SingularXYZ®

Horus Visual & Laser GNSS Receiver User Manual

2025.11.24V1.0

CONTENTS

1 INTRODUCTION

The SingularXYZ Horus Visual & Laser GNSS Receiver User Manual is aimed to help you get familiar with the GNSS receiver and start your project effectively. We highly recommend you to read this manual before start your surveying, even you have used other GNSS RTK receivers before.

1.1 Environmental Requirements

- **Operating Temperature**: -30 ℃ to +65 ℃
- **Storage Temperature**: -55 ℃ to +85 ℃
- **Humidity**: 100% Non-condensing
- **Waterproof & Dustproof**: IP67, fully protected against dust and water, suitable for harsh environments.
- **Drop Resistance**: Designed to withstand a 2-meter drop onto concrete.

1.2 About Horus

The Horus GNSS receiver integrates photogrammetry, laser measurement, and AR stakeout functions. It combines powerful performance, seamless connectivity, and user-friendly design, making it the ideal tool for achieving accurate, reliable results in a wide range of surveying and mapping applications.

Key Features:

- **Full-Constellation Support:**

Horus supports Full-Constellation satellite tracking with 1408 channels, enabling simultaneous tracking of GPS, BDS, GLONASS, Galileo, QZSS, IRNSS, and SBAS. This ensures centimeter-level positioning accuracy across a variety of environments.

- **Next-Gen IMU:**

Equipped with a next-generation Inertial Measurement Unit (IMU), Horus enhances reliability in various surveying tasks, including pole surveying, AR stakeout, laser surveying, and visual surveying, offering greater stability and precision.

- **Enhanced UHF Communication:**

With enhanced UHF capabilities, Horus can reach up to 15 km in optimal conditions, minimizing the need for external radios and ensuring stable communication over long distances.

- **Versatile Connectivity:**

Horus supports a wide range of connectivity options, including Bluetooth, Wi-Fi, NFC, and USB, allowing for flexible interaction with the devices to suit different needs and workflows.

- **12-Hour Battery Life:**

Powered by a 6600mAh built-in battery, Horus offers an impressive 12+ hours of continuous working time, while the fast 3.5-hour charging time ensures minimal downtime for your field operations.

- **Web UI Access:**

Access Horus via Wi-Fi through an intuitive web interface to configure work modes, download data, perform firmware upgrades, and monitor device status remotely, making it easier than ever to manage your device on-site.

1.3 Front Panel

The Horus contains three indicator LEDS and one power button on the front panel.

1.4 Back View

The receiver has a laser receiver and laser emitter on its back, as well as a camera for photogrammetry.

1.5 Lower Housing

Receiver lower housing contains a Type-C port, SMA connector and a camera.

1.6 Power Supply

The Receiver is equipped with internal batteries.

- 6600 mAh, up to 12 hours working time

- Fast charge of 3.5 hours charging time

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.*

2 RTK WORKFLOW

This chapter introduces how to conduct RTK surveying 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 team to obtain the installation package.

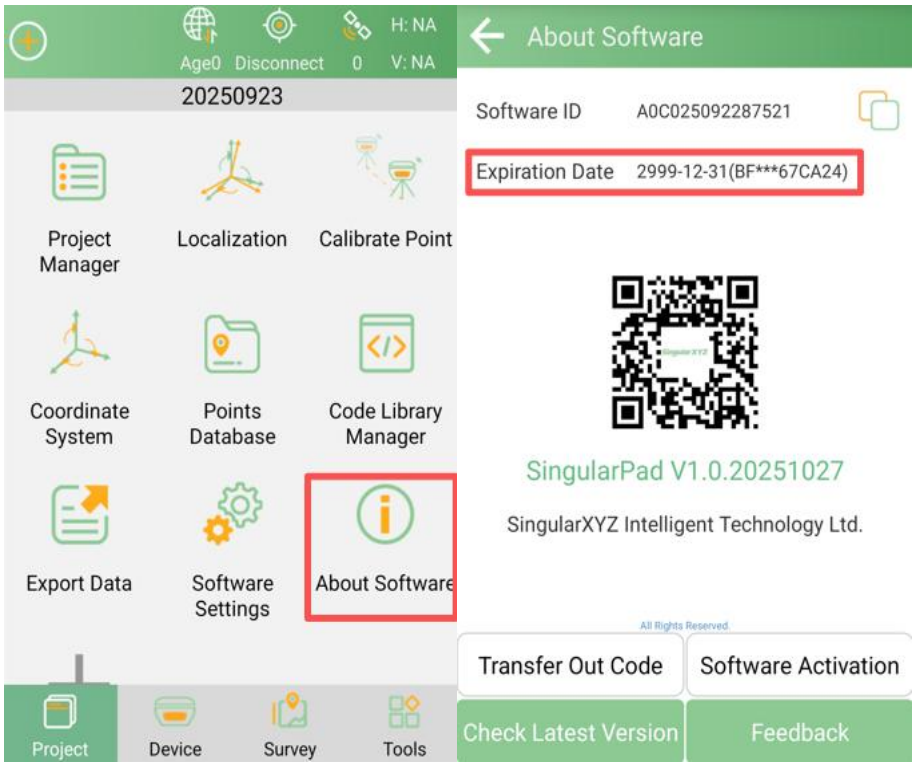
2.1.2 Software Registration

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

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

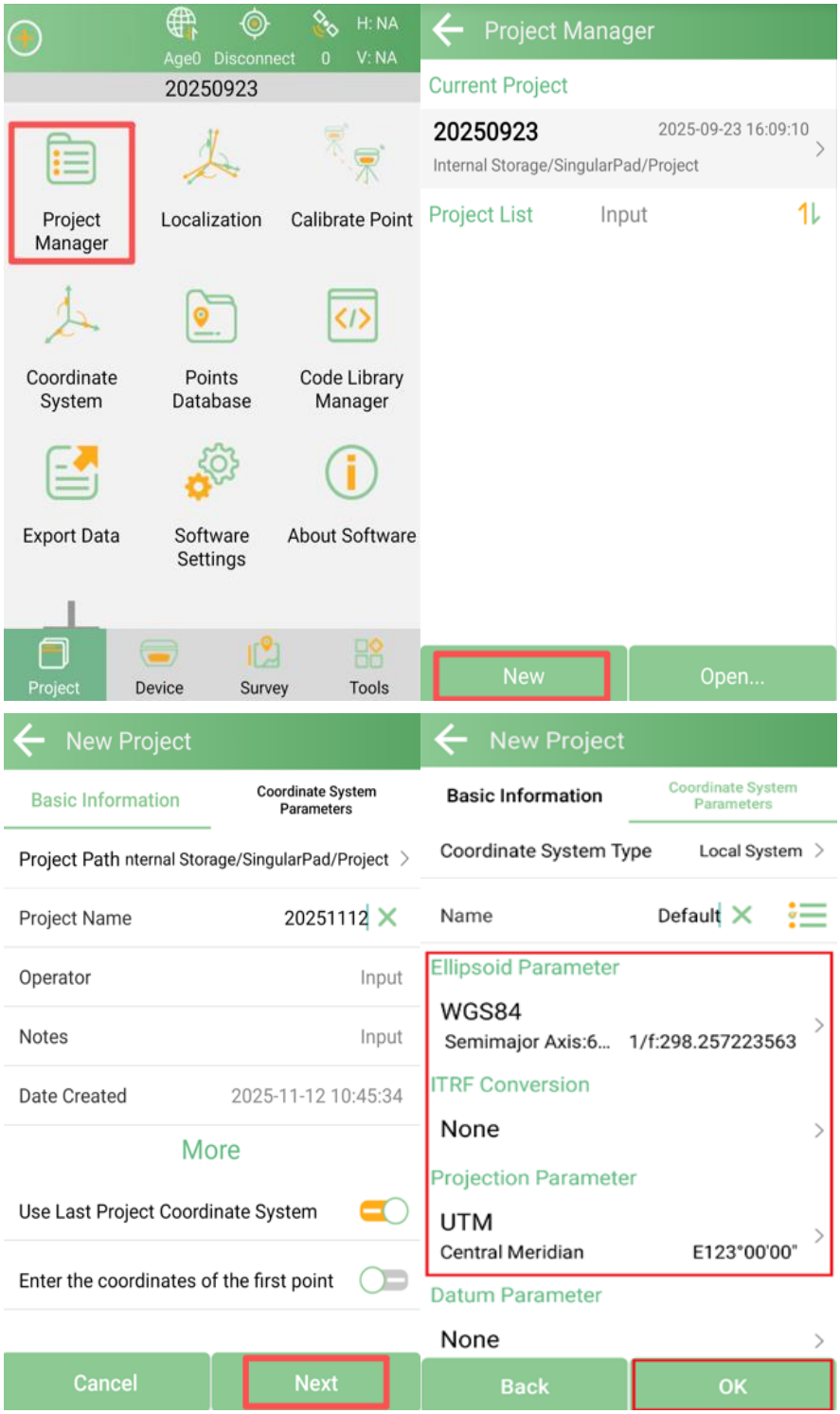
-If it shows ***2999-12-31***, this indicates a permanent registration of the software.

-If it shows ***Inactivated***， please click ***Software Activation***, then enter the permanent license to register and activate all software functions.


H: NA
Age0 Disconnect 0 V: NA
20250923
Project Manager
Localization
Calibrate Point
Coordinate System
Points Database
Code Library Manager
Export Data
Software Settings
About Software
Project
Device
Survey
Tools
About Software
Software ID A0C025092287521
Expiration Date 2999-12-31(BF***67CA24)
SingularPad V1.0.20251027
SingularXYZ Intelligent Technology Ltd.
All Rights Reserved.
Transfer Out Code
Software Activation
Check Latest Version
Feedback

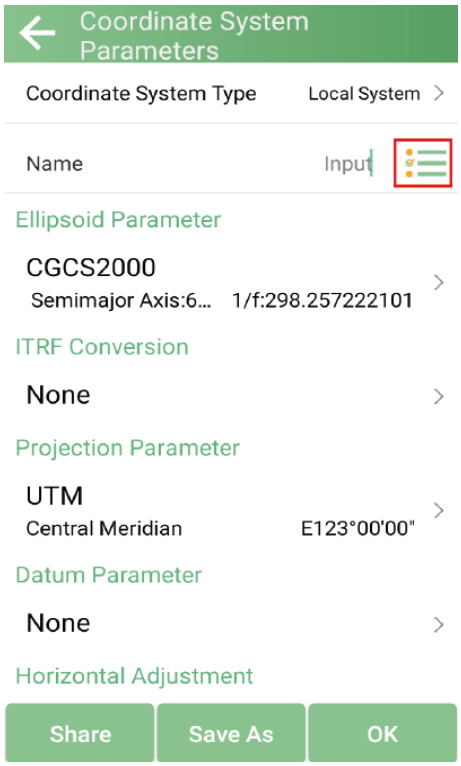
2.2 Create a New Project

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

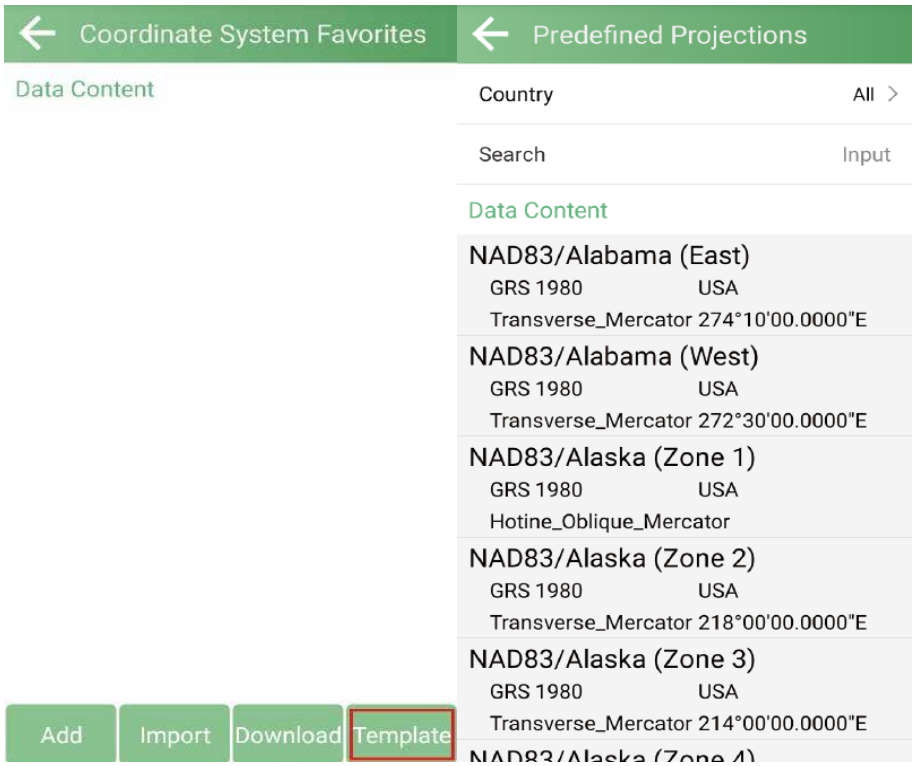


SingularPad includes many countries' coordinate systems, you can find what you need by country name or coordinate system name. The following steps give an example of how to find predefined coordinate systems in SingularPad.

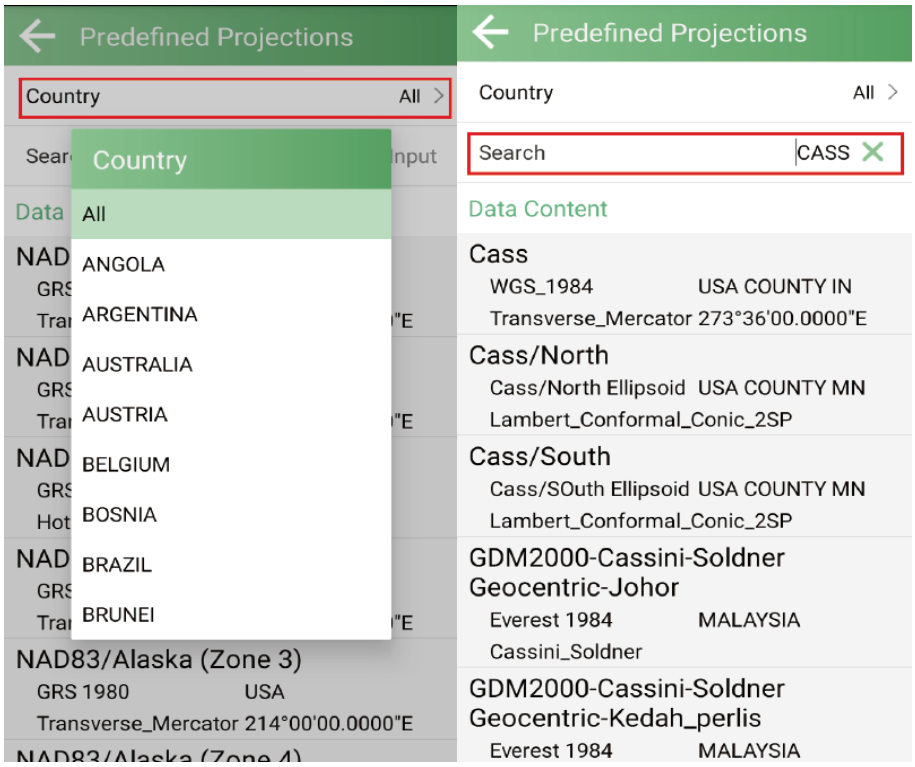
Click the button located after ***Name*** in Coordinate System Parameters interface.



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

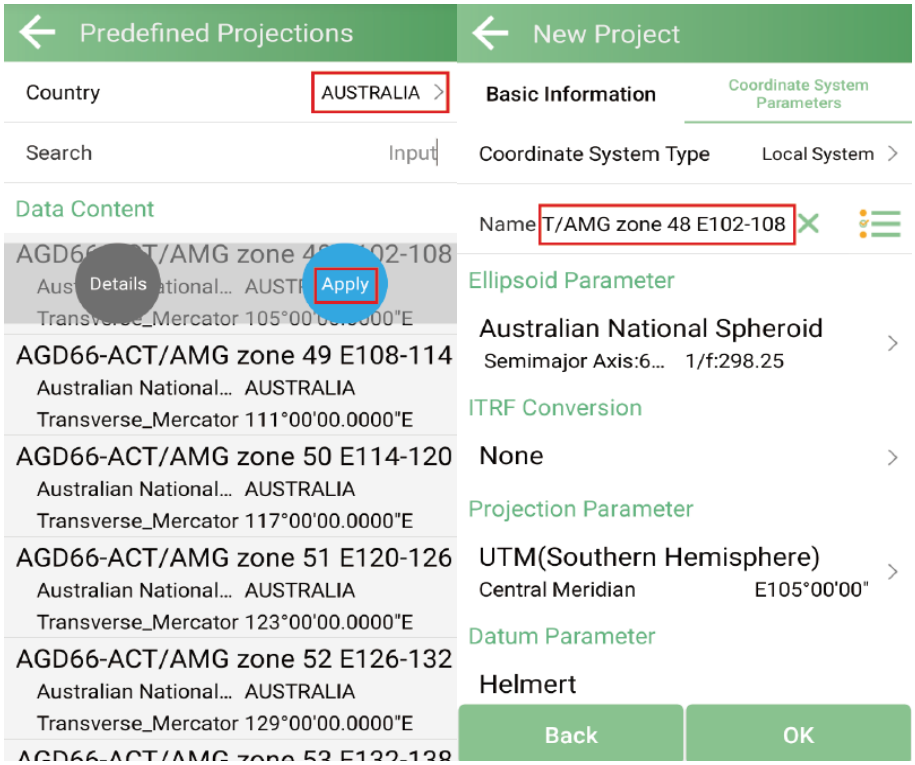


Click ***Country*** to select the country name or enter a keyword after ***Search*** to find desired coordinate system.

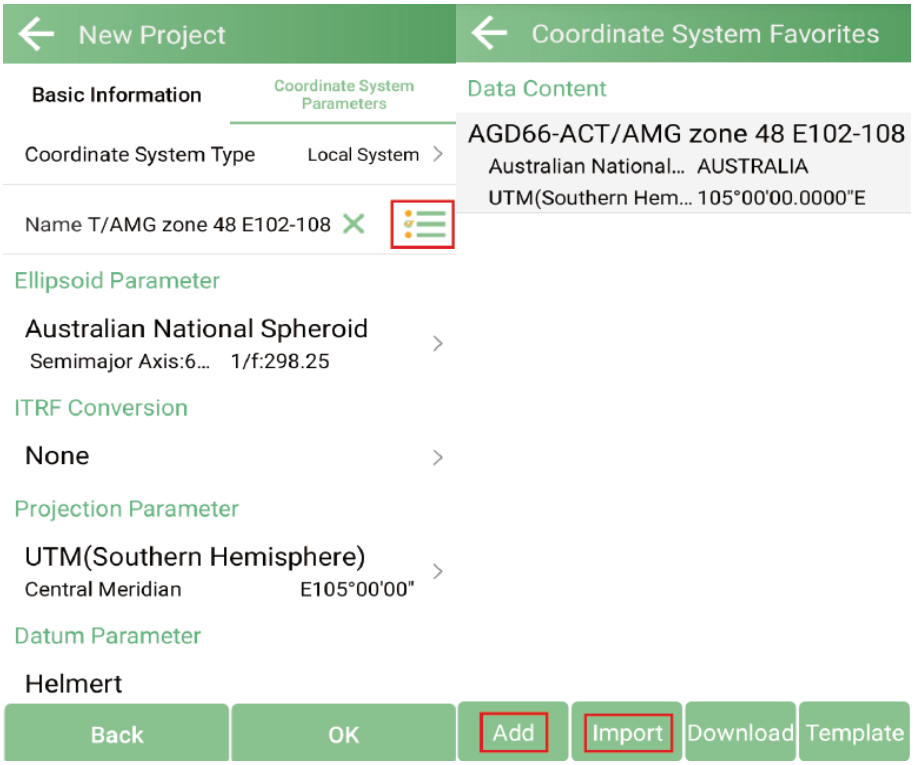


After finding the required coordinate system, click ***Apply*** to add it to coordinate

system parameters, click ***OK*** to apply it to the current project.



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



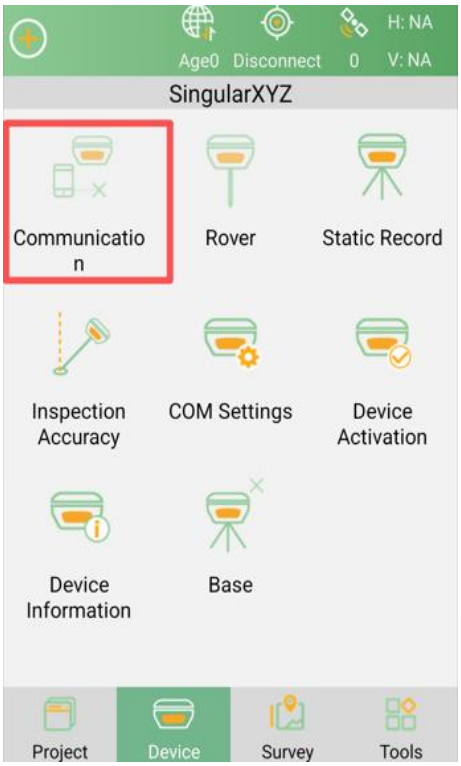
2.3 Device Connection

2.3.1 NFC Connection

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

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:

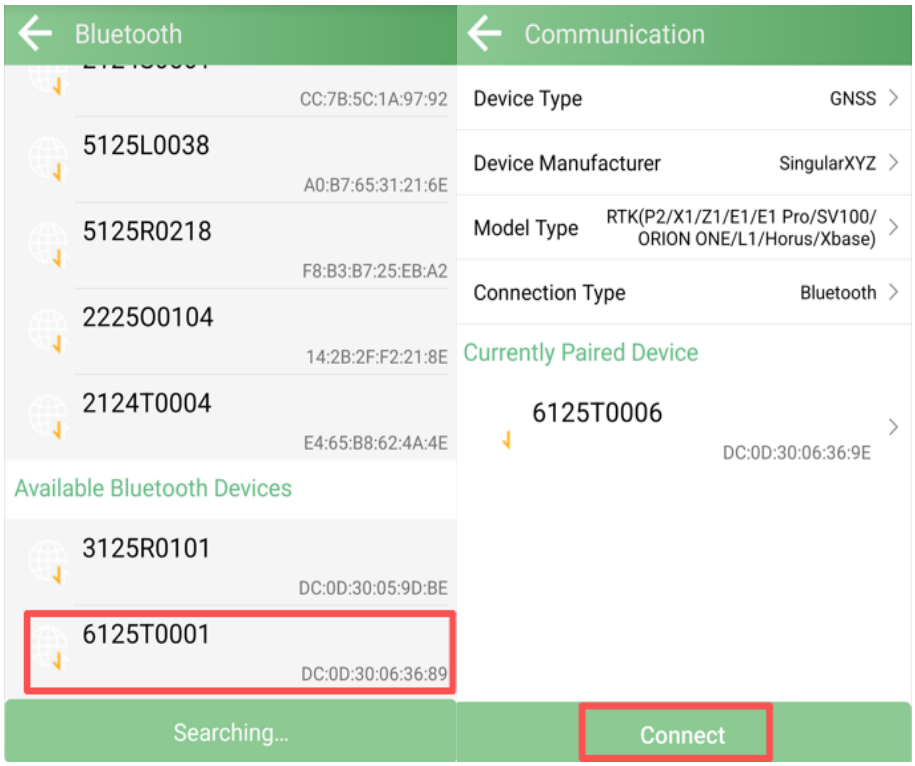
Device Type: GNSS

Device Manufacturer: SingularXYZ

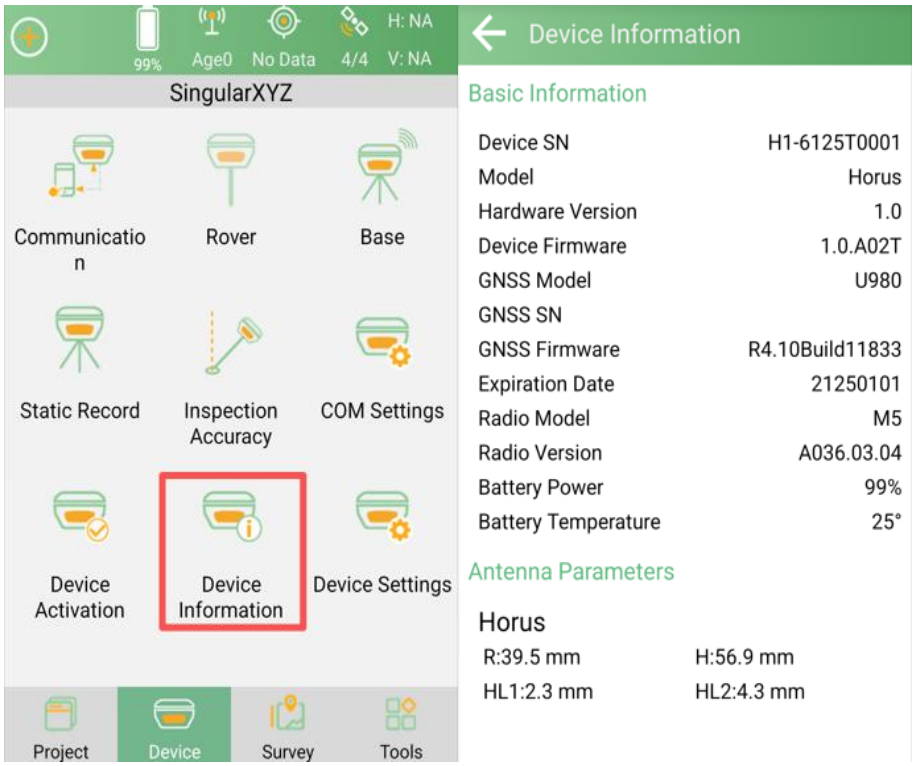
Mode Type: RTK (P2/X1/Z1/E1/E1PRO/SV100/ORION ONE/L1/Horus/Xb-ase)

Connection Type: Bluetooth

Make sure Bluetooth is enabled on the controller. Click ***Currently Paired Device*** to find the serial number (SN) of your Horus receiver. Click ***Connect***.



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



Tips:

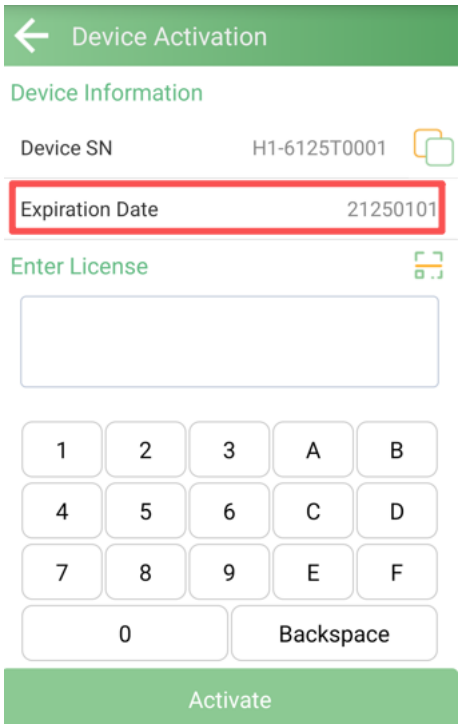
If you fail to connect with receiver through SingularPad, you can follow the prompts to enter the system Bluetooth settings interface of the PDA/data collector to ensure that the Bluetooth pairing is successful. Sometimes you need to cancel the device Bluetooth pairing, restart the receiver or SingularPad software and perform the pairing process again.

2.4 About Device Registration

The device can only function properly if it is in an activated state. Please check the device's expiration date in Device Activation.

-If the Expiration Date shows ***21250101***, the device is permanently licensed and valid indefinitely.

-If the displayed date has ***expired***, a registration code is required for registration, please contact SingularXYZ team to obtain a license code. Then enter the it to register, ensuring the device functions properly.



2.5 Concepts About RTK

2.5.1 Overview

RTK(Real-Time Kinematic) is a positioning technique used to improve the accuracy of a standalone GNSS receiver. A conventional GNSS receiver, like the one in a smartphone, could only provides the position accuracy within 2–4 meters (7– 3 feet). RTK technology enhances this accuracy to the centimeter level. 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 perturbed 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.

2.5.2 High Real-Time Precise

Two receivers are used in RTK. One of them is stationary, the other moves freely. These receivers are referred to as the base station and rover. The base station is

installed at a fixed, known location and continuously transmits correction data to the rover. Rover uses that data to achieve centimeter precise position. Any number of rovers can connect to one base if their input settings match the base's output.

2.5.3 Corrections over NTRIP

You do not necessarily need a second unit for RTK all the time. Usually, there are local services that share base corrections over the Internet. The technology is called NTRIP (Networked Transport of RTCM via Internet Protocol). 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;
•Independency from local providers, no additional NTRIP subscription fees.

2.6 Quick Setup Your Receiver

With the help of this section, you can easily configure your Horus and achieve accurate positioning for your subsequent surveying tasks. This chapter introduces four work modes, allowing you to select the one that best suits your working conditions and accuracy requirements.

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

	adjustment	

Note: *The cost and coverage area of the CORS service depend on your local service provider*.

2.6.1 Internal Radio Mode (SingularXYZ Base + Horus Rover)

If you've purchased one unit of SingularXYZ RTK Base (like X1-Series, Z1, etc.) and one Horus GNSS receiver as rover, you can conduct internal radio work mode. During configuration, you need to connect your PDA device or data collector to the base and rover respectively. When work as a Base station, SingularPad supports transmit the correction data in Internal Radio mode.

Internal Radio: This mode uses internal radio to transmit the correction data from Base.

•**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, 12000, 15000, 18000, 19200, 115200.

•**Power:** High and low (low power will reduce the transmission range).

Tips:

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 increase range.

Avoid:

- Obstacles: buildings, vehicles, towers, trees, etc.

- Interference: high-power radar, TV, cellular towers, power lines or electrical facilities.

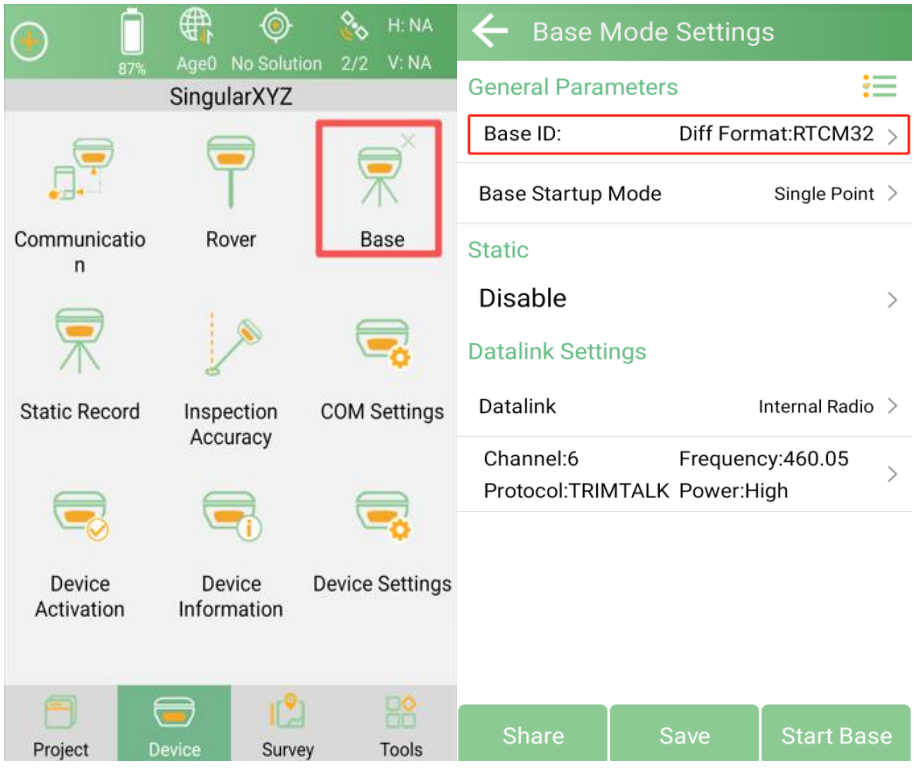
The following steps give an example of how to configure internal radio base mode.

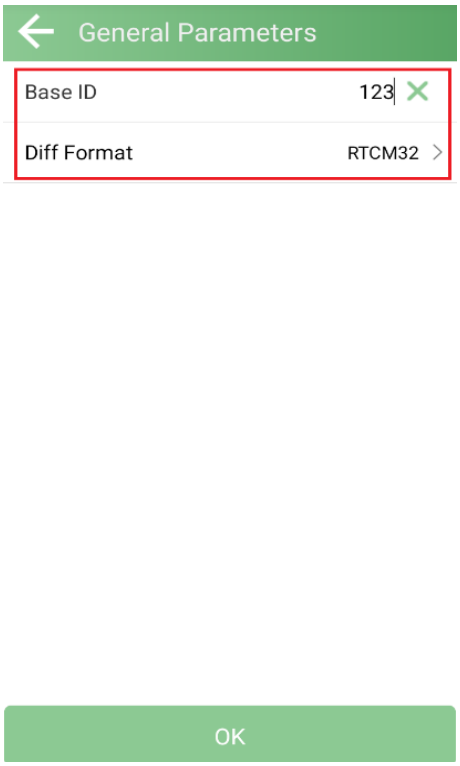
Note:

Set Internal Radio Work Mode:

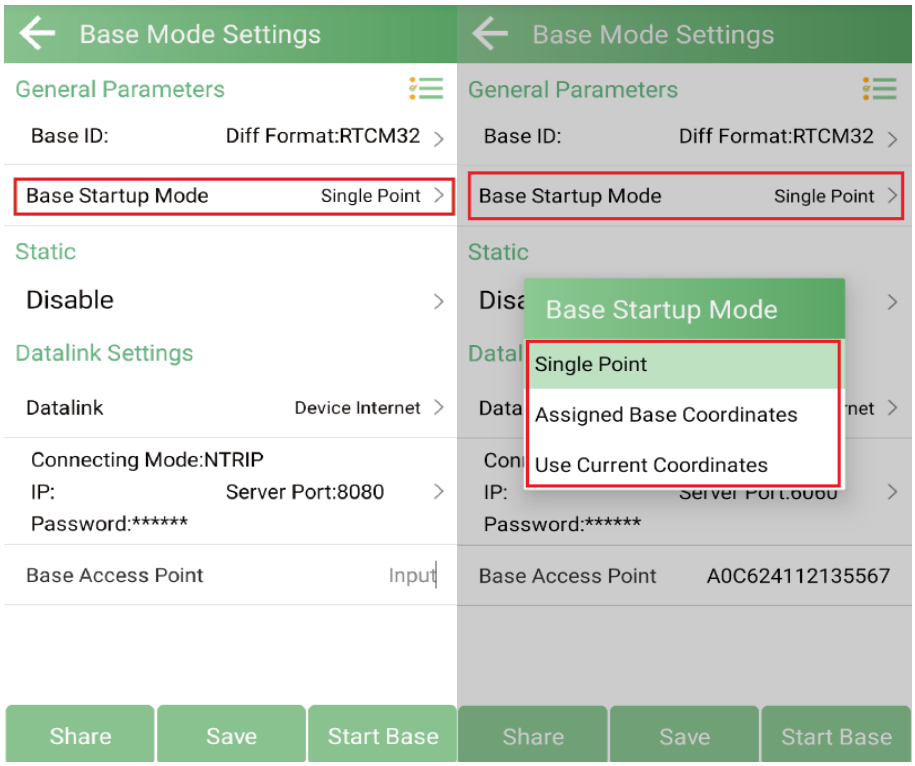
Connect the whip antenna to both your base station and rover. The Horus is equipped with non-contact laser surveying and camera AR stakeout capabilities and is commonly used as a rover for surveys. The X1-Series and Z1 RTK are recommended as the base choices for Horus rovers due to their reliable GNSS, communications and durability features.

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





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



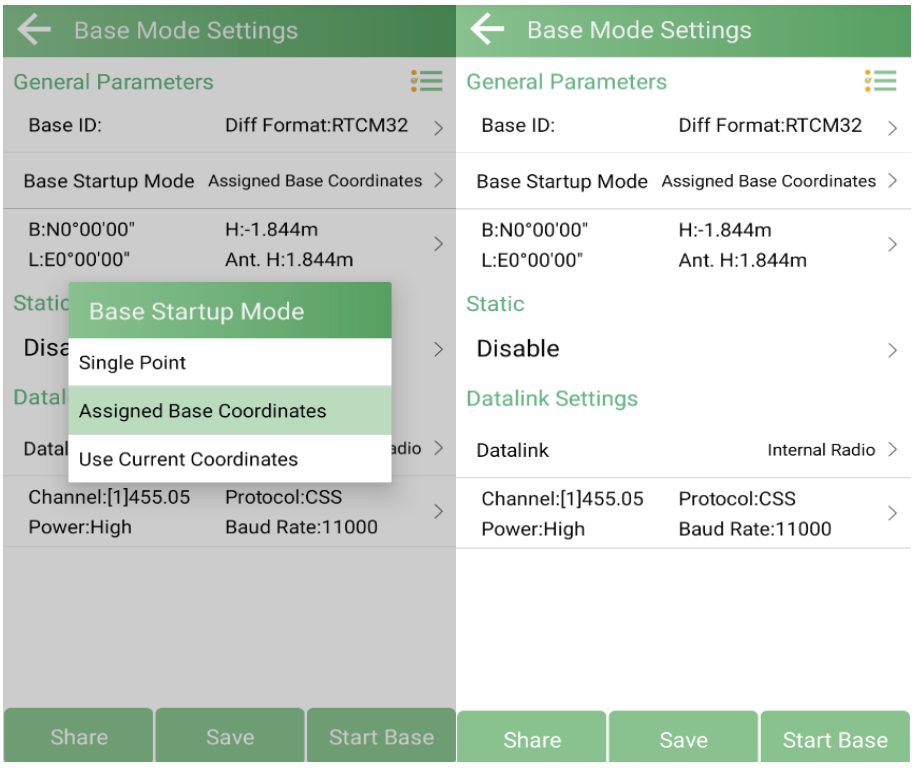
Single Point: Start the base station at unknown coordinates.

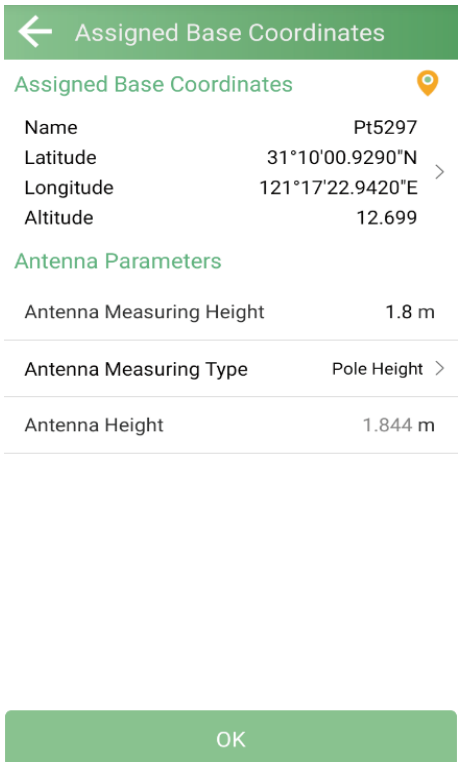
Assigned Base Coordinates: Start the base station at known coordinates, and you need to enter the latitude, longitude and the height.

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

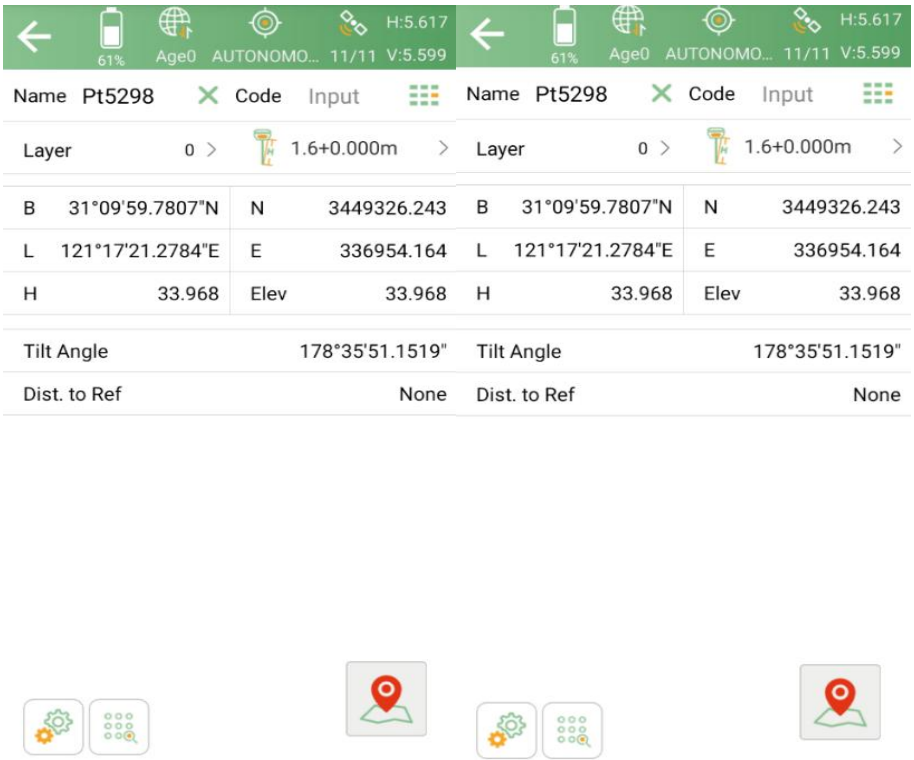
Note: *Please setup the base station at a known point. Select* ***Base Startup Mode*** *as* ***Assigned Base Coordinates*** *and input the known point coordinates. Make sure the current coordinates of the instrument is within 50 meters of the known point coordinates. Otherwise, you will need to conduct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

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

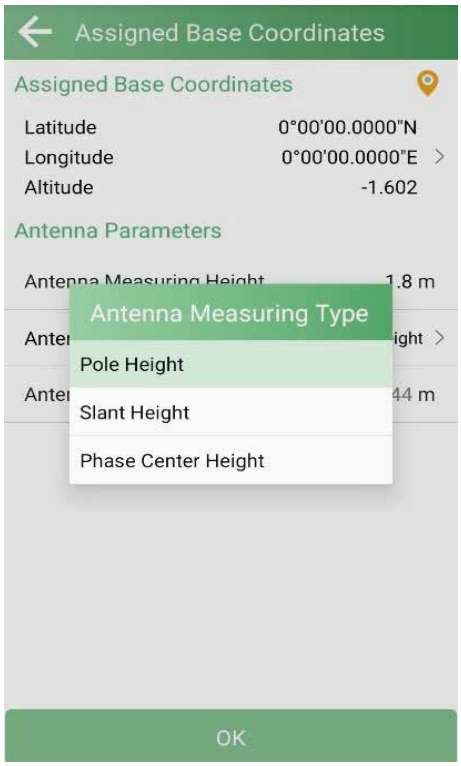




You can assign the coordinates from point database (input points/measured points) or click the survey icon to measure the current base location directly. Always use the same coordinates when starting base at the same location.



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



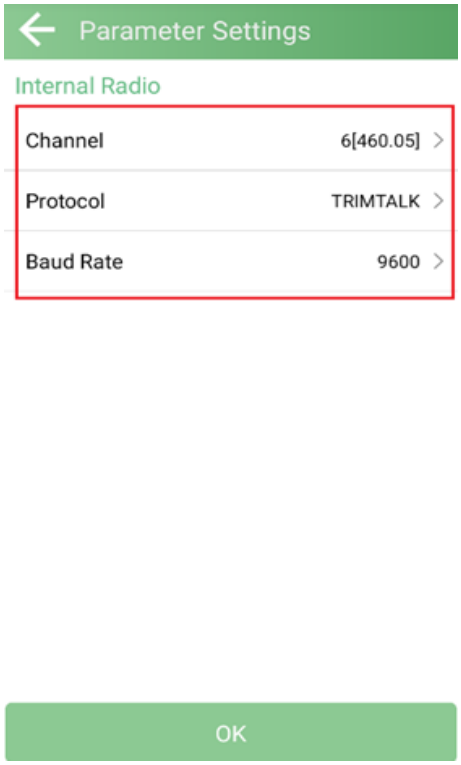
Pole Height: Pole height is the vertical height from the receiver bottom to the ground point. If you are using a range pole with bipod for base set up, you can fill the pole scale reading as the software ***Antenna Measurement Height*** when the pole is perpendicular.

Slant Height: If you are using a tripod to set up the device, you can measure the distance from ground point to 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.

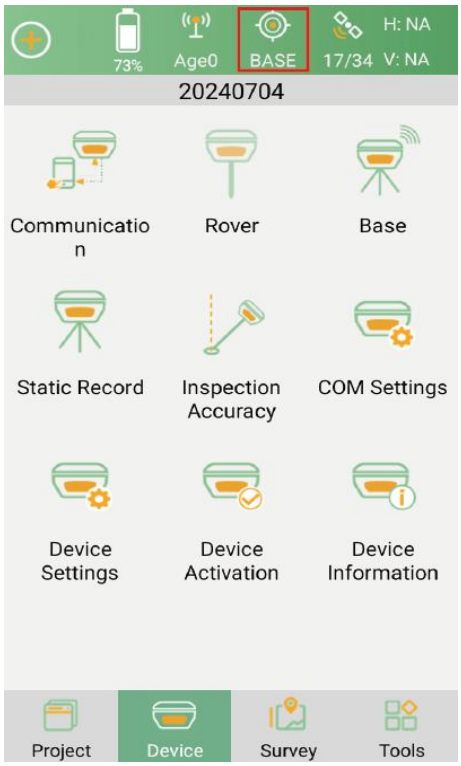
Phase Center Height: The phase center height is the distance from the ground point to the antenna phase center, but the antenna phase center is a virtual point of the instrument's electromagnetic wave, and cannot be measured directly.

4. Set ***Data Link*** as ***Internal Radio***.

Set parameter settings, Channel, Frequency, Protocol, Baud Rate and Power.



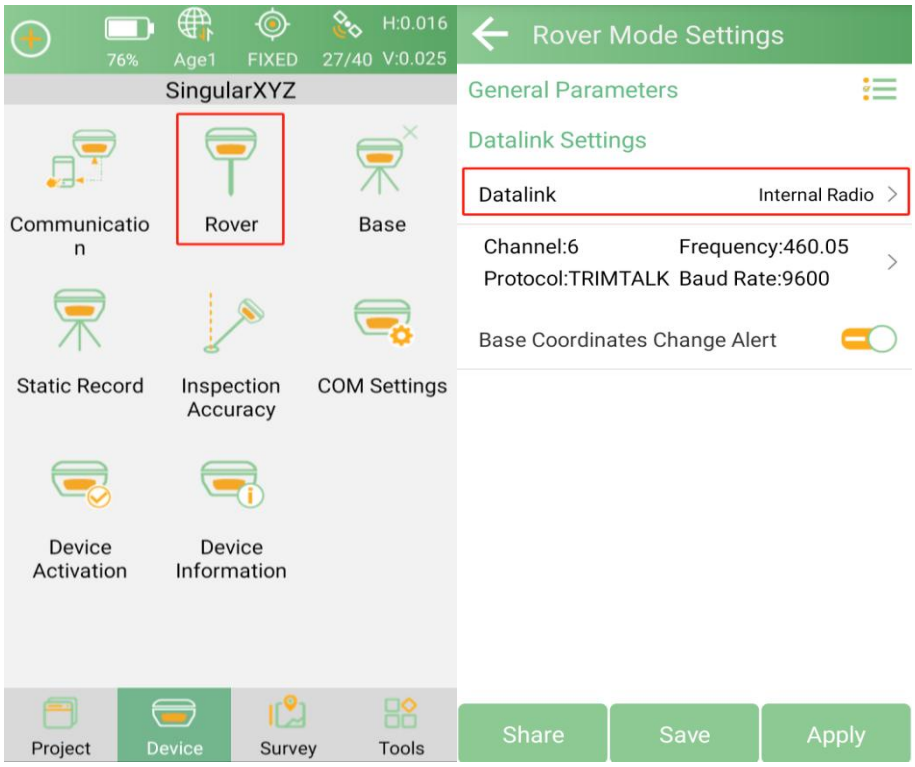
5. When start Base succeed, it will show as below in SingularPad.



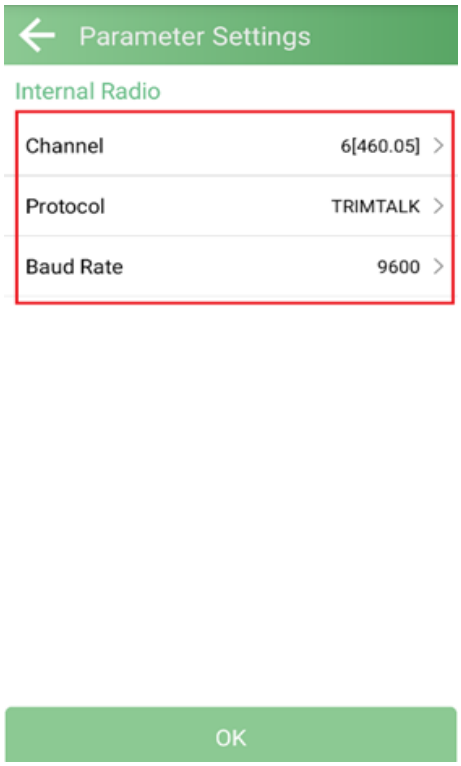
Note: *After base settings, please disconnect the base device and then search for the SN of rover to connect and configure the rover device. Select the same protocol and frequency with the Base.*

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

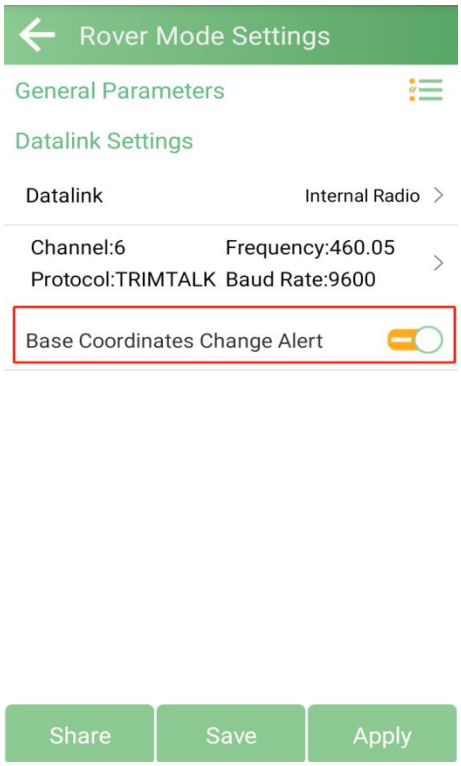
1. Go to ***Device*** >>> ***Rover***. Set ***Data Link*** as ***Internal Radio***.



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

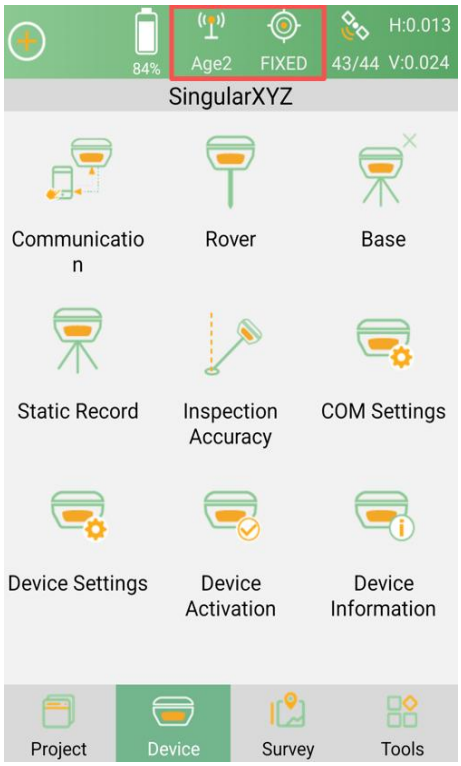


3. ***Base Coordinates Change Alert***: SingularPad will alert when the base station coordinates change while you are working. This may be because the rover is mistakenly connected to another base station or the base station has been moved.



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.

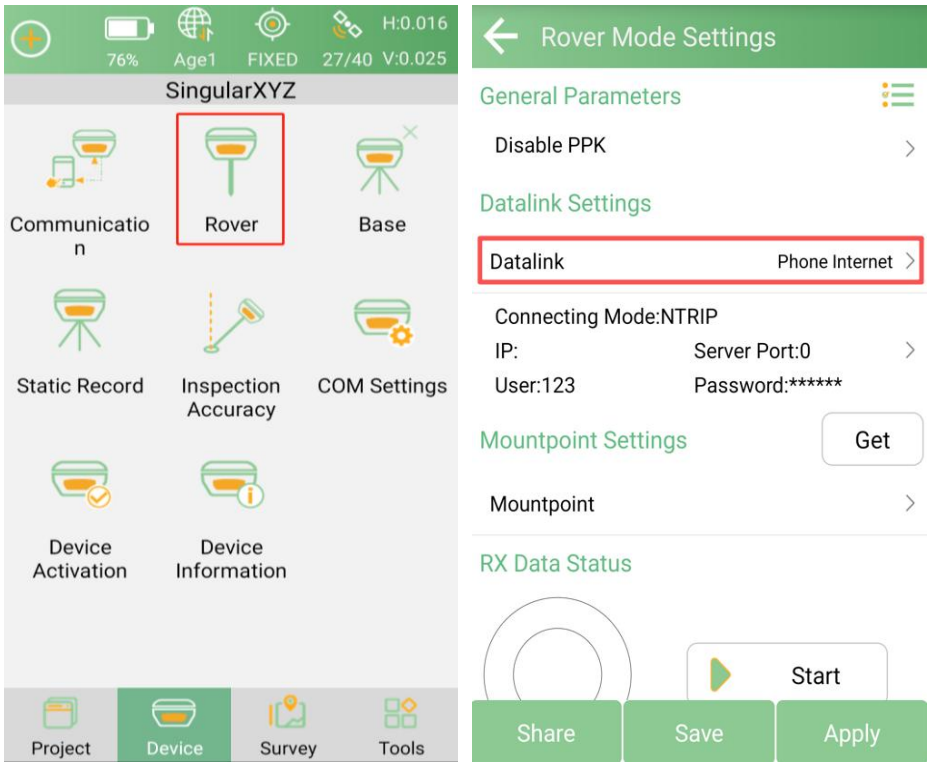


2.6.2 PDA CORS Mode (Single Horus Rover)

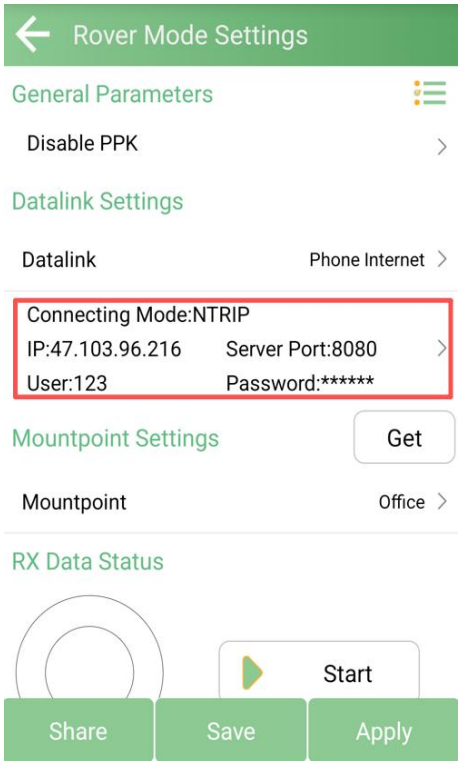
When works as a rover, SingularPad supports receive the correction data in ***Phone Internet Mode***.

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), Wi-Fi or hot spot.

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



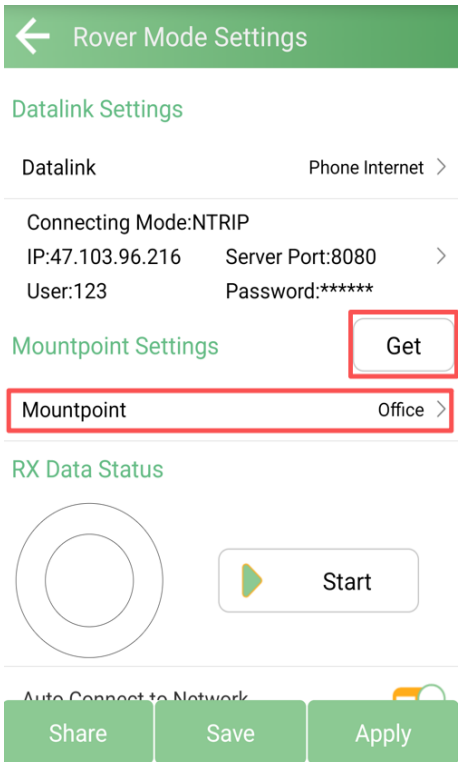
Set ***Connect Mode***, for Horus receiver supports NTRIP and TCP Client. Input the server IP, Port, User and Password in the ***CORS Settings***.



Note:

The IP & port in the picture is only for example, please enter your local CORS account instead. You can purchase a third party RTK corrections service account in your local area to obtain an RTK FIX solution.

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

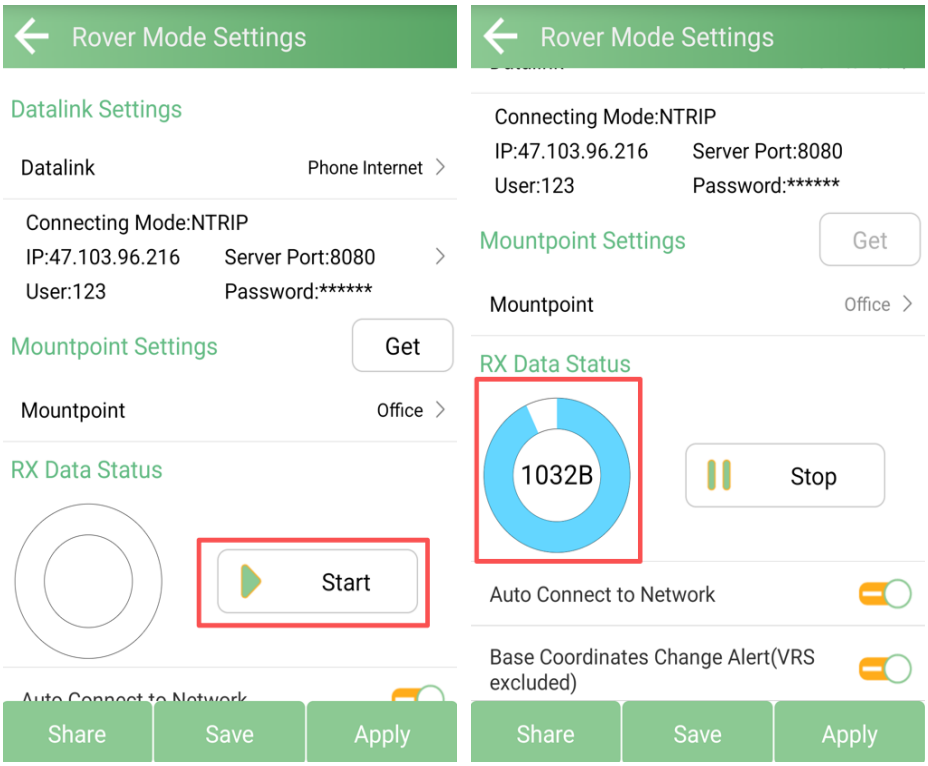


Note:

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

If you are unable to obtain a mountpoint, it may be due to a problem with your account. Please check if the IP address and port are entered correctly, or confirm with your local NTRIP/CORS provider whether the account is available.

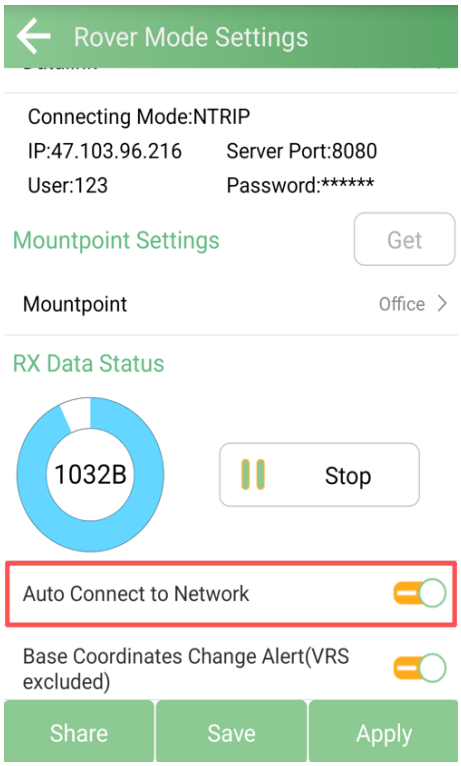
Click ***Start*** button on the right to receive data from CORS/RTK correction service. Then you can see the rover is receiving data.



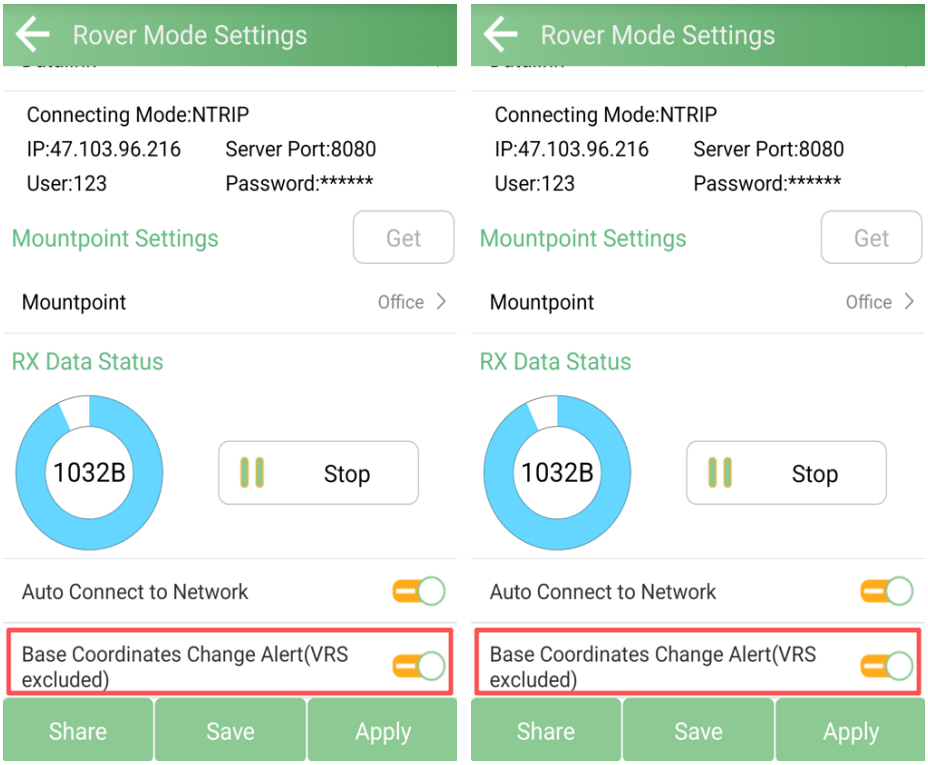
Note:

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

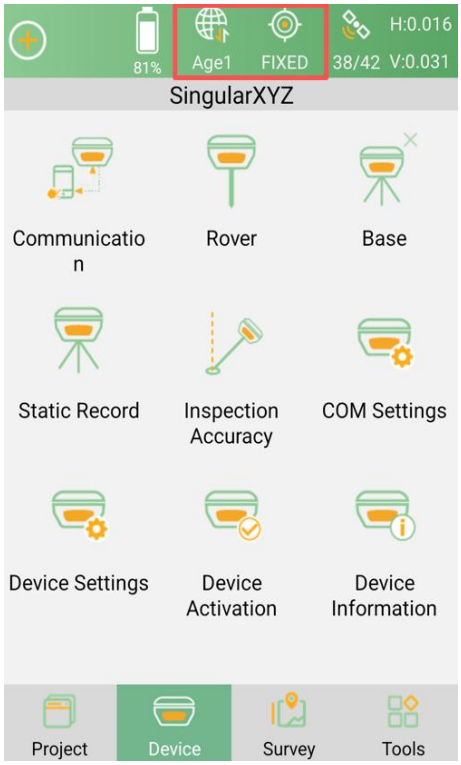
Auto connect to network: When this option is opened, SingularPad will connect to network automatically so that user don't need to click start to connect network.



***Base Coordinates Change Alert*: SingularPad will alert when you connect with different base station. When you are using VRS, please don't turn this on.**

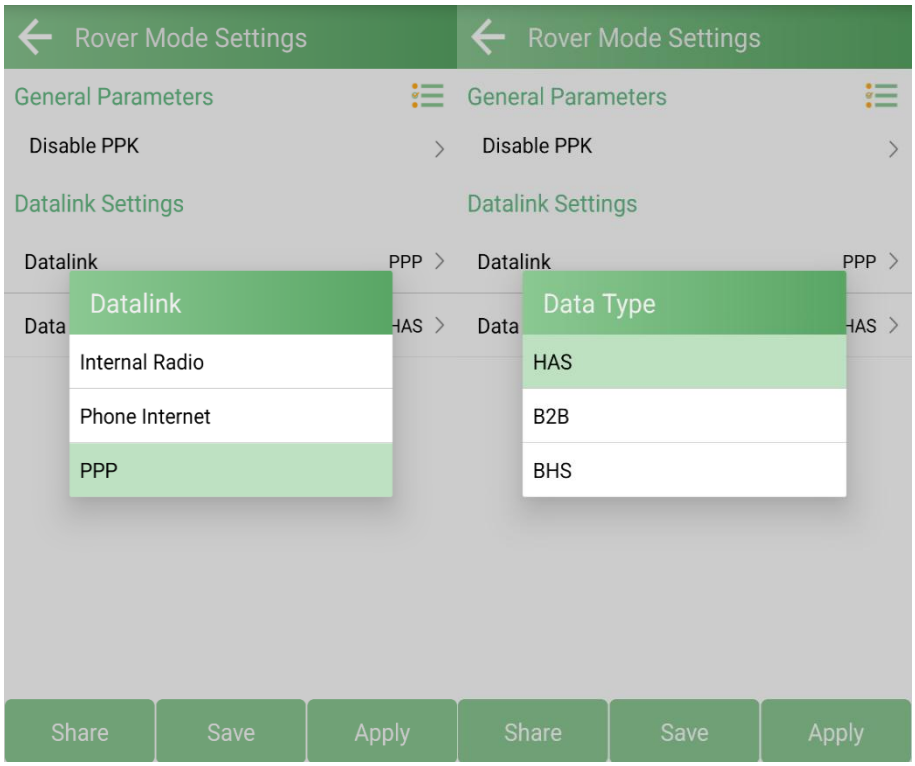


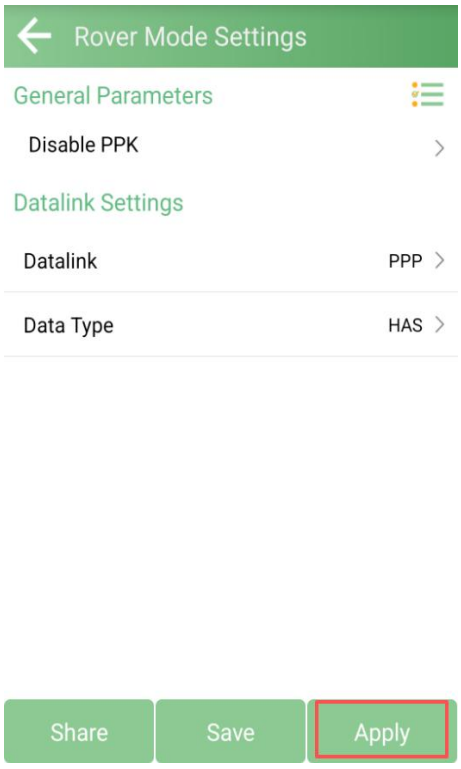
Click ***Apply*** to start the rover mode. After completing the configuration, please check the RTK status in the top status bar. Once the status changes to **"FIXED"** and the differential delay "**Age**" is within the range of 1-2 seconds, you have obtained reliable centimeter-level RTK positioning.



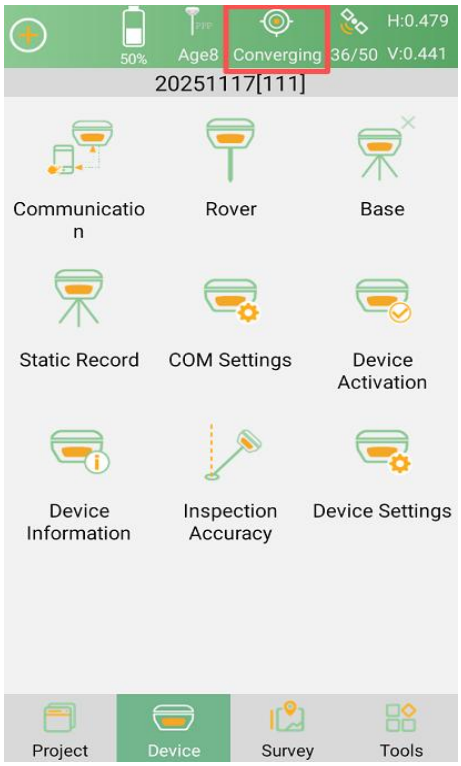
2.6.3 PPP Mode

Enter ***Device*** >>> ***Rover***, select ***Datalink*** as ***PPP***, and you can choose ***Data Type*** as HAS, B2B, BHS, then click ***Apply***.

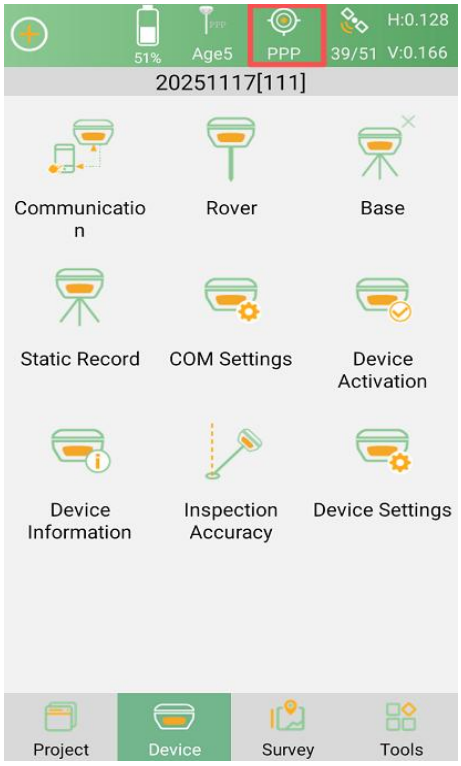




After configuration, the PPP mode will take around 10 minutes converging to typical accuracy. You can see the positioning state in the top status bar will change and remain in **Converging** for around 10 minutes.



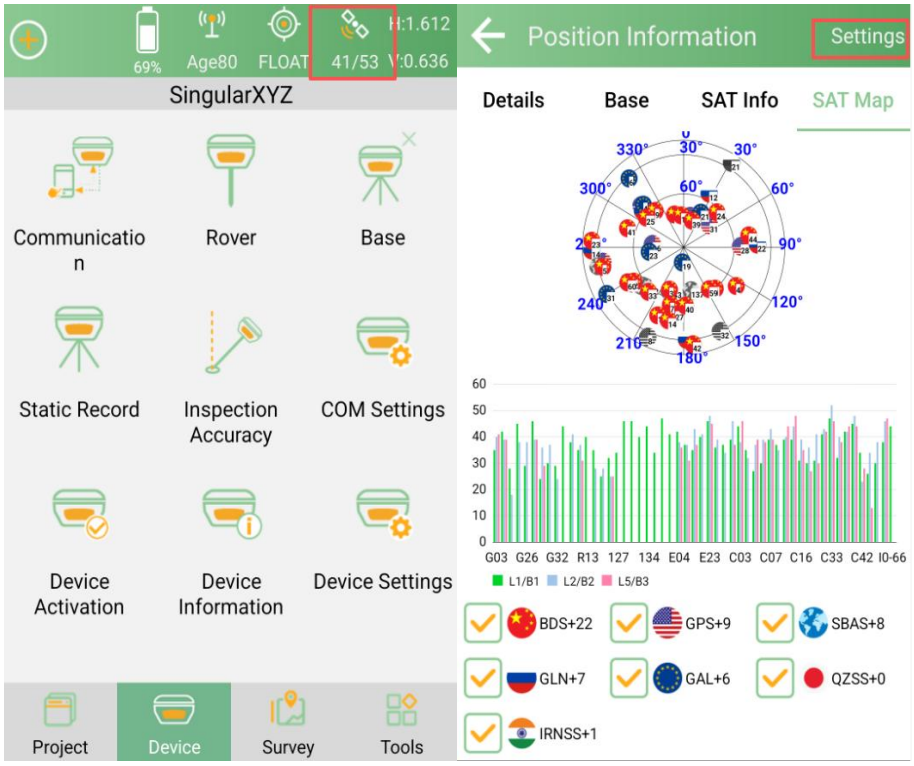
After the positioning state changes to **PPP** mode, you can then conduct surveying tasks.

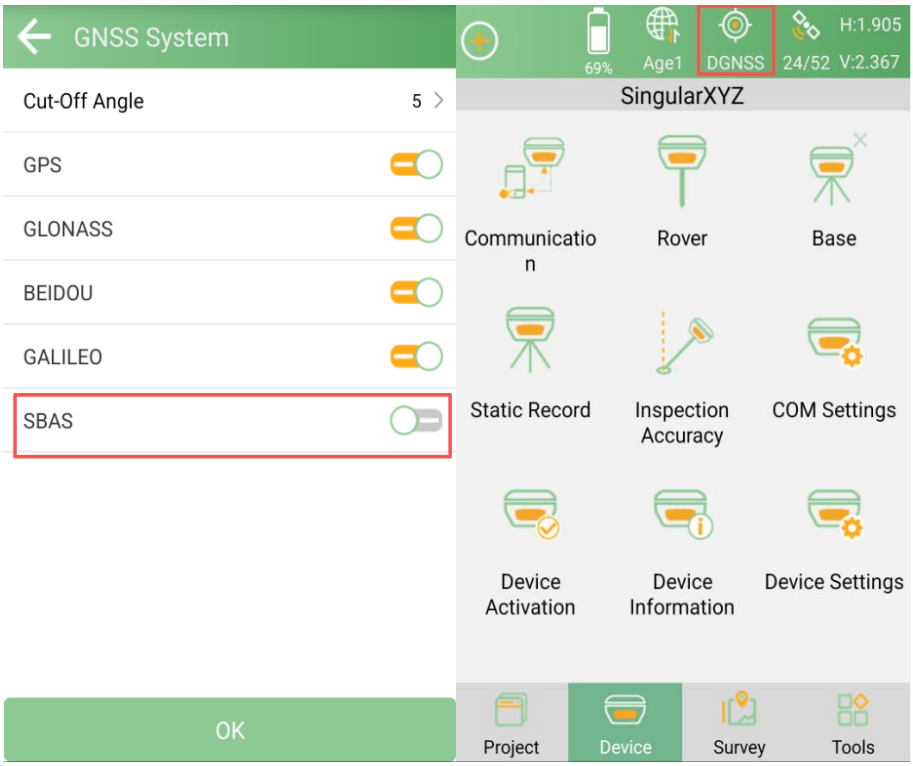


2.6.4 SBAS Mode

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

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




GNSS System
Cut-Off Angle
5
GPS
GLONASS
BEIDOU
GALILEO
SBAS
OK
69%
Age1
DGNSS
H:1.905
24/52 V:2.367
SingularXYZ
Communicatio n
Rover
Base
Static Record
Inspection Accuracy
COM Settings
Device Activation
Device Information
Device Settings
Project
Device
Survey
Tools

3 RTK SURVEY – FIELD DATA COLLECT

This section describes 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 Top Status Bar Introduction

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

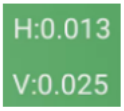
RTK Solution Status	Description
	Horus is receiving RTK corrections stably and obtaining a Fixed RTK solution with centimeter-level accuracy.
	Single-point satellite positioning without receiving RTK correction data. The accuracy is around meter-level.
	Horus receives corrections from the Base/CORS, but due to obstructions or magnetic field interference the signal reception is not very stable and the accuracy is sub-meter level.

Note:

*If you are using radio mode communication and the location status displays "**AUTONOMOUS**," this is likely because the radio parameter settings of the Base station and the Rover are inconsistent. Please go back and check the parameter settings to ensure that the channel, protocol, and baud rate used by the Base station and the Rover are the same.*

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

Age means the time since the last differential data was received.
When connecting to a CORS account for measurement work, please ensure the "Age" is within the range of 1-2.
When using the radio mode for measurement work, please ensure the "Age" is within the range of 2-5.
A high "Age" will result in poor measurement point accuracy.



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

Note:

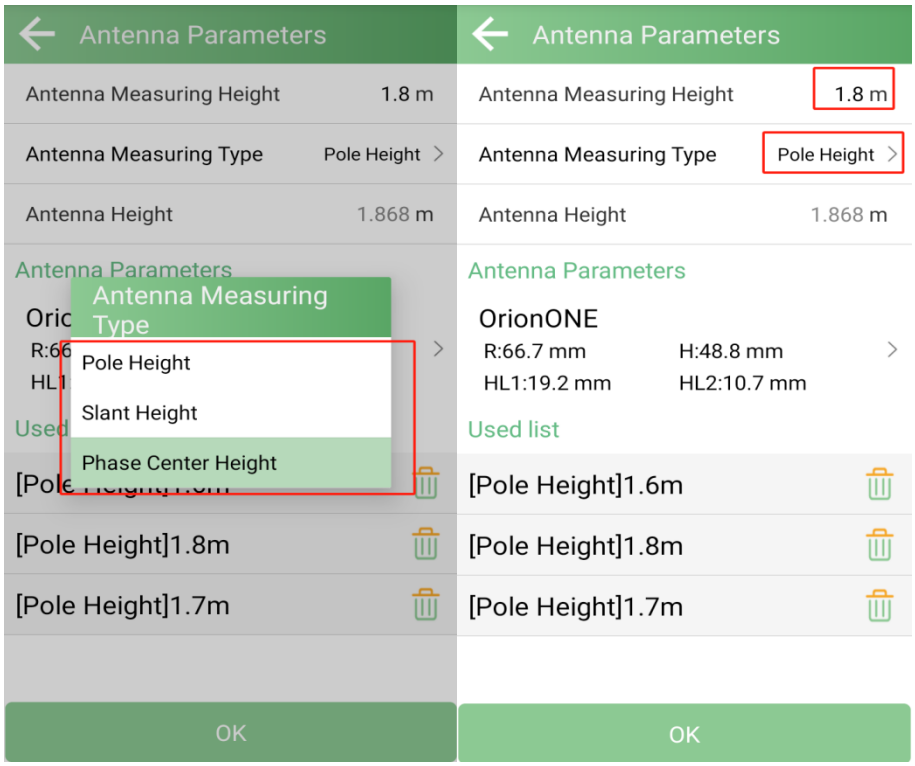
If you connect the device but the software shows 0 satellites being detected, this is most likely because the device is not activated. Please refer to section ***2.4 About Device Registration for details****.*

3.2 Point Survey

In the Survey interface, click ***Point Survey*** and enter point name, code and antenna height, then click  to measure a point.

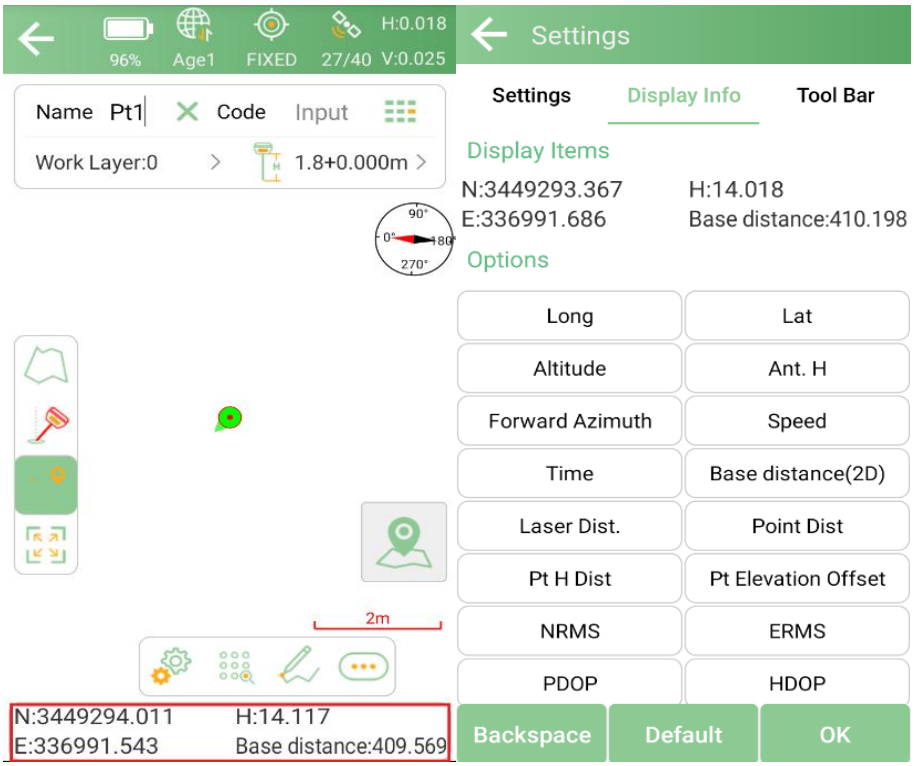
Note:

Our software supports 3 antenna measuring types. please refer to ***chapter 2.6.1 Internal Radio Mode*** *for details.*

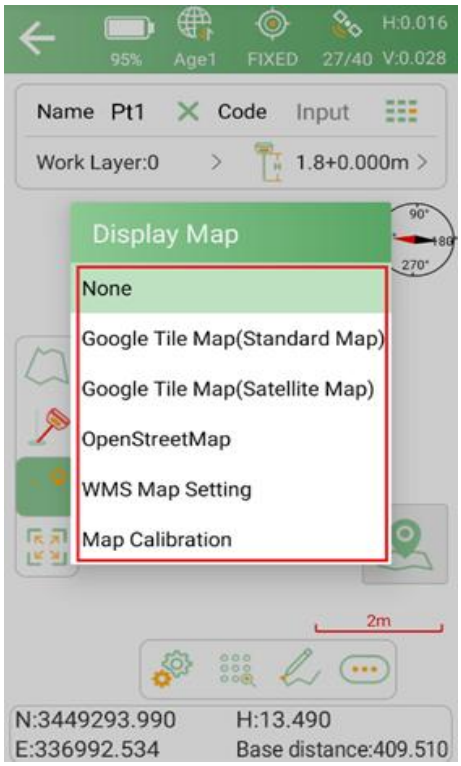


Pole Height: Typically, select the Antenna Measuring Type as Pole Height and enter the height of your centering pole.

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



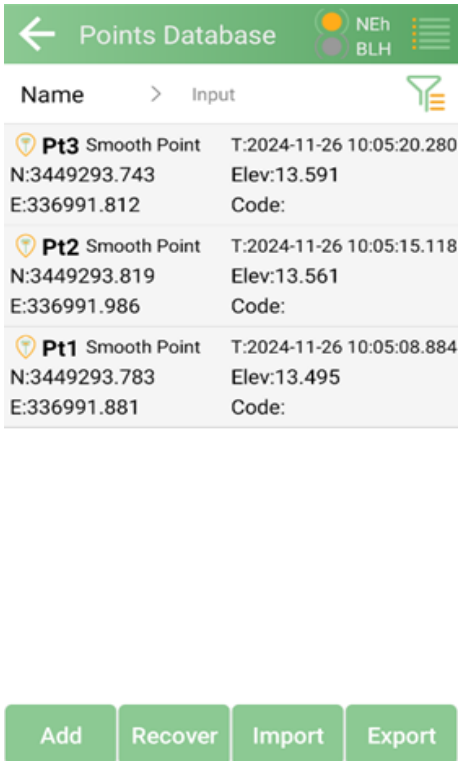
• Click  to select different map types or do map calibration. SingularPad supports Google Map (Standard Map/Satellite Map), OpenStreetMap and WMS Map.



- Click  to jump to map center.

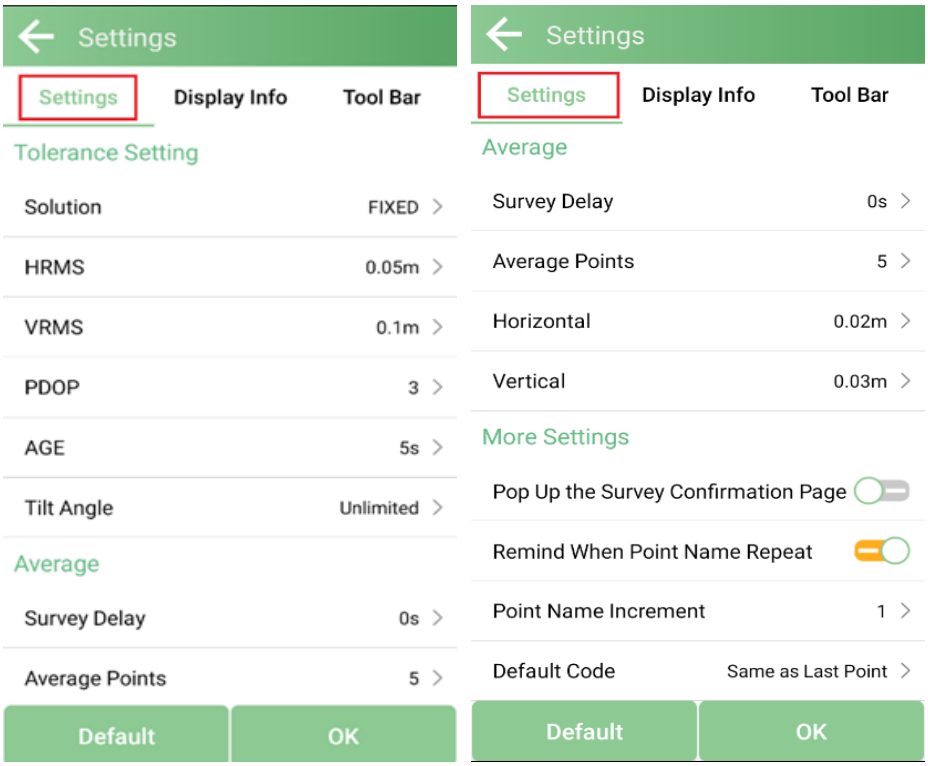
- Click  to show the all points on the interface.

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

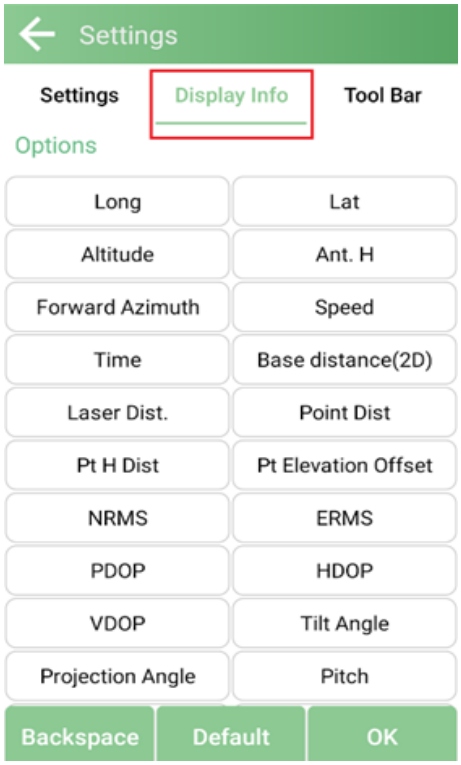


- Click  to enter Settings interface

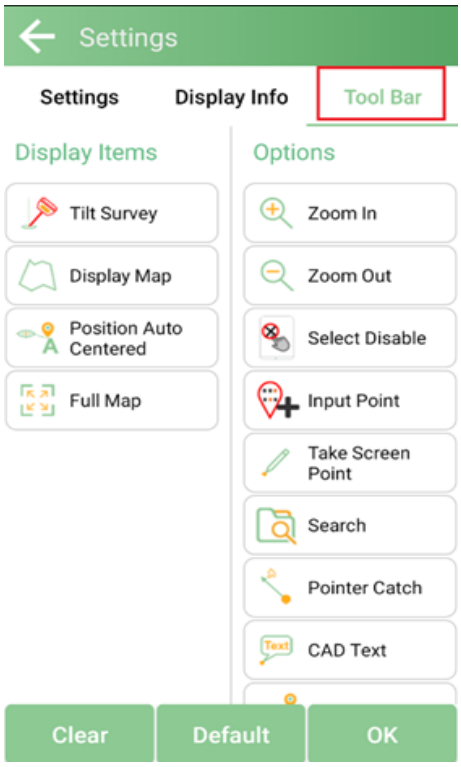
In ***Settings*** interface, you can modify ***Tolerance Setting*** such as solution limit, HRMS limit, VRMS limit and etc. and modify ***Smooth*** parameters and configure ***Settings*** options.



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



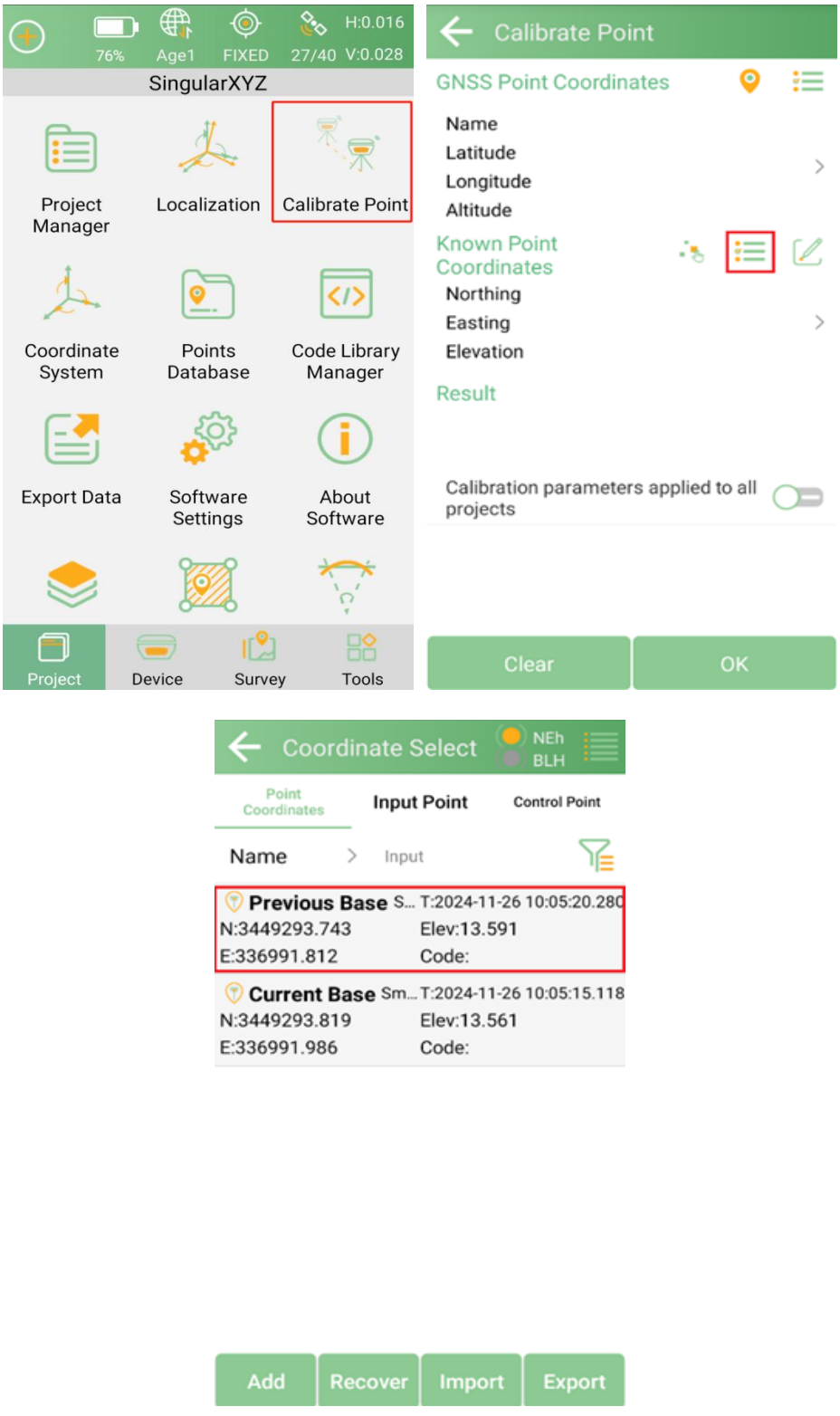
In ***Tool Bar*** interface, you can add or delete options that displayed on the point survey interface. You can customize the interface layout to suit your usage habits.



3.3 Calibrate Point

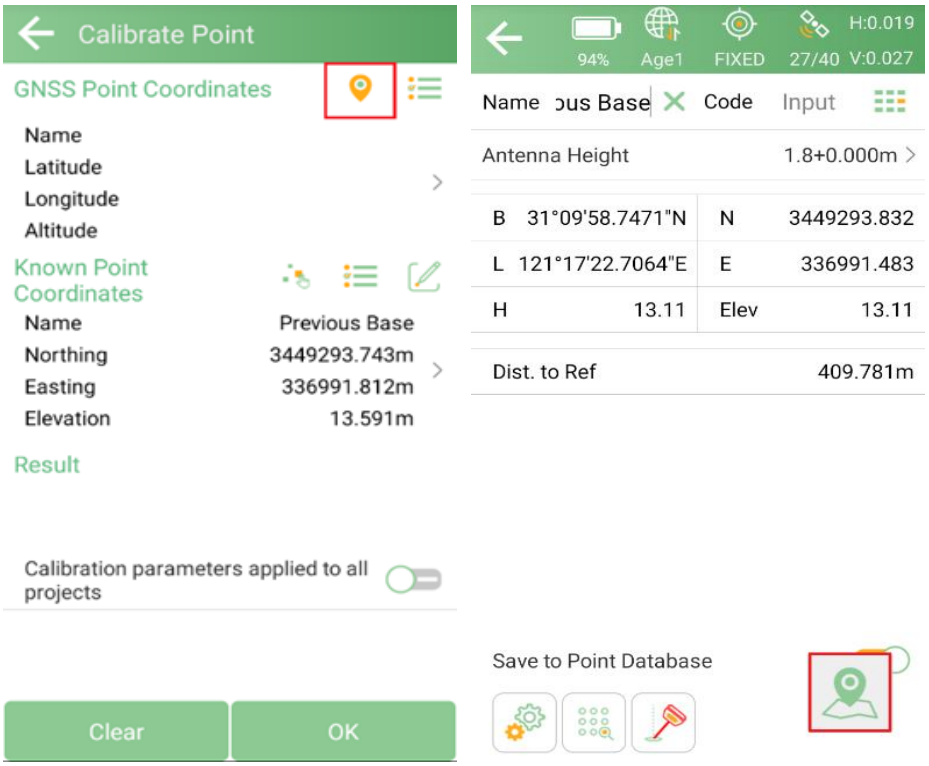
When changing the position of the base station, there will be offsets between surveying points base on different base stations. Users can use the Calibrate Point to calibrate the offset.

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***.

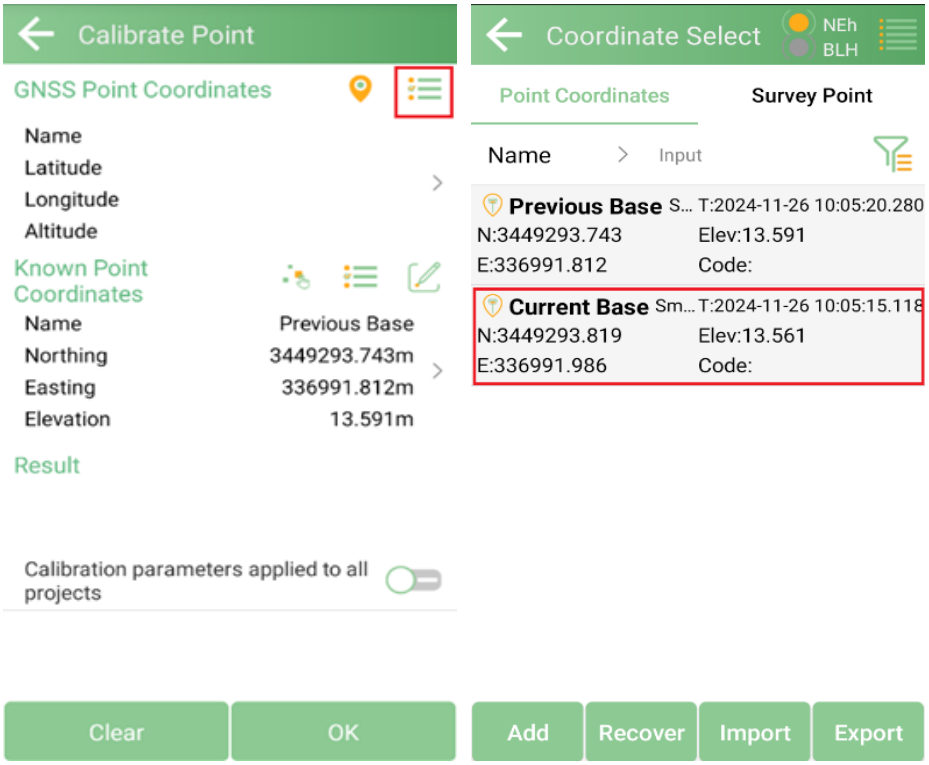


For the GNSS Point Coordinates, you can click the surveying icon to measure under the current base directly.

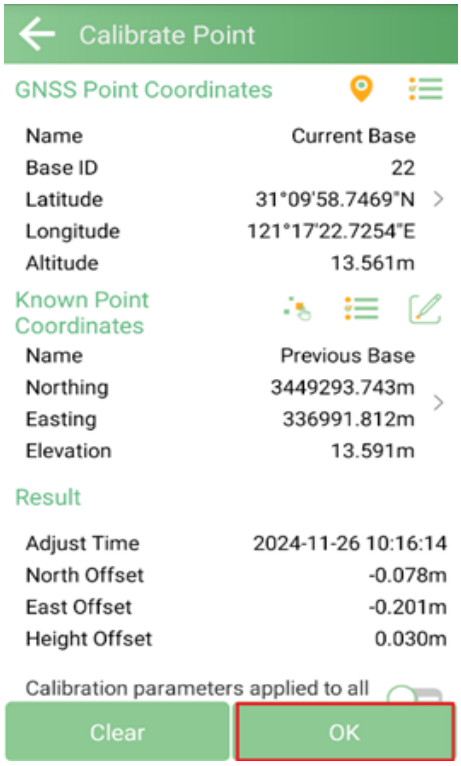
Note: *Please confirm the RTK status is FIXED.*



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



Then click ***OK*** to complete the Calibrate Point.



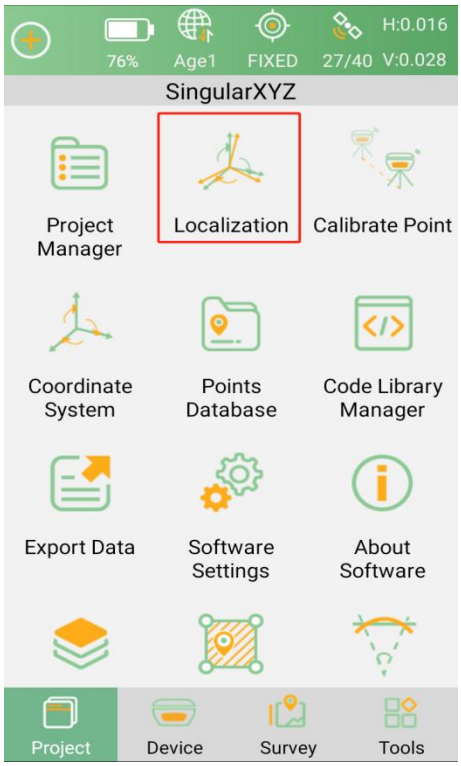
3.4 Localization

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

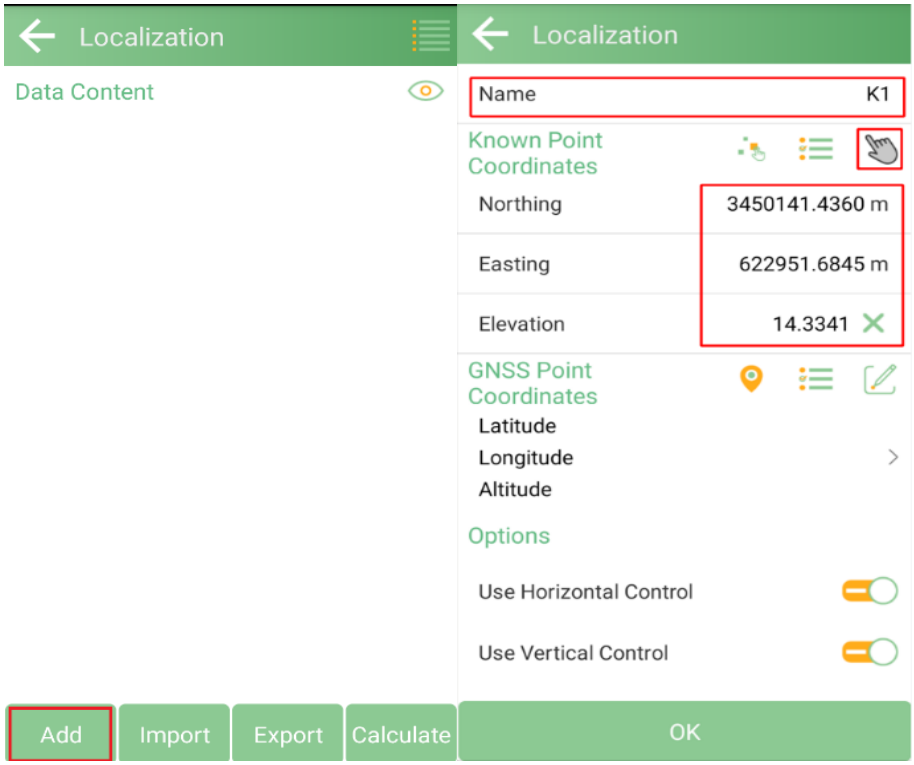
Go to ***Project*** >>> ***Localization***, add at least 3 pairs of points for the Localization.

Note:

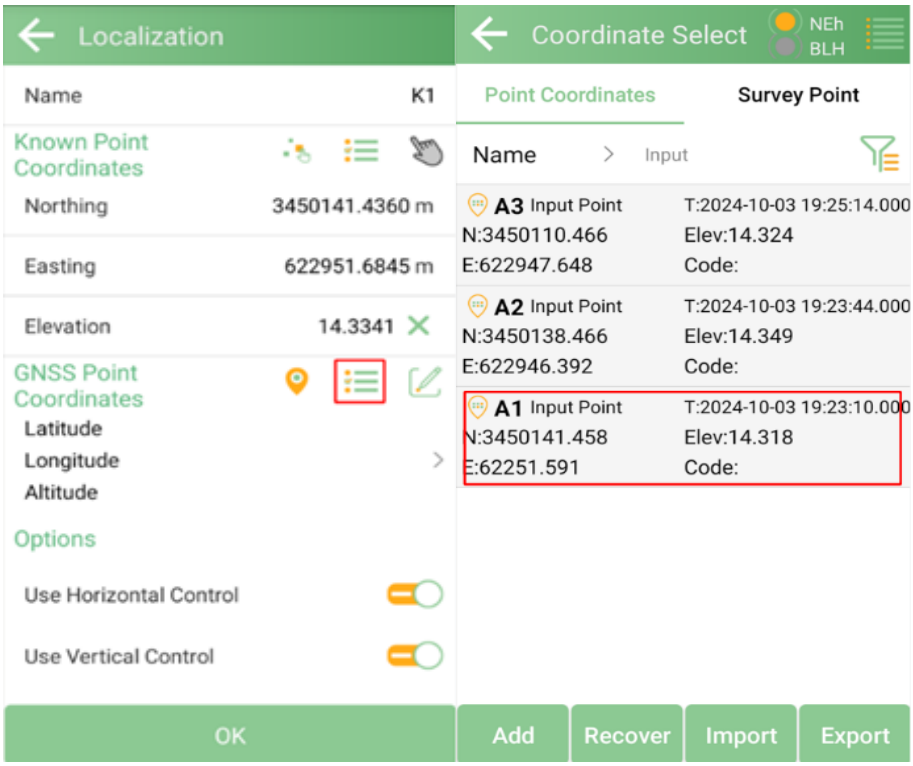
A pair of points are the known local coordinates and the surveying coordinates of the same point.

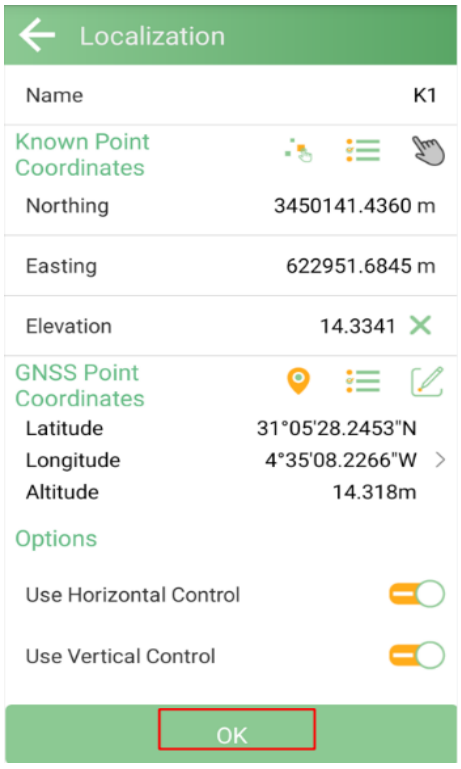


Click ***Add*** to add the corresponding pairs. Input the ***Known Point Coordinates***.

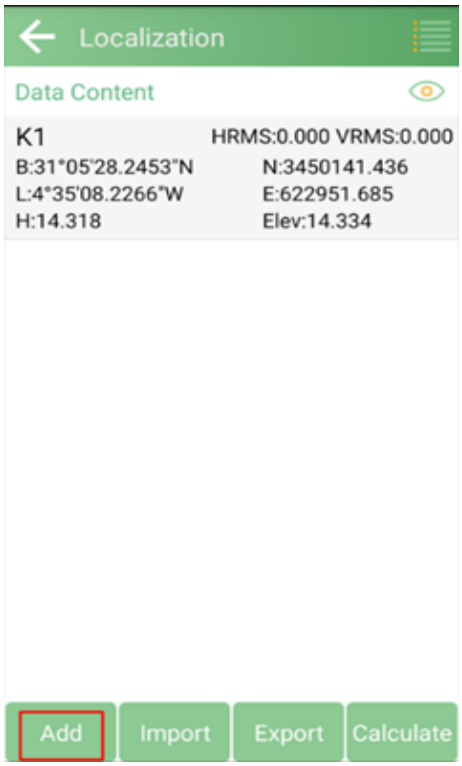


Then select the corresponding GNSS coordinates of the known point.

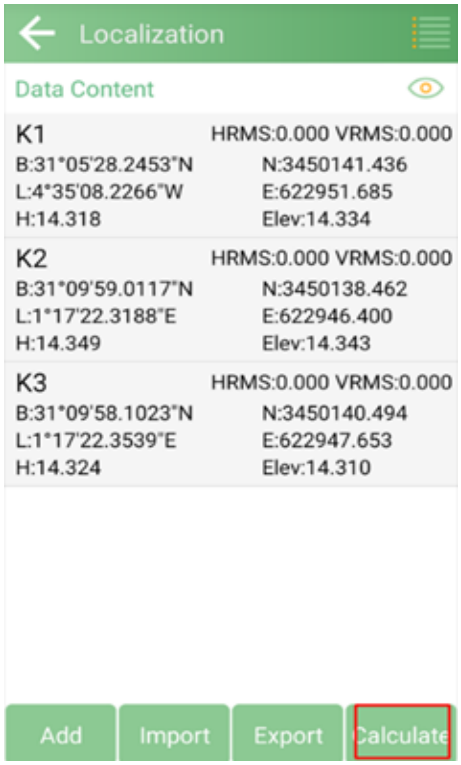




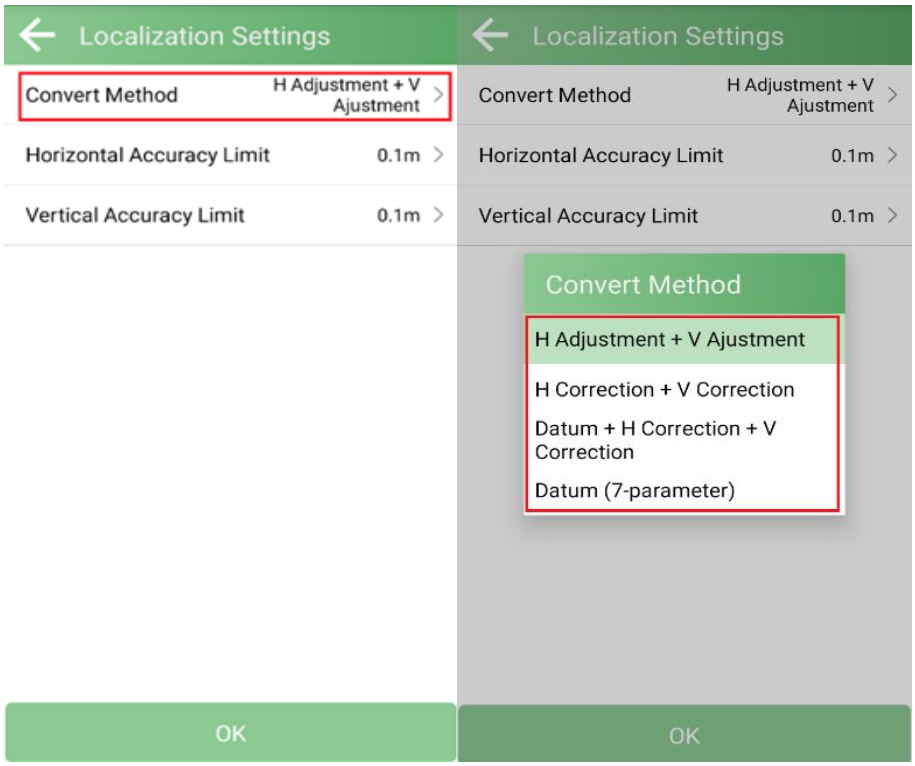
Add the remaining point pairs in sequence. You can also enter the known point in point database in advance and select the input points.

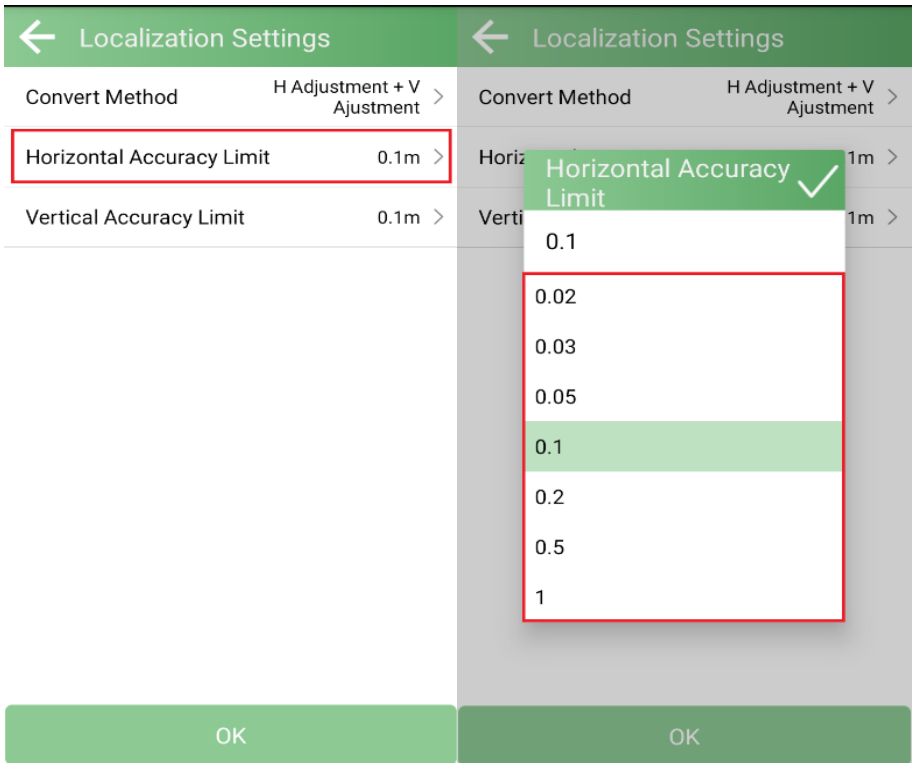


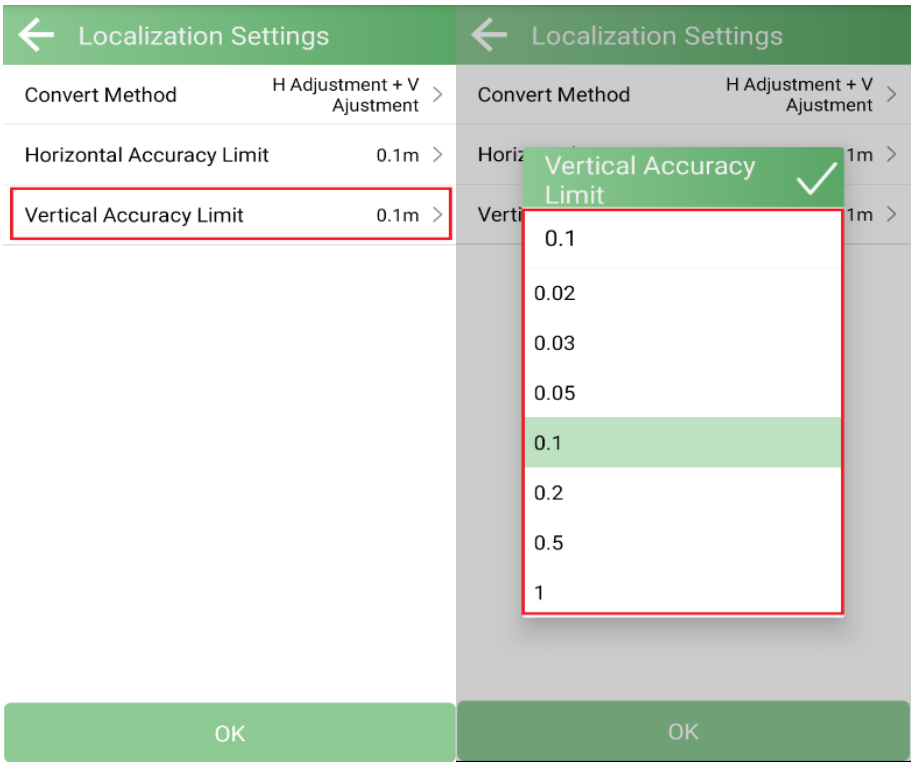
After adding all the point pairs, click ***Calculate***.

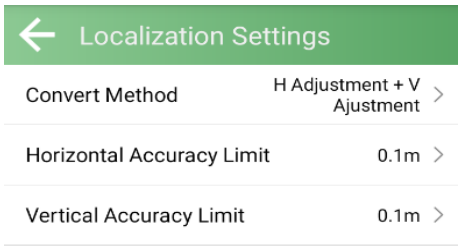


Select the convert method and the accuracy limit according to your project requirements.

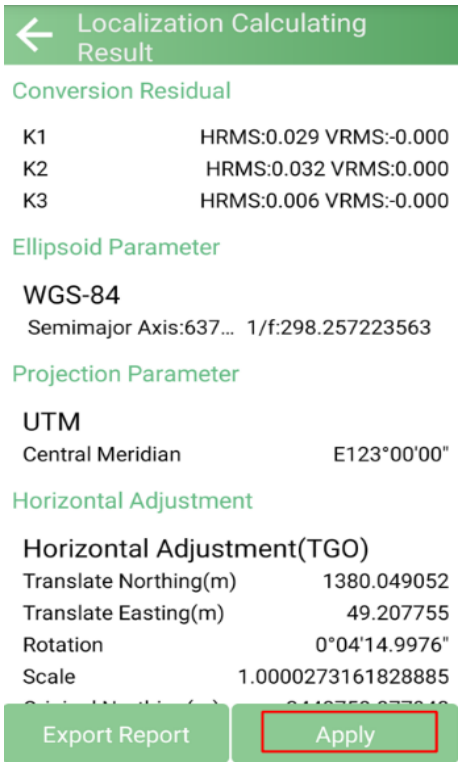

Localization Settings
Convert Method
H Adjustment + V Ajustment
Horizontal Accuracy Limit
0.1m
Vertical Accuracy Limit
0.1m
OK
Localization Settings
Convert Method
H Adjustment + V Ajustment
Horizontal Accuracy Limit
0.1m
Vertical Accuracy Limit
0.1m
Convert Method
H Adjustment + V Ajustment
H Correction + V Correction
Datum + H Correction + V Correction
Datum (7-parameter)
OK


Localization Settings
Convert Method
H Adjustment + V Ajustment
Horizontal Accuracy Limit
0.1m
Vertical Accuracy Limit
0.1m
OK
Localization Settings
Convert Method
H Adjustment + V Ajustment
Horizontal Accuracy Limit
0.1
0.02
0.03
0.05
0.1
0.2
0.5
1
OK



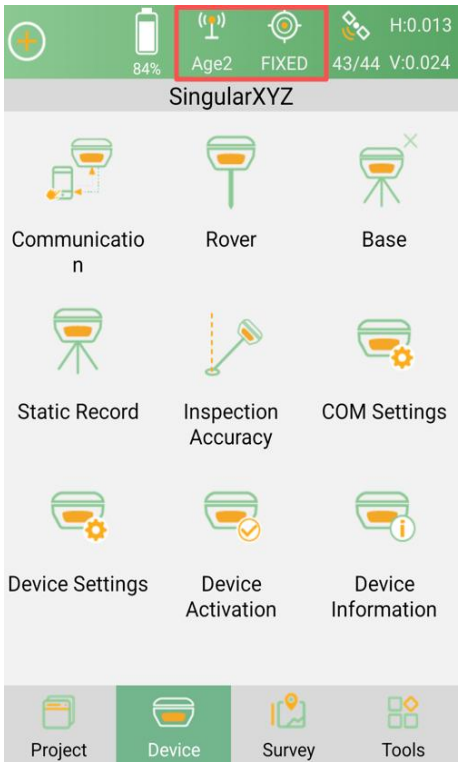


You can click Export Report to save the projected coordinate system parameters. Click ***Apply*** to apply the localization.



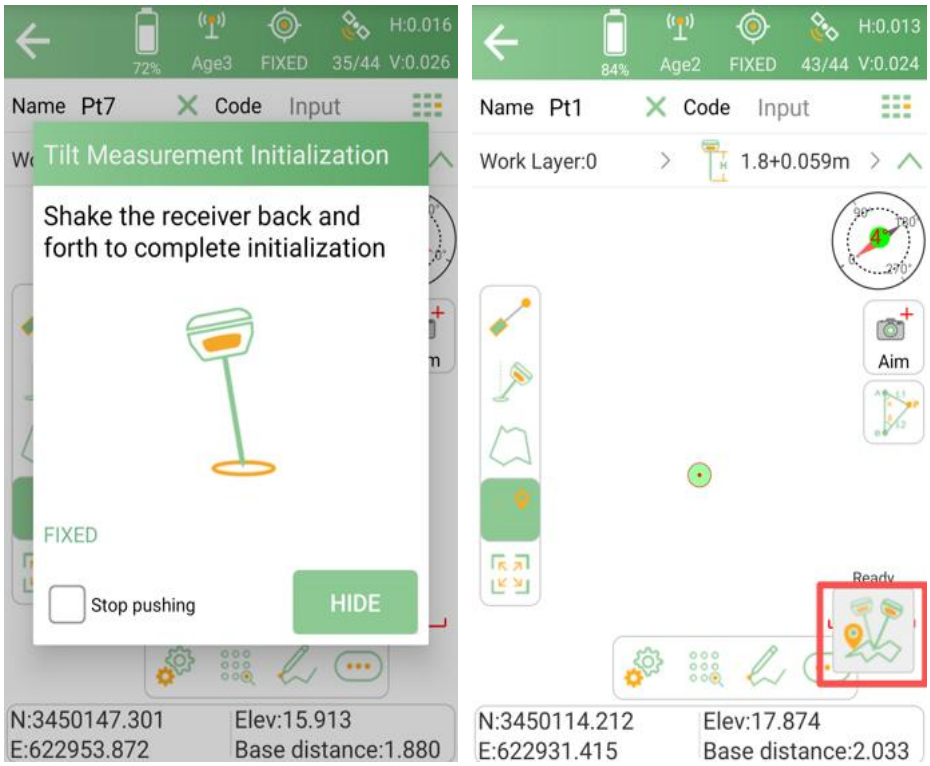
3.5 *Laser Survey*

Connect Horus receiver to SingularPad software via Bluetooth and ensure a fixed RTK solution is achieved.



Before performing laser surveying, you need to complete IMU initialization of Horus according to the software prompts. When the survey status icon shows ***Ready***, the accuracy of the laser surveying meets the requirements.

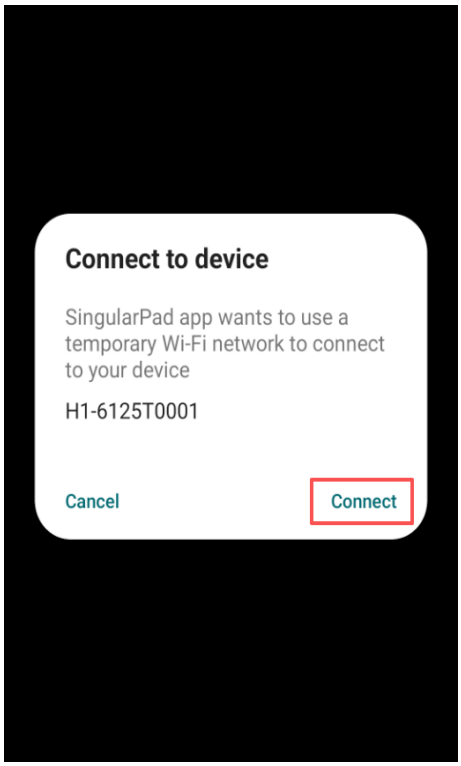
Tips: *Laser surveying is based on IMU, so shake it more times than usual to ensure that the IMU is initialized successfully.*

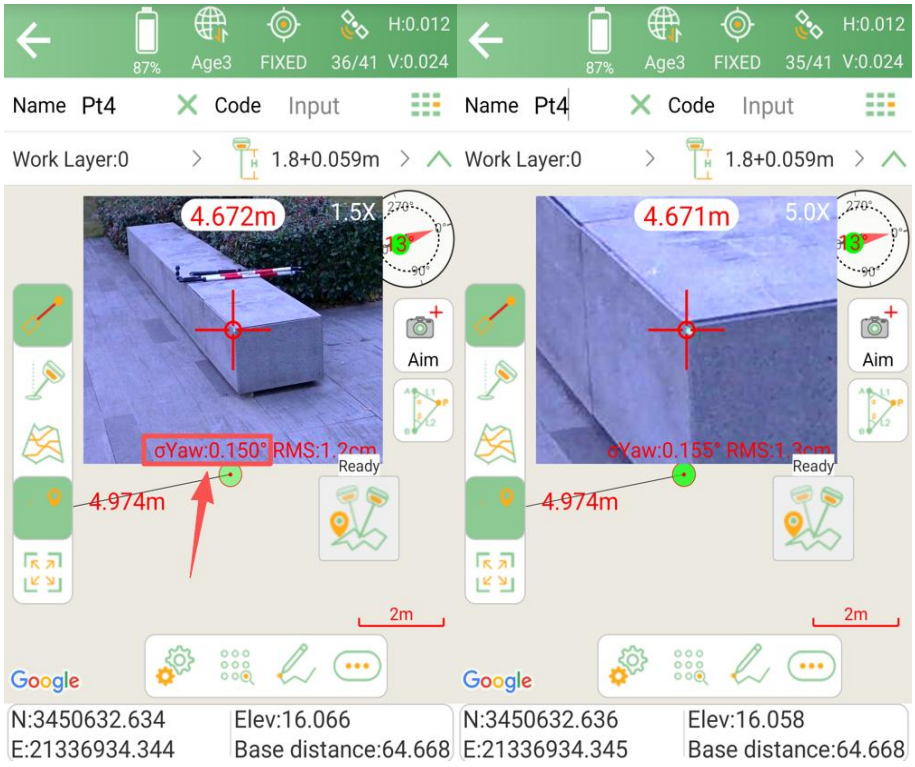


Turn on the laser surveying function in the Point Survey interface. After you click the Aim icon, the controller will automatically connect to the device's Wi-Fi. Then the Horus laser can be clearly seen, and the rear camera will been activated. And you can zoom in and out on the screen to change the camera magnification, with a maximum zoom level of 5x.

Once the camera is enabled, you will then see a red crosshair will appear in the image window, and a standard deviation value will be displayed at the bottom of the window. To ensure the accuracy, laser survey should be performed when the standard deviation is less than 0.2. If the standard deviation exceeds 0.2, it is recommended to hold the vertical centering pole and walk a few steps, then stop and check if the standard deviation has decreased.

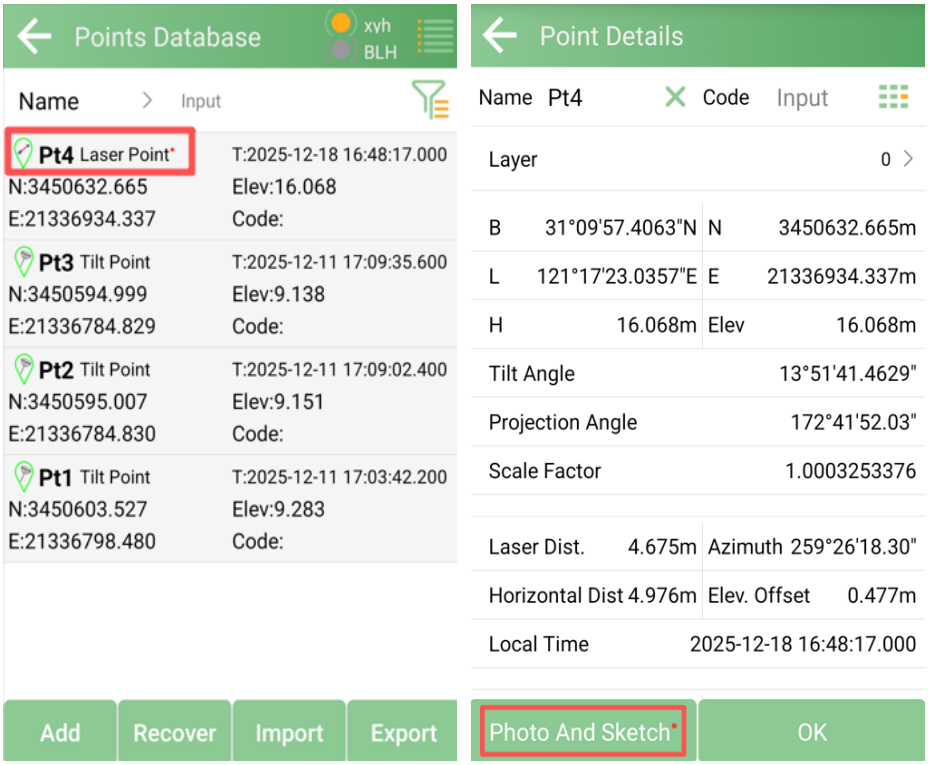

H:0.013
84%
Age2
FIXED
41/45 V:0.025
Name Pt1
Code
Input
Work Layer:0
1.8+0.059m
Aim
Ready
N:3450113.582
E:622931.466
Elev:17.852
Base distance:1.401


Connect to device
SingularPad app wants to use a temporary Wi-Fi network to connect to your device
H1-6125T0001
Cancel
Connect


H:0.012
87%
Age3
FIXED
36/41 V:0.024
Name Pt4
Code
Input
Work Layer:0
1.8+0.059m
4.672m
1.5X
Aim
oYaw:0.150° RMS:1.2cm
Ready
4.974m
2m
Google
N:3450632.634
E:21336934.344
Elev:16.066
Base distance:64.668
H:0.012
87%
Age3
FIXED
35/41 V:0.024
Name Pt4
Code
Input
Work Layer:0
1.8+0.059m
4.671m
5.0X
Aim
oYaw:0.155° RMS:1.3cm
Ready
4.974m
2m
Google
N:3450632.636
E:21336934.345
Elev:16.058
Base distance:64.668

Tips: *It is recommended to use a* ***bipod*** *for laser survey to reduce the shaking caused by human factors and lead to inaccurate precision.*

Now click the measure button and you can perform laser survey normally. Measured points using the laser can be viewed in the Points Database (Please refer to ***section 3.15 Point Database***). You can view the corresponding photo of that point in ***Photo and Sketch***, where annotations and markings can be added.

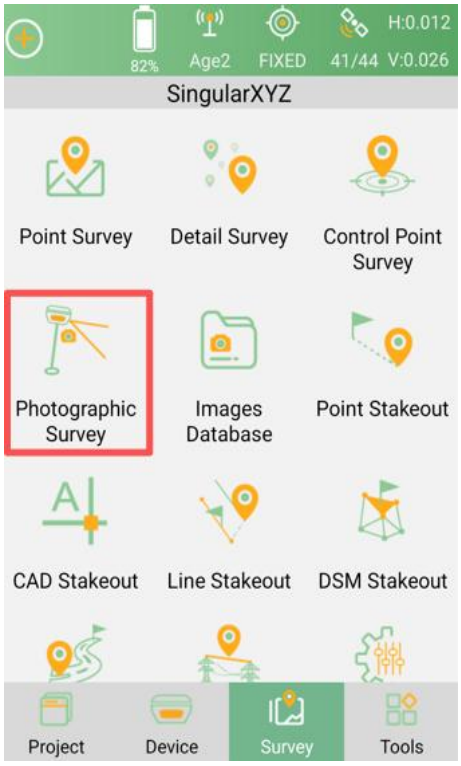


Tips: *The laser of Horus can reach a distance of about hundreds of meters, but it does not mean that effective measurement accuracy at those ranges. For optimal accuracy, laser surveying is recommended to use within approximately 10 meters.*

3.6 *Photographic Survey——Visual Survey*

Horus supports photogrammetric measurement with a centimeter-level accuracy. When the positioning status shows as FIXED and the Age value is around 1-4 seconds, you can start measuring.

Go to ***Survey*** >>>***Photographic Survey*** to enter the photogrammetry module.



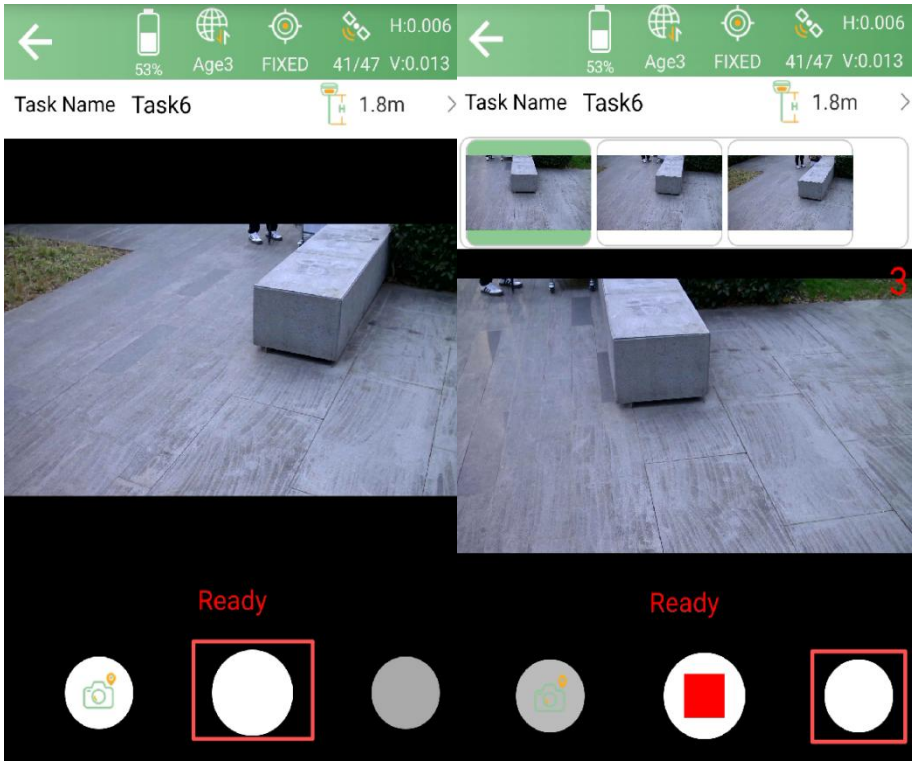
The **pole height** needs to be set before shooting begins. When "***Ready***" is displayed on the screen, you can tap the shutter button below to take pictures.

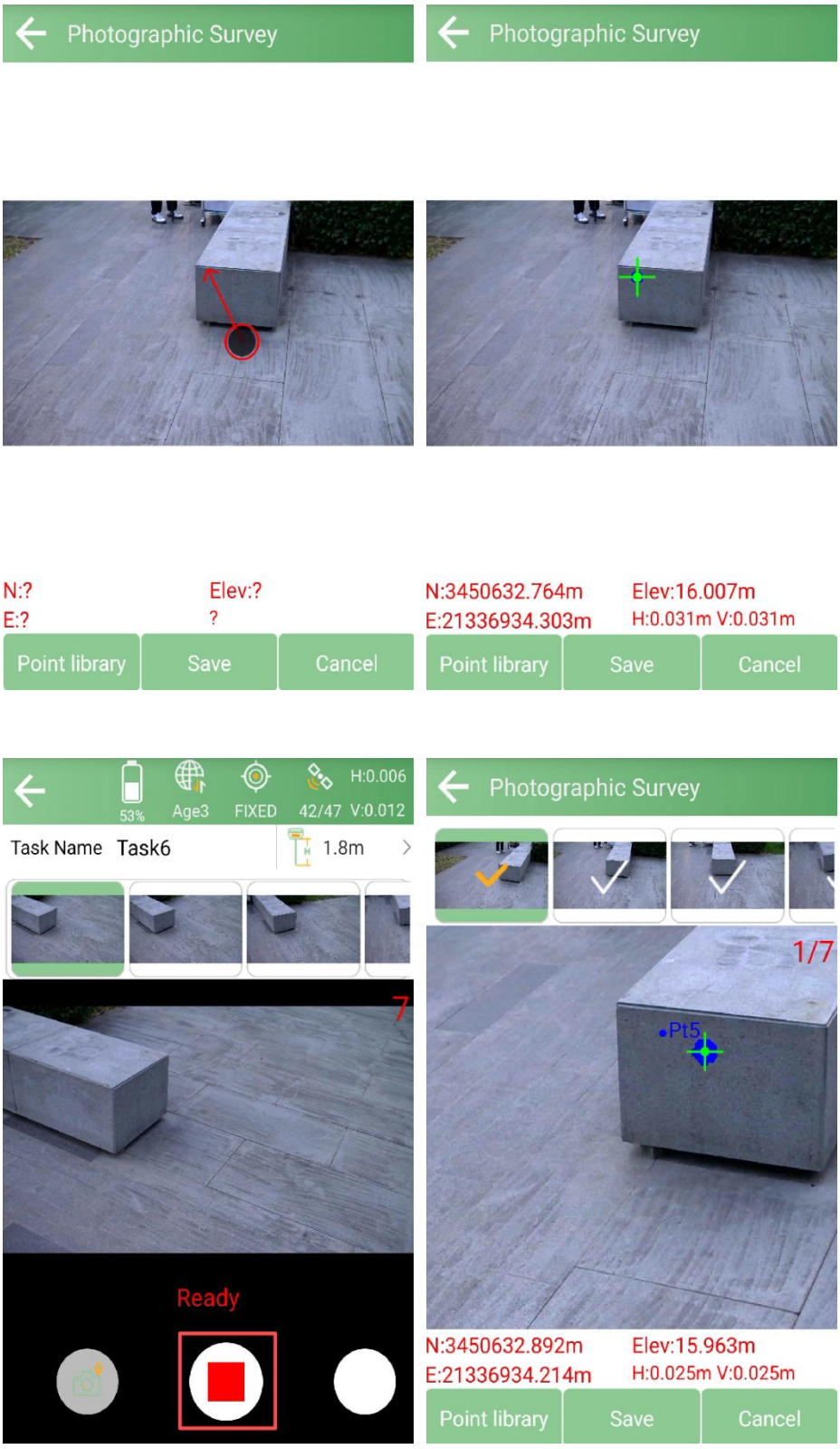
During image acquisition, you need to slowly move the device. The device will automatically take pictures, or you can manually take pictures by clicking the button to the right of the shutter button at the bottom of the screen.

After images are captured, you can drag the cursor on the screen to the point on

the image you want to measure, and the coordinates of that point will be displayed at the bottom of the screen. You can click ***Save*** to save the point.

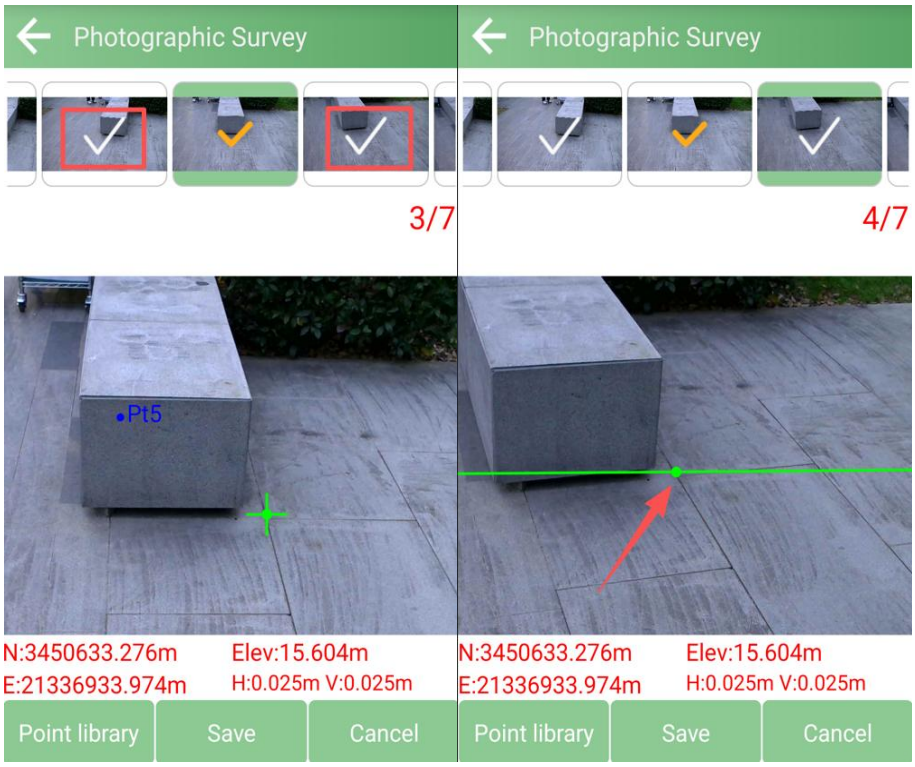
Once you have taken a sufficient number of pictures (at least five images are required), tap the shutter button again to stop taking pictures. The captured images will then be stored as a Task, and you can view the coordinates of points of interest within these pictures.



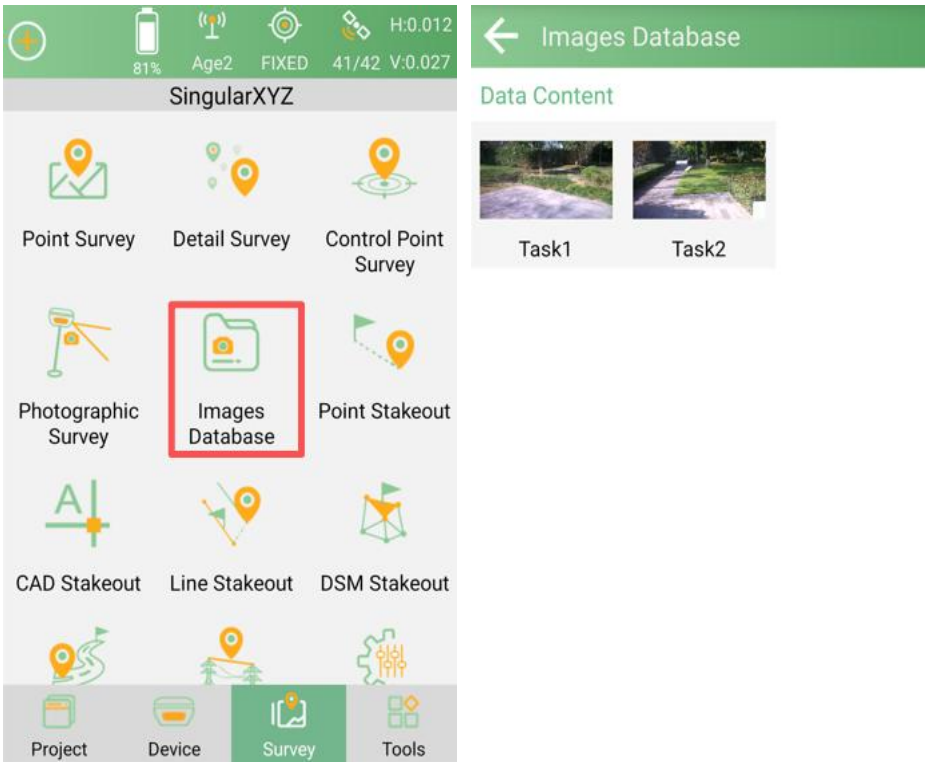


Additionally, other images marked with a "✓" indicate that the coordinates of that point are also present in that image.

When you need to select a point on another image, please click ***Cancel*** first to deselect the current point, then select a new point.



After the measurement is complete, you can also view the pictures you just took in ***Survey*** >>> ***Images Database***.



Note:

-When using the Horus photogrammetry module, please note the following guidelines:

1. Ensure the area to be measured is present in every captured image.

2. Do not move the receiver too quickly during image acquisition.

3. At least five images should be taken per task, capturing more images makes coordinate calculation easier.

4. Avoid moving people or objects within the camera's field of view.

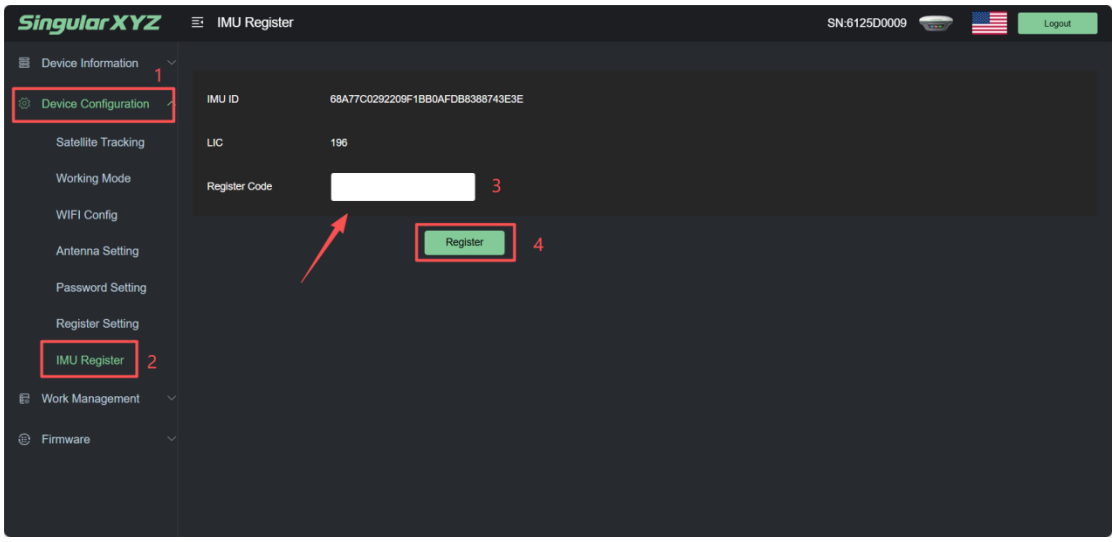
5. Areas without obvious feature points (including glass, water surfaces, or similar scenes) may not be measurable.

6. Photogrammetry cannot be performed under low-light conditions.

-If you encounter problems with the IMU or the camera function is unavailable during use, it's most likely because the IMU registration validity period has expired. In this case, you need to contact your sales representative to obtain a registration code. The registration steps are as follows:

Log in to the web page. (For details on the login process, please refer to section ***4.2 Static Data Download****.)*

Go to ***Device Configuration*** *>>>* ***IMU Register****, enter the registration code, and then click* ***Register****.*



3.7 Tilt Survey

The Horus GNSS receiver has 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 user's burden on centering pole at each measurement.

The tilt function option  will appear in each survey/stakeout function interface. You can click to turn this function on/off.

Tilt initialization is required when using it for the first time or when its calibration expires.

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

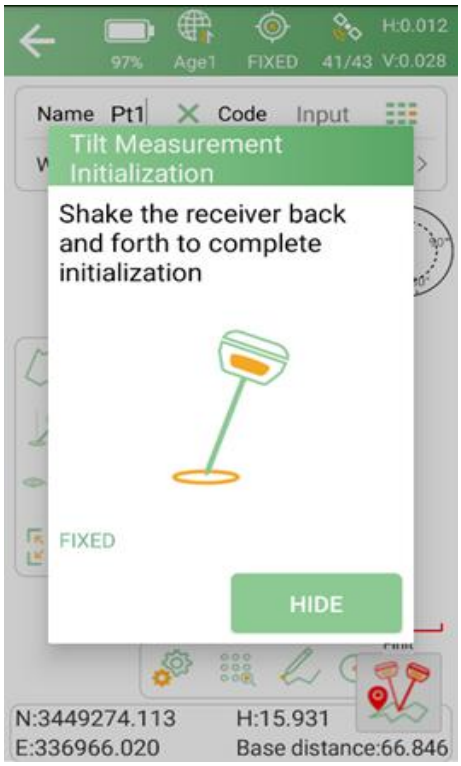
Open IMU: Go to ***Survey*** >>> ***Point Survey*** >> click the  button to open.

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

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

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

Note: *If the receiver is powered off or reset, it will need to be reinitialized.*



In survey interface, you can find the bubble 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 ±2.5cm.

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

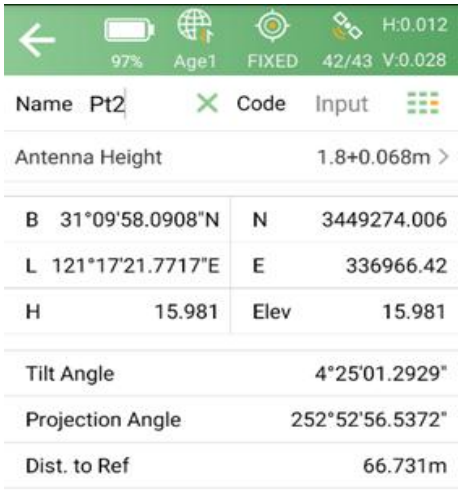
3.8 Detail Survey

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

In detail survey interface, both local coordinates and Latitude/Longitude will be displayed when measuring.

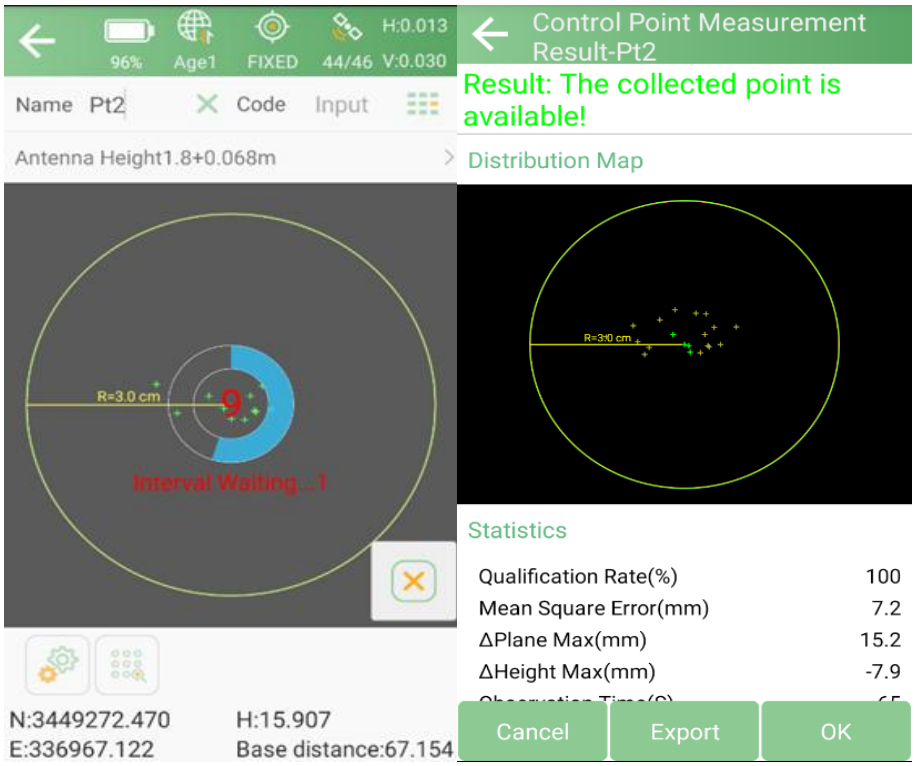
- Click  to start or stop collecting data
- Click  to set settings, display info and tool bar.
- Click to check point database; you can add note, info, arrow drawing and photo.
- Click  to open IMU to do tilt survey.

• Click  to open Fast Code Survey. You can input Remark and Code into it, then click the button that just created to start quick-collecting.



3.9 Control Point Survey

By measuring the coordinates of the same point multiple times and taking the average, you can get more accurate coordinates. This function is usually used to measure control points.



- Click  to start or stop collecting data.

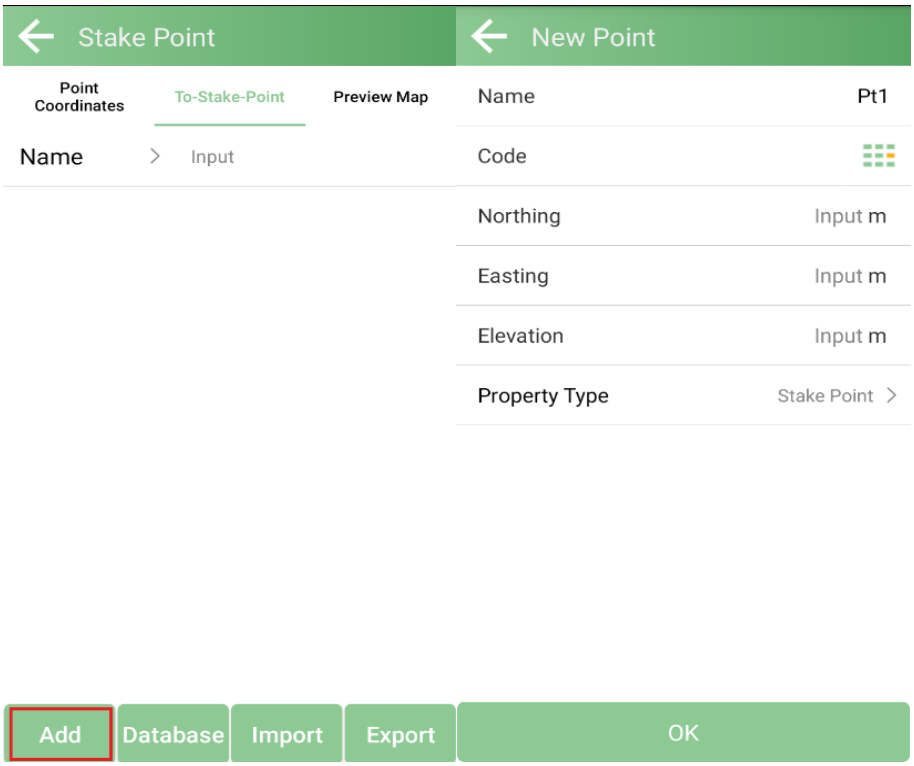
- Click  to set settings, display info and tool bar.

- Click  to check point database; you can add note, info, arrow drawing and photo.

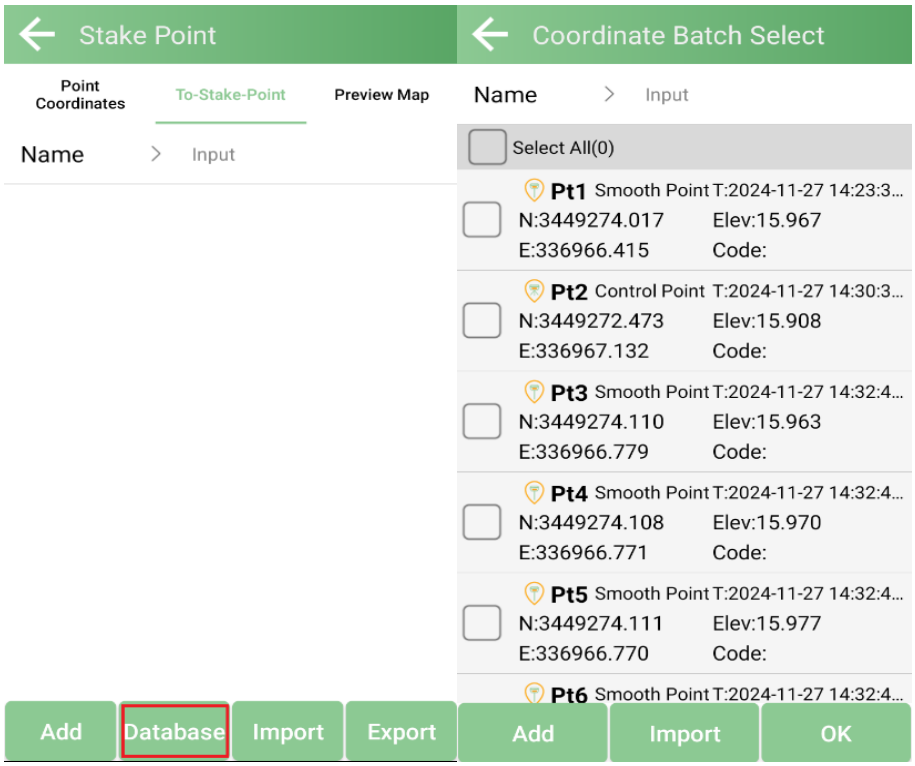
3.10 Point Stakeout

Go to ***Stake point*** interface, add or import the point coordinates you need to stake out, you can also click Button Library to select from the point database.

- Click ***Add*** to input coordinates

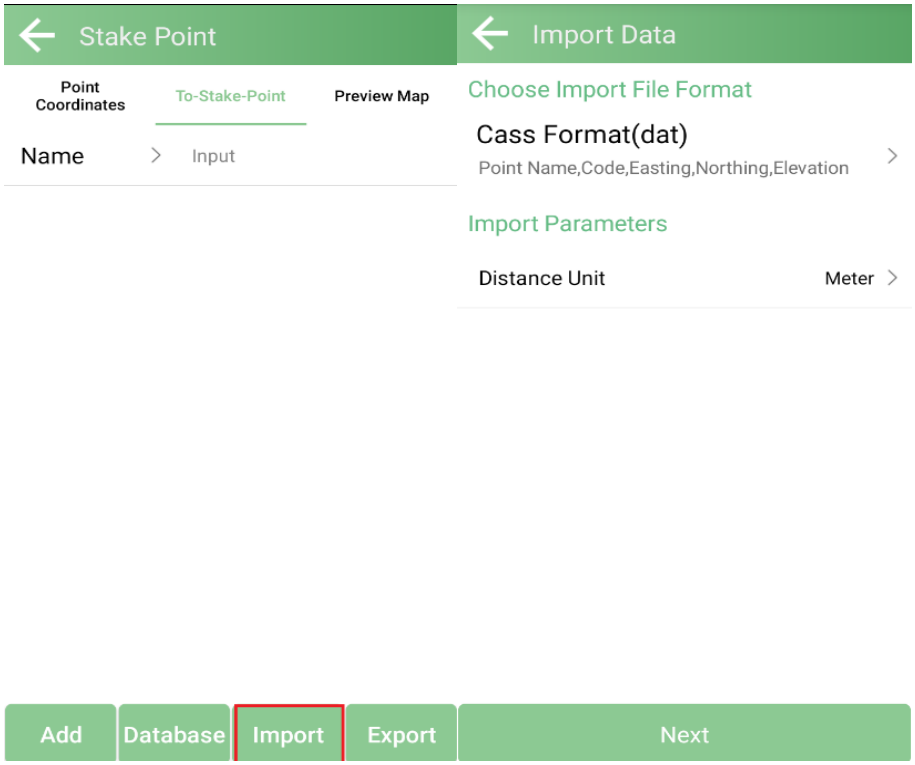


• Click ***Database*** to choose one.



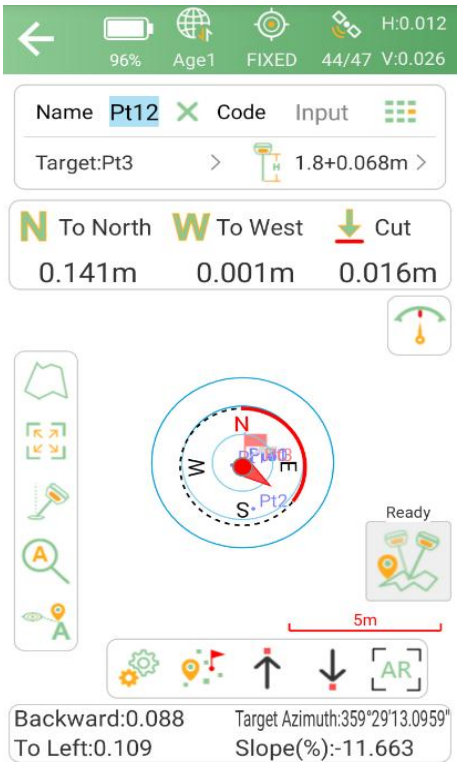
• Click ***Import*** to import point data in different file types. You can also define a

new format according to your needs.



Select a point to stake out. SingularPad provides a navigation map while staking out points/lines. The software alerts you when you approach the target point to the set range value.

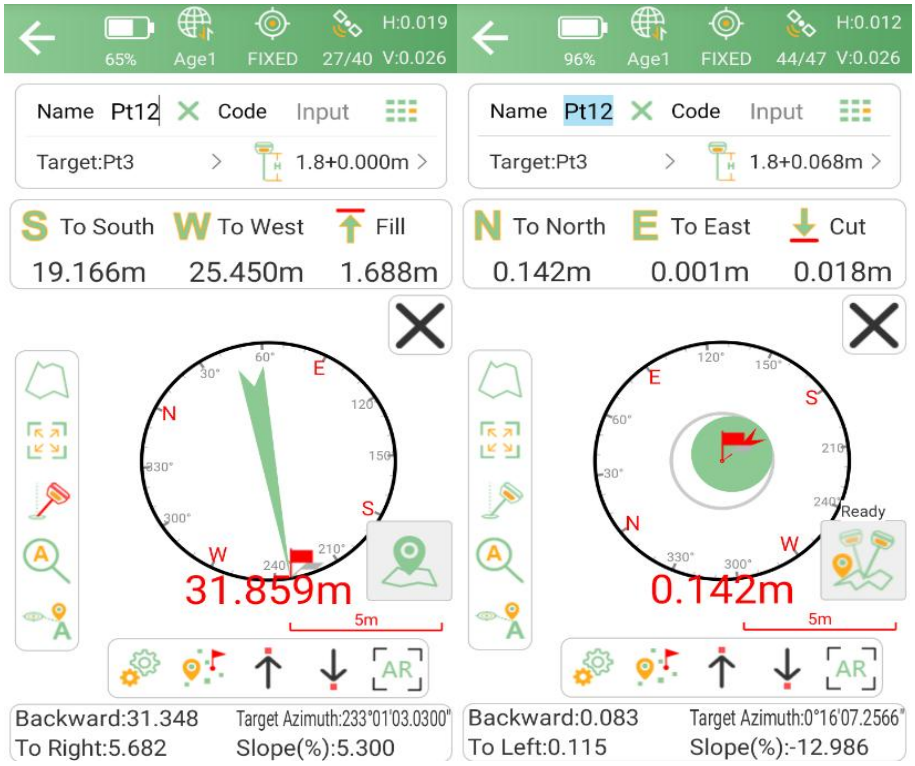
For Horus receivers, you can use the IMU stakeout feature. In IMU stakeout, you can turn on the IMU feature without keeping the receiver perpendicular to the ground. The maximum tilt angle is 60°.



There is a direction prompt on the floating window.

- Click  to start or stop stake points
- Click  to open or close IMU
- Click  to scale automatically to full map
- Click  to jump to current point
- Click  to jump to next point
- Click  to jump to previous point
- Click  to set stake out settings, display info and tool bar, you can edit the prompt range and range error

- Click  to open compass



3.11 *Visual AR Stakeout*

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

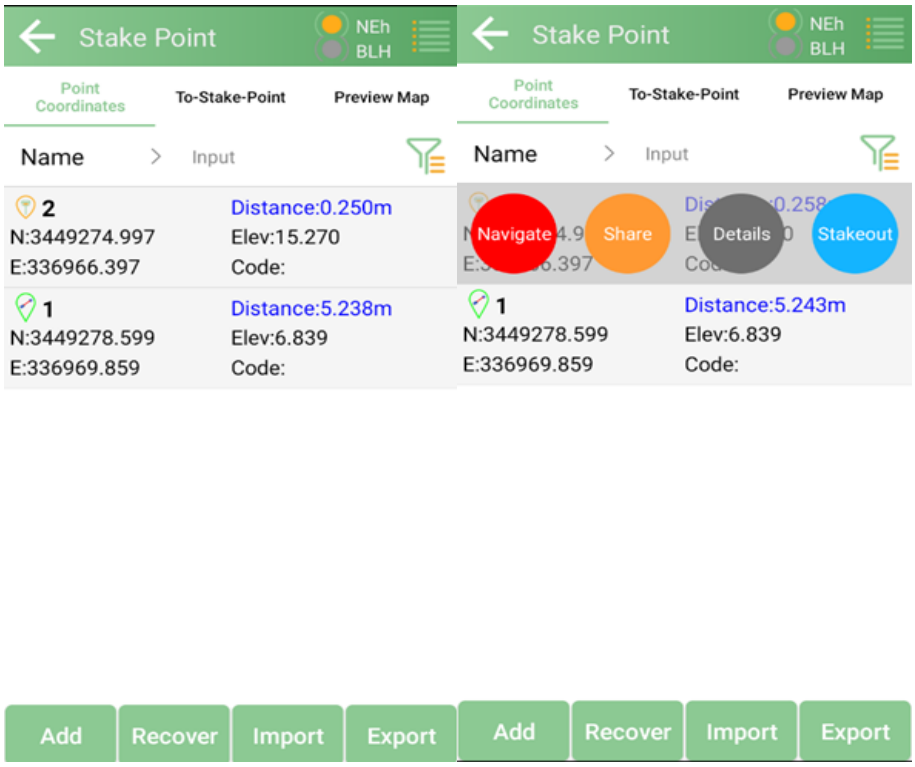
Get a fix solution: When using Visual AR Stakeout, you need to connect to Horus's Wi-Fi.

> If you are using CORS (using Phone Internet to obtain the network), please insert a SIM card into the controller instead of connecting the controller to Wi-Fi or Hot Spots.
>
> If you are using radio communication (no network required), no additional network configuration is needed.

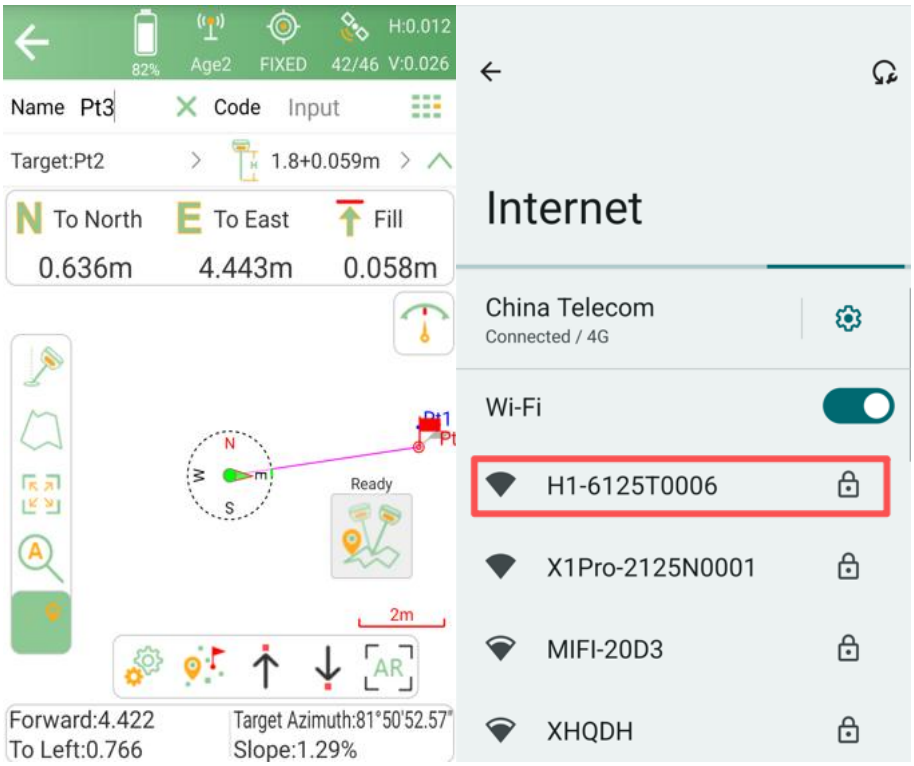
The AR stakeout function uses the Wi-Fi connection to transmit visual data.

Go to ***Survey >>> Stakeout Point***, you can import points (refer to the previous section), or select existing points, and then click ***Stakeout***.

After importing or entering stakeout points, enter the staking interface.

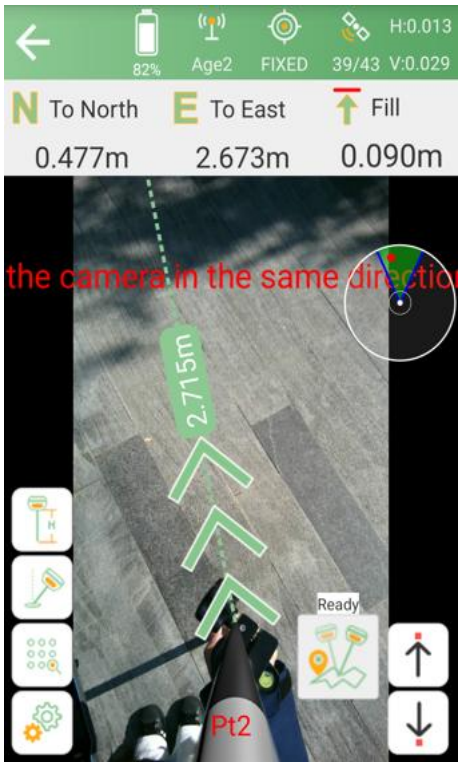


Then click the ***AR staking icon***, the controller will automatically connect to the Horus device's Wi-Fi. Then the Horus's rear camera will be activated.

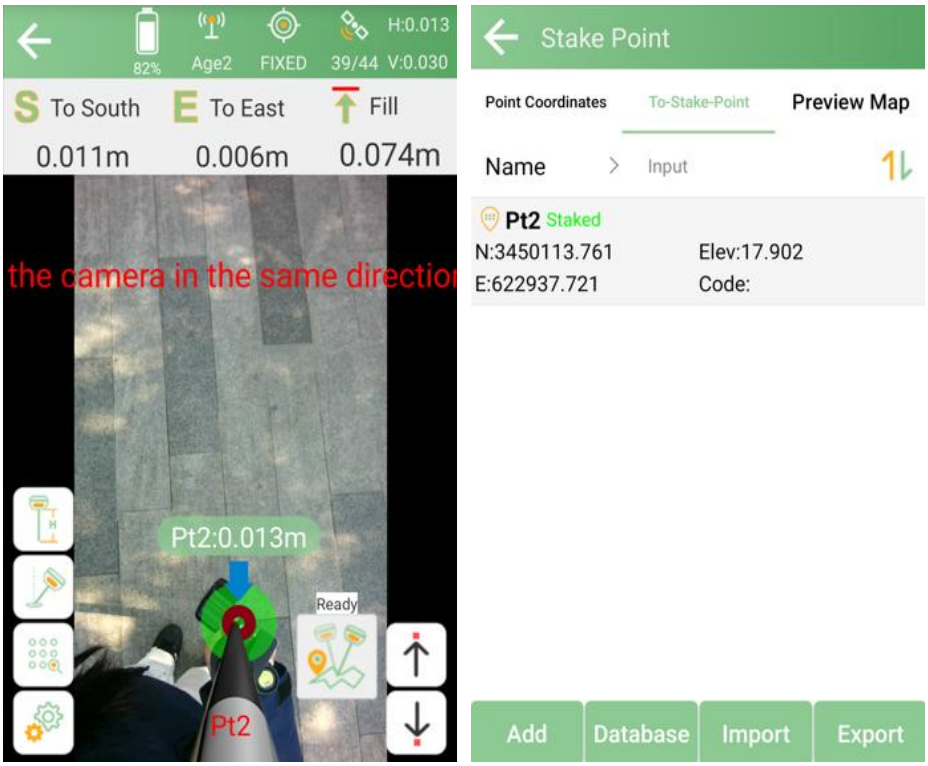


Follow the software prompts to ensure the receiver is facing backward. The rear camera will then be activated, and the software will display the specific location of the stakeout point overlaid on the camera view, providing AR guidance.

When you are within 3m of the stakeout point, the camera view will automatically switch from the rear camera to the bottom camera for better AR guidance.

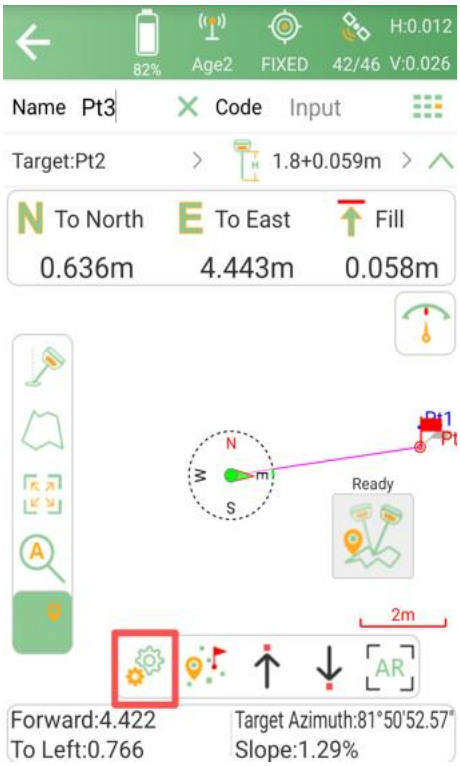


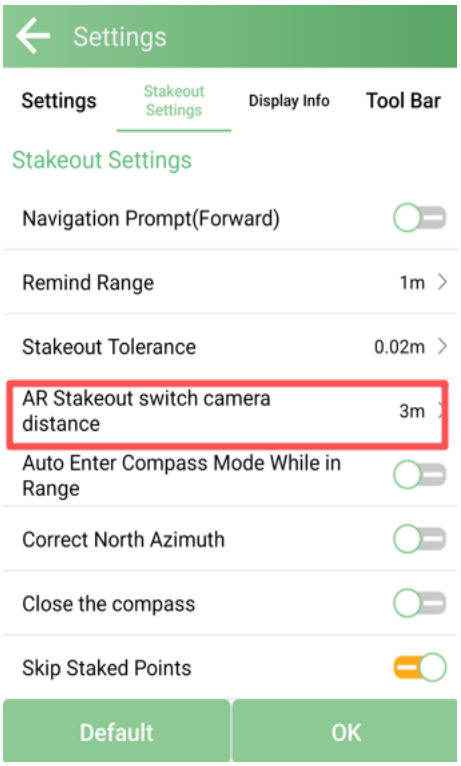
When you approach the point to be staked, the software will mark its location on the screen. At this time, align the tip of the pole with the position of the stakeout point. Then click the survey button to stake out.

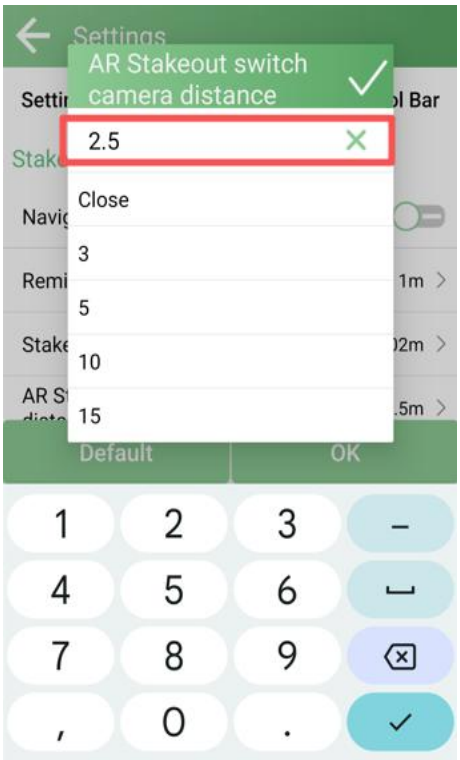


***Note**:*

*The distance at which the rear camera switches to the bottom camera can be manually adjusted. Go to **Stakeout Point**, click **Settings** >>> **Stakeout Settings** >>> **AR Stakeout switch camera distance**. You can choose a preset distance or add one manually. Click OK to apply the setting.*

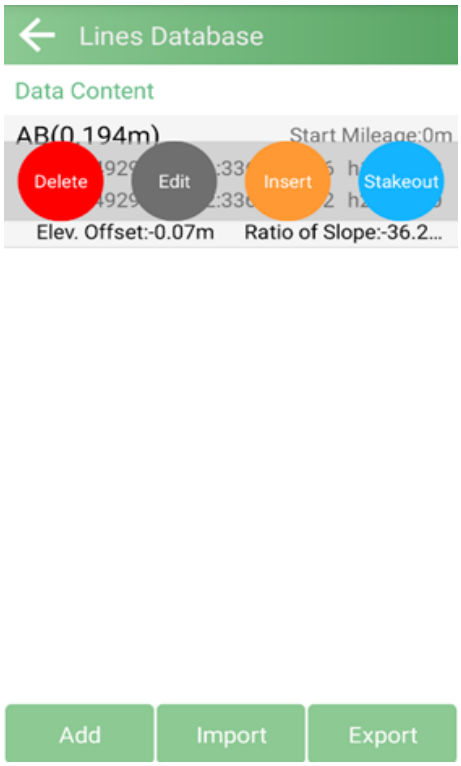






3.12 Line Stakeout

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



- Click Add to input line parameters

- Click Import to import point data in different file types. You can also define a new format according to your needs.

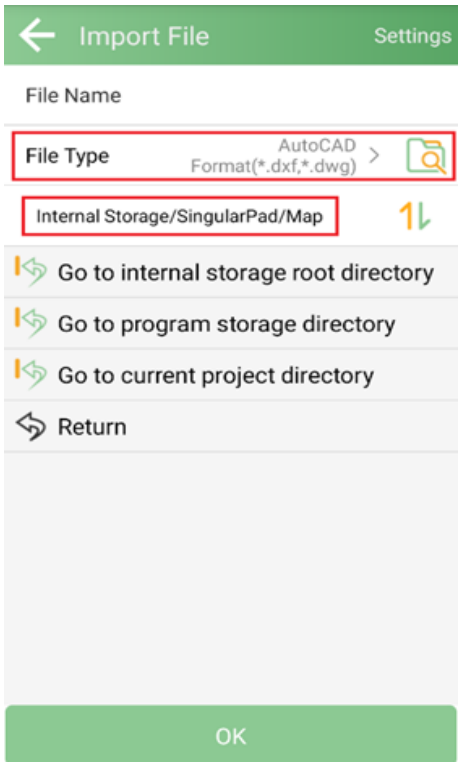
Choose a line to stakeout, set Offset, Cross-Section Slop and Stakeout by Pile-to-Pile Coordinate parameters.

- Click  to jump to next line
- Click  to jump to previous line

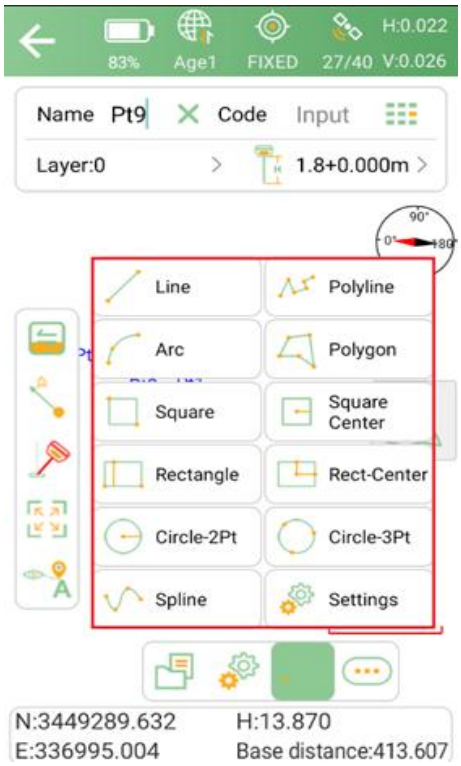
3.13 CAD Mapping and Stakeout

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

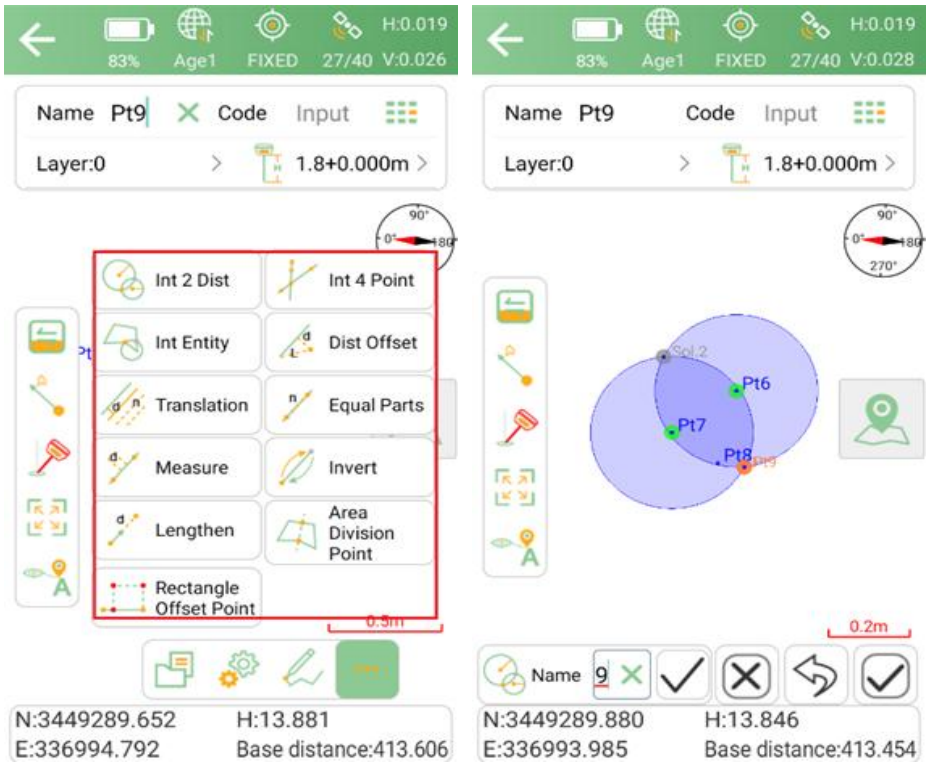
- Click  to create or import a CAD file, supporting *.dxf, *.dwg format.



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



• Click  on the Find tools. They can help you to work smoothly.



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

• Setting: Set the method of stake out, offset distance, interval etc.

• Start station: If you set the start station as 5m, then the final mileage will plus 5m.

• Offset: If you set the offset 5m, then you will stake the line 5m away from the line you choose. The plus and minus represent different sides of the line.

• Setting out by pile by coordinate: including station number, station distance and segment

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

• Segment: For example, if you set the segment as 4, then you will stake the line

at 4 segments, every segment length is the same.

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

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

3.14 DSM Stakeout

You can stakeout a surface by staking out elevation of each point on the surface.

If you haven't used a surface file before, you need to create one by adding, importing, or selecting from the database.

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

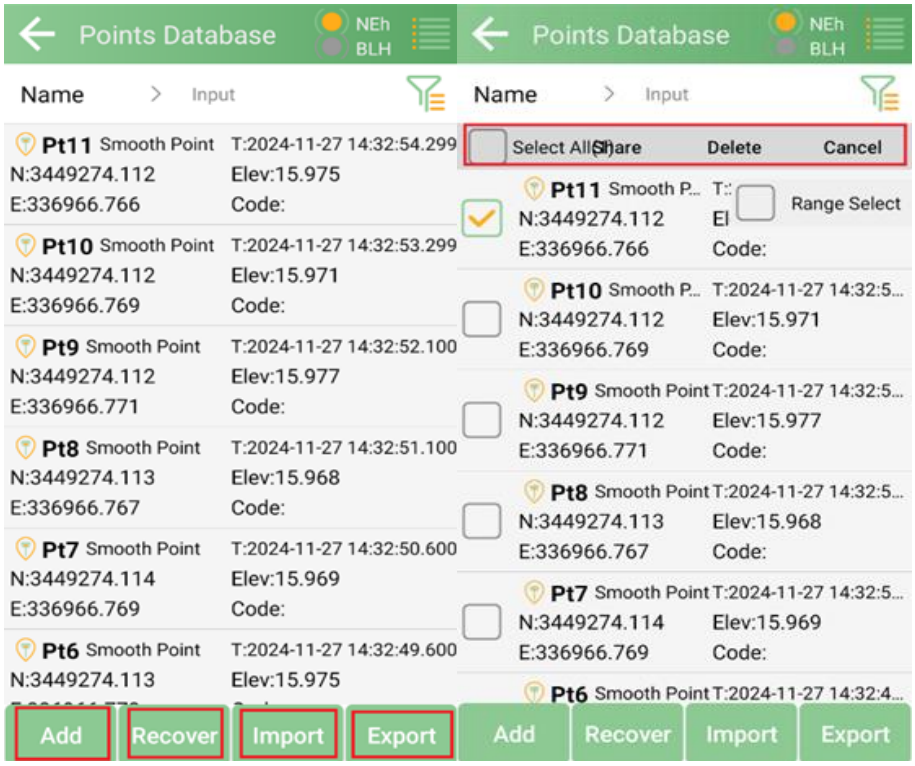
At the content list interface, you can find the surfaces you created, and you can edit, share and stake them.

If the current position is not within the design surface, it will prompt "Out of surface!". If the current position is within the design surface, it will show the fill

or excavation value.

3.15 Point Database

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



• Add: Support to add Input Point, and display type supports local coordinate and geodetic coordinate

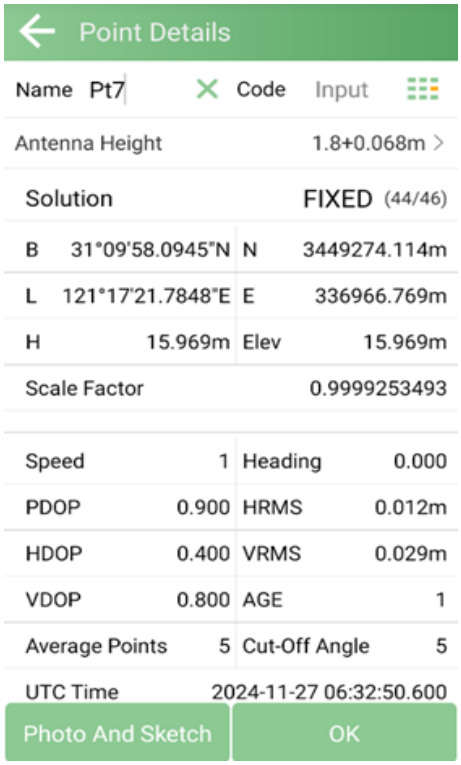
• Recover: After deleting the points, you can recover them in deleted points interface

• Import: Import points by different formats of files

• Export: Export points by different formats of files

• Search: Enter the name of the point you want share or delete

Tap any point to view the detailed information. The information includes antenna height, solution status, WGS84 Coordinate, local grid coordinate, base id and measure time. If the point has been calibrated, the offset parameters will be displayed.

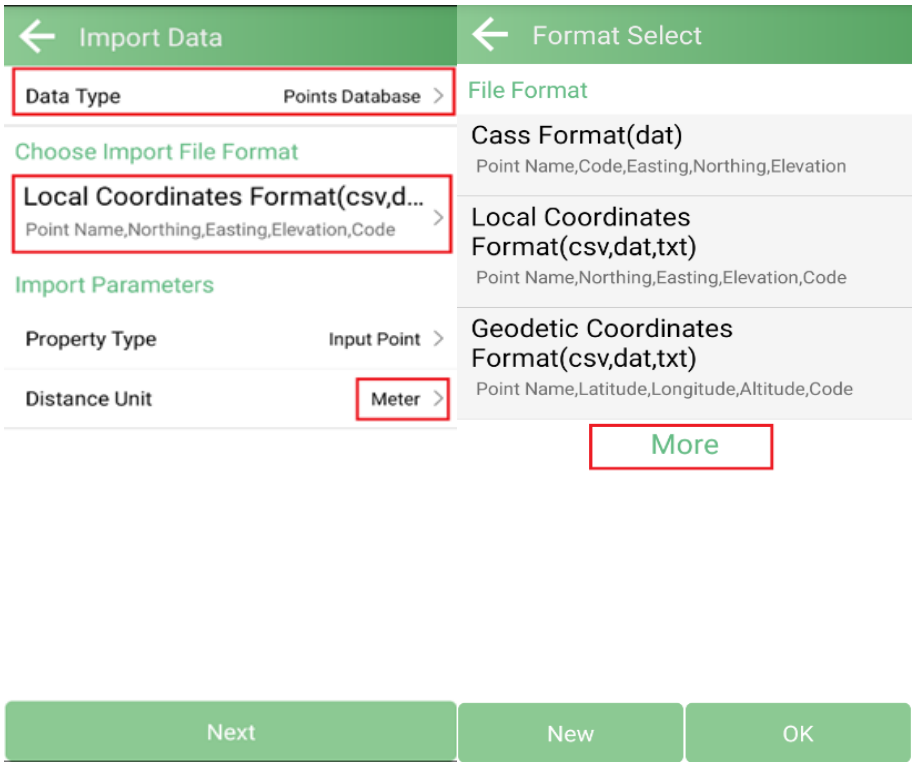


3.16 Data Import/Export

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

3.16.1 Import Points Data

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

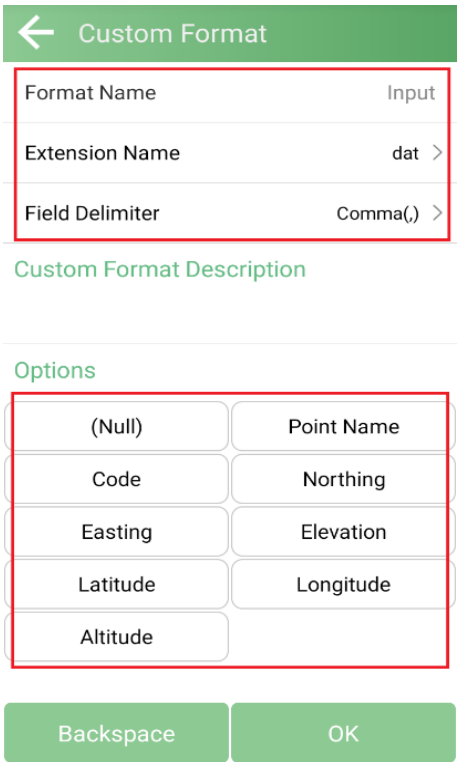


- Data Type: support point database, transformation parameters file and code library

- Import File Format: support *.csv, *.dat, *.txt, *.kml, etc.

- Distance Unit: support meter, US survey feet and international feet

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

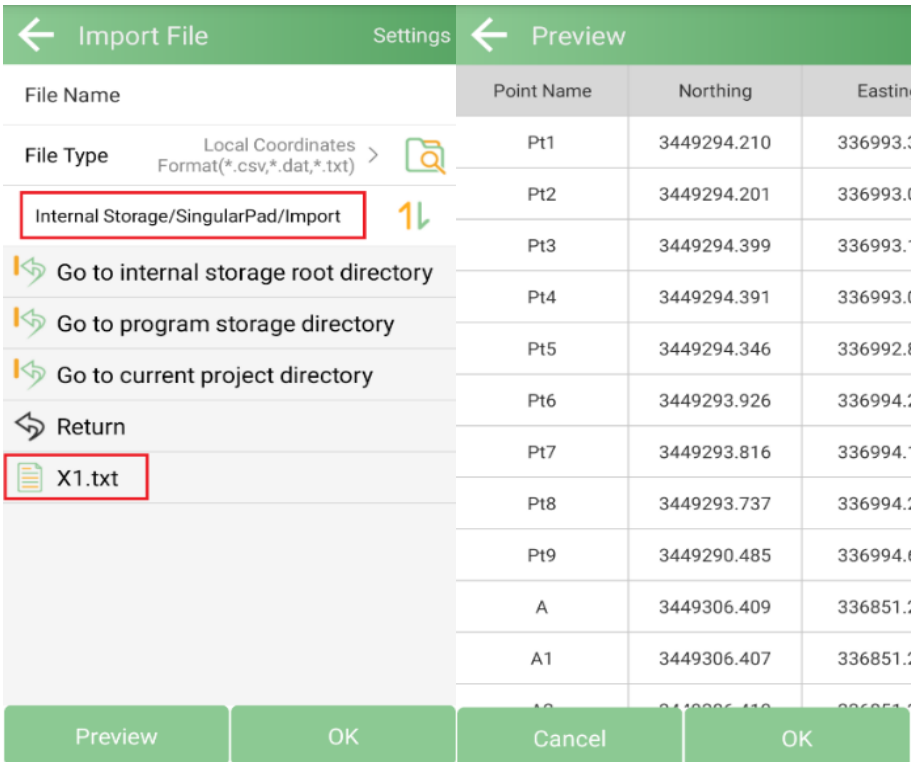


- Format name: Enter the name for the format

- Extension name: support *.csv, *.dat, *.txt, *xlsx format

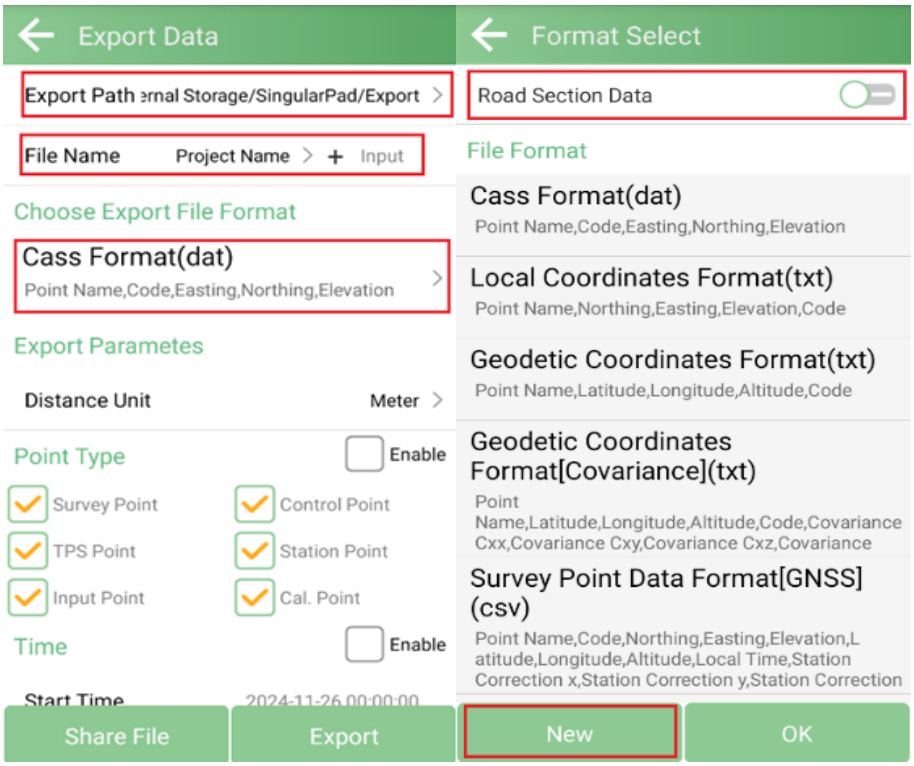
- Delimiter: support comma (,), semicolon (;), space ( ), tab (Tab)

Click to choose elements in the options list, click backspace to eliminate the previous element selected. The elements include: code, northing, easting, elevation, latitude, longitude, altitude. Choose one format to import data. The default export path is internal Storage/ SingularPad/Import. You can also change to any other path where the file is. Click preview to take an inspection whether the format is right.



3.16.2 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 where the file is

- File Name: support project name, operator, data, data time

- Export File Format: support *.csv, *.dat, *.txt, *kml, etc.

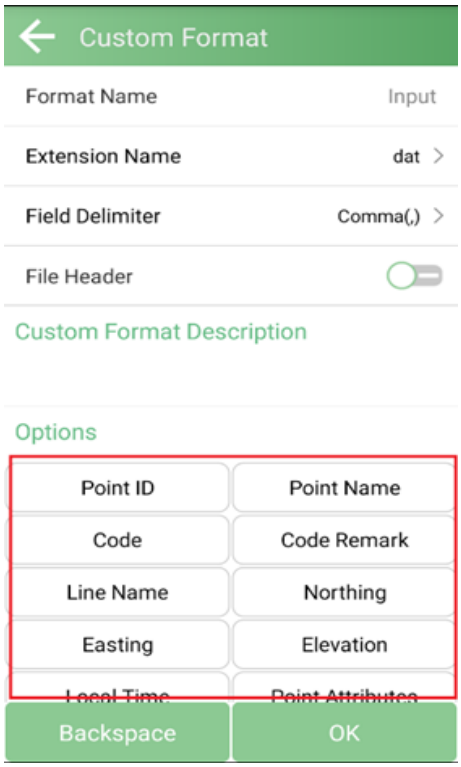
- Distance Unit: support meter, US survey feet and international feet

- Road section data: open to export road section data

Besides, you can click New to create a user defined type. The elements include: id, name , code, latitude, longitude, altitude, northing, easting, elevation, N, E, Z, type, local time, UTC time, solution status, AGE, max delay, min delay, use satellites, tracked satellites, cut-off angle, mount point, measurement method, repeat, start data, end time, RMS, HRMS, VRMS, PDOP, VDOP, speed, heading, antenna type, measuring type, measuring height, antenna height, base id, base

latitude, base longitude, base altitude, distance to ref, original latitude, original longitude, original altitude, undulation height, station correction h, inclination correction, pitch, roll, yaw, inclined angle, projected angle, stakeout type, target, station, offset, north diff, east diff, elevation diff.

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



4 STATIC SURVEY

This chapter describes how to conduct static survey through Horus receiver and SingularXYZ Converter software. For static survey, Horus supports 3 data formats: binary XYZ, Rinex 3.02 and Rinex 3.04. SingularXYZ binary format (*.XYZ) is a raw observation data format and you can convert it to RINEX format via SingularXYZ Converter Software. (Contact SingularXYZ support team for the tool).

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

4.1 Static Data Collection

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

• At least 3 GNSS receivers are required to form a stable triangulation network.

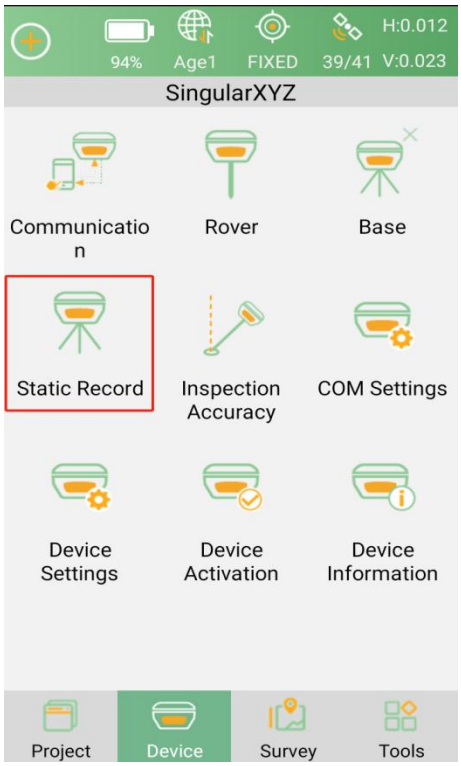
• It is better to collect static data on the known point.

• Power off the receiver before moving to other observation site.

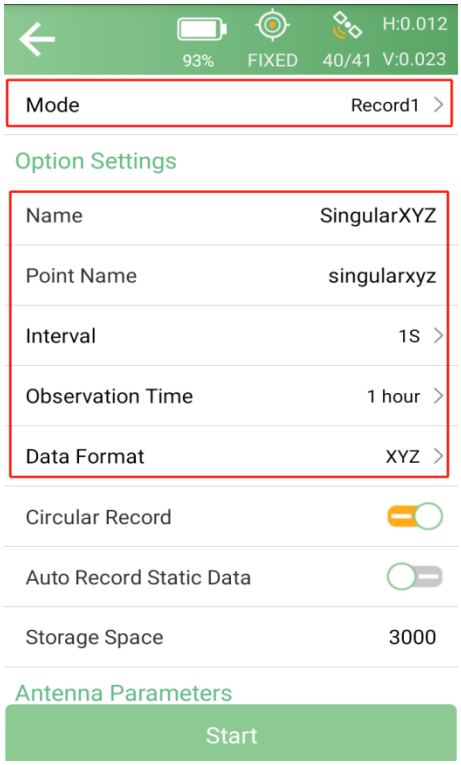
• For the convenience of post-process static observation raw data, record the station name, receiver SN, antenna height, start and end time for each observation site.

The following steps give an example of static survey:

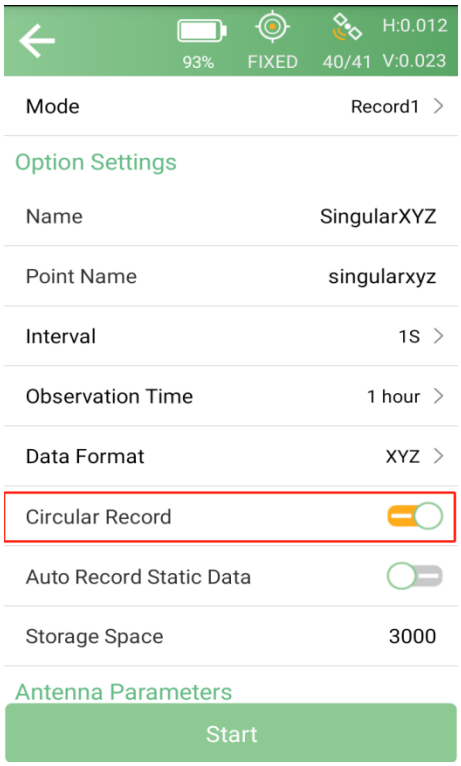
1. Go to ***Device*** >>> ***Static*** *and collect points*. Choose the Record mode, there are two record modes and they can record static data at the same time.



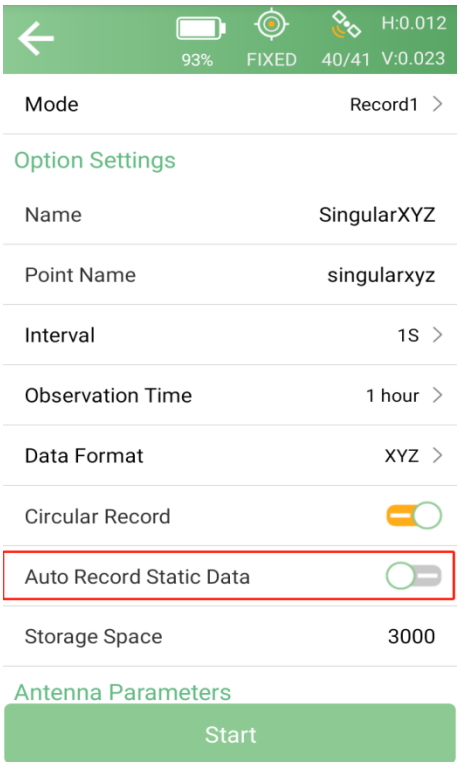
2. Options Settings interface: Input Record name and Point name. Set the Collection Interval, Observation Time and Data Format.



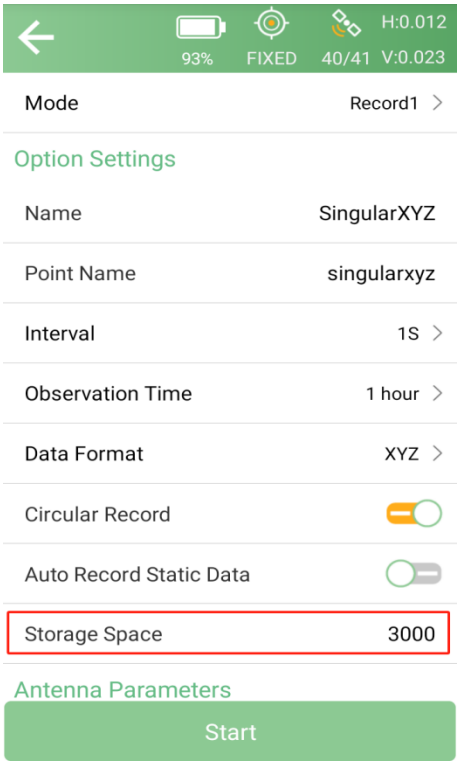
3. Turn on/off the ***Circular Record*** according to your needs. If this option is turned on, the receiver will delete the earliest recorded data to keep recording when the record space is full.



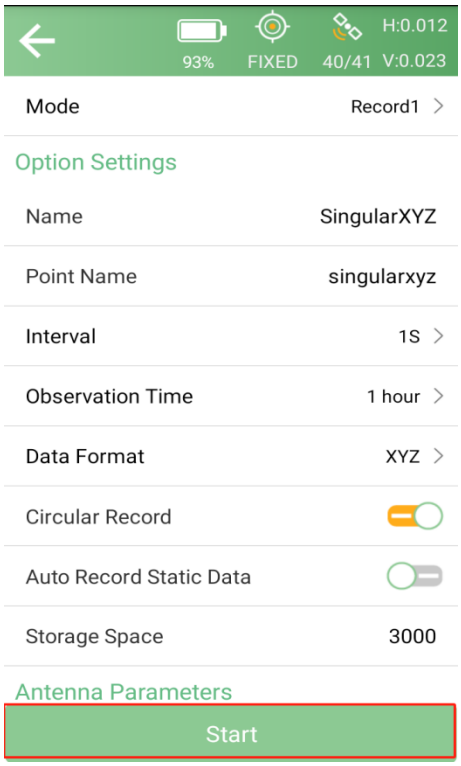
4. Turn on/off the ***Auto Record Static*** according to your needs. If this option is turned on, the receiver automatically records static data after it is power on.



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

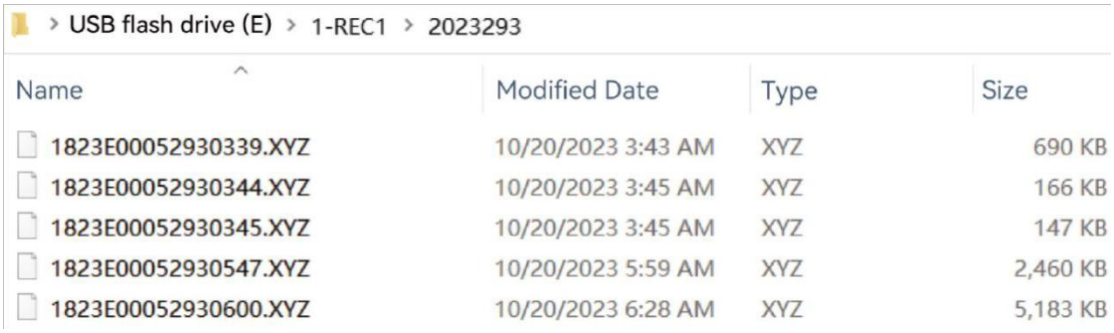


6. Click ***Start*** to start static survey.



4.2 Static Data Download

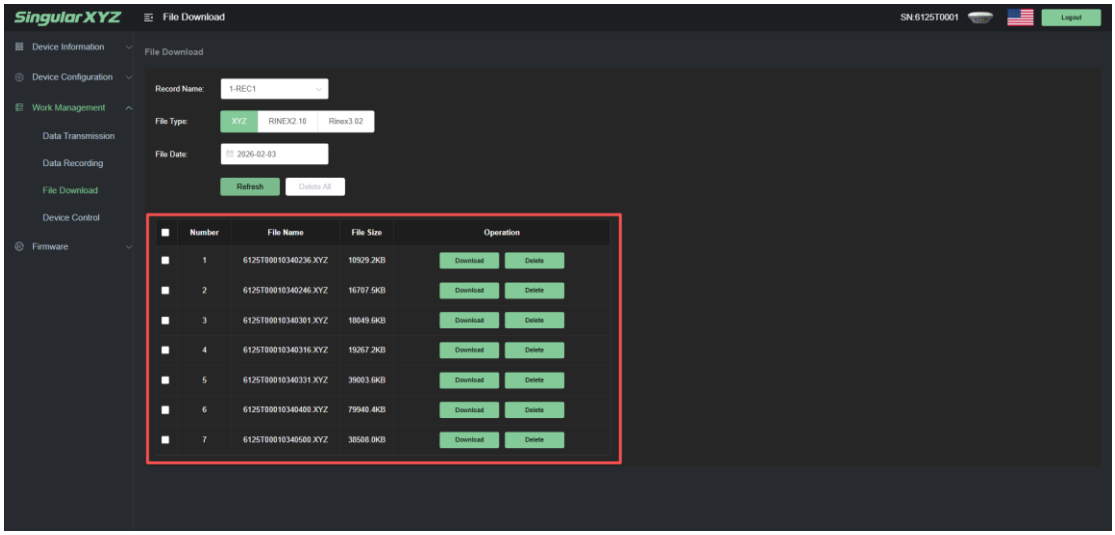
The raw observation data is saved in internal memory of Horus receiver, when connected with PC via TYPE-C cable, the Horus receiver can work as a USB Flash Disk, which means you can copy the static data to PC directly.



In addition, you can download the static data via Web UI, connect your PC or phone to the Wi-Fi of the Horus receiver (WLAN name: the SN of Horus) and log

in the web page in browser via IP 192.168.10.12 (Username: admin, Passwords: admin).

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 Convert

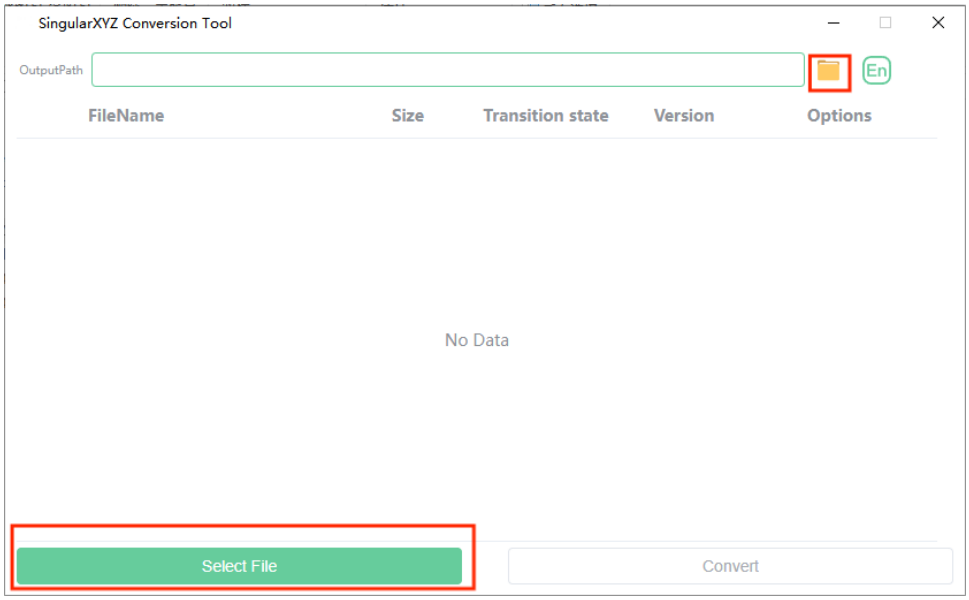
The raw observation data is saved in internal memory of Horus receiver, when connected with PC via TYPE-C cable, the Horus receiver can work as a USB Flash Disk, which means you can copy the static data to PC directly.

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

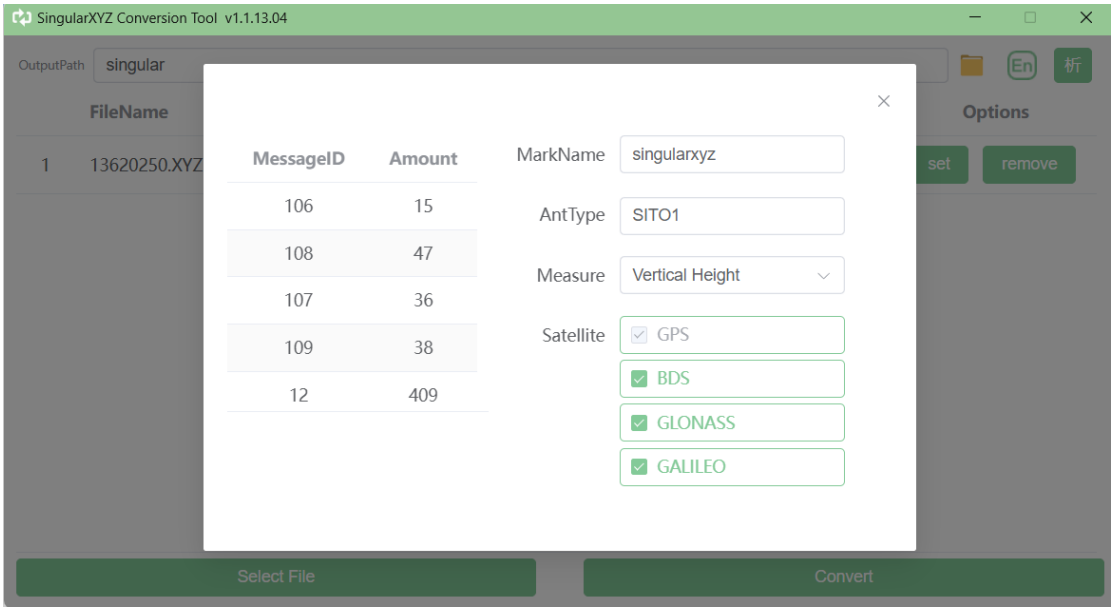
The following steps give an example of Rinex convert:

1. Start ***SingularXYZ Converter*** software.

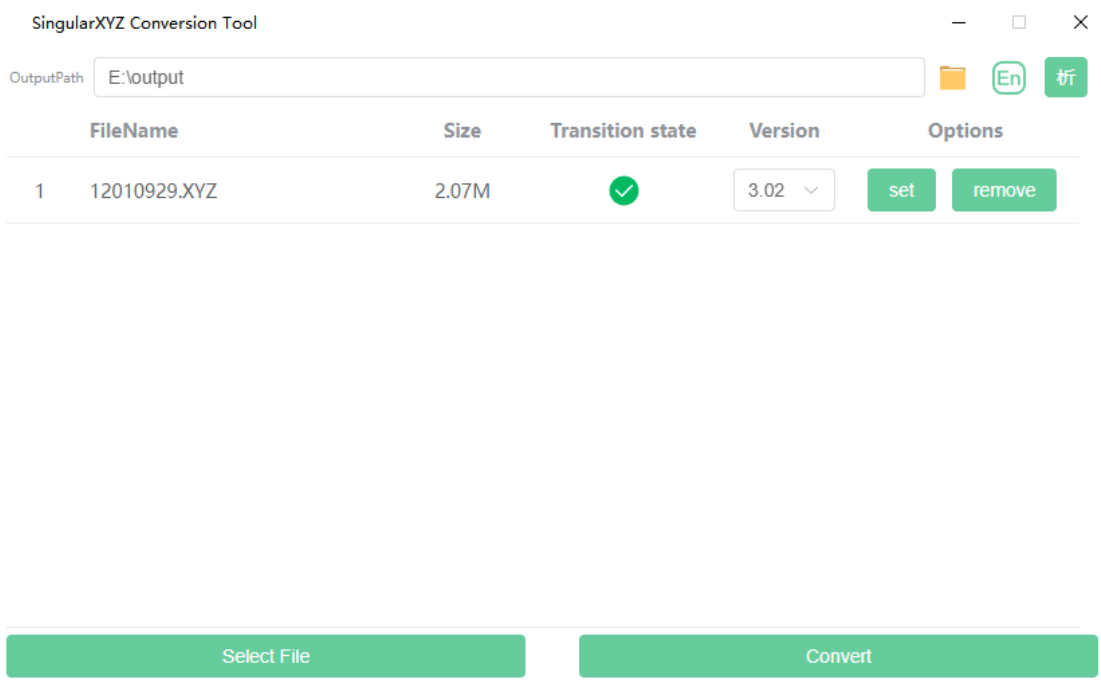
2. Set the output path and select to import the binary file.

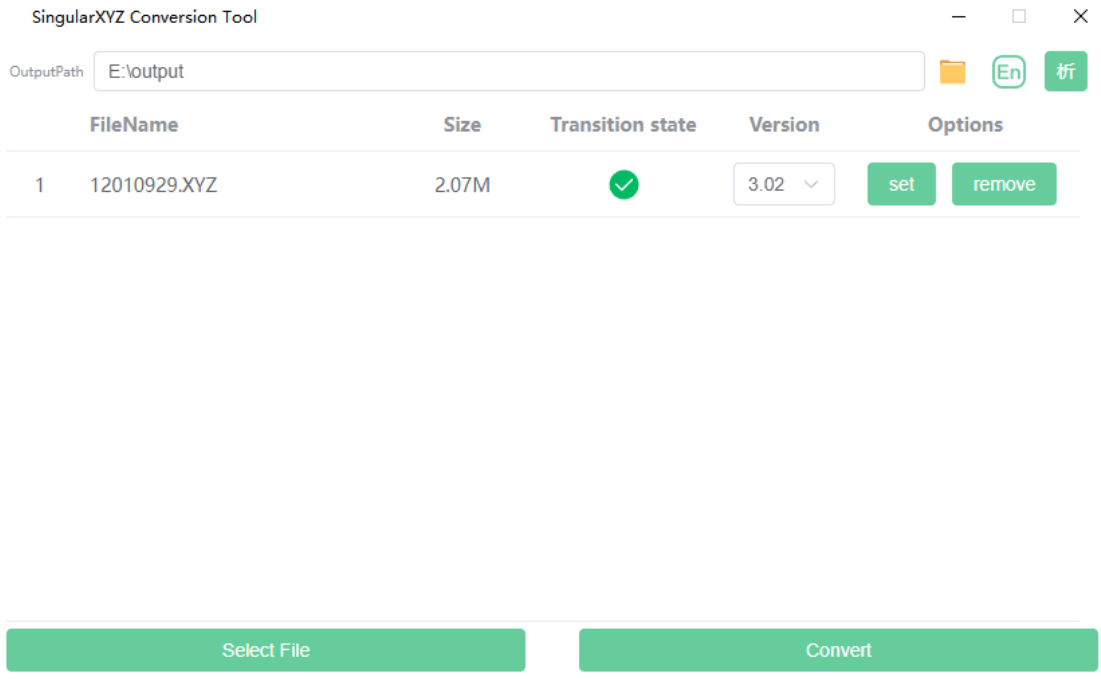


3. After import the binary file, click set then input the marker name and choose the measure type of antenna height, and the antenna type is automatically identified as SITE 1 for Horus receiver



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





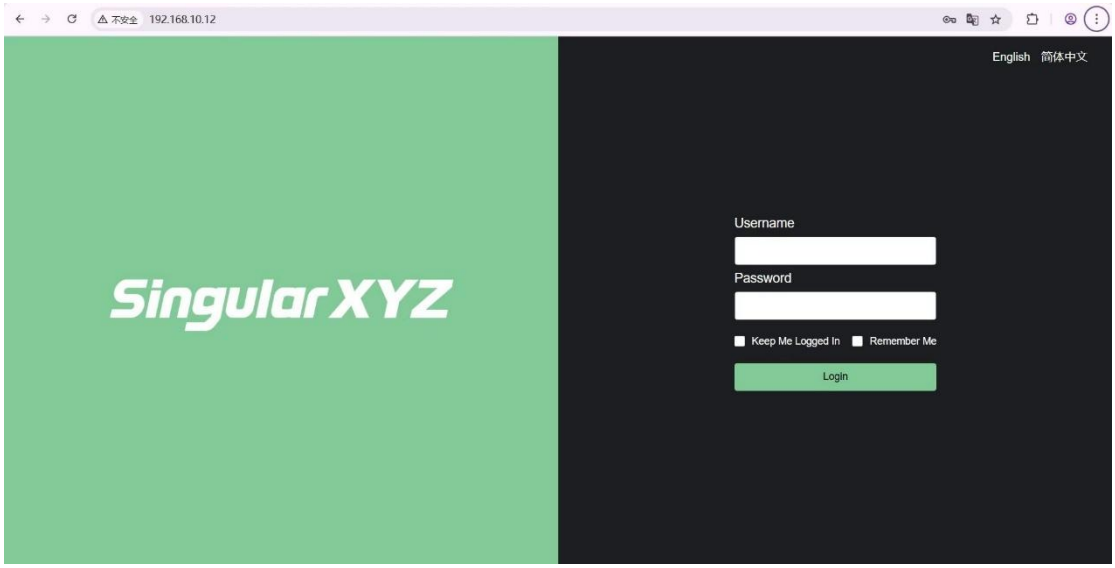
Note: *The output path of the conversion software and the storage path of the files to be converted can only contain English letters and numbers.*

5 WEB UI INTRODUCTION

This chapter mainly introduces the function of Web UI.

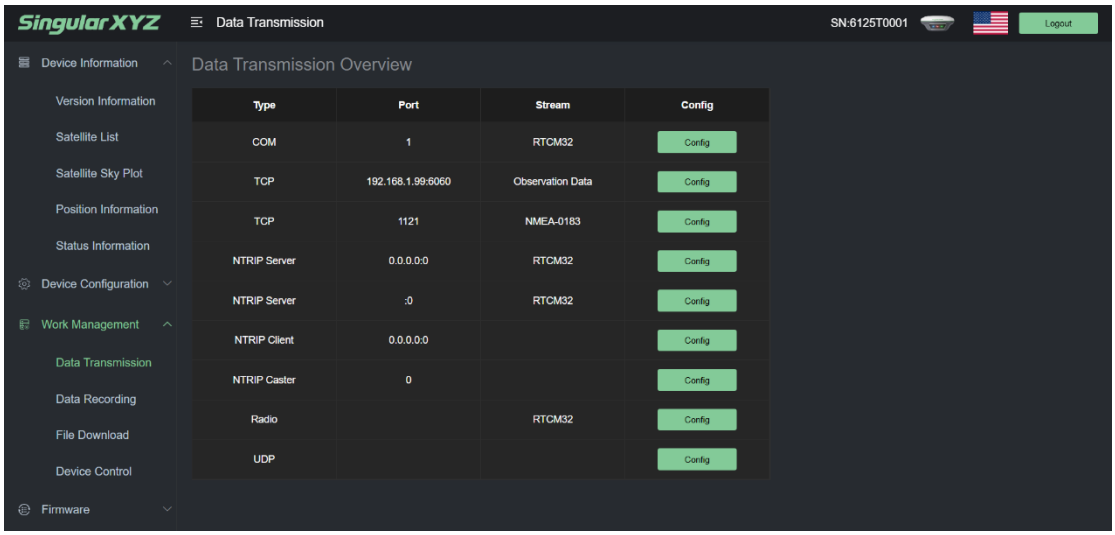
5.1 Access the Web Interface

Connect PC or mobile devices to Horus's Wi-Fi (Name: SN of Horus, Password: 12345678). Open browser and enter the web page via IP 192.168.10.12 (Username: admin, Password: admin).

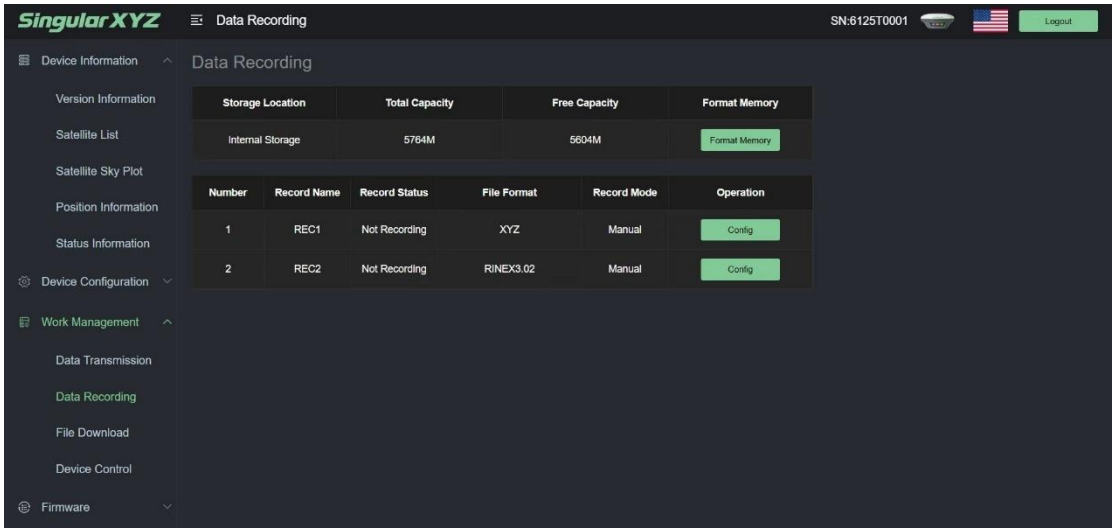


5.2 Work Management

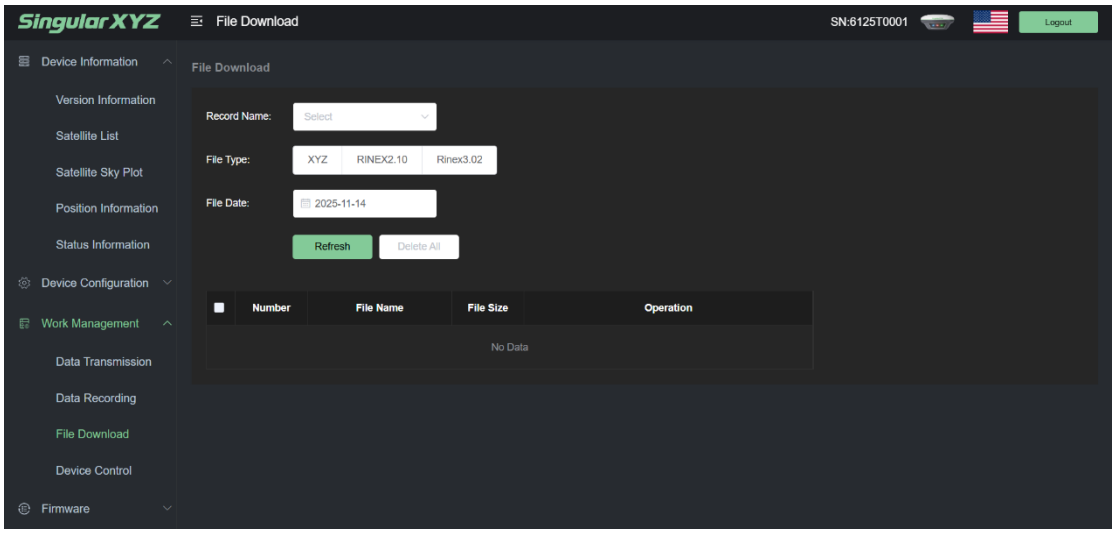
In Data Transmission, you can manually set the transmission method of data.



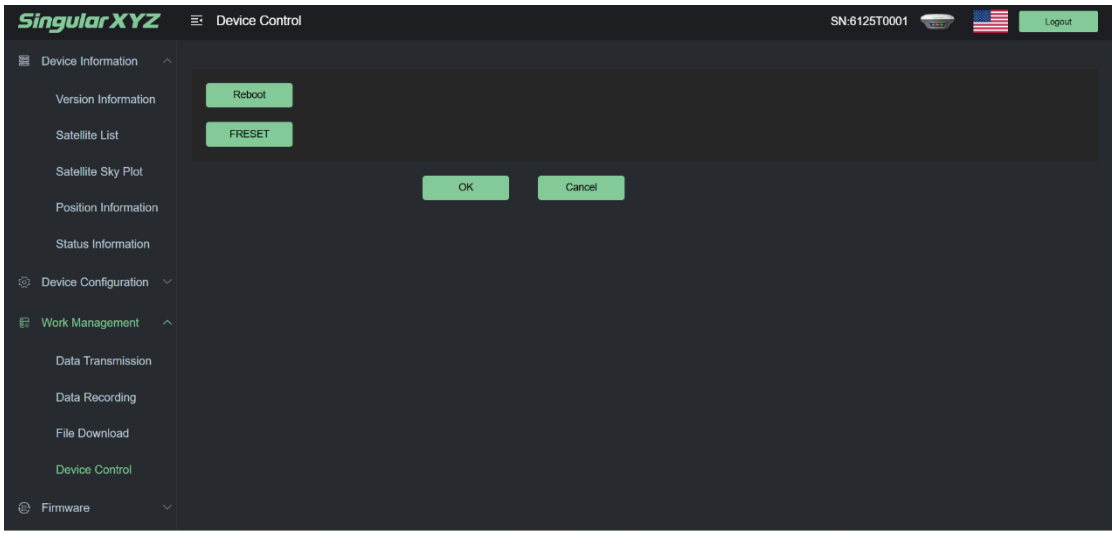
In Data Recording, you can set the parameters of the collected static data and start record. You can also format memory in this interface.



In File Download, you can download record static data.



In Device Control, you can choose to reboot or freset your device.



5.3 Firmware Upgrade

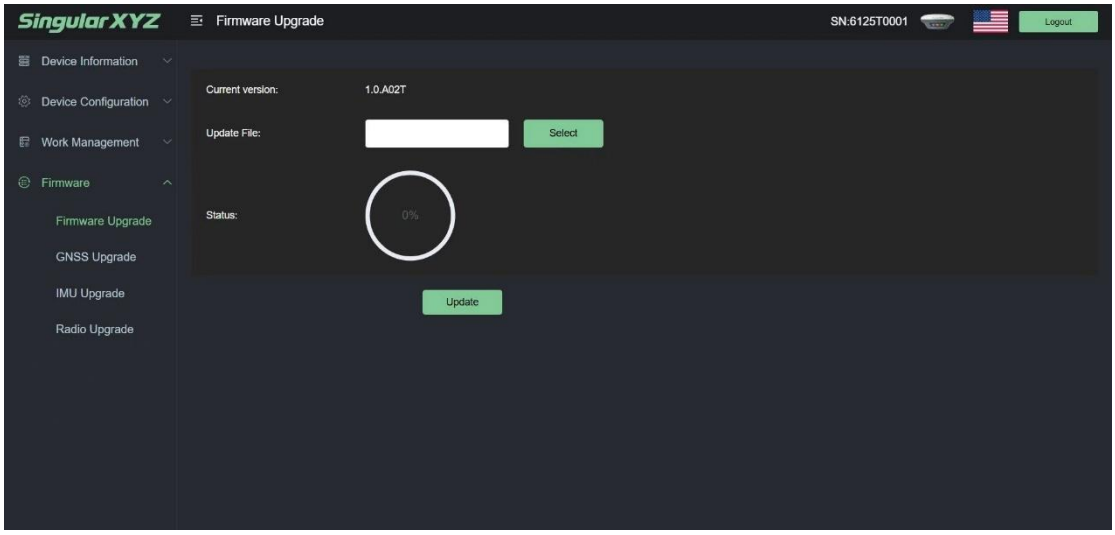
This function interface is used to upgrade the firmware version of the device.

1. ***Select*** the firmware file in this interface and click ***Update*** to update the firmware.

2. After the upload complete, the device will automatically restart and the upgrade is finished.

Note: If the page displays an update failure or gets stuck, you can try clearing the browser cache

or performing the firmware upgrade in another browser.



6 TROUBLESHOOTING

If you encounter any issues not addressed in this manual, please contact our support team for assistance. In this chapter, we will outline the basic information you need to provide to help our support team understand and resolve your issue quickly.

Please send the following information to our support team for further assistance.

•Serial number of your Horus device

•Problem description with supplementary video/screenshots

•Debug logs and project file

6.1 How to Find Serial Number

The serial number is a unique combination of numbers and letters assigned to your Horus receiver.

Find serial number

Find the serial number of your Horus as shown in the image below.

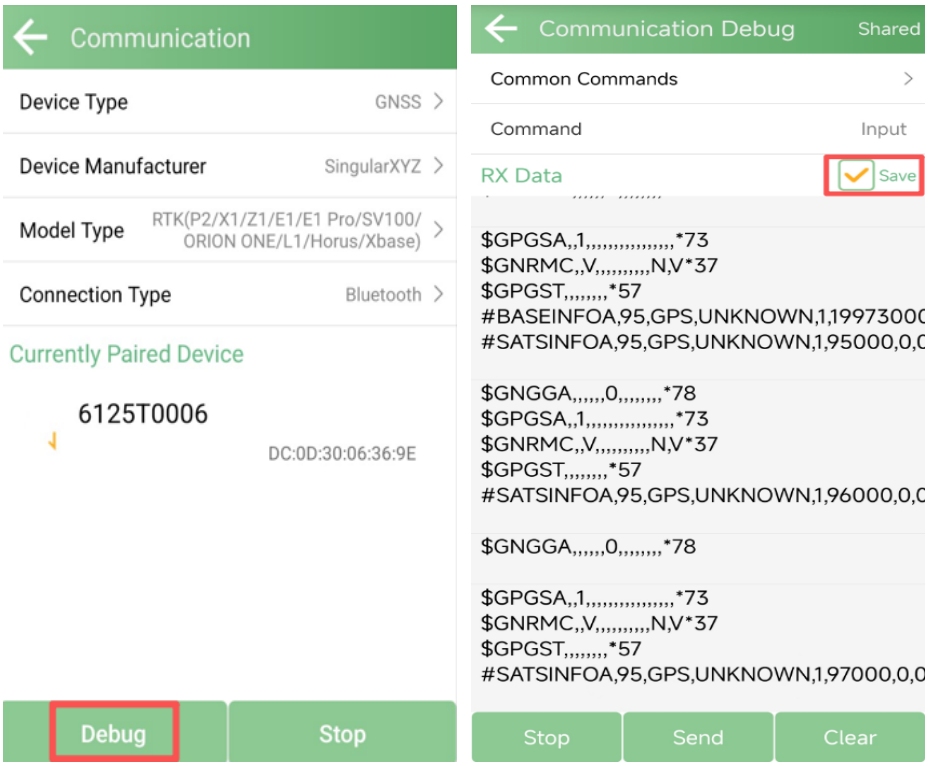
6.2 How to Get Debug Data & Project File

6.2.1 Save Debug File

The Debug data provides information about your current Horus Series internal state, helping support team facilitate troubleshooting.

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

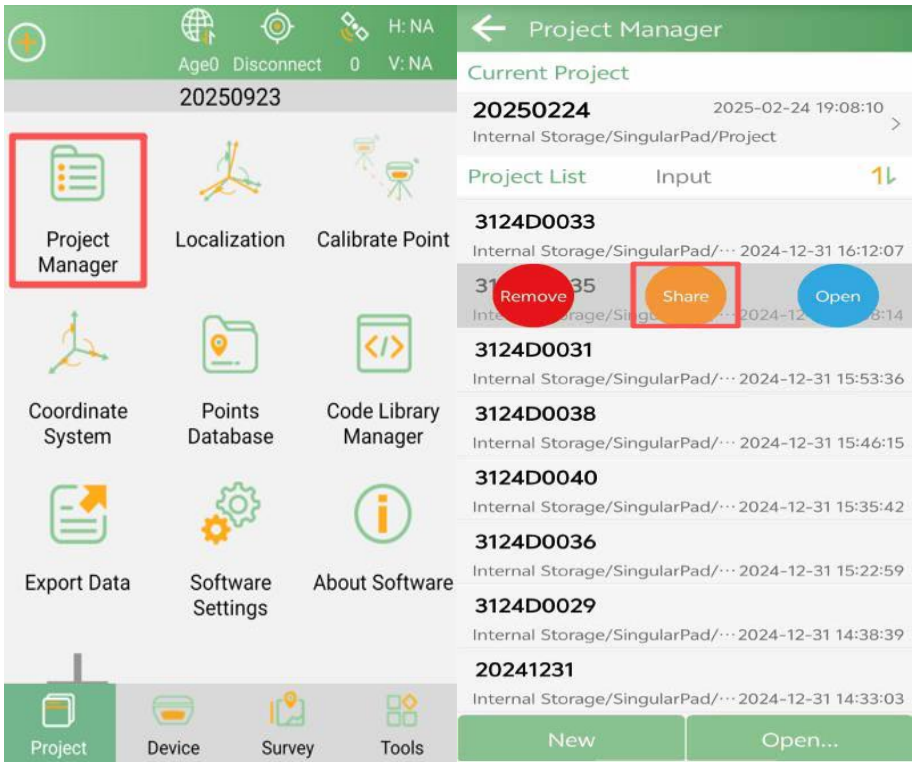
Enter ***Device*** >>> ***Communication*** >>> ***Debug***, then enable Save option to save debug file, which will be stored in the System folder (/SingularPad/Debug).



6.2.2 Share Project File

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

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


Age0 Disconnect 0 H: NA V: NA
20250923
Project Manager
Localization
Calibrate Point
Coordinate System
Points Database
Code Library Manager
Export Data
Software Settings
About Software
Project
Device
Survey
Tools
Project Manager
Current Project
20250224
2025-02-24 19:08:10
Internal Storage/SingularPad/Project
Project List
Input
3124D0033
Internal Storage/SingularPad/··· 2024-12-31 16:12:07
Remove
Share
Open
3124D0031
Internal Storage/SingularPad/··· 2024-12-31 15:53:36
3124D0038
Internal Storage/SingularPad/··· 2024-12-31 15:46:15
3124D0040
Internal Storage/SingularPad/··· 2024-12-31 15:35:42
3124D0036
Internal Storage/SingularPad/··· 2024-12-31 15:22:59
3124D0029
Internal Storage/SingularPad/··· 2024-12-31 14:38:39
20241231
Internal Storage/SingularPad/··· 2024-12-31 14:33:03
New
Open...