SinoGNSS

Mercury Laser RTK

Quick Manual



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This is the V1.0 (January, 2026) revision of the Mercury User Guide. It cannot be copied or translated into any language without the written permission of ComNav Technology Ltd.

Technical Assistance

If you have any question and can't find the answer in this manual, please contact your local dealer from which you purchased the Mercury. Alternatively, request technical support from ComNav Technology Website: *www.comnavtech.com* or technical support email: *support@comnavtech.com*. Your feedback about this Guide will help us to improve it with future revisions.

Safety Information

Before using the receiver, please make sure that you have read and understood this User Guide, as well as the safety requirements.

- Connect your devices strictly based on this User Guide
- Install the GNSS receiver in a location that minimizes vibration and moisture
- Avoid falling to ground, or colliding with other items

- Keep a sound ventilation environment
- Change the cable if damaged

Related Regulations

The receiver contains integral Bluetooth® wireless technology. Regulations regarding the use of the datalink vary greatly from country to country. In some countries, the unit can be used without obtaining an end-user license. But in some countries the administrative permissions are required. For license information, please consult your local dealer.

Use and Care

The receiver can withstand the rough treatment that typically occurs in the field. However, the receiver is high-precision electronic equipment and should be treated with reasonable care.

Warning and Caution

An absence of specific alerts does not mean that there are no safety risks involved. A Warning or Caution information is intended to minimize the risk of personal injury and/or damage to the equipment.

WARNING- A Warning alerts you to a potential risk of serious injury to your person and/or damage to the equipment, because of improper operations or wrong settings of the equipment.
CAUTION- A Caution alerts you to a possible risk of damage to the equipment and/or data loss.

Warranty Notice

ComNav Technology does not warranty devices damage because of force majeure (lighting, high voltage or collision).
ComNav Technology does not warranty the disassembled devices.

FCC Warning

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

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

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

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

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1. Introduction

The SinoGNSS Mercury User Guide is aimed to help you get familiar with the Mercury laser RTK and start your project effectively. We highly recommend you to read this manual before surveying, even you have used other GNSS receivers before.

1.1. About the receiver

With SinoGNSS® Quantum™ algorithm, Mercury can be applied in RTK mode with all GNSS constellations. It has ultra-small size and strong anti-interference ability to make it possible to work even in harsh environments. It is the ideal RTK/GNSS product for surveyors.

1.2. Receiver features

The SinoGNSS® Mercury key features:

- Utra small and super light
  - Size: 8.1 cm × 7.6 cm× 17.1 cm
  - Weight:550g with internal battery
- 1590 channels of simultaneously tracked satellite signals
- Increased measurement traceability with SinoGNSS® Quantum™ algorithm technology
- Able-free Bluetooth wireless technology
- 1 Color Touch Screen and 2 Function buttons
- IP68 waterproof
- Calibration-free IMU integrated for Tilt Survey
- Up to 120° tilt with 2.5 cm accuracy
- Integrated 50m Laser sensor
- With one cameras, surveyors gain a 3D visual view in topo survey and stake work.
- Support SBAS and PPP service
- Support NFC Fast Connection
- PDA Radio supports super datalink, supports a number of protocols, including Transparent/TT450S/South/Mac/SNLonglink. With SNLonglink, 5-15km working range is achievable under ideal conditions.
- Support long baseline E-RTK™ (Beidou B3 signal is included in RTK calculate engine)

1.3. Mercury parts list

This section provides overall Mercury parts list, including basic supplies and customized

kits based on your requirements.

1.3.1 Basic Supply kit

SinoGNSS® Mercury Basic Supply kit contains one receivers and related accessories

Essentials:

Item	Picture
1* Kits Mercury Receivers	
1*GNSS Connector	
1*Charger adapter (EU/USA/UK)	
1*USB—Type-C cable	
1*Phone Bracket	
1*U-Disk	
1*User Manual	

1*Vest	
1*Rover Case	
1*Survey Master Register Code	

Optional:

Item	Picture
R80 Controller	
Controller Charger	
Controller Type-C Cable x1	
Controller Bracket	
1*2m-Range Pole with yellow bag	

2. Setting up the receiver

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

2.1. Environmental requirements

To keep the receiver with a reliable performance, it is better to use the receiver in safe environmental conditions:

- Operating temperature: -40°C to 65°C
- Storage temperature: -40°C to 85°C
- Out of corrosive fluids and gases
- With a clear view of sky

2.2. Laser & Cameras Specification

To keep the laser with a reliable performance, It is better to use Mercury in the conditions that meet the specifications:

Laser specification

- Range: 50m
- Accuracy(room temperature): (3-5)mm + 1ppm
- Measuring Frequency: Classic Value: 3Hz
- Maximum Value: 5Hz
- Laser Injection Power: 0.9mW to 1.5mW
- Working Temperature: -20°C to +50°C
- Storage Temperature: -30°C to +60°C

Cameras specification

- Sensor pixels: 1600× 1300
- Field of view: 47°
- Video frame rate: 30 fps

2.3. Front panel

Receiver front panel contains 2 buttons, Power button and Menu button. The LEDs display shows the status of differential, satellite tracking, WIFI/GPRS and battery. For detailed information, see 3.2.



2.4. Lower housing

Receiver lower housing contains a type-c port and a threaded insert.

2.5. Power supply

Mercury supports internal battery and external power input.

2.5.1 Internal battery

The Mercury receiver adopts the rechargeable Lithium-ion battery design that provides you an effective survey workflow. The internal battery typically provide about 15-hour operating time as a rover. However, this operating time varies based on environmental conditions.

- Battery Safety

Charge and use the battery only in strict accordance with the instructions below:

- Do not use or charge the battery if it appears to be damaged. Signs of damage include, but are not limited to, discoloration, warping, and leaking battery fluid.
- Do not expose the battery to fire, high temperature, or direct sunlight.
- Do not immerse the battery in water.
- Do not use or store the battery inside a vehicle during hot weather.
- Do not drop or puncture the battery.
- Do not open the battery or short-circuit its contacts.

- Charging the Lithium-ion Battery

Please obey the following instructions when charging your batteries:

- Charge the battery completely before using it for the first time.
- Fully charge takes approximately 4 hours at room temperature.
- If the battery has been stored for a long time, charge it before your field work.
- Re-charge the battery at least every three months if it is to be stored for long time.

- Dispose of the Lithium-ion Battery

- Discharge a Lithium-ion battery before dispose of it.
- Dispose of batteries is an environmentally sensitive manner, and adhere to any local and national regulations concerning battery disposing or recycling.

WARNING – Do not damage the rechargeable Lithium-ion battery. A damaged battery can cause an explosion or fire, and can result in personal injury and/or property damage.

2.5.2 Charge Battery via Mercury

Mercury GNSS Receiver can work with a Type-C charger, it means you can charge batteries directly.

• Power off Mercury receiver with batteries inside;

• Connect Mercury receiver to 7.2V external power with serial cable;

• Receiver charge the battery, the red power led will flashing during charging and will off when battery full



+



2.6 Pole-mounted setup

To mount the receiver on a range pole as the figure shown below:



- Thread the receiver onto the range pole
- Mount the controller bracket to the pole
- Install the controller into the bracket

Tip: Do not tightly clamp the controller on the Range Pole.

3. General Operation

This chapter introduces all controls for the general operation, including button functions and all LED behaviors on the front panel.

3.1 Button functions

To turn off the receiver, long press the button for 3-4 seconds until the touch screen off.

There are two buttons on the front panel, power button and menu button.

- Power button:

Press the power button for about 1 second to turn on the receiver;

To turn off the receiver, long press the button for 3-4 seconds until the touch screen off.

- Menu button:

Press the menu button for about 1 second to turn on setting menu.

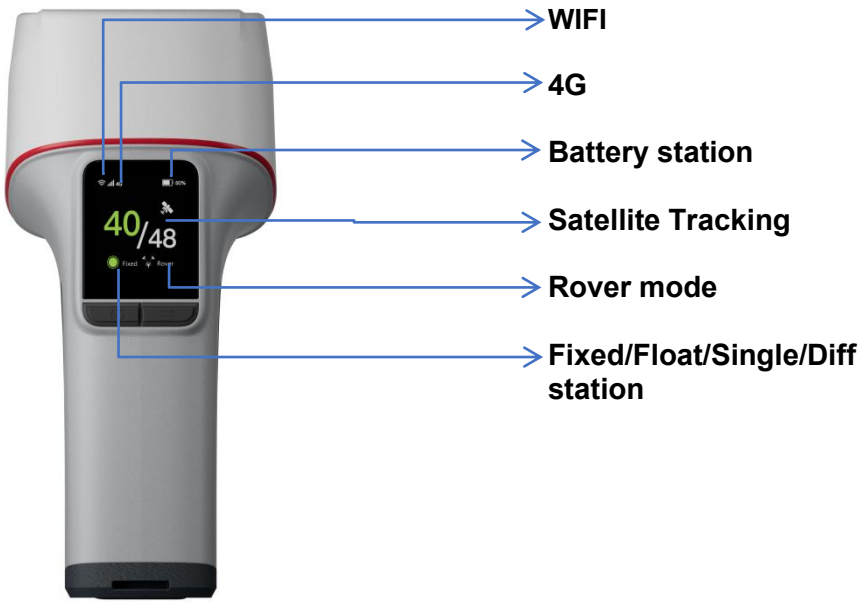
- Survey button:

Press the survey button once to start survey.

Press and hold the survey button to activate the camera, then release the button to survey.

3.2 Touch screen

The touch screen on the front panel indicate receiver working status. Generally, the receiver's touch screen shows fixed that indicates normal operation. The following table define each button state:



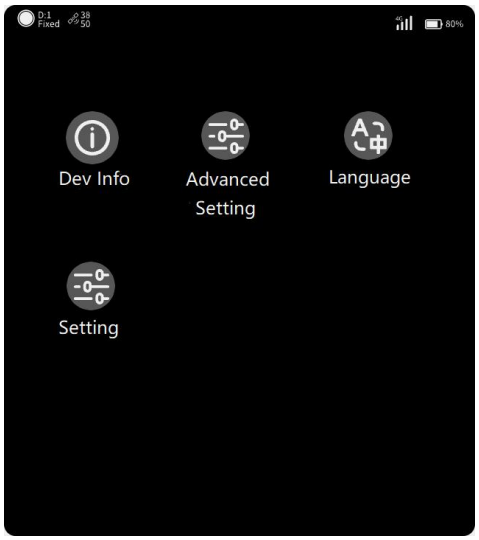
3.2.1 Home interface

The home interface includes: D (differential delay), fix status, satellite tracking, 4G signal, battery status, date, current receiver coordinates, and the button  to return to the measure interface.



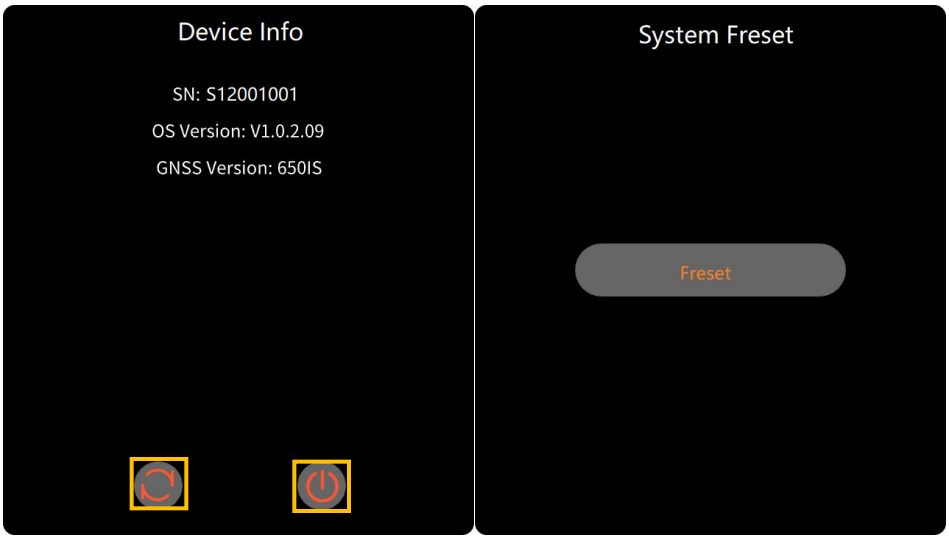
3.2.2 Setting interface

Swipe down from the home interface to enter the measure interface. It includes device info、advanced setting、language and setting.



Device info: Tap the button, you will view device's SN、OS Version and GNSS Version.

Click  button you can **freset** system. Click  button you can **reset** the receiver.



Advance Setting: Tap the button, you can get the corresponding QR code for Mercury, scan it with Survey Master on the controller to establish a connection. Mercury will then enter ***Tool Mode***, in which the Mercury receiver can work without a controller.



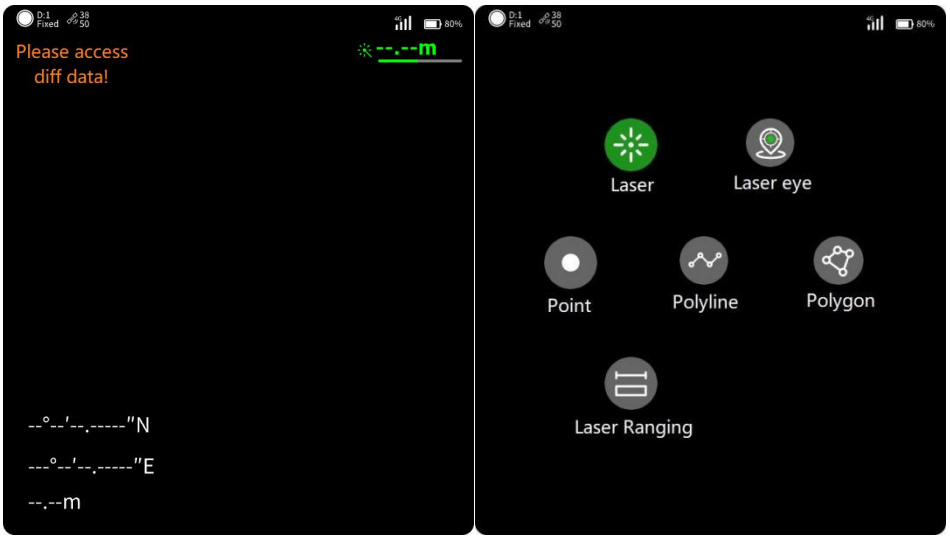
Language: Tap the button to switch between Chinese and English.

Setting: Tap the button, you can save picture during point measurement and enable laser ranging compensation.

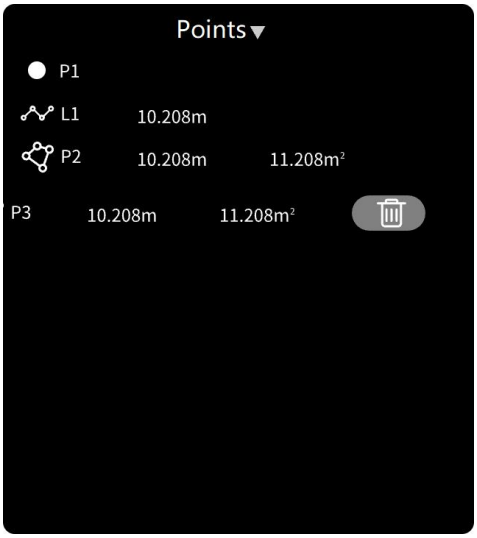
3.2.3 Measure interface

Swipe left from the main interface to enter the measure interface.

Swipe down on the measure interface to switch to the measurement mode settings interface. It includes laser measurement、polyline measurement、polygon measurement、laser ranging.



Swipe left on the measurement interface to switch to the point library interface.



3.3 Receiver Web GUI interface

Step 1: Connect Wi-Fi of Mercury receiver

Turn on the Mercury GNSS receiver and wait for the Mercury serial number to appear under the available Wi-Fi networks on your smart phone or office computer.

For example, Mercury-S12XXXXX (where xxxxx represents the last five digits of the receiver serial number).

Enter password: **12345678**

Step 2: Login the Web

Select the receiver, open a web browser and then enter the following IP address:

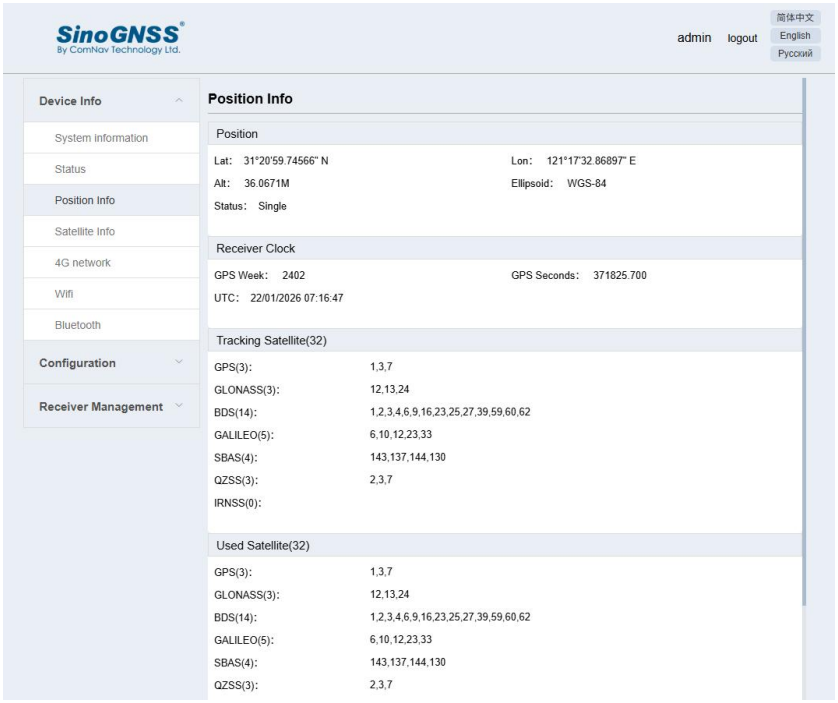
http://192.168.1.8

Tip: Most web browsers for computers / laptops and smart phones / PDAs support the receiver Web GUI

Step 3: Enter the default login settings to access the main page

- Username: admin
- Password: admin

After accessing the main page, configuration menus are listed on the left, and receiver's settings on the right. Each configuration menu will be demonstrated in the following sections.

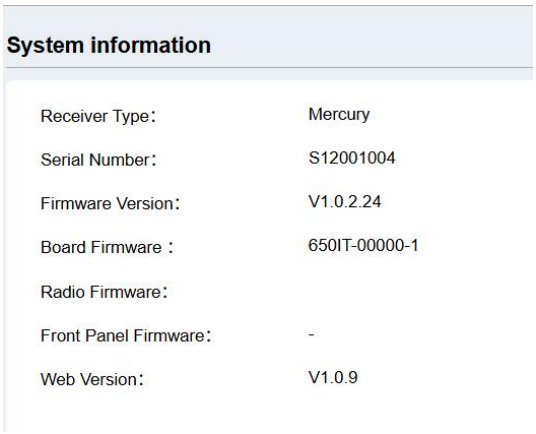


3.3.1 Checking the receiver status

In the section, you can check System information, Status, 4G Network, Bluetooth, Wifi, Position info, satellite info.

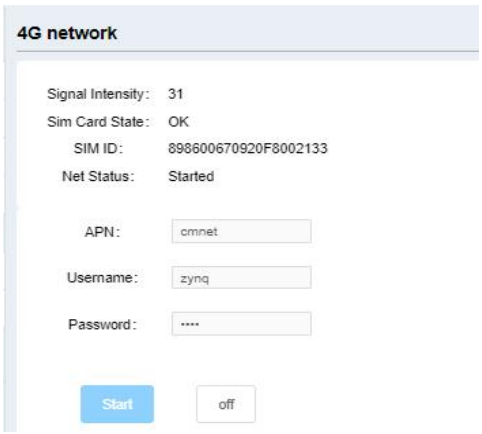
(1) System information, includes the basic information includes receiver type, serial number, system firmware version, board firmware version, radio firmware, front panel firmware (Mercury doesn't have radio and front LCD panel), Web version.

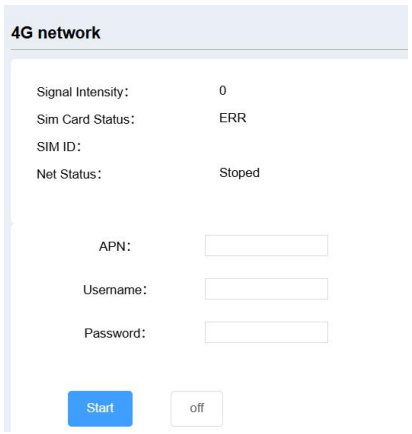
(2) Status: Show the device status and data link status, includes work mode, data link, internal storage capacity and current free storage. The default work mode is rover with the new device, others will be same with the Survey Master settings. Data link status will vary from different work mode, the default is null.



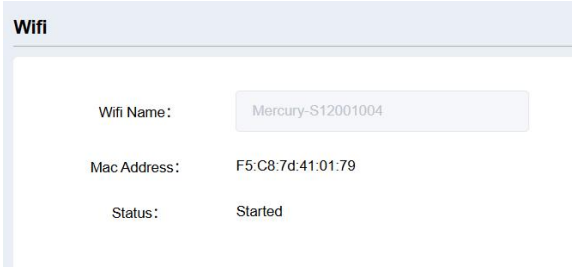


(3) 4G Network, when there is SIM card inside in the receiver, it will start itself, and read the signal intensity, APN, and show started. If there is no SIM card inside, it will show stopped.





(4) WIFI information, shows WIFI name, current Wifi password and Mac address. The Wifi password is 12345678, the client can change the password, click **Save config** to save configuration.Bluetooth information, shows Bluetooth name and Mac address, Bluetooth name cannot be changed;





(4) Position info, shows position status, clock status, tracking satellites, used satellites and DOP status.



Position Info

Position

Lat: 31°20'59.93903" N
Lon: 121°17'32.90040" E
Alt: 29.5987M
Ellipsoid: WGS-84
Status: Single

Receiver Clock

GPS Week: 2398
GPS Seconds: 444306.000
UTC: 26/12/2025 03:24:48

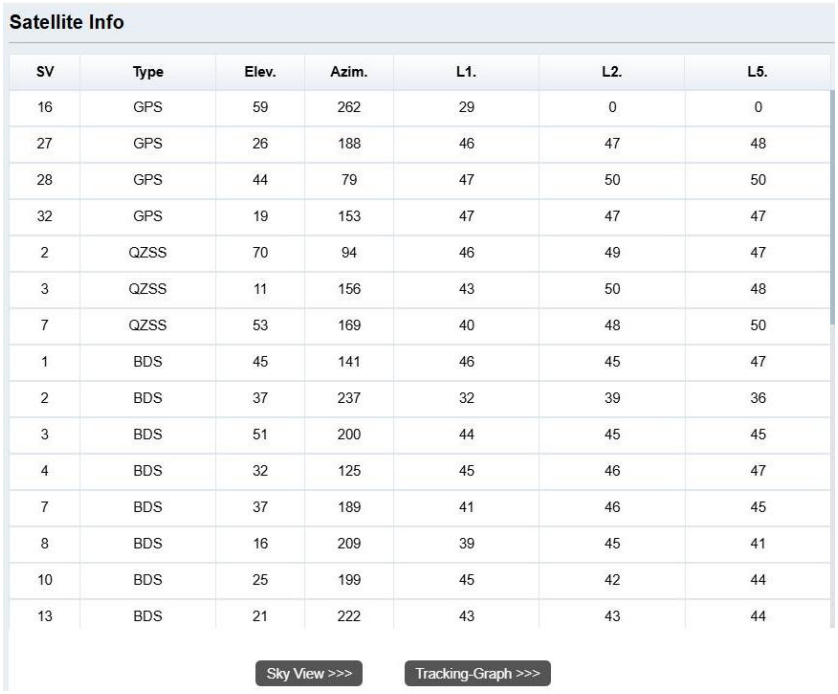
Tracking Satellite(36)

GPS(4):	16,27,28,32
GLONASS(4):	4,5,17,18
BDS(18):	1,2,3,4,7,8,10,13,21,35,38,40,42,44,45,59,60,62
GALILEO(3):	14,19,31
SBAS(4):	137,143,144,130
QZSS(3):	2,3,7
IRNSS(0):	

Used Satellite(36)

GPS(4):	16,27,28,32
GLONASS(4):	4,5,17,18
BDS(18):	1,2,3,4,7,8,10,13,21,35,38,40,42,44,45,59,60,62
GALILEO(3):	14,19,31
SBAS(4):	137,143,144,130
QZSS(3):	2,3,7
IRNSS(0):	

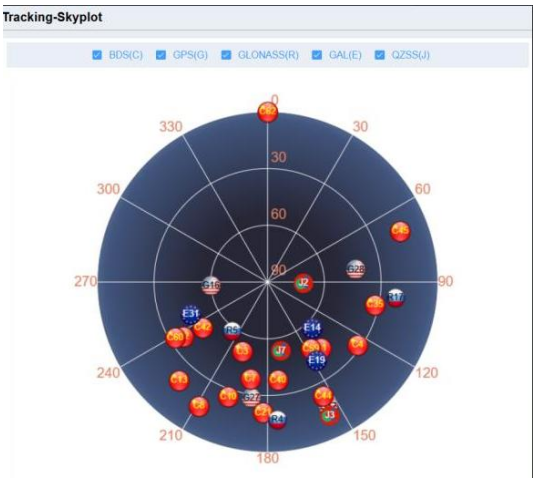
(6) Satellites Info, includes Tracking graph, Tracking skyplot.

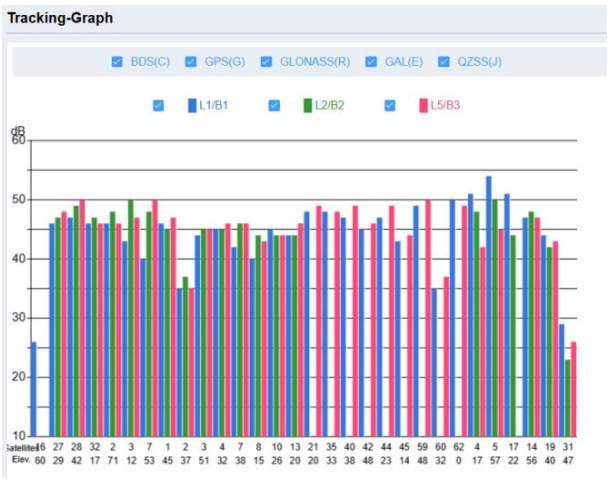


Satellite Info

SV	Type	Elev.	Azim.	L1.	L2.	L5.
16	GPS	59	262	29	0	0
27	GPS	26	188	46	47	48
28	GPS	44	79	47	50	50
32	GPS	19	153	47	47	47
2	QZSS	70	94	46	49	47
3	QZSS	11	156	43	50	48
7	QZSS	53	169	40	48	50
1	BDS	45	141	46	45	47
2	BDS	37	237	32	39	36
3	BDS	51	200	44	45	45
4	BDS	32	125	45	46	47
7	BDS	37	189	41	46	45
8	BDS	16	209	39	45	41
10	BDS	25	199	45	42	44
13	BDS	21	222	43	43	44

Sky View >>> Tracking-Graph >>>

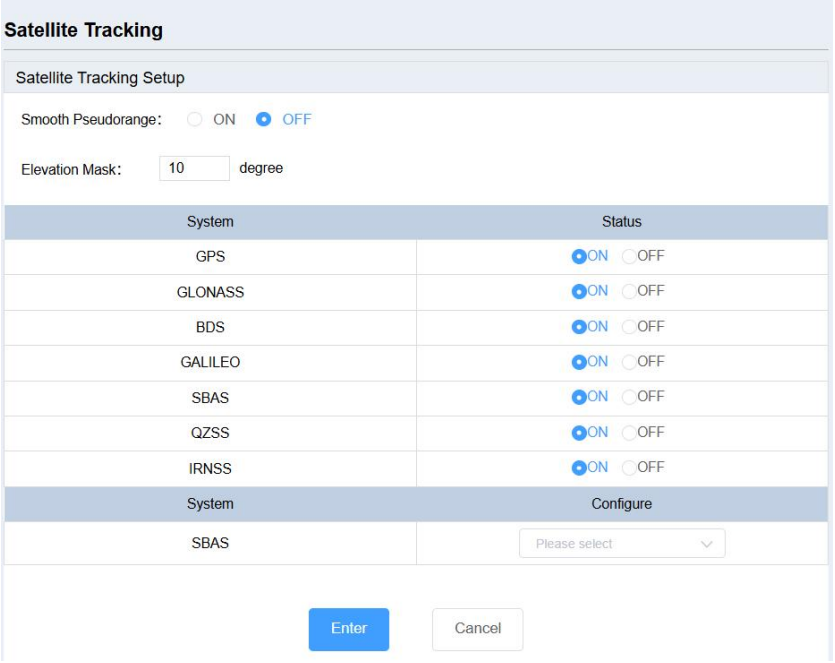




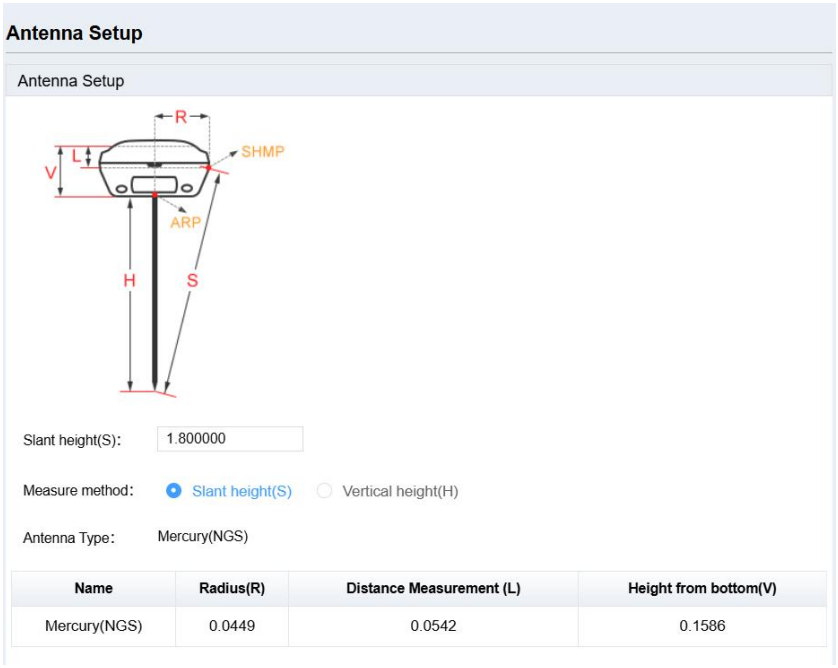
3.3.2 Configuration

This section includes Satellite tracking, work mode and Antenna setup configuration.

•**Satellite tracking:** includes Smooth Pseudorange, default is OFF; Elevation mask: default is 10 degrees; and every system status, supports to change by customers, click **Enter** to save settings, click **Cancel** to cancel the settings.

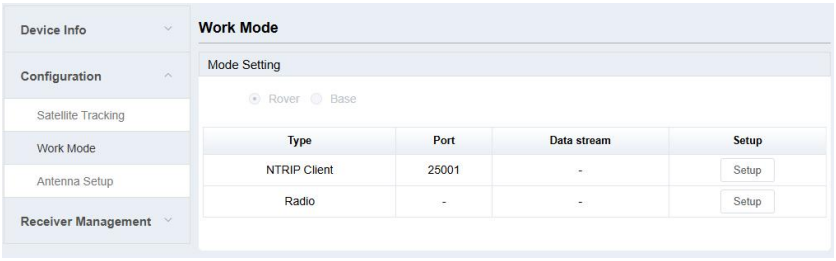


- **Antenna setup:** measure method supports Slant height and vertical height, choose Antenna type, and setup antenna height, click Enter to save configuration.

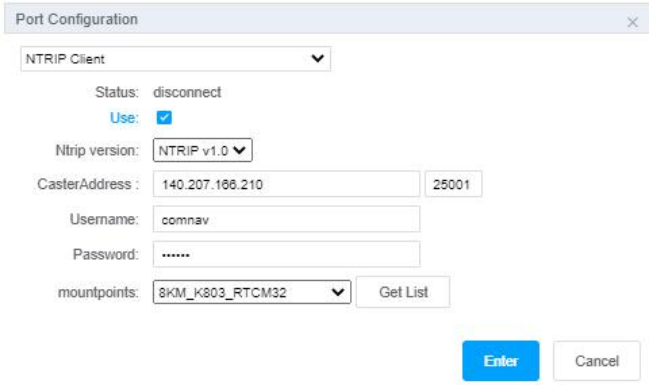


- **Work mode**, only includes rover settings.

Rover settings include Ntrip Client (Same with internal GSM in Survey Master).



Ntrip Client: Set Ntrip version, includes NTRIP v1.0 and NTRIP v2.0, IP, port, username, password, then click **Get List** and select mountpoint, check on **Use**, click **Enter** to apply the Ntrip Client; Check off **Use**, click **Enter** to cancel the work mode.



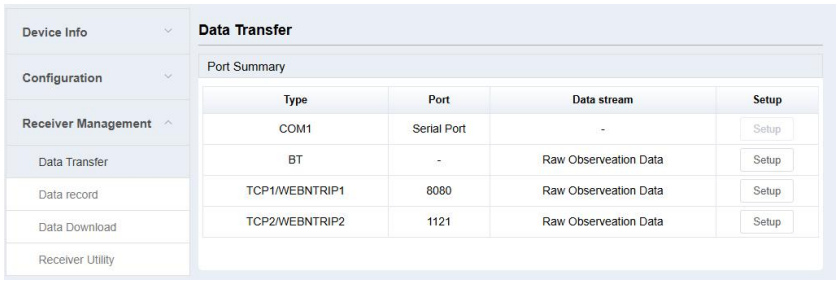
When setup the Ntrip Client, you can go to Device Info->Status to check current device status and datalink status.

3.3.3 Receiver Management

This section includes Data Transfer, Data record, Data Download and Receiver Utility.

3.3.3.1 Data Transfer

Data transfer has five types: Com1, Bluetooth, TCP Server, TCP Client, Web Ntrip.



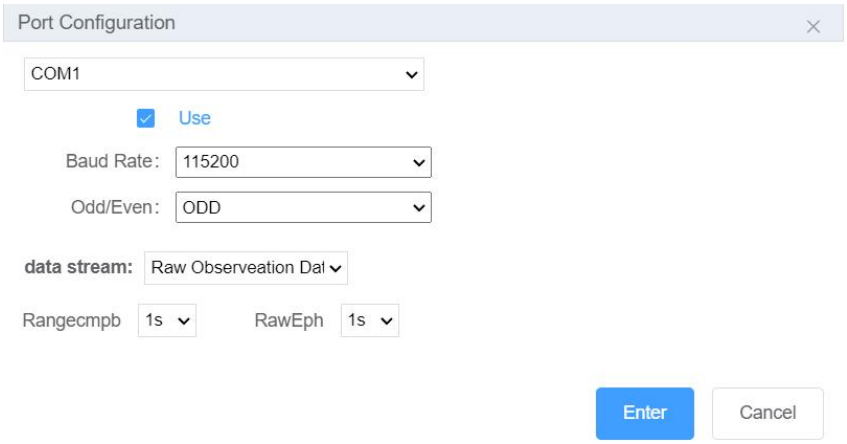
- **Com1**: This is setup to transfer the data through com1 port of the OEM board inside.

You can use serial port cable to check the data transmission (the lemo port is connected to Com1 of the OEM board inside).

(1) Baud rate supports 115200, 57600, 38400, 19200, 9600, the default is 115200.

(2) The supported file formats include raw observation data, NMEA,RTCM3.2, RTCM3.2(MSM5), RTCM3.0, RTD, CMR.

(3) Observation and ephemeris output frequency support 1s, 2s, 5s, 10s and 15s.

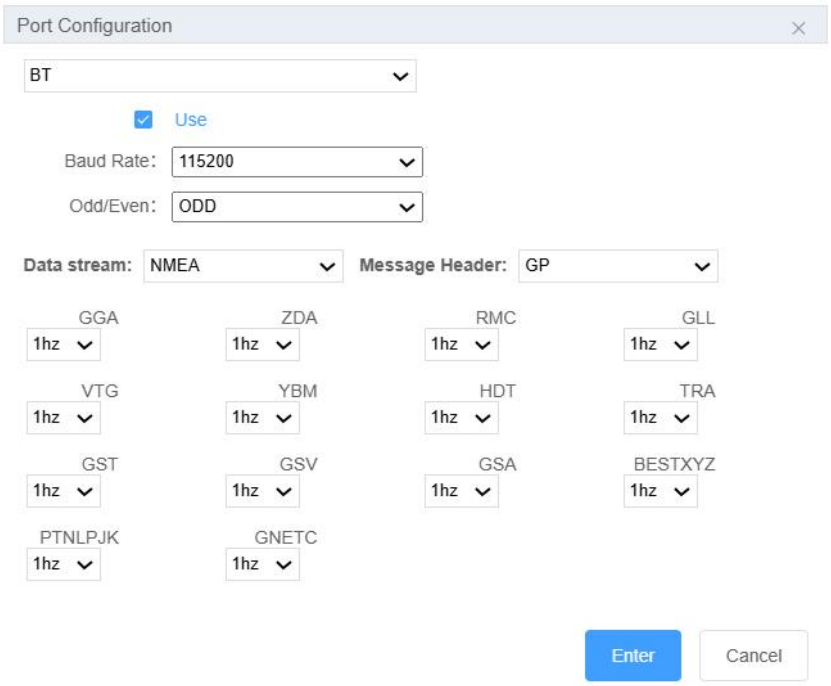


- **BT**: This is used to output data through com2 port of the OEM board (connected to the Bluetooth modem), you can output NMEA data via this port, it is the important step to connect the receiver to other brand software.

(1) Baud rate supports 115200, 57600, 38400, 19200, 9600, the default is 115200.

(2) The supported file formats include raw observation data, NMEA, RTCM3.2, RTCM3.2(MSM5), RTCM3.0, RTD, CMR.

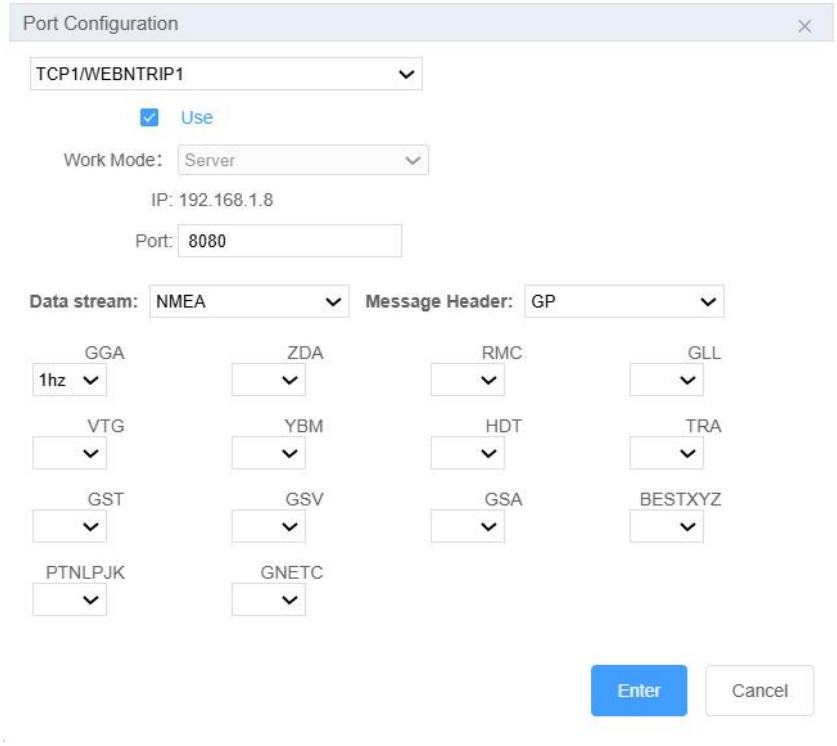
(3) NMEA data output frequency supports 1hz, 2hz, 5hz, 10hz, 15hz.



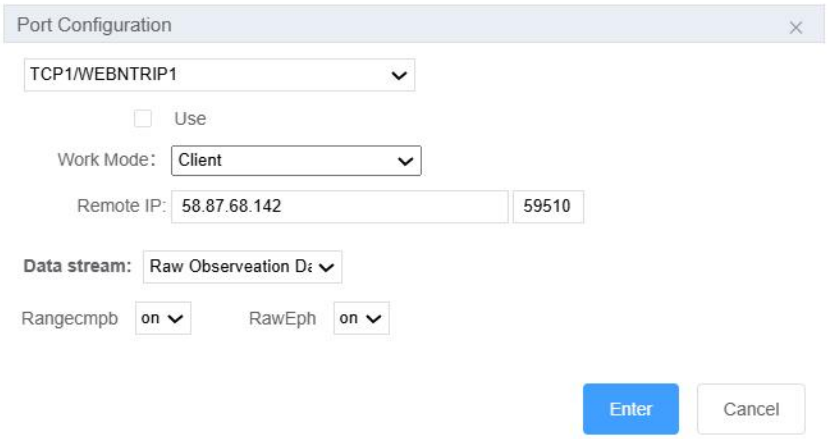
- **TCP Server**: You can output data through TCP server, then use TCP client to get data.

For example, connect your rover or computer and Mercury receiver in the same LAN, setup Mercury to output RTCM data via TCP server, and rover receives via TCP Client.

The supported file formats include raw observation data, NMEA, RTCM3.2, RTCM3.2(MSM5), RTCM3.0, RTD, CMR.



- **TCP Client**: If you have a TCP server with a static IP, you can output the data via TCP Client, then the data will be transmitted to your TCP server. The IP is your PC IP, the port should be mapped. For example, you can output the NMEA data to your TCP Server, then you can check the status of the rover in the office while the rover works in the field.



3.3.3.2 Data record

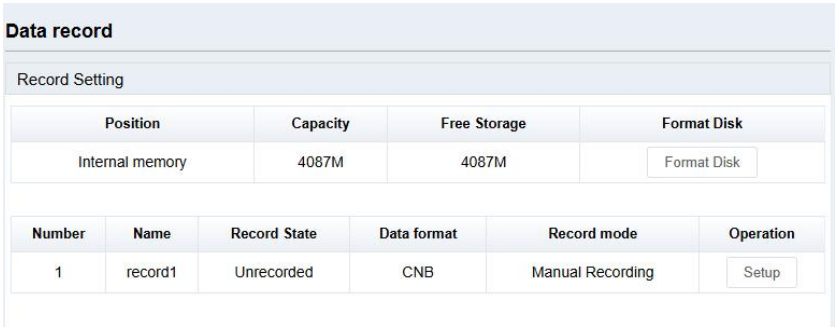
This is used to log static data, the data will be saved in the receive, you can download data via web interface, go to chapter 3.3.3.3 for more information, or you can use USB

cable to connect PC and download static data.

In recording setting interface, you can get following information:

•Current internal memory capacity and free storage; you can click Format Disk to format the receiver internal memory;

•Current record state, data format, record mode.



Click **Setup** to configure the static settings:

- **Name**: You can choose record1, then the file will be saved in record1 folder.

- **Sample Interval**: change the sample interval of observations, the maximum data rate is 20 Hz, the minimum is one observation per minute, it supports 0.05/0.1/0.2/0.5/1/2/5/15/30/60 S

- **File Split**: supports every 15 minutes or 1\2\4\24 hours to save a file, or you can choose Manual mode, then it will save a one file when you manually stop the record by pressing on the static button, or click the Stop button. If you select 24 as file split, it will create two data files when it occurs to 24 o'clock (UTC Time). One is from start time to 24 o’ clock, another is from 0 o’clock to end time.

- **Data format:** Supports CNB, RINEX 2.10, RINEX 3.02

- **Loop**: When storage is full, Yes means delete earliest data and store continually, No means stop recording

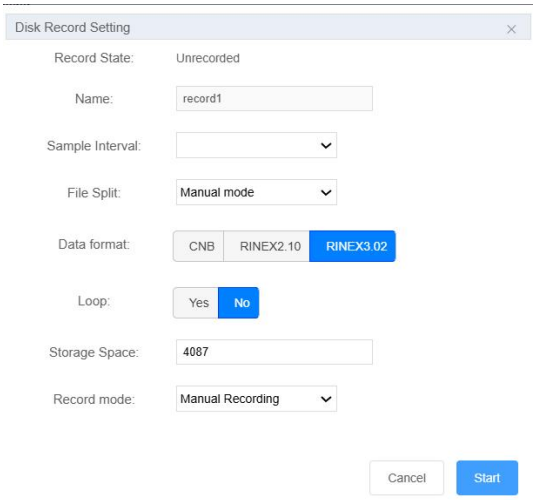
- **Storage Space**: Separate storage space in internal memory

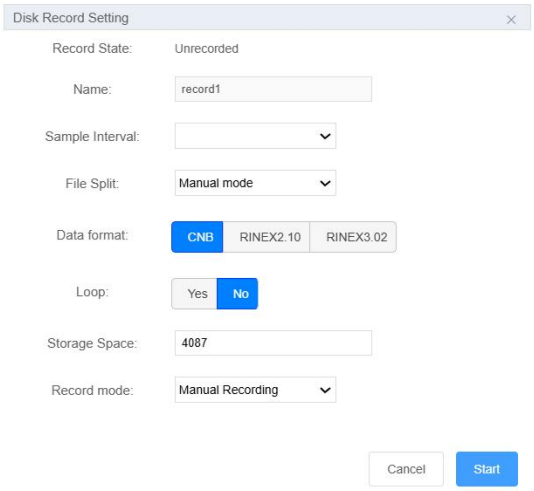
- **Record mode**: logging data manual recording or auto recording.

- **Auto recording**: when you set automatically, it will record static data automatically

when the receiver tracks satellites, and you can stop recording by pressing the static button on the receiver;

- **Manual recording**: when you set manually, then it will not record data automatically when the receiver tracks satellites, need to press the static button on the receiver. Click Enter to start the recording, and it will save the configuration, you can stop the recording by pressing the static button or click Stop on the interface.



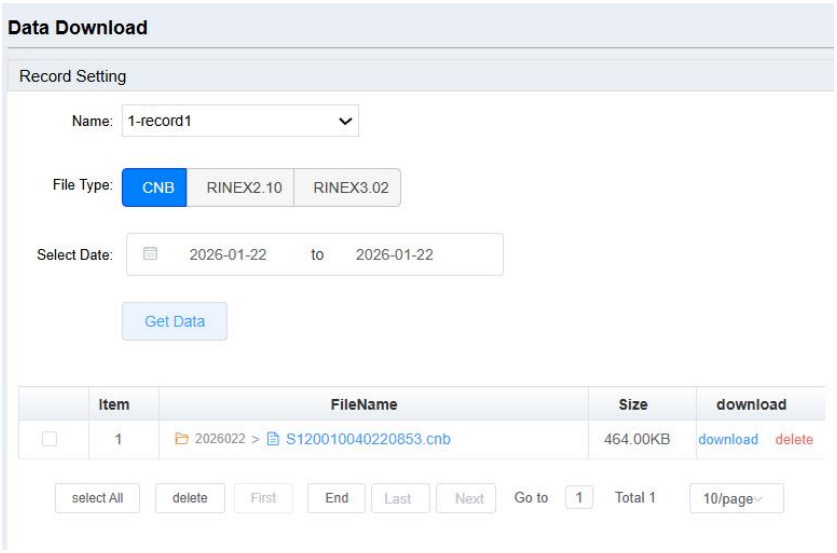


3.3.3.3 Data Download

- Firstly, select record Name, File type (CNB\Rinex3.02\Rinex2.10) and the date.

- Then click **Get Data**, you will see data files.

- Click **Download** icon to download the data file you need; or click **Delete** icon to delete this file; click **Select All**, you can select all the data in the current interface, download and delete them in batches. Rinex files include observations and ephemeris and not are zip files.



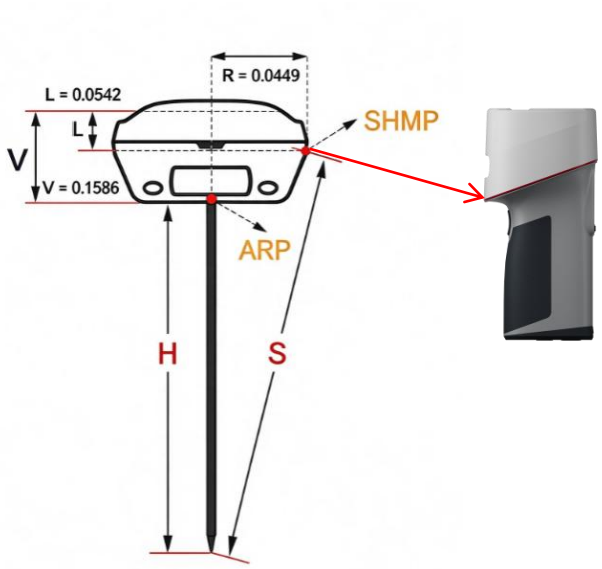
3.3.3.4 Receiver Utility

In this section, you can control Mercury remotely, including:

- Reboot: Restart the receiver
- Factory Default: recover the receiver to factory default setting



3.4 Receiver Antenna Measurement



Symbol	Definition
H	Pole Height: Vertical height from ground control point to ARP (antenna reference point at receiver bottom)
S	Slant: Slant distance from ground point to the SHMP survey height mark
R	Radius: Horizontal offset of SHMP mark relative to receiver central axis
V	Distance to bottom: Vertical distance from receiver bottom ARP to SHMP mark
L	Receiver mark to phase center: Vertical offset from SHMP mark to Antenna Phase Center (APC)

- **ARP:** Antenna Reference Point
- **SHMP:** Survey Height Mark Point
- **APC:** Antenna Phase Center, the reference point for GNSS elevation solution
- **Mercury: R=0.0449m, V=0.1586m, L=0.0542m**
- **If H=1.65m, If the pole height is used to calculate the i:** $i = H + V$
- **If the slant height is used to calculate the i:** $i = \sqrt{S^2 - R^2} + L$

i = Elevation from ground point to Antenna Phase Center (the instrument height entered into GNSS software). **i = 1.8086m**

- **If calculating the instrument height from the ground point to the ARP (Antenna Reference Point):**

$i_{ARP} = \sqrt{S^2 - R^2} - (V - L)$

Notes: *For receiver antenna parameters, please check* ***Antenna setup on the web interface****, or connect to Survey Master and go to* ***device->More->Antenna****.*

4. Static survey

This chapter describes static survey through Mercury receiver and CRU software. For static survey, you cannot change settings through front panel, you can configure it via Compass Receiver Utility (CRU): 1) Receiver configuration; 2) check receiver settings and status; 3) convert data to Rinex format.

4.1 Receiver Configuration

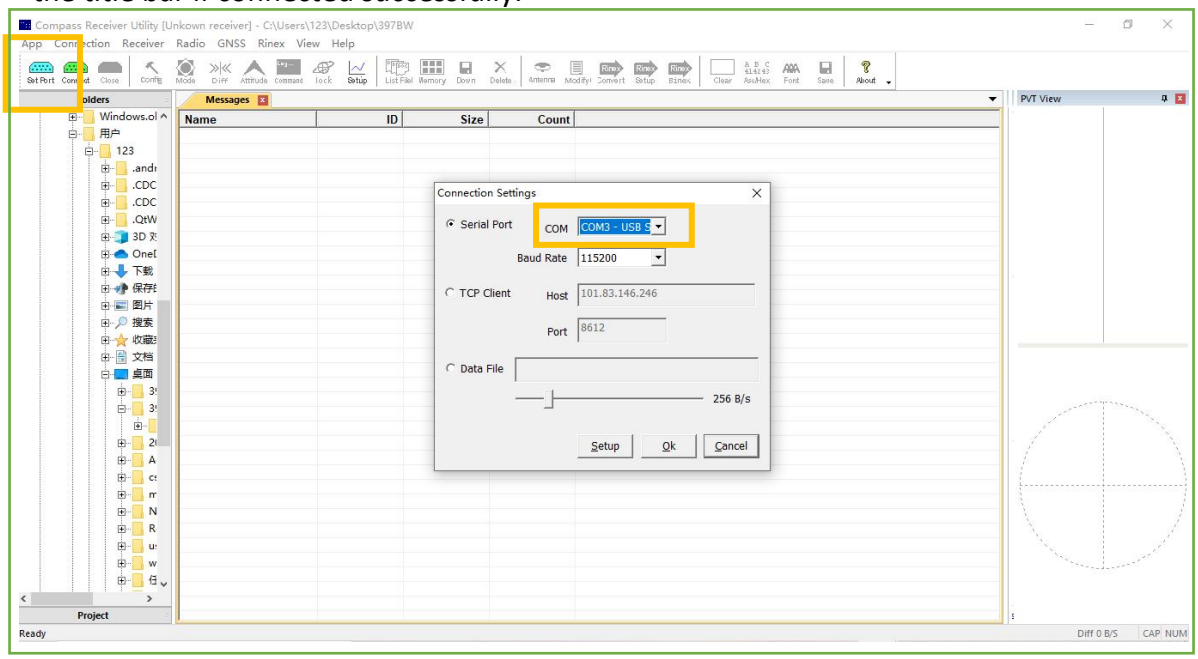
1. Download and install CRU software from the link below (ensure the driver is properly installed in your PC):

http://www.comnavtech.com/download.asp?bigclassid=28

2. Put a battery in the Mercury receiver and turn it on.

3. Connect the receiver with your PC through type-c cable.

4. Click set port in CRU -> select proper serial port in the serial port option-> enter proper baud rate -> click Ok to complete receiver connection.The SN of receiver will appear in the title bar if connected successfully.



4.2 Static Data Collection

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

- At least 3 GNSS receivers are required to form a stable triangulation network.
- It is better to set Data Log Session as manual on the known point.
- Power off the receiver before moving to other observation site.
- To quickly post-process static observation raw data, write down the station name, receiver SN, antenna height, start and end time for each observation site.

Tip: You can start recording static data in the front panel, it's convenient for you.

4.3 Static Data Download

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



Tips:

1. Default memory for Mercury receiver is 8GB, and 16GB, 32GB optional.

2. The receiver will stop recording raw data if the internal memory runs out.

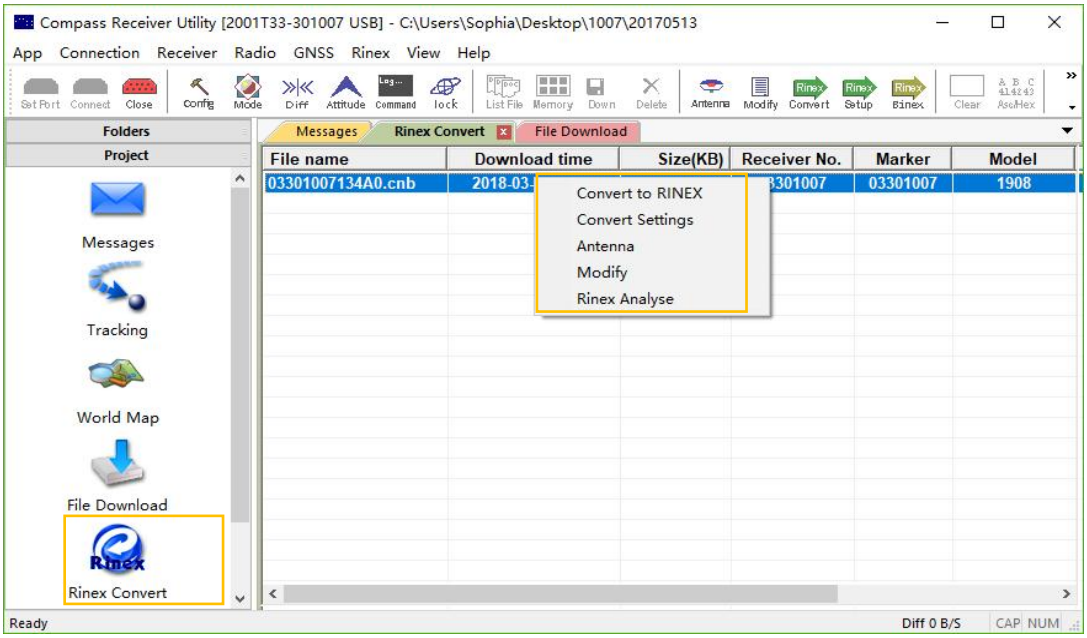
4.4 RINEX Convert

After copy raw observation data to PC, you can convert the data from ComNav binary format

(*.cnb) to RINEX in CRU software.

1. Start CRU software;
2. Click **Folders** and select the path of your CNB data;
3. Click Rinex Convert to check all raw data on main window. Right click on the file to

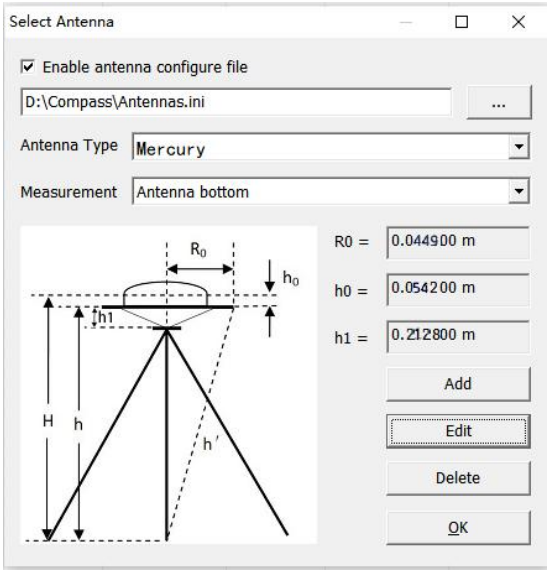
modify antenna, Convert Settings and Convert to RENIX, or use fast icon in standard bar.



4. Click Antenna to select the **Antenna Type** and **Measurement**. If you cannot find Mercury antenna.

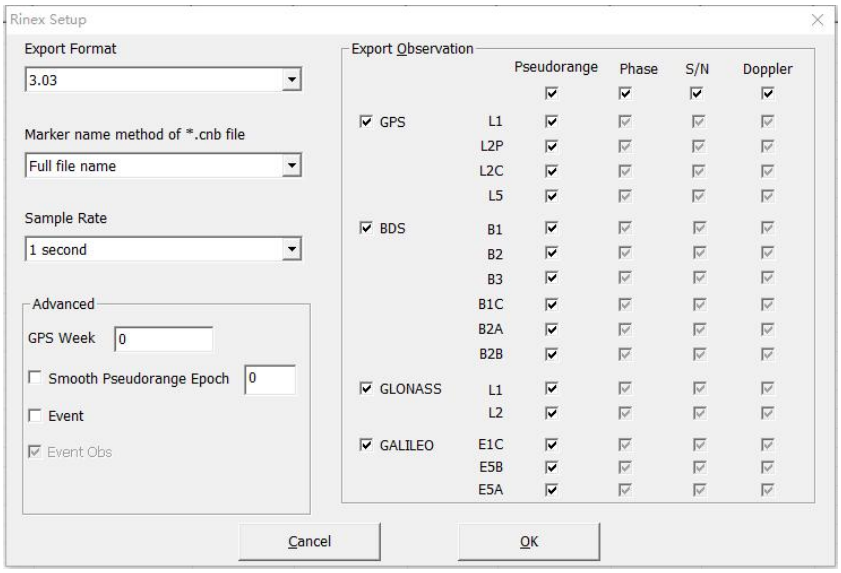
1) Input the value of R0 (horizontal offset from measurement mark to phase center), h0 (vertical offset from measurement mark to phase center) and h1 (vertical offset from measurement mark to receiver bottom). R0 is 0.0615m, h0 is 0.0243m and h1 is 0.0391m respectively for Mercury receiver;

2) Or check **Enable antenna configure file** to select **Antennas.ini** file to select Antenna type again. You can also add, edit and delete antenna types based on your requirement.



• Click 

to change **Convert Settings**, mainly export format and export observation information.



Tip: In some Post Processing software, the BeiDou observations cannot be processed, you can uncheck the BeiDou B1,B2,B3 observations.

• Click 

to Convert to RINEX, the RINEX data will be save in the same path as raw observation data.

5. Tool Mode Real-Time Kinematic Survey (RTK)

This chapter introduces how to conduct RTK Survey with Survey Master Software, including software installation, start a new project, receiver connection and RTK working modes (CORS).

5.1 Installation of Survey Master

Survey Master is available on Google play, you can download for free and install the software to SinoGNSS controller R80.

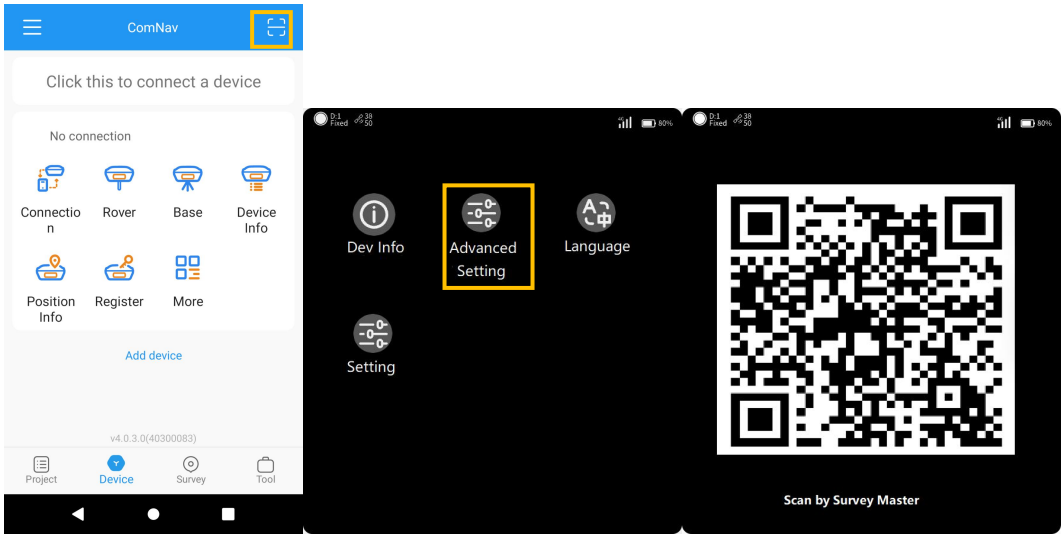
Also you can download the latest version from our website:
https://www.comnavtech.com/

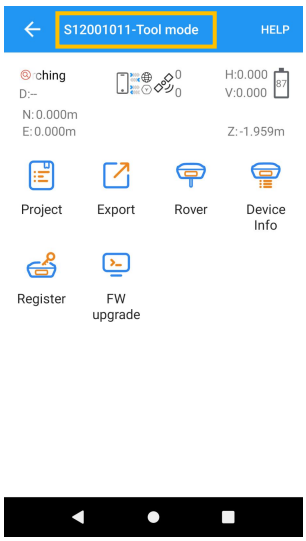
5.2 Connection

Mercury has two working modes: Tool Mode and Normal Mode. Tool Mode allows you to perform measurements without a controller.

Click  the scan button in the top-right corner. Then open the settings interface on the Mercury touch screen, click **Advanced Settings**, and bring up the QR code corresponding to the Mercury receiver.

You can scan it with Survey Master on the controller to establish a connection. Mercury will then enter ***Tool Mode***, in which the Mercury receiver can work without a controller.

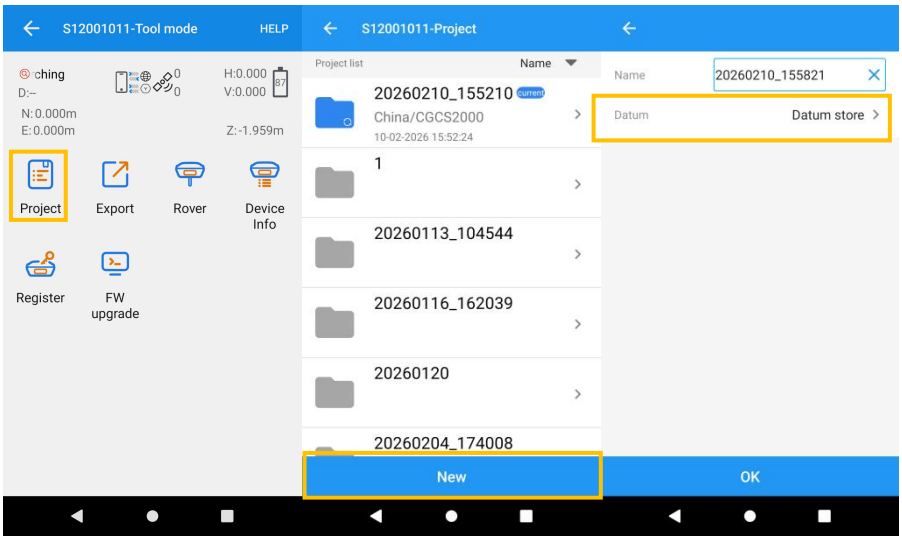




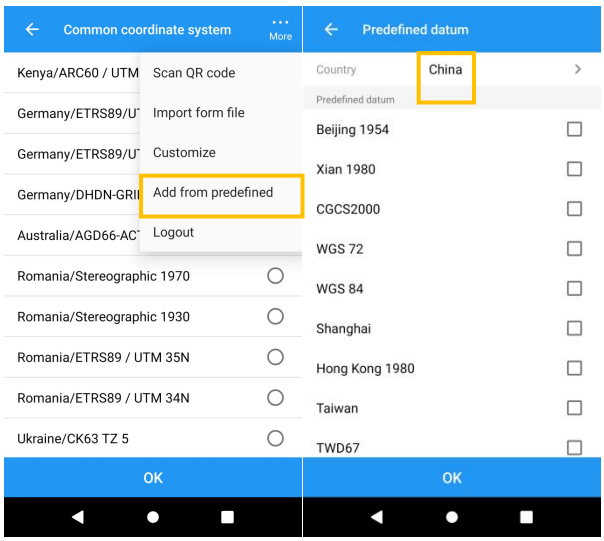
5.3 Start a New Project

Click ***Project***, you can use the same Datum with last project, choose a datum in store and scan QR code from other controller to add Datum, even sharing project with cloud.

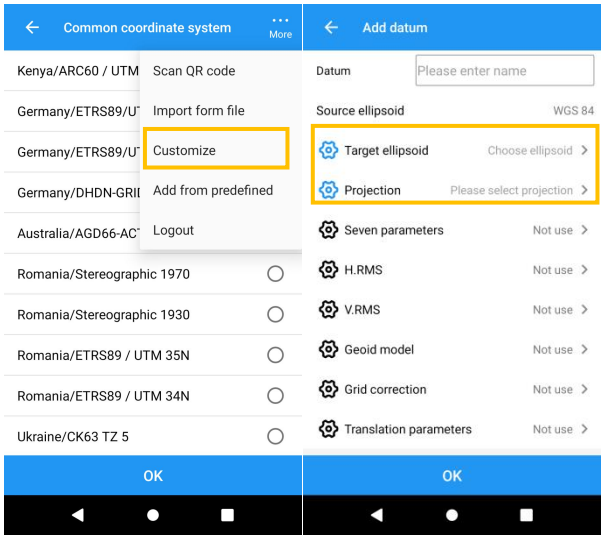
Click ***Project***->click New-> click datum store, then you can choose a datum in store.



- Select a Predefined datum: You can select datum directly from the list. Survey Master currently has 49 countries datum and will add more afterwards.

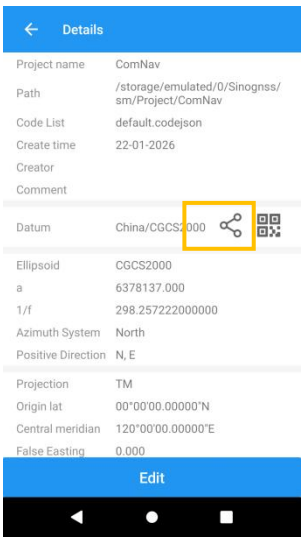


- Create a User defined datum: If you cannot find datum you want in the list, follow instructions below to add one: select Ellipsoid, Projection for your datum, and even seven parameters, geoid model based on your request.

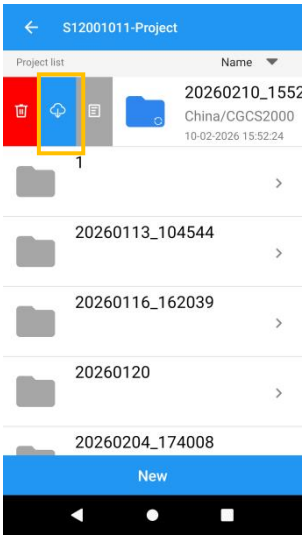


- Share Datum via QR code.

- After you build a project, press the project name, it will generate a QR code. Users can use the Scan function in the main interface to access the coordinate system.



Upload Project/Datum to cloud: sharing project with cloud. After data collection in **Tool mode**, first ***upload*** the project file to the cloud, disconnect to return to normal mode, where you can view the collection points and export the data.

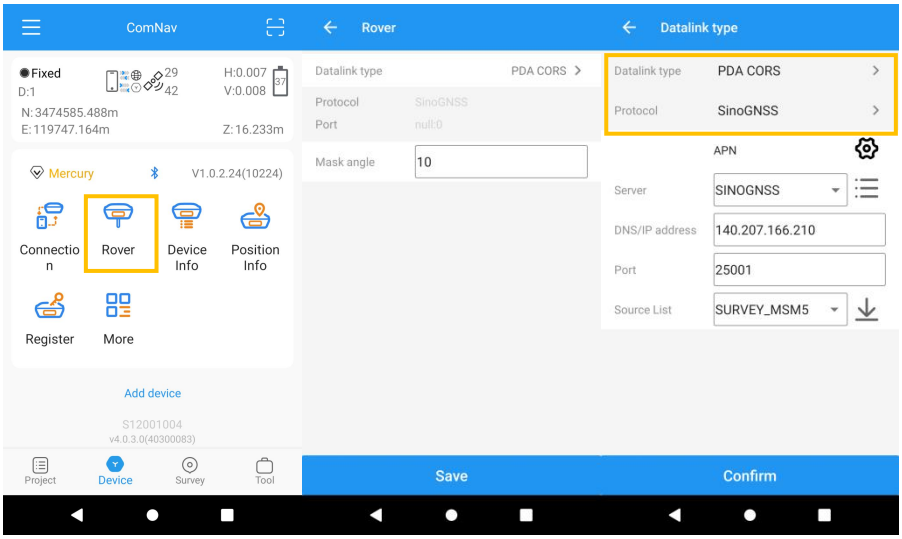


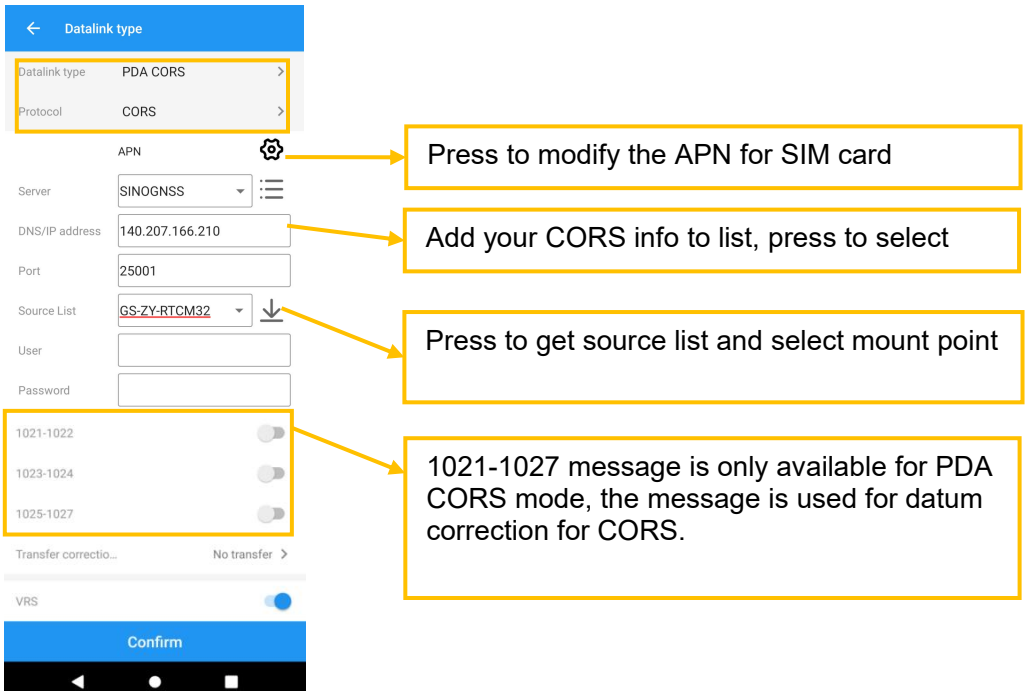
5.4 Work Mode

5.4.1 PDA CORS mode

For internal GSM need insert a SIM card to receiver, for PDA CORS need make sure controller can access to Internet.

You should enter the server IP and Port. In addition, enter User (login name) and Password to get Source List.



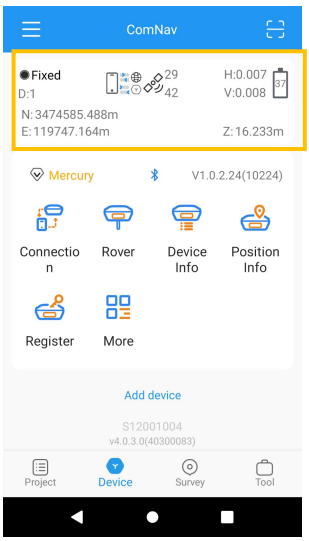


The protocol supports CORS, SinoGNSS, TCP.

SinoGNSS: This is the exclusive Ntrip protocol of ComNav, if you choose this protocol, then you will not be asked to enter the username and password.

CORS: This is a common Ntrip protocol, you need to set the username and password.

TCP: This is used to directly obtain the corrections transmitted by TCP protocol.



Tip: L-Band is only for PPP function, using PPP function can get the station coordinates directly, and there is no limit with the distance of stations, the accuracy can be up to 3-5cm.

5.5 Basic Survey Functions in Tool Mode

This section describes the basic survey functions of Tool mode, including It includes laser measurement、 polyline measurement、 polygon measurement 、 laser ranging and stake point. You should make sure your Survey Master version supports to connect Mercury.

5.5.1 Laser measurement

Click Laser ->click Point  to start measuring point. You only need to tap survey button.

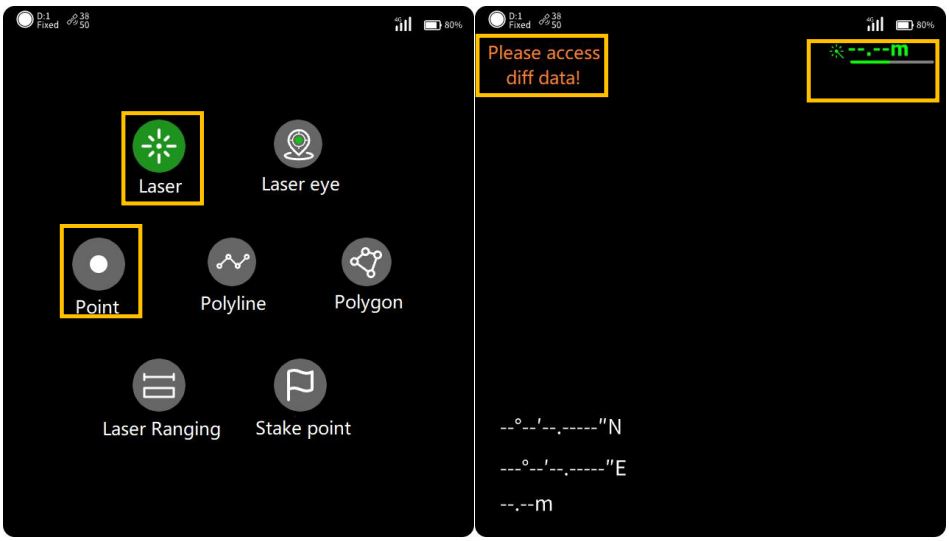
When you first time or long time no use, It may need to you initialize the laser. Go to laser measurement, you will find "***please accept diff data***" and "***Init progress:0***". Make the receiver get fix and click it and do the Initialization.

- When "***please accept diff data***" appears on the screen, it means the receiver is not fixed. You can only measure points when the receiver is fixed. During operation, make receiver can search the satellites and get a fixed solution.

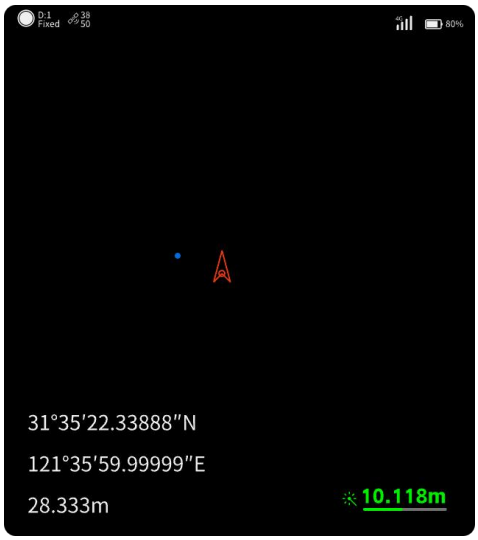
- When "***Init progress: 0***" appears on the screen, it means the IMU is not initialized. Just ***walk around*** to complete the initialization.

- When the accuracy bar is full and green, the IMU accuracy is optimal, and you can start measuring.

- The distance shown above is the **distance** from the measured point to the Mercury receiver.

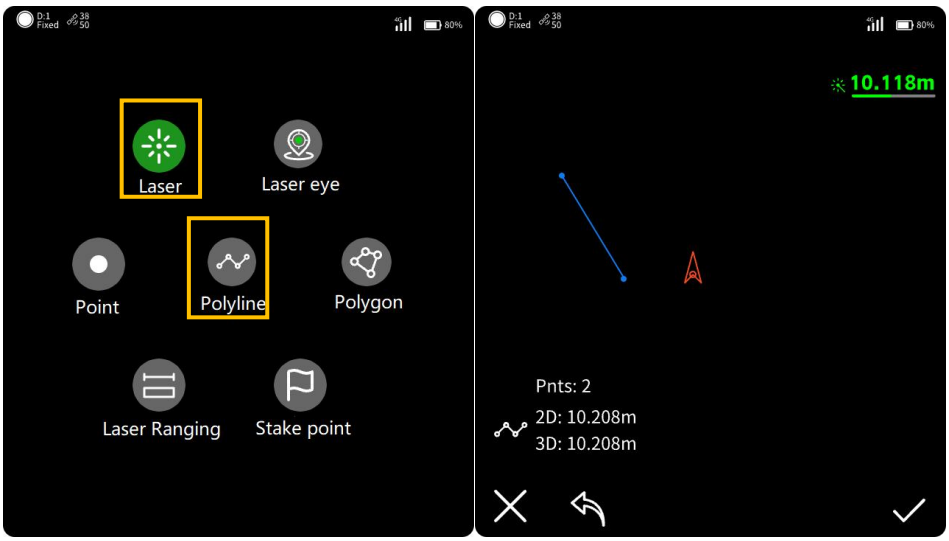


Click camera  to turn on the camera. The coordinates of the current measured point are displayed at the bottom-left corner of the point measurement screen.



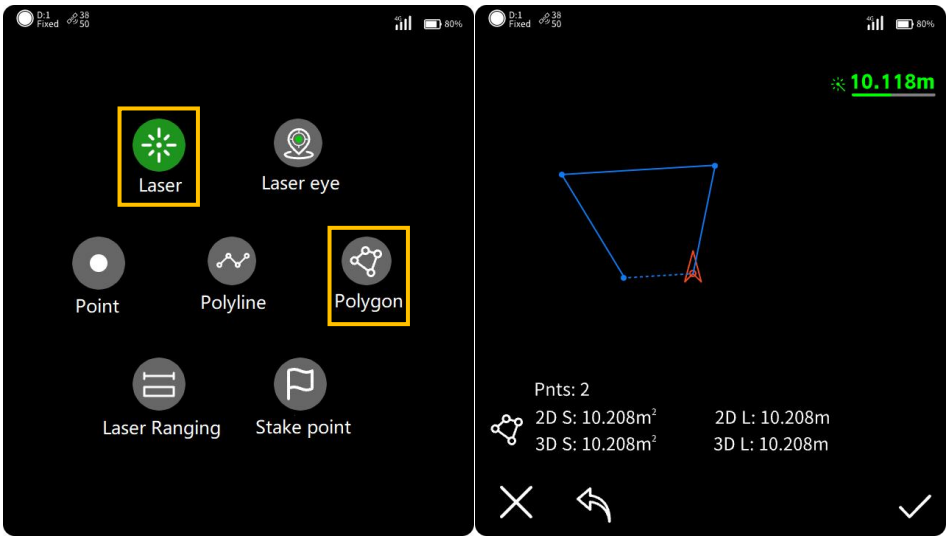
5.5.2 Polyline measurement

Click Laser ->click Polyline  to start measuring line. You can press the survey button to get two different points, and tap the √ symbol to save them automatically to the polyline library.



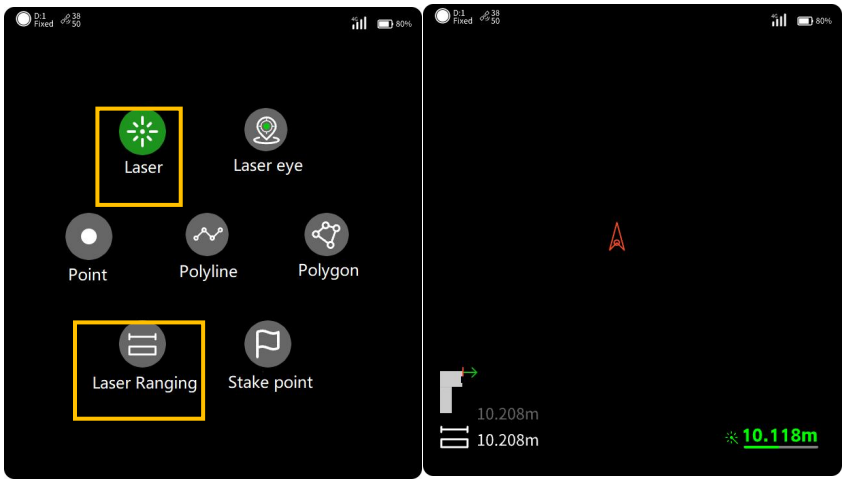
5.5.3 Polygon measurement

Click Laser ->click Polygon  to start measuring polygon. You can press the survey button multiple times to create a polygon, and tap the √ symbol to save it automatically to the polygon library.

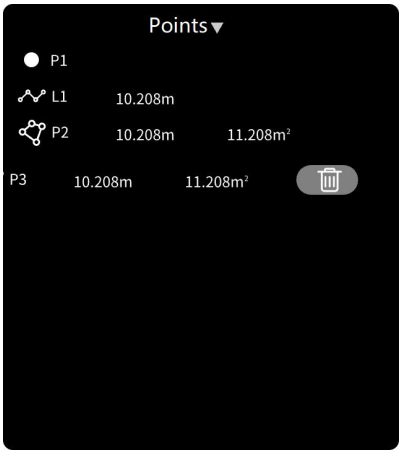


5.5.4 Laser Ranging

Click Laser ->click laser ranging  to start measuring point distance. Click camera  to turn on the camera.



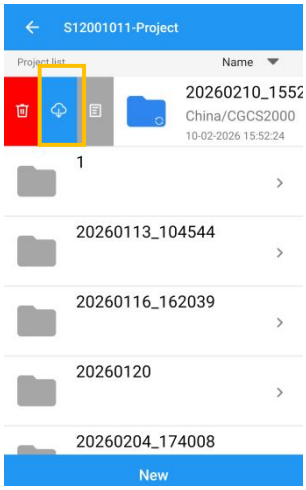
You can view point coordinates, polyline lengths and polygon areas in the database.



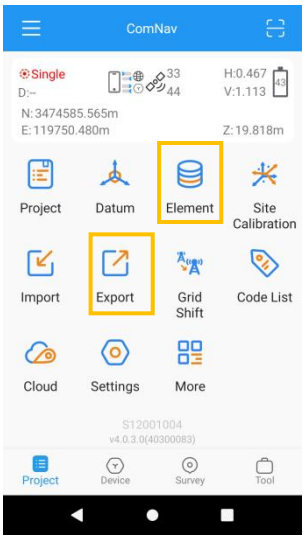
5.6 Data viewing

The data measured in Mercury Tool mode is stored in the Mercury **memory.**

When you finish the measurement, please Click  to download the project file to the controller.



Then disconnect tool mode to return to normal mode, where you can view the collection points and export the data.



6. Normal Mode Real-Time Kinematic Survey (RTK)

This chapter introduces how to conduct RTK Survey with Survey Master Software, including software installation, start a new project, receiver connection and RTK working modes (CORS).

6.1 Installation of Survey Master

Survey Master is available on Google play, you can download for free and install the software to SinoGNSS controller R80.

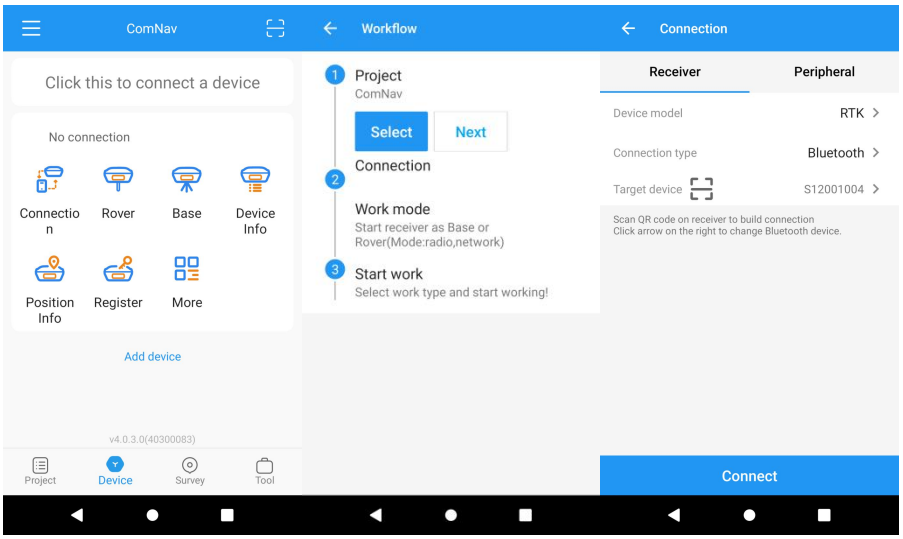
Also you can download the latest version from our website:
https://www.comnavtech.com/

6.2 Wizard function in Survey Master

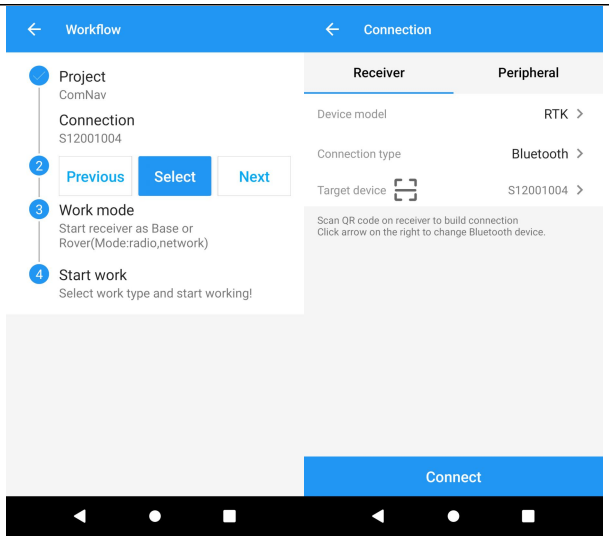
Follow the Wizard, you can quickly learn the general workflow of Survey Master, also you can quick enter the ***normal mode*** and start your survey by this function no matter you are experienced one or new user.

In Project menu, tap Wizard.

1. ***Project*****:** Click ***Select*** to go into Project interface to create or select a project. For detailed information, you can refer to chapter 6.3.

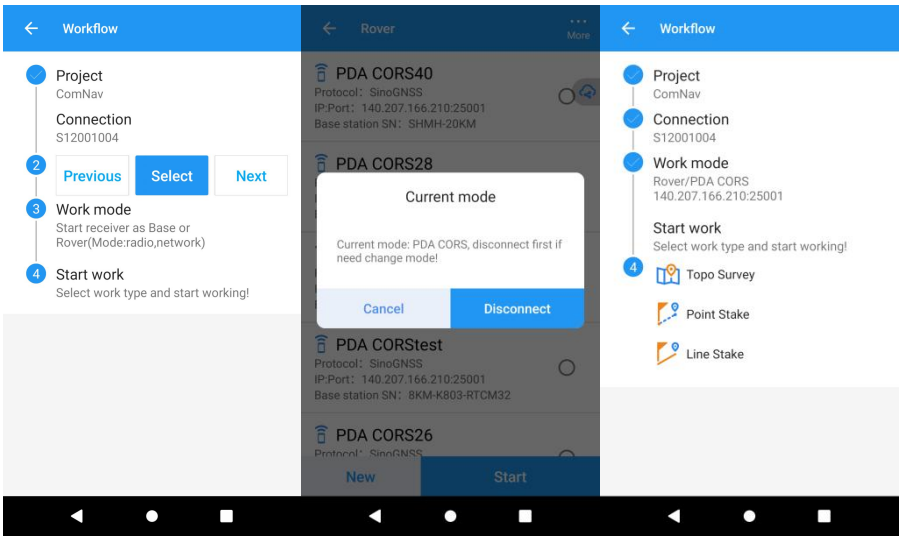


2. ***Connection***: Click ***Select*** to go into connection interface. Because Mercury has dual cameras,You can choose connect Mercury with Survey Master via WiFi, For detailed information, you can refer to chapter 6.4.



3. ***Work mode***: Click ***Select*** to go into Quick Setup interface to start your receiver as Rover. For detailed information, you can refer from chapter 6.5.

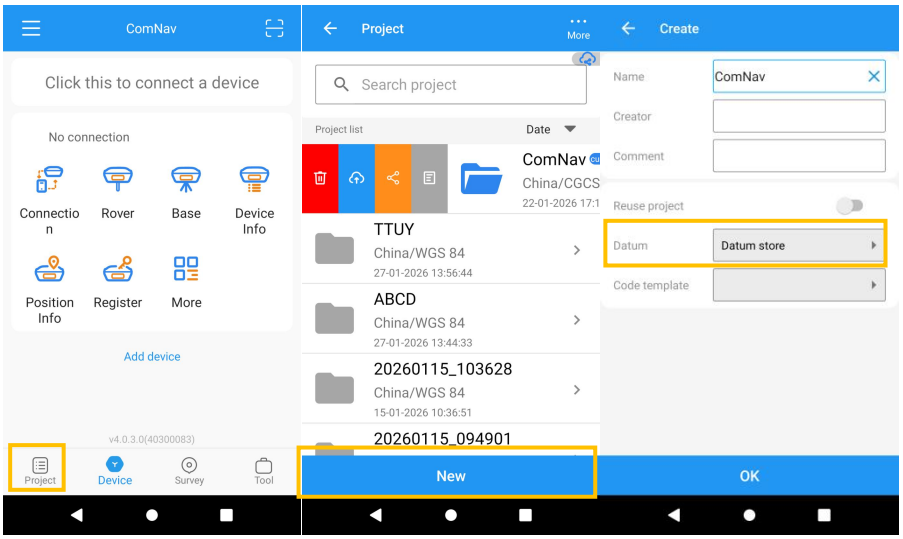
You start your receiver as Rover, then you can start work directly of topo survey or stakeout



6.3 Start a New Project

Click ***Project***, you can use the same Datum with last project, choose a datum in store and scan QR code from other controller to add Datum, even sharing project with cloud.

Click ***Project***->click New-> click datum store, then you can choose a datum in store.



If you want to start work with receiver, you should select one project with datum information.

In Project interface, you can click ***Create*** to add a new project or click  to open the previous project. It also supports to backup your project file by uploading your Cloud account, and download from it. If you delete the projects, you can recover them from Recycle Bin.

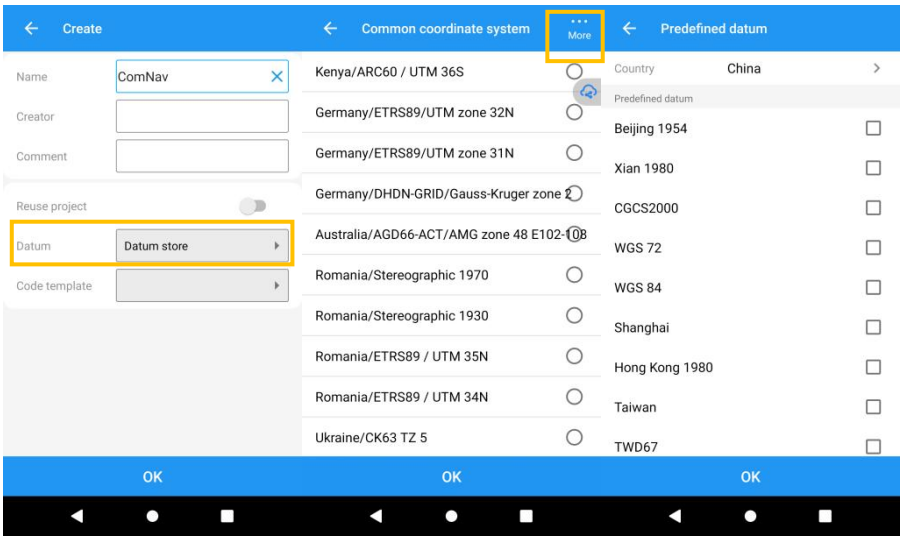
Survey Master supports to order the project by date and name, in order or reverse order.

If you have added one project, you can click ***View*** or click the project name in the main interface to check the current project details, including Project name, store path, and datum parameters. Click the ***QR*** to share your datum information to others. Besides, click Edit to change the datum parameters, also, you can change in the Datum interface.

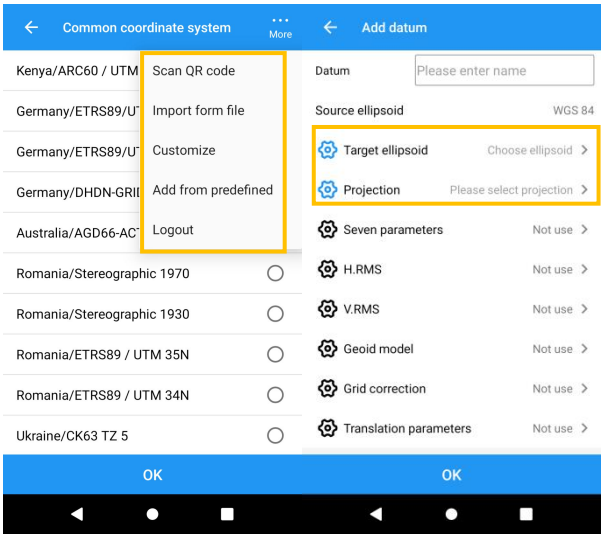
You can select a code list when you create a project, for more information, pls refer to Chapter 6.3.

To edit datum parameters, SM supports three methods: Use last project, Datum store, Scan QR code.

- Select a Predefined datum: You can select datum directly from the list. Survey Master currently has 49 countries datum and will add more afterwards.

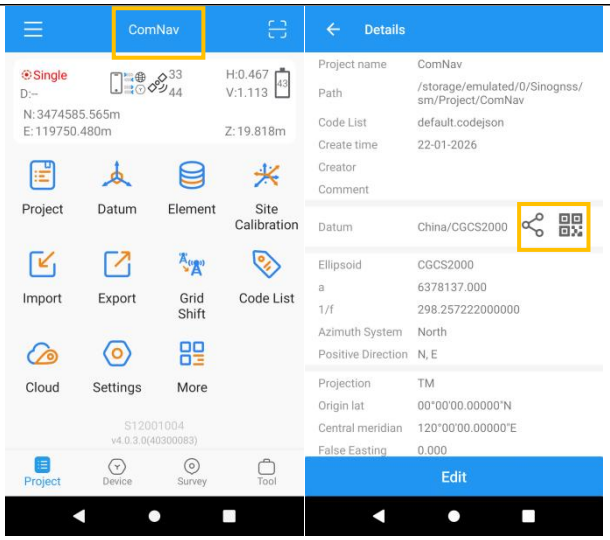


- Create a User defined datum: If you cannot find datum you want in the list, follow instructions below to add one: select Ellipsoid, Projection for your datum, and even seven parameters, geoid model based on your request.

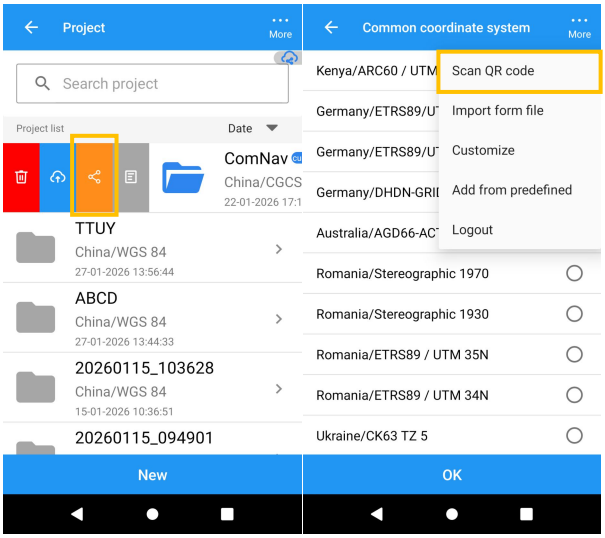


- Share Datum via QR code.

- After you build a project, press the project name, it will generate a QR code. Users can use the Scan function in the main interface to access the coordinate system.



Upload Project/Datum to cloud: sharing project with cloud.

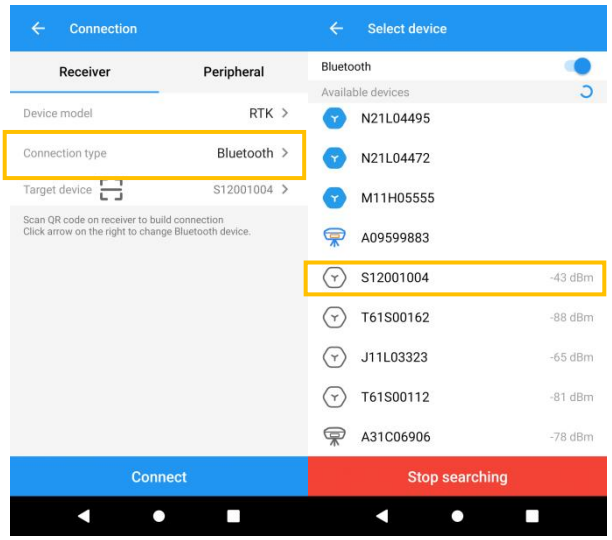


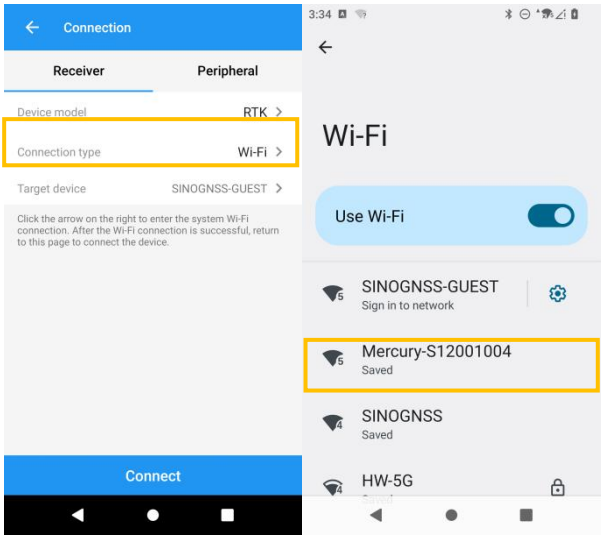
6.4 Connection

To connect Survey Master with Mercury, switch to ***Device*** interface, tap ***Connection*** to go into WiFi or Bluetooth connection interface.

- Make sure device WiFi or Bluetooth turned on;
- Click Find device—select SN of your Mercury —allow pair. If you use Bluetooth, you need to pair. If you use WiFi, the password is 12345678.

After connect ComNav receiver, you can check the device version in Device Info.





After connected successfully, the top will show the positioning status.

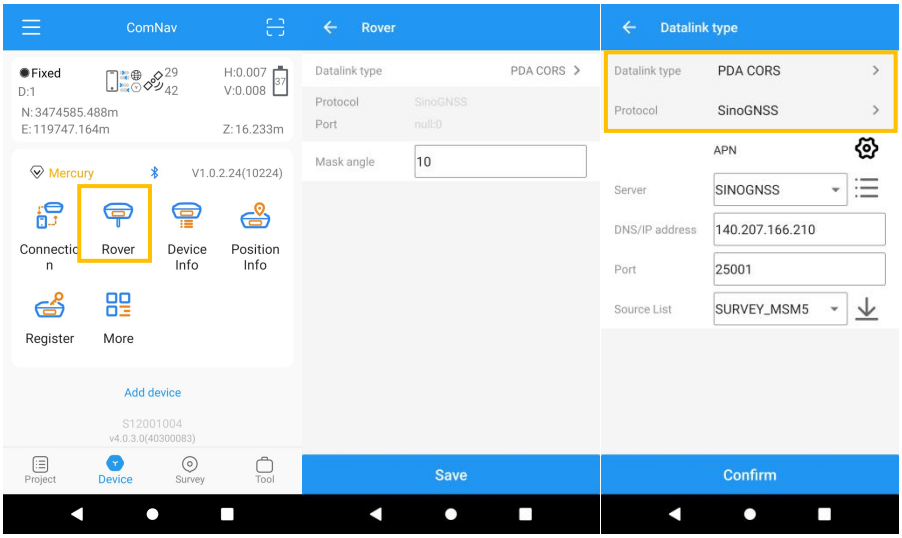
Tip: If you are failed to connect with receiver through Survey Master, you can just follow prompt info to go into the device Bluetooth setting interface to make sure Bluetooth paired successfully. Sometimes you need restart the receiver or Survey Master Software.

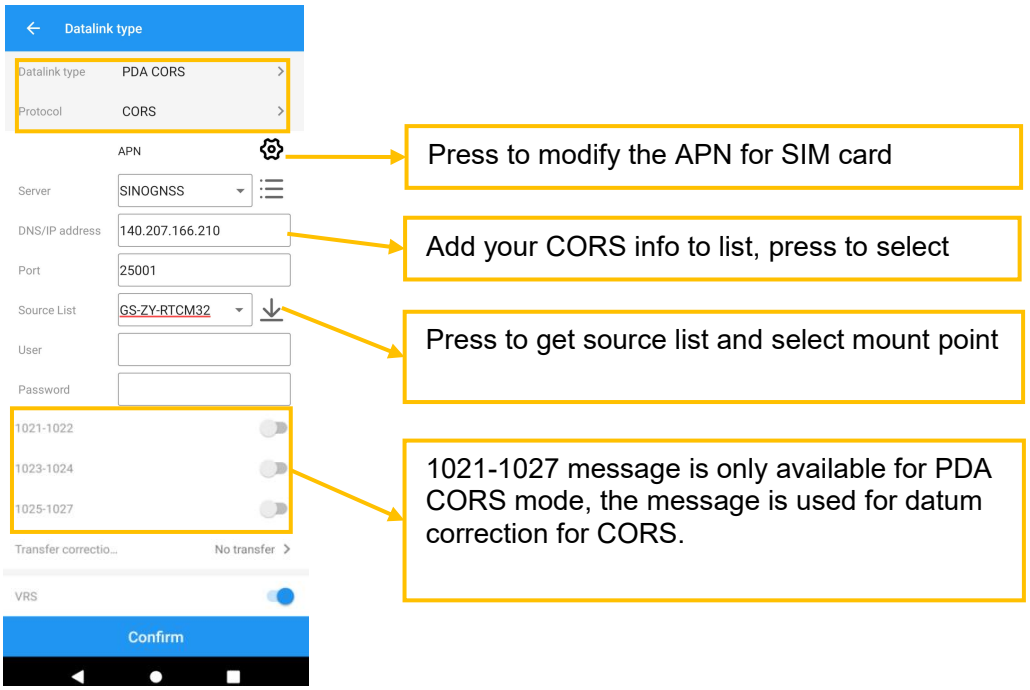
6.5 Work Mode

6.5.1 PDA CORS mode

For internal GSM need insert a SIM card to receiver, for PDA CORS need make sure controller can access to Internet.

You should enter the server IP and Port. In addition, enter User (login name) and Password to get Source List.



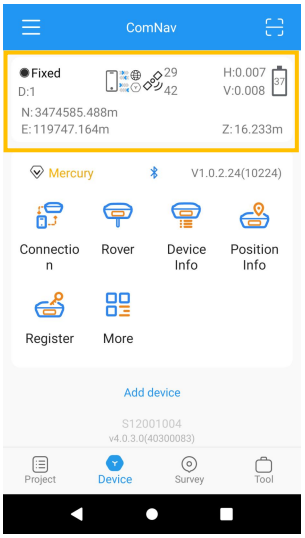


The protocol supports CORS, SinoGNSS, TCP.

SinoGNSS: This is the exclusive Ntrip protocol of ComNav, if you choose this protocol, then you will not be asked to enter the username and password.

CORS: This is a common Ntrip protocol, you need to set the username and password.

TCP: This is used to directly obtain the corrections transmitted by TCP protocol.



Tip: L-Band is only for PPP function, using PPP function can get the station coordinates directly, and there is no limit with the distance of stations, the accuracy can be up to 3-5cm.

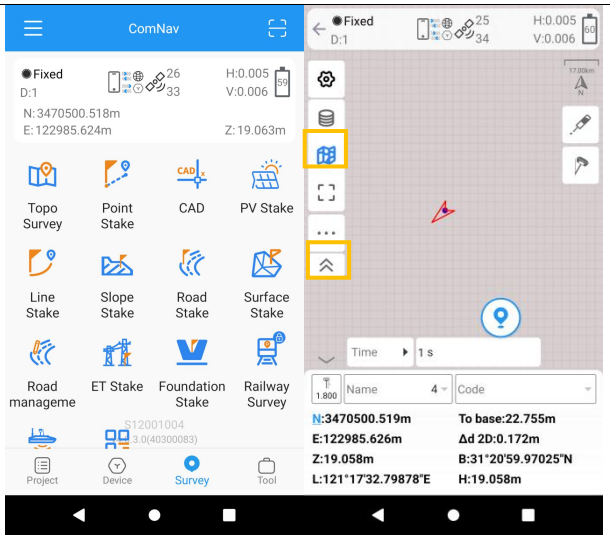
6.6 Basic Survey Functions in normal mode

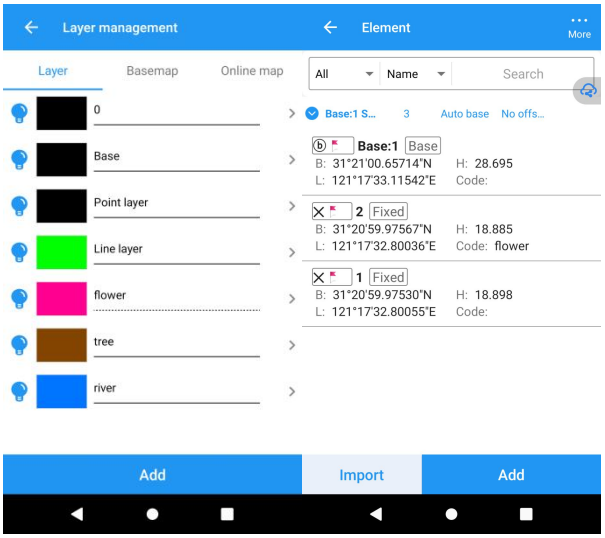
This section describes the basic survey functions of Survey Master, including point measurement, Topo survey, Auto survey, Area survey, Static, PPK, staking, site calibration, import and export measured points. You should make sure your Survey Master version supports to connect Mercury.

6.6.1 Topo survey

Click Topo Survey-> enter point name, ->click  to start or stop collecting data.

- You can quickly change antenna height in the survey interface.
- Tap Elem to check point coordinates.
- Tap Layer to show the layers you want display on map





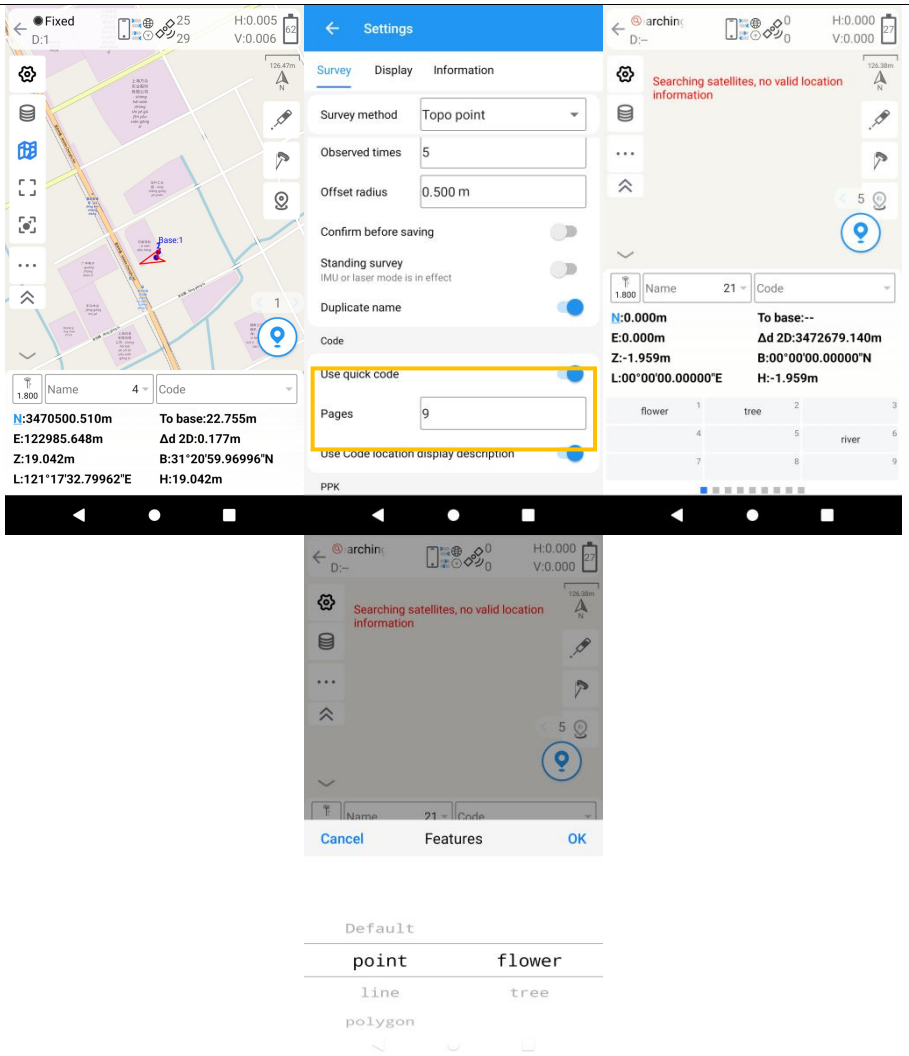
: Click this to show the whole points on the interface.

: If the arrow is out of sight on the interface, you can click this to locate the receiver position, then the arrow will be shown on the interface.

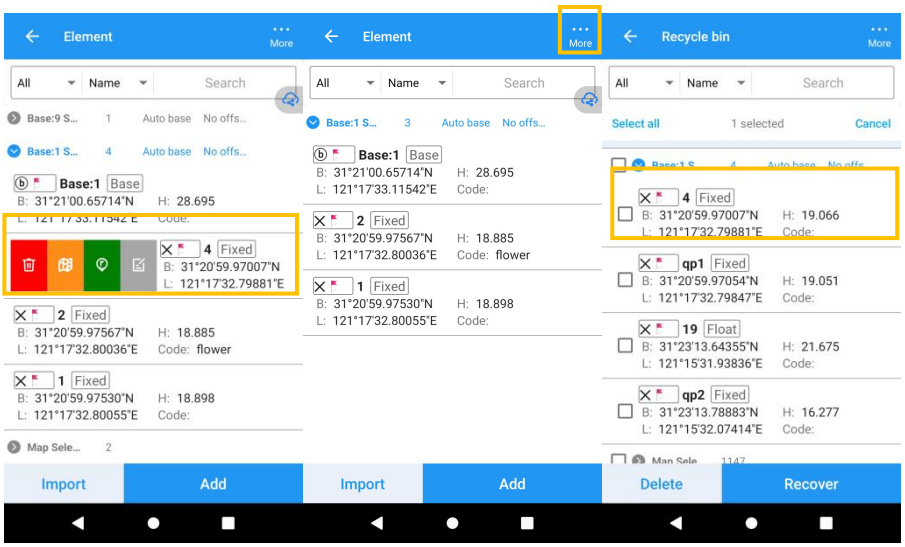
- Graphic survey: Tap the graphic button, after completing survey, will directly show the graphic on the map, you can export the graphic survey results as *.dxf format in Export interface.

- Fast survey by pressing Code: Tap the code in nine panels, will survey the point directly.

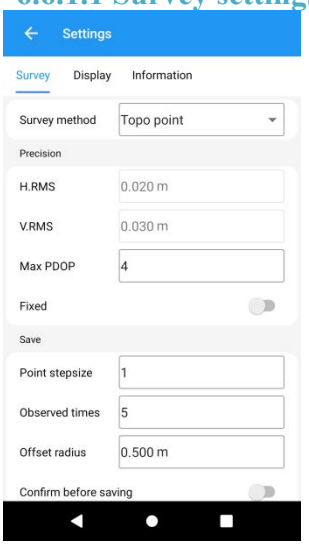
- Go into code management interface to modify code list, then you can choose code to use in nine panels.



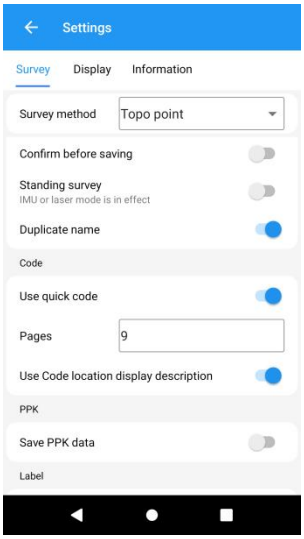
- Recover deleted points in Recycle Bin.



6.6.1.1 Survey settings



- **H.RMS\V.RMS**: point accuracy need higher than the value;
- **Fixed**: only fixed result can be saved;
- **Point stepsize**: for point name;
- **Occupation time**: measure times for one point;
- **Offset radius**: point cannot offset bigger than the value during measure;
- **Stake range**: show circle when close to target point;
- **Duplicate name**: allow point name same;



- ***Display option***: Items which can be shown in the survey interface, 8 items are the most.
- ***N, E, Z***: plane coordinates, displayed in a vertical column by default
- ***B, L, H***: latitude, longitude, ellipsoid height.
- ***Status***: receiver RTK solution status, includes searching, single, float, fixed.
- ***To base***: Distance from receiver current position to the base.
- ***Δd***: Distance from receiver current position to last surveyed point.
- ***Δh***: Height difference from current position to last surveyed point.

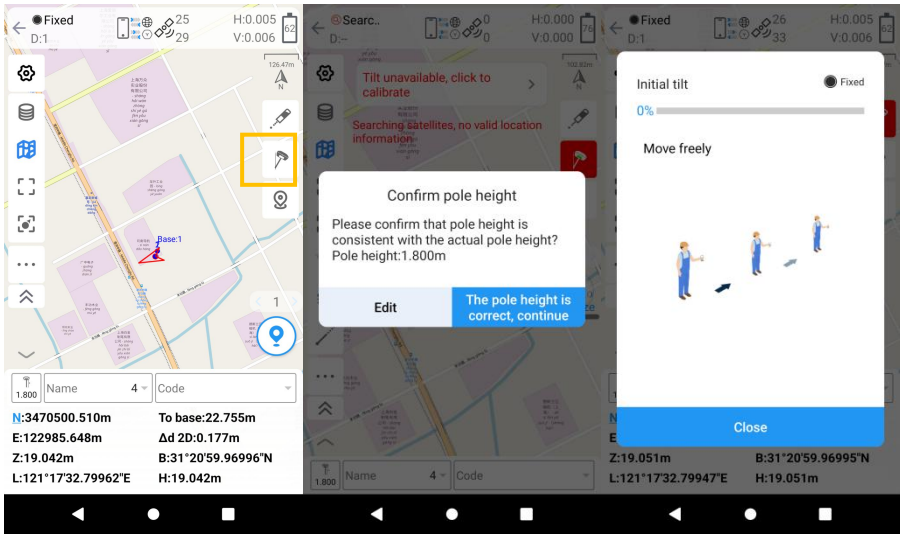
6.6.1.2 IMU Measurement

Tilt survey option will appear when receiver supports for tilt survey, it is available for ComNav Technology Mercury Laser RTK, use IMU sensor.

There are two mode you can choose: Tilt compensation or Laser measurement.

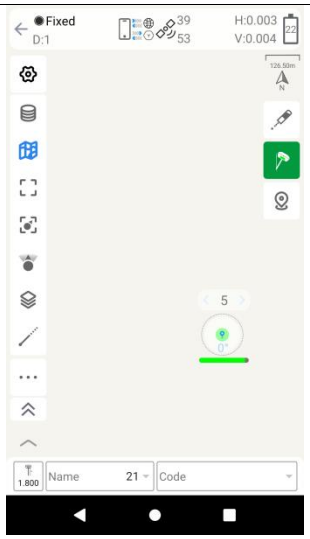
According to the IMU sensor, Mercury can meet the requirement of high precision measurement. When the tilts within 60°, the built-in sensor based IMU precisely calculates the actual offset, which accuracy can up to 2.5 cm

If you power off the receiver or freset it, need to initialize again. After open IMU button, you can follow the guidance in interface to complete it. During operation, make receiver can search the satellites and get a fixed solution.



Keep the receiver stationary Confirm pole height move freely with receiver

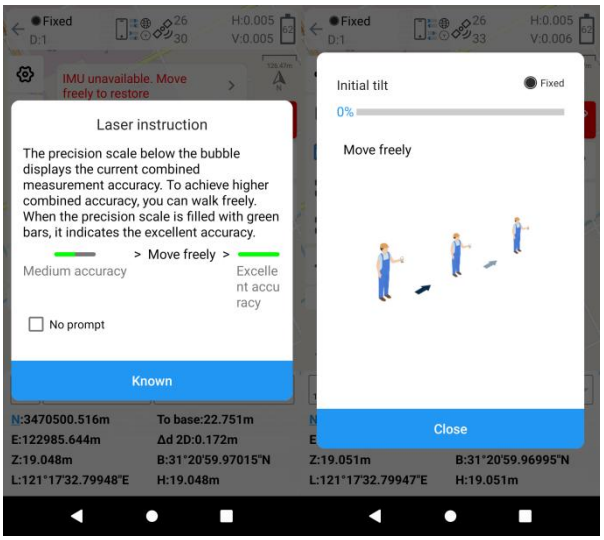
In survey interface, you can find the bubble and angle value shows the pole you tilt. For more accuracy, angle less than 60°will be better.



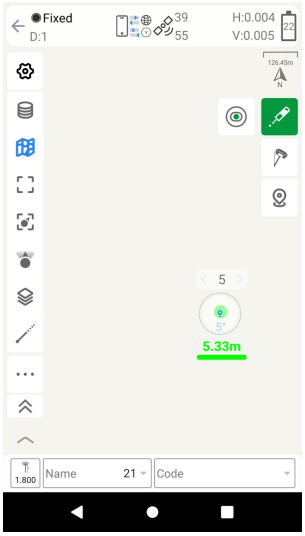
Tip: Do not shake or rotate the receiver violently, otherwise you need to re-initialize.

6.6.1.3 Laser Measurement

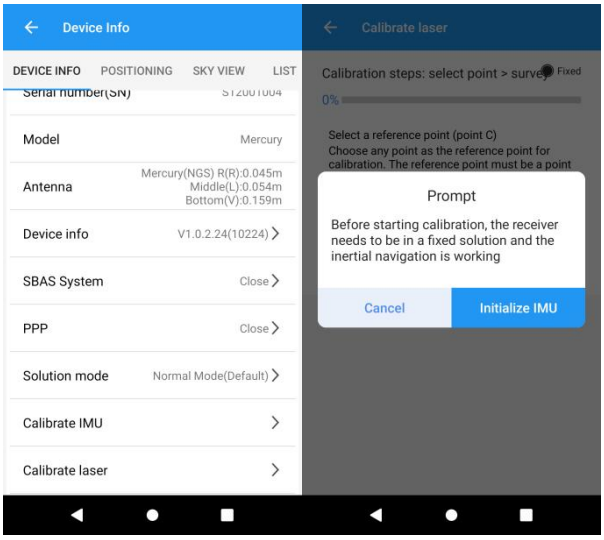
When you first time or long time no use, It may need to you initialize the laser. Go to topo survey, you will find laser button turn red. Make the receiver get fix and click it and do the Initialization.



When you finish the Initialization, it will turn green. You can go to point stake to stake point B out to check laser accuracy.

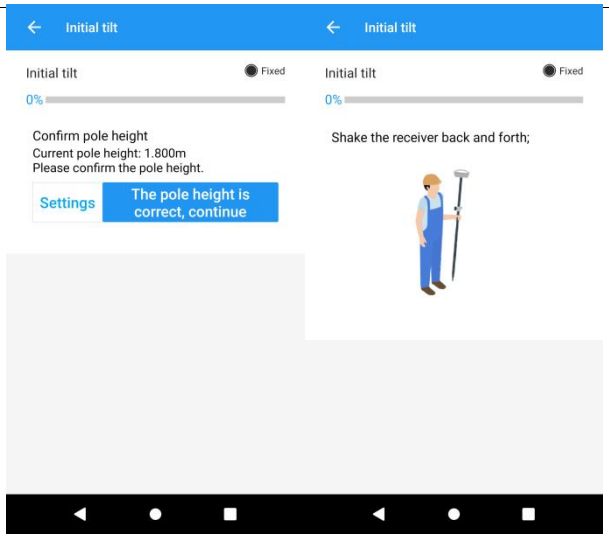


If you feel the accuracy of laser is not good, you need to go to Device >> Device info >> Calibrate Laser, start tile mode in survey interface and follow the steps to initialize the IMU. During operation, make receiver can search the satellites and get a fixed solution.

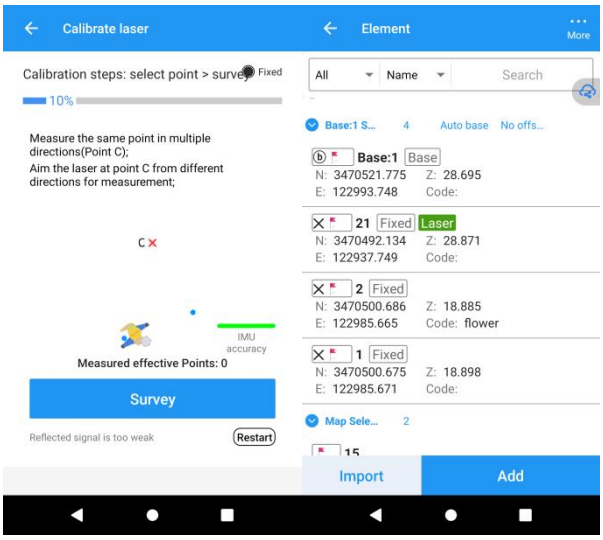


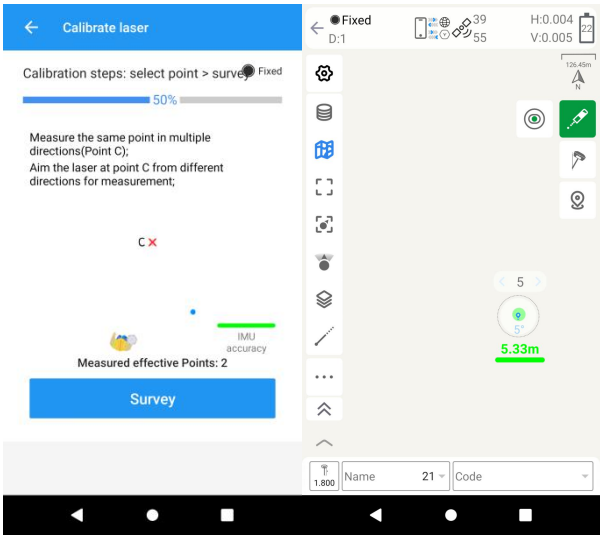
a) Making sure it gets fixed status

b) Because laser measurement is based on IMU module, you need to initialize IMU first, shake the receiver back and forth and finish IMU initialization.



c) Then choose a base point B, handle the Laser receiver to measure the same point B 5 times from different directions. You'd better do laser initialization within 3 meters to decrease laser offset.





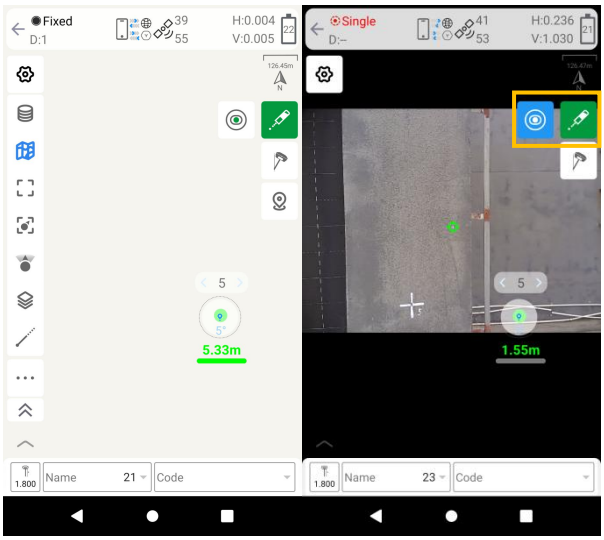
d) When you finish laser initialization, you can go to point stake to stake point B out to check laser accuracy.

In survey interface, you can find the bubble and angle value shows the pole you tilt, also laser distance. For more accuracy, angle should less than 60° , it will be better. And the laser icon will turn green, it means laser is ready to work.

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

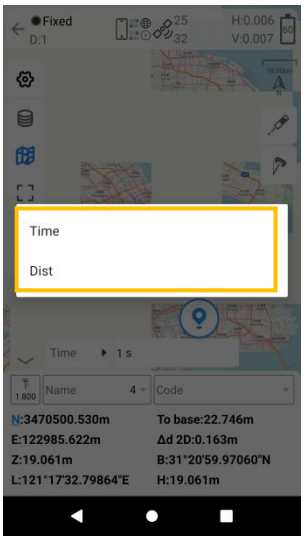
6.6.1.4 Visual Measurement

When you finish IMU and laser calibration, you can click camera button to start visual measurement. Camera can be switched on to help during measurement.



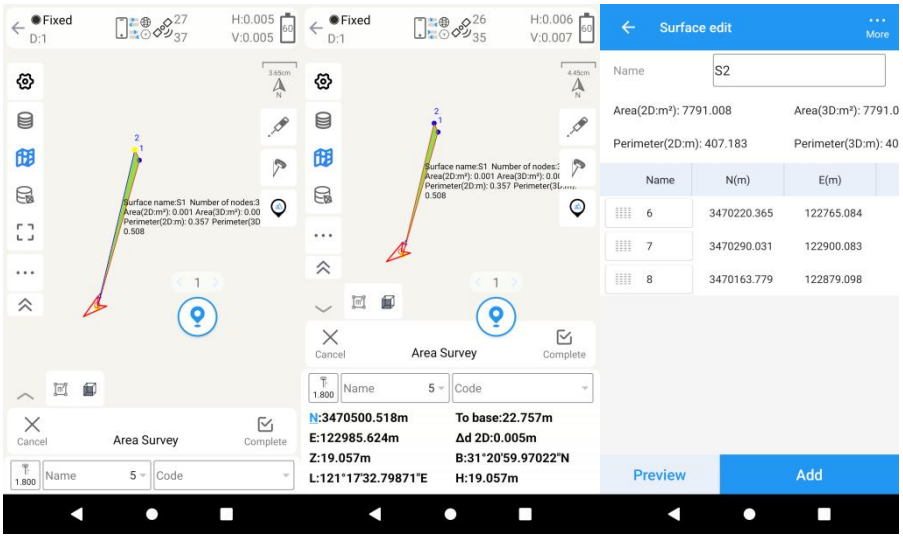
6.6.2 Auto survey/Area survey

For Auto survey, it supports automatic and continuous survey according to Time or Distance.



For Area survey, it can compute area directly after getting points.

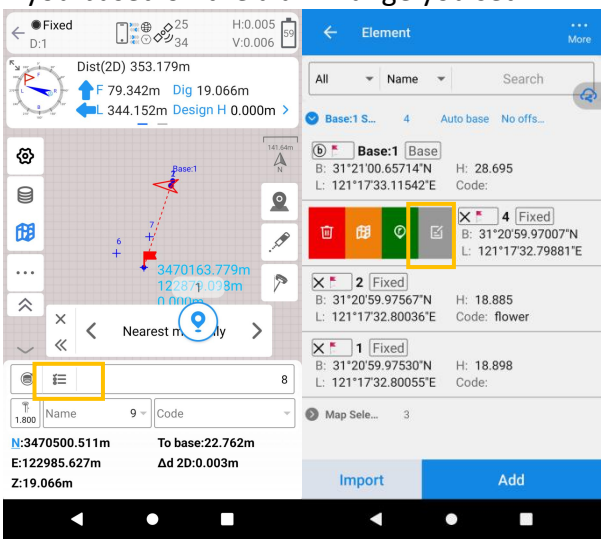
Press , it will show the coordinate information, press , it will show the area result, press Shape , it will show the shape on map.

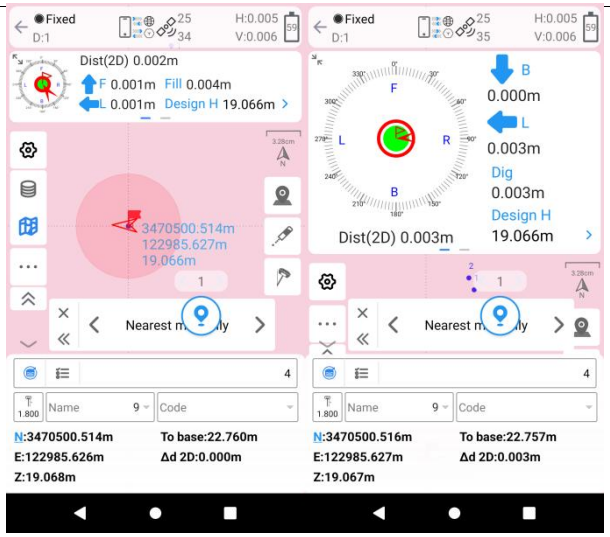


6.6.3 Stake Points/Lines

6.6.3.1 Stakeout Points

Go into Stake point interface, click to choose a point and tap Stake. Survey Master provides a navigation map when staking points/lines. If you are close to the target point enough, it will alarm you based on the alarm range you set.

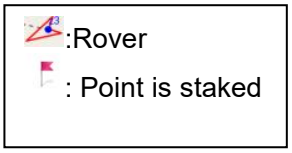




Various navigation info choices

Tip: Survey Master supports to select the point on the screen directly, including the surveyed points and points from the background layer, when you click the point on the map, it will change to this point automatically, so you can stake it. For the points selected from background layer, they will be saved to the Element as the ***Map Selected Point*** *type*



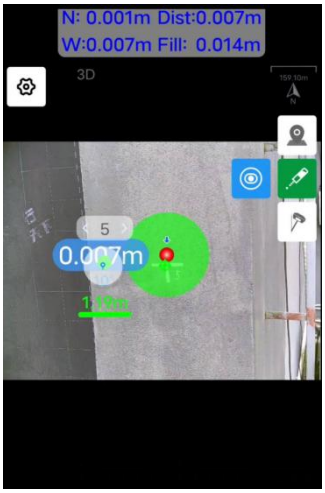


Tip: keep your receiver vertical to the ground.

In the IMU staking, you can open IMU function, and don't need to keep the receiver vertical to the ground, and the tilt angle supports maximum to 60 degrees.

6.6.3.2 Laser Stakeout

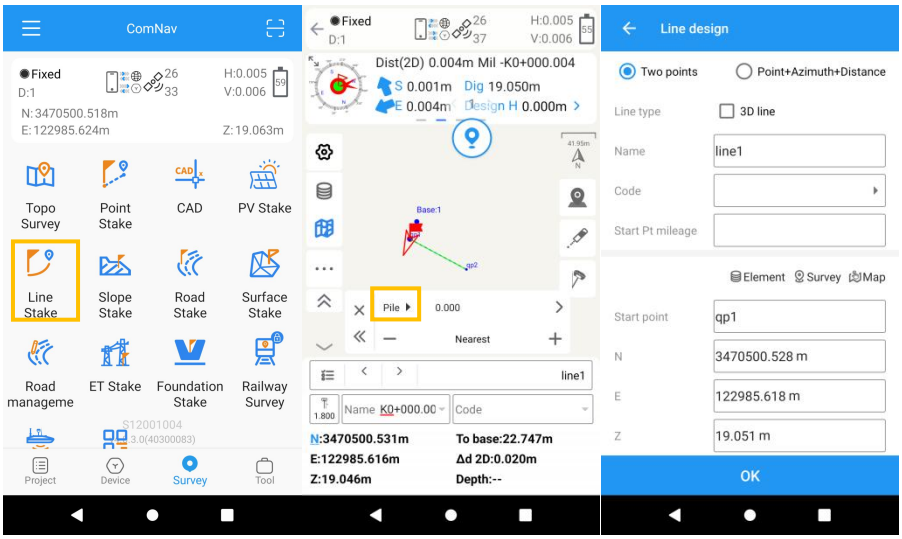
Laser Stake: Connect the Mercury and click on the  to enter laser stake mode. You can turn on the camera. It support 2D/3D stake.

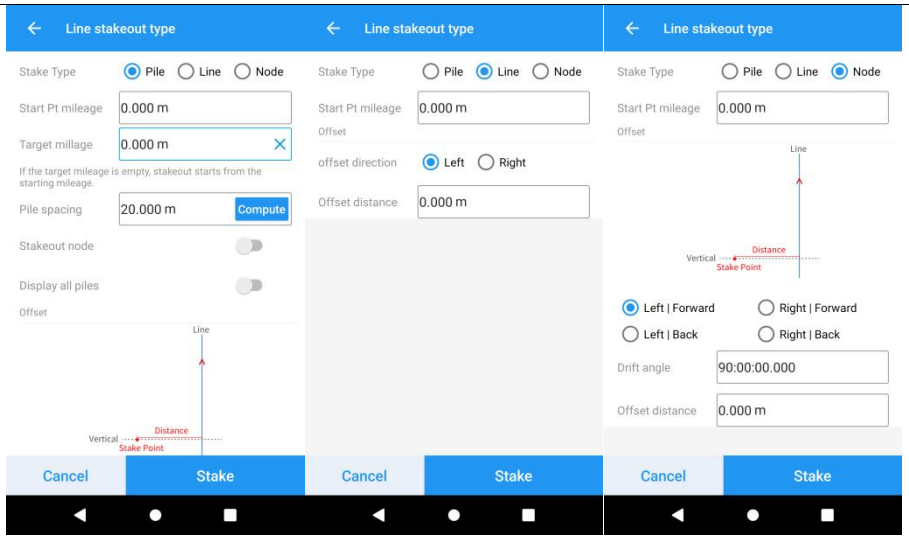


6.6.3.3 Stake line

For staking line, click  -> add line (Two points or Point + Azimuth + Distance) -> click  -> Choose one line and click Stake. It will show all the lines you added. The default method to stake is “To line”, press method to choose a method you want.

Survey Master supports to select the line which is from the background layer, the selected from the background layer will be saved to the line library.





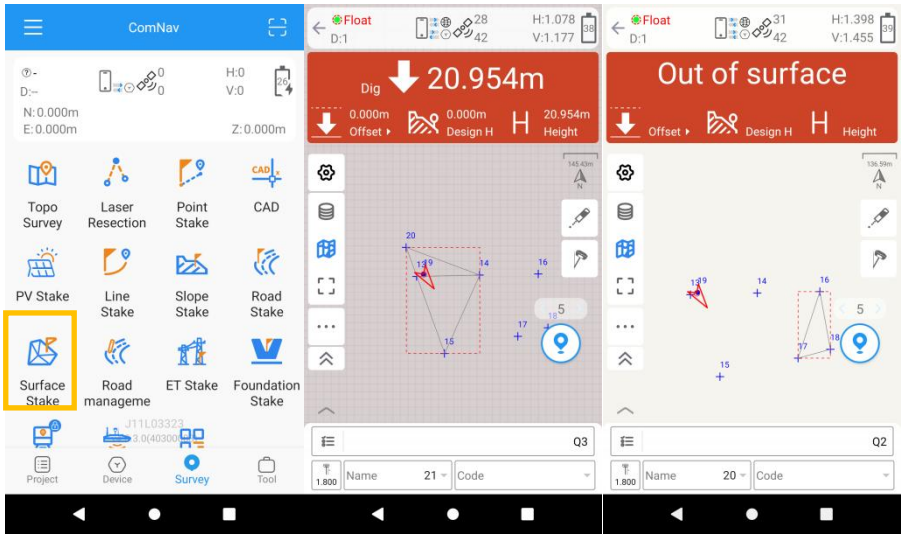
6.7 Stake Surface

You can stake the elevation using the design surface, then you can choose the fill or excavate according the stake result.

Go to ***Survey***->***Surface Stake***, if you don't open a surface before, then it will jump to the Surface interface;

If the current position is not within the range of the design surface, it will show "***Out of Surface!***" ; if the current position is within the range of the design surface, it will show the fill or excavation value;

There are two methods to stake the elevation, you can use the elevation from the ***Design surface***, or you can use the ***Design elevatio***n to get the fill or excavation value;



6.8 PPK

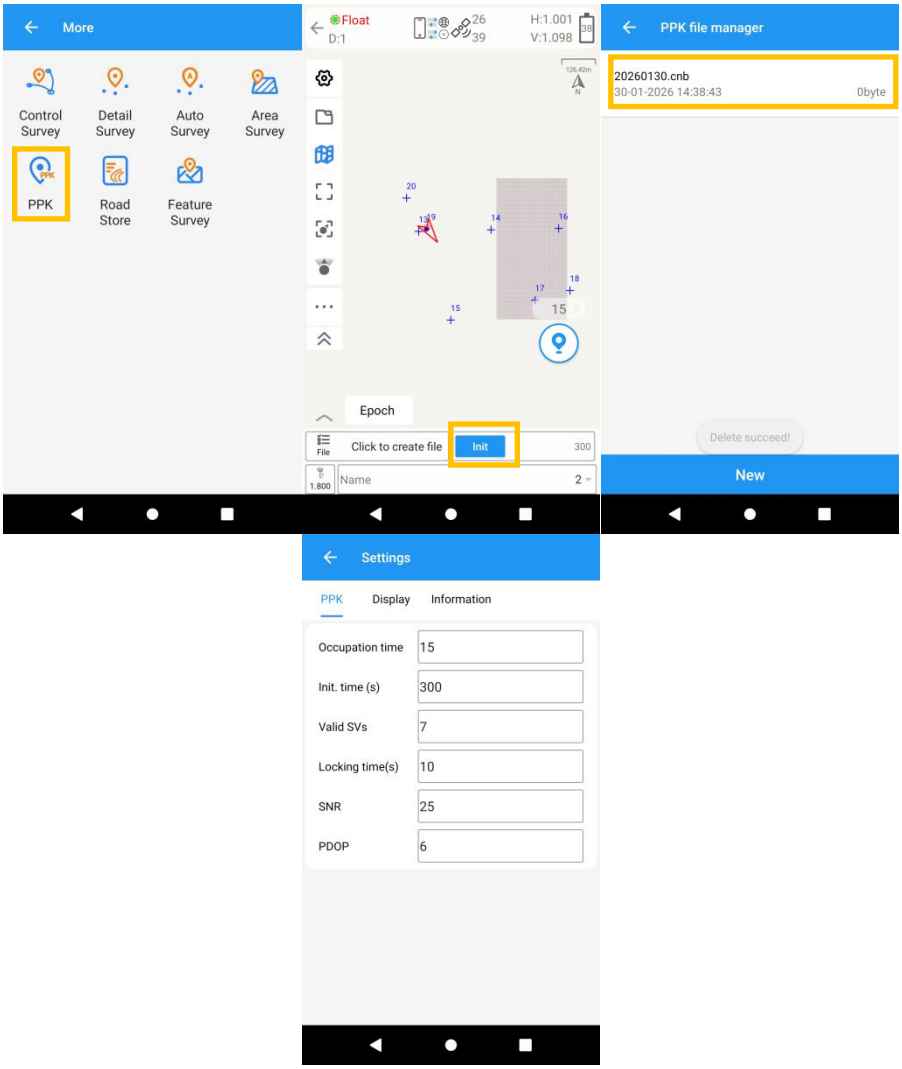
PPK (post processing kinetic) is the unique function of Survey Master, which is used for post-processing dynamic measurements.

It also needs two receivers to work together, one work as Base to record static data, and Mercury work as Rover as shown below.

1) Click PPK in survey interface -> choose or create a PPK file.

2) Go to settings, configure PPK settings based on your requirements.

3) To get stable epoch, click Init to initialize ->  to start PPK survey.

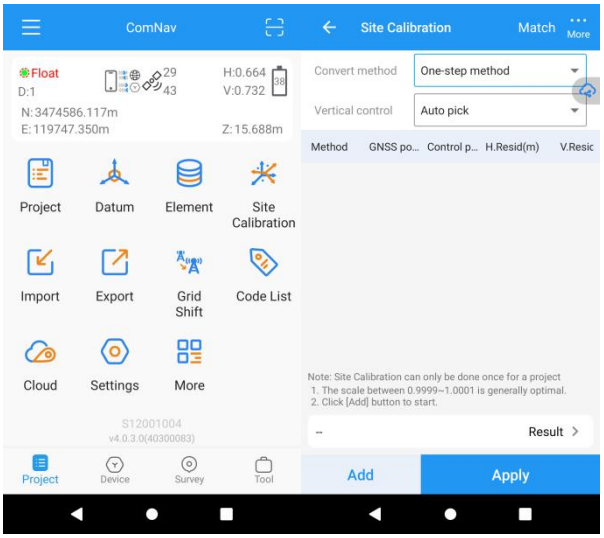


6.9 Site Calibration/Grid Shift

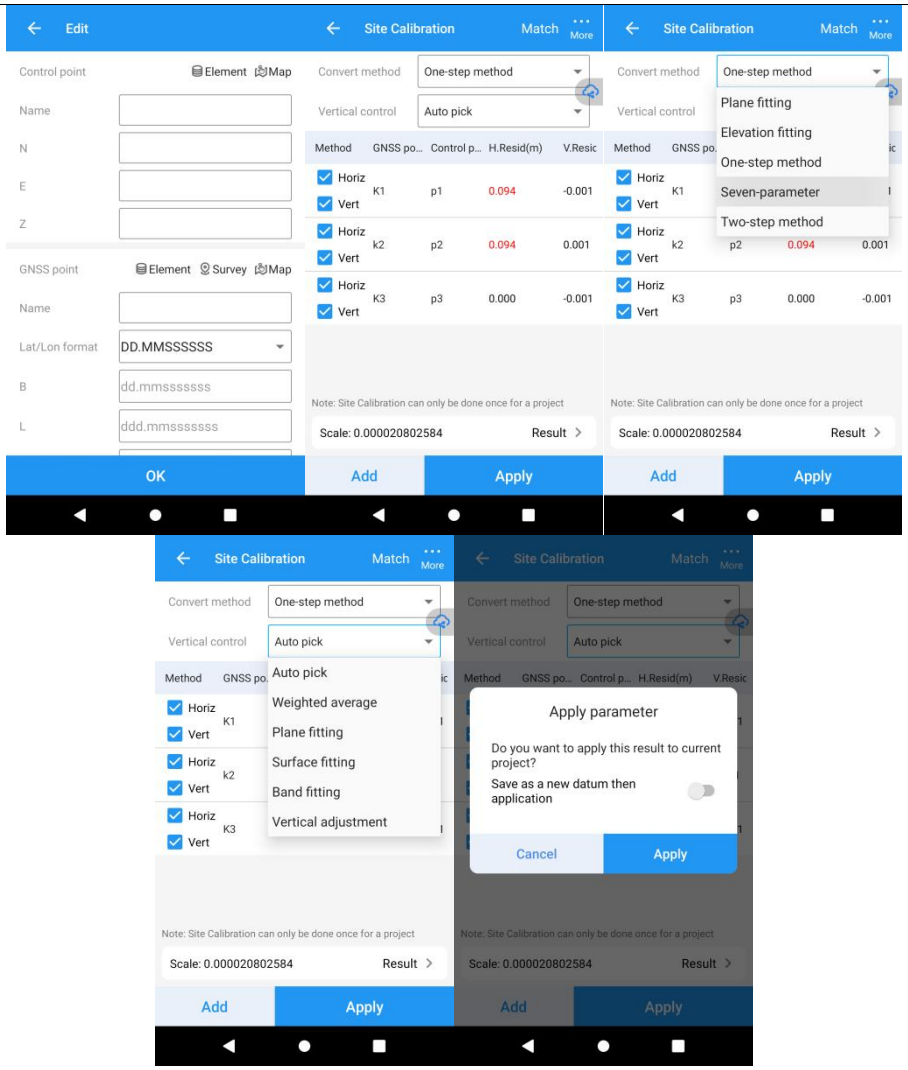
6.9.1 Site calibration

Site calibration is commonly needed once in one project, and all the points will be collected based on calibrated datum system.

1) Choose manual pair or auto pair.



2) If you choose manual pair, you can directly enter at least three groups' point to compute. (for example, take K1,K2,K3 as known points, take P1,P2,P3 as measured points) After click Compute to calculate, the software will calibrate automatically.

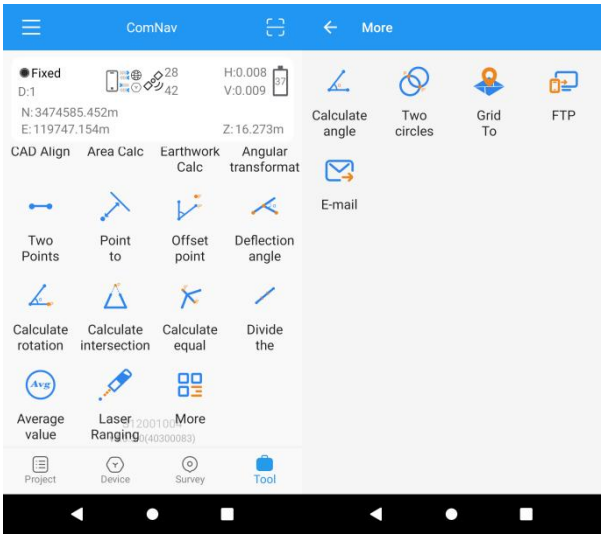


3) If you choose auto pair, it will auto compute according to the same name for known point and measured point. After click Compute to calculate, the software will calibrate automatically.

4) Click ***Apply*** to confirm to replace datum. The value of H.Resid and V.Resid should meet the requirement (H.Resid $\leqslant$ 0.015m, and V.Resid $\leqslant$ 0.02m).

6.9.2 COGO

In the tool interface, you can calculate points/lines/angle directly on field.



- Angular transformation: Angular type transform;
- Two points: Calculate two points distance;
- Point to line: Distance from point to one line;
- Offset point: Calculate point with azimuth and distance;
- Deflection angle: Calculate angle of two lines;
- Calculate rotation: Calculate point with angle and distance;
- Calculate intersection : Calculate intersection points from two lines;
- Calculate equal division angle: Calculate point from angle bisector;
- Divide the line: Calculate points on line by distance or segment;
- Average value of measuring point : Calculate average from points;

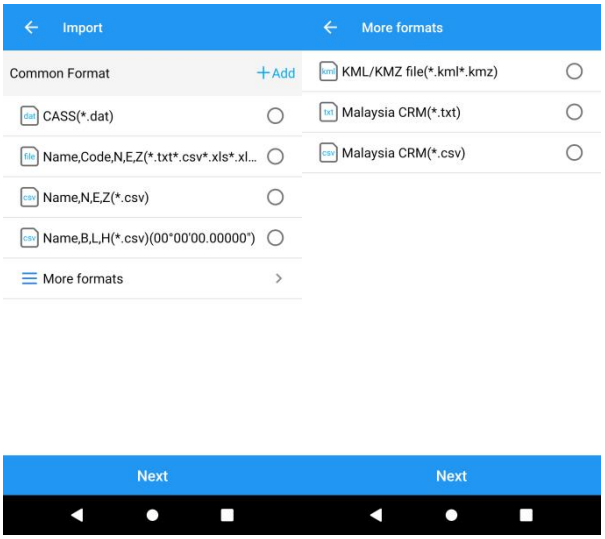
6.10 Data Export/Import

Survey Master supports to import/export data including grid coordinate, Lat/Lon coordinate with various data format, support import DXF/DWG file and export result of DXF/KML, etc.

6.10.1 Import

Tap ***Import*** in project interface, there are some predefined data formats, click ***More*** formats to get more predefined formats. Besides, you can click ***Add*** to create a User-defined type.

Long press the predefined data format that you don’ t use often, you can move this format to the More formats page; also, you can move the data format of More formats page to the previous page where stored the formats you usually use.



- Name: Enter the name for the format
- Delimiter: support Comma(,), Space( ), Semicolon(;)
- File format: support *.csv, *.dat, *.txt format

Click Select all to choose all elements, Click Clear to eliminate all elements selected.

The elements include: code, name, N, E, Z, B, L, H, X RMS, Y RMS, V.RMS, status, start time, occupation time, diff age, total AntHgt, Antenna height, measure type, antenna name, ending time, comment, RMS, PDOP, HDOP, VDOP, TDOP, GDOP, total SV, used SV, elevation, tilt offset, tilt angle, tilt distance

Tip: The format you defined will also be saved to Export interface.

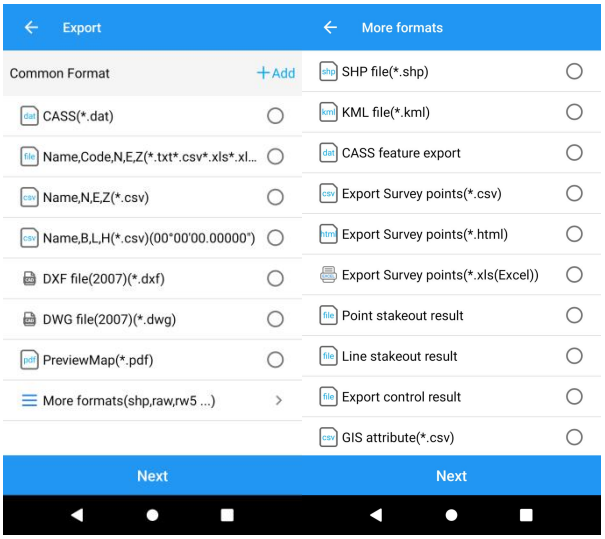
Choose one format to import data.

- The default export path is …/Survey Master/mn/data, you can also click Upperfolder to change to any other path where the file is.
- Point type: support Input point, Control point, Stake point

6.10.2 Export

Tap ***Export*** in Project interface to export simple data of survey points. Also, click ***More*** formats to export the survey points with detailed information or other formats like stake points/lines, DXF, SHP, KML, RAW, RW5, HTML, CASS feature result.

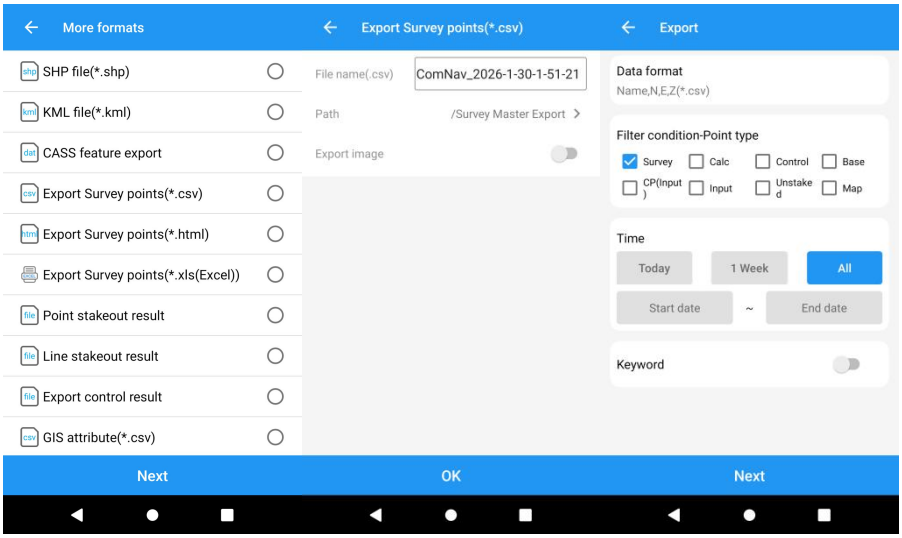
Same with Import result, long press the predefined data format to select the interface you want to place.



File format: support *.csv, *.dat, *.txt format choose one format to export data.

Select: support Survey point, Control point, Input point, Stake point, Base, also,you can set the data, name, code of data to specific export.

The default export path is ⋯/Survey Master/mn/export, and the previous saved file will be shown below, you can also click ***Upper*** folder to change to any other path



For the points, lines and polygons you surveyed in Topo survey and Feature survey, you can click ***Export DXF*** to export dxf file, then you can edit them in third party CAD software, or import to ***Basemap*** to check, or import to ***Stake CAD*** to stake.

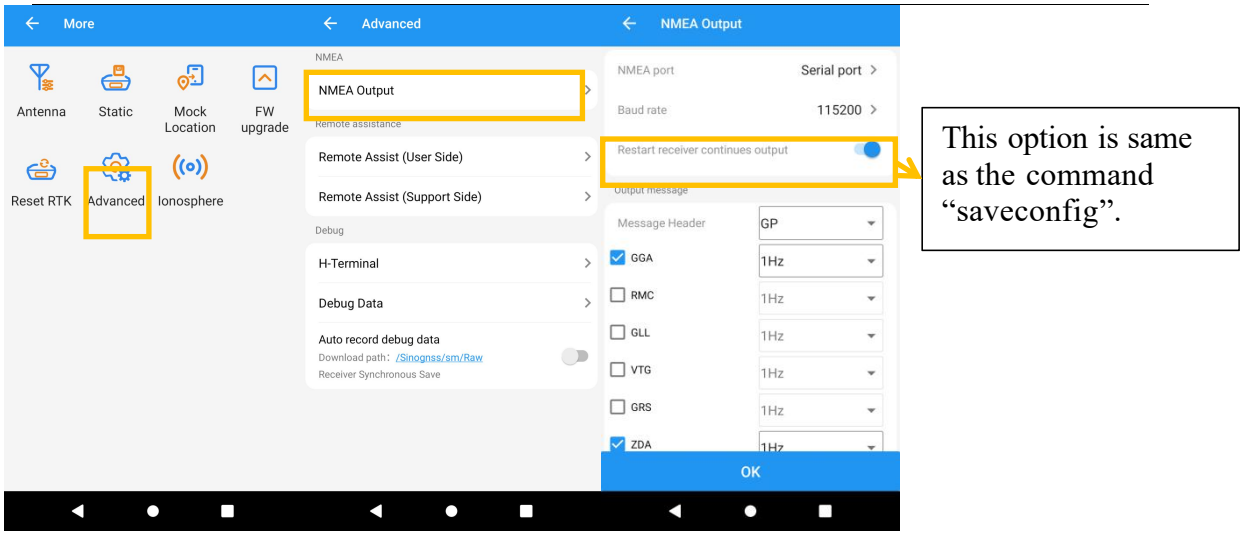
Choose the data that you want to export including survey point, input point, control point, stake point, line and polygon, and the layer properties includes name, code and height, the default text height is 0.5.

6.11 Export Result

6.11.1 NMEA 0183 output

With ***NMEA 0183*** function, you can quickly set to output NMEA data from lemo port or Bluetooth. In fact, this function is same as enter commands “log comX gpXXX ontime X ”.

Choose NMEA Port -> Baud -> check commands you want to output.



Data transfer: for transmit all the BT output to the address.

6.11.2 Register Mercury via Survey Master

Normally, the register code is like this, the digital code can be used to generate a QR code:

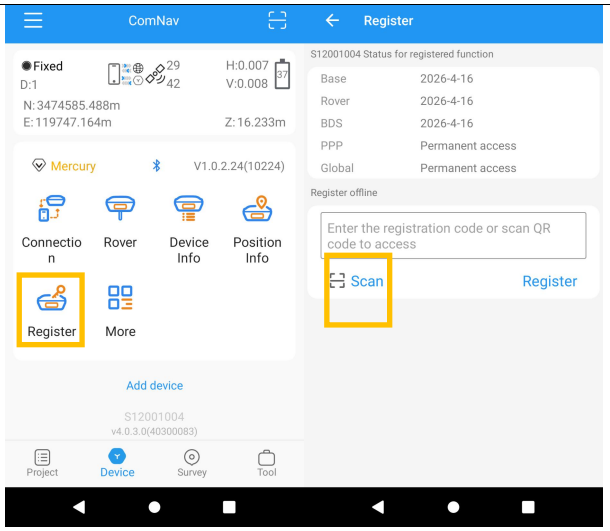
FUNCTIONREG:2207453726-3851620954-0949162572-0697504466-0613618189-0027539229

Note: The length of code may different according to different requirements.

Following shows three methods to register the receiver.

➢ **scan code**

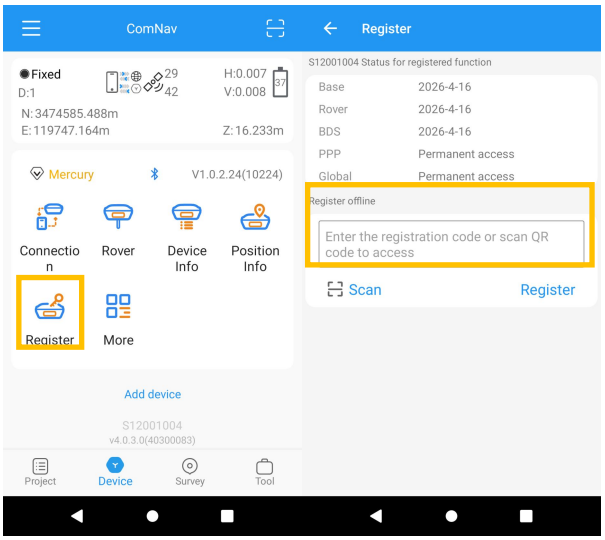
For **scan code**, you just need to scan the generated QR code:



➢ **Register function**

For Register function, you need only enter the number:

2207453726-3851620954-0949162572-0697504466-0613618189-0027539229



➢ **Register via commands**

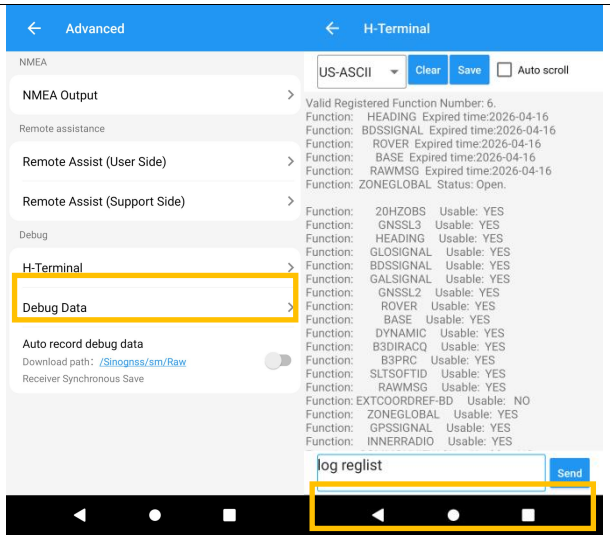
You need copy the whole code, include the word ‘FUNCTIONREG:’

FUNCTIONREG:2207453726-3851620954-0949162572-0697504466-0613618189-0027539229

Send command: LOG REGLIST

FUNCTIONREG:2207453726-3851620954-0949162572-0697504466-0613618189-0027539229

and enter the cursor to next line, then send.To check receiver register status.



6.12 Firmware Upgrade

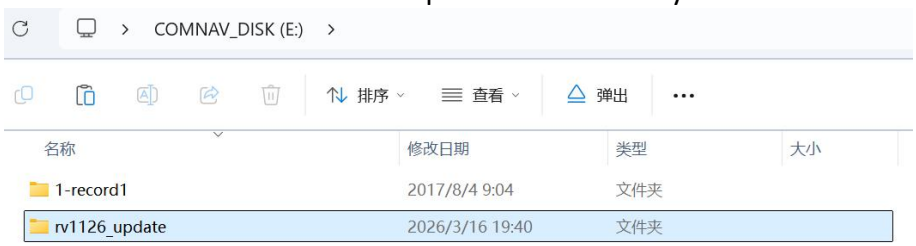
1) Upgrade by PC

Prepare a USB-Type C cable. And download a Driver of USB recognition. It’s important.

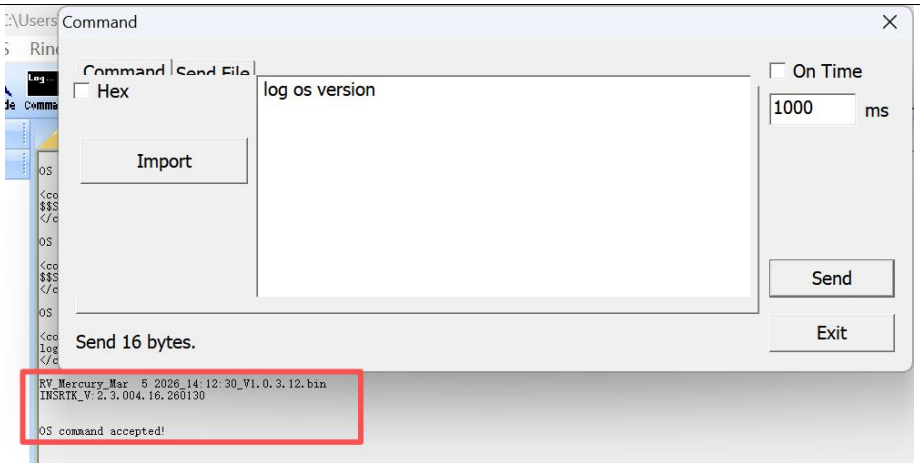
Mercury adopts the latest chip, integrated system and board, which shall be distinguished during upgrading.

Connect Mercury to your PC via type-c cable and turn on the receiver.

Extract the file, copy the folder directly to the root directory of the Mercury's internal memory, then restart the receiver. It will update automatically.



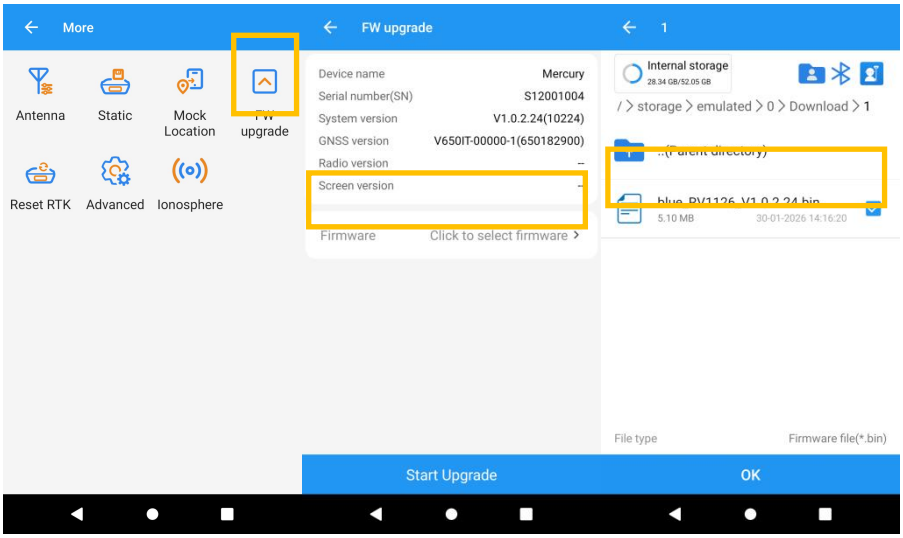
When the upgrade is complete, the firmware folder in the internal memory of the Mercury receiver will disappear. You can turn on CRU to check the firmware version.

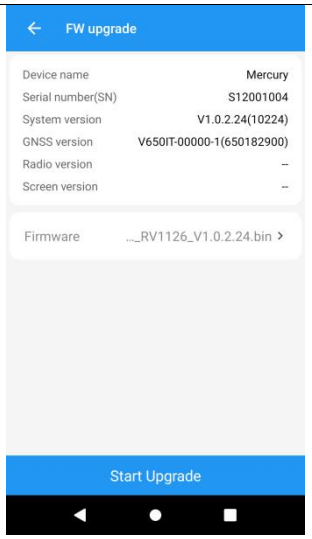


2) Upgrade by BIN file

If you want to update the firmware for your receiver, you need to copy the firmware to your controller first, connect your receiver to the Survey Master, then go to the ***Device->FW Update***, choose the firmware in your controller folder.

Go to ***Device Info-> Firmware Update***, or click the FW Update on the main interface, go to FW update interface, click Start, it will take about 10 minutes to finish the update. After you finish the update, you need to restart the receiver.





3) Upgrade by online

Click the ***Device Info->Firmware upgrade,*** choose a firmware upgrade directly.

