



X1-Series GNSS Receiver User Manual

V1.0, modified on 2023.9.

Corporate Office

SingularXYZ Intelligent Technology Ltd. Room 211, Floor 2, Building A, No. 599 Gaojing Road, 201702 Shanghai, China Tel: +86-21-60835489 Fax: +86-21-60835497 Website: <u>https://www.singularxyz.com</u> E-mail: <u>singularxyz@singularxyz.com</u>

Trademark notice

© 2021 SingularXYZ Intelligent Technology Ltd. All rights reserved. SingularXYZ is the official trademark of SingularXYZ Intelligent Technology Ltd., registered in People's Republic of China, EU, USA and Canada.

FCC Notice

SingularXYZ[®] X1 GNSS receivers comply with the limits for a Class B digital device, pursuant to the Part 15 of the FCC rules when it is used in the Portable Mode.

Operation is subject to the following two conditions:

(1) This device may not cause harmful interference;

(2) It must accept any interference received, including interference that may cause undesired operation.

Copyright Notice

This is the V1.0 (Sep, 2023) revision of the X1 GNSS Receiver User Guide. It can not be copied or translated into any language without the written permission of SingularXYZ.

Technical Assistant

If you have any question and can't find the answer in this manual, please contact your local dealer from which you purchased the X1 receiver. Alternatively, request technical support from SingularXYZ.

Website: <u>www.singularxyz.com</u> or technical support email: <u>support@singularxyz.com</u>. Your feedback about this Guide will help us to improve it with future revisions.

Safety Information

Before using the receiver, please make sure that you have read and understood this User Guide, as well as the safety requirements.

- Connect your devices strictly based on this User Guide
- Install the GNSS receiver in a location that minimizes vibration and moisture

- Avoid falling to ground, or colliding with other items
- Do not rotate 7-pin Lemo port
- Do not cover the radio, keep a sound ventilation environment
- To reduce radiation, please keep above 2 meters away from the radio station
- Take lighting protection measures when installing antennas
- Change the cable if damaged

Related Regulations

The receiver contains integral Bluetooth wireless technology and UHF. Regulations regarding the use of the datalink vary greatly from country to country. In some countries, the unit can be used without obtaining an end-user license. But in some countries the administrative permissions are required. For license information, please consult your local dealer.

Use and Care

The receiver can withstand the rough treatment that typically occurs in the field. However, the receiver is high-precision electronic equipment and should be treated with reasonable care.

Warning and Caution

An absence of specific alerts does not mean that there are no safety risks involved. A Warning or Caution information is intended to minimize the risk of personal injury and/or damage to the equipment.

WARNING- A Warning alerts you to a potential risk of serious injury to your person and/or damage to the equipment, because of improper operations or wrong settings of the equipment. CAUTION- A Caution alerts you to a possible risk of damage to the equipment and/or data loss.

Warranty Notice

SingularXYZ does not warranty devices damage because of force majeure (lighting, high voltage or collision).

SingularXYZ does not warranty the disassembled devices.

Contents

1 Introduction	1
1.1 About the receiver	1
1.2 Receiver features	1
1.3 X1 Receiver Packing List	1
1.3.1 Basic Supply kit	2
2 User Interface	3
2.1 Environmental requirements	3
2.2 Front panel	3
2.3 Lower housing	3
2.4 Power supply	4
2.4.1 Battery	4
2.4.2 External Power Supply	4
3 Static Survey	5
3.1 Static Data Collection	5
3.2 Static Data Download	8
3.3 RINEX Convert	9
4 RTK Workflow	11
4.1 Installation of SingularPad	11
4.2 Create a New Project	11
4.3 Device connection	13
4.3.1 NFC connection	13
4.3.2 Bluetooth connection	13
4.4 Quick setup X1 receiver	13
4.4.1 Start Base Station by SingularPad	13
4.4.2 Start Rover Station by SingularPad	18
5 RTK Survey-field Data collect	27
5.1 Point Survey	27
5.1.1 Tilt survey	33
2. Initialization	33
5.2 Detail survey	39
5.3 Control point survey	41
5.4 Point stakeout	41
5.5 Line stakeout	44
5.6 CAD mapping and stakeout	46
5.7 DSM stakeout	49
5.8 Points Database	50
5.9 Data export/ import	52
5.9.1 Import points data	52
5.9.2 Export points data	54

Chapter 1 Introduction

The SingularXYZ X1-Series (hereinafter X1) GNSS Receiver User Guide is aimed to help you get familiar with the X1 receiver and start your project effectively. We highly recommend you to read this manual before surveying, even you have used other GNSS RTK receivers before.

1.1 About the Receiver

With high precision GNSS module inside, X1 GNSS receiver can be applied in RTK mode with all GNSS constellations. X1 receiver has ultra-small size and strong antiinterference ability to make it possible to work even in harsh environments. It is the ideal RTK/GNSS product for surveyors.

1.2 Receiver Features

The SingularXYZ X1 GNSS Receiver key features:

- Ultra small and super light
- Size: Φ133.5 mm × 67 mm
- Weight: 870 g
- 1408 channels of simultaneously tracked satellite signals
- Fast charging via Type-C interface
- Cable-free Bluetooth wireless technology
- LCD Display with easy configure functions
- IP68 waterproof
- Full base/rover interoperability
- Integrated Rx&Tx radio with 12.5KHz frequency interval
- Integrated IMU sensor
- Long distance range radio module
- Integrated 4G module (exclude X1 Lite), support Ntrip and TCP protocols

1.3 X1-Series Packing List

This section provides overall X1 receiver packing list, including basic supplies and customized kits based on your requirements.

1.3.1 Basic Supply kit

Standard



Options For Rover

Data Collector ×1	Collector Bracket ×1	Centering Pole & Bag ×1
Jacob Barrow	R.	

Chapter 2 Setup the X1 Receiver

This chapter provides general information on environmental requirements, setup, power supply and connection of the X1 receiver.

2.1 Environmental requirements

To keep the receiver with a reliable performance, it is better to use the receiver in safe environmental conditions:

- Operating temperature: -40°C to +65°C
- Storage temperature: -55°C to +85°C
- Out of corrosive fluids and gases
- With a clear view of sky

2.2 Front panel

Receiver front panel contains 4 indicator LEDs, Function button and Power button.



2.3 Lower housing

Receiver lower housing contains a serial port, USB port, UHF radio antenna connector and one sim card slot.



2.4 **Power supply**

2.4.1 Battery

The receiver is equipped with internal batteries.

- 6700 mAh, over 20 hours working time
- Fast charge of 2.5 hours charging time

2.4.2 External Power Supply

The receiver is connected to an external power supply through a lemo to RS232 cable, and make sure that the red alligator clip is connected to the positive of external power supply, black one to negative. Over- voltage function cannot protect your X1 receiver if reverse connection.



Tip: The power consumption will be increasing if the base station transmits correction data through internal UHF in the RTK mode; therefore, we strongly suggest using external power (7-28 volt DC) for the base station.

Chapter 3 Static Survey

This chapter describes static survey through X1 receiver and SingularXYZ Converter software. For static survey, X1 supports 3 data formats: XYZ, Rinex3.02 and Rinex3.04. XYZ format is raw observation data and you can convert the data from SingularXYZ binary format (*.XYZ) to RINEX format via <u>SingularXYZ Converter Software</u> (Contact SingularXYZ support team for the tool).

3.1 Static Data Collection

Static survey is mainly used for the control survey. To reach millimeter accuracy, follow as below:

- At least 3 GNSS receivers are required to form a stable triangulation network.
- It is better to set Data Log Session as manual on the known point.
- Power off the receiver before moving to other observation site.
- To quickly post-process static observation raw data, write down the station name, receiver SN, antenna height, start and end time for each observation site.

Tip: You can start recording static data in the front panel, it's convenient for you.

The following steps give an example of static survey.

 Go to *Device* >> *Static and collect points*. Choose the Record mode, there are two record modes and they can work together.



2. Option Settings. Input Record name and Point name. Set the Collection Interval, Observation Time and Data Format.

÷	SINGLE Age0	H:5.411 V:6.753	22/27 89%
Record mo	de		Record1 >
Options Se	ettings		
Record nar	ne		REC1
Point name	9		$ \mathbf{x} $ $ imes$
Collection	Interval		1S >
Observatio	n Time		1 hour \rightarrow
Data Forma	at		xyz >
Loop Reco	rd		
Auto Reco	\bigcirc		
Record Spa	ace		3000
	Sta	rt	

3. Open the *Loop Record* according to you needs. If this option is opened, receiver will delete the earliest recorded data to keep recording when the record space is full.

÷	SINGLE Age0	H:5.411 V:6.753	22/27 89%
Record mo	de		Record1 >
Options Se	ttings		
Record nan	ne		REC1
Point name	1		X1 🗙
Collection I	nterval		1S >
Observation	n Time		1 hour \rightarrow
Data Forma	ıt		xyz >
Loop Recor	ď		
Auto Recor	d Static Data		\bigcirc
Record Spa	ce		3000
	Sta	rt	

4. Open the *Auto Record Static* according to you needs. If this option is opened, the receiver automatically records static data after it is power on.

÷	SINGLE Age0	H:5.411 V:6.753	22/27 89%
Record mo	de		Record1 >
Options Se	ttings		
Record nan	ne		REC1
Point name			$_{\rm X1}$ $ imes$
Collection I	nterval		1S >
Observation	n Time		1 hour \rightarrow
Data Forma	ıt		xyz >
Loop Recor	ď		
Auto Recor	d Static Data		0
Record Spa	ce		3000
	Sta	rt	

5. Set the *Record Space* in the end. It will limit the amount of data that receiver record.

÷	SINGLE	H:5.411 V:6.753	22/27
Record mo	de	1.0.700	Record1 >
Options Se	ttings		
Record nan	ne		REC1
Point name			$_{\rm X1}$ $ imes$
Collection I	nterval		1S >
Observation	n Time		1 hour \rightarrow
Data Forma	it		xyz >
Loop Recor	d		
Auto Recor	d Static Data		\bigcirc
Record Spa	се		3000
	Sta	rt	

6. Click **start** to static survey.



3.2 Static Data Download

The raw observation data is saved in internal memory of X1 receiver, when connected with PC via TYPE-C cable, the X1 receiver can work as a USB Flash Disk – SingularXYZ_DISK, which means you can copy the static data to PC directly.

📙 → U 盘 (E:) → 1-REC1 → 2023293								
0 KB								
6 KB								
7 KB								
0 KB								
3 KB								

In addition, you can download the static data via WebUI, connect the WiFi of the X1 receiver and log in **192.168.10.12** (Username: **admin**, Passwords: **admin**) Go to **Work management** >> **File Download** to download the static data.

5ingular XYZ	En	le Downica	1		
	Reco	ed Name:	148C1 V		
		1pe	XYZ Rine3.02		
	-	hanne -	0 2023-10-20		
File Download			Rebeat Deliver All		
		Kenter	File Name	File Size	
			1023000052930344.XYZ	195.740	Device Devic
			1823608052930045.XVZ	146.760	Dentar Dan
			1823608062930547 XVZ	2459.1420	Dourised Deide
	•		1023600062930600.XV2	5162.048	Duritar Deen

3.3 **RINEX Convert**

After copy raw observation data to PC, you can convert the data from SingularXYZ binary format (*.XYZ) to Rinex in SingularXYZ Converter software.

- The following steps give an example of Rinex convert.
 - 1. Start SingularXYZ Converter software;
 - 2. Click open and select the path of your XYZ data;

SingularXYZ C	Converter			-
MarkName	X1	AntType	SITX1	
Measure	Vertical Height	~		
XYZ File:	C:\Users\suppo\De	esktop\1823E00	052930600.XYZ	:
Output:	D:\SingularXYZCor	verterOutput		
	OPEN		SAVE	CONVERT
Output	MessageID	Number	File Name	Туре
	<	2	<	>

- 3. Input marker name and choose the measure type, and the antenna type is automatically identified as SITX 1 for X1 receiver;
- 4. Click *convert* to start convert XYZ to Rinex, and the Rinex files will be output to the output file path.

SingularXYZ C	onverter							
MarkName	X1	AntT	/pe S	ITX1				
Measure	Vertical Height	~						
XYZ File:	C:\Users\suppo\	C:\Users\suppo\Desktop\1823E00052930600.XYZ						
Output:	D:\SingularXYZConverterOutput							
	OPEN SAVE CONVERT						Т	
Output	MessageID	Number		File Name		Туре		
•	12	1691		1823E00052	930	с		
	106	364		1823E00052	930	G		
	107	107 224 1823E00052930			930	L		
	108	499		1823E00052	930	N		
	109	168		1823E00052	930	0		
	<		>	<			>	

Chapter 4 RTK Workflow

This chapter introduces how to conduct RTK Survey with SingularPad Software. SingularPad is professional Android-based surveying software developed by SingularXYZ team. SingularPad is fully functional as a field surveying software, equipped with complete work modes and necessary functions for surveyors. Projection/datum configuration, GSM/radio/PDA CORS work modes, point survey/stake out/CAD sketch/COGO calculation and etc. can all be found in SingularPad.

4.1 Installation of SingularPad

SingularPad has been pre-installed on SingularXYZ data collector before shipping, and you can use one month for free, if you want to download on your device, please connect us.

4.2 Create a New Project

Click **Project Manager**, click the **New** button in the lower corner if the screen and input project name, set coordinates systems parameters and click **OK** to save the project.



← Project Details	5	← Create Project	t	
Basic Information	Coordinate systems parameters	Basic Information Coordinate systems parameters		
Project Path gram Stora	ge/SingularPad/Project >	Coordinate systems pa type	rameters Local > parameters	
Project Name	X1	Name	3	
Operator	SingularXYZ	Ellipsoid Parameter		
Distance Unit	Meter >	WGS84 Semimajor axis:637	1/f:298.257223563	
Angle format	dd°mm'ss.ssss" >	ITRF Parameter		
Lat/Lon format	dd°mm'ss.ssss" >	Not Set	>	
Default 1st Point Name	e Pt1 >	Projections Paramete	er	
Notes		UTM Central Meridian	E123°00'00" >	
Date Created	2023-10-20 03:26:22	Datum Parameter		
Cancel	ОК	Previous	ОК	

In **Project Manager interface**, you can click previous projects in the Project List to **remove** or **open** it. If you have added one project, you can click the project name in the main interface to check the current project details, including Project Name, Project Path and Coordinate systems parameters. And you can edit it.



If you can not find the datum you want in the list, follow instructions below to add one: select ellipsoid para, projection para, datum para, and input horizon adjustment, vertical adjustment and local offsets based on your request. Save and apply it. Meanwhile you can share the coordinate system with your workmates.

4.3 **Device connection**

4.3.1 NFC connection

Equipped with an NFC chip, users can easily connect the X1 receiver and the data collector with just one touch, as shown in the figure below.



4.3.2 Bluetooth connection

After creating a new project, switch to **Device** interface, click **Communication**. You can connect SingularPad with SingularXYZ X1 GNSS receivers. Make sure device Bluetooth turned on, click Find device and select SN number of your X1 receiver. Then allow pair to finish the connection. After connecting X1 receiver, you can check the information of the receiver (like firmware version) in **Device Information**. After connected successfully, the floating window will show the positioning status.

Tip: If you are failed to connect with receiver through SingularPad, you can just follow prompt info to go into the device Bluetooth setting interface to make sure Bluetooth paired successfully. Sometimes you need forget the device Bluetooth, restart the receiver or SingularPad Software and get pair again.

4.4 Quick setup X1 receiver

4.4.1 Start Base Station by SingularPad

When work as a Base station, SingularPad supports transmit the correction data in Internal Radio mode and Device Internet mode.

Internal Radio: This mode uses internal radio to transmit the correction data from Base to Rover. You need to set Base and Rover with same protocol and frequency.

- Protocol: Supports TRIMTALK, TRIMMK3, TT450S, TRANSEOT and SATEL for base transmission
- Frequency: select a channel or customize a frequency, the range of frequency is 410-470MHz
- Baud rate: 4800, 9600 and 19200. This option is to set the baud rate of lemo

port

• Power: High and low (low power will reduce the RTK range)

The following steps give an example of internal radio transmission.

1. Go to *Device* >> *Base*. Set *Base ID* and choose the *Diff Mode* firstly.

SII	NGLE H:2. vge0 V:4.	191 🗞	•	÷	Base Setup Pa	ara
	X1		60%	Base	e ID	123 🗙
		•	\mathbf{R}	Diff I	Mode	RTCM3.2 >
Communica tion	- Rov	er	Base			
×			$\overline{\mathbb{R}}$			
Inspection accuracy	Devi Informa	ce s ation co	Static and llect points			
-		3	+			
Com Setting	s Devi Activa	ce ition	More			
Project	Device	Survey	Tools		0	ĸ

 Set Start up Mode, SingularPad supports Single Point, Input Base Coordinates and Use Current Coordinates. Single Point means startup base station in at unknown coordinates. Input Base coordinates means startup a base station in a known coordinates as need you input the latitude, longitude and the height. Use Current Coordinates means startup base station in current coordinates automatically.

÷	Base mode s	settings		
Base S	Setup Para			
Base	ID:123	Diff Mode:RTCM3	3.2 >	
Start I	Up Mode	Single I	Point >	
Datal	Start Up M	ode		
Data	Single Point		dio >	
Prote	Input Base C	Coordinates	>	
	Use Current	Coordinates		
1				
Share Collection Set Base Startup				

3. Set **Data Link** as **Internal Radio**. Set parameter settings, Channel, Frequency, Protocol, Baud Rate and Power.

← Parameter Settings				
Internal Radio				
Channel	6 >			
Frequency	460.05			
Protocol	TRIMTALK >			
Baud Rate	9600 >			
Power	High >			
Note: When Base station radio power is set to Low or 500mW & below, RTK range will be reduced!				
ок				

4. When start Base succeed, it will show as below in SingularPad.

Device Internet: This mode uses GPRS (internet data) to transmit the correction data from Base to Rover. You need to insert a SIM card to Base, set the Base to log

on the server (with static IP address), and the Rover receives the correction data by Ntrip protocol.

The following steps give an example of device internet transmission.

- 1. Insert a SIM card to the X1 receiver and then turn on the receiver.
- 2. Go to *Device* >> *Base*. Set Base ID and choose the Diff Mode firstly.



3. Set Start up Mode. And choose Device Internet in Data Link.

÷	Base m	ode settings		÷	Base m	ode settings	
Base S Base	Setup Pa	ara Diff Mode	e:RTCM3.2 >	Base S	Setup Pa ID:123	ara Diff Mode	RTCM3.2 >
Start L	Jp Mode		Single Point \rightarrow	Start	Up Mode		Single Point $>$
Datal	Start	Up Mode		Datal	Data I	_ink	
Data	Single	Point	net >	Data	Interna	al Radio	net >
IP:47	Input E	Base Coordinate	es >	IP:47 Pass	Device	Internet	>
Base	Use Cu	urrent Coordina	tes 0005	Base	Interna	al Radio+Device et	0005
			Set Base				Set Base
Sha	are	Collection	Startup	Sh	are	Collection	Startup

 Parameter Settings. Choose NTRIP in Connect Mode. Input the server IP, Port, Password in the CORS Settings. APN Settings (Access point number, acquire from the mobile service provider). Input Name, User and Password.

← Parameter Setti	ngs			
Device Internet				
Connect Mode	NTRIP >			
CORS Settings	Gr			
IP	47.103.96.216 🗙			
Port	8080			
Password	©			
APN Settings	81			
Name	3gnet			
User				
Password	0			
ОК				

5. Set the *Base access point* in the end.

← Base mode settings					
Base Setup Pa	ara	8			
Base ID:123	Diff Mod	e:RTCM3.2 >			
Start Up Mode		Single Point \rightarrow			
Datalink Settir	ngs				
Data Link	ſ	Device Internet >			
Connect Mode IP:47.103.96.2 Password:****	Connect Mode:NTRIP IP:47.103.96.216 Server Port:8080 > Password:******				
Base access p	oint	1823E0005			
		Set Base			

6. When start Base succeed, it will show as below in SingularPad.

Tip: X1 receiver does not support hot swap, please shut down the X1 receiver then insert the SIM card. If you turn on the receiver and insert the SIM card, please reboot the receiver.

4.4.2 Start Rover Station by SingularPad

When work as a Rover station, SingularPad supports receive the correction data in Internal Radio mode, Device Internet mode and Phone Internet Mode. Internal Radio: Select the same protocol and frequency with the Base receiver, and then the receiver status will turn single to be fixed. The following steps show an example of internal radio.

The following steps give an example of internal radio transmission.

- SINGLE ê Rover mode settings (+)Age0 V:4.729 26/47 **Datalink Settings** X1 Data Link Internal Radio Channel:6 Frequency:460.05 Communica-Rover Base Protocol:TRIMTALK Baud Rate:9600 tion Base Coordinates Change Alert Inspection Device Static and accuracy Information collect points Com Settings Device More Activation Tools Project Survey
- 1. Go to *Device* >> *Rover*. Set *Data Link* as *Internal Radio*.

2. *Parameter Settings*. Set Channel, Frequency and Protocol same with the Base.

← Parameter Settings	
Internal Radio	
Channel	6 >
Frequency	460.05
Protocol	TRIMTALK >
Baud Rate	9600 >
ОК	

3. **Base Coordinates Change Alert**: SingularPad will alert when you connect with different base station. When the Base station is VRS, please don't open this.

← Rover mode settings						
Datalink Settir	ngs					
Data Link			Internal Radio \rightarrow			
Channel:6 Frequency:460.05 Protocol:TRIMTALK Baud Rate:9600						
Base Coordina	tes Cha	inge Aler	t = O			
Share	Coll	ection	Apply			

4. Click **Apply** to start the Rover mode. When start Rover succeed, it will show as below in SingularPad.

Device Internet: Same with start Base station, you need to insert a SIM card to Rover,

set the server IP and port, and receives the correction data by Ntrip protocol. The following steps give an example of device internet transmission.

1. Go to *Device* >> *Rover*. Set *Data Link* as *Device Internet*.

SINGL	_E H:2.191	٠	← Rover mode	settings
Age0	V:4.729 26 X1	6/47 60%	Datalink Settings	
-			Data Link	Device Internet >
Communica- tion	Rover	Base	Connect Mode:NTR IP:47.103.96.216 User:SingularXYZ	IP Server Port:8080 Password:*****
		$\overline{\mathbb{R}}$	MountPoint Setting	Get
Inspection	Device	Static and	MountPoint	Office >
accuracy	Information	collect points	Phone internet acces	ss 💽
-		+	Base Coordinates Ch please close)	nange Alert(VRS
Com Settings	Device Activation	More	Radio relay	\bigcirc
	-			
Project D	evice Surve	y Tools	Share Co	llection Apply

 Parameter Settings. Choose NTRIP in Connect Mode. Input the server IP, Port, User and Password in the CORS Settings. APN Settings. Input Name, User and Password.

← Parameter Settings			
Device Internet			
Connect Mode	NTRIP >		
CORS Settings	9		
IP	47.103.96.216 🗙		
Port	8080		
Password	©		
APN Settings	8		
Name	3gnet		
User			
Password	õ		
OK			

 Click *Get* button on the right and "Get MountPoint succeeded" will be displayed below. Then choose the mountpoint.

← Rover mode settings				
Datalink Settings				
Data Link	Device Internet >			
Connect Mode:NTRIP				
IP:47.103.96.216 Se User:SingularXYZ Pa	rver Port:8080 > ssword:******			
MountPoint Settings	Get			
MountPoint	>			
Phone internet access				
Base Coordinates Change please close)	e Alert(VRS			
Radio relay	\bigcirc			
Get MountPoint s	ucceeded! Apply			

4. **Phone internet access**: Rover station will access the mountpoint via phone internet, you need to make sure controller have access to Internet. If don't open this, rover station will access the moutpoint via device internet.

\leftarrow Rover mode settings							
Datalink Settir	Datalink Settings						
Data Link	Data Link Device Internet >						
Connect Mode:NTRIP IP:47.103.96.216 Server Port:8080 > User:SingularXYZ Password:******							
MountPoint S	ettings			Get			
MountPoint	MountPoint Office >						
Phone internet access							
Base Coordinates Change Alert(VRS Coordinates Change Alert(VRS							
Radio relay							
Share	Coll	ection	,	Apply			

5. **Base Coordinates Change Alert**: SingularPad will alert when you connect with different base station. When the Base station is VRS, please don't open this.

\leftarrow Rover mode settings						
Datalink Settings						
Data Link		Device Internet >				
Connect Mode:NTRIP IP:47.103.96.216 Server Port:8080 > User:SingularXYZ Password:******						
MountPoint Se	ettings	Get				
MountPoint	MountPoint Office >					
Phone internet	Phone internet access					
Base Coordinates Change Alert(VRS =O						
Radio relay						
Share	Collection	Apply				

6. Click *Apply* to start the Rover mode. When start Rover succeed, it will show as below in SingularPad.

Phone Internet: This mode uses the phone internet to transmit the correction data from Base to Rover. Please make sure the PDA device is in good network conditions, such as 4G, WiFi or hot spot.

The following steps give an example of device internet transmission.

1. Go to **Device** >> **Rover**. Set **Data Link** as **Phone Internet**.

\leftarrow Rover mode settings					
Datalink Settir	ngs				
Data Link		Phone Internet	>		
Connect Mode IP:47.103.96.2 User:Singular)	e:NTRIP 216 Server KYZ Passwe	Port:8080 ord:*****	>		
MountPoint Se	ettings	Get			
MountPoint			>		
Receive data					
		Start			
Auto connect t	o network)		
Share	Collection	Apply			

 Set Connect Mode, for X1 receiver supports NTRIP and TCP Client. CORS Settings. Input the server IP, Port, User and Password in the CORS Settings.

← Parameter Sett	ings
Phone Internet	
Connect Mode	NTRIP >
CORS Settings	31
IP	47.103.96.216 🗙
Port	8080
User	SingularXYZ
Password	©
ОК	

3. Click *Get* button on the right to get the mountpoint list and choose the mountpoint.

\leftarrow Rover mode settings					
Datalink Settings					
Data Link	Ph	one l	Internet >		
Connect Mode:NTRIF IP:47.103.96.216 User:SingularXYZ	Server Port Password:*	:808	80 >		
MountPoint Settings			Get		
MountPoint			Office >		
Receive data					
	•	Star	t		
Auto connect to netwo	ork				
Share Coll	ection	ļ	Apply		

4. Click **Start** button on the right to receive data from Base station. Then you can see the rover station is receiving data.

← Rover n	node settings		🔶 Rover r	node settings	
Datalink Settir	ngs		Datalink Settir	ngs	
Data Link	I	Phone Internet >	Data Link	I	Phone Internet >
Connect Mode IP:47.103.96.2 User:Singular>	e:NTRIP 16 Server Po (YZ Passwor	ort:8080 > d:*****	Connect Mode IP:47.103.96.2 User:Singular)	e:NTRIP 216 Server Po KYZ Passwor	ort:8080 d:*****
MountPoint Se	ettings	Get	MountPoint S	ettings	Get
MountPoint		Office >	MountPoint		Office >
Receive data			Receive data	_	
\bigcirc		Start	1224B	Π	Stop
Auto connect t	o network		Auto connect t	o network	
Share	Collection	Apply	Share	Collection	Apply

5. **Auto connect to network**: When this option is opened, SingularPad will connect to network automatically so that user don't need to click start to connect network.

← Rover mode settings					
Connect Mode IP:47.103.96.2 User:Singular)	e:NTRIP 216 Server P XYZ Passwo	Port:8080 rd:*****			
MountPoint Se	ettings	Get			
MountPoint		Office >			
Receive data					
1227B		Stop			
Auto connect t	o network				
Base Coordina please close)	tes Change Aler	t(VRS			
Share	Collection	Apply			

6. **Base Coordinates Change Alert**: SingularPad will alert when you connect with different base station. When the Base station is VRS, please don't open this.

← Rover mode settings					
Connect Mode IP:47.103.96.2 User:Singular)	e:NTRIP 216 Server P XYZ Passwo	ort:80 rd:****	80		
MountPoint Se	ettings		Get		
MountPoint			Office >		
Receive data					
1227B		Sto	q		
Auto connect t	o network				
Base Coordina please close)	tes Change Aler	t(VRS			
Share	Collection		Apply		

7. Click *Apply* to start the rover mode. When start Rover succeed, it will show as below in SingularPad.

(1176B)	FIXED Age1	H:0. V:0.	011 021	🇞 38/47	41%	(
		X	1			
)				\mathbf{R}	×
Communi tion	ca-	Rov	er		Base	
					$\overline{\mathbb{R}}$	
Inspection accurac	on :y I	Devi nform	ce ation	S col	tatic a lect po	nd bints
-			2		-	
Com Setti	ngs	Devi Activa	ce ation	Devi	ice Set	ttings
	_					_
8)	IC.	2		
Project	Devi	се	Sur	vey	То	ols

Chapter 5 RTK Survey-field Data collect

This section describes the basic survey functions of SingularPad, including Point Survey, Detail Survey, Control Point Survey, Point Stakeout, CAD Mapping and etc. Before RTK survey, you need to connect to the receiver and get a fixed solution.

5.1 Point Survey

Before RTK survey, please make sure that receiver is receiving the correction data and get a fixed solution, age means the time since the last differential data was received, please check if this number keeps growing.



There are HRMS and VRMS on the top of the interface, click it you can check more details.

FIXED	H:0.011	8/47 419	÷	Posit	ion Infori	mation	
	X1	41%	Det	ail	Base	SAT Info	SAT Map
-	=	$\overline{\mathbf{P}}^{\times}$	Solu	ition St	atus FI	XED (G8+R	7+C22+E4/46)
• <u>-</u>		//\	В	31°09'5	58.5541"N	N 14	1230337.791
Communica- tion	Rover	Base	L	121°17'2	22.9152"E	E é	5759006.535
			н		17.597	Elev	17.597
		$\overline{\mathbf{x}}$	Spee	ed	0.000	Heading	0.00
Inspection accuracy	Device Information	Static and collect points	PDO	Р	0.800	HRMS	0.011
			HDO	P	0.700	VRMS	0.021
			VDO	Р	0.700	AGE	1
Com Settings	Device	Device Settings	UTC	time	2	2023-10-24 (07:18:18.000
	Activation		Loca	al time	2	2023-10-24 (07:18:18.000
	-		Dista	ance to I	Ref		39.091m
Project De	vice Surve	ey Tools					

The satellites number is on the top of the interface, click it you can check the satellite map and information.



In the Survey interface, click Point Survey and enter point name, code and antenna height, then click loss to start or stop collecting data.



In the floating window of the survey interface, you can see the display information. The default display information is NEH and Base distance, and click the floating window you can set them as you need. Except default display information, SingularPad supports Longitude, Latitude and Altitude etc.

FIXED H:0.0	21 42/46 41%	← Setting	S		
N:14230338.178 H:17.6 E:6759006.273 Base	537 distance:38.985	Settings	Displa	ıy Info	Tool Bar
	270° 90*	Options			
	180°	Long			Lat
		Altitude			Ant. H
		Forward azin	nuth		Speed
•		Time		F	Point dist.
		Pt. H dist		Pt. E	Elevation diff.
\square		σN			σΕ
A	Ο	PDOP			HDOP
		VDOP		Incl	ination Angle
Name Pt1 × Code	2m	Projection Ar	ngle		
Antenna Height	1.8+0.068m >	Backspace	Def	ault	ок

• Click Los select the map or calibration: Google Map (Standard Map/ Satellite Map), OpenStreetMap, WMS Map Config and Map calibration



• Click to check the point coordinates, you can add, recover, import, and export the data. After you choose a point, you can check the details and take notes or photos.



• Click for set settings, in settings interface, you can edit receiver parameter, for tolerance setting such as solution limit, HRMS limit, VRMS limit and etc., for smooth you can set survey delay and average GPS count and for settings you can set other options.

← Setting	S		← Setting	S		
Settings	Display Info	Tool Bar	Settings	Display	Info Tool Bar	
Tolerance Set	ting		AGE Limit		5 >	
Solution Limit		FIXED >	Smooth			
HRMS Limit		0.05 >	Survey delay		0 >	
VRMS Limit		0.1 >	Average GPS C	ount	5 >	
PDOP Limit		з >	' Settings			
AGE Limit		5 >	The survey cor	firmation	page pops up 🔵 🗩	
Smooth			Remind when t	here is sa	me point name 💻	
Survey delay		0 >	Point Name Inc	crement	1 >	
Average GPS (Count	5 >	Default Code		Same as last point $ ightarrow$	
Default		ОК	Default		ОК	

• Click ^w to set display info, in display info interface, you can set the display information to the floating window, such as longitude, latitude, altitude and etc.

← Settings				
Settings	Displa	ıy Info	Tool Bar	
Options				
Long			Lat	
Altitude	•	Ant. H		
Forward azir	muth	Speed		
Time		Point dist.		
Pt. H dis	t.	Pt. Elevation diff.		
σN		σΕ		
PDOP		HDOP		
VDOP	VDOP		nation Angle	
Projection A	ngle			
Backspace	Def	ault	ок	

• Click to set tool bar, in tool bar interface, you can add or delete options to point survey interface. You can customize the interface to meet whatever layout needs you might have.

← Settings					
Settings	Tool Bar				
Display Item		Optic	ons		
J Tilt Survey		Ð	Zoom in		
Display Map	p	Q	Zoom out		
Auto jump r	Auto jump map center				
Full Map		^	Pointer Catch		
		Text	CAD Text		
		, solution of the second secon	Map Navigation		
			Length&Area Measure		
			Distance&Height		
Clear	Defa	ault	ок		

5.1.1 Tilt survey

Tilt survey option will appear when receiver supports for tilt survey, it is available for SingularXYZ X1 GNSS receiver. When the pole tilts within 60°, the built-in sensor based tilt measurement system precisely calculates the actual offset according to angle, which can not only meets the requirement if high precision measurement, but also relieves the users from continually checking whether the pole is plumb.

When using it for the first time or the calibration expired, you should confirm that the antenna parameters and pole height are correct and then follow the interface prompts to initialize the IMU module; it will take you a few seconds. During operation, make sure that receiver can search the satellites and get fixed RTK solution.

The following steps give an example of tilt survey.

1. Open IMU: Go to survey >> Point Survey >> click the button to open.

After you click IMU button, it will give you one prompt to check the antenna information and you need the antenna height is correct.



2. Initialization

If you power off the receiver or reset it, need to initialize again. After open IMU button, you can follow the guidance in interface to complete it. During operation, make receiver can search the satellites and get a fixed RTK solution.



In survey interface, you can find the bubble and angle value shows the pole you tilt. To ensure the accuracy, please keep the tilt angle less than 60°. When the pole tilts within 60°, the built-in sensor based IMU precisely calculates the actual offset, the accuracy of which can be accurate to ± 2.5 cm.



Tip: Do not shake or rotate the receiver violently, otherwise you need to re-initialize.

5.2 Detail survey

Show both local coordinates and Latitude/Longitude when measuring.

- Click to start or stop collecting data
- Click it set settings, display info and tool bar.
- Click to check point coordinates; you can add note, info, arrow drawing and photo.
- Click loopen IMU to do tilt survey.

€	1210B	FIXED Age1	H:0.01 V:0.02	11 24	& 38/44	39%
Name	Pt4		Code			===
Anten	ına Heig	lht		1.	6+0.06	8m >
В	31°09'55	.1805"N	Ν		344918	6.739
L 1	21°17'16	5.0407"E	Е		3368	13.29
Н		17.907	Elev		1	7.907
Inclin	ation An	gle		3	8°49'57.	5535"
Proje	ction An	gle		130)°05'22.	3666"
Dista	nce to Re	ef				none
					Reac	ly

5.3 Control point survey

By measuring the coordinates of the same point several times, an accurate coordinate is obtained.

← 1204B) FIXED Age1	H:0.011 V:0.022	39/44 38%	Control Point Measurement Result-Pt5
Name Pt5	Code		Result: The collected point is available!
Antenna Height1.6+	0.068m		> Distribution Map
R=3.0 cm	HÐ I Walt1		R=3.0 cm + +++++++++++++++++++++++++++++++++
		×	Qualification rate(%) 100 Mean square error(mm) 1.8 Δplane max(mm) 3.2
N:3449188.842 E:336814.519	H:16.397 Base dist	ance:none	Cancel Export OK

- Click to start or stop collecting data
- Click 🖤 to set settings, display info and tool bar.
- Click to check point coordinates; you can add note, info, arrow drawing and photo.

5.4 Point stakeout

Go to **Stake point** interface, add or import the point coordinates you need to stake out, of course you can choose from button library.

• Click Add to input coordinates

🗲 Stake	e Point		← New point	
Point Coordinates	To-Stake-Point	Preview Map	Name	Pt1 ×
Name >	nput query keyword		Code	===
			Coordinates Type	Local Coordinate >
			Northing	
			Easting	
			Elevation	
			Property type	Input Point >
			Add time	2023-10-26 05:40:33
Add	Button Library Impo	rt Export		ЭК

• Click button library to choose one

🗲 Stal	ke Point			÷	Coord	linate list	selec	tion
Point Coordinates	To-Stak	e-Point Pr	eview Map	Nan	ne >	Input query	keyword	
Name >	nput query	keyword			Select All(1	1)		
					Pt1 s N:344918	mooth Point 86.748	E	Range selection
					E:336814	1.987	Code	:tree
					Pt2 s N:344919 E:336800	mooth Point 98.041).901	T:202 Elev: Code	3-10-24 07:37:09 17.782 :car
					Pt3 s N:344920 E:336804	mooth Point 08.860 1.094	T:202 Elev: Code	3-10-24 07:37:55 18.004 :building
					Pt4 S N:344918 E:336813	mooth Point 86.734 8.291	T:202 Elev: Code	3-10-24 07:48:13 17.902 :
					Pt5 0 N:344918 E-336817	Control Point 88.841	T:202 Elev:1	3-10-24 07:52:16 16.406 ·
Add	Button Library	Import	Export		Add	Imp	ort	ок

• Click Import to get coordinates with different kinds of files, you can also define a new form



Choose a point to stake, SingularPad provides a navigation map when staking points/lines. If you are close to the target point enough, it will alarm you based on the alarm range you set. For X1 receiver, you can use IMU staking function. In the IMU staking, you can open IMU function, and don't need to keep the receiver vertical to the ground, and the tilt angle supports maximum to 60°



- There is a direction prompt on the floating window
- Click 📥 to start or stop stake points
- Click to open or close IMU
- Click to scale automatically
- Click to jump to lasted point
- Click to jump to next point
- Click T to jump to previous point
- Click is to set skate out settings, display info and tool bar, you can edit the prompt range and range error
- Click to open compass



5.5 Line stakeout

Go into Stake line interface, add or import lines you need to stake out.

← Lines D	atabase	
Content List		
AB(18,895m Delete 918 9203 Elevation diff	Edit :336 Inser :1.409m Ratio o	Start Station:4 h Stakeout f slope:7.456%
Add	Import	Export

- Click Add to input line parameters, there are two types you can choose
- Click Import to get coordinates with different kind of files, you can also define a new format



Choose a line to stake, set calculation mode and interval.

Click → to jump to next line

- Click to jump to previous line
- Click to add stake

5.6 CAD mapping and stakeout

When using for the first time, the CAD interface has no layers and floating window to display the features you need to stake.



• Click to create or import a CAD file, supporting *.dxf, *.dwg format

← CAD lag	yer		← New layer	
Content List		t↓	Layer Name	
🗢 Default	t Wo	ork Layer	Color	
			Visibility	
New	Import	Export	Cancel	OK

Input parameters and save it

÷	CAD lay	/er		← Imp	ort File	Settings
Conte	ent List		t↓	File Name		
\bigcirc	Default	Wo	ork Layer	File Type	AutoCAD file(*.dxf,*.dwg)	> 🗟
				Program S	torage/SingularPad/Map	t↓
				崎 Go to i	internal storage root dire	ctory
				崎 Go to j	program storage director	y
				🥱 Return	I.	
N	lew	Import	Export		ОК	

Find the file you want to stake and import it. After create or import one, you can scan and edit in the CAD layer.

• Click to draw features, there are 12 types and methods you can choose, follow the prompts and draw.

← [224B	FIXED Age1	F V	l:0.022 /:0.051	20	42	279	
N:3449	185.3	20	H:1	6.83	2		374	0
E:3368	11.825	5	Ba	se dis	stan	ce:n	one	
Ant. H:	1.6m+	0.068m	Lay	yer:po	oint			
	/	line		٨r	poly	line		909
	<i>[</i>	arc		4	poly	gon		
		square		•	squa	ire ce	nter	
×		rect			rect	cente	r	
	\odot	circle 2p		\bigcirc	circl	e 3p		
	\checkmark	Spline		- - 	Setti	ngs		
Q			•••)	۲ ۲	2	5	J
Name	Pt6	\times (Code					
Antenn	Antenna Height				1.6+	0.06	8m	>

• Click to find tools; they can help you to work smoothly, For example, to find the intersection points of neighboring circles.

← [233B FIXED Age1	H:0.033 V:0.048	 		FIXED Age1	H:0.013 V:0.034	39/46 84%
N:3449	183.101	H:16.923 Base dist	anco:nono	N:3449295.7	18 6	HIT.512 Base dist	ance:28 500
Ant. H:	1.6m+0.068m	Laver:poi	nt	Ant. H:1.6m+	-0.068m	Laver:bui	ldina
,		Lajonpor	270° 90 180°	D)			270° 90°
	Int 2 Dist	F	nt 4 Point				
	Int Entity		Dist offset	^	Sol	2)
^	n Dist offse	: <u>۲</u> ۲	Divide		Pt7		tBo
רא א ע א	^d Measure	\mathcal{D} .	nvert	Second secon			
• °	Lengthen		Area division point				O
0		••• 😺		Name	Pt10	/ X	
Name	Pt6 X C	ode	===	Name Pt10	×c	ode	===
Antenn	a Height	1.	6+0.068m >	Antenna Hei	ght	1.	6+0.068m >

In the CAD interface, you can choose a feature you want to stake, it will show up in blue. You can know the details about it, including length, start point, end point and center point. And choose the way to stake.

In the CAD interface, you can choose a feature you want to stake, it will show up in

blue. You can obtain the details about it, including length, start point, end point and center point. And choose the way to stake.

- Setting: Set the method of stake out, offset distance, interval etc.
- Start station: If you set the start station as 5m, then the final mileage will plus 5m.
- Offset: If you set the offset 5m, then you will stake the line 5m away from the line you choose. The plus and minus represent different sides of the line.
- Setting out by pile by coordinate: including station number, station distance and segment

Station distance: Stake the line at a specified distance, for example, if the line is 40m, you set the specified distance as 8m, then you will stake the line at 8m distance every segment.

Segment: For example, if you set the segment as 4, then you will stake the line at 4 segments, every segment length is the same.

Station number: You will stake the line at the station at each interval point. You can stake it out according to the direction.

Key node: It will stake out the line with starting point, ending point, midpoint, fold point, etc.

Click to find tools; they can help you to work smoothly. For example, to find the intersection points of neighboring circles.

5.7 DSM stakeout

You can stake the elevation using the design surface, if you don't open a surface before, then you need to add one by adding, importing coordinates or choosing from the button library.

You can get a preview map after adding points and don't forget save it.

At the content list interface, you can find the surfaces you made, and you can edit, share and stake them.



If the current position is not within the range if the design surface, it will show "Out of surface!" if the current position is within the range of the design surface, it will show the fill or excavation value.

5.8 **Points Database**

The points, which are surveyed, staked, added, imported, and input from display map, will be stored in point database. The surveyed points will be shown under one base while surveying. Also, no matter where you need to select a point, all the points of the database are available.

← Points Datab	ase		÷	Point	s Databa	se	
Name > Input que	ry keyword	۲ <u> </u>	Name	>	Input query	keyword	۲.
E:336814.520	Code:		S	elect All	(1) Share	Delete	Cancel
Pt4 Smooth Point N:3449186.734 E:336813.291	T:2023-10-24 07:48:13 Elev:17.902 Code:	.000	(₽t4 1:34491 2:33681	Smooth Poin 186.734 3.291	t Tipping 10 E Ra Code:	nge selection
 Pt4 Smooth Point N:3449186.742 E:336813.288 	T:2023-10-24 07:47:18 Elev:17.903 Code:	.800		Pt4 1:3449 ⁻ 2:33681	Smooth Poin 186.742 3.288	t T:2023-10- Elev:17.90 Code:	24 07:47:18)3
 Pt3 Smooth Point N:3449208.860 E:336804.094 	T:2023-10-24 07:37:55 Elev:18.004 Code:building	.799		Pt3 1:34492 2:33680	Smooth Poin 208.860 14.094	t T:2023-10- Elev:18.00 Code:buil	24 07:37:55)4 ding
 Pt2 Smooth Point N:3449198.041 E:336800.901 	T:2023-10-24 07:37:09 Elev:17.782 Code:building	.000		 Pt2 Smooth Poin N:3449198.041 E:336800.901 		t T:2023-10- Elev:17.78 Code:buil	24 07:37:09 32 ding
Pt1 Smooth Point T:2023-10-24 07:36:33.399 N:3449186.748 Elev:17.892 E:336814.987 Code:tree			Pt1 1:3449 ⁻ ::33681	Smooth Poin 186.748 4.987	t T:2023-10- Elev:17.89 Code:tree	24 07:36:33 92	
Add Recover	Import Expo	ort	Ad	d	Recover	Import	Export

- Add: Supports to add Input Point, and Display type Supports Local coordinate and geodetic coordinate
- Recover: After delete the points, you can recover them in deleted points interface
- Import: Import points by different formats of files
- Export: Export points by different formats of files
- Search: Enter the name of the point you want share or delete

Tap a point to check the information about the base coordinate. The information includes antenna height, solution status, WGS84 Coordinate, local grid coordinate, base id and measure time. If you had calibrated the point, it will display offset parameters.

÷	← Point Details									
Name	Pt1	×	Code	tree	===					
Anten	na Height			1.6+0.06	8m >					
Solut	ion Status			FIXED (39/44)					
В	31°09'55.18	817"N	Ν	344918	6.748					
L '	121°17'16.10)48"E	E	33681	4.987					
н	1	7.892	Elev	1	7.892					
Scale	Factor		0.9999256646							
Speed	ł	1	Headir	ng	0.000					
PDOP		0.900	HRMS		0.011					
HDOF	· (0.800	VRMS		0.022					
VDOP		0.800	AGE		1					
Avera	ge GPS Cou	Cut-off	Angle	5						
Phot	o And Sket	ch		OK						

5.9 Data export/ import

SingularPad supports to export/ import data including grid coordinate, Lat/Lon coordinate with various data format, support import *.dat/*.csv/*.kml file and export result of *.dxf/*.kml/*.shp/*.xls/*.csv.

5.9.1 Import points data

Tap Import data in project interface, there are some predefined data formats, click More to get more predefined formats.



- Data Type: support point database, transformation parameters file and code library
- Import File Format: support *.csv, *.dat, *.txt, *.kml format etc.
- Distance Unit: support meter, US survey feet and international feet

Besides, you can click now to create a User defined type.

\leftarrow Custom format						
Format name						
Extension name	dat >					
Field delimiter	Comma(,) >					
Custom format descr	iption					
Options						
(null)	Point Name					
Code	Northing					
Easting	Elevation					
Latitude	Longitude					
Altitude						
Backspace	ОК					

- Format name: Enter the name for the format
- Extension name: support *.csv, *.dat, *.txt, *xlsx format
- Delimiter: support comma (,), semicolon (;), space (), tab (Tab)

Click to choose elements in the options list, click backspace to eliminate the previous

element selected. The elements include: code, northing, easting, elevation, latitude, longitude, altitude.

Choose one format to import data. The default export path is internal storage/ SingularPad/import. You can also change to any other path where the file is. Click preview to take an inspection whether the format is right.

← Import File	Setting	gs 🗲 Prev	view		
File Name		Point Name	Northin	ıg	Easting
File Type	ocal coordinates > (* csv * dat * txt) >	A1	3450216	297	622921.962
Program Storage/Singula	arPad/Import	A2	3450216	.286	622921.968
		A3	3450216	.283	622921.969
Go to internal storage root directory		A4	3450216	.284	622921.970
I Go to program storage directory		A5	3450216	288	622921.963
S Return		A6	3450216.286 62292		622921.968
X1.txt					
Preview	ОК	Can	Cancel OK		ОК

5.9.2 Export points data

Tap Export in Project interface to export simple data of survey points. Also, click More formats to export the survey points with detailed information or other formats like stake points/ lines, DXF, SHP, KML, RAW, RW5, HTML, CASS feature result.

← Export data		← Format select		
Export Path rogram Stor	rage/SingularPad/Export >	Road section data	OP	
File Name Proj	ect ame > 🕂	File Format		
Choose Export File F	ormat	Point Name,Northing,Easting,Elevation,Code		
Cass format(dat) Point Name,Code,Easting,Northing,Elevation		Geodetic coordinates format(txt) Point Name,Latitude,Longitude,Altitude,Code		
Export Para		Survey point data for	ormat[GNSS](csv)	
Distance Unit	Meter >	e,Longitude,Altitude,Local t x,Station Correction y,Statio	Easting,Elevation,Latitud time,Station Correction on Correction h,Original	
Point Type	Select All	Survey point data for	ormat[TPS](csv)	
Survey Point	Control Point	time,Point Type,SD[TPS],HI S],VA[TPS],Reflector,Prism	D[TPS],VD[TPS],HA[TP Constant(mm),Target	
TPS Point	Setup Point	AutoCAD format(d>	(f)	
Input Point	Calculate Point			
Time	Enabled	Mo	ore	
File sharing	Export	New	OK	

- Export Path: the default export path is internal storage/SingularPad/export; you can also change to any other path where the file is
- File Name: support project name, operator, data, data time
- Export File Format: support *.csv, *.dat, *.txt, *kml format etc.
- Distance Unit: support meter, US survey feet and international feet
- Road section data: open to export road section data

Besides, you can click New to create a user defined type. The elements include: id, name , code, latitude, longitude, altitude, northing, easting, elevation, N, E, Z, type, local time, UTC time, solution status, AGE, max delay, min delay, use satellites, tracked satellites, cut-off angle, mount point, measurement method, repeat, start data, end time, RMS, HRMS, VRMS, PDOP, VDOP, speed, heading, antenna type, measuring type, measuring height, antenna height, base id, base latitude, base longitude, base altitude, distance to ref, original latitude, original longitude, original altitude, undulation height, station correction h, inclination correction, pitch, roll, yaw, inclined angle, projected angle, stakeout type, target, station, offset, north diff, east diff, elevation diff.

For the points, lines and polygons you surveyed in point survey, you can export dxf file, then you can edit them in third party CAD software, or import to base map to check, or import to CAD to stake. Choose the data that you want to export including survey point, input point, control point, stake point, line and polygon, and the layer properties includes name, code and height.

← Custom format	
Format name	
Extension name	dat >
Field delimiter	Comma(,) >
File header	\bigcirc
Custom format description	

Options

Point Id	Point Name	
Code	Code Remark	
Northing	Easting	
Elevation	Local time	
Backspace	ок	