

SMA Survey App User Manual

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Read before use:



Please use the software strictly according to this manual! If you have any questions during use, please contact the service personnel in a timely manner.

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1 Introduction

1.1 Instructions for use

Welcome to the SMA Survey app (hereinafter referred to as SMA Survey or app) manual, which introduces how to set up and use SMA Survey.

1.2 Technical services

If you have any technical questions, please contact us and we will answer your questions in a timely manner.

E-mail: tech@smajayu.com; support@smajayu.com;

1.3 Comments and recommendations

If you have any comments or suggestions on this manual, please contact us. Your feedback information will greatly help improve the quality of our manual.

2 Software Overview

2.1 Software introduction

SMA Survey is an Android platform measurement software launched by SMAJAYU. It is combined with SMAJAYU GNSS receiver to provide users with high-precision measurement results. Users can use this app to control, query, or manage corresponding hardware products. This article takes SMAJAYU 20 series as examples to introduce users' operations such as setting and switching working modes, data measurement, and using commonly used tools on the device after connecting to the app.

2.2 Software features

Feature-rich and meticulous

From project creation, coordinate system selection, coding management, to point measurement, point stakeout, CAD stakeout and editing, to rich and practical tool modules, we delve into the industry, refine settings, and approach user scenarios.

• Fresh interface, intuitive icons

Page interaction minimalist design, what you see is what you get, making it more convenient for field surveyors to use.

Coordinate system

Powerful coordinate system function module, built-in EPSG predefined coordinate system, supports plane, elevation mesh model and geoid model correction, supports RTCM1021~ 1027 coordinate correction.

• External data and layer management

Support overlaying vector graphics on the map, including formats such as * .shp, * .xml, * .sjw, * .dxf, * .dwg, etc. You can also modify layer names, layer colors, and layer display/hide.

COGO calculation

Support commonly used measurement and calculation functions, including: reverse calculation, point-line distance, eccentric point, deflection angle, intersection calculation, line segmentation, arc segmentation, triangle, etc.

Online tutorials

The app provides online tutorials. You can watch operation videos while connected to the internet, or share links to watch on other browsers.

2.3 Software installation

SMA Survey can be obtained in the following ways:

1. The field handbook that comes with RTK products has been pre-installed with SMA Survey software. After a new version is available, the handbook will prompt for upgrade when it is connected to the Internet. Follow the upgrade wizard to operate:

2. Copy the * .apk installation file to your Android device and click Program to install it. After successful installation, the icon of SMA Survey will appear on the device desktop.



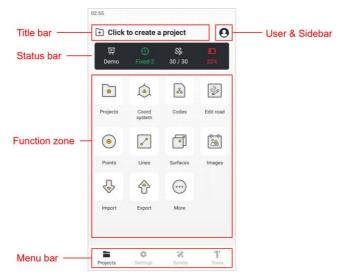
2.4 Interface introduction

When running the software for the first time after installation or update, the system will select the language used by the app based on the Android device language. If there is no corresponding language, English will be selected by default. After clicking "OK", you need to grant the software file management and other permissions. It is recommended to allow such permissions, otherwise the app may run incorrectly.

After selecting [**OK**], enter the main page, where there are a total of four menus at the bottom: Projects, Settings, Survey and Tools. The function categories are clear.

2240	
Please select language	
English	~
Deutsch	
Español	
Ελληνικά	
Français	
Italiano	
Magyar	
Polski	
Português	
ок	

When the SMA Survey connection receiver is working properly, the main page area is divided as follows:



2.4.1 Title bar

Display the current project name. If there is no project, display [Click to create project].

2.4.2 Status bar

Name	Icons and descriptions							
Communication status	① Null	ကု In-Radio	(∕¦») Ex-Radio		11 Controller		ي م	
					•	Receiver	Demo	
Positioning state	\odot	••	\odot	• • •				
	Initial	Single	RTD	Float	Fixed	<u> </u>		
Star search status	≫ 27 / 35							
	27735		∎		D			
Power status	(0,30)	[30,50)	[50,70)	[70,90)	[90,100]	Charging		

2.4.3 Function zone

Display the functions that can be used under each menu module. Long press the function icon to activate the editing status. Drag and drop to reorder. Click the red delete button in the upper right corner to hide the icon in the page [**More**].



2.4.4 Menu bar

It includes four functional modules: "Projects", "Settings", "Survey", and "Tools". Click on any module to switch to the corresponding page and display the corresponding function icon.

		* O ¥	4G 🛋 🛢 10:28	8		* 0 *	4G 🛋 🗎 10:28	•		\$ O \$	4G 🛋 🗎 10:28	8		* 0 *	4G 🛋 🗎 10:2
SMAJ	AYUSurve	ry	0	🖹 SMAJ	AYUSurve	ry	0	SMA.	JAYUSurve	ry	0	SMA	JAYUSurver	у	0
ঢ় Demo	(Flo	Ð et-3	Sý 30 / 30	Demo		⊕ at4	8% 30/30	핒 Demo		€ atr3	8% 30/30	Demo	() Floa		86 30 / 30
		*	-	-	P	8	()	®	۲	Q.,	<u>()</u>	٢		6	þ
Projects	Coord System	Codes	Edit Road	Connection	Rover	Base	General	Measure & Draw	Measure	Stake Points	Stake Lines	Area	Coord Transf	C060	Serial Port
۲	P		000	8	auğea	×	(4)	8	\square		70	1990 1990	ф.	Ģ	
Points	Lines	Surfaces	CAD Files	Device Info	NMEA Output	Static	Turn Off Receiver	Stake Road	Stake DTM	Site Calibration	Base Shift	PPK Calc	Unit Converter	Grid to Ground	Volume
2	₽	Ŷ	\odot	\odot					30	٨Ŷ	2	\odot			
Images	Import	Export	More	More				Stake CAD	Edit CAD	Auto Measure	Measure Control	More			
Projects	¢ Settings	₩ Survey	1° Tools	Projects	© Settings	2 Survey	1° Tools	Projects.	© Settings	X Survey	1° Tools	Projects.	t Settings	2 Jarvey	1 Tools
\bigtriangledown	(С		4		0		<	1 (0			a c		

3 Quick Start

This chapter takes SMA20 built-in radio station 1 + 1 (base station + rover station) as an example to introduce the operation of quickly binding the receiver for data measurement.

The specific operation steps are as follows:

3.1 Preparation work

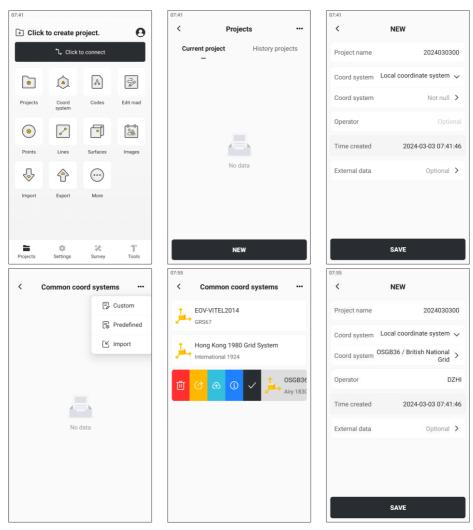
Prepare two sets of RTK equipment and a controller with SMA Survey installed.



3.2 Create a new project

- Open SMA Survey, select [Projects] → [Projects], click the bottom button [NEW], enter the project name, usually named after a date or other name. After editing the project name, select [Coord System] and select the coordinate system required for the project. You can select [...] in the upper right corner and add the required coordinate system to "Common Coordinate Systems" through [Custom], [Predefined] or [Import]. After adding, you can click on the corresponding coordinate system and click [✓] in the sidebar.
- 2. After all settings are set up, click [Save] to complete the project creation.

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3.3 Set working mode

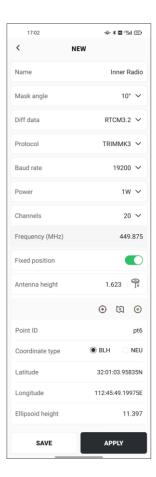
3.3.1 Base station setting

Click [Settings] \rightarrow [Connection], select **RTK** as the Device Type and **Bluetooth** as the connection Mode, then select the Bluetooth number (SN number suffix) of the base station, and click [CONNECT]. After the connection is successful, select [**Base**], click the bottom button [**NEW**], select [**Internal Radio**], enter the name, and configure GNSS parameters. After the configuration is completed, click the bottom button [**APPLY**].

Connection Device Type RTK Connection Mode Bluetooth Paired Devices * GNSS2400024 GNSS2400022 GNSS2200121 Bluetooth Devices Bluetooth Devices



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3.3.2 Rover station settings

After configuring the base station, disconnect and prepare to configure the rover station. Click [**Connection**], select the Bluetooth number (SN number suffix) of the rover station, and click [**CONNECT**]. After the connection is successful, select [**Rover**], click the bottom button [**NEW**], select [**Internal Radio**], and enter the radio parameter configuration interface, and pay attention to keeping them consistent with the base station. After completion, click [**APPLY**]. The controller prompts a fixed solution, and the instrument is successfully set up.

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< Rover	9:41.AM < NEW	🔳 lh. 🗢	9:41 AM	≑ .at∎ EW
TCP Network: Controller Network Pr: 45644 Part: 15646	Name	Internal radio	Name	Internal rad
	Pair mode	Channels 🗸	Pair mode	Channels N
Internal Radio Receive diff data by Internal Radio	Protocol	TRIMMK3 🗸		ver
A Ntrip	Baud rate	19200 🗸	parameters	· · ·
Receive diff data by Ntrip	Channels	20 🗸	2 Setting receive	er 🥑
Receive diff data by TCP	Frequency (MHz)	449.875	٥	к
NEW	SAVE	APPLY	SAVE	APPLY

3.4 Site Calibration

After obtaining a fixed solution for the instrument, if there are no coordinate parameters, the parameters need to be converted. Click [Projects] → [Points], click [NEW] or select [Import] in the upper right corner, enter the point name, select the control point for the point type, enter the coordinates, and click [CREATE]. Generally, two or more points are needed for Site Calibration, which can be added here in order.

10:19			10:20		10:31			
<	Points		<	New	<		Points	
		[ビ Import	Point ID	Enter here	All	~	Filter 🗸	Q Enter key words
		Z Export			No.	Туре	Point ID	Code
		+ Multi-select	Code	Enter or select. 🗸	1	۹	C3	2024-
			Attribute Type	Control point 🗸	2	۵	C2	2024-
			Coordinate type	BLH NEU	3	۹	C1	2024-
			Latitude	00:00:00.00000N				
	No data		Longitude	000:00:00.00000E				
			Ellipsoid height	Not null				
						_		_
	NEW			CREATE			NEW	

 After adding, it is necessary to measure the control points on site. Click [Survey] → [Measure] and enter [Antenna Height]. Note that the antenna height should be consistent with the height of the centering rod. Then, place the centering rod on the control point, strictly center the leveling bubble, and click the [**Measure**] button to measure the control point. After measuring at this point, you need to go to other control point locations and measure the control points one by one.

10:40		10:39				10:41			
< Antenna Par	ameters	<	Demo Fixe		H:0.02 V:0.03	<		Points	
Measured from	Pole length $\!$	Northing	3553952.218 E	asting 95	0291.98	All	~	Filter 🗸	C Enter key words
Measured height(m)	1.8	Height	11.256 L	at 32°01'10	0.13109'	No.	Туре	Point ID	Code
		0	s V M		7.64 m	1	0	pt3	2024-
Total height(m)	1.869		N			2	0	pt2	2024-
Ť	↑	A				3	۲	pt1	2024-
		\otimes	C1	ß		4	۵	C3	2024-
		<u>_</u>				5	۵	C2	2024-
						6	ě	C1	2024-
		8	۲		0		\checkmark	01	2024
		*			Terrain				
		Point ID		pt1	1.8 >			ALC: N	
ок		Code		ptional 🗸	*			NEW	

After the control point measurement is completed, return to [Survey], select [Site Calibration], click [+], and correspond the control points and measurement points one by one. Select two or more pairs of control points, select the point pair to be calculated, click [CALC] → [APPLY]. After completion, we can perform external operations such as Measure, Stake Points, or Stake Lines.

10:46				10:48				11:20				
🖹 V2.0.	.1		0	<	Site o	alibration		<	S	ite calibration	ı	
ाष्ट्र Demo	• Fixed-2	8 3 0 / 30	D 20%	Calibra	tion settings	T horizontal,elevat fitt	GO >	Calib	oration setti	^{ings} horizonta	TC I,elevatio fittio	on >
۲	@	<u></u>	8	List			+	List		Apply successfu	illy	+
Measure	Stake points	Stake lines	Stake road	No.	Point ID	Northing		nt/	Hor accuracy	Ver accuracy		
A	1	70	can l	1	C1	3553948.01	~		0.0009	0.0001	Y	~
Stake DTM	Site	//⊕ Base shift	Stake CAD	2	C2	3553985.85	~		0.0046	0.0001	Y	~
	calibration			3	C3	3553983.712	~		0.0045	0.0001	Y	
Can and a start of the start of	Y.		0									
Edit CAD	Auto measure	Measure control	Visual measure									
10 N	()										-	
Projects	© Settings	Survey	1 Tools	PREV	IEW	CALC	PPLY	PR	EVIEW	CALC	AP	PLY

4. Note that when the base station shuts down or moves, the position of the base station changes and requires a base station translation operation. Click [Base Shift], the operation here is similar to Site Calibration, but only requires one pair of points. Select the corresponding [Measure point] and [Known point], and click [CALC] & [APPLY].

11:22	
<	Base shift
Measure point	• 11 •
Point ID	Optional
Latitude	00:00:00.00000N
Longitude	000:00:00.00000E
Ellipsoid height	Not null
Known point	()
Point ID	Optional
N(X)	Not null
E(Y)	Not null
CALC	APPLY

3.5 Data measurement

Only when the positioning state is fixed and the **Site Calibration** meets the requirements can the measurement work be carried out. SMA Survey supports conventional measurements, such as **Measure**, **Measure Control**, **Auto Measure**, **Stake Points/Line/DTM** as well as unconventional measurements such as **Measure & Draw**, **Stake Road**, **Stake CAD**, etc.

₩ Demo		Ð ed-3	8 5 30 / 30
	0	8	<u>,</u>
Measure & Draw	Measure	Stake Points	Stake Lines
8	\mathbb{N}		ħ
Stake Road	Stake DTM	Site Calibration	Base Shift
(m)	11	٨Ŷ	
Stake CAD	Edit CAD	Auto Measure	Measure Control
0			
Visual Measure	More		
Projecta	¢ fetirga	X Survey	T Tools

3.6 Data export

After the measurement is completed, click [**Projects**] \rightarrow [**Export**]. Configuration information is as follows:

Name	Description					
Format	Optional text format and other formats					
	Corresponding to different format types, different export formats can					
Format name	be selected, text format can be customized, other formats support					
	* .dat/* .kml/* .dxf/* .shp/* .NCN/* .sim/* .html/* .xls					
Туре	Optional 5-point types					
Time	Customizable time period, export data within that time period					
Data Sort	In chronological order or reverse order					
Code	It can be exported after filtering by code.					

4 Personal center

4.1 Voice prompt

You can set whether to enable voice prompts, and drag the slider to increase or decrease the prompt volume.



4.2 Language

Currently, the software supports multiple simplified Chinese, English, German, Spanish, Greek, Portuguese, Russian, Japanese, etc.

When switching languages, in order to ensure the integrity of the app display and functions, the app will automatically restart.

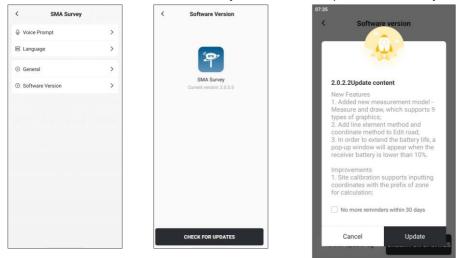
16:55		
<	Language	
English		~
Čeština		
Deutsch		
Español		
Ελληνικά		
Français		
Italiano		
Magyar		
Polski		
_		
	ок	

4.3 General

Click on [General] to open the software's general global configuration. For detailed information, please refer to Chapter7.5.

4.4 Software version

Click on 'Software Version' to view the current software version number. Click on 'Check for New Version', and if there is a new version, you can choose to update it immediately.



5 Projects

5.1 Projects

5.1.1 New

Before using a RTK job, you must create a new project to manage the data. Open SMA Survey, select [**Projects**] \rightarrow [**Projects**], click the bottom button [**NEW**], enter the project name, usually named after a date or other name.

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07:41				07:41			07:41	
🕂 Click	to create p	roject.	0	< Proje	ects		<	NEW
	ጊ Click	to connect		Current project —	History project	s	Project name	2024030300
۲		~	Z				Coord system	Local coordinate system \checkmark
Projects	Coord system	Codes	Edit road				Coord system	Not null ゝ
	~		[20]				Operator	Optional
Points	Lines	Surfaces	Images	, (=	= N		Time created	2024-03-03 07:41:46
Ŷ	Ŷ	•••		No d	ata		External data	Optional >
Import	Export	More						
Projects	© Settings	Survey	1° Tools	NE	w			SAVE

After editing the project name, select [**Coord System**] and select the required coordinate system for the project. You can select [...] in the upper right corner and add the required coordinate system to [**Common Coord Systems**] through [**Custom**], [**Predefined**] or [**Import**]. After adding, click the corresponding coordinate system and click [**·**] in the sidebar.

< Common coord systems	Common coord systems	07:55 < NEW
🕞 Custom	EOV-VITEL2014	Project name 2024030300
Predefined	GRS67	Coord system Local coordinate system 🗸
[L' Import	Hong Kong 1980 Grid System	Coord system OSGB36 / British National Grid >
	🛅 🕜 🙃 🛈 🗸 🔔 OSGB3€ Airy 1830	Operator DZHI
		Time created 2024-03-03 07:41:46
No data		External data Optional >
		SAVE

External data is optional and supports adding base maps to measurement maps. Currently, four formats are supported: * .dxf, * .shp, * .xml, and * .kml. Selecting a layer allows you to choose to show/hide, delete, or edit.

Note: To ensure the smoothness of map operation, it is recommended to add a file size of no more than 10 MB.

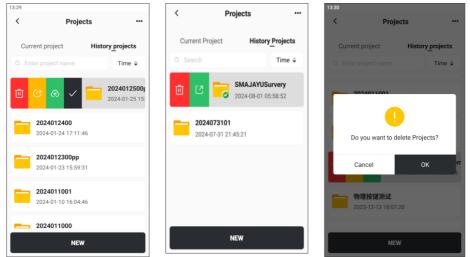
13:17			13:17				13:18			l
<	External data management		<	External data man	agement		<	External data ma	nagement	••
•	Strand-cgcs2000-2.dxf	•	•	Strand-cgcs2000-2.dx	:	•	-	Strand-cgcs2000-2.d	xf	
•	Leica sample.dxf	•		Leica sample.dxf		•		Leica sample.dxf	•	
			0			•	0		•	ļ
			0 Gr	0 Grid Lines & Text 🤤		c				
			10a	10a Spline Long & Open 🕺 📋 🌖 🌻						
			10b	10b Spline Closed 🤤			Confirm delete selected layer?			
			11a	11a Ellipse 🥊		•		Cancel	ок	l
			11b	Ellipse Circle		•	11b	Ellipse Circle	•	
			12a Ellipitical Arcs Large 🥊 🌻		•	12a	Ellipitical Arcs Large	•		
			12b Elliptical Arcs in Array		•	12b	Elliptical Arcs in Array			
			13a MText Flat 🤤		•	13a	MText Flat	•		
			13b	MText Rotated		•	13b	MText Rotated		b

After all settings are set up, click [SAVE] to complete the project creation.

5.1.2 Delete

Click on [**History Projects**], click on a project (open or unopened) in the project list, side-swipe buttons will be displayed, click the red delete icon, and a deletion confirmation dialog box will pop up. Click [**OK**] to delete the project file; select [**Cancel**] to cancel the box.

Note: It cannot be restored after deletion, please operate with caution.



5.1.3 Open

If you need to continue a previous project, you can open it. Select the project and click [✓]. When you need to open another project, also select the project you want to open in the [History Projects] interface and click [✓].

5.1.4 Upload and download

Project files can be uploaded to My Cloud Drive and downloaded locally from it, and the project can also be shared with other SMA Survey users. For details, please see **Chapter 5**.

5.2 Coord system

The coordinate system parameters include: ellipsoid, projection, seven parameters, four parameters/TGO horizontal, elevation fitting, plane grid model, elevation grid model and geoid model.

13:51		13:51				
< Coord system parameters		< Pr	ojection	< Coord	d system parameters	
Coord system Coord system dem				Coord system	ビ Import	
	denno	Projection	Gauss-Kruger 🗸	ooora oyotam	Z Export	
 Ellipsoid 	>	Central meridian	120:00:00.00000E 🛛 🔀	 Ellipsoid 	Bluetooth	
Projection	>	Origin latitude	00:00:00.00000N	 Projection 	Common coord sy	stems
Seven parameters	>	False easting	500000	Seven para	meters	>
Four parameters/TGO horizontal	>		300000	Four param	eters/TGO horizontal	>
 Elevation fitting 	>	False northing	0	 Elevation fit 	ting	>
Plane grid model	>	Projection scale	1	Plane grid r	nodel	>
Height grid model	>	Projection height	0	Height grid	model	>
Geoid model	>			Geoid mode	el	>
			ок			

[**Ellipsoid**]: Including ellipsoid name, major axis, reciprocal of flatness, etc. Semi-major axis and reciprocal of flatness do not need to be set, they can be set to default values, also the parameters here can be edited.

[**Projection**]: Built-in commonly used projection methods, including Gauss-Kruger, Transverse Mercator, UTM projection, etc., and display the parameters of each projection model. Usually, only the central meridian needs to be changed. If you customize the coordinate system, you can input the average longitude of the measurement area, and the longitude error is generally required to be less than 0.5 degrees.

- Central Meridian: After opening the software and connecting to the instrument, click the Get icon to obtain the central meridian of the measurement area; or when the input central meridian longitude does not match the actual longitude of the measurement area, it will prompt "Detected that the central meridian deviates too much from the current coordinates, please correct it" during measurement, click [OK] to jump to the coordinate system parameter interface, and click the Auto Get icon to obtain the central meridian of the current position.
- **False Easting**: In order to ensure that the converted coordinates are positive, the east-facing add constant is generally defaulted to 500,000 meters, which can be filled in as needed.

[**Conversion Parameters**]: Represents the mathematical model used for the conversion of two coordinate systems. The benchmark conversion model (including three parameters, seven parameters, and ten parameters). If the user has local seven parameters, they can directly input them without Site Calibration.

- Seven-parameter: At least three known points are required (known points can be coordinates in the national coordinate system or coordinates with a small rotation between the WGS84 coordinate system, preferably with three or more known points to check the correctness of the known points). This method solves the model rigorously, so it requires high coordinate accuracy of the known points and is generally used in large-scale operations. When the accuracy of the known points is not high, it is not recommended to use seven parameters.
- **Three-parameter**: At least one known point (the known point can be a coordinate in the national coordinate system, or a coordinate with a small rotation between the WGS84 coordinate system, preferably two or more known points, which can check the correctness of the known points), used in a small range, the accuracy is determined by the operating range, and decreases with the increase of the operating distance.

[Four parameters/TGO Horizontal]: After finishing Site Calibration and application, the correction parameters will be displayed on the coordinate system parameter interface.

[**Elevation Fitting**]: Currently, four algorithms are supported for elevation fitting: single benchmark, plane Fitting, surface fitting and TGO vertical. Plane fitting is selected by default.

• Plane fitting: refers to generating an optimal fitting plane corresponding to elevation anomalies at multiple horizontal points. When this plane is parallel to the horizontal

plane, plane fitting is equivalent to fixed error correction. This fitting method requires at least three starting points.

• Surface fitting: refers to generating the best fitting parabola corresponding to elevation anomalies at multiple leveling points. Surface fitting requires relatively high starting data. If the fitting degree is too poor, it may cause the elevation correction number in the work area to diverge, and the fitting requires at least five starting points.

[**Plane Grid Model**]: The representation of a plane is usually achieved through a twodimensional array or list. Each element of this array represents a point on the plane, and the coordinates of that point can be determined by its x and y values. To better describe this plane, we usually use a grid model, which consists of a series of rectangular grids with equal side lengths and known positions and directions in the coordinate system. In this way, we can more conveniently manipulate and study the plane, such as measuring distances and determining whether a point is on the plane.

[**Elevation Grid Model**]: A way to represent height information in three-dimensional space. In this model, we divide three-dimensional space into several equal small blocks, each of which is called a "unit", and each unit has an "elevation value" representing its height.

[**Geoid Model**]: After clicking to enter, turn on the [**Use**] switch and select the geoid model file. Currently, the software supports geoid model files in formats such as * .tif/*. gtx/* .asc/*. grd/*. ggf.

The plane grid model, elevation grid model and geoid model all support online downloads. Currently, the software platform has built-in commonly used correction models worldwide and supports filtering by continent and regions.

00:36			00:41		
<	Geoid model		<	Download model	
Use			Continent	North A	merica 🗸
File path	Please select 🗸 🗌 🔕		Regions		USA \checkmark
			List	Q Enter here	
			6379394386	491280723406560.xls	
			G12BUS.ggf		۲
			G12B-MN.gg	ıf	
ок				DOWNLOAD	

Establish the relationship between geoid model correction and RTCM1021-RTCM1027 receiving correction information, with priority given to RTCM1021-RTCM1027 correction information. When using RTCM1021-RTCM1027 correction information, if there is a message of 1023 or 1024, the geoid model cannot be selected. If RTCM1021-RTCM1027 correction information is not used, or if RTCM1021-RTCM1027 correction information is used but there is no message of 1023 or 1024, the geoid model can be selected.

Note: When switching from a single base station to multiple base stations, if you want to use the original Site Calibration parameters to cause a fixed difference between coordinates, you can create a new project using this correction parameter to eliminate this fixed difference.

5.3 Codes

The main function of codes is to finely manage the codes of different work environments, such as water conservancy measurement and road measurement, which require different codes. Establish multiple code sets, store them separately, and choose different code sets for different projects.

Go to [**Codes**] and click the [...] button in the upper right corner. You can import codes from the outside or from the code template, or save the current codes to the code list.

15:49											18:26					
<	C	Codes		<				Codes		•	<		Code te	emplate	9	
All	✓ Q Er	nter key words		AI		~	Ľ	Import			8	CASS Default	Counts:	185		
Туре	Code name	Code group	Symbol	ту	pe	Co	Ľ	Import from cod	le template			EPS				
Point	Flower	No group	•	Po	int		۳	Save to code ter	nplate		_	Default	Counts:	1386		
Point	tree	No group	+	Po	int		tree	No group	+		ŵ	C E	ð (1	~	4	Terrain 2024-03
Line	road			Li	ne		road									
		NEW						NEW			e	NE	W CODE	TEMPL	ATE	
		NEW						NEW				NE	WCODE	TEMPL	are	

Click [**NEW**] button at the bottom to create a code. It supports three types: point, line and polygon. You can set rich properties for the code.

Name	Description	
Code name	Enter code name	
Code type Optional types include: point, line, surface		
Code ID	Optional, supports letters and numbers, some industry	
Code ID	software supports recognition	
Code group Group management can be performed on encoding		
Description	Not required	
Currele e l	Node symbols, optional circle, cross, diamond, square,	
Symbol	triangle, etc	
Color	Set the color of the node symbol	
Contour	The contour line type of line/polygon elements can	
Contour	choose different dotted lines, solid lines, etc.	
Contour color	Set the color of the contour line	
Fill at da	When the target is a polygon element that is closed by a	
Fill style	line or directly created, optional filling	
Fill color	When the fill style is Fill, you can set the color of the fill.	
Preview	Preview able contour and fill styles	

17:34 <	New code	17:35 < New	code
Code name	Enter here	Code name	Enter here
Code type	Point 🗸	Code type	Line 🗸
Describe	Optional	Describe	Optional
Symbol	• ~		
Color	— ~		
			_
		Contour color	• •
		Fill style	Fill 🗸
	ок	0	к

5.4 Points

Points is used to unify the management of various types of coordinate points, including **Measure Point**, **Stake Point**, **Input point**, **Control point** and **Base point**.

Enter [**Points**], all points are in the point list, and can be filtered through the first line button.

- 1. [**Point Type**]: All points are displayed by default. Click to pop up the point type selection dialog box, which can quickly filter by type.
- 2. [**Point Filter**]: Provide 4 filtering methods, optional time, range of point IDs, wildcard (*) and code.
- 3. Search box: Can perform fuzzy search on point name and code.

19:55				19:58				
<		Point	s •••	<		Points		
All	~	Filter ~	C Enter key words	All	~	Filter 🗸		words
No.	Туре	Point ID	Code	No.	Туре	Point ID	Code	
1	0	P11-3	2023-		All			
2	0	P11-2	2023-		Measure	point		
3	0	P11-1	2023-		Stake poir	nt		
4	۲	P10-3	2023-		Input poir	nt		
5	0	P10-2	2023-		Control po	pint		
6	۲	P10-1	2023-		Base			
7	۲	P7-3	2023-	7	۲	P7-3		
	0				-		-	×
		NEW			间 Delete	↑ Export	Stakeout	

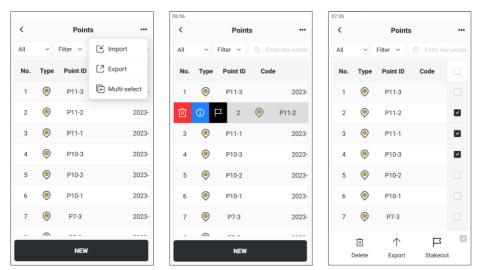
The point list displays the attributes of points in the form of a table, including:

No.	Time	Latitude (B)	Diff age
Туре	Northing (N)	Longitude (L)	HRMS
Point ID	Easting (E)	Ellipsoid height (H)	VRMS
Code	Elevation (U)	Status	Counts (refer to stake)

Click on the top right corner [...], a pop-up menu will appear, and you can choose [Import], [Export], or [Multi-Select].

Click on a point, the line slides sideways, and three operation buttons appear: **Delete**, **Details** and **Stake**. Click [**Details**] to view and modify the detailed properties of the point, including **General**, **Quality** and **Media** information.

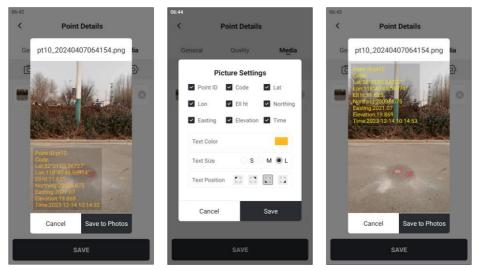
Click [**Multi-Select**] or long press a certain point to enter the multi-select interface. Select multiple points to achieve batch deletion, export or stake.



View [**Point details**], the general information has different editable attributes depending on the type of point. Quality information cannot be edited. Media information displays photos, videos and audio files at the same time.

07:33			07:34			07:38		
< Point details		<	Point details		<	Point deta	ils	
General	Quality	Media	General	Qu <u>a</u> lity	Media	Gene	al Quality	Media
Point ID		P11-1	Status		Fixed	Ō	Q	<u>ک</u>
Code		Optional 🗸	Obs times		30	() Р	11-1_2024030720280	5.jpg 🛞
Туре	I	Measure point	Max diff ag	le	2	P	11-1_2024030720291	5.mp4 🙁
Coordinate ty	ре ВLН Х	YZ INEU	Min diff ag	e	1	P	11-1_2024030720293	8.amr 🙁
Northing		3544433.734	GPS		4/8			
Easting		383167.509	BDS		16/17			
Height		11.547	GLONASS		6/6			
Antenna type		Trion V1	GALILEO		6/7			
	SAVE		QZSS		0/0		SAVE	
			Total		32/38			

Media information supports adding photos, videos and audio files to the point. Click the list thumbnail to preview. Click the setting button to set the basic information displayed when previewing the photo. Click the bottom button [**Save to Photos**] to save the photos with watermark information to the system photos.



5.5 Lines

Lines is used to store the position of line elements. When staking lines, you can directly select the target line from Lines. In the line list, click on the card to display executable operations: delete, preview and details.

:03		01:11	
<	Lines	••• <	Lines
C Line2 Start mileage: 2D length: 431.			ne2 iileage: K0+000.000 jth: 431.301 Radius: 544.31 3
O Line3 Start mileage: 2D length: 145			ne3 iileage: K0+000.000 th: 1453.463 Radius: 231.32 6
Line4 Start mileage: 2D length: 683		匝	Start mileage: K0+000.000 2D length: 683.989
Line5 Start mileage: 2D length: 948.			ne5 nileage: K0+000.000 th: 948.917 Node count: 5
	NEW		NEW

5.5.1 Line introduction

Click the bottom button [**NEW**] to create lines. Straight line, polyline, Circle, Arc and Line &Arc are optional:

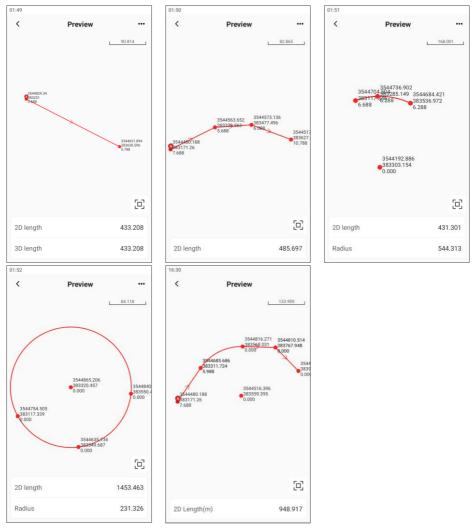
Line type	Creation method		
Straight line	Start point + end point		
Straight line	 Starting point + azimuth + length 		
Polyline	Measurement point selection/map selection/library selection		
Circle	Three points		
Circle	Center + radius		
	Three points		
Arc	Two points + radius		
	 Start point + azimuth + length + radius 		
Line & Arc	Add straight line/add arc		

Once created, click the card in the line list and select Details to edit and preview.

		01:23			01:25	
<	Lines	<	Edit		< Edit	
		Line type	s	Straight line		
C Line2		Pattern	Start point and end	point V	Line name	Line4
			otart point and one	point	Start mileage	0
		Line name		39-34	-	
Straig	ht line	Start milea	ade	0	List	
Polylir	ne		190	Ŭ	Straight line 300.87	
Circle		39	۲	۰	Mileage: K0+000.000 ~ K0 Start northing: 3544502.95	
Arc		34	۲	()	Start easting: 383095.966	
AIC			-		Start height: 5,988 End northing: 3544736,902	
Line +	- Arc	Other			End easting: 383285.149	
Start mileag	ge: K0+000.000	Azimuth	117°06	53.64279"	End height: 6.288	
		Length		433.208	C Arc 383.118	
		PRE	VIEW	ок	PREVIEW	ок

5.5.2 Line preview

Each created line can be previewed to assist in checking the correctness.



5.5.3 Import and export

Click the [...] button in the upper right corner to select **Import**, **Export** or **Multi-Select** operations. Among them, **Export** exports all line types by default, while **Multi-Select** operation is only effective for deletion.

When selecting Import or Export, click the cloud icon in the upper right corner, which supports uploading to or downloading from the cloud.

1) Import

Support importing custom *. Ine format file, which can fully restore the parameters

created during line creation.

Note: This format is currently incompatible with third-party software.

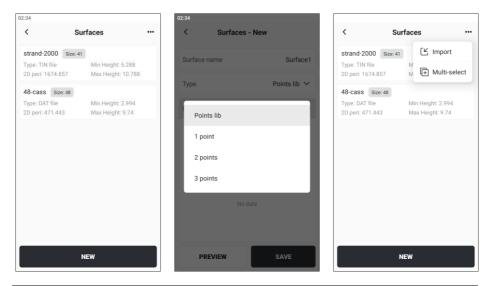
2) Export

		02:05			02:05		
< Li	nes …	<	Export	6	<	Export	<u> </u>
1 1123	🗠 Import	File name	Line_202403	10020437	File name	Line_2024	0310020437
Start mileage: K0+000.00 2D length: 562.141	Export	File type		shp 🗸	File type		shp 🗸
) Line6	(→ Multi-select	© 🗸	*	/		*	
Start mileage: K0+000.00 2D length: 996.668	Node count: 4	Pack	_		Pack		
⊃ Line5		shp			To cloud		
Start mileage: K0+000.00 2D length: 948.917	Node count: 5	Ine			To share		
Line4 Start mileage: K0+000.00 2D length: 683.989	10 Node count: 3		A			A	
O Line3							
NI	EW		EXPORT			EXPORT	

Support exporting custom *. Ine or * .shp format file.

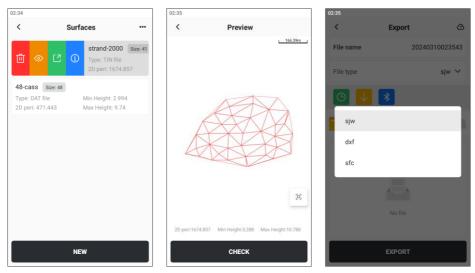
5.6 Surfaces

Surfaces is a location for storing surface type files. It can be called by the programs of Stake DTM and Volume. Click [**NEW**] button at the bottom of the main page to create a surface file; click [...] \rightarrow [**Import**] button in the upper right corner to create a surface by loading the file.



Type of surface	Description
Points	Select several points from Points to create a triangular mesh surface
1 point	Create a surface with one point and a slope of N/E, which extends infinitely and has no preview function
2 points	Create a surface with two points and a slope perpendicular to the forward direction, which extends infinitely and has no preview function
3 points	Create a surface with three points, which extends infinitely and has no preview function
*.dat text file	Create a triangular mesh from points in a *.dat text file (format: point name, code, easting, northing, elevation)
* .sjw/*.dxf/*.xml format file	Load existing triangle mesh files
	Points 1 point 2 points 3 points *.dat text file * .sjw/*.dxf/*.xml

Click on the surface file card to choose from **Delete**, **Preview**, **Export** and **Details**. Except for the three types of surfaces that cannot be previewed, other surface files can be previewed. Click the **Export** button to export the surface file as *.sjw, * .dxf file, or as SMA Survey custom surface file format *.sfc.



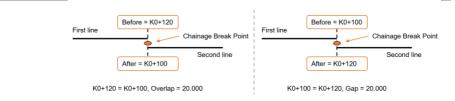
5.7 Edit Road

During road engineering construction, in order to ensure that the structures of each part of the line meet the design and specification requirements, and to better grasp and control the construction quality of the project, technical personnel need to constantly inspect and monitor the centerline and excavation (filling) edge of the line. The main work of **Stake Road** is to calibrate the plane position and excavation height of each pile point on the line.

Before performing road field survey, the road must first be edited or imported.

5.7.1 Glossary

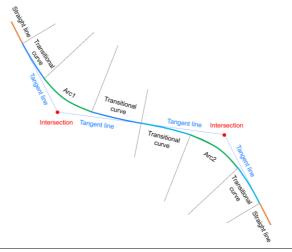
Glossary	Explanation
Intersection	Currently, the commonly used road design method only requires users to
	input the coordinates of the intersection points of the line curves and the
	corresponding information such as the length, radius, and mileage of the
	line to obtain the coordinates of the element points, pile points, and line
	points, as well as intuitive graphic display, making it easy to carry out
	measurement work such as line stakeout.
Element	The line element method, also known as the element method or building
	block method, divides the road according to the properties of straight
	lines, gentle curves, and circular curves. With each section of input, the
	shape of the line can be arbitrarily combined. For complex curves such as
	oval lines, multi-intersection curves, and virtual intersection points, the
	line element method can be used to define them.
Coordinate	Coordinate method is a new road input method developed on the basis
	of traditional element method and intersection method, which is simpler
	and easier to popularize.
	Due to the fact that some roads are composed of straight lines and
	circular curves, and the connection between these straight lines and
	circular curves is not absolutely tangent, in simple terms, the azimuth
	angle of the straight line is 130 °, and the starting azimuth angle of the
	circular curve it connects to is 140 °. This kind of road is more
	troublesome to handle with the element method and the intersection
	method, so a special and relatively simple flat curve design method -
	coordinate method has been extended.
Broken	The phenomenon of discontinuous pile numbers caused by local line
chain	changes or segmented measurements. There are mainly two situations:
	1. Long chain: Front mileage > Back mileage, the connection time is
	longer.
	2. Short URL: Front mileage < Back mileage, the connection is
	shorter.
	Breaking pointThe point where the new and old pile numbers are not
	continuous. Generally set at:
	1. The position where the new line meets the old line exactly.
	2. On a straight line or at points HZ/YZ, it is basically not set on a
	curve.



Horizontal During road construction alignment, due to the influence of terrain
 Alignment factors, the direction of the route on the plane inevitably needs to be changed. Therefore, the route determined by directional measurement is generally composed of broken lines. In order to meet the requirements of driving, curves must be used to connect adjacent straight line segments.



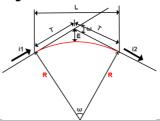
A flat curve consists of straight lines, gentle curves, and arcs.



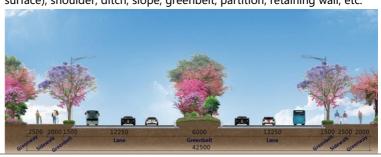
Vertical The intersection of two adjacent longitudinal slope lines on the
 Alignment longitudinal section of the road is called the slope change point. In order to ensure driving safety, comfort, and visual distance, a vertical curve is set at the slope change point. The main function of the vertical curve is to alleviate the impact caused by the change in driving momentum at the longitudinal slope change point, ensuring the longitudinal driving visual distance of the road; appropriately combining the vertical curve with the flat curve is conducive to road drainage and improving the visual guidance and comfort of driving.



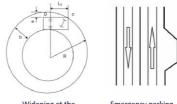
R: Vertical curve radius; L: Vertical curve length; T: Vertical curve tangent length; E: Vertical curve outer distance



CrossSection perpendicular to the centerline of the road. The mainsectioncomponents of the highway cross-section include: roadway (road
surface), shoulder, ditch, slope, greenbelt, partition, retaining wall, etc.



```
    Widths When a car is driving on a bend, the driving trajectories of each wheel are different. The radius of the driving trajectory of the rear wheel on the inside of the bend is the smallest, while the radius of the driving trajectory of the front wheel near the outside of the bend is the largest. In order to ensure that the car does not occupy adjacent lanes when turning, all curve sections with a radius of less than 250 meters need to be widened. Widening includes the following types: turning widening, emergency parking strip widening, and line separation widening.
```



Widening at the location of the turn Emergency parking strip widening

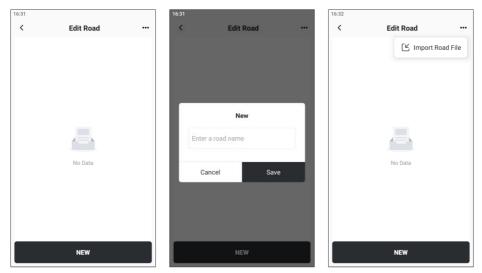
SuperelevatiWhen driving on a circular curve, sliding will occur due to lateral or
centrifugal forces. In order to counteract the centrifugal force generated
by the vehicle when driving on a circular curve section and ensure that
the vehicle can pass through the circular curve safely, stably, meet the
design speed, economically, and comfortably, a one-way horizontal slope
with the outer side higher than the inner side is set on the cross section
of the section. Simply put, when the line turns, one side is raised or the
other side is lowered to overcome the centrifugal force. This is reflected
in the software as changes in the plate slope.

On curved sections of roads, to counteract the centrifugal force generated by vehicles, the road surface is designed as a one-way cross slope with the outer side higher than the inner side. This is called superelevation on curves.



5.7.2 New roads

A project can only display one road file. Go to [**Edit Road**], click [**NEW**] to create a new road file, or click [**Import Road File**] in the upper right corner to open one directly.



A road usually consists of many lines. Click [+] icon to the right of the road file name to add a new line. The newly added line will be displayed in the list.

16:32	16:33
< Edit Road ···	< New Line
	Design Method Intersection 🗸
XR1 Intersection	Line Name Not null
Start Station:K17+312.307	Station Prefix K
XR2 Element Start Station:K17+312.307	Intersection
XR3 Coordinate	Element
Start Station:K0+000.000	Coordinate
NEW	SAVE

The information to be filled in for adding a new line is as follows:

Description						
Optional Intersection, Element and						
Coordinate method						
Enter the name of the line						
Fill in up to two letters						

Start station	Input line start station
Creation time	The time when the line is added cannot be
	modified.

5.7.3 New line - intersection

Select [Intersection] for the design method. After entering the information, click [SAVE] to enter the page Line Details, where you can edit the line or modify the line properties. Click on a line on the main page, select the details button, and you can also open the line details.

Note: once the line is newly built, the design method cannot be changed.

16:33	16:34		16:34		
< Line Details	< Line	< Line Details		Edit Road	
Edit Line Properties	Edit Line	Properties —			+
Broken Chain	Design Method	Intersection \lor	_		
 Horizontal Alignment 	Line Name	XR1	Ū ()	XR1 Intersection Start Station:K17+312.307	
 Vertical Alignment 	Station Prefix	к	XR2 Element	nt :K17+312.307	
	Start Station	17312.307	XR3 Coord		
	Creation Time	2024-03-10 03:43:47	Start Station		
	SA	AVE		NEW	

Currently supports editing broken chain, horizontal alignment and vertical alignment.

1) Broken chain

Click [Broken Chain] on the page Edit Line to enter the broken chain editing page.

1. Broken chain list

Display the overlap and gap, indicating the length, before and after station.

2. Create a new broken chain.

Click [**NEW**] to directly enter the before and after station values. The software will automatically determine whether it is a overlap or a gap based on the input values.

3. Import

You can export broken chain from some industry software, and then import it directly by clicking the import button in the upper right corner.

Note: If there is already broken data in the list, it will prompt that the original data will be cleared.

5:13			05:18		16:35		
<	Broken chain	Ľ	<	Broken chain	<	Broken Chai	'n
Overlap 292.307 Before: 24392.307	After: 24100.000		Before	41235.633		Import broken ch	ain file
Before: 24392.307	After: 24100.000		After	4140d			
Overlap 101.976						EXCEL broken chain file for	mat
Before: 29101.976	After: 29000.000					Suffix: xls,xlsx File Format:No., start station, en	
Delore, 2,9101.970	Antel: 2,9007.000	_				description	station,
Overlap 178.249					6	TXT broken chain file forma	nt
Before: 38778.249	After: 38600.000					Suffix: txt	
						File Format:before station, after	station
Gap 164.367							
Before: 41235.633	After: 41400.000					CSV broken chain file forma	it
						Suffix; csv	
						File Format:before station, after description	station,
						andxml	
						Suffix; landxml	
						File Format:landxml	
						Cancel	ок
	NEW			SAVE			

2) Horizontal alignment

The horizontal alignment is the most important design line in road design, and the three design methods are also distinguished. The advantage of the intersection method is that the input conditions are simple, generally centered on the intersection point, and the intersection method is the most convenient for defining symmetrical lines.

If the line is relatively complex, such as including C-shaped curves, oval curves, convex curves, composite curves, etc., it is recommended to use the element method for definition. In addition, the intersection method is generally used for highway mainlines, and the element method is generally used for interchange ramps.

Click on [Horizontal Alignment] on the page Edit Line to enter the editing page.

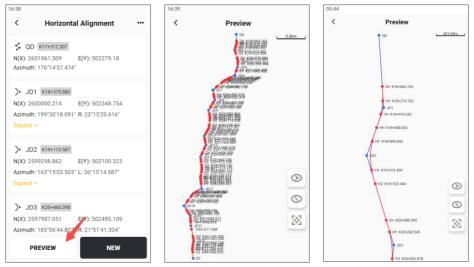
1. Create

Click **[NEW]** to choose from three-point types: start point, intersection and end point. Different point types correspond to different input elements, and intersection points have the most input information. During the adding process, you can also click the card and select the Insert Row button to insert a new row before the current element.

16:36		16:37		16:37	
< Create S	tart Point	< Ade	d PI	< Horizontal Alignment	
Point Type	Start Point 🗸	Point Type	Intersection 🗸	SQD K17+312.307 N(X): 2601061.509 E(Y): 502279.18	
Start Point ID	Not null	PI Name	Not null	Azimuth: 176*14'57.474"	
N(X)	Not null	N(X)	Not null	 > JD1 к18+375.880 N(X): 2600000.214 E(Y): 502348.754 	
E(Y)	Not null	E(Y)	Not null	Azimuth: 199°30'18.091" R: 23°15'20.616" Expand ~	
		Radius	Optional	> JD2 K19+113.587	
		L1	If not exist, enter 0	⊡ Ξ ① N(X): 2599298.862 Azimuth: 163°15'03.503	E(Y 3* L: 5
		L2	If not exist, enter 0	Expand ~	
		Initial Radius of 1st Transition Curve	If infinity, enter 0	> JD3 K20+460.398	
		Final Radius of 2nd Transition Curve	If infinity, enter 0	N(X): 2597987.051 E(Y): 502495.109 Azimuth: 185°06'44.807" R: 21°51'41.304"	_
SA	VE	SA	VE	PREVIEW NEW	

2. Preview

During the input process, you can preview the line and check its direction at any time. During the preview, both the intersection and the main point information can be displayed / hidden.

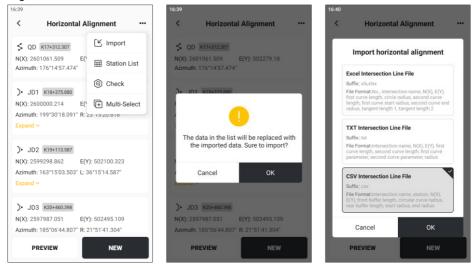


3. Import

Click on the top right corner $[...] \rightarrow [Import]$, you can import the horizontal alignment directly. The app has already adapted some formats.

Note: If there is already horizontal alignment data in the list, it will prompt that the

original data will be cleared.



4. Station list

The station list is an indispensable part of the design and construction of roads, railways, or other linear projects. This list details the precise coordinate information of each station position, which is used to guide the construction team to accurately calibrate the station position and ensure that the project is carried out according to the design requirements.

After entering the station list page, click the configuration button in the upper right corner to set the station interval. There are two incremental methods to choose from: whole station and start point increment, and the station interval is set to 20 meters by default.

If the vertical alignment has been defined, the corresponding station design elevation will be displayed. If it has not been defined, the design elevation will be displayed as N/A.

16:41		
<	Station List	0
	D61.509 E(Y): 502279.18	
Design Elev	ration: 42.091 Azimuth: 176°14'	57.474
	000 053.832 E(Y): 502279.683 ration: 41.937 Azimuth: 176*14'	
	000 033.875 E(Y): 502280.992 ration: 41.537 Azimuth: 176°14'	
	000 013.918 E(Y): 502282.3 ration: 41.137 Azimuth: 176*14'	57.474"
V17:200 0	000	
	EXPORT	

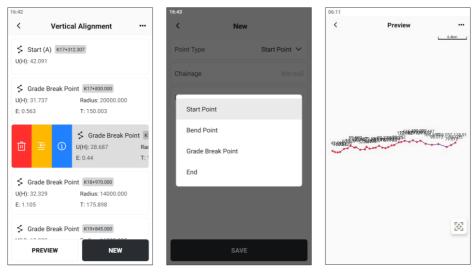
5. Check

The design coordinates can be calculated by the station, offset, and angle, or the relative relationship between the position and the line can be calculated by backtracking the coordinates.

06:02	
< Cł	heck
Traverse	Inverse
Station number	19200
Preceded * indicates overlap	station.
Offset	Optional
+ is right-biased and - is left-	biased
ncluded angle	090°00'00.00000"
Design N (X)	2599199.657
Design E (Y)	502156.904
esign elev	39.689
C/	ALC

3) Vertical alignment

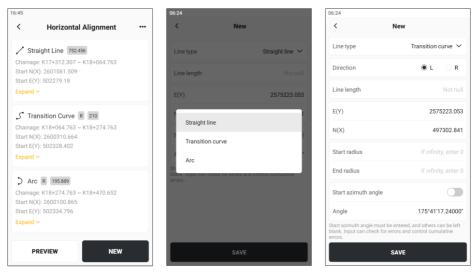
The definition of a vertical alignment is much simpler than that of a horizontal alignment. When adding a vertical alignment, the point type can be selected from the start point, bend point, grade break point and end point.



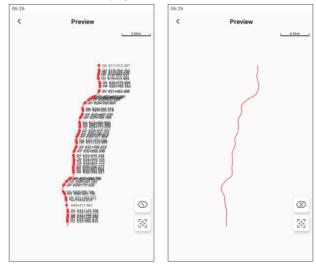
Vertical alignment can also be loaded from files exported by some industry software. The station list function is consistent with the horizontal alignment.

5.7.4 New line - element

The element method is the most commonly used way to define complex circuits. When using the element method to define circuits, the definition of broken chain and vertical alignment is consistent with the intersection method, which will not be repeated here. The only difference is the definition of horizontal alignment. When clicking [**NEW**], the line types can be selected as straight line, transition curve and arc.



During the input process, you can click [**PREVIEW**] to view the graphics, and the main point station information can be displayed / hidden.



5.7.5 New line - coordinate

When only straight line and arc are defined, the coordinate method is the fastest way to create them. Among them, the arc is defined by two points + radius.

16:47	16:47			16:47	
< Horizontal Alignment	 <	New		<	New
Straight Line 0.000 Chainage: K0+000.000 ~ K0+000.000	Line Type	Straight Line	~	Line Type	Arc 🗸
Start N(X): 2601061.509 Start E(Y): 502279.18 Expand ~	Start Point			Direction	● L ○ R
	N(X)	2600100	865	Start Point	
Arc R 752.457 Chainage: K0+000.000 ~ K0+752.457 Start N(X): 2600310.664	E(Y)	502334	.796	N(X)	2600100.865
Start E(Y): 502328.402	End	۵ (۱		E(Y)	502334.796
Expand ~	N(X)	Not	null	End	• • •
	E(Y)	Not	null	N(X)	Not null
				E(Y)	Not null
				Dadine	Not null
PREVIEW NEW		SAVE			SAVE

The main point station information during preview can be set to show/hide. Click $[...] \rightarrow [Import]$ in the upper right corner of the page to organize the table according to the prompt format and import it quickly.

06:34			16:48			
<	Preview	171.86m J	<	Horizontal A	lignment	•••
	• QD KG+000.000	171.600	Chainag Start N(raight Line 0.000 je: K0+000.000 ~ K0 X): 2601061.509 Y): 502279.18		
			Expand	~		
				Import horizont	al alignment	
			Suf	cel table format ffix: xls,xlsx e Format:Start N(X), star ection, radius	rt E(Y), line type,	
	K0+752.457			Cancel	ОК	
	(bernderder	0				
			Р	REVIEW	NEW	

5.8 Images

Click on [**Projects**] \rightarrow [**Images**] on the main page, open all visual measure tasks, there are a total of 3 states:

1. Modeling success

Display the photos used for actual modeling, click to start point measurement

immediately, see Chapter 8.13 for details.

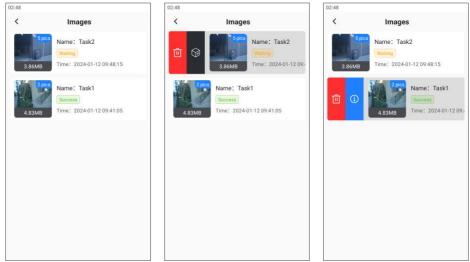
2. Modeling failure

You can browse the photos taken, but cannot start point measurement.

3. Not modeled

Click to execute modeling immediately.

The number of photos is displayed in the upper right corner of the thumbnail for each task. If the modeling is successful, the actual number used is displayed, otherwise the number taken is displayed.



Select the task that has not been modeled to perform modeling. Select the task that has been modeled and start point measurement. Please refer to **Chapter 8.13** for details.

5.9 Import

The data in Points can be exchanged with external data through import and export modules. Click [**Projects**] \rightarrow [**Import**] to open the page **Import**.

17:41				17:41		17:43	
Ē Hi_V2.	0.X		٢	< Im	port	<	Import
庾 Demo		€ ed-1	85 30 / 30	Format 🖲 Te	xt format 🔿 Other formats	Format	○ Text format
Demo		eu i	30730	Туре	Input point 🗸	Туре	Input point 🗸
•		60	-	Format name	p,n,e,h (*.txt) >	Format name	CASS(*.dat) 🗸
Projects	Coord system	Codes	Edit road	Use header			
0	8		2	suffix	TXT (*txt)		
				Separator	Comma (,)		
Points	Lines	Surfaces	Images	Lat and lon format	dd*mm'ss.sssss"		
₽	Ŷ			Format content Point	ID,Northing,Easting,Height		
Import	Export	More					
Projects	© Settings	Survey	1 Tools	N	EXT		NEXT

Name	Description					
	1. Text format: Custom fields, editable format;					
Format	2. Other formats: industry standard formats, which cannot be					
	edited.					
Turae	What type of point is assigned to the imported point.					
Туре	Optional input point, stake point and control point.					
F	Click to open the Format Management dropdown page or					
Format name	select the corresponding standard format.					
Format content Display content details in text format.						

Select [**Text Format**], click [**Format Name**], and open the format management page. The App predefines some formats with suffixes including * .txt, * .csv, * .xlsx, * .xls, etc. Click a format to choose Delete, Details and Apply. Click the Details button to view and modify the detailed information of the format.

:13		18:26	
< Import	+	< Cu	ustom
p,c,n,e,h (*.txt)		Format name	p,c,n,e,
p,n,e,h (*.txt)		Use header	
🔟 🚺 🗸 p,c,n,e,h	i (*.csv)	suffix	CSV (*c
p,n,e,h (*.csv)		Separator	Comm
o,c,n,e,h (*.xlsx)		Lat and lon format	dd°mm'ss.sss
o,n,e,h (*.xlsx)		Point ID,Code,Northin	ng,Easting,Heigh
,c,n,e,h (*.xls)		Optional	Selected
o,n,e,h (*.xls)		Longitude	Point I
p,B,L,H (*.csv) (dd°mm'ss.sss	("222	Latitude	Code
		Ellipsoid height	Northin
,B,L,H (*.csv) (dd.ddddddd))	s	AVE
DII/+) (dd	(200		

Select [**Other Format**], click [**Format Name**], and directly select the corresponding format from the list.

18:28			18:29	
<	Import		<	Import
Format	◯ Text format ●	Other formats	Format	O Text format Other formats
Туре	In	put point 🗸	CASS	S(*.dat)
Format na	me C/	AD(*.dxf) ∨	CAD	(*.dxf)
			KML	(*.kml)
			BLH	SHP(*.shp)
			NEU	SHP(*.shp)
			NET	CAD(*.NCN)
			Japa	n SIMA(*.sim)
	NEXT			NEXT

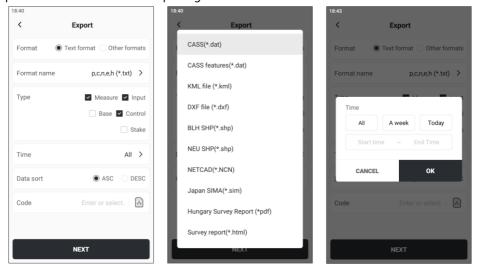
When selecting the file path, you can also click the cloud icon in the upper right corner, select the file from "My Cloud Drive" or enter the sharing code to get the file.

5.10 Export

By using the export module, point coordinates can be exported to the desired format. The coordinate types support two types: BLH and NEU. Select [**Projects**] \rightarrow [**Export**] to customize the export format and export path, or store it to the cloud or create a sharing

code.

Export format selection is the same as importing module. Filtering and sorting parameters are added when exporting.



6 Settings

6.1 Connection

6.1.1 Bluetooth

- Select [Settings] → [Connection], select the device type as RTK, select the connection mode as Bluetooth, select the receiver's Bluetooth number (i.e. the receiver's SN number) in the Bluetooth device list, and click [CONNECT].
- 2. If the corresponding Bluetooth number is not displayed, please check the device status or click the refresh button.
- After the connection is successful, the instrument can be set to the next working mode. Note: The SN number of the receiver can be viewed at the bottom of the device. If the
 Bluetooth connection is not available, you can restart the receiver and search again to pair
 and connect again.

18:07				15:33 🗖 💻 🕰 🖸 -	• * • • • °31 🗲
Ē Hi_V2	.0.X		0	< Cor	nnection
	℃, Click	to connect		Device Type	rtk 🗸
-	_	_		Connection Mode	Bluetooth \checkmark
6	Ĩ	Ā		Paired	GNSS0270001
Connection	Rover	Base	General	GNSS0270001	0
	nmea	0	٩	GNSS2400036	
				RTK_853	
Device info	NMEA output	Static	Turn off receiver	GNSS2400066	
)				Bluetooth Devices	Refresh
\bigcirc				GNSS0270001	~
More					
Projects	Settings	Survey	1' Tools	co	NNECT

6.1.2 Internal Android Device

The app can obtain the location information of internal Android device, and can measure and stakeout with meter-level accuracy. Select the device type as **Internal Android Device**, and simply click to connect.

6.1.3 Simulation

The simulation mode provides rich configuration parameters that can simulate realistic RTK device positions, including motion direction, speed, solution status, diff age and start point coordinate.

6.2 Rover

When the receiver is a rover station, a fixed solution is obtained by setting the differential mode.

6.2.1 Internal Radio

The receiver has two internal radios, 400M and 900M, which have different frequency ranges and configurations.

Name	Description
400M radio	410 MHz ~ 470 MHz
900M radio	840.5 MHz ~ 845MHz, 902 MHz ~ 928MHz

Click [**NEW**] button at the bottom, select [**Internal Radio**], and the configuration information of the 400M radio is as follows:

Name	Description			
Name	Enter a configuration name			
Pair Mode	Channel			
Protocol	Default TRIMMK3, optional TRIMTALK, TT450S,			
Protocol	TRANSEOT, SATEL			
Baud Rate	Different protocols can choose different baud rates			
	There are 25 defined frequency channels by default, and			
Channels	you can also customize the frequency. Note that the			
	frequency range is 410 MHz ~ 470 MHz			
Fraguancy (MHz)	Display the frequency value of the corresponding			
Frequency (MHz)	channel.			

14-32 🛄 🖸 🖉 🚱 🔹 🔹 🕏 HD 🖏 🕢 🐑		∎ ¥ ⊖ ♥4G 4 ∎ 17:03		🗟 🖇 🖨 🏷 4G 🚰 🗎 17:04
< Rover	< Interna	I Radio	< Inter	nal Radio
TCP TCP Network: Controller Network IP: 45464	Name	Internal Radio2	Name	Internal Radio2
Port: 15646	Pair Mode	Channels 🗸	Pair Mode	Channels 🗸
	Protocol	тrіммкз ∨	F. F	Rover
Internal Radio Receive diff data by Internal Radio	Baud Rate	19200 🗸	1 Sending con parameters	figuration 🥥
Receive diff data by Ntrip	Channels	20 🗸	2 Setting rece	iver 🥑
TCP Receive diff data by TCP	Frequency (MHz)	449.875		ок
	SAVE	APPLY	SAVE	APPLY
NEW	⊲ ⊂		\triangleleft	0 🗆

900M radio configuration information is as follows:

Name	Description
Name	Enter a configuration name
Pair Mode	900M radio can only select correlation code
Baud rate	Default 19200, optional 4800, 9600 and 19200
Correlation Code	The format is BSA + 5 bit serial number, consistent with
Correlation Code	the base station setting

14:32 🛄 🛛 🗱 🎱 • 🔹 🔹 🕫 HD "Sul 📼	8:14 рм 🛞	回 🖯 🕯 🛍 🗎 89%	8:14 рм 💿	🤨 🖂 🖬 🗎 89%
< Rover	< Inter	nal Radio	< Ir	iternal Radio
TCP TCP Network: Controller Network IP: 45464	Name	Internal Radio2	Name	Internal Radio2
Port: 15646	Pair Mode	Correlation Code \smallsetminus	Pair Mode	Correlation Code
Internal Radio	Baud Rate	19200 🗸	1 Sending	Rover
Receive diff data by Internal Radio	Correlation Code	BSA00668		receiver 🥑
TCP Receive diff data by TCP				ок
	SAVE	APPLY	SAVE	APPLY
NEW		• •	•	•

After completing the configuration, return to the main page. When using radio communication, you can use the **[RSSI]** in the **[Tools]** to assist in checking the radio signal strength of the receiver.

Note: When the communication method is radio, an external whip antenna is required, and the antennas of 400M and 900M are different.

6.2.2 Ntrip

Click [New] button at the bottom, select [Ntrip], and the configuration information is as follows:

Name	Description
Name	Enter a configuration name
Network	Default controller network, if the receiver supports internet access,
Network	optional receiver network
IP	Enter the IP address or dynamic domain name of the Ntrip server
Port	Enter the corresponding differential source port
	When the correct IP and port are entered, click the icon on the right
Source Node	to automatically get the source node, and then select the correct one
	from the pop-up list
Username	Username verification
Password	Password verification

Click the bottom button [APPLY] and wait for the differential signal to be received.

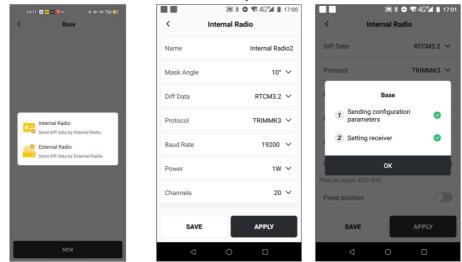
1432 ■ 2 2 2 0 0 + 4 + 0 15d => < Rover	19:07 <	Ntrip	<	ि ≭ ⊂ Ntrip	● 4G" ⊿ 🛢 10:49
TCP TCP Network: Controller Network IP: 45464	Name	Ntrip1	Name		Ntrip2
Pr. 43404 Port: 18646	Network	Controller Network \checkmark		Rover	
	IP	58.240.20.34 (P)	1 1	Network available	•
Receive diff data by Internal Radio	Port	8001	1 2	Connection status	•
Receive diff data by Ntrip	Source Node	FJD-NJ 🗸 🛱	3	Setting network mode	•
TCP Receive diff data by TCP	User Name	demo	4	Setting receiver	
	Password	📎	R	ок	
				SAVE	APPLY
NEW	SAVE	APPLY		< 0	

6.3 Base

GNSS receivers can be used as both rover and base stations, and the receiver mode can be configured through the [**Base**].

6.3.1 Internal Radio

Click [**Base**] \rightarrow [**NEW**], select [**Internal Radio**], enter relevant parameters, click [**APPLY**], and wait for the base station to be set successfully.



When setting up a base station, if it is a known point station, open the [**Fixed position**] switch and enter the antenna height and base station coordinate in turn; if it is not a known point station, keep the [**Fixed position**] switch closed, and the coordinate automatically obtained will be used as the base station coordinate when setting up the station.

Both internal and external radios require external whip antennas, and the antenna parameters of 400M and 900M are different.

6.3.2 External Radio

When the operation range is large, the baseline distance is more than 5 km, and there are many obstacles blocking, the external radio should be considered.

Click [Base] \rightarrow [NEW], select [External Radio], enter relevant parameters, click [APPLY], and wait for the base station to be set successfully.

sess Base	23:44 Exter	nal Radio	23:44 < Exter	mal Radio
	Name	External Radio	Name	External Radio
	Mask Angle	10° 🗸	Mask Angle	10° 🗸
	Diff Data	RTCM3.2 V		Base
Internal Radio	Protocol	TRIMTALK 🗸	1 Sending cor parameters	nfiguration 🥑
Send diff data by Internal Radio	Fixed position		2 Setting rece	iver 오
Send diff data by External Radio				ок
NEW	SAVE	APPLY	SAVE	APPLY

Note:

- 1. Considering the relatively large power of the external radio, the surveyor should not stay next to the external radio antenna for a long time.
- 2. In order to ensure the transmission distance, the antenna of the external radio station should be raised as high as possible.
- Generally, external radio stations are powered by power banks, batteries or mains power.

6.4 General

6.4.1 General settings

Name Description Page	
-----------------------	--

	Optional: meters, feet, US feet.	19:22 C General		
Length Unit	1 feet = 0.3048 meters			
	1 US feet = 0.3048006 meters	Length Unit	Meter 🗸	
Angle	5 common angle formats to choose	Angle	dd°mm'ss" 🗸	
Angle	from	Slope	Percentage 🗸	
Clana	4 commonly used slope formats are	Chainage Format	K0+000.000 V	
Slope	available	Decimals	>	
Chainage Format	Custom chainage prefix and format	Base Change Prompt		
Decimals	Set the displayed decimal places	Auto Connect Bluetooth		
Base Change	There is a pop-up prompt after the	Auto Connect Ntrip		
Prompt	base station changes.	NFC	Bluetooth First 🗸	
Auto Connect	The app automatically connects to			
Bluetooth	the receiver after opening	Satellite Tracking	>	
Auto Connect	App automatically surfs the internet	Survey Settings	>	
Ntrip	to receive differential data	Accessibility Settings	>	
NFC	Optional: Bluetooth first, Wi-Fi first	Upload Logs	>	
	All satellite systems are turned on by	Screen Style	Vertical Screen 🗸	
Satellite Tracking	default, and you can click to turn			
	them off.			
Survey Settings	See Chapter 7.2.5			
Accessibility				
Settings	See Chapter 7.3.5			
	Click to upload receiver logs and			
Upload Logs	app logs			
Scroop Stulo	Default vertical screen, optional			
Screen Style	horizontal screen			

6.4.2 Survey Settings

Survey Settings includes Survey, Stake, Road and Show settings, which can be accessed by clicking the toolbar setting button in the corresponding measurement module.

6.4.2.1 Survey

The Survey settings are divided into **Measure Terrain**, **Auto Measure** and **Measure Control**, each corresponding to different measurement functions.

8:47				18:48				18:48			
<	Survey	Settings		<	Survey	Settings		<	Survey Se	ettings	
Survey	Stake	Road	Show	Surve	y Stake	Road	Show	Survey	Stake	Road	Show
Measure terrain	Auto m	easure	Measure control	Measu terrair		measure	Measure control	Measure terrain	Auto mea		easure ontrol
Fixed				Survey m	ethod		Time 🗸	Measureme	nts		
Diff delay			10	Time Inte	rval(s)		5	Points meas	sured		
HRMS limit			0.03	Fixed				Observation	time per poi	nt	
VRMS limit			0.05	Diff delay			10	Horizontal li	mit diff betw	een rounds	0.
PDOP limit			3	Point ID p	refix		pt	Vertical limi	t diff betwee	n rounds	0.
Deviation lim	nit		0.1	Name ste	p		1	Horizontal li	mit diff betw	een points	0.
Obs times			5					Vertical limi	t diff betwee	n points	0.
Point ID pref	ĩx		pt					Delay time a	fter fixed(s)		
								Diff delay			

Measure Terrain setting instructions are as follows:

Name	Description	
	After the switch is turned off, the measurement result will no	
Fixed	longer be used as a verification basis for whether it is a fixed	
	solution.	
Diff Age	Default 10s, fixed solution will be lost if exceeded 10s	
HRMS Limit	Horizontal Root Mean Square	
VRMS Limit	Vertical Root Mean Square, elevation accuracy	
	Position Dilution of Precision, the strength of satellite position	
PDOP Limit	accuracy, the better the satellite distribution, the smaller the PDOP	
	value, generally less than 3 is a more ideal state	
Deviation Limit	The mutual difference limit of any two values at the observation	
	point	
Time Interval(s)	Time to acquire coordinates for each measurement cycle	
Point ID Prefix	Default measurement point prefix	

Name step	The difference between two adjacent point numbers	
Use Quick Code	After starting, add an code icon to the measurement toolbar, and	
	click to open the quick code panel.	
PPK Measure	After startup, a PPK icon will be added to the measurement	
	toolbar. For more details, please refer to the section.97	
E-Bubble	After starting the IMU, E-Bubble can be optionally displayed on	
	the measurement page.	

Auto Measure setting instructions are as follows:

Name	Description	
	Optional Time interval, 2D distance, 3D distance, AH. Choose	
Measure Method	different measure methods and display different parameter	
	settings accordingly.	
Time Interval (s)	It varies with the choice of measure method.	
	After the switch is turned off, the measurement result will no	
Fixed	longer be used as a verification basis for whether it is a fixed	
	solution.	
Diff Age	Default 10s, fixed solution will be lost if exceeded 10s.	
Point ID Prefix	Default point ID prefix	
Name Step	The difference between two adjacent point IDs	

Measure Control setting instructions are as follows:

Name	Description
Measurements	Set measurement cycle
Points measured	Set the number of measurements per cycle point
Observation time	When the value is greater than 1, the measurement result is
per point	averaged over multiple epochs
2D dist limit	The current mean of all points measured back and the plane
between rounds	difference limit of other measurements
H dist limit	The elevation difference between the mean of all points currently
between rounds	measured and other measurements is limited
2D dist limit	The difference between the last measured point and the mean
between points	plane of all points in the current measurement is limited
H dist limit	The difference between the elevation of the last measured point
between points	and the mean of all points in the current measurement is limited
Waiting time after	After obtaining the fixed solution for the first time, wait for

fixed(s)	several seconds before starting the measurement
Diff Age	Default 10s, fixed solution will be lost if exceeded 10s
PDOP Limit	The strength of satellite position accuracy, the better the satellite
	distribution, the smaller the PDOP value
Point ID prefix	Default measurement point prefix
Name step	The difference between two adjacent point numbers

Name	Description	Page
Stake Accuracy Limit	The plane distance limit between the measurement point and the stakeout point	20:59 Survey Settings Survey Stake Road Show
Stake DTM Arrow Color	Set the arrow color for cut / fill in the Stake DTM	Stake Accuracy Limit 0.050 Stake DTM Arrow Color >
Stake DTM	After opening, you can set the limit difference. There is a prompt	Stake DTM Sound Prompt ΔH limit
Sound Prompt	sound for the inner surface stakeout	Point ID Prefix stk_
△H limit	Set elevation threshold	Point ID Suffix Optional Camera Switch Distance 5.000
Point ID prefix	Default point name prefix for measure points during stakeout	Auto Zoom
Point ID suffix	Default suffix for measure points during stakeout	Stake Selected Point
Camera Switch Distance	Distance threshold for automatic switching between front and bottom camera views during AR Stakeout	
Auto Zoom	The view automatically scales to display the current and target positions	
Stake Selected Point	Support clicking the stake point on the map to start directly.	
Show Navigation Arrow	Stake arrow symbol setting	

6.4.2.3 Road settings

Name	Description	Page
Point ID style	Optional: Real-time station, target station	21.09 Survey Settings
Chainage Interval	The distance between adding and subtracting piles when setting road stakeout	Survey Stake Road Show Real-time station as point ID Target station as point ID
Include key point in adding or subtracting stations	Set whether to include the main point station number defined by the line	Chainage Interval 20.000 Include key point in adding or subtracting stations
Stratight and TS Stratey SC PI	Spiral SC CS Spiral Stray Stray Stray	

6.4.2.4 Show settings

Name	Description	Page
Snap Settings	Set whether to capture node, endpoint, midpoint, center, intersection and nearest points in Stake CAD / Edit CAD	20:41 Survey Settings Survey Stake Road Show Snap Settings
Background Color	Set CAD view background color	Background Color Black White
Show nodes after selecting a line	Can be set to turn on/off, turned on by default	Show nodes after selecting a line CAD Coord Sys UCS
CAD Coord Sys	Default UCS, optional WCS	CAD Length Unit Meter ✓ Point and line label 5.0
CAD Length Unit	Default meter, optional millimeter, centimeter, feet, US feet	Show Compass
Point and line label size	Set the display size of labels drawn in CAD	Point Filter
Show Compass	Off by default	Point Code
Layer Management	Open layer for CAD files	Coordinate After Selected
Point Filter	Set the display/hide of points on the map	C0G0 >
Point ID	Set whether to display point IDs on the map	-
Point Code	Set whether to display point codes on the map	-
Point Elevation	Set whether point elevation is displayed on the map	-
Coordinate After Selected	Click on a point on the map to display coordinates	-
COGO	Set the display and sorting of functions in the COGO shortcut window of the map toolbar	

20:58	20:59	21:06
< Snap Settings	< Point Filter	< Survey Settings
O Node ☑	Point Type	
🖉 Endpoint	Measure Input 🗌 Base	Inverse Point to Line Traverse
🖉 Midpoint 🗹	🗹 Control 🗹 Stake	× Z Z
Center	Time	Deflection Slope Offset Point
X Intersection	All A Week Today	
🔏 Nearest 🜌	Start Time ~ End Time	Intersection Segment Line Segment Arc
	Start ID Optional	
	End ID Optional	Average Triangle Bisect Angle
	Wildcard(*) Optional	ок
	Code Optional	

6.4.3 Accessibility settings

Mask angle setting, initialize Ephemeris, PPP, receiver restart and receiver network can be set by auxiliary features.

3:14			23:15		23:14		
<	Accessibility Settings		<	Accessibility Settings	<	Accessibilit	y Settings
Mask	Angle Setting	~	5		Mask	Angle Setting	
Initiali	ze Ephemeris	>	1	D°	Initiali	ze Ephemeris	
PPP		>	1	5°	PPP		
			2	D.			
			2	5°		Sure to initialize	ephemeris?
			3	D.		Cancel	ОК
			3	5°	16		
			4	D°			
			4	5°			

6.4.3.1 Mask angle setting

Set the height cutoff angle for rover station observation, optional: 5 °~ 45 °.

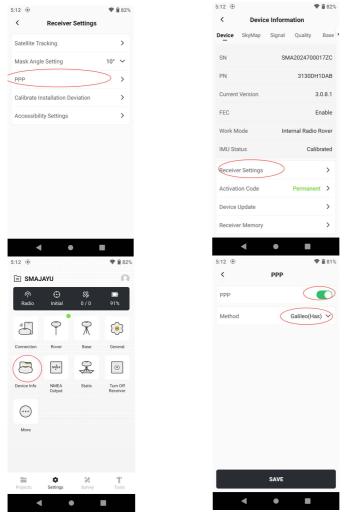
6.4.3.2 Initialize ephemeris

After connecting the receiver, click "Initialize Ephemeris", and the receiver will

automatically clear the ephemeris and search for stars again.

6.4.3.3 PPP

Click to open the PPP function, and the convergence time is about 15 minutes. Note, not all receivers support PPP functionality. Need to connect to the receiver setup





After connecting the receiver, click "Receiver Restart" and the receiver will automatically restart.

6.5 Device information

6.5.1 Device

After connecting the receiver, click [Settings] \rightarrow [Device Info] to view the detailed information of the current receiver.

Name	Description
Туре	Display receiver model
SN	SN number of the display device
PN	PN number of the display device
Current Version	Display the firmware version number of the receiver
IMEI	Display the IMEI number of the receiver
FEC	Radio forward error correction code status
Work Mode	Display receiver configuration mode
IMU Status	Calibrated by default
Device volume	Modify the volume of the receiver
Device	Display the activation status. When it is not permanent, click
activation code	to enter a new activation code.
Firmware	Click to check the current version, and choose local upgrade
Upgrade	or OTA check and upgrade.
Module	Radio, GNSS and IMU modules can be upgraded separately,
upgrade	and only local upgrades are supported
Receiver	Display the total memory size and remaining memory size of
memory	the receiver, optional formatting
Calibration	Click to recalibrate the IMU. Generally, it has been calibrated
Installation	at the factory.
Deviation	
Factory Reset	Click to Restore Receiver Factory Configuration.

6.5.1.1 Firmware upgrade

When a new firmware is released for the receiver, every time the receiver is connected to the Internet, a pop-up window will prompt that there is a new firmware. Click [Upgrade] to start downloading directly. If you do not upgrade temporarily, there will also be a red new version icon prompt on the page.

Note: it is recommended to always upgrade the receiver to the latest firmware.

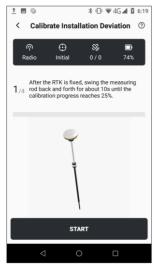
6.5.1.2 Module upgrade

The receiver firmware can be upgraded as a whole package, or by module (radio, GNSS, IMU), and can be automatically upgraded in the cloud or locally loaded.

5:41 рм 🙎			∎ 48%	5:41 рм 🙎			
<	Firmwar	e Upgrade		<	Firmwa	re Upgrade	
Current V	ersion		3.0.6.1	Radio		J	017
				GNSS			
				IMU			2
LOCAL U	PGRADE	CHECK FO VERSI		LOCAL U	PGRADE	CHECK F	

6.5.1.3 Calibration Installation Deviation

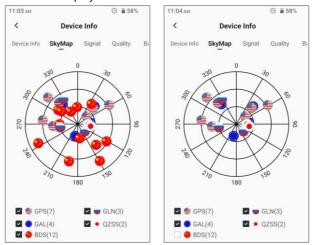
Receivers with IMUs are strictly calibrated for deviations when they leave the factory to ensure the availability of the IMU. Users can also manually perform repeated calibration. Calibration is very simple, check the height of the center rod according to the prompts, and then shake in four directions according to the animation.





6.5.2 SkyMap

Click [SkyMap] to display the current distribution of satellites, check the satellite system at the bottom, and set the display and hide.



6.5.3 Signal

Displays the signal to noise ratio information for different frequency bands of the tracking satellite.

🗟 🖇 🖨 🏷 4G 🚰 🛔 17:25								
<	Device Info							
evice Info	SkyMap Signal Quality Base							
PN	Sig	nal	Elev	Azimuth				
€5	L1:46 L2:43		49	274				
6	L1:42 L2:41 L5:44		37	88				
(11	L1:46 L2:47 L5:47		63	36				
 12	L1:40 L2:41		18	245				
6 13	L1:42 L2:23		30	179				
\$ 20	L1:47 L2:36		65	335				
6 25	11-90		12	272				
	\bigtriangledown	0						

6.5.4 Quality

Display the current positioning status, including solution status, coordinates, number of

observation satellites, and positioning accuracy.

5							
		37 × C	♥ 4G*2	17:25			
< Device Info							
SkyMap	Signal	Quality	Base	Battery			
Status:Fi	xed						
Lon		11	18°45'48.9	6018"			
Lat		5	32°01'08.9	9533"			
Ell <u>ht</u>				11.579			
Northing			35446	45.928			
Easting			3831	88.993			
Elevation	1			11.579			
Observation:39							
GPS				7			
		0					

6.5.5 Base

Displays baseline distance, elevation, azimuth latitude and longitude coordinates.

		3 *	● ♥ 4G 5	17:26		
< Device Info						
SkyMap	Signal	Quality	Base	Battery		
Distanc	е			42.84		
ΔН				-18.549		
Azimut	n		213°55'59	9.14864"		
Lat			32°01'07.	75007"		
Lon			118°45'48.	08982"		
Ell <u>ht</u>				30.106		
	\bigtriangledown	0				

6.5.6 Battery

Check the battery temperature, charging current and current power. You can also control whether the receiver needs to be turned on when connected to the power supply in the off state through the switch.

3:35 P	м 🛛			≣ 54%	3:35 P	м 🛛		
<		Device I	nfo		<		Device	Info
lap	Signal	Quality	Base	Battery	√ар	Signal	Quality	Base
Aut	o Power Or	n When Ch	arging		Aut	o Power (On When Cl	harging
Bat	tery Tempe	erature		31.4℃	Bat	tery Temj	perature	
Cha	rging Curr	ent		N/A	Cha	arging Cu	rrent	
Pov	ver			52%	Pov	ver		

6.6 NMEA output

SMA Survey can output NMEA observation data, with optional output methods including Serial port, Bluetooth. The output content includes GGA/ GSV/ GSA/ GST/ RMC/ VTG/ ZDA.

Output Mode	Description				
Serial port	The cable connects the receiver and the computer, and the NMEA				
Senai port	data is output to the computer's serial port tool.				
Bluetooth	The handbook connects to the receiver via Bluetooth and saves				
ыцеюотп	NMEA data on the handbook at a frequency of 2 Hz.				
Output content	Description				
GGA	Output latitude and longitude, solution status, number of satellites				
GGA	and other information				
GSV	Output satellite quantity, satellite ID, signal ID and other information				
GSA	Output receiver working mode, satellite and DOP information				
GSA	involved in positioning calculation				
GST	Output pseudorange error information				
RMC	Output information such as time, date, location, speed, etc				
VTG	Output ground heading, speed and other information				
ZDA	Output UTC time and date information				

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	M * (⊖ 🁽 4G ⊿ 🛢 21:16		🕅 🖇 🗢 💎 4G 🛋 🛢	21:16	1 🖬 🛈	⊁ (⊡ 🐨 4G 🛋 😫 6
<	NMEA Outp	out	< I	MEA Output		< I	NMEA Output
NMEA Output	t		NMEA Output		D	NMEA Output	
Output Mode		Serial Port 🗸	Output Mode	Serial Port	~	Output Mode	Bluetooth N
Baud Rate		115200 🗸	Baud Rate	115200	~	File Name	NMEA_1722507060
Serial Por	rt		Frequency	2Hz	~	File Path	SMAJAYU/SMASurvey/ nmea
Bluetooth	1		GGA		D	GGA	
GSV			GSV			GSV	
GSA			GSA			GSA	
GST			GST			GST	•
	ок			ок			ок
\triangleleft	0		\bigtriangledown	0 🗆		\bigtriangledown	0 🗆

6.7 Static

6.7.1 Static settings

Connect the receiver with storage function, select [Settings] \rightarrow [Static], choose [Static Settings] and [Static File Management]. Select [Static Settings] to open the setting page.

21:18					ST 🖇 🗢 💎	4G 🛋 🛢 21:10		🕅 🖇 🖨 💎 4G 🖌 🛔 21:10
🖹 0312V	/isualMea	sure	٢	<	Static		< Static	Settings
핒 Demo			⊗ 30 / 30	Static S	Settings	>	File Name	Not null
*5	Ŷ	R	()	5 Static F	ile Management	>	Station Name	Not null
Connection	Rover	Base	General				Time Interval	1Hz 🗸
8	nu ^g e A	04	٢				Record Time	0
Device Info	NMEA Output	Static	Turn Off Receiver				Mask Angle	5° ∨
							Antenna Height(m)	0.000
More			0.11				File Type	.gsd ∨
Projects	Settings	2 Survey	T Tools				ST	ART

Name	Description
File Name	Enter the name of the saved static file
Station Name	Enter the name of the observation point

Time Interval	Sampling rate, optional 1Hz, 2s, 5s, 10s, 15s, 30s
Record Time	Unit minutes, input range is [10,1440].
Mask Angle	Default 5 °, optional 10 °, 15 °, 20 °, 25 °, 30 °
Antonno Lloight	Input antenna height, and there are four optional antenna
Antenna Height	measurement methods
File Type	List optional file formats, including: * .gsd, * .rtcm

Note: During the collection process, you can choose to hide the collection page, which does not conflict with other functions. When you enter the static collection page again, the collection time will be automatically restored.

6.7.2 Static File Management

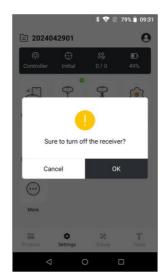
Select [Static File Management] to access static data in the receiver's memory. Optional [Delete] to release the receiver's memory.

	🕈 4G 🛋 🛢 21:10		🗟 🖇 🖨 🐼 4G 🛛	21:15			: ● 🐨 4G 🛋 🛢 21:
< Static		<	Static File Management		<	Static File Mar	nagement
Static Settings	>	6	Back static/20240415/gsd			20240415	
📴 Static File Management	>	FILE	v_0.gsd 2024-04-15 07:22:20 4M			20240416	
		FILE	20240415154752_1.gsd 2024-04-15 07:49:38 3M			20240422	~
			DELETE REFRES	ян		DELETE	REFRESH

6.8 Turn Off Receiver

When the app is connected to the receiver, you can quickly turn off the receiver.

- 1. After connecting the receiver, click [Turn Off Receiver].
- 2. The pop-up prompt asks "Sure to turn off the receiver?" Click [OK] and wait for the receiver to shut down.



ार Demo		Ð ed-1	8 2 30 / 30
*5	9	R	۲
Connection	Rover	Base	General
8	naften	×	٢
Device Info	NMEA Output	Static	Turn Off Receiver
More			
Projects	© Settings	20	Trada

7 Survey

7.1 Measure & Draw

RTK field work is gradually transitioning from simple point measurement work to measurement with graphics and attributes. Field work can draw line segments and graphics based on the collected points, add attribute information and save some time when processing data in the field.

Common extended functional modules include surveying and mapping (also known as surveying & mapping) and GIS acquisition.

Name	Description
	Draw line segments, closed graphics, etc. by measuring points.
Measure & Draw	Common post-processing drawing tools include AutoCAD, CASS,
	EPS, etc.
	Based on point, line, and surface elements, pre-defined attribute
	fields are used to input information in real-time during the
GIS Survey	collection process, and finally exported in shape format. Common
	post-processing GIS drawing tools include ArcGIS, SuperMap,
	QGIS, etc.

Note:SMA Survey does not currently support GIS collection function.

7.1.1 Draw

Click on [Survey] \rightarrow [Measure & Draw] to enter the main function page. The page preview and introduction are as follows.



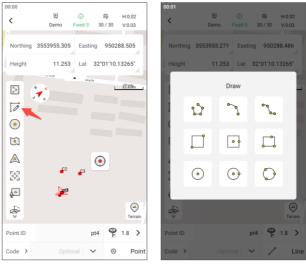
ne Description
us bar Display solution status, number of satellites, and RMS values
 Display real-time point information, including latitude, longitude, ellipsoidal height, north coordinates, east coordinates, elevation, HRMS, and VRMS.
 Click the information bar box to switch the display. When HRMS or VRMS exceeds the limit, the information box is highlighted in red.
pass Read the Compass information of the current handbook.
bar Display commonly used tools for operating this function.
 It can be used after starting IMU tilt measurement. It is turned off by default and can be enabled in Survey settings. When the tilt angle is ≥30 °, the color of the bubble turns black.
surement After reaching the target location, click the button to record the point on coordinates.
 IMU is not enabled. IMU is turned on but not available, need to shake for calibration. IMU is enabled and available.
k button Quickly switch between measurement modes: Terrain, Quick and Control.
 Point ID: Click to enter, the default measurement point name is the corresponding stakeout point name with the prefix "stk_", or you can add a suffix in the settings; Antenna height: Click to enter the antenna type selection and input page. Code: Can be manually entered. When there is a user-entered code in the code library, you can directly click the drop-down button to select it. Click the code label on the left, or you can directly jump to the "Codes" for selection. Code type: optional points and lines, quick classification of existing codes. When selecting a drawing operation, the coding type automatically switches to line.
codes. Wh

The toolbar provides a wealth of tools that bring many conveniences to actual measurement work.

lcon	Name	Description

>	Graphics library	Open the graphics library to display a list of drawn graphics.
D	Drawing	Click to select the drawn line type, a total of 9 common line types are provided.
•	Points	Click to open the point library.
٢	Мар	Click optional street and satellite map, the default is to turn off map mode
	Default Centered Follow	 Default: The map will not automatically zoom during measurement and stakeout, and manual operation is required. The interface will not update when the position changes. Centered: The current position and target point are always displayed in the interface. If you manually drag the map, wait a few seconds and it will automatically return to the centered mode. Follow: The map rotates as the stakeout direction changes, and the current position is always in the middle of the interface.
	Full screen	Click the rear view to zoom in and show all points.
	Media	Click to activate, and after completing the measurement, prompt to capture the Media information of the point.
	COGO	COGO tool shortcut entrance, can configure display/hide and sort in display settings.
0	Settings	Survey settings entrance, see Chapter 7.5.2 for details.

Click the Drawing button on the left toolbar and select one of the 9 line types to enter the state of Measure & Draw at the same time. The parameters and optional operations of each shape are different. Please follow the prompts on the page to complete the drawing.



9 types of line types are introduced as follows:

lcon	Name	Description
° °	Multipoint polyline	Draw polylines with multiple points, optional reverse
b 6		and closed
•	Three-point arc	Draw an arc with three points, optional reverse and
7	Three-point arc	closed
٩٩	Fitting output	Draw a fitting curve with multiple points, optional
60	Fitting curve	reverse and closed
	Two-point square	Draw a square with two diagonal points
••	Center point square	Draw a square by the center point and a midpoint on
		one side
⊢_ ●]	Three point rectangle	Draw a rectangle by two vertices of an edge and any
<u>ا</u>	Three-point rectangle	point on the opposite edge
•	One-point circle	Draw a circle by center + radius
•	Two-point circle	Draw a circle by its center and a point on it
\bigcirc	Three-point circle	Draw a circle with three points
_		

Taking drawing a multi-point line as an example, click on the multi-point line icon and measure the points in order according to the page prompts.



During the measurement process, the current position is connected to the previous node by a dotted line. Optional operations include: exit, return, close, and complete. When the node of the polyline is ≥ 2 , the complete button is available; when the node is ≥ 3 , the close button is available. After clicking the close button, enter the line name to complete the drawing directly.

The system provides default dot, line, and surface styles that can be modified by defining codes.

7.1.2 View

After completing the drawing of the figure, click the Graph Library icon on the toolbar to open the drawing list. Click to view optional operations. Multi-point polyline, three-point arc, and fitted curve can be selected to reverse or continue drawing.

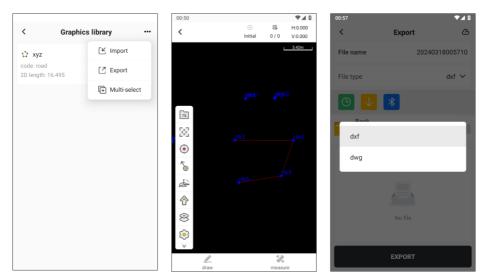
10:53 ()		0	😨 🔒 54%	10:54	()			0	9 😨 🔒 54%	10:54 🛞		o 😨 😨 🙆 💿
<	⊕ Fixed-1 2	S≱ 4/25	H:0.02 V:0.021	<		Graph	ics libr	ary		<	Preview	
Northing 3544486.913 Height 11.553	-		91.587 83500"	Ē	۲	(1)	⇔	e	හා xyz code: 2D length:			1.266
			2.03m rtk4							3544491.96 	9 <u>18</u>	355 988 11. 2544487.725 383196.613 11.426
			Solution Control of Co									5
Point ID	rtk7	ę	1.8 >							2D length		16.495
Code > Optio		/	Line							3D length		16.496

7.1.3 Export

It can be exported through the graphics library or in Edit CAD, see $\underline{\text{Chapter 8.10}}$ for details.

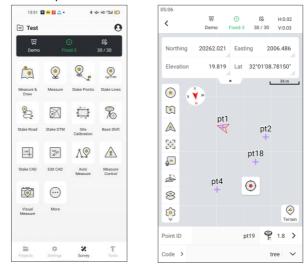
Location Operation		Description				
Craphics library	Import	Import custom * .dne files				
Graphics library	Export	Export custom * .dne or * .shp files				
Edit CAD	Export	Export * .dwg/* .dxf files				

SMA Survey App User Manual



7.2 Measure

Measure is to obtain coordinates from a known position. Click [Survey] \rightarrow [Measure] to open the main interface of point measurement. \rightarrow



7.2.1 Measure interface



Name	Description					
Status bar	Display solution status, number of satellites, and RMS values					
	1. Display real-time point information, including latitude, longitude,					
	ellipsoidal height, north coordinates, east coordinates, elevation,					
Information	HRMS, and VRMS.					
bar	2. Click the information bar box to switch the display.					
	3. When HRMS or VRMS exceeds the limit, the information box is					
	highlighted in red.					
Compass	Real-time display of direction information obtained from the					
Compass	handbook.					
Toolbar	Display the commonly used tools for operating this function, see					
IDUIDAI	Chapter 8.2.2 for details.					
	1. It can be used after starting IMU tilt measurement. It is turned off by					
E-Bubble	default and can be enabled in measurement settings.					
	2. When the tilt angle is ≥30 °, the color of the bubble turns black.					
Current	The triangular arrow indicates the current position, which can be					
position	modified in the settings.					
Measurement	After reaching the target location, click the measurement button to					
button	record the coordinates of the measurement point.					

	1. 🚬 IMU is not enabled.
IMU icon	2. 🎦 IMU is turned on but not available, need to shake for calibration.
	3. DIMU is enabled and available.
	Quick switch button for measurement mode:
Quick button	1. Terrain: Default measurement mode
Quick button	2. Quick: Set the observation time to 1s.
	3. Control: Switch to the control point for measurement
	1. Point ID: Click to enter, the default measurement point name prefix
	can be customized.
	2. Antenna height: Click to enter the antenna type selection and input
	page.
Editing area	3. Code: Can be manually entered. When there is a user-entered code
	in the Codes, you can directly click the drop-down button to select it.
	Click the code label on the left, or you can directly jump to the [Codes]
	for selection.

7.2.2 Measure toolbar

lcon	Name	Description					
		Click to open the point library, view the coordinates of the					
\odot	Points	measured points, and optionally edit or delete the measured					
		points by clicking on the measured points.					
	Мар	Click on the optional street and satellite map, the default is to					
	мар	turn off the map mode.					
		Default: The map will not automatically zoom during					
		measurement and stakeout, and manual operation is required.					
		The interface will not update when the position changes.					
\land	Default	Centered: The current position and target point are always					
	Centered	displayed in the interface. If you manually drag the map, wait a					
	Follow	few seconds and it will automatically return to the centered					
		mode.					
		Follow: The map rotates as the stakeout direction changes, and					
		the current position is always in the middle of the interface.					
	Full screen	Click the rear view to zoom in and show all points.					
BBB	РРК	PPK acquisition switch, see Chapter 9.7.2 for details.					
4	Fast code	Quick encoding switch, see Chapter 8.2.6 for details.					

	Media	Add a Media information switch to obtain and save Media
	weula	information after measurement is completed.
	6060	COGO tool shortcut entrance, can configure display/hide and
Ø	COGO	sort in display settings.
		Click to open the Layer Management (External Data
8	Layer	Management) page, where you can load vector layers on the
		map.
\bigcirc	Settings	Measurement settings entrance, see Chapter 7.5.2 for details.

7.2.3 Centralized measure

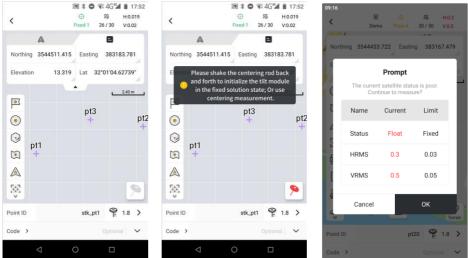
- 1. Enter the point name, antenna height and code information in the editing area of the measurement page.
- 2. Use the bottom tip of the centering rod to press against the point, so that the centering rod bubble is centered.
- 3. Click the measurement button in the fixed solution state, save the measurement points to the Points, and view the measured point in the "Points" interface.
- If the measurement exceeds the limit, a pop-up window will prompt whether to continue. Click the Settings button on the toolbar to set the specific limit in the measurement settings., See <u>Chapter 7.5.2.1</u> for details.

09:15	09:15		09:16		
く 原 ⊕ 粉 H:0.02 Demo Fixed-4 30 / 30 V:0.03	< Antenna Par	ameters	<		8% H:0.3 30 / 30 V:0.5
Northing 3544433.731 Easting 383167.49	Measured From	Pole Length 🗸	Northing 3	544433.722 East	ng 383167.479
Elevation 11.554 Lat 32*01'02.09988"	Measured Height(m)	1.8	E	Prompt	
● pt6	Total Height(m)	1.869	The	current satellite sta Continue to meas	tus is poor. sure?
			[Nar	me Current	Limit
A pt11	T T	1	4 Stat	tus Float	Fixed
< pt20			HR	VIS 0.3	0.03
			Ę HR	NS 0.3	0.03
				MS 0.5	0.05
			4		_
			Ca	ancel	ок
		Ţ	Deletite.		t20 🗣 1.8 >
	ок		Point ID	P	t20 🦞 1.8 >
	UK UK		Code >		Optional 📔 🗸

7.2.4 Tilt measure

When the receiver supports tilt measurement, you can enable tilt measurement in SMA Survey by clicking the IMU icon on the right side of the measurement page. It should be noted that:

- 1. For the first use, shake and calibrate according to the page prompts.
- 2. If you stay in place for a long time or the receiver rotates in place, the IMU accuracy will decrease. Please follow the page prompts to shake and recalibrate.
- 3. The best effect is to tilt within 30 °, and the maximum tilt angle is recommended not to exceed 60 °.
- 4. For high-precision measurements, it is recommended to turn off tilt measurement.



7.2.5 PPK measure

SMA Survey supports PPK collection and calculation, see Chapter 8.6 for details.

7.2.6 Quick code

Some projects require adding codes to the points to mark different attributes. If there are too many codes and the targets are mixed, frequent switching of codes is required during measurement, which is very inconvenient. Based on this requirement, SMA Survey has supported **Quick Code** function.

Click the Settings icon on the toolbar, turn on the Quick Code switch in Measurement Settings, and set the number of panels, the default is 2.

Note: Please add the code in Codes first before setting.

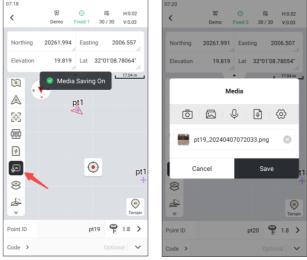
After setting up, there will be a Quick Code icon on the toolbar. Click on the icon to open the Quick Code panel. During the measurement process, you can click on the icon to show/hide the panel at any time.

The code panel is easy to operate. Click [+] to add a code, click the code to start measuring, and long press the code to modify or delete it.

07:00	07:03				07:08		
< Survey Settings	<	핏 🕀 Demo Fixed	∞ 30 / 30	H:0.02 V:0.03	<	ঢ় ⊕ Demo Fixed-'	8% H:0.02 30 / 30 V:0.03
Measure Stake Road Sh	Northing	20262.027 Ea	isting 20	006.503	Northing	20262.025 Eas	ting 2006.514
VRMS Limit	0.05	19.819 La	it 32°01'08	.78169"	Elevation	19.819 Lat	32°01'08.78165"
PDOP Limit	3 💿 3	S M N		17.04111	• • •		17.5411
Deviation Limit	0.1	pt1				pt1	
Time Interval	5				Edit		_
Point ID Prefix	pt 💽				Delete		
Name Step	1		۲	Terrain 1	*		Terrain 1
	Lamp	Road	Man	hole cover	Lamp	Road	Manhole cover
Use Quick Code	Tree	+		+	Tree	+	+
Quick Code Pages	2 Point ID		pt19	1.8 >	Point ID		pt19 🗣 1.8 >
PPK Measure	Code >			nal 🗸	Code >		Optional 🗸 🗸

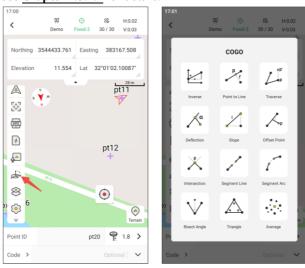
7.2.7 Media storage

Media information can be added to points in the point details, or added in real time during the measurement process.



7.2.8 COGO quick tool

Click COGO on the toolbar to quickly call up the COGO tool. The tool supports sorting



and show/hide, see Chapter 7.5.2.4 for details.

7.2.9 Layer

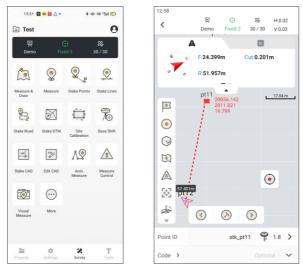
Support adding vector geospatial files to the map, currently supporting two formats: * .dxf and * .xml. Selecting a layer allows you to choose to show/hide, delete or edit.

Note: To ensure the smoothness of map operation, it is recommended to add a file size of no more than 10 MB.

13:17		
<	External data management	
•	Strand-cgcs2000-2.dxf	•
•	Leica sample.dxf	•

7.3 Stake Points

Stake Points is the process of finding the actual geographical location through coordinates. Click [Survey] \rightarrow [Stake Points] on the main page, select the point to be staked, and enter the point stakeout interface.



7.3.1 Stake Points interface

Compared with the measurement interface, the interface mainly has a navigation panel and a bullseye view.



Name	Description
Status bar	Display solution status, number of satellites and RMS values
Navigation bar	1. After selecting the staked point, the real-time display shows the
	relative relationship between the current position and the target
	point, including the relative relationship (front, back, left, right) and
	the absolute relationship (east, south, west, north), and switches the
	display by sliding horizontally.
	2. When the distance is less than 1 meter, the compass state will
	change to assist in stakeout.
Information	1. Display real-time point information, including latitude, longitude,
bar	ellipsoidal height, northing, easting, elevation, HRMS and VRMS.
	2. Click the information bar box to switch the display.
	3. When HRMS or VRMS exceeds the limit, the information box is
	highlighted in red.
Toolbar	Display the commonly used tools for operating this function, see
	Chapter 8.3.2 for details.
E-Bubble	1. It can be used after starting IMU. It is turned off by default and can
	be enabled in measurement settings.
	2. When the tilt angle is \geq 30 °, the color of the bubble turns black.
Bullseye view	1. When the stakeout distance is ≤ 1 meter, a bullseye view appears,
	with a total of two circles, the radius of the large circle is 1 meter, and
	the radius of the inner circle is 0.5 meters.
	2. When the stakeout distance is \leq 0.5 meters, the bullseye view is
	enlarged, with a total of two circles, the radius of the large circle is 0.5
	meters, and the radius of the inner circle is 0.05 meters.
Measurement	After reaching the target location, click the measurement button to
button	record the coordinates.
IMU icon	1. IMU is not enabled.
	2. 🔊 IMU is turned on but not available, need to shake for
	calibration.
	3. DIMU is enabled and available.
Editing area	1. Point ID: Click to enter, the default measurement point name is the
	corresponding stake point name with the prefix "stk_", or you can add
	a suffix in the settings;
	2. Antenna height: Click to enter the antenna type selection and input

page.

3. Code: Can be manually entered. When there is a user-entered code in the codes, you can directly click the drop-down button to select it. Click the code label on the left, or you can directly jump to the "Codes" for selection.

7.3.2 Stake Points toolbar

lcon	Name	Description						
<u> </u>	Input point	Stake according to the manually entered point coordinates.						
	Points	Click to open the points and select the stake point by single or multiple selection.						
TAR	AR stakeout	Click to enter the AR stakeout page, present the position of the						
		target point through the camera of the receiver, and find the						
		target point according to the real navigation.						
۲	Мар	Click on the optional street and satellite map, the default is to						
		turn off the map mode.						
\land	Default	Default: The map will not automatically zoom during						
	Centered	measurement and stakeout, and manual operation is required.						
	Follow	The interface will not update when the position changes.						
0		Centered: The current position and target point are always						
		displayed in the interface. If you manually drag the map, wait a						
		few seconds and it will automatically return to the centered mode.						
		Follow: The map rotates as the stakeout direction changes, and						
		the current position is always in the middle of the interface.						
	Full screen	Click the rear view to zoom in and show all points.						
	COGO	COGO tool shortcut entrance, can configure display/hide and						
		sort in display settings.						
8	Layer	Click to open the layer management page, where you can load						
		vector layers on the default map.						
\bigcirc	Settings	Measurement settings entrance, see Chapter 7.5.2 for details.						

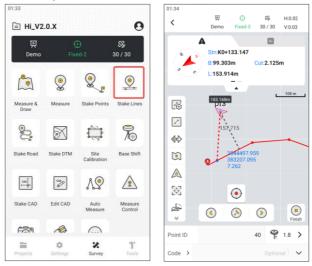
After entering the [Stake Points] and selecting the stake point from [Points], the target point will be marked with a red flag. The current position is connected to the target point with a dotted line, and the 2D distance to the target point will be displayed in real time above the arrow at the current position. When the stakeout distance is \leq 1 meter, the target point becomes a bullseye view, and the controller will emit a buzzing sound and vibrate. As the stakeout distance shortens, the buzzing sound will become faster and the vibration

frequency will increase. When the distance is \leq 0.05 meters, you will hear the correct sound reminder.

It should be noted that multiple selections are supported when selecting points. Three icons will appear at the bottom of the view: previous point, nearest point, and next point. You can switch between them conveniently by clicking or by pressing the left and right keys on the keyboard.

7.4 Stake Lines

Stake Lines is a simple tool for local line stakeout. The software provides five types of line stakeout. Click [Survey] \rightarrow [Stake Lines], select a line or create a line for stakeout.



7.4.1 Stake Lines interface



7.4.2 Line stakeout toolbar

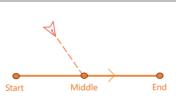
lcon	Name	Description	
6	Line setting	Optional three ways of selecting line stakeout:	
		1. Chainage: Customize the distance between adjacent stations	
		and achieve continuous stakeout by adding or subtracting	
		chainage;	
		2. Line: Find the position closest to the stakeout line segment at	
		the current position;	
		3. Node: including start point, midpoint, node and end point.	
	Lines	Click to jump to line selection in the lines.	
$\langle + \rangle$	Inversion	Exchange starting and ending points, and when adding chainage,	
		follow the new forward direction.	
0	Мар	Click on the optional street and satellite map, the default is to	
		turn off the map mode.	
\land	Default	Default: The map will not automatically zoom during	
	Centered	measurement and stakeout, and manual operation is required.	
	Follow	The interface will not update when the position changes.	
-		Centered: The current position and target point are always	
		displayed in the interface. If you manually drag the map, wait a	
		few seconds and it will automatically return to the centered	

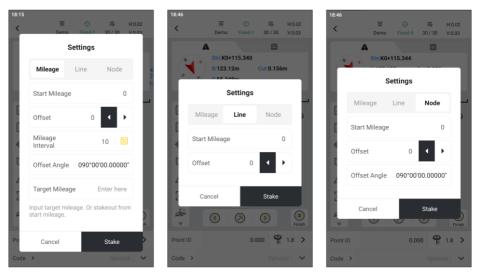
		mode.
		Follow: The map rotates as the stakeout direction changes, and
		the current position is always in the middle of the interface.
	Full screen	Click to zoom the map to show all points and the current
		stakeout line.
	COGO	COGO tool shortcut entrance, can configure display/hide and
		sort in display settings.
8	Layer	Click to open the layer management page, where you can load
		vector layers on the default map.
()	Settings	Measurement settings entrance, see Chapter 7.5.2 for details.

Enter [Stake Lines], select the line for stakeout from [Lines], open the line setting page, and choose to place chainage, line and node.

Line setting	Description	Illustration
Chainage	Customize the distance between adjacent chainage and achieve continuous stakeout by adding or subtracting stations. Custom content includes: 1. Start Chainage: Set the chainage value from the start point; 2. Offset: Set the offset value, left or right ; 3. Mileage Interval: Set the distance between adjacent stations; 4. Offset Angle: Angle of turning left/right in the forward direction. 5. Target Chainage: Set the chainage value of the target point.	Start End
Line	Find the position closest to the stakeout line segment from the current position. The custom content includes: start Chainage and Offset.	Closest Start End

Node The stakeout targets include: start point, midpoint, node and endpoint. **Note:** If it is a multi-segment line, then the targets are nodes; if it is a straight line, then the targets are start point, midpoint and end point.





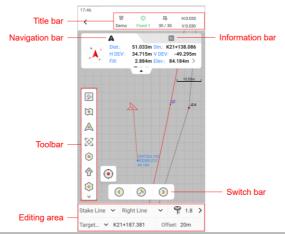
If there are multiple stakeout targets, three icons will appear at the bottom of the view: previous point, nearest point and next point. They can be easily switched by clicking or by pressing the left and right keys on the keyboard. During the stakeout process, you can click the Finish button on the right to end the stakeout immediately.

7.5 Stake Road

Click on the main page [Survey] \rightarrow [Stake Road], open the main page, select the correct road file, and the road graph will be displayed on the main page map.

7.5.1 Stake Road interface

The navigation bar provides more stakeout information for reference.



Navigation bar	Description
Dist	The distance from the current position
DISC	to the target.
Stn	Display the Chainage of the current
Sui	position.
	The distance from the current position
H DEV (a)	to the line, left negative and right
	positive.
	The delta chainage between the
	vertical point of current position to the
V DEV (c)	line and the vertical point of the target
	to the line, positive before and
	negative after.
Cut/Fill	If the current elevation is higher than
CutyPin	the target, it is Cut, otherwise it is Fill.
	1. Enter new design elevation: cover
	the elevation of the target station;
	2. Enter vertical offset: add or subtract
	the vertical offset value from the
Elev	design height of the target station to
	obtain the target elevation;
	3. Use original elevation: Default value,
	use the original design elevation of
	the target station.



The editing area consists of four parts:

- 1. Stake Line: optional (more options will be added in the future).
- Center Line: After selecting the Stake Line, you can also select the left or right line here. Use the forward direction as a reference to input the offset, with negative left and positive right. The map view will be updated after confirmation.
- 3. Antenna height: the height of the center rod.
- 4. Target Station: optional, the real-time station always displays the nearest station from the current position to the line, and the target station can also be selected. When the target station is selected, a pop-up window will appear to input the target station. Click [OK] to go directly to the target station. The station can be directly added or subtracted according to the station interval, and the configuration is described in **Chapter 7.5.2.3**.

Note: When measuring in Stake Road, there is no need to enter the point ID. The target station is automatically used as the point ID. If the point ID needs to be modified, it can be manually modified in the point library.

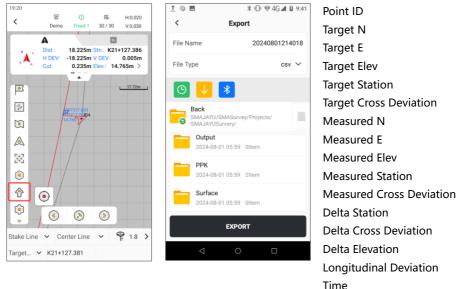
lcon	Name	Description	
	Points	Click to open the point library and view or modify the measured	
		points.	
2p	Edit Road	Click to open Edit Road, select a line to start the stakeout.	
	Мар	Click Optional Street and Satellite Map, the default is to turn off	
		map mode.	
		Default: The map will not automatically zoom during	
		measurement and stakeout, and manual operation is required.	
		The interface will not update when the position changes.	
\triangle	Default	Centered: The current position and target point are always	
	Centered	displayed in the interface. If you manually drag the map, wait a	
\bigcirc	Follow	few seconds and it will automatically return to the centered	
-		mode.	
		Follow: The map rotates as the stakeout direction changes, and	
		the current position is always in the middle of the interface.	
	Full screen	Click Rear View to zoom in and display the entire line.	
0	Check	Provide forward and reverse calculation functions.	
•	Input	Manually add station, optionally input coordinate or chainage	
		offset.	
	Export	Support exporting road stakeout results.	

7.5.2 Stake Road toolbar

L.	COGO	COGO tool shortcut entrance, can configure display/hide and
	COGO	sort in display settings.
\bigotimes	Lover	Click to open the layer management page, where you can load
\circ	Layer	vector layers on the default map.
$\widehat{\mathbf{O}}$	Settings	Measurement settings entrance, see Chapter 7.5.2 for details.

Export

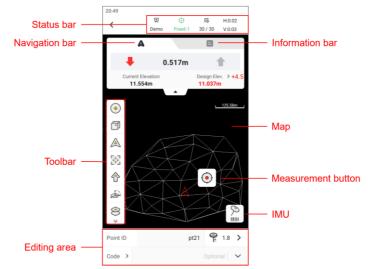
Click [Export] on the map toolbar to export road stakeout results. The content is as follows.



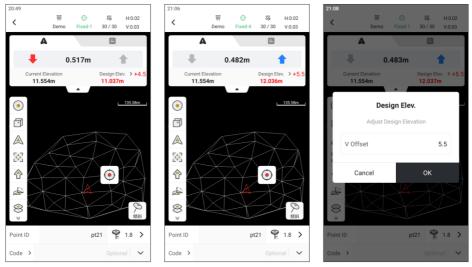
7.6 Stake DTM

In the measurement process, sometimes it is necessary to flatten an irregular field into a surface, and accurately and quickly lay out the elevation of any point on this surface. This situation is called RTK Stake DTM.

The main page of Stake DTM is as follows:



The navigation panel allows you to intuitively see the current elevation and the design elevation, which can be modified.



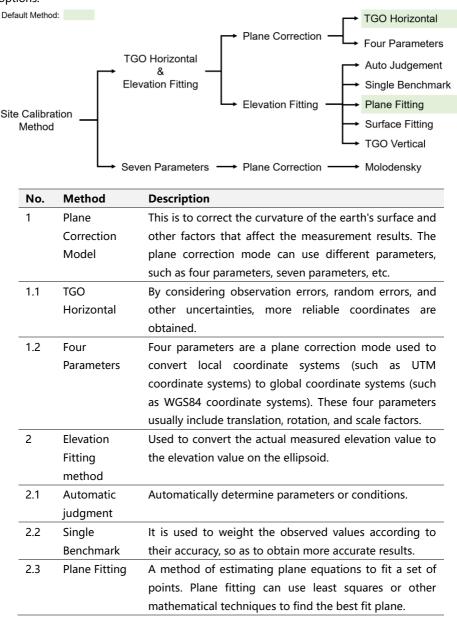
Click [**Export**] button on the toolbar to export the stakeout results to local or cloud, and the exported file records the value of Cut/Fill.

7.7 Site Calibration

Site Calibration is to convert the measured latitude and longitude coordinates into plane Cartesian coordinates used in engineering, and the calculation results of Site Calibration will be saved in the coordinate system.

7.7.1 Calibration method

The default calibration method is TGO Horizontal & Plane Fitting, with the following options.



2.4	Surface	Similar to plane fitting, but considering more complex
	Fitting	surfaces, such as quadratic surfaces or other nonlinear
		shapes.
2.5	TGO Vertical	A method for processing elevation data. It takes into
		account the curvature of the earth to obtain more
		accurate elevation measurements.

7.7.2 Operation process

After measuring the control points (known points), select [**Site Calibration**], click [+] in the upper right corner, and match the measurement points with the control points one by one. Add two or more pairs of control points, check them, and click [**CALC**] \rightarrow [**APPLY**]. After completion, you can perform field operations such as point measurement, point stakeout, or line stakeout.

~			•	<	Site c	alibration		<	s	ite calibration	1	
È V2.0.	1		0									
ज़ू Demo	• Fixed-2	8 3 0 / 30	20%	Calibrat	ion settings	T(horizontal,elevati fitti		Calil	bration setti	^{ngs} horizonta	TG I,elevatio fittir	on >
۲	8. <u>*</u>	<u>()</u>	2	List			+	List	A	pply successfu	ıllv.	Н
C Measure	Stake points	Stake lines	Stake road	No.	Point ID	Northing		nt/	Hor accuracy	Ver accuracy		
æ	Ê	Res	and and a	1	C1	3553948.01			0.0009	0.0001	Y	~
	- °			2	C2	3553985.85	~		0.0046	0.0001	Y	~
Stake DTM	Site calibration	Base shift	Stake CAD	3	C3	3553983.712	~		0.0045	0.0001	Y	~
Canology Can	∧.©		0									
Edit CAD	Auto measure	Measure control	Visual measure									
100 N	()										_	
Projects	© Settings	Survey	1' Tools	PREVI	EW	CALC AF	PPLY	PR	EVIEW	CALC	AP	PLY

7.7.3 Notes

- The known points should be distributed as far as possible at the edge of the work area, which can control the entire measurement area and avoid short sides controlling long sides. For example, if four points are used for correction, the work area should preferably be within the polygon connecting the four points.
- 2. Avoid linear distribution of known points, otherwise it will seriously affect the correction accuracy, especially in the elevation direction.
- If only plane coordinates are needed and elevation coordinates are not, it is recommended to use at least 2 known points for correction; if horizontal residuals of

known points need to be checked, then at least 3 points are needed; if horizontal residuals and vertical residuals of known points need to be checked, then at least 4 points are needed.

- 4. Before Site Calibration, please check the ellipsoid parameters and projection parameters.
- 5. Do not mix the levels of known points, for example, known points measured by GNSS and national high-level known points. If used together, the error of verification should be very large.
- 6. If an area is relatively large and has many control points, it needs to be calibrated by partition. It is not recommended to have more than ten or more points in one area participate in the calibration.
- 7. One area only needs to be corrected once.

7.8 Base Shift

If the RTK base station set up moves for some reason, the measurement result of the rover station will be biased. At this time, either re-establish the coordinate system or use Base Shift to correct it. Among them, Base Shift is a method often used by surveyors.

Click on the main menu [**Survey**] \rightarrow [**Base Shift**], select the measurement point and the corresponding known point coordinates, click [**CALC**] at the bottom to calculate the deviation of the base station. Click [**APPLY**] to complete the base shift operation.

Test			0	09:51	Base Shift		09:52			
娿		Ð	88	<	Base Shift		Trion:	Survey2.01	Demo	e
Demo	Fbr	ed-3	30/30	Ellipsoid H	leight	19.99	핏 Demo			8 30 / 30
	0	® "ª	<u>.</u>	Known Po	int	0				
Measure & Draw	Measure	Stake Points	Stake Lines	Point ID		P12		Apply s	uccessfully	0
8-	X	t ↓ ↓	70	N(X)		20001.334	Measure & Draw	Measure	Stake Points	Stake Line
Stake Road	Stake DTM	Site Calibration	Base Shift	E(Y)		2000	8		2000	9 /10
cu)	8	ß		U(H)		28.310			يحظو	
Stake CAD	Edit CAD	Auto Measure	Measure Control	0(1)		201010	Stake Road	Stake DTM	Site Calibration	Base Shif
0				Northing 7	Franslation	1.334	cao J.	Can p	1.	2
Visual Measure	More			Easting Tr	anslation	0.012	Stake CAD	Edit CAD	Auto Measure	Measure
				Elevation	Translation	0.074		0		Control
Projects	¢ Settings	× Survey	1 Tools	CA	ALC	APPLY	Frank I	~	*	т

Note:

1. The base shift function is a temporary solution after the base station changes. It is not recommended to use it for a long time or rely too much on it. Each project

should ensure the stability and reliability of the base station location as much as possible.

- 2. If the base shift is redone after application, the result will be overwritten and will not be accumulated based on the original result.
- 3. If the base shift is applied and the Site Calibration is redone, the base shift result will be cleared and will not affect the correct calculation of the Site Calibration.

7.9 Stake CAD

Based on existing CAD files (* .dwg, * .dxf), select points or lines on the drawing and start the stakeout work directly.

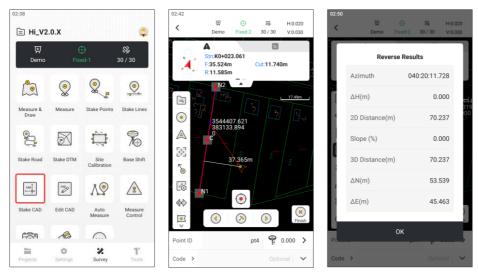
7.9.1 Stake CAD interface



7.9.2 Stake CAD toolbar

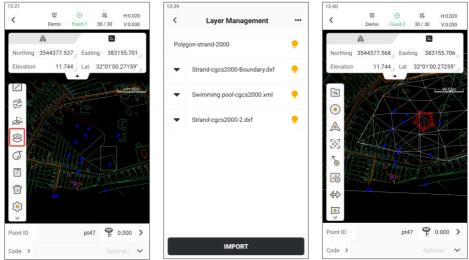
lcon	Name	Description
CAD	Open CAD	Click to load CAD files from the controller or Cloud Drive.
	Point	Click to open the point library and quickly browse the historical
(\circ)	library	measured points.
		Default: The map will not automatically zoom during
\land	Default	measurement and stakeout, and manual operation is required.
	Centered	The interface will not update when the position changes.
	Follow	Centered: The current position and target point are always
		displayed in the interface. If you manually drag the map, wait a

		few seconds and it will automatically return to the centered mode.
		Follow: The map rotates as the stakeout direction changes, and
		the current position is always in the middle of the interface.
[F	· · ·
	Full screen	Click to zoom in and show all points or lines.
ि	Capture	Precise selection of points.
		Optional three ways of selecting line stakeout:
		1. Chainage: Customize the distance between adjacent stations
		and achieve continuous stakeout by adding or subtracting
* ©	Line setting	chainage;
		2. Line: Find the position closest to the stakeout line segment at
		the current position;
		3. Node: including start point, midpoint, node and end point.
4.5	laveree	Exchange starting and ending points, and when adding the
	Inverse	chainage, follow the new forward direction.
<u> </u>	Input point	Stakeout according to the manually entered point coordinates.
1	Reverse	Select two points and calculate azimuth, coordinate difference,
	calculation	slope distance, etc.
P	Redraw	Reload the CAD drawing.
Ĩ	Blast	Separate the selected blocks by reference or polyline.
_	Carra	Save the selected point and modify the basic information before
	Save	saving.
1 I I I I I I I I I I I I I I I I I I I	Delete	Delete the selected point or line.
	COGO	COGO tool shortcut entrance, can configure display/hide and
¢		sort in display settings.
\bigcirc	l even	Click to open the layer management page, where you can load
\heartsuit	Layer	vector layers on the default map.
\bigcirc	Settings	Measurement settings entrance, see Chapter 7.5.2 for details.



7.9.3 Layer

SMA Survey supports importing dxf/LandXML/shape files and overlaying them with CAD files to assist with Stake CAD. Click the layer icon in the toolbar to add the files that need to be loaded.



Note:

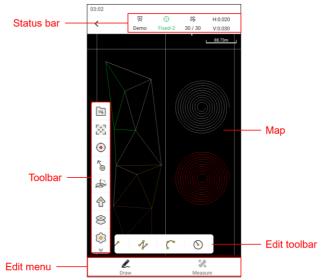
- 1. The size of a single file should not exceed 20 MB as much as possible. If the file is too large or too complex, there may be parsing failures or errors.
- 2. Import no more than 5 files.

3. If there is a situation where the drawing file cannot be parsed, please contact us for parsing and optimization.

7.10 Edit CAD

SMA Survey supports editing CAD drawings.

7.10.1 Edit CAD interface



7.10.2 Edit CAD toolbar

lcon	Name	Description
	Open CAD	Click to load CAD files from the controller or Cloud Drive.
	Full screen	Click the rear view to zoom in and show all points.
•	Measure	Draw graphics by collecting coordinates.
6	Capture	Precise selection of points.
<i>b</i>	COGO	COGO tool shortcut entrance, can configure display/hide and
		sort in display settings.
Ŷ	Export	Export the CAD file
8	Layer	Click to open the layer management page, where you can load
		vector layers on the default map.
()	Settings	Measurement settings entrance, see Chapter 7.5.2 for details.
- 40 0 0		

7.10.3 View

Click on a CAD element to view its relevant information. The selected target type will

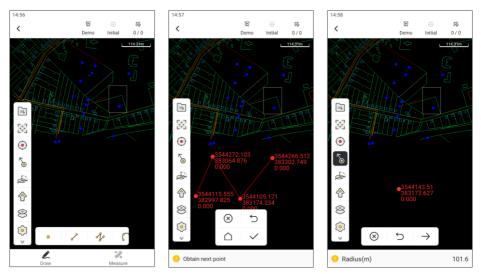
display different information. Select a target Afterwards, the description of the bottom menu is as follows:

lcon	Name	Description
	Stake	Jump to Stack CAD and directly execute point/line stakeout.
	Delete	Delete the selected target.
Ő	Blast	Displayed and available when a polyline or block reference is selected.
Ē	List	Display a list of nodes when selecting a line. Click on a node to save it to the point library.
	Property	View the properties of the target. The properties of points, lines, arcs, circles, etc. are all different. The layer and color can be modified.

	14:41				14:34		~	0	ল	14:19
Properties	<		e List	Nod	<	H:0.020 V:0.030	8% 30 / 30	⊕ Fixed-1	삕 Demo	<
Polyli	Туре	Elevation	Easting	Northing	Point ID	61.22m	RI		B	
	Vertices	0.000	-17300.784	13220.138	N1					
415.060(Mete	Length	0.000	-9533.794	36396.469	N2				N2	
	Close	0.000	4822.603	35910.740	N3	•N4		N3		
Default	Layer	0.000	15500.881	15995.746	N4					⊗ ⊙
— •	Color					. \				<i>™</i>
										&
						Properties	List	Explode	Delete	K

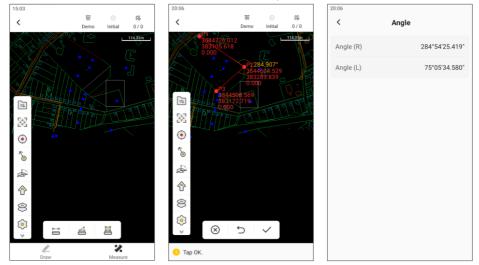
7.10.4 Draw

Edit CAD can draw common point and line graphics, including: point, line, polyline, three-point arc, one-point circle and three-point circle. When drawing, you can select existing points from the drawing by using the capture button, and you can also open the button through the toolbar [**Measure**] to use the collected coordinates as nodes.



7.10.5 Measure

Edit CAD supports measuring on the drawing: two-point distance, three-point angle, and multi-point area. Among them, the angle measurement results show the left and right corners, and the area measurement results show the perimeter and area.



7.10.6 Export

After editing the CAD drawing, it can be exported to the local or cloud. Click the Export button on the toolbar to open the export settings page.

Name	Description
Point Type	The exported content includes points from the point
	library, which can be exported by point type.
Other Settings	Switch item, closed by default, does not display the
	following content.
Point and line label	Sets the absolute size of the exported point and line target
size	labels.
Default style	The style of the optional exported points can also be
	modified in the PC software later.
Export line	Export the newly created line
Export points and	Export newly created points and lines to separate layers.
lines to newly	
created layer by	
type	
Label	Optional export point name, code, elevation and line
	namo

name.

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©			Line Name				EXPORT	
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7.11 Auto Measure

Setting up SMA Survey to automatically save measurement points according to certain rules during terrain measurement can greatly reduce user operations.

Click on [Survey] \rightarrow [Auto Measure] to enter the continuous point measurement. The measurement methods can be selected: time interval, 2D distance, 3D distance, and height

difference.

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7.12 Measure Control

In order to establish the basis of measurement in topographic mapping, a series of points with high plane and elevation accuracy need to be determined to form a measurement control network, which are called control points.

Generally, mm-level precision control points are obtained using total stations or GNSS static methods. However, if the accuracy requirement is in the cm level, RTK can be considered for acquisition. By increasing the number of measurements and some error limiting methods, the measurement accuracy of RTK can be further improved.

The measurement page of Measure Control is the same as Measure. Before starting the measurement, it is necessary to check the relevant limits in the settings. See Chapter 7.5.2.1 for details.

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During the measurement process, if the error exceeds the limit, it will be highlighted in red at the bottom of the page.

8 Tools

8.1 Volume

Earthwork calculation is an important step in engineering construction. During the engineering design stage, the amount of earthwork must be budgeted, which directly affects the cost estimate and scheme selection of the project. SMA Survey supports TIN method to calculate earthwork, and can set four parameters: reference elevation, reference point, reference slope, and two phases of earthwork.

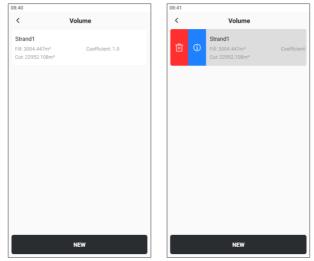
8.1.1 Glossary

Name	Explanation
Cut / Fill	Cut: When the surface of the roadbed is lower than the original
	ground, part of the soil and rock volume is excavated from the
	original ground to the surface of the roadbed.
	Fill: The volume of soil and rock filled from the original ground to the
	surface of the roadbed when the surface of the roadbed is higher
	than the original ground.
	Ground
	Cut Design elevation
Site leveling	By digging high and filling low, the original ground is transformed
Site leveling	into a site plane that meets people's production and living needs.
	The design elevation of the site must be determined as the basis for
	calculating the amount of excavation and filling earthwork, balancing
	earthwork allocation, selecting construction machinery, and
	formulating construction plans.
Design	The reference elevation for Cut is equal to Fill. The design elevation is
elevation	the basis for calculating site leveling and earthwork volume, as well
	as for overall planning and vertical design. Reasonably determining
	the site design elevation is of great significance for reducing
	earthwork volume, accelerating project progress, and reducing
	project cost.

Sparsity	Set parameters for earthwork calculation, range: $0 < x \le 100$, related
coefficient	
coenicient	to the compaction and looseness of the measurement target, and
	adjust the excavation and filling results proportionally.
TIN method	One of the earthwork calculation methods is to use the DTM model
	to calculate the earthwork volume based on the ground point
	coordinates (X, Y, Z) measured on site and the design elevation. By
	generating a triangular network, the earthwork volume of each
	triangular pyramid is calculated. Finally, the earthwork volume of
	filling and excavation within the specified range is accumulated, and
	the boundary line of filling and excavation is drawn.
Grid method	One of the methods of earthwork calculation, is to draw some small
	squares at a certain distance within the calculation range (establish
	an elevation triangle network based on the terrain elevation points,
	and then interpolate to calculate the elevation of grid corner points
	and boundary points). First, calculate the amount of soil filled and
	excavated in each square, and then accumulate and sum to obtain
	the total amount of earthwork measurement and calculation method.
Flat area	2D projection area of the surface file.

8.1.2 Add a task

Click [**Tools**] \rightarrow [**Volume**] from the main page to enter the earthwork calculation task list. In the task list, each task card displays: Fill value, Cut value and sparsity coefficient. Select a task to delete or click Details to view more information.



Click the button **[New**], open the new task page, enter the parameters listed, and click **[CALC]** to get the earthwork calculation results.

Name	Description
Task Name	Enter the name of the earthwork calculation task.
Coefficient	The soil quality is different, and the compaction or
	expansion of the earthwork is reflected by this
	coefficient.
Parameter	Different parameters will display different text boxes.
	1 Reference Elevation: Build a reference plane based on
	the input reference elevation.
	2 Reference Point: Build a reference plane based on the
	selected reference point elevation.
	3 Reference Slope: Use three points as the reference
	plane.
	4 2-phase Earthwork: Calculate the difference by
	selecting the surface triangle mesh before and after
	construction.
Surface File	When selecting the reference elevation, reference point,
	and reference slope, it usually appears as the surface
	triangulation mesh measured on site. Click to jump to
	the surface library for creation or selection.
Boundary	Calculate the earthwork within the boundary, and
File	calculate the earthwork in the public area if there is no
	boundary file. Click to enter the boundary management
	page to create or select.

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Task name	Та	sk1	Task name		Task1	圃	۲	2	1	~	Boundary1 Size
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Parameter	Reference elev	~	Parameter	Reference e	lev 🗸						
Create a reference plane v Reference elev	with the reference elevation entered.	5	F Reference elev								
Surface File Select TIN for calc.	48-cass	>	Reference point		1						
Boundary File Define the boundary.	Boundary1	>	Reference slope E 2-phase Earthwork	¢	1						
2											8
	CALC								NEW		

After inputting the necessary information, click the button [**CALC**] at the bottom. If the set parameters and surface file are correct, there will be a Toast Notification "Calculation Successful" and jump to the task list.

8.1.3 View details

Click the task card and select Detail button from the side slide menu to browse the task details.

		09:04		
<	Details	<	Deta	ails
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Task name		Strand1	Tarles (an	60.49
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Max Height				
Min Height				
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Task name	Display task name
Method	Using the TIN method
Parameter	Display the parameter selected for calculation
Reference elev	Display the calculation parameter
2D area	Earthwork calculates the 2D area of the actual area, and
	if there is a boundary, it is the 2D area of the
	overlapping area
Triangles	Count the number of constructed triangles
Max elevation	Maximum elevation in display area
Min elevation	Minimum elevation in display area
Design elev	Display the elevation value when Cut = Fill, which has
	reference significance for engineering design
Fill Volume	The volume of space calculated below the reference
	elevation
Cut Volume	The volume of space calculated above the reference
	elevation

Click [**Graph**] to display the earthwork calculation results in the form of a color spectrum, reflecting the amount of Cut and Fill through different color differences, giving users an intuitive feeling.

- 1. Red is the Cut area, the darker the color, the higher the elevation value;
- 2. Blue is the Fill area, the darker the color, the lower the elevation value;
- 3. Color ribbon: 0 means elevation = design elevation, no need to fill/dig.

After the calculation is completed, click [**Export Report**] button at the bottom to export the calculated graphic and text results as * .pdf or * .html files. The content includes:

- 1. Task information
- 2. Surface information
- 3. Boundary information
- 4. Cut area
- 5. Fill area
- 6. Graphic

8.2 Area

Click [**Tools**] \rightarrow [**Area**] to calculate the perimeter and area of the figure. The coordinates involved in the calculation can be measured, selected from map or selected from point library. The perimeter unit switches globally with the system, and the area is displayed in five units simultaneously for easy user viewing.

Node list:

- 1. Point selection method: Support measurement, map selection and point selection.
- 2. List: Display the Point ID, northing, easting and elevation of the selected point.
- After selecting a point in the list, it supports deletion and sorting up and down, because the points calculated by area have a connection order, and the calculation results are different with different orders.

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4	P13	19969.979	2131.5					L6=60.58	P7
5	P12	20000	2000		a(sq.m)		41589.8428		I
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Area(mu)			62.3848	Area	a(ha)		4.159		L4=134.956

Calculation results:

- 1. Perimeter: Display the perimeter of the calculated area.
- 2. Area: Five units are listed on one page, including: square meters, acres, square feet, acres and hectares.

Preview and export:

- 1. Preview: After the calculation results are out, you can click the [**Preview**] button to view the plane view of the area calculation, which also displays the length of each side.
- Export: You can save the file in * .html/* .pdf format, including node information, graphic information and result information.

8.3 Coord Transf

Define the coordinate system of the project first, and then you can use the coordinate transformation tool to achieve the mutual conversion of coordinates between different coordinate types.

In addition to supporting single-point conversion, it also supports batch conversion of a file. After selecting the correct source file and file format, you can preview part of the file below. The file conversion function is currently only available for scanner encrypted files,

and will be generalized in the future.

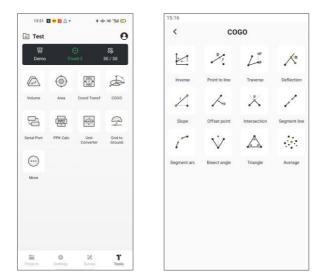
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8.4 COGO

Coordinated Geometry, a coordinate geometry language, refers to a commonly used tool calculator in surveying and mapping controllers. Currently, COGO calculation tools support 12 commonly used calculation functions, all of which support preview and allow for intuitive viewing of results on the map.

The COGO tool page has image definitions that vividly describe the known conditions and calculation results of the tool.

Currently, SMA Survey supports the following COGO tools:



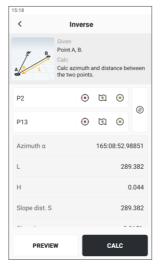
8.4.1 Inverse

Description:

Solve their relative relationship through two known points.

Calculation result:

- 1. Azimuth angle α
- 2. 2D distance L
- 3. Height difference H
- 4. Slope distance S
- 5. Slope i
- 6. Northing difference A N
- 7. Easting difference riangle E





8.4.2 Point to Line

Description:

Solve their relative relationships through three known points.

Calculation result:

 Point C longitudinal offset L
 cross offset r
 P-coordinate of the vertical foot

Explanation:

Support the vertical foot P on the forward/reverse extension line of AB.

8.4.3 Traverse

Description:

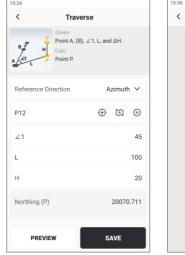
Similar to wire measurement. Given a point and its relative relationship with the target point, the coordinate of the target point can be solved.

Calculation result:

Target point P coordinate

<	Point to	line		
A	Given Point A, B an Calc C L, r, and Poin			
P2		۲	١	۲
P13		۲	١	۲
P6		۲	١	۲
L			95	5.167
r			116	6.809
Northing	P)		20157	7.706
PRE	VIEW	S/	AVE	







Explanation:

The angle of rotation from the reference direction is clockwise, and the reference direction can be selected from the north direction or two-point orientation.

86 m

5

8.4.4 Deflection

Description:

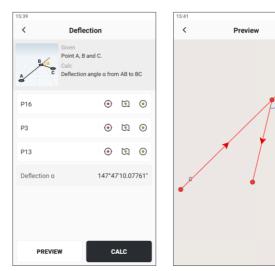
Given three points, solve for the relative deflection angle.

Calculation result:

Deflection angle α

Explanation:

Angle range: -180 ° < $\alpha \leq$ 180 °.



8.4.5 Slope

Description:

Given two points, calculate the slope value of the line connecting the two points.

Calculation result:

- 1. 2D distance L
- 2. Height difference H
- 3. Slope i

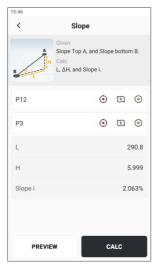
Description:

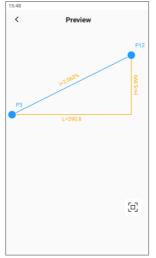
1. There are four ways to represent the slope, which can be configured in the general settings. The default is the commonly used percentage method.

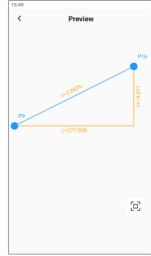
A. Percentage, i = H/L * 100%

- b. Degree, i = arctan(H/L)
- C. Mil, i = angle/0.06
- D. Fraction, i = H: L

2. If the input elevation at the bottom of the slope is greater than the elevation at the top of the slope, the slope and elevation difference are displayed as negative values.







8.4.6 Offset Point

Description:

Given two points and the relative relationship between the third point and the line connecting these two points.

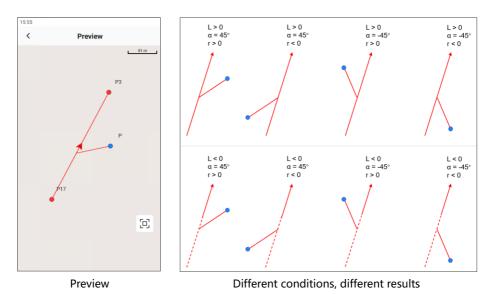
Calculation result:

Point P coordinate

Explanation:

1. When the distance L along the line is less than 0, the starting deflection point is on the reverse extension line; 2. Deflection angle: The angle format is unified with the whole, -180 ° < $\alpha \le 180$ °, default is 90 °, when $\alpha > 0$, it is the right turn angle along the line, and vice versa; 3. Offset distance: When r > 0, it extends outward along the deflection position, and when r < 0, the direction is opposite.





8.4.7 Intersection

Description:

Intersection provides four methods. After selecting a method, the graphic and text definitions on the page will switch accordingly. Intersection methods can be selected: two bearings, two distances, bearing & distance and four points.

Calculation result:

Intersection P coordinates. If there are two intersections, the coordinates of the two intersections can be saved.

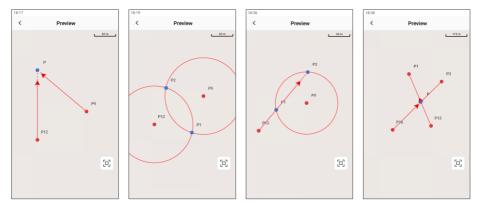
Explanation:

1. Azimuth conditions can be set to offset, left negative and right positive;

There are three types of intersection results: 1 intersection, 2 intersections, and no intersection. 3. Four kinds of results preview images are shown as

follows:





8.4.8 Segment Line

Description:

Given a line and the number of segments or the length of the segments it is divided into, find the segmentation node.

Calculation result:

Coordinates of segmented nodes.

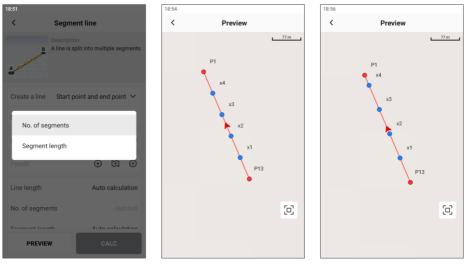
Description:

- 1. There are two ways to create a straight line, consistent with line library:
 - A. Start point + end point
 - B. Start point + azimuth + length
- 2. There are two types of segmentation methods:

A. Segment Nums, input range [2,1000];

B. Segment Length, input range [0.001, line length].

When automatically naming, if there are duplicate names, add (1) after them.



8.4.9 Segment Arc

Description:

Given an arc and the number of segments or segment length it is divided into, find the segment nodes.

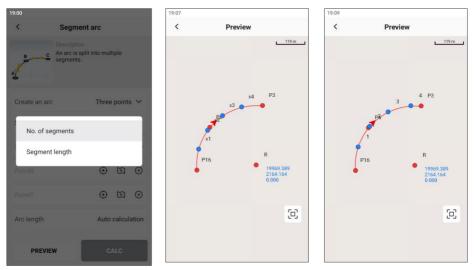
Calculation result:

Coordinates of segmented nodes.

Description:

1. There are three ways to create an arc, consistent with line library:

- A. Three points
- B. Two points + radius
- C. Start point + azimuth + length + radius
- 2. There are two types of segmentation methods:
 - A. Segment nums, input range [2,1000];
 - B. Segment length, input range [0.001, arc length]
- 3. When automatically naming, if there are duplicate names, add (1) at the end;
- 4. The preview shows the arc center point and arc center coordinates only, not saved.



8.4.10 Bisect Angle

Description:

Given points A, B, and C, the BP distance, P is on the ABC angle bisector, and BP is negative, indicating that it is on the reverse extension line.

Calculation result:

Point P coordinate.

Description:

P is on the angle ABC bisector. It should be noted that when BP is positive, it is displayed as P on the preview chart. When BP is negative, it is displayed as P 'on the preview chart.



8.4.11 Triangle

Description:

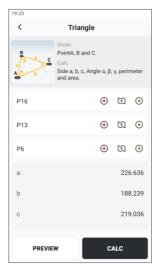
Given three points, solve for the side length, interior angle, perimeter, and area of the triangle.

Calculation result:

- 1. Three side lengths
- 2. Three internal angles
- 3. Perimeter
- 4. Area









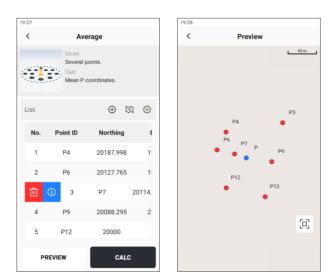
8.4.12 Average

Description:

Given several points, find the average.

Calculation result:

Mean coordinate



8.5 Serial Port

The intelligent serial port is used to view the message data of the current GNSS receiver and display it in the app window, which can be saved with one click. It is often used as a debugging tool for professionals.

Click [**Tools**] \rightarrow [Serial Port], open the page, the function description is as follows:

- 1. Switch: Turn on the serial port, default is off, can be manually turned on.
- 2. Message format: Optional US-ASCLL and HEX.
- 3. Auto Scroll: When there are many messages, the scrolling will be automatically refreshed by default. You can also uncheck it and manually swipe to view them.
- 4. Clear: The data in the window can be cleared and re-recorded.
- 5. Send: Configuration commands can be sent manually.

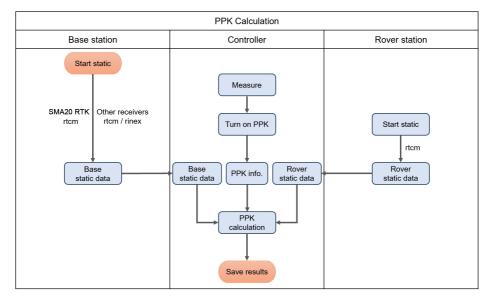
Note: Non-professionals, please do not modify the receiver configuration through instructions to avoid inaccurate positioning data caused by configuration changes. Please operate with caution.



8.6 PPK Calc

Differential positioning is divided into real-time differential and post-processing differential. When stable communication cannot be established on the surveying and mapping site, post-processing differential is often used as an effective measurement method. SMA Survey supports recording PPK data while RTK working, and can directly perform PPK calculation on the controller, and the calculation results can be stored in the project with one click.

8.6.1 Operation process



8.6.2 PPK measure

First, please confirm that both the SMA Survey version and the receiver version are the latest versions.

1) Create a new project

Create a project and define the correct coordinate system. Both PPK measure and PPK calculation are operated under this project.

2) Base configuration

This article takes the simultaneous operation of RTK + PPK as an example to introduce. If the current project only needs to collect PPK data, then the RTK benchmark station can be omitted.

The base station needs to complete two configurations in sequence: RTK radio broadcast and static configuration. It should be noted that the radio is configured first, followed by static configuration. After the configuration is completed, the controller and receiver will be automatically disconnected.

a) RTK radio broadcast configuration

Please start with a known point so that the static file can store accurate base station coordinate.

b) Static configuration

Main parameters: sampling interval 1Hz; recording time (minutes) needs to be longer to prevent the rover station from stopping before it finishes collecting, such as inputting 1440; file type rtcm.

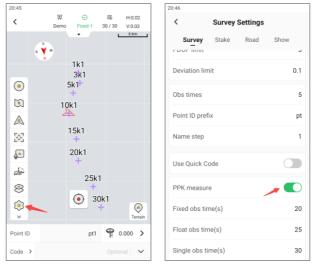
3) Rover configuration

a) Receive base differential data

Configure the rover station to internal radio mode, set the same protocol and channel as the base station, and obtain a fixed solution.

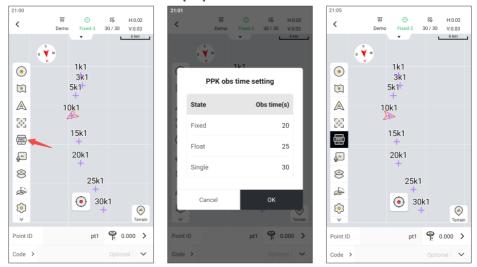
b) Entry [Measure], turn on PPK function switch

The PPK measure function is integrated into the Measure module. This function is turned off by default and needs to be manually turned on in the measurement settings. Click the settings button, turn on the [**PPK measure**] function switch at the bottom of the measurement settings, and you can set the default PPK measure time under different solution states. After setting, simply click the back button in the upper left corner.



4) Measure operation

After the PPK measure function switch is turned on, a PPK button will appear in the map toolbar. Click the button to confirm the observation time of different solution states again. By default, it takes 20 seconds to collect fixed solutions, 25 seconds to collect float solutions, and 30 seconds to collect single solutions. In order to ensure the calculation effect of PPK post-processing, it is recommended to use default parameters or more. That is, when point measurement, static data corresponding to the collection time will be synchronously recorded for PPK calculation. Click [**OK**] to start PPK collection.



The PPK button on the toolbar will remain active, indicating that the PPK data is being recorded. At this time, users do not need to pay attention to the PPK information, just like normal RTK Data Acquisition. During the operation, please keep the PPK button active. If you need to change the area to continue the operation or need to interrupt for a long time, you can turn off the PPK button first. Click start again when you work next time. Each time you click PPK to close, an rtcm file will be created in the receiver.

It should be noted that the app has some restrictions on RTK results by default. If not closed or modified, it will frequently prompt that the result exceeds the limit when collecting in the float/single solution state. Users can adjust according to the actual situation.

8.6.3 PPK calculation

1) Data preparation

Copy both the static data of the base station and the PPK collected data to the specified directory of the controller. When copying, you can use the controller OTG function to directly connect the receiver, and then access the receiver's memory for copying. Alternatively, copy the file to the computer first and then to the controller directory.

Name	Description
Base data	1. When the base station is SMA20 the copied file format is rtcm.
	2. When the base station is a third-party receiver, the copied file
	format is rinex / rtcm, and the coordinate and antenna height in the
	header of the file must be accurate;
	3. The base station data can be multiple.
Rover data	1. Stored in the receiver, please choose the correct RTCM file according
	to the observation time and file name;
	2. The rover station PPK file can be multiple.
Controller	1. Copy the base data to:/SMAJAYU/SMASurvey/Projects/{Project
directory	Name}/PPK/PPK_base
	2. Copy the rover station data to:/SMAJAYU/ SMASurvey/Projects/
	{Project Name}/PPK/PPK_rover

2) PPK calculation

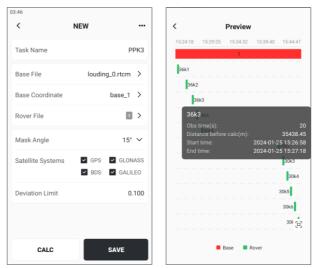
PPK calculation does not require post-processing software, it can be solved directly on the controller. After completing the data copy, go to [**Tools**] \rightarrow [**PPK Calc**], click the [**NEW**] button at the bottom, and set it as follows:

Name	Description
Task Name	Required field
Base File	Required, can select one or more files
Base Coordinate	Optional modify the coordinate of the base

Rover File	Required, can select one or more files
Mask Angle	Required, default 15 °
Satellite systems	Default all satellite systems
Deviation Limit	Default 0.1 m, control the reliability of the results

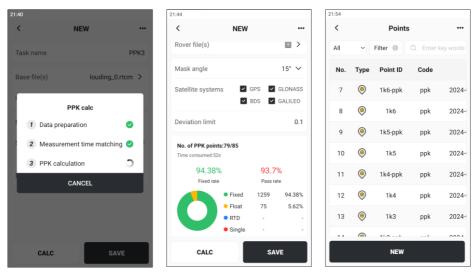
21:23				21:23		03:45	
≧ 20240	012500pp	k	0	<	РРК	<	NEW
ार्म Demo	⊕ Fixed-1	85 30 / 30	D 20%	PPK1 Obs time: 9.5h Start time: 2024-01-	No. of PPK points: 85	Task Name	PPK3
	٢	O TELA T	, d	PPK2 Obs time: 9.5h		Base File Base Coordinate	Not null >
Volume	Area	Coord transf	COGO	Start time: 2024-01-	25 01:58:55	Rover File	Not null 🔰
Serial port	PPK calc	Unit	More			Mask Angle	15° 🗸
		converter				Satellite Systems	✓ GPS✓ GLONASS✓ BDS✓ GALILEO
						Deviation Limit	0.100
Projects	\$ Settings	X Survey	1 Tools		NEW	CALC	SAVE

After selecting the data of the base station and the rover station, you can click on the upper right corner [...] \rightarrow [**Preview**] to view the relative relationship between the observation time of the base station and the rover station. The view can be zoomed, scrolled, and dragged back and forth.



Click the [**CALC**] button at the bottom, and the app starts to calculate PPK data. Users can see the calculation process, including data preparation, measurement time matching, and PPK calculation.

After the calculation is completed, the calculation results will be displayed on the page, including: the number of PPK measurement points (qualified /total), calculation time, fixed rate (the proportion of fixed solutions for all epochs), qualified rate (the proportion of qualified solutions for all fixed epochs, which needs to meet the deviation limit), and pie chart (showing the number and proportion of various calculation states). Click [**Save**], and the qualified calculation results will be automatically saved to the point library. Add the suffix ppk to the point name to distinguish it from the points measured by RTK.



Click on the top right corner $[...] \rightarrow [Export]$ to export the PPK calculation report, with the file extension * .html.

Calc	ulation	details	
Rover file(s)		٢	Preview
Mask angle	_	2	Export
Satellite systems	_	_	GLONASS
Deviation limit	_	_	0.1
No. of PPK points: Time consumed:52s	79/85		
94.38% Fixed rate		93.7 Pass ra	-
	 Fixed Float 	1259 75	94.38% 5.62%
	 RTD Single 		-
CALC		SA	VE

The PPK calculation report consists of the following parts: project information, coordinate system, PPK calculation results, and PPK measurement details. The PPK measurement details record the results of each epoch calculation in detail.

	JURE_EV	① 文件 D:/Down			10:000	110 10 00000707	01 10 01 01 01 01 01	10.000	1.003	T TIMEN T	ଷ 🖈 👌 🛆 🗋 🔘
1314	36k2_21	2024-01-25 15:26:54	3509436.277	388039.194	16.803	118*49*08.33817*	31*42'07.87862*	16.803	1.869	Fixed	
315	36k1_1	2024-01-25 15:25:10	3509428.522	388034.408	16.81	118'49'08.15961"	31"42'07.62522"	16.81	1.869	Fixed	
316	36k1_2	2024-01-25 15:25:11	3509428.524	388034.404	16.801	118*49'08.15949*	31"42'07.62527"	16.801	1.869	Fixed	
317	36k1_3	2024-01-25 15:25:12	3509428.51	388034.391	16.841	118*49'08.15899*	31°42'07.62483*	16,841	1.869	Fixed	
318	36k1_4	2024-01-25 15:25:13	3509428.512	388034.394	16.843	118*49*08.15909*	31"42'07.62489"	16.843	1.869	Fixed	
319	36k1_5	2024-01-25 15:25:14	3509428.526	388034.405	16.8	118*49*08.15950*	31"42'07.62533"	16.8	1.869	Fixed	
320	36k1_6	2024-01-25 15:25:15	3509428.513	388034.392	16.839	118*49'08.15901*	31°42'07.62490*	16.839	1,869	Fixed	
1321	36k1_7	2024-01-25 15:25:16	3509428.513	388034.394	16.847	118'49'08.15912*	31"42'07.62491"	16.847	1.869	Fixed	
322	36k1_8	2024-01-25 15:25:17	3509428.509	388034.394	16.844	118*49'08.15910*	31"42'07.62480"	16.844	1.869	Fixed	
323	36k1_9	2024-01-25 15:25:18	3509428.509	388034.391	16.845	118*49'08.15899*	31*42'07.62478*	16.845	1.869	Fixed	
1324	36k1_10	2024-01-25 15:25:19	3509428.511	388034.391	16.84	118°49'08.15900"	31°42'07.62486*	16.839	1.869	Fixed	
325	36k1_11	2024-01-25 15:25:20	3509428.512	388034.392	16.841	118*49*08.15901*	31*42'07.62487*	16.841	1.869	Fixed	
326	36k1_12	2024-01-25 15:25:21	3509428.51	388034.391	16.839	118*49'08.15898*	31°42'07.62480*	16.839	1.869	Fixed	
327	36k1_13	2024-01-25 15:25:22	3509428.51	388034.392	16.839	118°49'08.15902*	31°42'07.62482*	16.839	1.869	Fixed	
328	36k1_14	2024-01-25 15:25:23	3509428.511	388034.391	16.835	118*49*08.15897*	31*42'07.62486*	16.835	1.869	Fixed	
329	36k1_15	2024-01-25 15:25:24	3509428.509	388034.393	16.847	118*49'08.15907*	31*42'07.62479*	16.847	1,869	Fixed	
1330	36k1_16	2024-01-25 15:25:25	3509428.519	389034.403	16.808	118*49*08.15942*	31°42'07.62509*	16.807	1.869	Fixed	
331	36k1_17	2024-01-25 15:25:26	3509428.509	388034.392	16.841	118*49*08.15904*	31°42'07.62478*	16.841	1.869	Fixed	
332	36k1_18	2024-01-25 15:25:27	3509428.51	388034.393	16.842	118*49'08.15908*	31*42'07.62481*	16.842	1.869	Fixed	
333	36k1_19	2024-01-25 15:25:28	3509428.507	388034.392	16.845	118*49*08.15904*	31°42'07.62470*	16.845	1.869	Fixed	
334	36k1_20	2024-01-25 15:25:29	3509428.506	388034.391	16.84	118°49'08.15898*	31°42'07.62467*	16.84	1.869	Fixed	
335	36k1_21	2024-01-25 15:25:30	3509428.516	388034.403	16.804	118*49*08.15943*	31"42'07.62501"	16.804	1.869	Fixed	

Note:

- 1. You can modify the calculation configuration and recalculate.
- 2. The calculation time depends on the performance of the end point, the number of epochs of a single measurement point, the total number of measurement points, the length of the base line, signal quality and other factors. Please be patient during the calculation process.
- 3. The recalculated result overwrites the original PPK result when you click Save to Points again.

8.7 Unit converter

The unit converter tool provides conversion between different units of angle, distance, and slope commonly used in surveying and mapping, which is very convenient.

- 1. Angle: It can achieve mutual conversion between dms, degrees, radians, and percentiles.
- 2. Distance: Can achieve mutual conversion of commonly used length units.
- 3. Slope: Four types of slope units can be converted to each other, with percentages and fractions formatted for display.

3:38			23:44		
<	Unit converte	er	<	Unit converter	r
Angle	Distance	Slope	Angle	Distance	Slope
Angle unit		dd°mm'ss" ∨	Distance unit		Meter 🗸
ddd°mm'ss.sss	iss"	000°00'00.00000"	Meter		1000
d.ddddd			Millimeter		1000000
Radian			Mile		0.621
Gon			Feet		3280.84
			US Feet		3280.833
			Inch		39370.079
	CALC			CALC	

8.8 Grid to Ground

When GPS and total station work together, it is usually necessary to modify the distance measured by the total station so that it is consistent with the distance projected onto the Gaussian plane by GPS measurement. If GPS or total station work alone, there is no problem with distance modification. Near the central meridian, the distance modification value is small, and the farther away from the meridian, the larger the distance modification value. If you want to avoid distance modification, you can appropriately reduce the projection bandwidth. When providing coordinate results, special explanations should be made to ensure the accuracy and reliability of the data.

The following equation is the formula for calculating the distance D from the length S of the geodetic line to the straight line on the Gaussian plane. It can fully meet the requirements for the reduction of first-order side lengths, and can be omitted for the reduction of second-order side lengths. For the reduction of third and fourth-order side lengths, it can be further omitted. $y_m^4 \Delta y^2$

$$D = (1 + \frac{y_m^2}{2R^2} + \frac{\Delta y^2}{24R^2} + \frac{y_m^4}{24R^2}) \cdot S$$

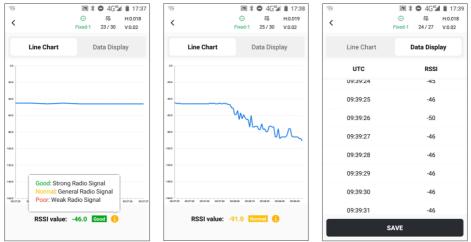
In the app, select the current location to calculate the grid factor, elevation factor, and comprehensive factor. After clicking [CALC] and [APPLY], return to [**Inverse**] to view the grid data and plane data of the selected distance.

:16		03:17		03:17	
Grid to Gro	ound	<	Inverse	<	Inverse
oordinate	• • •	P2	• • •	P2	۲
coordinate Type 🔵 BLH	XYZ NEU	P12	• • •	P12	۲
(X)	3544626.7287	Туре	Grid Grid	ound Type	
(Y)	383212.6895	Azimuth α	192:56:53	.559 Azimuth a	
J(H)	11.55	L	256	.247 L	
Grid Scale Factor	1.000167	н		0.19 H	
Elevation Scale Factor	0.999998	Slope dist. S	256	.247 Slope dist. S	
Combined Scale Factor	1.000165	Slope i	0.0	173% Slope i	
		$\triangle N$	-249.7	7313 🛆 N	
CALC	APPLY	PREVIEW	CALC	PREVI	ew

8.9 RSSI

RSSI (Received Signal Strength Indicator) is an indicator of the received signal strength. The RSSI value is usually a relative quantity used to measure the strength of the received wireless signal power. In wireless communication systems, the size of the RSSI value is very important for evaluating communication quality, signal coverage, and determining whether to adjust transmit power or receive sensitivity.

When RTK uses radio to transmit or receive differential signals, the RSSI function can be used to assist in checking the signal strength of the current radio station.



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