Hi-Survey Software

User Manual

Manual Revision

File number：

Revision	Revision	Description

Preface

Introduction

Welcome to use Hi-target Hi-Survey Road Software.

This introduction describes how to install, set and use the product.

Experience Requirement

In order to help you use Hi-Target series products better, Hi-Target suggests you carefully reading the instruction. If you are unfamiliar with the products, please refer to www.hi-target.com.cn.

Tips for safe use

Notice: The contents here generally are special operations, needing your special attention. Please read the contents carefully.

Warning:

The contents here generally are very important. Such wrong operation may make the machine damaged, make the data lost, even breaks down the

system and endangers personal safety.

Exclusions

Before using the products, please carefully read the operating instruction, and it will help you better use it. Hi-Target Surveying Instrument Co., Ltd will not assume the responsibilities if you fail to operate the product according to the requirements in operating instruction, or operate the product wrongly because of failing to understand the operating instruction.

Hi-Target is committed to constantly perfect product functions and performance, improve service quality and reserve the rights to change the contents in operating instruction without separate notice.

We have checked the consistency between contents in instruction and software & hardware, without eliminating the possibility of deviation. The pictures in operating instruction are only used for reference. In case of inconformity with products, the products shall prevail.

Technology and Service

If you have any technical issues, you can call Hi-Target technology department for help, we will answer your question in time.

Relevant Information

You can get this introduction in the following ways:

1. After purchasing hi-target receivers, you can find this manual in the instrument container to guide you how to operate instrument.
2. Log in hi-target official website, download the electronic version introduction in "Download Center" → "Manual" → "Surveying Products"

Advice

If you have any comments and suggestions, please call us or Dial the national hotline: +86 400-678-6690. Your feedback information will help us to improve the quality of the product and service.

Content

CHAPTER

1

Software Introduction

This chapter describes:

- Software Introduction
- Software Feature
- Software Installation
- General Collection

Software Introduction

Hi-Survey is the first measure software with high accuracy on Android system of Hi-Target in 2013, including Hi-Survey Road and Hi-Survey Elec.

Hi-Survey software should run on Android 2.3.3 or above, can run on Hi-Target professional measure controller, general phone, pad and some other Android devices. Just copy the Hi-Survey APK to the Android device and install it or do it by third party assistance software.

Hi-Survey Road

Hi-Survey Road is designed for road measuring and staking, can be used for staking complex road, combining road line, and has three road algorithms (Intersection, Element, Coord), cross section can be defined freely. Generally, the computing result can support all kind roads, and connect receivers to measure online by WIFI, Bluetooth and network.

1.1. Software Feature

1. Easy to use

(1)More logical, more convenient, less interface level than Hi-RTK;

(2)Text and Graphic measuring interface in Detail Survey can be chose by user;

(3)Simple design to give a big mapping screen;

(4)Station option can be one key set by configuration file;

(5)Defined coordinate system and selected by region, convenient to set coordinate parameters;

(6)Support many kinds angle unit, meet the operating habits and business demand customers, good for globalization.

2. Support operating big data

(1) Support big raster, vector data (.ed2, .edt, .dxf);

(2) Raw data and coordinate data saved independently, and the antenna type and height of raw data can be changed, to make sure the data can be recovered;

(3) More complete antenna parameters management.

3. Fashionable

(1) The software and receiver firmware check the update online automatically;

(2) Hi-Target and profession news are real-time pushed;

(3) Beautiful and fashionable interface;

(4) Wonderful and rich visual and touch experience.

1.2. Software Installation

Installation

Copy the Hi-Survey Road program (.apk) to Android device, click it to start installing, installed success after several time, there will be a Hi-Survey Road icon on desktop. The software also can be installed by third party assistance software.

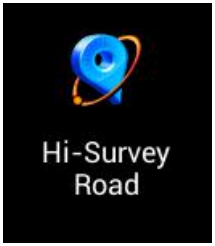


Figure 1-3-1

Starting interface

The first running, it will show the welcome pages to tell the software features, slide them to the starting interface.

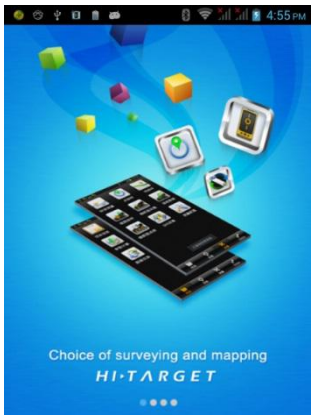


Figure 1-3-2

Figure1-3-3

There are 4 pages on main interface: Project, Device, Survey, COGO. (Slide or press the Tab button to change the page)

There are 3 main interface themes: List, Style Box (default) and Simple. It can be changed on Configure-Theme.

In all theme, the module can be added and deleted, long press the module to delete. In Style Box and List, the module can be recovered in Project-Configure-Module Recovery.

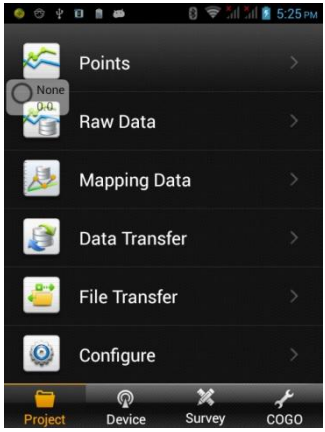


Figure 1-3-4 (List)

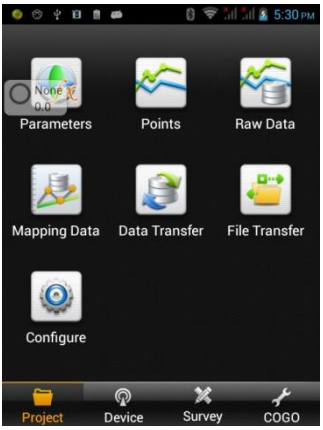


Figure1-3-5 (Style Box)

Figure 1-3-6 (Simple)

Hi-Survey working on the folder ZHD and project is saved in folder ZHD/Project/Road.

When doing measurement, firstly create a new project, set the parameters and they are saved in the *.prj file, meanwhile, there will be a *.dam file with name of the project, also the coordinate points, stake points, control points will saved in map folder. After project creating, the project files structure just like the picture showing. (If no SD card, will automatically create backup file *.bak)

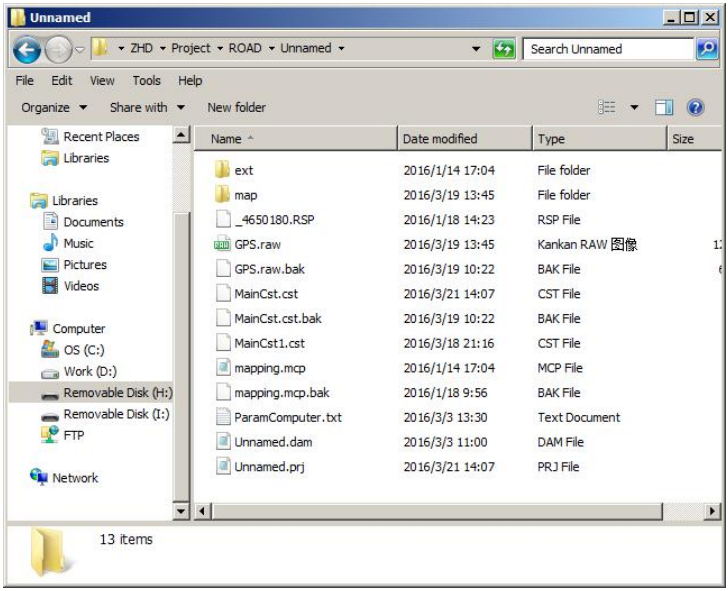
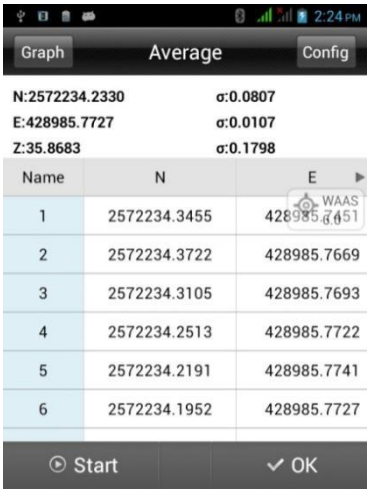


Figure 1-3-7

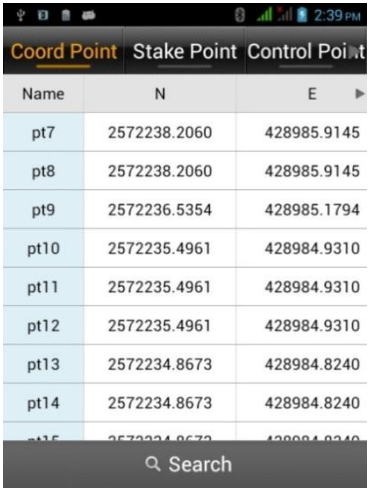
1.3. General Collection



Average

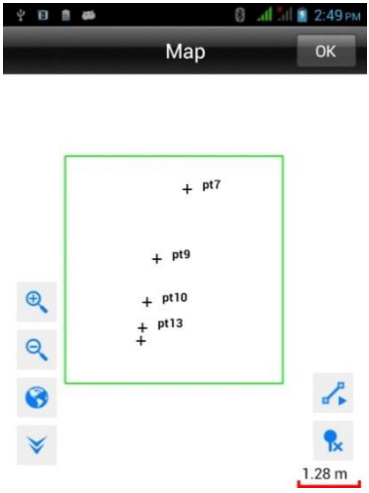
Get the coordinate in single status by average, 10 times default, including average, weighted average, window average, median filter.

Real-time Collecting



Select point in library

The NEZ point can be selected in Coord Point library, Stake point library, Control Point library. The BLH points can be selected in Raw Data library and Control Point library.



Select point on map

Also you can select the points on map.

CHAPTER

2

Project

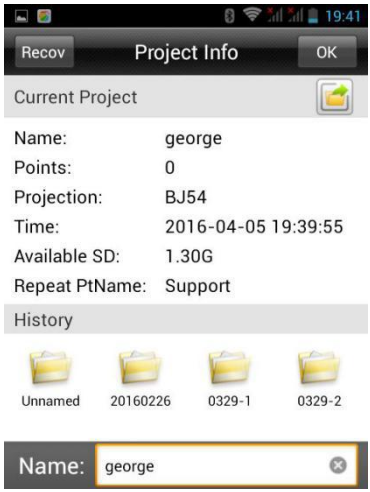
This chapter describes:

- Project Introduction
- Project Settings
- Projection
- Parameters Calculation
- Points
- Raw Data
- Mapping Data
- Data Transfer
- File Transfer
- Configuration

2.1. Project Introduction

Click Project Info in main interface to get the project information, and manage the project. In here, you can check the Name, Points, Projection, Time, Available, whether support Repeat PtName and some History information. The Project Report can be created, opened, deleted, recovered and exported.

Figure 2-1



【OK】

After input the project name, if there is a history project has the same name, and it will be opened after clicking OK; Or create a new project and be the current project.

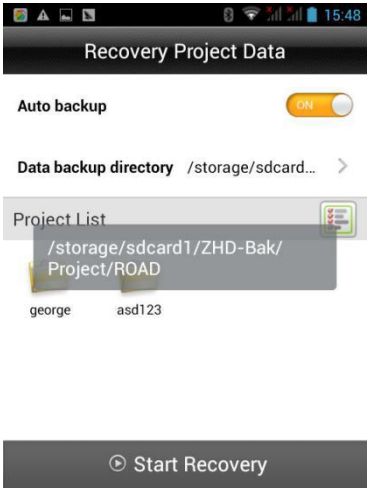
The history project can be opened and deleted by long pressing.

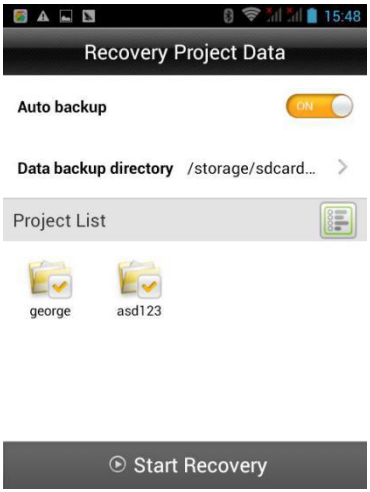
【Delete】

Delete the selected project. The project can be deleted directly or backup before delete, so customers can rescue their project after unintended operation.

【Open】

Let the project be the current project.





【Recover】

Created a project or collected a point, the raw data, dam file or QR code, project information file, cross section points library will be backed up in the same project name folder in external SD card ZHD-Bak folder. The Recover function can't be used if no external SD card.

【Project】→【Project Info】→【Recover】, the Raw data, coordinate parameters and project information can be recovered from ZHD-Bak folder of external SD card to the working folder. Long press the project to select, press again to cancel select. Click 【Select All/Cancel All】 to select all projects or cancel. After selecting, click 【Start Recovery】 to recover.

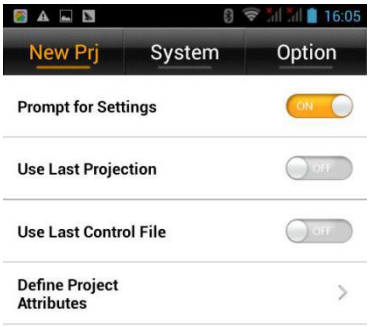
The recovered project will be saved on 【Project Info】→【History】, if there is a history project has the same name as the recovered project, it will add "_1" at the end of the recovered project name.

【Export】

Export the Project Report of the current project.

2.2. Project Settings

New project



【Prompt for Settings】

Opened, it will automatically go Project Settings- System interface after creating a new project.

【Use Last Projection】

Opened, the current project will use the same coordinate parameters of the last project.

【Use Last Control File】

Opened, the control point of the last project will be copied o the current project.

【Define Project Attributes】

After defining project attribute, it will auto go this attribute inputting interface to edit corresponding attribute after creating a new project.

System

Coordinate parameters can be set (by dam file, QR code and coordinate system manager) and managed in 【System】. If coordinate parameters are changed, the coordinate point library will be updated.

Project coordinate parameters include Projection, TuckPoint, TruckPoint Info, RegulatePoint, RegulatePoint Info; Data Management is for external data management.

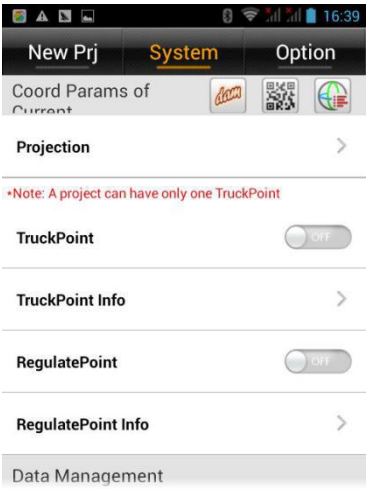


Figure 2-2-1

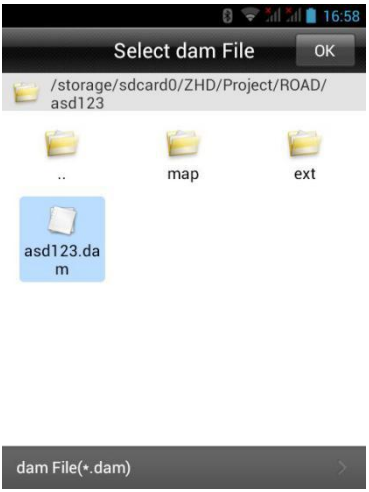


Figure 2-2-2

Coordinate Parameters -【dam file loading】

Click  to load existing dam file and apply the coordinate parameters to the current project.

Coordinate Parameters -【QR code】

Click  to QR code scanning interface, to get coordinate parameters from QR code, and create, encrypt, share your QR code.

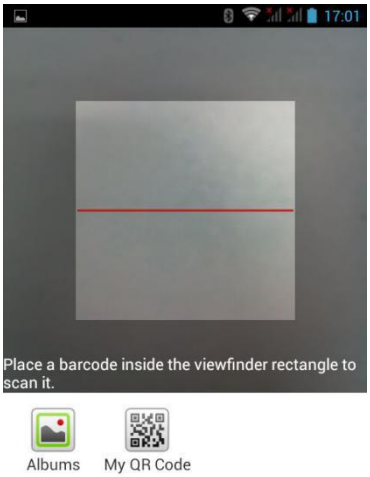


Figure 2-2-3

Figure 2-2-4

【My QR Code】Press it and it will create a QR code of the current project coordinate parameters, you can encrypt it, share it or save it, scanned the encrypted QR code, the parameters just for using but cannot be seen and edited.

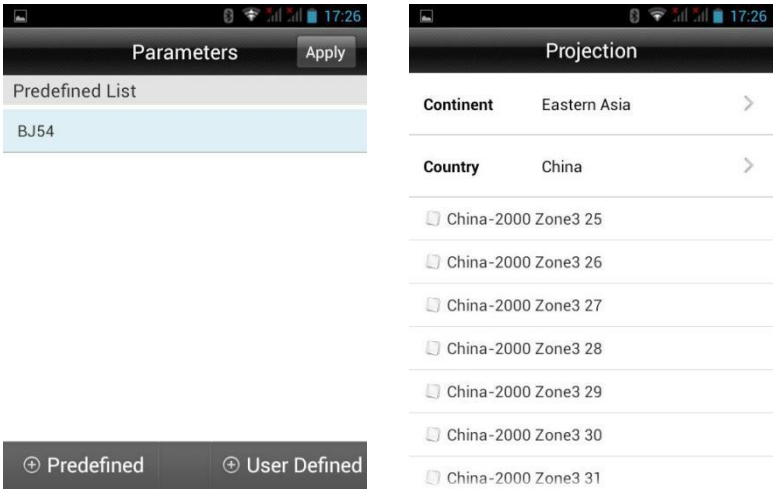
【Encrypt】The encrypted QR code also can be Shared and saved;

【Share】The QR code can be shared by the third party software to other customer;

【Save】The QR code can be saved as a picture in controller.

Coordinate Parameters -【Coordinate System Manager】

Click  to coordinate system manager interface.

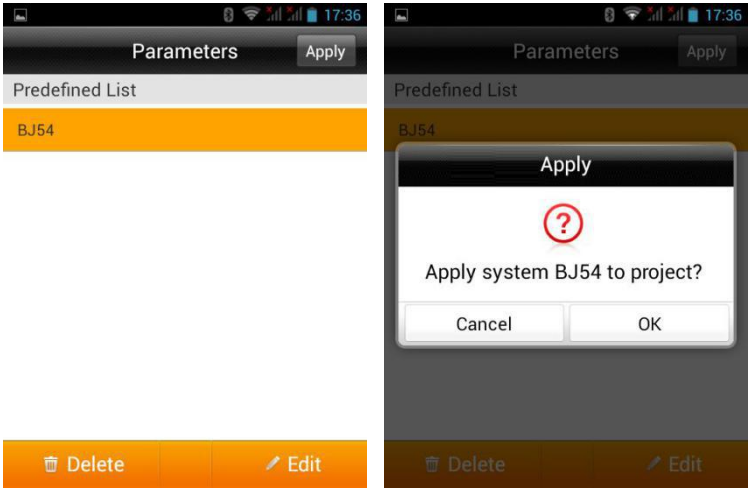


【Predefined】

The predefined coordinate systems are classified by continent and country, for convenient selection.

【User Defined】

Add user defined coordinate system according to local situation.



【Delete】【Edit】

Long press the coordinate system on Predefined List to delete and edit.

【Apply】

Apply the selected coordinate system to the current project.

Projection

Press "Projection" to go coordinate system parameters edit page, you can edit the current project coordinate parameters, but the created coordinate system just for the current project, before save, you can choose whether to update the parameters to the corresponding projection list.

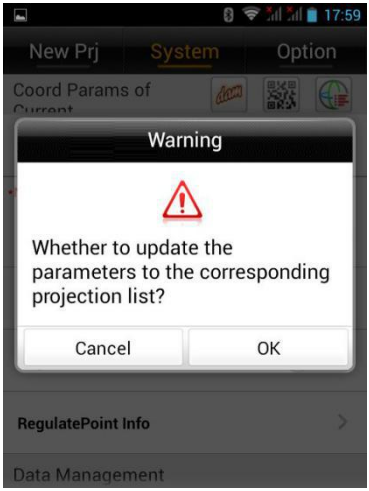
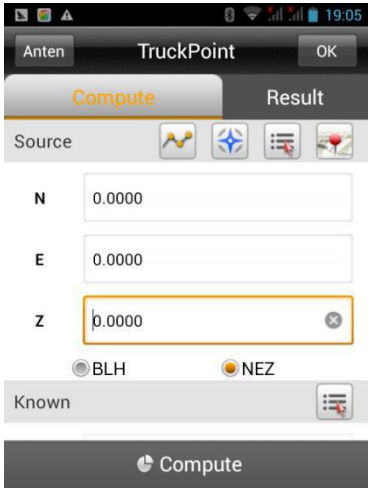


Figure 2-2-5

TruckPoint

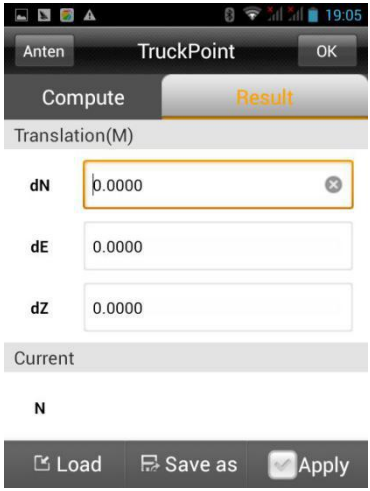
It is for computing the horizontal and vertical translation between two coordinate systems. Customers can transfer the collected GNSS coordinate to local NEZ by one point. For example, give the top left point as (0,0,0), then other points are translated to an independent coordinate system according to the point. Generally the translation value is too large, if translate BLH and NEZ, there will be a big projection error, so after translating, the BLH is still the original BLH, while the NEZ is local.



【Compute】

The source point can be got from average measurement, library, map or real-time collection. And the known point can be input directly or selected from library.

Compute the dN, dE, dZ from the source point and known point.



【Apply】

Check it to apply the correct value to project.

【Load】

Load the existing translation file.

【Save as】

Save the translation parameters as txt file, so it can be used by other projects.

【OK】

Save the translation parameters and update the project.

RegulatePoint

It is for computing the horizontal and vertical translation between two coordinate systems, generally used for two situations below.

1. Only one BJ-54, XIAN-80 point or only one point of a coordinate system which is a little rotated from WGS-84. Set the Base, then take the Rover to a known point, go Regulate Point-Compute, collect the WGS-84 coordinate, input the know point, press Compute to get the Correcting amount dN, dE, dZ, press Apply to apply the parameters and the collected points will be corrected to the coordinate system of the known point.

2. Created a project, worked a while, but don't want to set the base on the same place, so now you can set the Base on any place, and use the Regulate Point function.

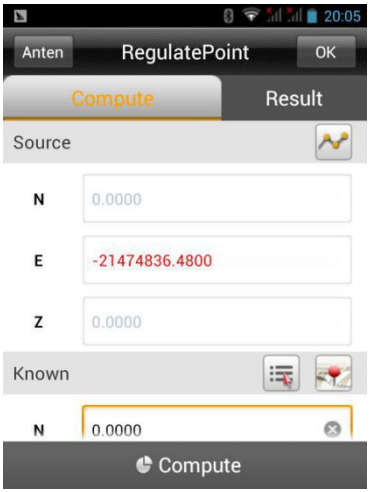


Figure 2-2-6

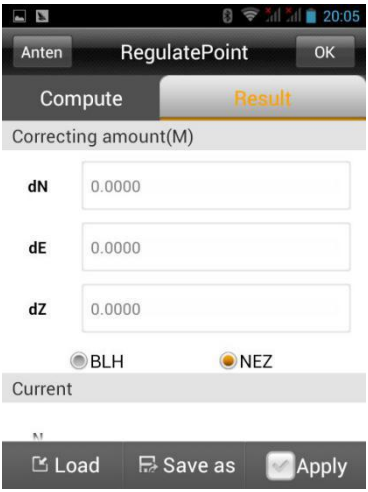


Figure 2-2-7

Data Management

Go External data management, click【Add】to load layer file (.ed2, .edt, .dxf) as the map background. After loading point, line, area layer, the raster layer always be at the bottom, followed by area, line and point.

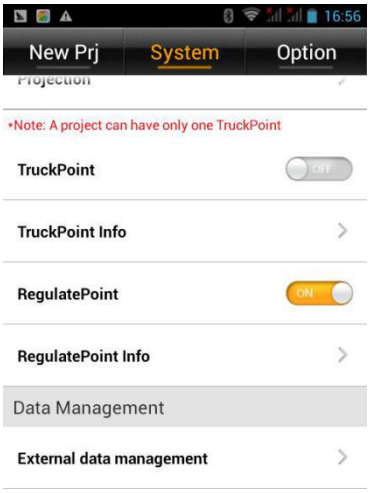


Figure 2-2-8

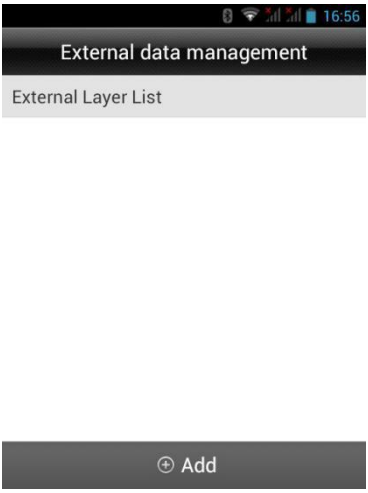
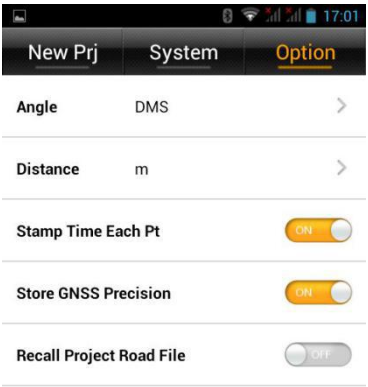


Figure 2-2-9

Option

Do some other configuration, including angle unit, distance unit, stamp time each point, store GNSS precision, recall project road file.



【Angle】

Confirm the angle unit, including DMS, Gons, mil.

【Distance】

Confirm the distance unit, including m, Feet, U.S.Feet.

【Stamp Time Each Pt】

Record the start time and end time of each point collection.

【Store GNSS Precision】

Record the precision of each point collection.

【Recall Project Road File】

Load the road file used last time after opening project.

2.3. Projection

There are 3 methods to get in the coordinate system setting interface:

(1).Main Interface →【Project】→【Projection】;

(2).Main Interface→【Project】→【Project Settings】→System →Projection;

(3). Main Interface →【Project】→【Project Settings】→System →CoordParams of Current → Coordinate System Management, long press the Coordinate system on the list to go coordinate system setting interface.

Press “Save” after setting all the parameters, there will give a prompt “Whether to update the parameters to the corresponding projection list?” Click ok to finish this parameters

setting

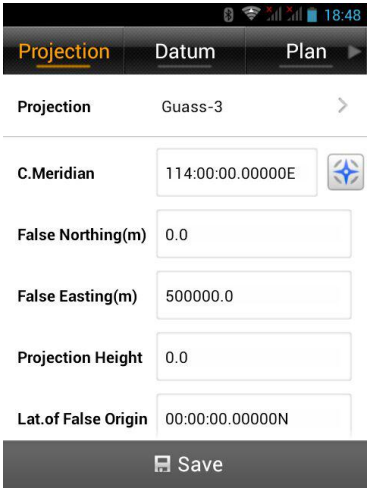


Figure 2-3-1

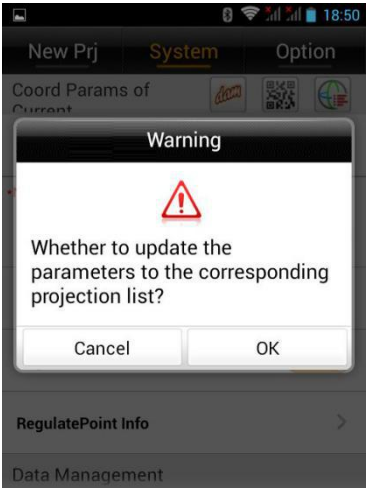


Figure 2-3-2

Projection

Frequently-used projection built-in: Gauss, Mercator, Lambert and so on. When using Guass-3 or Guass-6, the device can automatically compute the C.Meridian after connecting.

1. You can choose to add the zone number by opening Zone+;

2. Opened Zone+, all E coordinate inputting box will be zone number checked, if not matched, the coordinate will be red;

3. All data are in range of (-21474836.48~21474836.48).

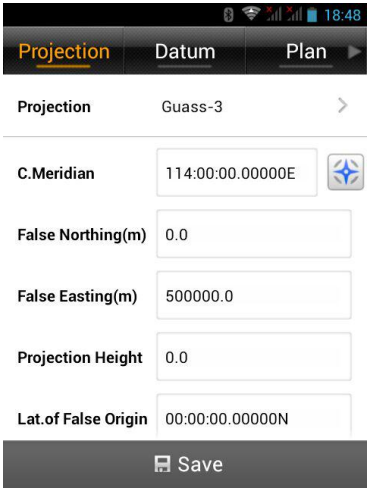


Figure 2-3-3

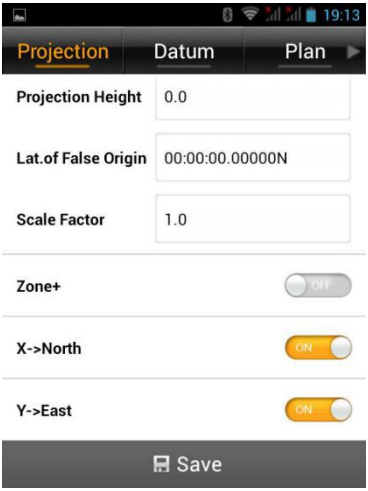
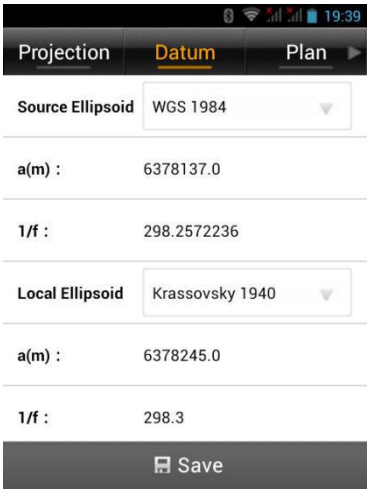


Figure 2-3-4

Datum

You can set source ellipsoid, local ellipsoid and datum transfer model.



【Save】

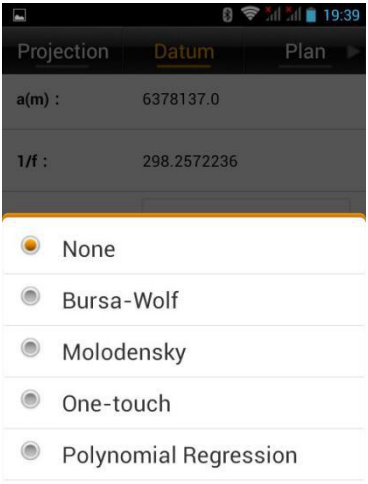
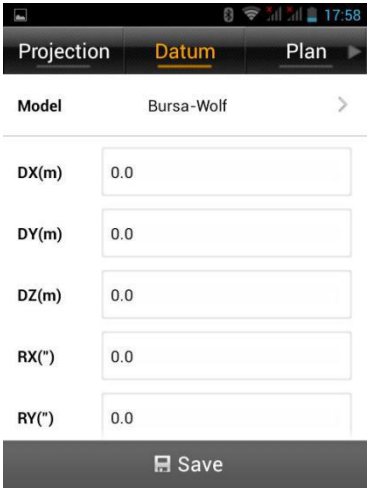
Save the parameters in a .dam file.

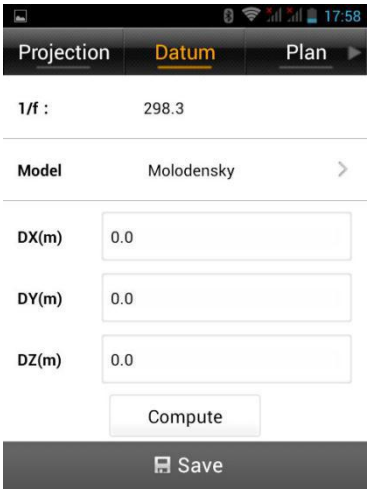
【Source Ellipsoid】

Generally using WGS-84, “a” means semi-major axis, “f” means flattening, and there are many frequently-used ellipsoids built-in.

【Local Ellipsoid】

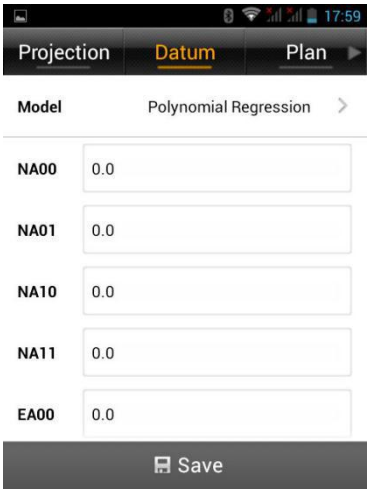
Local used ellipsoid.

	
Including: Bursa-Wolf, Molodensky, One-touch, Polynomial Regression	【Bursa-Wolf】 Including translation, rotation, scale parameters between two ellipsoids, and the rotating angle should be very small, need three points to compute.



【Molodensky】

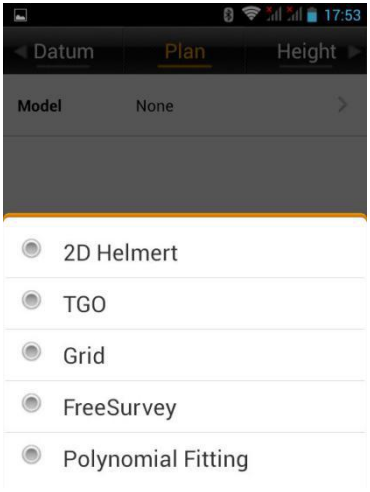
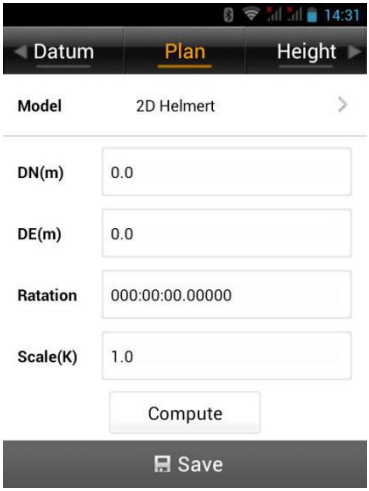
A simplified mode of Bursa-Wolf, only space translation parameters, it is a low accuracy mode, and just need one point to compute.

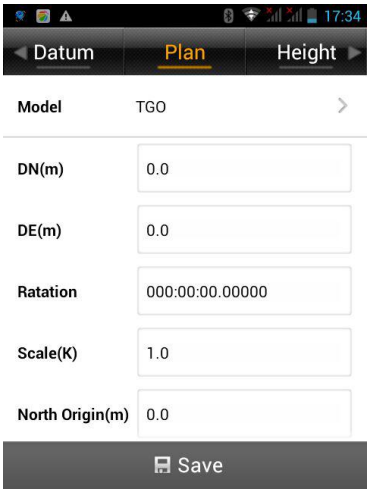


【Polynomial Regression】

Express the transfer relations of each space vector between two ellipsoids by a polynomial.

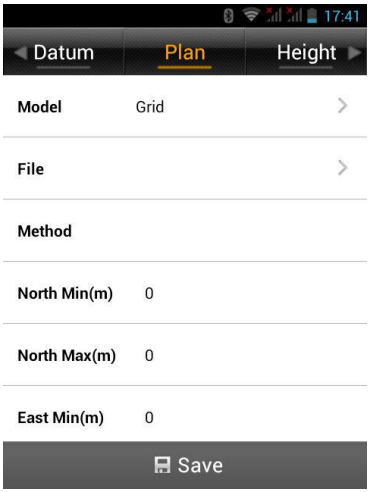
Plan

<table>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>Including:
2D Helmets, TGO, Grid, Free Survey and Polynomial Fitting.</td>
<td>【2D Helmets】
Including translation, rotation, scale parameters between two plane coordinate systems, just need two points in any coordinate system of them to compute.</td>
</tr>
</table>



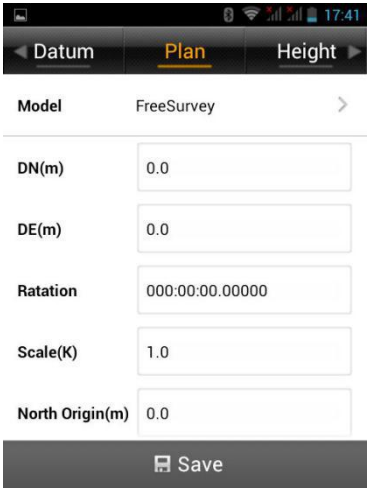
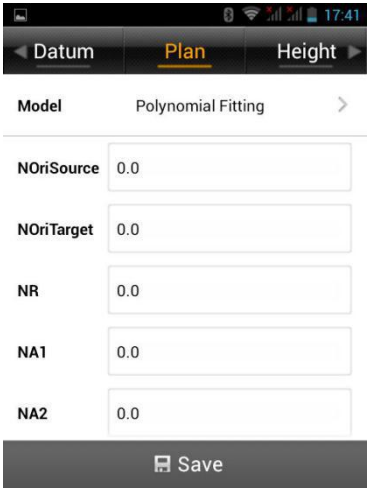
【TGO】

A plane coordinate system transfer method of TGO software, extra North Origin, East Origin than 2D Helmets.

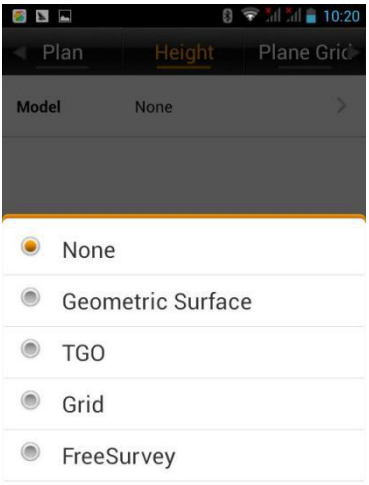


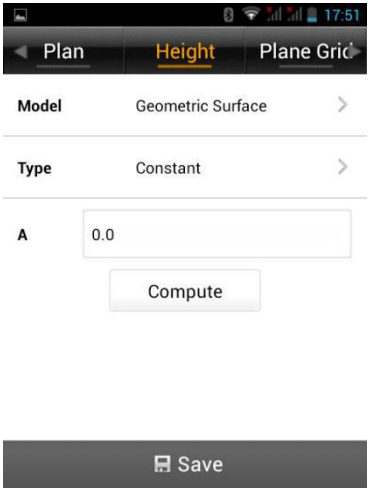
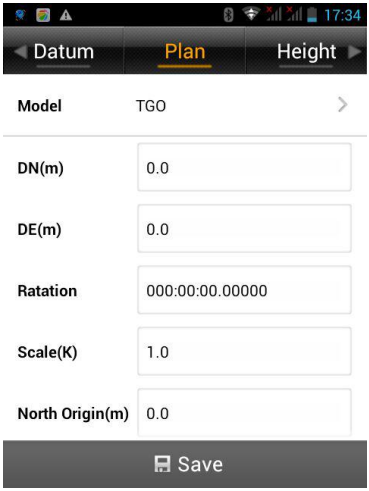
【Grid】

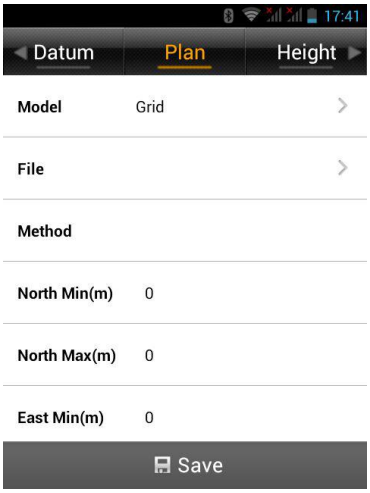
Select existing grid file to transfer WGS-84 to grid coordinate. The grid file needs to be copied to the GeoPath folder in ZHD.

	
【Free Survey】 A transfer method of THALES company, extra North Origin, East Origin than 2D Helmets.	【Polynomial Fitting】 Transfer the place by a polynomial model.

Height

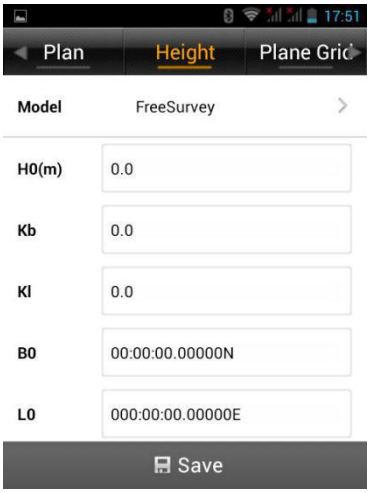
	Including: Geometric Surface, TGO, Grid, Free Survey.

<table>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>【Free Survey】
Constant: Translation, need one starting point at least. Add a constant to the height receiver measured, the constant can be negative.
Plane: Need three starting points at least.
Quadratic Surface: Need five starting points at least.</td>
<td>【TGO】
A height transfer model of Trimble TGO software, parameters include H0, Kb, Kl, North Origin and East Origin.</td>
</tr>
</table>



【Grid】

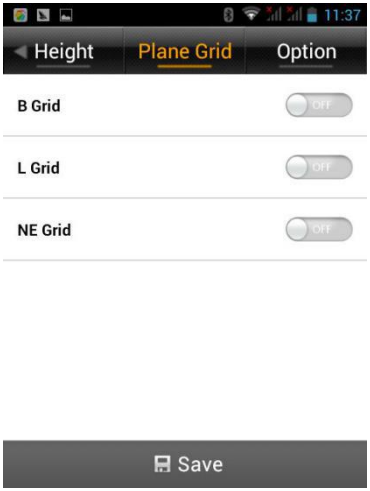
Select existing grid file to fit height. The grid file needs to be copied to the GeoPath folder in ZHD. Hi-Survey Supports ggf (Trimble), zgf (Hi-Target), bin (Geoid99), compatible with egm-96 model.



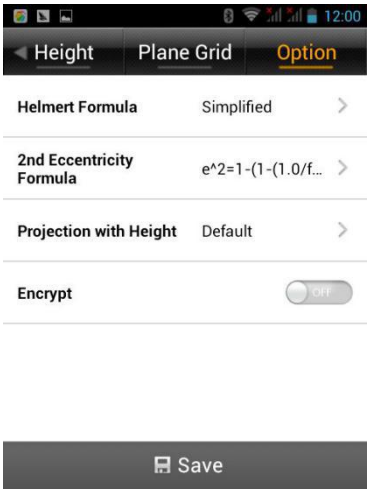
【Free Survey】

A transfer method of THALES company, parameters include H0, Kb, Kl, B0 and L0.

Plane Grid

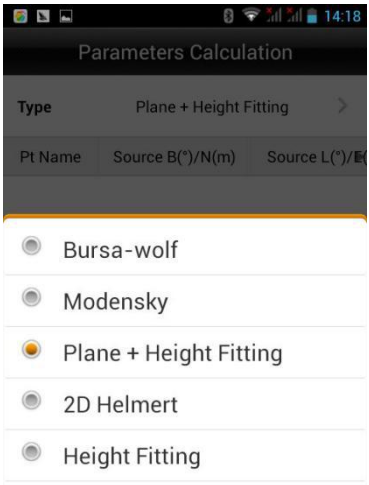
	Open the Grid needed, and then select the grid file. The grid file needs to be copied to the GeoPath folder in ZHD.

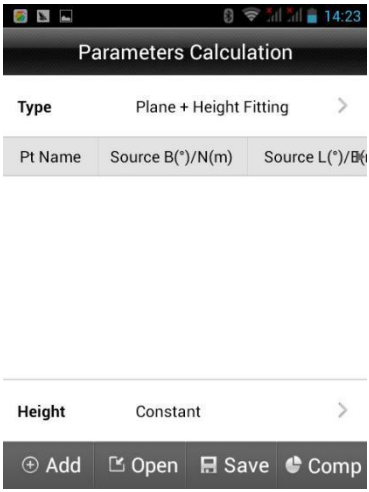
Option



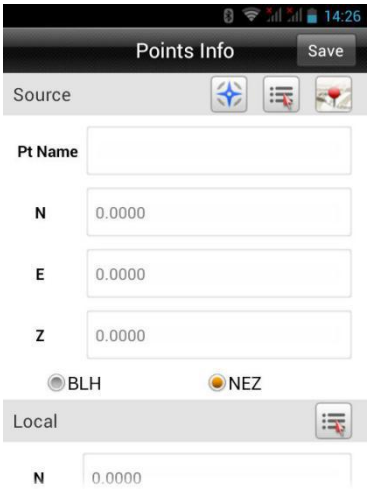
If want to apply the parameters computed by HD-Power to Hi-Survey, just input the parameters, select Simplified Helmets Formula and the first 2nd Eccentricity Formula.

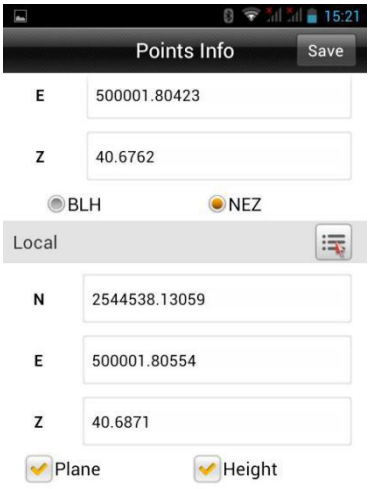
2.4. Parameters Calculation





This function is for compute the transfer relation between two coordinate systems, including Bursa-wolf, Modensky, Plane+Height Fitting, 2D Helmets, Height Fitting.

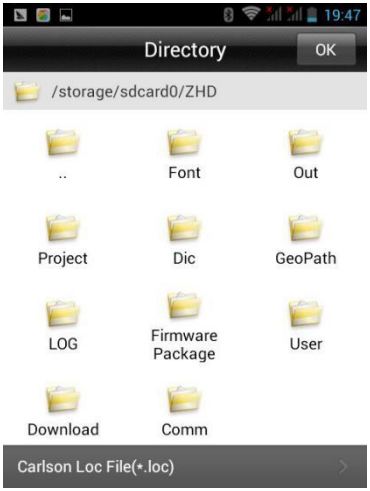
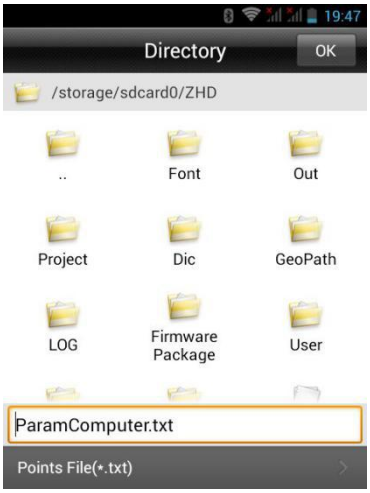


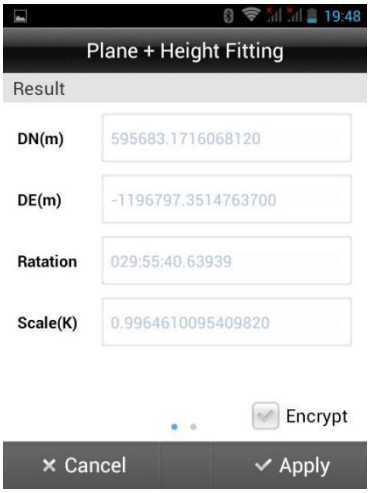


【Add】

Add a source point and a local point; source point can be input from manual, real-time collecting, library and selecting on map, local point can be input from manual and library. The real-time collecting support saving to the point library.

In Plane+Height Fitting, check Plane to use NE coordinate, check Height to use Z coordinate.

	【Open】 Support point to point file like *.txt, *.loc (Carlson).
	【Save】 Save the point to point coordinate information.



【Comp】

Compute the transfer parameters from source point to local point, Hi-Survey will compute the parameters and HRMS, VRMS of each point.

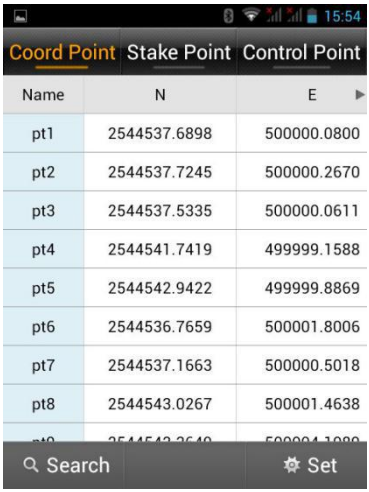
【Apply】

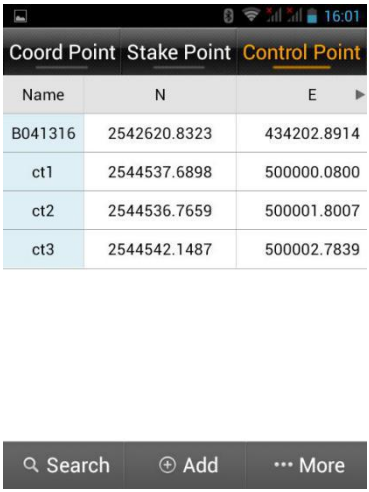
Apply to corresponding coordinate parameters, and the result will be updated to point library.

【Cancel】

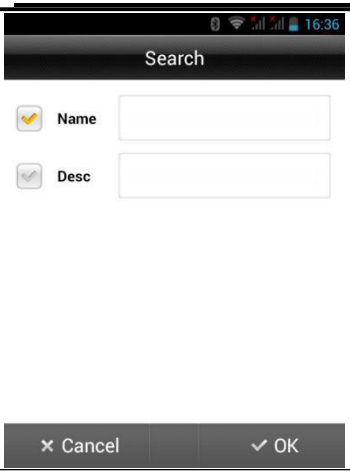
Cancel the parameters computing result and go back to calculation interface.

2.5. Points

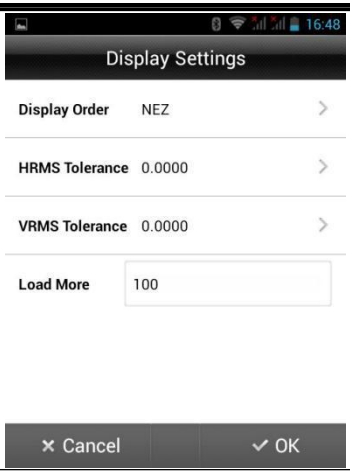




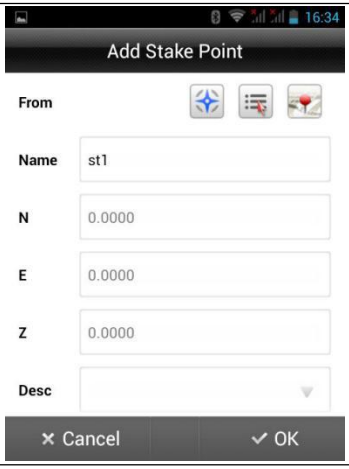
All coordinate point, stake point, control point data will be saved in here, including Name, N, E, Z, and Description. You can search and add points, change the display settings. Long press to enter select mode, check  select all, the selected points can be deleted or edited, you can delete many points, but just edit one point.



【Search】Search a point by name and description.

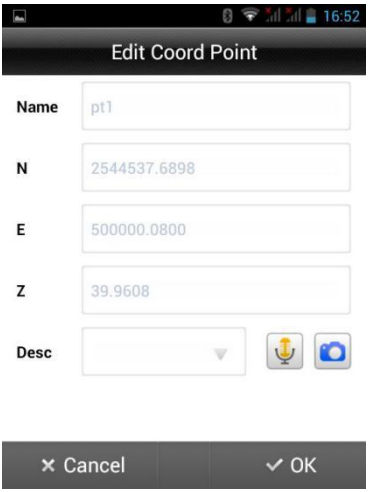
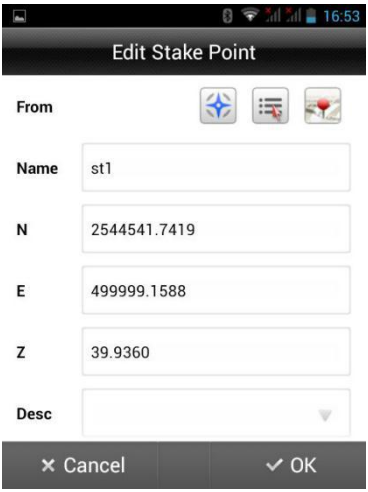


【Set】Display Setting.



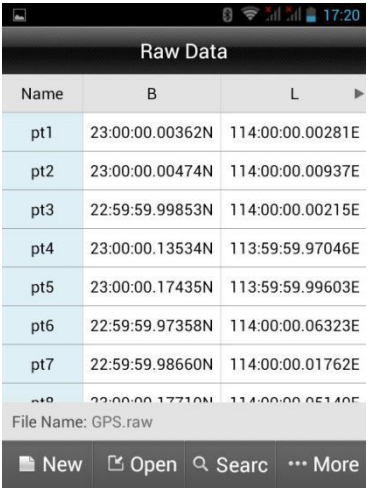
【Add】Add stake point or control point, can be added from library, map and real-time collecting.

【Delete】Delete the selected stake point and control point, check select all. Coord point can't be

	deleted.
	
【Edit】Only can edit description of coord point. All data of stake point and control point can be edited.	

2.6. Raw Data

In this library, record BLH, target height and antenna type of all collected point, can be transferred to plane coordinate by coordinate transfer system.



【New】

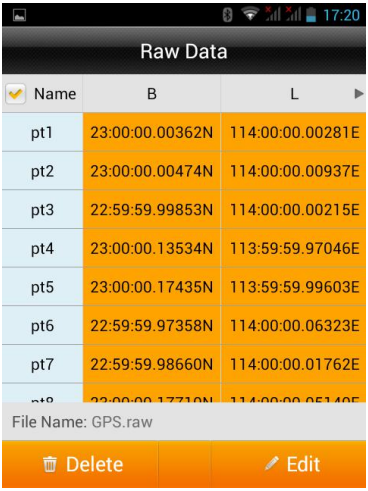
Create a raw data file (*.raw).

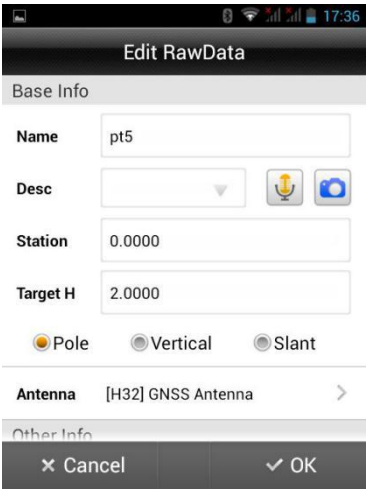
【Open】

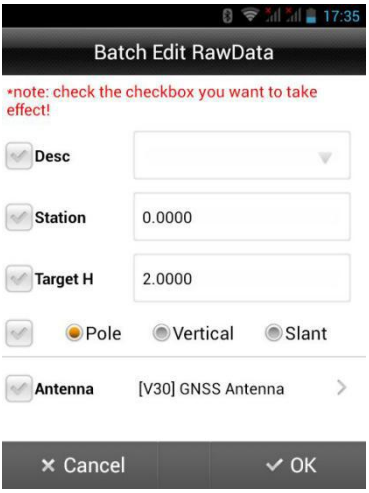
Open an existing raw data file.

【Search】

Search the coordinate point by name or description.



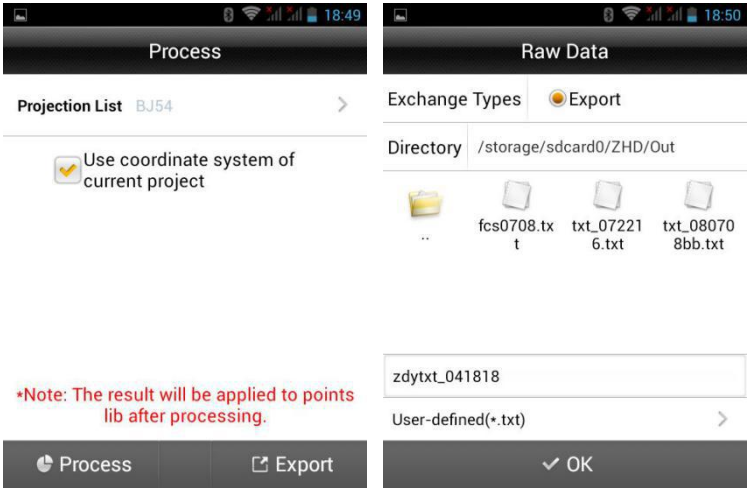




【Edit】

Edit the raw data point name, description, station, target height, height type and antenna type, and it supports batch edit; the corresponding coordinate point name

will be changed after editing raw data.



【Process】

Apply the current parameters to point library and get the result. Don't check 【Use coordinate system of current project】if need to update coordinate system, just go 【Coordinate System Management】to set. Check slope correction if needed.

The processed data can be exported with many formats.

2.7. Mapping Data

【Mapping Data】Shows all mapping survey points, and it supports creating, opening, searching points, and long pressing to delete and edit.

2.8. Data Transfer

Export or import raw data, stake point, control point and mapping data of the current project, for convenient searching and use to user. If there is a file with the same name as the exporting one, it will show “A file with the same name already exists”, can check “cover” to export it with covering the old one.

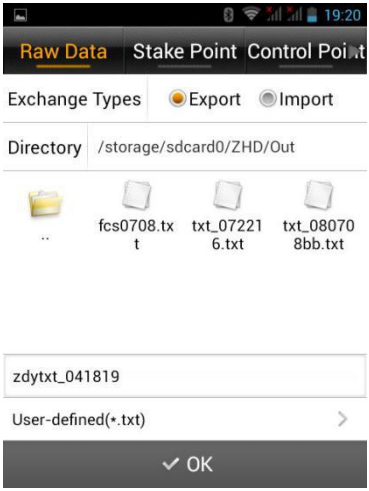


Figure 2-8-1

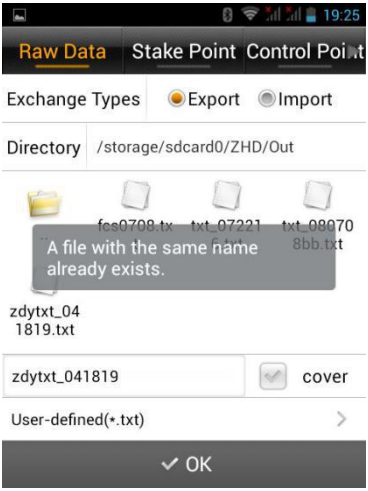
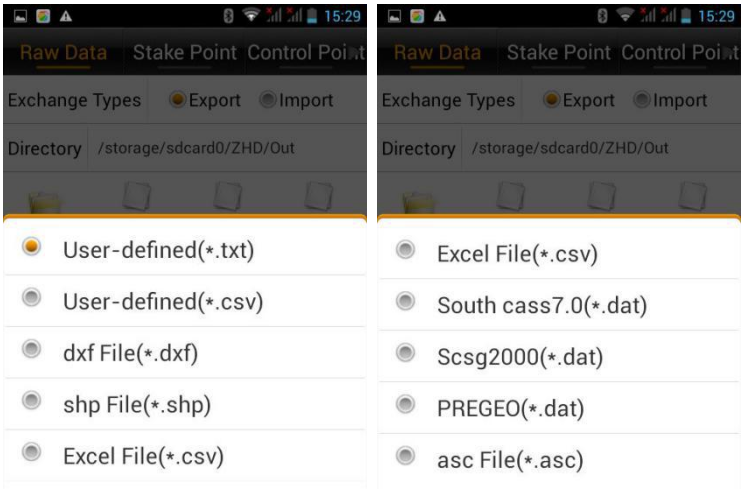


Figure 2-8-2



Raw data export format includes:

User-defined(*.txt), User-defined(*.csv), dxf File(*.dxf), shp File(*.shp), Excel File(*.csv), South cass7.0(*.dat), Scsg2000(*.dat), PREGEO(*.dat), asc File(*.asc).

Coordinate point, stake point and control point are saved as Store.ed2, Stake.ed2, Control.ed2 in Map folder.

Raw data supports importing from Hi-RTK; the raw data, stake point and control point support user-defined importing.

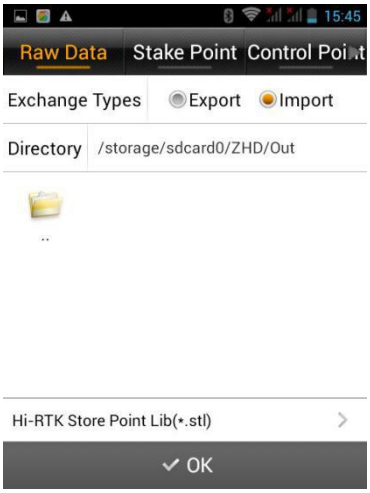


Figure 2-8-3

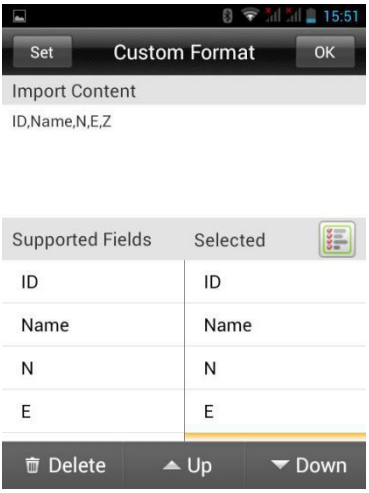


Figure 2-8-4

2.9. File Transfer

An Android email client, customer can send the project files by email.

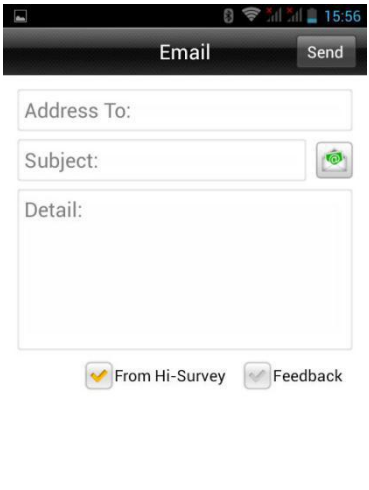


Figure 2-9-1

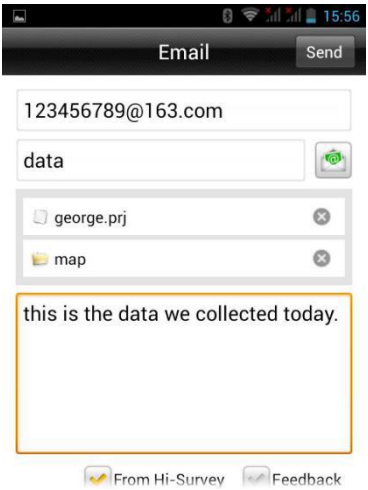
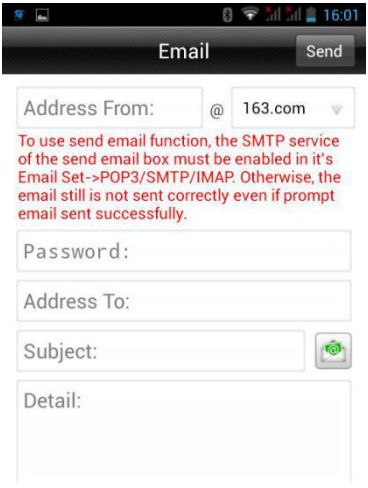
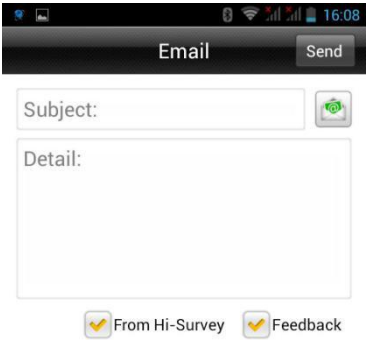
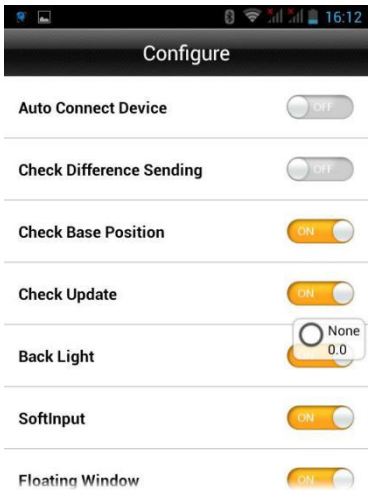


Figure 2-9-2

	
【From Hi-Survey】 Check it to let Hi-Target enterprise mail as sender. If not check, customers can their own address.	【Feedback】 Check it to send to Hi-Target enterprise mail.

2.10. Configuration



【Auto Connect Device】

Opened, it will auto prompt "Whether to connect to last device automatically?" when get in connecting interface.

【Check Difference Sending】

Opened, Hi-Survey will check difference sending status and will show it on floating window in Base model.

【Check Base Position】

Opened, when rover first getting difference, if the Base position is different from before, it will prompt "Whether to regulate point?"

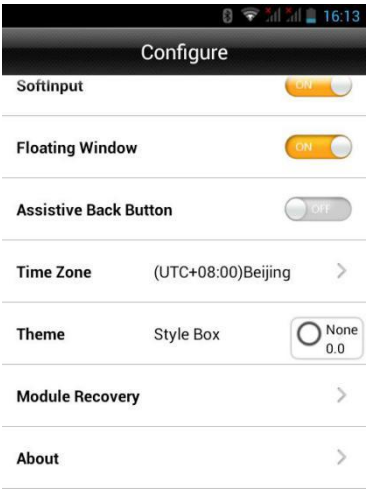
【Check Update】

Opened, it will give update prompt automatically if it is not the latest version.

【Back Light】

Screen will not always be light if closed this function.

【Soft Input】

	You can use input software if opened this function, if close, only input by keyboard. 【Floating Window】Floating window shows information of satellites tracking, solution status and receiver battery.
	【Assistive Back Button】 A button showed on screen, so customer can go back not by pressing keyboard. 【Time Zone】 Correct the time zone of receiver. 【Theme】 Three themes: List, Style Box, Simple. 【Module Recovery】 If deleted some modules in theme Style Box or List, this function will help to recover the deleted module. 【About】 Software information and update information.

CHAPTER

3

Device

This chapter describes:

- Device
- Base
- Rover
- Demo
- HPC
- Others
- Console

3.1. Device

3.1.1. Device Connection Introduction

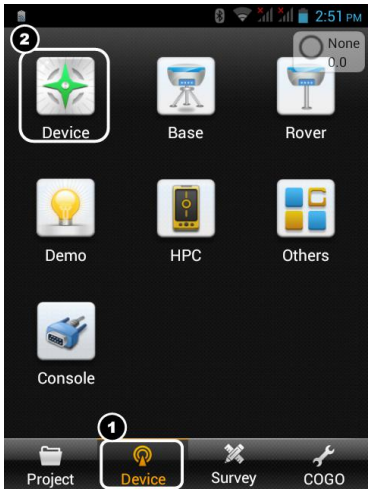
In device connection interface, users need to setup the manufacturer, connection type and the antenna type. Before users confirming that information, users need to connect the GNSS receiver with handheld controller.

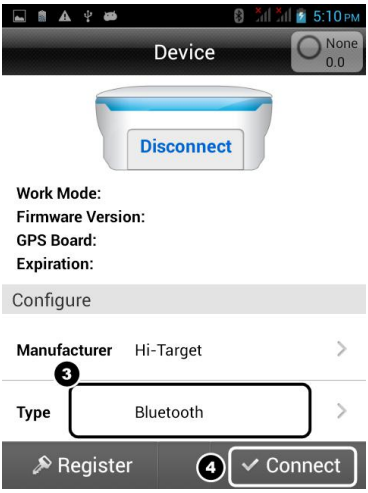
For manufacturer: users can choose Hi-Target, Android Device and Demo mode.

For connection type: users have four ways to choose; and they are Bluetooth, NFC, Network and WiFi. But Network is only for national users. When choosing Bluetooth or WiFi connection, make sure both the GNSS receiver and the handheld controller have enabled the Bluetooth or WiFi function. Detail operation steps as below show.

3.1.2. Bluetooth Connection

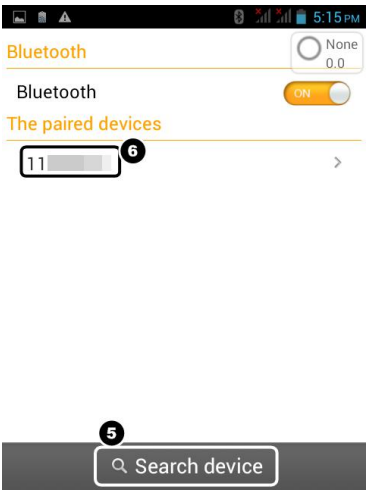
The receiver can be connected by Bluetooth manually.

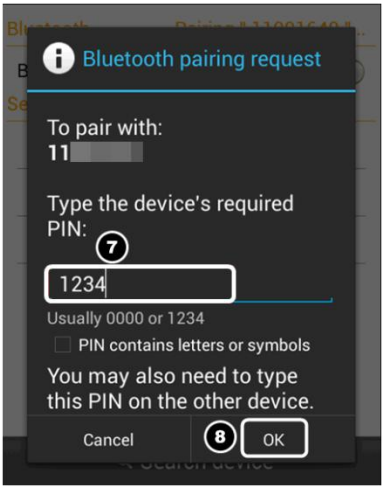




1. Slip to *Device* tab.
2. Press *Device*

3. Select *Bluetooth*.
4. Press *Connect*





5. Search device.

6. Or select the receiver from the list directly

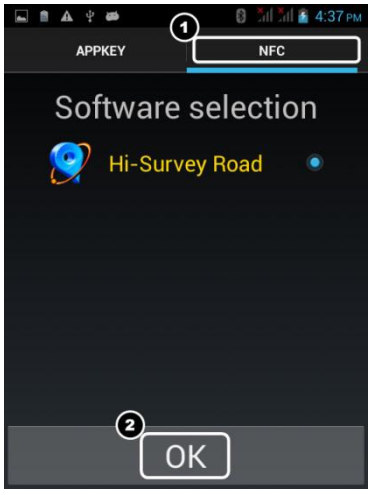
7. When connect to a new receiver, PIN is needed.

8. Enter 1234,press OK

3.1.3. NFC(Near Field Communication)

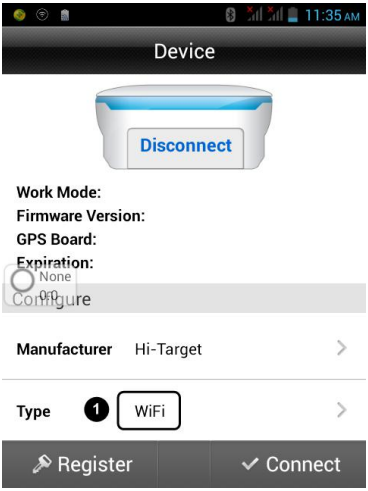
NFC is used to quickly establish Bluetooth connection. On condition that the handheld controller or smart phone which supports NFC function.

The application of NFC, combined with new intelligent handheld, a light touch will realize automatically connecting to receiver and run the software through Bluetooth.

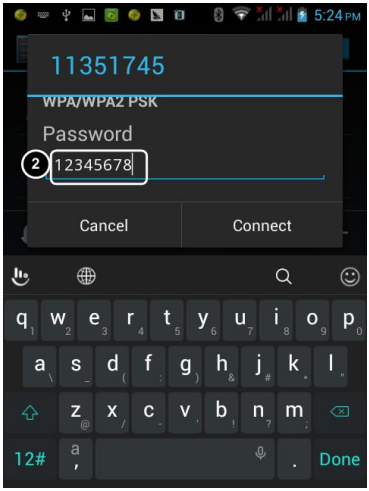
	
1. Long press "APP" button on keyboard. Press NFC; select "Hi-Survey Road". 2. Press "OK".	3. Take ihand20 NFC response area close to receiver's NFC response area.

3.1.4. WiFi Connection

When choose WiFi connection, make sure both the GNSS receiver and the handheld controller have opened the WiFi function. Detail operation steps as below show.



1.Choose the WiFi connection type, and click[Connect]



2.Choose your WiFi hotspot and input the password12345678 if needed

3.Return to the connection interface ,and click [Connect]

When the GNSS receiver is connected successfully, Hi-Survey will show the current connection state, including the SN code number, mainboard information, firmware version information, antenna type, connection mode and the expiration time etc...

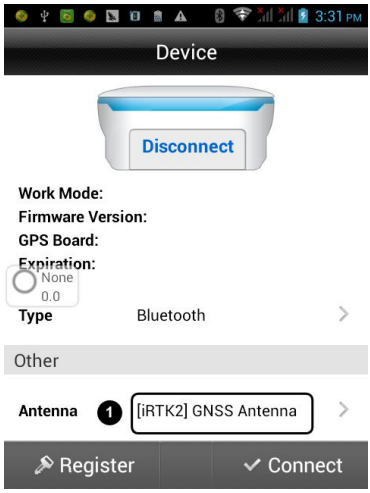
[Work Mode] displays the current operating state of the receiver, usually the base station or rover station mode.

[Firmware version] receiver firmware version number.

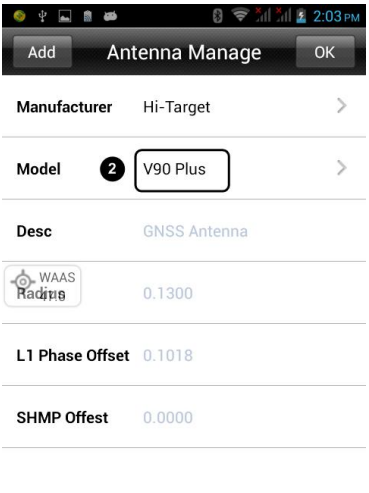
[Mainboard Version]Data receiver board version number.

[Expiration Time]The deadline for registration code to use.

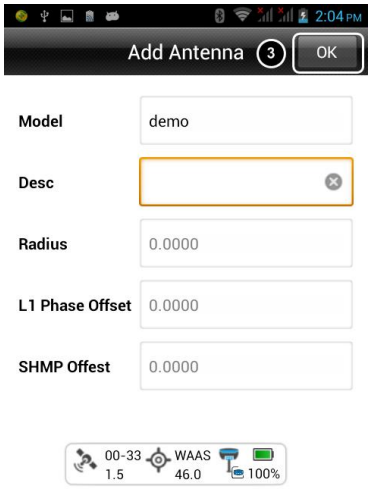
Antenna Settings and Registration



1. Click Antenna type to enter into the antenna type config interface

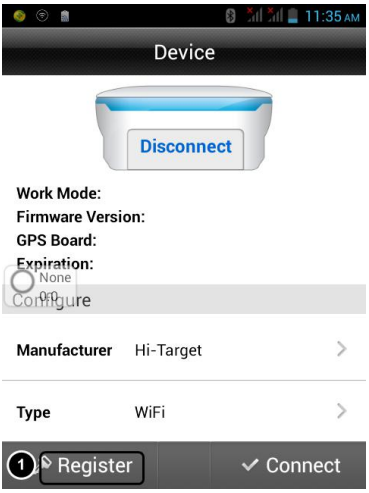


2. choose your Antenna model and click ok.



3.Add antenna if needed

L1 Phase Offset: the offset of



1.press register and input 24 register code .

Antenna phase center SHMP Offset: the offset of the receiver bottom to the measuring mark	2. confirm it and press ok.

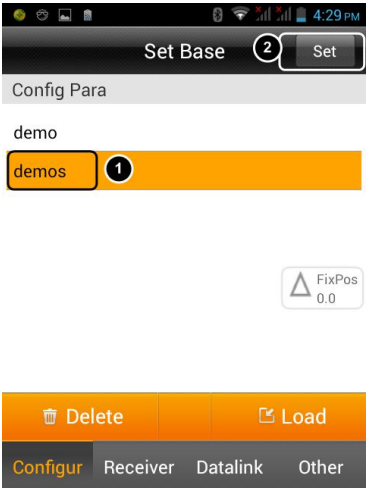
3.2. Base

3.2.1. Base Settings Introduction

When users connected the GNSS receiver, users can setup the base station working parameters, including base configuration, the base coordinates, data link and other parameters.

3.2.2. Base Configuration Settings

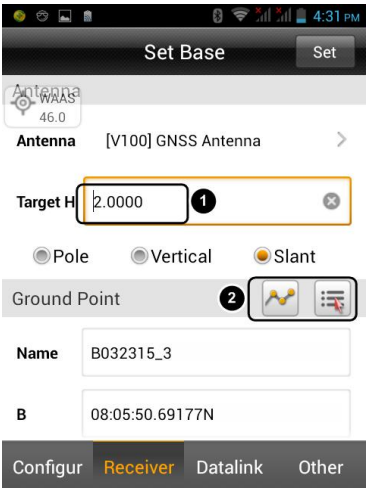
1. Input the configuration name and press save if needed.



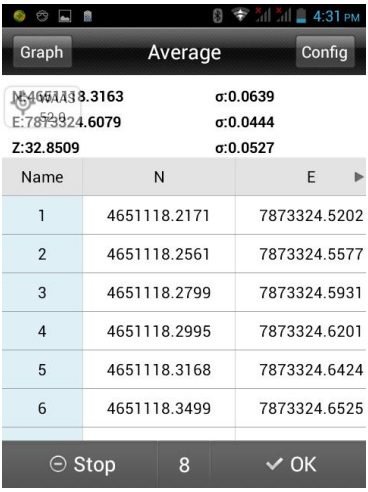
1.select your config parameters and click ok.

Users can setup all the parameters and saved in the configuration file, Also users can load the parameters directly from the configuration file.

3.2.3. Base Station Settings



1. Input the target antenna height
2. Ground point can be gained by input directly, average collection and selected from the point library



2.Average collection interface.

When setup the base station on the known point, users can input the coordinates directly or select from the point library by click into the point library icon.

When setup the base station on the unknown place, the coordinate of points can be obtained by smooth collection.

For smooth collection, also called average collection.

[Stop] Click smooth, smooth software will automatically start; you can manually click [Stop] to terminate the smooth,

[OK] apply the current smoothing coordinate data .

[Graphics] to enter the smooth collection of graphical interface, you can view a graphical

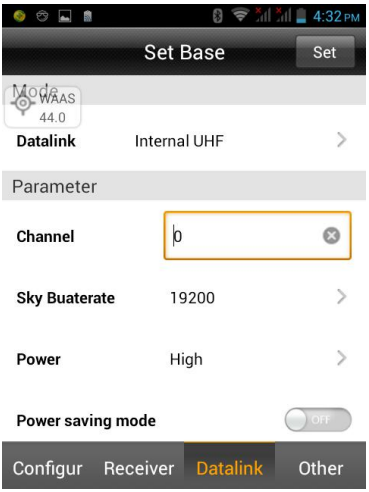
distribution of smooth points.

[Configuration] can setup smooth ways and times.

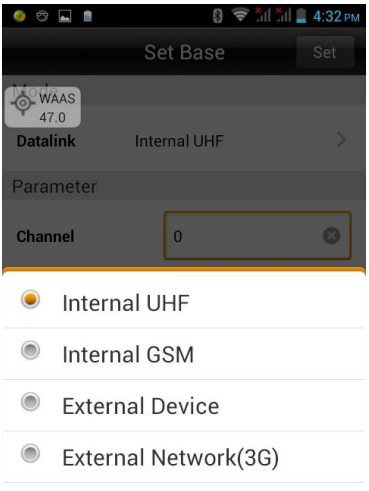
[Delete]Long press point list item, you can delete that point.

3.2.4. Base Data Link settings

Base data link settings is used for setup communication types between base and rover station, including 'built-in radio'(UHF), 'internal network' and 'external data chain' and 'external network (3 G)'.



1. data link interface

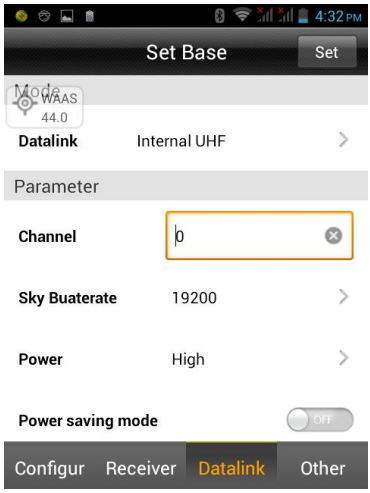


2.Settings interface.

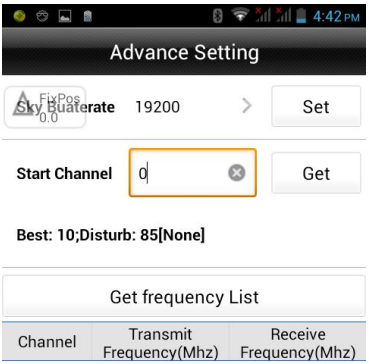
UHF settings

When choosing UHF as the communication link; select the internal UHF and setup the

channel, Sky baud rate and power settings; enter into [advanced] interface to obtain optimal channel.



1. Input the channel, select the sky baud rate and power mode.

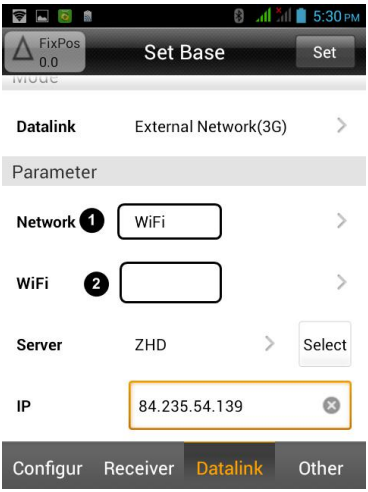


2. If the current channel is not the optimal results, of the search channels, you can change the channel to continue starting a new search...

Internal GSM settings

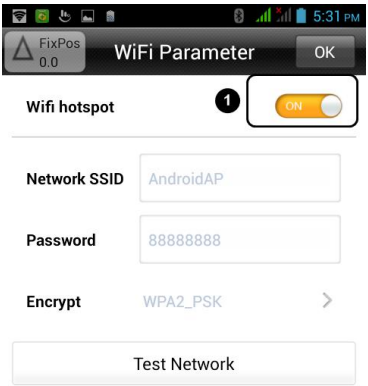
When choosing Internal GSM mode as the communication link; Click to select network mode, including the GPRS, CDMA, GSM, WiFi.

1.When the handheld are connecting with the receiver which have the WiFi connecting function, users can choose WiFi as the connection type. In this mode, receiver can be setup to connecting with third-part WiFi hot spots and transmit differential data via WiFi.

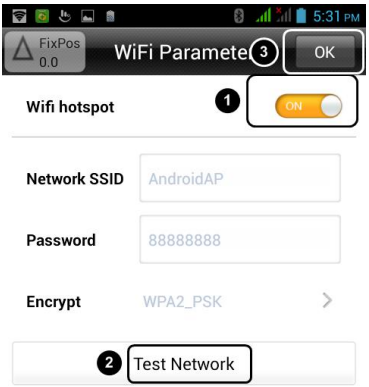


1. Select WiFi as the Network mode
2.press WiFi to enter into the settings

2.When choosing third part hotspots as WiFi connection spot,



1.When using the Handheld as the WiFi hotspot,

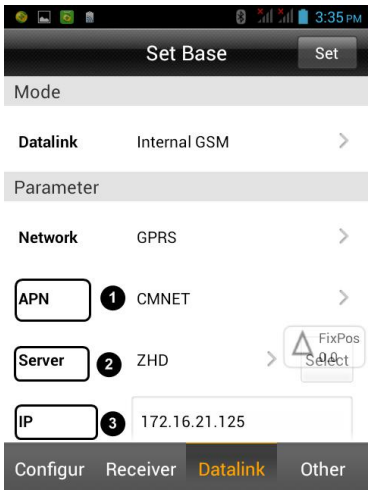


2. Test Network.
3. After confirm it, press ok.

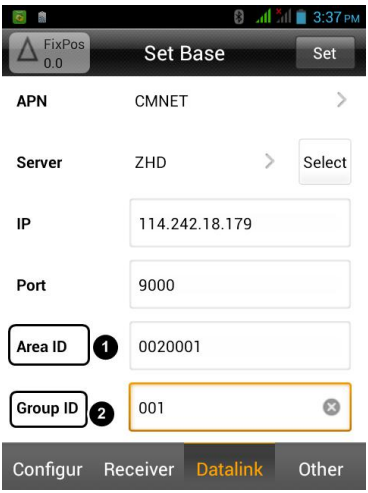
2. When choosing GPRS or CDMA as the connection mode. Make sure the APN, User Name and the Password are correct.

External data link

When choosing external data link, users can select external radio, if users have customized the 3G communication module, the data link can be used to 'External network (3G)'mode.



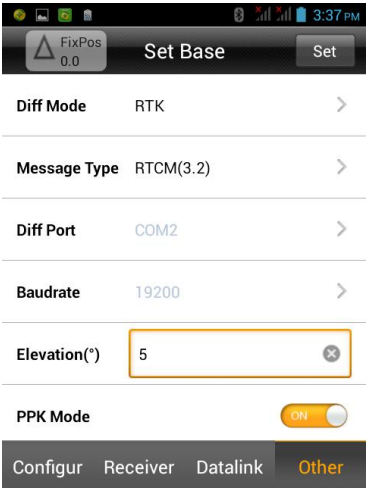
1.Input the right APN, Server and the IP



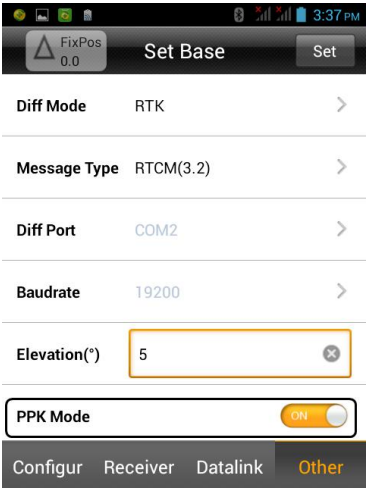
1.Input the Area ID and the Group ID,

Tips: 7 digits for Area ID and 3 digits for Group ID. Make sure the Group ID is less than 255 and all the parameters are the same in base and rover.

3.2.5. Other Settings



1.Other settings interface



1. Enable PPK mode if needed, and the receiver will collect static data while transmit differential data.

Diff Mode: including RTK, RTD, RT20; Defaults Diff mode are RTK and RTD. RTD means code differential mode and RT20 is for single frequency RTK.

Message Type: Including RTCA, RTCM(2.X), RTCM(3.0), RTCM(3.2), CMR, Novatel, NovAtelx, sCMRx. RTCM3.2 will support multi-constellation system, and sCMRx will enable BDS differential data.

Elevation: cutoff angle for the receiver to receive satellites, can be adjust between 5 to 30 degrees.

3.3. Rover

Rover settings mainly including setup rover parameters , which include the receiver settings , data link parameters and other settings. Those settings are similar to the base station settings.

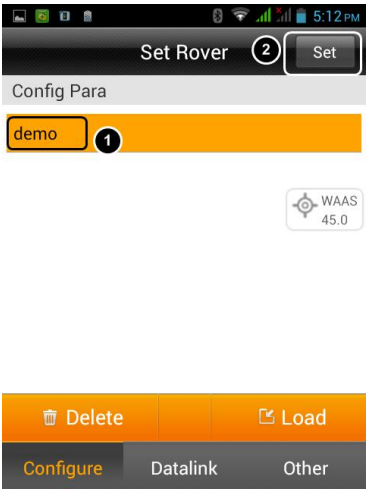
3.3.1. Rover Configuration Settings

Users can setup all the parameters and saved in the configuration file, Also users can load the parameters directly from the configuration file.

The operation of the rover configuration settings are similar with the Base station, the only difference is that rover can scan the RQ code from the base and then setup parameters directly.

3.3.2. Rover Data Link Settings

Rover data link settings is used for setup communication types between base and rover station, including 'built-in radio'(UHF), 'internal network' and 'external data chain' and 'external network (3 G)' and Data Collector Internet. Only when the Ihand20 connecting receiver by Bluetooth that Data Collector Internet can be used.

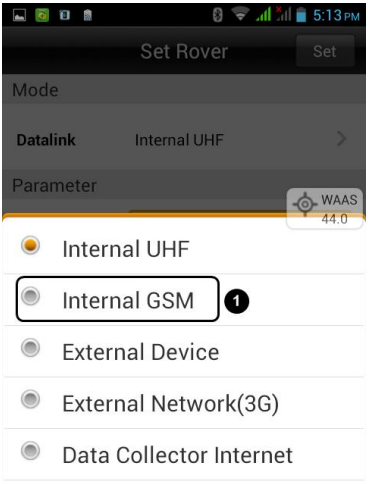
	
1. After setup, Input the configuration name and press save or set if needed.	1. Select the config file and press set or load if needed.

Rover UHF mode

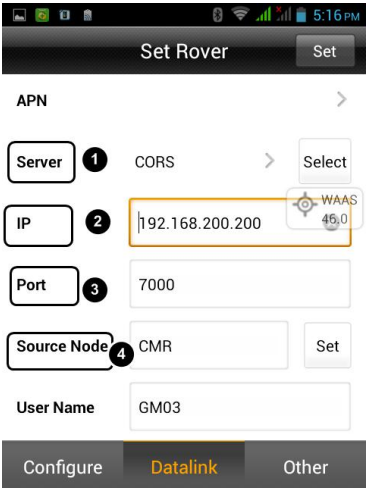
When the rover is using the UHF mode as data link, Radio channel must be same with base station. Detail operations refer to the Base station setup.

Rover Internal GSM mode

When the rover are using Internal GSM mode, Network can be GPRS, CDMA and GSM.



1. When using Internal GSM mode, the APN parameters should be setup according the inserted SIM card.

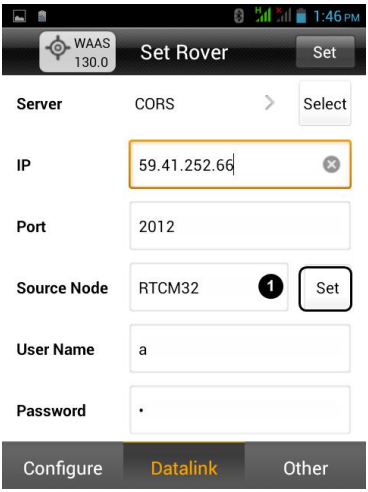


1. The Server can be selected from CORS or ZHD server.
2. Input the right IP and Port.
3. Input or setup the Source Node.

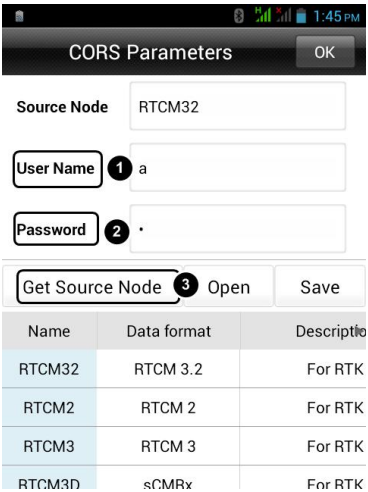
Server, IP and Port: can be input manually or selected from Server list. And Server including ZHD servers and CORS.

Area ID and Group ID: 7 digits for Area ID and 3 digits for Group ID. Make sure the Group ID is less than 255 and all the parameters are the same in base and rover. Area ID and Group ID should be the same with Base stations when choosing ZHD server.

When choosing CORS, Input the right IP and Port. Setup the Source Node or input directly. Then input User name and Password



1. Input the Source Node directly or click Set to get Source Node.



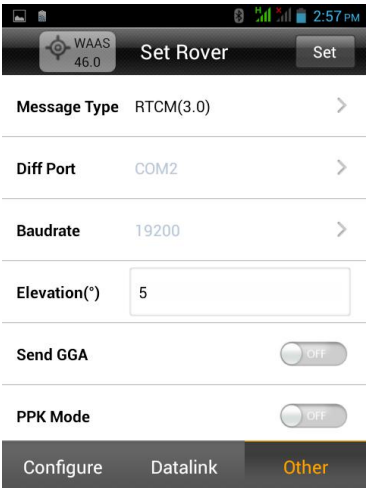
1.Input the User name and Password.

2.Click Get Source Node and select it

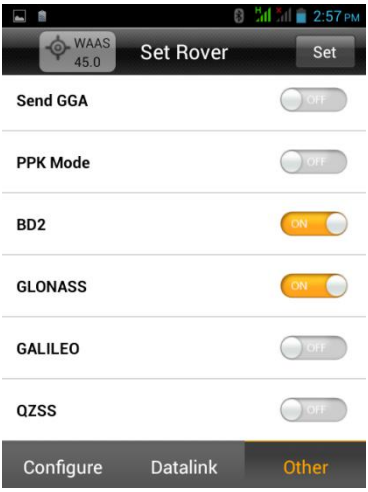
Rover Data Collector Internet Mode

When choosing Data Collector Internet as the data link. the Ihand20 network will connect to the Server directly. And the correction data will transmit from Hi-Survey to rover by Bluetooth. All those parameters settings are similar to the above settings. Under this data link mode, Users can conduct Net RTK without inserting SIM card into the receiver.

3.3.3. Rover Other Settings



1.Message type should be the same with Base station



2. Setup other parameters if needed

Diff Mode: including RTK, RTD, RT20; Defaults Diff mode are RTK and RTD. RTD means code differential mode and RT20 is for single frequency RTK.

Message Type: Including RTCA, RTCM(2.X), RTCM(3.0), RTCM(3.2), CMR, NovAtel, NovAtelx, sCMRx . RTCM3.2 will support multi-constellation system, and sCMRx will enable BDS differential data.

Elevation: cutoff angle for the receiver to receive satellites, can be adjust between 5 to 30 degrees.

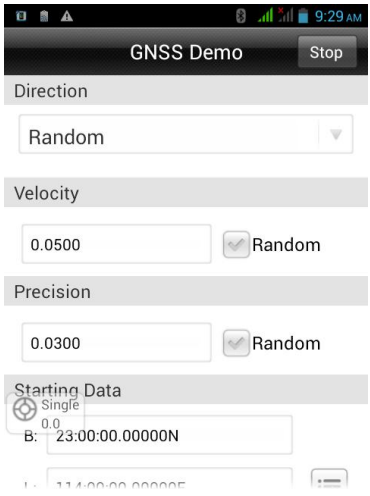
Send GGA: When connect to CORS network and enable send GGA, the roughly coordinate of the rover will send to the reference station .Default frequency 1HZ.

PPK mode: Enable PPK mode if needed, and the receiver will collecting static data while

receiving correction data. And under [Detail Survey], [Point stake out],[Line stake out] will record the RSP file when collecting data in average collection mode. The file name of the RSP file will be the same with static file name.

3.3.4. Demo

Under demo mode, users can simulate the measurement function, easy to learn and familiar with the Hi-Survey.

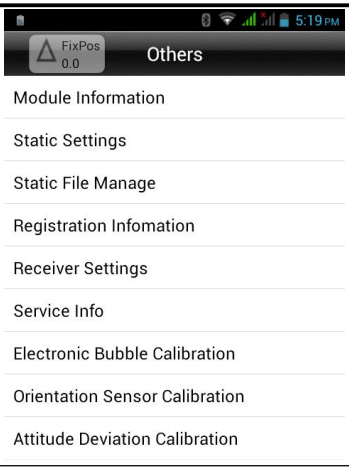
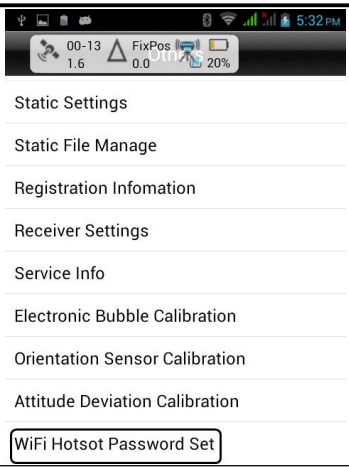
<table>
<tr>
<td> 
</td>
<td>Direction：There are four directions users can choose and they are Random，Input，Map and Line.
Velocity: moving speed of the current point, can be input or given randomly.
Precision: Limitation of the current point can be input or given randomly.
Starting data: Users can specify any coordinate as the starting point. Point coordinate can be Input or selected from point library directly.</td>
</tr>
<tr>
<td>1.Select the Direction,Velocity ,Precision and Starting Data.
2.Confirm all the settings and press OK.</td>
<td>3. then go Detail Survey or Staking interface to learn with Hi-Survey.</td>
</tr>
</table>

3.4. HPC

Under this interface, Users can check the current Handheld type， Instructions， Authorized status，ID ，IMEA，Android Version.

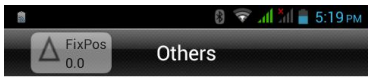
3.5. Others

Receiver auxiliary function include the module information, Static settings, Static files manage, Registration information, Receiver Settings, Service Info, Electronic Bubble Calibration, Orientation Sensor Calibration, Attitude Deviation Calibration and WiFi Hotspot Password Set.

	
1.Others setting interface	1.When connecting receiver by Bluetooth, Users can modify the WiFi Hotspot password.

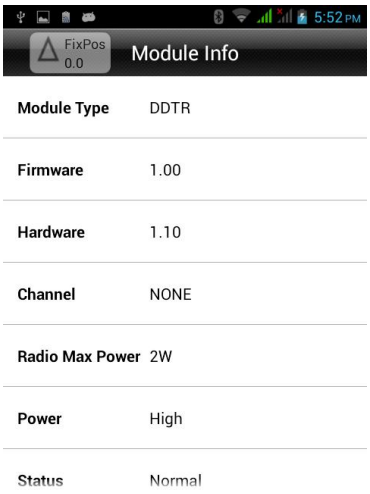
3.5.1. Module Information

Users can check the communication module type, status and firmware version etc..



- Module Information
- Static Settings
- Static File Manage
- Registration Infomation
- Receiver Settings
- Service Info
- Electronic Bubble Calibration
- Orientation Sensor Calibration
- Attitude Deviation Calibration

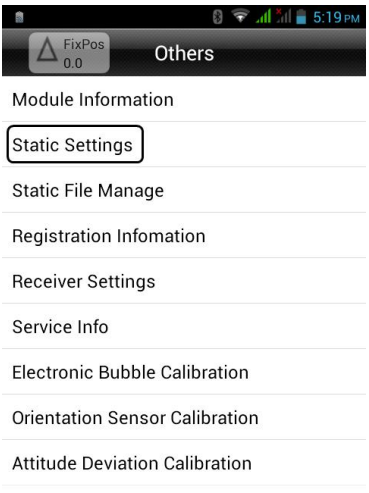
1.press Module Information to enter into the checking interface.

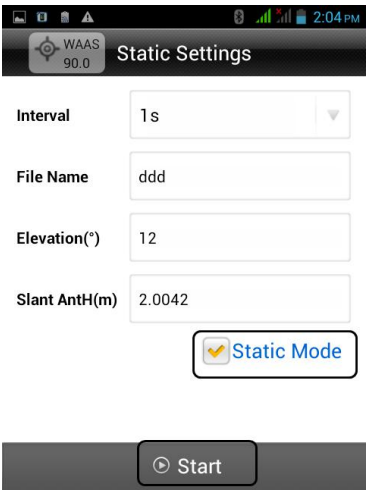


1. Module Information Interface

3.5.2. Static Collection Settings.

Under RTK working mode, Users can enter into static collection at the same time.





1.Press Static settings to enter into the setting interface.

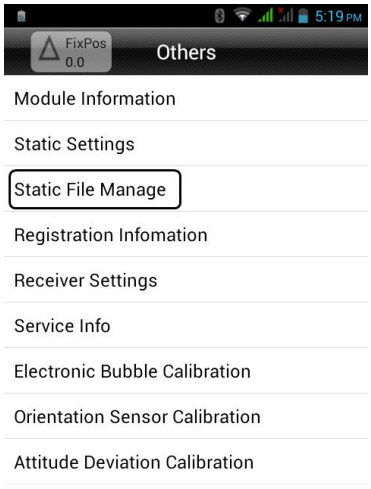
2.Input the Interval time, File name, Elevation angle

3.Measure the Slant height of the antenna.

4. Confirm all the settings and press start, then receiver will record the static data while doing RTK mode. If tick up the static mode, the receiver will record static data only;

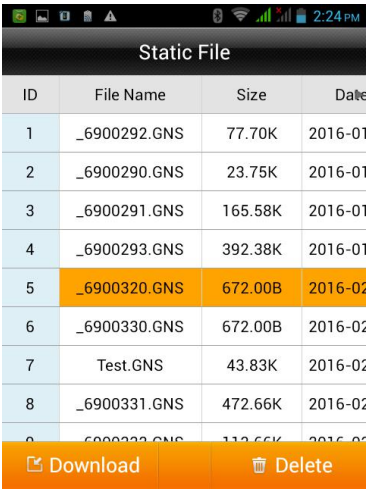
3.5.3. Static Files Manager.

Static files manage: Users can check the static file and conduct related operations. .



1.Press to Enter into the Static File Manage interface.

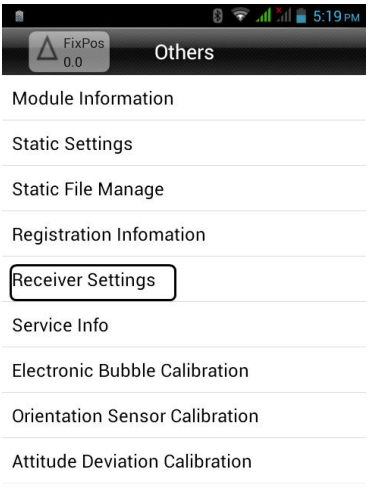
2.Format or refresh the static data

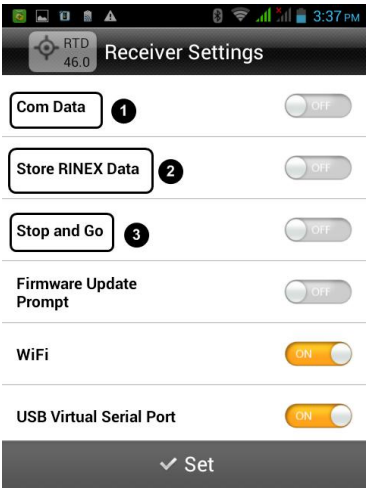


1.Long press to select one recorded data;

2.Static data can be deleted or download and save to path: ZHD/Static directory.

3.5.4. Receiver Settings.





1.Press to Enter into the Receiver Settings Manage interface.

Service Info： Display the current version of the receiver type and its corresponding functions.

1.five-pin data output option.

2.When tick on, receiver will record the static data and RINEX data at the same time.

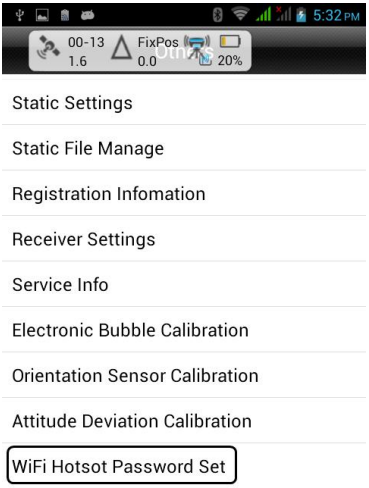
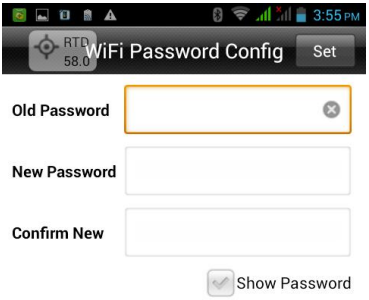
3.Support collect temporary static data under Stop &Go collection mode when tick on this function.

4.[Sound Type] switching sound between None/Default/User Defined.

Electronic Bubble Calibration, Orientation Sensor Calibration and Attitude Calibration please refer to chapter 7 “Tilt survey”.

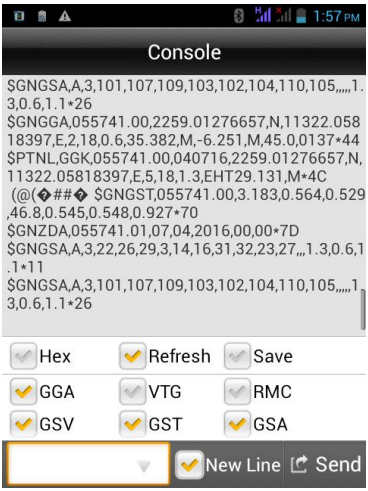
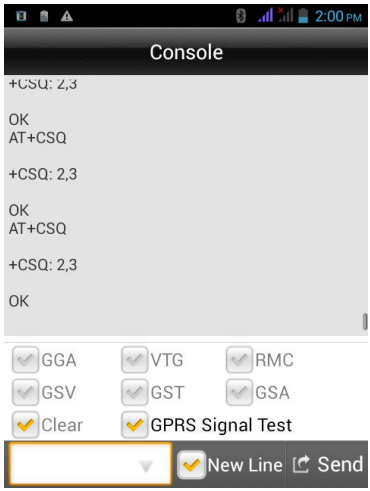
3.5.5. WiFi Hotspot Password Settings.

When connecting Receiver through Bluetooth, Users can modify the password.

<table>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>1.Press to Enter into the WiFi Hotspot Password Settings interface.</td>
<td>1.The factory default password is 12345678
2.If forget the original Password users can setup a new password by the GNSS Receiver management software.</td>
</tr>
</table>

3.6. Console

Console is data debug in other words. This function is mainly used for debugging and testing GPRS signal intensity.

<table>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>[HEX] When tick on ,will show in hexadecimal format.
[New line] Select the command and press send.
[Save]save the output data.
[Send]input the command and send it.</td>
<td>CSQ represents GPRS signal intensity value .
For example: +CSQ:2,3 .the first value 2 is signal intensity and 3 is the signal error rate. For the first value ,the bigger value, the better signal; and for the later value should be 0 to normal.</td>
</tr>
</table>

CHAPTER

4

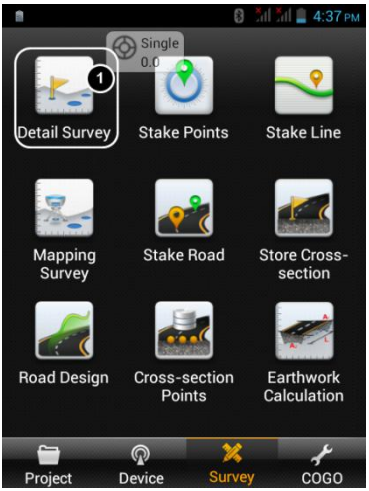
Survey

This chapter describes:

- Detail Survey
- Stake points
- Stake line
- Mapping Survey

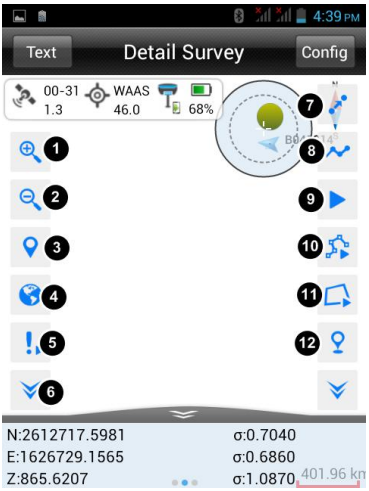
4.1. Detail Survey

Press the 'Detail Survey' icon on the main interface to enter into the Detail Survey.



1.Slip to *Survey* tab.

Press *Detail Survey*.



① Zoom in ②Zoom out

③Centering current position

④Full view ⑤Attribute querying

⑥Hide Tools ⑦Indirect Survey

⑧Average Survey ⑨Auto Survey

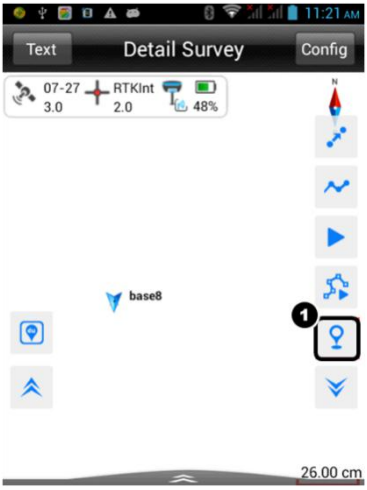
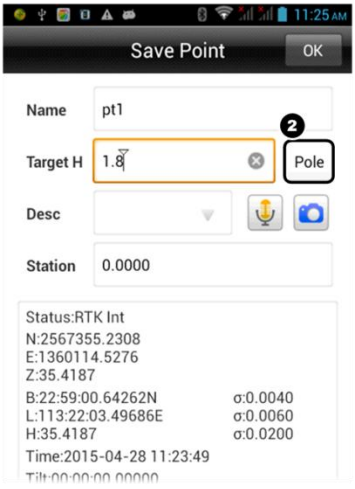
⑩Line Survey ⑪Linking Planes

⑫Manual Survey

Detail Survey also called data collection, after the settings for the above project and Base as well as Rover being completed successfully; enter into data collection interface for collection. Corresponding collection methods can be selected according to different demands.

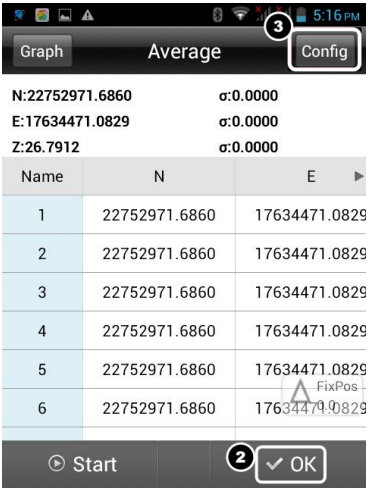
1. Single-point collection

Single-point collection means collecting the data of each point by manual operation.

<table>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>1.Press ① (or the same button on physical keyboard) to collect.</td>
<td>2.Press ② to select the height type then input the value</td>
</tr>
</table>

2. Average collection

That is averaging for the multi-measurement value of coordinate for each point.

<table>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>1.Press ① to collect</td>
<td>2.Press OK to save the point
3.Press here to change the configuration</td>
</tr>
</table>

3. Automatic collection

Point measurement will be recorded automatically according to the configured record condition.

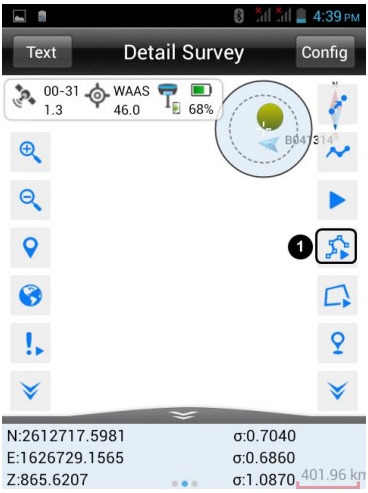
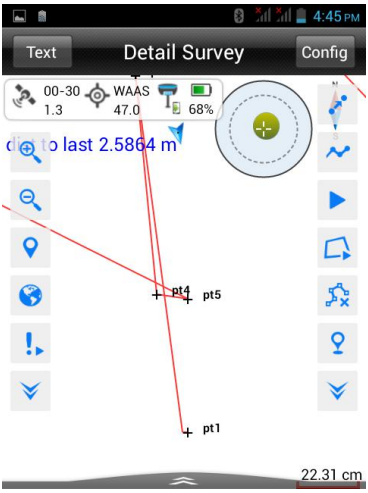
<table>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>1.Press ① to start automatic collection.</td>
<td>2.Select the mode and enter the interval
3.Press OK to start collecting</td>
</tr>
<tr>
<td> 
</td>
<td>4. All the points will be auto saved.
Press here to end collecting.</td>
</tr>
</table>

4. Indirect collection

Indirect collection also called intersection collection which is designed for some place where we cannot reach up or no GNSS signal. Normally speaking, only plane coordinates(X,Y) can be obtained, and the elevation data(Z) should be obtained by other measurements .

Detail operation please refers to chapter 7.6 Intersection Measurement.

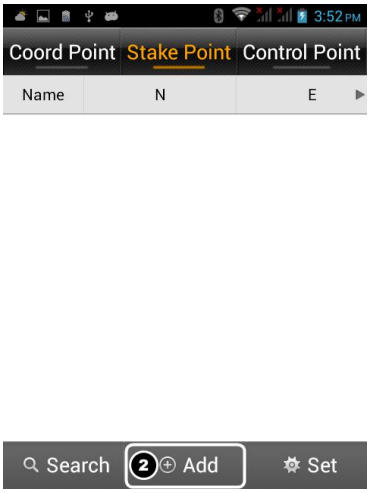
5. Line collection

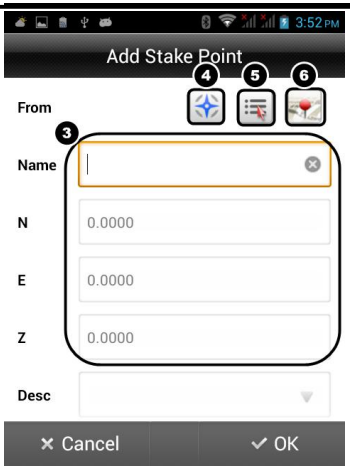
	
1. Click Line icon to open this function.  =turn off  =turn on	2.Line collection interface

4.2. Stake Point

1. Import the points to be staked out

1) Add the point manually

<table>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>1. Press ① to add the point manually.</td>
<td>2. Press ② to add point to the list.</td>
</tr>
</table>



You can add stake point by:

③Enter manually

④Get from receiver

⑤Select from list

⑥Map picking

Press *OK* to confirm

2) Import the points/lines from file（Support Dxf file to be staked）

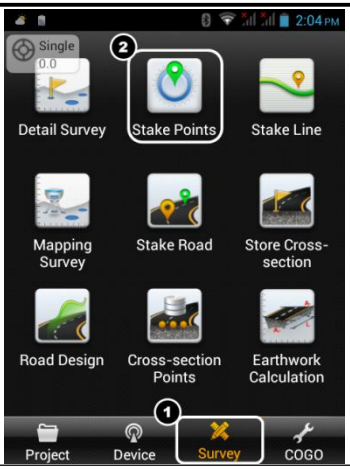
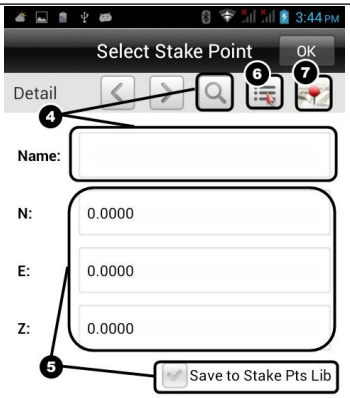
1. Press ① to import the points from file.

2. Slip to *Stake Point*.

3. Select *Import*.

4. Choose the file you uploaded

2.Point Staking

<table>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>1. Slip to Survey tab.
2. Press Stake Points</td>
<td>3. Click here to enter into points selection interface</td>
</tr>
<tr>
<td> 
</td>
<td>You can add stake point by:
④Enter the point name then search it from list
⑤Input the coordinates manually and save the point to the list by ticking the option.
⑥Select from list
⑦Map picking
Press OK to confirm and start staking-out</td>
</tr>
</table>

3.Stake interface

Backward: Southward

Towards the Right: Eastward

Delta H: Altitude difference between stake coordinate and actual position

Name : Name of stake point

σ: Relative precision

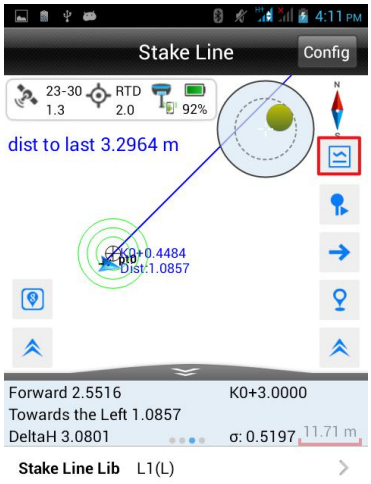
HD: Horizontal Distance

Notice:

You can define the line to be staked-out manually or import it from files. Please refer to the manual of *Hi-Survey* software to get the procedures.

4.3. Stake Line

Stake line is used for stake points in special lines. There are four basic lines on Hi-Survey: line, arc, spiral and circle. When we stake line, we should input milestone to search stake points.



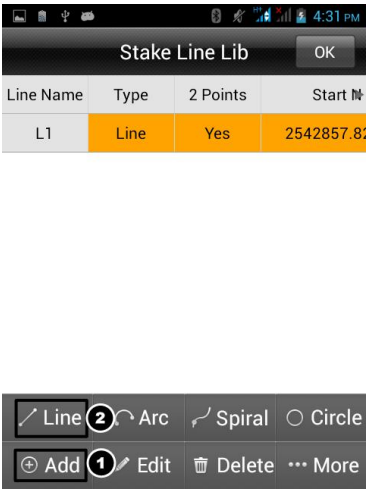
Click this to enter *Stake Line Lb* interface to design lines.

We can add line, arc, spiral and circle.

4.3.1. Define lines

We can define lines as below.

Line:



Click "*Add*"—"*Line*" to enter line defined interface.

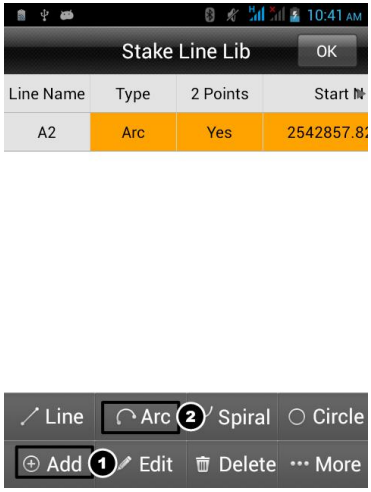
Type: Line is for plane line, 3D-line is for space line.

There are two method:

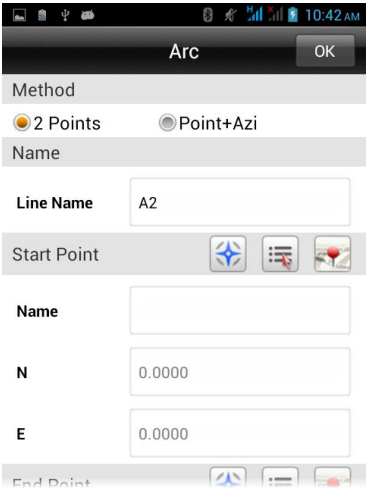
2 Points: Input coordinates of start point and end point.

Point+Azi: Input one coordinate and the azimuth.

Arc:



Click "*Add*"—"*Arc*" to enter arc defined interface.

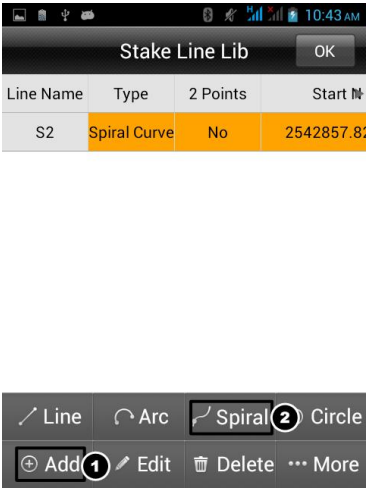


There are two method:

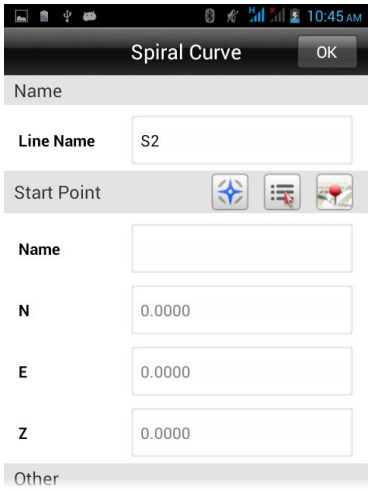
2 Points: Input coordinates of start point and end point, start station, radius and direction.

Point+Azi: Input coordinate of start point, start station, radius, azimuth, length and direction.

Spiral:

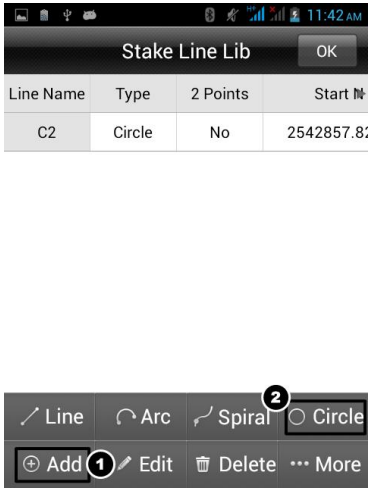


Click "*Add*"—"*Spiral*" to enter spiral defined interface.

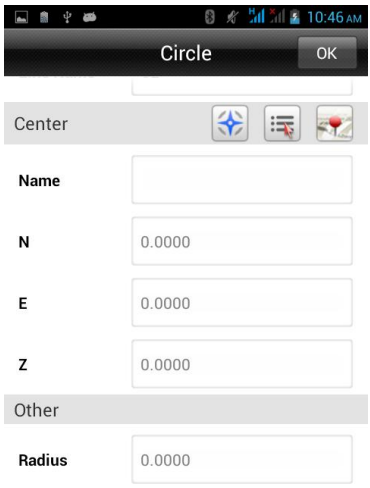


Input coordinate of start point, start station, azimuth, length, radius of start, radius of end and direction.

Circle:

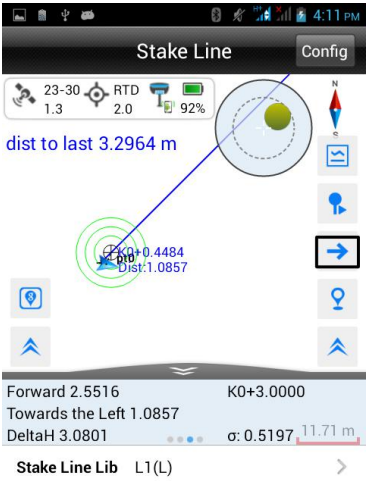


Click "*Add*"—"*Circle*" to enter circle defined interface.

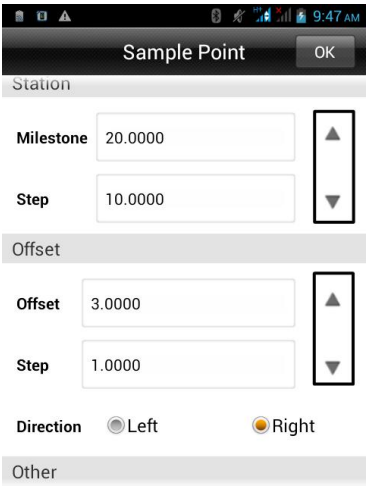


Input coordinates of circle center and radius.

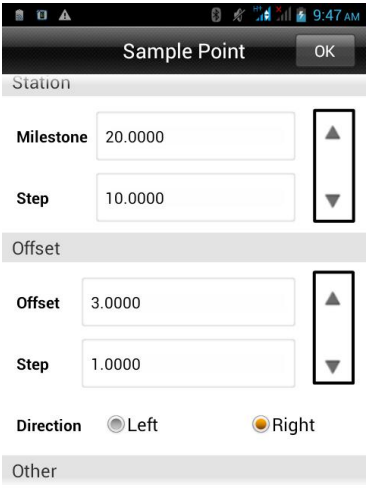
4.3.2. Stake points in lines



Click this to enter sample point interface. We should input milestone to stake.



Click this to adjust the value of milestone and offset. Every time we click it, the value will be adjusted by step value.



Click this to adjust the value of milestone and offset. Every time we click it, the value will be adjusted by step value.

Milestone: The station of stake point.

Step: The value added every time entering this interface. For example, if we need stake out piles every 10 meters and the start station is 100m.After we have staked out the first pile, the milestone will be changed to 110m whenwe enter this interface again.

Offset: The vertical distance of offset point to defined lines.

The blue arrow is current point.

The circle with cross in is the stake point.

Just find the point refer to the prompt the same as *Stake Point*.

When seeing like this picture, it means the stake out is successful.

CHAPTER

5

COGO

This chapter describes:

- Angle Conversion
- Distance Conversion
- Coordinate Conversion
- Areas Calculation
- Distance and Azimuth
- Intersection Measurement
- Included Angle Calculation
- Calculator

5.1. Angle Conversion

As show in the figure, input a value to any item (radian, degree, DMS, gon or mil), click [Compute], another several values will be calculated.

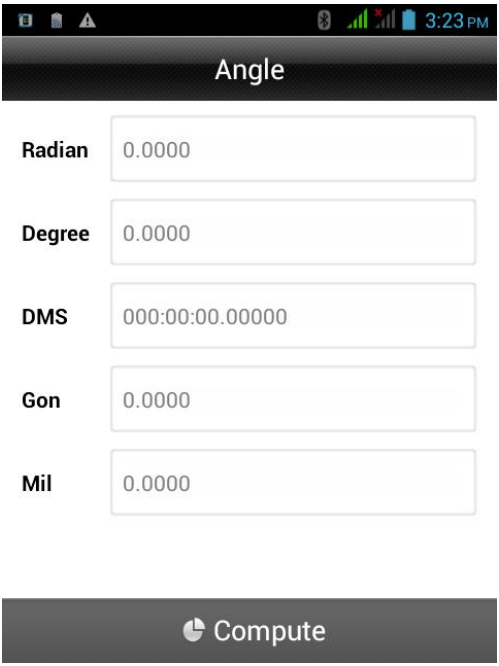


Figure 5-1

5.2. Distance Conversion

After input a value to any item, click [Compute], another several values will be calculated.

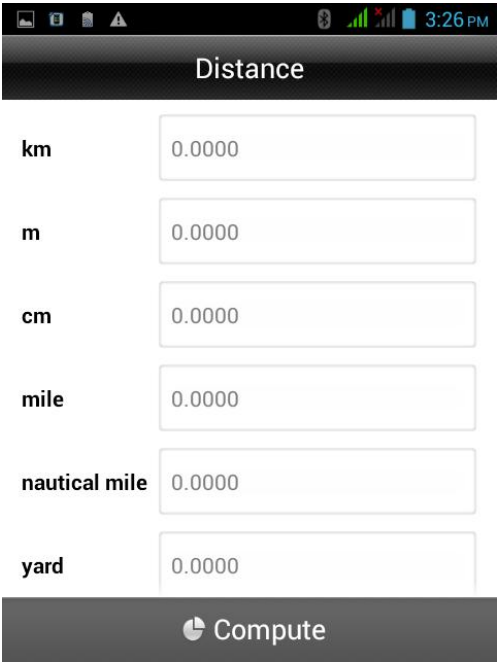


Figure 5-2

5.3. Coordinate Conversion

The data includes local ellipsoid and source ellipsoid. After input point information, you can switch between BLH, XYZ or NEZ. Click [To Local] or [To Source] to complete conversion between local ellipsoid and source ellipsoid. The coordinate of point can be selected from receiver collected, coordinate library or map.

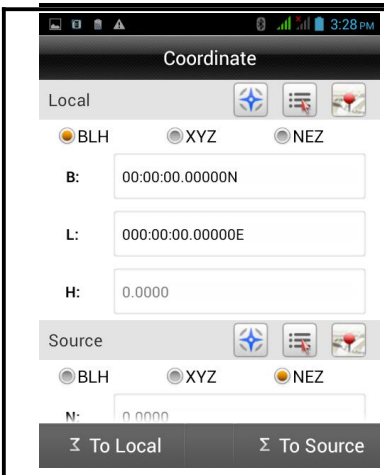


Figure 5-3

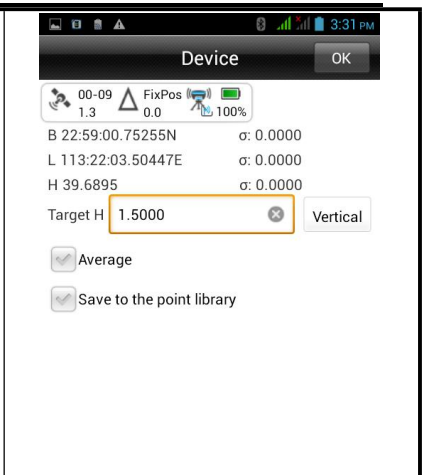


Figure 5-4

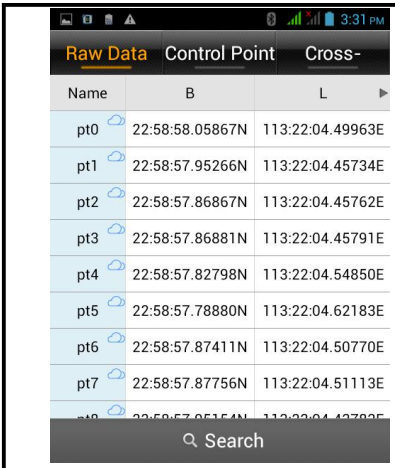


Figure 5-5

Figure 5-6

5.4. Areas Calculation

Used to calculate area, circumference, etc. parameters of graph, area indicated by ‘sq.m’ or ‘mu’, circumference indicated by ‘m’. The coordinate of point which will participate in calculation can manual added, or real time collect, or select from coordinate library or map.

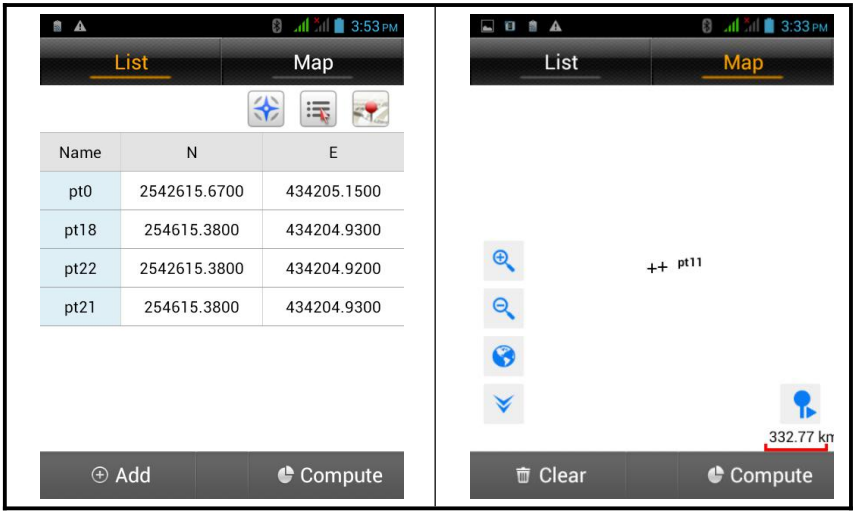


Figure 5-7 Figure5-8

[Add] point add to list

[Compute] compute the area and circumference of graph which is in order formed by current points.

5.5. Distance and Azimuth

Used to calculate distance and azimuth between two points. The coordinate of two points can be manual input, or read from receiver, coordinate library or map. After read successfully, click [Compute] to calculate '2D-Distance', '3D-Distance' and Azimuth.

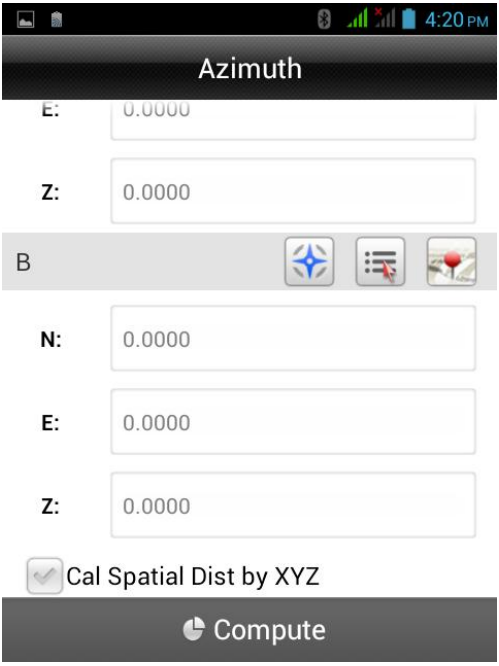


Figure 5-9

5.6. Intersection Measurement

In the case of a point need measure but observation conditions are not ideal, calculate the needed point coordinate by measuring a near point. Click every icon to enter corresponding measurement mode. The software support six measurement modes: 4Pt, 2Pt2L, 2Pt1L, 2Pt2A, 2Pt1A1L, Azimuth.

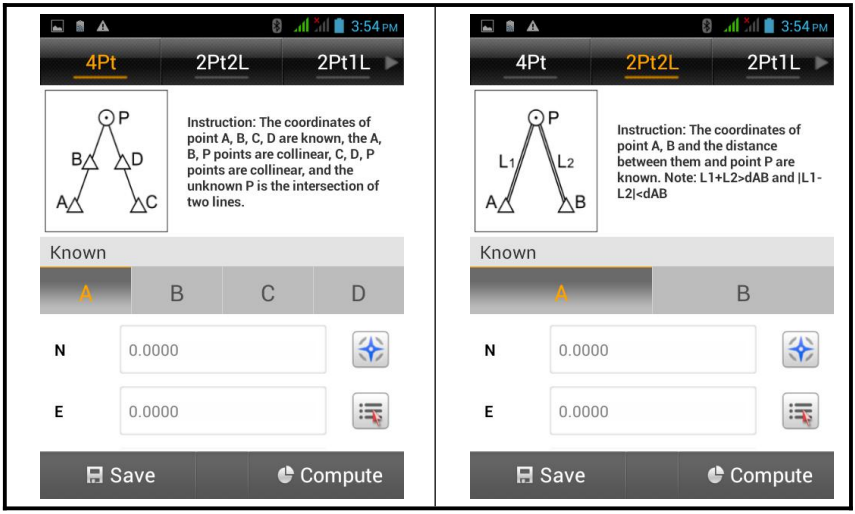


Figure 5-10 Figure5-11

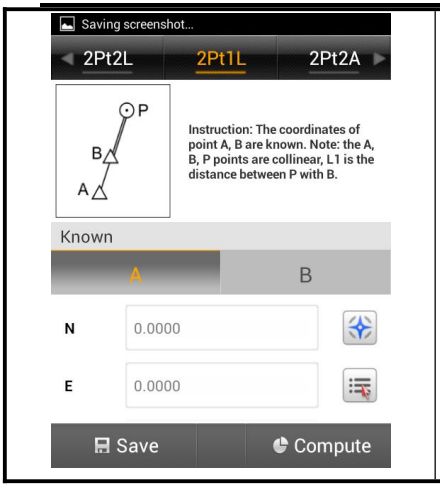


Figure 5-12

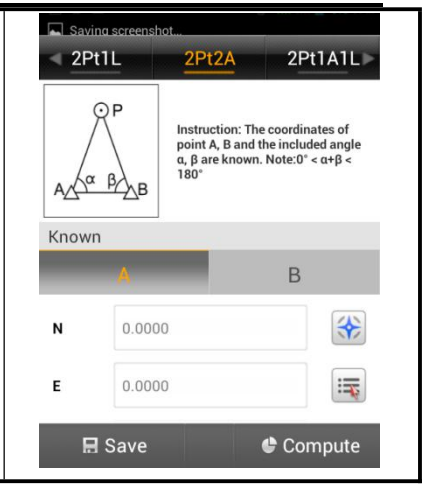


Figure5-13

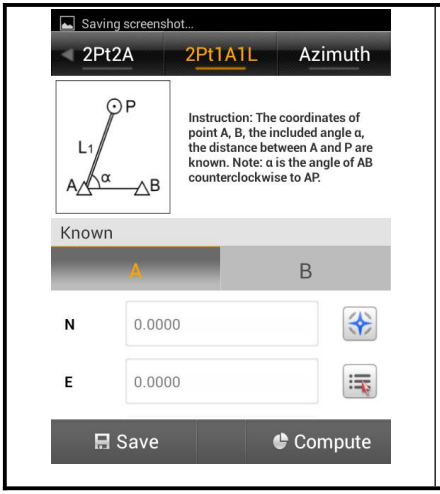


Figure 5-14

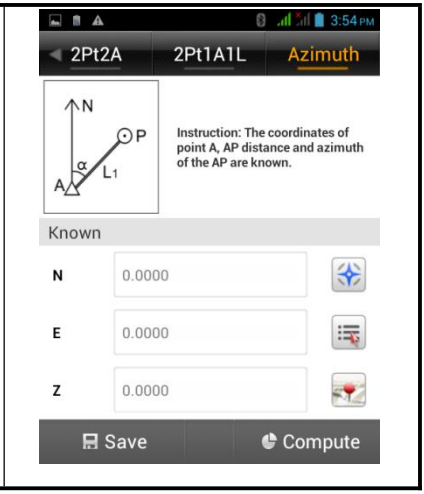


Figure5-15

2Pt2L, 2Pt2A, 2Pt1A1L, above three methods according to theory should have two positions. If input the coordinate of A first, the position of P will be located above AB line.

Conversely, if input the coordinate of B first, the position of P will be located under AB line.

In the above various intersection measurement methods, select known point 'ID', input the coordinate of intersection measurement point (manual input, or read from receiver, coordinate library, map), input other known key (such as: L1, L2,etc.), click [Compute],calculate the coordinate of unknown point 'P', click [Save], input name, description and so on to save into the coordinate library.

In intersection measurement, when click GPS to collect point, prompt accuracy information (accuracy is set in the configuration) to know real time accuracy conveniently.

5.7. Included Angle Calculation

Used to calculate the angle of the three-point line

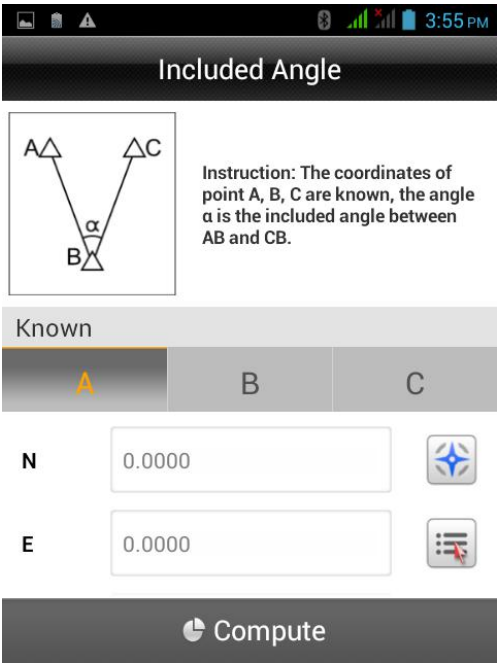


Figure 5-16

5.8. Calculator

Used to simple mathematical calculations

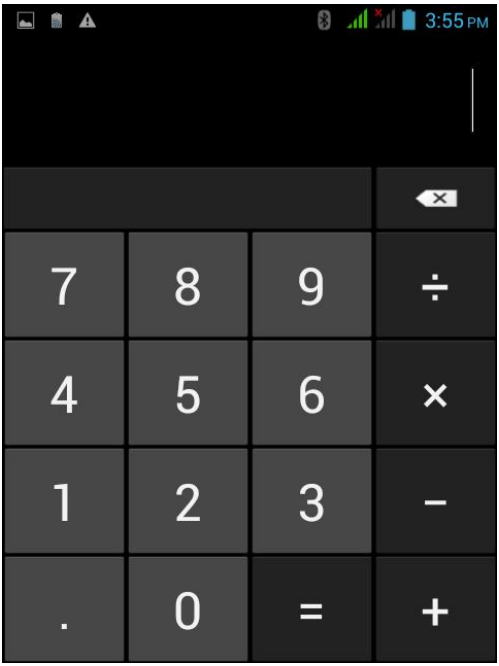


Figure 5-17

CHAPTER

6

Road

This chapter describes:

- Road work procedure
- Stake Road
- Road Design
- Store Cross-section
- Cross-section Points
- Earthwork Calculation
- Configure

6.1. Road Work Procedure

The road engineering measurement contains Route reconnaissance and design survey and Road construction measurement.

Route reconnaissance and design survey:

Survey the coordinate and elevation information of primary route designed before designing the construction drawing.

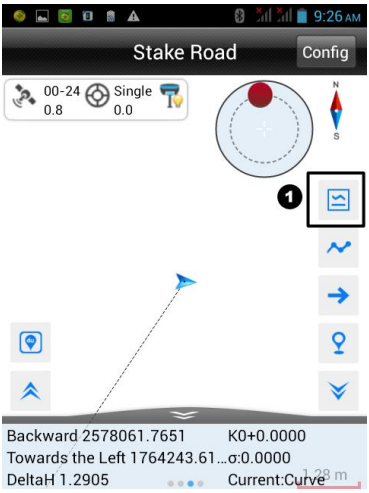
Road construction measurement:

Survey the centerline, subgrade side pile and vertical curve of road according to construction drawings.

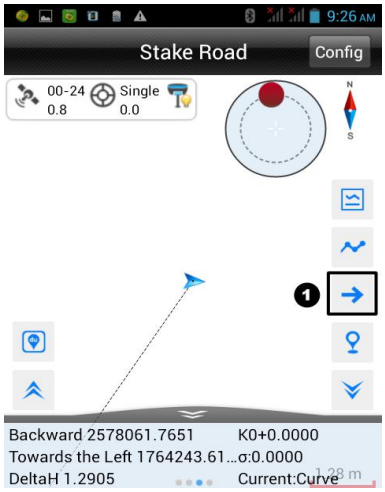
6.2. Stake Road

The stake road is an important function of Hi-Survey. The excellent working mode will make our surveying work more efficient and systematic.

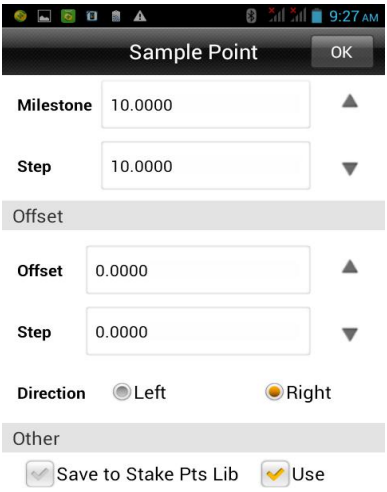
6.2.1. Route design

<table>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>1. Press ① to choose data files of road. There are Centerline, Profile and Cross-section.</td>
<td>2. Press Display you can see the design by graph.
3. You can also see the path.</td>
</tr>
</table>

6.2.2. Define the sample points



1. Press ① to enter *Sample Point*.



2. You can input the *Milestone*, *Step* and *Offset*.

3. Press *OK* to start stake out.

Every time you enter the interface, the value of Milestone and Offset will be added by step.

USE: When staking out the sample point, there will be a dashed line between current point and sample point in the graph interface to indicate.

6.2.3. Stake out

This step is the same as the Stake Line.

Menu key: Click the MENU key in the Stake Road interface, you can switch between the related interface and current interface.

6.3. Road Design

6.3.1. Centerline Design

Users can design centerline by intersection, element and by coordinate. The intersection method limits the line type. you can design any shape of line when using element method. The line designed by element must be smooth and can't support polyline. The format of element (*.sec) will remove the turn-angle information of polyline. The default element combination is spiral in curve --- arc --- spiral out curve. For the coordinate method, you should define the coordinates of start and end point in elements.

This software supports smooth spiral curve. When importing the unsmooth spiral curve, you should check every milestone to ensure there is no route deviation. Then you can stake out correctly.

Caution：

1) The two spiral curves can be unsymmetrical. They are must fit the follow equation:

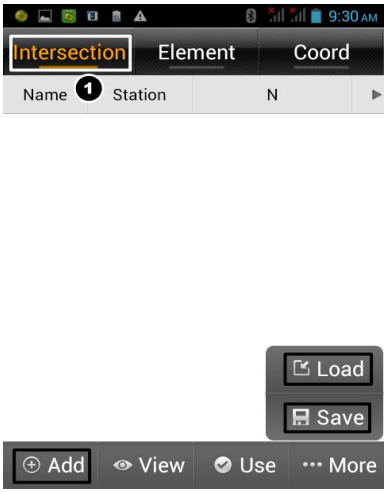
Radius * length of spiral curve = the square of curve parameters

2) The reverse loop should be processed to normal curves.

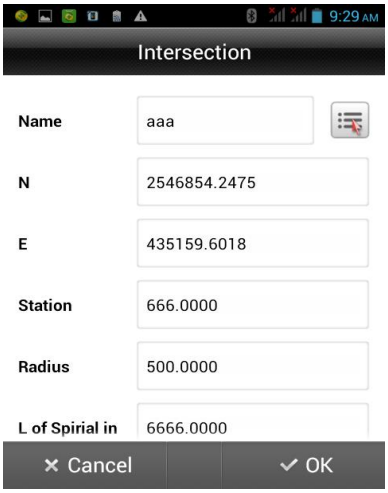
3) Don't support virtual intersection.

4) Support partial curve. The length of spiral curve can be zero.

Intersection method



1. Press ① to enter *Intersection*.



2. You can input the *Name*, *N, E, Station, Radius, L of Spiral in* and *L of spiral out.*

Add: Click it to add intersections one by one.

Load: Import the intersection file (*.PHI) from folders

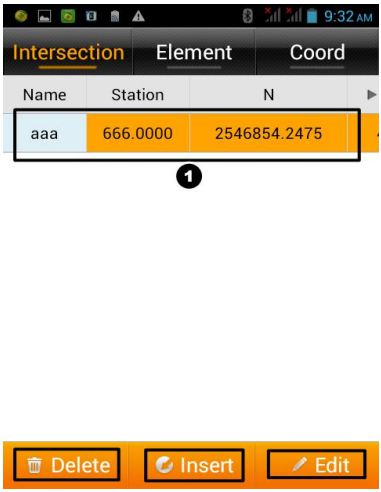
Save: Click it to save a PHI format file.

View: Click it to view the graph of route.

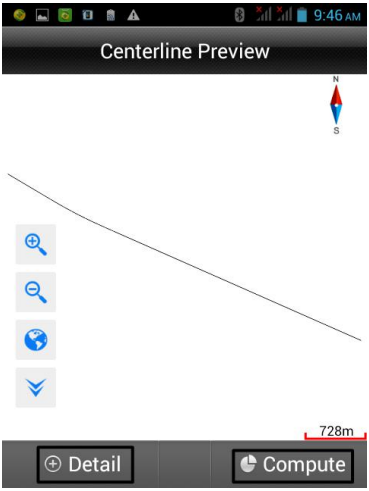
Delete: Delete an intersection data.

Insert: Insert an intersection data.

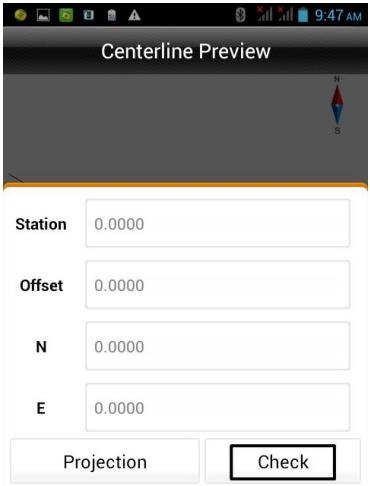
Edit: Edit the existing intersection data.



Long press ①, you can see the interface.

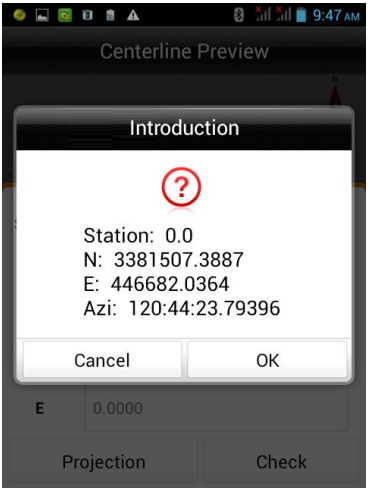


Press *View* to enter this interface.

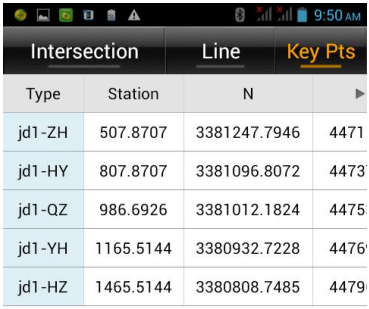


Press *Compute* to enter this interface.

After inputting Station, click *Check*.



Then you can see the checking information in this interface.



Press Detail to enter this interface.

You can see the detail parameters.

Press Use to load the current route to software.

You can press Yes to save data.

Element method

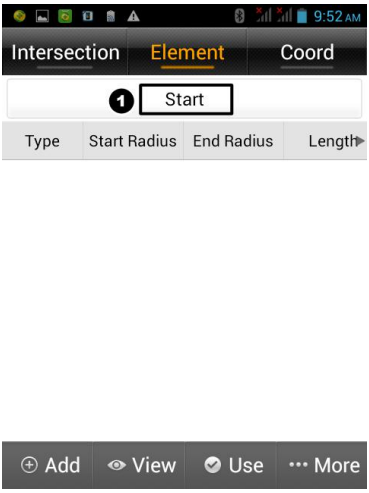
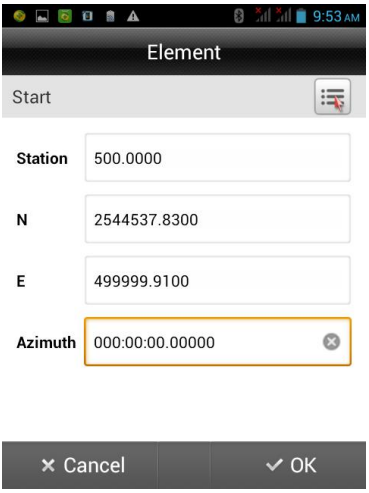
In element method, create a route by connecting lines, arcs and spiral curves. You can input the elements or import from .sec file.

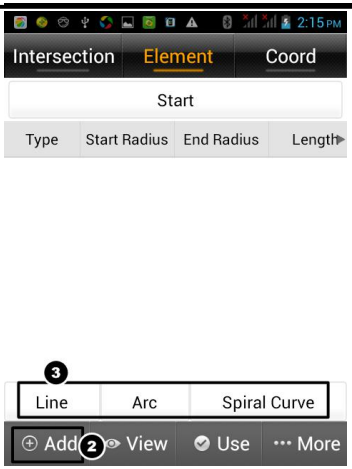
The elements you should input are origin coordinate, station and azimuth. Press *Add*, there will be *Line*, *Arc* and *Spiral Curve* to choose.

Click “Line”, you need to input length of line.

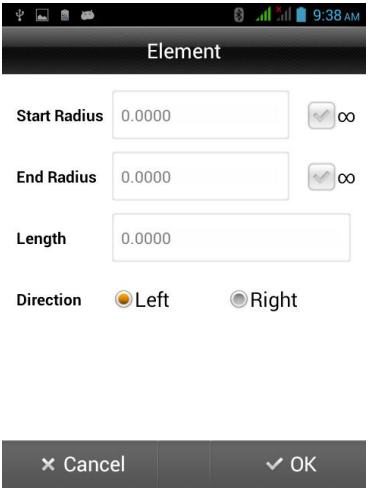
Click “Arc”, you need to input Start Radius, length of arc and direction.

Click “Spiral Curve”, you need to input Start Radius, End Radius, length of spiral curve and direction.

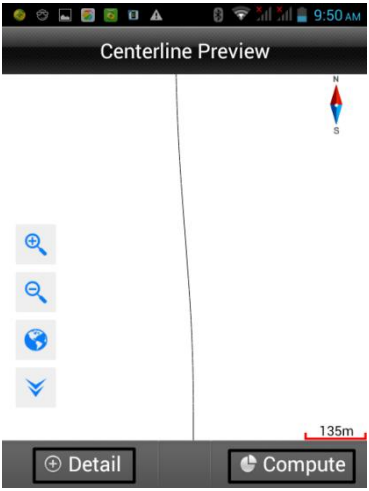
	
Press *Start* to enter edit interface.	Edit the information of origin point in this interface.

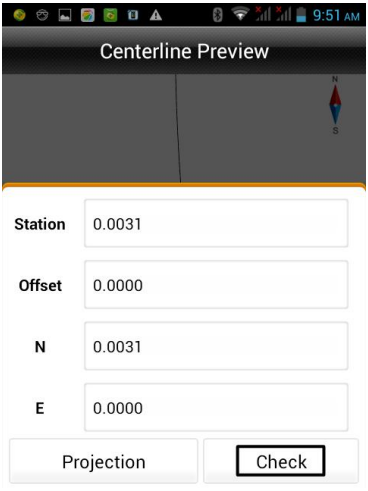


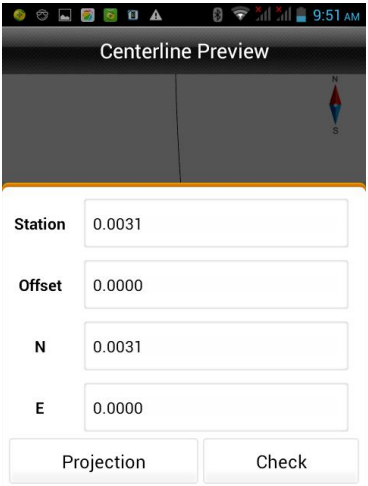
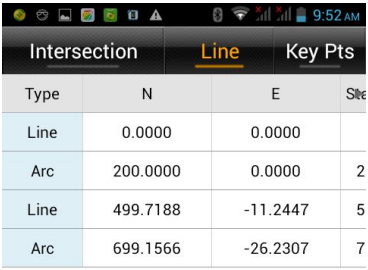
Press Add to create a line, arc or spiral curve.



Edit the detail information of elements.

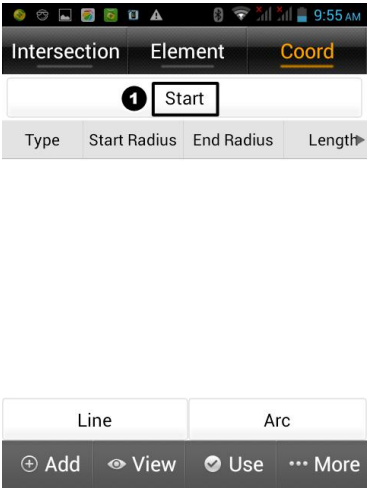




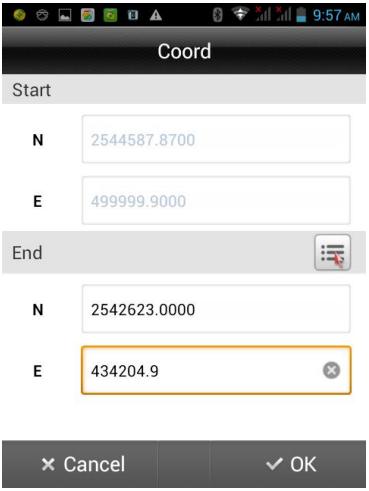
Press View to enter this interface.	Press Compute to enter this interface. After inputting Station, click Check.
	
Then you can see the checking information in this interface.	Press Detail to enter this interface. You can see the detail parameters.

Coordinate method

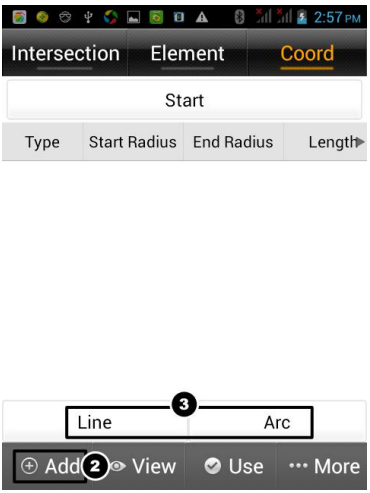
In coordinate method, you should define the coordinates of origin and end point of each element.

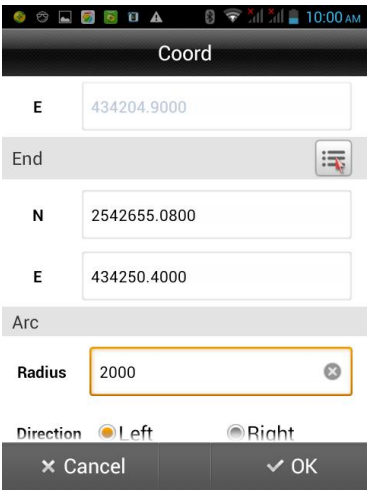


Press *Start* to enter edit interface.



Edit the information of origin point in this interface.





Press Add to input the coordinates of a line or arc .	Input the coordinates of line or arc.

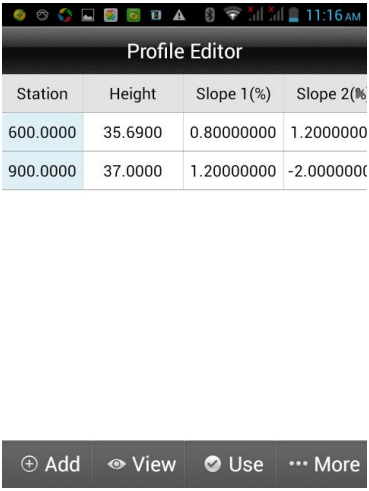
In she step ③, you can choose *Line* or *Arc*.

Line: Input the coordinate of start and end point.

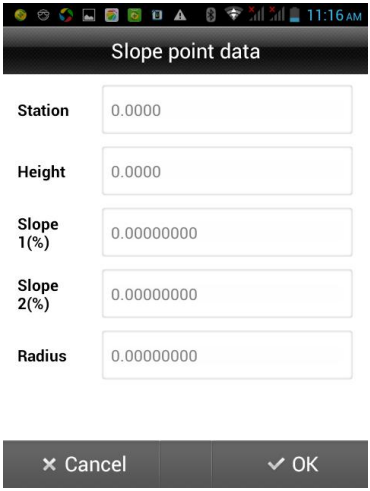
Arc: Input the coordinate of start point, coordinate of end point, radius (∞ means infinity of radius, then the arc turns line.) and direction (The *Left* and *Right* means the left and right in your forward direction).

6.3.2. Profile design

The profile is a description of road trend in lengthwise. We can input the factors or import PVI file.

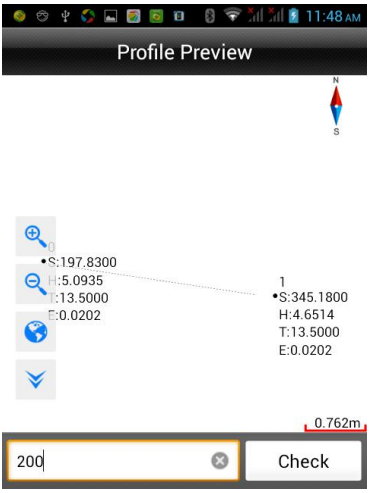
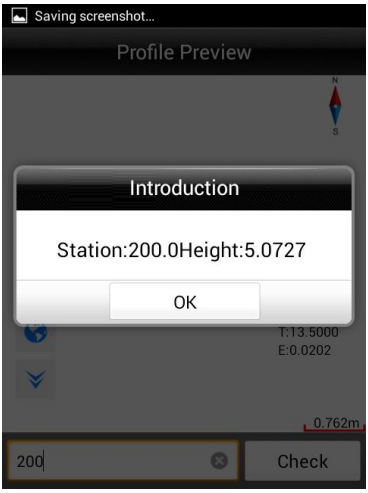


Press *Profile* to enter this interface.



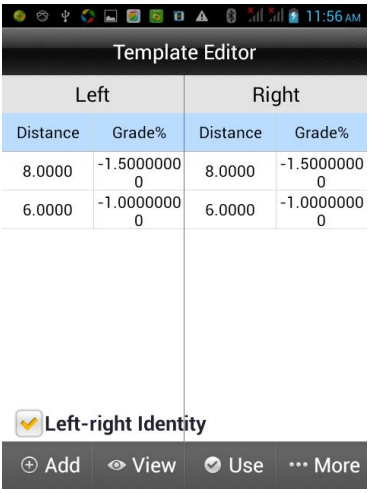
Edit the detail information of Slope point.

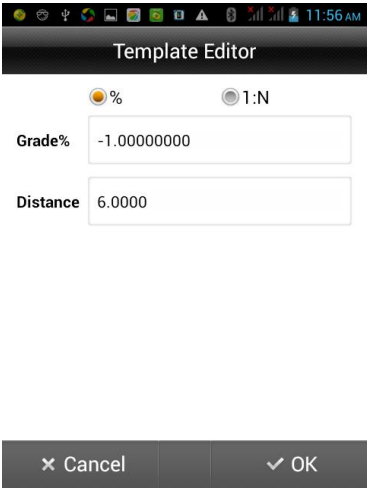
In general, Slop2 is equal to Slop1. The Slop1 of origin point is 0 and the Slop2 of end point is 0.

	
Press *View* to enter this interface.	After inputting Station, click *Check*.

6.3.3. Cross-section design

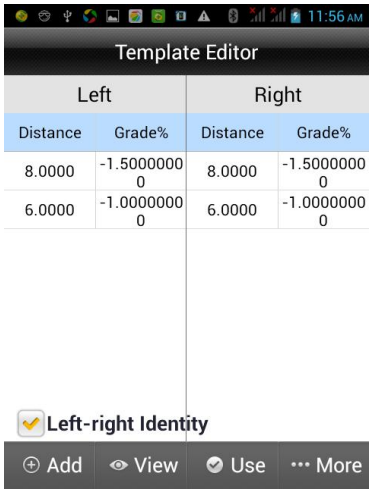
We can add and edit the data of cross-section as below:

<table>
<tr>
<td> 
</td>
<td>Press Add to create cross-section information.

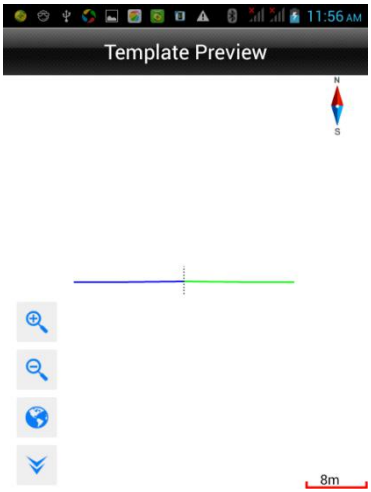
Left-right Identity: Enable it to make symmetry between Left and Right.</td>
</tr>
<tr>
<td> 
</td>
<td>Input slope and distance to add cross-section.

Grade: The slope of cross-section.

Distance: The length of cross-section.</td>
</tr>
</table>



Press *View* to enter *Template Preview* interface.



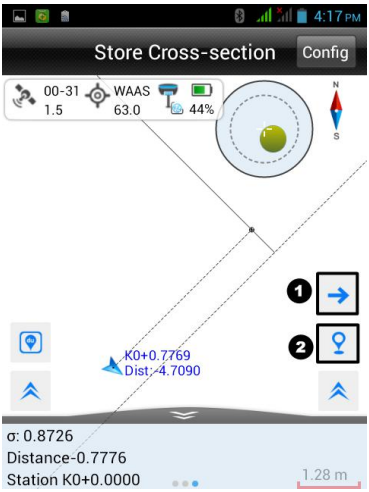
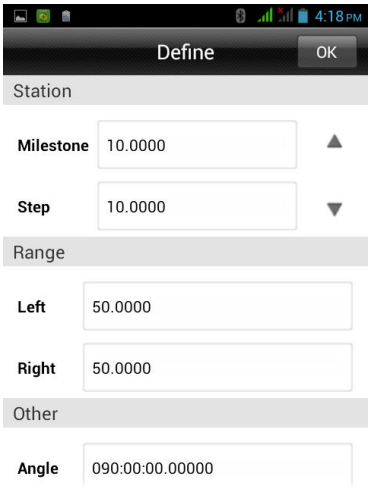
View the graph of cross-section.

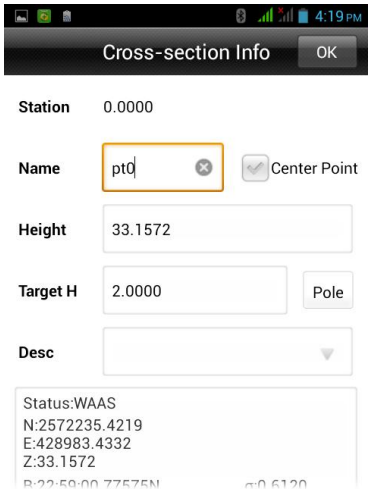
Caution：

There is only one cross-section in memory. In different road sections, there are different cross-sections. We could predefine several cross-sections before working. When you need to use it, just import the files.

6.4. Store Cross-section

In Store Cross-section, we can define a cross-section by inputting milestone. Then we can collect points in this range. After importing road files and inputting milestone, software will compute the cross-section line and display as a dashed line on screen for reference. When we get close to the reference line, the software calculates the distance between current points to reference line. If the distance is less than cross-section precision, we can store the points.

<table>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>Press ① to enter Define interface.
Press ② to store points</td>
<td>We can input Milestone, Step, Range and Angle in this interface.</td>
</tr>
</table>



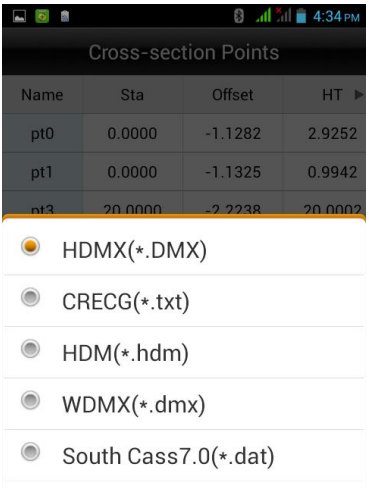
When we enable the Center Point, this point will be stored as a reference point of this cross-section.

Notice: We must define the Milestone and Center Point in each cross-section. Or the points collected will be invalid. The Center Point can be add after collecting.

6.5. Cross-section Points

We can export different format HDMX (*.DMX), CRECG (*.txt), HDM (*.hdm) and so on. The detail information is as below:

Press Export to export other formats.



Select the format you want.

6.5.1. The Format of Cross-section Points (*.cst)

Point name, N, E, Z, B, L, H, Target height, Target height type, antenna type [manufacturer : model], NRMS, ERMS, HRMS, solution type, average times, record time, elevation angle, visible satellites, common-satellites, PDOP, latency, offset distance, milestone in cross-section design, real time milestone calculated through coordinate collected, N of center stake, E of center stake and the tangential direction of cross-section. Here is a sample below:

pt0,2572235.267964896,428988.1435523343,2.9251999997842312,22:59:00.77521N,113:

22:03.63481E,5.027,00:00:00.00000N,00:00:00.00000E,0.0,2.0,0,Hi-Target:V90 Plus,7.119,9.812,21.41,Single,1,2016-03-29 08:24:42,2016-03-29 08:24:42,10,17,0,2.3,0.0,0.0,0,0,0.0,0.0,0.0,0,-1.1282473965355038,0.0,2572237.5392,428987.4679,5.497787143782138

6.5.2. HDMX (*.DMX)

The explanation of HDMX format is like below:

1 //Number of cross-section

47 //Milestone of cross-section

-2.015 -0.436 //Distance from Center Point, Elevation difference (points in the left of road)

2.013 -0.329 3.034 -0.036 // Distance from Center Point, Elevation difference (points in the right of road)

6.5.3. CRECG (*txt)

The explanation of CRECG format is like below:

47 -11.3990 //Milestone of Center Point, Elevation of Center Point

-2.235 -0.456 //Distance from Center Point, Elevation difference (points in the left of road)

3.513 -0.424 1.034 -0.326 // Distance from Center Point, Elevation difference (points in the right of road)

6.5.4. HDM (*.hdm)

The explanation of HDM format is like below:

70 // Milestone of Center Point

2 50.4239 -1.3706 21.7416 -5.3290 //Quantity of points left of Center Point, Distance from last point, Elevation difference

2 31.4820 3.7557 9.6482 19.9462 // Quantity of points right of Center Point, Distance from last point, Elevation difference

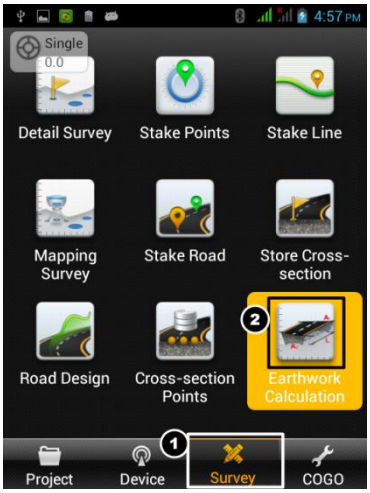
6.5.5. WDMX (*dmx)

The explanation of HDM format is like below:

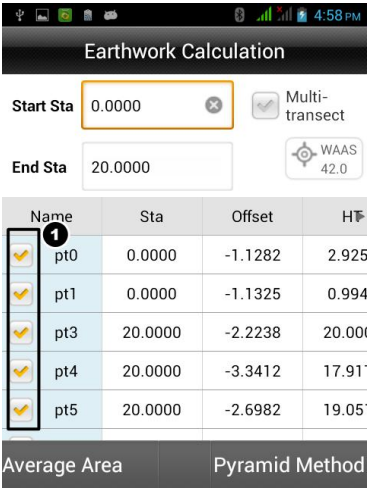
47 -19.3182 // Milestone of Center Point, Elevation of Center Point

6.6. Earthwork Calculation

There are two methods in Earthwork Calculation. One method is Average Area, another is Pyramid Method. Average Area is usually used in road because it's simple and practical. For its low accuracy, we should use this method when the area of the near cross-section is almost the same. When the area of the near cross-section is quite different, we should use Pyramid Method.



Press *Survey*, and then press *Earthwork Calculation*. The points collected will be added auto.



1. We can select the points which will be used in calculation.

Notice:

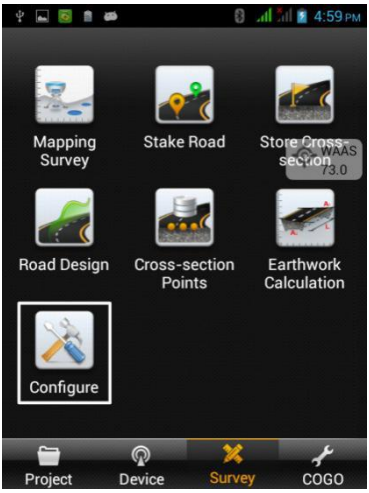
(1) There must be at least two different cross-sections which have stored points and center point.

(2) If we enable *Multi-transect*, we should input projective distance limit in the box below.

(3) The start and end milestone which will be used to calculate is the milestone of cross-section nearest from start and end.

6.7. Configure

Configure is a common menu to configure graphic display of interfaces including Detail Survey, Stake Points, Stake Line, Stake Road, Store Cross-section and Road Design.

	Press *Configure* to enter configure interface.

Below is the detail description of each configuration:

6.7.1. Display

In this interface there is Road Survey Config and Common Survey Config.

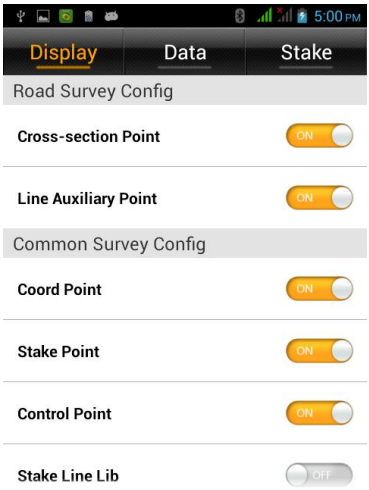


Figure 6-7-1

"Cross-section Point": Display or hide the name of Cross-section Point when collecting

"Line Auxiliary Point": Enable it to display line auxiliary point on survey interface when doing road survey.

"Coord Point": Enable it to display the name of coordinate point.

"Stake Point": Enable it to display the name of stake point.

"Control Point": Enable it to display the name of control point.

"Stake Line Lib": Enable it to display the stake line library.

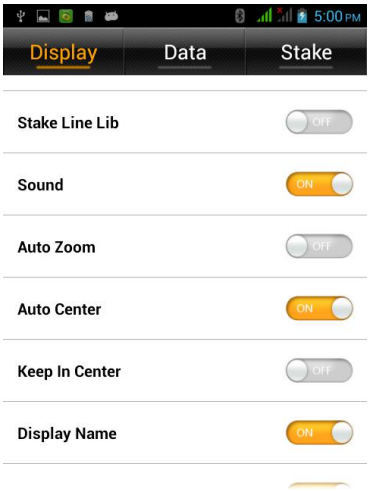


Figure 6-7-2

"Sound": Enable it to play prompt sound when staking out.

"Auto Zoom": Enable it, the scale will adjust auto to make a good vision on screen when staking out. If we enable Auto Zoom, the Auto Center and Keep In Center will be unavailable.

"Auto Center": Center the current point on screen auto when the point is out of screen.

"Keep In Center": Center the current point on screen all the time.

"Display Name": Enable it to display point names.

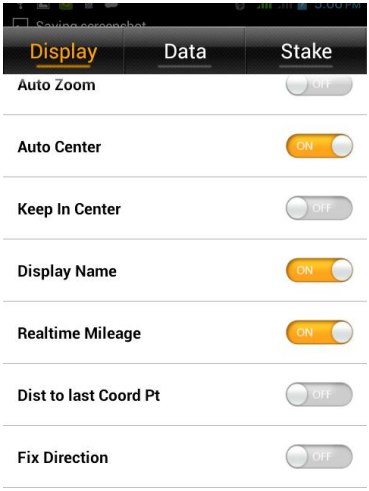


Figure 6-7-3

"Realtime Mileage": Enable it to display real time mileage (only available in stake line model).

"Dist to last CoordPt": Enable it to display the distance from current point to last point in survey interface.

"Fix Direction": Average the data of the points in a period, so the average direction will be stable.

6.7.2. Data

Data configuration contains Road Survey Config and Common Survey Config.

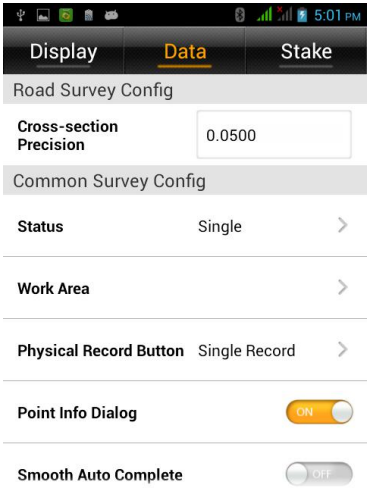


Figure 6-7-4

"Cross-section Precision": The default value is 0.0500m.

"Status": There are 7 types including Single, WAAS, RTD, PPP Float, PPP Int, RTK Float and RTK Int. If the solution quality is low, there will be a warning on screen.

"Work Area": We can draw a survey area and get over range tips.

"Physical Record Button": Set the physical record button as a shortcut button for single record or smooth record.

"Point Info Dialog": Enable it to show a confirm box after collecting a point.

"Smooth Auto Complete": After the smooth collecting is finished, it will turn to save-point interface auto.

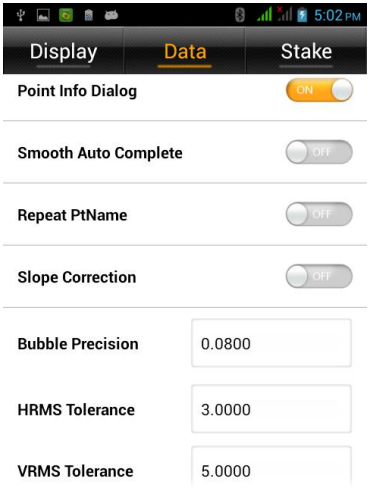


Figure 6-7-5

"Repeat PtName": Enable it and we can save the points which the point name is the same.

"Slope Correction": Before doing tilt survey, enable this option.

"Bubble Precision": Set the bubble precision.

"HRMS Tolerance": Set thehorizontal RMS. Input the max limit value, then there will be a tip when precision is bad.

"VRMS Tolerance":Set thevertical RMS. Input the max limit value, then there will be a tip when precision is bad.

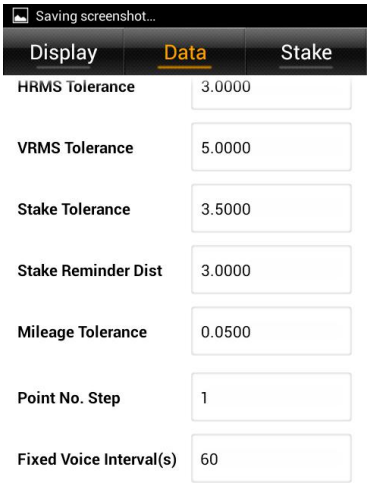


Figure 6-7-6

"Stake Tolerance": Set the limit of stake out points. When the device is in the limit range, there will be a prompt on screen.

"Stake Reminder Dist": Set a prompt range. When the device is in this range, the color of limit line will change.

"Mileage Tolerance": The tolerance of mileage which calculated by software when we stake line with Real-time Mileage enabled.

"Point No. Step": Set the interval value of point number which will be added auto.

"Fixed Voice Interval": Set the interval of voice prompt when the solution is fixed. The default value is 60s.

6.7.3. Stake

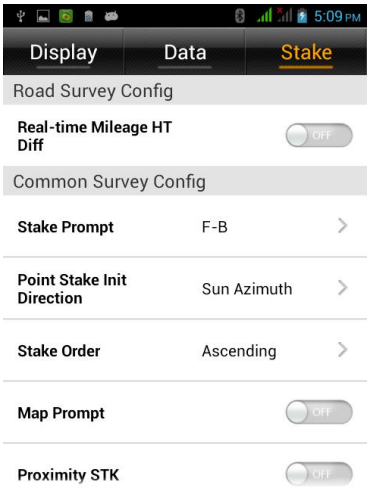


Figure 6-7-7

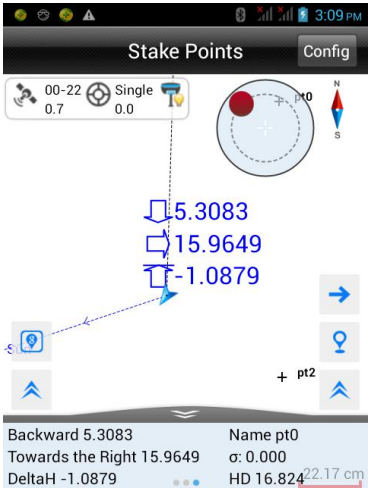
"Real-time Mileage HT Diff": After enable it, software will prompt elevation difference refer to the elevation of real time mileage when staking out.

"Stake Prompt": Choose F-B or N-S. F-B means the forward direction is the reference. N-S means north is the reference direction.

"Point Stake Init Direction": Choose sun azimuth, base azimuth or custom azimuth as the reference direction.

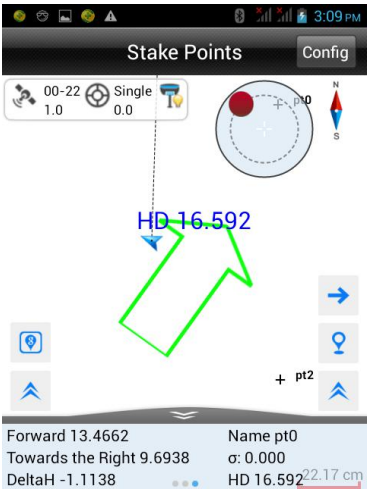
"Stake Order": Choose ascending or descending. It means setting stake out sequence as positive sequence or backward sequence.

"Map Prompt": Enable it to display three blue arrows and distance to target on screen as the picture below:



Turn off *Proximity STK*and turn on *Map Prompt*.

"Proximity STK": Enable it to display a big arrow and horizontal distance to target when the distance to stake point is longer than *Stake Reminder Dist* as the picture below:



Turn on Proximity STK and the distance to stake point is longer than Stake Reminder Dist.

If we get far away from target, the green arrow will turn red.

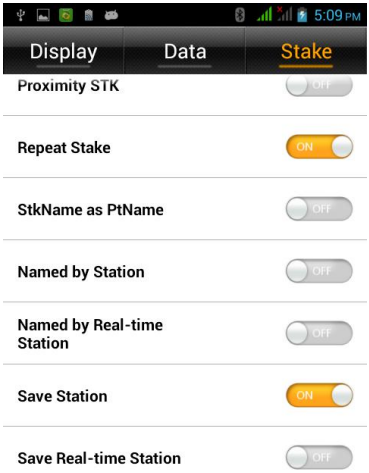


Figure 6-7-8

"Repeat Stake": Enable it to support repeat stake.

"StkName as PtName": Name the point by stake point name.

"Named by Station": Name the point by station.

"Named by Real-time Station": Name the point by Real-time station.

"Save Station": Save the station of the point.

"Save Real-time Station": Save the Real-time station of the point.

CHAPTER

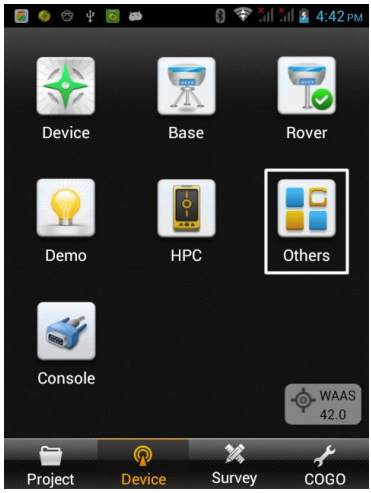
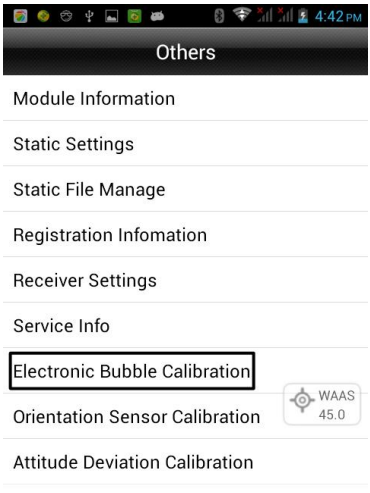
7

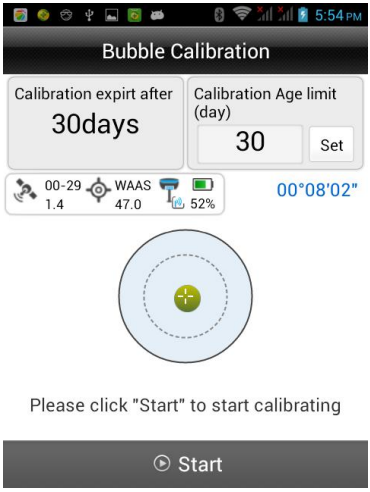
Tilt Survey

This chapter describes:

- Electronic Bubble Calibration
- Tilt Calibration and Verification
- Tilt survey

7.1.Electronic Bubble Calibration

	
Press *Others* to enter next interface.	Choose *Electronic Bubble Calibration* to enter calibration interface.

	
Put the device on tribrach and level.	Press Start to calibration.

If it prompts success, the electronic bubble calibration is finished. After the calibration, we can see Calibration Age limit. The default is 30 and we can set any value in the input box. Finishing electronic bubble calibration, we can use the electronic bubble on Hi-Survey when collecting points.

7.2.Tilt Calibration and Verification

The whole tilt calibration has four steps:

1. Electronic bubble calibration
2. Orientation sensor calibration
3. Attitude deviation calibration
4. Calibration verification

Notice:

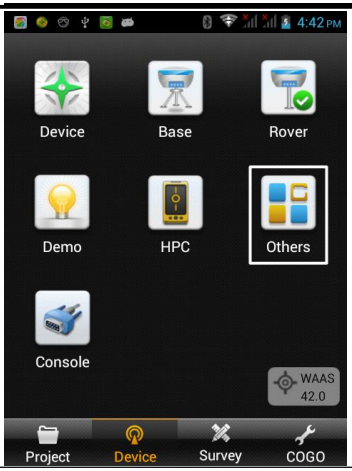
1) The calibration should be done in low magnetic interference and open field. Don't do calibration on the roof or top of a high building.
2) Before we do calibration, we should change the data link of receivers to external device. We don't use the internal UHF link to avoid magnetic interference.
3) We shouldn't change battery during all the calibration steps. If battery has been changed, we must calibrate again.

Here are the detail operations below:

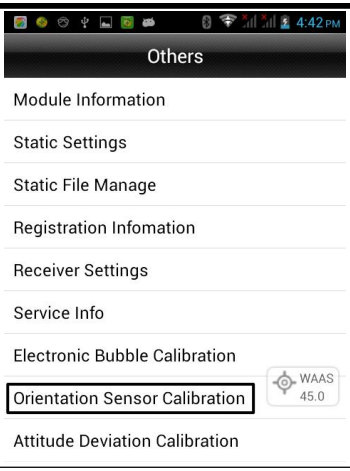
1. Electronic bubble calibration

Please refer to 7.1 Electronic Bubble Calibration.

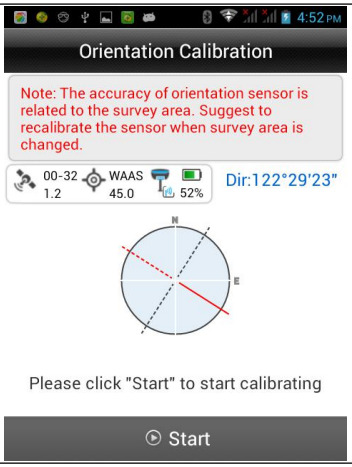
2. Orientation sensor calibration



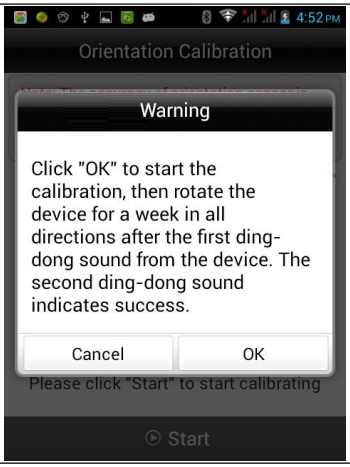
Press *Others* to enter next interface.



Press *Orientation Sensor Calibration* to enter calibration interface.

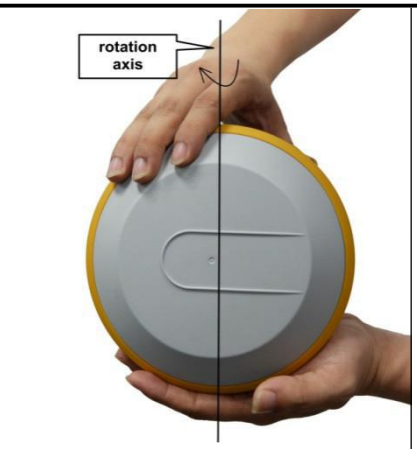


Press *Start* to begin calibration.

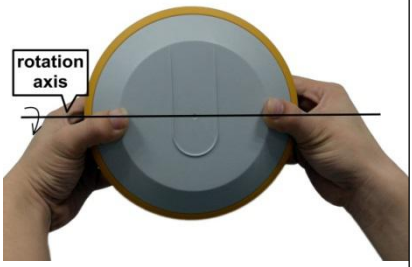


Click *OK*.

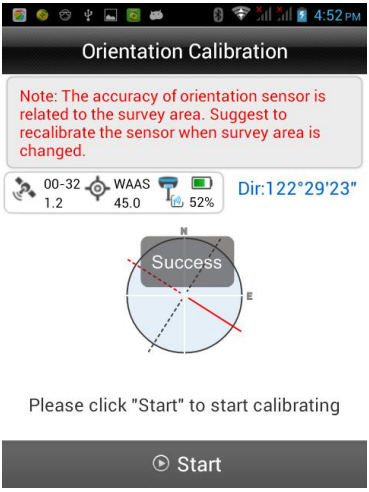
Calibration on horizontal: Keep the device on horizontal and rotate it clockwise slowly around vertical axis. The rotation speed should be less than 20 degrees per second. Rotation time should be at least 20 seconds.



Calibration on vertical: Keep the device vertical and rotate it clockwise slowly around vertical axis. The rotation speed should be less than 20 degrees per second. Rotation time should be at least 20 seconds.

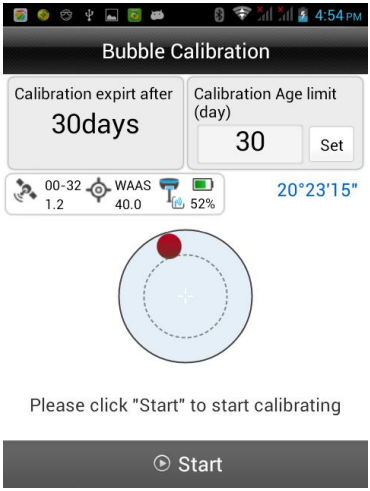


Flip horizontal: Keep the device on horizontal and rotate it clockwise slowly around horizontal axis. The rotation speed should be less than 20 degrees per second. Rotation time should be at least 20 seconds.



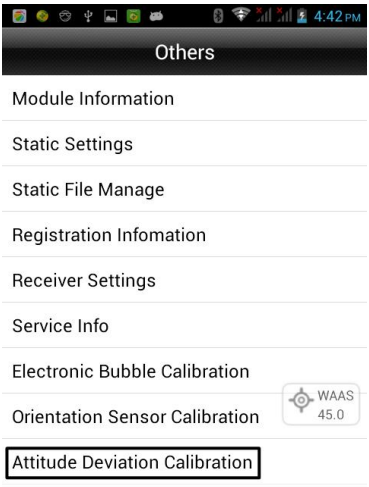
When hearing the voice “dingdong” again and it prompts success on screen, it means the Orientation Sensor Calibration is success.

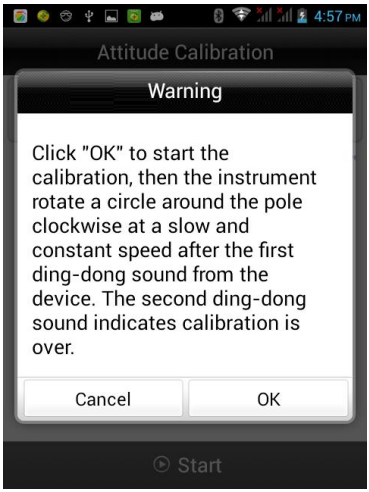
Attitude Deviation Calibration



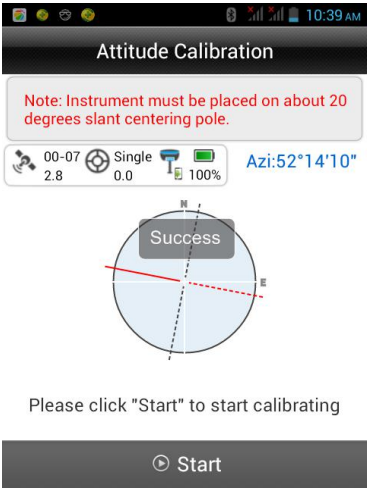
Put device on the pole and tilt pole to 20 degrees.

We can see the tilt angle in *Bubble Calibration* interface.





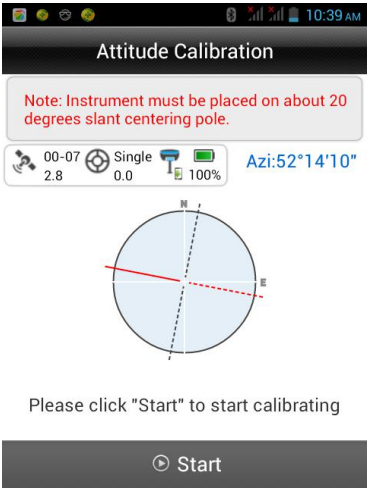
Press *Attitude Deviation Calibration*.	Click *OK*.
	Unscrew the knob and rotate device clockwise slowly around pole. Note: 1.The pole shouldn't be moved. 2. Rotate the device clockwise.

	When the calibration is success, there will be a prompt. Then do calibration verification.

Calibration verification

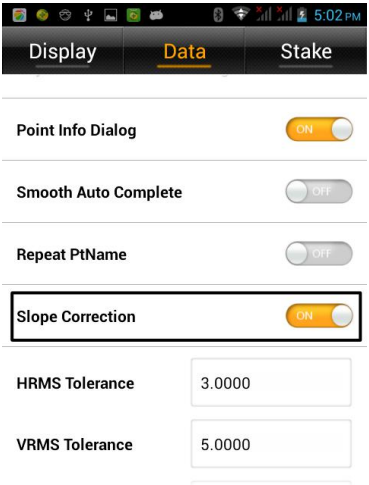
Because of the high sensitivity of orientation sensor and dependence of surrounding magnetic field, we should make calibration verification before surveying for better accuracy.

	Put device on the pole and tilt pole to 20 degrees. Unscrew the knob and rotate device clockwise slowly around pole.

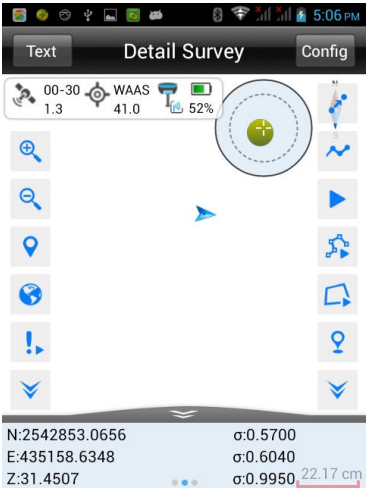
	Enter Attitude Calibration interface and see the change of azimuth. If the difference of maximum and minimum is less than 5 degrees, the verification is success. Or we should do all the calibration again. Note: 1.The pole shouldn't be moved. 2.Rotate the device clockwise. 3.Rotate speed should be 2 degrees per second.

6.1. Tilt Survey

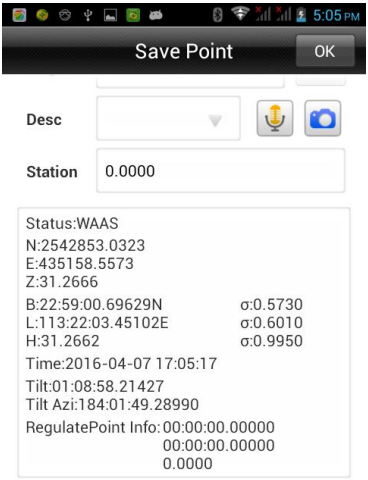
After electronic bubble calibration, orientation sensor calibration, attitude deviation calibration and verification are success, we can do tilt survey. When doing tilt survey, the pole should be static and tilt angle should be less than 20 degrees.



Before we do tilt survey, we must enable the “Slope Correction”.



Enter “Detail Survey” interface to start collecting points.



When we save point, we can see the information of tilt angel and tilt azimuth of the point in “Save Point” interface.

CHAPTER

8

iHand20 Introduction

This chapter describes:

- Handheld controller iHand20
- Registration

8.1.Handheld Controller iHand20

Front of handheld controller

The front of iHand20 handheld controller includes touch screen, keyboard and microphone

Figure 8-1-1

- Touch screen: Multipoint capacitive touch screen with touch pen, which supports Chinese and English input.
- Keyboard: Photograph, direction control, switch between Chinese and English, data collection, volume control, power on, power off and other functions.

- Microphone: Internal microphone can be used for field collection of voice message.

Reverse side of handheld controller

There are camera, battery cover, belt, trumpet, etc. on the reverse side of iHand20 handheld controller.

Figure8-1-2

- Camera: Used for field collection of image information.
- Battery cover: Internal removable lithium battery
- Belt: Connect the belt to prevent sliding down.
- Speaker: Conduct real-time voice broadcast for the instrument operation and status.

Side of handheld controller

Figure 8-1-3

- Mini USB: Used for connecting USB data line and iHand20 handheld controller.
- Audio port: Used for connecting headphone cable and iHand20 handheld controller.

Warnings:

In case of not using audio port or Mini USB, please close the rubber cover so as to be waterproof and dustproof.

Handheld controller accessories

Charger

Figure 8-1-4

Battery (Lithium battery: 3.7V /6300mAh)

Figure 8-1-5

Data line

Figure 8-1-6

Connect to the USB port of computer, and used for download of data Connect to the USB port of charger and used for charging handheld controller

Touch pen

Figure 8-1-7

In case of using touch pen to operate the handheld controller, it is required to start the function of "handwriting pen", and open the handheld controller's [system setting] → [auxiliary function] → check [handwriting pen]

Operation of handheld controller

Keyboard

Most settings and operations of Hi-Target iHand20 handheld controller can be completed by the touch pen, and commonly used operations can be completed by Keyboard. Appearance and functions of Keyboard are introduced briefly as follows.

Figure 8-1-8

Keyboard include: Back, OK, Power, APP, Fn, Collect, Camera, etc. on button board of iHand20.

Back: Delete or exit the operation of current window.

OK: Confirmation.

Power: Press it for above 3s for power on/ power off. Under the power on status, press power button for 1s to turn off / turn on the screen backlight.

APP: Quick start of Hi-Survey software, press button APP for a long time for the Road popup, then select "Hi-Survey Road" and click [Ok]. And the software selected this time can be started quickly only by pressing button APP next time.

Cautions: When installing Hi-Survey Road for the first time, it is necessary to press button APP for 3s for software quick start selection settings. Otherwise, corresponding software cannot be started quickly by only pressing button APP.

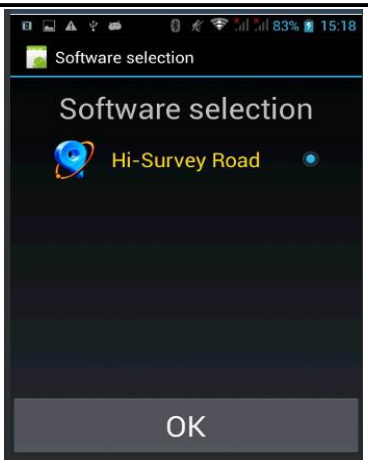


Figure 8-1-9

Fn button: Press Fn button for 3s and popup interface of software switching so as to achieve fast switch of input method. In case of [physical button input method], only press Fn button to switch over input methods of Chinese Pinyin ,strokes, digitals and letters under input status.

Collect button: Collect data by manual operation.

Camera button: Press it for a short time to enter into photograph interface; Press it for 3s

on the non-camera interface to start up/shut down flashlight function.

Screenshot: Press "VOL-" and power button simultaneously for 3s, screen capture will be kept in the file of "Mobile phone storage→ Pictures→ Screenshots".

Cautions:

1. When the iHand20 handheld controller is not used in the work, please turn off the backlight for saving electric quantity and prolonging the working time.

2. Only the image collection interface supports the shortcuts operation. In order to avoid the input conflict of input box, the text interface does not support shortcuts operation.

(1) Average collection shortcut is Button "7";

(2) Indirect measurement shortcut is Button "8".

Data download

1. Connect handheld controller to computer by USB data line, and pull down the notice column and click USB computer connection [open USB storage].

2. If it is required to synchronously operate handheld controller or install and use third-party software to debug data on the computer, "USB debugging" function shall be ticked. Turn on the handheld controller, and click [System Settings] → [Developer options] → [USB debugging] on the desktop menu.

3. In the popup debugging window, click [OK] to complete the connection between handheld controller and computer.

4. In the computer, file operations between handheld controller and computer can be conducted by [Portable Devices].

8.2.Registration Procedure

Register iHand20

Step 1: Run the *Auth Code* App which icon is like a lock. (You can find it on the desktop or the Apps Listing.)

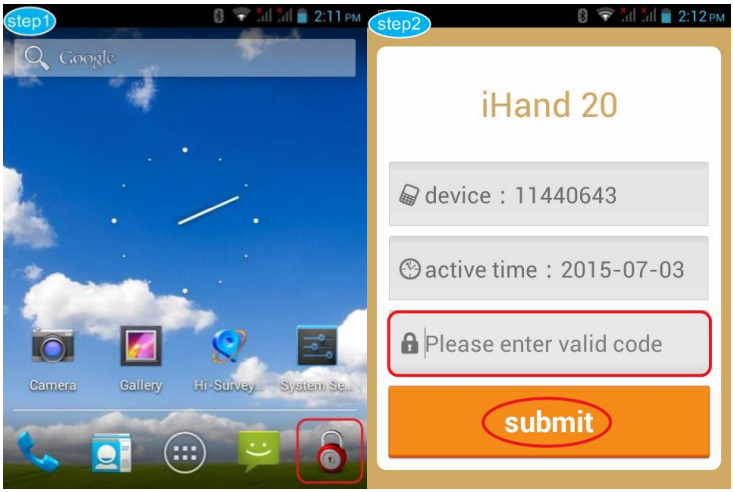


Figure 8-2-1

Step 2: Enter the registration code in the input box, then click *submit.*

Step 3: Registration should be successful. If failed, please check the code and try more times.

Register GNSS receiver via Hi-Survey App

Step 1: Power on your GNSS receiver then run the *Hi-Survey* App and click the *Device* icon

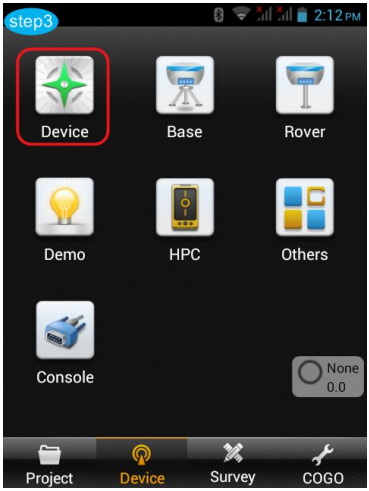


Figure 8-2-2

Step 2: Connect your GNSS receiver first, and then click the *Register*icon. Input the 24 bit registration code, press *OK.*

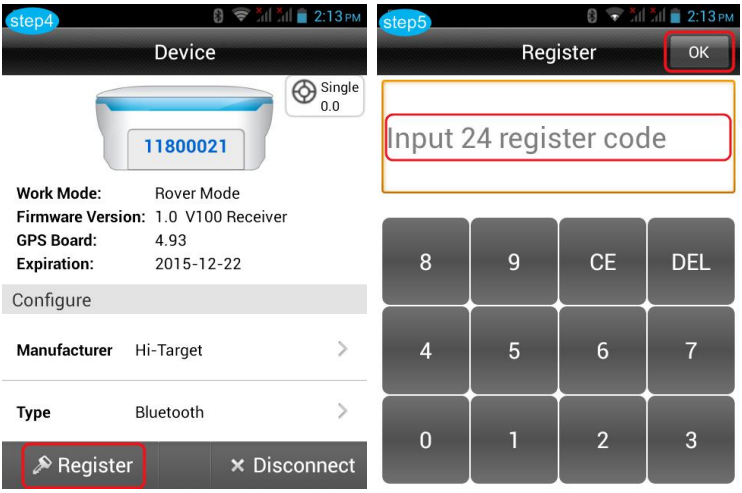


Figure 8-2-3

Step 3: Registration should be successful. If failed, please check the code and try more times.

CHAPTER

9

Appendix

This chapter describes:

- Troubleshooting
- File formats & description

9.1.Troubleshooting

1. The software cannot run or crash frequently.

Try to reinstall the software, update to new version. If these operations cannot work, reset the controller to factory settings and try installing and running again.

2. The rover station cannot get access to Internet in internal GSM/GPRS/3G mode.

① No SIM card, unsupported SIM card or improper installation of SIM card.

② Network configuration is incorrect. Please check the values:

IP, Port, APN, Mountpoints, User name &Password (in CORS Mode), Area ID & Group ID (in ZHD Mode).

③ The bad network signal. Try moving to another area.

④ The CORS server is abnormal. Try changing to another server.

⑤ Reset the network module.

3. The rover station cannot receive corrections and get fixed solution.

① In UHF radio mode, please make sure the channel and baud rate of base and rover are the same

② In Network mode, please make sure the rover has access to Internet and the parameters of CORS server is working normally.

③ Please select the same correction format of both base and rover.

④ Make sure the signal quality of satellites is good (The number of public satellites is more than 4).

4. The controller cannot connect to the receiver.

① Make sure the receiver isn't working in static mode.

② Make sure the eight-pin cable hasn't been occupied.

③ Searching for the Bluetooth device and try connecting again.

④ Reboot the controller or the receiver once.

⑤ Install the latest version of firmware and software.

5. The ihand20 controller cannot be recognized by computer.

① Please check whether the drivers of controller have been installed on your computer.

② Make sure that both of USB port and cable are normal. Try changing to another port or using another cable.

③ Enable the USB storage option on Android OS notification bar.

9.2.File Formats &Description

【*.dam】: Ellipsoidal parameter

【*.prj】: Project file

【*.raw】: Raw data file

【MainCst.cst】: Transverse section point library

【*.mcp】: Mapping data file

【*.bak】: Backup file

【 ParamComputer 】: Mated points (be used to calculate projection transformation parameters)

【*.RSP】: PPK time log file

【*.ppk】: PPK post-processing file

【*.txt】: Text file

【*.csv】: CSV Excel file

【*.dxf】: Dxf AutoCAD file

【*.shp】: Shp ArcGIS file

【*.dat】: Cass7.0, Scsg2000, PREGEO data file

【*.stl】: Hi-RTK Points lib record

【*.line】: Line lib file

【*.ICD】: Elcad format

【*.PHI】: Point of horizontal intersection

PHI file is stored in line, separated by comma. The first line is format description [File header]. Starting from the second line there will be the information of intersection point. The structure is as below:

No., Coordinate N, Coordinate E, Mileage of starting point, curve radius, First easement

curve, Second easement curve

For example:

1，3361410.701，524798.9388，200000，0，0，0

2，3361729.719，516179.2477，207750.218，7000，400，400

3，3362156.214，514352.2852，209804.108，7000，400，400

4，3363142.054，511810.6419，212590.856，7000，400，400

5，3365587.828，502113.9878，222784.866，10000，270，270

【*.Zline】：File used in coordinate method

【*.PVI】：Point of vertical intersection

PVI file is stored in line, separated by comma. The first line is format description [File header]. Starting from the second line there will be the information of intersection point. The structure is as below:

Mileage S, Elevation H, The first slope ratio i1, The second slope ratio i2, Circular curve radius：

For example:

S，H，i1，i2，R

19653.349，794.963，0，0.049，0

20070，815.379，0.049，0.007，12000

22180，830.155，0.007，-0.025，30000

23880，787.655，-0.025，-0.014，17000

23974.007，786.339，-0.014，0，0

【*.TPL】：Cross-sectional design line file

TPL file is stored in line, separated by comma.

The first line is format description [File header].

The second line is the design line of left side.

The third line is the design line of right side.

The structure is as below:

Design line of left side [distance, slope ratio]\r

Design line of right side [distance, slope ratio]\

For example:

10,-0.1

10, 0.1

【*.Sec】: Element file

Sec file is stored in line, separated by comma.

The first line is format description [File header].

The second line is the information of starting point, including: coordinates, mileage and azimuth.

The third line is the description of element formats.

Starting from the fourth line there will be the information of elements. The structure is as below:

Type, the radius of starting point, the radius of ending point, length of element, deflecting direction

Notice:

*.Type: line, arc, easement curve.

*. Radius: -1 represents infinity.

*. Deflecting direction: Left turn :LRight turn :R.

For example:

X0, Y0, S0, Azi0

3829469.058, 494798.067, 0, 1.67595677755068

[Type{L, A, S}, R1, R2{-1=infinity}, Length, Direction{L, R}]

L, -1, -1, 334.315, L

S, -1, 300, 145, R

A，300，300，60，R

S，300，90，60，R

A，90，90，75，R

Import and export files format description

Points in***.csv** format

Point name，N，E，Z，description

4，20.9919，7.8963，-0.0147，Test

Points to be stake-out in ***.txt** format

Point name，N，E，Z，description，mileage，if it has been staked out or not(0：no，1：yes)

1，2542604.5095，434458.4638，47.5900，tree，10.0000，0

22，2542604.5062，434458.4614，45.4771，light，30.0000，1

Control points in ***.txt** format

Point name，N，E，Z，description，coordinates type（0:BLH，1:XYZ），B，L，H

t，2542604.2867，434459.2702，47.9231，C pointA，1，22:58:52.51358，113:21:38.93873，47.9231

uu，2542604.5062，434458.4614，45.4771，Test，1，22:58:52.5206，113:21:38.91030，45.4771