

***SingularXYZ***



# **GNSS Receiver User Manual**

*V2.0, modified on 2024.8.*



## Dear users,

Thank you for choosing SingularXYZ X1 GNSS Receiver. We recommend that you spend some time reading this User Manual in order to have a full understand of this product and get started easily.

Please read the following important factors carefully.

- RTK rover (Network Rover mode): The X1 can be used as a GNSS RTK rover. In this mode, you need to get the RTK corrections via internet (2/3/4G) in NTRIP protocol.
- RTK rover (UHF/radio rover mode): The X1 can be used as a RTK rover with the UHF mode suppose you have the existing base which can work with the radio protocols that the X1 supports.
- RTK Base station mode: You can setup the X1 as the base and stream the correction data via UHF. The X1 supports most common UHF/radio protocols in the market.
- Static mode: The X1 can be used as static mode to collect GNSS raw data for post processing.

## 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.

## 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: [www.singularxyz.com](http://www.singularxyz.com) or technical support email: [support@singularxyz.com](mailto:support@singularxyz.com). Your feedback about this Guide will help us to improve it with future revisions.

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## 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.

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.

## 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.

## 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: [www.singularxyz.com](http://www.singularxyz.com) or technical support email: [support@singularxyz.com](mailto:support@singularxyz.com). 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 lightning protection measures when installing antennas
- Change the cable if damaged

## 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.

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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 anti-interference ability to make it possible to work even in harsh environments. It is the ideal RTK/GNSS product for surveyors.

Currently, there are three types of receivers in the X1 series: X1 Lite, X1 Standard, and X1Pro, and the following are the features that have been reduced or added in comparison to X1.

**X1 Lite:** Compared to the X1, the X1 Lite receiver does not have a SIM card slot, which means it does not support Device Internet mode.

**X1 Pro:** Compared to the X1, the X1 Pro receiver is equipped with color LED display, which clearly shows the receiver operating status.

## 1.2 Receiver Features

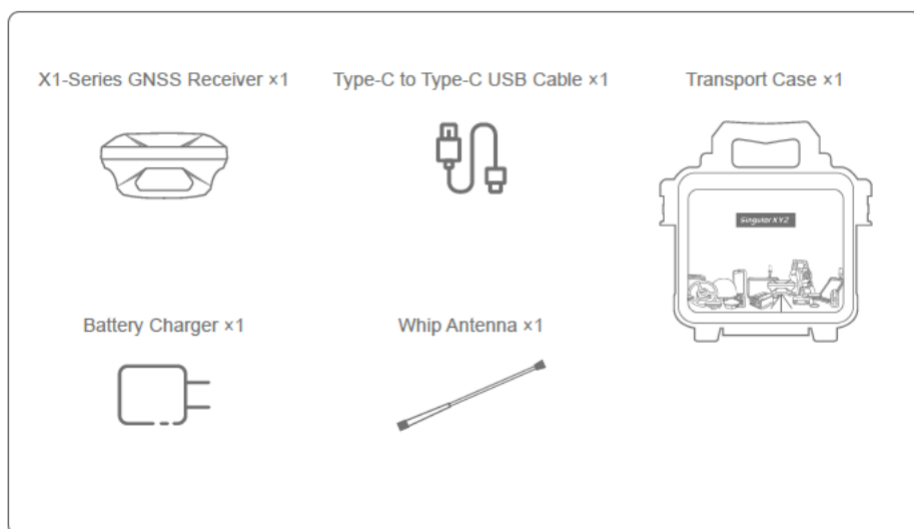
The SingularXYZ X1 GNSS Receiver key features:

- Ultra small and super light
- Size:  $\Phi 133.5 \text{ mm} \times 67 \text{ mm}$
- 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 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.

### Standard





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.



| Indicators                                                                                                                                                             | Description                           |                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
|                                                                                       | <b>Satellite Tracking Indicator</b>   | Flash N times every 5s<br>N: Number of tracking satellites                                                                    |
|                                                                                       | <b>Static &amp; Network Indicator</b> | Yellow light flashes: recording static data                                                                                   |
|                                                                                                                                                                        | <b>Function Button</b>                | Press twice in succession to start/stop static data recording                                                                 |
|                                                                                       | <b>Correction Data Indicator</b>      | Flash when TX/RX correction data                                                                                              |
| <br> | <b>Power Indicator</b>                | Red light on: receiver on<br>Red light flashes: power < 10%<br>Green light flashes: charging<br>Green light on: fully charged |
|                                                                                                                                                                        | <b>Power Button</b>                   | Long press to turn on/off the receiver                                                                                        |

## 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

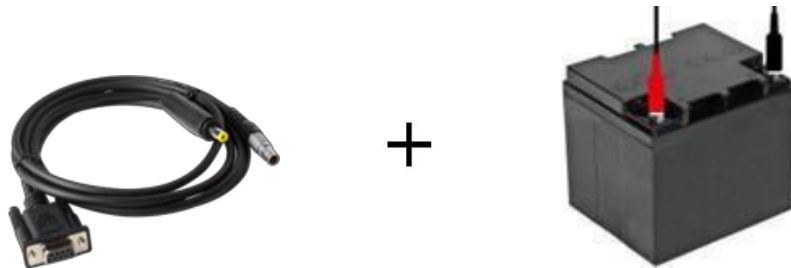
### 2.4.1 Battery

The receiver is equipped with internal batteries.

- 6700 mAh, over 20 hours working time
- Fast charge of 2.5 hours charging time (when using a 100W fast charging charger)

### 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. (These two cables are optional. If needed, please communicate with the sales to confirm before placing an order.)



*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 (9-28 volt DC) for the base station.*

This chapter describes how to conduct static survey through X1 receiver and SingularXYZ Converter software. For static survey, X1 supports 2 data formats: XYZ, Rinex. SingularXYZ binary format(\*.XYZ) is a raw observation data format and you can convert it to RINEX format via SingularXYZ Converter Software. (Contact SingularXYZ support team for the tool).

If you need post-processing software, please contact the support email at <support@singularxyz.com> for assistance.

### 3.1 Static Data Collection

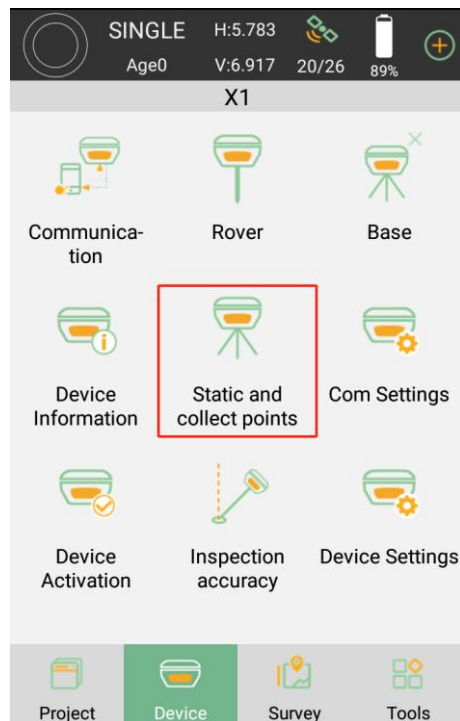
Static survey is mainly used for the control survey. To reach millimeter accuracy, follow as below:

- 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.
- For the convenience of post-process static observation raw data, record the station name, receiver SN, antenna height, start and end time for each observation site.

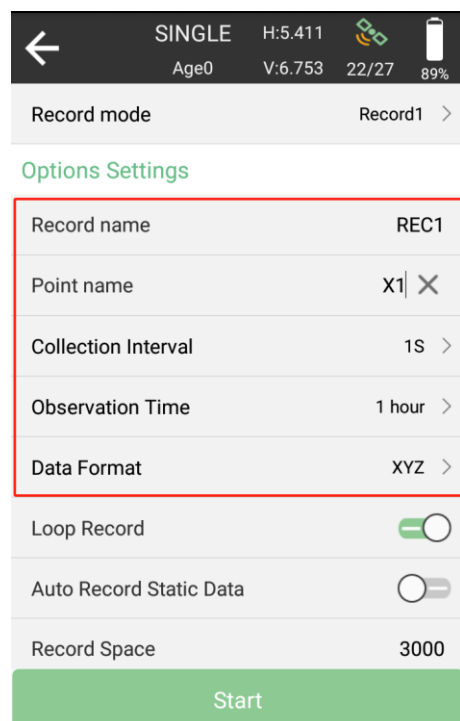
*Tip: You can start recording static data in the front panel by double-pressing the function button, it's convenient for you.*

The following steps give an example of static survey.

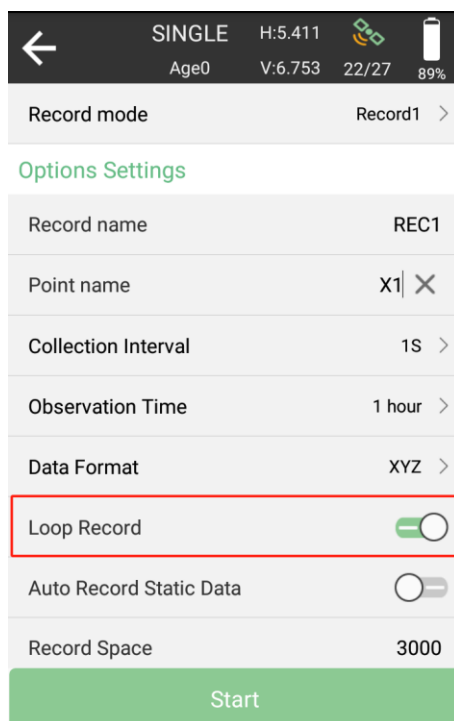
1. Go to **Device** >> **Static and collect points**. Choose the Record mode, there are two record modes and they can record static data at the same time.



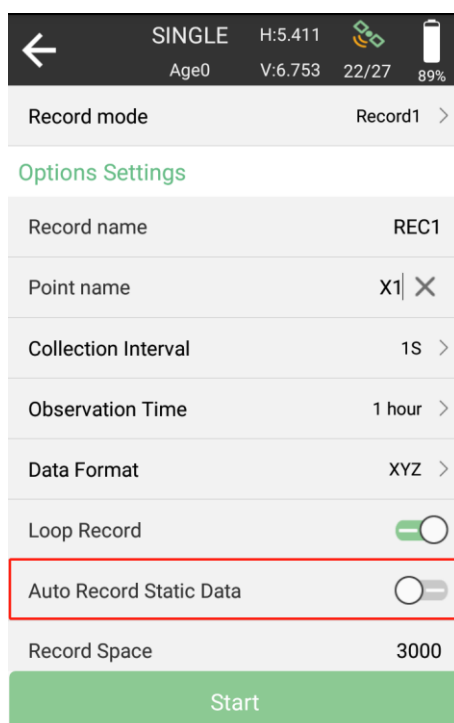
2. Option Settings interface : Input Record name and Point name. Set the Collection Interval, Observation Time and Data Format.



3. Turn on/off 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.



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



5. Set the **Record Space** in the end(unit:MB). It will limit the amount of data that receiver record.

← SINGLE H:5.411 Age0 V:6.753 22/27 89%

Record mode Record1 >

Options Settings

|                         |                                     |
|-------------------------|-------------------------------------|
| Record name             | REC1                                |
| Point name              | X1   ✕                              |
| Collection Interval     | 1S >                                |
| Observation Time        | 1 hour >                            |
| Data Format             | XYZ >                               |
| Loop Record             | <input checked="" type="checkbox"/> |
| Auto Record Static Data | <input type="checkbox"/>            |
| Record Space            | 3000                                |

Start

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

← SINGLE H:5.411 Age0 V:6.753 22/27 89%

Record mode Record1 >

Options Settings

|                         |                                     |
|-------------------------|-------------------------------------|
| Record name             | REC1                                |
| Point name              | X1   ✕                              |
| Collection Interval     | 1S >                                |
| Observation Time        | 1 hour >                            |
| Data Format             | XYZ >                               |
| Loop Record             | <input checked="" type="checkbox"/> |
| Auto Record Static Data | <input type="checkbox"/>            |
| Record Space            | 3000                                |

Start

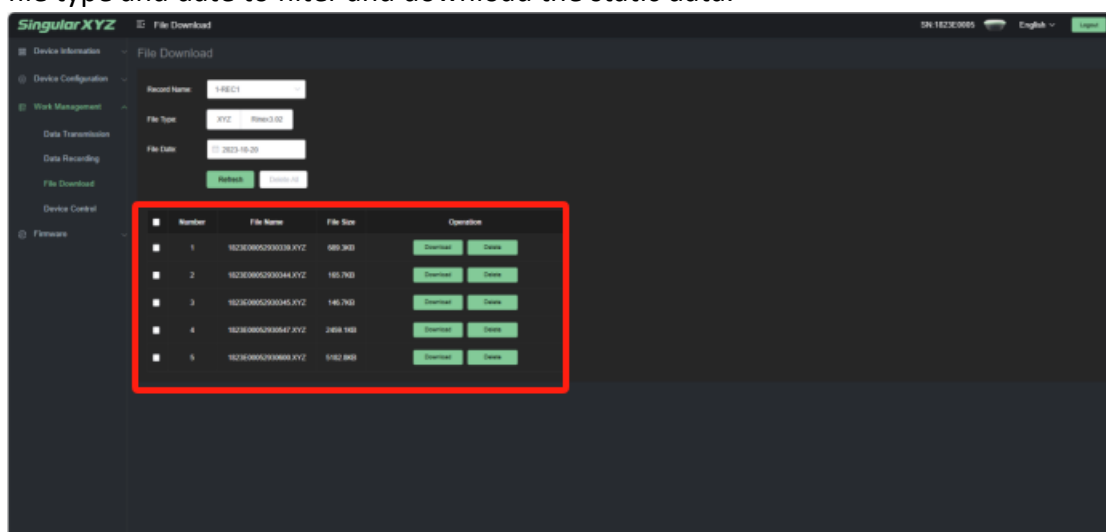
## 3.2 Static Data Download

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 |                    |        |          |  |
|---------------------------------|--------------------|--------|----------|--|
| 名称                              | 修改日期               | 类型     | 大小       |  |
| 📄 1823E00052930339.XYZ          | 10/20/2023 3:43 AM | XYZ 文件 | 690 KB   |  |
| 📄 1823E00052930344.XYZ          | 10/20/2023 3:45 AM | XYZ 文件 | 166 KB   |  |
| 📄 1823E00052930345.XYZ          | 10/20/2023 3:45 AM | XYZ 文件 | 147 KB   |  |
| 📄 1823E00052930547.XYZ          | 10/20/2023 5:59 AM | XYZ 文件 | 2,460 KB |  |
| 📄 1823E00052930600.XYZ          | 10/20/2023 6:28 AM | XYZ 文件 | 5,183 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.

Go to Work management >> File Download, select the corresponding record name, file type and date to filter and download the static data.



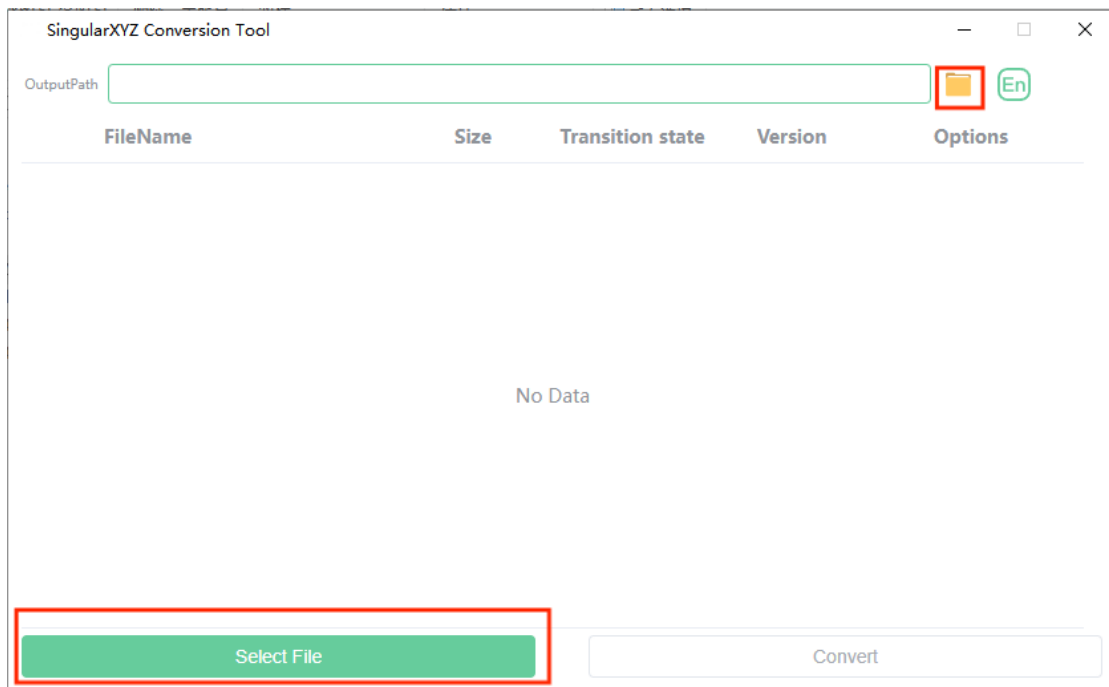
### 3.3 RINEX Convert

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. Set the output path and select to import the binary file;





3. After import the binary file, click set then input the marker name and choose the measure type of antenna height, and the antenna type is automatically identified as SITE 1 for X1 receiver;

| MessageID | Amount | MarkName |
|-----------|--------|----------|
| 108       | 50     | 136      |
| 107       | 12     |          |
| 109       | 10     |          |
| 12        | 252    |          |
| 106       | 20     |          |

|           |                                                                                                                                                                                  |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AntType   | SITX1                                                                                                                                                                            |
| Measure   | Phase Center Height ▾                                                                                                                                                            |
| Satellite | <input checked="" type="checkbox"/> GPS<br><input checked="" type="checkbox"/> BDS<br><input checked="" type="checkbox"/> GLONASS<br><input checked="" type="checkbox"/> GALILEO |

4. Click **convert** to start convert XYZ to Rinex, and the Rinex files will be output to the output file path.

SingularXYZ Conversion Tool

OutputPath

E:\output

En

析

|   | FileName     | Size  | Transition state | Version | Options                          |
|---|--------------|-------|------------------|---------|----------------------------------|
| 1 | 12010929.XYZ | 2.07M | ✓                | 3.02 ▾  | <div>set</div> <div>remove</div> |

Select File

Convert

**NOTE**

The output path of the conversion software and the storage path of the files to be converted can only contain English letters and numbers.

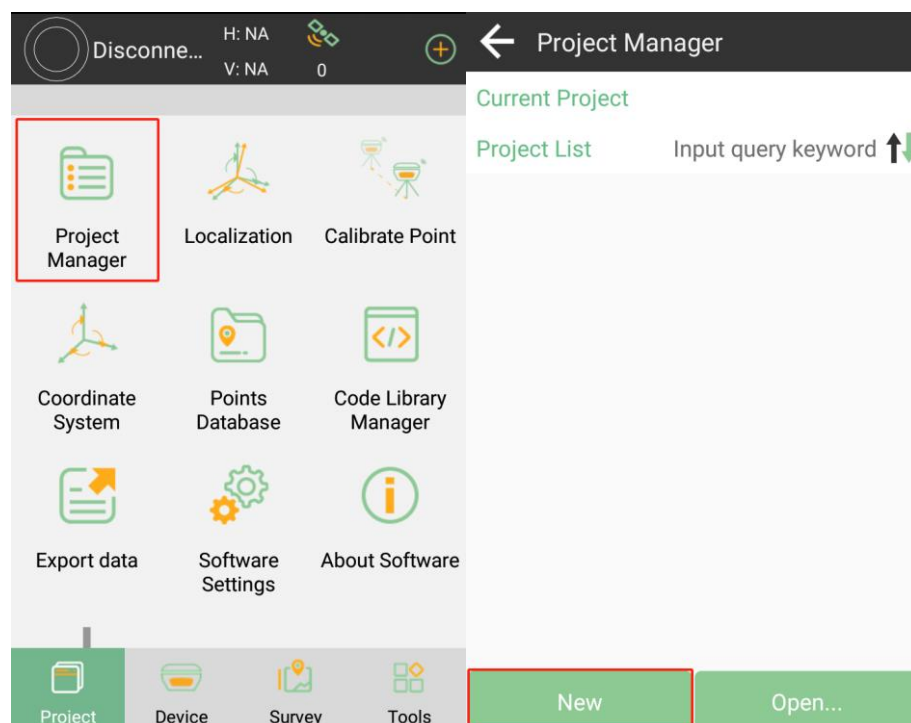
This chapter introduces how to conduct RTK Survey with SingularPad Software. SingularPad is professional Android-based surveying software developed by SingularXYZ team. SingularPad is fully functional as a field surveying software, equipped with complete work modes and necessary functions for surveyors.

## 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 of the screen and input project name, set coordinates systems parameters and click **OK** to save the project.



←

Project Details

←

Create Project

| Basic Information      |                                      | Coordinate systems parameters | Basic Information                       | Coordinate systems parameters |
|------------------------|--------------------------------------|-------------------------------|-----------------------------------------|-------------------------------|
| Project Path           | rogram Storage/SingularPad/Project > |                               | Coordinate systems parameters type      | Local parameters >            |
| Project Name           | X1                                   |                               | Name                                    | ≡                             |
| Operator               | SingularXYZ                          |                               | Ellipsoid Parameter                     |                               |
| Distance Unit          | Meter >                              |                               | WGS84                                   | >                             |
| Angle format           | dd°mm'ss.ssss" >                     |                               | Semimajor axis:637... 1/f:298.257223563 |                               |
| Lat/Lon format         | dd°mm'ss.ssss" >                     |                               | ITRF Parameter                          |                               |
| Default 1st Point Name | Pt1 >                                |                               | Not Set                                 | >                             |
| Notes                  |                                      |                               | Projections Parameter                   |                               |
|                        |                                      |                               | UTM                                     | >                             |
|                        |                                      |                               | Central Meridian                        | E123°00'00"                   |
| Date Created           | 2023-10-20 03:26:22                  |                               | Datum Parameter                         |                               |
| Cancel                 | OK                                   | Previous                      | OK                                      |                               |

**NOTE**

Our software has added coordinate systems for most countries. You can find the coordinate system you need by filtering the country name or searching the coordinate system name.

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.

←

Project Manager

Current Project

X1

>

Program Storage/SingularPa... 2023-10-23 06:46:33

Project List

Input query keyword ↑↓

Remove

Share

Open

New

Open...

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.

The following steps give an example of how to find the predefined coordinate system you need in SingularPad software.

Click the button located after **Name** in Coordinate System Parameters interface.

Coordinate System Parameters

Coordinate System Type Local System >

Name Input

Ellipsoid Parameter

CGCS2000  
Semimajor Axis:6... 1/f:298.257222101 >

ITRF Conversion

None >

Projection Parameter

UTM  
Central Meridian E123°00'00" >

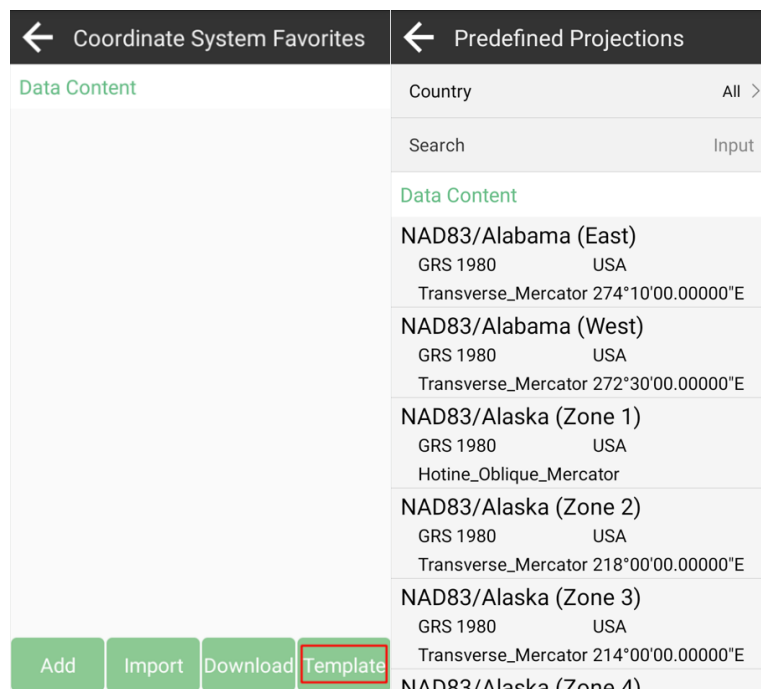
Datum Parameter

None >

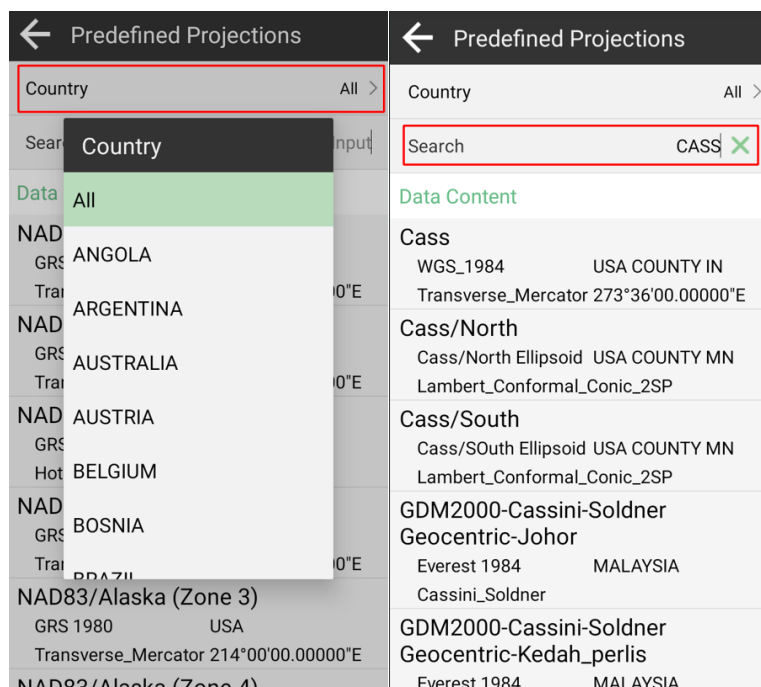
Horizontal Adjustment

Share Save As OK

In the Coordinate System Favorites interface, click the **Template** below to enter the Predefined Projections interface.



Click **Country** to select the country name or enter a keyword after **Search** to find it.



After finding the required coordinate system, click **Apply** to add it to coordinate system parameters, click **OK** to apply it to the current project.

←

Predefined Projections

Country

AUSTRALIA >

Search

Input

Data Content

AGD66-ACT/AMG zone 48 E102-108

Aus...

Details

ational...

AUST...

Transverse\_Mercator 105°00'00.00000"E

AGD66-ACT/AMG zone 49 E108-114

Australian National...

AUSTRALIA

Transverse\_Mercator 111°00'00.00000"E

AGD66-ACT/AMG zone 50 E114-120

Australian National...

AUSTRALIA

Transverse\_Mercator 117°00'00.00000"E

AGD66-ACT/AMG zone 51 E120-126

Australian National...

AUSTRALIA

Transverse\_Mercator 123°00'00.00000"E

AGD66-ACT/AMG zone 52 E126-132

Australian National...

AUSTRALIA

Transverse\_Mercator 129°00'00.00000"E

AGD66-ACT/AMG zone 53 E132-138

Australian National...

AUSTRALIA

Transverse\_Mercator 135°00'00.00000"E

Apply

Coordinate System Parameters

Coordinate System Type

Local System >

Name

AGD66-ACT/AMG zone 48 E102-108

Ellipsoid Parameter

Australian National Spheroid

Semimajor Axis:6356583.714 1/f:298.25 >

ITRF Conversion

None

>

Projection Parameter

UTM(Southern Hemisphere)

Central Meridian E105°00'00" >

Datum Parameter

Helmert

ΔX(m) -129.193 Δα(s) -0.246

ΔY(m) -41.212 Δβ(s) -0.374 >

Share

Save As

OK

If you can't find what you need in Predefined Projections, you can click **Add** or **Import** to create new coordinate system.

←

Coordinate System Parameters

Coordinate System Type

Local System >

Name

AGD66-ACT/AMG zone 48 E102-108

Ellipsoid Parameter

Australian National Spheroid

Semimajor Axis:6356583.714 1/f:298.25 >

ITRF Conversion

None

>

Projection Parameter

UTM(Southern Hemisphere)

Central Meridian E105°00'00" >

Datum Parameter

Helmert

ΔX(m) -129.193 Δα(s) -0.246

ΔY(m) -41.212 Δβ(s) -0.374 >

Share

Save As

OK

Add

Import

Download

Template

←

Coordinate System Favorites

Data Content

AGD66-ACT/AMG zone 48 E102-108

Australian National...

AUSTRALIA

UTM(Southern Hem... 105°00'00.00000"E

Favorite

17

X1-Series GNSS Receive User Manual V2.0

## 4.3 Device connection

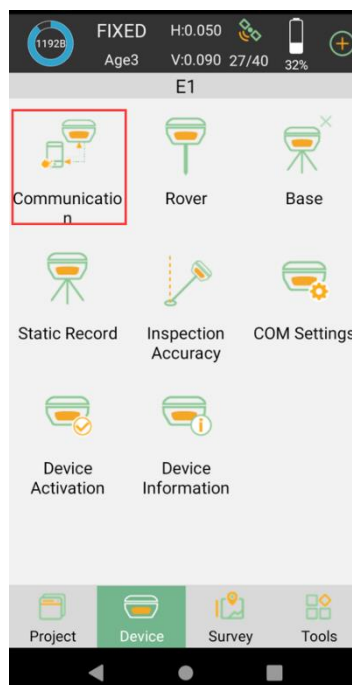
### 4.3.1 NFC connection

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.



Select the corresponding parameters according to the following requirements

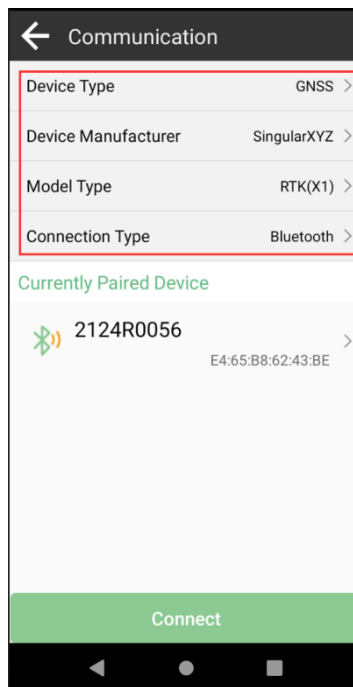
Device Type: GNSS

Device Manufacturer: SingularXYZ

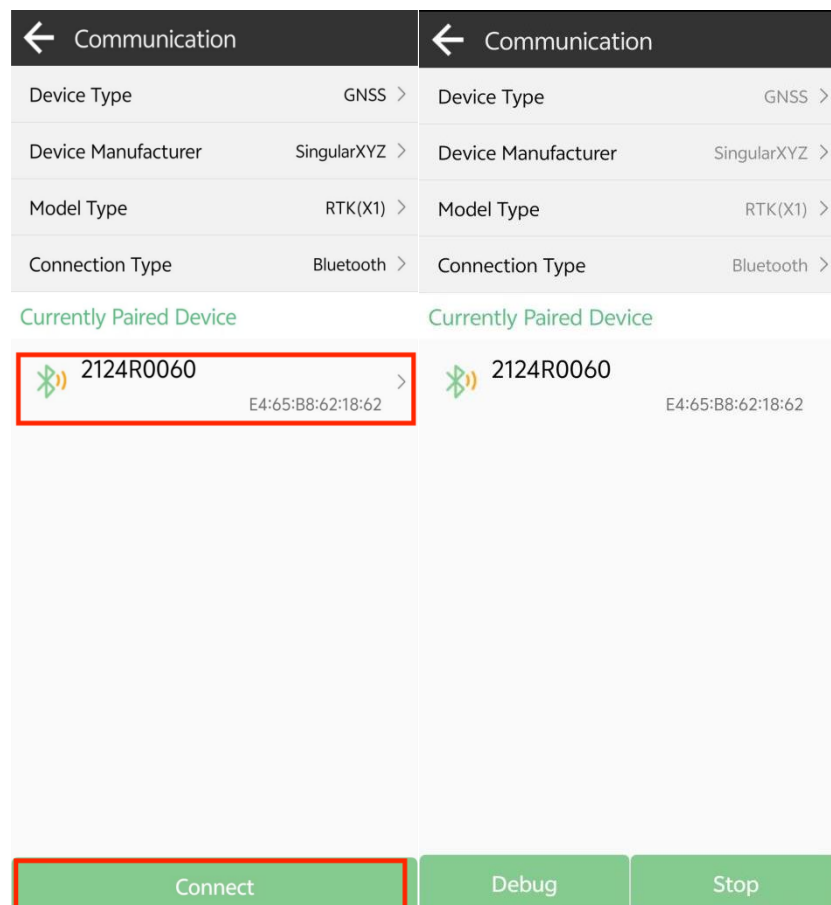
Mode Type: RTK(X1)

Connection Type: Bluetooth

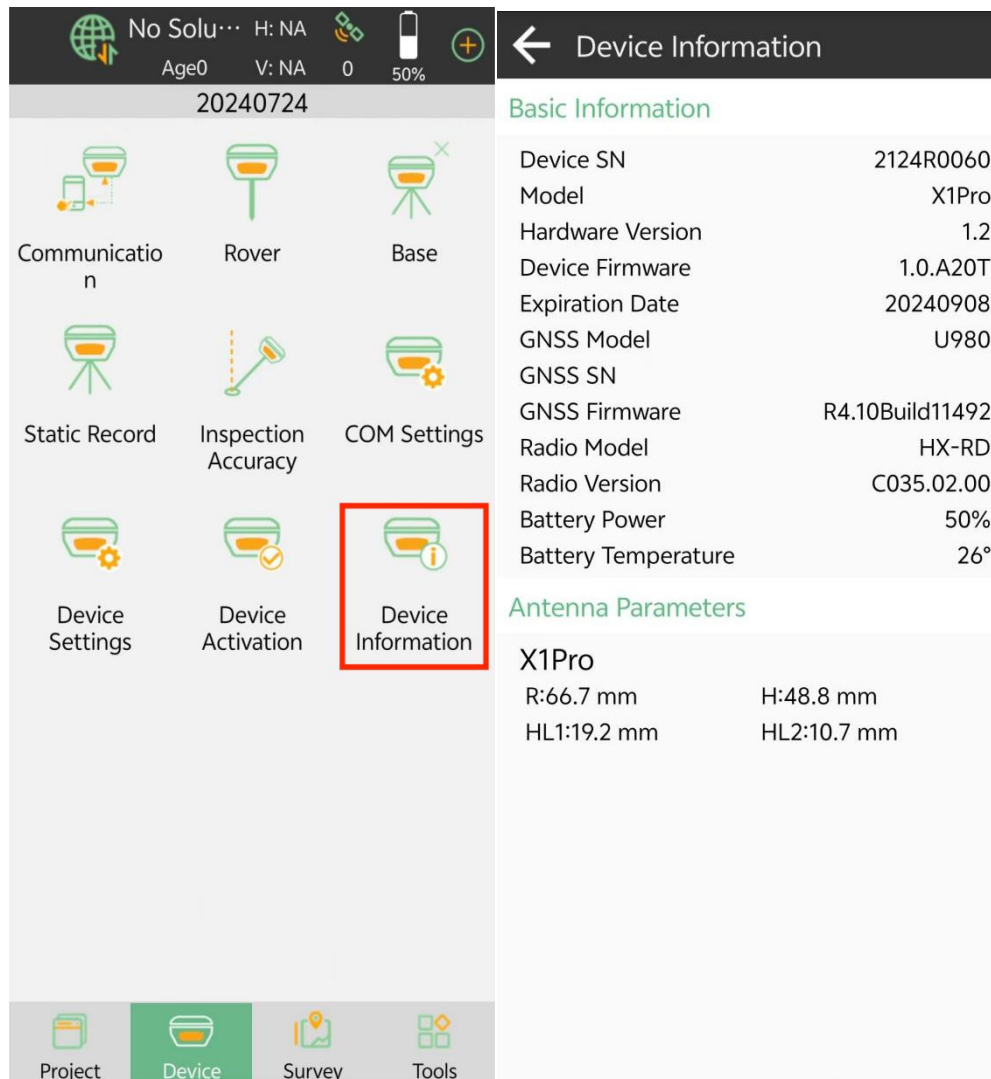




Make sure device Bluetooth turned on, click below Currently Paired Device to find SN number of your X1 receiver. Click **Connect**.



After connecting X1 receiver, you can check the information of the receiver (like firmware version) in **Device Information**.



*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

If you've purchased 2 units of X1 GNSS receiver, please select one X1 as base and the other as rover. During configuration, you need to connect your PDA device or data collector to the base and rover respectively.

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.

*Tip: X1-Series GNSS receiver has two radio versions, U and LU version. U version radio supports many radio protocols whether base or rover, but data transmission distance can only reach 3-5 kilometers under ideal environment; LU version radio only supports CSS radio protocol when set as base, and also supports many radio protocols including CSS radio when set as rover, but data transmission distance can reach 10-15 kilometers under ideal environment. **Please contact the sales to confirm which radio version to purchase.***

 **TIP**

**Where to Set Up the Base Station?**

**Ideal Environment:**

- Clear outdoor sky view, free from obstructions
- Place GPS and radio antennas as high as possible to reduce signal interference and increase range

**Avoid:**

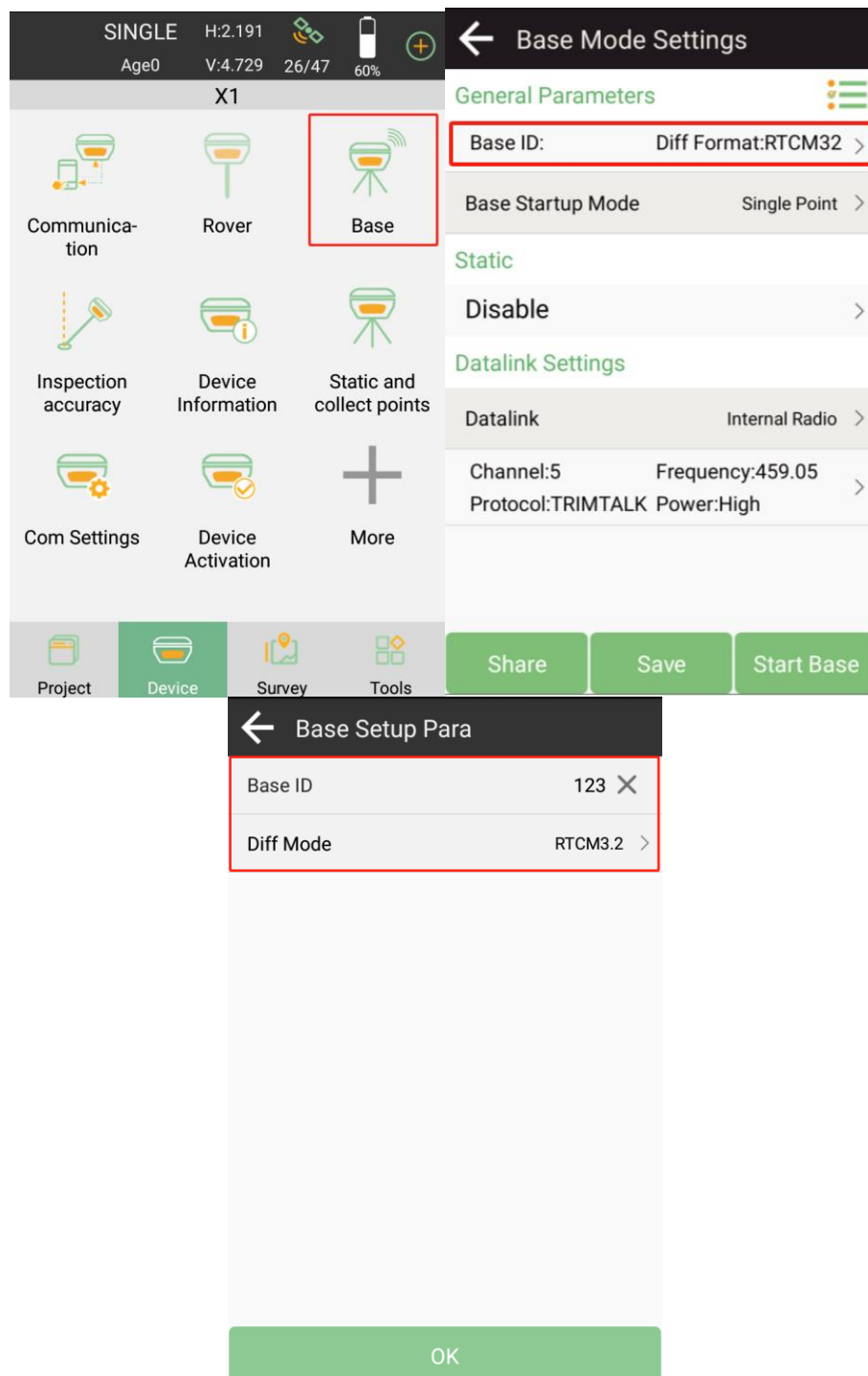
- Obstacles: buildings, vehicles, towers, trees, etc.
- Interference: high-power radar, TV, cellular towers, power lines or electrical facilities

The following steps give an example of internal radio transmission.

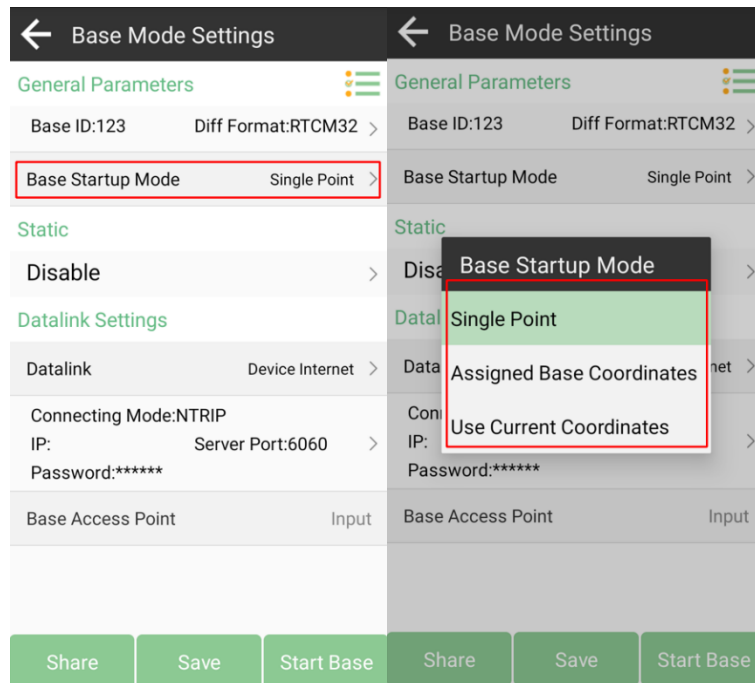
 **NOTE**

Set Internal Radio Work Mode: Connect the whip antenna to both your base station and rover.

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



2. Click Base Startup Mode to select the base startup way.



**Single Point:** Start the base station at unknown coordinates.

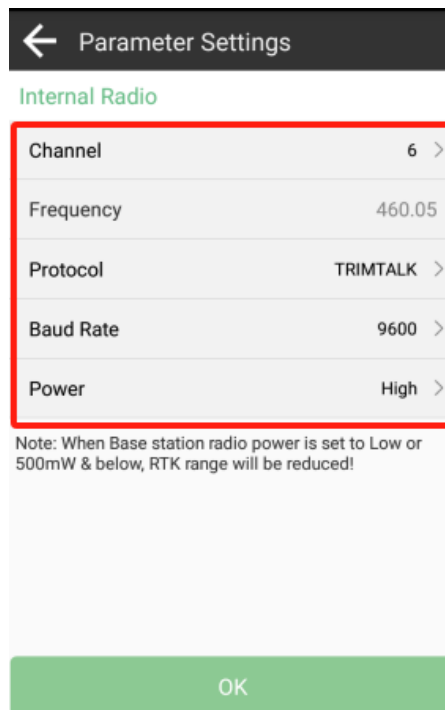
**Assigned Base Coordinates:** Start the base station at known coordinates, and you need to enter the latitude, longitude and the height.

**Use Current Coordinates:** Automatically start the base station at current coordinates.

**NOTE**

Please setup the base station at a known point. Select **Base Startup Mode** as **Assigned Base Coordinates** and input the known point coordinates. Make sure the current coordinates of the instrument is within 50 meters of the known point coordinates. Otherwise, you will need to conduct **3.3 Calibrate Point** after or before surveying.

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



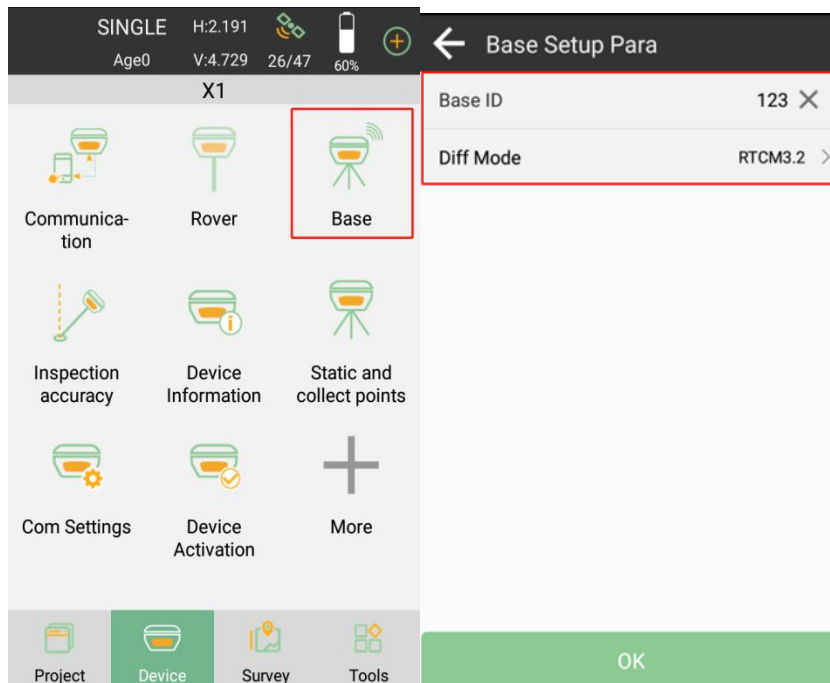
4. When start Base succeed, it will show as below in SingularPad.

**Device Internet:** This mode uses 4G(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.

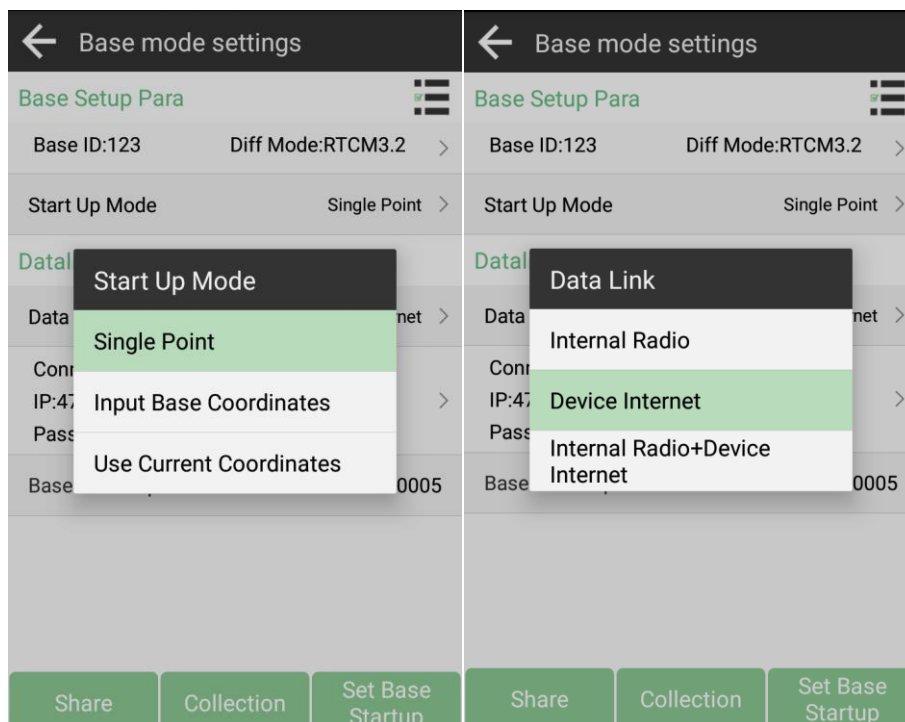
*Tip: Compared to the X1 and X1 Pro, the X1 Lite receiver does not have a SIM card slot, which means it does not support Device Internet mode. **When inserting the SIM card, be careful not to insert it upside down, otherwise the card slot may be damaged.***

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**.



4. **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 Settings

Device Internet

Connect Mode NTRIP >

CORS Settings

IP 47.103.96.216 ✕

Port 8080

Password •••••

APN Settings

Name 3gnet

User

Password

OK

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

← Base mode settings

Base Setup Para

Base ID:123 Diff Mode:RTCM3.2 >

Start Up Mode Single Point >

Datalink Settings

Data Link Device Internet >

Connect Mode:NTRIP

IP:47.103.96.216 Server Port:8080 >

Password:\*\*\*\*\*

Base access point 1823E0005

Share Collection Set Base Startup

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.*



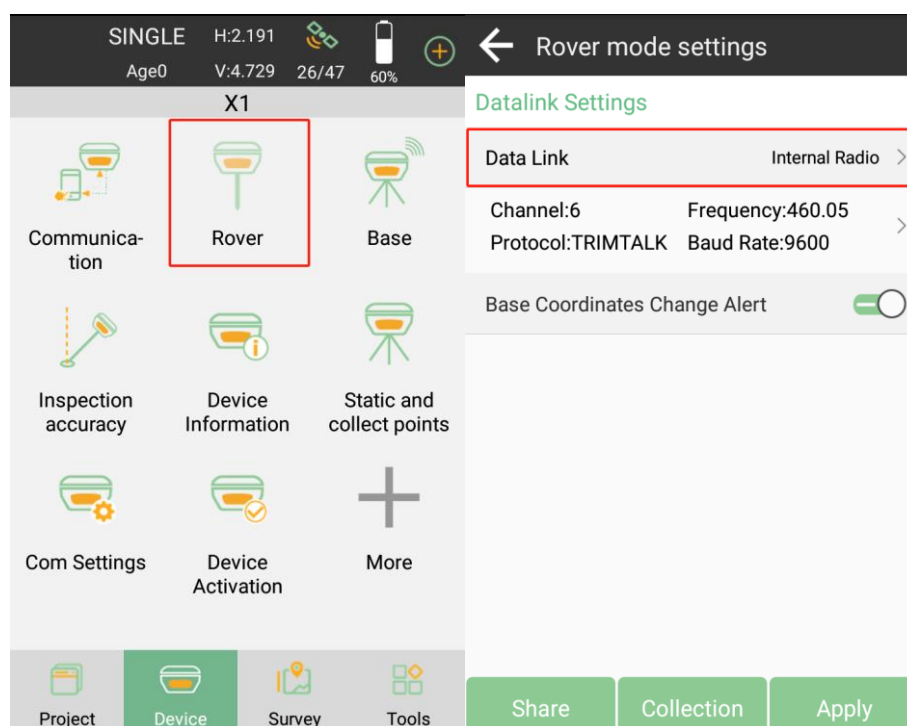
#### 4.4.2 Start Rover Station by SingularPad

When work as a Rover station, SingularPad supports receive the correction data in Internal Radio mode, Device Internet mode and Phone Internet Mode.

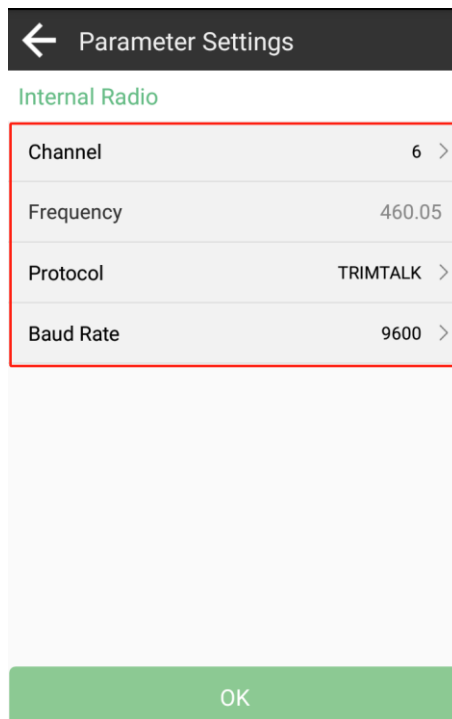
**Internal Radio:** Select the same protocol and frequency with the Base receiver, and then the receiver status will turn single to be fixed. The following steps show an example of internal radio.

The following steps give an example of internal radio transmission.

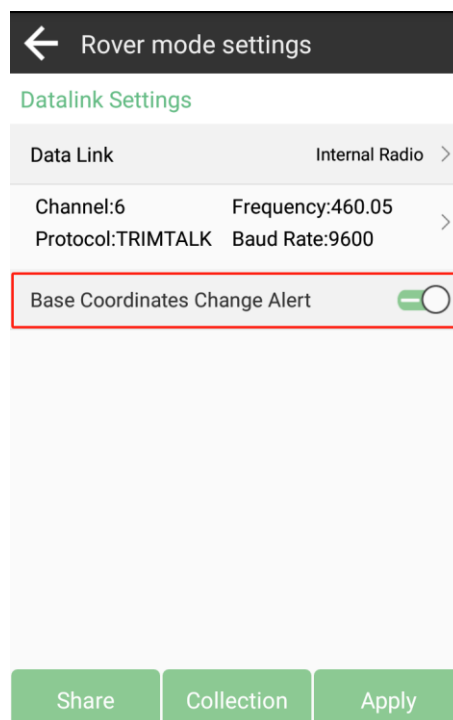
1. Go to **Device** >> **Rover**. Set **Data Link** as **Internal Radio**.



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



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.

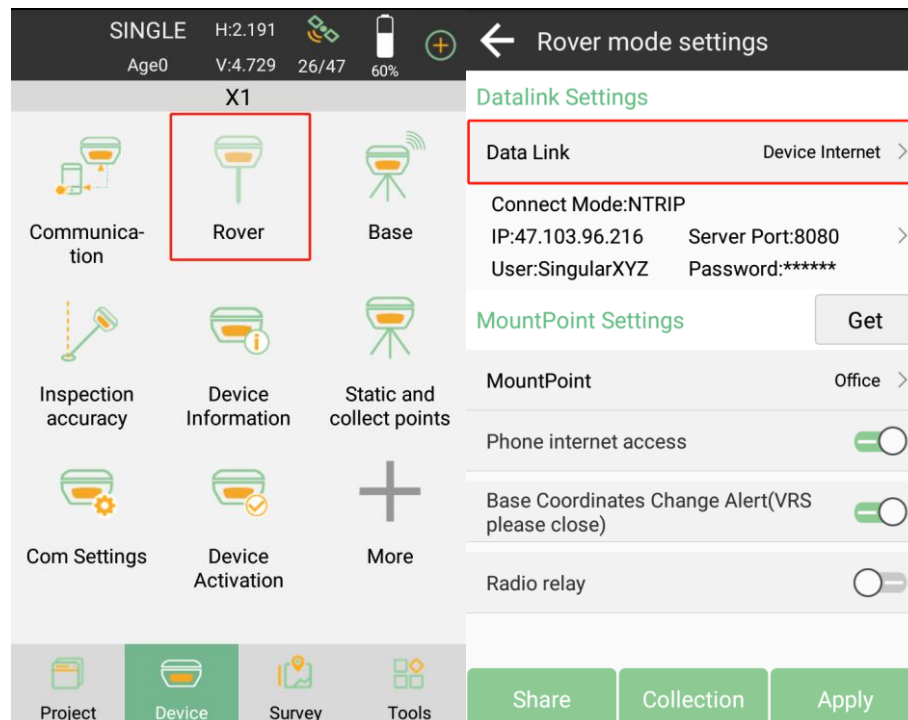


4. Click **Apply** to start the Rover mode. When start Rover succeed, it will show as below in SingularPad.

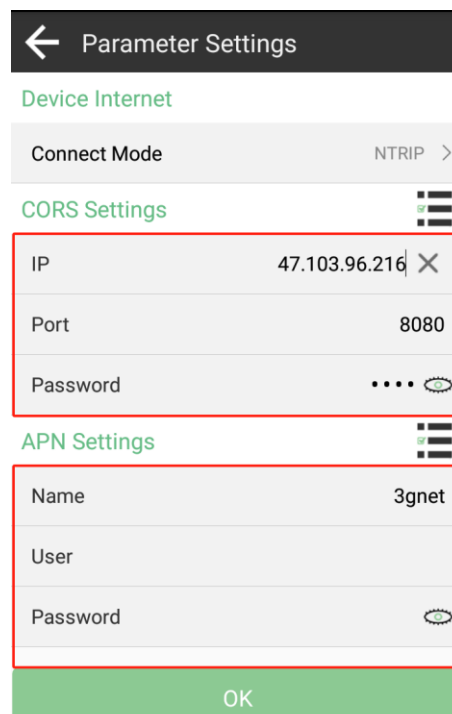
**Device Internet:** Same with start Base station, you need to insert a SIM card to Rover,

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

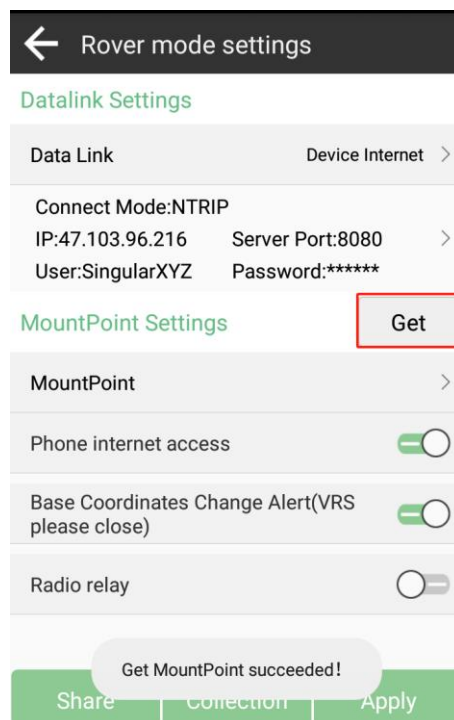
1. Go to **Device** >> **Rover**. Set **Data Link** as **Device Internet**.



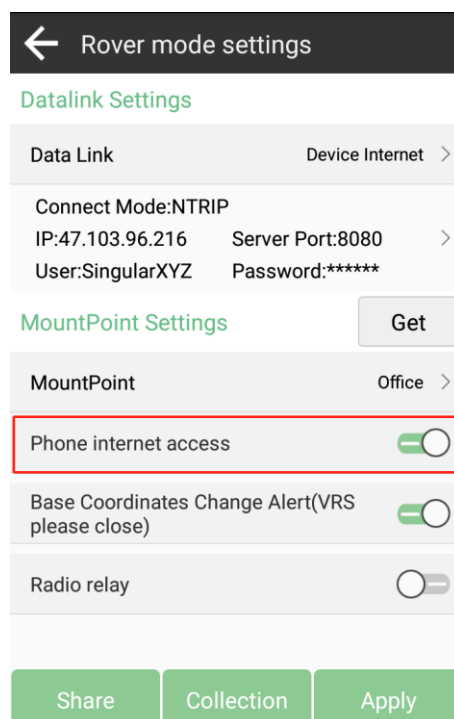
2. **Parameter Settings**. Choose NTRIP in Connect Mode. Input the server IP, Port, User and Password in the CORS Settings. **APN Settings**. Input Name, User and Password.



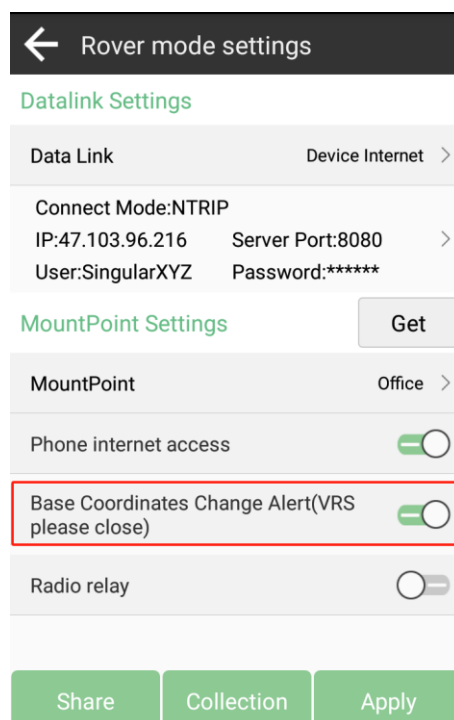
3. Click **Get** button on the right and “Get MountPoint succeeded” will be displayed below. Then choose the mountpoint.



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.



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.

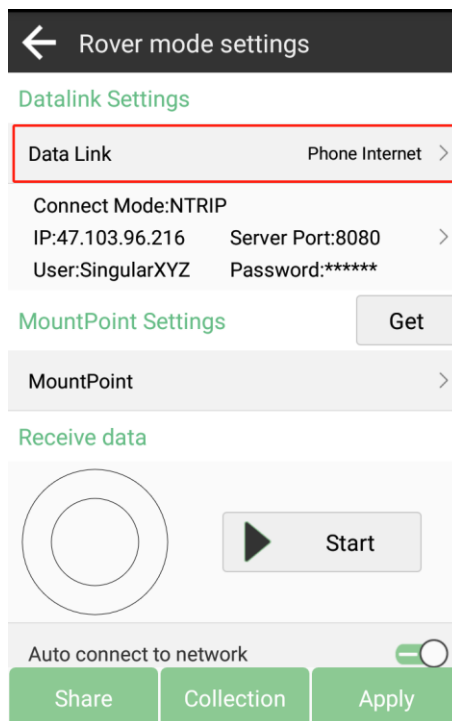


6. Click **Apply** to start the Rover mode. When start Rover succeed, it will show as below in SingularPad.

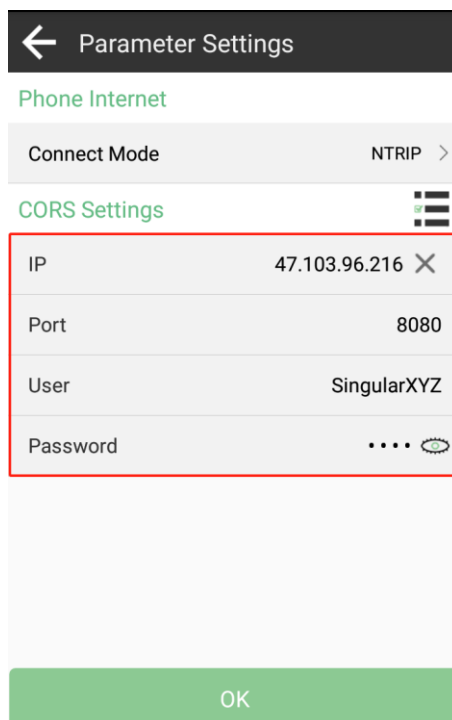
**Phone Internet**: This mode uses the phone internet to transmit the correction data from Base to Rover. Please make sure the PDA device is in good network conditions, such as 4G, WiFi or hot spot.

The following steps give an example of device internet transmission.

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



2. 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.



**NOTE**

The IP & port in the picture is only for example, please enter your local CORS account instead.

You can purchase a third party RTK corrections service account in your local area to obtain an RTK FIX solution.

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

 Rover mode settings

Datalink Settings

Data Link

Phone Internet >

Connect Mode:NTRIP

IP:47.103.96.216

User:SingularXYZ

Server Port:8080

Password:\*\*\*\*\*

>

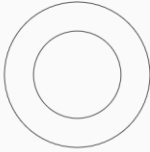
MountPoint Settings

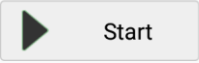
Get

MountPoint

Office >

Receive data





Auto connect to network



Share

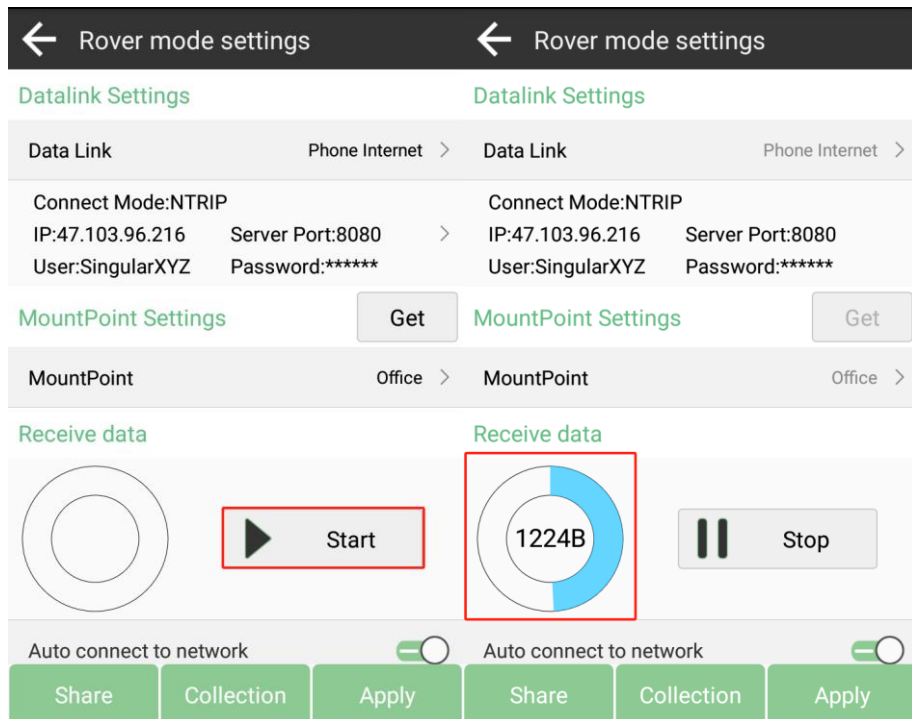
Collection

Apply

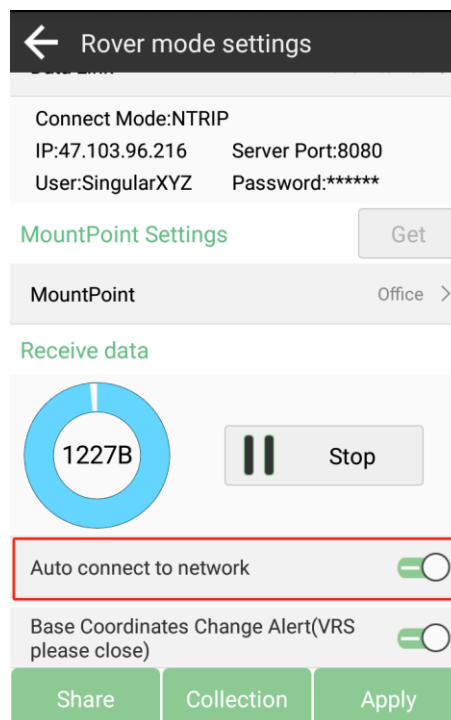
**NOTE**

The mount point "Office" in the figure is an example. Please find out the appropriate mount point via the website of your local NTRIP/CORS provider. Make sure that the baseline doesn't exceed 50km.

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

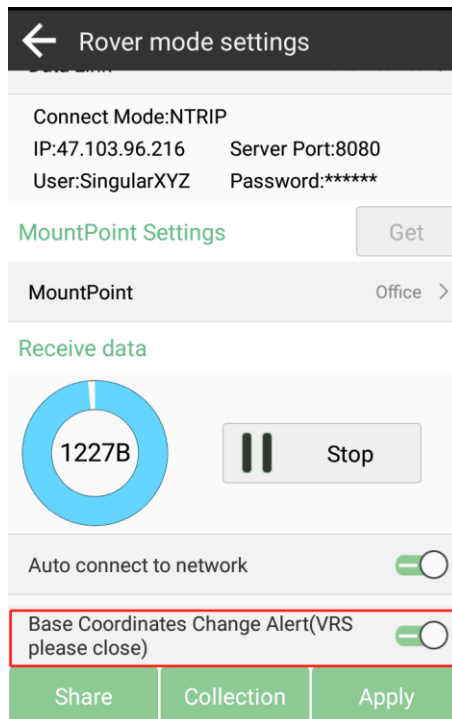


5. **Auto connect to network**: When this option is opened, SingularPad will connect to network automatically so that user don't need to click start to connect network.

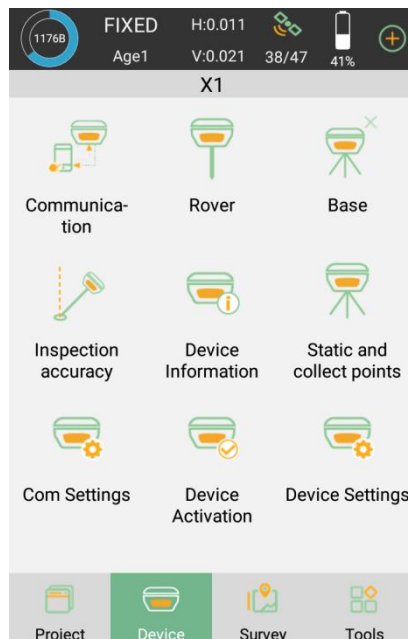


6. **Base Coordinates Change Alert**: SingularPad will alert when you connect with different base station. When the Base station is VRS, please don't open this.





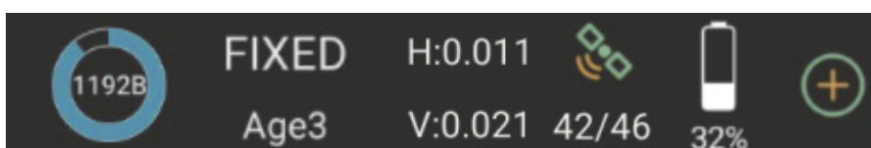
- Click **Apply** to start the rover mode. After completing the configuration, please check the RTK status in the top status bar. Once the status changes to "FIXED" and the differential delay "age" is within the range of 1-2 seconds, you have obtained reliable centimeter-level RTK positioning.



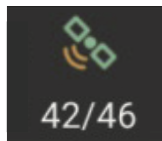
This section describes the basic survey functions of SingularPad, including Point Survey, Detail Survey, Control Point Survey, Point Stakeout, CAD Mapping and etc.

### 5.1 SingularPad Top Status Bar Introduction

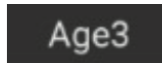
After completing your X1 RTK setup, check current RTK solution status at the top of the SingularPad software.



| RTK solution status | Description                                                                                                                                                                           |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>FIXED</b>        | E1 is receiving RTK corrections stably and obtaining a Fixed RTK solution with centimeter-level accuracy.                                                                             |
| <b>SINGLE</b>       | Single-point satellite positioning without receiving RTK correction data. The accuracy is around meter-level.                                                                         |
| <b>DGNSS</b>        | E1 received corrections from the base/CORS, but it needs more time to calculate due to environmental interference or correction data quality. The accuracy is around decimeter-level. |
| <b>FLOAT</b>        | E1 receives corrections from the base/CORS, but due to obstructions or magnetic field interference the signal reception is not very stable and the accuracy is sub-meter level.       |



The satellite icon shows calculated satellites number/tracked satellites number. You can click it to check satellite map and more information.

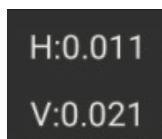


Age means the time since the last differential data was received.

When connecting to a CORS account for measurement work, please ensure the “age” is within the range of 1-2.

When using the radio mode for measurement work, please ensure the “age” is within the range of 2-5.

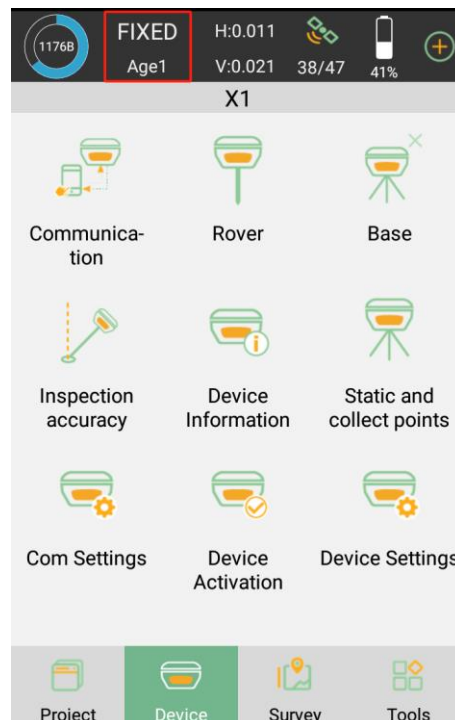
A high “age” will result in poor measurement point accuracy.



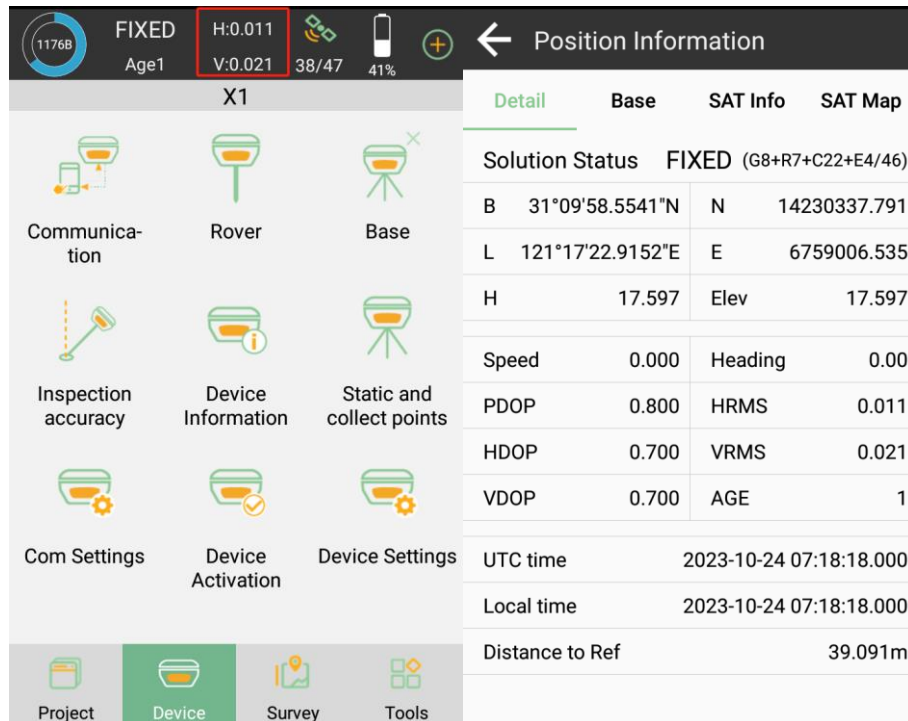
There are HRMS and VRMS on the top of the interface, click it you can check more details.

## 5.2 Point Survey

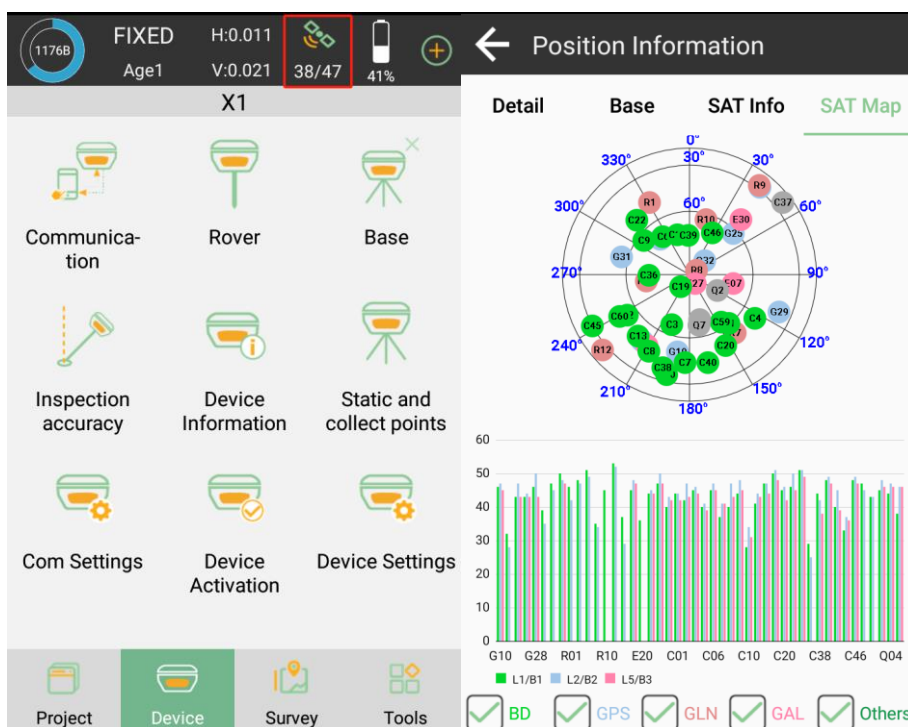
Before RTK survey, please make sure that receiver is receiving the correction data and get a fixed solution, age means the time since the last differential data was received, please check if this number keeps growing.



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

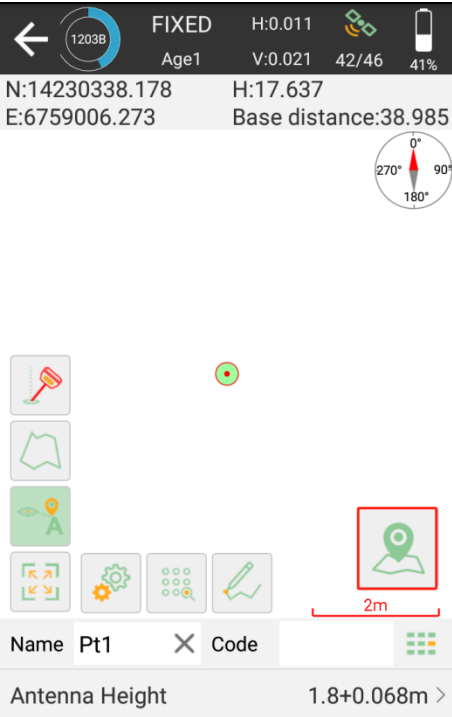


The satellites number is on the top of the interface, click it you can check the satellite map and information.

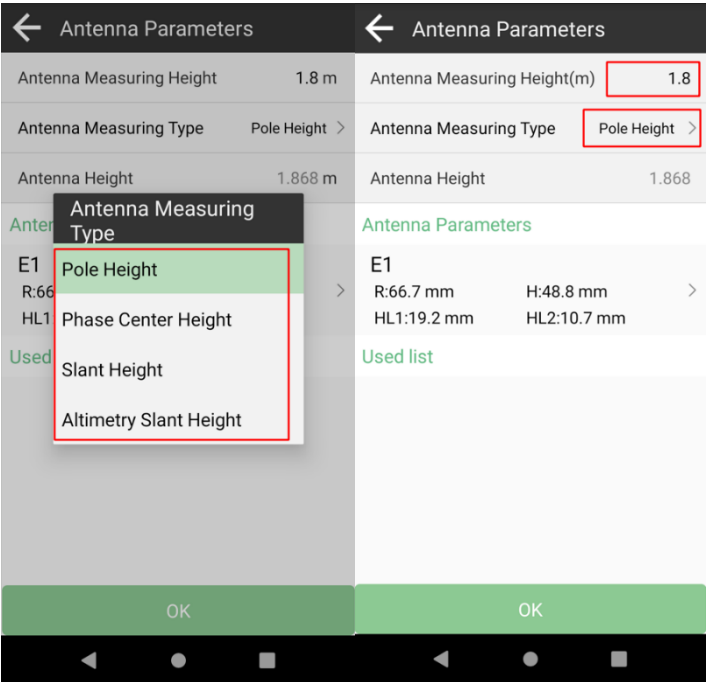


In the Survey interface, click **Point Survey** and enter point name, code and antenna

height, then click  to measure a point.

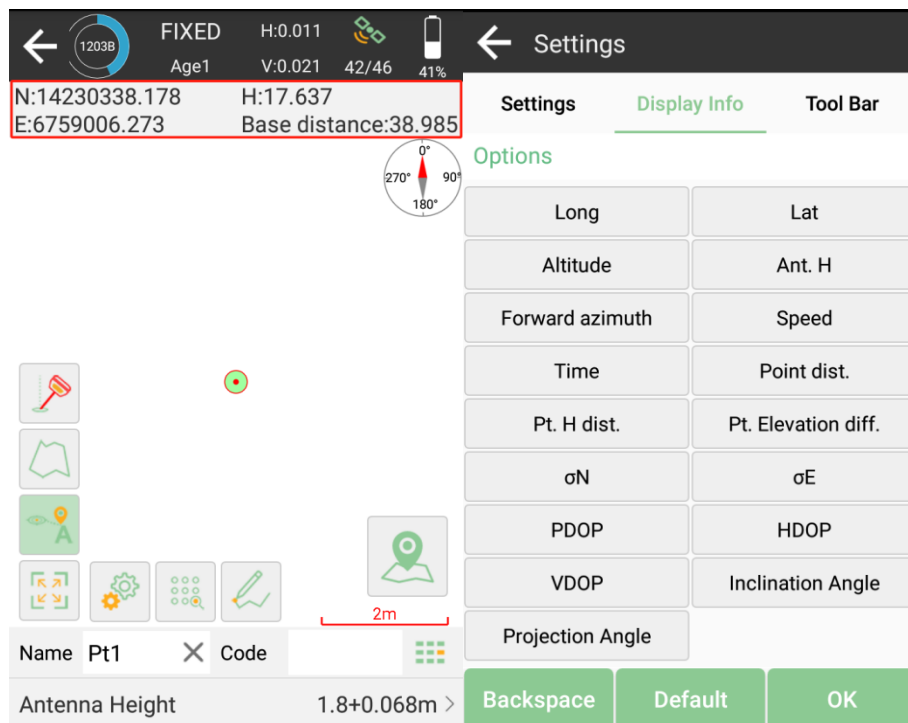


Note:  
Our software supports 4 antenna measuring types

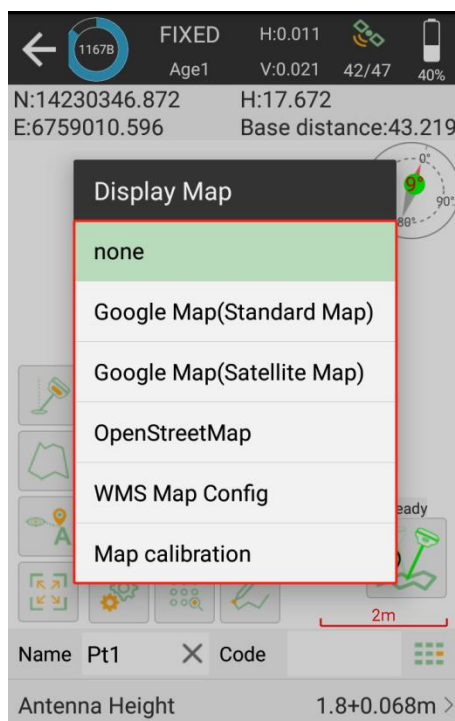


Pole Height: Typically, select the Antenna Measuring Type as Pole Height and enter the height of your centering pole.

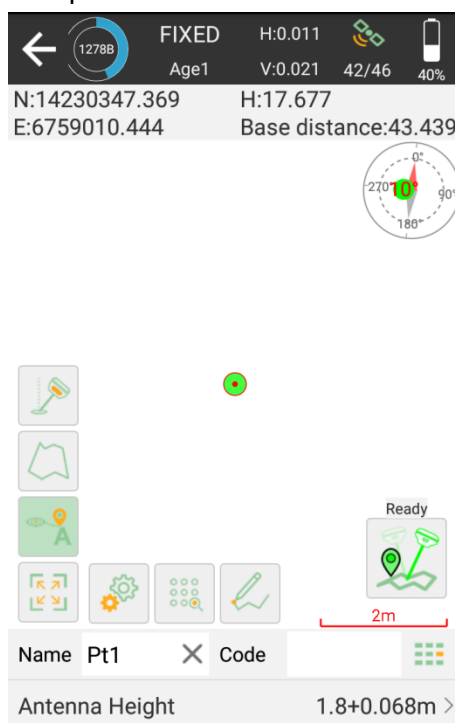
In the floating window of the survey interface, you can see the display information. The default display information is NEH and Base distance, and click the floating window you can set them as you need. You can also click  to enter the display information settings interface and select the information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



- Click  to select different map or do map calibration. SingularPad supports Google Map (Standard Map/ Satellite Map), OpenStreetMap, and WMS Map.



- Click  to jump to map center



- Click  to show the all points on the interface
- Click  to enter the point database and view the coordinates of the measured points. You can add, recover, import, and export the data. After selecting a point, you can check the details and take notes or photos.