

SingularXYZ®



Xbase GNSS Receiver User Manual

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1 INTRODUCTION

The SingularXYZ Xbase GNSS Receiver (referred to as Xbase) User Manual is intended to help you get familiar with the Xbase receiver and start your project effectively. We highly recommend that you read this manual before you start your project, even if you have previous experience with other GNSS RTK receivers before.

1.1 About the Receiver

As a full-featured RTK solution, the Xbase is designed to deliver outstanding performance while maintaining a compact and lightweight design. It offers comprehensive enhancements in key aspects such as multiple work modes, 25km extended-range UHF, and a built-in web interface. Xbase GNSS receiver is a professional GNSS base station. The working performance is close to GNSS receiver with an external radio, but user does not need to carry a heavy external battery, an external radio and a radio antenna. The built-in 5W radio enables up to 25 km operating range under ideal conditions. Powered by a 1408-channel GNSS engine, Xbase supports full-constellation tracking with strong anti-interference performance, delivering stable, high-quality correction data for reliable RTK operation in challenging field environments.

1.2 Lower Housing

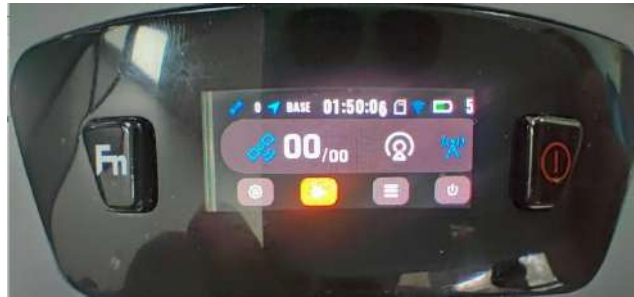
The lower housing of the receiver contains a serial port, a USB port, and a SIM card slot. The antenna used for radio communication is located on the top of the device.



IMPORTANT NOTICE:

If the receiver is not used for an extended period, it is recommended to charge it every three months to prevent potential damage to the lithium battery cells.

1.3 Front Panel Operation



(1) Hardware Button Description

The device uses two physical buttons to simulate a scroll wheel for interaction.

- Power button: Used for confirm/execute key (The push function for the scroll wheel)
- Fn key (function key): Used for navigation control. Single click scrolls the wheel down, double click scrolls the wheel up.

(2) General Interaction Logic

In all pages except the "parameter selection interface" (such as the homepage, menu page, and switch page), the operation logic is consistent as follows:

Switch focus (navigation): Press the Fn key (use the scroll wheel to switch focus).

-Switch focus between different options on the screen.

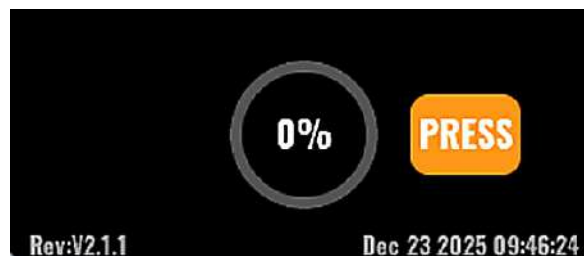
Confirm/Select: Power button (scroll wheel push button).

-Function: Confirm current action

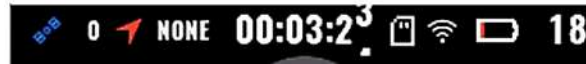
(3) Detailed operation guide for the page

① Charging interface

When the device is powered and the main page is not active, the top status bar will automatically slide down and appear after 10 seconds of inactivity.



- **Interface description:** No component switching is available on this interface; there is only one button component, which is the default focus. On this screen, the device can only be powered on by pressing the power button.



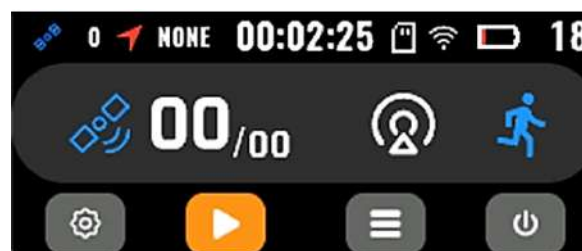
- **Top status bar:** The top status bar displays the following items in sequence: number of satellites used, positioning status, operating time, static status, Wi-Fi status, and battery status.
- **Operation method:** Press and hold the push button until the progress bar reaches 100%. Then hen complete the operation.



② Hardware Check Page

- **Interface description:** After the power-on logo appears, a hardware check will be performed The MCU may exit the self-check process earlier once communication with the mainboard has been established.). During this time, the scroll wheel push function will be disabled.

③ Main Standby Page



- **Interface description:** Used to display operating information, including number of satellites acquired, radio operating status, board operating mode. The top status bar will remain active after power-on.
- **Bottom button bar:** From left to right are



Working mode settings and switching



Static data acquisition switch



View current system parameters



Power off

- **Operating instructions:** Press the Fn key to move the focus between menu items. Press the Power button to confirm the selected function.

④ Radio Parameter Adjustment Page



- **Interface description:** Contains a configuration list of options (such as frequency Freq, protocol Prot).



Used for switching up and down.



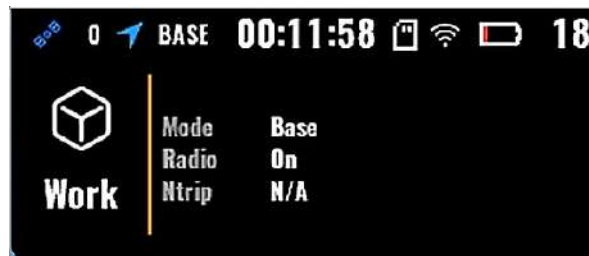
Used for reset protocol and channel options



Available operating modes include: Base Station, Mobile station, and Network Base Station.

- **Operating instructions:** Press the Fn key to move the selection focus. Press the Power button to confirm the selected option.
- **Save Settings:** After selecting the radio protocol and channel, simply choose the configured working mode. No further confirmation of the radio protocol and channel is required; the settings displayed in the radio protocol and channel boxes on the current page will reflect the configured settings.

⑤ System Parameters Page



- **Interface description**
This page displays the following system parameters (working mode): current GPS location coordinates, WIFI working mode and IP, battery information, static storage information, and front panel system information.
- **Operating instructions:**
 1. Press the Fn key to browse through the available information.
 2. Press the Power button to return to the previous page.

⑥ Power Off Page



- **Interface description:** This page is used for powering off, Only one button is available, and it is selected by default.

Press and hold the button until 100%, then go back to power off.

Short press to return to the main page.

- **Operating instructions:**

Force shutdown: Press and hold the Fn key for several seconds from any interface to force the receiver to shut down.

2 RTK WORKFLOW

This chapter introduces how to conduct an RTK Survey with SingularPad Software. SingularPad is a 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.

2.1 About Software

2.1.1 Installation of SingularPad

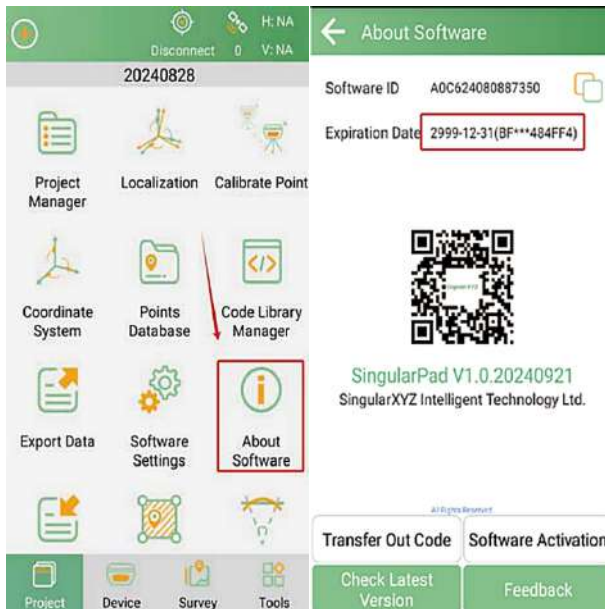
SingularPad has been pre-installed on SingularXYZ data collector before shipping. If you want to download on your own device, please contact SingularXYZ for installation support.

2.1.2 Software Registration

After the software is installed, you can check your software registration status (network connection required) by following these steps:

Go to Project >> About Software and check the Expiration Date.

- If it shows 2999-12-31, this indicates a permanent registration of the software.
- If it shows Inactivated, please click Software Activation, then enter a valid permanent license to register and activate all software functions.

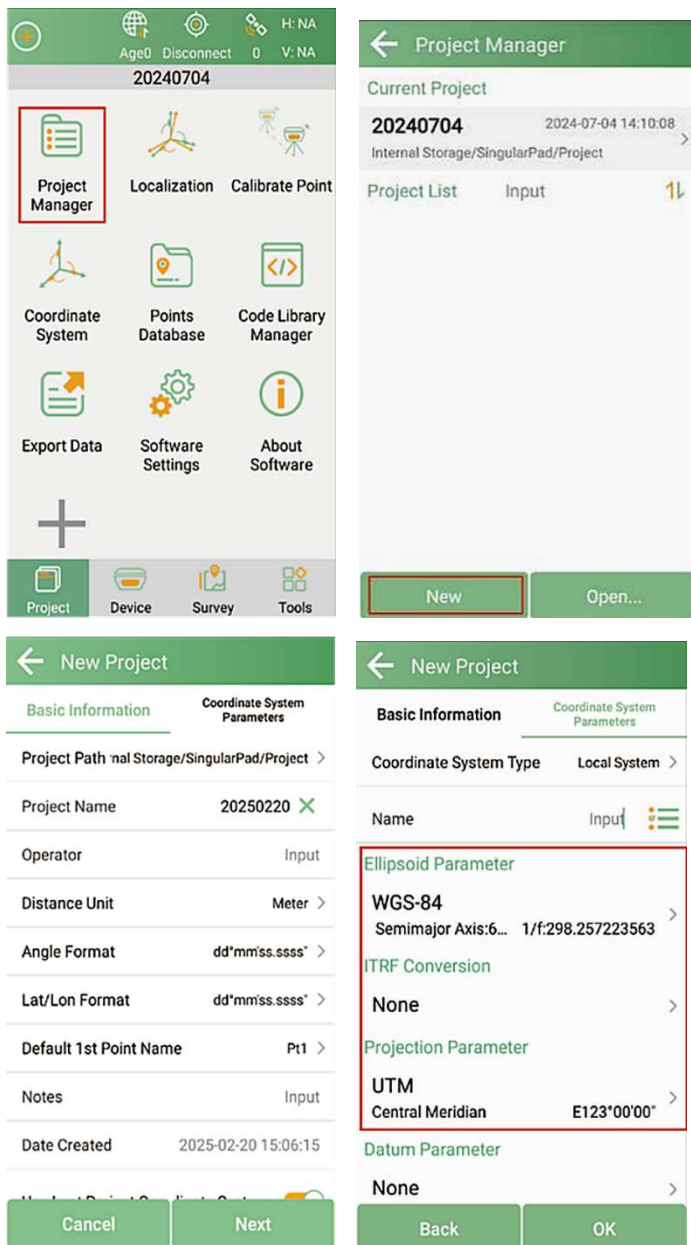


NOTE:

If you do not have an activation code, please contact our sales or support team, providing your order details and software ID to obtain it.

2.2 Create a New Project

Click **Project Manager**, click **New** to create a new project file and input project name, set coordinates systems parameters and click **OK** to save the project.



NOTE:

SingularPad includes pre-defined coordinate systems for most countries and regions. You can find the coordinate system you need by filtering the country name or searching the coordinate system name.

The following steps demonstrates how to find the predefined coordinate system you need in SingularPad software.

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

Coordinate System Parameters

Coordinate System TypeLocal System

NameInput

Ellipsoid Parameter

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

ITRF Conversion

None

Projection Parameter

UTM
Central MeridianE123°00'00"

Datum Parameter

None

Horizontal Adjustment

ShareSave AsOK

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

Coordinate System Favorites

Data Content

AddImportDownloadTemplate

Predefined Projections

CountryAll

SearchInput

Data Content

NAD83/Alabama (East)
GRS 1980USA
Transverse_Mercator 274°10'00.0000"E

NAD83/Alabama (West)
GRS 1980USA
Transverse_Mercator 272°30'00.0000"E

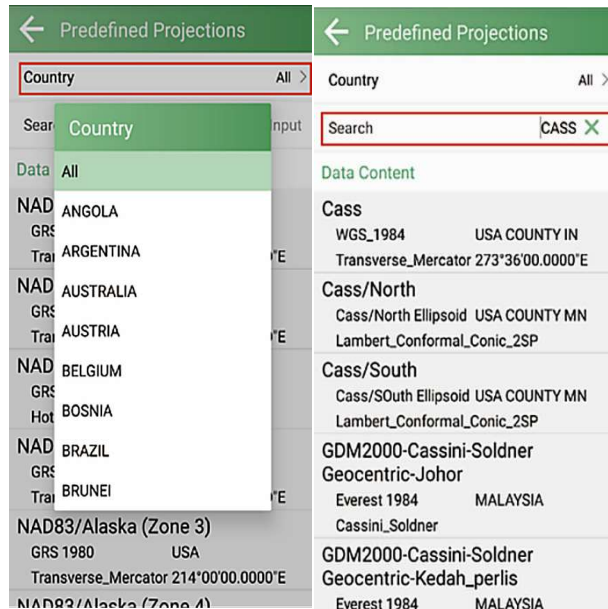
NAD83/Alaska (Zone 1)
GRS 1980USA
Hotine_Oblique_Mercator

NAD83/Alaska (Zone 2)
GRS 1980USA
Transverse_Mercator 218°00'00.0000"E

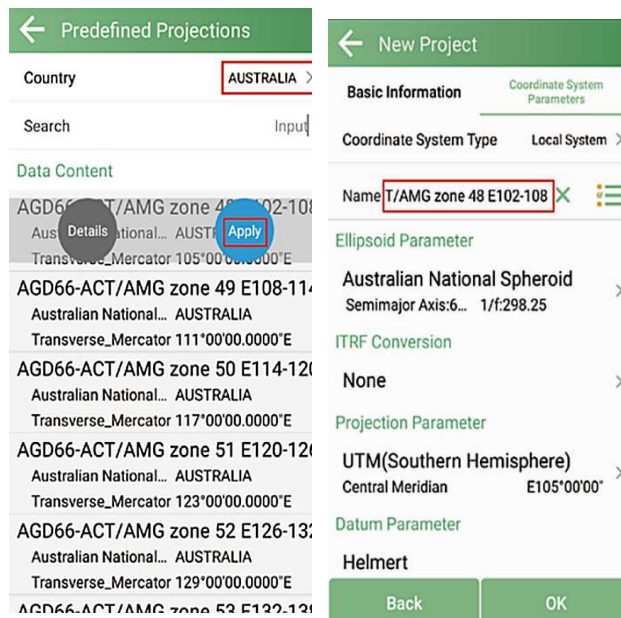
NAD83/Alaska (Zone 3)
GRS 1980USA
Transverse_Mercator 214°00'00.0000"E

NAD83/Alaska (Zone 4)

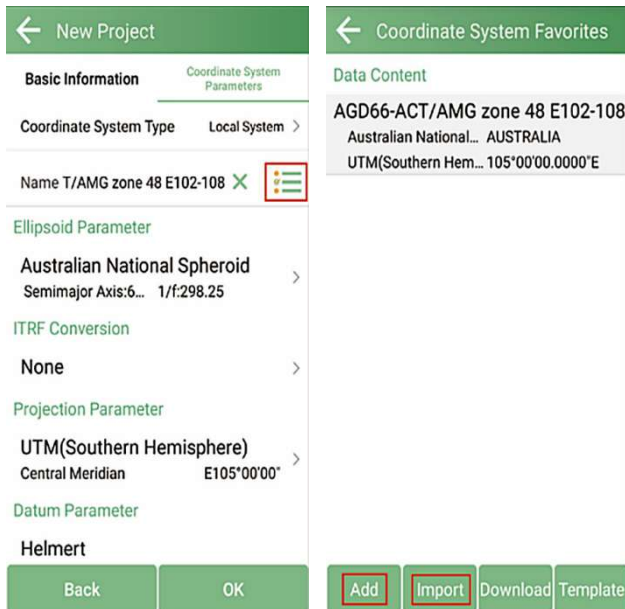
3. Click **Country** to select the country name or enter a keyword in **Search** to find it.



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



If you can not find the required coordinated system in Predefined Projections, you can click **Add** or **Import** to create new coordinate system



2.3 Device connection

2.3.1 NFC connection

The Xbase GNSS Receiver is equipped with an NFC module, users can easily connect the Xbase receiver to the data collector with just one touch, as shown in the figure below.



NFC Connection

2.3.2 Bluetooth connection

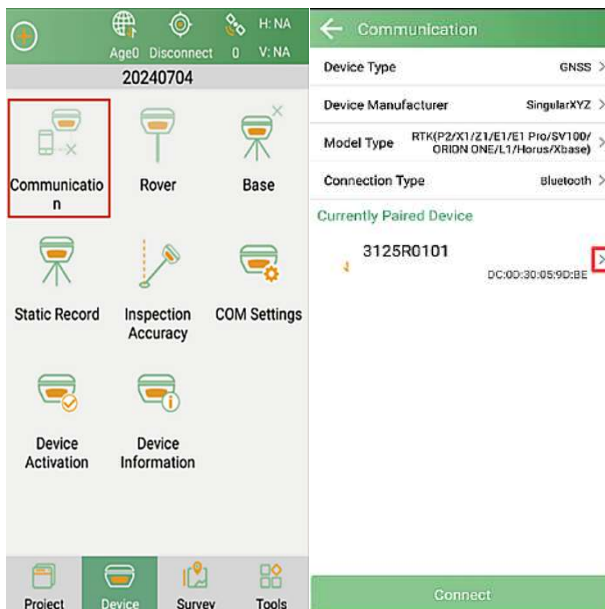
After creating a new project, switch to Device interface, click Communication. Select the corresponding parameters according to the following requirements.

Device Type: GNSS

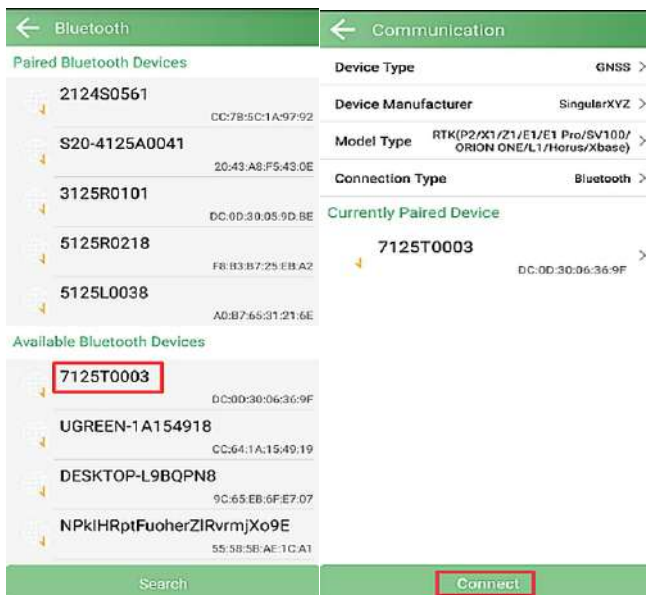
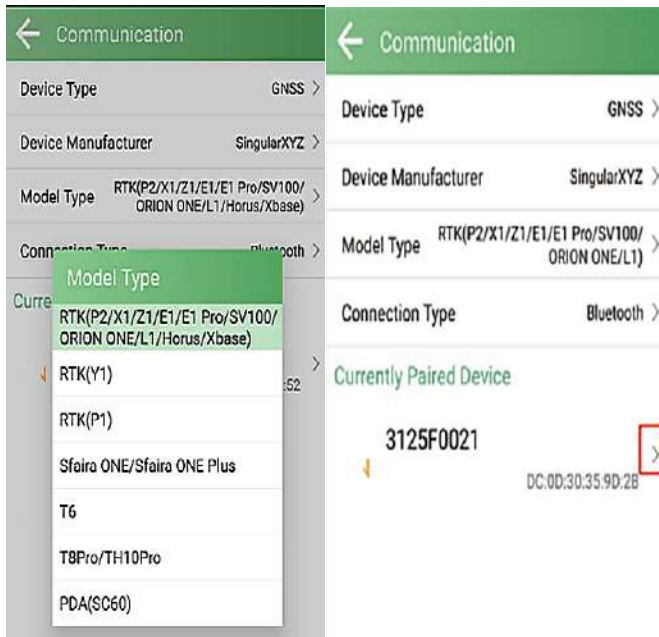
Device Manufacturer: SingularXYZ

Model Type: **RTK (P2/X1/Z1/E1/ E1 Pro/SV100/ORION ONE/L1/Horus/Xbase)**

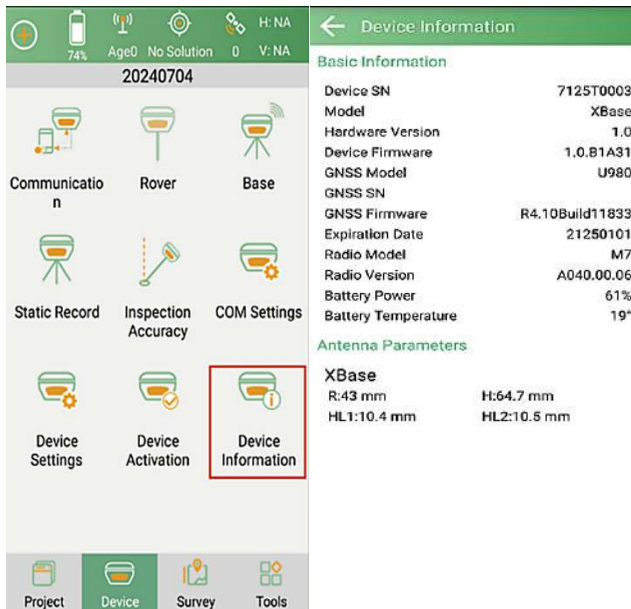
Connection Type: Bluetooth



Ensure the Bluetooth is enabled on the data collector. Click Current Paired Devices below to find the SN of the Xbase receiver. Click **Connect**



After connecting Xbase receiver, you can check the information of the receiver (such as firmware version) in **Device Information**.



Troubleshooting

After connecting to the receiver, if <No Data> is displayed in the top status bar, it may indicate that the<Model Type> does not match the connected receiver.

Please go back to communication interface and verify the model type, switch to <RTK(P2/X1/Z1/E1/E1 Pro/SV100/ORION-ONE/L1)> and reconnect the device.

If <No Solution> is displayed in the top status bar, it means you are indoors without sufficient satellite signals. Please go outdoors for satellite searching.



Tip: If you fail to connect with receiver through SingularPad, you can follow the prompts to enter the system Bluetooth settings interface of the PDA/data collector to ensure that the Bluetooth pairing is successful.

Sometimes you need to cancel the device Bluetooth pairing, restart the receiver or SingularPad software and pair again.

2.4 Concepts About RTK

2.4.1 Overview

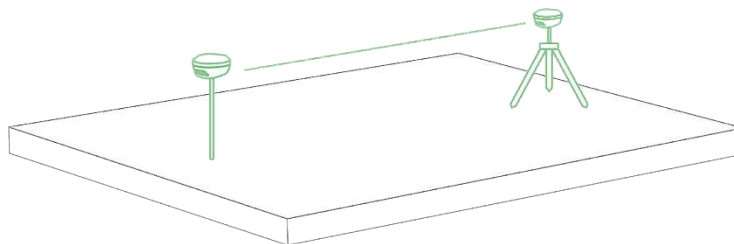
Real-Time Kinematic (RTK) is a GNSS positioning technique used to improve the accuracy of a standalone GNSS receiver.

Traditional GNSS receivers, like the one in a smartphone, could only determine the position with 2–4 meters (7– 13 feet) accuracy. RTK can give you centimeter accuracy.

GNSS receivers measure how long it takes for a signal to travel from a satellite to the receiver. Transmitted signals travel through the ionosphere and atmosphere and are slowed down and affected on the way. For example, travel time on a cloudy day and in clear sky conditions would be different. That is why it is difficult for a standalone receiver to precisely determine its position. RTK is a technology that solves this issue.

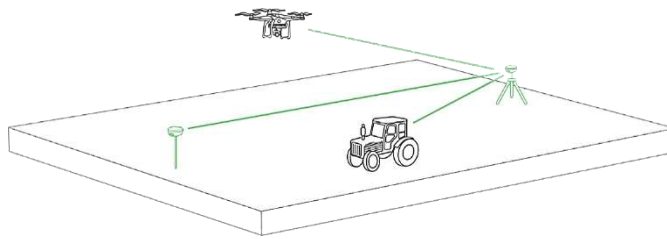
2.4.2 High-Precision Real-Time Positioning

Two receivers are used in RTK. One of them is stationary, another moves freely. They are called base station and rover.



The base is installed in a fixed location and send correction data to a moving receiver. Rover uses that data to achieve centimeter precise position. Any number of

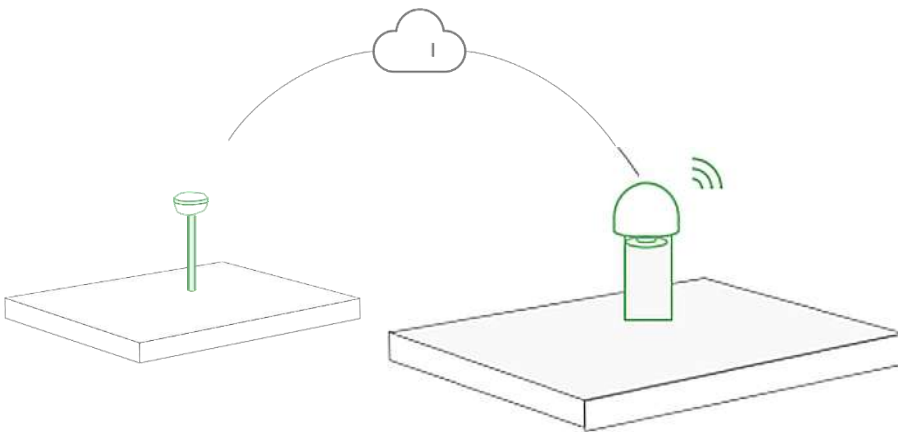
rovers can connect to one base if their input settings are compatible to the base's output.



2.4.3 Corrections over NTRIP

A dedicated local base station is not always required for RTK operation. Usually, there are local services that share base corrections over the Internet. This technology is called NTRIP. NTRIP is a good option for areas with strong 3G/LTE coverage and a vast network of NTRIP bases nearby. In other cases, using the second receiver as a local base station has two advantages:

- Autonomy in remote areas as there's no need in the Internet connection;
- Independence from local providers, no additional fees by NTRIP service.



2.5 Quick Setup Guide

With the help of this section, you can easily configure your Xbase and achieve accurate positioning for your subsequent tasks. This chapter introduces three work modes, allowing you to select the most suitable operating mode for your working conditions and accuracy requirements.

Work Mode	Use Conditions	Accuracy
Radio Mode	-Two GPS RTK units (base and rover) required	Centimeter level
Network/ GSM Mode	- Two GPS RTK units (base and rover) required - Network required - Ntrip Caster Platform required	Centimeter level
PDA CORS Mode	- Network required - RTK correction service subscription / CORS account needed	Centimeter level
PPP Mode	No network or RTK correction service needed	10 - 20 cm
SBAS Mode	- No network or RTK correction service needed - SBAS coverage required	Submeter level
Static Mode	≥3 GNSS units required for stable triangulation network adjustment	Millimeter level

Note: The cost and coverage area of the CORS service may vary by country and region depending on your local service provider

2.5.1 Internal Radio Mode

2.5.1.1 Internal Radio Base

During configuration, you need to connect your PDA device or data collector to the base.

When working as a Base station, SingularPad supports transmitting the correction data in Internal Radio 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 the same protocol and frequency.

- Protocol: Supports CSS, TRIMTALK, TRIMMK3, TT450S, TRANSEOT and SATEL.
- Frequency: select a channel or customize a frequency, the range of frequency is 410-470 MHz
- Baud rate: 4800,9600,11000,19200,115200
- Power: High and low (low power reduces the transmission range)

TIP - Condition of the base station setup

Ideal Environment:

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

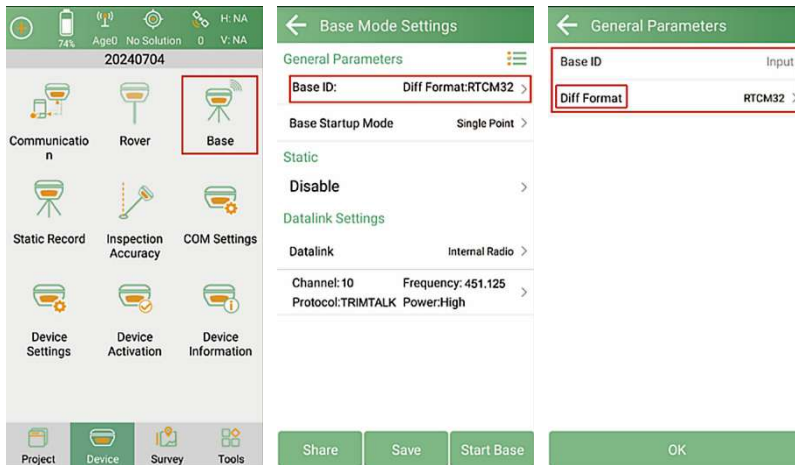
Avoid:

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

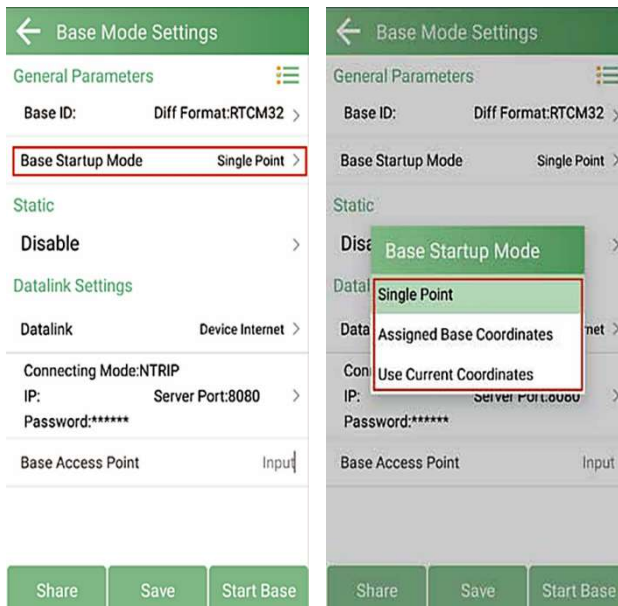
The following steps give an example of how to configure internal radio base mode.

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 Format**.



2. Click Base Startup Mode to select from the following options.



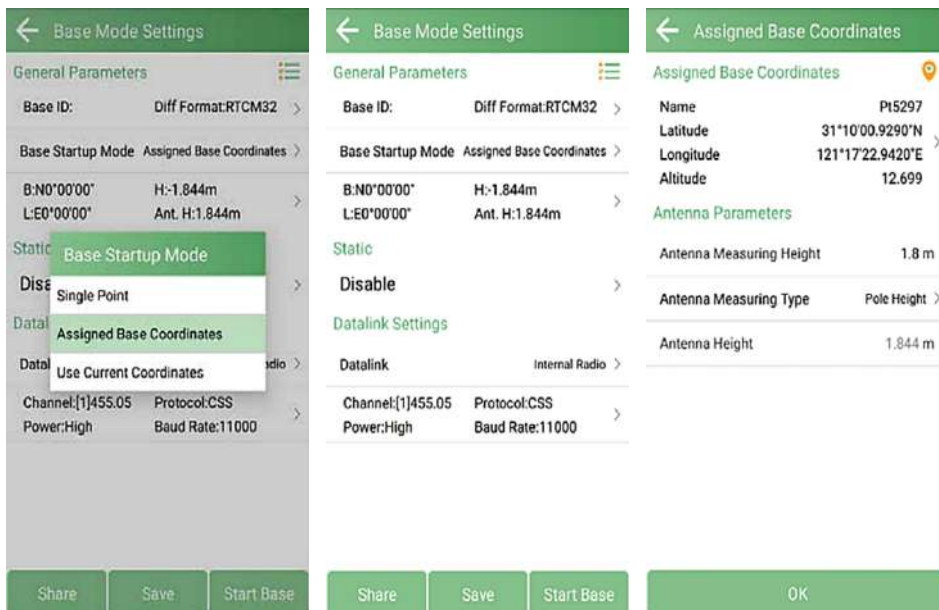
Single Point: Start the base station at unknown coordinates

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

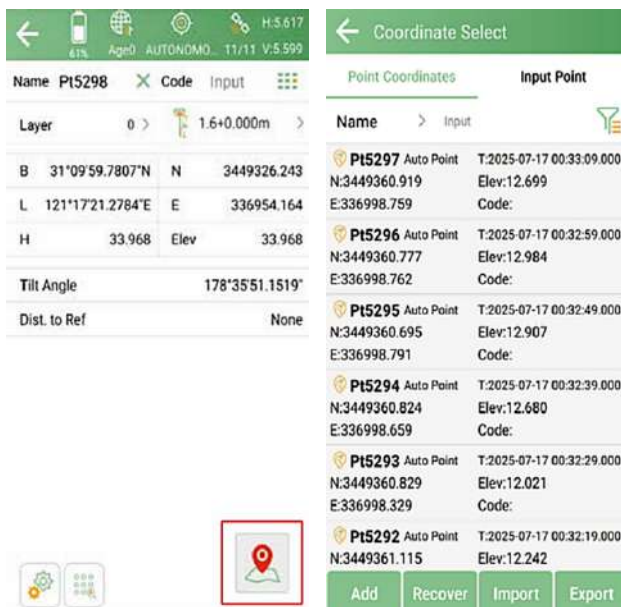
Use Current Coordinates: Automatically start the base station at the current coordinates.

NOTE: For the best RTK accuracy, it is recommended to set up 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 receiver are within 50 meters of the known point coordinates.. Otherwise, you will need to conduct 3.3 Calibrate Point after or before surveying.

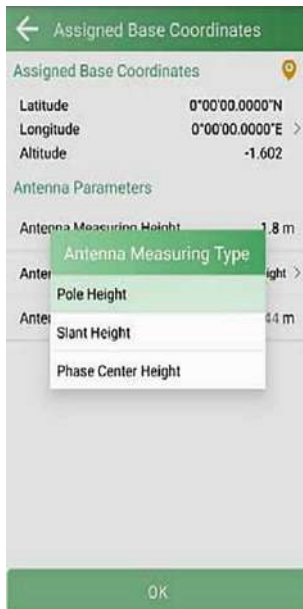
Typically, select Base Startup Mode as Assigned Base Coordinates and start the base station at known coordinates.



You can assign the coordinates from point database (input points/measured points) or click the survey icon to measure the current base location directly. Always use the same coordinates when starting base at the same location.



After setting the base coordinates, set the **Antenna Parameters** for accurate elevation. Click to select **Antenna Measuring Type**, there are three main types:

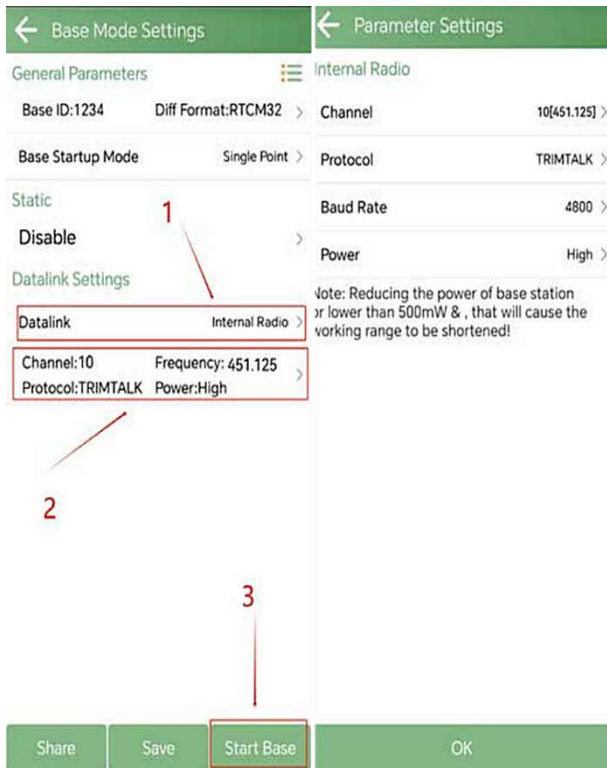


Pole Height: Pole height is the vertical height from the receiver's bottom to the ground point. If you are using a range pole with a bipod for base set-up, you can fill the pole scale reading as the software **Antenna Measurement Height** when the pole is perpendicular.

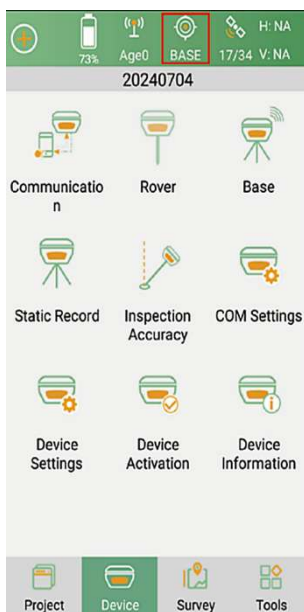
Slant Height: If you are using a tripod to set up the device, you can measure the distance from the ground point to the antenna slant height measurement mark (marked in the figure below). Fill the reading into the **Antenna Measurement Height**, then the software will calculate the actual height.

Phase Center Height: The phase center height is the distance from the ground point to the antenna phase center, but the antenna phase center is a virtual point of the instrument's electromagnetic wave, and cannot be measured directly.

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



4. When the base station starts successfully, the status will show as below in SingularPad.



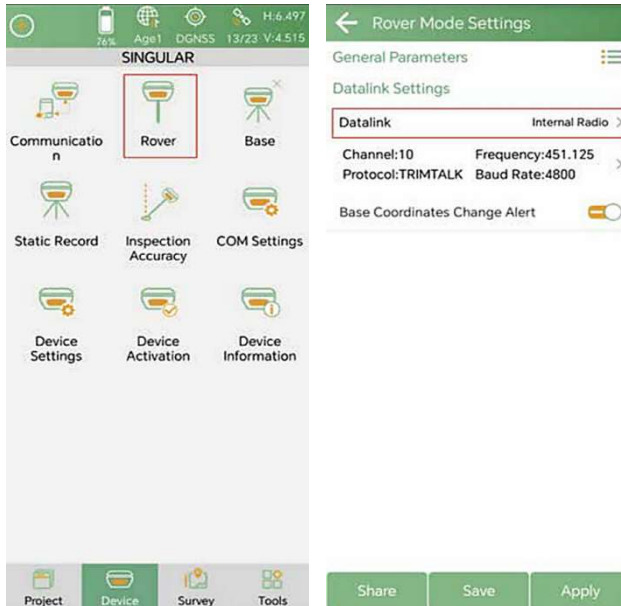
NOTE: After configuring base station settings, please disconnect the base device and then search for the SN of the rover to connect and configure the rover device. Select the same protocol and frequency as the

base station.

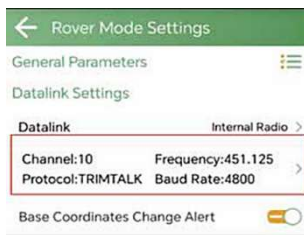
2.5.1.2 Internal Radio Rover

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

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



2. Parameter setting: Set channel, Frequency and Protocol the same as the base station



3. Base Coordinates Change Alert: SingularPad will alert when the base station coordinates change while you are working. 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 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. Now you can proceed to **3.2 Point Survey** to start surveying.



2.5.2 Network Mode

In addition to radio-based RTK correction transmission, the Xbase also supports network-based modes.

You can choose from the following configuration options depending on your working environment and available resources.

2.5.2.1 Internal GSM Base Mode

Network Base Options:

Local RTK Service/CORS: You can subscribe to a local CORS/RTK Service account to get RTK corrections. Typically, the account includes IP address, port, mountpoint, username, and password for accessing correction data.

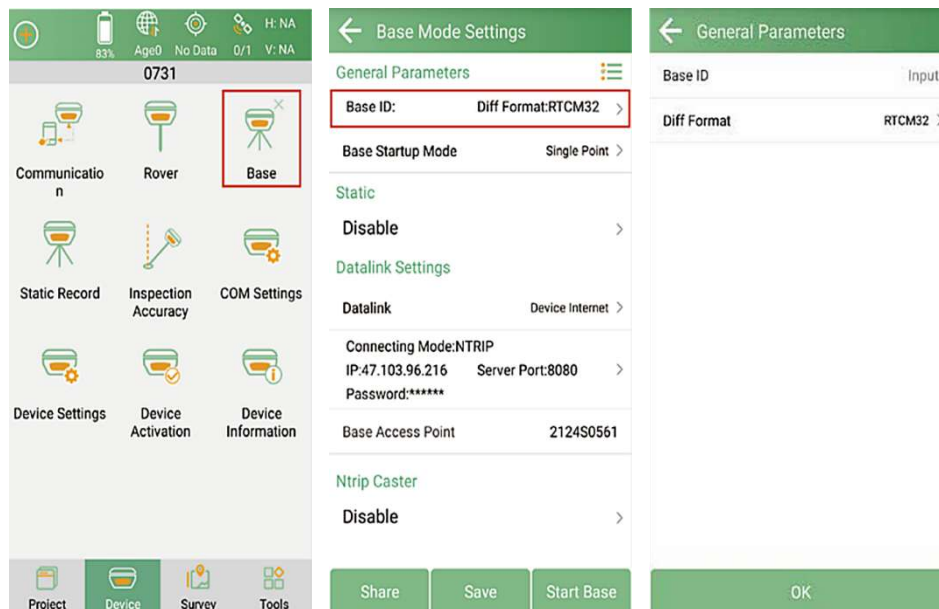
Internal GSM Base Mode (XBASE): Set up the receiver as an internal GSM base to broadcast RTK corrections via a network connection.

NOTE: A valid SIM card must be inserted into the receiver. You will also need a NTRIP caster platform to distribute correction data from the base to the rover.

When working as a base, SingularPad supports broadcasting the correction data in Device internet Mode.

Device Internet: This mode uses the receiver network to transmit the correction data from Base to Rover. Please insert a valid SIM card into your Xbase receiver.

1.Go to **Device >> Base**. Set Base ID and choose the Diff Mode (typically RTCM32).



2. Set **Start up Mode** (please refer to chapter 2.5.1 for details). And set Data link to the **Device Internet**.

← Base Mode Settings

General Parameters

Base ID: Diff Format:RTCM32 >

Base Startup Mode Single Point >

Static

Disable >

Datalink Settings

Datalink Device Internet >

Connecting Mode:NTRIP

IP:47.103.96.216 Server Port:8080 >

Password:*****

Base Access Point 2124S0561

Ntrip Caster

Disable >

Share Save Start Base

3. Set **Connecting Mode** as Ntrip and input the detailed parameters: Input the IP, Port, Password according to your Ntrip Caster platform. Input APN Settings according to your SIM card mobile service provider.

← Parameter Settings

Device Internet

Connecting Mode NTRIP >

CORS Settings

IP 47.103.96.216

Port 8080

Password *****

APN Settings

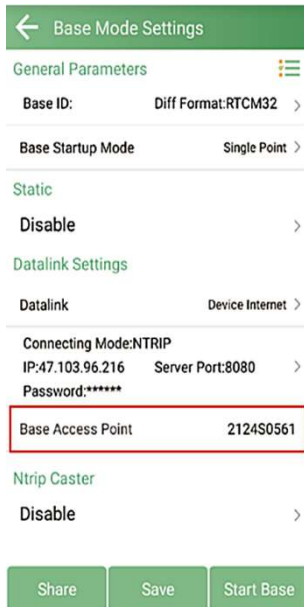
Name 3gnet

User Input

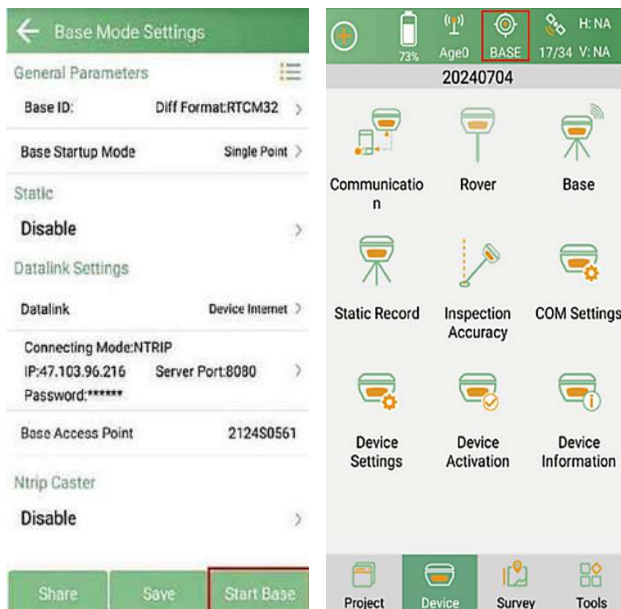
Password *****

OK

4. Set the Base Access Point in the end, which will be the mountpoint name when configuring RTK rover.



5. Click **Start Base**. After the base station starts successfully, its status will show in SingularPad as below.



Note:

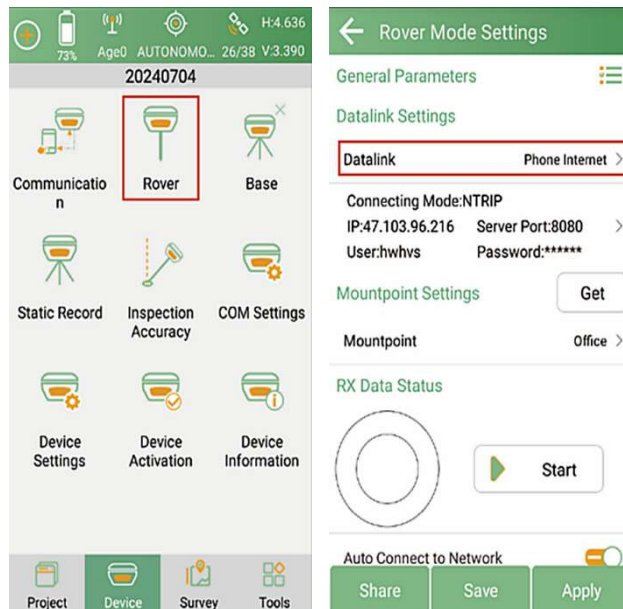
XBase receiver does not support hot swap of SIM card. Please shut down the receiver then insert the SIM card. If you insert the SIM card when the receiver is on, please reboot the receiver.

2.5.2.2 PDA CORS Rover Mode

When working as a Network Rover, SingularPad supports receiving the correction data in Phone internet Mode.

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 (SC200/SC300 data collector can obtain a 4G network signal by inserting a SIM card), WiFi or hot spot.

1. Go to **Device >> Rover**. Set Data link to the Phone Internet.



2. Set Connecting mode as NTRIP. CORS Settings: Input the server IP, Port, User and Password in the CORS Settings.

The image displays two side-by-side screenshots of a mobile application interface. The left screenshot is titled 'Rover Mode Settings' and shows the 'Datalink Settings' section. It includes a 'Connecting Mode' dropdown set to 'NTRIP' and a 'CORS Settings' section with fields for 'IP' (47.103.96.216), 'Port' (8080), 'User' (4645), and 'Password' (*****). The right screenshot is titled 'Parameter Settings' and shows the 'CORS Settings' section with the same fields. Both screenshots have a red box highlighting the 'Connecting Mode: NTRIP' and the 'CORS Settings' fields. Below the screenshots are buttons for 'Share', 'Save', 'Apply', and 'OK'.

NOTE: 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.

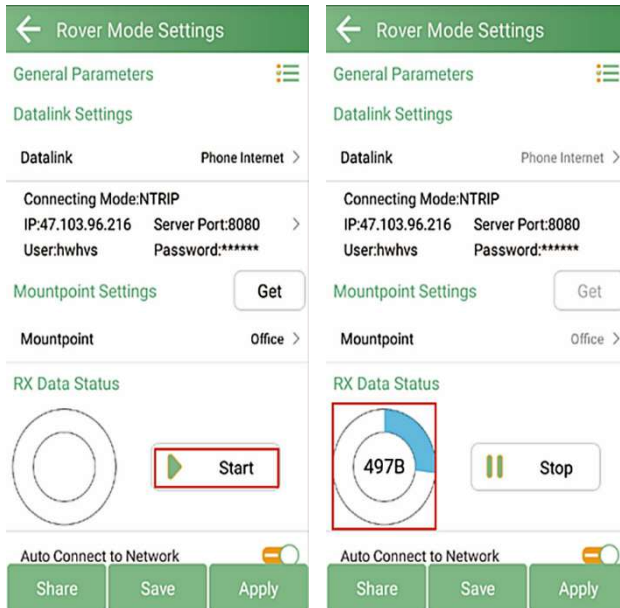
3. Click **Get** button to get the mountpoint list and choose the mountpoint.

The image shows a screenshot of the 'Rover Mode Settings' screen. The 'Mountpoint Settings' section is highlighted with a red box, and the 'Get' button next to it is also highlighted with a red box. The 'Mountpoint' dropdown is set to 'Office'. Below the screenshot are buttons for 'Share', 'Save', and 'Apply'.

NOTE:

The mountpoint shown in the figure is for demonstration purposes only. Please find out the appropriate mount point via the website of your local NTRIP/CORS provider. Make sure that the baseline does not exceed 50km.

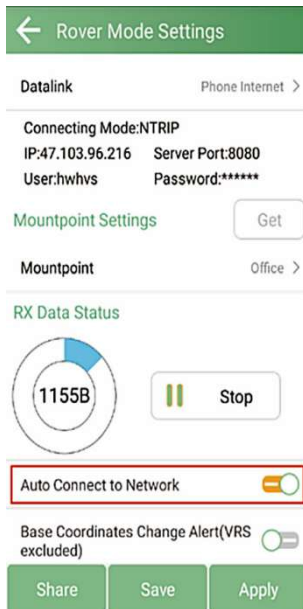
4. Click Start button to receive data from CORS/RTK correction service once the connection is established.



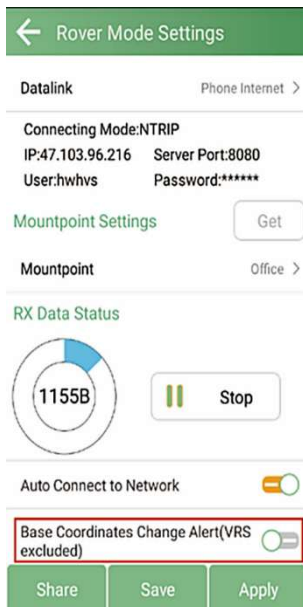
NOTE:

If you have clicked Start but there is no data displayed in RX Data Status, please check the parameter information above.

5. Auto connect to network: When this option is opened, SingularPad will connect to the network automatically so that users do not need to click Start to connect to the network.



6. Base Coordinates Change Alert: SingularPad will alert the user if correction data is received from different base station. When you are using VRS, it is recommended to disable this option.



7. 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. Now you can proceed to **3.2 Point Survey** to start surveying.

2.5.2.3 INTERNAL GSM ROVER MODE

Network Rover Options:

PDA CORS Rover Mode: Receive RTK correction data via the mobile network of your data collector or other Android PDA device.

NOTE:

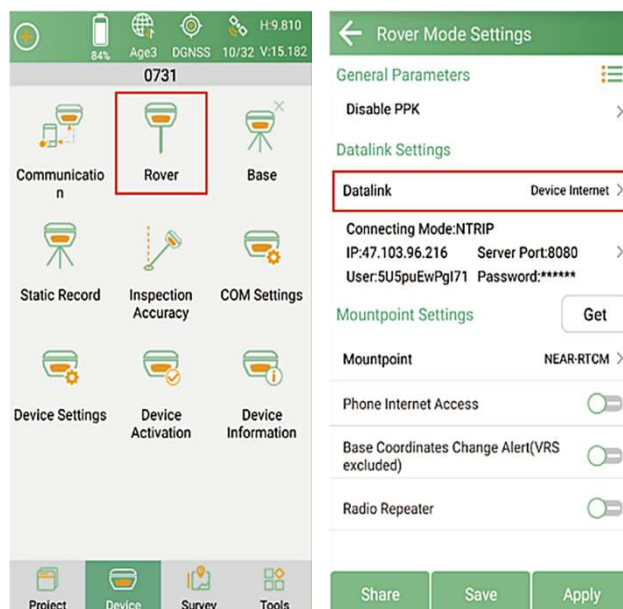
Make sure the data collector or mobile device you are using has an active internet connection.

Internal GSM Rover Mode: Insert a SIM card into the GNSS receiver and access RTK correction data directly through the receiver network.

When operating as a Rover, SingularPad supports receiving RTK correction data in Device internet Mode.

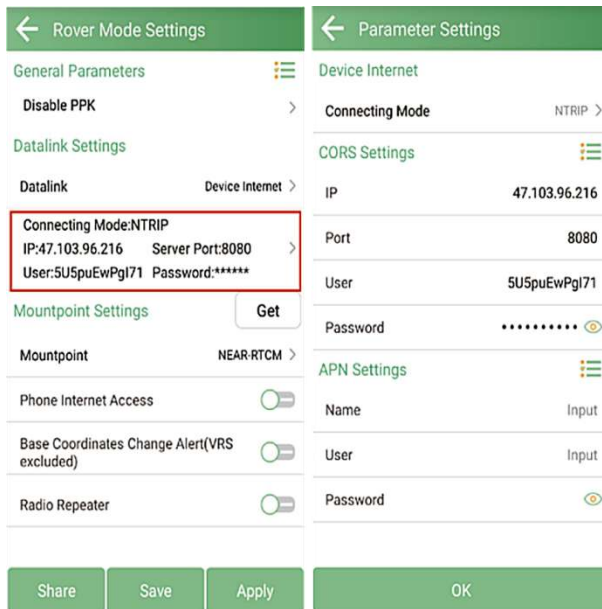
Device Internet: This mode uses the receiver's network to transmit the correction data from Base to Rover. Please insert a valid SIM card into your XBASE receiver.

1. Go to **Device >> Rover**. Set Data link to the **Device Internet**.



2. Set Connect mode, for Xbase receiver supports NTRIP and TCP Client.

CORS Settings: Input the server IP, Port, User and Password in the CORS Settings.



3. Click Get to get the mount-point list and choose the mountpoint.

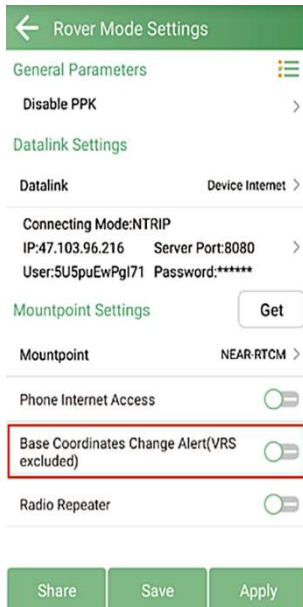


NOTE:

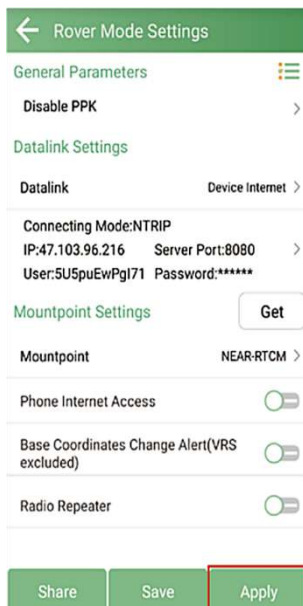
The mount point "NEAR-RTCM" shown in the figure is an example only. Please find out the appropriate mount point via the website of your local NTRIP/CORS provider or the base name you set in internal GSM base mode. For optimal RTK performance, it is recommended that the baseline does not exceed 50km.

4. Base Coordinates Change Alert: SingularPad will alert when you connect with different base station. When you are using VRS, it is recommended to disable this

option.



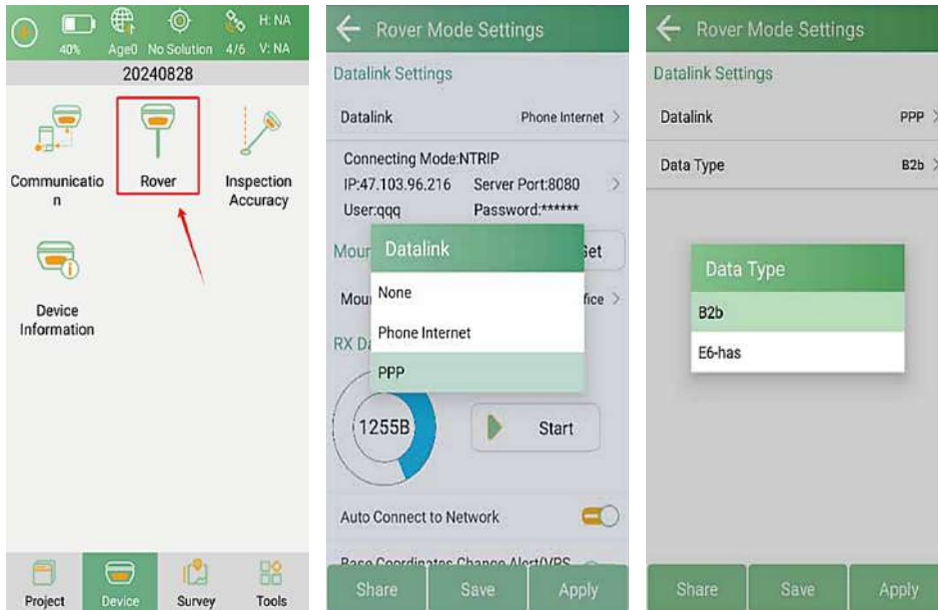
5. Click Apply to start the Rover mode



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. Now you can proceed to **3.2 Point Survey** to start surveying.

2.5.3 PPP MODE

Enter Device >> Rover, select Datalink as PPP, and you can choose Data Type between Beidou B2b and Galileo E6-has, then click Apply.

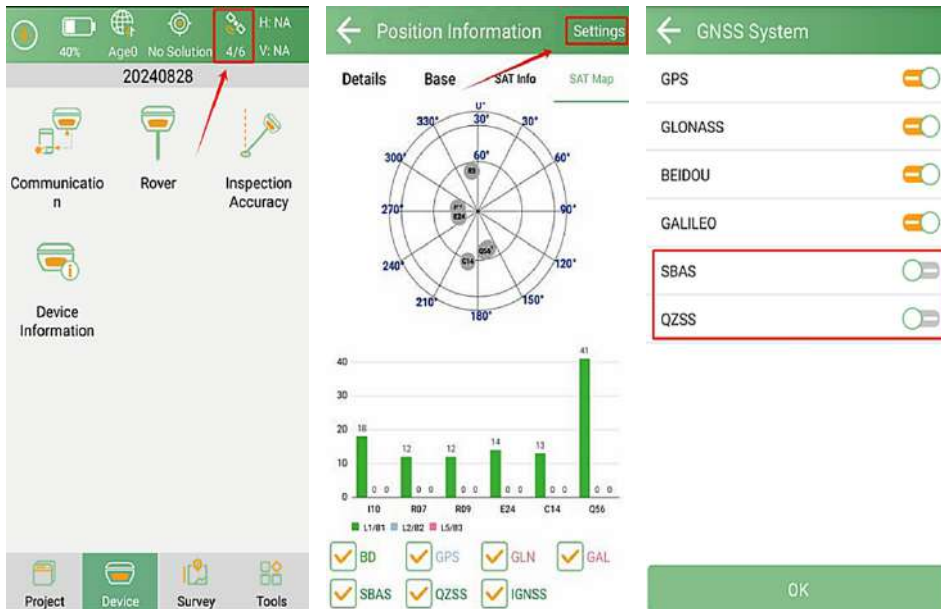


After configuration, the PPP mode will take around 10 minutes converging to typical accuracy. You can see the positioning state in the top status bar will change and remain in Converging for around 10 minutes. After the positioning state changes to PPP mode, you can then conduct surveying tasks.

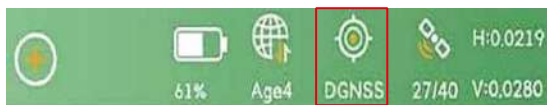


2.5.4 SBAS MODE

Click the satellite icon in the top status bar to enter the Position Information interface, then click Settings. Enable SBAS and click OK.



After configuration, you can see the positioning state in the top status bar will change to DGNSS, now you are ready to conduct surveying tasks.



3 RTK SURVEY - FIELD DATA COLLECTION

This section introduces the basic survey functions of SingularPad, including Point Survey, Calibrate Point, Localization, Tilt Survey, Point Stakeout and etc. Before RTK survey, you need to connect to the receiver and get a fixed solution.

3.1 SingularPad Status Bar

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



RTK solution status	Description
	The device is receiving RTK corrections stably and obtaining a Fixed RTK solution with centimeter-level accuracy.
	Single-point satellite positioning without receiving RTK correction data. The accuracy is around meter-level.
	The device 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.



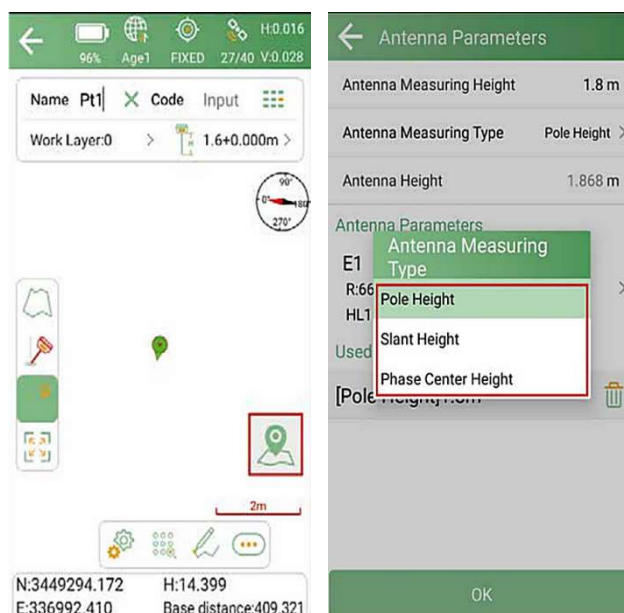
The satellite icon shows calculated satellites number/tracked satellites number. You can click it to check satellite map and more information.

H:4.636
V:3.390

The status bar also displays HRMS and VRMS on the top of the interface. Tap the HRMS or VRMS value to view detailed positioning quality information.

3.2 Point Survey

In the Survey interface, click **Point Survey** and enter point **Name**, **Code** and **Antenna height**, then click  to start or stop collecting data.



NOTE: Our software supports 3 antenna measuring types, please refer to chapter 2.5.1 for details.

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

←

Antenna Parameters

Antenna Measuring Height

1.8 m

Antenna Measuring Type

Pole Height >

Antenna Height

1.8751 m

Antenna Parameters

XBase

R:43 mm

H:64.7 mm

HL1:10.4 mm

HL2:10.5 mm

>

Used list

[Pole Height]1.8m

OK

In the floating window of the survey interface, you can see the real-time survey information. The default display information is N, E, H, and Base distance. Click the floating window to customize the displayed information. You can also click  to enter the display information settings interface and customize the information you need to display. Except default display information, SingularPad supports Longitude, Latitude, Altitude, etc.

←

97% Age1 FIXED 27/40 V-0.025 H:0.015

Name Pt Code Input

Work Layer:0 > 1.6+0.000m >

270°

0°

90°

2m

N:3450172.620

E:622942.410

Point Dist:2.504

H:13.689

Base distance:369.164

←

Settings

Settings

Display Info

Tool Bar

Options

Long

Lat

Altitude

Ant. H

Forward Azimuth

Speed

Time

Base distance(2D)

Laser Dist.

Pt H Dist

Pt Elevation Offset

NRMS

ERMS

PDOP

HDOP

VDOP

Tilt Angle

Projection Angle

Slope(%)

Slope(1:N)

Backspace

Default

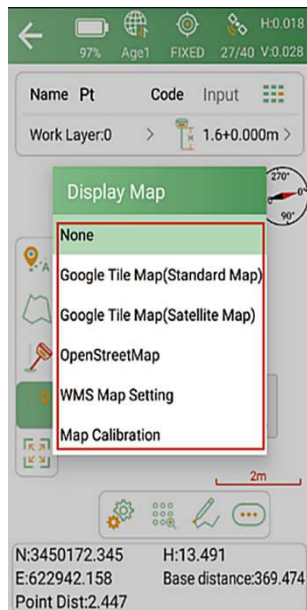
OK

Click  to select different map types or do map calibration. SingularPad

40



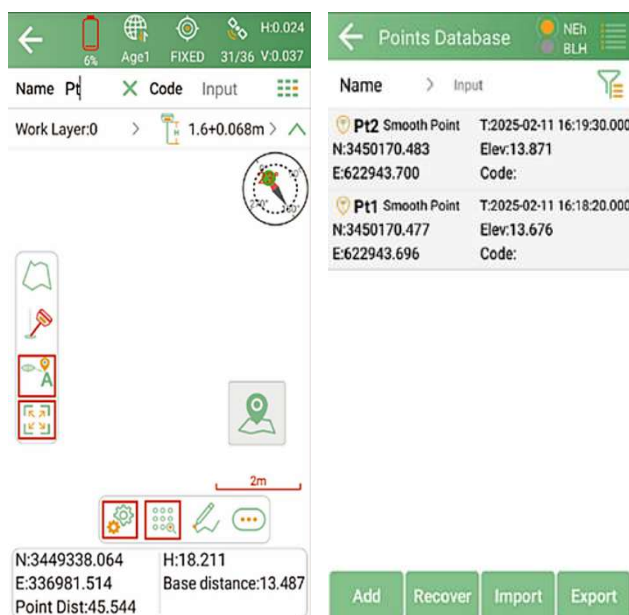
supports Google Map(Standard Map/Satellite Map), OpenStreetMap and WMS Map.



Click  to center map on current position

Click  to display all survey points on the interface.

Click  to enter the point database. You can add, recover, import and export data. After selecting a point, you can view the details and add notes or attach photos.



Click  to enter Settings interface

In Settings interface, you can modify Tolerance Setting such as solution limit, HRMS limit, VRMS limit and etc. and modify Smooth parameters and other Settings options.

← Settings

Settings

Display Info

Tool Bar

Tolerance Setting

Solution

FIXED >

HRMS

0.05m >

VRMS

0.1m >

PDOP

3 >

AGE

5s >

Tilt Angle

Unlimited >

Average

Survey Delay

0s >

Average Points

5 >

Default

OK

← Settings

Settings

Display Info

Tool Bar

Average

Survey Delay

0s >

Average Points

5 >

Horizontal

0.02m >

Vertical

0.03m >

More Settings

Pop Up the Survey Confirmation Page

☐

Remind When Point Name Repeat

☒

Point Name Increment

1 >

Default Code

Same as Last Point >

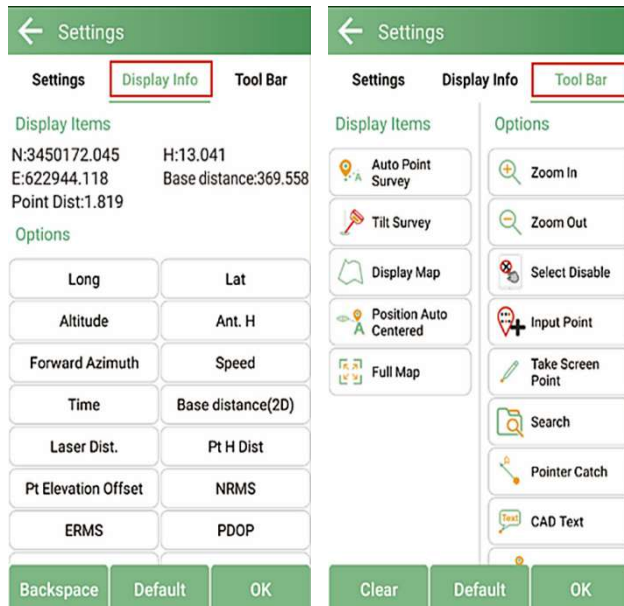
Default

OK



In Display Info interface, you can set the display information to the floating window, such as longitude, latitude, altitude, etc.

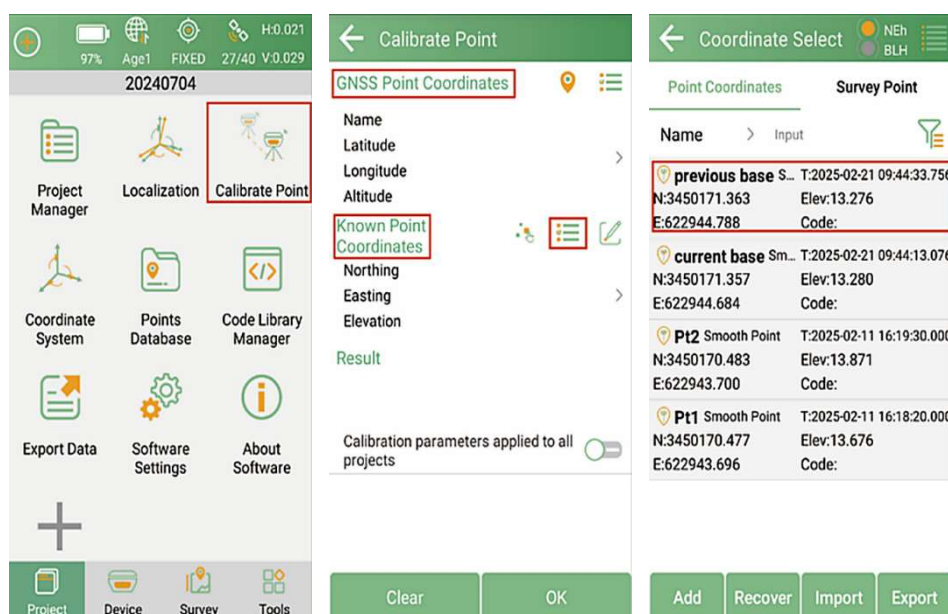
In Tool Bar interface, you can add or delete options that displayed on the point survey interface. You can customize the interface layout to suit your preferences.



3.3 Calibrate Point

When changing the position of the base station, there will be offsets between surveying points under different base stations. Users can use the Calibrate Point to calibrate the offset.

Go to Project > Calibrate Point. Add a point measured under the previous base station as Known Point Coordinates, and measure the same point under current base station as GNSS Point Coordinates.



For the GNSS Point Coordinates, you can click the surveying icon to measure under the current base directly.

NOTE: Please confirm the RTK status is *FIXED* before performing the calibration.

← Calibrate Point

GNSS Point Coordinates

Name

Latitude

Longitude

Altitude

Known Point Coordinates

Name

Northing

Easting

Elevation

Result

Calibration parameters applied to all projects

ClearOK

← 97% Age1 FIXED 27/40 V.0.029 H:0.019

Name

ous base

Code

Input

Antenna Height

1.6+0.000m

B

31°10'00.0741"N

N

3450171.185

L

121°17'22.3021"E

E

622945.57

H

12.886

Elev

12.886

Dist. to Ref

370.255m

Save to Point Database

Or measure the GNSS point under the current base station in advance and click to select from the point database.

← Calibrate Point

GNSS Point Coordinates

Name

Latitude

Longitude

Altitude

Known Point Coordinates

Name

Northing

Easting

Elevation

Result

Calibration parameters applied to all projects

ClearOK

← Coordinate Select

Point Coordinates

Survey Point

Name

Input

previous base

S...

T:2025-02-21 09:44:33.756

N:3450171.363

Elev:13.276

E:622944.788

Code:

current base

Sm...

T:2025-02-21 09:44:13.076

N:3450171.357

Elev:13.280

E:622944.684

Code:

Pt2

Smooth Point

T:2025-02-11 16:19:30.000

N:3450170.483

Elev:13.871

E:622943.700

Code:

Pt1

Smooth Point

T:2025-02-11 16:18:20.000

N:3450170.477

Elev:13.676

E:622943.696

Code:

AddRecoverImportExport

← Calibrate Point

GNSS Point Coordinates

Name

Base ID

Latitude

Longitude

Altitude

Known Point Coordinates

Name

Northing

Easting

Elevation

Result

Adjust Time

2025-02-21 09:46:26

North Offset

0.005m

East Offset

0.121m

Height Offset

-0.005m

Calibration parameters applied to all projects

ClearOK



3.4 Localization

When starting a new project, if you are using the local coordinate system, you can use Localization function to transform the geodetic coordinates system to your local coordinate system.

Go to **Project > Localization**, add at least 3 pairs of points to perform Localization.



NOTE: A pair of points are the known local coordinates and the surveying coordinates of the same point

Click **Add** to add the corresponding pairs. Firstly, input the Known Point Coordinates.

← Localization

Data Content

Name

K1

Known Point Coordinates

Northring

3450141.4360 m

Easting

622951.6845 m

Elevation

14.3341

GNSS Point Coordinates

Latitude

Longitude

Altitude

Options

Use Horizontal Control

Use Vertical Control

Add

Import

Export

Calculate

← Localization

Name

K1

Known Point Coordinates

Northring

3450141.4360 m

Easting

622951.6845 m

Elevation

14.3341

GNSS Point Coordinates

Latitude

Longitude

Altitude

Options

Use Horizontal Control

Use Vertical Control

OK

Then select the corresponding GNSS coordinates of the known point.

← Localization

Name

K1

Known Point Coordinates

Northring

3450141.4360 m

Easting

622951.6845 m

Elevation

14.3341

GNSS Point Coordinates

Latitude

Longitude

Altitude

Options

Use Horizontal Control

Use Vertical Control

OK

← Coordinate Select

Point Coordinates

Survey Point

Name

Input

A3 Smooth Point

T:2025-02-21 09:48:56.725

N:3450171.787

Elev:12.879

E:622945.934

Code:

A2 Smooth Point

T:2025-02-21 09:48:49.520

N:3450171.614

Elev:12.895

E:622945.964

Code:

A1 Smooth Point

T:2025-02-21 09:48:42.328

N:3450171.337

Elev:12.874

E:622945.907

Code:

previous base S...

T:2025-02-21 09:44:33.756

N:3450171.363

Elev:13.276

E:622944.788

Code:

current base Sm...

T:2025-02-21 09:44:13.076

N:3450171.357

Elev:13.280

E:622944.684

Code:

Add

Import

Export

← Localization

Name

K1

Known Point Coordinates

Northring

3450141.4360

Easting

622951.6745 m

Elevation

14.3341 m

GNSS Point Coordinates

Latitude

Longitude

Altitude

Options

Use Horizontal Control

Use Vertical Control

OK

47

Add the remaining point pairs in sequence. You can also enter the known point in point database in advance and select the input points.

The screenshot shows the 'Localization' app interface. At the top is a green header bar with a back arrow and the text 'Localization'. Below the header is a 'Data Content' section with a toggle icon. It displays a table with one entry, K1, with the following data: HRMS:0.000 VRMS:0.000, B:31°10'00.0789"N, N:3450141.436, L:121°17'22.3149"E, E:622951.675, H:12.874, and Elev:14.334. At the bottom of the screen are four buttons: 'Add', 'Import', 'Export', and 'Calculate'. The 'Add' button is highlighted with a red rectangular box.

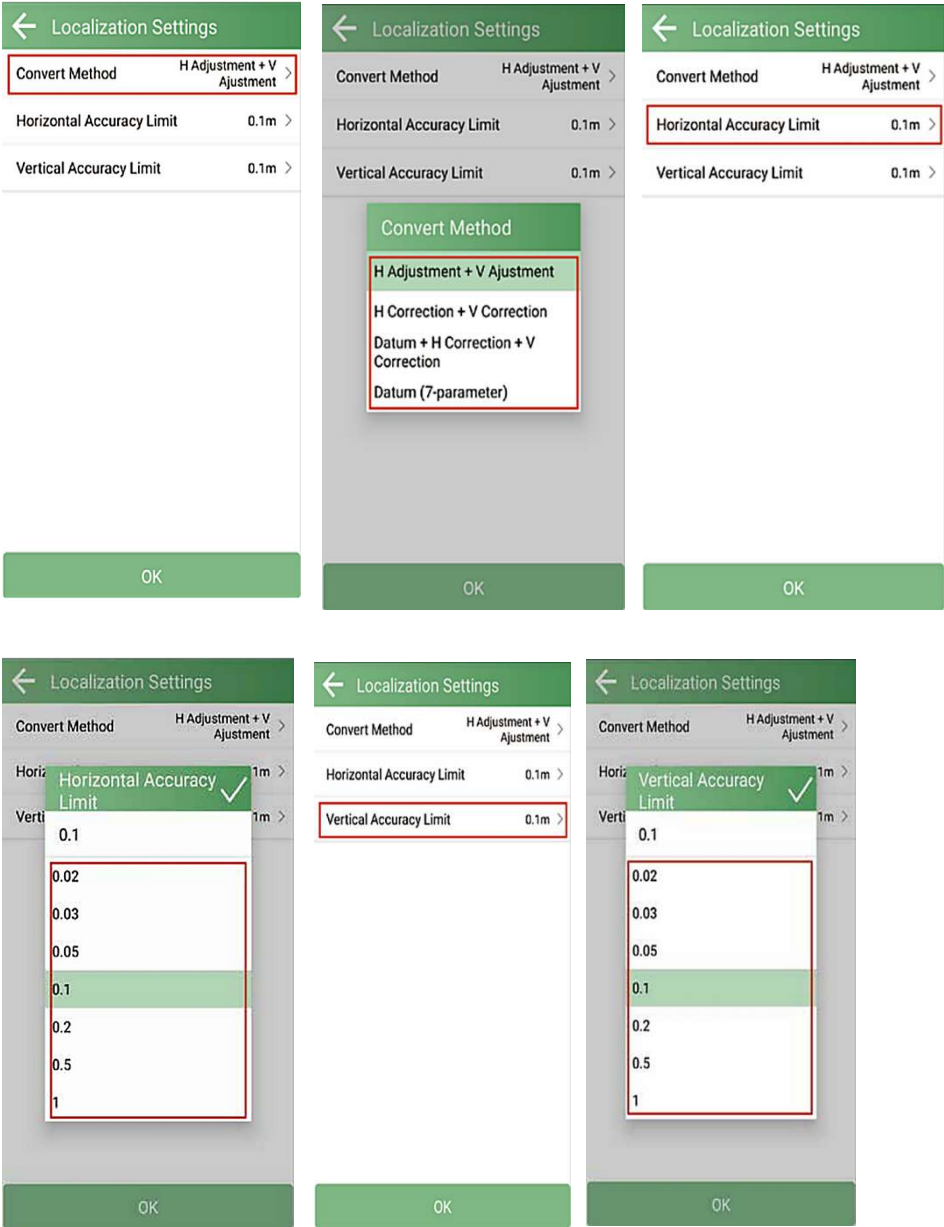
Point ID	HRMS	VRMS	Bearing	Northing	Longitude	Easting	Height	Elevation
K1	0.000	0.000	31°10'00.0789"N	3450141.436	121°17'22.3149"E	622951.675	12.874	14.334

After adding all the point pairs, click **Calculate**.

The screenshot shows the 'Localization' app interface with three point entries. The 'Data Content' section displays a table with three entries, K1, K2, and K3, each with the same set of data as K1 in the previous screenshot. At the bottom of the screen are four buttons: 'Add', 'Import', 'Export', and 'Calculate'. The 'Calculate' button is highlighted with a red rectangular box.

Point ID	HRMS	VRMS	Bearing	Northing	Longitude	Easting	Height	Elevation
K1	0.000	0.000	31°10'00.0789"N	3450141.436	121°17'22.3149"E	622951.675	12.874	14.334
K2	0.000	0.000	31°10'00.0878"N	3450141.436	121°17'22.3172"E	622951.685	12.895	14.334
K3	0.000	0.000	31°10'00.0935"N	3450141.436	121°17'22.3161"E	622951.685	12.879	14.334

Select the convert method and the accuracy limit according to your project requirements.



Localization Settings

Convert Method

H Adjustment + V Adjustment

>

Horizontal Accuracy Limit

0.1m

>

Vertical Accuracy Limit

0.1m

>

OK

You can click Export Report to save the projected coordinate system parameters.
Click Apply to apply the localization.

Localization Calculating Result

Conversion Residual

K1

HRMS:0.029 VRMS:-0.000

K2

HRMS:0.032 VRMS:0.000

K3

HRMS:0.006 VRMS:-0.000

Ellipsoid Parameter

WGS-84

Semimajor Axis:637... 1/f:298.257223563

Projection Parameter

UTM

Central Meridian

E123°00'00"

Horizontal Adjustment

Horizontal Adjustment(TGO)

Translate Northing(m)

1380.049052

Translate Easting(m)

49.207755

Rotation

0°04'14.9976"

Scale

1.0000273161828885

Export Report

Apply

3.5 Tilt Survey

If using the Xbase as a base station, there is no need to enable the IMU; however, if using it as a rover, the IMU can be initialized to perform tilt measurements.

The XBase GNSS receiver features a built-in IMU module that supports tilt surveying up to 60°. The system will accurately calculate the actual offset based on the tilt angle, reducing the need to keep the range pole perfectly vertical during measurements.

The tilt function option  will appear in each survey/stakeout function interface. You can click the icon to enable or disable tilt compensation.

Tilt initialization is required when using it for the first time or when the calibration has expired.

The following steps give an example of how to use tilt survey.

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

After enabling the tilt IMU button, the system will prompt you to check the antenna information, please check whether the antenna height is correct.



2. Initialization

After clicking the IMU button, you can follow the guidance on the interface to complete it.

During the operation, ensure that the receiver can search for satellites and obtain a fixed RTK solution.

NOTE: If the receiver is powered off or reset, IMU initialization must be performed again.

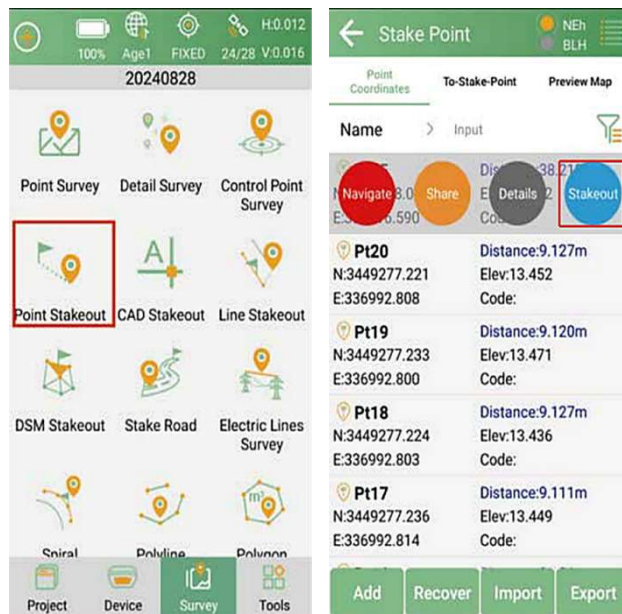
In survey interface, you can find the bubble indicator and angle value showing how you tilt the pole in real time. To ensure the accuracy, please keep the tilt angle less than 60° . When the pole tilts within 60° , the built-in IMU precisely calculates the actual offset, the accuracy of which can be accurate to $\pm 2.5\text{cm}$.



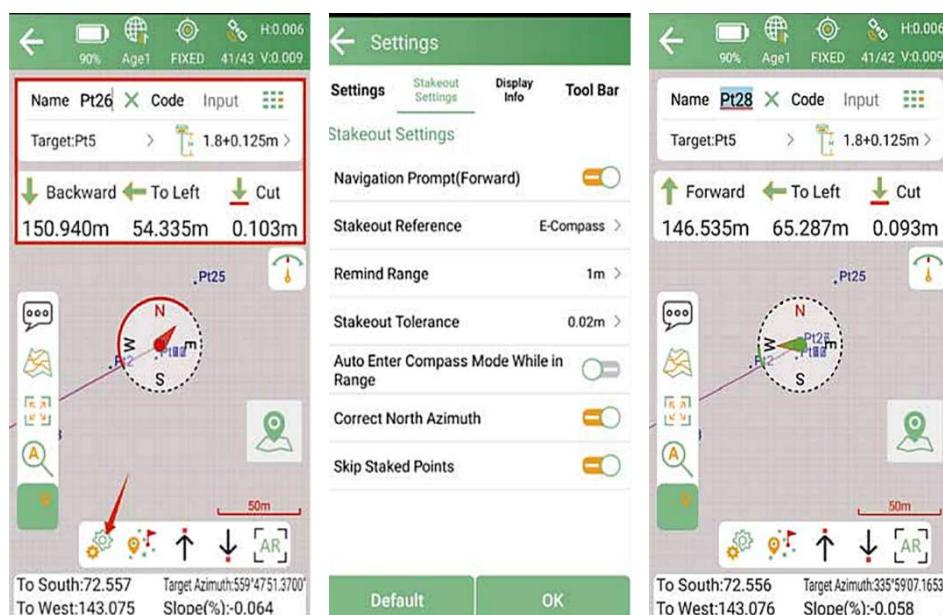
NOTE: If rapid rotation, falling and other violent movements cause IMU status loss, it needs to be reinitialized by gently shaking the pole for about 5 seconds.

3.6 Point Stakeout

Go to Point Stakeout interface, you can select a point from the point database to Stakeout. You can add or import the required point coordinates into the point database.



Select a point to stake, and follow the navigation guidance displayed on the map for staking points/lines. Once you get close enough to the target point, it will alarm you based on the alarm range you have set.





Click  to start or stop staking points

Click  to enable or disable IMU

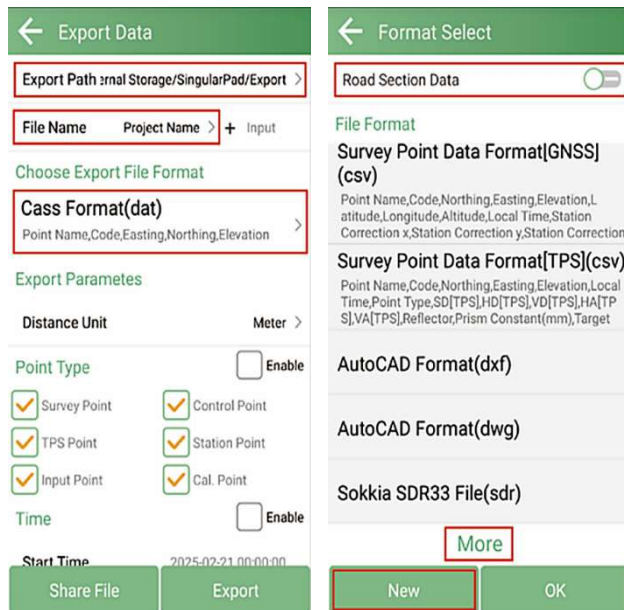
Click  to automatically zoom to the full image

Click  to jump to the current point

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

3.7 Export points data

Tap Export in Project interface to export point data. Also, click More formats to export the survey points in various formats like stake points/ lines, DXF, SHP, KML, RAW, RW5, HTML, CASS feature result.



Export Path: the default export path is internal storage/SingularPad/export; you can also change to any other path if required.

- File Name: support project name, operator, data, data time
- Export File Format: support *.csv, *.dat, *.txt, *.kml, etc.
- Distance Unit: support meter, US survey feet and international feet
- Road section data: open to export road section data

Additionally, 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, used satellites, tracked satellites, cut-off angle, mount point, measurement method, repeat, start date, 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 as .dxf file, then you can edit them in third party CAD software, 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 include name, code and height.

← Custom Format

Format Name

Input

Extension Name

dat >

Field Delimiter

Comma(,) >

File Header

☐

Custom Format Description

Options

Point ID	Point Name
Code	Code Remark
Line Name	Northing
Easting	Elevation

Local Time

Point Attributes

Backspace

OK

4 STATIC SURVEY

This chapter describes how to conduct static survey through Xbase receiver and SingularXYZ Converter software. For static survey, Xbase supports SingularXYZ binary format (*.XYZ), which is a raw observation data format. You can convert it to RINEX format via SingularXYZ Converter Software.

For the converter software, please contact the SingularXYZ support team at <support@singularxyz.com> for assistance

4.1 Static Data Collection

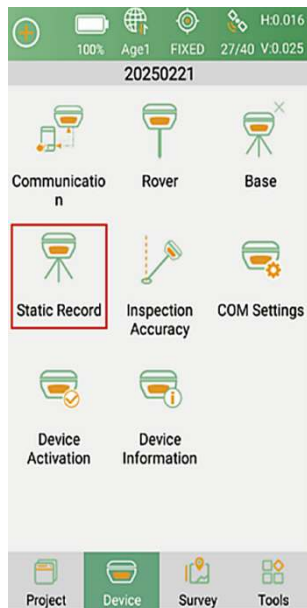
Static survey is mainly used for the control point survey. To reach millimeter accuracy results, please follow the recommendations below:

- At least 3 GNSS receivers are required to form a stable triangulation network.
- It is better to collect static data 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.

For convenient operation, you can start recording static data by double-pressing the function button on the front panel. The flashing yellow indicator on the function button indicates that static data recording has begun at a 1Hz frequency.

If you need to do more detailed settings about static survey, please follow these steps to configure them in the SingularPad software.

1. Go to **Device >> Static Record** for static settings.



2. Choose the Record mode. There are two record modes and they can record static data at the same time.

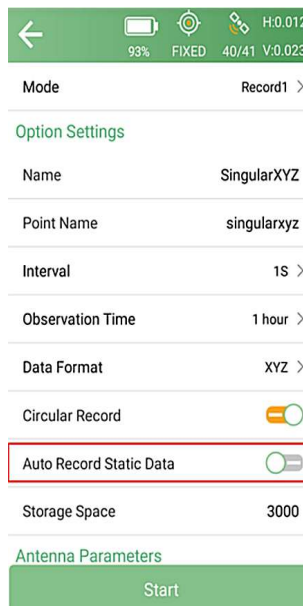
Options Settings interface: Input Record name and Point name. Set the Collection Interval, Observation Time and Data Format.



3. Turn on/off the **Circular Record** according to your needs. If this option is turned on, the receiver will automatically delete the earliest recorded data to keep recording when the storage space is full.

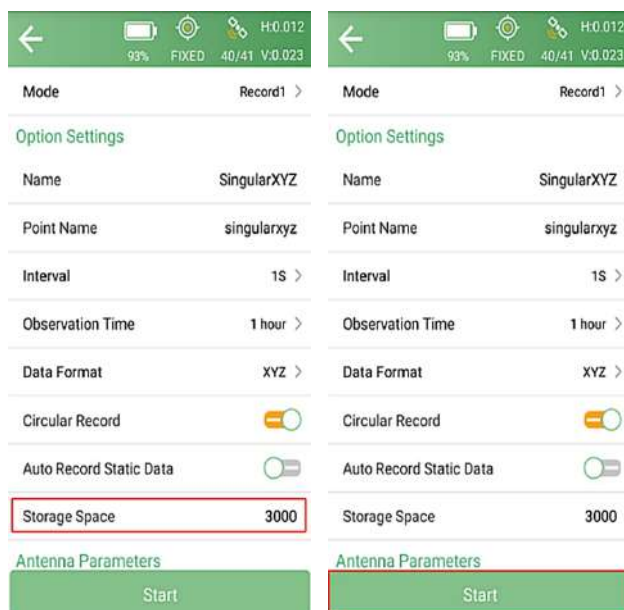


4.Enable/disable the **Auto Record Static Data** according to your needs. If this option is turned on, the receiver will automatically record static data after it is power on.



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

6.Click **start** to start static data collection.

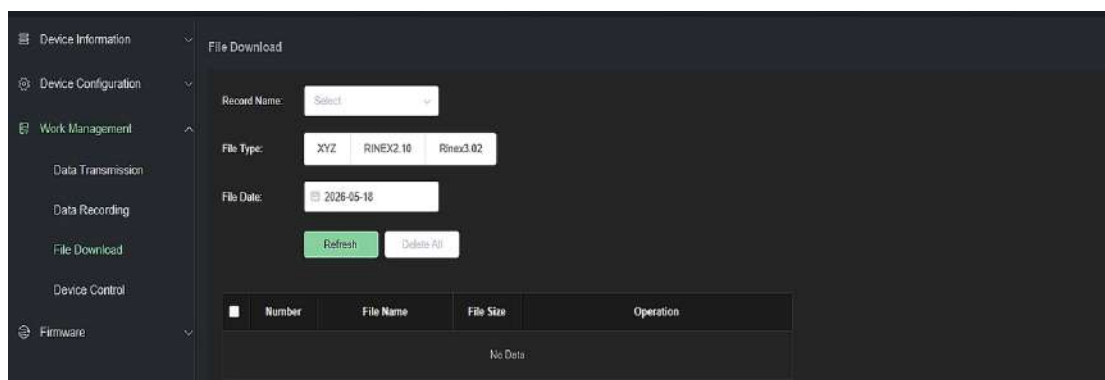


4.2 Static Data Download

The raw observation data is saved in the internal memory of the Xbase receiver. The specific steps to download the static data from the Xbase receiver are as follows:

Refer to Chapter 5.1 Access the web interface to go to the Xbase web page.

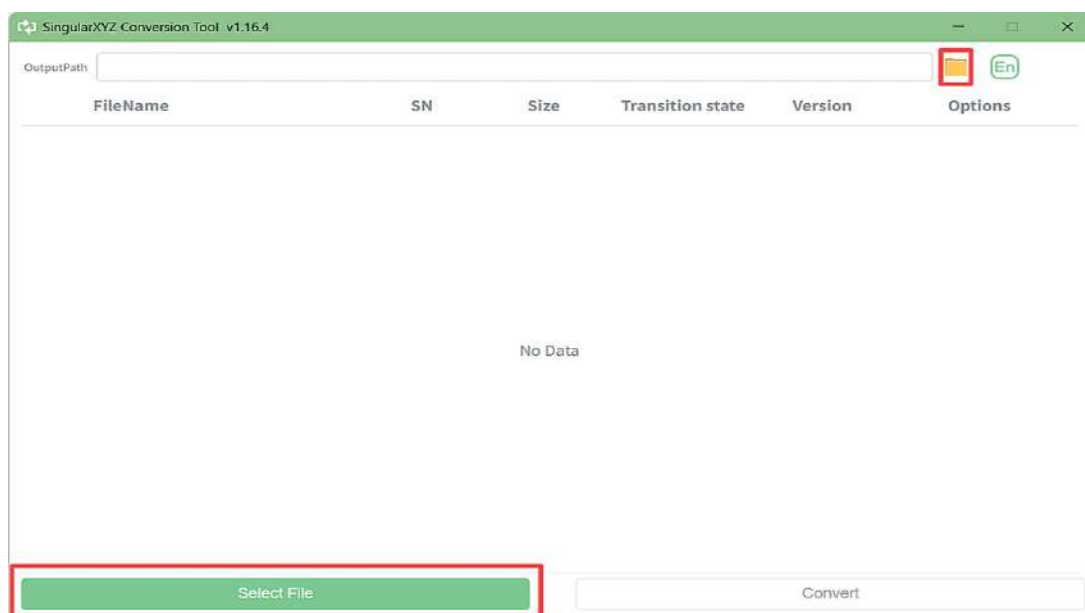
Go to Work management >> File Download, select the corresponding record name, file type and date to filter and download the static data.



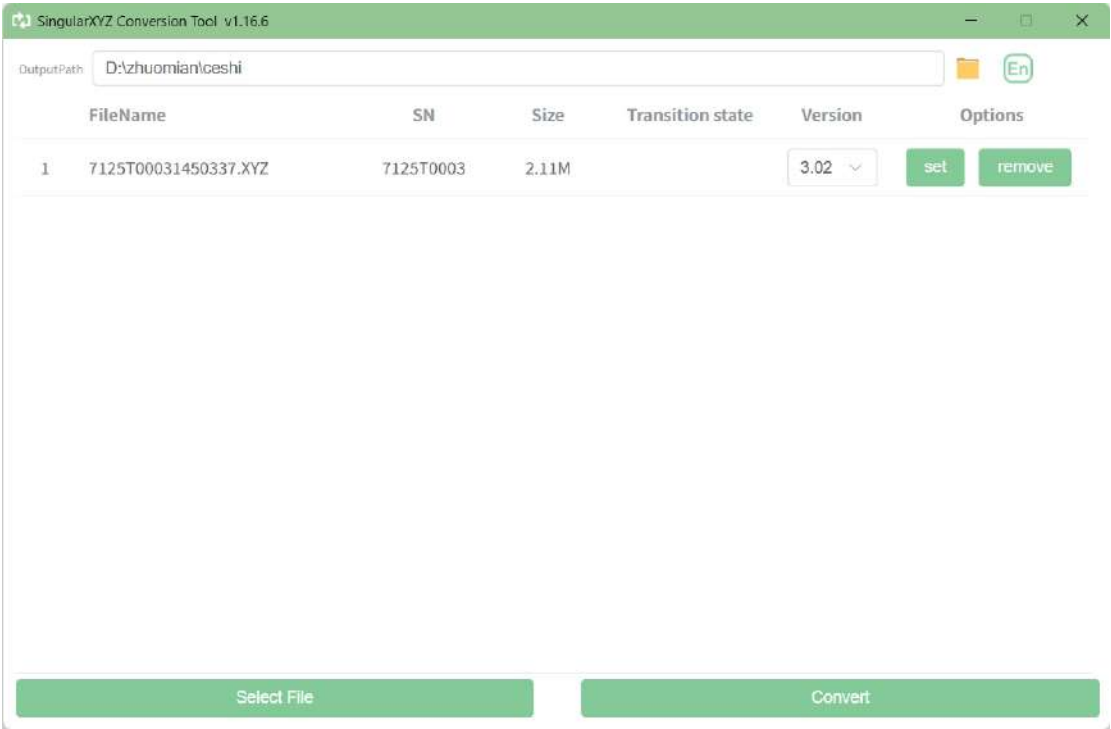
4.3 RINEX Conversion

After download raw observation data to PC, you can convert the data format from SingularXYZ binary format (*.XYZ) to Rinex in SingularXYZ Converter software. The following steps give an example of Rinex conversion.

1. Start SingularXYZ Converter software.
2. Click the **file folder icon** to set the output path and click **Select file** to import the binary file.



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



NOTE: The output path and GNSS raw data storage path must contain only English letters and numbers.

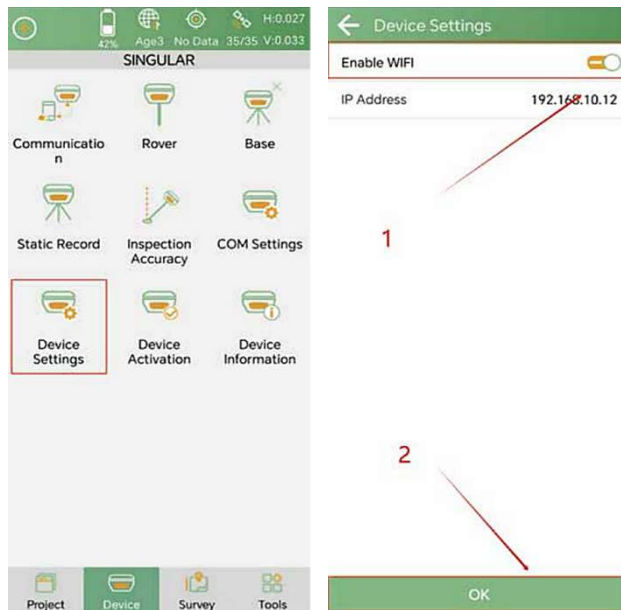


5 WEB UI INTRODUCTION

This chapter mainly introduces the function of Web UI.

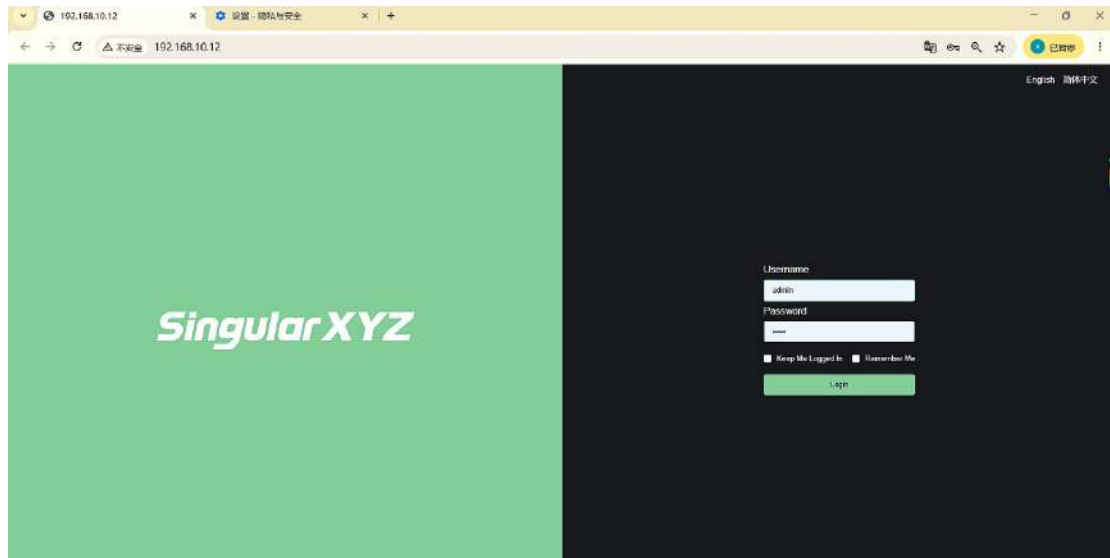
5.1 Access the web interface

After you connect Xbase GNSS Receiver to SingularPad via Bluetooth, go to Device >> Device Settings. Keep the default IP address and enable WIFI, click OK.



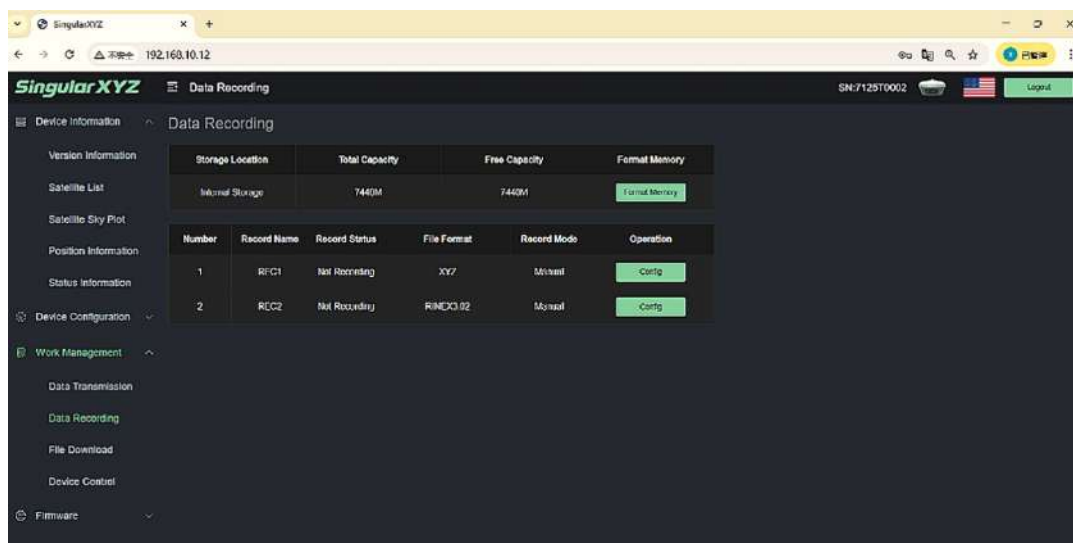
NOTE: By default, the Xbase receiver starts with Bluetooth enabled and Wi-Fi disabled. Bluetooth and Wi-Fi cannot be enabled simultaneously. Therefore, to use Wi-Fi, you need to enable it through the PAD software. After restarting the device or configuring it via the web interface, Bluetooth will be enabled again.

Connect PC or mobile devices to Xbase WiFi (Name: SN of Xbase, Password: 12345678). Open browser and enter the web page via IP 192.168.10.12 (Username: admin, Password: admin).

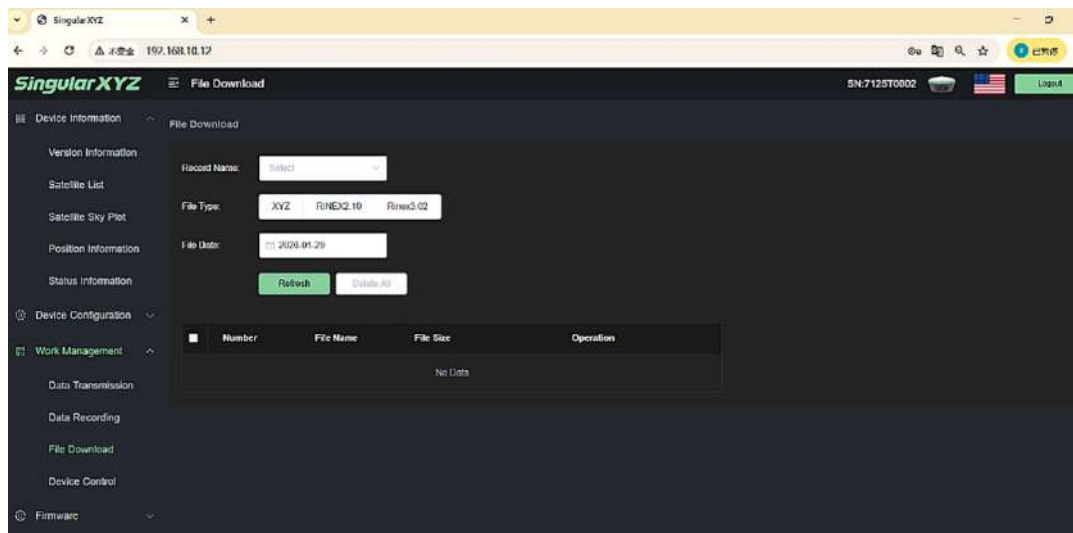


5.2 Work Management

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



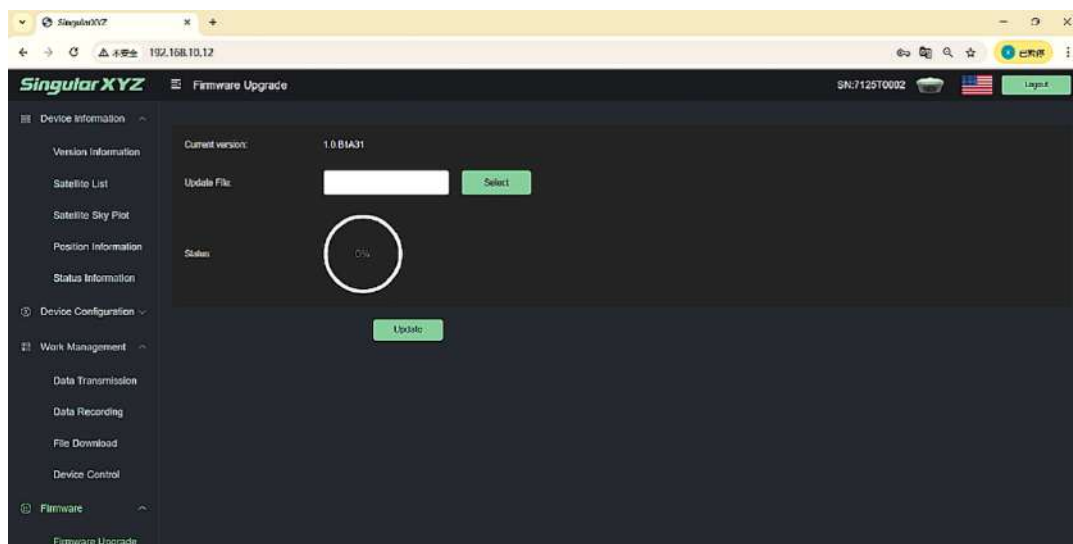
In file download section, you can download recorded static data.



5.3 Firmware Upgrade

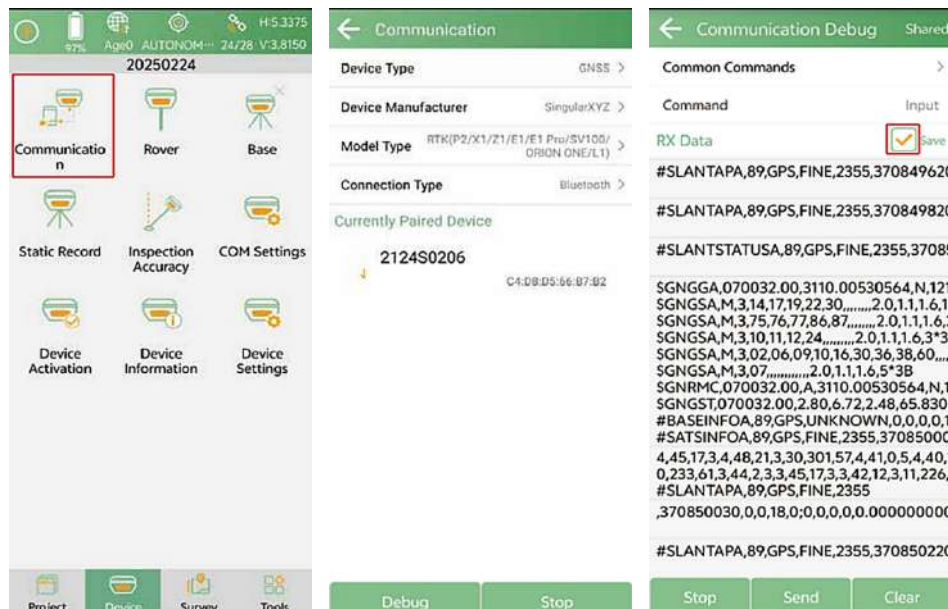
This function interface is used to upgrade the firmware version of the device.

1. Select the firmware (*.bin file) in this interface and click Update to upload the firmware package.
2. After the upload complete, the device will automatically restart and the upgrade is finished.



After connecting the device, you can access the Debug section.

Enter Device>>Communication>>Debug, then enable Save option to save debug file, which will be stored in the System folder (/SingularPad/Debug).



6.2.2 Share Project File

The project file and its parameters will also help us identify the issues. You can share your project with us by following these steps:

Enter **Project>>Project Manager**, select your project and click Share.



WARRANTY CARD

If you meet any issues while using the product, please contact SingularXYZ support team or your local SingularXYZ distributor partner for supporting and debugging first

product Model:	_____
serial Number:	_____
Date of shipment:	_____
customer Name:	_____
Address:	_____
Address:	_____

To request warranty service, please contact your local SingularXYZ distributor or our support team at:

✉ support@singularxyz.com

📞 [Support.SingularXYZ](https://support.singularxyz.com)

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.

FCC Warning

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 60cm between the radiator and your body.