3A GeoCanada

3AGeoCanada Inc.

BANFF

Banff-BASE GNSS Receiver User Manual

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1 INTRODUCTION

The 3AG Banff-BASE GNSS Receiver (referred to as Banff-BASE) User Manual is intended to help you get familiar with the Banff-BASE receiver and start your project effectively. We highly recommend that you read this manual before you start your

1.1 About the Receiver

project, even if you have previous experience with other GNSS RTK receivers before. As a full-featured RTK solution, the Banff-BASE 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. Banff-BASE 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 radio enables up to 25 km operating range under ideal conditions. Powered by a 1408-channel GNSS engine, Banff-BASE supports full-constellation tracking with strong anti-interference performance, delivering stable, high-quality correction data for reliable RTK

1.2 Lower Housing

operation in challenging field environments. 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 (2) General Interaction Logic down, double click scrolls the wheel up. 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). Confirm/Select: Power button (scroll wheel push button). -Switch focus between different options on the screen. (3) Detailed operation guide for the page -Function: Confirm current action Charging interface ① 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. System Parameters Page ⑤

 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. Power Off Page

⑥ □ 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 GeoPad Software. GeoPad is a professional Android-based surveying software developed by 3AG team. GeoPad 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 GeoPad

GeoPad has been pre-installed on 3AG data collector before shipping. If you want to download on your own device, please contact 3AG 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.

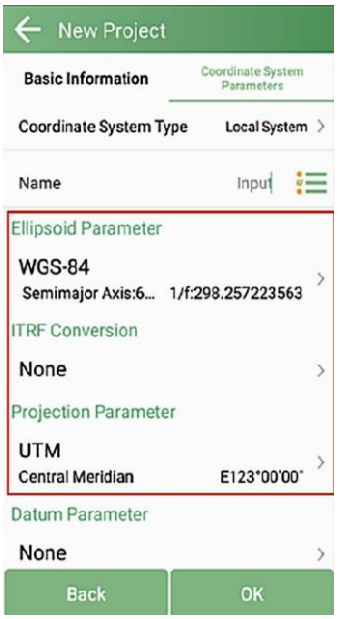
- If it shows 2999-12-31, this indicates a permanent registration of the software.
- If it shows Inactivated, please click Software Activation, then enter a valid permanent license to register and activate all software functions.

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.

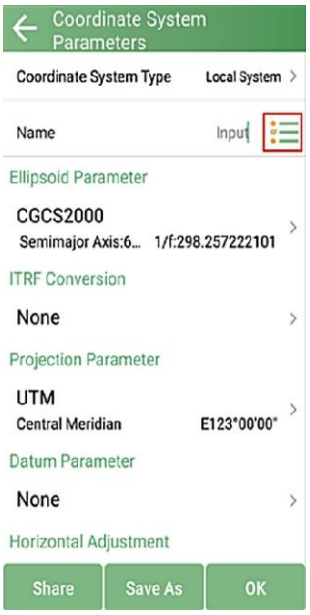
2.2 Create a New Project

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

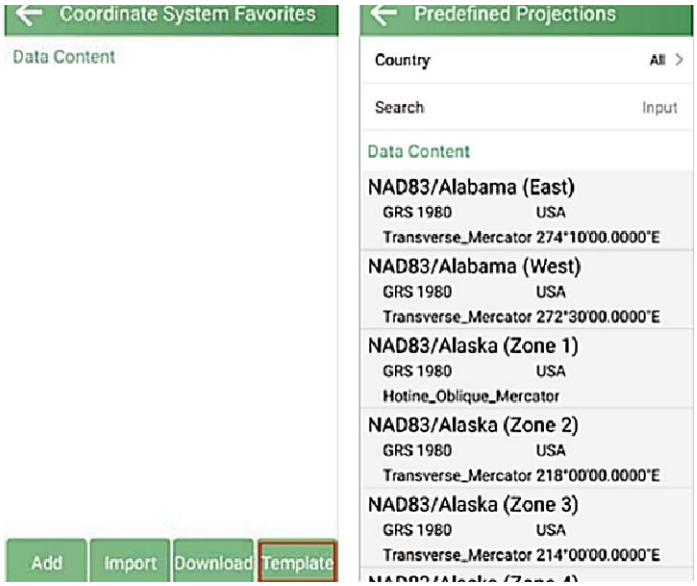


NOTE :

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

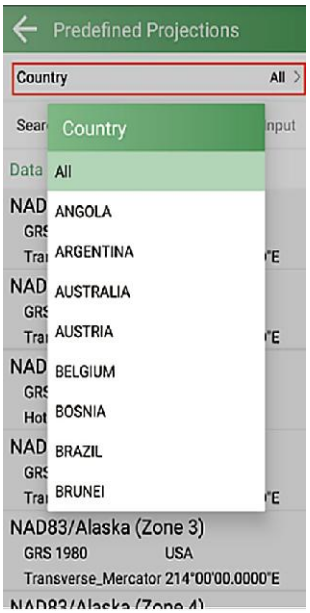


Template 2. In the Coordinate System Favorites interface, click the below to enter



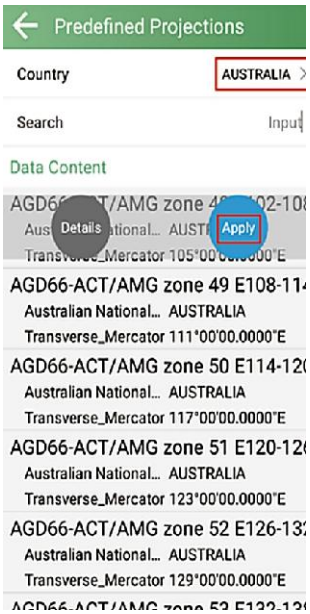
the Predefined Projections interface.

Country Search

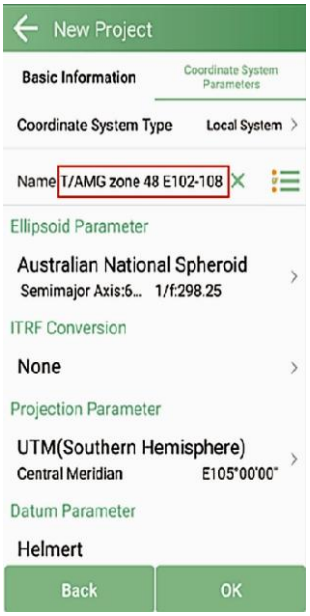


3. Click to select the country name or enter a keyword in to find it.

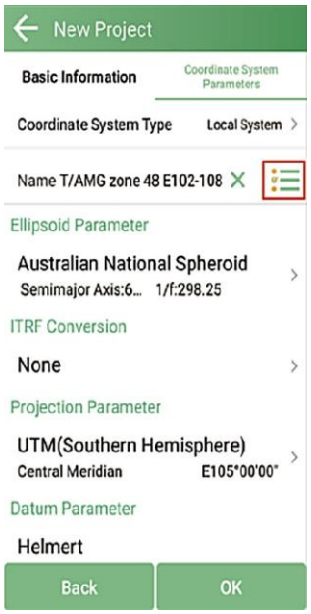
Apply OK 4. After locating the required coordinate system, click to add it to coordinate



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



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



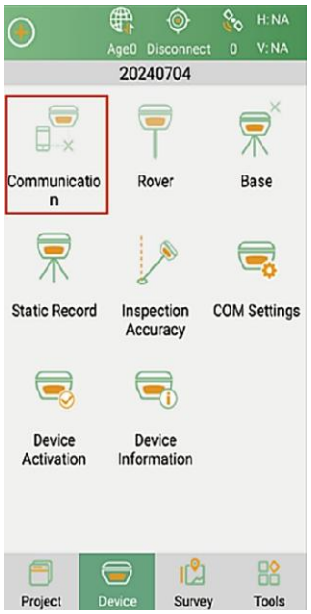
2.3 Device connection

2.3.1 NFC connection

The Banff-BASE GNSS Receiver is equipped with an NFC module, users can easily connect the Banff-BASE receiver to the data collector with just one touch.

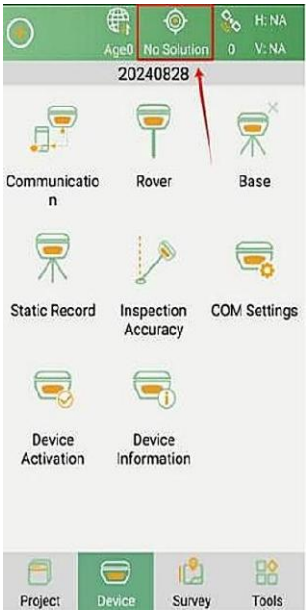
2.3.2 Bluetooth connection

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



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

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, 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 GeoPad, 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 GeoPad software and pair again.

2.4 Concepts About RTK

2.4.1 Overview

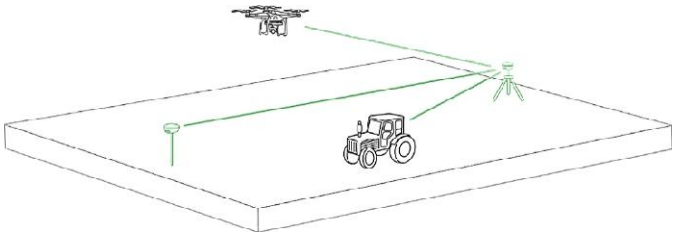
Real-Time Kinematic (RTK) is a GNSS positioning technique used to improve the accuracy of a standalone GNSS receiver. Traditional GNSS receivers, like the one in a smartphone, could only determine the position with 2–4 meters (7– 13 feet) accuracy. RTK can give you centimeter accuracy. GNSS receivers 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

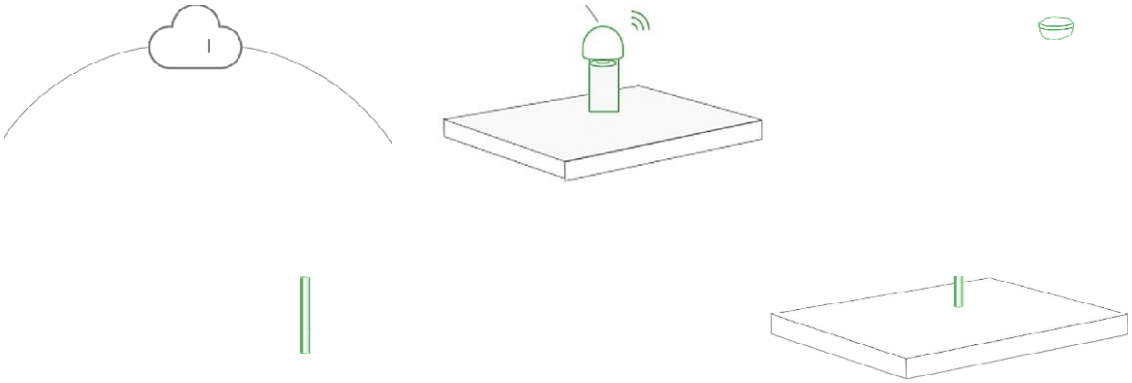
rovers can connect to one base if their input settings are compatible to the base's output.



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 Banff-BASE 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 Use Conditions Accuracy Mode Radio -Two GPS RTK units (base and Centimeter Mode rover) required level Network/ - Two GPS RTK units (base and Centimeter rover) required level GSM Mode - Network required - Ntrip Caster Platform required PDA - Network required Centimeter level CORS - RTK correction service Mode subscription / CORS account needed PPP Mode No network or RTK correction 10 - 20 cm service needed SBAS - No network or RTK correction Submeter Mode service needed level - SBAS coverage required Static ≥3 GNSS units required for stable Millimeter Mode triangulation network adjustment 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, GeoPad supports transmitting the correction data in Internal Radio mode.

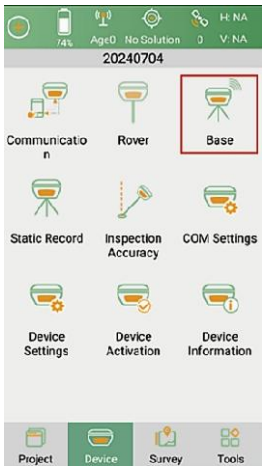
Internal Radio:

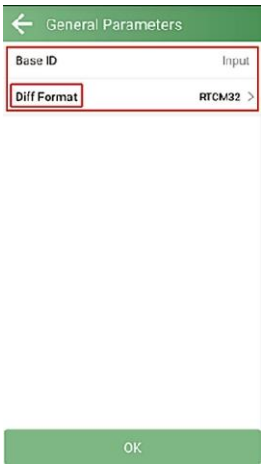
This mode uses internal radio to transmit the correction data from Base to Rover. You need to set Base and Rover with the same protocol and frequency.

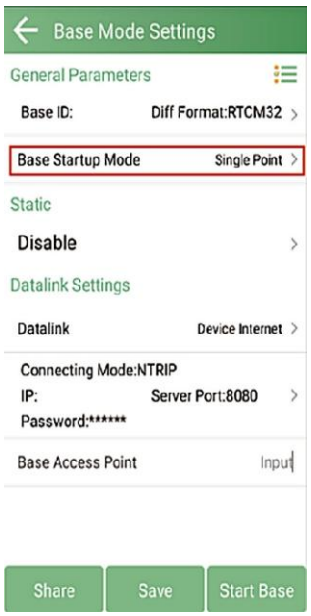
- Protocol: Supports CSS, TRIMTALK, TRIMMK3, TT450S, TRANSEOT and SATEL.
- Frequency: select a channel or customize a frequency, the range of frequency is 410-470 MHz
- Baud rate: 4800,9600,11000,19200,115200
- Power: High and low (low power reduces the transmission range) TIP - Condition of the base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

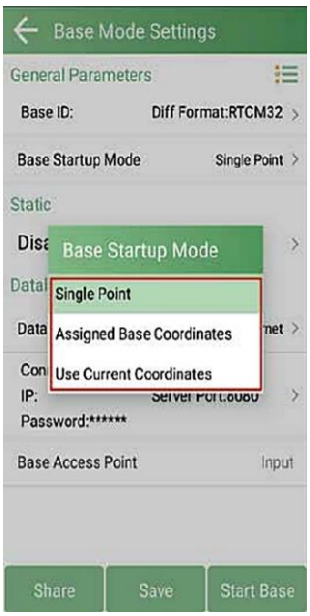
Ideal Environment: Avoid:

· Clear outdoor sky view, free · Obstacles: buildings, vehicles, from obstructions. towers, trees, etc. · Place GPS and radio antennas · Interference: high-power radar, as high as possible to reduce TV, cellular towers, power lines or signal interference and electrical facilities maximize communication range. The NOTE following : Set Internal steps Radio give Work an Mode: example Connect of the how whip to antenna configure to both internal your base radio station base and mode. rover. Device Base Base ID Diff Format. 1.Go to >> . Set and choose the









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

Single Point:

Start the base station at unknown coordinates

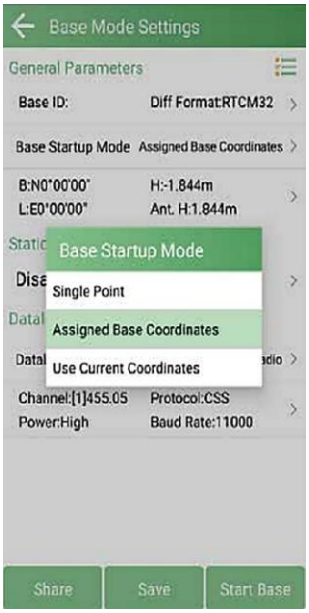
Assigned Base Coordinates:

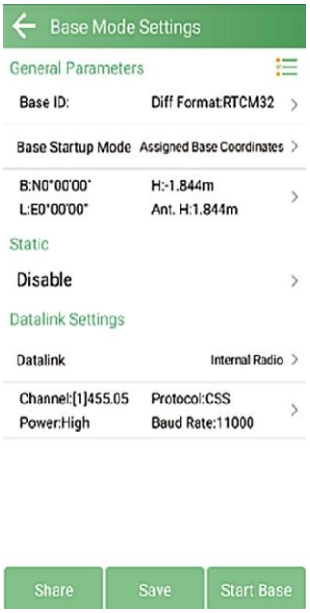
Start the base station at known coordinates, and you need to enter the latitude, longitude and the height

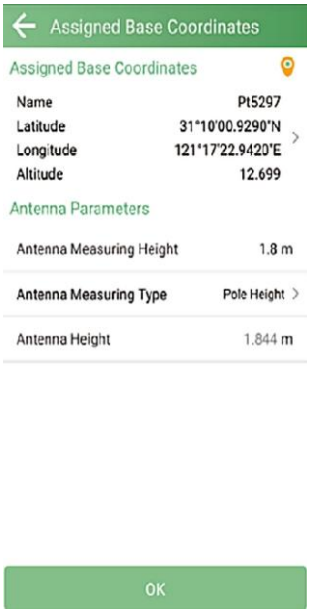
Use Current Coordinates:

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.

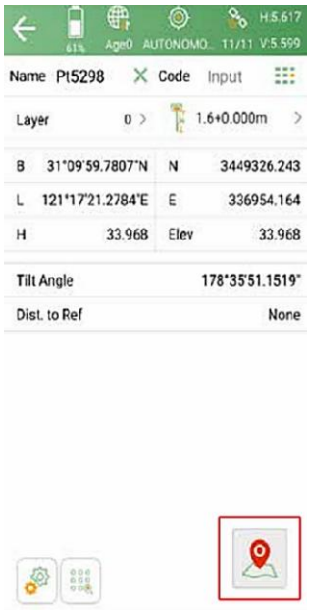
Typically, select Base Startup Mode as Assigned Base Coordinates and start the base



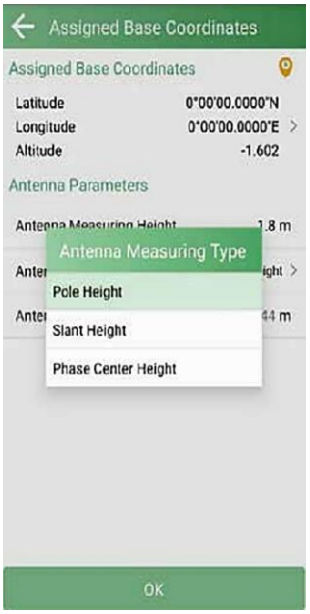




station at known coordinates. You can assign the coordinates from point database (input points/measured points) or click the survey icon to measure the current base location directly. Always use the



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



Pole Height:

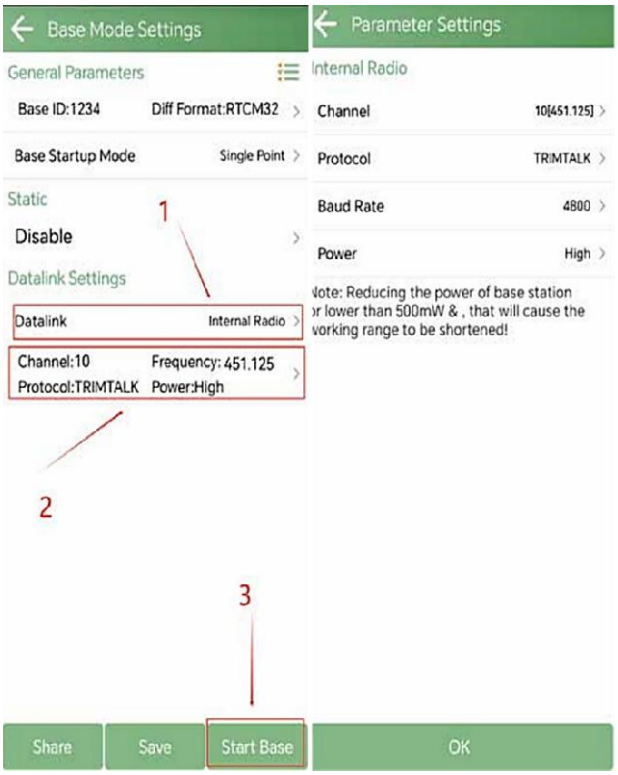
Pole height is the vertical height from the receiver's bottom to the Antenna Measurement Height ground point. If you are using a range pole with a bipod for base set-up, you can fill the pole scale reading as the software when the pole is perpendicular.

Slant Height:

If you are using a tripod to set up the device, you can measure the Antenna Measurement distance from the ground point to the antenna slant height measurement mark Height (marked in the figure below). Fill the reading into the , 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. Data Link Internal Radio 3.Set as . Set parameter settings, Channel, Frequency, Protocol, Baud Rate and Power.



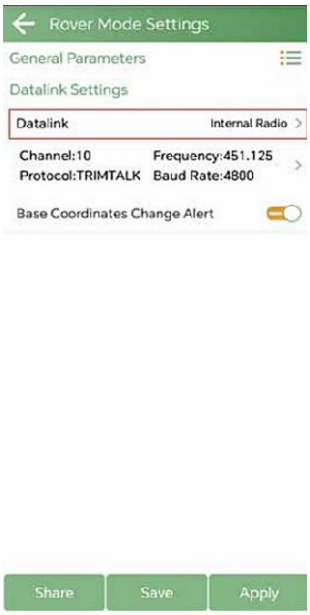
4.When the base station starts successfully, the status will show as below in GeoPad.

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

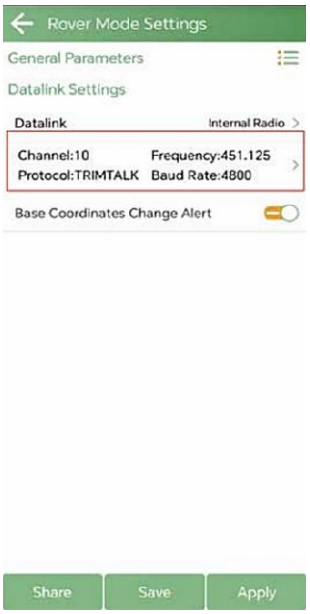
base station.

2.5.1.2 Internal Radio Rover

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

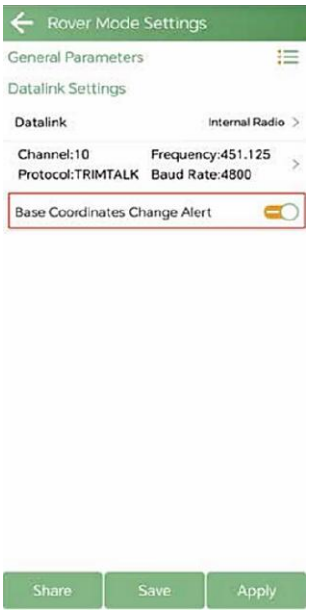


1. Go to >> . Set Data Link as Internal Radio. 2. Parameter setting: Set channel, Frequency and Protocol the same as the base



station

3. Base Coordinates Change Alert: GeoPad 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. Apply 4. Click to start the rover mode. FIXED After completing the configuration, please check the RTK status in the top status bar. Once the status changes to " " and the differential delay “Age” is within the 3.2 Point Survey range of 1-2 seconds, you have obtained reliable centimeter-level RTK positioning.



Now you can proceed to to start surveying.

2.5.2 Network Mode

In addition to radio-based RTK correction transmission, the Banff-BASE also supports network-based modes. You can choose from the following configuration options depending on your working environment and available resources.

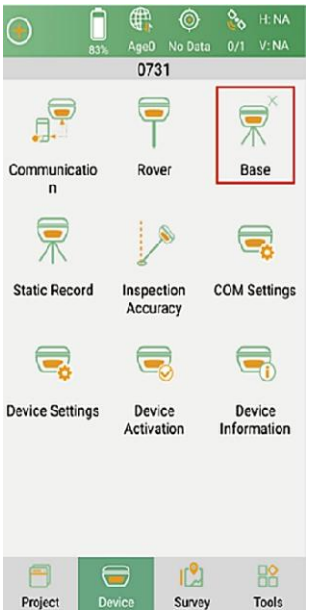
2.5.2.1 Internal GSM Base Mode

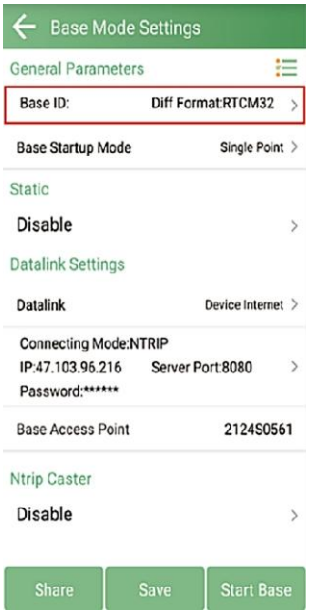
Network Base Options:

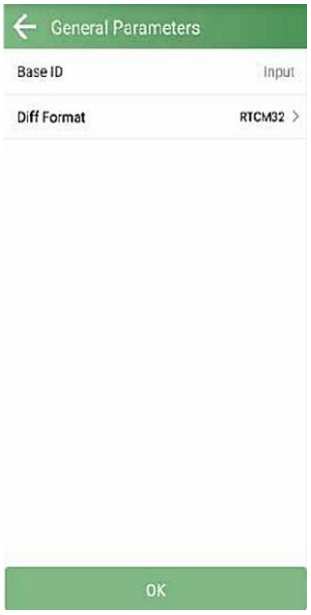
Local RTK Service/CORS: You can subscribe to a local CORS/RTK Service account to get RTK corrections. Typically, the account includes IP address, port, mountpoint, username, and password for accessing correction data. Internal GSM Base Mode (Banff-BASE): Set up the receiver as an internal GSM base to 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, GeoPad supports broadcasting the correction data in Device internet Mode.

Device Internet:

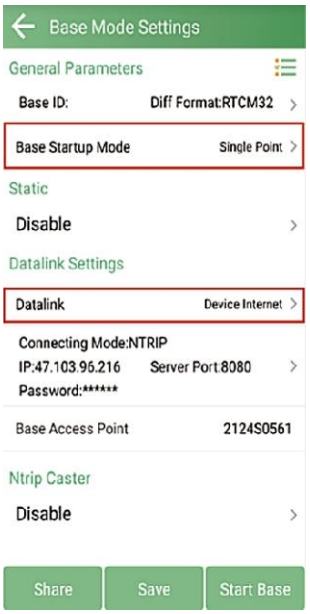
This mode uses the receiver network to transmit the correction data from Base to Rover. Please insert a valid SIM card into your Banff-BASE receiver. Device Base



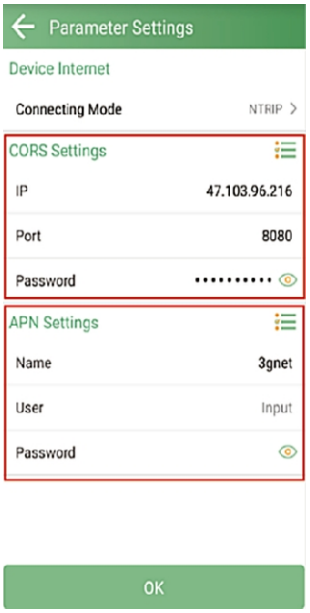




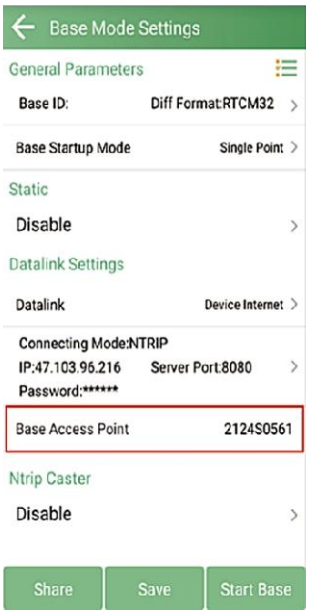
1.Go to >> . Set Base ID and choose the Diff Mode (typically RTCM32). Set Start up Mode Device Internet. 2. (please refer to chapter 2.5.1 for details). And set Data link to the



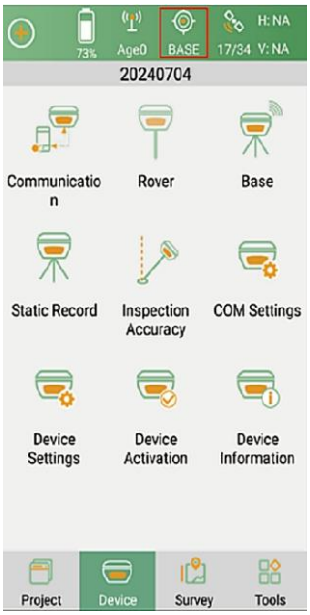
Connecting Mode 3. Set as Ntrip and input the detailed parameters: Input the IP, Port, Password according to your Ntrip Caster platform. Input APN Settings



according to your SIM card mobile service provider. 4. Set the Base Access Point in the end, which will be the mountpoint name when configuring RTK rover.



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



GeoPad as below.

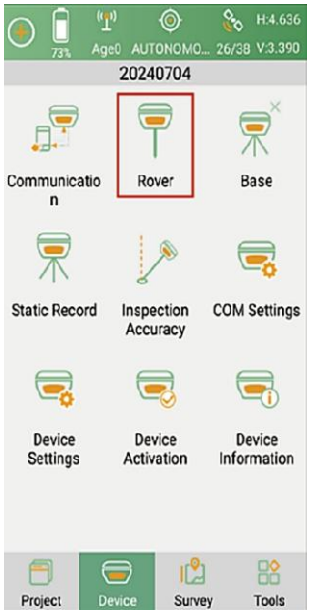
Note:

Banff-BASE 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.

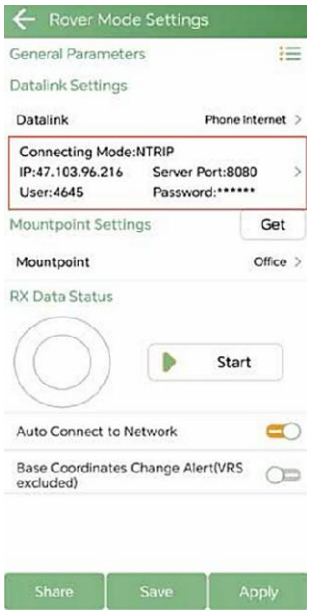
2.5.2.2 PDA CORS Rover Mode

When working as a Network Rover, GeoPad 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 (data collector can

obtain a 4G network signal by inserting a SIM card), WiFi or hot spot. Device Rover 1. Go to >> . Set Data link to the Phone Internet.



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

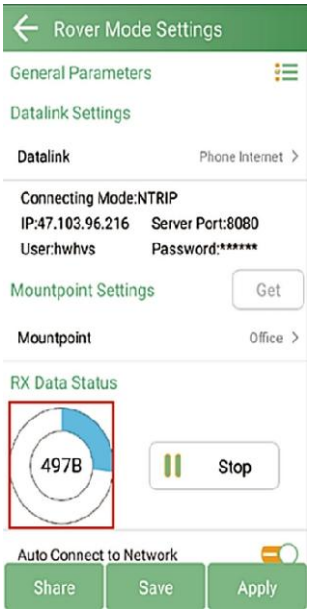


Password in the CORS Settings. NOTE : IP & port in the picture is only for example. Please enter your local CORS account instead. You can purchase a third-party RTK corrections service account in your local area to obtain an RTK FIX solution. Get

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

NOTE :

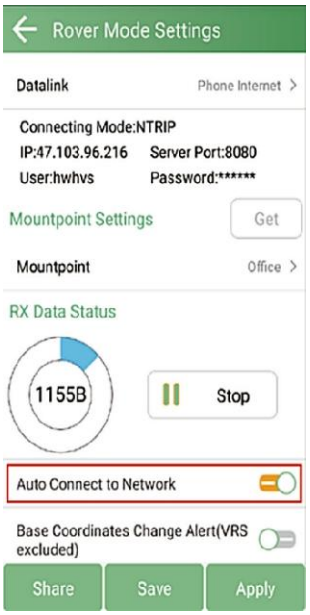
The mountpoint shown in the figure is for demonstration purposes only. Please find out the appropriate mount point via the website of your local NTRIP/CORS provider. Make sure that the baseline does not exceed 50km. 4.Click Start button to receive data from CORS/RTK correction service once the



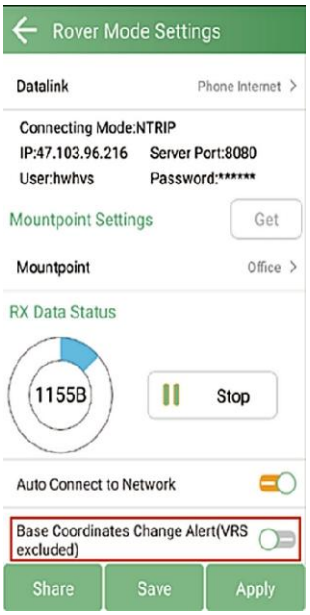
connection is established.

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, GeoPad 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: GeoPad 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. "FIXED" Age After completing the configuration, please check the RTK status in the top status bar. Once the status changes to and the differential delay " " is within the 3.2 Point Survey range of 1-2 seconds, you have obtained reliable centimeter-level RTK positioning. Now you can proceed to to start surveying.

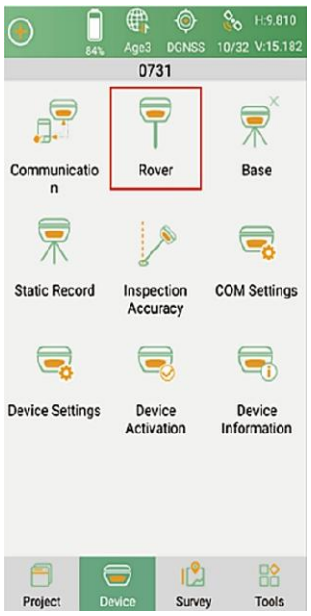
2.5.2.3 INTERNAL GSM ROVER MODE

Network Rover Options:

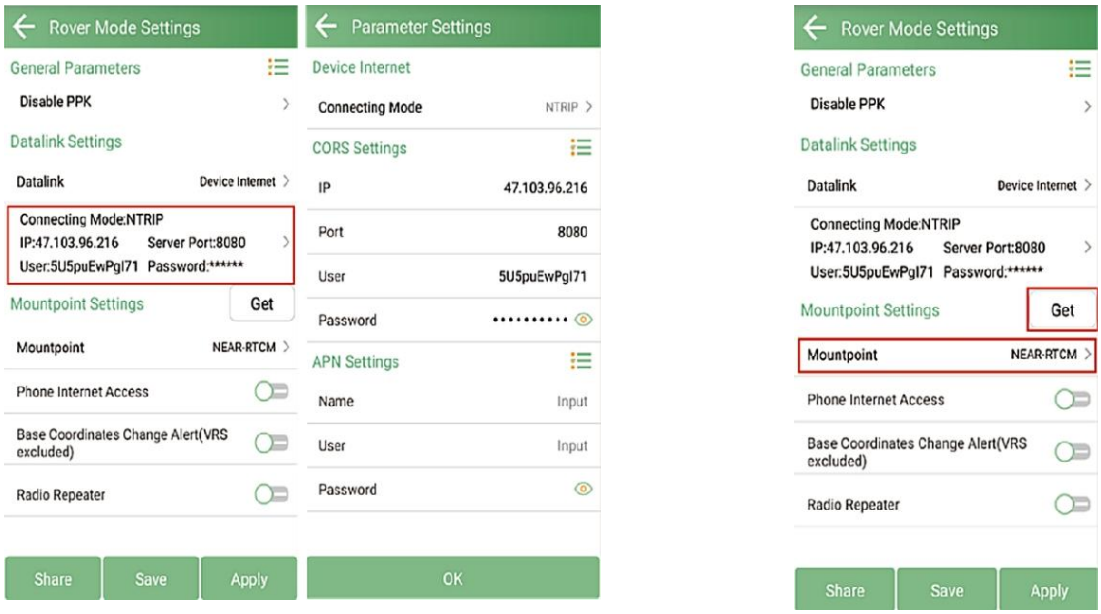
PDA CORS Rover Mode: Receive RTK correction data via the mobile network of your data collector or other Android PDA device.

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, GeoPad 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 Banff-BASE receiver. Device Rover Device Internet. 1. Go to >> . Set Data link to the



2. Set Connect mode, for Banff-BASE 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.

Base Coordinates Change Alert:

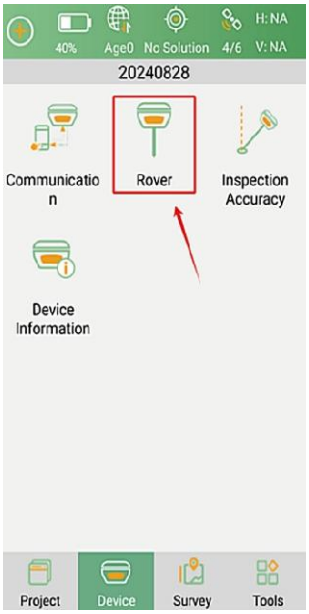
4. GeoPad will alert when you connect with different base station. When you are using VRS, it is recommended to disable this

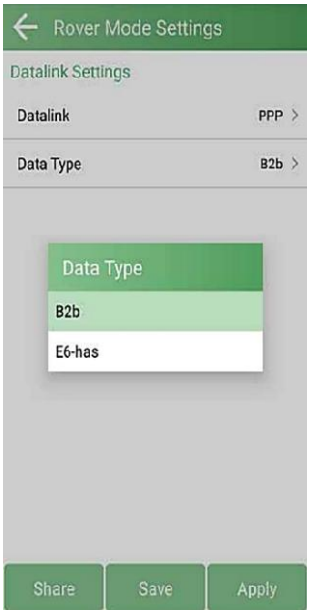
option. 5. Click Apply to start the Rover mode

"FIXED" age After completing the configuration, please check the RTK status in the top status bar. Once the status changes to and the differential delay “ ” is within the 3.2 Point Survey range of 1-2 seconds, you have obtained reliable centimeter-level RTK positioning. Now you can proceed to to start surveying.

2.5.3 PPP MODE

Enter Device >> Rover, select Datalink as PPP, and you can choose Data Type





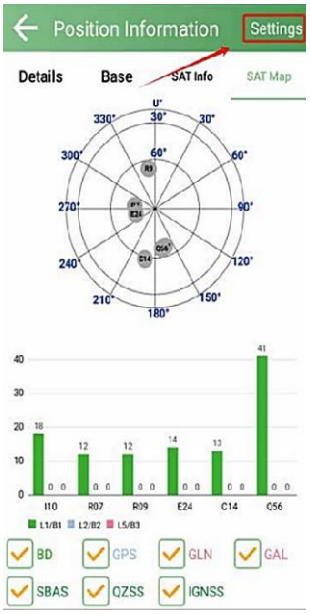
between Beidou B2b and Galileo E6-has, then click Apply. After configuration, the PPP mode will take around 10 minutes converging to typical accuracy. You can see the positioning state in the top status

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 GeoPad, 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 GeoPad Status Bar

After completing your Banff-BASE RTK setup, check current RTK solution status at the top of the GeoPad 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.

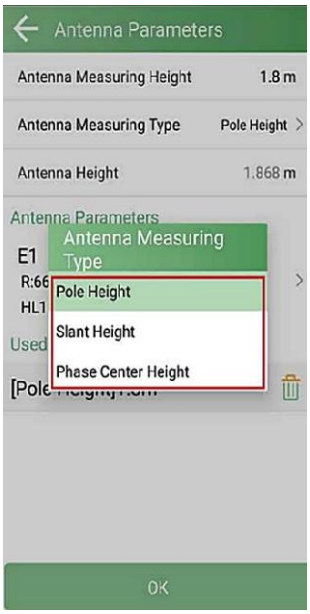
The satellite icon shows calculated satellites number/tracked satellites number. You can click it to check satellite map and more information.

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.

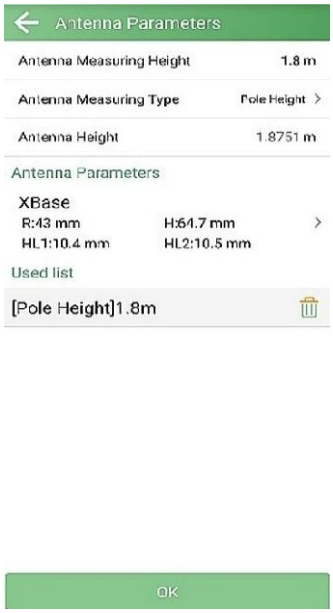
3.2 Point Survey

Point Survey Name Code

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

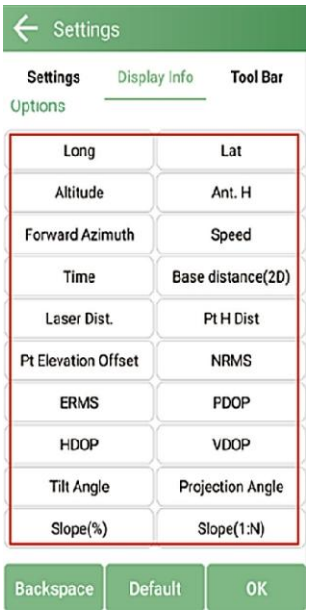


NOTE : Our software supports 3 antenna measuring types, please refer to chapter 2.5.1 for details. Pole Height: Typically in rover mode, select the Antenna Measuring Type as Pole Height and enter the height of your centering pole.



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, GeoPad supports Longitude, Latitude, Altitude, etc.

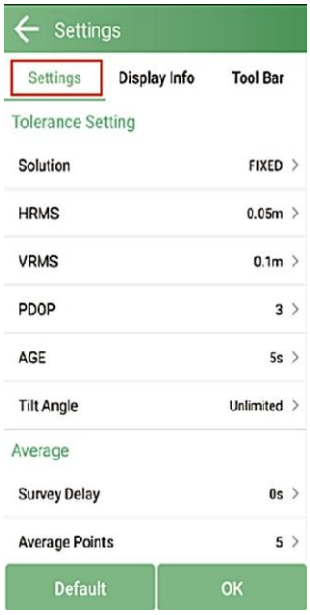


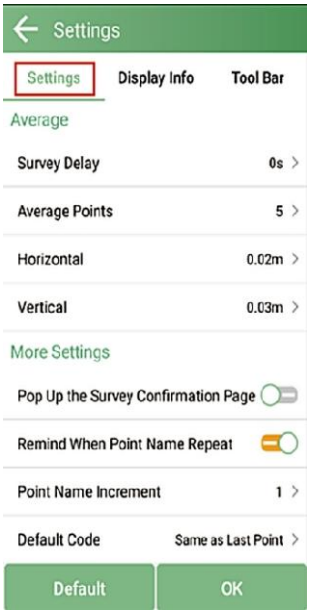
Click to select different map types or do map calibration. GeoPad supports Google Map(Standard Map/Satellite Map), OpenStreetMap and WMS Map.

Click to center map on current position Click to display all survey points on the interface.

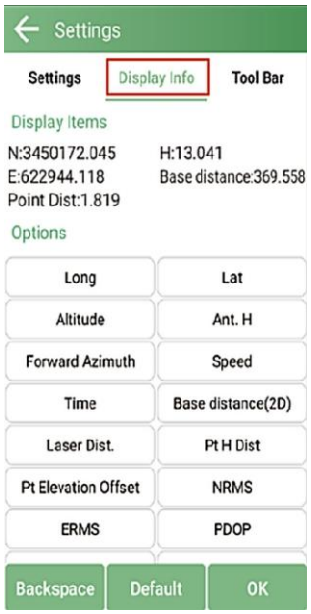
Click to enter the point database. You can add, recover, import and export data. After selecting a point, you can view the details and add notes or attach photos.

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.



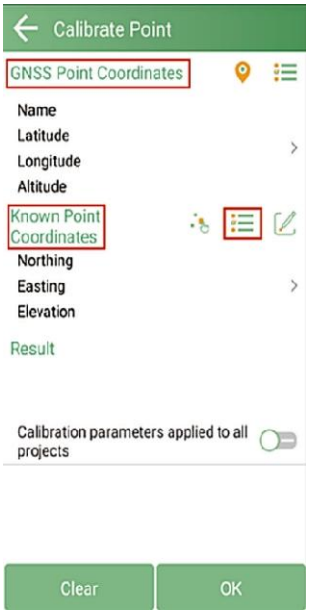


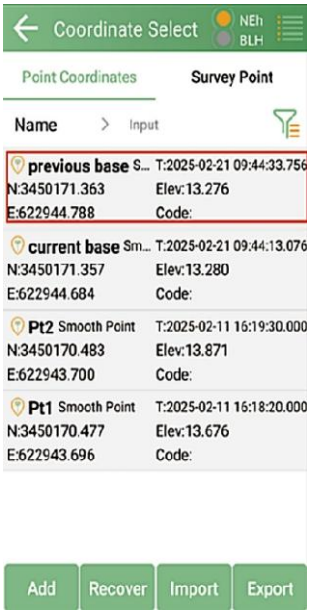
In Display Info interface, you can set the display information to the floating window, such as longitude, latitude, altitude, etc. In Tool Bar interface, you can add or delete options that displayed on the point survey interface. You can customize the interface layout to suit your preferences.



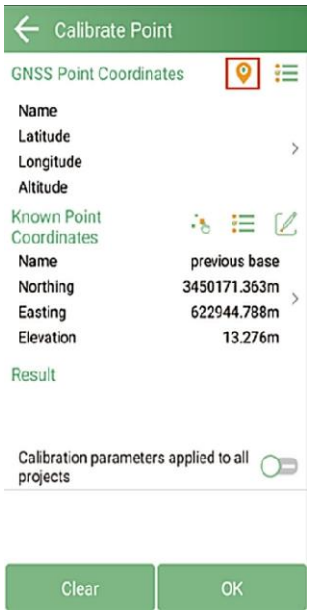
3.3 Calibrate Point

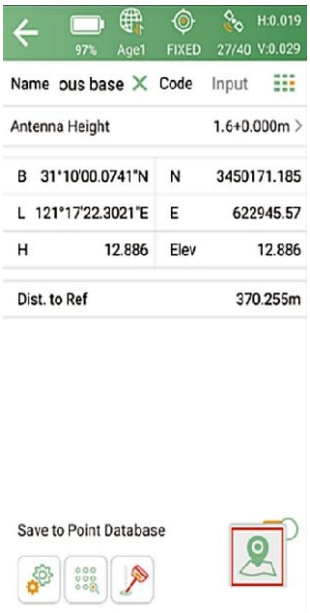
When changing the position of the base station, there will be offsets between surveying points under different base stations. Users can use the Calibrate Point to calibrate the offset. Go to Project > Calibrate Point. Add a point measured under the previous base station as Known Point Coordinates, and measure the same point under current base station as GNSS Point Coordinates.



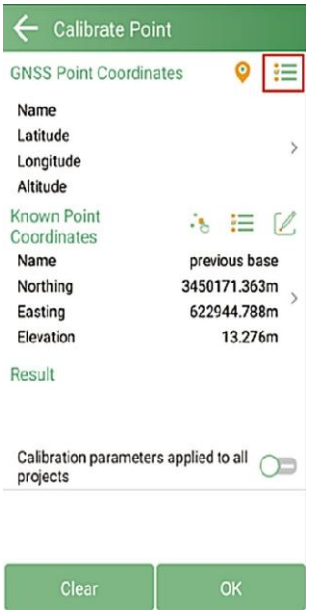


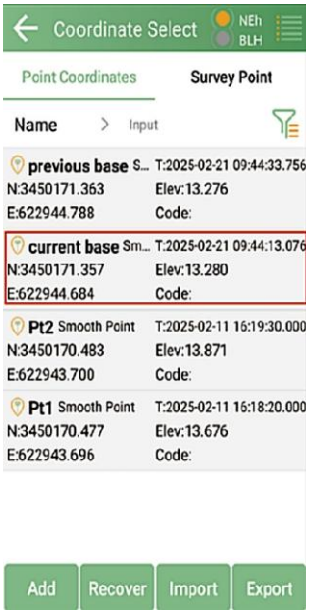
For the GNSS Point Coordinates, you can click the surveying icon to measure under the current base directly. NOTE: Please confirm the RTK status is FIXED before performing the calibration.





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



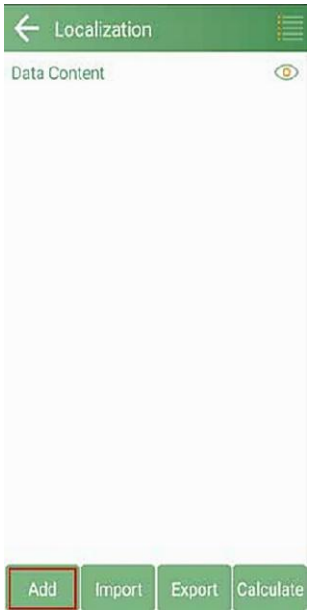


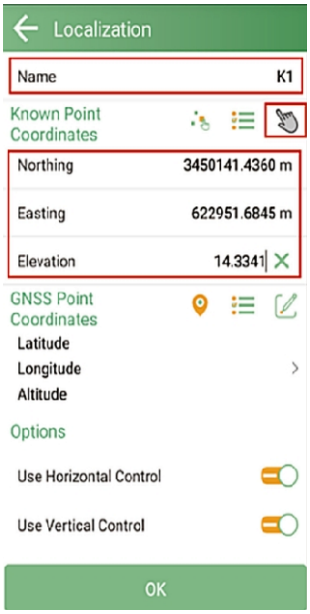
3.4 Localization

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

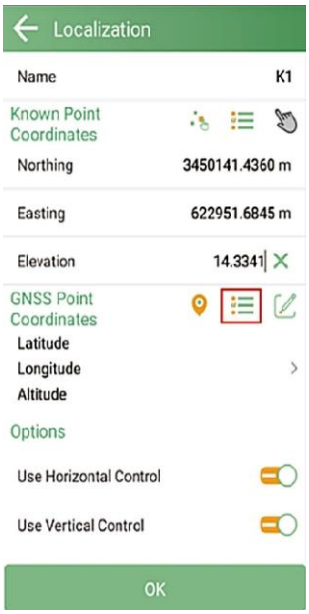
NOTE : A pair of points are the known local coordinates and the surveying coordinates of the same point

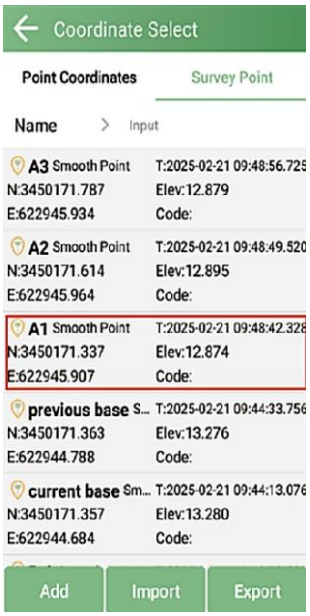
Add Click to add the corresponding pairs. Firstly, input the Known Point Coordinates.

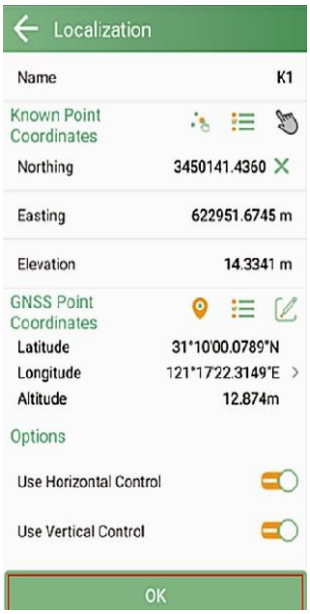




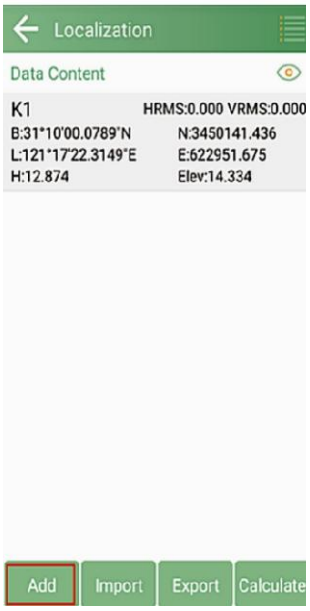
Then select the corresponding GNSS coordinates of the known point.



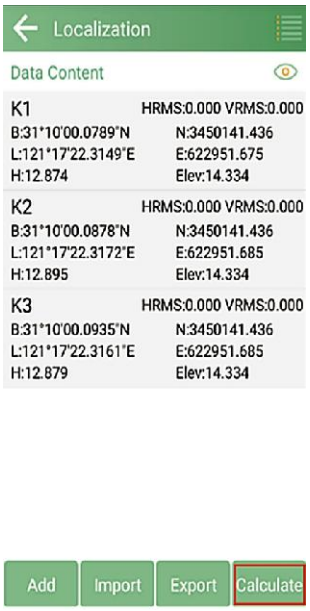




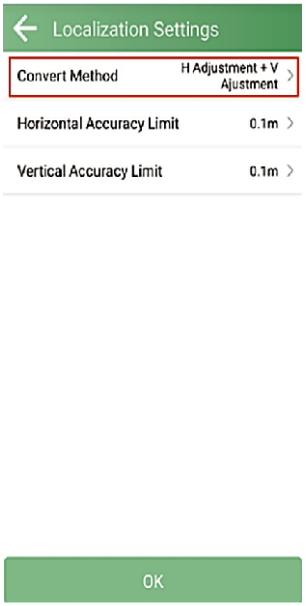
Add the remaining point pairs in sequence. You can also enter the known point in point database in advance and select the input points.

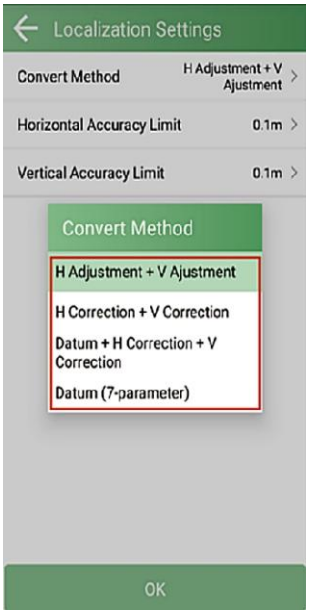


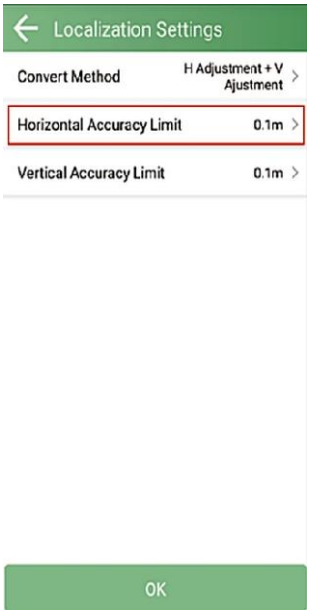
Calculate After adding all the point pairs, click .

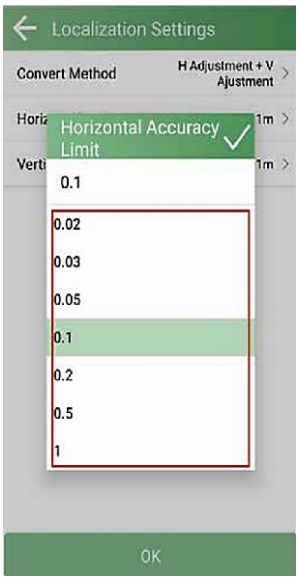


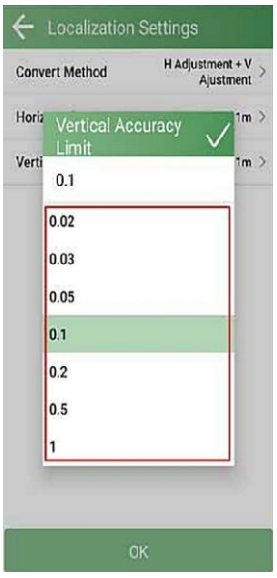
Select the convert method and the accuracy limit according to your project requirements.

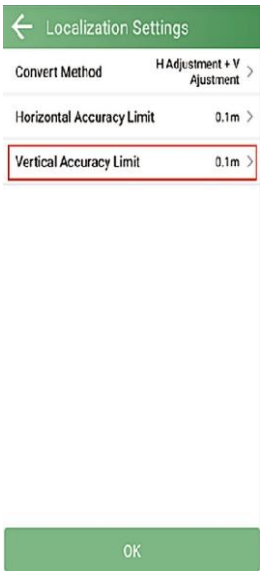












You can click Export Report to save the projected coordinate system parameters. Click Apply to apply the localization.

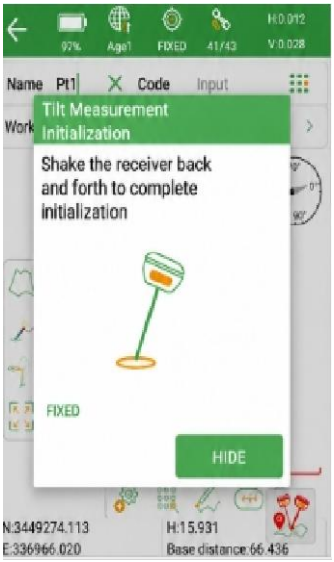
3.5 Tilt Survey

If using the Banff-BASE 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 Banff-BASE 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 ±2.5cm.

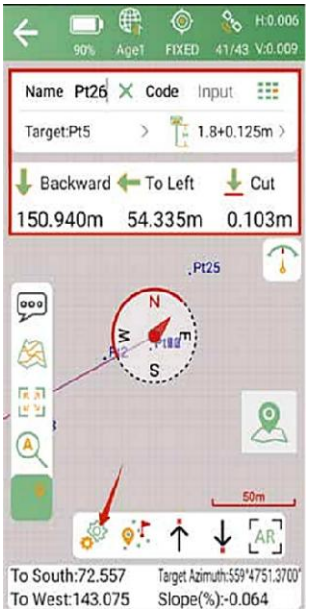


NOTE :If rapid rotation, falling and other violent movements cause IMU status loss, it needs to be reinitialized by gently shaking the pole for about 5 seconds.

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

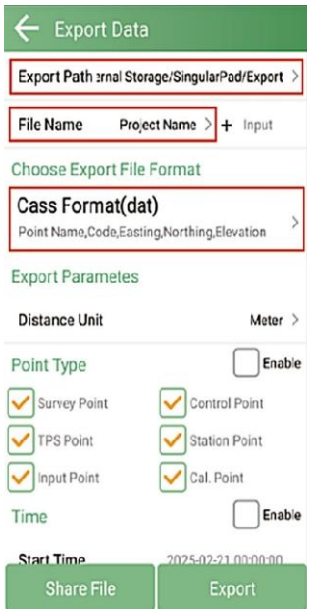
Click to enable or disable IMU

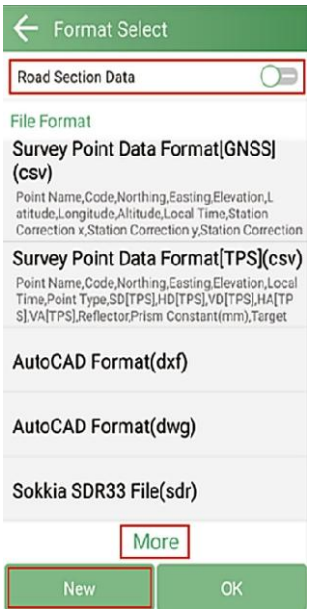
Click to automatically zoom to the full image Click to jump to the current point

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.

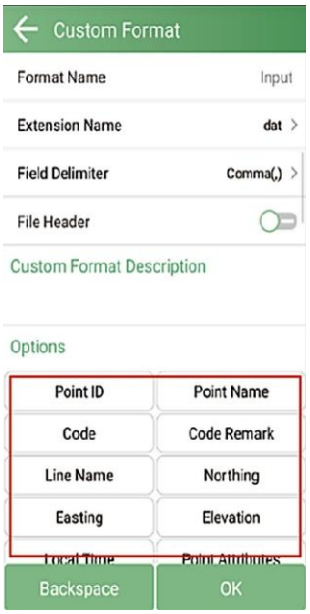




Export Path: the default export path is internal storage/GeoPad/export; you can also change to any other path if required.

- 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.



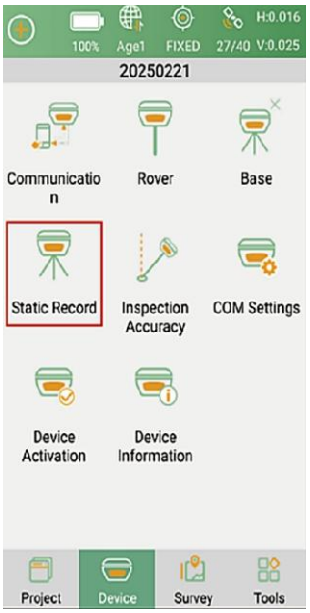
4 STATIC SURVEY

This chapter describes how to conduct static survey through Banff-BASE receiver and 3AG Converter software. For static survey, Banff-BASE supports 3AG binary format (*.XYZ), which is a raw observation data format. You can convert it to RINEX format via 3AG Converter Software. For the converter software, please contact the 3AG support team at <support@3AG.com> for assistance

4.1 Static Data Collection

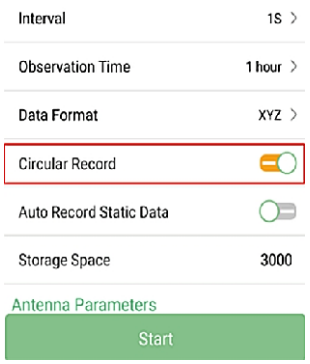
Static survey is mainly used for the control point survey. To reach millimeter accuracy results, please follow the recommendations below:

- 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 GeoPad software. Device Static Record 1. Go to >> for static settings.

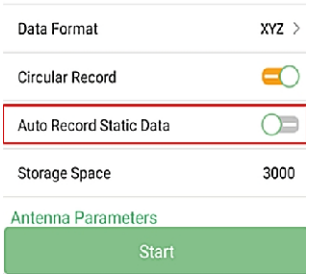


2. Choose the Record mode. There are two record modes and they can record static data at the same time. Options Settings interface: Input Record name and Point name. Set the Collection Interval, Observation Time and Data Format.

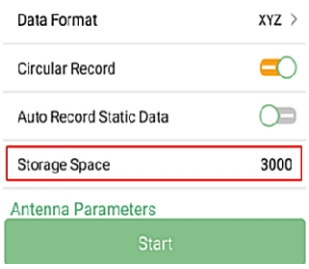
Circular Record 3. Turn on/off the according to your needs. If this option is turned on, the receiver will automatically delete the earliest recorded data to keep recording when the storage space is full.



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



Storage Space 5.Set the at the end (unit: MB). It will limit the amount of data that receiver can record. start 6.Click to start static data collection.



4.2 Static Data Download

The raw observation data is saved in the internal memory of the Banff-BASE receiver.

6 TROUBLESHOOTING

If you encounter any issues that are not addressed in this manual, please contact 3AG support team for assistance. To help our support engineers diagnose and resolve the issue efficiently, Please send the following information to our support team for further assistance.

- Serial number of your Banff-BASE device
- Problem description with supplementary video/screenshots
- Debug logs and project file

6.1 How to Find Serial Number

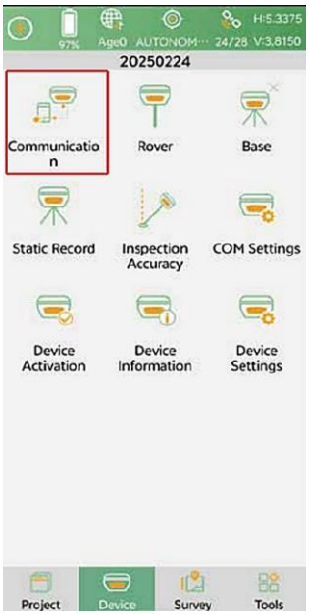
The serial number is a unique combination of numbers and letters assigned to your Banff-BASE receiver for identification and technical support purposes. Find serial number Find the serial number of your Banff-BASE as shown in the image below.

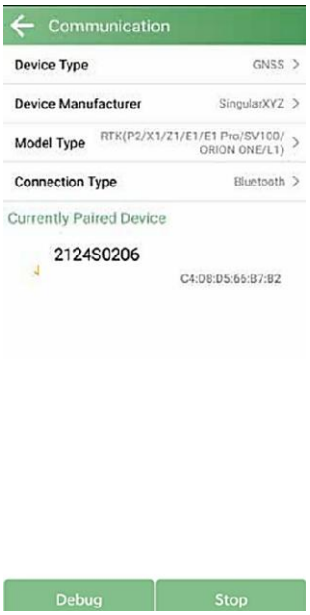
6.2 How to Get Debug Data & Project File

6.2.1 Save Debug File

The Debug data provides information about your current Banff-BASE 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 (/GeoPad/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: Project Project Manager Enter >> , select your project and click Share.