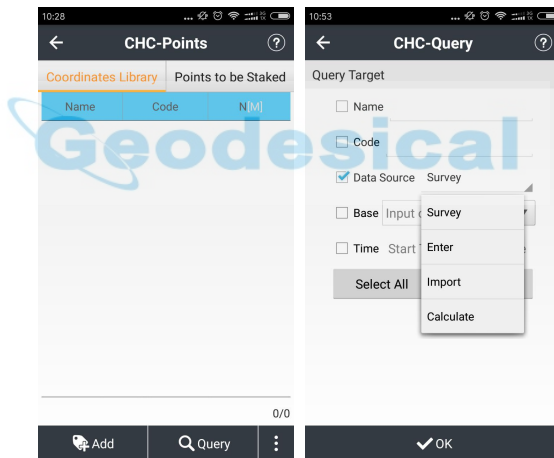
Name: Completely matched or screened name.

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 difference 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.



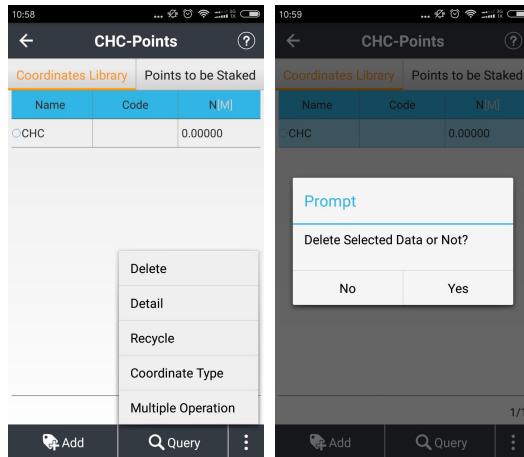
Click **OK** complete query a point.

2.7.3 Delete

Click bottom-left icon and select **Delete**. When you want to select point, click **Delete**, a dialog box “Delete Selected Data or Not?” will pop up. Click **Yes** to delete this record.

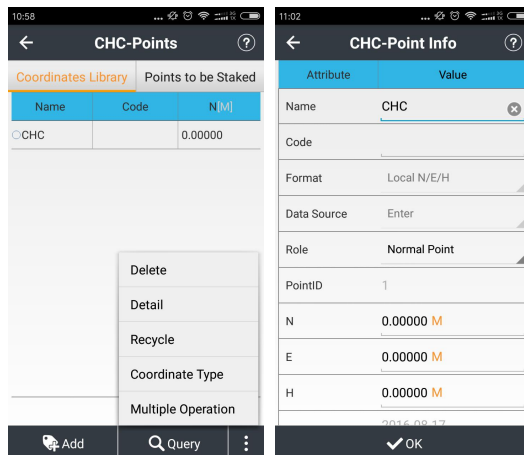
Note: When you don't select points before clicking **Delete**, it will pop up a

prompt: “Please Select Data First!”



2.7.4 Details

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



2.7.5 Recycle

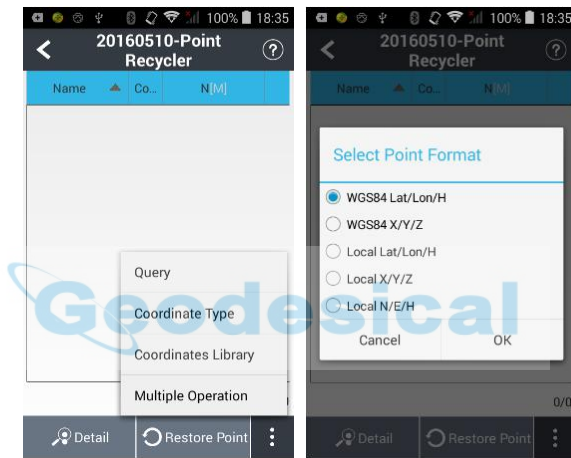
Recycle is used to restore deleted records, and if deleted records do not exist, it will prompt "No Record".

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.

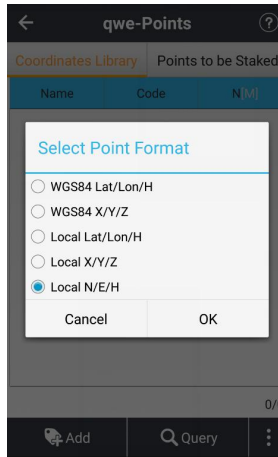


Coordinates Library: Click to view coordinates library.

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

2.7.6 Coordinate Type

You can set coordinates types of points.



2.7.7 Multiple Operation

Click it, then, you can delete points from point management not only one item but also multi-items.

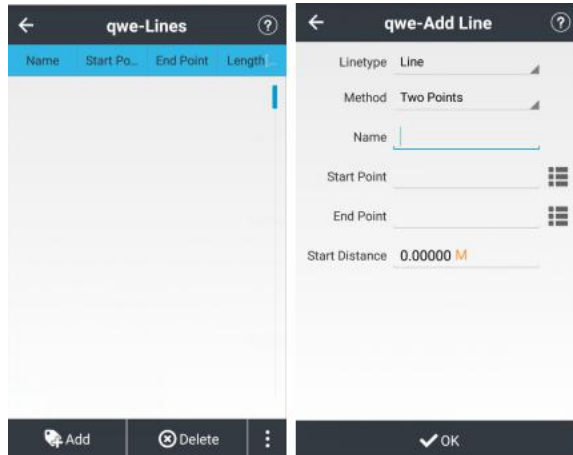


2.8 Lines

2.8.1 Add

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

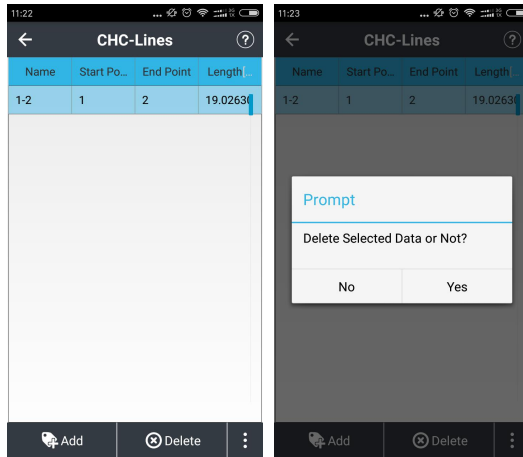
Linetype (Including: Line, Circle, Arc), **Method** (Including Two Points, One Point + Azimuth + Distance), **Name**, **Start Point**, **End Point**, **Start Distance**.



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

2.8.2 Delete

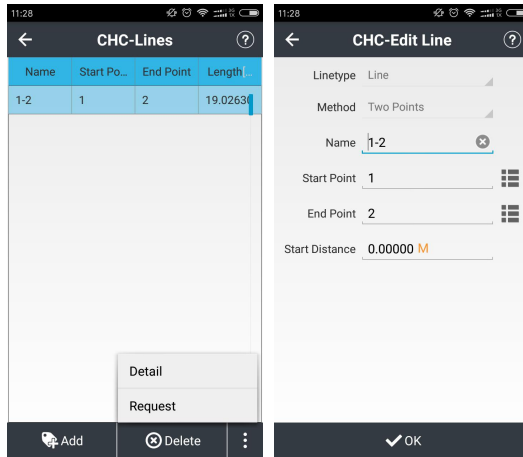
When selecting line, click **Delete**, and then it will pop up a dialog box "Delete Selected Data or Not?", Select **Yes**, remove this record, select **No**, do not delete this record.



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

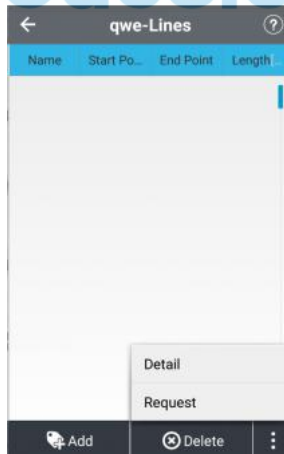
2.8.3 Detail

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 Request

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

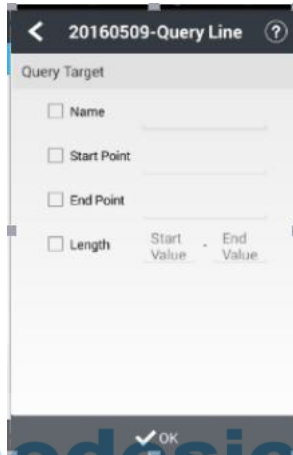


Name: exactly match the query line.

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

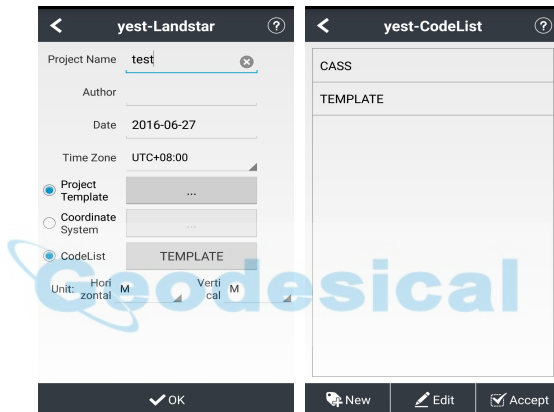
Click **Features**, then it will display the line or region features which collected in current project. Double click **Map Display**, the collected features will display in Map Display and it can also inquire or delete by Map Display.

2.10 Cloud

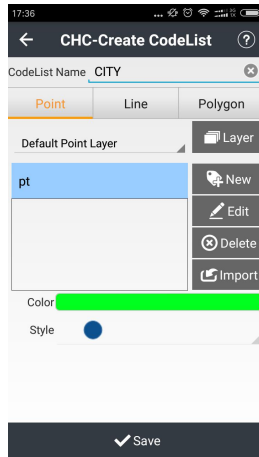
Cloud is the login interface of Cloud, and you can upload or download tasks, coordinate system, work mode etc. You can ask local dealer or salesman for obtaining an account and password to use Cloud. CHC will help customers to build own cloud server (Customer need to provide server and network) if necessary. For more information, please contact local dealer or salesman.

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 we save these codes in one list, it is not easy to select when we do the field jobs. So it is better to create the different code lists to save the different codes, and you 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.



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**.



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17:41

← CHC-Create Layer ?

Name TREE

Type Point

Color

Size 2/100

Style

Description

← Cancel ✓ OK

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

17:43

← CHC-Create CodeList ?

CodeList Name CITY

Code Create

Code AspT

Type Point

Color

Size 1/100

Style

Description Aspen

Cancel OK

✓ Save

17:43

← CHC-Create CodeList ?

CodeList Name CITY

Code Create

Code CamT

Type Point

Color

Size 1/100

Style

Description Camphor Tree

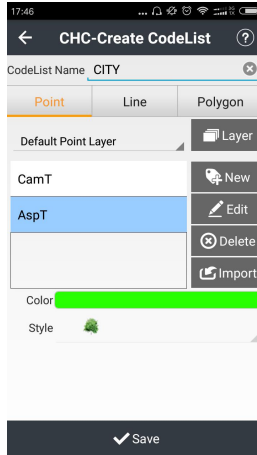
Cancel OK

✓ Save

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

AspT represents Aspen Tree.

CamT represents Camphor Tree.

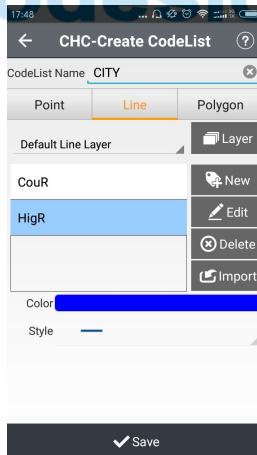


You can use **Edit** to edit the code, click **Delete** to delete the code, or click **Import** to import the code list.

Line:

CouR represents Country Road.

HigR represents Highway.

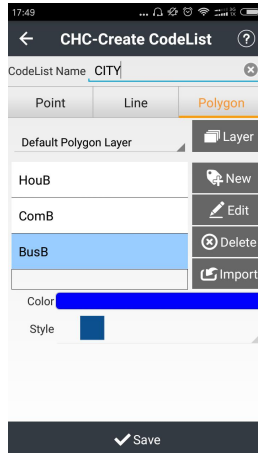


Polygon:

HouB represents House Building.

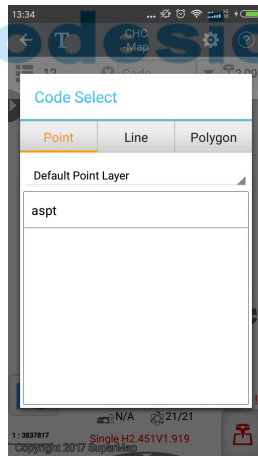
ComB represents Commercial Building.

BusB represents Business Building.



Application of CodeList:

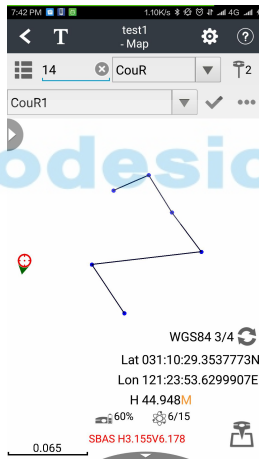
After the creation of CodeList and connection of receiver, you now open Map. Click **Code** to select the features: point, line or polygon.



Point survey:



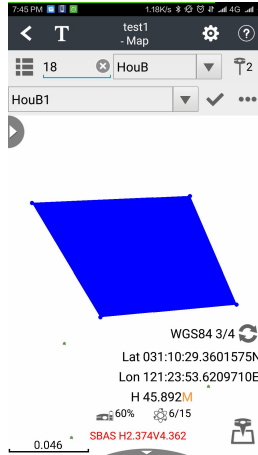
Line Survey:



Click **Tick** to finish a line.

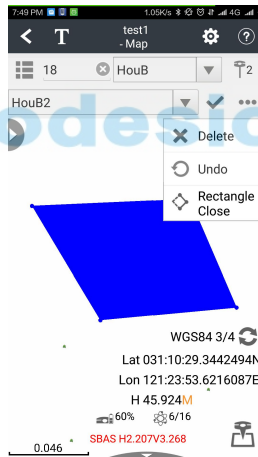
Polygon Survey:

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Click **Tick** to finish a polygon.

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



2.12 PRJ Codes

Click **PRJ Codes**, then you will find the codes currently you used. And you can create, edit and delete one code. You can also input one code from other code lists. If you use the template codes, when you 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 you want to save the functions for the next time, please choose Cancel and the functions will be saved in the **Template** codelist.

3 Config

3.1 Connect

Used for receiver connection.



Manufacturer: CHC in common.

Device Type: Including the choices of **i80**, **GNSS RTK**, **local**, **peripheral**.

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

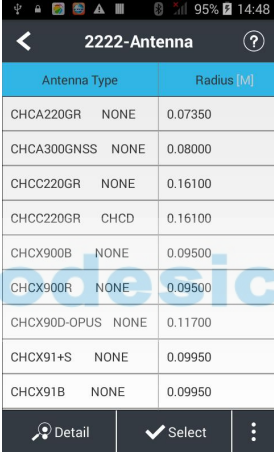
Bluetooth: While using Bluetooth connection (Suitable for i80 and GNSS RTK), click **Bluetooth List** to the interface of Bluetooth. Select Bluetooth management, click **Refresh** to find the device to Pair (Default password is 1234 if it's required to input). When the connection is successful, you will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

WiFi: While you use Smart GNSS for device type, connection type can select

WIFI. Click **Connection List** of Hot Spots, then it will show you 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, you will back to connection interface.

Demonstration: Enter Demo mode, and then you 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. You can handle specific item by clicking **Detail**, **Add**, **Edit**, or **Delete**.



Antenna Type		Radius [M]
CHCA220GR	NONE	0.07350
CHCA300GNSS	NONE	0.08000
CHCC220GR	NONE	0.16100
CHCC220GR	CHCD	0.16100
CHCX900B	NONE	0.09500
CHCX900R	NONE	0.09500
CHCX90D-OPUS	NONE	0.11700
CHCX91+S	NONE	0.09950
CHCX91B	NONE	0.09950

Auto Connect: Switch on, then, it will connect previous device when you 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.

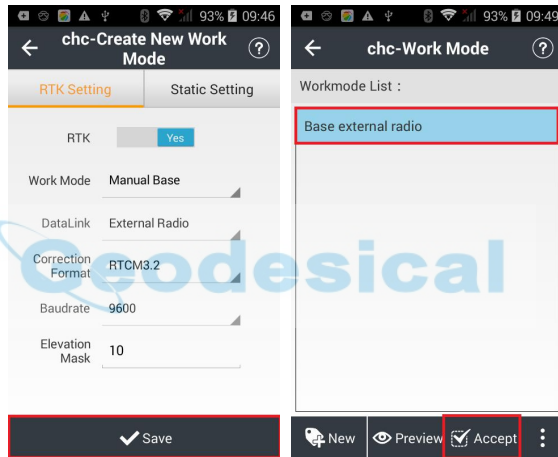
Work Mode: Select **Manual Base**.

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 your **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.

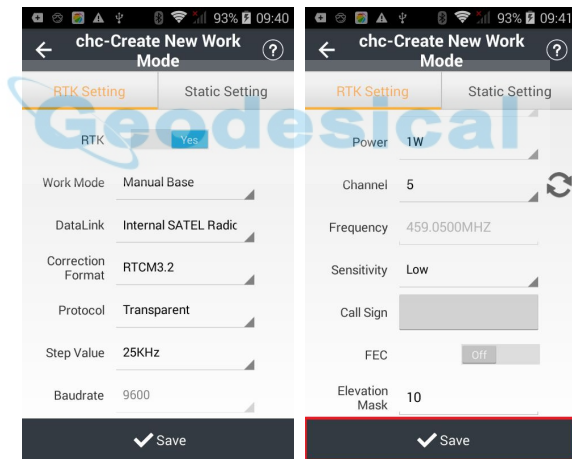
Power: Select 1W.

Channel: Select 5.

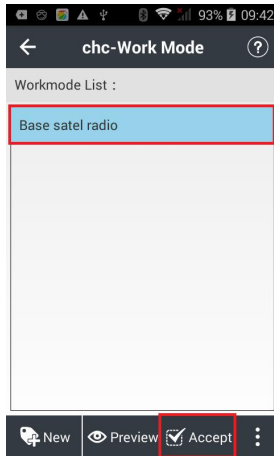
Note: Click the fresh button, then, you can update channel and its corresponding frequency. Working radius is less than 3km.

Sensitivity: Select **Low**.

Click **Save**, then the prompt “Please Set a Name for The New Mode” will pop up. Enter your **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**.

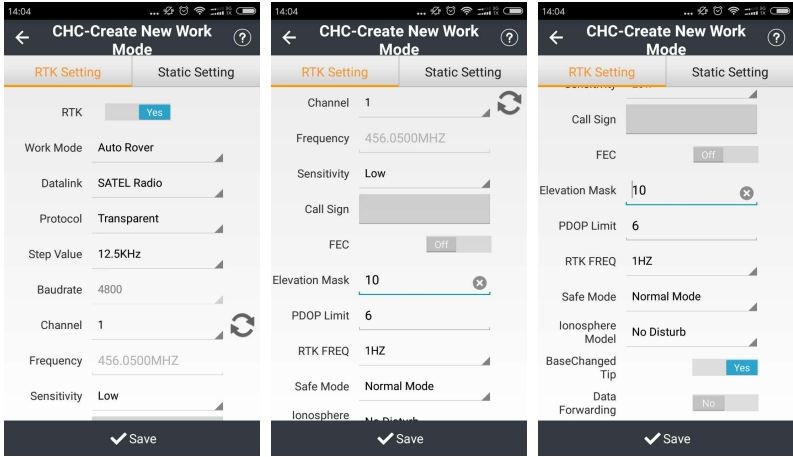
Protocol: Select **Transparent**.

Step Value: Select 25KHz.

Channel: Select 1.

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

Sensitivity: Select **Low**.



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

Note: Please check the i80 PN number when you 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 your 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.

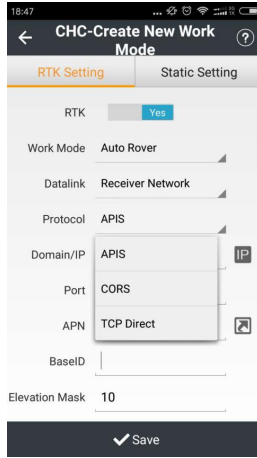
RTK: Switch on.

Work Mode: Select **Auto Rover**.

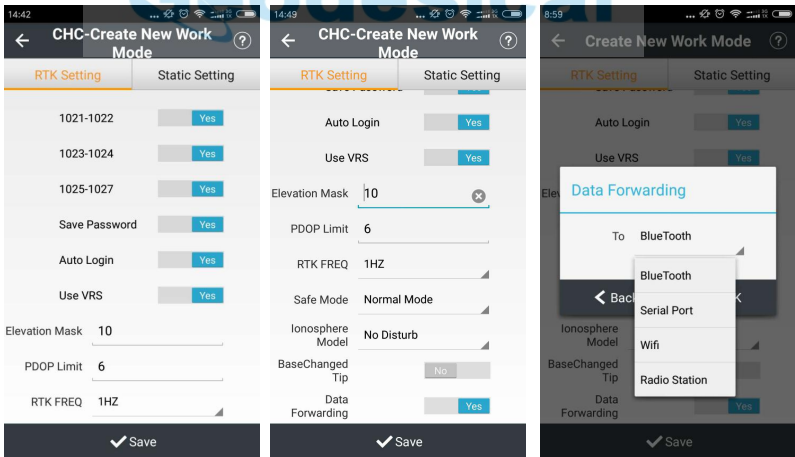
Datalink: Select **Receiver Network**.

Protocol: Select **CORS**.

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

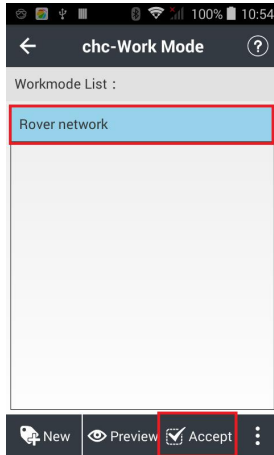


Click **Download** to get the source table. Input the **User name** and **Password** for your Ntrip account. Do taking it in note that the RTCM 1021-1027 messages need to be switched on or off here. If the mount point without corresponding messages, please switch off here. You can also forward data through Bluetooth, Serial Port, WIFI, and Radio Station.



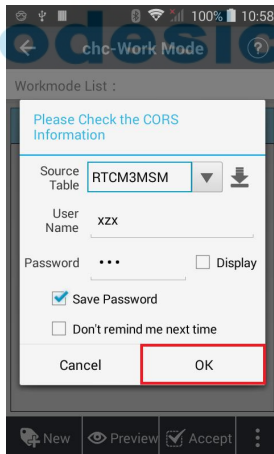
After setting other parameters, click **Save**, then the prompt “Please Set a Name for The New Mode” will pop up. Enter your **Name**, and click **OK**. Then, the prompt “Create Mode Successfully” will pop up. Click **OK**, now, the work

mode is available in the list. Please select the work mode then click **Accept**.



Then, the interface will lead you to check CORS information. You 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.

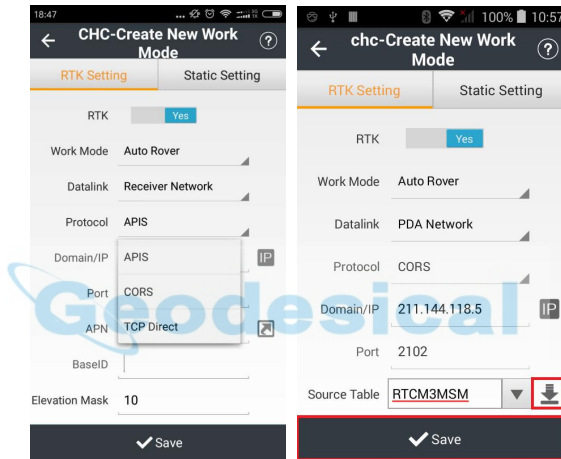
RTK: Switch on **Yes**.

Work Mode: Select **Auto Rover**.

Datalink: Select **Receiver Network**.

Protocol: Select **CORS**.

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



Input the **User Name** and **Password** for your Ntrip account. Do taking it in note that the RTCM 1021-1027 messages need to be switched on or off here. If the mount point without corresponding messages, please switch off it here.

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chc-Create New Work Mode

RTK Setting Static Setting

User Name xzx

Password Display

Don't remind me next time

1021-1022	No
1023-1024	No
1025-1027	No

Save Password Yes

Save

Click **Save**, then the prompt “Please Set a Name for The New Mode” will pop up. Enter your **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**.

chc-Work Mode

Workmode List :

Rover pda

chc-Create New Work Mode

RTK Setting Static Setting

Auto Login Yes

Use VRS Yes

Elevation Mask 10

PDOP Limit 6

RTK FREQ 1HZ

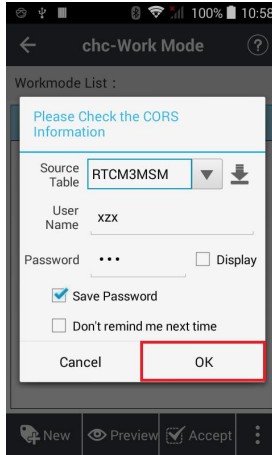
Safe Mode Normal Mode

Ionosphere Model No Disturb

New Preview Accept

Save

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

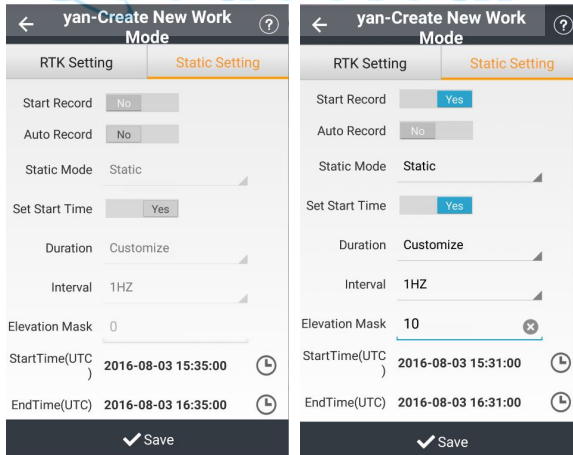


Then the green LED will flash and the states will come from **Single** to **Fix**, which means the rover is getting the correction data from base.

3.2.6 Static Settings

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

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



Set Start Time: Switch on, and it means start time is turned on, otherwise off.

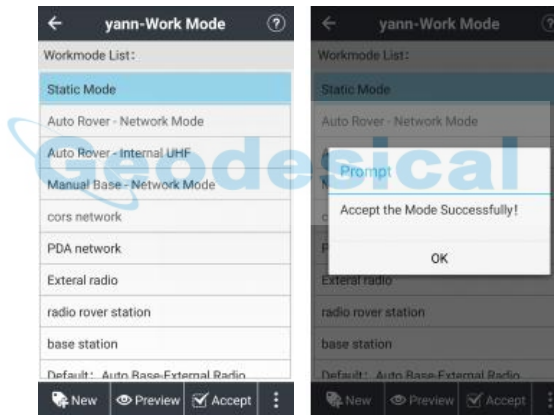
Duration: Default duration is 1 day, and you can also customize. Then, you

should set start time and end time at the bottom of the interface, otherwise you cannot start static recording.

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

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

After setting these parameters, click **Save**, then the prompt "Please Set a Name for The New Mode" will pop up. Enter your 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**. The software will prompt "Accept This Mode?" click **Yes**, then, the software prompts "Accept the Mode Successfully!" click **OK**, and then we finish completing static mode setting.



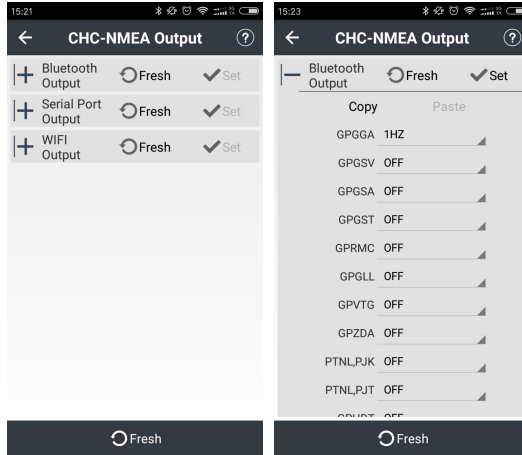
Now, you have already been static recording. However, when RTK and static recording exist at the same time again, RTK status will become a priority, including whether automatically record, recording period, mask angle, the sample interval. Click **Info** or **Config - Device Info** to view the current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



3.3 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 you have done the set of the output mode by Bluetooth, Serial Port or WiFi, you can copy the config and paste it to other output mode when you 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.

3.4 Device Info

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 your local dealer or CHC technical to get the code.

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

Modify

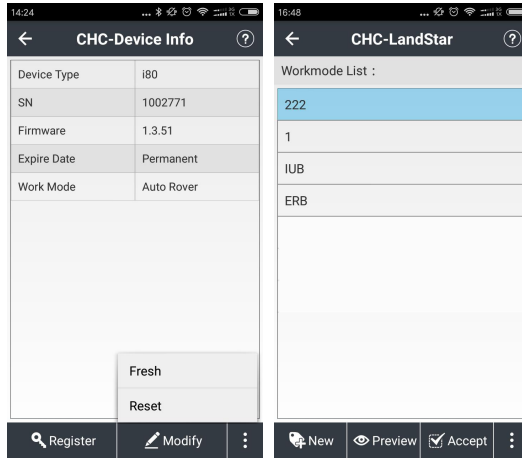
Click **Modify**, it will display the list of the Work Mode to modify the receiver working mode.

Fresh

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

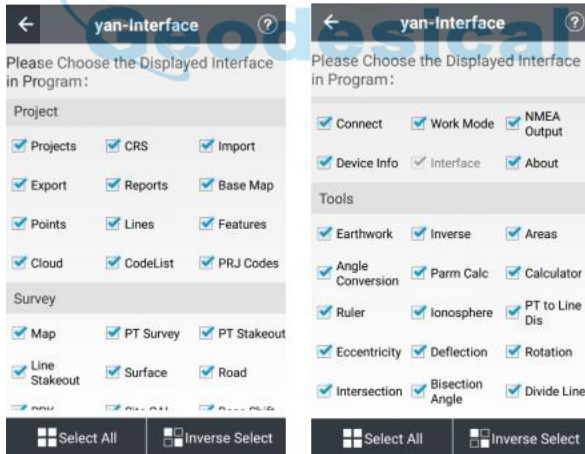
Reset

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



3.5 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.



3.6 About

If the software isn't registered, please contact your sales representatives. You can visit CHC official website by scanning **Website QR Code**.

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

4 Survey

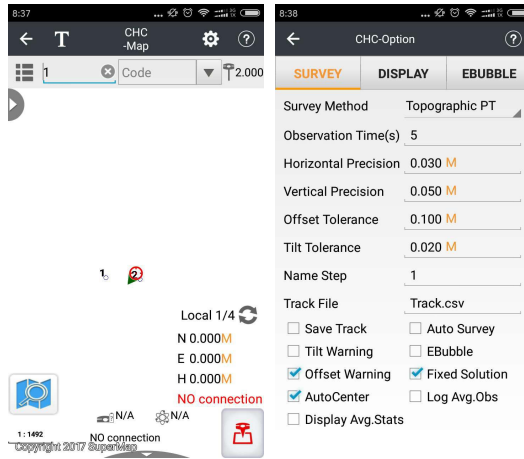
4.1 Map

Main functions:

1. You can see the graph with basemap, and all the basemaps can be displayed.
2. During measurement, the point, line and surface will be displayed in different color or style (colors of points, lines and surfaces follow generally the colors chosen when you create the new codes).
3. During measurement, you can select the codes for the points, lines and surfaces (on point survey interface, only the codes of points are available).
4. During the features surveying (points, lines and surfaces), if the job of feature surveying is not finished one time, and you 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 you are doing.

4.1.1 Option

SURVEY: You can view survey information in this interface.



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

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 you need to do the auto survey, and then the current point survey will stop; if you choose **Continue**, the survey will continue.

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

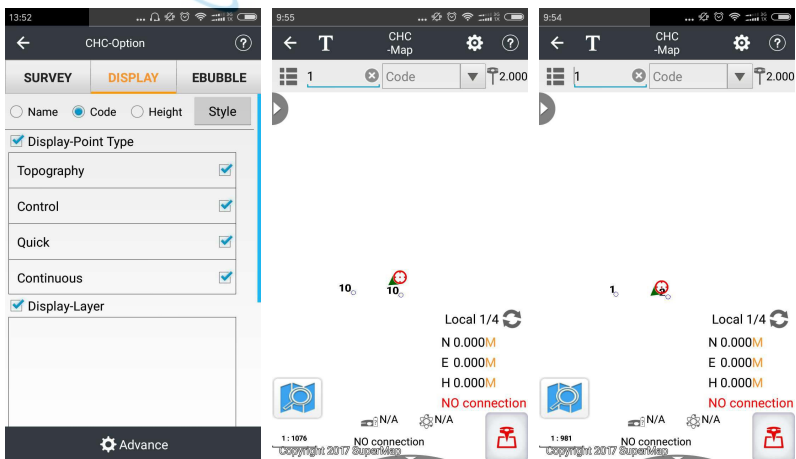
Fixed Solution: If the fixed solution ticked, then you can measure only when the solution is fixed; please uncheck the fixed solution, if you want to measure even when the solution is single or floating.

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.

DISPLAY: Set to modify what to display on the main interface.



Name/Code/Height: If one item is selected to be displayed, you will see it on

the interface display area. For example, if selecting **Name**, you will see the point name on the display area after measurement.

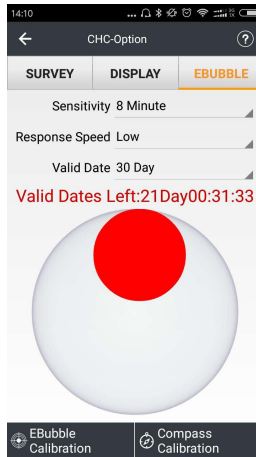
Display - Point Type: Tick to choose point type to display in the interface. For example, when we have measured a lot of topography points, control points and quick points, we can tick **Topography** if we want to see only the topography points. Then in the interface, what we can see are the topography 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.

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



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, you 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.

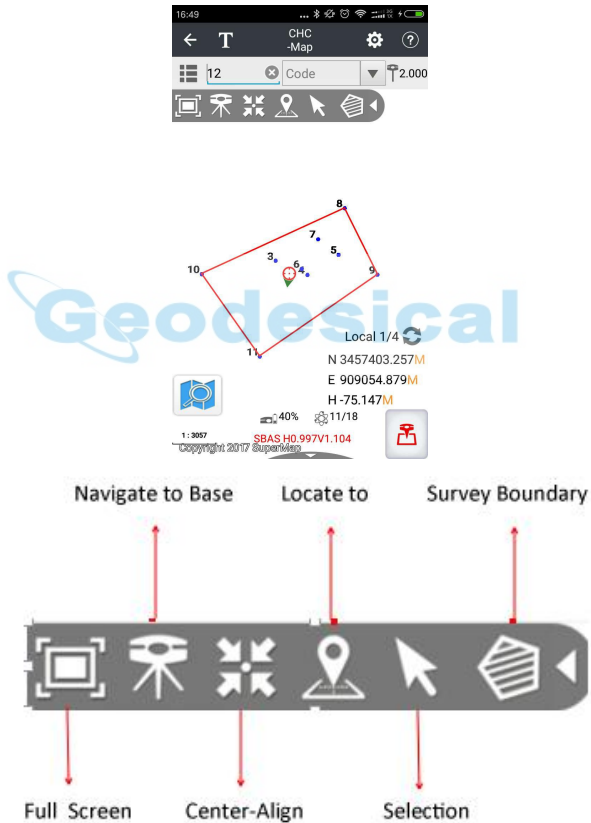
Compass Calibration: Click to view compass calibration interface, and then you will read “1) According to the Illustration Slowly Rotating Equipment” and “2) At the Same Time Rotate Yourself Slowly”. You should keep the i80 receiver level, and make the LCD panel face to yourself. Then do the clockwise 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 you 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: You 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

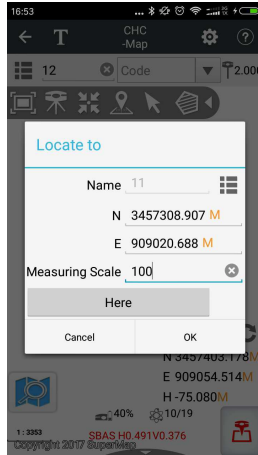
sensor. If you can't avoid the condition mentioned, please stay away from the above items when doing the calibration of magnetic sensor.

4.1.2 Symbols

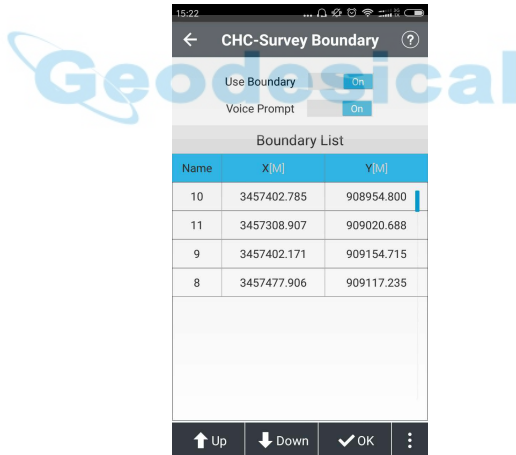
Symbols: You will view symbols in drop-down menu on the left of interface.



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



Survey Boundary: Click to view survey boundary interface, you 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**, **Eccentric PT** and **Compensate PT**.

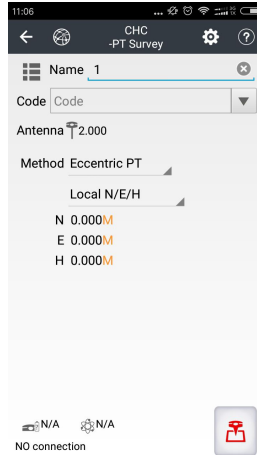
Continuous PT: Continuously survey points automatically according to a preset fixed time period or space distance.

Eccentric PT: When you cannot reach the target point, this function is helpful. Input the azimuth angle between the target point and the current position (You 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).

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).

Note: Before surveying, you 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 you 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 you 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 we stakeout the points, we 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 (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.

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

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, we 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 you want to go back to use other features of stakeout line, you can erase the mileage that you already input.

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 & horizontal-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 you 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 you 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, you can input the point directly, or you 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 you 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 you choose "one point +azimuth angle + distance", you 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.

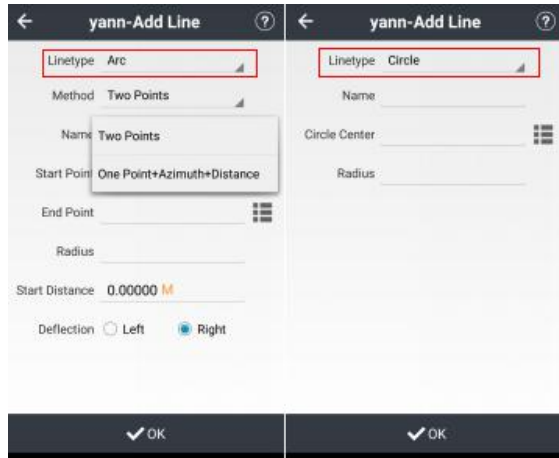


Select the Circle, select the coordinates of the center point from the library, enter the radius;

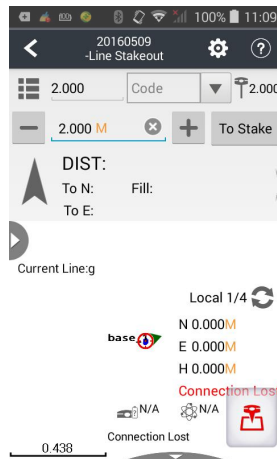
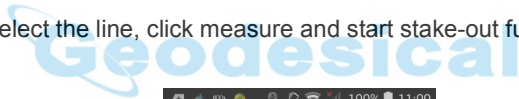
Select the Arc Line, "two-point type": Enter the starting point, end point, start mileage, radius, deflection direction; "one point+ azimuth angle

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+distance" ,enter the starting point,radius, starting mileage, length, starting azimuth angle, deflection direction.



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



4.5 Surface Stakeout

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 you 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, you can click icon on left to set stakeout information (the light point is we add Cut Tolerance and Fill Tolerance) .

Coordinates Library		Points to be Staked	
<input type="checkbox"/>	Name	Code	N
<input checked="" type="checkbox"/>	23	A1	34... 53
<input checked="" type="checkbox"/>	22	A1	34... 53
<input checked="" type="checkbox"/>	21	m2	34... 53
<input checked="" type="checkbox"/>	20	m2	34... 53
<input checked="" type="checkbox"/>	19	m2	34... 53
<input checked="" type="checkbox"/>	18	m2	34... 53
<input checked="" type="checkbox"/>	17		34... 53
<input checked="" type="checkbox"/>	16		34... 53
<input checked="" type="checkbox"/>	15		34... 53

13/27

The screenshot displays the 'CHC-Option' configuration screen on the right and a map view on the left. The configuration screen includes the following settings:

- STAKEOUT | DISPLAY | EBUBBLE
- Observation Time(s): 1
- Horizontal Precision: 0.100 M
- Vertical Precision: 0.200 M
- Tilt Tolerance: 0.020 M
- Offset Tolerance: 0.100 M
- Name Step: 1
- Lift Value (Vertical): 0.000 M
- Cut Tolerance: ≥ 0.100 M
- Fill Tolerance: ≥ 0.100 M
- Tilt Warning:
- EBubble:
- Offset Warning:
- Fixed Solution:
- AutoCenter:
- Alarm:

The map view on the left shows a red polygon with vertices numbered 1 through 11. A central point is marked with a red circle and a blue dot. The map includes a scale of 'Local 1/4', coordinates (N 3457403.257M, E 909054.879M, H -75.147M), a battery level of 40%, and a date of 11/18. A copyright notice for 'SBAS HD 997V1.104' is also visible.

4.6 Road

4.6.1 The introduction of Road interface

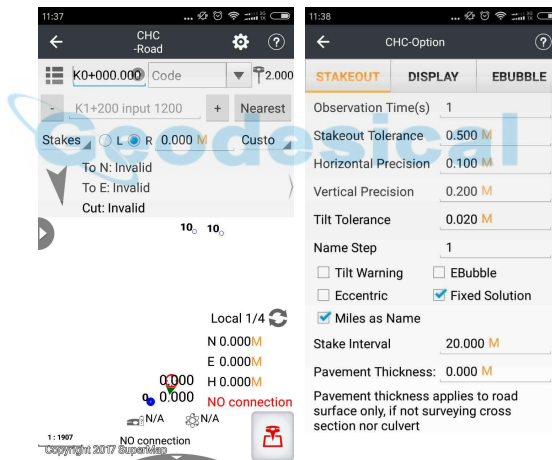
The text introductions of road stakeout divide into three ways:

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.

4. 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 your 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.

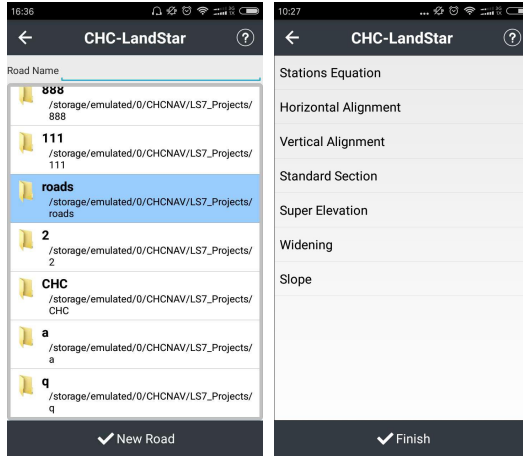
Nearest: To check the nearest stake from current position.

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

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

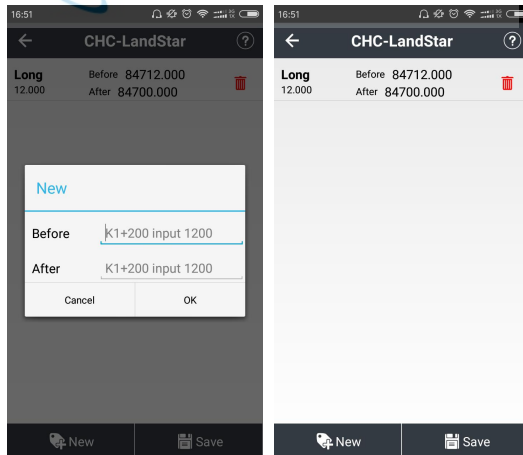
4.6.2 Road

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.

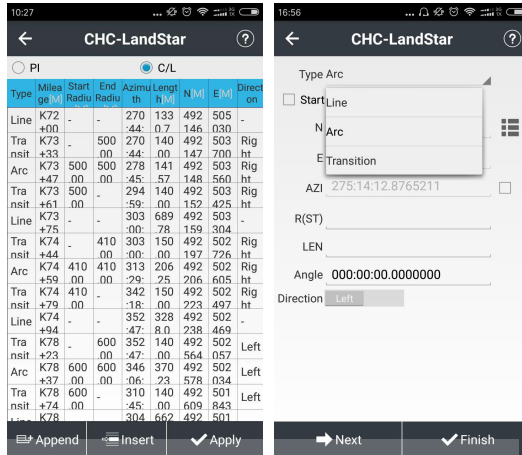
Stations Equation: Click **New** to input before and after mileage, click OK to confirm.



Horizontal Alignment:

- 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.

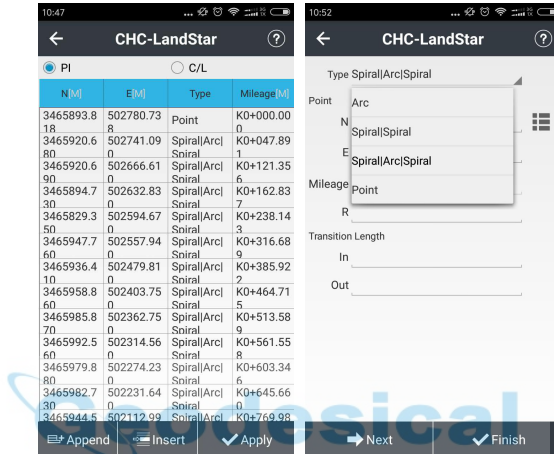
Insert: Insert roads parameters.

Edit: Modify selected roads parameters.

Delete: Delete selected roads parameters

- **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.

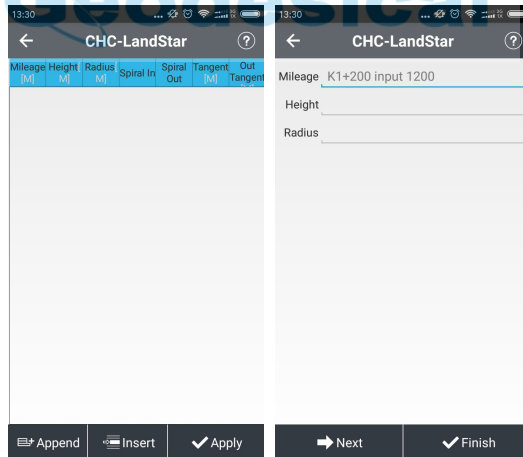
Next: Click until all curve parameters inputted, click **Finish**, and then **Apply**.

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**.

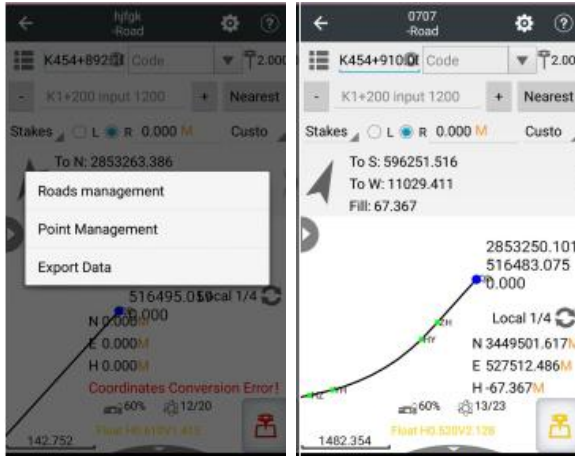
Slope: Click **New**, input slope name, slope type, start mileage, end mileage, click **Confirm and Continue** to input next slope, and then click **Save**.

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

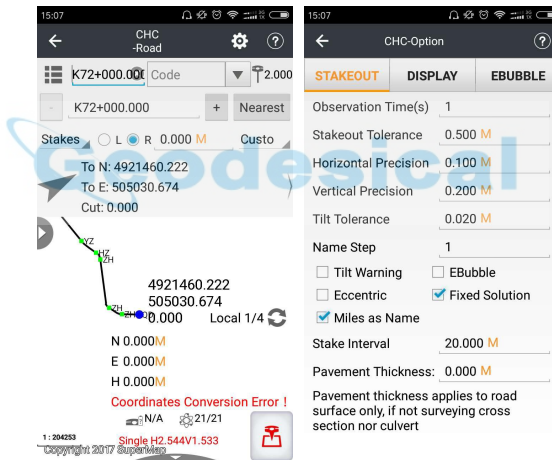
Export Data: Click to input file name, select export type and export path.

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.



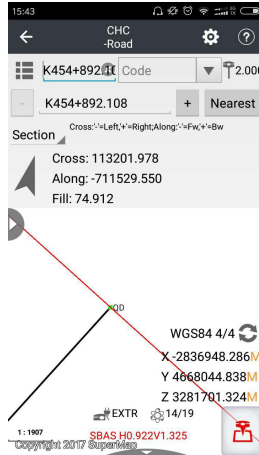
Miles as Name: Check this box, the center stake name will use the mileage.

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.



Cross: Distance from the current to cross section.

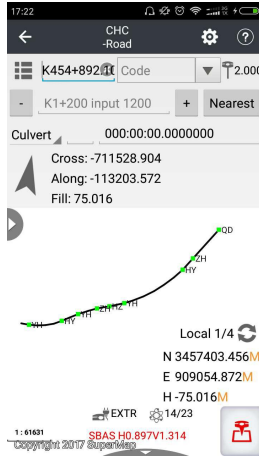
Along: Distance from projection of current position to cross section. - Indicates current position is at road.

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.

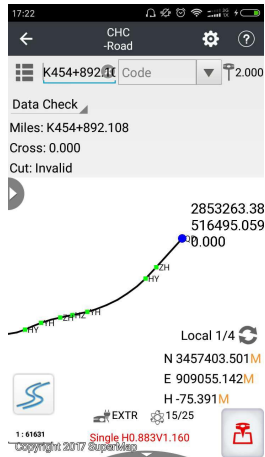
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Slope: Display current slope will appear in the main interface.



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



Free Slope: When meet slope with same type, you 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 difference 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

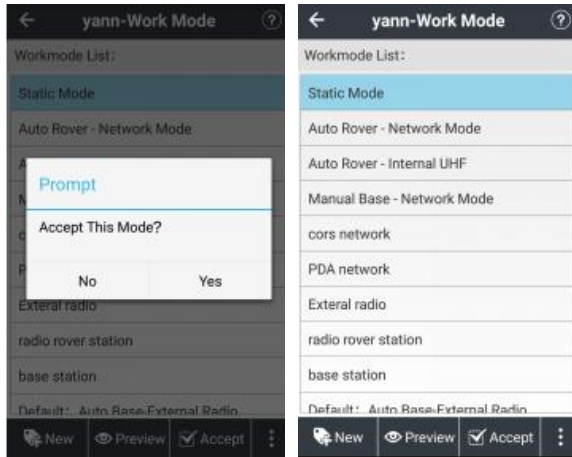
Connect: Click to set receivers as base station or rover station.

Work Mode: Set static mode from **Static Setting**.

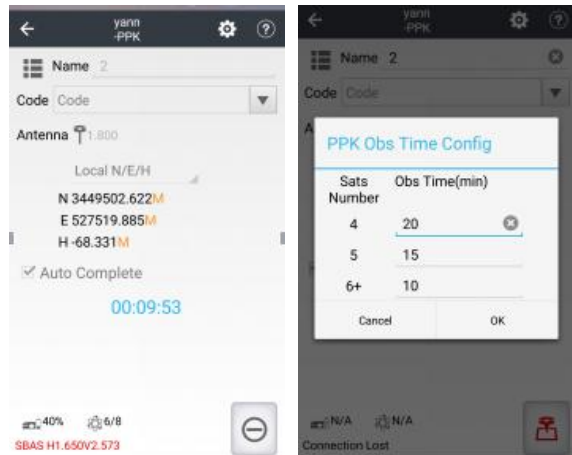
Note: Start Record button must be Yes, the suggestive value of interval and Elevation Mask should be 1HZ and 13 degree respectively, default duration is **1 Day**. If you choose **Customize**, you must set start time and end time as you wish, and end time must be latter than start time. You can only record static data after start time and before end time.



Accept: Click to Accept work mode.



Use PPK function: When you 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.



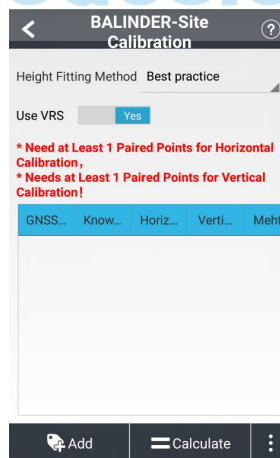
4.8 Site Calibration

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 you 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.



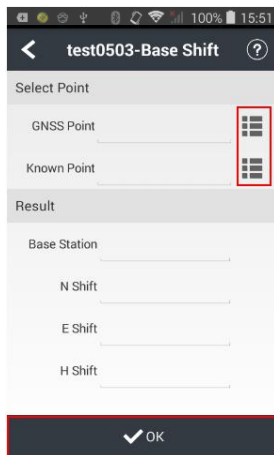
Height Fitting Method: Include fixed difference, surface fitting, best practice. Default plane fitting method is best practice.

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.

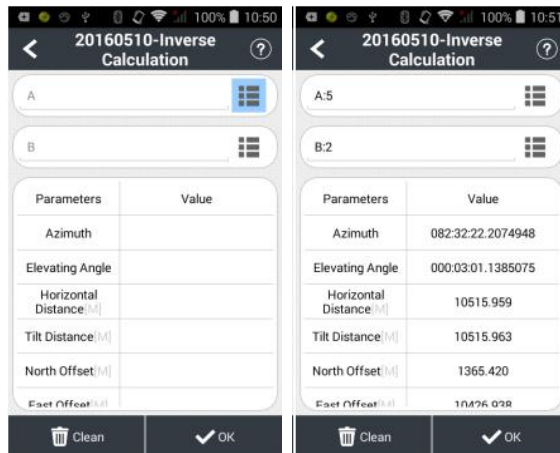


Base Shift: Click to enter base shift interface. In base shift Interface, click the icon beside GNSS Point to select a current point surveyed at a control point, click the icon beside Known Point to select the corresponding control point. The calculation results will show automatically. Then click **OK**. 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.

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.

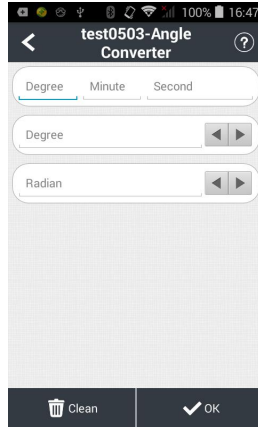


5.3 Angle Converter

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.

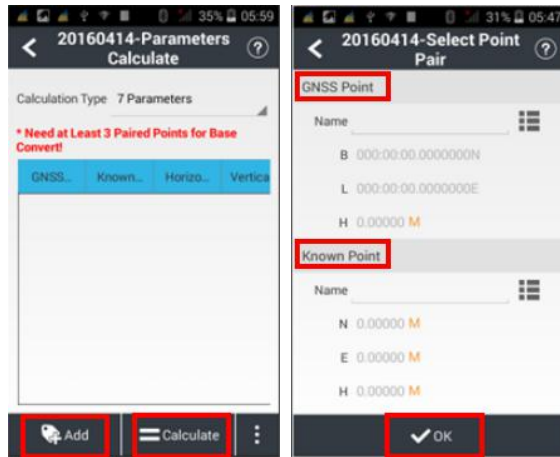


5.4 Parameters Calculate

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.

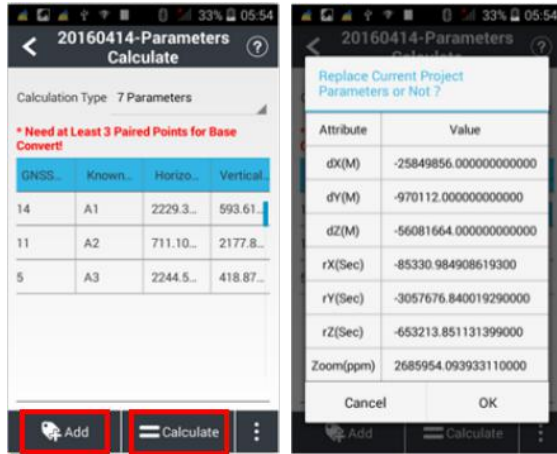
Select Point Pair: Click **Add** to add point pairs and input pairs of GNSS point and known points to calculate 7 parameters. Add WGS-84 coordinates at **GNSS Point** and add plane coordinates at **Known Point**.



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.

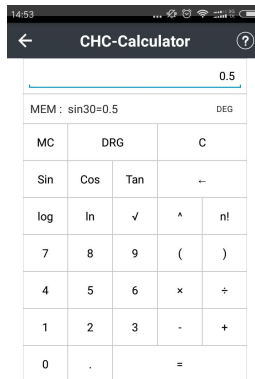
Datum trans: Back to the main menu, click **CRS** to view Datum trans interface and 7 parameters can be viewed. Default datum transformation is 7 parameters. Click **Login**, input name is admin and password is 123456, and then parameters will be unlocked.



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), $\sin 30(\text{DRG}) = 0.5$.

←: Back.

log/ln: $\log 10 = 1$.

$\sqrt{\quad}$: $8\sqrt{3} = 2$.

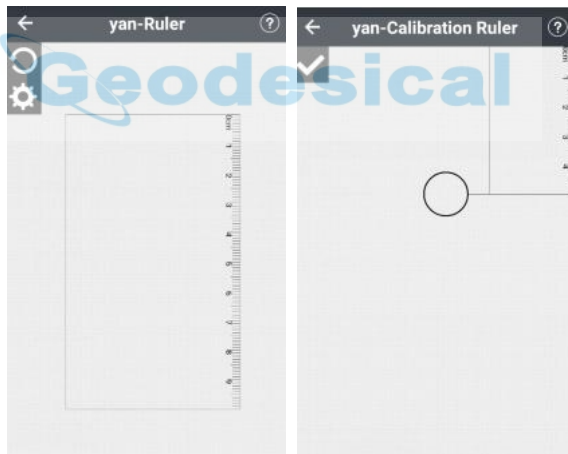
\wedge : $8^2 = 64$.

n!: $3! = 6$.

5.6 Ruler

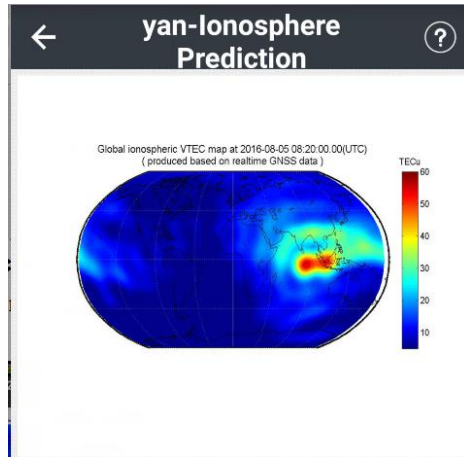
This function will provide you a ruler to do some simple measurement.

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



5.7 Ionosphere Prediction

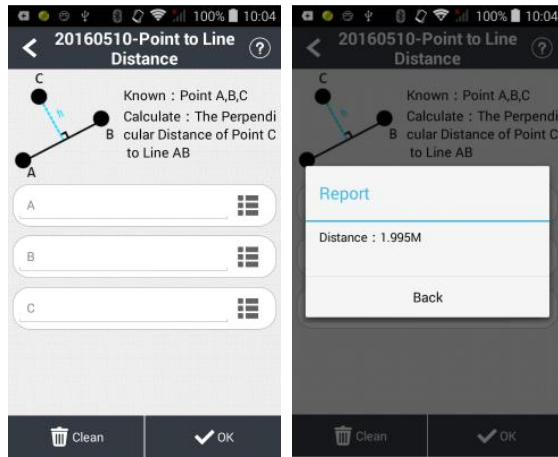
Display ionospheric conditions at present and update every 10 minutes.



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.

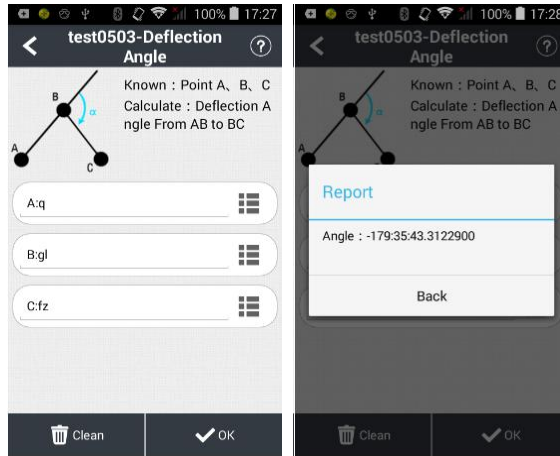
Perpendicular (PP '): Input the vertical distance.

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

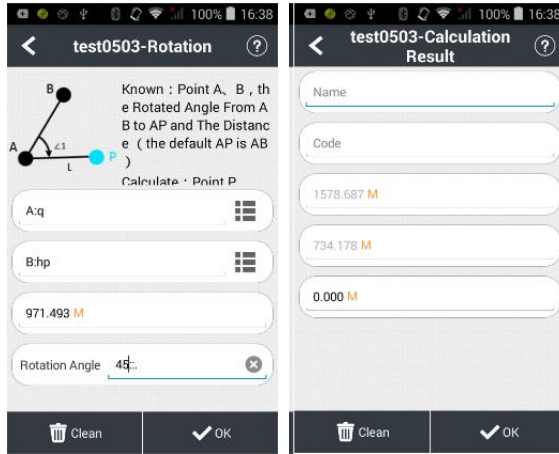
Rotation: Point P is on the line AB which rotates a certain angle. After selecting AB points, the system will calculate the distance between A point and B point as default and this distance as initial value for AP. the value of AP can be negative which means the P point is in the extension line of selected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

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

AP: Initial distance.

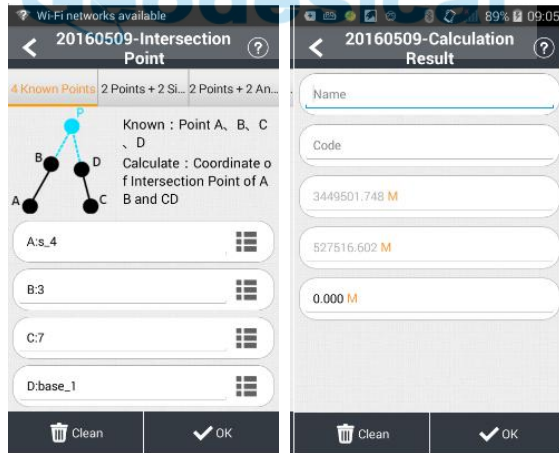
Rotation Angle: Click **OK** will show calculate result.

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



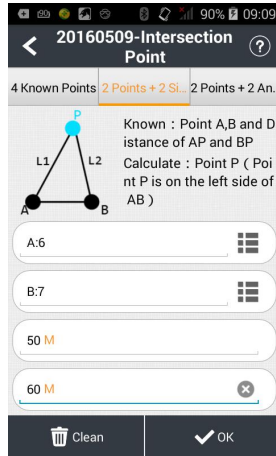
5.12 Intersection Point

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

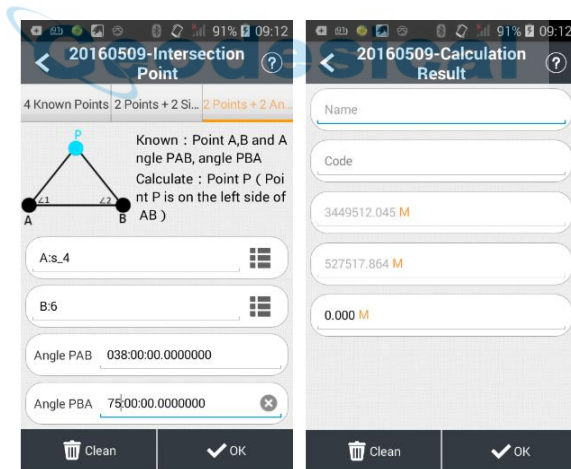


Points + 2 Sides: Select points A and B from point management. Enter the length of line AP and line B. Click **OK** to calculate. Input a name, and click **OK**

to save.



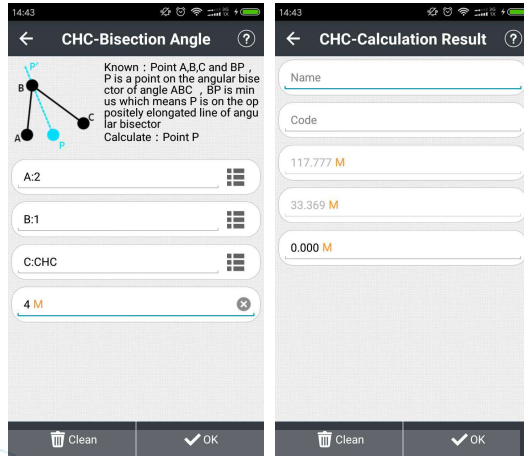
Points + 2 Angles: Calculate intersection P with known points A and B and the inner angle of PAB. Click **OK** to calculate. Input a name, and click **OK** to save.



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 means Point P is on the oppositely extension line of the angle bisector 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 you a successful division. Click Points of **Project** to review points.



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