Hi-Survey Road User Manual

HITARGET

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Manual Revision

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Dec., 2015	1	Hi-Survey Road User Manual B/6 Version
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Preface

Introduction

Welcome to the Hi-Target Hi-Survey Road. This introduction describes how to use this product.

Experience Requirement

In order to help you use Hi-Target series' products better, we suggest you carefully read the instructions. If you are unfamiliar with the products, please refer to <u>http://www.hi-target.com.cn/</u>

Tips for Safe Use



Notice: The contents here are special operations and need your special attention. Please read them carefully.



Warning: The contents here are very important. Wrong operation may damage the machine, lose data, break the system and endanger your safety.

Exclusions

Before using the product, please read these operating instructions carefully: they will help you to use it better. Hi-Target Surveying Instrument Co., Ltd assumes no responsibility if you fail to operate the product according to the instructions, or operate it wrongly due to misunderstanding the instructions.

Hi-Target is committed to constantly perfecting product functions and performance, improving service quality and we reserve the right to change these operating instructions without notice.

We have checked the contents of the instructions the software and hardware, without eliminating the possibility of error. The pictures in the operating instructions are for reference only. In case

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of non-conformity with products, the products shall prevail.

Technology and Service

If you have any technical issues, please call Hi-Target's technology department for help.

Relevant Information

You can obtain this introduction by:

1. Purchasing Hi-Target products: you will find this manual in the instrument container to guide

you on operating the instrument.

2. Logging onto the Hi-Target official website, downloading the electronic version introduction

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at "Download center" \rightarrow "Partners" \rightarrow "Partner center".
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Advice

If you have any comments and suggestions for this product, please email info@hi-target.com.cn.

Your feedback will help us to improve the product and service.

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CHAPTER

Software Introduction

This chapter contains:

- Introduction
- Features
- Installation
- Quick Start
- General Collection

Hi-Survey Road is measurement software with a high degree of accuracy on the Android system of Hi-Target.

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

1.1.1 Hi-Survey Road

Hi-Survey Road is designed for road measuring and staking with strong functions; it can be used for staking complex roads, combining road lines, and has three road algorithms (intersection, element, coordinate): cross sections can be defined easily. The linear element method adopts the unified curve element model with rigorous theory, and the numerical integration algorithm is used to avoid the higher order errors of traditional algorithms. Generally, the computing result can support all kinds of roads, common line and multi-type complex lines and connect receivers to measure online via Wi-Fi, Bluetooth and networks.

1.1.2 Road Function

- Support for horizontal-section, vertical-section, cross-section, road-staking, slope-staking and visual cross-section collection.

- Calculate line-staking point in real time, support for adding stake over any mileage, mileageprojecting in real time, and displaying the mileage of staking points.

- Direct and convenient guidance method of staking, with line-staking and mid-level measurements working at the same time.

- The horizontal section line supports the common method (intersection, element, coordinate) and can freely define the line of any form. For example: interchange ramp.

- The cross-section earthwork provides two methods: Mean Area method and Prism method to calculate the amount of excavation.

- Supports multiple cross-section grade-change point-setting, the left and right slope can be edited into asymmetric type; it can also edit over-elevation and widening of a slope.

- Supports DTM surface design, DTM surface-staking and DTM earthwork calculation.

1.2 Features

1. Easy to Use

- More logical, more convenient, less interface levels than Hi-RTK;

-Text and Graphic measuring interface in Detail Survey can be chosen by user;

-Simple design to give a big mapping screen;

-Station option can be one-key set by configuration file;

-Defined coordinate system selected by region, convenient to set coordinate parameters;

-Supports many kinds of angle units, meets the operating habits and demands of business customers: good for globalization.

2. Supports Operating Big Data

-Supports big raster, vector data in .dxf, .td2, .shp format (geodetic coordinate and plan

coordinate)

-Raw data and coordinate data saved independently to make sure the data primitiveness and realize post- processing kinematic, it is more flexible in data storing and processing, and the

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antenna type and height of raw data can be changed, to make sure the data can be recovered (by resetting the coordinate parameters, antenna type and height);

-More complete antenna parameters management.

- 3. Fashionable
- -The software and receiver firmware check the updates online automatically;
- Hi-Target and profession news are real-time pushed;
- -Beautiful and fashionable interface;

-Wonderful and rich visual and touch experience, help make users enjoy working.

1.3 Installation

1.3.1 Installation

Copy the Hi-Survey Road program (.apk) to an Android device, click it to start installing, a Hi-Survey Road icon will appear on the desktop if installation is successful. The software can be installed by third party assistance software.



Figure 1-3-1 Hi-Survey Road

HINTARGET 1.3.2 Starting Interface

On first running, it will show the welcome pages listing the software features, slide them to the starting interface. The welcome pages will not be displayed after the first starting (view it in the *About* interface).

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



Figure 1-3-2 Welcome Page (1)

Figure 1-3-3 Welcome Page (2)

There are 3 main interface themes: List, GridView and Simple: the default setting is GridView.

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Software Introduction



Device Base Rover GNSS Demo Mode Controller Additional Settings Ē ନ Ø Project Device Survey COGO

Figure 1-3-4 Device-GridView





Figure 1-3-6 Device-Simple

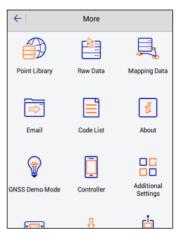
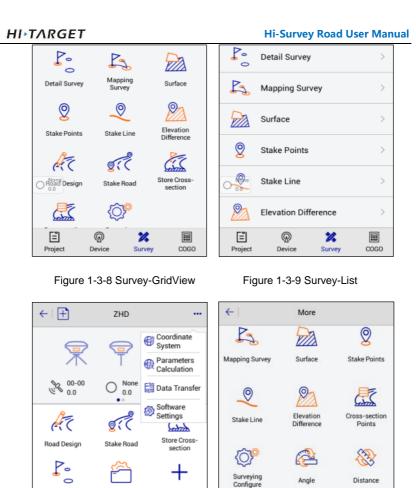
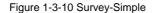


Figure 1-3-7 Device-More





Project Settings

Detail Survey

Figure 1-3-11 Survey-More

I

B

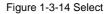
The module can be added and deleted in simple theme, and can be deleted and recovered in *gridview* and *list* theme. Long press the module to delete, the module can be recovered in $Project \rightarrow Configure \rightarrow Module Recovery.$

More

HI.T/	RGET			Software Introduction
e	8 23	<u>850</u>	← Software Settings	Module Restore
O D.0 Project Info	Project Settings	Coordinate System	O 0.0 Keep Screen Light On	Mapping Data
			Soft Input	Data Transfer
Parameters Calculation	Point Library	Raw Data	Floating Window	About
2		⊘ ⊂>¯	Time Zone (UTC+08:00)Beijing >	Code List
Mapping Data	Data Transfer	Email	Theme GridView >	Email
	<i>[</i>]	o 2	Screen Orientation Portrait >	
Ĕ	R X		Module Restore >	
Project	Device Survey		User Guide >	Restore

Figure 1-3-12 Delete

1-3-13 Module Restore



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

	Name	Туре
ZHD • Project •	🕌 ROAD	File folder

Figure 1-3-15 Project

When doing measurements, first create a new project, set the parameters - they are saved in the *.prj file; meanwhile, there will be a *.dam file with the same name of the project; the coordinate points, stake points, control points will be saved in the map folder. Afterward, create a new project (project name is *Unnamed*), as in the picture follow.

	Name	Туре
	\mu ext	File folder
	🔰 map	File folder
	F GPS.raw	RAW File
	GPS.raw.bak	BAK File
	mapping.mcp	MCP File
	mapping.mcp.bak	BAK File
ID + Project + ROAD + Unnamed +	PowerFrame.pfp	PFP File
	DewerLine.pli	PLI File
	PowerPoint.selc	SELC File
	PowerPoint.selc.bak	BAK File
	SectionFrame.pfp	PFP File
	TSPPoint.stsp	STSP File
	TSPPoint.stsp.bak	BAK File
	Unnamed.dam	DAM File
	Unnamed.prj	PRJ File

Figure 1-3-16 Road Work File



Notice:

1. If you create a new project when the hand-held does not have an external SD card, the project folder will automatically generate a * .bak backup file.

2. When the handbook has the external SD card, the backup data will be saved in the ZHD-Bak folder. The specific project data is stored in the corresponding project folder, as in the picture follow.



Figure 1-3-17 Road Backup

1.4 Quick Start

The following is the software quick start-operation process- refer to the detailed description of each chapter for the steps. This process is only a solution that we provide to users; skilled users do not need to follow this step.

1.4.1 Build a Project

1. Open the Hi-Survey software, the software main interface is as follows:



Figure 1-4-1 Main Interface

2. Create a new project, click *Project* → *Project Info* to enter the project name and click *OK*.

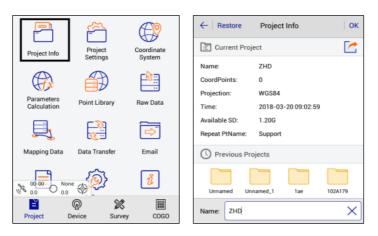
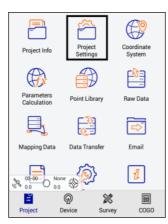


Figure 1-4-2 Project Info

Figure 1-4-3 New Project

3. Project Settings: select the projection, set the source ellipsoid and projection parameters.

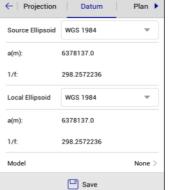


← New Prj System Option
🗠 Load Coord System 🧼 🙀 🕀
Coordinate System
Note: A project can only have one set of Framework Shifting parameters.
Framework Shifting
Framework Shifting Info
Framework Calibration
Framework Calibration Info
Data Management
External data management

Figure 1-4-5 Coordinate System

Figure 1-4-4 Project Settings

	Datum Plan 🕨	
Projection	Guass-3 >	
Origin Longitude	000:00:00.00000E	
False Northing(m)	0.0	
False Easting(m)	500000.0	
Projection Height(m)	0.0	
Lat. of False Origin	00:00:00.00000N	
Scale Factor	10	
Save		



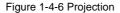


Figure 1-4-7 Datum

1.4.2 Set the Base

Connect the device, click $Device \rightarrow Device$ Connection \rightarrow Connect to select the base station number for Bluetooth pair connection.

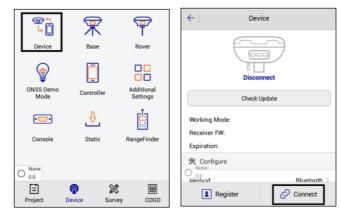


Figure 1-4-8 Device

		-
Figure	1-4-9	Connect

← Bluetooth Connect		← Dev	ice
Status:		0	
Bluetooth			
11014696	>	δL	
11620994	>	1101	4696
11800952	>	Check	Update
11007946	>	Working Mode: Base Mo	de
11620981	>	Receiver FW: 4.3 V60 Expiration: 2018-06	Receiver
11800547	>	🛠 Configure	
O18670052	>	A fix Pos 0.0 Method	Bluetooth >
13670056	>	Register	X Disconnect

Figure 1-4-10 Device Number

Figure 1-4-11 Disconnect

Set the base station and receiver position, then set the Datalink and Other.

1. Select antenna type to enter the height and type.

2. Set the base location. If the base station is located at a known point and know the conversion

parameters, you may not select the smooth, direct input or select the point of the WGS-84 BLH coordinates from point library, or open the conversion parameters in advance, enter the local NEZ coordinates, so that the base station puts the point of the WGS-84 BLH coordinates as a reference and does the transmission of differential data. If the base station is set as unknown, click *Average* \bowtie , and click *OK* after smoothing to complete the coordinates of the base station.

\leftarrow	Set Base Set	← Grap	h Average	Configure
Antenna		N:200260	38.7333 0	r:0.0092
Antenna	[V60] GNSS Antenna $>$	E:193676 Z:44.6331		x:0.0132 x:0.0057
Target H	2.0000	Name	Ν	E
	Vertical Slant	1	20026038.7187	19367613.9093
Position		2	20026038.7219	19367613.9050
Position	M	3	20026038.7252	19367613.9006
Name	B032009	4	20026038.7286	19367613.8960
B A Fix Pos	22:58:53.86065N	5	20026038.7319	19367613.8914
Δ 0.0		6	20026038 7352	19367613 8867
Configure	Receiver Datalink Other	\mathbf{E}	Start	🕢 ок

Figure 1-4-12 Set Base

Figure 1-4-13 Average

3. Click Data Link, select the data link type and enter the relevant parameters.

(eg: when you use the Hi-Target server data to transfer operation, you need to set the parameters and select the built-in network; where the packet number and group number can be changed, the packet number is seven digits, the group number is three digits less than 255. When you use the radio station to work, you should select the *Internal UHF* as the data link, and then select the radio channel).

Radio mode is the traditional data link mode, and the built-in radio mode is taken as an example, to illustrate the introduction of radio station mode using simple steps.

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- Internal UHF: built-in radio

- *Channel*: $0 \sim 115$ any number, but the mobile station settings should be consistent with the base station.

- Airborne baud rate: 9600/19200 optional, the choice of mobile stations should be consistent

with the base station

- Power: High / Middle/ Low

←	Set Base	Set
Mode		A Fix Pos
Datalink		Internal UHF \geq
Parameter		
Channel	22	X
Link Rate		19200 >
Power		High >
	Advance	
Configure	Receiver Data	link Other

Figure 1-4-14 Data Link

4. Click *Other*, select the differential mode, the text format, click *Set* and it will promptly set up successfully. The parameters of the base station must be consistent with the rover station settings.

← Set B	ase Set
Diff Mode	RTK >
Correction Type	RTCM(3.2) >
Diff Port	COM2 >
Baudrate	115200 >
Pos Frequency	1HZ >
Elevation Mask(<=30°)	10 ×
•Note: If working in PPK mode, all	constellations will be on.
PPK Mode	
Configure Receiver	Datalink Other

Figure 1-4-15 Other

5. Check whether the host differential light is flashing once every second (2/sec in power-saving mode). When using the external radio station, the radio will flash once every second, if it is normal, it will prompt *Base station is ready, do you want to set Rover now?*

After the parameter is set, click *Set* and the host will have a voice prompt, the host light will flash twice every second, indicating that the base station is set up successfully and sending the differential data.

Wait until the green light flashes once every second (2/sec in power-saving mode) and the radio red light flashes once every second, indicating that the base station is successfully operating, and is transmitting the signal. If the signal does not blink, you can restart the receiver host and re-operate once again.



Figure 1-4-16 Set Prompt

1.4.3 Set the Rover

Connect to the rover by Bluetooth, and confirm that the rover data link and other parameters are consistent with the base station. The setting of the rover station is the same as that of the base station. The data link parameters of the rover station must be the same as the base station, to receive differential data. Then click *Set* and the host will do a voice prompt. Wait until it shows *Fix Pos*, and then start the measurement.

←	Set Rover	Set
Mode		
Datalink		Internal UHF \geq
Parameter		
Channel 22		
	Advance	
		Fix Pos 0.0
Configure	Datalink	Other

Figure 1-4-17 Set Rover

1.4.4 Parameter Calculation

First set the control point library in *Point Library* \rightarrow *Control Point* to add control points, enter the name and the corresponding coordinates by manual input, real-time collecting, point library or map selection, and then click *OK*.

P	ŕ		← Co	oord Point S	Stake Point	Control Point	←	Edit Control Point
Project Info	Project Settings	Coordinate System	Name	•	н	Code	From	🚸 📑 🔞
(Px			B032009	:41.85071E	52.3152	set_base	Name	B91314
Parameters Calculation	Point Library	Raw Data					N	91314.3806
⊟,							E	81924.3682
Mapping Data	Data Transfer	Email				🙆 Set	z	8.5000
00-11 A	(a)	ů				🕂 Batch	Code	guardrail 🔍
€ 00-11 00 00 01						+ New	Туре	NEZ O BLH
Project	P X		(+) Add	🔁 Oper	n Q Searc	ch 🧮 More	\otimes	Cancel 🔗 OK

Figure 1-4-18 Point Library Figure 1-4-19 Control Point Figure 1-4-20 Edit Point

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Click *Parameter Calculation*, select *Plane + Height Fitting* type and *Constant Vertical Offset* in *Height* (the *Height* can be selected as *Plane Fitting* when there are three points above), and then add point pairs, select the point as the source point, enter the corresponding control point coordinate in the target point, then click *Save*.

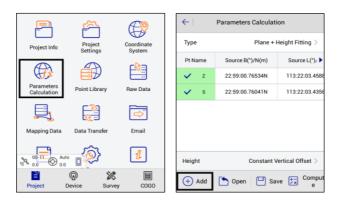


Figure 1-4-21 Parameters Calculation Figure 1-4-22 Add Point

← Points Info Save	← Plane + Height Fitting
🖉 Source 🛞 📑 🕅	Result
Pt Name Z	DN(m) -80261.4610179766
N 3669852.235	DE(m) -270009.961493787
E 6525532.369	Rotation 005:20:12.78534
Z 8.5	Scale(K) 1.05287478387132
O BLH	Max HRms 0.000000 (pt99)
© Local	
N 81221.89	Cancel 🔗 Apply

Figure 1-4-23 Save Point

Figure 1-4-24 Result

After adding more than two points, click *Calculate*, it will show the calculated *Plane* + *Height Fitting* results, mainly to see the rotation and scale. The result of the plane translation is generally smaller in the north and east, the rotation is about zero, the scale is between 0.9999 and 1.0000 (in general, the closer to 1, the better the scale is), the smaller the plane and elevation residual is, the better the result . Click *Apply* and the software will automatically use the new parameters to update the coordinate point library.

1.4.5 Detail Survey

In the *Detail Survey* interface, start the acquisition coordinates work when the display can be fixed. After the rover station on the unknown point is OK, you can press the acquisition key \Im and enter the *Name*, *Target H* and *Target-H type*. Then press *OK* to record the point.



Figure 1-4-25 Detail Survey

Figure 1-4-26 Save Point

1.4.6 Stake Out

Click *Stake Points* to enter the point staking-out interface and click the \Rightarrow button to select the staked-out point, then, according to the direction and distance, tips to find the staked-out points. There is a process to make the current point (triangle mark) close to the target point (round plus cross sign). When the staking-out circle turns red, it is finished and meets the precision

parameters.

In the process of staking-out, you can also collect detail points, by the *Store* $\$ on the interface or store keying on the hand-held.

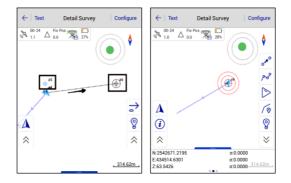


Figure 1-4-27 Staking Point Figure 1-4-28 Stake Success

1.4.7 Data Transfer

In the *Data Transfer* interface, select *Raw Data*, and select the exchange type for export, select the corresponding format export or *User-defined* export, input the file name, select the file save the path, and then click *OK* to export data. If it's *User-defined* export, after clicking *OK*, you can enter the custom format settings to select export content, then click *OK* to export the data.

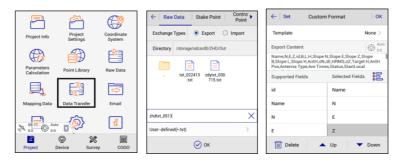


Figure 1-4-29 Data Transfer Figure 1-4-30 Export Figure 1-4-31 Custom Format

1.4.8 Connect the and-held to Download Data

Connect the hand-held to the computer with the USB data cable. Click USB Storage in the

following dialogue box, then click OK in the dialog box when that appears.



Figure 1-4-32 Transfer by USB

Find the path to export the data file on the hand-held (default: ZHD\Out), copy it to the computer,

and then the RTK measure is finished.

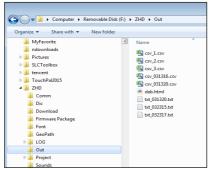


Figure 1-4-33 Exported Data

1.5 General Collection

There are four common ways to get coordinates: Average, Select Point, Select point on map,

Real-time Collection.

1.5.1 Average

Get the coordinate in single status by average, 10 times default, including Average, Weighted average, Window average, Median filter.

← Grap	ph Average	Configure	\leftarrow		Average		\leftarrow	Average	
N:200260 E:193676		:0.0092 :0.0132	Average	e Method		Average >	Average Metho	d Average	
Z:44.6331		:0.0057	Status			Fix >	Status	Fix	
Name	N	E	Ave Tin	165	10		Ave Times	10	
1	20026038.7187	19367613.9093							
2	20026038.7219	19367613.9050	Ave Pre	cision			Ave Precision		D
3	20026038.7252	19367613.9006	σN	0.020	0		Average	~	
4	20026038.7286	19367613.8960	σE	0.020	0	Auto 0.0	Weighted Avera	ge 🛞	Auto
5	20026038.7319	19367613.8914	UL.	0.020			Window Averag		0.0
6	20026038 7352	19367613 8867	σZ	0.030	0				
۲	Start	🕢 ок					Median Filter		

Figure 1-5-1 Average

Figure 1-5-2 Configure

Figure 1-5-3 Type

Notice:

When using the hand-held for data collection, it supports shortcut key operation. The shortcut keys are only supported for detailed survey graphic collection. To avoid input conflict, the text interface has no shortcut keys.

Button 1:	🕀 Zoom In	Button 2 : \bigcirc Zoom Out	
Button3:	Soom cente	r Button 4 : 🕄 Zoom Al	1

HINTARGET	Hi-Survey Road User Manual
Button5: 🖉 Culture C	reate Button 6: DAuto Collection
Button7: prof Average S	urvey Button 8: of Indirect Survey
Button *: Open the cor	figure Button Shift : text-map

1.5.2 Select Point in Library

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

← Co	ord Point Stake Point	Control Point
Name	N	E
B032009	2542671.2195	434514.6301
Z20	2542673.6607	434514.6205
B032109	2542671.2195	434514.6301
B032109_1	2542674.7322	434516.1693
B032109_2	2542674.7504	434516.1495
B20511	2542671.2195	434514.6301
Q	Search	🐼 Set

Figure 1-5-4 Coord Point

1.5.3 Select Point on Map

Click \uparrow or \checkmark to enter the select point on map mode, click \uparrow to select the points in the box. Select a number of points with the icon \Rightarrow . Click \uparrow again to exit the map selection, When the icon is on \checkmark status, it can select points on screen, click \checkmark again to exit *choose node on line* mode, then click *OK* to complete.

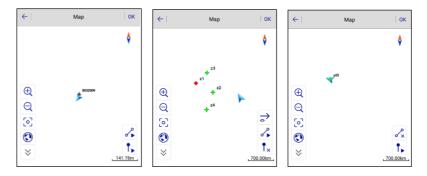


Figure 1-5-5 Select Point Figure 1-5-6 Map Selected Figure 1-5-7 Line Selected

1.5.4 Real-Time Collecting

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Real-time collecting refers to real-time data acquisition through the receiver equipment.



Figure 1-5-8 Real-time Collecting



Notice:

1. To carry out real-time collection and support data storage, select *Save to point library* (save to *Point Library* and *Raw Data* library), then click *OK* to collect.

2. Connect to devices supporting electronic bubble, they will display the electronic bubble view in the *Device* Collection interface, devices that do not support the electronic bubble will not display.

CHAPTER



Project

This chapter contains:

- Project Info
- Project Settings
- Coordinate System
- Parameters Calculation
- Point Library
- Raw Data
- Mapping Data
- Data Transfer
- Email
- Code List
- Software Settings
- About

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2.1 Project Info

Click *Project Info* in the main interface to manage the *Project*. Check the project information, including name, points, projection, time, available space and whether to support the collection of the same name point and history point. You can make some operations with the project, including create, open, delete, recover, export, view, edit, and add attributes.

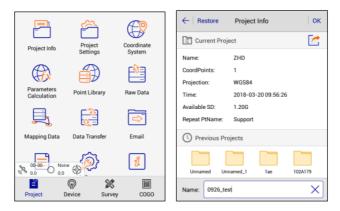


Figure 2-1-1 Main Interface

Figure 2-1-2 New Project

- *OK*: After you input the project name, click *OK* to get a new project and automatically open it for the current project. If there is already a project with the same name, click *OK* to open it; or create a new project as the current project. The old project can be opened or deleted by long pressing.

- *Attribute*: Save the title and content of the current project. Long press a project to select *Properties* in the toolbar. The attribute length is not limited, nor supported for writing and deleting in batches; attribute titles can be the same, when adding attribute names you can enter different values; the attribute name cannot be null, it need to be digits, Chinese or English

characters.

← Restore P	roject Info	ר [← Attri	bute OK	<		A	dd At	tribut	e	ок
Current Project	2		Attribute Name	Attribute Value	Attr	ibute Nar	me k	k			
Name: ZH			kk	0924			Ē				_
CoordPoints: 1			zd	0924	Attr	ibute Val	ue	924			 ×
	GS84										
	118-03-20 09:56:26										
	20G ipport				F	#		Ũ			
Previous Project					1		3				
Previous Project					4		6				: #
Unnamed Unname	d_1 1ae 102A179				7	8	9				
Delete	Attribute 📄 Open		(+)	Add	abc						



Figure 2-1-4 Edit

Figure 2-1-5 Add Attribute

- *Delete*: Delete the selected project. The project can be deleted directly or backup delete (similar to recycle bin), providing the user with a remedial measure after mis-operation. (backup delete compresses and then deletes the project). The compressed version is stored at *ZHD* / *Project* / *ROAD* directory).

← Restore	Project Info	← Restore Project Info
Current Proj	ect 🛃	🔚 Current Project
Name: CoordPoints: Projection: Time: Available SD: Repeat PtName:	ZHD 1 WGS84 2018-03-20 09:56:26 1.20G Support	Name: ZHD CourdPoints: 1 Pr Delete Ti Are you sure to delete 1 ae? Av Are you sure to delete 1 ae? Re Cancel OK
C Previous Pro	ojects	C Previous Projects
Unnamed Uni	named_1 1ae 102A179	Unnamed Unnamed_1 1ae 102A179
Delete	(i) Attribute 🗁 Open	Delete 🧃 Attribute 🏳 Open

Figure 2-1-6 Delete

Figure 2-1-7 Prompt to Delete

Restore: The *Raw Data*, *Coordinate Parameters* and *Project Info* can be restored from the *ZHD-Bak* folder of the external SD card of the work folder. When creating a project or collecting
 28

the points, the raw data file, dam or QR code coordinate parameters file, project information file and cross-section points library in the same project name folder will be backed up on the external SD card *ZHD-Bak* folder. The *Restore* function can only be used when installing an external SD card.

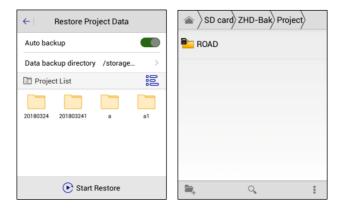


Figure 2-1-8 Restore List

Figure 2-1-9 Backup Folder



Notice:

1. If there is no external SD card, it will prompt every time you start the Hi-Survey.

2. The backup function requires that the hand-held version must be in V1.0.2 and above.

When you restore data, long press the project to select, press the selected project again to cancel.

Click *Select All / Cancel All* to select all projects or cancel. After selecting, click *Start Restore* to recover.

← Restore Project Data					
Auto backup					
Data backup directory /storage	>				
E Project List	000				
20180324 201803241 a	al				
Start Restore					

Figure 2-1-10 Select All or Cancel All

The recovered project will be saved at Project Info \rightarrow Previous Projects. If there is a previous

project with the same name as the restored project, it will add _1 at the end of the recovered project name.

← Restore Project	ОК					
C Previous Projects						
Unnamed 123	14528	145554				
Unnamed_1 1234	666	20180324				
a a_1	aa					
Name: a X						

Restore Project Data					
Auto backup					
Data backup directory /storage	>				
🖹 Project List	ÖÖÖ				
20180324 201803241	al				
aa					
Start Restore					

Figure 2-1-12 the Recovered File

ок

-Export: Export the current project reports in *.txt format, *.html format of Project Report or MappingPoint Report in *.html format.

	Project Info	ок	\leftarrow	Export	0
Current Pro	ject		/stora	ge/sdcard0/ZHD/Out	
Name: CoordPoints: Projection: Time: Available SD: Repeat PtName:	ZHD 1 WGS84 2018-03-2010:53:33 1.19G Support		-	txt_022413 zdytxt_030 .txt 715.txt	
Project Report(*	.txt)	~			
Project Report(*	.html)	1	1001		×
MappingPoint R	eport(*.html)		Project Rep	ort(*.txt)	

Figure 2-1-13 Export Format

Figure 2-1-14 Export

2.2 Project Settings

2.2.1 New Project



Figure 2-2-1 New Project

- *Auto Enter Project Settings*: On opening, it will automatically go to *Project Settings*, and show the *System* interface to set coordinates.

- *Use Last Localisation Params*: After opening, the current project will use the same coordinate parameters as the last project (including the transformation model and parameters of plane conversion and elevation fitting).

- Use Last Control Point File: After opening, the control point of the last project will be copied to the current project.

- *Define Project Attributes*: Set the note of a new project. It will automatically go to the attributeinputting interface to edit the corresponding attribute, after defining the project's attribute.

2.2.2 System

In *System* interface, coordinate system parameters can be set with the *dam* file, QR code or in **32**

Coord Sys Management. If coordinate parameters are changed, the coordinate point library will be updated too.

Project coordinate parameters include *Coordinate System, Framework Shifting, Framework Shifting Info, Framework Calibration* and *Framework Calibration Info*. Data Management is used for external data management.

← New Prj System	Option
🗠 Load Coord System	🧼 器 🕀
Coordinate System	>
+Note: A project can only have one set of Frame	work Shifting parameters.
Framework Shifting	
Framework Shifting Info	>
Framework Calibration	
Framework Calibration Info	>
Data Management	
External data management	>

Figure 2-2-2 Load Coord System

1. Coordinate Parameters - Dam File Loading

Each software project corresponds to a separate *.*dam* file, there will be a new *Dam* file (the same name as the project) when you create a project. In *Project Settings* \rightarrow *System* interface, the

user clicks *e* to load a dam file, getting the coordinate parameter of the existing project applied to the current project: the coordinate point library will be updated at the same time.

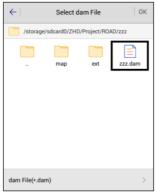


Figure 2-2-3 Add Dam File

2. Coordinate Parameters - QR Code

In Project Settings \rightarrow System interface, click $\stackrel{\square}{\frown}$ to enter the QR code scanning interface, to get

coordinate parameters from the QR code, and then create, Encrypt, share and Save the QR code.



Figure 2-2-4 Scan QR Code

Click My QR Code and it will create a QR code of the current project coordinate parameters; the

user can encrypt, share and save it. The scanned encrypted QR code only can be used, it cannot be viewed and edited.

- *Encrypt*: The user can choose to encrypt the coordinate parameters first, and then re-generate the QR code; the encrypted QR code can be shared and saved; encrypted parameters are not visible and cannot be edited, only called.

- Share: The QR code can be shared by third party software to other customers;

- *Save*: The QR code can be saved as a picture in the controller. If there is a file with the same name under the save path, you can tick the coverage or enter a new filename.



Figure 2-2-5 QR Code

Figure 2-2-6 Encrypt

d Input Dialog

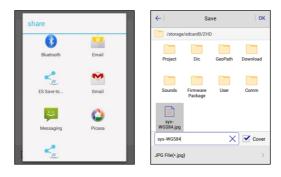


Figure 2-2-7 Share

Figure 2-2-8 Save

Project

Q 0.0 New Prj System Opti	on	← Projection	Datum Plar
😢 Load Coord System 🥪		Projection	Transverse.
Coordinate System	2	Origin Longitude	
The QR Code has been		False Northing(m)	
encrypted, please input the password!	2	False Easting(m)	
P. OK		Lat. of False Origin	
Framework Calibration Info	>	Scale Factor	
Data Management		70004	
External data management	×	8	Save

Figure 2-2-9 Prompt

Figure 2-2-10 Projection

3. Coordinate Parameters - Coord Sys Management

← New Prj System Opt	tion
🕼 Load Coord System) 🞇 🕀
Coordinate System	>
*Note: A project can only have one set of Framework S	hifting parameters.
Framework Shifting	
Framework Shifting Info	>
Framework Calibration	
Framework Calibration Info	>
📰 Data Management	
External data management	>

Figure 2-2-11 Coord Sys Management

The software coordinate transformation module is CoordLib module, which has been verified for many years and provides practical and full coordinate calculation ability. In *Projection*, it includes *Gaussian*, *Mercator*, *Lambert* projection, etc. In *Datum* conversion, it provides *Bursa-Wolf Transformation*, *Molodensky*, *Ten Params* and others. In *Plane* conversion, it provides 2D *Helbert*, *TGO*, *Planar Transformation Grid*, *FreeSurvey and Polynomial Fitting* and other conversion methods. In Height Fitting conversion, it provides Mathematical Models, TGO,

FreeSurvey and Geoid-Ellipsoid Separation Grid.

In the Project Settings \rightarrow System interface, users can click \bigoplus to enter the Coord Sys

Management interface. Common coordinate systems can be added to system lists for easy use.

← Coord Sys Management Apply	← Coord Sys Management
E Predefined List	Continent Eastern Asia >
BJ54	Country China >
Korea-GRS80 125N	China-2000 Zone3 25
UTM-Kertau -Zone 48N	China-2000 Zone3 26
China-2000 Zone3 37	China-2000 Zone3 27
China-2000 Zone3 38	China-2000 Zone3 28
TaiWan-UTM-WGS84 Zone 51N	📄 China-2000 Zone3 29
(+) Predefined (+) User Defined	Q Search

Figure 2-2-12 Pre-defined List Figure 2-2-13 Pre-defined Coord

- Pre-defined: Support for loading the Pre-defined coordinate systems, which are classified by continent and country, for convenient selection.

- User Defined: Add user defined coordinate system according to local situation.

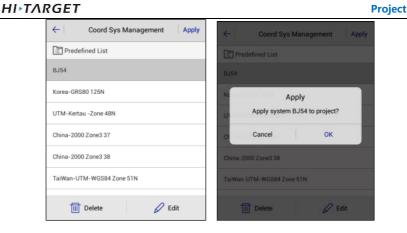


Figure 2-2-14 Select Coord



- *Delete/Edit*: Long press the coordinate system on *Pre-defined List* to delete and edit. Editing coordinate system parameters in the system list do not affect the coordinate system parameters in the project, unless you click the *Apply* button after editing the coordinate system.

- *Apply*: Update the projection parameters used by the project. There will pop up a dialog to prompt whether the selected coordinate system should be applied to the current project. Click *OK* and the parameters are used successfully. The software converts the *WGS84* geodetic coordinate *BLH*, measured by the receiver, to the plane coordinate *NEZ* of the selected coordinate system parameters.

4. Coordinate System

Click *Coordinate System* to go to the *Coord Sys Management* edit interface; you can edit the current project coordinate parameters and the created coordinate system is just used for the current project. Whether to update the parameters to the corresponding projection list can be chosen when saving. If *OK*, coordinate system parameters will be applied to the project according to current settings; if you select *Cancel*, coordinate system parameters will not be

HI-TARGET updated.

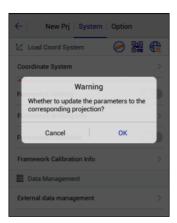


Figure 2-2-16 Warning

5. Framework Shifting

This is for computing the horizontal and vertical translation between two coordinate systems. The user can transfer the collected GNSS coordinates 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 you translate BLH and NEZ, there will be a big projection error, so after framework-shifting, the saved BLH is still the original BLH, while the NEZ is the local one.

- *Compute*: Compute the *dN*, *dE*, *dZ* from the current point and known point. Users need to obtain the source point (the current point) coordinates and the coordinates of the known point first. The known point can be input directly or selected from the library. The source point can be got from

Project

HI TARGET

average collection $\overset{\checkmark}{\sim}$, real-time collection $\overset{\diamondsuit}{\Rightarrow}$, library $\stackrel{\Longrightarrow}{\rightrightarrows}$ and map $\stackrel{\boxtimes}{\boxtimes}$.

← Antenna F. Shifting OK					- Ante	enna F. Sh	ifting	ок
Compute		Re	Result Comp		npute		Result	
Ø Sour	ce	r# 🚸	🔄 😥	т	ranslatio	n(M)		
Ν	2542671.2378				dN	0.0183		
E	434514.6103				dE	-0.0198		
z	63.5724		X		dZ	0.0298		
			Z	C	Current			Fix Pos
© Knov	wn		∆_ <u>0.0</u> _ :=∖	_	Ν	2542671.2195		
	Compute				📩 Loa	ad 💾 S	ave as	Apply

Figure 2-2-17 Compute

Figure 2-2-18 Result

- Apply: Check it to apply the correct value to the project.

- Load: Load the existing translation file.
- Save as: Save the translation parameters as a .txt file, so it can be used by other projects.
- OK: Save the translation parameters and update the project.

The calculated point translation parameter can be selected in the Project Settings \rightarrow System

interface.

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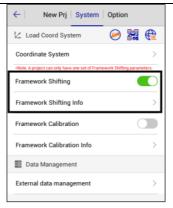


Figure 2-2-19 Framework Shifting

6. Framework Calibration

This is for computing the horizontal and vertical translation between two coordinate systems, generally used for situations as below:

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, click *Framework Calibration* \rightarrow *Compute*, collect the *NEZ* coordinate, input the known point, click *Compute* to get the *Correction dN*, *dE*, *dZ* of the known point and source point, press *Apply* to apply the

parameters and the collected points will be corrected to the coordinate system of the known point. You created a project, it worked, but you don't want to set the base at the same place, so now you can set the base at any place, by using the *Framework Calibration* function Open the firstused project to a known point to correct the coordinates. The correction method is the same as the first situation.

- *Compute*: Calculate the coordinate correction *dN*, *dE*, *dZ* according to the current point and the known point. Users need to obtain the source point (the current point) coordinates and the

coordinates of the known point first. The known points can be entered in three ways: select from the point library $\exists s$, select from the map \mathbb{N} , or enter the coordinates directly. Select O NEZ/

• BLH: the resulting known point coordinates will correspond to the NEZ/BLH format.

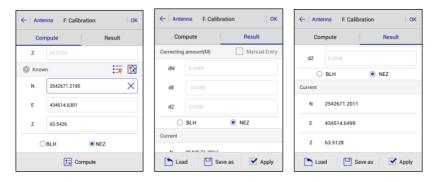


Figure 2-2-20 Compute Figure 2-2-21 Correcting Amount Figure 2-2-22 Current - *Apply*: Apply the calculated correction to the project.

- *OK*: Select *Apply* after computing, and click *OK* to apply the framework calculation parameters (notice: it is different from the *OK* that appears after pressing the return key).

- *Cancel/OK*: Select *Apply*, and click the return key to pop up the prompt dialog, click *Cancel* to return the framework calculation parameters; click *OK* to give up modifying the parameters.

- Load: Load the stored parameters.

- Save as: Store the calculated calibration parameters.

The calculated calibration parameters can be selected in the *Project Settings* \rightarrow *System* interface.

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Figure 2-2-23 Framework Calibration

After using the framework calculation parameter to collect points, the parameters are automatically recorded in the raw data of each point, so that the geodetic coordinates of WGS-84 coordinates are restored when errors occur. In the Raw *Data* \rightarrow *Edit RawData* interface, the framework calculation parameters of the original data can be viewed.

7. External Data Management

Enter *External data management*, click *Add* to load layer file *.*td2*, *.*dxf* and *.*shp* (when the external data format is incorrect, the file can't be imported) as the map background. Support for arc, circle and spiral curve. The imported dxf can be viewed in map in colours. The colour can be switched in *Configuration* \rightarrow *Display* \rightarrow *Display colour*. Switch on to display all kinds of colours in *.*dxf*; switch off to display the default black. After loading point, line, polygon in *.*td2* format, the raster layer is always at the bottom, followed by polygon, line and point.

Project

HI•TARGET

← New Prj System Option	← External data management
🗠 Load Coord System 🧼 🎇 🌐	External Layer List
Coordinate System >	V dxf_sample2010_arc.td2
Note: A project can only have one set of Framework Shifting parameters. Framework Shifting	<pre>dxf_sample2010_circle.td2</pre>
Framework Shifting Info	<pre>dxf_sample2010_line.td2</pre>
Framework Calibration	<pre>dxf_sample2010_lwpolyline.td2</pre>
	<pre>dxf_sample2010_mtext.td2</pre>
Framework Calibration Info >	<pre>dxf_sample2010_points.td2</pre>
📰 Data Management	<pre>dxf_sample2010_polyline.td2</pre>
External data management >	(+) Add

Figure 2-2-24 External Data Management Figure 2-2-25 External data

External data management	← External data management
External Layer List	External Layer List
	<pre>dxf_sample2010_arc.td2</pre>
	<pre>dxf_sample2010_circle.td2</pre>
	<pre>dxf_sample2010_line.td2</pre>
	dxf_sample2010_lwpolyline.td2
DXF File(.dxf)	<pre>dxf_sample2010_mtext.td2</pre>
Layer File(.td2)	<pre>dxf_sample2010_points.td2</pre>
Shapefile(BLH)(.shp)	<pre>dxf_sample2010_polyline.td2</pre>
Shapefile(xyz)(.shp)	Delete 🕑 Open 🛞 Close

Figure 2-2-26 Add External Data Figure 2-2-27 Edit External Data



Notice:

External data management: opens all layers by default when adding the base map. Click the icon in front of the list, to switch layer visibility (on or off), which corresponds to that the base map of measurement interface display or not. Long press the added layer to open/close/delete the operation.

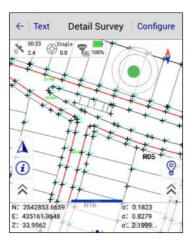


Figure 2-2-28 Display External Data

2.2.3 Option

Do some other configurations, including Angle, Distance, Apply Unit to Data Output, Time Stamp, Store GNSS Precision and Auto Load Last Road File.

DMS >
m >

Figure 2-2-29 Option

- Angle: Confirm the angle unit, including DMS, Gons and mil.
- Distance: Confirm the distance unit, including m, Foot and U.S.Foot.
- Apply Unit to Data Output: Export data according to the set angle and distance format.
- Time Stamp: Record the real-time of each collecting point.
- Store GNSS Precision: Record the precision of each point collection.
- Auto Load Last Road File: Load the road file used when last opening the project.

2.3 Coordinate System

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

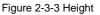
1. Main Interface Project→Coordinate System;

- 2. Main Interface *Project* → *Project Settings* → *System* → *Coordinate System*;
- 3. Main Interface $Project \rightarrow Project$ Settings \rightarrow System \rightarrow Coord Sys Management, long press the Coordinate system on the list to edit and enter the interface. Click Save after setting all the parameters, the system will prompt whether to update the parameters to the corresponding projection list, click *OK* to finish setting parameters.

← New Prj System Opti	on		Datum Plan 🕨	← I ◀ Plan	Height Plane Gr 🕨
🖄 Load Coord System	₩	Projection	Guass-3 >	Model	TGO >
Coordinate System	>	Origin Longitude	000:00:00.00000E	HD(m)	0.0
Framework Shifting		False Northing(m)	0.1	Kb(ppm)	0.0
Framework Shifting Info	>	False Easting(m)	500000.0	Kl(ppm)	0.0
Framework Calibration		Projection Height(m)	0.0	North Origin(m)	0.0
Framework Calibration Info	>	Lat. of False Origin	00:00:00.00000N	East Origin(m)	0.0
Data Management		Scale Factor	10		
External data management	>	Scale Factor	3 Save		Save

Figure 2-3-1 System

Figure 2-3-2 Projection





Notice:

All the tabs in the software can be swiped by gestures, or click the tab page title

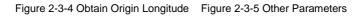
bar to switch the page and make the tab page title bar automatically centred.

Frequently-used projections built-in: Gauss, Mercator, Lambert, etc. (notice: when using

Gauss-3 or Gauss-6, the device can automatically compute the origin longitude after

connecting, other custom projections are not supported).

	Datum Plan 🕨		Datum Plan 🕨
Projection	Guass-3 >	False Easting(m)	500000.0
Origin Longitude	000:00:00.00000E	Projection Height(m)	0.0
False Northing(m)	0.1	Lat. of False Origin	00:00:00.00000N
False Easting(m)	500000.0	Scale Factor	1.0
Projection Height(m)	0.0 🗙	Zone+	
Lat. of False Origin	00:00:00.00000N	X->North	
Scale Factor	1.0	Y->East	
E	3 Save	e	3 Save





Notice:

1. Coordinate system-Projection-Zone+ to set whether to add the number.

2. After opening *Zone*+, all coordinate E input box will be carried out with the number detection, if the number does not match, the input box will display the red font indicating that the number does not match the data confirmation.

2.3.2 Datum

Users can set source ellipsoid, local ellipsoid and datum transfer model (including: Bursa-Wolf

Transformation, Molodensky, One-touch, Polynomial Regression and Ten Params).

← Projection	Datum	Plan 🕨
Source Ellipsoid	WGS 1984	•
a(m):	6378137.0	
1/f:	298.2572236	
Local Ellipsoid	Krassovsky 1940	•
a(m):	6378245.0	
1/f:	298.3	
Model		None >
	🕒 Save	

Figure 2-3-6 Datum Settings

Figure 2-3-7 Datum Model

- *Save*: Click *Save* to save the parameters in a .dam file after settings, the set parameters are invalid without clicking Save.

- *Source Ellipsoid*: Generally using *WGS*-84, *a* means semi-major axis, *1/f* means the inverse of flattening, and there are many frequently-used ellipsoids built-in.

- Local Ellipsoid: Local used ellipsoid.



Notice:

Customize the ellipsoid:

Edit the name of the source ellipsoid or target ellipsoid, long axis a(m) and the inverse of flattening (1/f) into the two lines to be input, the user input, the corresponding parameters and save it. Then the custom ellipsoid parameters will be saved in the file ZHD / Ellipse.csv

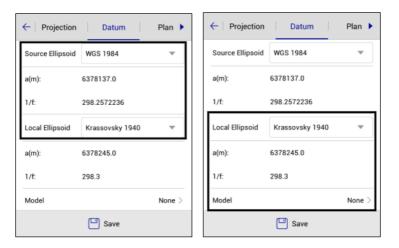


Figure 2-3-8 Datum-Source Ellipsoid Figure 2-3-9 Datum-Local Ellipsoid

1. Bursa-Wolf

Including translation, rotation, scale parameters between two ellipsoids, the rotating angle should be very small. Bursa-Wolf needs at least three points to compute, it's suitable for conversion between different ellipsoidal coordinates.

2. Molodensky

A simplified mode of Bursa-Wolf, only space translation parameters, it is a low accuracy mode and just needs one point to compute: suitable for the transformation of WGS-84 to a national coordinate system.

3. Polynomial Regression

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

2.3.3 Plan

← 🔍 Datum	Plan	Height 🕨
Model		TGO >
DN(m)	0.0	
DE(m) None	0.0	
2D Helmert		
TGO		~
Planar Transform	nation Grid	
FreeSurvey		
Polynomial Fittin	ig	

Include 2D Helmert, TGO, Planar Transformation Grid, FreeSurvey and Polynomial Fitting.

Figure 2-3-10 Plan Method

1. 2D Helmert

Includes translation, rotation, scale parameters between two plane coordinate systems, it just needs two points in any coordinate system to compute.

← I ◀ Datum	Plan	Height 🕨
Model		2D Helmert >
DN(m)	0.0	
DE(m)	0.0	
Rotation	000:00:00.0000	10
Scale(K)	0.0	
	Compute	
	💾 Save	

Figure 2-3-11 Plan Configure

A plane coordinate system transfer method of *TGO* software, more *North Origin, East Origin* than 2D Helmert.

3. Planar Transformation Grid

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

4. FreeSurvey

A transfer method of THALES company, more North Origin, East Origin than 2D Helmert.

5. Polynomial Fitting

Transfer the place by a polynomial model. In some projects, when the known points involved in calculating plane transformation and elevation fitting parameters are different points, use 2D *Helmert* and *Height Fitting* to individually calculate parameters.

The 2D Helmert is used in the calculation part of the plane, and the method is similar to the datum conversion model.

- When using four-parameters, the scale parameter is generally very close to 1, about 1.0000x or 0.9999x.

- When using three-parameters, the parameters generally need to be less than 120.

- When using seven-parameters, the parameters are required to be smaller, preferably less than 1000.

Include Mathematical Models, TGO, Geoid-Ellipsoid Separation Grid and FreeSurvey.

1. Mathematical Models

- Constant Vertical Offset: Translation needs one starting point at least.
- Planar Fitting: Needs three starting points at least.
- Quadratic Surface: Needs six starting points at least.
- Zonal: Needs three starting points at least.
- 2. *TGO*
- A height transfer model includes five parameters: H0 (constant adjustment), Kb (north slope),
- Kl (east slope), North Origin and East Origin.

3. Geoid-Ellipsoid Separation Grid

Select existing grid file to fit height. The grid file (*.grd) needs to be copied to the GeoPath folder in ZHD path.

4. FreeSurvey

A transfer method includes five parameters: H0 (constant), Kb (north slope), Kl (east slope), B0 (origin latitude) and L0 (origin longitude).

Project

← I ◀ Pla	an Height Plane Gr 🕨	\leftarrow	Parameters Calcula	tion	\leftarrow	Height Fitting
Model	Mathematical Models >	Туре		Height Fitting >	Result	
Туре	Constant Vertical Offset >	Pt Name	Source B(*)/N(m)	Source L(*)/ 🕨	A	36.27265
A	16.0424	✓ B20515	2542671.2378	434514.6103	Max VRms	-0.000150 (B20515)
	Compute	✔ 820518	2542671.3728	434514.6103		
		Height	Constant	Vertical Offset >		Fix Pos
	Save	(+) Add	🎦 Open 🔛 Si	ave 😥 Comput e	🚫 Cano	el 📿 Apply

Figure 2-3-12 Height Figure 2-3-13 Parameters

Figure 2-3-14 Result

The calculation of the individual height-fitting parameters includes *Constant Vertical Offset*, *Planar Fitting, Quadratic Surface*, and *Zonal*, which correspondingly require one, three, six and three starting points, at least, to be used. Enter the *Name*, *N*, *E*, the original *H* and the target *H* of the point involved in the height fitting parameters calculation, then click *Add*. After adding all points, click *Compute* to see the residual values, the maximum residual value is generally required to be less than 3 cm. If the value meets the requirements, click *Apply*. If not, click *Cancel*, remove the points with a big error and have a re-solution.

Set the height fitting mode:

- *Constant Vertical Offset* refers to the receiver measured height plus a fixed constant as the use of elevation: the constant can be negative.

- *Planar Fitting* refers to the height anomaly corresponding to multiple levelling points to produce an optimal fitting plane. When the plane is parallel to the horizontal plane, the planar fitting is equal to the constant vertical offset.

Quadratic Surface refers to the height anomaly corresponding to multiple levelling points to produce an optimal fitting paraboloid. *Quadratic Surface* is relatively high for the starting data, and if the fitting is too poor, it may cause a height correction value divergence in the work area.
 54

- Zonal: two known benchmarks to create a virtual mark, used to make the planar fitting.

- *Grid Fitting* needs to select the grid fitting file, it supports *Trimble (ggf), HI-Target (zgf), Geoid99 (bin)* formats, compatible with *egm-96* model. Grid fitting files are often large, the reading may take some time, please be patient. *Grid Fitting* is rarely used. If *Grid Fitting* and the other four kinds of elevation method are selected at the same time, *Grid Fitting* will be taken first, and then the hother fittings.

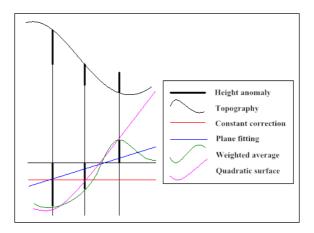


Figure 2-3-15 Height Fitting Plane Simulation

Notice: When importing parameters from the computer, the parameters can be edited into * .txt, parameter formats are as follows:

Four-parameters	Seven-parameters
// The first line is skipped and just written	// The first line is skipped and just written
DX:9847.12172733449	DX:511.755584317388
DY:-200265.017483647	DY:-674.430387295999
R:0.0162640727776042	DZ:-656.294939762613
m:0.000162436743812444	RX:-0.000126577363609681
	RY:-1.44916763174951E-05
	RZ:0.0261524898234588
	m:0.000168070284370492

Table 2-3-1 Built-in Network Parameter Settings

2.3.5 Plane Grid

Open the *Grid* needed and select the grid file. The grid file (*.*grd*) needs to be copied to the *GeoPath* folder in *ZHD*.

$\leftarrow \blacktriangleleft$ Height	Plane Grid Option	← I ← Height Plane Grid Option
B Grid		B Grid
File	$EGG97_QGR.GRD >$	File ETRS89_KRASOVSCHI42_2D.GRD >
L Grid		L Grid
File	None >	EGG97_QGRJ.GRD
NE Grid		ETRS89_KRASOVSCHI42_2D.GRD
NEZ Grid		ETRS89_KRASOVSCHI42_2DJ.GRD
File	Hungarian.GSF >	ETRS89_Stereo30_2D.GRD
	Save	ETRS89_Stereo30_2DJ.GRD

Figure 2-3-16 Plane Grid Figure 2-3-17 Grid-Grid File

HI+TARGET

To apply the parameters computed by *HD-Power* to Hi-Survey Road, just input the parameters, select Simplified in *Helmert Formula* and the first in *2nd Eccentricity Formula*.

- *ncrypt*: To display the file encryption, the settings cannot be changed; if the *dam* parameter file is encrypted, you can see if the coordinate system date is expired.

- Plane Correction Grid: Bilinear Interpolation/Dual-quadratic Spline Interpolation. The default is dual-quadratic spline interpolation.

- *Plane Correction Grid*: It is hidden by default, and it can be seen only if the model in the *Plane* interface is either *Planar Transformation Grid*, or the *NE Grid* or *NEZ Grid* in *Plane Grid* interface is opened.

After modifying the values above, click *Save*, the software will modify the *dam* file under the current project, with the same name as the project; if the reference ellipsoid has been transformed, the coordinates will change.

← 🖣 Height 🕴 Plane Grid	Option	← I ◀ Height Pla	ane Grid Option
Helmert Formula	Simplified >	Helmert Formula	Simplified)
2nd Eccentricity Formula e^2=1-(1	-(1.0/f))^2 >	2nd Eccentricity Formula	e^2=1-(1-(1.0/f))^2
Projection with Height	Default >	Projection with Height	Default
Is encrypt	No	Is encrypt	No
		Plane Correction Grid	Dual-quadratic
Save		•	Save

Figure 2-3-18 Option

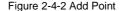
Figure 2-3-19 Plane Correction Grid

2.4 Parameters Calculation

This function is for computing the transfer relation between two coordinate systems, including Bursa-wolf Transformation, Modensky, Plane + Height Fitting, 2D Helmert Transformation, Height Fitting and One Touch.

\leftarrow	Parameters Calculat	ion	\leftarrow		Points Info	Save
Туре		Height Fitting >	<i>©</i> s	ource	· · · · · · · · · · · · · · · · · · ·	¥ 🕅
Pt Name	Source B(°)/N(m)	Source L(*)/ >	Pt Na	ame	z	
✓ B20515	2542671.2378	434514.6103	N	I	3669852.235	
✓ B20518	2542671.3728	434514.6103	E		6525532.369	
			Z		8.5	
			(О ВІ	LH	
Height	Constant	/ertical Offset >	ΦL	ocal		*
rieigilt	Constant	vertical offset /	N		81221.89	X
+ Add	🎦 Open 💾 Sa	ve 😥 Comput e				

Figure 2-4-1 Parameters Calculation Figure 2-4-2 Add Point



- Add: Add the source point and local point; the source point can be input from manual, real-time collecting, library and selecting on map (BLH by default), the local point can be input from manual and library. Single or average collection is used for parameter calculation and data storage is supported (save to the Coord Point & Raw Data). After input, click Save. If you need to manipulate the existing point information, long press it to edit or delete.

\leftarrow	Device	ок					
00-1	³ 💮 ^{Auto} 🚺						
Status: Center							
N: 254	2647.9074	σ: 2.7580					
E: 434542.3848		σ: 2.7580					
Z: 20.4	116	σ: 5.5159					
Target	H 2.0000	Pole(P)					
Av	Average						
Save to the point library							
Name	Z20	×					
Code	guardrail	- 🔮 🙆					

Figure 2-4-3 Save to the Point Library

- Open: Support for Point pairs (*.txt), Carlson Loc File (*.loc), User-defined (*.txt).

- *Save*: Save the point pairs coordinate information, support for *Point pairs* (*.*txt*) and *User-defined* (*.*txt*). The angle format and exported file can be set in *User-defined* (*.*txt*)

- *Compute*: Compute the transfer parameters from source point to local point, it will compute the parameters and *HRMS*, *VRMS* of each point (*HRMS*: the horizontal *RMS* of the current point; *VRMS*: the vertical *RMS* of the current point).

← Parameters Calculation					
Туре		Plane + Height Fitting $>$			
Pt Name	◀ Z(m)	HRMS	VRMS		
✓ B20515	0.000	0.0000	-0.0008		
✓ B20518	0.0000	0.0000	-0.0005		
✓ B20520	0.0000	0.0000	0.0028		
✓ B20524	0.0000	0.0000	0.0000		
✓ B20522	0.000	0.0000	0.0000		
Height Constant Vertical Offset >					
(+) Add	C Oper	n 💾 Save	Compu e		

Figure 2-4-4 HRMS and VRMS

- Apply: Apply to corresponding coordinate parameters, and the result will be updated to Coord

point library.

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

\leftarrow	Parameters Calcula	tion	← Bursa	-Wolf Transformation
Туре	Plane +	Height Fitting >	Result	
Pt Name	Source B(°)/N(m)	Source L(°)/E 🕨	DX(m)	1245184.0
✓ B20515	2542671.2378	434514.6103	DY(m)	-6291456.0
✓ B20518	2542671.3728	434514.6103	DZ(m)	-1572864.0
✓ B20520	2542671.2379	434514.6103	RX(")	
✓ B20524	2542671.2379	434514.6103		
✓ B20522	2542671.2378	434514.6103	RY(*)	Fix Po
Height	Constant	Vertical Offset >	RZ(*)	32228.8759761088
	elete	🖉 Edit	(×) Cance	Apply

Figure 2-4-5 Edit Point

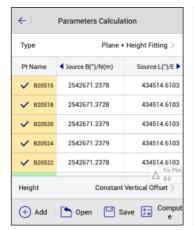


Figure 2-4-7 Plan + Height Fitting

Figure 2-4-6 Result

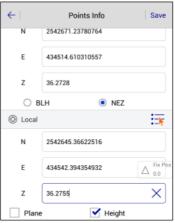


Figure 2-4-8 Add Point

The coordinate information input of point pairs by *Plane* + *Height Fitting* calculation can be set with specific types:

- Tick Plane: Use the plane coordinate NE of the point.

- Tick Height: Use the elevation coordinate Z of the point.

- Tick *Plane* & *Height*: Use the plane coordinate NE and elevation coordinate Z of the point, to compute plane and height fitting.

The colour description of point pairs in *Plane* + *Height Fitting*:

- Blue: Use plane coordinate information of point pairs only.

- Yellow: Use elevation coordinate information of point pairs only.

- Green: Use plane and elevation coordinate information of point pairs.



Notice: 1. From the *Project Settings* \rightarrow *System* \rightarrow *Coord Sys Management*, enter the *Edit* or *Define Project Attributes* coordinate parameter interface to do the parameter calculation, which is the calculation for parameters' conversion corresponding to current custom or edited coordinate system type (you can't change the parameter calculation type);

2. From the Project \rightarrow Parameter calculation or Project \rightarrow Coordinate system \rightarrow Parameter calculation or Project \rightarrow Project Setting \rightarrow System \rightarrow Parameter calculation - to calculate the current project coordinate conversion parameters. The parameters' calculation type can be selected independently, and the default is the Plane + Height Fitting. Height-fitting type is the current selected type for parameter fitting by default.

2.5 Point Library

All coordinate point, stake point, control point data will be saved here, including *Name*, *N*, *E*, *Z*, and *Description*. The list can be viewed by left and right slipping. You can search and add points, or change the display settings. Long press to enter select mode, tick \leq to select all/ cancel all; the selected points can be deleted or edited, you can delete many points, but only edit one point.

	oord Stake oint Point	Control Point	← _ Co	ord Point Stake Point	Control Point	← Coo	ord Point Stake Poin	Control Point	
Name	N	E 🕨	AN 800 C	N	E 🕨	Name	Ν	E	
pt1	2542645.6935	434540.6433	st1	2542671.2378	434514.6103	B032009	20026052.5397	19367605.5514	
pt2	2542645.6977	434540.6444	st2	2542671.2259	434514.5891	B91314	91314.3806	81924.3682	
pt3	2542645.7007	434540.6452							
B031609	2542854.3071	435160.2970							
B031614	2542854.3071	435160.2970			(A)			Set	
B31615	2542644.1476	434541.3913		(©) Set				Batch	
B031918	2542854.3071	435160.2970	t Batch					<u> </u>	
B032009	2542854 3071	435160 2970			H New			H New	
Q s	Search	🙆 Set	(+) Add	Den Q S	earch 📰 More	(+) Add	🎦 Open 📿 S	arch More	

Figure 2-5-1 Coord Point Figure 2-5-2 Stake Point Figure 2-5-3 Control Point



Notice:

1. In the *Coord Point* and *Raw Data*, the coordinate point list is a positive sequence display, the latest collection points shown in the last.

2. *Coord Point* - only for viewing, showing and editing the description, it does not allow *add* or *delete*.

- Search: Search the corresponding point by name and description.

- *Set*: Set the *NEZ* display order of the coordinate points, the decimal number of the coordinates, and the number of coordinate points.

←	Display Settings	
Display Order		NEZ >
HRMS Tolerand	ce	0.0000 >
VRMS Tolerand	ce	0.0000 >
Load More Poi	nts 100	
🗙 Can	cel	🕗 ок

Figure 2-5-4 Display Settings

- *New*: Create the new stakeout document at the same project. Click *Stake Point*, the current list will be cleared, at the same time, the file system will be in a fixed file directory (*map* folder under project) new a blank *Stake Point* as the current staking points file.

- *Open*: Open other stakeout documents at the same project; if you need to open the A project stakeout point, you must first copy the **.td2* and **.tdb* file of A to the same project directory.

- Batch: Support to add numerous stake and control points from the point library.

- Add: Add coord point information, including name, coordinate and description; the coordinate

can be from real-time collection \circledast , select point \overline{i} and select on map \mathbb{N} .

- *Edit*: Only edits description of coord points. All data of stake point and control point can be edited.

←| €I Edit Control Point Edit Coord Point €I Edit Stake Point 🚸 🗐 🔞 🚸 🗐 🐼 From Name From BD92009 N Name stl Name в 22:59:00.72534N 2542671.2378 F Ν 113:22:03.52939E 434514.6103 z E J н 33.2368 × ිට Code set_base z 36.2728 guardrail Code Code ~ v BLH 0.0000 Туре O NEZ 🕗 ок 🗴 Cancel 🗙 Cancel 🕗 ок Cancel 🕢 ок

Figure 2-5-5 Coord Point Figu

Figure 2-5-6 Stake Point

Figure 2-5-7 Control Point

Project



HI TARGET

Notice:

1.*Point Library* of *Edit* operation does not allow editing the name and coordinates, it can only edit *description*.

2. Edit operation can only choose one edit at a time.

- Delete: Delete the selected stake point and control point; points can be deleted en asse, or tick

✓ in front of a name to select all to delete. *Point Library* cannot be deleted. If you need to delete the coordinates, go to *Raw Data* interface for deletion.

2542671.2378	101531 (2100			
	434514.6103	st1	2542671.2378	434514.61
2542671.2259	434514.5891	st2	2542671.2259	434514.58
2542671.2378	434514.6103	st3	2542671.2378	434514.61
2542671.2378	434514.6103	st4	2542671.2378	434514.61
2542671.2378	434514.6103	st5	2542671.2378	434514.61
	2542671.2378 2542671.2378	2542671.2378 434514.6103 2542671.2378 434514.6103	2542671.2378 434514.6103 st3 2542671.2378 434514.6103 st4	2542571.2378 434514.6103 #3 2542671.2378 2542571.2378 434514.6103 #4 2542671.2378

Figure 2-5-8 Delete

Figure 2-5-9 Delete All



Notice:

1. The *Stake Point* and control point support *full / full cancel*. The *Point Library* does not support this operation.

2. Long press to enter the selection mode, click to select multiple points, check the

✓ button to select the *all / cancel all* operation; you can delete one or more selected points, but each time only one point to edit.

2.6 Raw Data

Raw Data is to record BLH, Target H RMSE and description under WGS-84 ellipsoid collection,

it can be transferred to get plane coordinates by using the coordinate transfer system.

\leftarrow	Raw Data		\leftarrow	Raw Data	
Name	В	L 🕨	🗹 Name	В	L
B032009	22:58:53.86065N	113:21:41.85071E	B032009	22:58:53.86065N	113:21:41.85071
Z20	22:58:53.94000N	113:21:41.85000E	Z20	22:58:53.94000N	113:21:41.85000
		Set			
File Name: G	PS.raw	📩 ss Pro	File Name: G	PS.raw	
+ New	🏱 Open 📿 S	Search Transmission More		Delete	🖉 Edit

Figure 2-6-1 Raw Data

Figure 2-6-2 Select Raw Data

- 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, code, station, target height, height type and antenna type; it supports batch edit; the corresponding coordinate point name will be changed after editing raw data.

View other information of point, including solution type, coordinate information, number of average, difference ages, PDOP, satellite, the recording time, station coordinates, the vertical Angle, azimuth of tilt vector and points calibration information, etc.



Notice: 1. *Raw Data* list shows the ground point of the earth coordinates *B*, *L*, *H* (consider *Framework Calibration*, the *Antenna* high), slide to right to view the original data list.

2. All the geodetic coordinates shown in measurement interfaces are geodetic coordinates of ground points.

←	Edit RawData	← Batch Edit RawData
Information		•Note: Check to box to enable the setting.
Name	B080209_4 ×	Code orbit 💌
Code	set_base 🔻 🔮 🙆	Station 0.0000
Station	0.0000	Target H 2.0000
Target H	2.0000	O Pole(P) Vertical(V) Slant(S)
Pole(I	P) O Vertical(V) O Slant(S)	Antenna [iRTK5] GNSS Antenna >
Antenna	[iRTK5] GNSS Antenna	
(×) c	Cancel OK	Cancel 🕢 OK

Figure 2-6-3 Edit RawData

Figure 2-6-4 Batch

Notice:



Turn on Surveying Configure → Data → Allow Same PtName function, raw data supports the same name point collection. If you close it, the name of the reentry will be prompted to repeat that Duplicate name: please enter it again.
 In the Edit RawData→Other Info can check Framework Calibration information. If the project does not open using the Framework Calibration, the Framework Calibration value is 0.

- Upload: Upload raw data to the private cloud.

- Set: Set the loading sequence and display.

- *Process*: Apply the current parameters to point library and get the result. Tick *Use coordinate system* of current project, the project coord system is used by default, do not tick *Use coordinate system* of current project if you need to update the coordinate system, just go to *Coord Sys Management* to set it.



Notice:

Data after the handle will update the coordinate point library by default, the measurement interface will display the new point coordinates after opening the new coordinates system.

Project

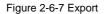
HI TARGET

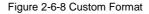
\leftarrow	Raw Data		← Process
Name	В	L 🕨	Projection List BJ54 >
B032009	22:58:53.86065N	113:21:41.85071E	Use coordinate system of current project
Z20	22:58:53.94000N	113:21:41.85000E	
File Name: G	PS.raw	is Setis bees	•Note: The result will be applied to points lib after processing.
H New	🎦 Open 📿 S	earch More	Frocess Export

Figure 2-6-5 Raw Data

Figure 2-6-6 Process

← Raw Data	← Set Custon	n Format OK	
Exchange Types Export	Template	None >	
Directory /storage/sdcard0/ZHD/Out	Export Content		
	id,Name,N,E,Z,B,L,H,Slope N,Slope E,Slope Z,Slope B,Slope L,Slope H,AntH,oN,oE,HRMS,oZ,Target H,AntH Pos,Antenna Type,Ave Times,Status,StartLocal		
txt_022413 zdytxt_030 .txt 715.txt	Supported Fields	Selected Fields	
	id	id	
	Name	Name	
zhdtxt_0921	N	N	
User-defined(*.txt)	E	E	
⊘ ок	Delete	Up 🔻 Down	





Processed data can be exported and export content can be selected in the optional field of the custom format setting. If there is the same file name, then it will prompt "the same file name already exists', you can check to *Cover* the original data or enter a new file name, then click *OK* to export.

Optional fields include: *id*, *Name*, *N*, *E*, *Z*, *B*, *L*, *H*, *Tilt N*, *Tilt E*, *Tilt Z*, *Tilt B*, *Tilt L*, *Tilt H*, 68

Antenna H, σN, σE, Plane HRMS, σZ, Target H, Ave Times, Status, StartLocal time, EndLocal time, StartUTC time, EndUTC time, Desc, Latency, Sats, Shared Sats, PDOP, Elevation(°), VRS Name, Base B, Base L, Base H, Station, Tilt Angel, Tilt Azi, Tilt X, Tilt Y, TiltX Azi, Local B, Local L, Local H, Baseline Length, Azimuth, Offset, Audios, Images and Null.

2.7 Mapping Data

Mapping Data can show all mapping survey points and supports *New, Open, search*, and long pressing to delete and edit.

←	Mapping Da	ta		← Co	oord Point Stake Poi	nt Control Point
Name	N	E	۲	Name	N	E
mp1	2542853.6122	435160.2354		mp1	2542853.6122	435160.2354
mp2	2542853.6080	435160.2366		mp2	2542853.6080	435160.2366
mp3	2542853.6037	435160.2366		mp3	2542853.6037	435160.2366
File Name	c 0921.mcp			文件名:	0921.mcp	
🕂 New 🖻 Open 🛛 Q Search				Delete	🖉 Edit	



Figure 2-7-2 Edit Mapping Data

2.8 Data Transfer

Export or import Raw Data, Stake Point, Control Point and Mapping Data of the current project,

for convenient searching and using. If there is a file with the same name as the exporting one, it

will show A file with the same name already exists, tick Cover to export it - this does not delete the old one.

← Raw Data	Stake Point	Control Point		
Exchange Types	Export	Import		
Directory /storage/sdcard0/ZHD/Out				
A file with the same name already exists.				
txt_022413	×	Cover		
User-defined(*.txt)				
⊘ ок				

Figure 2-8-1 Export

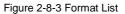
Raw data export format includes:

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), kml(*.kml), NETCAD (*.NCN).

Hi-Survey Road User Manual

← Raw Data Stake Point Control ►	← Raw Data Stake Point Contro
Exchange Types Export Import	Exchange Types Export Import
Directory /storage/sdcard0/ZHD/Out	Directory /storage/sdcard0/ZHD/Out
User-defined(*.csv)	South CASS7.0(*.dat)
DXF File(*.dxf)	Scsg2000(*.dat)
Shapefile(*.shp)	PREGEO(*.dat)
Excel File(*.csv)	ASC File(*.asc)
South CASS7.0(*.dat)	KML File(*.kml)
	NETCAD(*.NCN)

Figure 2-8-2 Format-CSV Figure 2-8-3 Format List



Coordinate point, stake point and control point are saved as Survey.td2, Stake.td2, Control.td2 in the Map folder.

Raw data supports importing from Hi-RTK, which realises the data compatibility between Hi-RTK and Hi-Survey Road. The raw data, stake point and control point support user-defined importing.

The import and export operation of custom format file method is:

← Raw Data Stake Point Point	← Set Custo	m Format OK
Exchange Types O Export Import	Template	None >
Directory /storage/sdcard0/ZHD/Out	Import Content	
	Name,N,E,Z,Desc,Sta	tion,Is Staked
**	Supported Fields	Selected Fields 😜
	Name	Name
	N	N
	E	E
Hi-RTK Store Point Lib(*.stl)	z	z
⊘ ок	Delete	Up 🔻 Down

Figure 2-8-4 Import

Figure 2-8-5 Fields

1. In the *Supported Fields* list, select the fields that need to be exported. The *Selected Fields* are automatically filled in the *Selected Fields* list click the button \mathbb{E} to select the full or full cancellation fields. The *Export Contents* will show the heads of the parts in proper order;

2. Select one item of *Selected Field*, clicking *Delete* will not export the field. If you move *Up* or *Down* to adjust the export order, the *Export Contents* field order will change all together;

3. Click the *Set* button to set the *Angle* format, *Precision, Splitter* and whether to include the *Format Header* and *Template Management*, etc;

$\leftarrow \mid Set$	Custom For	mat OK		
Import Conte	Import Content			
Name,N,E,Z,Desc,Station,Is Staked				
Set				
Angle		DD:MM:SS >		
Splitter	ļ	▼		
Format Hea	der			
Template M	anager	>		

Figure 2-8-6 Custom Format

4. After setting, click *OK* to import or export the file; when the software is reintroduced into the staking point interface, the import format will default to be the data format of the last import, as long as the user does not do data cleaning or uninstall the software.

5. Project tilt measurement, *Data Transfer* \rightarrow *Raw Data* custom export, supports the export of non-tilt correction of the plane coordinates.

6. If the item PPK function is ticked, when the mobile station is set, the PPK correction prompt

box will pop up when the original data is exported in *Raw Data* \rightarrow *Data Processing or Data Exchange*. Click *Yes* to enter the *PPK* correction file selection box, then select the file to correct the processing or exported point.

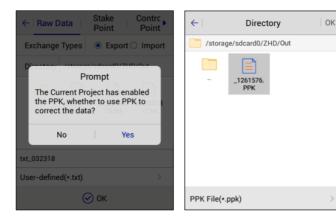


Figure 2-8-7 Prompt PPK

Figure 2-8-8 Select PPK File



Notice:

1. All the import and export methods involved in the file custom format are the same with this step.

2. The file import data needs to do the number and coordinate range detection (including *parameter Calculation* Loading, *Data Exchange - Stake Point / Control Point import, Stake Line*—*Stake Line Library loading, Road Stake/Cross-section Collection*—*Road Design File the choice of loading, Road Design* \rightarrow *Plane-Section Design Line* intersection, line element, coordinate method of loading. If the test data is not within the range of the value, or the E coordinate band number does not match, the *Input import error* prompt box is displayed.

2.9 Email

As an Android email client, the user can send project files by email to realize for remote uploading of data.

\leftarrow	Email	Send
abc@163.c	om	
data		Ø
GPS.raw		×
test data		
	From Hi-Survey	Feedback

Figure 2-9-1 Email- From Hi-Survey

Tick From Hi-Survey to let Hi-Target send mail as the sender.

Otherwise , users can switch to the mail type and enter the address, it supports most email

systems.

\leftarrow	Email	Send
Address From:	@ n	etease.co*
 Note: Email addres IMAP service, or reci- liftum on the SMTP authorization code, p code instead of the p Password : 	pient would not g service and the en please input the a	et email. nail box has the
abc@163.com		
data		Ø
GPS.raw		×

Figure 2-9-2 Email-Enter Address

Tick Feedback to give the feedback to Hi-Target - the default address is Hi-Target enterprise

mail.

\leftarrow	Email	Send
data		Ø
📄 ZHD.dam		<i></i>
test data		
	From Hi-Survey	Feedback

Figure 2-9-3 Feedback

File browser operation method (all operations involved in the file browsing options are applicable to this method in this software):

1. Press and hold an item; when the bottom right corner of the current item Z appears, put all

items into selection mode, press the BACK button to exit the selection mode;

2. In the selection mode, you can select or deselect, or select multiple options;

3. In non-selection mode, click – on each page, to return to the upper directory, until you reach

the root directory of *sdcard*;

4. Click *OK* to complete the file selection;

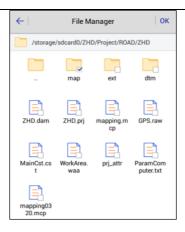


Figure 2-9-4 File Manager

File transfer network status test; enter the file transfer interface initially, without displaying the network status test button. When clicking *Send* and the message fails to send, it will show the *Test Network* button; click it to *Test Network* status, and display the test results.

\leftarrow	Email	Send
zhd-rtk@h	ni-target.com.cn	
data		ଜ
test data		
The	network of device is disabl	led
	From Hi-Survey	Feedback

Figure 2-9-5 Check the Network

Code List is to replace the long description with a short code. The user can enter *Code List* from the main interface, to *Add, Search, Edit* and *Delete* the code, and the code is synchronised with the *property_txt* or *property_zh.txt*.

←	Code List
Code	Desc
fh	
Stake Points	
guardrail	
orbit	
Q	Search (+) Add

Figure 2-10-1 Code List

- *Add*: Users click *Add* to switch to the add page, user input code and descriptions; click *OK* to store the code, the software will update the *Code List*.

$\leftarrow \mid$	Add	
Code	222	
Desc	barrier	×
🗙 Ca	ncel	🕑 ок

Figure 2-10-2 Add Code

- Search: Users can click Search to switch to the search page, or the user input code; click OK, and the software will retrieve a match, switch to Code List showing the matched code. If no results appear, the search page is stopped.

←	Search		←	Cod	e List	
Code	zzz	×	Code		C	Desc 🕨
Desc			ZZZ		ba	arrier
				Find	1 data!	
🗙 Canc	el	🕢 ок	Q	Search		+ Add

Figure 2-10-3 Search Figure 2-10-4 Search Result

- Edit: Long press the specific code, click Edit to switch to the edit page, click OK to store the code; the software will switch to Code List to update the list (NB no support for batch editing).

- Delete: Long press the specific code, click Delete to delete the selected code (batch editing supported).

\leftarrow	Code List	\leftarrow		Edit			←	c	ode Lis	t	
Code	Desc	Code	guardri	ail			Code			Desc	•
fh							ħ				
Stake Points		Desc				s			Delete		
guardrail							gu Are y	ou sure you	want to	delete the	
orbit							selec	ted 5 items?			
222	barrier						222	Cancel		ОК	
							nh				
1	Delete 🖉 Edit	🚫 Ca	ncel		🕢 ок			Delete		🖉 Edit	

Figure 2-10-5 Select Code

Figure 2-10-6 Edit Code Figure 2-10-7 Delete Code

2.11 Software Settings

HI TARGET

← Software Settings	← Software Settings
Auto Connect Device	Keep Screen Light On
Check Correction Transmitting	Soft Input
Check Base Position	Floating Window
Keep Screen Light On	Time Zone (UTC+08:00)Beijing >
Soft Input	Theme GridView >
Floating Window	Screen Orientation Portrait >
Time Zone (UTC+08:00)Beijing >	Module Restore
Theme GridView >	User Guide

Figure 2-11-1 Software Settings (1) Figure 2-11-2 Software Settings (2)

- *Auto Connect Device*: Once opened, it will auto prompt whether to connect to last device automatically when in the connecting, station setting and survey interface.

- *Check Correction Transmitting*: Once opened, it will check difference sending status in Base model and check difference receiving status in Rover model, and will show it in a floating window. ^{SS}: close check correction transmitting; ^{SS}: send no difference message; ^{SS}: sending difference message. When in the handle difference mode, there is difference detection function, so there is no Check Correction Transmitting option.

- Check Network Status: Once opened, it can detect the network status of the host, or support iRTK5 series host. In the built-in network mode, open the software Settings → Check Network Status switch and open the floating window to view the current network signal strength directly.
- Check Base Position: Once opened, when rover is first getting the difference, if the Base

position is different from before, it will prompt whether to calculate a point. During operation,

if a base station change is detected, it will prompt the user base station location to change, and the user can judge the problem according to the actual situation.

- *Keep Screen Light On*: The shutdown status indicates that the power-saving mode is selected and the screen is not in light status.

- Soft Input: You can use soft input (screen input method) if opened; if closed, only via the keyboard.

- *Floating Window*: The floating window is set to display in the non-survey interface. The fixed position of floating window in the survey interface shows no shrinkage; when in non-survey interface, you can hold the floating window and drag it to any position in the screen, after 5 seconds, it automatically shrinks



Figure 2-11-3 Floating Window

2-11-4 Floating Window Display



Figure 2-11-5 Floating Window

(1) Public satellites & Visible satellites (2) PDOP

80 ③ Solution state ④ Differential age

- *Public satellites*: There is no public satellite in Base station, only when rover station receives the difference data. Public satellites refer to the calculated used satellites, when the base and rover station participate in whole cycles and search at the same time, generally it needs more than 5 to work properly.

- Visible satellites: The number of satellites received by the receiver, and 5 at least in RTK works.

- *PDOP*: The spatial geometrical intensity factor of satellite distribution; the better the satellite distribution, the smaller the *PDOP* value; generally, less than 3 is the ideal state.

- Solution state: mainly includes the following modes (except for the fixed coordinates, the precision ranges from high to low): the known points refer to the fixed (base station) $\triangle \rightarrow Fix$ Pos $+ \rightarrow RTK Fix + \rightarrow Float \oplus \rightarrow DGPS \oplus \rightarrow SDGPS \oplus Auto \odot \rightarrow None$ (no GNSS Data). - Differential Age: Refers to the time when a rover station receives a base station signal for solution.

Description of working mode mark of the Floating Window:

P Rover Station (close *Check Correction Transmitting*)

Rover Station (send no difference)

Base Station (close check correction transmitting) Rease Station (send no difference)

Rease Station (sending difference) 🛽 Built-in GPS 🛛 🚏 Demo Mode

Description of Floating Window data link:

No data link With data link Built-in network

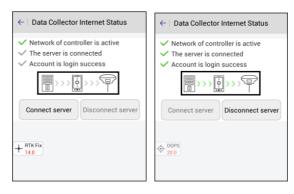
■ External network (3G) ⁽¹⁾ Built-in radio ⁽²⁰⁾ External radio

Handle difference (sending difference)

Handle difference (no difference)

^(D)Handle difference (non-normal difference) ^(C) WIFI data link

When the data link is handle difference, $\operatorname{click}^{(1)}$ on the floating window to enter the *Data* Collector Internet Status interface and check the network status. Click Connect server to achieve the handle difference forwarding; if the user has connected to the receiver for the rover station difference, click Disconnect server to stop forwarding difference.



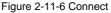


Figure 2-11-7 Disconnect

- Time Zone: Select work time zone, correct the UTC time input by GNSS receiver to the local time in the user's area.

Notice:



For the iRTK5 host, after the time zone is selected, the handle is connected to the receiver, and the software pops up the waiting box to set the receiver time zone. The handle sets the time zone of the receiver each time the device is connected. After the software has set the time zone, the host needs to be restarted, which can be verified by static file creation time.

- Theme: Three themes, including List, Style Box and Simple.



Figure 2-11-8 Simple

Figure 2-11-9 Gridview



- Screen Orientation: Can be either landscape or portrait. (the function applies to QpadX5).

- *Module Restore*: Long press to delete module, press return key to exit delete mode, software settings module cannot be deleted. After deletion, module recovery can restore the deleted module to its original location.

- *User Guide*: The user guide can be viewed through a third-party PDF reader. When viewing the user guide, you need to have a PDF document in the ZHD directory, or the handle on the Internet, and a PDF reader installed.

2.11.1 Location Information

Click position icon on the floating window to quickly view the location details.



Figure 2-11-11 Floating Window - Location Information

Local time, and so on.

Display the location information of the current point, including NEZ, Velocity, solution state,

RTK	Fix	Latency	2.0	RTK	Fix	Latency	2.0
N 254	2644.4950)		Base Coord	1		
E 434	541.6406			В	22:58:53	.83249N	
Z 47.5	5788			L	113:21:4	1.82468E	
HRMS	0.0100		+ BTK Fix	н	49.6789		+ BTK Fix
VRMS	0.0150	90250		Baseline Length	2.0951		
Velocity	0.00360			Base 2D Distance	0.0123		
Local time Reset		23 18:30:34. Clear Ephe		Horizontal Azimuth	70:32:45	.92410	
Enable I Conne		Disable In Connec					
Location	n Info	Base St	ation	Location	n Info	Base S	tation

Figure 2-11-12 Location Info Figure 2-11-13 Base Station

- *Reset RTK*: Rover station will calculate the received difference from base station again, usually under the condition of poor satellite status, you can calculate it many times, save the coordinates, to rule out an incorrect solution with multipath interference.

- *Enable internet connection*: Check whether the network is disconnected; after connecting, it is convenient to direct reconnect.

- Disable internet connection: Disconnect the network after connecting.

- *Clear Ephemeris*: When the rover station is out of lock, floating and unable to achieve the fixed location, and cannot find Beidou or GLONASS, then click the Clear the ephemeris button. Reset the main board after clearing.

- Base Station Information: Display base station coordinates, distance, horizontal distance and azimuth

2.11.2 Satellite Information

Click satellite icon on the floating window to quickly view the satellite details.



Figure 2-11-14 Floating Window-Satellite Information

1. SATView

View the projected location of the satellite, the national flags represent their satellites, and the corresponding number below each satellite is the number of the locked satellites.

- GPS: The Prn range is 1-33

- GLONASS: The Prn range is 65-96

- SBAS: The Prn range is 120-151(EGNOS: Prm values: 120,124,126; SDCM: Prm values:

125,140,141; GAGAN: Prm values: 127,128; MSAS: Prm values: 129,137; WAAS: Prm values:

133,135,138)

- BDS: The Prn range is 161-195

- GALILEO: The Prn range is E1-E52

- QZSS: The Prn range is J191-J195

View and set GNSS satellite elevation mask, click Set to set the elevation mask.



Figure 2-11-15 SATView

Set the colour according to the L1 carrier signal-to-noise ratio of satellite, colour: red <= 31, 31

< orange <=41, green >41.



Figure 2-11-16 Status

2. Satellite Signal-To-Noise Ratio Map

PRN is satellite number, *Azi* is the azimuth of satellite, *Ele* is the elevation mask, *L1* is the signal-to-noise ratio of L1 band, *L2* is the signal-to-noise ratio of L2 band, and *Type* is the satellite type.

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\leftarrow	SATVie	w Stat	us SA	T Info	
Sat	s	PDOP	Ele	vation Mask	:(<=30*)
32	2	1.2		5	Set
PRN	Azi	Ele	LI	L2	Туре
2	46	58	45	34	GPS RTK Fix
5	339	56	51	46	T 1.0 GPS
6	94	28	33	39	GPS
12	229	16	46	43	GPS
13	172	54	47	34	GPS
15	207	28	46	44	GPS
19	151	14	33	16	GPS

Figure 2-11-17 SAT Info

2.12 About

Here are the related instructions for the software version and upgrade.

Open the application in the networked state, and when a new version of the software is detected, the system will display the popup, according to the configuration information on the server. If the current link is a non-WIFI data link, the user will be prompted whether to download.

Project



Figure 2-12-1 Update

Figure 2-12-2 QR Code

The interface added the QR code of Hi-Target Facebook and Youtube, which can be accessed

by scanning.



Notice:

The information above is virtual information, the factual operations are based on

actual information.

CHAPTER



Device

This chapter contains:

- Device
- Base
- Rover
- GNSS Demo Mode
- Controller
- Additional Settings
- Console
- Static
- RangeFinder

HI→TARGET 3.1 Device

3.1.1 Device Connection

To connect the hand-held controller to GNSS receivers set the device connection method and antenna type (can be modified after connection), and then click *Connect*.

← Device		← Bluetooth Connect	
		Status:	
O None		Bluetooth The paired devices	
Disconnect		GeoNavB-11616316	>
Check Update		11007946	>
Working Mode:		11800547	>
Receiver FW: Expiration:		O None 0.0	
🛠 Configure			
Mathad	Blueteeth		
💶 Register 🖉	Connect	Q Search device	

Figure 3-1-1 Device

Figure 3-1-2 Bluetooth Connect

There are three methods of connection, Bluetooth, network and Wi-Fi. In addition, the built-in GPS and demo modes can be set independently with the hand-held controller.

1. In *Bluetooth* connection mode, it's necessary to turn on the Bluetooth function of the receiver and hand-held controller at the same time, and click *Connect* to enter the Bluetooth connection interface. Click *Search device* to search for the device that needs to be connected, choose it in the list by the S/N and there will be a Bluetooth pairing prompt. Enter the pairing password (default password is 1234) to connect the device, and paired devices do not need to enter the pairing password again. If no device is found, please click *Search device* to search again.

2. In *Network* connection mode, click *Connect* to enter the network settings interface, and set the ID and password to connect the device (NB only supported on specific models). If it's the first time of connnection, please connect the receiver by Bluetooth first. Set the IP and port in *Additional Settings* \rightarrow *Receiver Settings* \rightarrow *Remote Connection*, then use the network connection to do wireless remote operation easily.

$\leftarrow \mid$	Network
Address	rtk.zhdgps.com
Port	8999
Device ID	0961234
Password	•••
🗹 Use def	ault server parameters
O None 0.0	
🚫 Car	cel 📀 Connect

Figure 3-1-3 Network

2. In *Wi-Fi* connection mode, if there is no Wi-Fi connected to the current hand-held controller, it will automatically enter the system Wi-Fi connection interface. Please choose the Wi-Fi that is needed, then click *Connect*. If there is already Wi-Fi connected, users can choose *Cancel*, *Other* or *OK*, according to the situation.

Device

← Device	← Device
O None Disconnect	Disconnect
Check Update	Wi-Fi Prompt
Bluetooth	Current Connected Wi-Fi is V 11616316, Sure to Connect?
Network	E Cancel Other OK
Wi-Fi 🗸	🛠 Configure
Built-in GPS	Wi-Fi >
Demo	 Other Register Connect

Figure 3-1-4 Wi-Fi

Figure 3-1-5 Wi-Fi Prompt

4. In *Built-in GPS* connection mode, it will display the S/N of the hand-held controller, when using the Hi-Target hand-held controller, otherwise it will be blank. In working mode, receiver FW and expiration will be blank too.

← Device				
Auto 0.0	1444213			
Che	Check Update			
Built-i Working Mode:	in GPS is on!			
Receiver FW:				
Expiration:				
🛠 Configure				
Method	Built-in GPS >			
Register	🔀 Disconnect			

Figure 3-1-6 Built-in GPS

5. In Demo connection mode, the working mode, receiver FW and expiration will be blank too.

S/N will display as demo mode.

← GNSS Demo Mode Start		雬	Ţ
	Device	Base	Rover
Random			
C Velocity	₩ _o	Ļ	
0.0500 Random	GNSS Demo Mode	Controller	Additional Settings
U" Precision	GNSS ••	S Demo Mod	e is on
0.0300 Random	Console	Static	RangeFinder
🗄 Start Point 📑 🕅			
O NOT BLH O NEZ	Auto	-	. –
B: 23:00:00.00000N	Project D	-	rvey COGO

Figure 3-1-7 Demo Mode Figure 3-1-8 Mode Prompt

The current receiver's connection status will be displayed after the device is connected successfully, including the S/N, Check Update, Working Mode, Receiver FW, Expiration, Method and Antenna.

← Device					
	11616316				
	Check Update				
Working Mode:	Working Mode: Rover Mode				
Receiver FW:	Receiver FW: 5.1 V90 Plus				
Expiration:	Expiration: 2018-06-12				
- 45.0					
Method	Bluetooth >				
🧷 Other					
Antenna [V90 Plus] GNSS Antenna >				
🚺 Registe	r 🛛 🕅 Disconnect				

Figure 3-1-9 Device Info

- *Check Update*: Check and upgrade the connected host and motherboard firmware. After connecting the receiver by Bluetooth or Wi-Fi, click *Check update* to enter the firmware update interface. If there is new firmware, there will be a prompt, and users can click *Update* button to upgrade.

← Firmware Update				
Firmware file	Up to date			
Motherboard firmware file	Up to date	Update		

Figure 3-1-10 Firmware Update

- *Working Mode*: Display the current receiver's operating status, generally base mode, rover mode or static mode.

- Receiver FW: Receiver firmware version number and receiver type.

- Expiration: Deadline for registration code use.

- Antenna: Set the antenna type. Enter the antenna manage interface to choose it, according to the model; if there is no matching antenna type, you can click Add to add the custom antenna type by inputting the Model, Desc, Radius, L1 Phase Offset, L2 Phase Offset and SHMP Offset in the Add Antenna interface.

← Add Antenna	a Manage OK	← Ado	d Antenna
Manufacturer	Hi-Target >	Model	
Model	V90 Plus >	Desc	
Desc	GNSS Antenna	Radius	0.0000
Radius	0.13000	L1 Phase Offset	0.0000
1 Phase Offset	0.09450	L2 Phase Offset	0.0000
2 Phase Offset	0.08980		0.0000
SHMP Offest	0.00000	SHMP Offest	0.0000
SDGPS 69.0			

Figure 3-1-11 Antenna Manage Figure 3-1-12 Add Antenna

3.1.2 Register

Registering the receiver. Connect the GNSS receiver, input the receiver registration code, or scan the receiver QR code to register (please ask the Hi-Target service person for the registration code or QR code). The code for the 7-digit S/N receiver is 21-digits, with a 24-digit code for the 8digit S/N receiver.

←	ОК			
Registration code (24 digitals)				
7	8	9	DEL	
4	5	6	CE	
1	2	3	0	

Figure 3-1-13 Register

HINTARGET 3.1.3 NFC Connection

Users can scan the NFC-enabled receiver's NFC tag, with the NFC-enabled hand-held controller, to connect the device.

The current receiver's connection status will be displayed after the device is connected successfully, including *Working Mode, Receiver FW, Expiration, Method, Antenna*, etc.

3.2 Base

The base settings mainly set the working parameters of the base station, including the base coordinates, data link and other parameters.

3.2.1 Base Configuration

Users can save all the parameters, set in the base station, as a configuration file, or load the parameters directly from the configuration file.

←	Set Base	Set	\leftarrow	Set Base	e Set
Base Con	nfig File		Base Conf	ig File	
HT1			HT1		
HT2			HT2		
△ Fix Pos 0.0			△ Fix Pos 0.0		
			🔟 De	elete	📩 Load
Configure	Receiver Datali	nk Other	Configure	Receiver [Datalink Other

Figure 3-2-1 Configure Figure 3-2-2 Delete or Load

- Save: Input the configuration name and click to save the current set parameters.

- Delete: Delete the selected configuration file.
- Load: Load parameters of the selected configuration file.
- Generate the parameters of the current settings as a QR code.

3.2.2 Receiver Position

Set the coordinates of the base station to the latitude and longitude coordinates in the WGS-84 coordinate system (requires the GNSS to be measurable to get the height anomalous value, because the H of the base position is the ellipsoid height and the motherboard needs the geoidal height of the internal model).

\leftarrow	Set Base Set
Antenna	
Antenna	[V90 Plus] GNSS Antenna \geq
Target H	1.5000 X
O Pole	e 💿 Vertical 🛛 🔿 Slant
Position	💉 😪
Name	B031609
B Fix Pos 0.0	22:59:00.73934N
Configure	Receiver Datalink Other

Figure 3-2-3 Receiver

When setting up the base station at an unknown point, point coordinates can be obtained by average collection. (the more coordinates in the average collection, the higher the reliability). When setting up the base station on a known point, users can input the coordinates directly, or select data from the point library by clicking the point library icon.

- Antenna: To enter the antenna type management interface and select antenna type.

- Target H: Input the instrument height and height type of the base station.

- *Position*: The ground reference point of the base station, it can be manually-set or obtained by average collection, or from the point library.

- M: Point library. It is used to get points in the coordinate library to the current interface.

- in: Average collection. To enter the average collection interface, the default number of smoothing is 10 times.

 ← Graph Average Configure N:2542645.0317 σ:0.0005 E:434542.1663 σ:0.0009 Z:50.2278 σ:0.0029 			
Name	Ν	E 🕨	
1	2542645.0323	434542.1675	
2	2542645.0318	434542.1667	
3	2542645.0314	434542.1659	
4	2542645.0310	434542.1651	
O Auto			
─ Stop 4			

Figure 3-2-4 Average

In the Average interface, users can collect points manually

- *Stop*: Click the average collection icon and it will start smoothing automatically. Users can click *Stop* to stop it, or click *Start* to begin the collection.

- OK: Apply current average coordinate data.

- *Graph*: Enter the graphical interface of the average collection, and view the distribution of points.

- Configure: Set the Average Method, Status, Ave Times and Ave Precision.

- *Delete*: According to the accuracy of points, users can select the point to participate in the **98**

average calculation. Long press on an item, in the list of average points, to delete the point (it will be unrecoverable).

3.2.3 Data Link

Data link settings are used to set the communication mode and parameters between the base and rover, including the *Internal UHF*, *Internal GSM*, *External Radio*, *Wi-Fi* and *Data Collector Internet* (for specific models).

\leftarrow	Set Base	Set	\leftarrow	Set Base	:
Mode			Mode		
Datalink	Interna	I GSM >	Datalink	Interna	I GSM
Parameter					
Network		GPRS >	Network		GPRS
APN	C	MNET >	Internal UHF		
Server	CORS >	Select	Internal GSM		~
IP △ ^{Fix Pos} 0.0	218.255.188.30	×	External Radio		
Configure F	Receiver Datalink	Other	Wi-Fi		

Figure 3-2-5 Datalink Figure 3-2-6 Choose the Datalink

1. In the *Internal UHF* mode, users can set the *Channel, Power, Advance settings* (for specific models), etc.

\leftarrow	Set Base	Set
Mode		
Datalink	Intern	al UHF >
Parameter	r	
Channel	3	
Protocol	SATELLI	NE-3AS >
Power		High >
SDGPS 45.0	Advance	
Configure	Receiver Datalin	k Other

Figure 3-2-7 Internal UHF

- Power: There are three options, including high, middle and low options.

- Advance: Click to enter the interface to get the most suitable channel (for specific models).

← Reset	Frequency List	Save
Channel	Freq. (MHz)	Band
1	462.5	25 >
2	462.75	25 >
3	463.0	25 >
4	463.25	25 >
5	463.5	25 >
6	463.75	25 >
	464.0	25 >
8	464.25	25 >
	Refresh	

Figure 3-2-8 Channel List Figure 3-2-9 Frequency

Click the frequency of a channel to modify the frequency of the channel, within the frequency range specified by the channel.

- Refresh: If the result of the current search is not a suitable channel, users can change the starting 100

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channel to continue a new round of searches.

- Reset: Click to restore the list to default state.
- Save: After modifying the frequency table, please click to complete the modification.

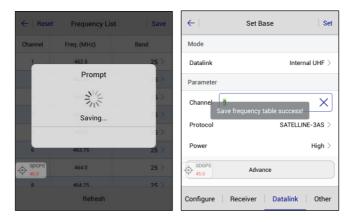


Figure 3-2-10 Saving Prompt

Figure 3-2-11 Save Success

2. In *Internal GSM* mode, users can click *Network* to choose the network type (GPRS, GSM, CDMA).

←	Set Base	Set	\leftarrow	Set Base	Se
Mode			Mode		
Datalink	Interna	I GSM >		In	ternal GSM 🤇
Parameter			Parameter		
Network		GPRS >	Network		GPRS >
APN	C	MNET >	APN		CMNET >
Server	CORS >	Select	GPRS		~
	218.255.188.30		GSM		
Configure	Receiver Datalink	Other	CDMA		

Figure 3-2-12 Internal GSM

Figure 3-2-13 Network

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- APN: Different networks will have different settings.

- Server: Choose the mode. Input the IP and port manually, or click Select to enter the server list

and choose a suitable server.

←	Server	Add
Name	IP	Port 🕨
HiTargetServer	rtk.zhdgps.com	9000
HiTargetGZ1	121.33.218.242	9000
HiTargetGZ2	202.96.185.34	9000
QXWZ	60.205.82.126	9000
Fix Pos		

Figure 3-2-14 Server

When in ZHD mode, there are two kinds of group types, including City Number and Base Station

SN.

Fix Pos	Set Base	Set	A-Fix Pos	Set Base	Set	Fix Pos	Set Base	Set
APN		CMNET >	APN		CMNET >	Network		GPRS >
Server	ZHD	Select	Server	ZH	D > Select	APN	С	MNET >
IP	218.255.188.30	×	IP	218.255.188.30	×	Server	ZHD >	Select
Port	2101		Port	2101		IP	218.255.188.30	×
Group Type	By City I	Number >	Group Type	By Ci	ty Number >	Port	2101	
By City Numl	ber	~	Area ID	0000000		Group Type	By Base Stati	ion SN >
By Base Stat	ion SN		Group ID	0		Base S/N	11616316	
			Configure R	eceiver Data	link Other	Configure F	Receiver Datalink	Other

Figure 3-2-15 Group Type

Figure 3-2-16 City Number Figure 3-2-17 Base S/N

- By City Number: The Area ID and Group ID are 7 and 3 digits respectively. The group ID

needs to be less than 255. The base and rover need the same parameter settings to work properly.

- By Base Station SN: Input the base S/N, and set the same number in the same way with the rover.

When you use the *CORS* mode, please set the right IP, port, mountpoint, etc. Then click *Set* to save the settings.

3. In the External Radio mode, the device can connect to the external radio to transmit data.

Fix Pos	Set Base	Set
Mode		
Datalink	Externa	al Radio >
Parameter		
Configure R	eceiver Datalin	k Other

Figure 3-2-18 External Radio

4. For the *Wi-Fi* mode, after the hand-held controller is connected to a WiFi-enabled receiver, through a non-WiFi connection, the data link will add the Wi-Fi mode. In this mode, the receiver can be set to connect to a third-party Wi-Fi and send differential data.

HI	TARGET					D	evice
	\leftarrow	Set Base	Set	(Set Base	Set	
	Mode			Mode			
	Datalink		Wi-Fi >	Datalink		Wi-Fi >	
	Parameter			Parameter			
			>	Wi-Fi		>	
	Internal UHF			Server	CORS	Select	
	Internal GSM			IP	218.255.188.30	×	
	External Radio)		Port	2101		
	Wi-Fi		~		Receiver Datalin	k Other	

Figure 3-2-19 Wi-Fi Mode

Figure 3-2-20 Wi-Fi Mode Settings

Click the Wi-Fi option to enter the *Wi-Fi Parameter* interface. When the Wi-Fi hotspot is turned on, the connection to the Wi-Fi of the hand-held controller is supported; otherwise, a third-party Wi-Fi hotspot will be connected.

← Wi-Fi Parameter	ОК	•	← Wi-	Fi Parameter	ОК
Wi-Fi hotspot			Wi-Fi hotspot		
"11616316"	Select		Network SSID	AndroidAP	
SSID: "11616316" Password: "12345678"			Password	042e992d7d64	
Encrypt: WPA_PSK Signal: 100.0%			Encrypt	WPA2_PSK	>
Linked Speed: 65 Mbps Network Status: Unknown Staus			Т	est Network	
Test Network △ Fix Pos		2	Fix Pos		

Figure 3-2-21 Wi-Fi Parameter

Figure 3-2-22 Wi-Fi Hotspot

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5. In Data Collector Internet mode, it supports ZHD and CORS mode to connect the server (for

specific models).

🖬 🕯 🌾 🖞	8 🕺 Ål Ål 56%	2 16:02
\leftarrow	Set Base	Set
Mode		
Datalink	Data Collector Inte	ernet >
Parameter		
APN		>
Server	cors >	Select
IP	218.255.188.30	X
- Pont 46.0	2101	
Configure	Receiver Datalink	Other

Figure 3-2-23 Data Collector Internet

It uses the hand-held network to connect the server as the RTK, dial-up internet access by the network module of the hand-held. Send the received differential data to the host by Bluetooth after connecting to the server, so that the host can do network RTK without the SIM card.

3.2.4 Other Options

Set the Diff Mode, Correction Type, Elevation Mask and other parameters.

\leftarrow	Set Base	Set
Diff Mode		RTK >
Correction Ty	ре	RTCM(3.2) >
Diff Port		COM2 >
Baudrate		115200 >
Pos Frequenc	:y	1HZ >
Elevation Ma	sk(<=30°) 5	×
+Note: If working i	n PPK mode, all co	nstellations will be
Configure R	eceiver Da	talink Other

Figure 3-2-24 Other

- *Diff Mode*: Including RTK, RTD and RT20. The default is RTK, RTD is the code differential GNSS positioning, and RT20 is the single-frequency RTK.

- Correction Type: Including RTCM(3.2), RTCM(3.0), CMR and RTCM(2.x).

- Diff Port and Baudrate: The default is COM2 and 115200 (unchangeable).

- Pos Frequency: Software update positioning data frequency, supports 1Hz and 2Hz.

- Elevation Mask: Adjustable from 0 to 30 degrees.

- *PPK Mode*: Connect to a receiver that supports PPK function; the receiver will start a temporary static acquisition synchronously after the base turns on the PPK mode.

Click *Set* after all the base parameters are set, and there will be a prompt to indicate the success or failure of the settings.

3.3 Rover

The rover settings mainly set the working parameters of the rover, including *Configure, Datalink*, etc.

3.3.1 Rover Configuration

Users can save all the parameters set in the rover as a configuration file, or load the parameters directly from the configuration file.

In the configure interface, users can click the QR code icon to read the QR code shared by the base station, to obtain the configuration parameters quickly.



Figure 3-3-1 QR Code

3.3.2 Data link

Rover data link settings are used to set communication types and parameters between the base and rover, including the *Internal UHF, Internal GSM, External Radio, Data Collector Internet, External Network (3G), PPP Service* (for specific models), etc.

\leftarrow	Set Rover	Set
Mode		
Datalink SDGPS		PPP Service >
Internal UHF		
Internal GSM		
External Radio		
Data Collector	Internet	
PPP Service		~

Figure 3-3-2 Datalink

1. In the Internal UHF mode, users can set the Channel, Protocol, etc. The channel must be consistent with the channel of the base.

2. In the Internal GSM mode, users can click Network to choose the network type (GPRS, GSM, CDMA).

←	Set Rover Set	←	APN Parameters	ОК
Mode		APN	CMNET	×
Datalink	Internal GSM >	User Name	CMNET	
Parameter				
Network	GPRS >	Password	CMNET	
APN	CMNET >			
Server	CORS > Select			
	218.255.188.30	+ RTK Fix		
Configure	Datalink Other			

Figure 3-3-3 Internal GSM Figure 3-3-4 APN Parameters

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- APN: Different networks will have different settings. It's parameters of the host SIM card.

- Server: Choose the mode, including ZHD and CORS. Input the IP and port manually, or click

Select to enter the server list and choose a suitable server.

- Net Relay: Click to open the net relay option (for specific models), and set the Relay Channel,

Protocol, Power, etc. Then it can relay to other rovers while working.



Figure 3-3-5 Net Relay

When use ZHD mode, the settings needs to be same as the base settings. And when you use the CORS mode, please set the right IP, port, mountpoint, etc. Click Set to enter the CORS Parameters interface, and click Get Mountpoints to choose the suitable mountpoints and input the User Name and Password to finish the settings.

RTK Fix	Set Rover	Set	$\leftarrow $	CORS Paramet	ers OK
Parameter			Mountpoir	RTCM32S	
Network		GPRS >	User Name	eb	
APN Server		MNET >	Password	•	
561761	cons /	Select	Get Mountpoints Open Save		
IP	218.255.188.30		Name	Data format	Descriț 🕨
Port	2101		cmr	CMR	Obs(1),Info(
Mountpoint	RTCM32S	Set	RTCM3.1	RTCM3	1004(1),1012(1),10 10)
			RTCM32S	RTCM3.2	1074(1),1084(1),1 05/1007(10
Configure	Datalink	Other	Caster	RTCM3.2	1074(1),1084(1),1 05/1007(10

Figure 3-3-6 Set Rover

Figure 3-3-7 CORS Parameters

- Open: Load existing CORS parameters.

- Save: Save the current CORS parameters.

- OK: Complete the settings and return to the previous screen.

3. In the *External Radio* mode, the hand-held controller needs to be connected to a host that supports external radio.

4. In *Data Collector Internet* mode, users can choose ZHD or CORS mode, and the correction data will transmit from the software to rover by Bluetooth. With server support, the differential format (including the coordinate system) can be set manually (RTCM 1021: reference ellipsoid, RTCM 1023: seven-parameters and RTCM 1025: elevation parameters).

RTCM1021	RTCM1023
RTCM1025	

Figure 3-3-8 RTCM Formats

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The APN of the data collector internet mode are the parameters of the hand-held controller system. If the WiFi is not connected, the hand-held controller must be installed with the SIM card to do APN settings, otherwise there will be a prompt.

←	Set Rover Set			
Mode				
Datalink	Data Collector Internet >			
Parameter				
APtThe SIM card is not inserted or the SIM card is temporarily Serunavailable. CORS > select				
-OP ^{SDGPS}	218.255.188.30			
Port	2101			
Configure	Datalink Other			

Figure 3-3-9 APN of the Data Collector Internet Mode

5. In the PPP Service mode, users can set the Diff Mode (satellite or network).

3.3.3 Other Options

Set the Diff Port, Pos Frequency, Elevation Mask and other parameters.

\leftarrow	Set Rover	Set
Diff Port		COM2 >
Baudrate		115200 >
Pos Frequenc	у	1HZ >
Elevation Mas	sk(<=30°) 10	
*Note: If working in on.	PPK mode, all cons	tellations will be
PPK Mode		
Configure	Datalink	Other

Figure 3-3-10 Other

HI TARGET

- Diff Port and Baudrate: The default is COM2 and 115200 (unchangeable).

- Pos Frequency: Software update positioning data frequency, supports 1Hz and 2Hz.
- Elevation Mask: Adjustable from 0 to 30 degrees.

- *PPK Mode*: The receiver will start a temporary static acquisition synchronously after the rover turns on the PPK mode. It will record the RSP file in the *Detail Survey, Stake Points, Stake Line* when using the average collection. The file name will be consistent with the static collection file name.

Notice:



If the project was turned on in *PPK Mode*, when setting up the rover, there will be a PPK correction prompt when the original data is exported.

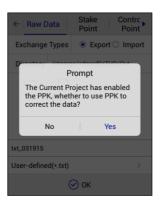


Figure 3-3-11 Prompt

Click *Set* after all the rover parameters are set, and there will be a prompt to indicate the success or failure of the settings.

3.4 GNSS Demo Mode

The receiver can simulate measurement data in the demo mode to make it easy to learn the software.

GNSS Demo Mode Start
➡ Direction
Random 🔻
Velocity
0.0500 Random
U" Precision
0.0300 Random
🗄 Start Point 📑 🔀
BLH O NEZ
B: 23:00:00.00000N

Figure 3-4-1 Demo Mode

Choose the Direction according to demand, including Random, Input, Map and Line.

Q-None 0.0 GNSS Demo Mo	de Start
✿ Direction	
Random	•
Velocity	
0.0500	Random
Random	~
Random Input	~
	~

Figure 3-4-2 Direction

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- Random: Current point direction is displayed randomly.

- Input: Specify the travel azimuth.

- *Map*: Specify the direction as the direction of the map. There are four options, East, South, West and North.

- Line: Specify the line in the Stake Line or Stake Road.

Velocity is the moving speed of the current point, it can be a specified speed or random. *Precision* is the precision limitation of the current point, it can be input or given randomly. *Start Point* can be specified with any coordinate. The coordinate can be input, or selected from the point library or map directly.

After completing the settings, click *Start* to start the demo mode. If the GNSS receiver or builtin GPS is connected, it will prompt whether to disconnect to start the demo mode. After the demo mode is started, the interface will automatically jump to the main software interface.

3.5 Controller

In this interface, users can check the current hand-held controller type, Bluetooth support status, network, serial port, etc. It will display the corresponding model with the Hi-Target hand-held controller, and display *General* for others (all non-Hi Target Android devices).

← Contr	roller O None
Controller	iHand 20
Description	Full Keybord, ZHD.
Authorization Status	Yes
Controller SN	11444213
MAC	00:08:22:3e:c3:62
IMEI	1111111111111111
Build Number	iHand20_English_V 6.0.1
Android Version	4.2.2

Figure 3-5-1 Controller

3.6 Additional Settings

The additional settings include module info, registration info, 5-pin port data output, satellite tracking switch, receiver settings, service info, restore system, network diagnostics, electronic bubble calibration, orientation sensor calibration, magnetic calibration, Wi-Fi hotspot password set, update firmware, PPP service authority, etc. Different types of devices or connections support different functions.

←	Additional Settings	
Module	Info	
Registra	ation Info	
5-pin Po	ort Data Output	
Satellite	Tracking Switch	
Receive	r Settings	
Restore	System	
Network	 Diagnosis 	
PPP Ser	vice Authority	

Figure 3-6-1 Additional Settings

3.6.1 Module Info

Check the radio module type and network module type. The viewing of module information only supports some models.

- Radio Module Type: Displays the type information of the host radio module.
- Network Module Type: Displays the type information of the current network module.

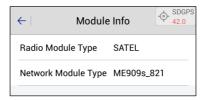


Figure 3-6-2 Module Info

3.6.2 Registration Info

In the registration info interface, check the device registration code and expiration time. **116**



Figure 3-6-3 Registration Info

3.6.3 5-pin Port Data Output

Open the 5-pin port data output option; users can select the corresponding port's baudrate, commands that need to be sent and the corresponding frequency (1Hz, 2Hz and 5Hz).

After turning on the settings, static collection will be stopped and it will not be allowed to open. If users try to open this option, when using the static collection or the base mode, the software will prompt that the current mode does not support this operation.

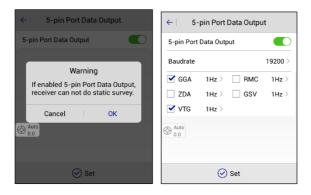


Figure 3-6-4 Warning Figure 3-6-5 5-pin Port Data Output

3.6.4 Receiver Settings

Set the store RINEX data, stop and go, firmware upgrade prompt, remote connection, USB virtual serial port, store static data in receiver SD card, sound type, volume, one-step set station,

quasi dynamic RTK, etc. Different hosts have different settings.

← Receiver Setting	s
Store RINEX Data	
Firmware Update Prompt	
Remote Connection	
USB Virtual Serial Port	
Store Static data in receiver SD card	
Sound Type	Default >
Volume 1	10
SDGPS	

Figure 3-6-6 Receiver Settings

- *Store RINEX Data*: After turning on, the RINEX format data will be recorded synchronously with the static collection.

- Stop and Go: Support the function to collect temporary static data after turning on.

- *Firmware Upgrade Prompt*: After turning on, there will be a prompt when there is upgradeable firmware.

- *Remote Connection*: The host will automatically connect to the corresponding server after turning on. Remote connection IP and port do not need to be changed, the default value is OK.

- USB Virtual Serial Port: After turning on, users can connect the USB debugging virtual serial port.

- Store Static Data in Receiver SD Card: Set static files to save to SD card.

- Sound Type: Switch the voice announcement (None, default and user defined).

- Volume: Adjust the volume.

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- One-step set station: After turning on, the base can be set automatically after power on.
- Quasi dynamic RTK: Users can do it in the detail survey after turning on.

3.6.5 Service Info

The service info interface will display the current receiver version type and its corresponding function rights.



Figure 3-6-7 Service Info

3.6.6 Restore System

Restore the firmware to its original state.

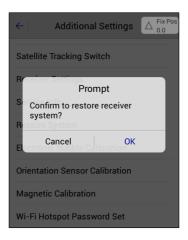


Figure 3-6-8 Restore

3.6.7 Wi-Fi Hotspot Password Set

To modify the connection password for the receiver's Wi-Fi hotspot, please connect the receiver by Bluetooth first. Then enter the old password and new password twice correctly, and click *Set* to complete the operation.



Notice:

1. The default Wi-Fi password is 12345678;

2.If you forgot the Wi-Fi password, you can use the GNSS Receiver Manager

 \rightarrow Wi-Fi Password Settings to set a new password.

HI▶TARGET	н	i-Survey Road User Manual
	← Wi-Fi Password Config Se	t
	Old Password]
	New Password	
	Confirm New	
	Show Passwor	d
	△ Fix Pos 0.0	

Figure 3-6-9 Wi-Fi Password Config

3.6.8 Update Firmware

Connect the receiver by Wi-Fi first, and choose the file to upgrade the firmware of the host and motherboard. The corresponding motherboard can only select the corresponding file to upgrade. If the wrong BRD file is imported, the host will prompt 'upgrade failed' during the upgrade process. This function only works on some models.

\leftarrow	Update firmware	
Firmware	storage path	>
Fix Pos 0.0		
	Start Update	

Figure 3-6-10 Update Firmware

3.6.9 Network Diagnosis

Check the state of the network module, SIM card, network signal, network registration, dial-up and server connection. And this function only supports some specific models.

← Network Diagnosis
✓ Is network module normal?
× Is the SIM card normal?
✓ Is network signal OK?
Is registed to network?
✓ Is dial-up successful?
\checkmark Is the server connected successful?
SIM card error or no SIM card!
Network Diagnosis
O Auto

Figure 3-6-11 Network Diagnosis





- 🗹 : Not checked.

3.6.10 PPP Service Authority

View and register the PPP service authority information. If the PPP service authority has expired, it will be displayed in red. If it has not expired, it will be displayed in black (only supported on some models).

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HI→TARGET 3.7 Console

It's mainly used to debug data and detect the GPRS signal strength. It can save the received debugging data as files.



Figure 3-7-1 Console

- Hex: Select to display data in hexadecimal format.
- Refresh: Select to refresh the output.
- Save: Select to save the output data.
- New Line: Select to send the new line, select it when sending commands normally.
- Send: Click to send the command after entering the command.

- *GPRS Signal Test*: When using the internal GSM mode (for some specific models), select and click *OK* to enter the signal test. The current GPRS signal strength will be displayed in the text box in the pass-through mode. +CSQ: 6,2 means that the signal strength is 6.



Figure 3-7-2 Warning

Figure 3-7-3 Pass-through Mode

Device



Notice:

The two numbers behind the CSQ represent the GPRS signal strength value and the signal symbol error rate. The larger the previous value, the better the signal. The last value is 0 normally.

The software presets commonly-used data types and can receive data without selecting the command. Select data types, it supports multi-selection combination sending. Users can select *Clear* to clear the receiver's current data and request the selected data again and then click *Send* to send the data.

There will be sensor values output when using the demo mode or built-in GPS mode.

\leftarrow	Console	Send
sensor values: sensor values: sensor values: sensor values: sensor values: sensor values: sensor values: sensor values: sensor values:	232.3, -8.2, 1.1 231.9, -6.4, 0.5 233.0, -5.8, 0.8 233.7, -5.7, 0.7 233.8, -6.1, 0.5 233.6, -6.5, 0.6 233.1, -6.8, 0.5 232.7, -6.8, 0.5 232.7, -7.1, 0.5	
Hex	🗹 Refresh	Save
GGA	VTG	RMC
GSV	GST	GSA
Auto 0.0		🖌 New Line

Figure 3-7-4 Sensor Values

3.8 Static

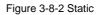
3.8.1 Static Settings

	$\overline{\mathbb{R}}$	Ţ	\leftarrow
Device	Base	Rover	Static Settin
@	Ē		Static Data
GNSS Demo Mode	Controller	Additional Settings	
•	₽		
Console	Static	RangeFinder	
A Fix Pos 0.0		-	∆ ^{Fix Pos} 0.0
Froject	Pevice S	Survey COGO	

Figure 3-8-1 Device Interface



Static



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In RTK mode, if users need to do static acquisition at the same time, please click to enter the static settings interface to input the interval, file name, pole and elevation mask. Users can view the GDOP, start time and recording time. Click *Start* to start recording.

← Static	Settings		\leftarrow	Static	Settings	
Interval	1s	•	Interval		1s	▼
File Name			File Name			
Vertical(V)	2.0000	Set	Vertical(V)		2.0000	Set
Elevation Mask(<=30°)	5		Static survey El ^{ev} dynamic RTI	v cann'i < open	t open while quas ed	i
Set Duration(h)		•	Set Duration	ı(h)		•
GDOP 1.8 Start Time	1		GDOP Start Time	1.8	3	
Time	Static M	ode	Time		Static I	Mode
Fix Pos 0.0	Start		Fix Pos 0.0	€	Start	

Figure 3-8-3 Set Duration

Figure 3-8-4 Static Mode

The *Set Duration* function can be enabled only when the *Static Mode* option is selected (for some specific models). After the specified acquisition time is enabled, the current acquisition will stop and the receiver will automatically shut down.

Notice:



The height limit (antenna height) cannot be greater than 65m. If the height exceeds 65m, the HGO display antenna will be inconsistent. The software will fail and prompt when users input a value that exceeds 65m. The elevation mask limit must also not exceed 30 degrees.

C ► 2018-02 2018-02 2018-02 2018-02 2018-02 2018-01 2018-01 2018-02

HINTARGET 3.8.2 Static Data Management

← Static Data Management			←	Static Data Ma	nagement	
id	File Name	Size	C 🕨	id	File Name	Size
1	_3163620.GNS	14.77K	2018-02	1	_3163620.GNS	14.77K
2	_3160100.GNS	14.89K	2018-01	2	_3160100.GNS	14.89K
3	_3160101.GNS	32.38K	2018-02	3	_3160101.GNS	32.38K
4	_3160102.GNS	19.55K	2018-02	4	_3160102.GNS	19.55K
5	_3160103.GNS	12.87K	2018-02	5	_3160103.GNS	12.87K
6	_3160104.GNS	6.42K	2018-01	6	_3160104.GNS	6.42K
7	_3160240.GNS	45.34K	2018-01	7	_3160240.GNS	45.34K
8	3160380.GNS	39.55K	2018-02	8	3160380 GNS	39.55K
Format 🗘 Refresh			sh		Download	Till Delet

View static files in the current receiver and do some related operations.

Figure 3-8-5 Static Data Management

Figure 3-8-6 Download or Delete

- Format: Format static data, data is not recoverable.

- Refresh: Refresh the current file list interface.

- Download: Connect the receiver by Wi-Fi, it supports the FTP static files download to the local

store. Long press to choose files, and it will prompt the save path after the download is successful.

- *Delete*: Long press a record to delete the selected static data, allowing multiple files to be selected and deleted.

3.9 RangeFinder

3.9.1 RangeFinder Connection

Select the type of the rangefinder to be connected, including the Leica Disto D8/D5/D3 and Trupulse 360B, and click Connect to connect. The rangefinder choice is not available if already connected.

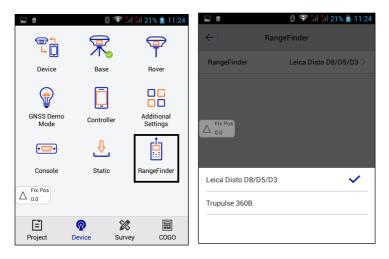


Figure 3-9-1 Device Interface

Figure 3-9-2 Choose the RangeFinder

3.9.2 RangeFinder Intersection

Click COGO→Intersection in the main interface to enter the intersection interface.

HI •TARGE	т			Hi-Survey Ro	ad User Manual
	() (†)	🕯 🕅 24% 👔 11:42			åll 49% 🛃 14:09
<u></u>			< ◀ ▲∠<	2Pt2A 2Pt1A1L	Azimuth
Angle	Distance	Coordinate	© Kn	own	*
Area Area $\Delta_{0.0}^{\text{Fix Pos}}$	Dist and Azi	Intersection	E	0.0000	
Angle	1200	+- ×=	z	0.0000	
Calculation	Volume	Calculator	LI	0.0000	(3)
			۵	000:00:00.00000	()
Project	Device Surv		[Save 📩	Compute

Figure 3-9-3 COGO Interface

Figure 3-9-4 Azimuth Interface

When the rangefinder device is not connected, users can click the Bluetooth button (2) in the 2Pt2L, 2Pt1L, 2Pt1A1L and Azimuth interface to enter the rangefinder interface to connect the rangefinder.

After entering the rangefinder interface, click *Connect* to connect the rangefinder by Bluetooth and use the rangefinder to measure the corresponding value.

Notice:

When using the software to read the rangefinder ranging value, make sure that the rangefinder is in the initialized state and not in the waiting state.

CHAPTER



Survey

This chapter contains:

- Detail Survey
- Stake Points
- Stake Line
- Menu
- Mapping Survey

4.1 Detail Survey

Click the *Detail Survey* icon in the *Survey* interface to enter detail survey; text interface and graphical interface can be switched via the *Text / Graph* button.

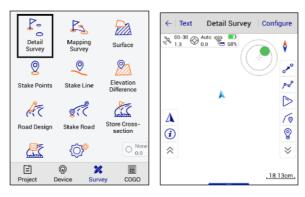
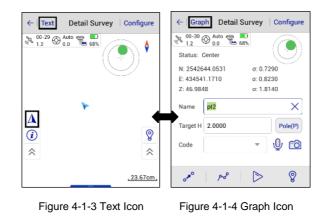
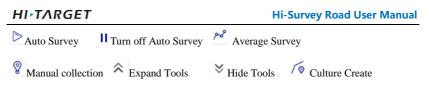


Figure 4-1-1 Survey Interface

Figure 4-1-2 Detail Survey







4.1.1 Map Navigation

Enter the *Survey* interface; the map navigation \triangle is shown when the left toolbar is hidden. It allows users to view the current position, or search for a point position more intuitively, and the navigation tool provides three types walk, driver and bus for route searching.

4

Xiaod





Google Maps

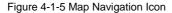


Figure 4-1-6 Map Navigation



Notice:

In *Survey* interface you can enter map interface by clicking the icon.
 Map navigation function doesn't display the points collected during measurement; The third party map in the configuration can display the points of the measurement.

3. It not only supports domestic maps, but also offline maps (download offline maps in configuration).

After entering the Map navigation interface, the same tools as the survey interface will not repeat

the introduction; add the following functions:

Satellite Imagery : Layer General : Route Search : Point Search

Click and tools, loaded map can be switched between satellite image and layer general.

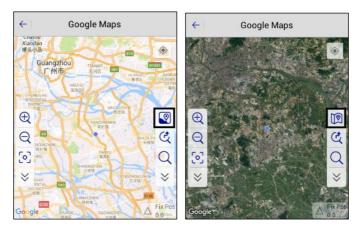


Figure 4-1-7 Satellite Imagery

Figure 4-1-8 Layer General

During the survey, you can use the function point search Q if you search for the position of a

point, use for route search. The coordinates of the search point can be obtained by real-time collection, point library, graphic selection and manual input, and then clicking *Search*. Back to the map interface, the red icon on the map is the position of the search point. If you want to search the route to the point, click *Go Here*, then it will display route mileage at the bottom of the screen; you can select three methods walking- , driving and bus. Click *Details* to view the detailed route of start to end points.

If you know the start and end points, you can use the route search ^(C). After entering its interface,

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select the route type, input coordinates of start point and end point, and then click Search.

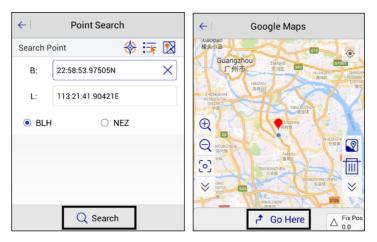


Figure 4-1-9 Search

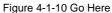
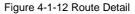




Figure 4-1-11 Route



4.1.2 Manual Collection

In general, you reach the survey position, according to the survey coordinates, accuracy and $\ensuremath{134}$

solution state displayed on the interface, and then decide whether to collect points. General RTK

Fix solution; click for manual collection, the software first checks the accuracy (accuracy settings in *Surveying Configure* \rightarrow *Data* in detail). If accuracy is not required, the software will be prompted.

Before completion of the collection the interface of *Save Point* will pop up with the details, you can check the reliability of the point; at the same time, the software automatically records data cumulatively, according to the global point number and the prefix of point name from last use. You can directly input *Target H*, and also click *Pole* for detailed settings of target height configuration and antenna type. *Code* can input note information, and you can also select commonly used note types; Set *Station* in the collection confirmation frame.

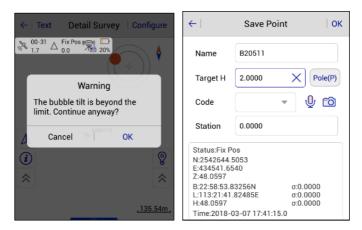


Figure 4-1-13 Bubble Warning

Figure 4-1-14 Save Point

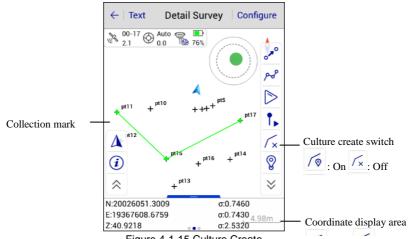
4.1.3 Culture Create

Open the culture creation. After, you can take the point of real-time collection as the point of

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culture creation: collection point and detail point are synchronously connected. On finishing Culture Create, it will prompt line collection in a pop-up window, which displays whether to close the ticked culture; do not tick Culture Close to create a line, tick to create the surface, and mark on the map.

A hidden bar at the bottom displays WGS-84 BLH, local NEZ and BLH coordinates, with leftright sliding to select to display coordinate types.







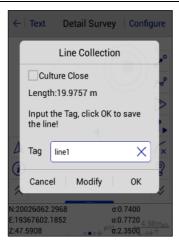


Figure 4-1-16 Line Collection



Figure 4-1-18 Polygon

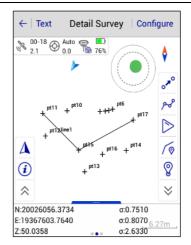


Figure 4-1-17 Line

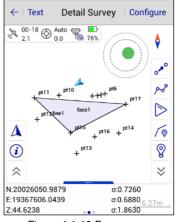


Figure 4-1-19 Face

4.1.4 Collect Input Method

After demo mode, built-in GPS or connecting device, it can support electronic bubble survey.

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It will display the diagram of the electronic bubble position in the software interface, you can select electronic bubble automatic survey in *Auto* and automatic collect point according to the state of electronic bubble. Electronic bubble has the following states:

- center: Bubble is within the set limits, center good.

- Wait center: Waiting for user to adjust the pole to center the bubble.

- Wait survey: Waiting 2 seconds after center, enter the survey state, and collect points in this state.

- *Wait move*: After the last collection point is finished, it waits for you to move the pole; after moving a distance it will start the next survey.

- Out of Range: In the set limits, bubble deviates from the center position.

$\leftarrow \ \textbf{Graph} \textbf{Detail Survey} \ \textbf{Configure}$	$\leftarrow \text{ Graph } \text{ Detail Survey } \text{ Configure } \\$	$\leftarrow \mid$ Graph Detail Survey \mid Configure
№ 2.2 0.0 № 76% Status: Center 0.0		 № 00-15 ⊕ 0.0 % 76% Status: Wait Center
N: 20026039.5225 o: 0.7180	N: 20026042.3215 o: 0.8640	N: 20026043.0424
Ε: 19367632.0615 σ: 0.6650	Ε: 19367622.7458 σ: 0.7590	E: 19367596.8283
Ζ: 46.8928 σ: 1.6920	Ζ: 51.6128 σ: 1.8330	Ζ: 50.6418 σ: 2.6460
Name p138 X Target H 2.0000 Pole(P) Code V () Co	Name p18 X Target H 2.0000 Pole(P) Code V () Cole	Name p124 X Target H 2.0000 Pole(P) Code
~ ~ D 8	🖋 🖉 ▷ 😵	~ ~ II 🖇

Figure 4-1-20 center Figure 4-1-21 Out of Range Figure 4-1-22 Wait

When collecting coordinate points, it supports input voice and photo attributes of coordinate points. In the prompt box or text interface, click $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ to enter *Audio* or *Image* information, and you can input and view voice and photo information; after point collection, the attribute is saved in the file. It supports voice and picture file addition; click *Add File*, audio file format can be *.amr, *.wav, *.mp3 and image file formats supported are *.jpg, *.png, *.bmp.

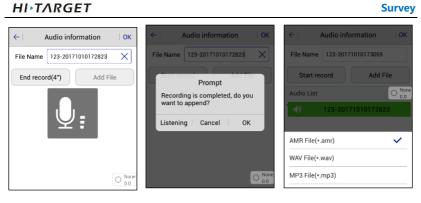


Figure 4-1-23 Audio

Figure 4-1-24 Prompt

Figure 4-1-25 Audio Format

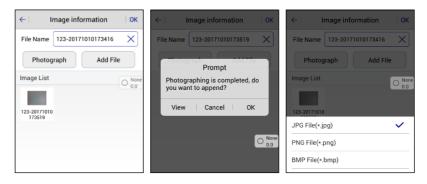


Figure 4-1-26 Image

Figure 4-1-27 Prompt Figure 4-1-28 Image Format

After returning to the parent interface, once the user has input voice or photo information, the

interface icon is changed to $\frac{4}{3}$ $\frac{1}{2}$.

When you select point description information, you can directly select the common description information, or manually edit the *property.txt* file (/sdcard/ZHD contents) according to the actual work situation. The edited description information will be displayed in the description list.

4.1.5 Automatic Collection

Click the *Auto* icon \triangleright , enter automatic collection interface, select automatic collection mode (including *Time interval*, *Plane interval* (N or E direction change value), *Slant Interval*, *Electronic bubble center*), input the prefix, number, annotation and other information of the point name. Click *OK*; the software enters automatic collection mode. Accuracy will be checked during automatic collection (accuracy is set in *Surveying Configure* \rightarrow *Data* has a detailed description. If it meets the accuracy requirements, it will automatically collect and prompt to save points; if it does not meet the accuracy requirements, there will be no prompts until the accuracy meets the requirements to continue to automatically collect and prompt points to save):click \blacksquare to finish automatic collection.

← Auto	ОК	\leftarrow
Auto	Time >	Auto
Interval(s) 5		Interval(s)
Sync with Pos Free	None	Sync w
Prefix	0.0	Prefix
Time	~	ID
Dist		Desc
Slant Dist		
Bubble Is Centered		

Figure 4-1-29 Auto Method



When the automatic collection mode is *Time*, the interval(s) value can be set, and it will be in automatic collection mode, according to the set time interval.

When the automatic collection mode is *Distance*, the interval(s) value can be set, and it will be in automatic collection mode, according to the set plane interval.

When the automatic collection mode is *Slant Distance*, the interval(s) value can be set, and it will be in automatic collection mode, according to the set slant interval.

When the automatic collection mode is *Bubble is centered*, hold it straight for automatic collection, and take away immediately after collection, with no further human intervention. Clicking on the upper-right corner of the interface *Configure* \rightarrow *Data* \rightarrow *Bubble Precision* can

set the bubble precision.



Figure 4-1-31 Auto Collection Interface

4.1.6 Average Collection

Average Collection is a simple way to improve measurement accuracy; according to the error theory, the error occurs in any direction, so if there are a large amount of observed quantities, accidental errors will be offset (but it's just theory, it doesn't mean that the more observed quantities, the higher the precision). In *Average Collection* interface, click *Start*, the software will collect points, and display the current point position at the same time. The software automatically analyzes the quality of the data, then calculates and displays standard deviation (root mean square error).

Average Collection supports text and graphic displays. After average collection reaches the set number and stops, in the *Text* interface, you can delete some scattered points in the average list to improve the collection accuracy (long press average list, display *Delete* toolbar), and then the software will automatically redo the average calculation. In the graphic display interface, click on the average collection point to display the point coordinates.

←∣Gra	ph Average	Configure	← Text Average Configure ← Graph Average	Configure
	616.3708	σ:1.6171 💮 ^{Auto} σ:1.5515 σ:0.8912	E:19367593.8640	σ:0.1337 💮 ^{Auto} 0.0 σ:1.3948 σ:0.6567
Name	Ν	E 🕨	Name N	E 🕨
1	20026037.6027	19367613.1663	⊕ +26⊕+15,10 +4 +3 +2 +1 1 20026045.1671	19367596.7834
2	20026038.1779	19367614.1120	2 20026045.1596	19367596.3239
3	20026039.1279	19367615.0397	3 20026045.1066	19367595.6993
4	20026038.4235	19367617.0503	4 20026045.0379	19367594.8961
5	20026038.0092	19367617.8096		19367594.0950
و 💽	Start	🕑 ок	€ Start	

Figure 4-1-32 Average

Figure 4-1-33 Text

Figure 4-1-34 Graph

The calculated error is the same as the error of the measurement. However, because the average process is from a small collection of data, the estimated error may be less than the actual measurement error.

Configuration can be done before average collection; click *Configure* in the upper right of the collection interface. Set the average type, solution type, average times, average precision. Each time you exit the software, the solution type of the average collection configuration is set to the fixed solution. It cannot be configured during average collection. If it fails to achieve the average accuracy, as well as configuration over-limit, it will prompt *Unable to start average due to low precision*. Then you need to reconfigure the average precision.

$\leftarrow \mid$ Graph	Average	Configure	\leftarrow	Avera	age
N:2002604		σ:0.0000 💮 Auto	Avera	ge Method	Average >
E:1936759 Z:47.7158	0.5679	σ:0.0000 σ:0.0000	Status	:	Fix >
Name	Ν	E	Ave T	mes 10	
			Ave P	recision	
			σN	0.0200	
			σE	0.0200	
Unable to s	tart average due	to low precision	σZ	0.0300	
😑 Sto	p 0	🕑 ок			O Auto

Figure 4-1-35 Configure Figure 4-1-36 Precision

4.1.7 Indirect Survey

Intersection collection is designed for places where we cannot reach or there is no GNSS signal. Usually only plane coordinates can be obtained by intersection, and the elevation data should be obtained by other measurements. The principle of intersection is a simple graphical intersection calculation; there are many intersection ways, with different required quantity, you can choose according to your measurement tools (please refer to chapter 5 of this book for specific usage: *Tools* \rightarrow *Intersection*).



Notice: The points calculated by intersection are saved in *Coordinate Data* and *Raw Data*.

4.1.8 Attribute Querying

Click *(i)* to open *Attribute Querying*, to go directly into the *Attribute Querying* state; it supports query line, face. Click and select line, face on the graphics, it will show the length of the line, the area, mu and length of face, and can delete, modify operation; after the operation click *OK*

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or *Cancel*. Click (1) again to exit the attribute querying.



Figure 4-1-37 Attribute

Stake instructions: Forward

stake point and current point.

Towards the Left to 0 means it has

reached stake point. DeltaH represents

the Verticals difference between the

Figure 4-1-38 Line Info

 \leftarrow

and

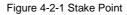
Figure 4-1-39 Face Info

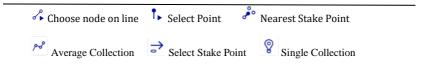
Configure

4.2 Stake Points

€ 00-20 △ Fix Pos 2 1, <u>م</u> ኤ ⇒ Ø Δ $\hat{\sim}$ \leq Forward 0.0000 Name pt1 Towards the Left 0.0000 σ: 0.000 HD 0.000 DeltaH 0.0000

Stake Points





- Select Stake Point: In the Stake Point interface click 🖻 , enter Select Stake Point interface; it

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provides three ways to define a point:

- 1. Manual input.
- 2. Select from the Coordinate Library.

Enter the name of the point to be searched at the point name, click the search button to search from the *Coordinate Point Library*, *Stake Point Library* and *Control Point Library*, *Mapping Data Point Library*, *Cross section Point Library*. The search results are displayed in the interface for user selection; if you do not find the coordinates of the specified point, a name will be prompted.

\leftarrow	Select Stake Point OK	\leftarrow	Search Resul	ts I OK	\leftarrow	Select Stake Point OK
Detail	< > Q 🐺	Pt Name	N	E 🕨	Detail	< > Q 🗄
Name:	Z1	FYI	426856.0000	5568886.5690	Name:	x X
N:	2542850.2440	FFS	5568.6599	236856.5666	N:	45536.2698
E:	435155.6017				E No s	earch results, please specify litions to find again!
Z:	29.0261				Z:	17.5668
	Save to Stake Pts Lib					Save to Stake Pts Lib

Figure 4-2-2 Search Icon Figure 4-2-3 Results Figure 4-2-4 Select Point

3. Select from picture (select point on line \checkmark and select point on the map \uparrow). When at stake point, click \lt >, it will automatically extract the coordinates of *Stake Point Library*, according to the positive sequence or reverse order to stake out. In *Select Stake Point* interface, check *Save to Stake Pts Lib*: corresponding points can be saved to the *Stake Point Library*.

- *Near*est Stake Point: End users click $\stackrel{\bullet}{\sim}$ icon, you can set the nearest point as the current stake point; in the process of approaching the nearest stake point, if you configure options such as voice prompts, precision, and prompt on approaching point etc., the software will make a prompt,

according to the distance, such as icons, voice and words.

4.3 Stake Line

Stake Line is a simple local staking tool. There are four basic lines: line, arc, spiral curve and circle. The line can be defined by two point coordinates, or one coordinate and the azimuth for plane or space; the arc can be defined by 2 points, or a unified curve metamodel with one point and the azimuth; the spiral curve can be defined by a unified curve metamodel with one point and the azimuth; the circle can be defined by the center and radius. (Note: in order to unify the concept, we think that stake of one line is the stake of a circuit, for each stake point, its position is only indexed by mileage).

Usually, stake line first needs to select line style.

Click is to enter *Stake Line Library; it* defines line data, and includes four types of lines: *Line*, *Arc, Spiral Curve*, and *Circle*. You can add, edit, delete, create, load, save, save as, and open data for the *Stake Line Library*.

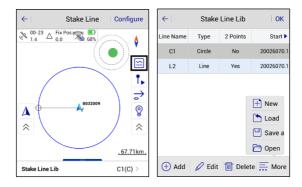


Figure 4-3-1 Stake Line Library Figure 4-3-2 Stake Line Interface

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\leftarrow	Stake	Line Lib	ОК
Line Name	Туре	2 Points	Start 🕨
C1	Circle	No	20026070.1
L2	Line	Yes	20026070.1
A3	Arc	Yes	20026048.3
S4	Spiral Curve	No	20026048.8
🦯 Line	Arc	Spira Curve	e O Circle
			e 🧮 More
Ŭ			

Figure 4-3-3 Add Type

Figure 4-3-4 Stake Circle

- *Add*: Add the relevant parameter information of *Line*, *Arc*, *Spiral Curve*, and *Circle*, according to your requirement.

- Edit: Edit selected existing line elements.
- Delete: Delete the selected stake line.
- Create: New *.line file.

- *Load*: Accumulate line metafiles, the software will select the line element in the file and then switch to other projects and switch back. The loaded line element will be displayed in *Stake Line Library*.

Line library file (*.line) is the internal format of the software; add, edit, and save data by using software. *Two-point-line* file (*.2pt) is a public format, it can be edited by the user, choose to load *Two-point-line* to the *Stake Library* in the software.

- Save and Save as: Save current line element information.
- Open: Open the *.line file saved in /ZHD/Project/ROAD/Unnamed.

The following are the descriptions of each line type.

HI>TARGET 4.3.1 Define Line

Click *Line* button; enter line parameter definition menu - you can select to define a flat line or a three-dimensional line. The software provides two types, *Two-points to determine line* and *one point + azimuth*; if you select *Two-points to determine line*, extract two point coordinates from the *Point Library*, input the start mileage; If you select a *point + azimuth*, you only need to extract the coordinates of a point from the *Point Library*, then input the azimuth of the line and the start point mileage, and click *OK*.

Click sample point \Rightarrow , input the mileage to be staked. Among them, the mileage and margins will automatically accumulate according to the increments. Click *OK* to enter the stake interface. Calculate the position of the stake point and input mileage; (if necessary, calculate side stake), the *Up* and *Down* icons in the interface help to quickly adjust the mileage value, unit adjustments are the increments, the data is recorded in global variables. So each time you enter the interface, the software automatically calculates a mileage/offset as the default value to save time. For example, to stake a pile every 10 metres, set the increment to 10, the mileage of the starting stakeout point is 1850. After the end of the first point of thestakeout, enter this interface again. The software will automatically calculate the mileage as 1860, so click *OK* and continue to work.

- Mileage: Mileage of current stakeout points.

- *Offset*: In the direction of increasing mileage, the distance from the current point to the vertical line of the defined line (left is negative and right is positive).

- Step: Each time you enter a menu, the mileage increases.

- *Direction*: Taking defined line as the reference, set the direction to the left or to the right. According to the prompt, the process of staking the specified milestone points is the process of the current point (triangle) closing to the target point (circle with cross).

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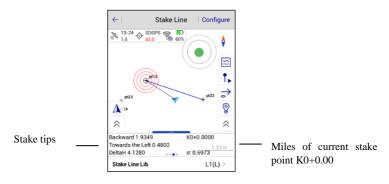
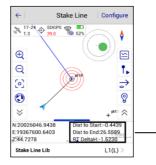


Figure 4-3-5 Stake Line One



Display real-time mileage, realtime display of the distance from the current point to the line segment

K0+0.00

Manually increase the offset, automatically increase one increment per click offset.

←	Sample Point	t	ОК		
Milestone	3.4142				
Step	10.0000		~		
Offset					
Offset	0.0000				
Step	0.0000		$\overline{\mathbf{v}}$		
Direction	⊖ Left	Ri	ght		
Other					
🗌 Save to Stake Pts Lib 🗹 Use					

Figure 4-3-6 Stake Line Two

Figure 4-3-7 Sample Point

Manually increase the mileage, automatically increase one increment per click *Mileage*.



Notice: *Offset* is generally used when the road side pile; *Left* or *Right* in *Deflection* represents the left and right of the line, respectively; input distance from the center line to the edge line, in increments of zero, to stake a specific mileage.

In addition, when opening the real-time mileage function, the software will project the current position point on the line and display the mileage of the projection point, which is helpful to determine the walking direction.

Select the *Three-dimensional line* to define a three-dimensional line. Three-dimensional lines are defined in two types: *Two-point* and *One point* + *Azimuth* + *Slope*.

When three-dimensional lines are staked, the defined stake miles are three-dimensional spaces long, and non-traditional two-dimensional projections are long.

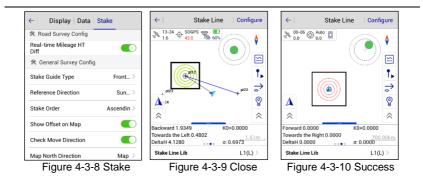
In order to guide the destination, the software draws a connecting line, just make sure that the current walking direction coincides with the connecting line, to ensure that the walking direction is correct. At the same time, there are some guidelines below, for some strong sense of location, or point to clear areas, can be the software below the lofting instructions guide.

Stake instructions can be selected in two types: Front-Back, North-South. In the configuration item of the configuration interface, select the stake prompt types you want.

If you turn on *Real-time Mileage HT Diff*, the current mileage will be displayed on the interface, and its connection with the current point will be drawn. Draw a small dot on the line to indicate the position of the projection; *Real-time Mileage* is also used to determine whether the direction of walking is correct (compare real-time mileage with stake point mileage, and increase direction).



Notice: Triangle is the position and velocity direction of the current point, circular icon is the target point, the dotted line is the line connecting the current point and the target point. As long as the walking direction coincides with the connecting line, it is possible to ensure that the stake direction is correct, so that the target point can be easily found. The following information box is the staking information, indicating the difference between the walking direction and the vertical direction.



- Green: When close to the stake point it prompts Reach the preset tip range.

- Red: Stake success prompts Reach the set stake precision.

You can also turn on staking voice prompt in the configuration. When reaching the preset prompt range, and reaching the lofting accuracy, the hand-held will give different voice prompts.

4.3.2 Define Arcs and Spiral Curves

Click the *Arc* or *Spiral Curve* to define the line type; after defining the line style, the staking function is similar to *Line*. You only need the Stake Line interface; click the *Stake Point*,

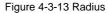
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input the mileage to be the stake point. Among other data, the mileage and margins will automatically accumulate according to the step. Click OK to enter the stake interface.

$\leftarrow \mid$	Arc	ЮК	$\leftarrow $	Spiral Curve	ЮК	←∣ s	piral Curve OK
Method			Name			Z 48.22	48
2 Poir	nts 🔿 Point+Azi		Line Na	me \$2	×	Other	
Name			Start Poi	nt 🚸 :	* 🕅		
Line Nar	me A2	\times				Start Station	0.0000
Start Poi	nt 🛞 🗄	¥ 🕅	Name	pt3		Azi	000:00:00.00000
Name	pt4		N	20026070.1549		Length	0.0000
N	20026070.1549		E	19367587.4692		Radius of Start	0.0000
E	19367587.4692		Z	48.2248		Radius of End	0.0000
End Poin	nt 😽 🗄	¥ 🕅	Other			Direction	● Left ○ Right

Figure 4-3-11 Arc Figure 4-3-12 Spiral Curve Figure 4-3-13 Radius



- 2 Points: Input line name, start and end point coordinates, start point mileage, radius and deflection direction;

- Point + Azi: Input line name, start and end point coordinates, start point mileage, radius, azimuth, length and direction.

- Radius of Start: Spiral curve of radius of start, check ∞ to indicate a straight line.

- Radius of End: Spiral curve of radius of end, check ∞ to indicate a straight line.

Click the menu button of the hand-held in the *Detail Survey/Stake Point/Stake Line* interface; it will pop up a menu button for quick jumps or data viewing between associated interfaces.



Figure 4-4-1 Menu Key One

Click the menu button of the hand-held in the *Base/Rover* interface, to pop up the device connection button to quickly jump to the device connection interface.

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Figure 4-4-2 Menu Key Two

4.5 Mapping Survey

Mapping Survey is the work of measuring the plane coordinates and elevation of the control points needed for the mapping.



Figure 4-5-1 Mapping Icon

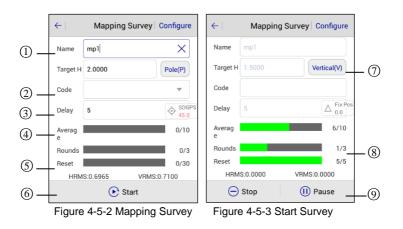
HI TARGET

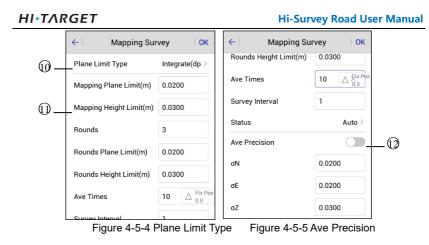
The accuracy of the map root point, RMS in point position relative to adjacent level control point, should not be greater than 0.1mm on the mapping; The error of elevation should not be greater than 1/10 on mapping.

Enter the *Map root measurement* interface; to see the map root acquisition progress, click *Configuration* setting parameters, the configuration page can automatically record the last input, and the name of point can be increased.

- HRMS: The horizontal RMS of the current point;

- VRMS: The vertical RMS of the current point.





- (1) Edit point's name, or it will automatically add by default
- (2) Input map root point of description (3) Motherboard reset interval (s)
- (4) Progress of smoothing times per return (5) Motherboard reset progress
- 6 After the parameters are set, click Start
- ⑦ Click to select target high type, input target high
- (8) Measured number and progress
- (9) Can be stop or pause during mapping root collection
- 1 Select Plane Limit Type

 \bigcirc When the plane limit typed is selected as the integrate, then the integrate is set here, conversely, it is each component

D Press to open, you need to set Σn , σe , Σz precision.

4.5.1 Mapping Data

Project interface → Mapping Data; you can view all map root measurement data, and you can

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also create, open, or search for data. Long press the map root point to delete and edit.

P	<u>6</u>	æ	\leftarrow	Mapping D	ata		←	Mapping D	ata
Project Info	Project	Coordinate	Name	N	E 🕨	•	🗹 Name	Ν	E 🕨
	Settings	System	mp1	20026070.1549	19367587.4692		mp1	20026070.1549	19367587.4692
(f)	é)		mp2	20026070.1549	19367587.4692		mp2	20026070.1549	19367587.4692
Parameters Calculation		Raw Data							
		Þ							
Mapping Data	Data Transfer	Email							
	<i>[</i> @}	20.0	File Nan	ne: mapping.mcp			File Nam	e: mapping.mcp	
Project	Device Sur		₽ N	ew 📄 Oper	Q Search		Ī	Delete	🖉 Edit

Figure 4-5-6 Mapping Data

ta Figure 4-5-7 List

Figure 4-5-8 Long Press

4.5.2 Mapping Survey report export

Project interface→Project Information; click icon to export mapping reports in *.html format by default. The report can view the measured antenna height, observation time, and XYZ and BLH values of field observations at the map root point of the plot (the optimal value in 3 tests, the optimal value of 1 total data, and the average value of 4 data). Average collection of data for each point of DX, DY, DH, in the Statistical data table can also see the xyh point of Error (RMS), the point and maximum value of HRMS, aesccording to the percent of pass, it can judge whether the point is available.

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← Restore Project Info 0	CK ← Restore Project Info OK
Current Project	🗂 Current Project 🔄
Name: Unnamed CoordPoints: 39 Projection: WGS84 Time: 2018-03-2011:56:10 Available SD: 1.76G Repeat PtName: Support	Name: Unnamed CoordPoints: 39 Projection: WGS84 Time: 2018-03-2011:56:10 Available SD: 1.766 Repeat PtName: Support
© Previous Projects Unnamed 1 Name: Unnamed 2	Project Report(*.txt) Project Report(*.html) MappingPoint Report(*.html)

Figure 4-5-9 Export

Figure 4-5-10 Format

CHAPTER

5

Road

This chapter contains:

- Operation Procedure
- Stake Road
- Road Design
- Store Cross-section
- Cross-section Points
- Surface
- Elevation Difference
- Surveying Configure

5.1 Operation Procedure

The road engineering survey contains the route reconnaissance and design survey and road construction survey.

1. Route reconnaissance and design survey

Preliminary measurement: Control measurement. Measure the strip topographic map and profile diagram, collect geological hydrological data along the line, do the paper location or site location and make comparison plans to provide a basis for the preliminary design.

Decided measurement: Route center line survey on the route of the selected design. Measure the profile diagram, cross-sectional profile, bridges and culverts, route crossing and facilities along the route to provide information for the construction design.

2. Road construction survey

Follow the design drawings to restore the road, measure the subgrade sidepiles and vertical curve, and do the project completion acceptance measurement.

5.2 Stake Road

Stake road is the key function of the Hi-Survey Road. The excellent working mode will make the surveying more efficient and systematic.

Stake road and stake line operations are mostly the same. The definition of the road is more complicated than the definition of the line, it will use the profile diagram and cross-sectional profile to design the line, so the calculation is more complicated. But, relatively speaking, the difference between the process of the stake road and stake line is only based on the operation

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• 0 42 V//A \leftarrow Stake Road Configur Mapping Survey Surface + RTK Detail Surve 22-33 1.2 P 92% 4 0 0 0 Elevation Stake Line Stake Points E.C \simeq **ø**: Store Cros ⇒ Road Dec Stake R 8 Δ Lin $\hat{\sim}$ \approx Cross-sect Points Ē R 믎 _700.00km COGO Project Devic

of defining the line; point collection and staking-out operation are the same.

Figure 5-2-1 Survey Interface Figure 5-2-2 Stake Road

1. Load the road line

Click it to enter the road designer file interface, load the centerline, profile, cross-section and

side-section. Check the file path, and click Display to view the graphic and check the data.

\leftarrow	Road Designer File	\leftarrow	Road Designer File
Centerline	/sdcard/ZTest/Stake Road/ RoadC.PHI	Centerline	/sdcard/ZTest/Stake Road/ > RoadC.PHI
	Break Chain Display Clear		Break Chain Display Clear
Profile	/ZTest/Stake Road/ > RoadP.PVI	Profile	/ZTest/Stake Road/ > RoadP.PVI
	Display Clear	Line Element	File(*.sec)
Cross-section	/ZTest/Stake Road/ > RoadCs.TPL	Points of inte	ersection(*.PHI)
	Display Clear	XY File(*.XY)
Side-section	/ZTest/Stake Road/ > RoadSs.BPI	Poling Data(*.CSV)
	Display Clear	Elcad(*.ICD)	

Figure 5-2-3 Road Designer File

Figure 5-2-4 Formats

Click to switch the perspective (top view of the road or cross-section), and there will be the

Side-section for users to choose if the side-section and cross-section are enabled.

If there is no profile elevation, cross-section elevation collection and side-section staking-out can't be done. Because the elevation is not known, it's impossible to get the height of filling and cutting.

In the cross-section view, the red dot indicates the corresponding position of the current position in the cross-section. In the upper left of the interface, the current real-time mileage and the offset from the center line are displayed. At the bottom left of the interface, the height of filling and cutting is displayed.



Figure 5-2-5 Cross-section View

2. Confirm the location of stakeout points.

Click \Rightarrow to input and adjust the milestone and offset manually, or by \blacksquare and \triangleq buttons. Click *OK* and the coordinate of this position will be calculated as the coordinate of the stakeout point automatically.

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←	Sample Point	ОК
Milestone	194645.0000	
Step	10.0000	-
Offset		
Offset	0.0000	
Step	0.0000	-
Direction	◯ Left	Right
Other		
Save to	o Stake Pts Lib 🛛 🗹 U	lse

Figure 5-2-6 Sample Point

- *Use*: Stake out the stakeout point; the graphic interface will display the dashed line connection between the current point and the stakeout point, as well as the stakeout indication.

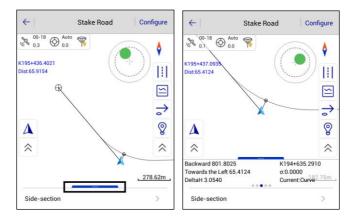


Figure 5-2-7 Stake Road

Figure 5-2-8 Menu Key

. Menu key. Click to display and check the data status.

3. Stake out

This process is the same with the stake line operation.

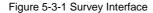
5.3 Road Design

In the *Stake Road* interface, click is to enter the road designer file interface. For the centerline, users can load the Line Element File(*.sec), Points of intersection(*.PHI), XY File(*.XY), Poling Data(*.CSV), Elcad(*.ICD), Coord File(*.Zline), HDPM(*.pm), WDPM(*.pm) and LandXml File(*.xml), and click *Break Chain* to edit. For the *Profile*, users can load the PVI file(*.PVI) and LandXml File(*.xml). For the *Cross-section*, users can load the Template File(*.TPL) and LandXml File(*.xml). For the *Side-section*, users can only load the BPI File(*.BPI). After loading, please click *Display* or *Clear* to preview or delete data.



Notice: It's not possible to do the next mileage collection and stakeout without the centerline; and the slope cannot be staked out without the cross-section design line.

HI TARGET • 0 62 VIA Mapping Surface Detail Survey Survey 0 0 Elevation Stake Points Stake Line Differen tore Cross Road Desig Stake Poar section Cit SDGF 0 Cross-section Surveying 46.0 Points Configure R Ē % Device Project Surve COGO



\leftarrow	Road Design	
Centerline		>
Profile		>
Cross-section		>
Side-section		>
		SDGPS 44.0



5.3.1 centerline

There are many methods for centerline alignment, including the Intersection, Element and Coordinate methods. The intersection method is based on certain conventions; there are certain restrictions on the type of lines. The element method can combine line shapes arbitrarily, it supports polylines and is suitable for complex curves, including oval lines, multi-intersection curves and imaginary intersection points. The coordinate method is similar to the element method, but the definition of each line element is determined by defining coordinates of the start and en point. The line element format (*.sec) files won't contain the polyline corner information, so if the polyline corner information is needed, please save the file as the Coord File (*.Zline) format.

The Hi-Survey Road supports the Intersection, Element and Coordinate methods and the default line element combination within the intersection is the straight line - the first transition curve circular curve - the second transition curve. It supports the smooth transition curve, and the nonsmooth transition curve supports the transverse import.

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Notice:

1. Two transition curves can be asymmetrical.

2. The reverse loop needs to be treated as a non-reverse loop, such as adding

an intersection.

- 3. It supports the imaginary intersection point.
- 4. It supports the local curve, and the transition curve length can be zero.
- 1. Intersection method

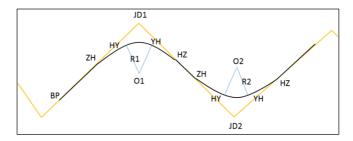


Figure 5-3-3 Intersection

- Intersection JD1/JD2: The intersection of two adjacent lines.

- *ZH*: The point where the straight line intersects with the first transition curve, that is, the start point of the first transition curve.

- *HY*: The point where the first transition curve intersects with the circular curve, that is, the end point of the first transition curve.

- *YH*: The point where the circular curve intersects with the second transition curve, that is, the start point of the second transition curve.

- *HZ*: The point where the second transition curve intersects with the straight line, that is, the end point of the second transition curve.

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- ZH-HY: The first transition curve.
- YH-HZ: The second transition curve.
- HZ-ZH: The straight line.
- HY-YH: The circular curve.

Click *Intersection* to enter the intersection table data-editing interface. Click *Add* to add the intersection information, input the information manually or select the point from the point list.

← Intersection Element Coord				← Intersection		
Name	Station	Ν	•	Name	JD39	:
				N	3941818.2560	
				E	511962.5880	
		[*) L	oad	Station	196187.7711	
		— s	ave	Radius	800.0000	
		E		L of Spirial in	100.0000	
		_ } =	reak C	L of Spirial out	100.0000	
+ Add	View	🕑 Use 🗮	More	🚫 Canc	el	🕢 ок

Figure 5-3-4 Intersection Interface Figure 5-3-5 Add Intersection

- Load: Open the existing Points of intersection (*.PHI) or Poling Data (*.CSV) file.

- Save: Save the file in the *.PHI format. The default save path is the ZHD/ROAD folder.

- *Export*: Export the file in the Poling Data (*.CSV) or Line Element File (*.sec) format. The default save path is the ZHD/Out folder.

← Break Chain Pile					
Name	Front Mileage	Back Mileage 🕨			
bc1	10.0	10.0			
	elete	6 Edit			

Figure 5-3-6 Break Chain Pile

- Break Chain: Long press the break chain pile record to delete or edit the break chain data.

← Intersection Element Coord		←	Intersection		
Name	Station	N	•	N	3940938.4790
BP	194635.2910	3942425.9650		E	513970.5498
JD38	195456.1218	3941799.4410		Station	198405.8150
JD39	196187.7711	3941818.2560			
JD40	197407.4394	3941383.3270		Radius	
JD41	197880.9963	3941042.1710		L of Spirial in	
JD42	198405.8150	3940938.4790		L of Onicial aut	
JD43	199160.8647	3940642.1590		L of Spirial out	0.0000
JD44	199611.3065	3940623.6710		Virtual Point	
🔟 Del	III Delete ⊘ Insert ⊘ Edit ⊗ Cancel ⊘ OK				

Figure 5-3-7 Record Operation

Figure 5-3-8 Virtual Point

Long press to select and operate the intersection record.

- Delete: Delete the existing point record.
- Insert: Insert a intersection data above the selected point record.

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- Edit: Edit existing intersection data.

When adding the intersection data, the software will identify the suspected oval curve and users can change the data manually, according to the prompt.

It supports the virtual point option with the imaginary intersection point and reverse loop. Input the first point of the virtual point combination normally, and open the virtual point option after the second point is entered.

Click View to check if the centerline graphic is correct.

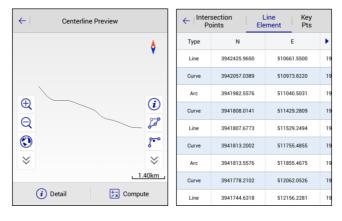


Figure 5-3-9 centerline Preview

Figure 5-3-10 Detail

- Detail: Click to enter the interface to check the detail parameters, including the Intersection Points, Line Element and Key Pts.

- *Compute*: Input the station and offset; it can check the coordinates; input the coordinates, calculate the station and offset.

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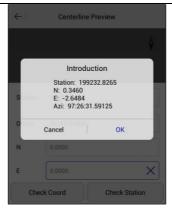


Figure 5-3-11 Compute

- Click to input the limit point manually. Users can also select it from the point list or do

real-time collection to get the point.

\leftarrow	Limit Point					
Name	limitPoint		*	:=		
N	0.0000					
E	0.0000					
		Sav	e to Stake	Pts Lib		
(Cancel		🕢 ок			

Figure 5-3-12 Limit Point

- Change the line. Click to choose the point to be changed (start and end points are not

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selectable), and change it by Manual input or Select from map.

← Centerline Preview	← Centerline Preview
¢	\$
BP Please choose the JD point to change	Warning Choose how to change it?
JD38	Manual input Select from map
JD39	<u>©</u>
JD40	× ×
JD41	(i) Detail 🗦 Compute

Figure 5-3-13 Change the Point Figure 5-3-14 Change Methods

- i: Line auxiliary points. Click to view corresponding auxiliary points and auxiliary dashes

in the figure.

←	Centerline Pre	view
		\$
€ Q	1635.2910 1039 19545 304	
 ♥ ♥ 		8 8
		1.40km
(i) Detail	Compute

Figure 5-3-15 Line Auxiliary Points

Click Use to load the currently edited line data into the project, and users can select whether to save the defined or modified line data.

2. Element method

Element alignment decomposes the combination of complex route lines into several linear units. If there is information (coordinates, tangential direction, radius of curvature, etc) about the starting point of the route plane curve, the unit that extends in any direction can be set from the start point, and the end point information of the unit can be calculated. Then the end of this unit can be used as the starting point for the next unit.

Common lines contain the straight line, arc and spiral curve. Users can input the line manually or load files directly, including the Line Element File (*.sec), HDPM (*.pm), WDPM (*.pm), LandXml File (*.xml) and Poling Data (*.CSV) formats.

← In	← Intersection Element Coord					tersection	ement Coo	rd	
	Start				Start				
Туре	Start Radius	End Radius	Lengt 🕨		Туре	Start Radius	End Radius	Lengt 🕨	
					L	00	00	483.3430	
	Load				s	00	600.0000	100.0000	
					A	600.0000	600.0000	435.6690	
			Save		s	600.0000	00	100.0000	
			Export		L	00	00	226.3040	
			Break C		Line	Arc	Spira	l Curve	
+ Add	View	🕑 Use	More		+ Add	View	🕑 Use	More	

Figure 5-3-16 Element

Figure 5-3-17 Add

In the general working process, users need to input the coordinate of the starting point, mileage and azimuth. Click *Add* to choose the line type and input the information.

HIT AR	GET				Road
←	Element	←	Element	\	Element
Length	0.0000	Start Radius	0.0000	Start Radius	0.0000 🔲 🚥
Start Offset	0.0000	Length	0.0000	End Radius	0.0000 🔲 😡
Start Azimuth	000:00:00.00000	Direction	● Left ○ Right	Length	0.0000
		Start Offset	0.0000	Direction	● Left ○ Right
		Start Azimuth	000:00:00.00000	Start Offset	0.0000
				Start Azimut	h 000:00:00.00000
Cancel	🐼 ок	Cancel	🔗 ок	🚫 Cancel	🔗 ок

Figure 5-3-19 Arc

Figure 5-3-18 Line

Figure 5-3-20 Spiral Curve

- Line: Input the Length, Start Offset and Start Azimuth.

- Arc: Input the Start Radius, Length, Direction, Start Offset and Start Azimuth.

- Spiral Curve: Input the Start Radius, End Radius, Length, Direction, etc.

Click Start to enter the element interface to edit the start point.

Start		:*
Station	194635.2910	
N	3942425.9650	
E	510661.5500	
Azimuth	139:45:15.28903	

Figure 5-3-21 Start Point

Click *View* to preview and edit the centerline.

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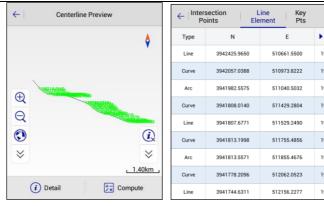
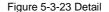


Figure 5-3-22 Preview



- Detail: Click to check the detail parameters, including Line, Curve and Arc.

- *Compute*: Input the station and offset, it can check the coordinates; input the coordinate, calculate the station and offset.

2. Coordinate method

The coordinate method is similar to the element method, but the definition of each line element is determined by defining coordinates of the start and end point. It can only load the Coord File (*.Zline) format.

In the general working process, users need to input coordinates of the start and end point. Click *Start* to input the station and coordinate manually, or select points from the point list. Click *Add* to choose the line type to input the line information.

HI	TARG	ET						R	Road
	← In	tersection E	lement Coor	ď	← Ir	tersection E	lement Coord	b	
	Start			Start					
	Type Start Radius End Radius Lengt				Туре	Start Radius	End Radius	Lengt 🕨	
			Ľ	Load					
			Ē	_					
				Export					
			- 6	Break C		Line	Arc	;	
	+ Add	View	🕑 Use	More	+ Add	💽 View	🕑 Use	More	



Figure 5-3-25 Add Lines

- Line: Click to input the coordinates of the start and end point.

- Arc: Click to input the coordinates and arc information.

5.3.2 Profile

The profile is an expression of the vertical movement of the road (the line fluctuates). It can be added manually, and users also can load the file in the PVI file (*.PVI) or LandXml File (*.xml) format.

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\leftarrow	Profile	Editor		←	Slope point data
Station	Height	Slope 1(%)	Slope 2 🕨	Station	44194.0000
43874.0000	54.7331	0.00000000	1.20000000	Height	61.0531
43984.0000	56.0531	1.20000000	4.00000000	rieigin	
44094.0000	60.4531	4.00000000	0.60000000	Radius	2000.00000000
44194.0000	61.0531	0.6000000	-1.30000000		
44304.0000	59.6231	-1.30000000	-4.51282051		
44421.0000	54.3431	-4.51282051	Load		
44584.0000	53.5431	-0.49079) Load 00] Save		
44684 0000	54 3431	0.800000000	J Save		
+ Add	🕚 View	🕑 Use	More	\otimes	Cancel 🔗 OK

Figure 5-3-26 Profile Editor

Figure 5-3-27 Slope Point Data

Click *Add* to add the slope point data, and long press the record to delete, insert or edit it. Click *View* to check the profile preview, and input the station value to check the height of the station.

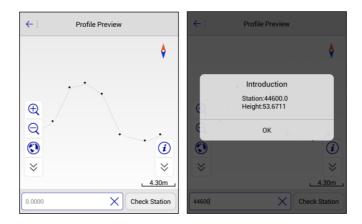


Figure 5-3-28 Profile Preview

Figure 5-3-29 Check Station

5.3.3 Cross-section

The cross-section interface contains three options, including Standard, SuperEle and WidePlus.

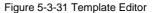
Road

Users can add, edit and delete the cross-section data.

1. Standard

←∣ Star	ndard Supe	rEle WideF	Plus	\leftarrow	Templ	ate Editor
Le	eft	Ri	Right		Sidewalk	
Name	Roadway	Name	Roadway			
Distance	10.0000	Distance	10.0000		• %	○ 1:N
Grade	-3.0000	Grade	-3.0000			0
Curb	0.0000	Curb	0.0000	Grade	1.0000	
Name	Sidewalk	Name	Sidewalk			
Distance	3.0000	Distance	3.0000	Wide	3.0000	
Grade	1.0000	Grade	1.0000			
Curb	0.2000	Curb	0.2000	Curb	0.2000	
Left-ri	ght Identity	C	Load Save			
+ Add	🕚 View	🕑 Use	More	8	Cancel	🐼 ок

Figure 5-3-30 Standard



- *Left-right Identity*: The selection indicates that the left and right slopes are consistent, and the right slope data will be covered with data symmetrical to the left slope (the original right slope data will be covered and cannot be recovered).

- Name: The name of the current plate.

- *Grade*: From the middle of the road, uphill is positive and downhill is negative. The slope value is the ratio of the height difference between the two ends of the plate and the width of the plate.

- Wide: The width of the current plate.
- Curb: Click to input the height difference of the curb.

Click View to check the template preview, and input the station value to check it

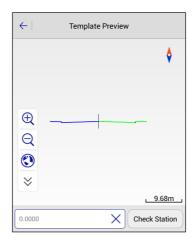


Figure 5-3-32 Template Preview



Notice:

There is only one cross section in memory. A road has different cross-sections at different road sections. Users can predefine several typical cross-sections according to their needs, and then transfer the cross-sections suitable for the terrain in different sections to stake out.

2. SuperEle

It's a way to make the road a lateral high-internal one-way cross slope to reduce the centrifugal force generated by a vehicle driving on the curve road.

In the *SuperEle* interface, users can choose the corresponding cross-section and input the super elevation information.

Figure 5-3-33 SuperEle

Figure 5-3-34 Edit SuperEle

Click View to check the template preview, and input the station value to check it.

\leftarrow	Template Preview
	\$
€ Q ≫	
0.0000	9.68m Check Station

Figure 5-3-35 Preview

3. WidePlus

In order to make the road surface transition from the normal width to the curve, a widened width is set so that a transition zone of curve widening needs to be set. In the transition zone of curve widening, the road surface has a gradually varying width. There are different settings methods of different road properties and levels.

In the *WidePlus* interface, users can input widening change point information according to design drawings.

← Stan	← Standard SuperEle WidePlus			$\leftarrow \mid$	Edit WidePlus	
Station	Wide	Gradual	Plates	Milestone	60.0000	
20.0000	4.5000	Line	Right:1		[
30.0000	5.2000	Line	Right:1	Wide	4.5000	
40.0000	6.0000	Line	Right:1			
50.0000	5.2000	Line	Right:1			
60.0000	4.5000	Line	Right:1			
Left Right						
(+) Add () View () Use . More				(×) c	cancel 📀 (ОК

Figure 5-3-36 WidePlus

Figure 5-3-37 Edit WidePlus

Click View to check the template preview, and input the station value to check it.



Notice:

Users can switch *Standard, SuperEle* and *WidePlus* interfaces to view road data, and click *Use* on any of the three interfaces to apply the current cross-section to the road after confirmation. Users can also click *More* \rightarrow *Save* to save it as the Template File (*.TPL) for subsequent loading and reuse.

← Template Preview	← Stan	dard Supe	rEle WideP	lus
6	Station	Wide	Gradual	Plates
•	20.0000	4.5000	Line	Right:1
	30.0000	5.2000	Line	Right:1
	40.0000	6.0000	Line	Right:1
€	50.0000	5.2000	Line	Right:1
Q	60.0000	4.5000	Line	Right:1
 €.45m 				Load Save
40 X Check Station	+ Add	View	🕑 Use	E More

Figure 5-3-38 Check Station

Figure 5-3-39 Load or Save

5.3.4 Side-section

In the Side-section interface, users can add, load, apply, and save the side-section.

\leftarrow	Side-section	
Side list		
Side1	Fill	
Side2	Cut	
+ Add	Load 🕢 Apply	🛄 Save

Figure 5-3-40 Side-section

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- Add: Click to choose and add the Fill or Cut. Input the side-section name, and edit the side-section features.

← Side-section	$\leftarrow \mid$	Cut	Side2	ОК
Side list	Factor name	Start offset	End offset	Start del 🕨
Side1 Fill	Hillslope	0.0000	3.5000	0.0000
Side name	Platform	3.5000	5.5000	7.0000
Side2	Ditch Inside	5.5000	5.5000	7.0020
Side4	Ditch Bottom	5.5000	7.5000	6.0020
Cancel OK	Ditch Outside	7.5000	7.5000	6.0020
Fill Cut				
Gut				
+ Add Load Apply Save	+ Add	🖉 Edit	🕚 View	Delete

Figure 5-3-41 Side Name

Figure 5-3-42 Features

- *Load*: Click to load the BPI File (*.BPI), and the side-section list will show all the section information in the current file.

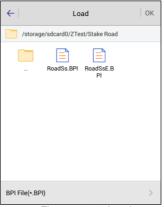


Figure 5-3-43 Load

- *Apply*: Click to apply the slope in the current side-section list to the current project road, and it will prompt *Use data successfully*.

- Save: Click to save the file in the BPI File (*.BPI) format.

Long press the record to delete or edit the side-section information.

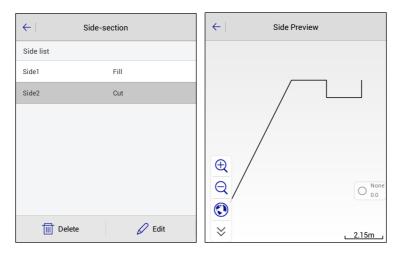


Figure 5-3-44 Delete or Edit

Figure 5-3-45 Side Preview

- Delete: Click to delete the side-section record.

- Edit: Click to edit the hillslope, platform and ditch; click View to check the side preview.

5.4 Store Cross-section

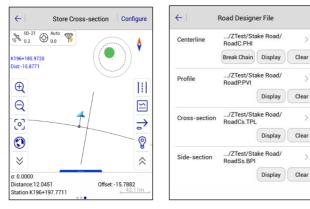


Figure 5-4-1 Store Cross-section Figure 5-4-2 Road Designer File

Click \square to load existing road designer files, then click \Rightarrow to define a specified mileage of the cross-section and input other settings. It will automatically calculate the cross-sectional position, at that distance, and display a dashed line as a reference line on the graph.

Define	ок	← Display Da	ta Stak
on			C
ilestone 196207 7711		HRMS Tolerance	3.0000
		VRMS Tolerance	5.0000
p 10.0000	•	Stake Tolerance	3.5000
nge			
50.0000		Stake Prompt in	3.0000
ht 50.0000		Mileage Tolerance	0.0500
ner		PtName Increasing by	1
ngle 090:00:00.00000		No Fixed Prompt in(s)	60

Figure 5-4-3 Define

Figure 5-4-4 Data Settings

When approaching this reference line, the software will calculate the distance between the current position and the reference line. If the distance is less than the setting value of the cross-sectional tolerance (the value can be set in *Configure* \rightarrow *Data*), users can do a cross-section point acquisition.

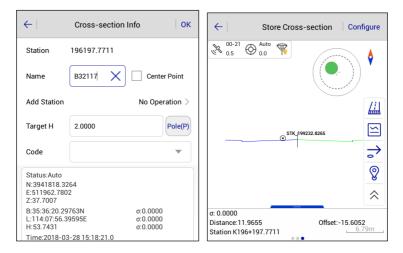


Figure 5-4-5 Cross-section Info

Figure 5-4-6 Cross-sectional View

- Section points and input the cross-section information. If the *Center Point* is selected, the point will be used as the reference point of the cross-section. The cross-section point library will store the horizontal elevation of other points on the cross-section relative to the center point (each section must define a section mileage and collect the center point, otherwise the section points collected in this section will be invalid, or users need to add the center point manually afterwards).

- III: Click to switch to the cross-sectional view and check it.

5.5 Cross-section Points

Cross-section data can be edited and managed in the cross-section points library.

← Cross-section Points					
Name	Sta	Offset	нт 🕨		
B32117	194635.2910	-600.6265	37.9838		
B32118	194635.2910	-599.1453	37.9146		
File Name:	MainCst.cst		Load New Work Cal		
↓ Center region Point Point Point More					

Figure 5-5-1 Cross-section Points

- Center Point: Click to add the center point.
- Open: Open other files in the project.

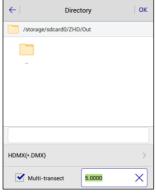


Figure 5-5-2 Export

Sta 194635.2910	Offset -600.6265	HT 37.9838				
194635.2910	-600.6265	37.9838				
MX)		~				
CRECG(*.txt)						
m)						
WDMX(*.dmx)						
ghn)						
	n) Imx)	xt) m) mx)				

Figure 5-5-3 Export Formats

- Export: Export files to other data formats, including HDMX (*.DMX), CRECG (*.txt), HDM

(*.hdm), WDMX (*.dmx), BGHN (*.bghn), HDMG (*.DMG), South CASS7.0 (*.dat), South

CASS7.0 (*.hdm), Defined (*.txt) and EICAD (*.HDX).

- Load: Load and merge cross-section data in current or other projects.

- New: Create a new cross-section points file in the project.

- Work Cal: Click to enter the Earthwork Calculation interface.

In the *Earthwork Calculation* interface, it will load all the cross-section points by default to the calculation list. Click the point name to choose whether to participate in the calculation.

← Earthwork Calculation					
Start Sta	194635.2910	Multi trans			
End Sta	194635.2910	5.00			
Name	Sta	Offset	E		
B32117	194635.2910	-600.6265	37.983		
🗸 ВЗ2118	194635.2910	-599.1453	37.914		
🔊 Averaç	e Method	🛞 Pyramid N	/lethod		

Figure 5-5-4 Earthwork Calculation

The earthwork calculation requires at least two cross-section points and corresponding center points within the range of start and end mileage. If the *Multi-transect* mode is selected, please input the projection distance limit in the input box. The result of the calculation is the amount of earthwork between the two cross-sections that are closest to the start and end mileage.

The earthwork calculation provides two methods, the Average Method and Pyramid Method.

The average method is simple and practical, but accuracy is not good. When the adjacent crosssectional areas have a large difference, the pyramid method is more accurate.

5.6 Surface

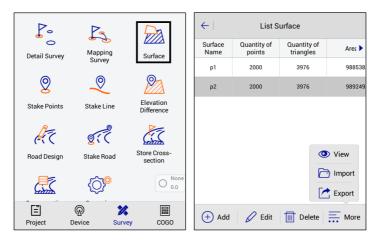


Figure 5-6-1 Surface Function

Figure 5-6-2 Surface List

This function is to design the DTM surface. Users can manage, add, delete, edit, import and preview the DTM surface.

- *Add*: Click to add the surface. Set the surface name, point name and coordinate. The point information can be obtained from real-time acquisition, point library or map selection. A DTM surface should contain no less than three points.

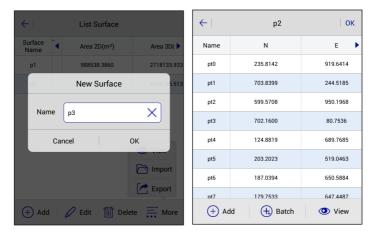




Figure 5-6-4 Surface Points List

- *Batch*: Add points in the point library in batches, select the check box before the point name to select all the points.

←	Add Surface Point	← Coor	d Point Stake Poin	nt Control Pc 🕨
From	🚸 🔙 🔞	🗹 Name	Ν	E 🕨
Name		B032009	2542671.2378	434514.6103
		Z20	2542673.6790	434514.6007
N	0.0000	B032109	2542671.2378	434514.6103
E	0.0000	B032109_1	2542674.7505	434516.1495
z	0.0000	B032109_2	2542674.7504	434516.1495
		B20511	2542671.2378	434514.6103
		B20513	2542671.2378	434514.6103
		B20514	2542671.2378	434514.6103
\otimes	Cancel 📀 OK	\otimes	Cancel	🔗 ок

Figure 5-6-5 Add Surface Point

Figure 5-6-6 Batch



Figure 5-6-7 Delete or Edit

- Edit: Edit existing surfaces. Long press the selected surface point to delete or edit it.
- Delete: Click to delete existing surfaces.



Figure 5-6-8 Surface Preview

- View: Select or create a new surface, and then click to view the surface preview.

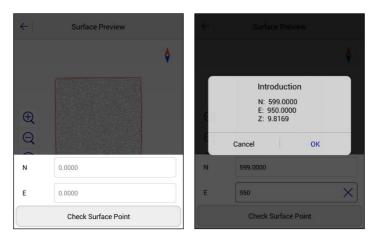


Figure 5-6-9 Check Surface Point Figure 5-6-10 Calculation

- *Check Surface Point*: Calculate the elevation of the input point. If the point is not in the plane, it can't be calculated. If the point is in the plane, click *OK* after the check, the point will be saved in the stakeout point library and the description will be the checkpoint.

- Import: Click to import the surface file in the Surface File(*.ttin) format.

- Export: Click to export the surface file in the CASS Format (*.sjw) format.

5.7 Elevation Difference

This function is to do the DTM surface stakeout, and calculate the elevation difference between the current point and the fitted point of the selected surface.

Click *Stake Surface Lib* to choose the surface to stake out, then it will display the TIN grid information in real-time. The *Fill* value will be displayed on the top left, and the coordinates and

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detailed height will be displayed on the bottom slide bar.

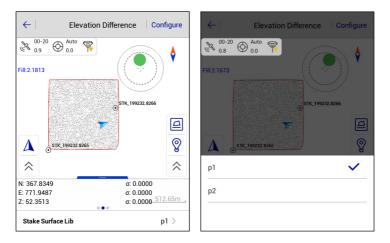


Figure 5-7-1 Elevation Difference

Figure 5-7-2 Select the Surface

- []: Click to enter the surface library interface to add or load the surface, and edit the surface

\leftarrow	List S	ОК	
Surface Name	Quantity of points	Quantity of triangles	Area 🕨
p1	2000	3976	988538
p2	2000	3976	989249
		Ē	View Import Export
+ Add	🖉 Edit	Delete	More

information.

Figure 5-7-3 Surface Library

5.8 Surveying Configure

The surveying configuration is a common menu that is used to configure the graphical display of the work interface, including the road and general survey configuration of the *Detail Survey*, *Stake Points, Stake Line, Stake Road, Store Cross-section* and *Road Design*.

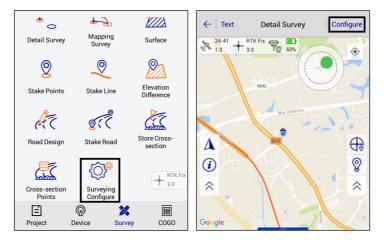


Figure 5-8-1 Surveying Configure

Figure 5-8-2 Configure

5.8.1 Display

The display configuration contains the Road Survey Config and General Survey Config.

Road Survey Config: Cross-section Point and Roadline Transition Point.

General Survey Config: Coord Poinft, Stake Point, Control Point, Stake Line Lib, Voice Prompts, Optimize Scale, Centered Display GPS, Keep GPS Centering, Display Name, Electronic Bubble, Real-time Mileage, Dis to last Coord Pt, Fix Direction, Controller Dir, Display Colorand Online Map.

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Hi-Survey Road User Manual

🛠 Road Survey Config	Voice Prompts		
	voice Prohipts	Display Name	
Cross-section Point	Optimize Scale	Electronic Bubble	
Roadline Transition Point	Centered Display GPS	Realtime Mileage	
🛠 General Survey Config	Keep GPS Centering		
Coord Point		Dist to last Coord Pt	
Stake Point	Display Name	Fix Direction	
Control Point	Electronic Bubble	Controller Dir	0
	Realtime Mileage	Display Color	
Stake Line Lib	Dist to last Coord Pt	Online Map	Google Maps

Figure 5-8-3 Display(1)

5-8-4 Display(2)

5-8-5 Display(3)

- *Cross-section Point*: Select whether to display the point name of the cross-section point during the road collection.

- *Roadline Transition Point*: Choose whether to display line feature points in the measurement interface during the road collection.

- Coord Point: Choose whether to display the coordinate point name.

- Stake Point: Choose whether to display the stake point name.

- Control Point: Choose whether to display the control point name.
- Stake Line Lib: Choose whether to display the stake line library.

- *Voice Prompts*: Choose whether to open the voice prompts. Users can record user-defined voice prompts in the *.wav format: the file storage path is *ZHD/Sounds*. Customized file names have prescribed formats, including fixed.wav, losefix.wav, savedone.wav, stakereminder.wav and stakedone.wav.

A Phone st	ZHD	
Cut		
Project		
<mark> </mark> Sounds		
E Static		
<mark>二</mark> User		
E .	Q	:

5-8-6 Voice Files Path

- *Optimize Scale*: Choose whether to automatically adjust the scale to the right size. When enabled, it will automatically adjust the screen display based on the coordinate range in the coordinate data, and the *Centered Display GPS* and *Keep GPS Centering* will be invalid.

- *Centered Display GPS*: When the current point is not in the screen display range, the current point will be automatically centered.

- Keep GPS Centering: The current point is always in the middle of the screen.

- Display Name: Choose whether to display the point name.

- *Electronic Bubble*: Choose whether to display the electronic bubble. When it's not displayed, the inclination won't participate in the acquisition accuracy judgment.

- *Real-time Mileage*: Select whether to display the current real-time mileage value in the *Stake Line* and *Stake Road* interface.

- Dis to last Coord Pt: Select whether to display the distance to the last point.

- *Fix Direction*: Smooth the sample over a period of time, and the calculated direction value will be relatively stable to reduce the irregular beats in direction.

- *Controller Dir*: After selecting, click *OK* as prompted to keep the hand-held controller screen upward, and move the hand-held controller according to the prompt to complete the calibration. Then return to the survey interface; the direction of the current point will be the direction of the hand-held controller.



5-8-7 Controller Dir Prompt

- Display Color: Select whether the map is displayed in the feature color.

- *Online Map*: Select Google maps as the basemap to survey or stake out. Make sure the network is connected and it has updated to the latest Google service.

5.8.2 Data

The data configuration contains the Road Survey Config and General Survey Config.

Road Survey Config: Cross-section Precision, the default value is 0.0500m.

General Survey Config: Required Solution, Working Area, Physical Record Button, Point Info Dialog, Auto Start Average, Auto Store After Average, Store Average Points, Allow Same PtName, Tilt Survey, Bubble Precision (<2.0000), HRMS Tolerance, VRMS Tolerance, Stake Tolerance, Stake Prompt in, Mileage Tolerance, PtName Increasing by and No Fixed Prompt in(s).

← Display Data Stake	← Display Data	Stake	← Display Da	ta Stake
🛠 Road Survey Config	Auto Store After Average		HBMS Tolerance	
Cross-section Precision 0.0500	Store Average Points		HHMS Tolerance	3.0000
🛠 General Survey Config	Allow Same PtName		VRMS Tolerance	5.0000
Required Solution Auto >			Stake Tolerance	3.5000
Working Area >	Tilt Survey		Stake Prompt in	3.0000
Physical Record Button Single Record >	Bubble Precision(<2.0000)	0.0800	Mileage Tolerance	0.0500
Point Info Dialog	HRMS Tolerance	3.0000		
Auto Start Average	VRMS Tolerance	5.0000	PtName Increasing by	1
Auto Store After Average	Otalia Talanna	2.5000	No Fixed Prompt in(s)	60

Figure 5-8-8 Data(1)

5-8-9 Data(2)

5-8-10 Data(3)

- *Required Solution*: Limit the solution type, including the *Auto, SDGPS, DGPS, Float* and *Fix*. When the solution type is limited to the *Fix*, the accuracy prompt box will not pop up if the solution is acquired in the fixed solution state.

- Working Area: Users can draw the range of the survey area and select over range tips.

←	Survey Area OK				
🗹 draw survey area 🗹 over range tips 📡					
Name	Ν	E	Z 🕨		
		(View		
		Ľ	Load		
		Θ	Batch		
		E	New		
+ Add	🖉 Edit	Delete	More		

5-8-11 Survey Area

- *Physical Record Button*: Set the acquisition key on the physical keyboard as the *Single Record* or *Average Record* shortcut key.

- *Point Info Dialog*: Choose whether to display the point information confirmation box after collection.

- *Auto Start Average*: Check this option and click the average button, to enter the average collection interface, to automatically start smoothing. If this option is not checked, the smoothing won't start automatically, users need to click the start button in the average collection interface to start.

- *Auto Store After Average*: After it's turned on, click *OK* to do the average collection. When the number of smoothing reaches the set number, it will automatically exit the average interface and save points. User can also click *OK* to end average collection in advance.

- Store Average Points: Choose whether to save average data automatically.

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- Allow Same PtName: Choose whether users can collect points with the same name.

- *Tilt Survey*: Tilt survey can be done after turning on, and there will be tilt correction during data processing to get coordinates of points to be measured (only for specific models, and users can only start the tilt correction after completing calibration steps).

- *Bubble Precision* (<2.0000): Set the electronic bubble acquisition accuracy. The acceptable range of tilt distance when acquiring coordinates is recommended to be within 30 degrees.

- *HRMS Tolerance*: The horizontal RMSE of points, users can enter the maximum RMSE limit. When collecting points, there will be a prompt if it exceeds the limit value.

- *VRMS Tolerance*: The vertical RMSE of points; users can enter the maximum RMSE limit. When collecting points, there will be a prompt if it exceeds the limit value.

- *Stake Tolerance*: The precision limitation of stakeout points. Within the limit, the software will indicate that it has reached the accuracy range of the stakeout. If the sound prompt is enabled, an audio prompt will be given.

- *Stake Prompt in*: Set the prompt range of the stakeout. When the stakeout point is within the range, the range line will change colour. If the sound prompt is enabled, an audio prompt will be given.

- Mileage Tolerance: Set the maximum error limit for real-time mileage.

- *PtName Increasing by*: The accumulation number value of the point name suffix. The default value is 1.

- *No Fixed Prompt in* (*s*) : Voice prompt interval when the fixed solution is reached. The default value is 60s.

Notice:



The default value of data acquisition accuracy of the fixed solution in the software is the value (m) shown in the figure below:

← Display Data	Stake
Tilt Survey	
Bubble Precision(<2.0000)	0.0200
HRMS Tolerance	0.0200
VRMS Tolerance	0.0300
Stake Tolerance	0.0500
Stake Prompt in	3.0000
Mileage Tolerance	0.0500

5-8-12 Default Values

5.8.3 Stake

The stake configuration contains the Road Survey Config and General Survey Config.

Road Survey Config: Real-time Mileage HT Diff.

General Survey Config: Stake Guide Type, Reference Direction, Stake Order, Show Offset on Map, Check Move Direction, Map North Direction, Repeat Stake, StkName as PtName, Named by Station, Named by Real-time Station, Save Mileage and Save Real-time Mileage.

Display Data Stake	← Display Data Stake
K Road Survey Config	Check Move Direction
Real-time Mileage HT Diff	Map North Direction Map North >
🛠 General Survey Config	
Stake Guide Type Front-Back >	Repeat Stake
Reference Direction Sun Azimuth >	StkName as PtName
Stake Order Ascending >	Named by Station
Show Offset on Map	Named by Real-time Station
Check Move Direction	Save Mileage
Map North Direction Map North >	Save Real-time Mileage

Figure 5-8-13 Stake(1)

Figure 5-8-14 Stake(2)

- *Real-time Mileage HT Diff*: After turning on, the height difference in the information bar of the *Stake Road* interface is the height difference between the current point projection on the line and the current point (make sure there is a road profile).

- Stake Guide Type: Select the stake guide type, including Front-Back and North-South.

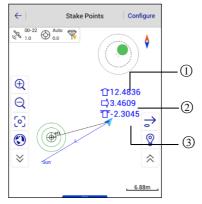


Figure 5-8-15 Stakeout Prompts

Road

(1) In the *Front-Back* mode, the upward arrow indicates forward, and the downward arrow indicates backward. In the North-South mode, the upward arrow indicates the north, and the downward arrow indicates the south.

(2) In the *Front-Back* mode, the left arrow indicates left, and the right arrow indicates right. In the *North-South* mode, the left arrow indicates the west, and the right arrow indicates the east.

(3) In both modes, it indicates the height difference.

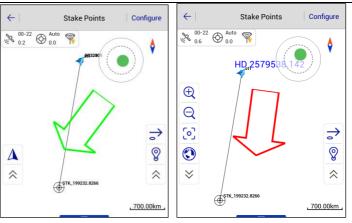
- *Reference Direction*: Select the reference direction, including the *Sun Azimuth, Base Azimuth* and *Custom Azimuth*.

- Stake Order: Select stakeout points with ascending or descending order.

- *Show Offset on Map*: When turned on, the stakeout prompt will be displayed on the map during the point stakeout process. If the *Check Move Direction* is turned on at the same time, and the distance from the current point to the stakeout point is greater than the stakeout distance, the horizontal distance from the current point to the stakeout point will be displayed; otherwise, the front-back or south-north prompt will be displayed.

- *Check Move Direction*: After turning on, when the distance from the current point to the stakeout point is not within the range of the stakeout distance, a large arrow will be displayed to indicate the deflection angle between the moving direction and the direction from current point to the stakeout point. If it's approaching the stakeout point, it will be displayed in green. If it's moving away from the stakeout point, it will be displayed in red. If the moving direction is almost perpendicular to the direction from current point to the stakeout point, it will be displayed in yellow.

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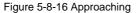


Figure 5-8-17 Moving Away

- Map North Direction: Select the map direction, including the Map North or Forward.

- *Repeat Stake*: When turned on, it supports the repeat stake. Users can choose whether to skip the collected stakeout points automatically.

- StkName as PtName: Select whether to set the stakeout point name as the default point name.
- Named by Station: Select whether to set the station as the default point name.

- *Named by Real-time Station*: Select whether to set the real-time station as the default point name. This option can't be opened simultaneously with the *Named by Station*.



Notice:

When turning on the Named by Station or Named by Real-time Station option, users need to select the Allow Same PtName option in the Configure \rightarrow Data interface.

- Save Mileage: When collecting points, the mileage will be automatically filled as the

stakeout point mileage.

Road

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- *Save Real-time Mileage*: When collecting points, the mileage will be automatically filled as the real-time projection mileage (the *Save Mileage* and *Save Real-time Mileage* must and can only be selected one at a time).

CHAPTER

COGO

This chapter contains:

- Angle Conversion
- Distance Conversion
- Coordinate Conversion
- Area Calculation
- Distance and Azimuth
- Intersection Measurement
- Angle Calculation
- DTM Volume Calculation
- Calculator

6.1 Angle Conversion

Support Radian, Degree, DMS, Gon, Mil angle units transforming mutually. After you input a

value to any item, click Compute: another several values will be calculated.

←	Angle	
Radian	1.5708	
Degree	× (0e	
DMS	090:00:00.00000	
Gon	100.0000	
Mil	1600.0000	
Compute		

Figure 6-1-1 Angle Conversion

6.2 Distance Conversion

\leftarrow	Distance	
km	I X	
m	1000.0000	
cm	100000.0000	
mile	0.6214	
nautical mile	0.5400	
yard	1093.6133	
foot	3280.8399	
Compute		

Figure 6-2-1 Distance Conversion

Support km, m, cm, mile, nautical mile, yard, foot, inch distance units transforming mutually.

After inputting a value to any item, click *Compute*: another several values will be calculated.

6.3 Coordinate Conversion

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

← Coordinate	← Device OK
🖉 Source 😽 式 🕅	₩ 00-23 ⊕ Auto ₩ 44%
● BLH ○ XYZ ○ NEZ	Status: Center
B: 22:58:53.97505N X	B 22:58:53.83075N σ: 0.8270 L 113:21:41.87389E σ: 0.8240
L: 113:21:41.90421E	H 44.8498 σ: 1.8390 Target H 2.0000 Pole(P)
H: 48.2248	Average
🖉 Local 🛞 🔄 🕅	Save to the point library
○ BLH ○ XYZ ● NEZ	Name B32017
N: 20026049.2047	Code 🗸 🕀 FÕ
$\overline{\Box}$ To Local \sum To Source	

Figure 6-3-1 Coordinate Conversion Figure 6-3-2 Receiver Collection

← Coor	d Point Stake Point		← Мар	ОК
Name	▲ N	E 🕨		٨
B032009	20026070.1549	19367587.4692	B032009	•
pt1	20026070.1549	19367587.4692	+ 832015	
pt2	20026070.1549	19367587.4692	pt5	
pt3	20026070.1549	19367587.4692	N:20026049:2047 E:19367610.7659	pt26
pt4	20026070.1549	19367587.4692	Q	
pt5	20026049.2047	19367610.7659	$\overline{\mathbb{S}}$	⇒
				~▶
				1
Q	Search	🔁 Open	\approx	13.51m

Figure 6-3-3 Point Library Selection Figure 6-3-4 Select Point from Map

6.4 Area Calculation

Used for calculating area, circumference and some other parameters of graph. Area is indicated by *sq.m* or *mu* and circumference is indicated by *m*. The coordinate of point participated in calculation can be added manually, or real-time collected from the receiver, or selected from a coordinate library or map.

Notice:

In the Map interface of Area, the Select Point $\stackrel{\bullet}{\blacktriangleright}$ is not the same as the Map selection $\stackrel{\bullet}{\boxtimes}$ in the List interface of Area. In the former, the points on the map are selected by clicking on the point, and the latter by the way of selecting points in the circle and selecting the node on line.

The difference of map selection between *Area* and the other interface is: click \square to enter map selection mode. Frame select point on the map when the icon is in the state \uparrow_{\times} , when frame select multiple points, press \Rightarrow but only one point in the box can be selected, click \uparrow_{\times} again to exit the map selection mode; Among them, when the icon is in the status \uparrow_{\times} , you can select multiple points in the box, click \uparrow_{\times} or \uparrow_{\times} again to exit the map selection mode, click *OK* to complete. Return to the list to view the selected points.

\leftarrow	List	Мар
		🚸 🔄 😥
Name	N	Е
pt4	20026070.1549	19367587.4692
pt5	20026049.2047	19367610.7659
pt6	20026049.1023	19367610.6672
(+) Add	😾 Compute

Figure 6-4-1 Area Calculation

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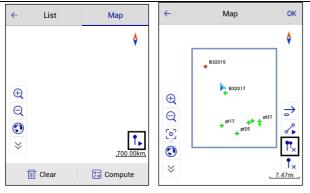


Figure 6-4-2 Select Point

Figure 6-4-3 Multiple Select

- *Add*: The points can be added to list by the way of real time collection, point library and graph selection.

- *Compute*: Calculates the area, mu, and length of the current point in order, and can view graphics and calculations in the result interface.

6.5 Distance and Azimuth

Used for calculating distance and azimuth between two points. The coordinate of A and B points can be manually input, or read from receiver, coordinate library or map. After reading successfully, click *Compute* to calculate *Azimuth, Bank Angle, 2D-Distance, 3D-Distance and H-Distance.*

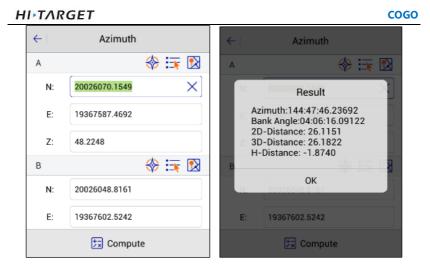


Figure 6-5-1 Distance and Azimuth

Figure 6-5-2 Result

6.6 Intersection Measurement

In the case of a point needing measurement, but observation conditions are not ideal, calculate the needed point coordinate by measuring a nearby point. Click every icon to enter the corresponding measurement mode. The software supports six measurement modes (*4Pt*, *2Pt2L*, *2Pt1L*, *2Pt2A*, *2Pt1A1L*, *Azimuth*).

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2Pt1A1

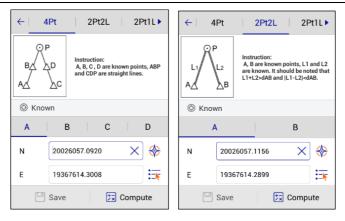


Figure 6-6-1 4Pt Interface

Figure 6-6-2 2Pt2L Interface

Instruction:

20026057.1438

19367614.2344

Save

2Pt2A

A, B are known points, angle α and β are known. It should be noted that P is on the left side of AB and 0° < $\alpha+\beta<180^\circ$

В

 \times -

T Compute

← ◀ 2Pt2L	2Pt1L 2F	Pt2A►	< ◀	2Pt1L
⊙P BA A∆	Instruction: A, B are known points, AB straight line, L1 is length I B and P.		AZ	P β β β
© Known			© Kr	nown
А	В			Α
N 2002	26057.1311	} �	N	200
E 1936	57614.2635	:	Е	193
🖾 Save	보 Comp	ute	Ľ	Save

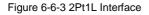


Figure 6-6-4 2Pt2A Interface

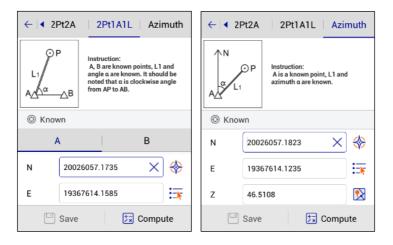


Figure 6-6-5 2Pt1A1L Interface

Figure 6-6-6 Azimuth Interface

There are two positions of *P* according to the theory of 2Pt2L; 2Pt2A, 2Pt1A1L. If you input the coordinate of *A* first and then the coordinates of *B*, the position of *P* will be located above the *AB* line. Conversely, if you input the coordinate of *B* first, the position of *P* will be located under the *AB* line.

In the above intersection measurement methods, select known point *ID*, input the coordinate of the intersection measurement point (manual input, or read from receiver, coordinate library, map), input other known keys (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 the *Intersection*, when you click GPS collection, prompting precision information (accuracy setting is performed in the *Configuration*) is easy for understanding of real-time accuracy.

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6.7 Angle Calculation

← Ang	gle Calculation	← Angle Calculation
AA AC	Instruction: Angle A, B, C are known points, α	© Known
(X B	is interior angle from AB to BC.	A B C
Known		N 23.0000
A I	ВС	E 26.0000 × 🗮
N	23.0000	Interior Angle 000:00:00.00000
E	26.0000 ×	Exterior Angle 000:00:00.00000
(Compute	🚼 Compute

Used for calculating the angle of the three-point line.



6.8 DTM Volume Calculation

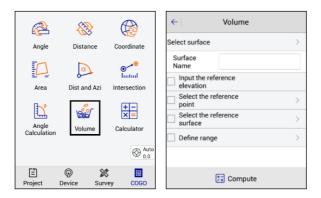


Figure 6-8-1 COGO interface Figure 6-8-2 Volume interface

Calculate the volume, 2D perimeter, 3D perimeter, and DTM area of two DTM surfaces, or between a DTM surface and a predetermined elevation.

- Select surface: Click extend icon >, Select an actual surface from the List Surface.

Input the reference elevation: Check it, the reference elevation and the surface are used for volume calculation. Click extend icon , input the target height needed to fill/dig. *Select the reference point*: Check it, the reference point and the surface are used for volume calculation. Click extend icon , Select a point as a reference point from the *Point Library*. *Define range*: Check it, calculate the volume inside boundary; conversely, without checking it, it will calculate the volume in the public area. Click extend icon , you can select the range points on the *Define range* interface, and add, edit, delete, load, and save the range points.

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←	Volume				
Select sur	face		>		
Surface Name					
Input t	he referenc ion	e			
	ked:comp daries	ute inside	>		
Select surfac	the referen e	ce	>		
✓ Define range					
Name	Ν	E	z 🕨		
	Compute				

Figure 6-8-3 Checked Boundaries

←	← Define range OK		~	Boundary Point	
Name	N	E	Z 🕨	Ø From	🚸 🏣 🔞
pt1	20026070.154 9	19367587.469 2	48.2248	Name	pt1 X
pt7	20026048.881 7	19367609.952 3	45.4328		
pt5	20026049.204 7	19367610.765 9	45.1818	N	20026070.1549
				E	19367587.4692
	(O) View		View	z	48.2248
			Load	Туре	• NEZ O BLH
		(Batch		
(+) Add	+ Add 🖉 Edit 🔟 Delete 🧮 More		🚫 Ca	ncel 🤗 OK	

Figure 6-8-4 Define Range

Figure 6-8-5 Boundary Point

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- *Add*: Add a range point by manual input, real-time collection, point library selection or map selection, *Define Range* requires at least three points.

- Edit: Select the range point you want to edit: you can edit the coordinates of the point.

- Delete: Select a range point, click Delete to delete directly, no prompt.

- Load: Load an existing boundary file (*.waa), the load path is: ZHD\ Project\ ROAD\ Project Name\ dtm folder.

- *Save*: Save the re-add/edit volume boundary file: the save path and file format is consistent with that in *Load*. When the saved file name already exists, it cannot be saved, but check *Cover* to save modified file. Also, click *OK* will also save re-add / edit volume boundary file.



Figure 6-8-6 Save Directory

After selecting different calculation methods, click *Compute* and view the volume calculation, measurement surface, digging area, and fill area product information on the *Results* interface.

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←	Volume					
Select su	rface		>			
Surface Name	•					
lnput eleva	the reference tion	9				
Selec point	Select the reference >					
	Select the reference >					
Define range						
Name	Name N E Z 🕨					
20026070 154 10367587 460						
	, t∓ Co	ompute				



← Volume		← Volum	ne
Select surface	>	Select surface	>
Surface Name		Surface Name	
Input the reference elevation		Input the reference elevation	
Select the reference point	>	Elevation 0.0000	
Point Name		Select the reference point	>
Elevation		Select the reference surface	>
Select the reference surface	>	Define range	>
🗔 Compute	2	🐹 Com	pute

Figure 6-8-8 Surface and Point Figure 6-8-9 Surface and Elevation

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← Res	ults 🔼	•	←	Results	
	sult between the two faces	1	Area 2D(m²)	28.2898	
Sui	aces		Area 3D(m²)	436000.4395	
Surface	3		D	40.4007	
Reference Surface	1		Perimeter 2D(m)	48.4231	
neierenee oundee	•		Perimeter 3D(m)	91566.1301	
Volume-Time of Cal:784ms					
Cut(m ³)	40856.5471	'	Cut areas(m ²)		
	40030.3411		Area 2D(m²)	4.9633	
Fill(m ^a)	0.0000				
Surface:3		4	Area 3D(m²)	76494.3398	
Surface.S			Fill areas(m ²)		
Area 2D(m ²)	28.2898		. ,		
A 0.D(3)	105000 1005		Area 2D(m²)	0.0000	
Area 3D(m²)	436000.4395		Area 3D(m²)	0.0000	

Figure 6-8-11 Result Below

Figure 6-8-10 Result Above

← 1 Results 1 \leftarrow Results The result of the calculation of reference The result of the calculation of reference poin elevation Surface 1 Surface 1 1.0000 Ref.Elevation(m) 48.2248 Ref.Elevation(m) Volume-Time of Cal:29ms Volume-Time of Cal:27ms 119.9862 9736.7196 Cut(m³) Cut(m3) Fill(m³) 105.2325 Fill(m³) 0.0000 Surface:1 Surface:1 Area 2D(m²) 205.8657 Area 2D(m²) 205.8657 Area 3D(m²) Area 3D(m²) 242.2758 242.2758

Figure 6-8-12 Elevation Result Figure 6-8-13 Point Result

- Area $(2D: m^2)$: The area projected onto the horizontal plane.
- Area $(3D: m^2)$: The area projected onto the slanted reference plane.

- *Perimeter (2D: m)*: The length of the polygon from the start point to the current measurement point in surface (2D).

- *Perimeter (3D: m)*: The length of the polygon from the start point to the current measurement point in surface (3D).

COGO

ньтлядет 6.9 Calculator

Used for simple mathematical calculations.



Figure 6-9-1 Calculator

CHAPTER

7

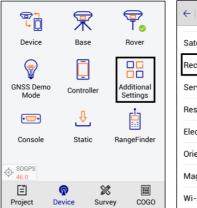
Tilt Survey

This chapter contains:

- Electronic Bubble Calibration
- Tilt Calibration and Verification
- Tilt Survey Procedure

7.1 Electronic Bubble Calibration

1. Connect to the receiver with tilt survey function. In *Additional Settings*, click *Electronic Bubble Calibration* to enter the program.



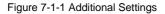




Figure 7-1-2 Receiver Settings

2. When the device had been perfectly levelled up, click Start for calibration, then click OK.



Figure 7-1-3 Bubble Center

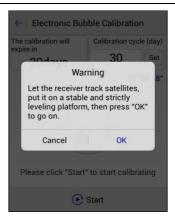


Figure 7-1-4 Warning

3. When success is prompted, the electronic bubble and horizontal bubble of base will be centered at the same time.

← Electronic Bu	ubble Calibratio	on	← Electronic But	oble Calibratio	on	
The calibration will	Calibration cy	cle (day)	The calibration will expire in 30days	Calibration cy	Calibration cycle (day)	
expire in 20days	30	Set		30	Set	
			₹ 16-31 1.9 45.0 Suc	cess	°00'00"	
Calibrating		Suc Please click "Start	cess " to start calib	rating		
🕞 Start			\odot	Start		

Figure 7-1-5 Calibrating

Figure 7-1-6 Calibration Success

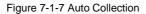
4. Calibration is finished. Notice: It is recommended to calibrate the device every 30 days, but the calibration cycle can be adjusted.

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5. Auto collection. When the auto mode is set as Bubble Is centered the software will collect the

points automatically when the electronic bubble is centered.

\leftarrow	Auto Auto OK
Auto	Bubble Is Centered >
Prefix	z
ID	5
Desc	
Time	
Dist	
Slant Dist	
Bubble Is C	Centered 🗸





Notice: When use the *Bubble Is Centered* for automatic collection, first set bubble precision. Connect a receiver with tilt measurement function, enter main interface \rightarrow *Survey* \rightarrow *Surveying Configure* \rightarrow *Data* (or: enter survey interface \rightarrow click *Configure* at the top right corner \rightarrow *Data*), the *Bubble Precision* can set when tilt Survey is off.

← Display Data Stake			
Tilt Survey			
Bubble Precision(<2.0000)	0.080 ×		
HRMS Tolerance	3.0000		
VRMS Tolerance	5.0000		
Stake Tolerance	3.5000		
Stake Prompt in	3.0000		
Mileage Tolerance	0.0500		

Figure 7-1-8 Tilt Survey And Bubble Precision

7.2 Tilt Calibration and Verification

7.2.1 Tilt Calibration

The whole tilt calibration has three steps:

- 1. Orientation sensor calibration;
- 2. Electronic bubble calibration;
- 3. Magnetic calibration.

The order of 1 and 2 steps can be reversed, but must be performed before step 3.



Notice:

 The calibration should be done in a low magnetic interference area or an open field. Don't do calibration on the roof or top of a high building.

2. Calibration should be done in external station mode, don't use the internal

UHF link,h to avoid magnetic interference.

3. Don't change battery and power off during all the calibration steps.

Here are the detailed operations below:

1. Orientation Sensor Calibration

Additional Settings \rightarrow click Orientation sensor calibration to enter calibration interface.

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Tilt Survey

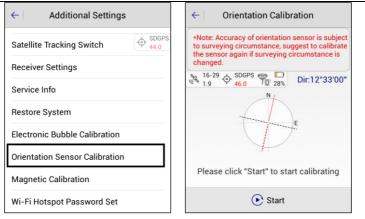


Figure 7-2-1 Sensor Calibration

Figure 7-2-2 Start Calibration

Click *Start* to begin calibration, the calibration of the orientation sensor needs to be calibrated according to the demo.

← Orientation Calibration	\leftarrow Orientation Calibration
•Note: Accuracy of orientation sensor is subject to surveying circumstance, suggest to calibrate the surveying circumstance and the subject of the subject o	•Note: Accuracy of orientation sensor is subject to surveying circumstance, suggest to calibrate the sensor again if surveying circumstance is changed.
After pressing "OK", please rotate the receiver for a cycle in each direction after the "ding dong" sounds. The second "ding dong" means calibrated success. Cancel OK	⊕ Take the hands connection as axis, rotate the device at a constant speed 7 seconds each cycle ⊕ After finished 1 cycle, clockwise rotate about 45 degrees, repeat step1, need totally 8 cycles at least
Please click "Start" to start calibrating	Rotate the device at a constant speed
● Start	● Start

Figure 7-2-3 Warning

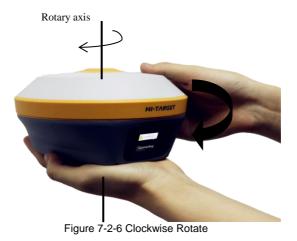


Rotate at an average speed, approximately 7 seconds for a cycle.



riguro r 2 o riotary roto

Clockwise rotate about 45 degrees, repeat step a, you need a total of 8 cycles at least.



After the calibration is completed in each direction, the second *Ding-Dong* sound indicates *Success* from the device, that means calibration is finished. Conversely, prompting failure - do do calibration again.

Tilt Survey

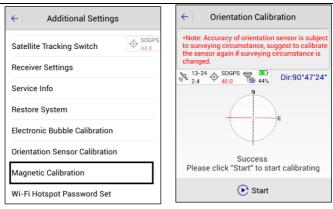


Figure 7-2-7 Calibration

Figure 7-2-8 Calibration Success

2. Electronic Bubble Calibration

Please refer to: Electronic Bubble Calibration.

3. Magnetic Calibration

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This step can be done only after the calibration of electronic bubble and orientation.

Additional Settings \rightarrow click Magnetic calibration to enter calibration interface.

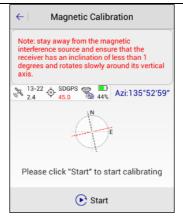


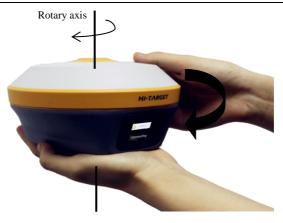
Figure 7-2-9 Start Calibration

Click Start to start calibration, magnetic calibration needs calibration in horizontal position.

← Magnetic Calibration	← Magnetic Calibration
Warning Click "OK" to start the calibration, then keep the device horizontal and slowly rotate the device for at least a circle in all directions after the first ding-dong sound from the device. The second ding-dong sound indicates success.	Note: stay away from the magnetic interference source and ensure that the receiver has an inclination of less than 1 degrees and rotates slowly around its vertical axis.
Cancel OK Please click "Start" to start calibrating	Calibrating
€ Start	() Start

Figure 7-2-10 Warning Figure 7-2-11 Calibrating

Keep the device on horizontal and rotate it clockwise a week, slowly and evenly around the vertical axis. Rotation speed is recommended to be less than 20 degrees per second, it slow uniform rotation and no pause during rotation.





When horizontal calibration is complete, the second *Ding-Dong* sound from the device indicates *Success*. Conversely, prompting failure - do calibration again.

← Magnetic Calibration	← Magnetic Calibration
Note: stay away from the magnetic interference source and ensure that the receiver has an inclination of less than 1 degrees and rotates slowly around its vertical axis.	Note: stay away from the magnetic interference source and ensure that the receiver has an inclination of less than 1 degrees and rotates slowly around its vertical axis.
Subscript{SDGPS} Subscript{SDGPS} Subscript{SDGPS} Subscript{SDGPS} Subscript{SDGPS} Subscript{SDGPS} Azi:230°27'34" Azi:230°27'34" Subscript{SDGPS} Subscriter Subscript{SDGPS} Subscript{SDGPS} Subscript{	
E	e n
Because of the mistakes of oritention calibration,please return back to oritention calibration to re-calibrate.	Magnetometer calibrated successful.
💽 Start	🕞 Start

Figure 7-2-13 Failure

Figure 7-2-14 Successful

7.2.2 Calibration verification

In order to make sure accuracy is not strongly interfered with by the environment and procedure, verification is necessary before starting the tilt survey.

Put the device at 30 degree tilt approximately, on the pole, and rotate it slowly clockwise for a week. View the azimuth changes, if the differences between maximum and minimum values is less than 5 degrees, it means the sensors are working well and you can do a tilt survey directly, otherwise module verification will be required.



Notice:

1. The pole shouldn't be moved.

2. Rotation speed should be 2 degrees per second and it takes about 3 minutes to rotate one week.



Figure 7-2-15 Calibration Verification



Notice:

1. When replacing a new measurement area, or the terrain complex environment of the measurement area changes greatly, module verification is required before measurement.

2. When the new device first uses tilt measurement, it must be calibrated.

3. After the new battery is replaced, the device must be calibrated.

7.3 Tilt Survey Procedure

After electronic bubble calibration, orientation sensor calibration, magnetic calibration and verification are successful, we can do a tilt survey. If the device has not undergone calibration, users will be prompted when *Tilt Survey* is opened: you must complete all calibrations before you can open *Tilt Survey*. Tilt Survey conditions are limited to: static, within 20 degrees of tilt.

1. Tilt Survey must be opened when we do a tilt survey, click Surveying Configure \rightarrow Data \rightarrow Tilt

Survey.

← Display D	ata Stake
Auto Start Average	
Auto Store After Aver	age
Store Average Points	
Allow Same PtName	
Tilt Survey	
Slope Method	Normal Slope >
HRMS Tolerance	3.0000
VRMS Tolerance	5.0000

Figure 7-3-1 Tilt Survey

Figure 7-3-2 Slope Method

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2. When *Tilt Survey* is not opened, the software will not do tilt survey, the software survey interface displays and records the coordinates of the tilt point to the point library. Conversely, when *Tilt Survey* is opened, the interface displays and records coordinate points to the point library: this coordinates point is the calculated ground coordinate point.

3. Collect Point

Enter survey interface to collect points, it supports two survey modes: *Corner Slope and Normal Slope*. The corner slope mode is accurate and reliable, the normal slope mode is simple to operate.



Figure 7-3-3 Collection Point

7.3.1 Corner Slope

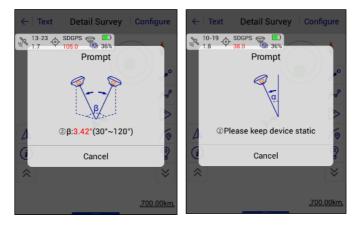
This mode is more precise, but it takes little a longer in the field. Orientation and magnetic calibration recommendation is prompted when interference is found by the device.

1. Please keep the receiver tilted and static, then click the collection icon. The best tilt angle is 10 degrees \sim 20 degrees: follow the prompts to operate.



Figure 7-3-4 Step One

2. Tilt in the other direction, with an azimuth span angle of 30 degrees to 120 degrees (*Azimuth Span Angle:* the angle formed by the vertical projection of the pole in two directions), and keep it static. There will be a sound promps '*Di*' indicating that collection is complete.



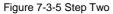


Figure 7-3-6 Step Three

2. In the *Save Point* interface, you can see the tilt angle and tilt azimuth of the point. **234**



Figure 7-3-7 Save Point

7.3.2 Normal Slope

This method is much simpler, the receiver will collect points when it is still (function available in firmware version after v5.1 for V90 Plus and v1.1 for iRTK5). Orientation and magnetic calibration recommendation is prompted when interference is found by the device.

1. Enter process interface Raw Data \rightarrow More \rightarrow Process.

	<u>~~</u>	SDGPS	←	Raw Data		← Proces	s
Project Info	Project	Coordinate	Name	В	L 🕨	Projection List	WGS84 >
. roject into	Settings	System	danguixuan waimian1	22:59:59.99902N	113:59:59.99397E	Use coordinate	system of
(fx	í í		danguixuan waimian2	23:00:00.00566N	113:59:59.98801E	current project	
Parameters Calculation	Point Library	Raw Data	danguixuan waimian3	23:00:00.00047N	113:59:59.98936E		
	_ ™		danguixuan waimian4	23:00:00.00240N	113:59:59.99090E		
	Data		Z 5	22:58:53.85060N	113:21:41.82561E		
Data	Transfer	Email	Z 6	22:58:53.85061N	() Set		
	<u> (</u>	Ů	Z 7 File Name:	22:58:53.85070N GPS.raw	Proces	*Note: The result will be lib after proc	
Project	Device Surv		H New	🖻 Open 📿 S	earch 📻 More	Process	🛃 Export

Figure 7-3-8 Raw Data

Figure 7-3-9 More

Figure 7-3-10 Process

2. *Data Transfer* is a raw data custom export. It supports export not an increase in plane coordinates for tilt correction (tilt N, tilt E, tilt Z is not tilt correction of plane coordinates). Select the export path and input the export file name and after completing the custom format settings, click *OK* to export.

← Raw Data Stake Point Contrc	← Set Custom Format OK
Exchange Types	Template None >
Directory /storage/sdcard0/ZHD/Out	Export Content
csv_zhd_ test.csv	idName N E.Z.B.L.H.Slope N.Slope E.Slope Z.Slope B.Slope L.Slope H AntH.oN.GE.HRMS.GZ.Taraet H AntH Supported Fields Selected Fields Selected Offset Tilt Azi Audios Tilt X
csv_zhd_test 🗌 Cover	Images Tilt Y
User-defined(*.csv)	Null TiltX Azi
⊘ ок	🔟 Delete 🔺 Up 🔻 Down

Figure 7-3-11 Save Raw Data Figure 7-3-12 Custom Format

7.3.3 Abnormal prompt

1. When you have finished following the prompts, if the prompt Corner Slope fail appears, the

current point is not saved.



Figure 7-3-13 Prompt

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2. When it prompts *The current low precision, whether to save data*, click *OK* to save the calibration ground point coordinates, click *Cancel* to not save the coordinate data.

3. When the collection point prompts *Magnetic is change*, so it is not collecting points and you need to do the three steps of tilt calibration.

CHAPTER



Quasi-dynamic Survey

This chapter contains:

- Function Introduction
- Operation Procedure

8.1 Function Introduction

Quasi Dynamic RTK Survey was invented by Hi-Target, a new way to survey in tough areas where there is strong multi-path interference, signal blocking like standing beside big trees; the reliability is much better than the normal RTK survey in those conditions. It can offer precise coordinates in 20 - 40 seconds, with better fixing rate, accuracy and reliability.

8.2 Operation Procedure

1. Activate the function.

Additional Settings \rightarrow Receiver Settings \rightarrow Quasi Dynamic RTK \rightarrow Set.

← Additional Settings	← Receiver Settings ♦ SDGPS
Module Info	Port 8999
Registration Info	USB Virtual Serial Port
5-pin Port Data Output	Store Static data in receiver SD card
Satellite Tracking Switch	Sound Type Default >
Receiver Settings	Volume 1
Service Info	One Step Set Station
Restore System	Quasi dynamic RTK
Electronic Bubble Calibration	Set

Figure 8-2-1 Receiver Settings

Figure 8-2-2 Quasi dynamic RTK

^{2.} After the RTK correction from base receiver or CORS service had been received for more

than 30 seconds, the quasi dynamic RTK survey is ready to work.

3. Go to *Detail Survey* interface, click button in the screen to start. If you get the feedback *PPK engine is under preparation*, then please make sure the receiver is getting corrections.

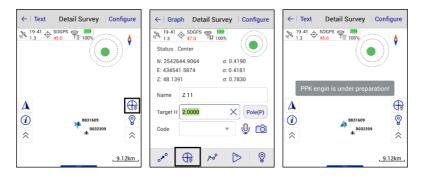


Figure 8-2-3 Button(1) Figure 8-2-4 Button(2) Figure 8-2-5 Prompt

4. It should take 20 - 40 seconds to finish collection, during the procedure please keep the receiver as steady as possible, rotating and shaking is not allowed.



Figure 8-2-6 Prompt

5. After the dingdong sound is tweeted, the collection is done and point is saved. In this mode,

the normal detail survey RTK point collection is still available.

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CHAPTER



Appendix

This chapter contains:

- Technical Terms
- Troubleshooting
- File Formats

9.1 Technical Terms

1. Global navigation satellite system (GNSS)

Global navigation satellite system (GNSS), this is the standard generic term satellite navigation system, it provides global coverage of geographic spatial orientation, including the US GPS, Russian GLONASS, Chinese BDS and the European Union's Galileo.

2. GPS time

The time measurement used by the NAVSTAR GPS system.

3. UTC

Universal Time Coordinated. Time standard for local daylight hours based on Greenwich meridian. See GPS time.

4. Multipath

Interference (similar to the heavy shadow on a television screen). GNSS signals arrive at multiple paths before they reach the antenna through different paths.

5. Degree of ambiguity

The number of weeks in the carrier phase pseudo space between GNSS satellite and GNSS receiver.

6. Ephemeris

Current satellite position prediction. It is transmitted in the data.

7. Epoch

Measurement interval of GNSS receiver .Variation of the calendar element with measurement type:

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- For real-time measurement, it is set to one second.

- For post-processing measurements, set to one second and one minute.
- 8. Antenna height

The height of the receiver phase center to the center of the station.

9. Reference station (base station)

In a certain period of time, and if one or several receiver, on one or a few test sites, keep tracking an observation satellite, with the receiver in a certain range, the fixed station is called a reference station.

10. Mobile station

In a certain period of time, and if one or several receivers, on one or a few test sites, keep tracking an observation satellite, and the receiver is within a certain range, the fixed station is called a reference station.

11. Single reference station RTK measurement.

Only one base station is used, and the carrier phase difference correction parameter is measured by the data communication technology receiving base station.

12. Network RTK (CORS/VRS)

Refers to multiple reference stations in an area, network coverage to the region composition, and continuous tracking observation, through the sites of GPS observation network, covering the region and the time period for RTK correction parameters, in the region for RTK line RTK real-time correction way of positioning.

13. Cut-off height angle

In order to shield the effect of occluded objects (such as buildings, trees, etc.) and the multipath effect, the value of the angle threshold is lower than that of the satellite in the field of view,

which is usually set to 10 degrees.

14. Fixed solution

This indicates that the ambiguity has been solved and the measurement has been initialized. It is the most accurate type of solution.

15. Floating solution

Indicates that the ambiguity has been solved and the measurement has not been initialized.

16. DOP (dilution of precision)

Position Dilution of Precision (Dilution of Precision) are GNSS quality marks. It takes into account the position of each of the satellites, relative to the other satellites in the constellation, and their geometric position relative to the GNSS receiver. The smaller the DOP value, the higher the accuracy reliability. Standards applied by GNSS DOP value are: - the PDOP - position (3d coordinate) - RDOP relative (position), average time - HDOP - level (two-dimensional horizontal coordinates) - VDOP - vertical (only height) - TDOP - time (the clock offset only).

17. Spatial position dilution of precision (PDOP)

A unit number that represents the relationship between user position error and satellite position error. The factors reflecting the attenuation of positioning accuracy are related to the spatial geometric distribution of the measured satellite, and the larger the spatial distribution range, the smaller the PDOP value and the higher the positioning accuracy; conversely, the larger the PDOP value, the lower the positioning accuracy.

18. PDOP limit

The highest PDOP value for the receiver's computed position.

19. PPM

The measurement of the slanting distance of one millionth is corrected for the impact of the

earth's atmosphere. PPM is determined by the observed pressure and temperature as well as the specific instrument constants.

20. The RMS

The Root Mean Square is used to indicate the measurement accuracy of the point. It is the error circle radius at about 70% of the fixed point.

21.SNR

(Signal-to-Noise Ratio) • It is a measure of the strength of satellite signals. SNR ranges from 0 (no signal) to 99, of which 99 is the best, and 0 means the satellite is not available. The typical good value is 40. Normally, when SNR is above 25, GNSS systems begin to use satellites.

22. Weighted index

The weighted index is used in the neighbourhood adjustment calculation. The calculated distance from each new point to the control point, in the station establishment, will be weighted according to the weighted index when the coordinate adjustment applied to the new point is calculated.

23. Pile distance/station distance.

The distance or interval along a line, arc, or path.

24. Projection

Projection is used to produce a plane map that represents the surface of the earth, or that part of the surface.

25. The ellipsoid

The earth's mathematical model of the rotation of an ellipse around a short axis.

26. Geodetic datum

A mathematical model designed to fit some or all of the geoid surface (physical earth surface).

27. Earth level

It's very close to the universal gravitation of the sea's surface.

9.2 Troubleshooting

1. Receiver keeps tracking but failed to give coordinates.

Please try the possible solutions below:

(1) Set up the receiver again in another place with much less electromagnetic wave interference

(like a power station, radar station, etc.)

(2) Set the working mode of the receiver to static, then collect static data for 3-5 min, then

switch it back to the original mode (base or rover)

(3) Long press function button to reset motherboard, or restart the device.

2. Base station failed to send correction signal.

Please try the possible solutions below:

(1) Replace the battery in case the battery power is too low (power LED will flash red)

(2) Abnormal LED display in base mode

a. Satellite LED flashing, means the receiver failed to track the satellites and the coordinates cannot be provided:

The place where the base was set might be blocked by buildings or shelters and the useful

satellites were less than 4. Find a better place to set up station again.

Coordinates provided by the base station are far from the actual coordinates; in this case a reaveraging of base coordinates is required.

b. Satellite LED keeps on but signal LED does not flash: this means the base does not transmit the correction signal. Please reset up the base.

- (3) Central meridian might be set with a mistake, double check this parameter.
- (4) Reset motherboard, restart the device.
- 3. Rover cannot receive signals even if it is very close to the external radio of the base station:
- (1) If the signal LED is not flashing, please refer to problem 2 (previous problem).
- (2) Transmitting LED RX/TX does not flash (flashes once every second in normal conditions)

a. Check if the cable is connected firmly.

- b. Check if the cable is broken, try to replace the cable.
- c. Replace the power if the battery is too low.
- (3) Everything is alright with the base part but the rover signal LED does not flash.
- a. Make sure the radio channel and link rate are the same as the settings in base.
- b. Internal radio module in rover is abnormal, try to replace it, or grade the firmware or restart the device.
- (4) Rover signal LED flashed but in the software there is no common satellite number showing.
- a. Make sure the message types between base and rover are the same.
- b. Rover is severely interfered with and common satellites number is less than 4, so the number

is not showing. In this occasion please go to an open air area to set the rover.

4. Short range of radio communication in external radio base mode.

These are three possible reasons:

(1) External battery power is too low to supply enough power to transmit the signal. Replace the battery.

(2) Transmission method is not set to be external radio on base station.

(3) External radio abnormal.

a. Power is set too low.

- b. Transmission antenna is not installed properly.
- c. Cable is not connected firmly.
- d. Antenna on rover is not installed firmly or broken.
- (4) Strong interference in the base area. Try to change the channel or change the place to set up base
- 5. Failed to connect to internet in internal GSM mode.

How to solve:

- (1) Cellular internet antenna is not installed or not installed firmly.
- (2) Internet setting incorrect (check IP address, port, telecom operator, APN, CORS ID and password, etc.)
- (3) SIM card problems
- a. Not installed properly, or the position is not matched to the pins, either too shallow or too deep.
- b. No balance in the SIM account.
- c. Band of SIM card is not matching the band in the cellular modem. Try to use another SIM card from other telecom operator.
- (4) Cellular signal is weak in the region.
- (5) CORS server is not working properly. Try to use another device to test it.
- (6) Reset the device.
- 6. ZHD Server connection failed.

How to solve:

- (1) Check the IP, port, Area ID, Group ID, message type is same between base and rover.
- (2) Account or Group ID and Area ID occupied by other users. First come, first served.
- (3) Server abnormal. Please contact CORS service center for help.

7. Rover failed to get signal from CORS.

How to solve:

(1) Signal LED flashing green, but failed to connect to server:

a. SIM card issues (no balance, SIM card slot loose, band incompatible);

b. CORS parameters issues (IP, port, mountpoint, account ID and password, etc.)

c. Contact the CORS service center for help if the above are checked and are ok.

d. Internal cellular modem problem, try to reset or restart the device.

(2) Signal LED stays green but failed to receive correction signal.

a. Check IP, port.

b. Contact CORS service center for help if the things above are checked.

(3) Signal LED is green and flashes yellow every second, but no common satellites number shows.

a. Check if message type is correct

b. Check if the GNSS signal is severely blocked or interfered.

8. Bluetooth connection failed between controller and receiver

How to solve:

(1) Check if the working mode of receiver is static; if yes, switch it back to

base or rover mode; check if 8-pin port of receiver is occupied or not.

(2) Clear the Bluetooth search result list, search again and connect the device.

(3) Either switch off and switch on the Bluetooth function, or restart the device or controller.

(4) Update the firmware of controller, or the firmware of receiver.

9. Android controller cannot connect to PC (windows).

How to solve:

(1) Check if the driver was successfully installed or windows updated to the latest version.

- (2) Check if the anti-virus software blocks the connection due to its security.
- (3) Check if the "USB debug" function is activated.
- (4) Check the USB cable is not broken.
- 10. Big coordinates difference after the Localisation work (coordinate system parameters calculated)

Possible reasons:

- (1) Accuracy is not good during the data sampling in control point survey.
- (2) Control point is not distributed properly in the restion 3 Abnormal control point coordinates.

How to solve:

- (1) Check the parameters result, if the scale is far from 1, then the control points might not be correctly input.
- (2) Check the distribution of the control points, they should not be so close to each other.
- (3) Try to delete the points whose RMS are bigger, if there are more than 3 control points.

9.3 File Formats

9.3.1 Road file

[*. Dam] : parameter file.

[*.prj] : engineering documents.

[*.raw] : raw database file.

[maincst.cst] : cross-section point library file.

[*.mcp] : the graph root data file.

[*.bak] : the backup file will be automatically generated by the new project software if there is

no external SD card.

[ParamComputer] : apply the dot to the file.

[*.rsp] : PPK time file.

[*.ppk] : PPK post-processing file.

[*.txt] : custom TXT file.

[*.csv] : custom CSV file.

[*.dxf] : DXF file.

[*.shp] : SHP file.

[*.csv] : Excel file.

[*.dat] : Cass7.0, Scsg2000, and PREGEO data files.

[*.stl] : Hi-RTK record point library file.

[*.line] : line library file.

[*.sec] : line meta files.

[*.PHI] : intersection file.

- [*.xy] : iron courtyard.
- [*.csv] : five pile files.
- [*.icd] : Elcad format.
- [*.zline] : coordinate method file.
- [*.pvi] : change the slope point file.
- [*.tpl] : cross section design line file.

9.3.2 File format specification

1. Intersection of road plane design line [*.PHI]

PHI: Point of Horizontal Intersection.

PHI file is stored in a text format, separated by a comma, and the first line is the format description [when the program reads it], starting from the second line, and a behaviour of the internode information; the storage format is:

Intersection number, coordinate N, coordinate E, starting range, curve radius, forward detente curve, then detente curve

Intersection number, coordinate N, coordinate E, starting range, curve radius, forward detente curve, and then detente curve.

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

2. Road plane line element file. [*.Sec]

Sec: short for Section.

Sec files are stored in text format, separated by commas.

The first line is: the starting information format specification [skip] when the program is read.

The second line is: the starting point of the line, including the starting point, starting distance,

and starting point angle.

The third line is the line element format specification.

The fourth line is: the beginning line is a line element information.

Its storage format is: type, starting radius, end radius, line element length, deflection direction.

Note: *. Type: straight line, arc, detente curve

*. Radius: -1 represents infinity.

*. Deflection direction: left L; Turn right R

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

3. Road longitudinal section changes the slope point file [*.PVI]

PVI: short for Point of Vertical Intersection.

PVI files are stored in text format, separated by commas.

The first line is the format specification [skip] when the program is read.

From the second row, the row is a slope point information; its storage format is:

The slope of the slope is S, the elevation of the slope is H, the first slope is higher than i1, the

second slope is i2, and the circle radius is R.

%The sample

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

4. Road cross section design line document [*.tpl]

TPL: short for Template.

The TPL files are stored in text format, separated by commas.

The first line is the format specification [skip] when the program is read.

Second behaviour left design line.

Third behaviour right design line.

Its storage format is: the left design line [distance, slope ratio]\r right design line [distance, slope

ratio].

Left design line [distance, slope ratio]\r right design line [distance, slope ratio]

10, -0.1, 1, 0, 10, 1, 1, 0, 10, 1

10, -0.1, 1, 0, 10, 1, 1, 0, 10, 1

The cross-section point library (*.cst) can be opened directly with notepad, and the coordinate points of data exchange module can be exported *.csv, sample points, control points can be exported or imported *.txt format, which facilitates data exchange with the computer.

(1) Export Excel file (*.csv)

Roll call, N, E, Z, describe information

4, 20.9919, 7.8963, -0.0147, Test

(2) Sample library import/export Txt file (*.txt)

Roll call, N, E, Z, description, set point range, whether it has been lifted (0: no, 1: yes)

1, 2542604.5095, 434458.4638, 47.5900, Lk pile 1, 10.0000, 0

22, 2542604.5062, 434458.4614, 45.4771, Street lamp, 30.0000, 1

(3) Control point library import/export Txt file. (*.txt)

Roll call, N, E, Z, description, coordinate type (0:blh, 1:xyh), B, L, H

t, 2542604.2867, 434459.2702, 47.9231, control points A, 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

(4) Cross section point library format (*.cst)

CrossSec points[Ver:1]

E, N roll call, north coordinates, east coordinates, elevation plane Z, WGS84 latitude raw measurement data, B WGS84 longitude L raw measurement data, WGS84 raw measurement data height H, high target, high target type, the antenna type [manufacturer:type], north coordinate RMS values, East coordinates the RMS value, surface elevation RMS value, type, number of smooth, recording time, satellite altitude Angle, visible satellite number, Shared satellite number, PDOP value difference ages, setover, mileage (cross-sectional defined mileage), by collecting the real-time mileage by inverse calculation of coordinate, defined when mileage in the section of the pile point collection N coordinates, acquisition defined when mileage in the section of the pile point coordinates, E acquisition defined when the tangent of the transverse section is in the center of the road.

pt0, 321.83562359172527, 75.99595486273756, -0.7214999980390115, 00:00:10.445790N, 109:30:49.422520E, 0.0, 0.609600000000044, 0, Hi-Target:V30, 0.014002636, 0.011343374, 0.016180737, Single point positioning, 1, 2013-10-08 15:07:16, 0, 19, 0, 1.7887421, 1.0, 6.263659450178594E-5, 30.0, 31.30462646484375, 321.0, 75.0, 0.8726646259971647.