SurPro6.0

(Android version)

User Manual



GUANGZHOU ALPHA GEO-INFO CO., LTD

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SurPro6.0 Software Overview

1.1 Software Introduction

SurPro6.0 software is GUANGZHOU ALPHA GEO-INFO CO.,LTD. developed based on GNSS hi gh-precision location application development of engineering surveying application software, devel opers according to years of mapping development and market experience accumulation, combined with a large number of industry users using habits and Android operating style habit fusion, Develo ped high-precision position measurement and acquisition, point line stake, road design stake, CAD and other powerful and simple operation of engineering measurement application software.The soft ware has the characteristics of simple operation and user-friendly operation process, powerful road design and construction stake function, powerful CAD drawing stake function, functional menu dis play is convenient for users to customize design and so on.

The following describes the basic functions of the software: The software mainly includes four parts: project, instrument, measurement and tool.

1.1.1 Project

This part is mainly for project configuration, project data management and software Settings and other related operations, mainly including project management, calculation of conversion parameters, base station translation calibration, coordinate system parameter setting, coordinate point library, code library management, survey area setting, conversion setting, software and other functions.

1.1.2 Device

This part is mainly aimed at the operation related to the connection of high-precision GNSS equipment and equipment setting, mainly including communication setting, mobile station mode setting, reference station mode setting, static mode setting, instrument information viewing, instrument setting, satellite star map star map and positioning information viewing.

1.1.3 Survey

This part mainly uses GNSS position to carry out field data measurement, stake and other operations related to industry application, mainly including point measurement, fragment measurement, control point measurement, point stake, CAD, linear stake, site elevation control, road design stake, GIS data collection and other functions.

1.1.4 Tools

This part is mainly related to the measurement of some common practical tools, mainly including coordinate conversion, Angle conversion, perimeter area calculation, calculator and other functions.

1.2 Software Installation and uninstallation

Installation process:

1. Download android SurPro6.0 software installation (*.apk).

2. Copy the SurPro6.0 software installation program to your mobile phone (Handheld) device. Find the software installation in file Management on your handheld device and click the installer to instal 1 it.

3. Click the desktop SurPro6.0 software to enter the software (you need to create a project when ent ering the software for the first time, and it will automatically open the software and use the project a fter each startup).

Uninstallation process:

Uninstall Method 1: Hold down the software icon on the desktop, drag it to the Uninstall option box, and click OK to uninstall the software.

Project

The main window is displayed. Click Project.Figure 2-1 shows the corresponding menu. The project t includes project management, localization, calibrate point, coordinate system, point database, code library management, survey range settings, software setting, about software and other functions.



Figure 2-1

All data and operations of the software are stored and managed by engineering pr ojects. After entering the software for the first time, you must create a projec t first. After entering the software each time, the software will automatically load the project used for the last time. Each Project is stored in the correspon ding directory (default location: Internal storage ->SurPro->Project) as a Proje ct name folder. The basic information of the Project is stored in Project name.j ob, and other data is stored in the corresponding directory file.

2.1 Project Management

Click [Project] -> [Project Management], as shown in Figure 2.1-1. Project management includes cr eating a project, removing a project, opening a project, and opening a disk project that is not in the l ist.

Click the item shown in the item list, and the functions of remove and open will appear, as shown in Figure 2.1-2. Click Remove, as shown in Figure 2.1-3, to remove the project from the list. If you se lect Delete data file at the same time, the data on the disk of the project will be deleted; if you do no

t select delete data file at the same time, the project will only be removed from the list, and you can open the project in other projects later, as shown in Figure 2.1-4.

Click New Project, as shown in Figure 2.1-5. To create a Project, you need to fill in the Project nam e, operator, Project description and other basic information of the Project. You can also modify the path of the Project in disk (internal storage ->SurPro->Project by default), click Next, and fill in the coordinate system parameters used by the Project. As shown in Figure 2.1-6, click Finish to comple te the new project.

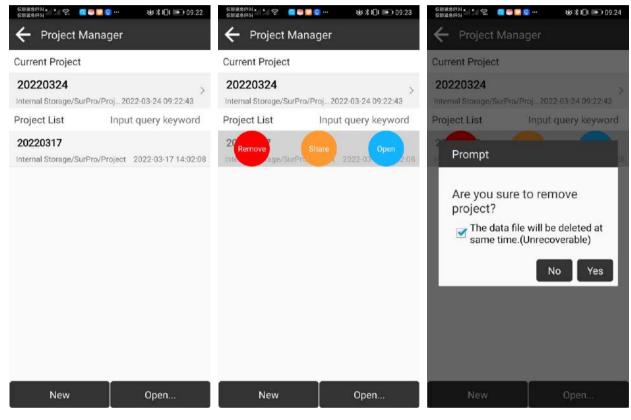


Figure 2.1-1

Figure 2.1-2

Figure 2.1-3

File Name	Basic Information	Coordinate systems parameters	Basic Information	Coordinate systems parameters
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■ 20220324	Lat/Lon format	dd°mm'ss.ssss" >	ITRF Parameter	
	Default 1st Point Name	Pt1 >	Projections Parameter	
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2.2 Localization

Click [Project] -> [Calculate conversion parameters], as shown in Fig.2.2-1.The high-precision posi tion obtained by the software from GNSS equipment is the longitude and latitude coordinates of sat ellite positioning, but in actual engineering operations, the plane coordinates of the ground are ultim ately needed for measurement and application.If the customer has coordinate conversion parameters, the coordinate system parameter values can be directly set in the coordinate system (Detail 2.4). If t he customer does not have specific coordinate system parameters, but the corresponding values of 1 ongitude and latitude coordinates and plane coordinates are called control points. In the case of cont rol point data, conversion parameters can be calculated by this function and applied to engineering p rojects.

In conversion parameter management, you can manually add control points, as shown in Figure 2.2-2. You can also import control point parameters in multiple formats, as shown in Figure 2.2-3. The commonly used formats are listed. You can set a format to be commonly used or not, as shown in Figure 2.2-4, or add a custom format, as shown in Figure 2.2-5. In the control point list, click the data item to enter modify edit control point parameters. You can hold down a data item to select multiple data items and delete all data items, as shown in Figure 2.2-6. You can also export control point dat a to a file and provide it to third-party software.

After editing the control point parameters, calculate the conversion parameters of the control point a nd click "Calculate" to pop up the setting of calculation parameters, as shown in Fig.2.2-7. The para meter conversion process includes ellipsoid datum conversion, horizontal correction and vertical cor

rection. The conversion parameters that can be calculated may be all or part of the combination. The calculated conversion parameters are considered usable as long as the corresponding accuracy is ac hieved within the permissible accuracy range. Ellipsoid reference conversion is usually seven param eters, which is the conversion parameter of spatial rectangular coordinates between two ellipsoids. Horizontal correction method includes four parameters and horizontal difference parameters, and el evation correction method includes weighted average, plane fitting, surface fitting and vertical plane error. Under normal circumstances, if the operation scope is very wide, it is necessary to use ellipso idal datum conversion to meet the accuracy requirements of all control points; if the operation scope is relatively small, the corresponding accuracy can be achieved by plane correction.

After the calculation conditions are configured, click OK to display the calculation results of conver sion parameters, as shown in Figure 2.2-8. After the conversion parameters are calculated, the calcu lation report can be exported for project review and inspection. If the conversion parameters are qua lified, the parameters can be applied to the engineering project, and the normal measurement operati on can be carried out.

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C	ж	Export Report	Apply
Figur	ce 2.2-4	Figure 2	2. 2–5

2.3 Calibrate Point

Click on [project] - > calibrate point, as shown in figure 2.3 1, in the process of practical application, GNSS difference data combined solution of equipment through the base station is of high precision position, here we know reference station coordinates is known, in fact, the output of high-precision GNSS equipment location is the relative position of base station. In the actual application process, a part from some users using the differential data of CORS reference station, a considerable number o f users also use the differential data of reference station construction, a project may involve multipl e startup of reference station, and when starting reference station, The start position and start the base e station coordinates may change, and start the coordinates are not necessarily the right, in the case of without calibration, use these stations differential data measurement and the coordinates of the new differential data before get the coordinates of the differential data of the new base station calibration is required w hen the mobile station receives the differential data of the new base station for measurement operati ons, so that the coordinates obtained by the software are matched with those obtained by connecting the last base station.

After the starting coordinate or starting position of the base station changes, it is necessary to use a known position to calibrate the coordinates correctly.Select a known point in the point library (usin g the coordinates measured at a certain position of the last base station), then put GNSS equipment at the position of the known point to measure a new anchor point and calculate the deviation, as sho wn in Figure 2.3-2.After the point is determined, the coordinates received by the software are match ed with those measured last time.

Base station coordinates changes remind whether to recalibrate. If it is to receive differential signals from self-built reference stations, base station coordinates change, indicating that base station transl ation calibration needs to be carried out, and translation calibration needs to be recalibrated.

Note: THE CORS reference station is a long running reference station whose position and starting c oordinates do not change. If the differential data of the CORS reference station is used, the obtained coordinates will be correct even though the received coordinates may change, without translation c alibration.

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2.4 Coordinate System

Click [Project] -> [Coordinate System], as shown in Figure 2.4-1. The coordinate system parameter s are to convert the longitude and latitude coordinates received by GNSS equipment to the plane co ordinates required by users through certain algorithm calculation. This calculation is converted to se t corresponding parameters. The whole calculation conversion process is as follows:

1. Original latitude and longitude coordinates -> Spatial cartesian coordinates of the WGS84 ellipso id: use the WGS84 ellipsoid parameter;

2. Spatial cartesian coordinates of WGS84 ellipsoid -> Spatial cartesian coordinates of target ellipso id: use datum conversion parameters;

3. Spatial cartesian coordinates of target ellipsoid -> Target latitude and longitude coordinates: use t arget ellipsoid parameters;

4. Target latitude and longitude coordinates -> Projection plane coordinates: use target ellipsoid + p rojection parameters;

5, projection plane coordinates -> target plane coordinates: use plane correction + vertical correctio n parameters;

Click "Ellipsoid Parameters" to enter the ellipsoid management interface, as shown in Figure 2.4-2. Select the required ellipsoid from the ellipsoid list. You can also add or delete ellipsoid parameters.

Click "Projection Parameters" to enter the interface for editing projection parameters, as shown in F igure 2.4-3. You can choose gaussian projection, UTM projection, Mercator projection, tilted stereo

graphic projection, double stereographic projection, etc. If it is gaussian projection, enter the correct central meridian, north plus constant, east plus constant, projection scale, datum latitude and other parameters.

Click "Datum Parameters" to enter the interface for editing datum conversion parameters, as shown in Figure 2.4-4. The transformation models include Boolean sand, Boolean sand (with origin param eters), Boolean sand strict algorithm, Helmert, three-parameter transformation models, etc.

Click "Horizon Adjustment" to enter the interface for editing plane correction parameters, as shown in Figure 2.4-5. The transformation model includes four parameters and horizontal adjustment mod el. Also support grid conversion file conversion, import grid offset file, according to the transition p oint in the grid position, to correct the coordinates.

Click "Vertical Adjustment Parameters" to enter the interface for editing vertical correction paramet ers, as shown in Figure 2.4-6 and 2.4-7. The transformation model includes fixed error, surface fittin g and vertical adjustment model. Also support geoid file conversion, import geoid file, according to t he conversion point in the level position, to correct the coordinate elevation. Levelling file managem ent interface, as shown in Figure 2.4-8, allows users to import and remove levelling files and set par ameters by selecting required levelling files.

Click "Local Offsets" to enter the local offsets editing interface. In small scale jobs, sometimes ther e is only one control point, and you just need to translate from the projected plane coordinates to the target plane coordinates, which can be set here. The difference between translation parameters here and base station translation calibration is that coordinate system parameter setting here will affect a ll data of the whole project. If there is any change, the transformation of longitude and latitude coor dinates and plane coordinates will be recalculated, while base station translation calibration will onl y affect the measurement coordinates after calibration operation.

In addition to manually entering coordinate system parameters, you can also click after the name

is l, select coordinate system parameters from the list of commonly used coordinate systems. Com mon coordinate system management can be added, imported, or selected from a template, or remov ed from the list with a long press.

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Figure 2.4-1 Figure 2.4-2 Figure 2.4-3

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Fi	gure 2.4-7	Figure	2.4-8	Figur	e 2.4-9

2.5 Points Database

Click [Project] -> [Points Database], as shown in Figure 2.5-1. Here you can view and manage the p oint data in the project, including adding, deleting, restoring, viewing point details, importing, expor ting and other functions.

Add: as shown in Figure 2.5-2, manually input roll call, code and corresponding coordinates;

Delete: As shown in Figure 2.5-3, you can hold down and select points in batches to delete.

Recover: Restore the point data that is mistakenly deleted, as shown in Figure 2.5-4.

View point details: Click the data item in the list to view point details, as shown in Figure 2.5-5 (sm ooth point) and 2.5-6 (control point). You can also modify the roll call code information, and for co ntrol points, you can also export from here to generate control point reports.

Import: Select the format of the data to be imported, and select a data file to import the data, as sho wn in Figure 2.5-7. You can also set common formats and add or delete custom formats in format m anagement.

Export: Select the data format, location, and file name, and click Export to export data, as shown in Figure 2.5-8. If you choose to export multiple formats, it will be generated in a folder.

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Figure 2.5-4

Figure 2.5-5

Figure 2.5-6

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Figure 2.5-7	figure 2.5-8

2.6 Code library management

Click "Project" -> "Code Library Management", as shown in Figure 2.6-1. The code base is pre-defined by the code attributes of the external collection points, and the code values are quickly filled in by the choice of the image name description.

In code library management, as shown in Figure 2.6-2, select the code library to be used by the proj ect. You can import the code library, as shown in Figure 2.6-3, or manually add the code library, as shown in Figure 2.6-4 and 2.6-5. In addition to filling the code in the collection point, the same cod e value can also be set for automatic mapping, which can quickly and conveniently measure the gro und object icon of straight line and line removal type.

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2.7 Survey Range Settings

Click [Project] -> [Survey Range Settings], as shown in Figure 3.7-1. The function is to determine whether the current positioning position is within the range of the measurement area in real time by setting a certain range of coordinates in the process of field measurement. If it is beyond the range, i t will timely remind the user of the scope of the work beyond the scope, so as to avoid the user to do the work beyond the scope of work.

Edit and manage the test range, including adding coordinates, batch selecting from the point databas e, as shown in Figure 2.7-2, and importing and exporting the coordinates of the test range. You can view a preview of the test area, as shown in Figure 2.7-3.

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		Button		8-4	

2.8 Software Settings

Click [Project] -> [Software Settings], as shown in Figure 2.8-1, 2.8-2, 2.8-3, 2.8-4. The settings inc lude system Settings, display Settings, voice prompt Settings, and shortcut key Settings.

System Settings: As shown in Figure 2.8-1, the settings mainly include length unit, Angle display for rmat, mileage display format, language, and text coding.

Display setting: as shown in Figure 2.2-2, it mainly includes mapping display of measurement data, display sequence of north coordinate and east coordinate in the database, interface style, screen dire ction and other Settings.

Shortcut key Settings: As shown in Figure 2.8-4, the manual physical keyboard is predefined to trig ger corresponding functions, and shortcut keys are added, as shown in Figure 2.8-5. Select a functio n for which you want to define a shortcut key and set a shortcut key. This function can be triggered quickly during application measurement. You can also hold down and delete defined shortcut keys.

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Figure 2.8-1

Figure 2.8-3

Figure 2.8-2

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Fi	igure 2.8	-4	figure 2.	8-5

2.9 About Software

Click [Project] -> [About Software], as shown in Figure 2.9-1. Software registration and authorizati on information, software version information, copyright information, etc. Here you can activate aut horization, transfer authorization, check the new version and give feedback.

Software activation: Enter the entitlement code or scan the QR code to activate the software, as sho wn in Figure 3.9-2.

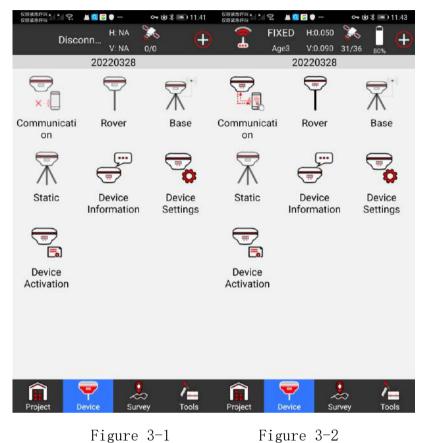
Check the new version: if there is a new version, the new version information will pop up. Click Up date to update the software to the latest version. If there is no new version, a message is displayed in dicating the latest version.

Feedback: As shown in FIG. 3.9-3, in order to provide better services to users, if you have any probl ems during the use of the software, you can feedback the problems to our technology through here, and we will provide you with immediate support. Note: Be sure to leave your contact information (mainly email), the problem description is as complete as possible, if there is any attachment (icon, video, document, etc.), you can submit it together, thank you!

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Device

On the main interface of the software, click the corresponding function menu of [Device], as shown in Figure 3-1 and 3-2. The instrument includes communication setting, mobile station mode, base st ation mode, static mode, instrument information, instrument registration and other functions.



The data measurement, collection and application of the software are based on the application of G NSS high-precision position. Before operation, it is necessary to establish communication with GN SS positioning equipment. The software obtains high-precision position from the equipment, and th e equipment also needs certain conditions to obtain high-precision position, and equipment paramet ers need to be configured.

3.1 Communication

Click [Device] -> [Communication], as shown in FIG. 3.1-1. Select the instrument manufacturer, in strument type and connection mode, then select the device parameters, and click "Connect" to comp lete the device connection. After the device is successfully connected, the main window of the soft ware is displayed, as shown in Figure 3-2. Then enter communication Settings, as shown in FIG. 3. 2-2, and click to stop cross-sectional device connection.

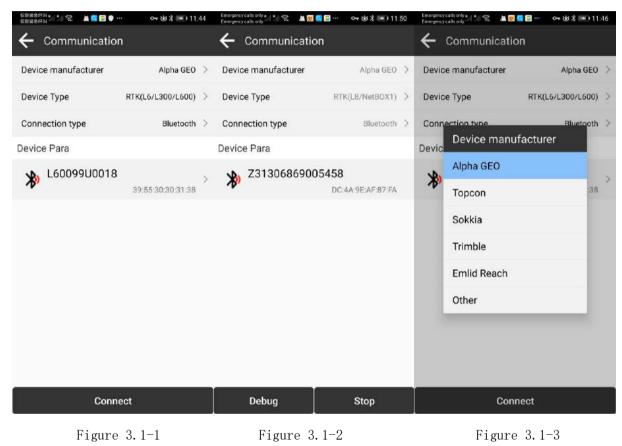
1. Device manufacturer: The software supports access of positioning equipment from GNSS instrument manufacturers such as Topcon, Sokkia, Trimble, Emlid, ect as shown in Figure 3.2-3.

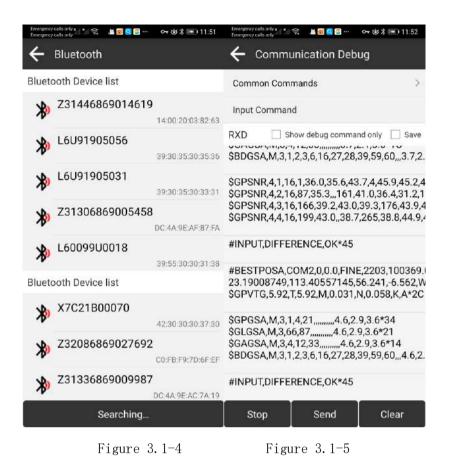
2, Device type: usually RTK, some manufacturers of equipment according to the equipment model.

3, Connection type: WIFI connection, serial port connection, TCP client connection, etc., which ma y be supported by different instrument manufacturers. The basic Bluetooth mode is basically suppor ted by all manufacturers.

4. Click 'update' to enter Bluetooth search and selection, as shown in FIG. 3.1-4. Click device to sel ect the device to be connected.

5. After the device is successfully connected, click "Debug" to view the data of communication bet ween the software and the device, as shown in Figure 3.1-4. Debugging commands can be sent to th e device to troubleshoot problems related to device positioning through the communication data.



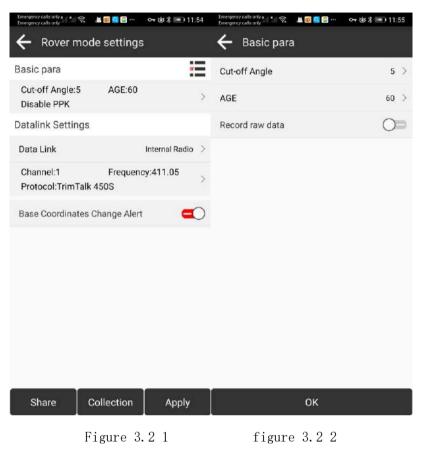


3.2 Rover

Click [Device] -> [Rover], as shown in FIG. 3.2-1.GNSS positioning device can be calculated by sa tellite reception positioning coordinates, in the case of no other conditions, due to the effect of atmo sphere of signal positioning device can only get a single point in the coordinates of the location, the accuracy is not high, in order to ensure the GNSS can get high precision position, in addition to GN SS satellite reception decoding position with the device itself, Also need to receive another near the fixed position of GNSS signal equipment, signal as reference signal to another device, because of th e influence of the atmosphere to the signal in a certain region within the scope of basic consistent, r eference signal in the condition of GNSS device known as the base station, GNSS equipment with unfixed position is called mobile station. Compared with GNSS satellite signal of mobile station, d ata transmitted from reference station is called differential data, and data transmission mode is calle d data chain. The setting of mobile station mode is to set GNSS as mobile station and configure cert ain parameters to transmit GNSS satellite signals of the reference station to the GNSS equipment in a certain way, so that the GNSS equipment can obtain high-precision positioning position.

In addition to differential data transmission configuration, basic parameters such as height cutoff An gle of GNSS and whether PPK is enabled can also be set. Click basic parameter content to enter the parameter editing interface, as shown in Figure 3.2-2. When the altitude Angle is lower than a certai n value, the satellite signal can not be received. In the case of poor satellite signal at a low Angle, it is conducive to precision calculation. The PPK parameter is to record the original GNSS observatio

n data to the GNSS receiver and use the post-processing algorithm to calculate the high-precision co ordinates.



Differential data parameter setting is mainly to set that the differential data of the reference station will be transmitted to the current equipment in some way, so as to provide necessary calculation con ditions for the equipment to solve high-precision coordinates. Data link mode mainly includes built-in radio, external radio, host network, notebook network and so on. Among them:

1. Built-in radio: as shown in Figure 3.2-1, the built-in radio of GNSS equipment receives differenti al data of the radio station according to a certain protocol and frequency for high-precision calculati on. Click Parameters to modify and edit the parameters, as shown in Figure 3.2-3. Ensure that the pr otocol and frequency of the radio station are consistent with that of the transmitting radio station, so that the data of the normal receiving radio station can be received. If the frequency corresponding t o the channel is inconsistent with that of the transmitting radio station Settin gs" to modify the frequency corresponding to each channel of the radio station, as shown in Figure 3.2-4. Click on the icon 🗮 You can select the channel frequency configuration from the predefined channel management list, as shown in Figure 3.2-5.

2. External radio: as shown in FIG. 3.2-6, GNSS equipment connects to external independent radio equipment through serial port. After receiving differential data from external radio equipment, it is t ransmitted to GNSS equipment for high-precision calculation. Click Parameter to modify and edit t he serial port baud rate parameters. In addition to ensuring that the serial port parameters of the devi

ce connecting to the external radio are correct, ensure that the protocol and frequency of the externa l radio are consistent with that of the transmitting radio.

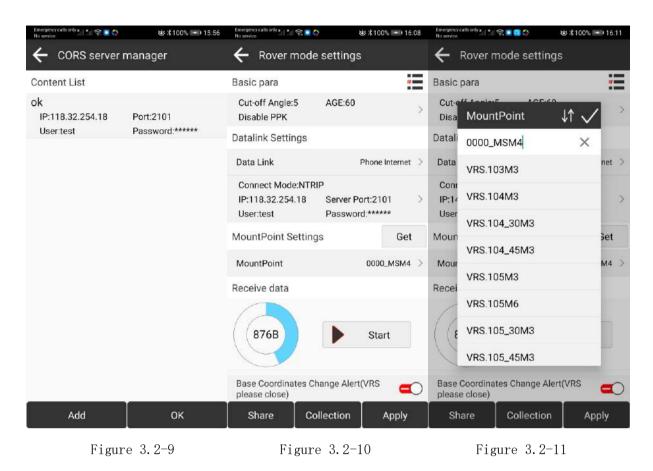
3. Host network: as shown in Figure 3.2-7, it refers to obtaining differential data from the specified server address according to a certain protocol through the SIM card network of GNSS equipment fo r high-precision calculation. Click Parameters to modify and edit the parameters, as shown in Figure 3.2-8. When the connection mode is differential data transmission protocol, NRTIP and TCP client are used to input the server IP address, port number, user name and password. The SIM network is a dedicated network, and APN parameters need to be set. CORS server parameters can be selected fr om the server management list, as shown in Figure 3.2-9. After the server address is correctly confi gured, obtain the access point list and select the corresponding access point to obtain differential dat a. In addition to obtaining an access point from the host network, you can also obtain the access point from the corresponding network of a mobile phone.

4. Manual network: as shown in Figure 3.2-10, differential data is obtained from the specified serve r address according to a certain protocol through the network of the device where the software is loc ated, and then sent to the device through the communication connection between the software and G NSS equipment for high-precision calculation. Click Parameters to modify and edit the parameters. The parameter Settings are similar to those of the host network. You do not need to configure APN parameters. Click start connection, if the configuration is ok, the data receiving progress bar will mo ve around. If the progress bar has no data, check whether the parameters are correctly configured.

Note: built-in radio and external radio data link can be set whether the base station coordinate chang e reminder, mainly because the radio is a one-way transmission, there may be more of the same freq uency radio source, can lead to a radio signal gathering, if the received signal, the other may result i n inaccurate coordinates, to remind the user to check.

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		Channel			445.125 445.525	445.225 445.626	445.325 445.725	445.425 445.825
Protocol	411.05 TrimTalk 450S >	Frequ Prote		11.05 50S >	HiTarget-2	230.825	230.925	231.025
		2 3			231.125 HuaCe 456.05 459.05	231.225 456.55 460.05	231.325 457.05 461.05	231.425 458.05 462.05
		4			Topcon 451.55 459.55	453.55 461.55	455.55 463.55	457.55 465.55
		6 7			Leica 445 445.5	445.125 445.625	445.25 445.75	445.375 445.875
		8			Trimble 411.05 415.05	412.05 416.05	413.05 417.05	414.05 418.05
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					CORS Setti	nne		67

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Figu	ıre 3.2–6		Figure	3.2-7		Figure	e 3.2-8



3.3 Base

Click [Device] -> [Base], as shown in FIG. 3.3-1. The function is that GNSS equipment acts as a ref erence station to send satellite information data in a certain way and provide it to the mobile station for reception, providing high-precision calculation conditions. It is necessary to set up the starting c ondition parameters, starting mode and data broadcast parameters of the base station.

Note: The device is not allowed to move during the base station startup, otherwise the coordinates c alculated by the mobile station will be wrong.

Start conditions include base station ID, height cutoff Angle, differential data format, PDOP limit, d elay start and other parameters. Click the parameter content to enter the parameter editing interface, as shown in Figure 3.3-4. Differential data formats include RTCM2.3, RTCM3, CMR, CMR+, DG PS, RTCM3.2 and other commonly used differential data encoding formats.

The startup mode includes single point positioning startup, designated base station coordinate startup, and measuring point coordinate startup, among which:

1. Single point positioning startup: it means that GNSS equipment outputs differential broadcast dat a for startup coordinates according to the current positioning value (low accuracy);

2. Start with specified coordinates: as shown in FIG. 3.3-2, it means that the early user knows the co ordinate position in advance according to the location of the equipment, and uses the coordinate val ue as the starting coordinate to output differential broadcast data; Click the coordinate parameter con

tent to enter the parameter editing interface, as shown in Figure 3.3-5. You can click on the \checkmark The measurement icon measures a point in real time, or you can click on the coordinate content to select a coordinate value from the point library.

3. Positioning coordinates of measuring points, as shown in FIG. 3.3-3, means that the user collects a real-time point according to the positioning data of the current GNSS equipment and certain colle ction and measurement conditions, and starts the real-time point according to the specified coordina tes. Click the parameter content to enter the parameter editing interface, as shown in FIG. 3.3-6.

Differential data parameters are mainly the differential data output by the device after the base stati on is started and transmitted in certain ways, which are received and used by the mobile station. The main ways include host network, built-in radio, external radio and dual-transmission combination. Parameter Settings are similar to those of mobile stations, the differences are as follows:

1. Built-in radio will have transmitting power. The higher the transmitting function, the farther the d istance and the greater the power consumption.

2. For host network NTRIP protocol, the base station is to set the access point for starting transmissi on, while the mobile station is to obtain the access point list and select the corresponding base statio n access point for connection, as shown in Figure 3.3-2.

3. The reference station uses the manual network to broadcast differential data independently.

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Start Up Mode	Single Point	>	Start Up Mode	Single Point	>	Start Up Mode	Single Point
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Figure 3.3-1

Figure 3.3-2

Figure 3.3-3

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PDOP Limit	3.0 >		3°24'20.0931" > 47.776	HRMS Limit	0.05 >
		Antenna Parameters		VRMS Limit	0.1 >
		Antenna Measured Height(m)	1.8	PDOP Limit	3 >
		Antenna Measurement Type	leight to phase center >	AGE Limit	5 >
		Antenna Height	1.8	Smooth	
				Survey delay	0 >
				Average GPS Count	5 >
				Settings	
				Remind when there is same	e point name 🔘
				Point Name Increment	1 >
				Default Code	Same as last point
ок		ок		Default	ок

Figure 3.3-4 Figure 3.3-5 Figure 3.3-6

3.4 Static

Click [Device] -> [Static], as shown in Fig.3.1-1. The purpose of this function is to store the origina l satellite observation data of GNSS equipment in the setting disk file, record the observation data o f one time for solving the high-precision coordinate position with static post-processing software, us ually used for control point acquisition. Static file roll call, PDOP limit, height cutoff Angle, acquisi tion interval, antenna parameters and other recording conditions need to be set.

Emergency calls only * * * • • • • • • • • • • • • • • • •		32
Options Settings		
Point name	PT	1
PDOP Limit	3.0	>
Cut-off Angle	5	>
Collection Interval	1HZ	>
Antenna Parameters		
Antenna Measured Height		0
Antenna Measurement Type	Height from Phase Center	>
Antenna Height		0
Apply		

Figure 3.4 1

Note: During static recording, the device is not allowed to move, otherwise it will lead to the coordi nate error calculated after processing.

4.5 Device Information

Click [Device] -> [Device Information], as shown in Fig.4.5-1. You can view basic information abo ut GNSS devices, such as the instrument serial number, firmware version, mainboard type, and mai nboard serial number.

Device Infor	∎ 🗟 🖻 😻 \$ 100% === 08:54 mation
Basic Information	
Serial Firmware Version Current DataLink Battery Power Expiry date	L60099U0020 L600-20220216 Phone Internet 95% 20220424
Antenna Parameter	s
L600 R:80 mm HL1:29 mm	H:38 mm HL2:29 mm

Figure 3.5 1

3.6 Device Activation

Click [Device] -> [Device Activation], as shown in Fig.4.5-1.If the GNSS equipment has expired, y ou can obtain the registration authorization code from the dealer and register the equipment here.

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1 4 7	2 5 8	3 6 9	A C E	B D F
	0		Backsp	ace
		Activatio		

Figure 3.6 1

3.7 other

1. Click the "battery quantity Icon" in the title bar of the software **1**, you can view the battery statu s, as shown in Figure 3.7-1.

2. Click on the title bar of the software To enter the communication setting function, as shown in Figure 3.1-1.

3. Click on the title bar of the software voos You can view the location coordinates output by the de vice, as shown in Figure 3.7-2. You can view the base station information and star map and star tabl e information, as shown in Figure 3.7-3, 3.7-4, and 3.7-5. As the antenna parameters of the base stat ion are not transmitted in the differential data, only the phase center coordinates of the base station a re transmitted. In order to get the ground coordinates corresponding to the starting of the base station n, the antenna parameters corresponding to the base station can be input.



4. Click on the title bar of the software You can view the information received by the device satellite, as shown in Figure 3.7-5.

5. Click "Settings" in the title bar of the star map star list to set the switch of the satellite system, as shown in Figure 3.7-6.

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<ul> <li>✓ Sat</li> <li>Detail</li> <li>G27</li> <li>L1 Ele</li> <li>G32</li> <li>L1 Ele</li> <li>C01</li> <li>L1 Ele</li> <li>E08</li> <li>L1 Ele</li> <li>E08</li> <li>L1 Ele</li> <li>E08</li> <li>E1</li> <li< td=""><td>Figurent Statement Figurent Statement Statemen</td><td>are 3. 7–1 formation SAT Info L2:0 Azimuth:176 L2:0 Azimuth:143 L2:0 Azimuth:143 L2:0 Azimuth:144 L2:0 Azimuth:151 L2:0 Azimuth:123 B2:0 Azimuth:234 B2:0 Azimuth:187 B2:0 Azimuth:187 B2:0 Azimuth:236 B2:0</td><td>100% ⇒ 09.01 SAT Map L5:0 Used L5:0 Used L5:0 Visible L5:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 D</td><td>Cet Det</td><td>Satelli Satelli tail</td><td>Base 30° 6 CO CO CO CO CO CO CO CO CO CO</td><td>SAT Info SAT Info 30° 50° 50° 50° 50° 50° 50° 50° 50° 50° 5</td><td>o SAT Map</td><td>50 - 40 - 30 20</td><td>270° 240°</td><td>Allites info Base 330 (07 (07) (07) (07) (07) (07) (07) (07)</td><td>SAT Info</td><td>\$100% = 0.09.03 SAT Map 0° 60° 90° 120°</td></li<></ul>	Figurent Statement Figurent Statement Statemen	are 3. 7–1 formation SAT Info L2:0 Azimuth:176 L2:0 Azimuth:143 L2:0 Azimuth:143 L2:0 Azimuth:144 L2:0 Azimuth:151 L2:0 Azimuth:123 B2:0 Azimuth:234 B2:0 Azimuth:187 B2:0 Azimuth:187 B2:0 Azimuth:236 B2:0	100% ⇒ 09.01 SAT Map L5:0 Used L5:0 Used L5:0 Visible L5:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 D	Cet Det	Satelli Satelli tail	Base 30° 6 CO CO CO CO CO CO CO CO CO CO	SAT Info SAT Info 30° 50° 50° 50° 50° 50° 50° 50° 50° 50° 5	o SAT Map	50 - 40 - 30 20	270° 240°	Allites info Base 330 (07 (07) (07) (07) (07) (07) (07) (07)	SAT Info	\$100% = 0.09.03 SAT Map 0° 60° 90° 120°
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<ul> <li>✓ Sat</li> <li>Detail</li> <li>G27</li> <li>G32</li> <li>G33</li> <li>G44</li> <li>G44&lt;</li></ul>	Figures Figure	are 3. 7–1 formation SAT Info L2:0 Azimuth:176 L2:0 Azimuth:143 L2:0 Azimuth:143 L2:0 Azimuth:144 L2:0 Azimuth:151 L2:0 Azimuth:123 B2:0 Azimuth:234 B2:0 Azimuth:187 B2:0 Azimuth:187 B2:0 Azimuth:236 B2:0	100% ∞ 109.01 SAT Map L5:0 Used L5:0 Used L5:0 Visible L5:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 Used B3:0 D3 D3 D3 D3 D3 D3 D3 D3 D3 D3 D3 D3 D3 D3 D3 D3 D3 D3 D3 D	2 Det	Control of the second s	ites infor Base 30° 6 60° 213° C3 60° 213° C3 60° 213° C3 60° 213° C3 60° 213° C3 60° 213° C3 70° 6 70° 6 70° 7 70° 70° 70° 70° 70° 70° 70° 70° 70° 70°	Cito Cito Cito	O         SAT Map           30*         60*           60*         90*           120*         120*           150*         41           45         43           25         1           26         1           20         00         00	50 - 40 - 30 ²⁹ 10 0 G	etail 300° 270° 240° 48 45 4 48 45 4	Ellites info Base 330 (07) (07) (07) (07) (07) (07) (07) (07	SAT Info SAT Info 30 60 60 60 60 61 61 62 61 61 61 61 61 61 61 61 61 61 61 61 61	SAT Map SAT Map 0° 60° 50° 2 45 30 41 41 41 41 41 41 41 41 41 41

## Survey

On the main interface of the software, click [Survey], as shown in Figure 4-1. It includes point survey, ey, detail survey, control point survey, point stakeout, CAD, line stakeout, DSM stakeout, Stake roa d, polyline survey, polygon survey and function customization (GIS).

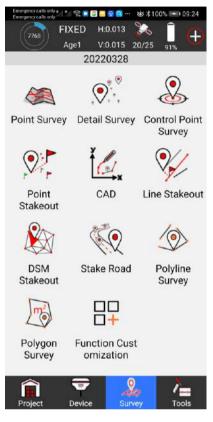


Figure 4-1

In the software, the project is the engineering data management and parameter configuration, for the field measurement function to do the necessary preparation and the measurement results of the data export; Instrument is the basic necessary condition for software to obtain high-precision position; A nd measurement is the main work of the software, which deals with what to do with high-precision coordinates and how to do it.

## 4.1 Survey

Click [Survey] -> [Point Survey], as shown in Fig.4.1-1.The positioning of GNSS equipment output is measured and collected according to certain precision limitation conditions and stored in coordin ate point database.In the point measurement interface, the title bar displays the basic positioning inf ormation output by the current GNSS device, including the current solution state, difference delay, HRMS, VRMS and other positioning accuracy evaluation values, as well as the number of receiving satellites.Below the title bar is displayed in the status bar, other important information display cont ent can be set according to user's interest in the set, the default display in the north east high in point measurement coordinates and the distance from the base station information, the middle area is me asured data mapping information, also can set the display network map, drawing area in the top righ

t corner of the electronic compass for hand thin compass shows, It is convenient for users to judge t he direction when needed.Painting area, according to the left here are functions of the acquisition of these functions can also according to the needs of the user in the Settings menu will display the req uired functionality here fast operation certain functions, area of the lower right corner drawing scale, scale the icon above is triggered measurement acquisition function keys, the keys can be used in th e according to user's mobile location, Put it in a more convenient place.Click the button to start the measurement function, as shown in Fig. 4.1-2.Below the drawing area are the measurement attribut e roll call and coding input positions, as well as the antenna height Settings and the entrance to the c oordinate point library.

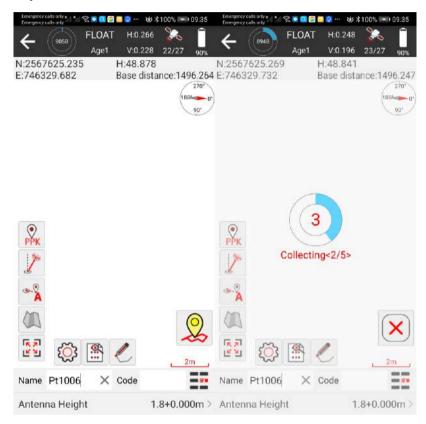


Figure 4.1 1 figure 4.1 2

Click Settings Con, enter the measurement setting interface, as shown in Figure 4.1-3. The limit ation conditions of measurement and collection are set here, such as solution state, HRMS, VRMS, PDOP, differential delay, etc. Users can set the limitation conditions according to the accuracy requ irements of the operation. The setting of smoothing points is to collect the average value of multiple anchor points to indicate the accuracy. You can also set default roll call and default encoding. Setti ng the information display is to set the content displayed in the status information bar. Users can set the information displayed according to their priorities, as shown in Figure 4.1-4.Function menu sett ing is to display common function Settings to the left menu bar according to the needs of users in the process of operation, so that users can call some functions quickly and conveniently. These feature s include: tilt measuring switch selector switch, network map, drawing zoom in the full positioning center, take the screen, such as CAD text annotation, length, area measurement, the drawing set the

background color, CAD layer set, the function such as coordinate transformation tool, calculator too l, click on the left side of the menu icon to trigger the corresponding function.

Measuring a collection point usually requires entering a roll call and a code click The icon can se lect the preset code in the code base for quick filling of ground object attributes, as shown in Figure 2.1-6. If there are many codes in the code library, the codes that are used more frequently will be dis played in the front for users to quickly select.

Click the antenna height display to modify and edit the antenna height information, as shown in Fig ure 2.1-7. The antenna height is set to obtain the actual position of the measurement target on the gro und by subtracting the antenna height from the phase center coordinates of GNSS. If the antenna inf ormation is incorrect, click the antenna information to select the correct antenna type in antenna Ma nagement (used when the GNSS device does not output antenna information or external antenna is used), as shown in Figure 2.1-8.

Settings Display Info	o Tool Bar	Settings	Display Info	Tool Bar	Settings	Display Info	Tool Bar
Tolerance Setting		Display Item			Display Item		
Solution Limit	FIXED >	N:2567625.205 E:746329.763	H:48.962 Base dista	ince:1496.18	N:2567625.205 33 E:746329.763	1 10 070713	2 tance:1496.18
HRMS Limit	0.05 >	Options			Options		
VRMS Limit	0.1 >	Long	Lat		Long	Lat	
PDOP Limit	3 >	Altitude	Ant. H		Altitude	Ant. H	
PDOP Linit	8.0	Forward azimuth	Speed		Forward azimuth	Speed	
AGE Limit	5 >	Time	Point dist.		Time	Point dis	st.
Smooth		Pt. H dist.	Pt. Elevati	on diff.	Pt. H dist.	Pt. Eleva	tion diff.
Survey delay	0 >	σN	σE		σN	σE	
Average GPS Count	5 >	PDOP	HDOP		PDOP	HDOP	
Settings		VDOP	Inclination	Angle	VDOP	Inclinati	on Angle
Remind when there is same	point name	Projection Angle			Projection Angle		
Point Name Increment	1 5	Display			Display		

Figure 4.1-3

Figure 4.1-5

Figure 4.1-6

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PARK	A001	Antenna Height	1.8	L600	
HOUSE	A002	Antenna Parameters		R:80 mm HL1:29 mm	H:38 mm HL2:29 mm
HUUSE		none	>		
LAMP	A003				
LAKE	A004				
Add Export	ок	ок		Add	ок
Figure 4.1-6	3	Figure 4.1-7		Figur	re 4.1-8

#### **4.2 Detail Survey**

Click [Survey] -> [Detail Survey], as shown in Fig.4.2-1. This function is similar to point measurem ent, but without the graphical interface of point measurement, the content required for measurement of collection points can be displayed more concisely and intuitively. This feature can be used to me asure the collection point directly when the user does not need a drawing reference. The lower part of the interface is the function entrance of measurement Settings, point library and tilt measurement switch.

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Dist	tance to Re	f		1496.:	260m
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Figure 4.2-1

### **4.3 Control Point Survey**

Click [Survey] – [Control Point Survey], as shown in figure 4.3-1, sometimes need to measure a hig h accuracy point, collecting the points need to reset the device for many times, asking for a fixed sol ution for a period of time after acquisition, and need to collect a lot of points, through a certain way of calculation, playing in addition to the average value of the deflection point, A high-precision anc hor point is obtained by taking the average value of the basic several optimal values. The points coll ected by this method have high accuracy guarantee, and we call this type of points as control points. In the control point measurement interface, all coordinate points collected by the control point are di splayed in the middle area in real time, and the graph distribution of the measurement points of the control point can be seen, so the precision of the control point can be judged in a certain program. T he two ICONS below the figure are the measurement Settings and point library function entrance re spectively.

Measurement Settings, as shown in FIG. 4.2-2, in addition to setting acquisition limit, control point acquisition parameters, such as smoothing points, smoothing interval, repetition times, etc.

After the control point measurement is completed, the measurement result page will pop up, as sho wn in Fig.4.2-3, showing the measurement analysis and results of the control point, observation tim e, pass rate, whether the control point meets the accuracy requirements, etc.

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← 🚱 FLC	- <b>N</b> -	🖌 🗲 Settings		Control Point Measurement Result-Pt1007
Name Pt1007	× Code			Result: The collected point cannot be used!
Antenna Height1.8	+0.000m	> Solution Limit	FIXED >	
		HRMS Limit	0.5 >	
		VRMS Limit	0.5 >	
		PDOP Limit	3 >	R-150.4 m
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R=20.0 cm		Control Point Settings		
		Average GPS Count	10 >	
		Average GPS Interval	2 >	
		Repeat Count	2 >	Qualification rate(%)         25           Mean square error(mm)         711.4           Δplane max(mm)         1505.2
	0	Fixed Age	5 >	Δheight max(mm) 420.4
		Plane Limit	0.2 >	Observation Time(S)         102           Start Time         2022-03-29 10:48:29.452
		Elevation Limit	0.2 >	End Time 2022-03-29 10:50:10.131 Record number 20
N:2567625.713 E:746329.971	H:48.431 Base distance:1496.3	Default	ок	Cancel OK
Figur	e 4.3-1	Figure 4.3	3-2	Figure 4.3-3

### 4.4 Point Stakeout

Click [Survey] -> [Point Stakeout] to enter the interface of stake point library, as shown in FIG. 4.4-1. Point stake means to find the location of points through coordinate points in the field site under th e condition that point coordinates are known. Unstaked points and staked points will be displayed in the points. Click stake points to remove stakeed points, view details and stakeed points. Stake point s are part of the coordinate point library, and the operation of adding and removing stake points is c onsistent with the coordinate point library. You can also select points in coordinate points (all points in the coordinate point library) to stake. After selecting a point for stake, enter the stake interface, a s shown in Figure 4.4-2.

Point stake interface layout is similar to point measurement, but there are some differences, in the st atus information bar to display the value of the target, northwest, southeast deviation value of fill. C ompass Compass is not in the upper right corner of the drawing area and is currently positioned tog ether. At the bottom of the drawing area, in addition to the measurement Settings function, there are also stake the nearest point, stake point, stake next point these functions.

In addition to measurement Settings, information display Settings and function menu Settings in poi nt measurement, the settings also include stake Settings, as shown in Figure 4.4-3. You can set the t arget according to the southeast, northwest or around the reference direction can be the front directi on of the host or according to the known reference point direction, in addition, you can set the prom pt range, stake limit difference, etc.

#### How to get to the target point faster?

If the user has a good sense of direction, in the real-time field can distinguish between the southeast and northwest, stake compass display, you can directly see the continuity of the current anchor point and the target point, pointing to which direction to which direction can go past. As shown in Figure 4.4-2, the target point Pt4 can be found by walking southwest.

If the user has a poor sense of direction and can't tell the difference between east, west and west, loo k at the small arrow of the current position. The small arrow points to the direction of the hand whe n the hand is flat, as shown in Figure 4.4-2, the current hand is pointing south. You can turn the han d thin pointing, when the hand thin pointing and the current point and the target point coincide, that the hand thin pointing and the target point azimuth is consistent, this time according to the hand thin pointing, go forward.

← Stake Point		← Stake Point		← Settings	
Point To-S	take-Point Preview Map	Point To-St	ake-Point Preview Map	Settings Stakeout Display Info	Tool Bar
Name > Input que	ery keyword	Name > Input que	ry keyword	Navigation Prompt(Forward)	
<b>Pt1000</b> To-Stake	T:2022-03-28 10:02:05.275 h:-1.802	<b>Pt1000</b> To-Stake N:2547686.827	T:2022-03-28 10:02:05.275 h:-1.802	Stakeout Reference Forward	Direction
E:807666.309	Distance:2.243m	E:807666.309	Distance:2.243m	Prompt Range(m)	1 0
Pt1002 To-Stake N:2547686.772 E:807666.479	T:2022-03-28 10:02:09.314 h:-1.845 Distance:2.364m	V Pt1002 To-Stake N:2547686.772 E:807666.479	T:2022-03-28 10:02:09.314 h:-1.845 Distance:2.364m	Automatically enter the stakeout compass mode	0
Pt1003 To-Stake	T:2022-03-28 10:09:42.649	Pt1003 To-Stake	T:2022-03-28 10:09:42.649	Stakeout range error(m)	0.02
N:2547686.292 E:807666.990	h:-0.721 Distance:2.676m	N:2547686.292 E:807666.990	h:-0.721 Distance:2.676m	Automatic scaling	0
<b>Pt1004</b> To-Stake N:2547686.432 E:807665.402	T:2022-03-28 10:16:38.103 h:-0.671 Distance:1.269m	Pt1004 To-Stake N:2547686.432 E:807665.402	T:2022-03-28 10:16:38.103 h:-0.671 Distance:1.269m	Automatic Stakeout Latest Point	0
<b>Pt1005</b> To-Stake N:2567625.564 E:746329.892	T:2022-03-29 08:29:38.000 h:47.776 Distance:64494.339m	<b>Pt1005</b> To-Stake N:2567625.564 E:746329.892	T:2022-03-29 08:29:38.000 h:47.776 Distance:64494.339m		
<b>Pt1006</b> To-Stake N:2567625.260 E:746329.732	T:2022-03-29 09:36:00.000 h:48.839 Distance:64494.397m	<b>Pt1006</b> To-Stake N:2567625.260 E:746329.732	T:2022-03-29 09:36:00.000 h:48.839 Distance:64494.397m		
Add Button Library	Import Export	Add Button Library	Import Export	Default C	ж

In the stake points to be stakeed, click the data item and click Details to enter the detailed informati on of stake points, including the information of each stake point and the distribution diagram of stak e targets and stake collection points, as shown in FIG. 4.4-4.

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L E114°00	00.0131	E	807666.309
н	-1.802	h	-1.802
Time	2	2022-03-28	8 10:02:05.275
Stake Recor	ď		
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Northing 25	47685.825	North dif	ff -1.002m
Easting 8	07665.580	East diff	-0.729m
Elevation	-3.210	Elevation	n diff1.002m
Time:2022-0	3-29 10:59	:51.267	
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Figure 4.4-4

# 4.5 CAD

Click [Survey] -> [CAD], as shown in Fig.4.5-1. CAD functions include CAD graphic display, dra wing of ICONS such as lines, broken lines, arcs and polygons, graphic calculation, import and expo rt of DXF and DWG graphics, layer management and stake of CAD graphics.

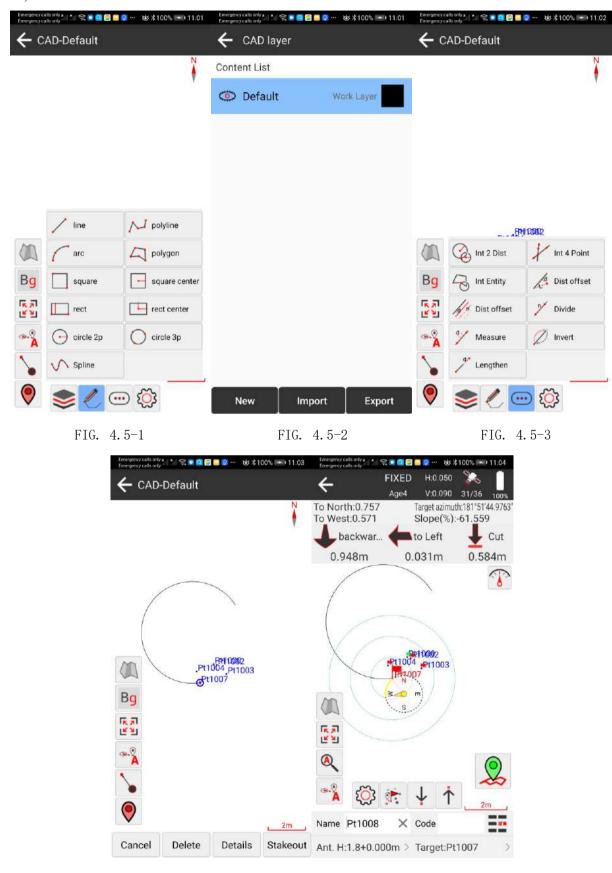
Click on the Enter CAD layer management, as shown in Figure 4.5-2. You can create and delete layers, set whether layers are visible, import DXF and DWG drawings, export DXF files, and set a layer as a working layer.

Click on the Create a figure, as shown in Figure 4.5-1. Including line segment, broken line, arc, p olygon, two-point fixed square, center point + length fixed square, three-point fixed rectangle, center r point + length + width fixed rectangle, center point + radius fixed circle, three-point circle, curve a nd other types of graphics. You can draw a new graph directly in the drawing area, and point elemen ts can select existing points or freely take points from the screen.

Click on the Perform some CAD tool calculations, as shown in Figure 4.5-3. Including two circl e intersection point, two lines intersection point, two arbitrary graph intersection point, distance offs et point calculation, element translation, according to the number of equal points, according to the d istance calculation point, element reverse and line extension and other functions.

After selecting the CAD figure, see Figure 4.5-4. You can delete graphics, view details, stake and ot her operations.

After selecting elements, click Stake to enter stake CAD interface, as shown in FIG. 4.5-5. Stake is t o find the location of the target coordinates in the actual location, stake operation is similar to point



stake, line stake.

Figure 4.5-1

figure 4.5-2

# 4.6 Line Stakeout

Click [Survey] -> [Line Stakeout] to enter the interface of line library, as shown in Figure 4.6-1. Lin e stake is to provide a designed line, input it into the line library, and perform field stake on the line. Points on a straight line can be stakeed point by point according to real-time stake mileage, skew di stance, height difference, etc., or by dividing the line into points at a certain interval.

Line library management, can add, delete, import, export line data; Create a line, as shown in Figure 4.6-2. Output the line name and set the starting point and ending point coordinates, and create a lin e by starting point + azimuth + length. Click on the Select point data from the coordinate point l ibrary and click point information to enter the point editing interface, as shown in Figure 4.6-3.

Click the line list item to delete the edit stake line. Click Stake, as shown in Figure 4.6-4. You can s et stake in the form of line or point by point. If it is point by point, you need to set the calculation m ethod according to pile number or the whole pile distance, distance interval and whether to automati cally stake the nearest point.

Then press OK to enter the line stake interface, as shown in Figure 4.6-5. Can operate through the menu stake a line, a line, a point, a point, etc.

Stake point by point, sometimes need to stake calculation outside the point, need to specify the rang e and offset stake point, this is called piling, click Pile stake, as shown in Figure 4.6-6.

← Lines Databa	100	← Line parame			← Line param	
Content List		Name	Pt1007_Pt100	5 ×	Name	Pt1007_Pt1005
m)	4495.425 Start Station:0	Start Station		0	Start Station	0
N1:2547685.825 E1:807665.580	N2:2567625.564 E2:746329.892	Input Type	Start Point+End Po	oint >	Input Type	Start Point+End Point
h1:-3.210	h2:47.776	Set Start Point	i.		Set Start Point	
		Northing: 2547685.825	Name:Pt1007	>	Name	Pt1007
		Easting:807665.580	Elevation:-3.210		Northing	2547685.825
		Set End Point	6		Easting	807665.58 🗙
		Northing: 2567625.564	Name:Pt1005	>	Elevation	-3.21
		Easting:746329.892	Elevation:47.776			
					Set End Point	5
					Name	Pt1005
					Northing	2567625.564
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Figure 4.6-4		Figu	ıre 4.6–5		Figure 4.	6-6

### 4.7 DSM Stakeout

Click [Survey] -> [DSM Stakeout], as shown in Fig.4.7-1. According to the existing site triangulatio n data, the current positioning coordinates are used to carry out elevation stake of the site to determi ne whether the real-time site at a certain location needs to be filled or dig.

The site elevation database can be created, imported, edited and deleted, etc., and the site elevation f ile can be created, as shown in Fig.4.7-2 and 4.7-3. The coordinate of triangulation net file can be in put manually, also can choose from the point library with batch, can adjust the order of point coordinate up and down, also can import coordinate and so on.

Click the site elevation database data item to edit and delete the elevation file, and click the stake to enter the elevation stake interface, as shown in FIG. 4.7-4.

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	Content List			•
	Pt1006 N:2567625.260 E:746	5329.732 H:48.839		7.1
	Pt1000 N:2547686.827 E:807	7666.309 H:-1.802		×
	Pt1002 N:2547686.772 E:807	7666.479 H:-1.845	/	$\langle   \rangle$
	Pt1003 N:2547686.292 E:807	7666.990 H:-0.721		P11008
			1	91
				200m
New Import	Add Button Library	Import OK	Export	ок
Figure 4.7-1	Figure 4.	. 7-2	Figure	4.7-3
	Age0 Target:ij N:2547686.742	H:0.050 200 V:0.090 31/36 1009 H:-2.433 E:807666.451 Ant. H:1.8m+0.000m		
	P1009	Pt1	0'	
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	Name Pt1013 ×	Code		

Figure 4.7-4

Ant. H:1.8+0.000m > Target:ij

# 5.8 Road design stake

Click [survey] -> [Stake Road] into the interface, as shown in figure 5.8-1, by way of plane curve a nd vertical curve, chain scission, standard cross-sectional, ultra-high, widen design, slope design ele ments such as data file, according to the circuit design documents and GNSS satellite positioning, T hread construction stake, section data collection and a series of road thread related applications. It is suitable for data survey and collection, line construction, line acceptance and other engineering oper ations of highway and railway lines at all levels.

Road design, as shown in Figure 4.8-2. The elements of road design include flat curve, vertical curv e, chain break, standard cross section, slope, standard cross section includes the elevation and widen ing of section plate, etc.

1. Flat curve design: as shown in Figure 4.8-3. The flat curve is the center line of the road, which is t he direction of the whole road. The methods of flat curve design are linear element method, intersect ion point method and coordinate method. All roads are composed of road starting points, straight lin es, relaxation curves, and circular curves. The line element method is a design line formed by directl y inputting the elements of the road, in which the starting point contains the starting distance and sta rting point coordinates, the straight line contains the starting azimuth of the element and the length of the line, the easing curve contains the starting azimuth of the element and the starting and ending radius and the length of the curve, and the circular curve contains the starting azimuth of the elemen t and the radius and the length. In general, the end azimuth of the former element is equal to the start ing azimuth of the next element, the radius of the connecting end of the easing curve and the straigh t line is infinite, and the radius of the connecting end of the easing curve and the circle is equal to th e circle radius.Intersection point method is to calculate the combination of road design elements thr ough some algorithms through the coordinates of control points and corresponding easing curve len gth, easing curve parameters, circle radius and other parameters. The coordinate method calculates t he combination of road design elements according to the coordinate points on the line and the radius of the arc before the coordinate points according to a certain algorithm. The road generated by the c oordinate method only has the starting point, straight line and arc, which is a simplified line without easing curve.

2. Vertical curve design: as shown in Figure 4.8-4. The vertical curve is the elevation fluctuation of t he road center line at each mileage. It is the design height of the line center line, which needs to inp ut the elevation corresponding to each mileage of the line elevation change point and the arc radius corresponding to the slope change point. The software calculates the elevation value of the line at ea ch mileage point according to these design elements.

3. Chain break design: as shown in Figure 4.8-5. In the process of circuit design, sometimes in adva nce design good lines due to the actual environmental conditions do not allow the building or constr uction cost is too high, had to be somewhere to local modification of circuit design, circuit changes, line may be long or short, than the original line at this time in order to modify the line behind the de sign of the mileage data remains unchanged, then use broken, Broken chains are divided into long a nd short chains. At a certain mileage point, start using a new mileage value, leaving the mileage data following this mileage value unchanged.

4. Standard cross section design: as shown in FIG. 4.8-6.In the actual construction road, the road ce nter line is only the planning direction of the line, and the actual road includes motor vehicle lane, n on-motor lane, green belt, sidewalk and other road plates for various purposes. The width, slope and other parameters of the whole road of these plates are called the standard cross section. In a real-tim e way, because of the influence of the built environment, often cannot be built according to the stan dard cross section, sometimes some plates may need to start at a particular narrow width, sometimes

due to the large road camber, extensions to slope safety need somewhere, there needs to be widene d parameters Settings section plate high, as shown in figure 4.8-7.Ultra wide set according to the ne eds of each plate, add according to the changing mileage.

5. Slope design: as shown in Fig.4.8-8. In the actual process of road construction, in addition to buil ding the road outside of the main road, the road may through the mountain, lake and road environm ent of the elevation difference is large, if after the mountain digging up roads could lead to a mounta in fall damage road, so I need to fill the lake mountain and according to certain standard building sl ope, protect the road.

If the roads according to the above elements design, is a complete line of design, sometimes differe nt need only part of the basic construction units, will not have all the design data, users according to their own actual project requirements in terms of design, good road design can be used after the roa d design documents for construction work.

Note: in order to facilitate road design editing, the software supports road import in various formats, which are not described here.

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← Roads Database	← Road Design		$\leftarrow$ Centerline	
Content List	Name	test ×	Design Data	Preview Map
1.test(Line Element method) 860.000m Internal Storage/SurPro/Road/test.rob Centerline:6	Road Data	Preview Map	Design Method	Line Element method
	Broken station		Content List	
	none	>	1.Start Point	Start Station:2
	Centerline		N:2547690.136	E:807652.577
	Line Element metho Count:6	d ength:860m >	2.Line Azimuth:2°00'00.00	Start Station:2 000" Length:20.000
	Station range:2 ~ 862		3.Line	Start Station:22
	Vertical Profile		Azimuth:2°00'00.00	000" Length:20.000
	none		4.Curve(Left)	Start Station:42
	Standard Cross Section	1	Azimuth:2°00'00.00 Radius:15	000" Length:20.000
	none	>	5.Spiral(Left)	Start Station:62
	Slope		Azimuth:285°36'20 Start Radius:15	.2 Length:600.000 End Radius:co
	none	>	6.Line Azimuth:219°41'24	Start Station:662 .1 Length:200.000
		- 		
New Import	Check	ок	Add I	mport Check

Figure 4.8-1

Figure 4.8-2

Figure 4.8-3

		$\leftarrow$ Broken station	1.1	← Standard Cros	s Section
Design Data	Preview Map	Content List		Left section	Right section
Design Method	Intersection method 🗦	1.Short Before station:3.000	Length:0.000m After station:3.000	Content List	
Content List . Pt1011(Station:2	2)	2.Short Before station:4.000	Length:0.000m After station:4.000	test Width:2.000 Ultra Height:none	Slope:0% Ultra Width:none
N:2547588.000 First Spiral length:0.0.	E:807988.000 Second Spiral length:	3.Short Before station:10000	Length:1900000.000m . After station:200000	-	Slope:0%
2. Pt1010(Station:3 N:2547189.000 First Spiral length:25	<ul> <li>Radius:15.000</li> <li>E:807100.000</li> <li>Second Spiral length:</li> </ul>	4.Long Before station:25.000	Length:23.000m After station:2.000	Ultra Height:none g Width:5.000	Ultra Width:none Slope:0%
8. Pt1008(Station:C N:2547689.309 First Spiral length:6.0.	) Radius:6.000 E:807653.969 Second Spiral length:			Ultra Height:none	Ultra Width:none
Add Im	port Check	Add Imp	ort OK	Add	Import
FIG.	4.8-4	FIG.	4.8-5	FIG.	4.8-6
FIG.					4.8-6
FIG.	4.8-4 Energency calls only and the Constant Energency calls only and the Constant Constant on the Constant of	🚔 🧑 ··· 🕹 🕉 📧 ) 16:58	4.8-5		4.8-6
FIG.	Emergency calls only a the set of	🚔 🧑 ··· 🕹 🕉 📧 ) 16:58	Emergency calls only and a second s		4.8-6
FIG.	Energy calls only and a second s	∎⊠ख ३ == ) 16.58 Jitra Width	Emergency calls only a 1 to 1	a m - 彼才 = 0 16.59	4.8-6
FIG.	Ultra Height	Ultra Width Ultra Width Slope:25%	Emergency calls or loss Comprency calls or loss Comprency calls or loss Slope Left-Cut Left-Fill	a m - 彼才 = 0 16.59	4.8-6
FIG.	Content List Station:1	Ultra Width Ultra Width Slope:25% Slope:38%	Left-Cut Left-Fill Content List Station:2	Right-Cut Right-Fill Level Count:1	4.8-6
FIG.	Ultra Height Content List Station:1 Gradual mode:Linear of Station:2	© ● · · · v ≥ · • • 16.58 Ultra Width Ultra Width Slope:25% change Slope:38% Slope:28%	Content List Station:2 Width:12.000	Right-Cut Right-Fill Level Count:1 Elevation:6.000	4.8-6
FIG.	Ultra Height Ultra Height Content List Station:1 Gradual mode:Linear of Station:3 Gradual mode:Linear of	© ● · · · v ≥ · • • 16.58 Ultra Width Ultra Width Slope:25% change Slope:38% Slope:28%	Content List Station:2 Width:12.000	Right-Cut Right-Fill Level Count:1 Elevation:6.000	4.8-6

Road stake: the design of the road line files, construction operations.

Figure 4.8-9 shows the stake of a road center line. The stake interface and operation are similar to p oint stake and line stake. Click line stake to switch to other stake modes, including line stake point b y point, cross section stake, cross section measurement and other road stake related operation functi ons.

Line stake point by point, as shown in Figure 4.8-10.Click the function menu icon below to enter th e measurement Settings, enter the stake library, stake the upper point, stake the next point, piling an d so on.The stake library is displayed, as shown in Figure 4.8-11.You can select a point in the base f or stake, or automatically stake the nearest point, and recalculate the pile-by-pile coordinate points o f the road center line, as shown in Figure 4.8-12.Set the coordinate point according to the whole pile number or the whole pile distance, and calculate the coordinate point according to a certain mileage deviation distance.You can also set up a calculation of the left and right side pile with stake.

Measure the cross section, as shown in Figure 4.8-13. According to a certain mileage interval, colle ct the elevation data of the section of the road line and its surroundings, which can be used for the p reliminary survey work of the road construction, calculate the amount of road earthwork and evalua te the construction cost.

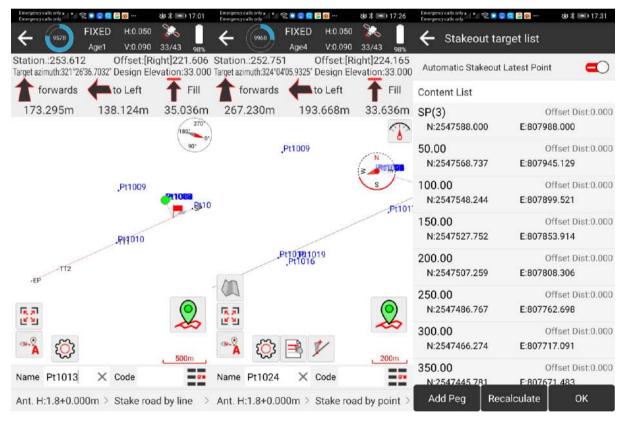


Figure 4.8-9

Figure 4.8-10

Figure 4.8-11

Emergency calls only * 11 * 11 🕤 💿	😰 🚾 🗃 🚳 ··· 🛛 😻 🕉 📧 በ7	:30	Emergency calls only and the 😪 💽 🔯 🕻	<b>i 🗟 🚳 ···</b>	谢 🕸 🎫 17:32
← Calculate	Stake		← 😡 FIXED Age2	) H:0.050 V:0.090	33/43 98%
Calculation mode	Stakeout by station number	>	Station.:253.597 Target azimuth:226°27'06.3154		ght]223.246 vation:33.000
Interval	50	>	🔶 backwar 🗲	to Left	1 Fill
Offset Dist		0	2.478m 2	.607m	33.808m
Side-Stake Point					90°
Left peg offset	0	Ż	.Pt1009		
Right peg offset	0	>		Curtons	.B#1011
				PPTER	90[253.597]
			P±1010+1010		
			P+10F21019 1016		
			E al		
			🐴 🔅 🖻	V	_ 200m _
			Name Pt1025 ×	Code	
	ок		Ant. H:1.8+0.000m >	Cross sea measurer	1
	Figure 4.8-12		figure	4.8-13	}

# Tools

On the main interface, click Tools, as shown in Figure 5-1. The tools include coordinate conversion, Angle conversion, perimeter area calculation, calculator and other common measurement tools.

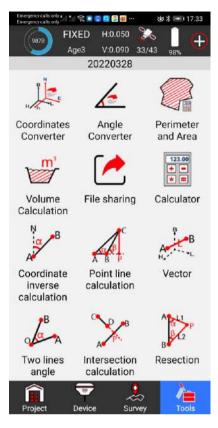


Figure 5-1

## **5.1 Coordinate Converter**

Click [Tools] -> [Coordinate Converter], as shown in Fig.5.1-1 and 5.5-2. The coordinate system pa rameters set by the current project are used to convert the coordinates of plane, geodetic and space.

Click on the  $\blacksquare$  You can select a point from the point library to perform the calculation transformat ion, and you can save the calculation point to the point library.

Coordina	ates Convei		Coordinate	es Converter
ource Coordir	nate		Source Coordinat	e 🧧
Local Coordinate	Geodetic Coordinate	Spatial Coordinate		Geodetic Spatial Coordinate Coordinate
Northing		2547688.865	Latitude	23*00'00.067067"
Easting		807668.11	Longitude	114°00'00.07772"
Elevation		-0.788	Altitude	-0.788
lesult			Result	
Latitude		N23°00'00.0671"	WGS84 X	-2389216.61
Longitude		E114°00'00.0777"	WGS84 Y	5366262.93
Altitude		-0.788	WGS84 Z	2476720.92
WGS84 X		-2389216.616	Northing	2547688.86
WGS84 Y		5366262.938	Easting	807668.11
WGS84 Z		2476720.921	Elevation	-0.78
Save		Calculate	Save	Calculate

### **5.2 Angle Converter**

Click [Tools] -> [Angle Converter], as shown in Figure 5.2-1.Through the function of degree, degre e minute second, radian and other Angle display formats before the transformation, select input one of the formats, calculate the value of the other formats.



Figure 5.2 1

# **5.3 Perimeter and Area**

Click [Tools] -> [Perimeter and Area], as shown in Figure 5.3-1. You can add and delete coordinate points, import and export coordinate points, and view the block graph in the preview view, as show n in Figure 5.3-2. Click to calculate, as shown in Figure 5.3-3.

Emergency calls only * * 🗟 🔍 🔍 🕵 Emergency calls only		Emergency calls only		Emergency calls only a to the to the total and t	ბყ≵ ∞0 17.39
Point Coordinates	Preview Map	Point Coordinates	Preview Map	Point Coordinates	Preview Map
Content List Pt1000 N:2547686.827 E:807 Pt1002 N:2547686.772 E:807 Pt1003 N:2547686.292 E:807 Pt1004 N:2547686.432 E:807 Pt1005 N:2567625.564 E:746	7666.479 H:-1.845 7666.990 H:-0.721 7665.402 H:-0.671	Perimeter:24 Area:27542 Area:27.54	2.215m²	Perimeter:2480.5 Area:27.5422.21 Area:27.5422.21 Result Perimeter:2480.529m Area:275422.214775m ² Area:27.542221ha	5m²
		-	_200m_		_200m
Add Button Imp	ort Export Calculat	Calcul	ate	Calculate	
Figure	e 5.3-1	Figure 5.	3-2	Figure 5.	3-2

# **5.4 Calculator**

Click "Tools" -> "Calculator", as shown in Figure 5.4-1. Do some simple math.

Calculator							
				(			
V	(	)	С	DEL			
π	7	8	9	÷			
tan	4	5	6	*			
cos	1	2	3	-			
sin	0		=	+			

Figure 5.4-1