SingularXYZ


# Z1 GNSS Receiver

# User Manual

*V1.0*

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## Trademark notice



## FCC Notice

SingularXYZ® Z1 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



## Technical Assistant

If you have any questions and can't find the answer in this manual, please contact your local dealer from which you purchased the Z1 receiver. Alternatively, request technical support from SingularXYZ.
Website:*www.singularxyz.com*
Technical support email: *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 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 integrated 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 is 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

# Chapter 1 Introduction

The SingularXYZ Z1 GNSS Receiver (hereinafter Z1) User Guide is aimed to help you get familiar with the Z1 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, Z1 GNSS receiver can be applied in RTK mode with all GNSS constellations. Z1 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.

## 1.2 Receiver Features

The SingularXYZ E1 GNSS Receiver key features:

- Ultra-small, ultra-light
- Dimensions: Φ107 mm × 58.7 mm
- Weight: 547 g
- 1408 simultaneous tracking satellite signal channels
- Fast charging via Type-C interface
- Wireless Bluetooth
- IP67 waterproof
- Full base/mobile station interoperability
- Integrated Rx&Tx radio, 12.5KHz frequency spacing
- Integrated IMU sensor
- Long-range radio module
- Support Ntrip protocol

# Chapter 2 User Interface

This chapter provides general information on environmental requirements, setup, power supply and connection of the E1 receiver.

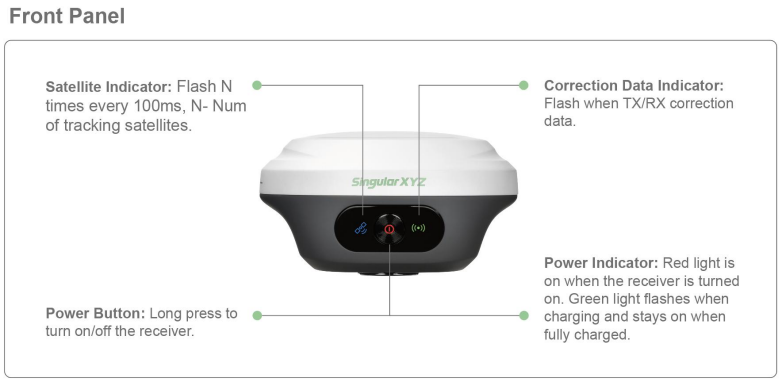
## 2.1 Environmental requirements

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

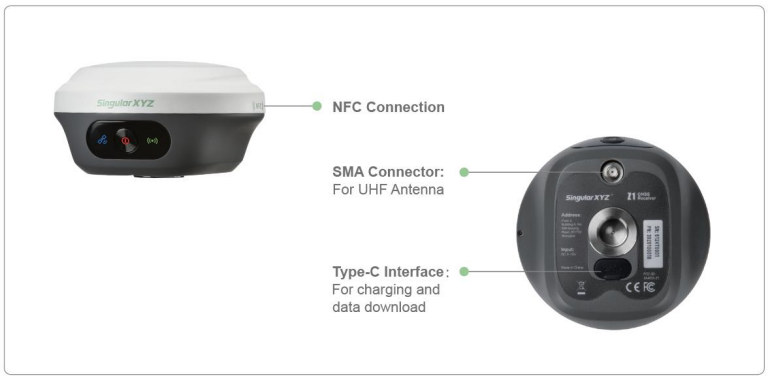
## 2.2 Front panel

The receiver front panel contains 2 LED indicators and a power button.




## 2.3 Lower housing

The lower shell of the receiver contains a type-c port and an SMA radio antenna connector.



## 2.4 Power Supply

The receiver is equipped with internal batteries.

- 4200 mAh, up to 12 hours working time
- Fast charge of 3 hours charging time

# Chapter 3 RTK Workflow

This chapter describes how to perform RTK measurements using SingularPad software. SingularPad is a professional Android-based measurement software developed by the SingularXYZ team. As a field measurement software, SingularPad is feature-rich and equipped with a complete set of working modes and the necessary functions for surveyors.

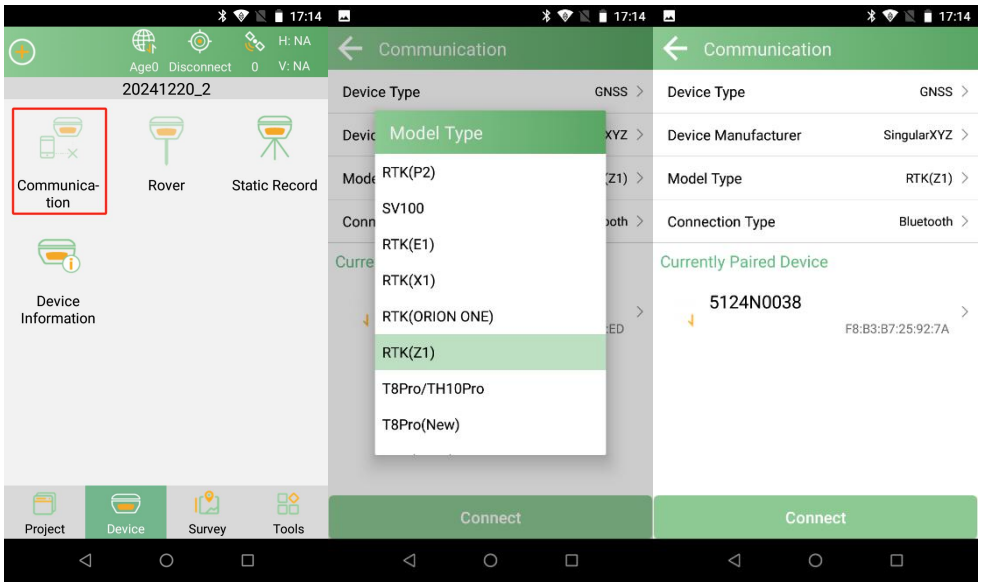
## 3.1 Software Installation

SingularPad is pre-installed on the SingularXYZ data collector before shipment. If you wish to download it onto your own device, please contact us.

## 3.2 Device Connection

### 3.2.1 Connect via Bluetooth

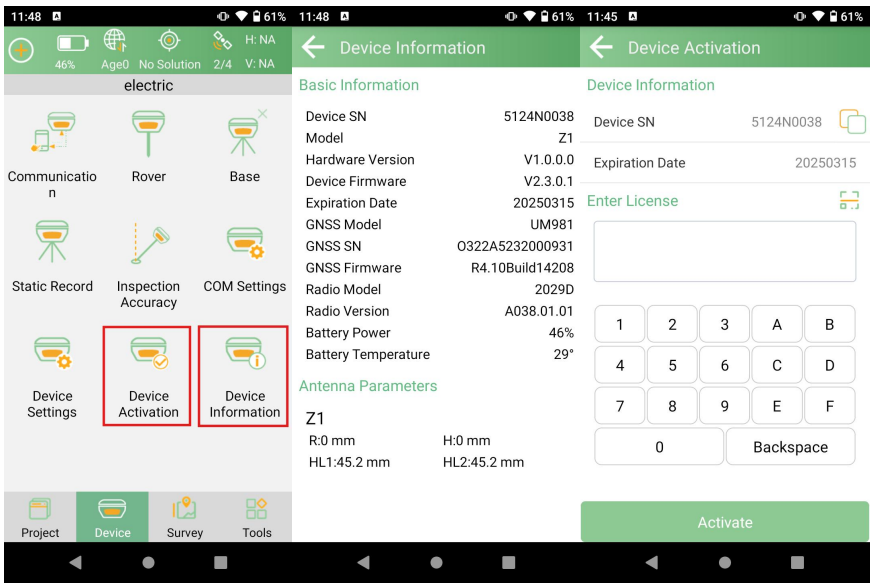
Open the SingularPad software, enter the **Communication**, select Z1 as the Device type, and search for the device Bluetooth to connect.



### 3.2.2 Connect via NFC

The receiver is equipped with an NFC chip, and users can easily connect the Z1 receiver to the data logger with just a tap, as shown in the figure below.

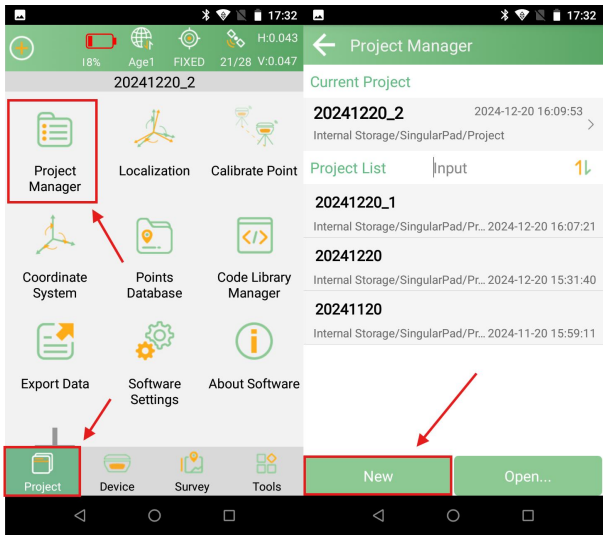

After connecting the Z1 receiver, you can view the information (such as firmware version) in the **Device Information**, and check or register the device in the device registration.



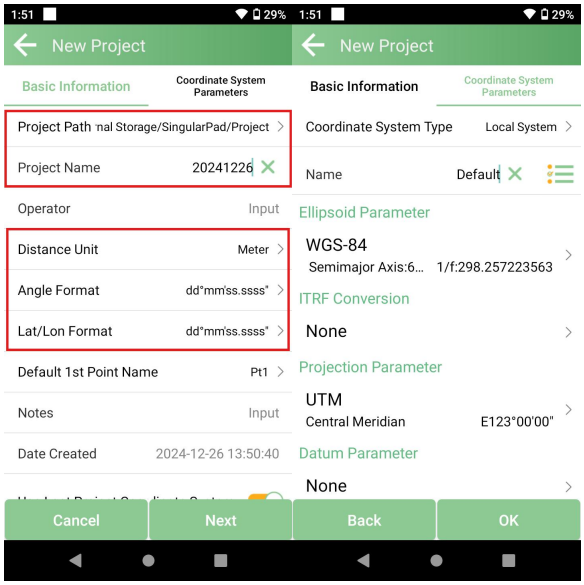

*Tips: If the connection to the receiver via SingularPad fails, please follow the prompts to enter the PDA/data collector system's Bluetooth settings. Ensure that the Bluetooth pairing is successful. Sometimes, it may be necessary to unpair the device, restart the receiver or the SingularPad software, and then pair them again.*

## 3.3 Create new project

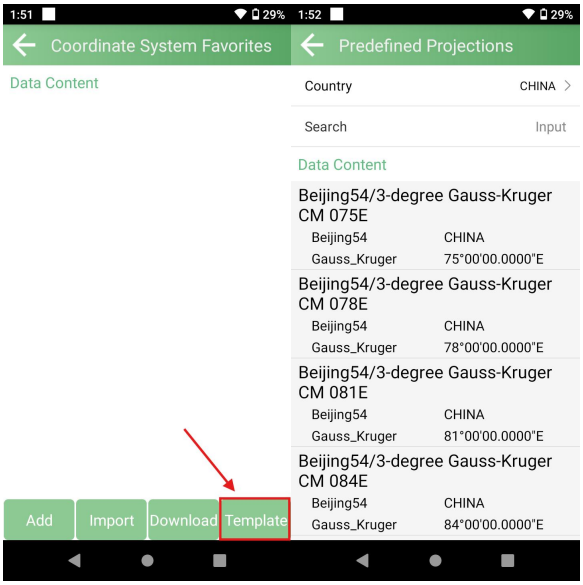
Enter the **Project**->**Project Manager**, click the "New" button in the lower-left corner of the screen.




Enter the **project name** and other relevant information, set the coordinate system parameters, and then click "OK" to save the new project.



If you need to use different coordinate system parameters, click  to configure.



## 3.4 Static Survey

This chapter explains how to perform static measurements using the Z1 receiver and SingularXYZConverter Software.

For static measurements, the Z1 supports the data format: Binary XYZ. The binary format (*.XYZ) is a raw observation data format, which can be converted into RINEX format using the SingularXYZConverter Software (please contact the SingularXYZ support team for access to this tool).

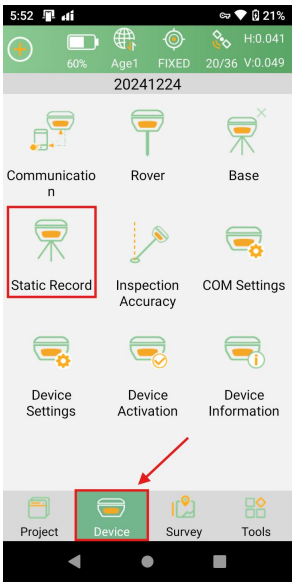
If you require post-processing software, please contact the support email at support@singularxyz.com for assistance.

### 3.4.1 Static Data Collection

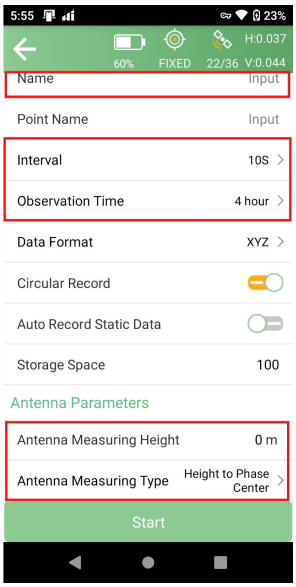
Here are the steps for static data collection:

Select a stable measurement location with good satellite signal reception, ensuring the receiver is securely positioned.

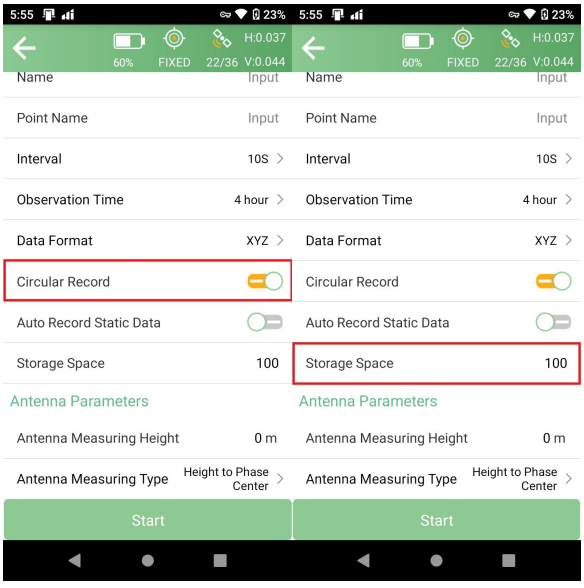
1、 Enter **Device->Static Record**



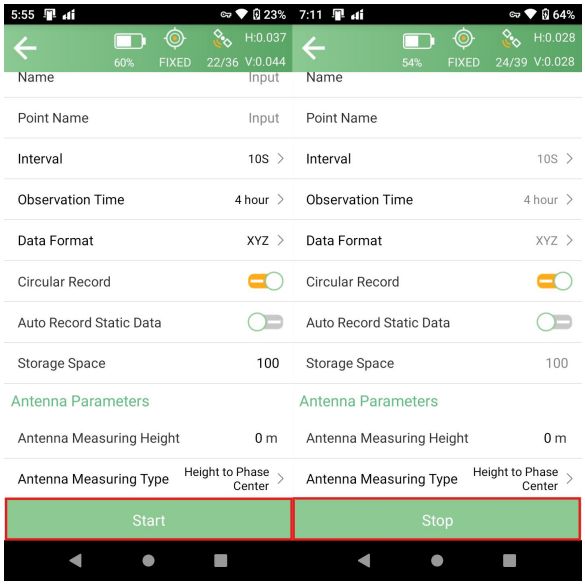
2、 **Enter Options Settings Interface**: Enter the **record name** and **point name**. Set the **Interval** and **Observation Time** and **Antenna Parameters**.




3、 **Enable/Disable Circular Recording**: Enable this option if you want the receiver to delete the oldest recorded data and continue recording when the storage space is full. You can also set the storage space (in MB), which will limit the amount of data the receiver can record.



4、 At last, click the “Start” to start record static data.



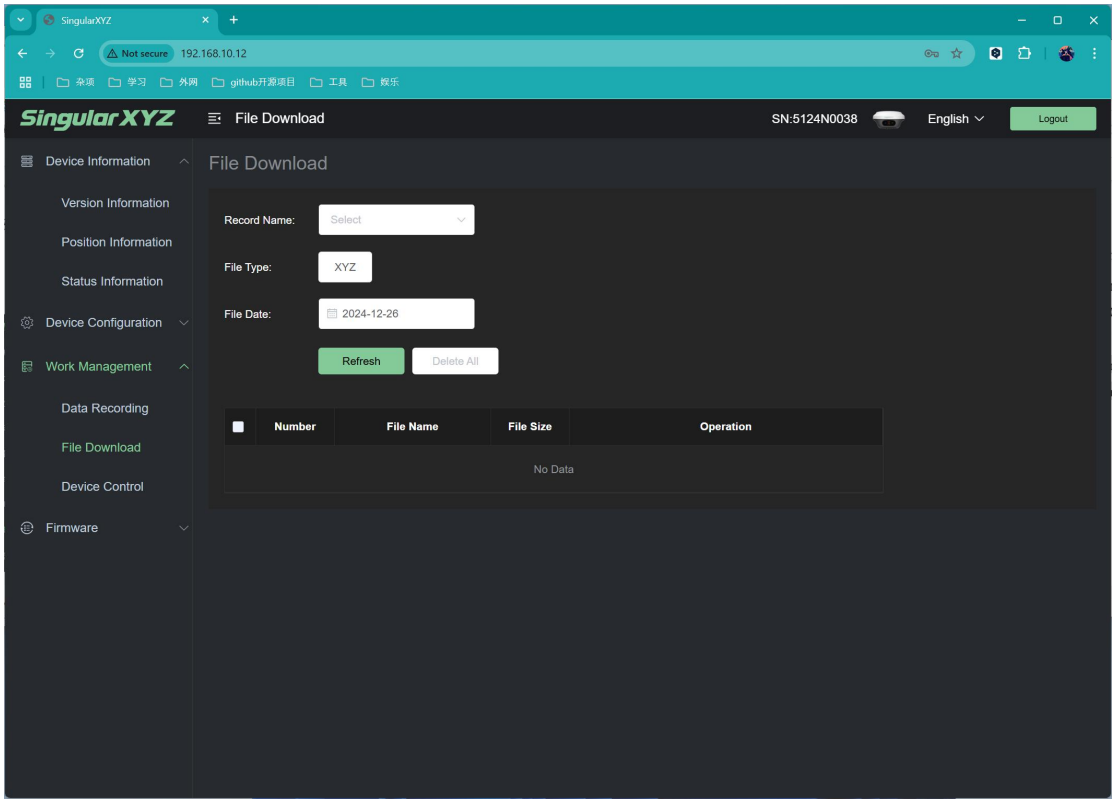
### 3.4.2 Static Data Download

The raw observation data is stored in the internal memory of the Z1 receiver, The specific steps to download the static data from the Z1 receiver are as follows:

1、 Enable the device's Wi-Fi through the PAD software (refer to Chapter 4.1 for device Wi-Fi configuration)

2、 Connect device's WIFI, and enter WebUI, enter **Work Management->File Download**

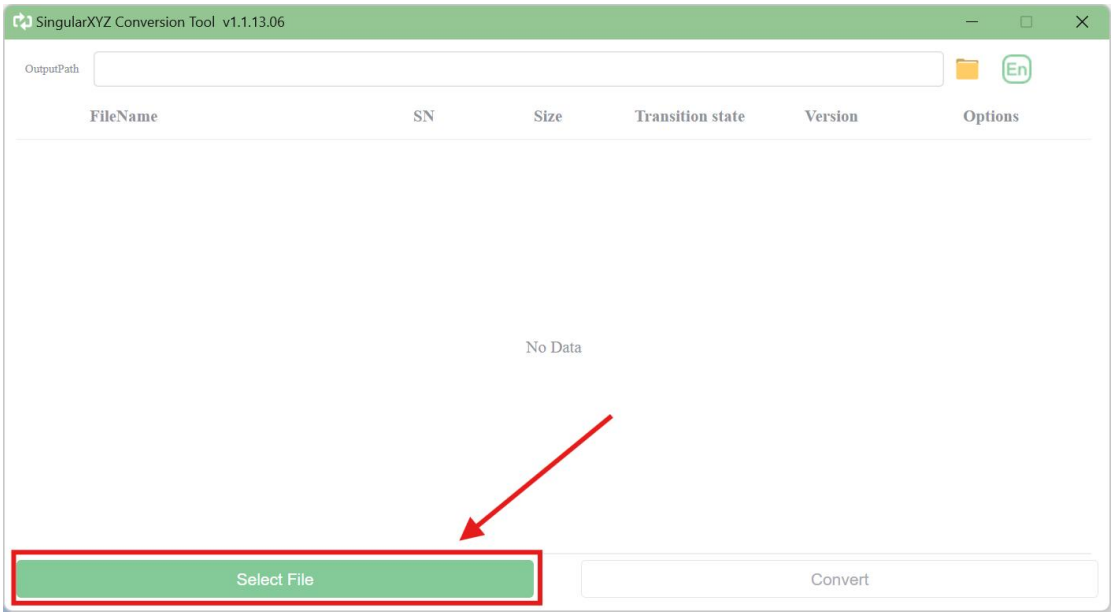
3、 Select **Record Name**, **File Type** and **File Date**, then click **Refresh**, then you can download the static data file.



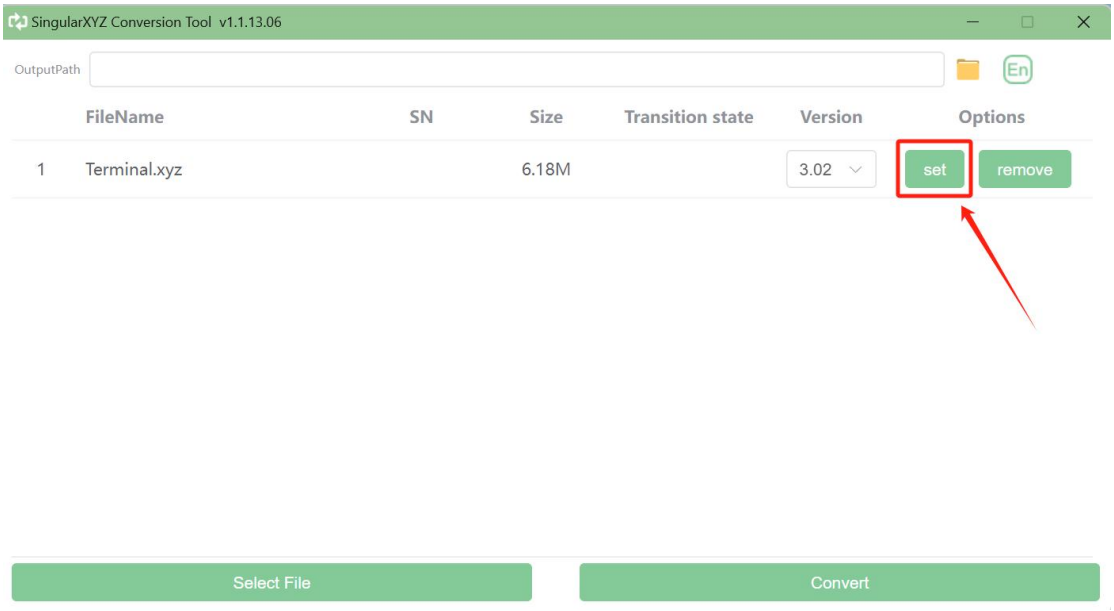
### 3.4.3 Rinex Convert

The Z1 receiver stores static data in xyz format, which needs to be converted to Rinex format using the Singular conversion tool. The specific steps are as follows:

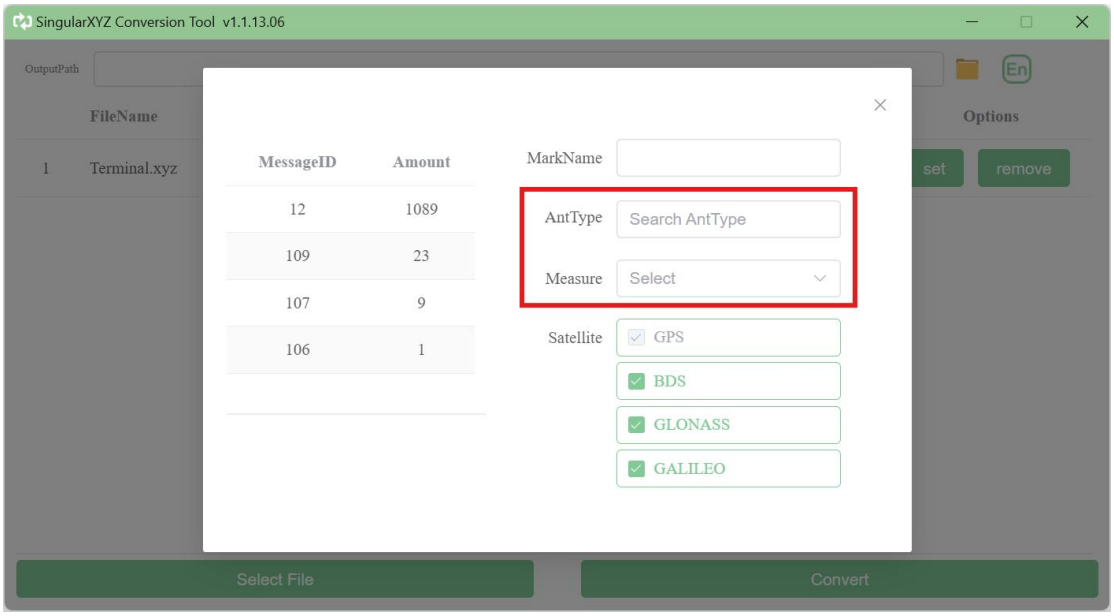
- After opening the conversion tool, click **Select File**



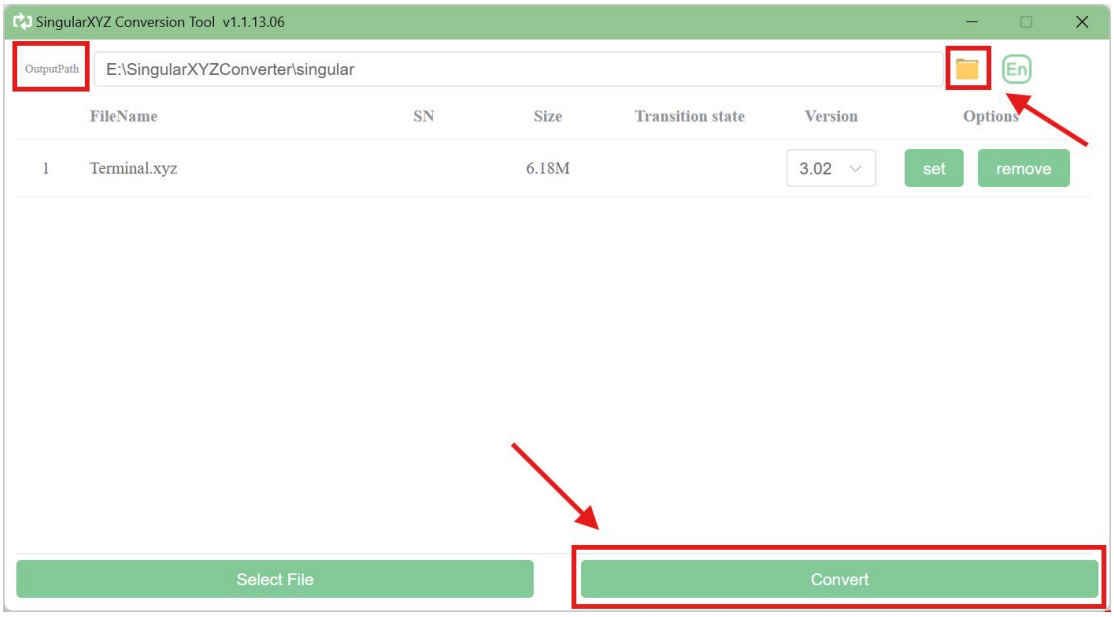

- After selecting the file, you can **set** the antenna parameters



- You can set the antenna type and antenna measurement method




- Finally, after selecting the file output path, you can **convert**



## 3.5 Quick Setup

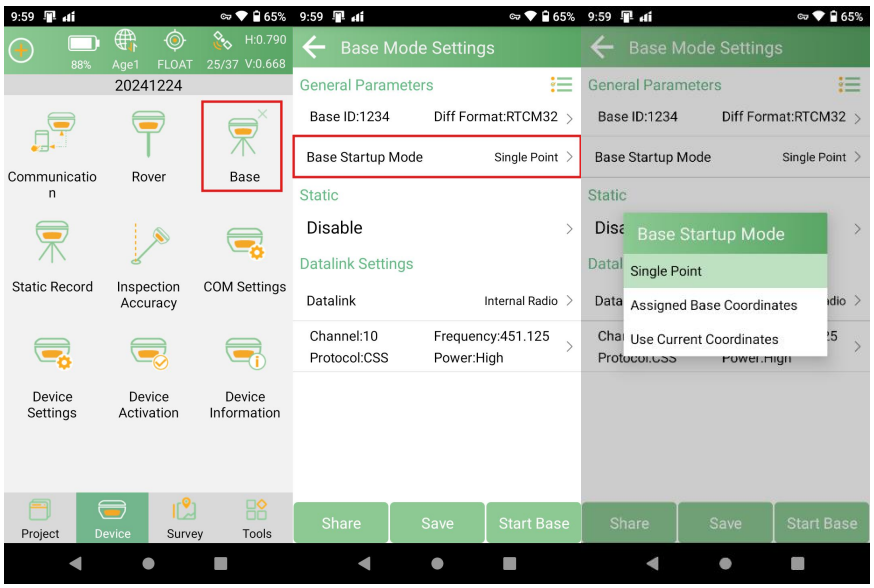
This section will guide you on how to configure the Z1 receiver to achieve centimeter-level RTK. Below is the mode introduction of radio and Phone Internet.

### 3.5.1 Radio Mode

If you purchase two Z1 GNSS receivers, you can choose one Z1 as a base station and the other as a rover. You can use data controller or mobile phone to connect to the base station and rover respectively.

Internal Radio: This mode uses the internal radio to transmit correction data from the base station to the rover. You need to set the base station and rover to the same protocol and frequency.

- Supported protocols: TRIMTALK, TRIMMK3, TT450S, TRANSEOT, SATEL and CSS (only supported in LU version)
- Frequency: Select channel or custom frequency, frequency range is 410-470MHz
- Baud rate: 4800, 9600, CSS protocol supports 11000, 12000, 15000, 18000 in LU version
- Power consumption: high or low (low power will reduce the radio working range)

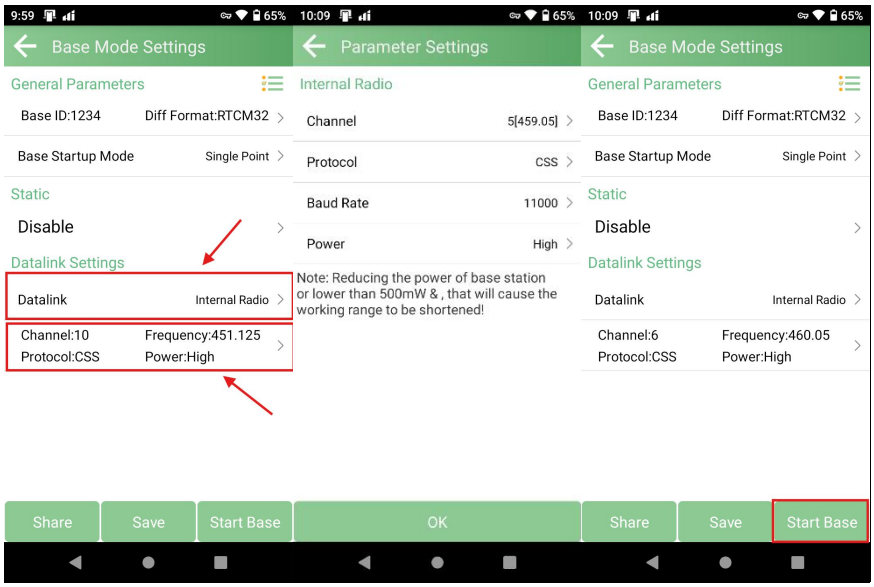



**Single point**: Start the base station at unknown coordinates.

**Assigned Base Coordinates**: Start the base station at known coordinates, and enter the latitude, longitude and altitude.

**Use Current Coordinates**: Measure the current coordinates and automatically start the base station with these coordinates.

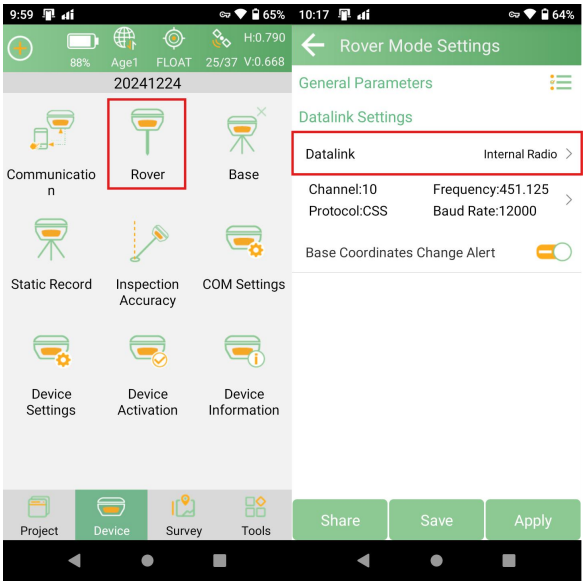
Set the **data link** to the **internal radio**. Set the parameter settings including channel, frequency, protocol, baud rate and power.



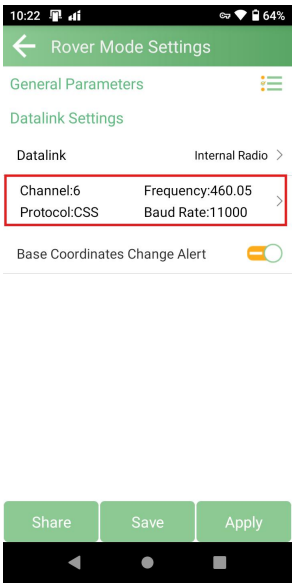

*Note: After the base station is set up, please disconnect the base station device and search for the SN of the rover station, connect and configure the rover station device, and select the same protocol and frequency as the base station.*

The following steps give an example of how to configure the internal radio for rover mode.

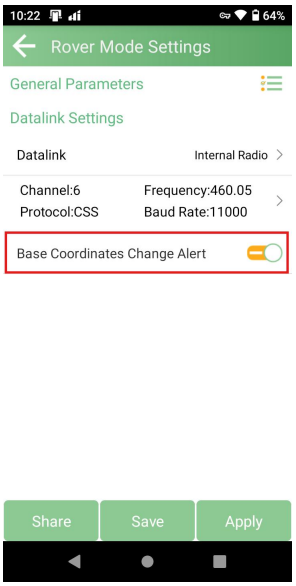
1、 Go to **Device** >> **Rover**. Set Data Link to Internal Radio.



2、 **Parameter setting**: Set the channel, frequency and protocol to be the same as the base station.




3、 **Base Coordinates Change Alert**: When you are working, if the base station coordinates change, the engineering communication will issue an alarm. This may be because the rover is mistakenly connected to another base station or the base station has been moved.




4、 Click **Apply** to start rover.

*Tips: After configuration is complete, check the RTK status in the top status bar. Once the status changes to "Fixed" and the differential delay "Delay" is in the 1-3 second range, you have reliable centimeter-level RTK positioning.*

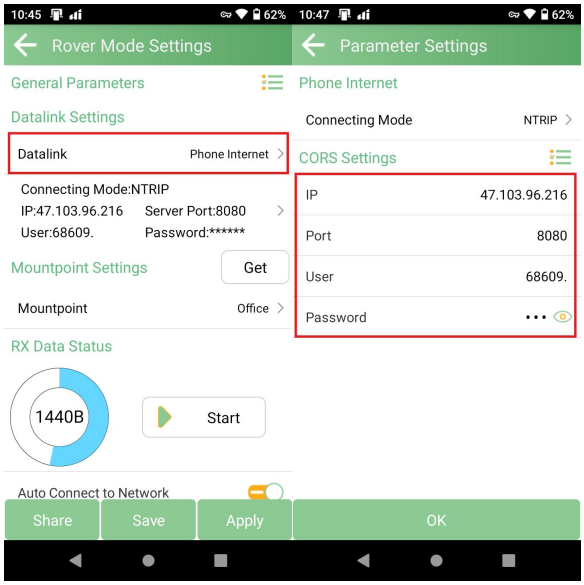
### 3.5.2 Phone Internet

When used as a rover station, SingularPad supports Phone Internet mode to receive correction data.

Phone Internet: This mode uses the mobile phone to access the Internet to transfer the correction data from the base station to the mobile station. Please make sure that the Phone device is in a good network state, such as 4G (SC200 data collector can obtain 4G network signal by inserting a SIM card), WIFI or hotspot.

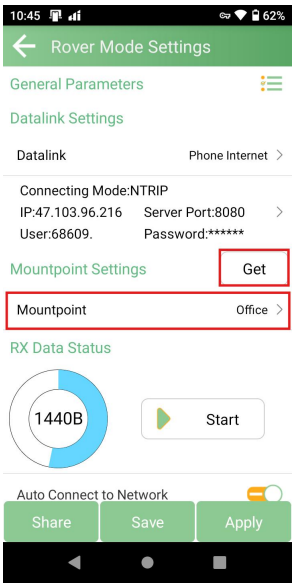
1、 Enter **Device**>>**Rover**, Set the **data link** to the **Phone Internet**. Configure CORS parameters.

2、 Set the connection mode, the Z1 receiver supports NTRIP and TCP.

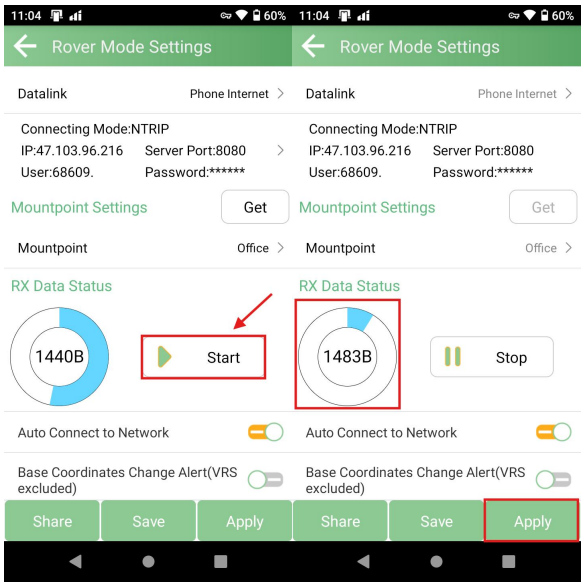



*Note: The IP and port in the image are for reference only, please enter your local CORS account.*

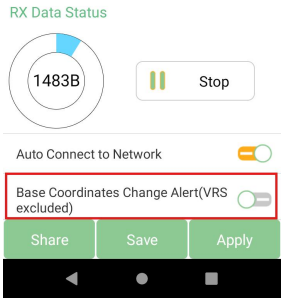
3、 After setting the parameters, click the **Get** button on the right to get the mount point list and select a mount point.




4、 Click the **Start** button on the right to receive data from the CORS/RTK correction service. Then you can see that the rover is receiving data. Then click **Apply** to save the configuration.




If you frequently receive notifications of base station changes, please turn off VRS.


RX Data Status
1483B
Stop
Auto Connect to Network
Base Coordinates Change Alert(VRS excluded)
Share
Save
Apply

## 3.6 RTK Data Collection

### 3.6.1 Top status bar

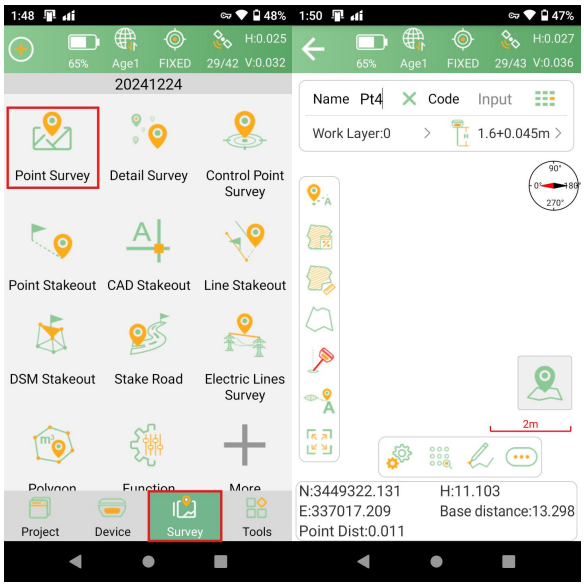
After completing the Z1 Base Station and Mobile Station settings, please check the current RTK status in the top status bar of the SingularPad software.


| RTK Status | Description |
|---|---|
| **Fixed** | Z1 stably receives RTK corrections and obtains a fixed RTK solution with centimeter-level accuracy. It has high accuracy. |
| **Autonomous** | No RTK correction data is received. This is single-point satellite positioning with an accuracy of up to meter level. |
| **DGNSS** | Z1 has received corrections from the reference station/CORS, but due to environmental interference or correction data quality, more time is needed for calculation. The accuracy is about decimeter level. |
| **FLOAT** | Z1 receives corrections from the base station/CORS, but due to obstacles or magnetic field interference, the signal reception is not very stable and the accuracy is sub-meter. |

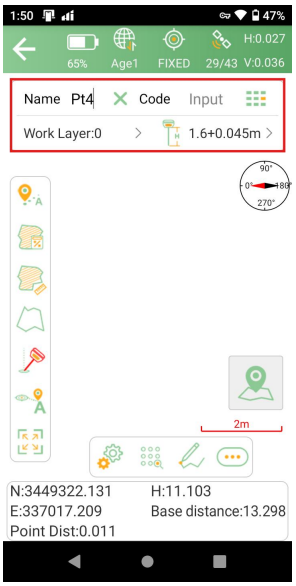
| Function | Description |
|---|---|
|  | The satellite icon shows the number of satellites in used (27) / number of satellites tracked (40). You can click it to see satellite map and more information. |
|  | Age indicates the time since the last difference data was received.<br>When connected to a CORS account for measurement work, ensure that "Age" is in the range of 1-2.<br>When using radio mode for measurement work, ensure that "Age" is in the range of 2-5.<br>High "Age" will result in poor measurement point accuracy. |
|  | There are HRMS and VRMS in the upper right corner of the software interface. Click them to view more details. |

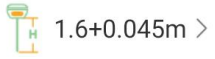
## 3.7 Point Survey

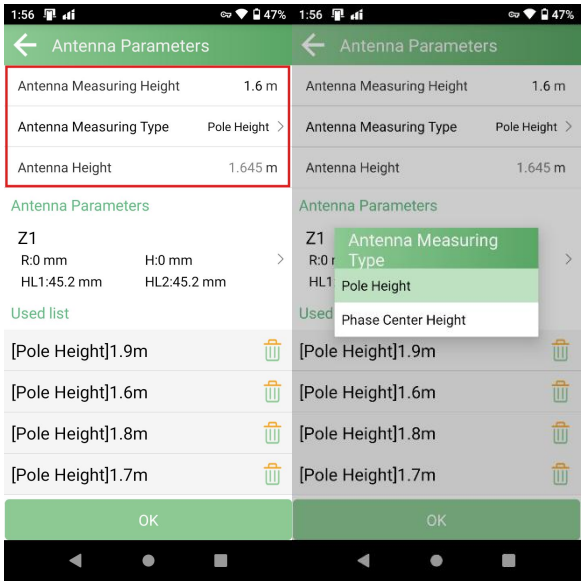
1、 Go to **Survey->Point Survey** to enter the measurement interface.



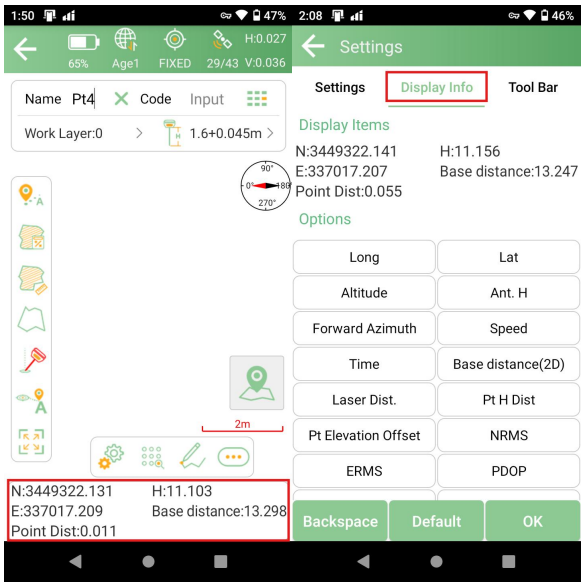

2、 Enter the **point Name**, **code** and **antenna height**.



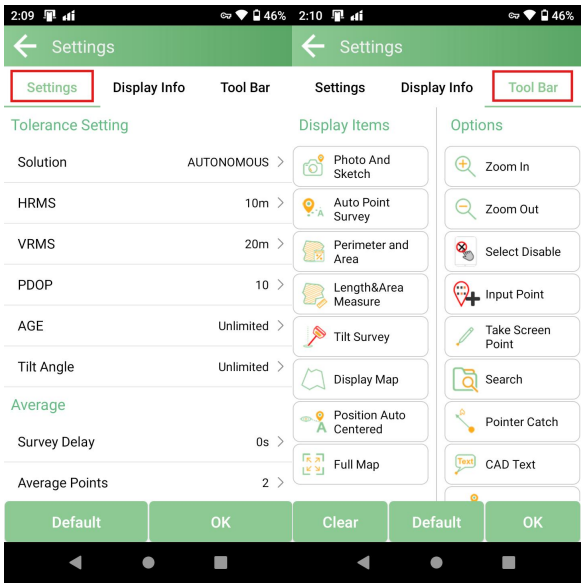
3、 Click  to enter the antenna height setting, you can set the antenna height and its measurement method, and then click the measurement button  to survey point.



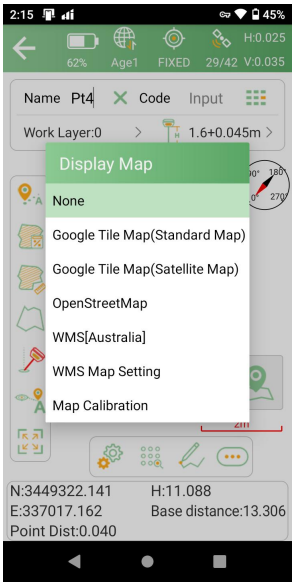

- In the floating window of the measurement interface, you can see the display information. The default display information is north, east, height and base station distance. Click Setting  to enter the display information setting interface and select the information to be displayed. In addition to the default display information, SingularPad also supports longitude, latitude, altitude, etc.



- If you need to modify the measurement settings and function menus, you can do so at the location shown in the figure below.

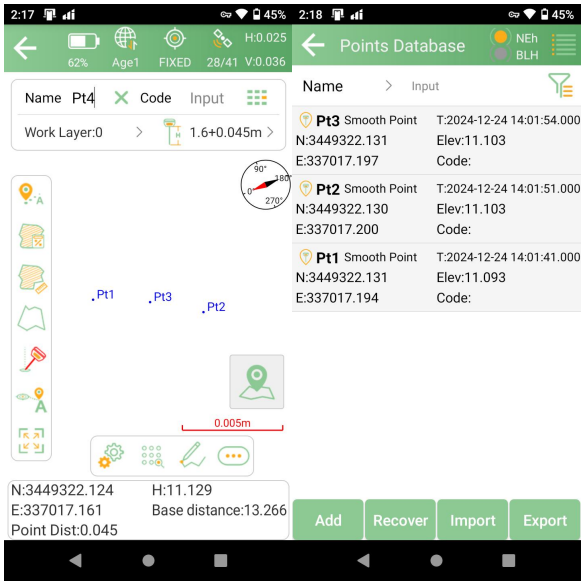



- Click  to select different map types or perform map calibration. SingularPad supports Google Maps (standard maps/satellite maps), OpenStreetMap and WMS maps.

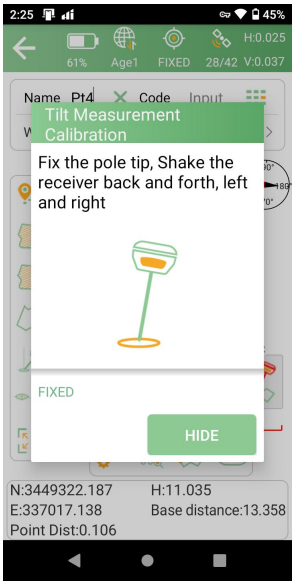


- Click  to display all points on the interface

- Click  to enter the point library and view the coordinates of the measured points. You can add, recover, import, and export data. After selecting a point, you can view details, mark it, or take a photo.



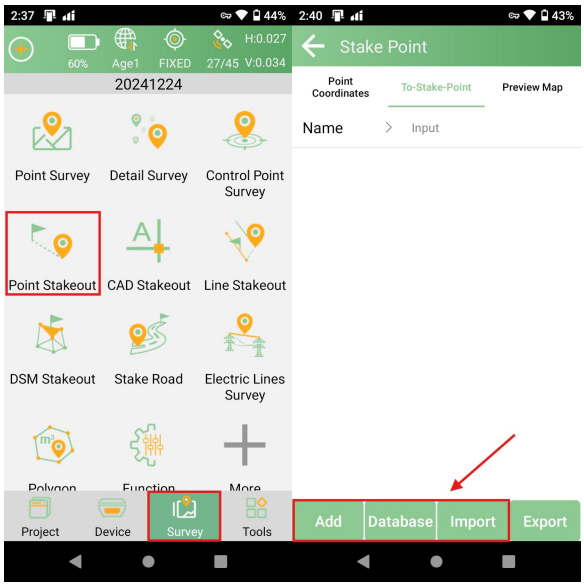

- Z1 also supports IMU tilt measurement. If you need to use this function, click  to turn on IMU, and then you will be prompted to initialize the IMU. Make sure that the receiver can obtains a fixed solution during the entire initialization process.




*Note: Shake the measuring rod back and forth and left and right to initialize as required. The first initialization after powering on takes about 40 seconds.*

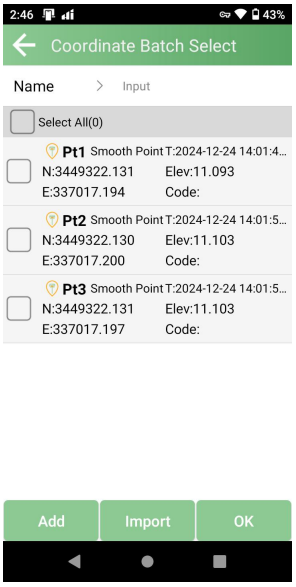
## 3.8 Point Stakeout

1、 Click **Survey->Point Stakeout** to enter the point stakeout interface. You can add or import the coordinates of the points to be staked, or click the button Library to select from the point library.

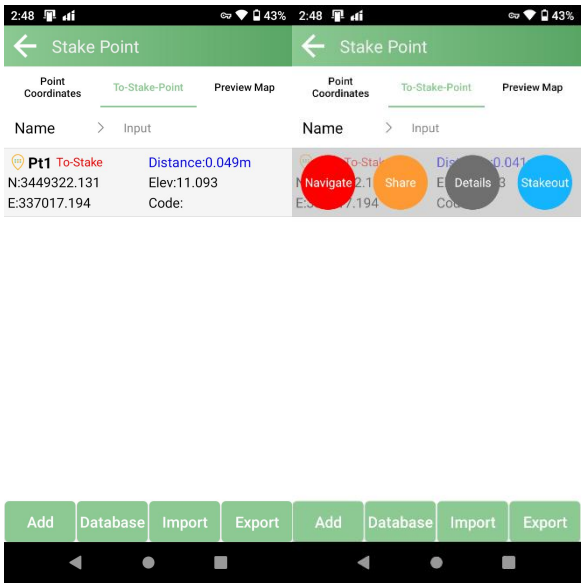



This document uses the points in the Database as examples:

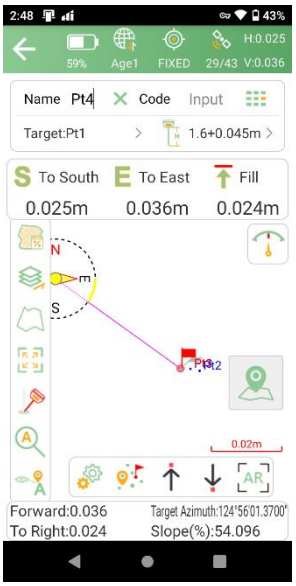
2、 Click **Database**, then select point you want to stakeout in Database.



3、 After selecting the staked point, the To-staked and staked points will be displayed here. Click the un-staked point to stakeout.

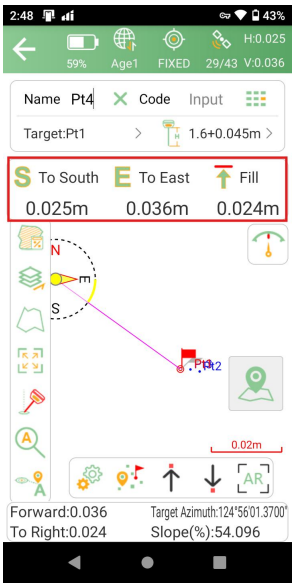



4、 Select the point to be staked. SingularPad provides a navigation map when staking out points. When you approach the target point to the set range value, the software will remind you.




*For the Z1 receiver, you can use the IMU Stakeout feature. In IMU Stakeout, you can turn on the IMU feature without keeping the receiver perpendicular to the ground. The maximum tilt angle is 60°.*

After entering the stakeout interface, there is a direction prompt in the floating window.




Click  to start or stop staking points

Click  to turn on or off IMU

Click  to automatically zoom to the full image

Click  to jump to the current point

Click  to jump to the next point

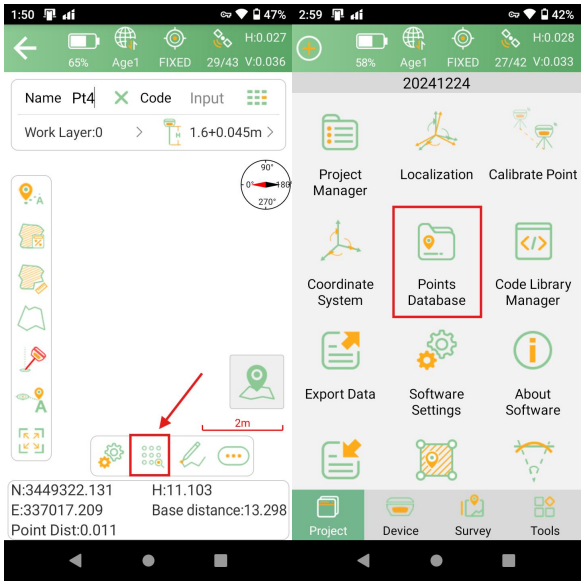
Click  to jump to the previous point

Click  to set up the slide-out settings, display information and toolbar, you can edit the prompt range and range error

Click  to enter AR staking

## 3.9 Database and export/import

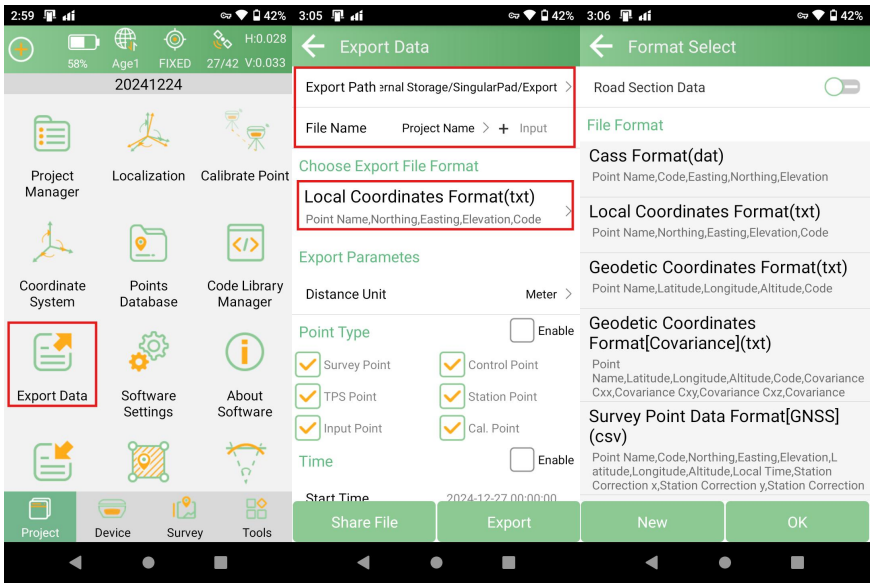
Points measured, staked, added, imported and entered from the displayed map will be stored in the point database. In the SingularPad software, you can enter the point database through the measurement interface or the project in the main interface.




SingularPad supports exporting/importing data in various data formats including latitude/longitude coordinates.

### 3.9.1 Data Export

Go to **Project**-> **Export Data**. Select the export path and export file name and export data format. In addition, click More Formats to export the measured points in various formats, such as staked points/lines, DXF, SHP, KML, RAW, RW5, HTML, CASS, etc.



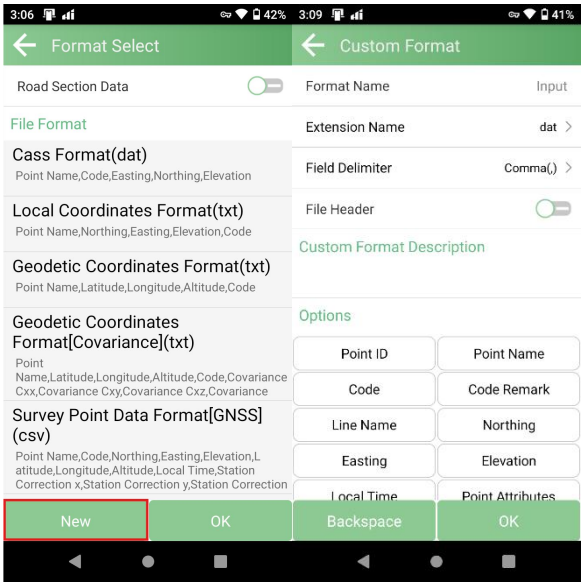

a) **Export path**: The default export path is internal storage/SingularPad/export, you can also change it to any other path where the file is located

b) **File name**: Supports project name, operator, data, data time

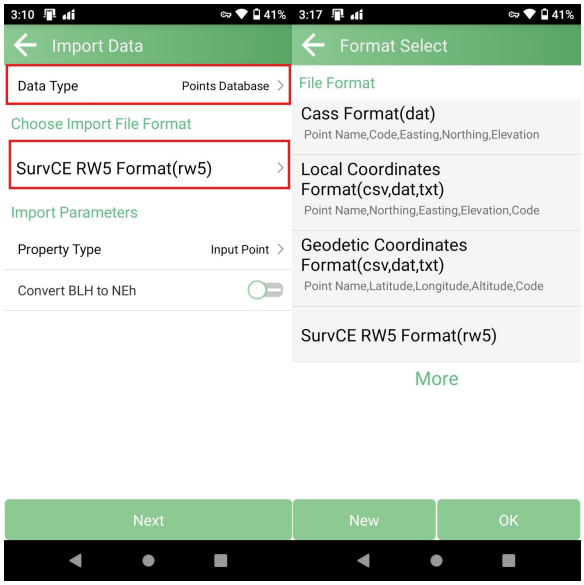
c) **Export file format**: Supports *.csv, *.dat, *.txt, *kml, etc.

d) **Distance unit**: Supports meters, US feet and international feet

Alternatively, you can click New to create a user-defined type.



### 3.9.2 Data Import




a) **Data Type**: Supports point database, conversion parameter file and code library

b) **Import file format**: Supports *.csv, *.dat, *.txt, *.kml, etc.

c) **Distance Unit**: Supports meters, US feet and international feet

In addition, you can also create user-defined types instantly with one click.

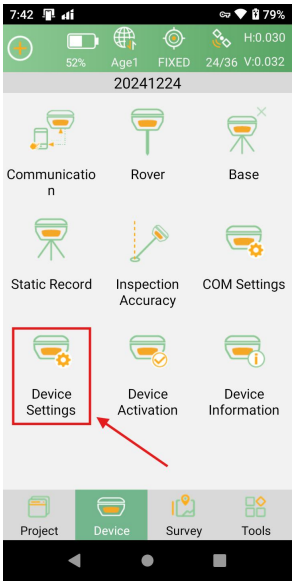
# Chapter 4 WebUi Introduction

## 4.1 Web Configuration Interface

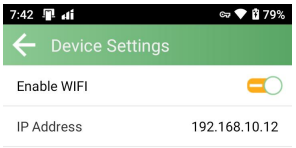
This chapter mainly introduces the functions of downloading static data and upgrading firmware in the Web of Z1 receiver.

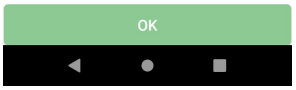
*Note: The Z1 receiver defaults to having Bluetooth enabled and Wi-Fi disabled upon startup. Bluetooth and Wi-Fi cannot coexist simultaneously. Therefore, to use Wi-Fi, you need to enable it through the PAD software. After restarting the device or configuring it via the web interface, Bluetooth will be re-enabled. Below are the steps to enable Wi-Fi:*

**1**、 After you connect Z1 GNSS Receiver via SingularPad, then enter **Device Settings**



2、 Use the default IP address, then click OK to enable WIFI.

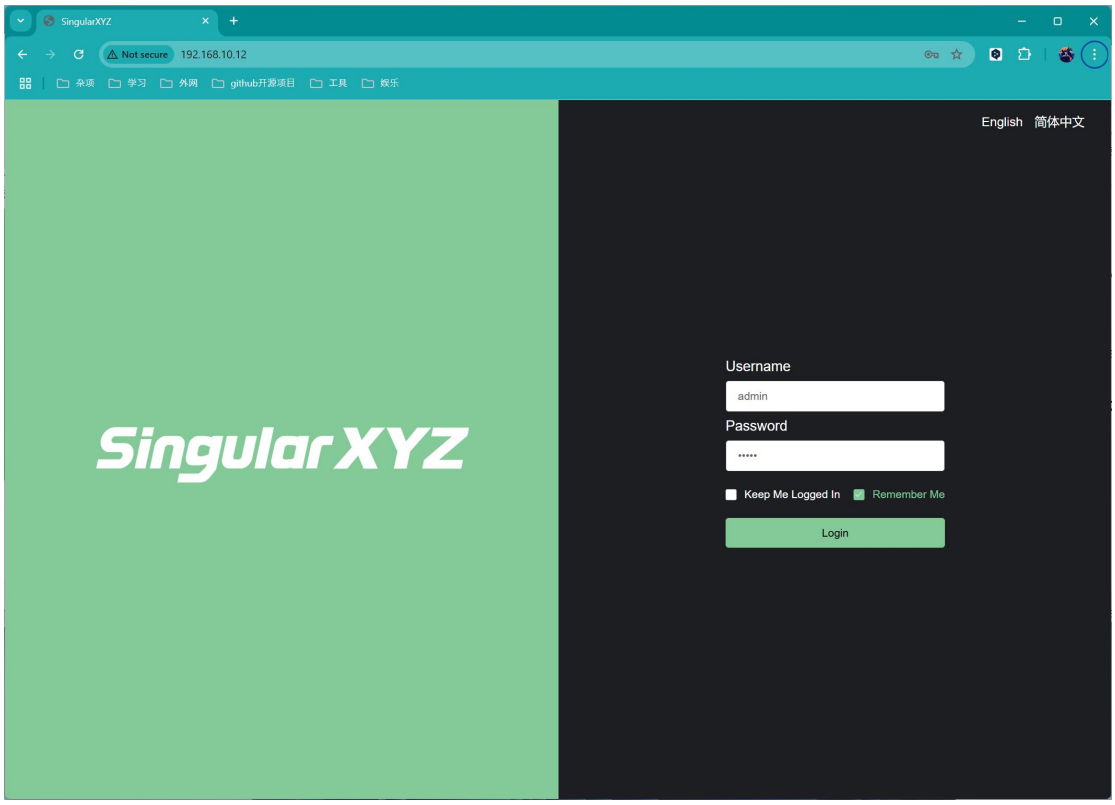



*Tip: After Wi-Fi is enabled, Bluetooth will automatically be disabled, causing the PAD software to lose connection and display "No Data."*

3、 Connect Z1 device WIFI, name of WIFI is device serial number, and password of WIFI is 12345678.

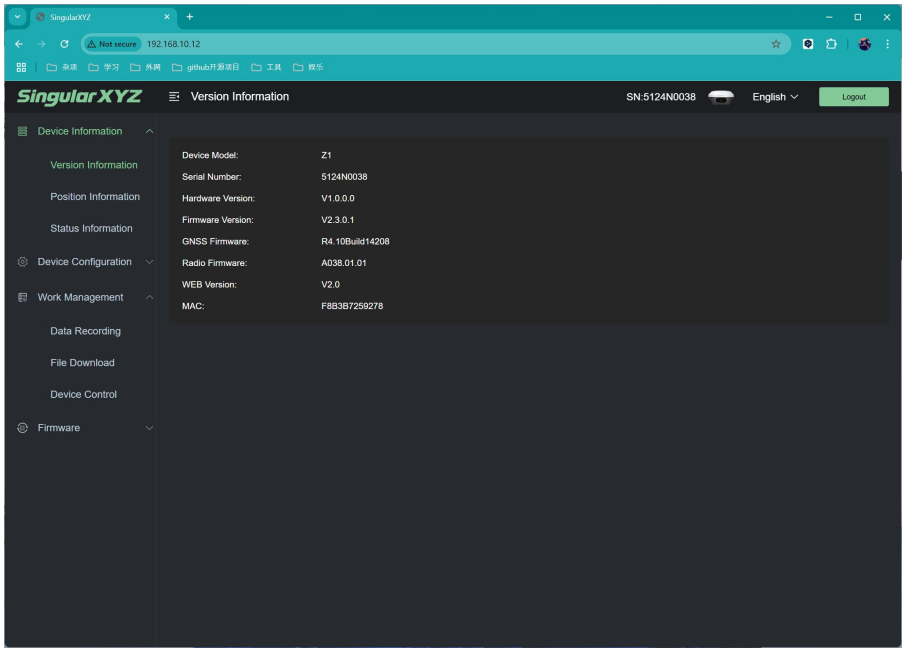
4、 Enter 192.168.10.12 in the browser navigation bar and press Enter. Enter the username and password, both are admin



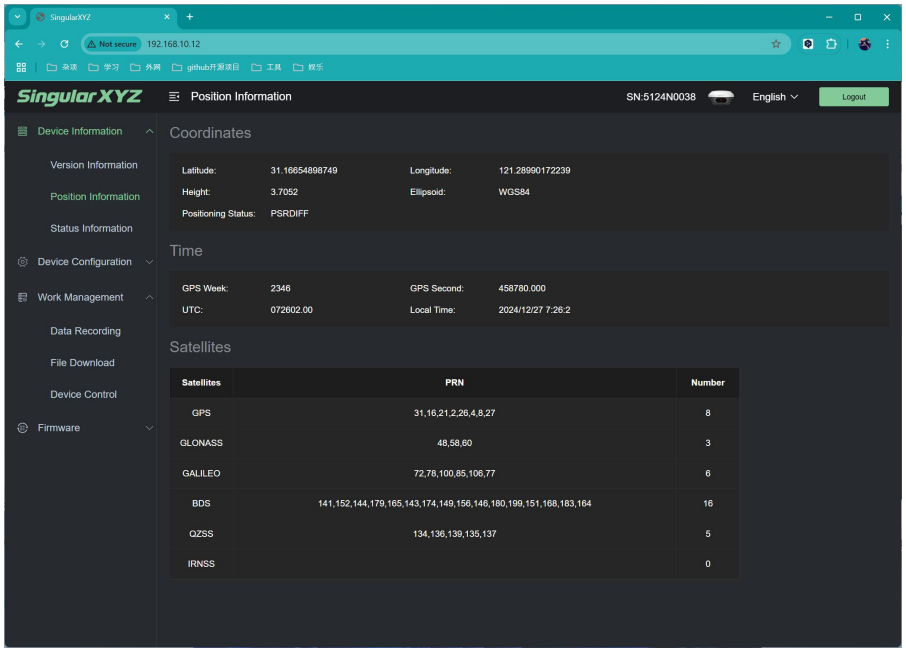
## 4.2 Device Information

The **Device Information** includes **version information**, **position information**, and **status information**.

In the **version information**, you can check the device model, SN number, firmware version and other information

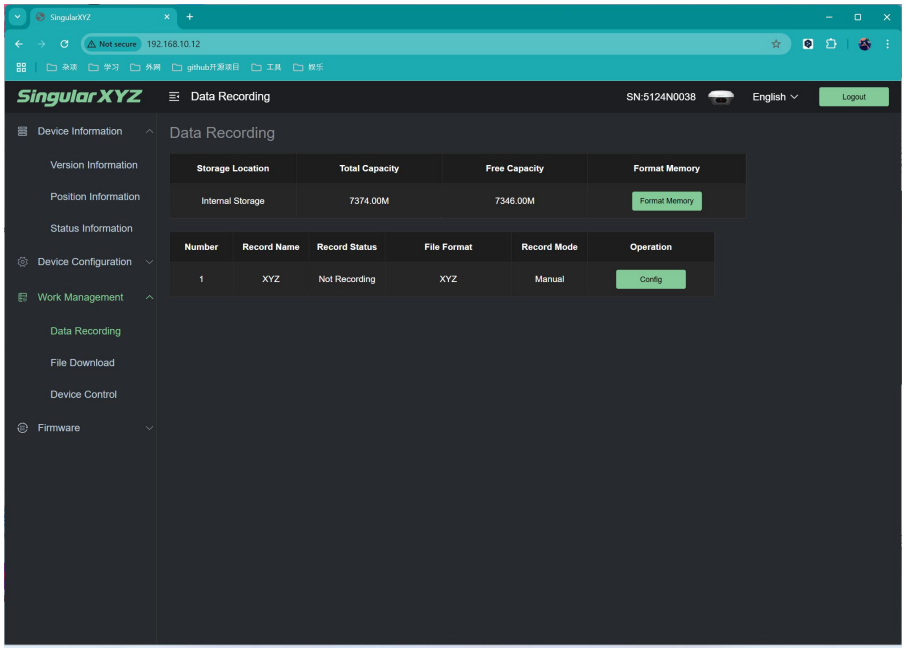



In the **position information**, you can check the current latitude and longitude information and positioning status

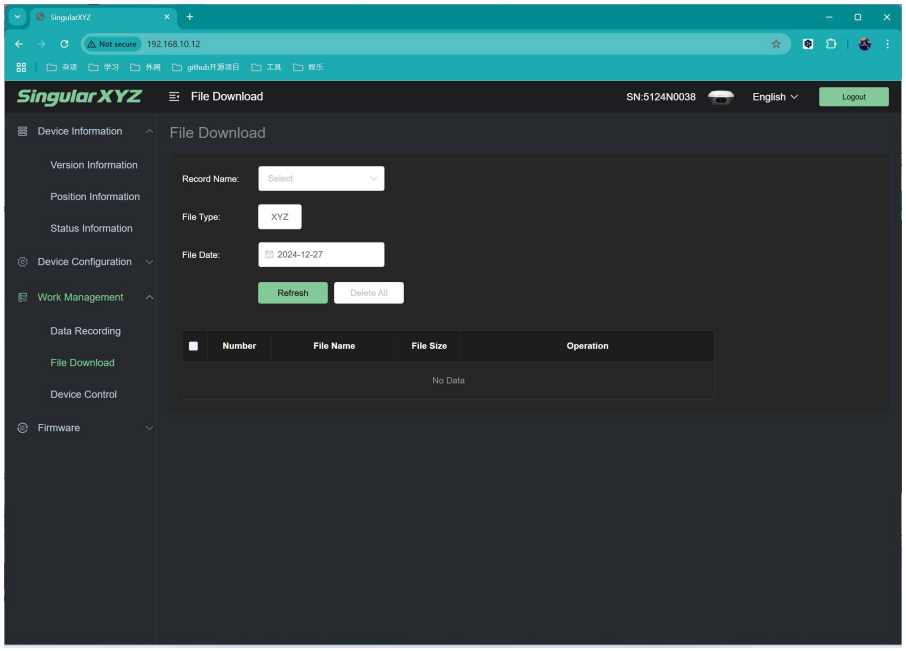


## 4.3 Work Management

In Data Recording, you can set the parameters of the collected static data and start record. You can also format memory in this interface.



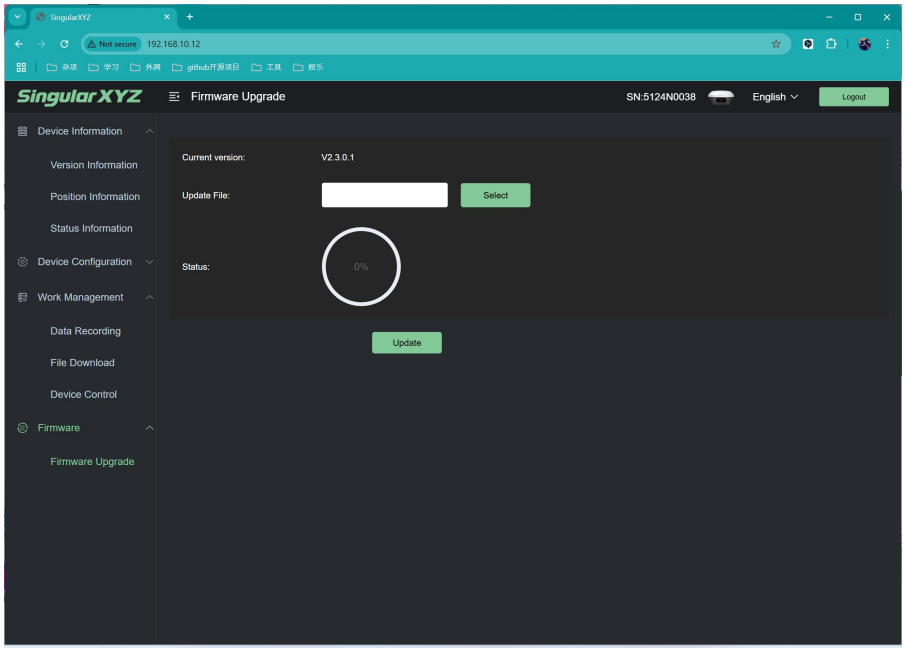

In file download, you can download recorded static data



## 4.4 Firmware Upgrade

This function interface is used to upgrade the firmware version of the device.

- Select the firmware (*.bin file) on this interface and click Update Firmware
- After waiting for the upload to complete, the device will automatically restart and the upgrade will be completed




## 4.5 Contact Us

If you have any questions and can't find the answer in this manual, please contact us.

- SingularXYZ Official Website: www.singularxyz.com
- Technical Support Email: support@singularxyz.com