SinoGNSS®
By ComNav Technology Ltd.

# T30 IMU RTK GNSS Receiver

## User Guide



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## Trademark notice

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## FCC Notice

SinoGNSS® T30 IMU GNSS receivers comply with the limits for a Class B digital device, pursuant to the Part 15 of the FCC rules when it is used in the Portable Mode.
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference;
(2) It must accept any interference received, including interference that may cause undesired operation.

## Copyright Notice

This is the V1.0 (Feb, 2020) revision of the T30 IMU GNSS Receiver User Guide. It cannot be copied or translated into any language without the written permission of ComNav Technology.

## 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 T30 IMU receiver. 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
- Do not rotate 7-pin Lemo port

- Do not cover the radio, keep a sound ventilation environment
- To reduce radiation, please keep above 2 meters away from the radio station
- Take lighting protection measures when installing antennas
- Change the cable if damaged

## Related Regulations

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

## Use and Care

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

## Warning and Caution

An absence of specific alerts does not mean that there 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.

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# 1 Introduction

The SinoGNSS® T30 IMU GNSS Receiver User Guide is aimed to help you get familiar with the T30 IMU receiver and start your project effectively. We highly recommend you to read this manual before surveying, even you have used other Global Positioning System (GPS) receivers before.

## 1.1 About the receiver

With SinoGNSS® Quantum™ algorithm, T30 IMU GNSS receiver can be applied in RTK mode with all GNSS constellations. T30 IMU receiver has ultra-small size and strong anti-interference ability to make it possible to work even in harsh environments. It is the ideal RTK/GNSS product for surveyors.

## 1.2 Receiver features

The SinoGNSS® T30 IMU GNSS Receiver key features:

- Ultra small and super light
  - Size (W × H): 15.5cm × 7.3cm
  - Weight: 1.2kg (including 2 batteries)
- 574 channels of simultaneously tracked satellite signals
- Increased measurement traceability with SinoGNSS® Quantum™ algorithm technology
- Hot swap battery design
- Cable-free Bluetooth wireless technology
- 5 LEDs and 2 function buttons
- IP67 waterproof
- Full base/rover interoperability
- Integrated receiving & transmitting radio with 12.5KHz frequency interval
- Integrated IMU sensor
- Integrated WiFi module
- Integrated 4G module, support Ntrip and Point to Point/Points protocols
- Support long baseline E-RTK™ (Beidou B3 signal is included in RTK calculate engine)

## 1.3 T30 IMU Receiver parts list

This section provides overall T30 IMU receiver parts list, including basic supplies and customized kits based on your requirements.

### 1.3.1 Basic Supply kit

SinoGNSS® T30 IMU GNSS Receiver Basic Supply kit contains two receivers and related accessories.

| Item | Picture |
|---|---|
| 2* Kits T30 IMU Receivers |  |
| 1*GNSS Connector |  |
| 2*7-pin Lemo to RS232 Cable |  |
| 2* 7-pin Lemo to USB Cable |  |
| External Power Cable |  |
| 2* Whip Antenna (UHF) |  |
| 1*2m-Range Pole with yellow bag |  |

| | |
|---|---|
| 4* Lithium-ion Battery |  |
| 2* Battery Charger |  |
| R550 Controller |  |
| Controller Battery, Charger and Cable |  |
| Controller Bracket |  |

Optional accessories:

| | |
|---|---|
| Double Bubbles Tribrach with High Adapter |  |
| 1* 30cm Extension bar |  |

### 1.3.2 Optional Datalink kit

This kit is necessary for long distance radio communication, shown in the following figures:

| Item | Picture |
|---|---|
| External Radio<br>CDL5 |  |
| 2-pin Lemo Power Cable |  |
| 7-pin Lemo Data Cable |  |
| N-Type to TNC Convertor |  |
| N-type to N-type Antenna Cable |  |
| N-Type Radio Antenna |  |

### 1.3.3 Transport Cases

Standard transport case is designed for containing basic supply kit of one SinoGNSS® T30 IMU GNSS Receiver.






Base



Rover

The optional choice is provided to have capacity of two kits of T30 IMU receivers.



# 2 Setting up the receiver

This chapter provides general information on environmental requirements, setup, power supply and connection of the T30 IMU receiver.

## 2.1 Environmental requirements

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

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

## 2.2 Front panel

Receiver front panel contains one 5 LEDs, Power button and Record button. The indicator LEDs show the status of radio and satellite tracking. For detailed information, see *chapter 3.3*.



## 2.3 Lower housing

Receiver lower housing contains a serial port, UHF radio antenna connector, two removable battery compartments (the SIM card slot is located in compartment A), and a threaded insert.



## 2.4 Power supply

T30 IMU GNSS receiver supports internal batteries and external power input.

### 2.4.1 Internal batteries

The receiver is equipped with two rechargeable Lithium-ion batteries, which can be removed for charging. The T30 IMU receiver adopts the hot swap battery design that provides you an effective survey workflow. The internal batteries typically provide about 12-hour operating time as a rover, about 7-hour operating time if operated as a base station with internal UHF Tx (transmit at 1-2 watts). 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

Although a dual battery charge is provided, the lithium-ion battery is supplied partially charged. To charge the battery, first remove the battery from the receiver, and then place it in the battery charger, which is connected to AC power. Please obey the following instructions when charging your batteries:

- Charge the battery completely before using it for the first time.
- Fully charge takes approximately 6 hours per battery 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.

- Storage of the Lithium-ion Battery

- Do not keep batteries inside the receiver if the receiver not used for long time.
- Keep batteries in dry conditions.

| |
|---|
| – Take out the batteries from receiver for shipment. |
| ● Dispose of the Lithium-ion Battery<br>– Discharge a Lithium-ion battery before dispose of it.<br>– 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.**

### 2.4.2 External Power Supply

The receiver is connected to an external power supply through a lemo to RS232 cable, and make sure that the red alligator clip is connected to the positive of external power supply, black one to negative. Over-voltage function cannot protect your T30 IMU receiver if reverse connection.

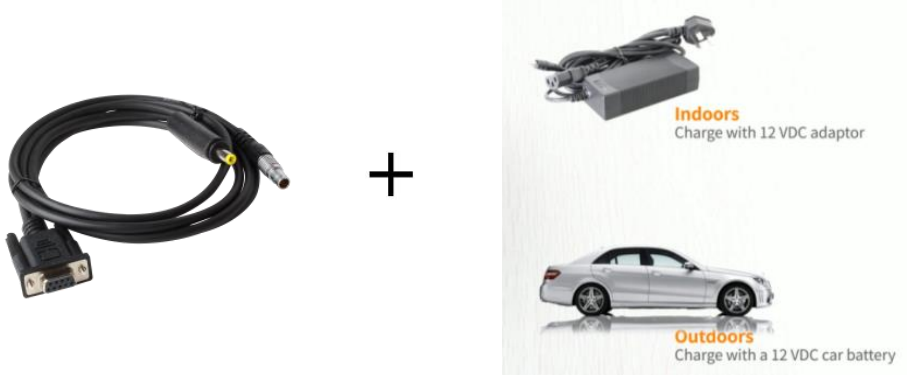


*Tip: The power consumption will be increasing if the base station transmits correction data through internal UHF in the RTK mode; therefore, we strongly suggest using external power (7-28 volt DC) for the base station.*

### 2.4.3 Charge Battery via T30 IMU Receiver

T30 IMU GNSS Receiver can work as a charger, it means you can charge batteries directly if the charger not by your side.

1. Power off T30 IMU receiver with batteries inside;
2. Connect T30 IMU receiver to 12V external power with serial cable;
3. Receiver will charge the battery from Side B to Side A, the red power led will flashing during charging and will off when battery full.



## 2.5 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 OLED display, button functions and all LED behaviors on the front panel.

## 3.1 Button functions

There are two buttons on the front panel, power button and record 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 all LEDs off.

- Record button:

Switch to static mode：Long press the record button for about 2 seconds, release immediately when hearing beep from receiver;

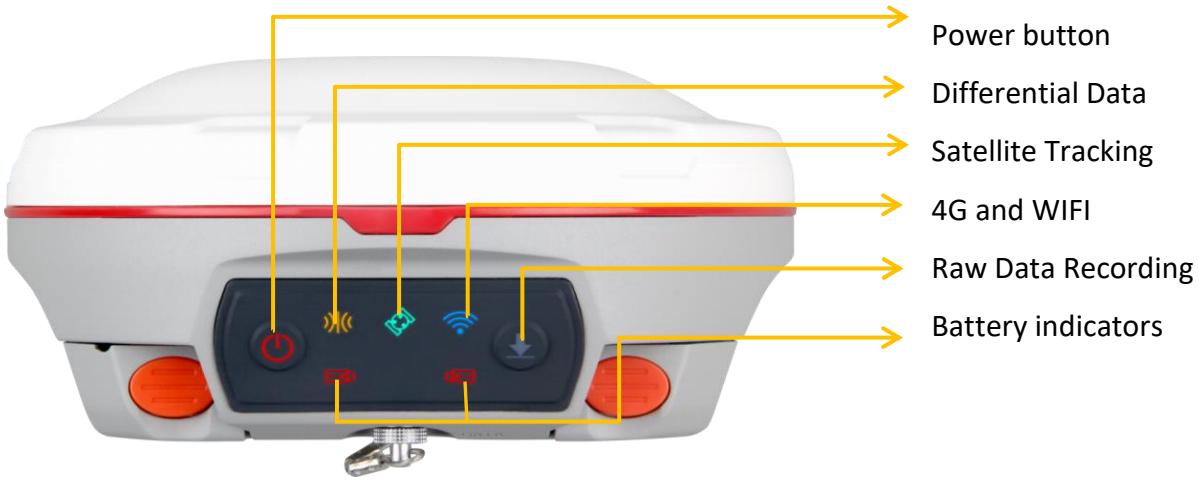
Switch to RTK mode: press the button until Raw Data recording LED off.

*Tip: The record button only works when receiving satellite signals, otherwise it will show timeout.*

## 3.2 LED behavior

The LEDs on the front panel indicate receiver working status. Generally, a lit or slowly flashing indicates normal operation, and an unlit LED indicates that no operation is

occurring. The following figure and table define each possible LED state:




| LEDs | States | Description |
|---|---|---|
| Power | Lit | Enough power |
| | Flashing | Low power |
| Differential Data | Flashes once per second | Receiving/transmitting differential data |
| Satellite Tracking | Fast flashing | No satellite received |
| | Flashes N times every 5 seconds | Received N satellite signals |
| Internal 4G and WIFI | Flashes once per second | GPRS function is working |
| | Flashes once per five- second | WIFI is working |
| Raw Data recording | Flashes according to the selected sample interval | 1) Sample interval varies from 20Hz to 60s.<br>2) Flashing 1/s simultaneously with differential light if internal memory is run off |

## 3.3 Receiver Web GUI interface

**Step 1: Connect Wi-Fi of T30 IMU receiver**

Turn on the T30 IMU GNSS receiver and wait for the T30 IMU serial number to appear under the available Wi-Fi networks on your smart phone or office computer.

For example, ***T30 IMU-0340XXXX*** (where xxxx represents the last four 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://192.168.1.1***

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




# 4 Static survey

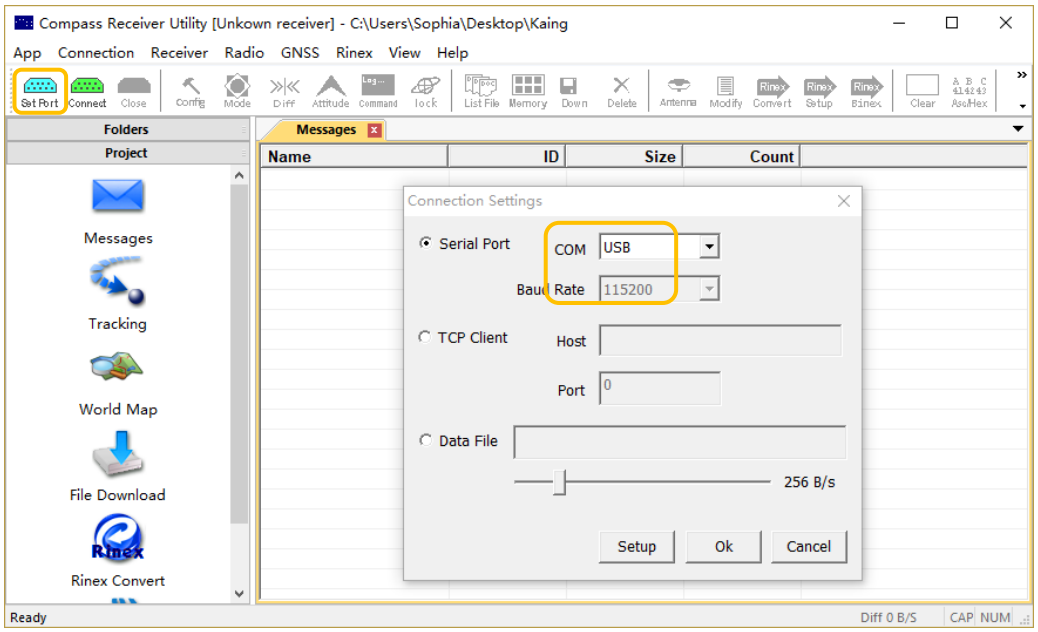
This chapter describes static survey through T30 IMU receiver and CRU software. For static survey, you cannot change settings through front panel, you can configure it via Compass Receiver Utility (CRU): 1) Receiver configuration; 2) check receiver settings and status; 3) convert data to Rinex format.

## 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. Connect the receiver with your PC through 7-pin lemo to RS232 cable.
3. Turn on your T30 IMU receiver and click ***set port*** in CRU ->***U S B*** 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.



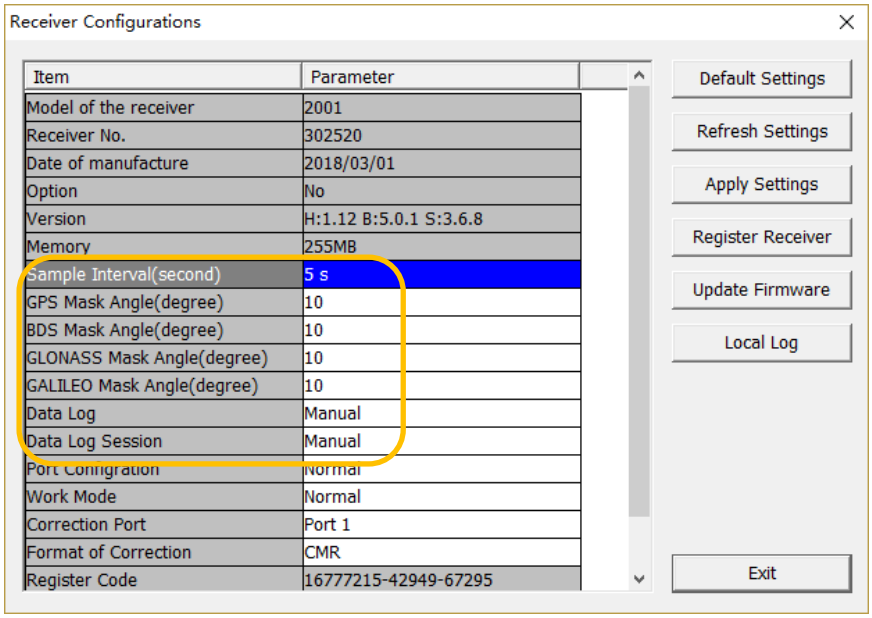

*Tips: two types of cable are provided in your package,*

*1) We recommend to use 7-pin Lemo to USB cable to configure the receiver and raw observation data downloading;*

*2) With 7-pin Lemo to RS232 cable, you can connect T30 IMU receiver with external power or firmware upgrade.*

4. Click ***Config*** to configure the receiver:

- **Sample Interval**: change the sample interval of observations, the maximum data rate is 20 Hz, the minimum is one observation per minute.
- **Mask angle**: disable the receiver to track satellites that below the mask angle. You can set mask angle values for different constellations, which can reduce serious multipath influence or low SNR.
- **Data Log**: logging data manually or automatically.
- **Data Log Session**: 1) Manual means that the receiver keeps recording data in one file until the receiver is turned off or its memory runs out; 2) if set to 1\2\3\4\12 hours, the data recorded will be saved into a file every 1\2\3\4\12 hours.




5. Complete all configurations and click ***Apply Settings*** to save settings. Exit and restart the receiver to activate configurations.

## 4.2 Static Data Collection

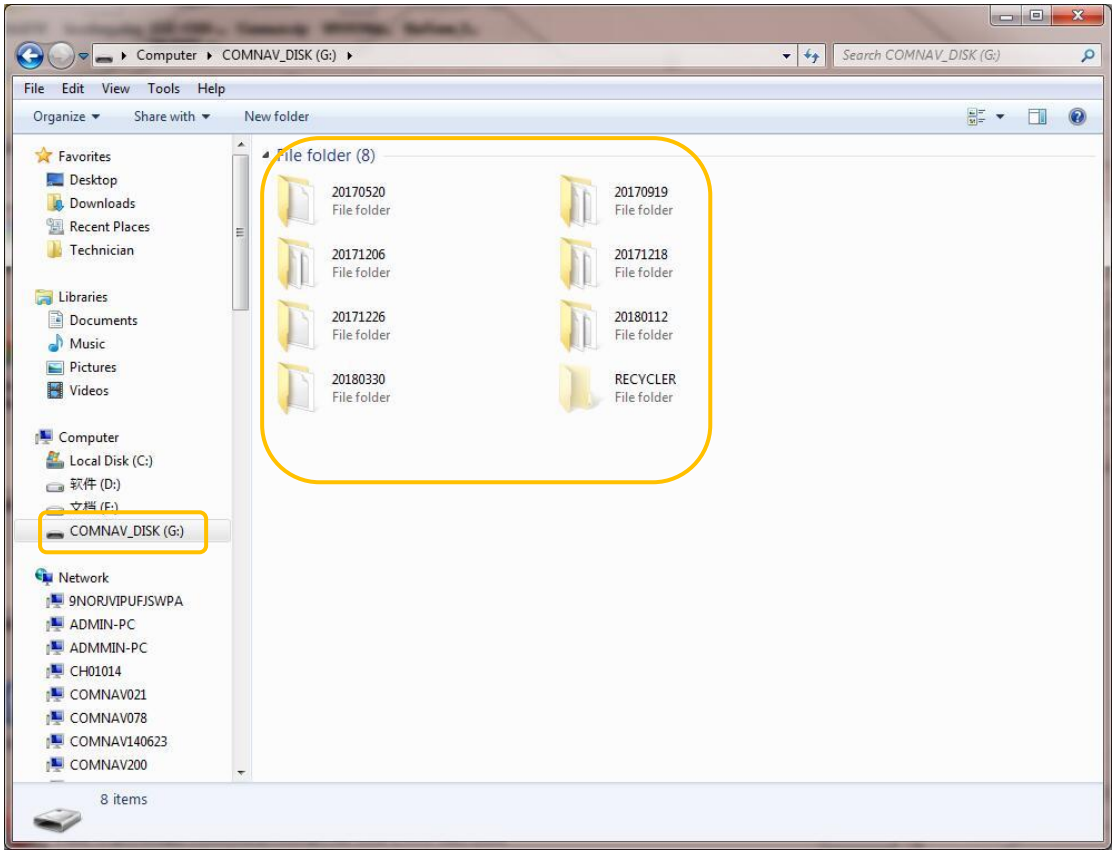
Static survey is mainly used for the control survey. To reach millimeter accuracy, follow as below:

- 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 T30 IMU receiver, when connected with PC via USB cable, the T30 IMU receiver can work as a USB Flash Disk, which means you can copy or cut static data to PC directly.



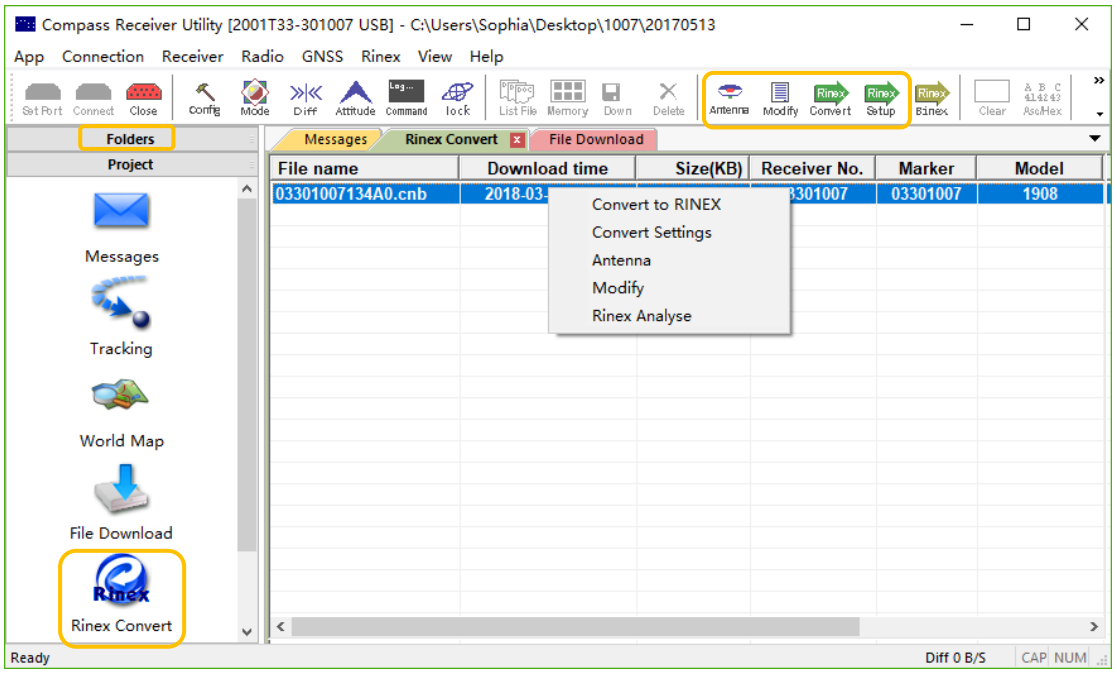

*Tip1: Default memory for T30 IMU receiver is 8GB, and 16GB, 32GB optional.*

*Tip2: The receiver will stop recording raw data if the internal memory runs out.*

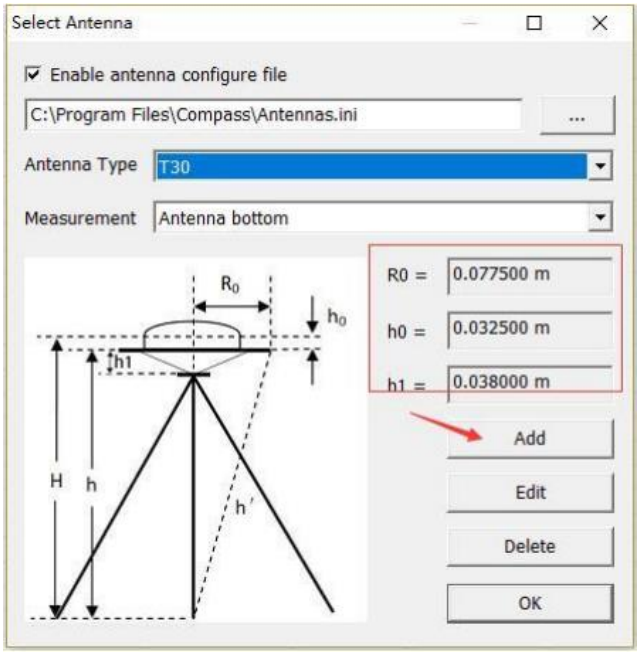
## 4.4 RINEX Convert

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.

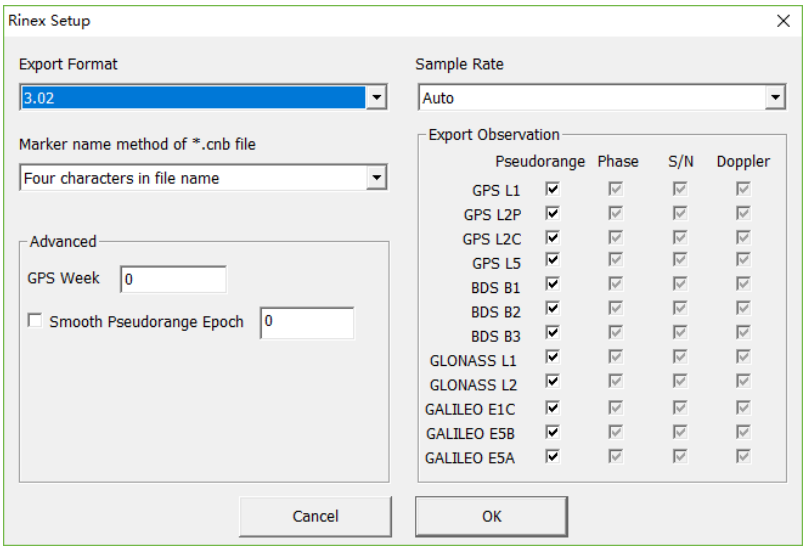



- Click Antenna to select the ***Antenna Type*** and ***Measurement***. If you cannot find T30 IMU antenna, 1) input the value of R0 (horizontal offset from measurement mark to phase center), h0 (vertical offset from measurement mark to phase center) and h1 (vertical offset from measurement mark to receiver bottom). R0 is 0.0775m, h0 is 0.0325m and h1 is 0.038m respectively for T30 IMU 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 Rinex Setup 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 Rinex Convert to ***Convert to RINEX***, the RINEX data will be save in the same path as raw observation data.

# 5 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 (Radio, CORS and GPRS).

## 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 R550.

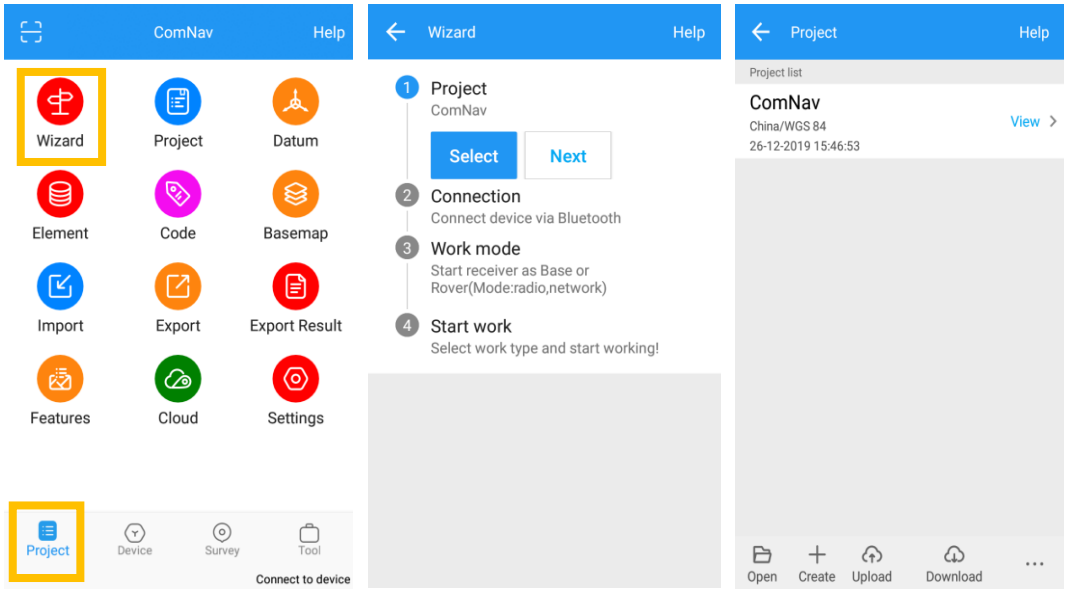
Also you can download the latest version from our website:
http://comnavtech.com/download.asp?bigclassid=28

## 5.2 Wizard function in Survey Master

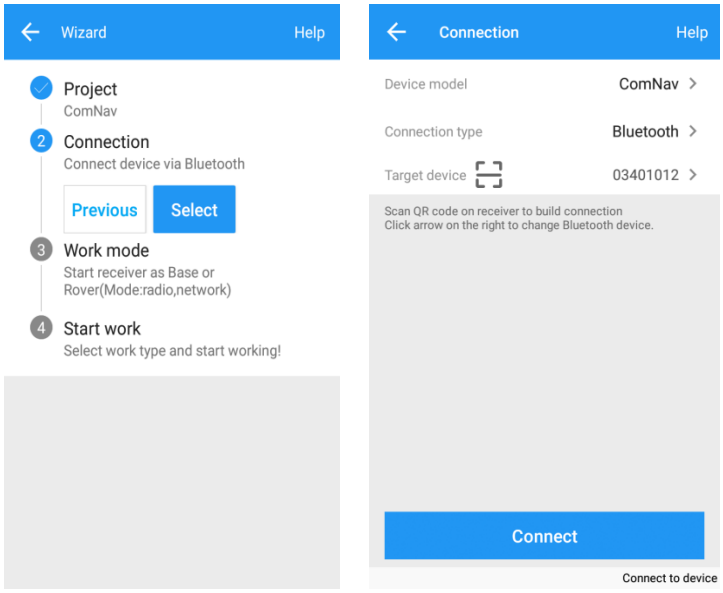
Follow the Wizard, you can quickly learn the general workflow of Survey Master, also you can quick start your survey by this function no matter you are experienced one or new user.

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 5.3.

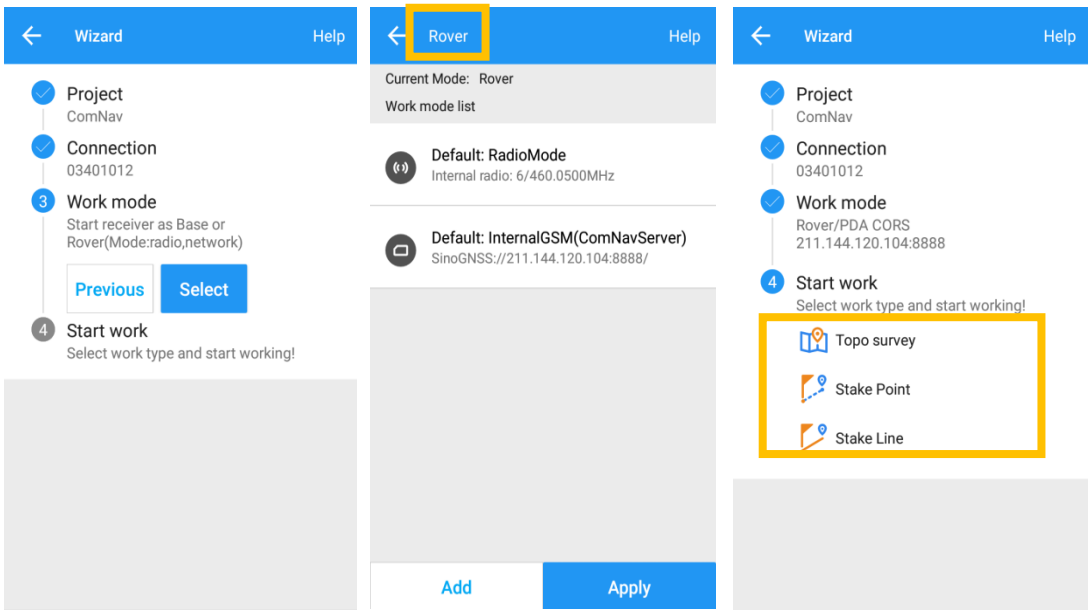



2. ***Connection***: Click ***Select*** to go into Bluetooth connection interface. For detailed information, you can refer to chapter 5.4.

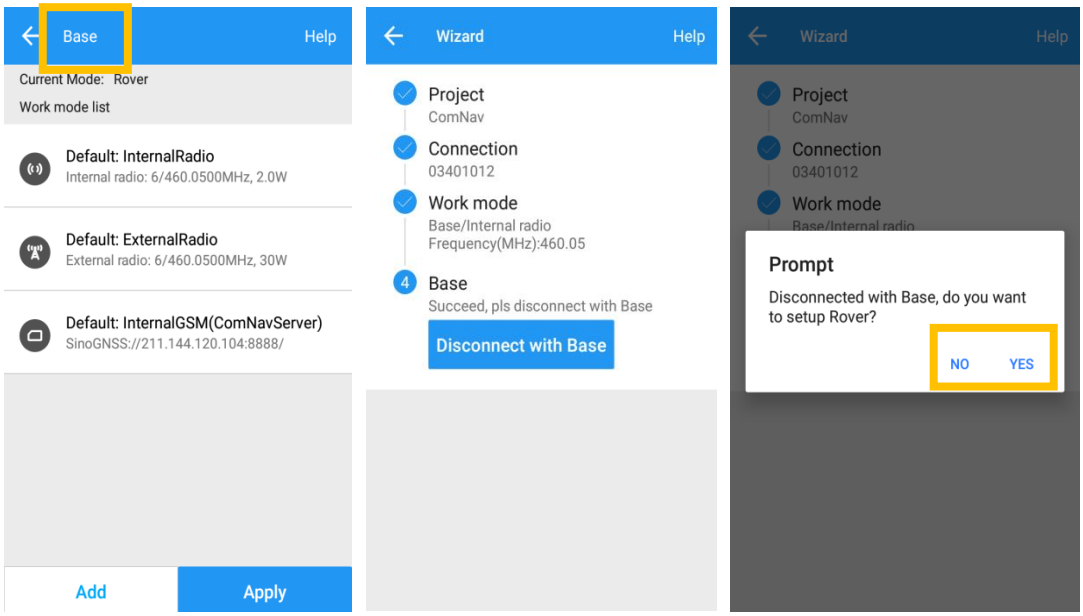



3. ***Work mode***: Click ***Select*** to go into QuickSetup interface to start your receiver as Base/Rover. For detailed information, you can refer from chapter 5.5.

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

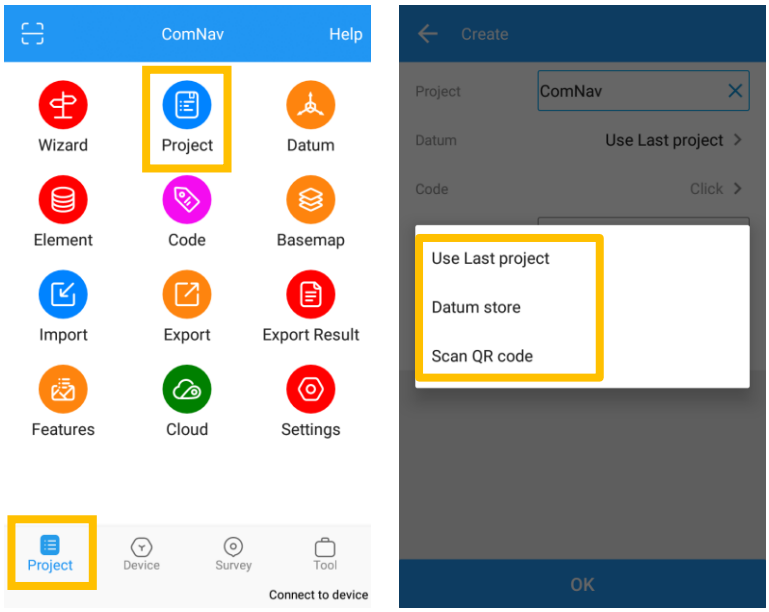



If you start your receiver as Base, after Disconnect with Base, there will be a Prompt.
YES: will guide you to start Rover in Wizard interface;
NO: will disconnect the base and exit Wizard.

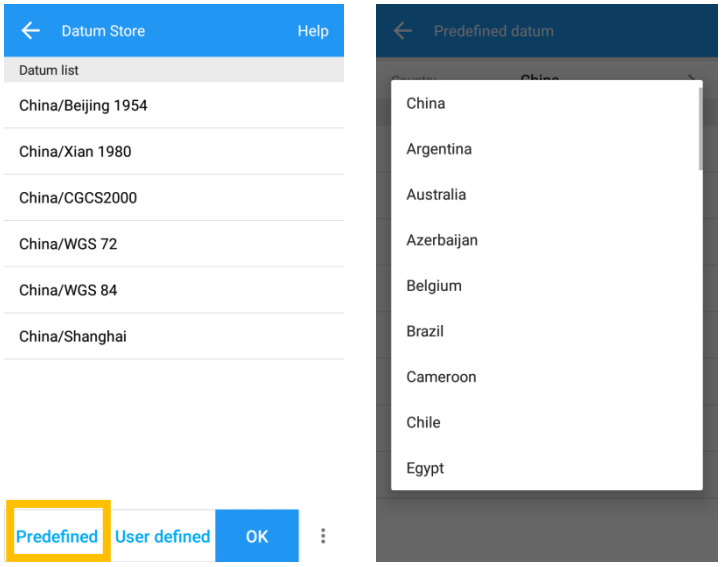



## 5.3 Start a New Project

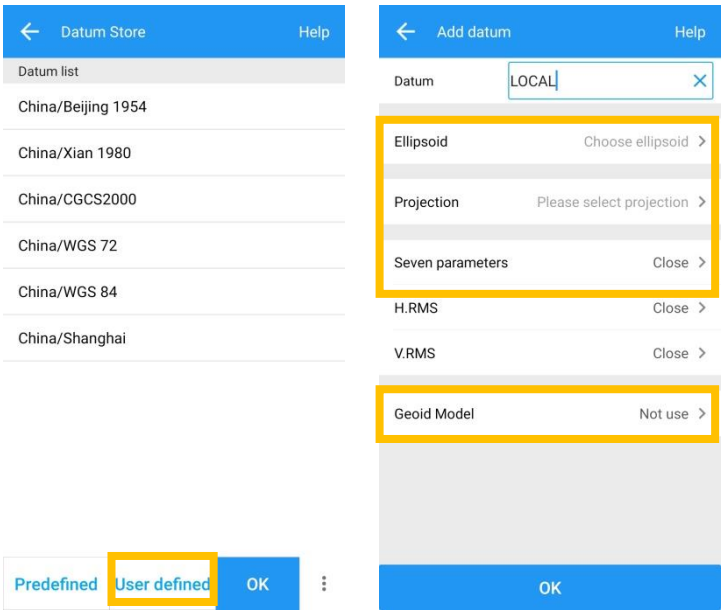
Click ***Project***, you can use the same Datum with last project, choose a datum in store and scan QR code from other controller to add Datum, even sharing project with cloud.




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

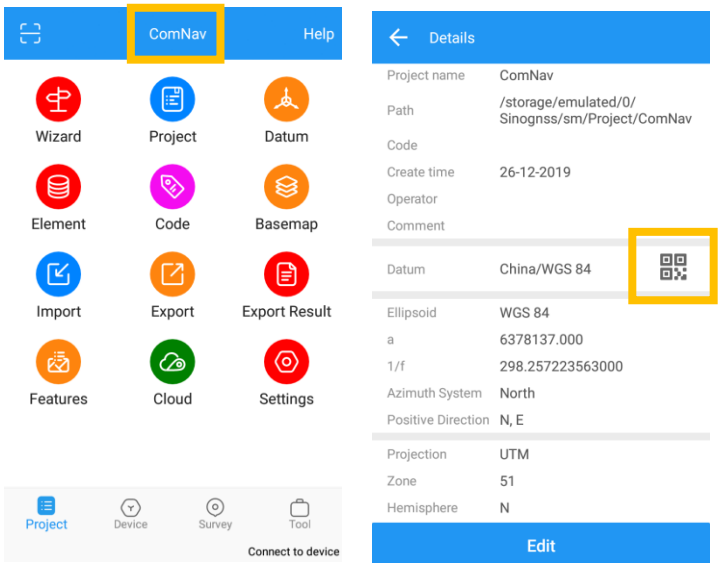



- Create a User defined datum: If you cannot find datum you want in the list, follow instructions below to add one: select Ellipsoid, Projection for your datum, and even seven parameters, geoid model based on your request.




*Tip1: if asked username and password for seven parameters, enter **admin** **admin***
*Tip2: For H.RMS and V.RMS, it will show if do **Site Calibration**.*

- 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.

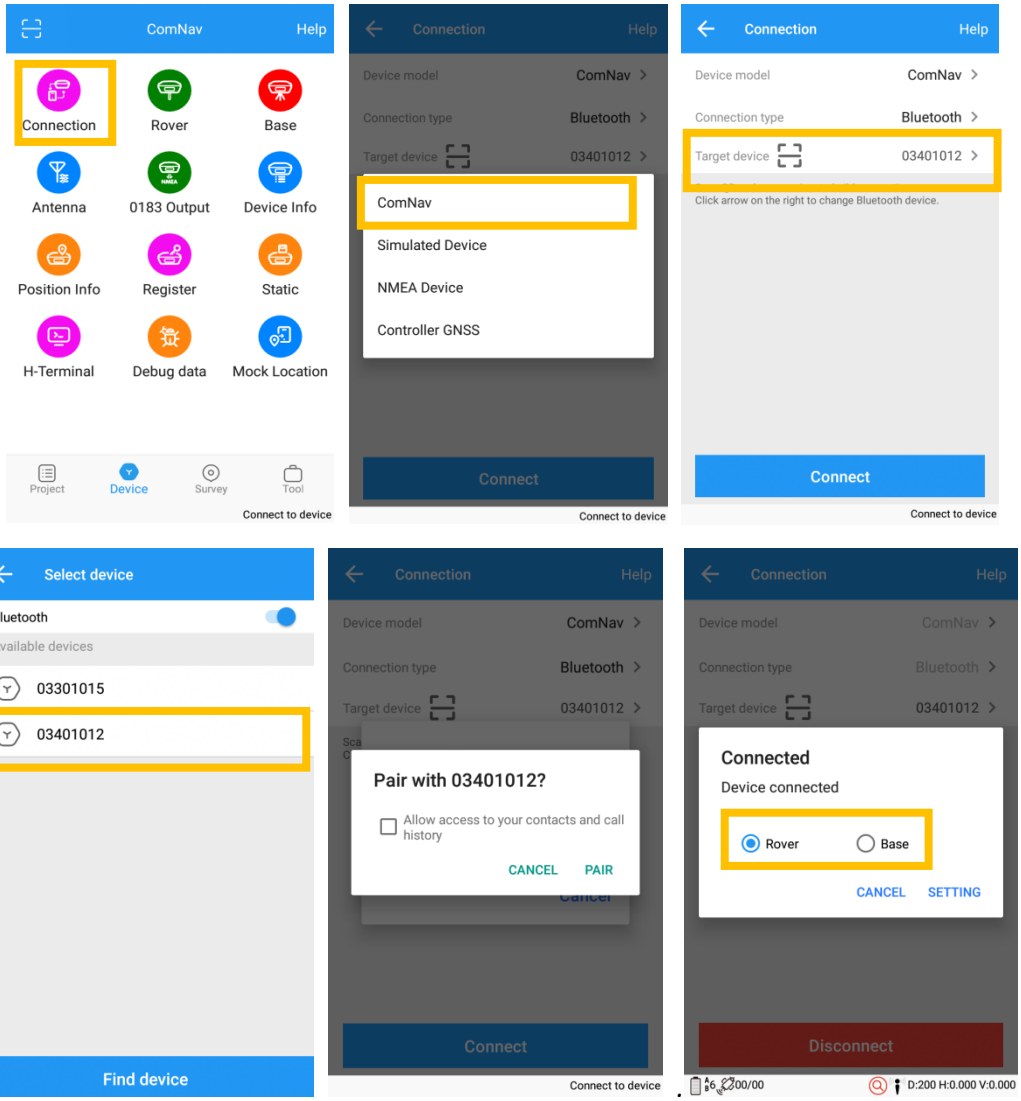



## 5.4 Bluetooth connection

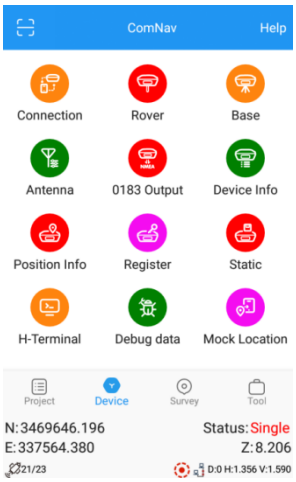
To connect Survey Master with T30 IMU, switch to ***Device*** interface, tap ***Connection*** to go into Bluetooth connection interface.

- Make sure device Bluetooth turned on;
- Click ***Find device***—select SN of your T30 IMU receiver—allow pair

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



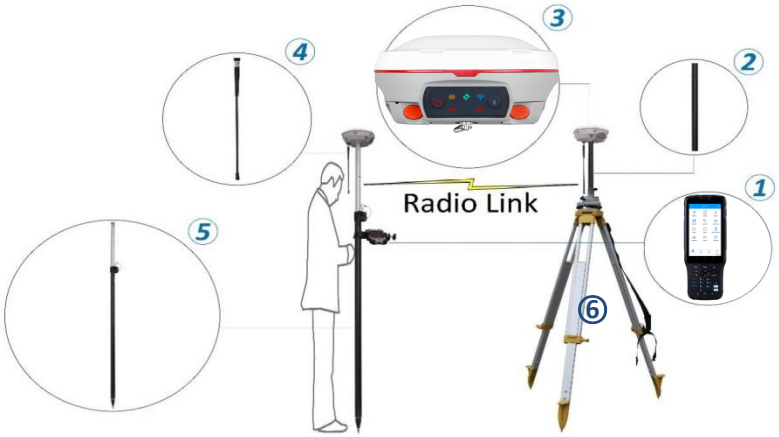

After connected successfully, the bottom will show the positioning status.



*Tip: If you 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.Som etimes you need restart the receiver or Survey Master Software.*

## 5.5 Internal Radio Mode

T30 IMU GNSS receiver supports transmit & receive the correction data in internal radio mode. To conduct the RTK survey in internal radio mode, it requires:




① A controller with software installed
② An extension bar
③ Two units of T30 IMU GNSS receiver
④ Two whip antennas
⑤ A range pole with bracket
⑥ Tripod and tribrach

*Tip: The external power supply is recommended when T30 IMU set as a base station.*

*More: Aim to improve the radius of work field, we can change the base receiver's Whip Antenna to External Antenna. And others no need change.*

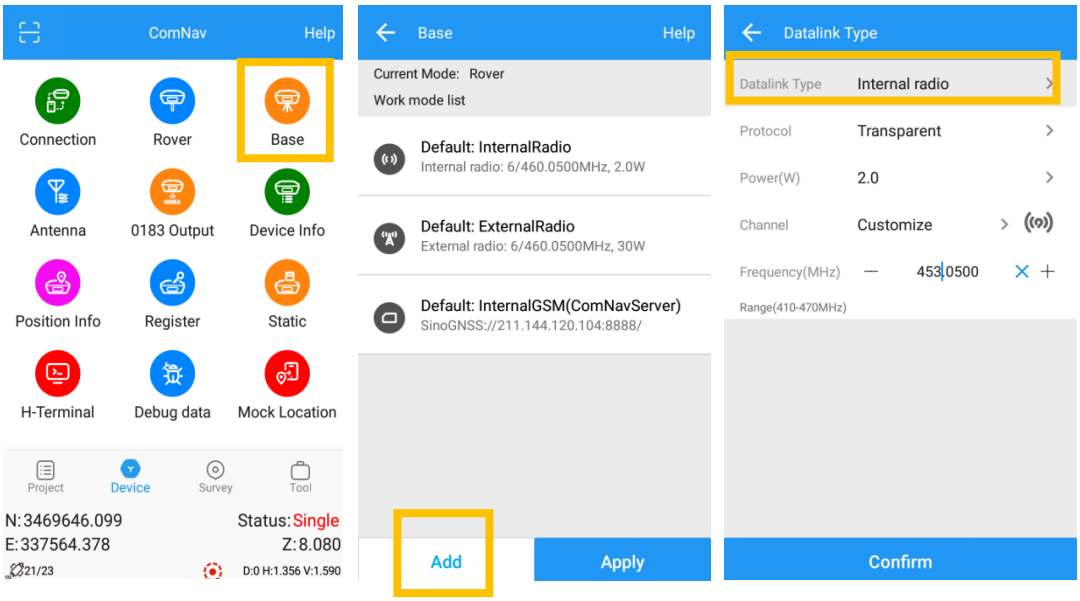


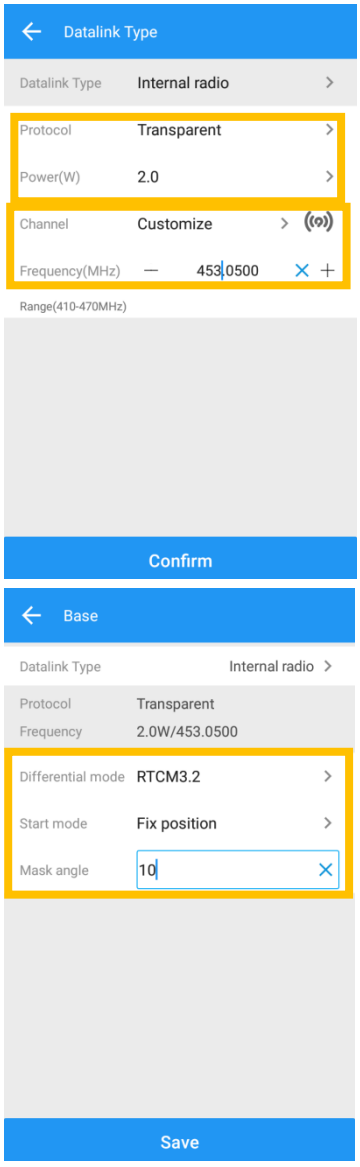

① T30 IMU GNSS Receiver
② External Antenna

### 5.5.1 Start Base Station by Survey Master

Firstly, build Bluetooth connection between the T30 IMU receiver and your controller as shown in Chapter 5.4.
Secondly, modify parameters including correction format, antenna type and communication protocols:

- Click *Device*-> *Base* ->*Add*, select *Internal radio*.

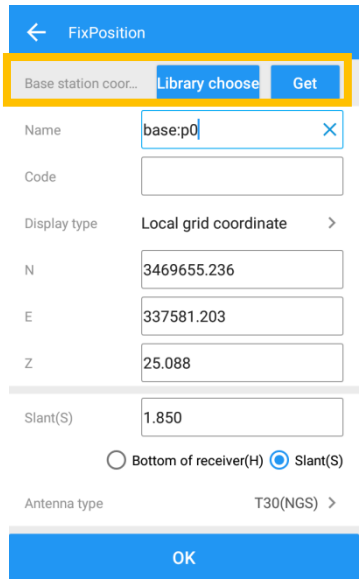



- Choose Protocol and Frequency for Base receiver.

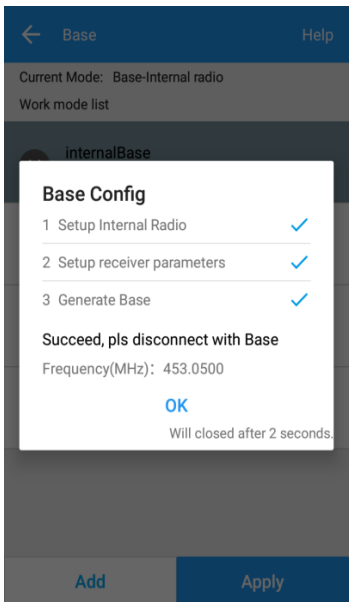
- Start mode: Fix position means you have a known coordinate for Base, or get a point from GNSS;

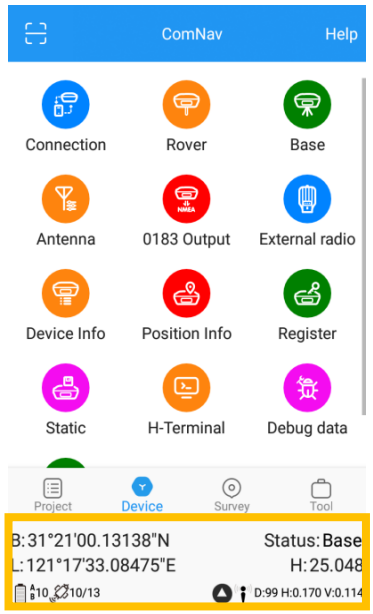
- Differential mode: Make sure to choose RTCM32




- Library choose: Choose a known point from Elem;
- Get: Get a point coordinate from GNSS

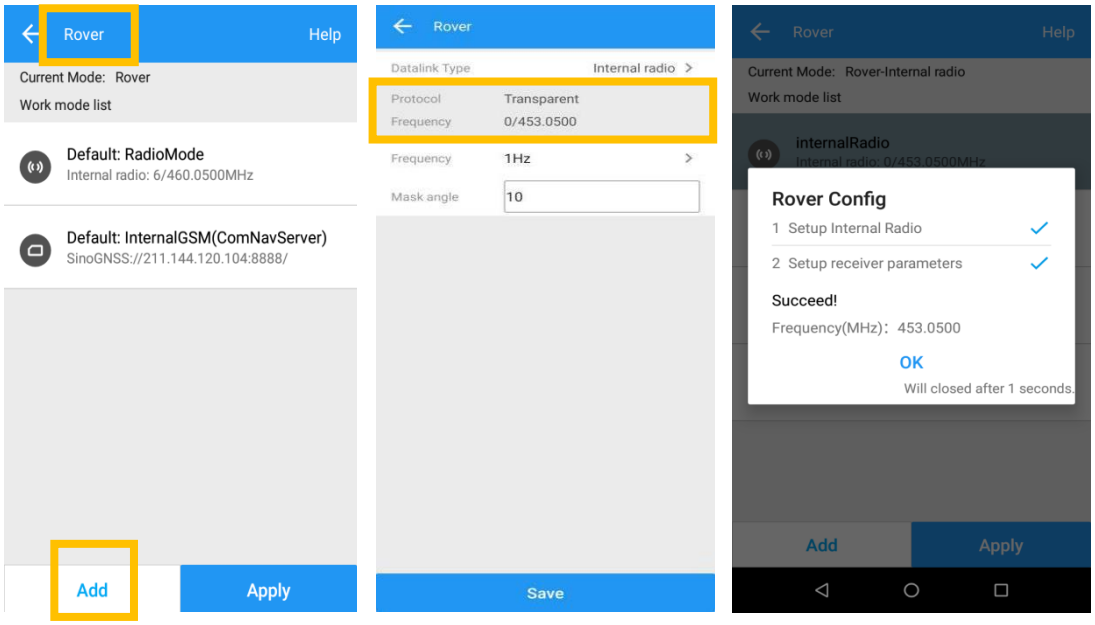
When start Base succeed, it will show as below in Survey Master.




### 5.5.2 Start Rover Station by Survey Master

- Connect Survey Master with T30 IMU receiver via Bluetooth based on Chapter 5.4.
- Set same protocol and frequency with Base receiver.
- The current status on the bottom will change from Single to Fixed.




## 5.6 External radio mode

The external radio mode can extend RTK working distance, which is ideal for areas with high constructions or strong signal interference. To set up external radio mode, it requires:

- Base station




① An external radio
② An external power supply
③ A long whip antenna
④ Transmission cables
⑤ A T30 IMU receiver
⑥ Tripod and tribrach

*Tip: 1) See Appendix A for detailed definition of 7-pin Lemo cable that connects the T30 IMU receiver and external radio; 2) See Appendix B for the operating information of CDL5.*

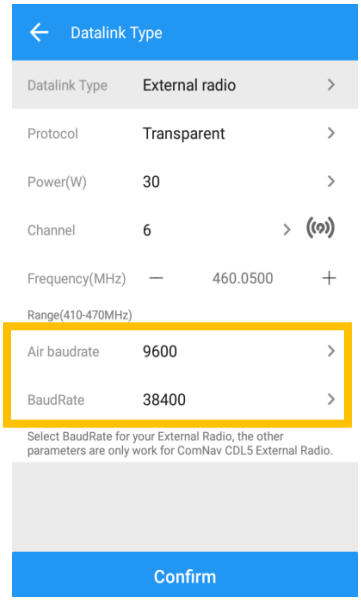
*Warning: 1) You **MUST** connect CDL5 to external antenna firstly and then supply power, otherwise the CDL5 will have a risk of burnout;*

- Rover station



① A T30 IMU receiver
② A Whip antenna
③ A controller with software installed
④ A range pole with bracket

- Click *Device*-> *Base* ->*Add*, select *External radio*.

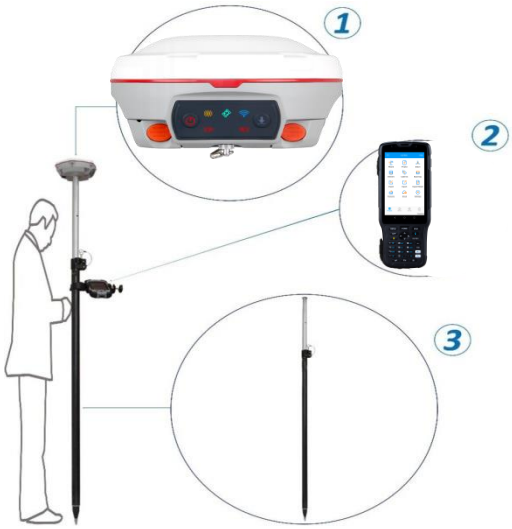



- When start succeed, set up the frequency channel, and Rover frequency should be same.

- Be sure to set the same baud rate as your CDL5 (default value is 38400, you also can change in ***Param tab*** based on your CDL5).

## 5.7 PDA CORS Mode

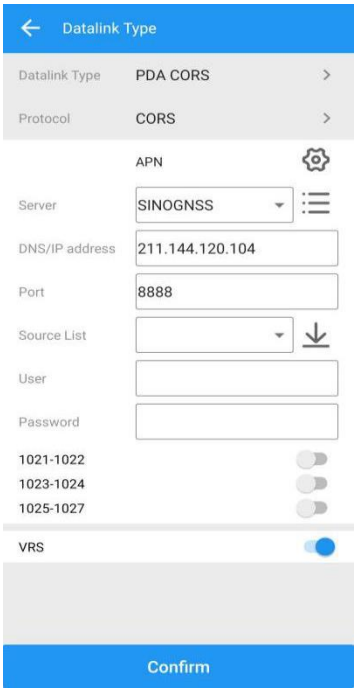
Without setting up your own base stations, the T30 IMU GNSS receiver can receive correction data transmitted from continuously operating reference station via PDA's GPRS or WIFI. To do RTK survey in PDA CORS mode, it requires:




① A T30 IMU receiver
② A controller with SIM card and software
③ A range pole with bracket

Configure the Rover as below:

- Make sure your controller can access to internet via SIM card or Wi-Fi, then run Survey Master Software.
- Build Bluetooth connection as shown in chapter 5.4, Click ***Device*** -> ***Rover*** -> PDA CORS.




- Enter CORS ***DNS/IP address*** and ***port***-> Click ***Source List*** and select the proper source -> enter ***User*** and ***password***.
- After ***Confirm*** succeed, the diff LED (yellow) on receiver will flash, and software can get a fixed result.
- It also provides TCP protocol.

## 5.8 Internal GPRS Mode

For Internal GPRS mode, T30 IMU receiver supports Point to Point/Points and Ntrip client mode. To acquire the APN (access point number) from the mobile service provider, you need to insert a SIM card into the T30 IMU receiver. It commonly acquires the APN from the mobile network provider, otherwise try to get via the link:

http://www.hw-group.com/products/HWg-Ares/HWg-Ares_GSM_APN_en.html#top

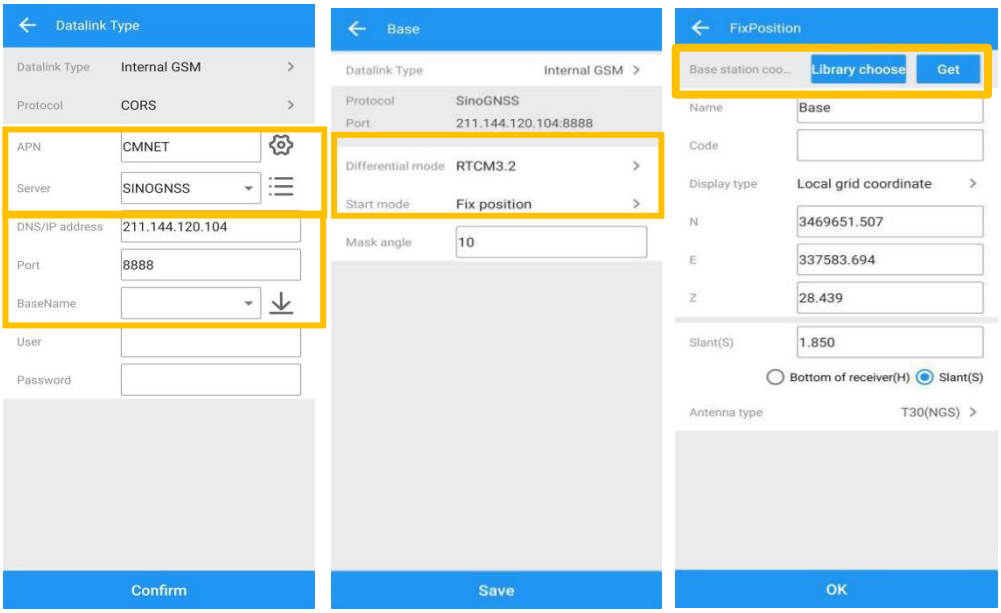
### 5.8.1 Point to Point/Points mode (P to PS mode)

In point to point mode, the correction data is transmitted from the base station to the server, then rovers can log on the server to get the correction data. Therefore, SIM cards are required both in the Base and Rover.

*Tip: ComNav technology provides a free static server address 18.220.121.113:2333, anyone can upload CORS data as long as abide by the agreement.*

Below shows Base configuration with ComNav server:

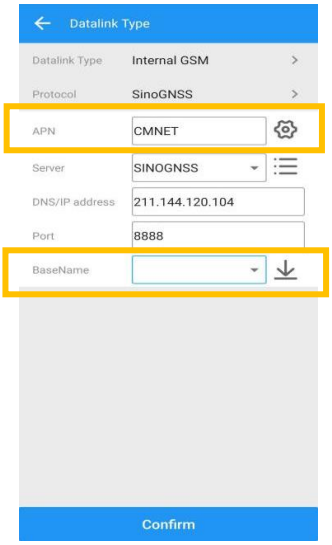
- ***Server***: select SINOGNSS server(***IP:*** *18.220.121.113* ***Port:****2333*)
- ***BaseName***: Click BaseName to get SN of Base receiver directly, when start Rover, just select the name as source
- Differential mode: make sure to choose ***RTCM32***
- Fix Position: Click ***Library choose*** to select a known point for the Base, or ***Get*** from GNSS if you do not have a known point.




After successfully starting the Base station, the differential LED (yellow) flashes once per second, which means the Base is broadcasting correction data;

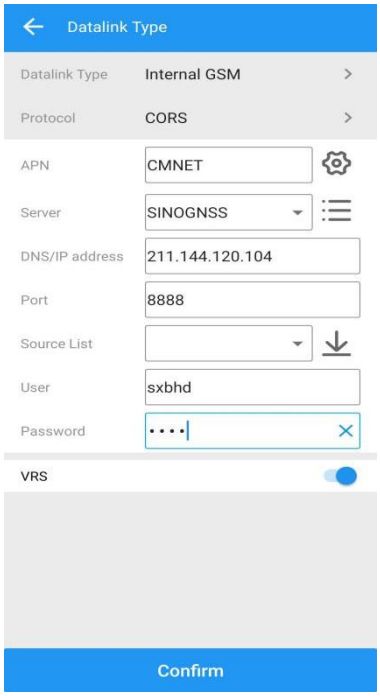
Configure the Rover as below:

- Protocol: Select ***SINOGNSS*** directly;
- BaseName: Enter the SN of the Base receiver.




### 5.8.2 Internal 4G Ntrip client mode

For Ntrip client mode, Rover acquires correction data from Ntrip(CORS) server.




- Enter proper ***APN, DNS/IP Address and Port***.
- Click ***Source List***, select the proper source-> enter User and Password

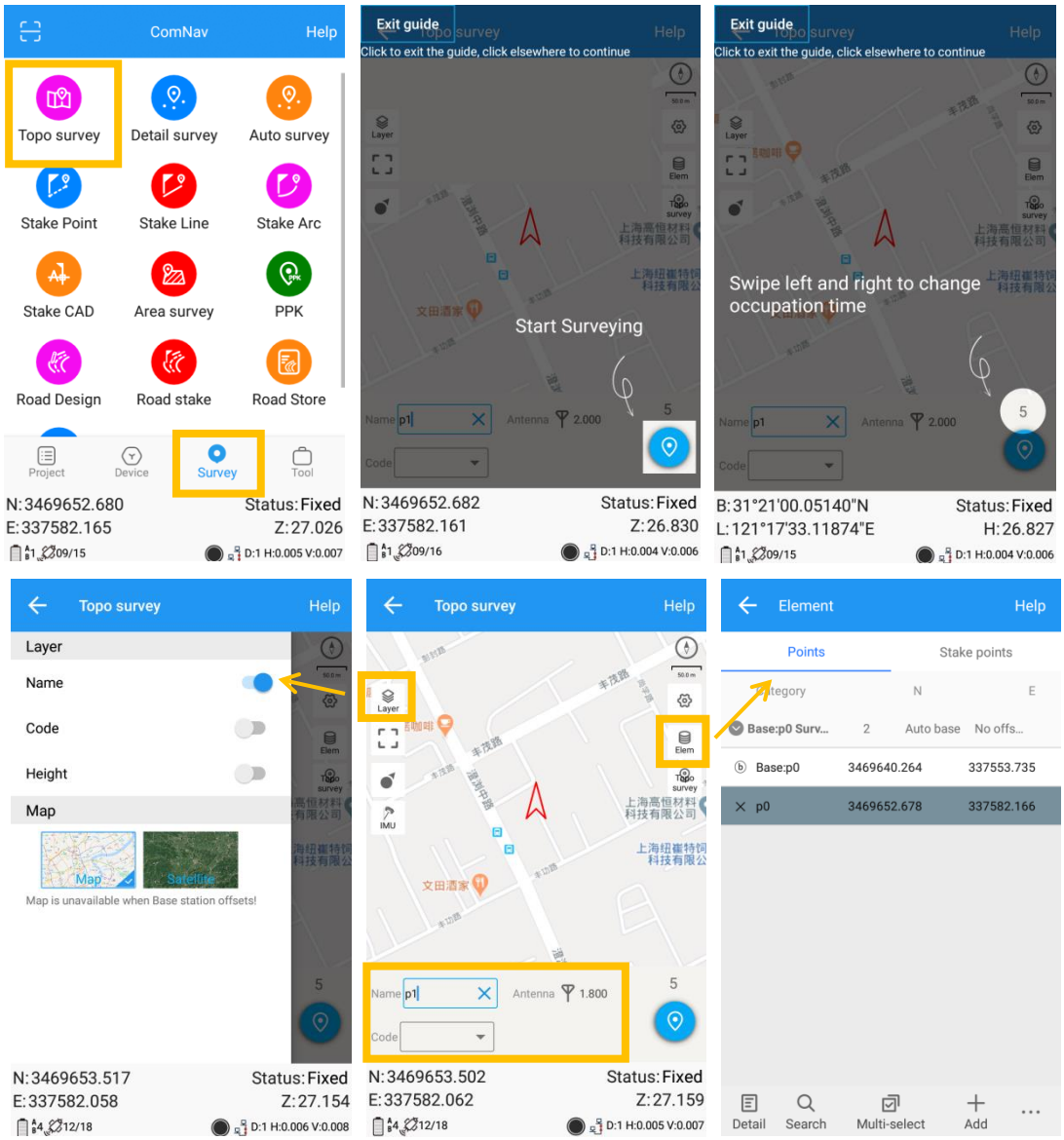
# 6 Basic Survey Functions

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.

## 6.1 Topo survey

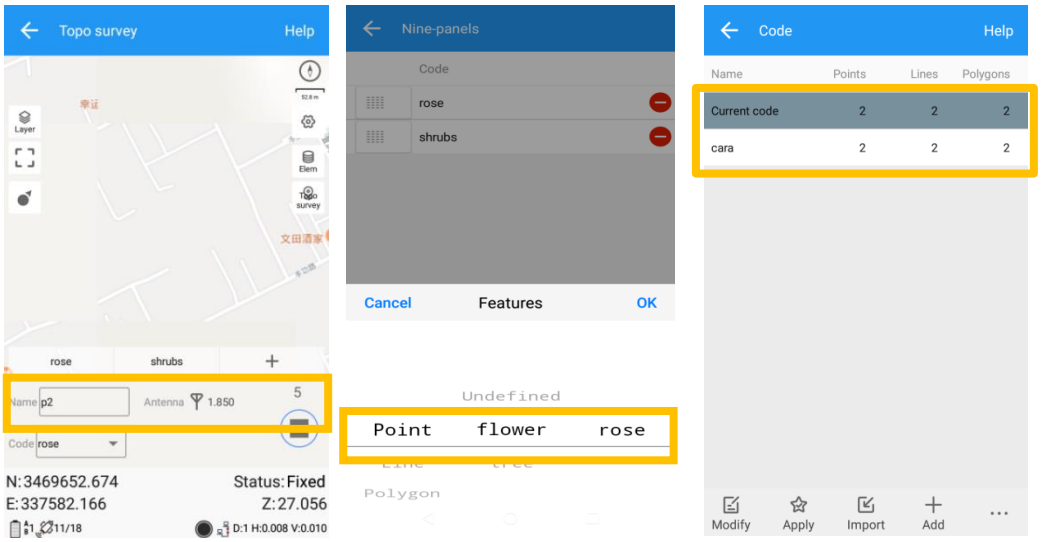
Click Topo Survey-> enter point name, ->click  to start or stop collecting data.

- 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.

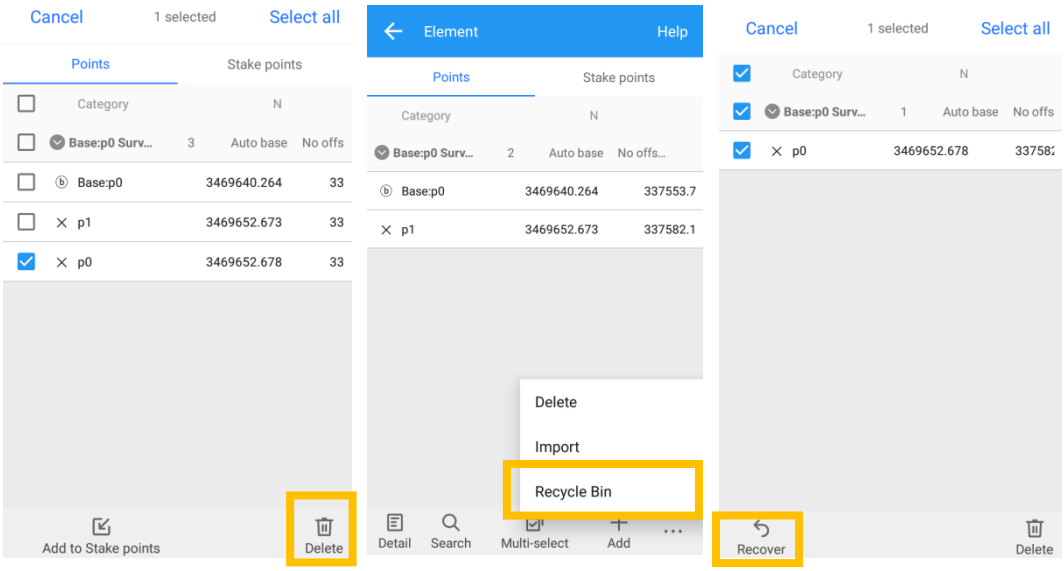


- Fast survey by pressing Code: Tap the code in nine panels, will survey the point directly.

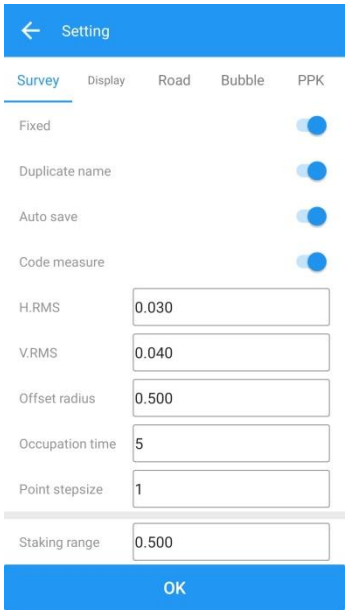
Go into code management interface to modify code list ,then you can choose code to use in nine panels.



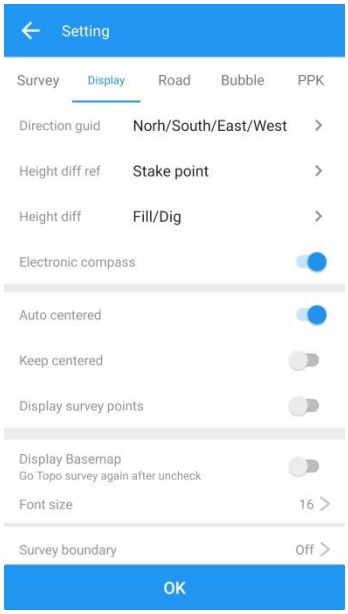

- Recover deleted points in Recycle Bin.



### 6.1.1 Survey settings




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

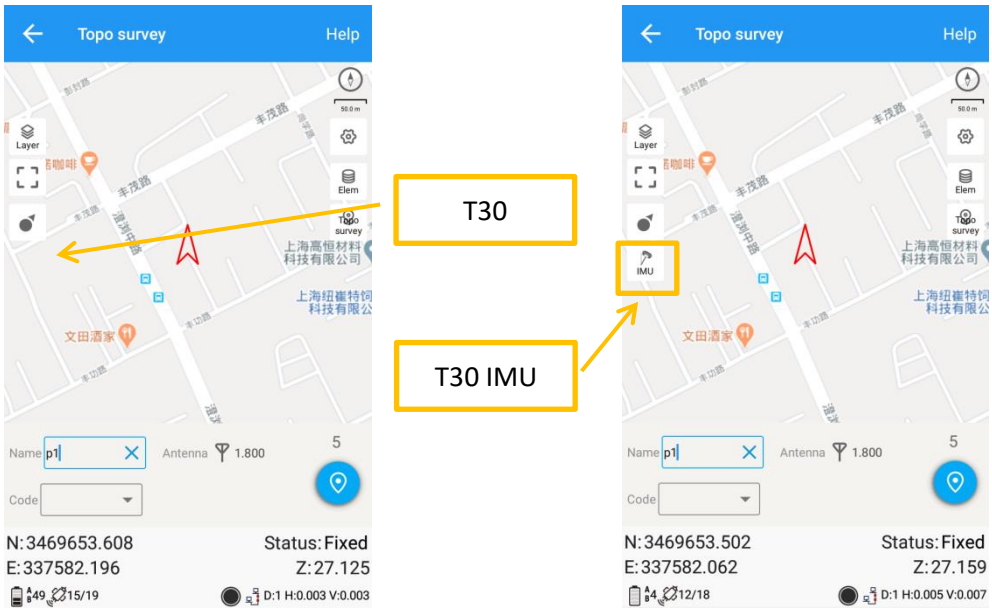



- Direction guide: 3 methods showing guide for stake out;
- Electronic compass: Use controller compass during stake out;
- Auto centered: Map will go to current location after 5 seconds;
- Keep centered: Map will go to current location after 1 second;
- Display survey points: will show all survey points on map;
- Display Basemap: for showing DXF/SHP file on map

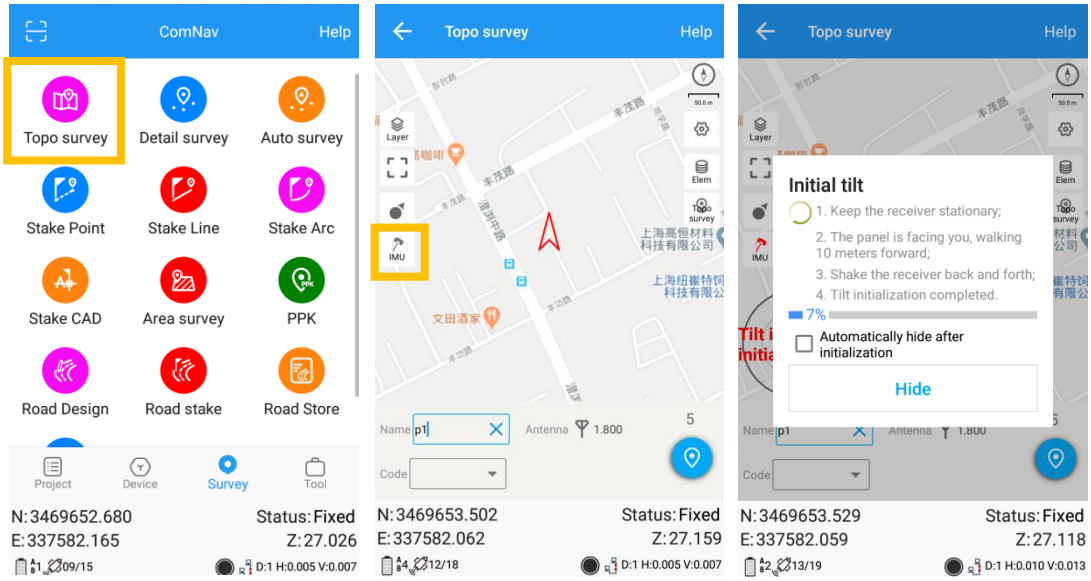
### 6.1.2 Bubble setting for Tilt survey

Bubble option will appear when receiver supports for tilt survey, it is available for ComNav Technology T30 IMU GNSS receiver, use IMU sensor.

According to the IMU sensor, can not only meets the requirement of high precision measurement, but also relieves the users from continually checking whether the pole is plumb. When the pole tilts within 60° , the built-in sensor based IMU precisely calculates the actual offset, which accuracy can up to 2.5 cm

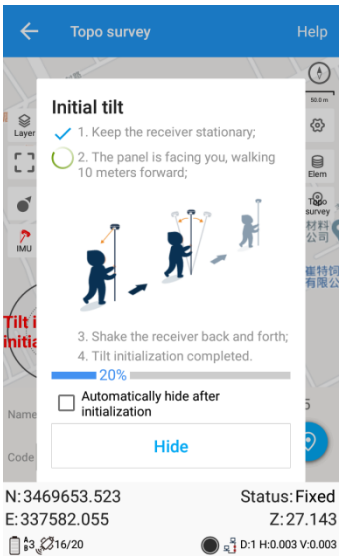


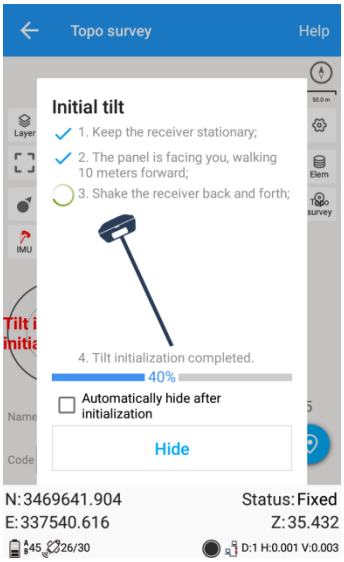

1. Open IMU: Go into Topo survey—click the button to open.

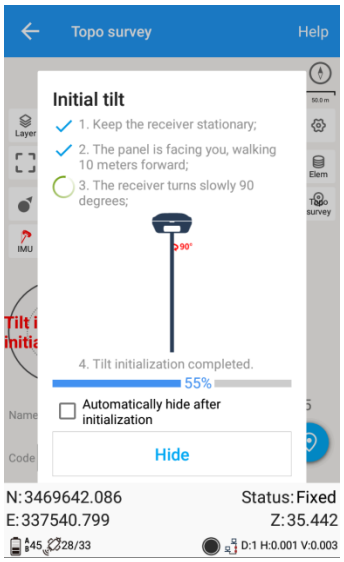



2. Initialization

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.

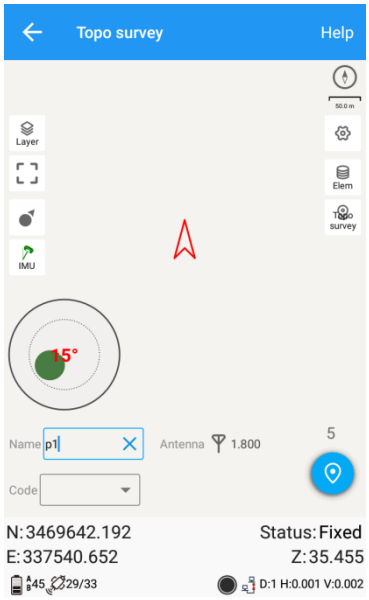



*Walking 10 meters* *shake the receiver* *rotating the receiver*

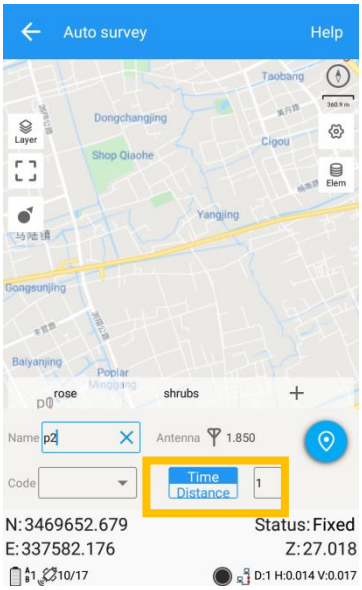
In survey interface, you can find the bubble and angle value shows the pole you tilt. For more accuracy, angle less than 60° will be better.




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

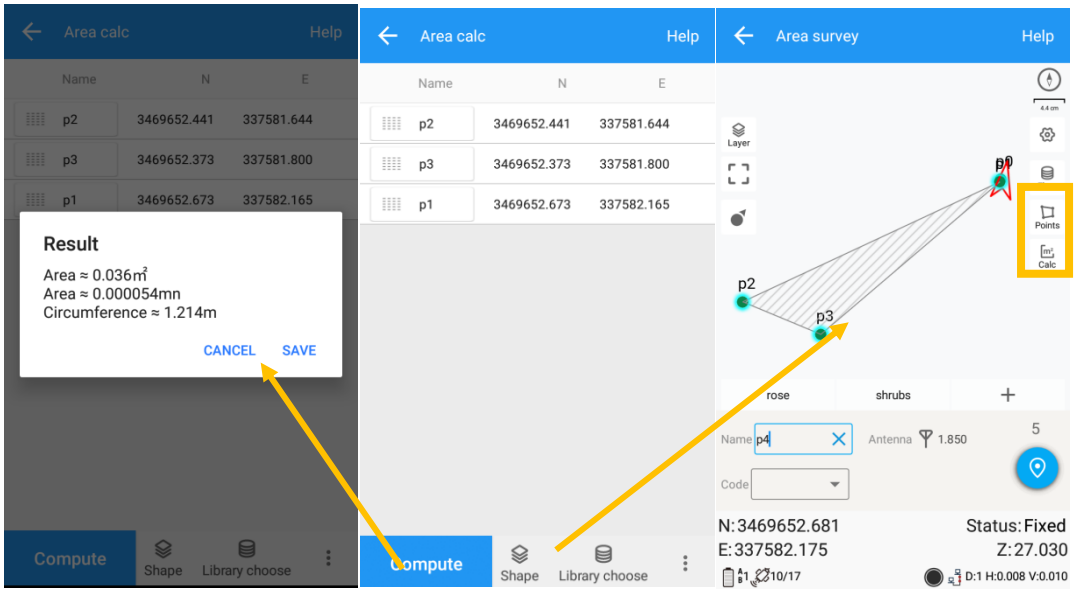
## 6.2 Auto survey/Area survey

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.

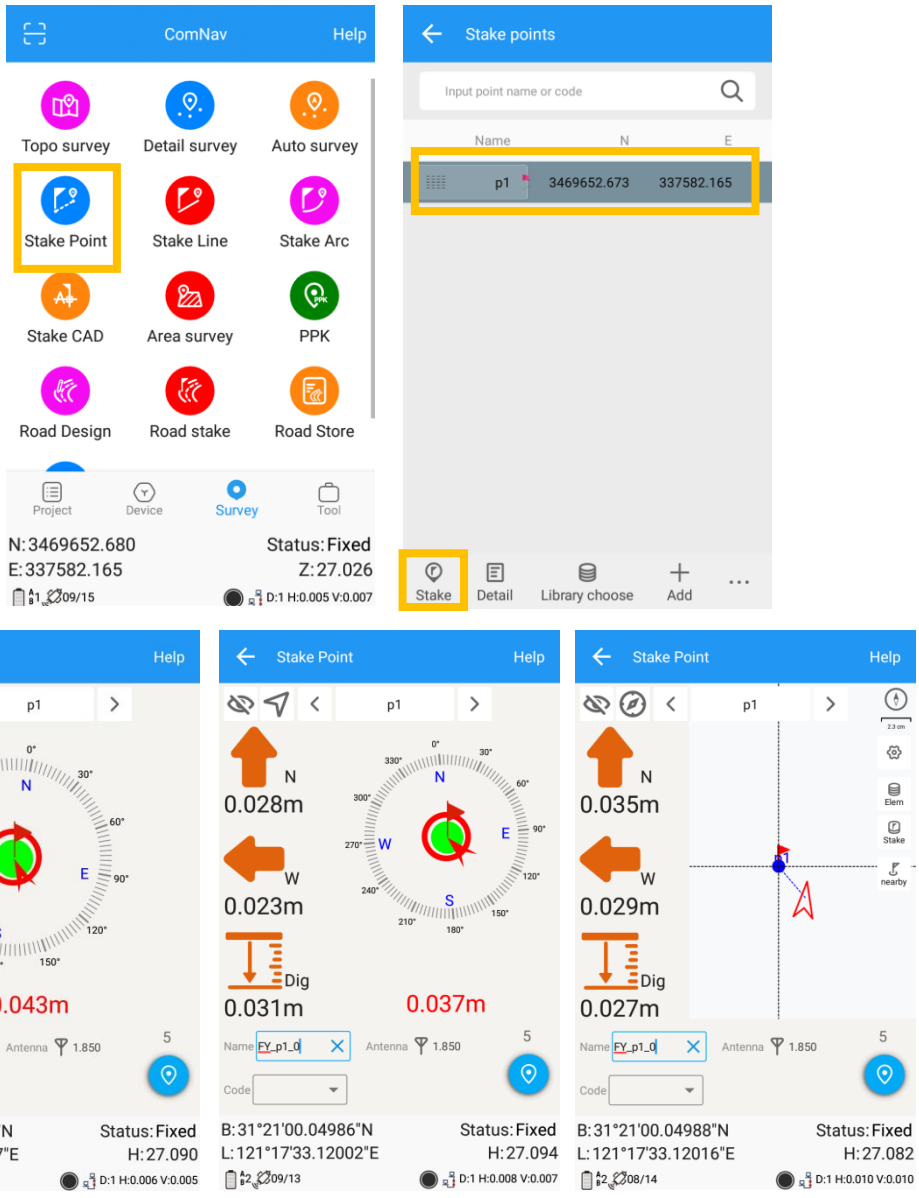
Press Points, it will show the coordinate information, press Calc, it will show the area result, press Shape, it will show the shape on map.




## 6.3 Stake points/lines

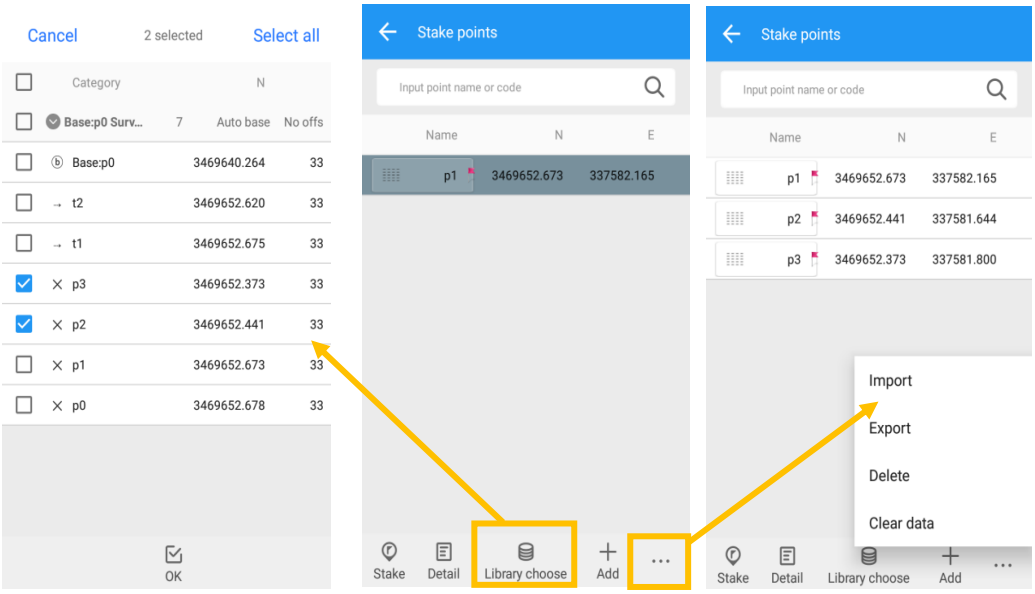
Go into ***Stake point*** interface, click to choose a point and tap ***Stake***. Survey Master provides a navigation map when staking points/lines. If you are close to the target point enough, it will alarm you based on the alarm range you set.

Enter the point name and code based on your requirements, then click 



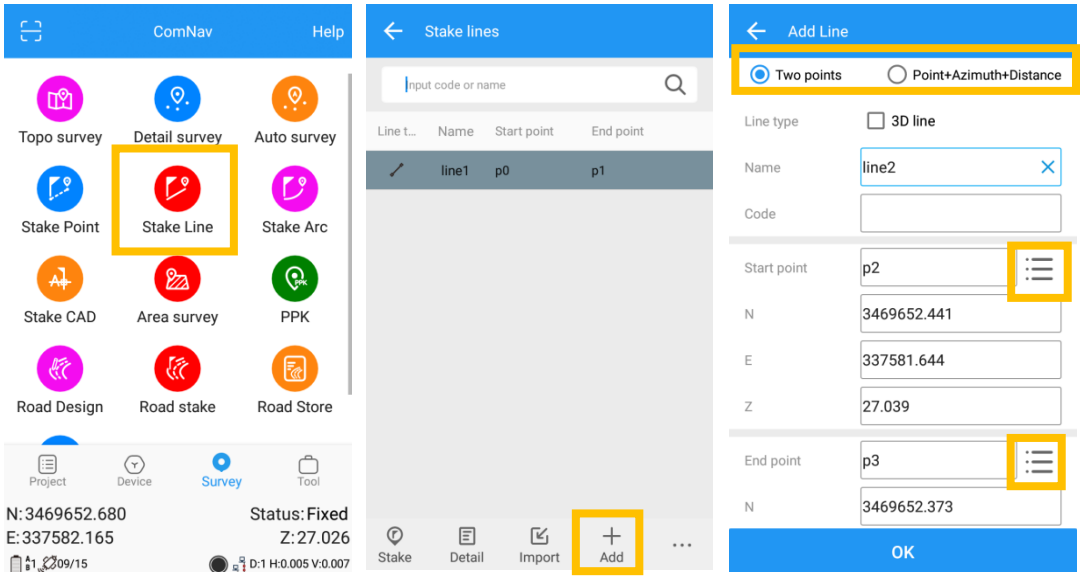

*Various navigation info choices*

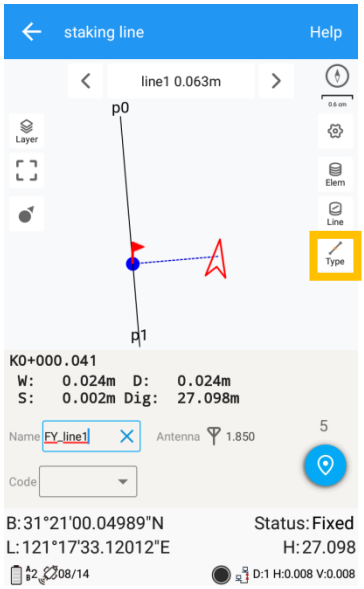
You can also ***Import*** points for staking, or add from ***Library choose.***

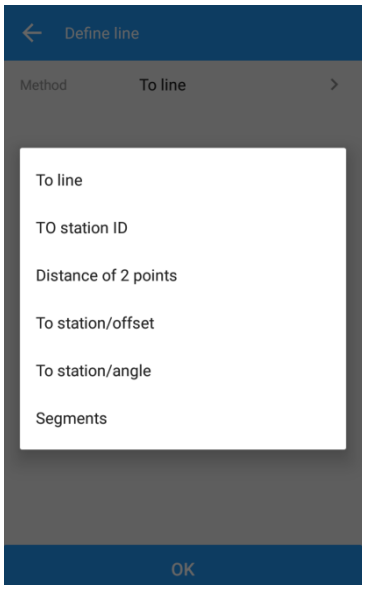



*Tip: keep your receiver vertical to the ground.*

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





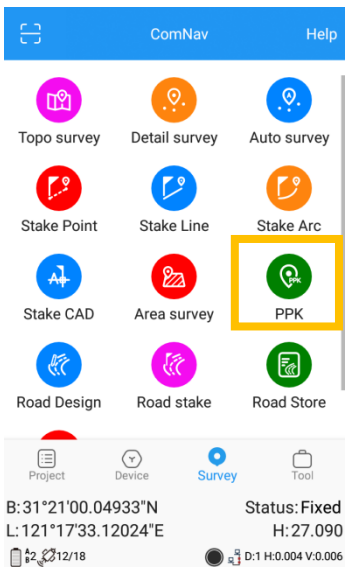

- To line: show shortest way to find a point on line;
- To station ID: stake points on line by defined interval;
- Distance of 2 points: show distance of current location to the line's start point and end point;
- Segment: Stake on line by defined segment value.

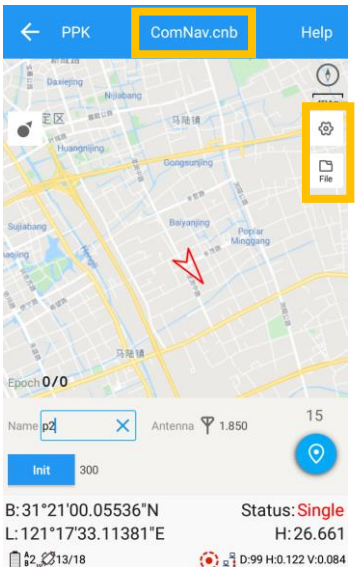
## 6.4 PPK

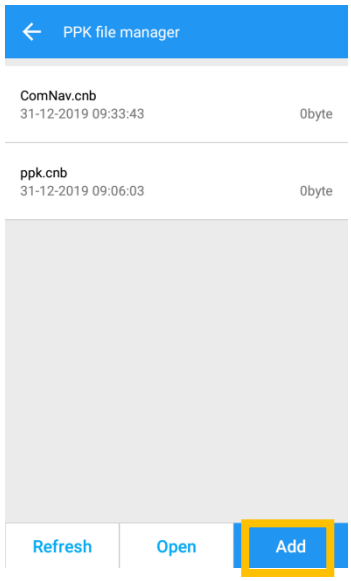
PPK (post processing kinetic) is the unique function of survey master, which is used for post-processing dynamic measurements.

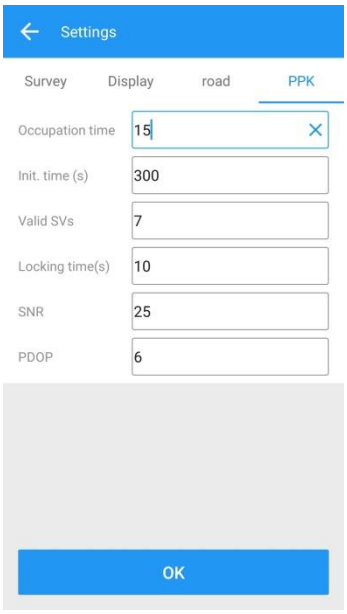
It also needs two receivers to work together, one work as Base to record static data, and another one work as Rover as shown below.

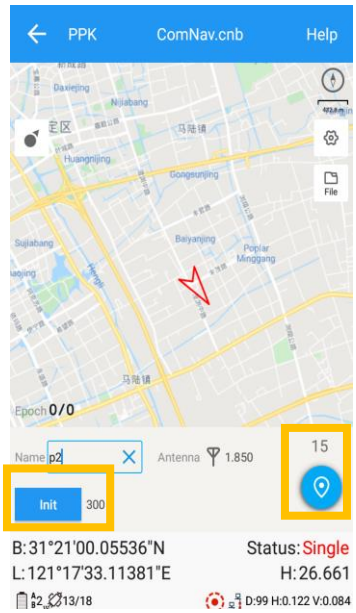
1. Click PPK in survey interface -> choose or create a PPK file.
2. Go to settings, configure PPK settings based on your requirements.
3. To get stable epoch, click Init to initialize -> to start PPK survey.





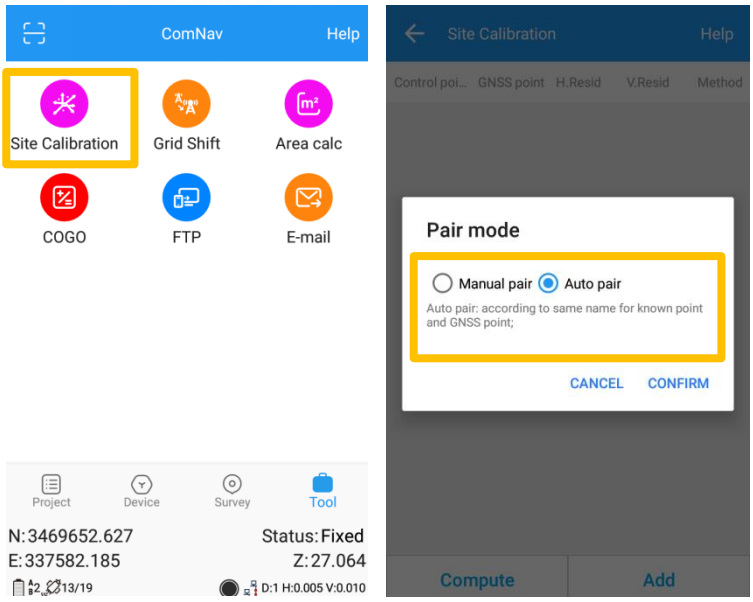




## 6.5 Site calibration/Grid Shift

### 6.5.1 Site calibration

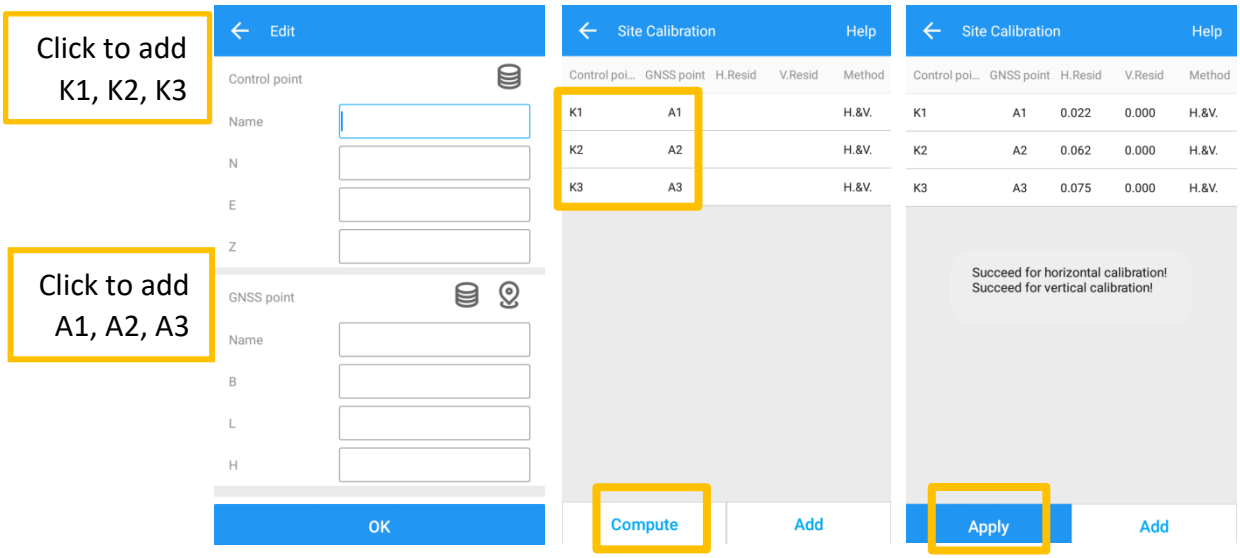
Site calibration is commonly needed once in one project, and all the points will be collected based on calibrated datum system.

1. Choose manual pair or auto pair.

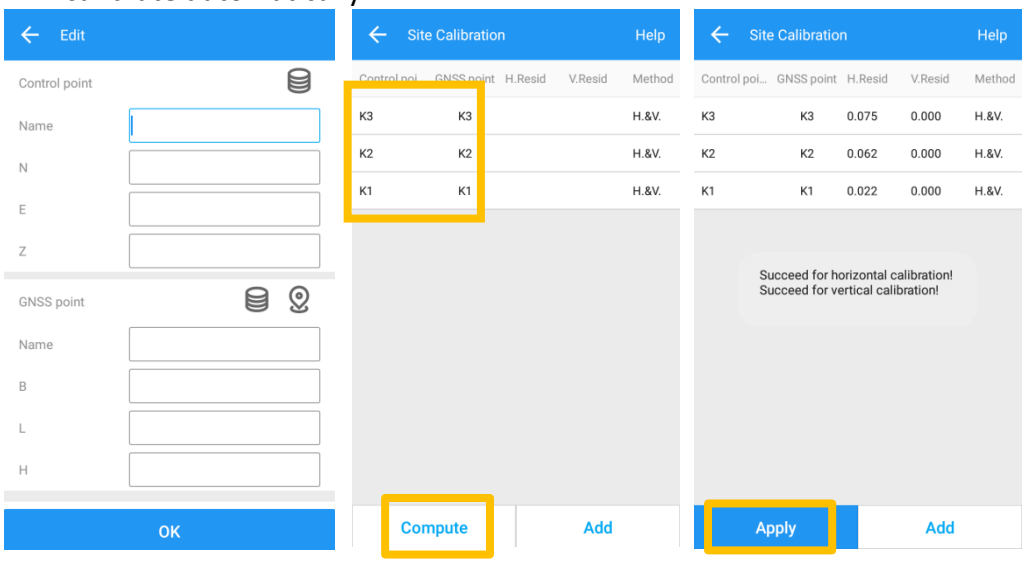



2. If you choose manual pair, you can directly enter at least three groups' point to compute. (for example, take K1,K2,K3 as known points, take A1,A2,A3 as measured points) After click ***Compute*** to calculate, the software will calibrate

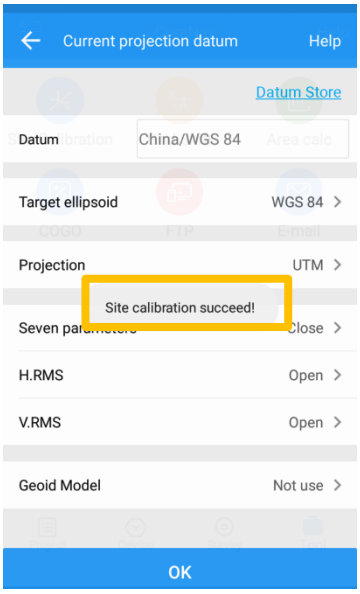
automatically.




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.



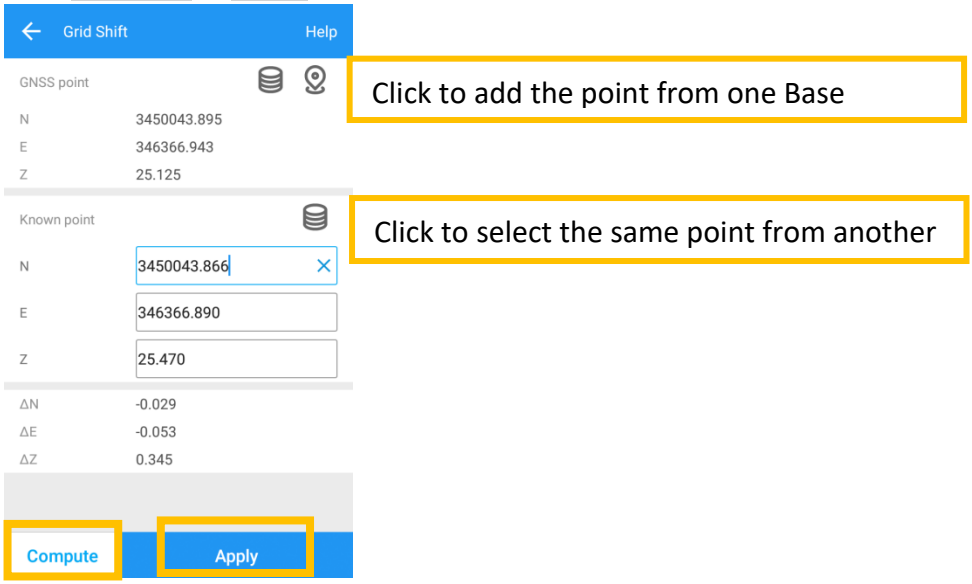

4. Click ***Apply*** to confirm to replace datum. The value of H.Resid and V.Resid should meet the requirement (H.Resid ≤ 0.015m, and V.Resid ≤ 0.02m).




### 6.5.2 Grid Shift

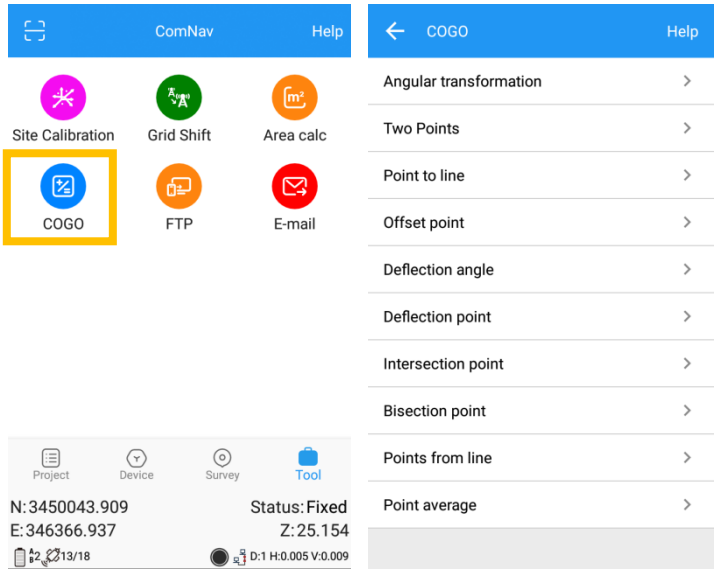
Grid reset function is applied when you need to change the position of Base station in the same project.

Click ***Grid Shift*** in Survey interface -> add current Base point and target Base point -> Click ***Compute*** -> ***Apply*** to complete grid shift.




## 6.6 COGO

With COGO function, 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;
- Deflection point: Calculate point with angle and distance;
- Intersection point: Calculate intersection points from two lines;
- Bisection point: Calculate point from angle bisector;
- Points from line: Calculate points on line by distance or segment;
- Point average: Calculate average from points;

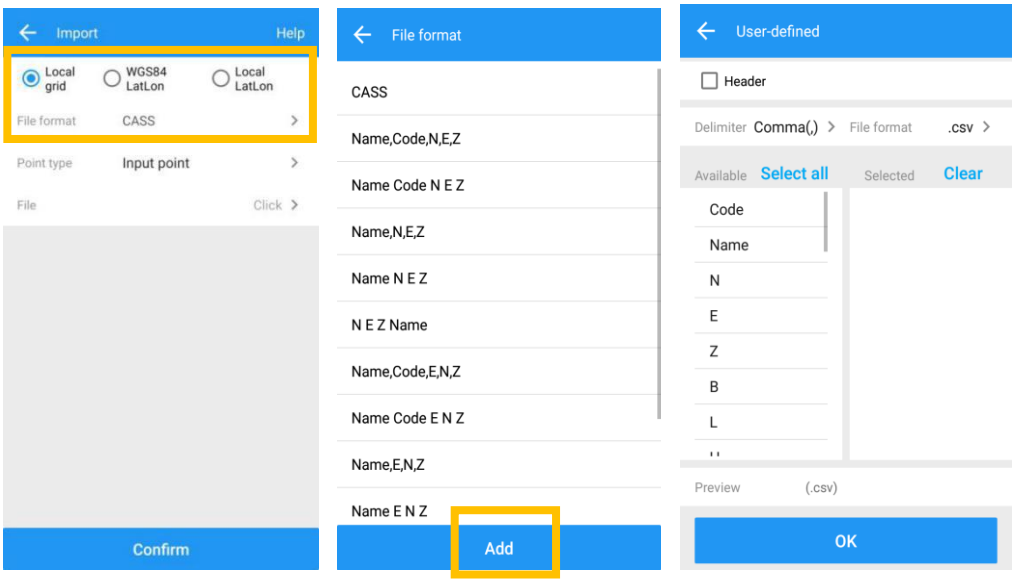
# 7 Data Export/Import

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.

## 7.1 Import

Tap ***Import*** in project interface ->Choose Grid Coordinate/WGS84/Local LanLon -> Click Path to add files.

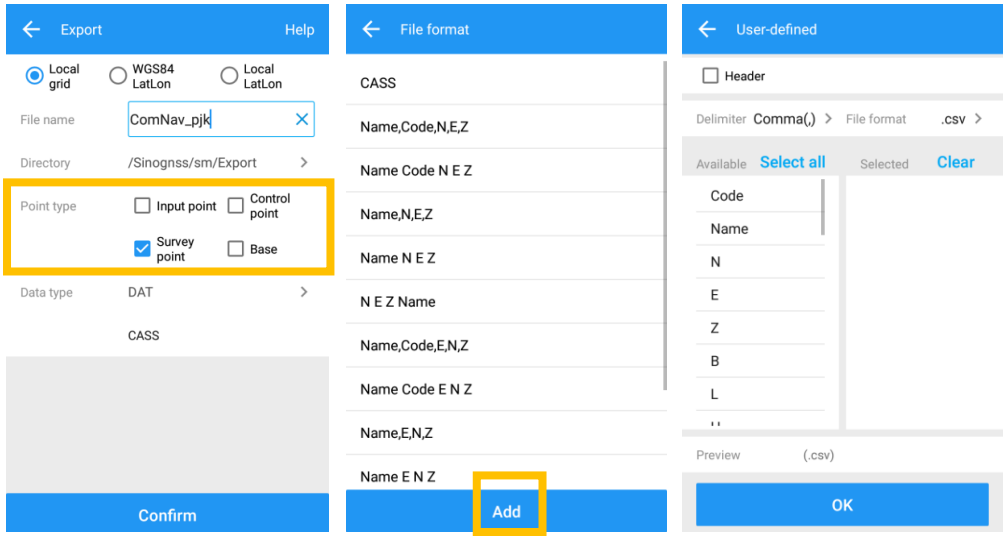
- Data type: you can select a predefined type or click ***Add*** to create a User-defined type.
- File format: support *.csv, *.dat, *.txt format.




## 7.2 Export

Tap ***Export*** to export survey points.

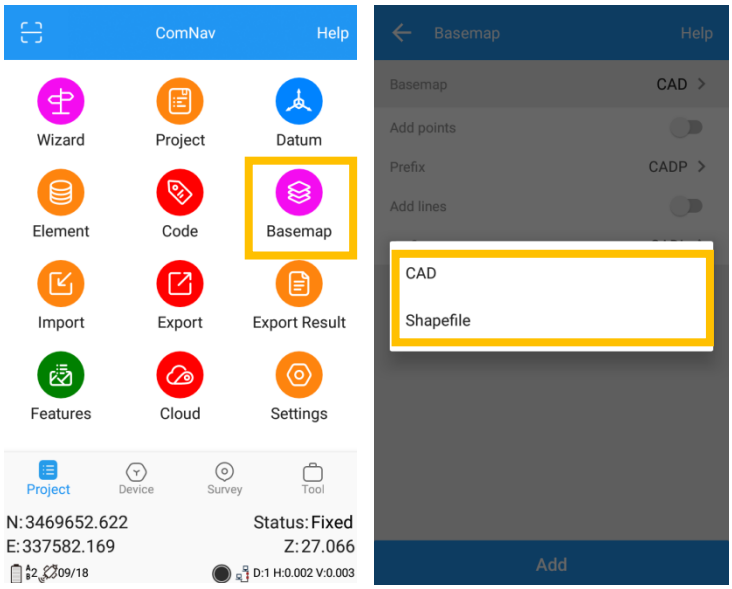
- Data type: you can select a predefined type or click ***Add*** to create a User-defined one.
- File format: support *.csv, *.dat, *.txt format.
- The default export path is …*/Sinognss/sm/data/export*



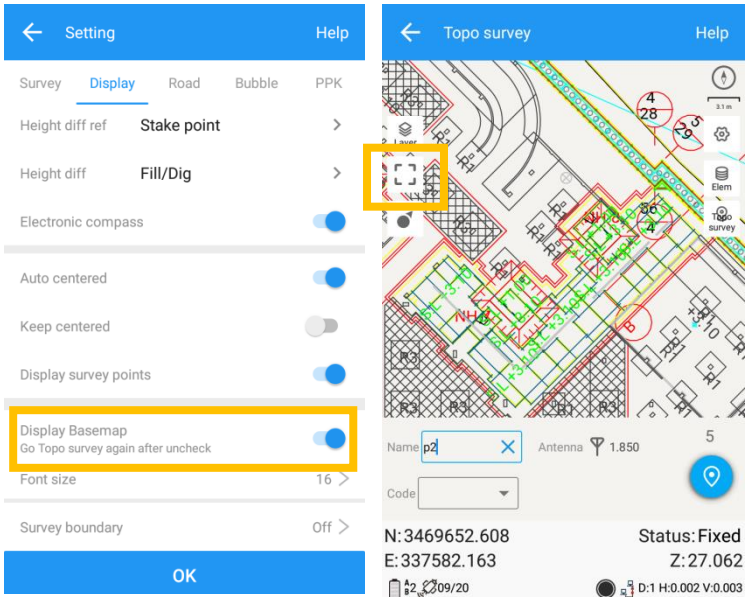

## 7.3 Import Basemap

Tap ***Basemap*** to import DXF/DWG/SHP file into Survey Master.

- Add points: Save points from the dxf/dwg/shp file to element.
- Add lines: Save lines from the dxf/dwg/shp file to element.
- Prefix: Support add prefix name for points/lines saved to Elements.




Remember go survey settings to check on display basemap, click zoom button to auto show basemap.



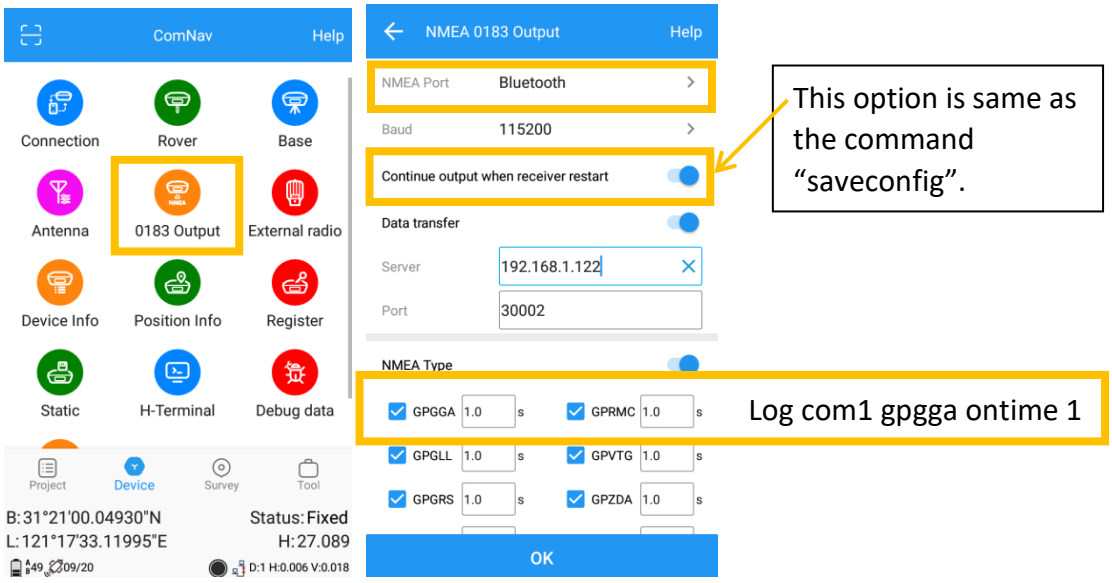

## 7.4 Export Result

Export result including export the survey points with detailed information, stake points/lines, DXF, KML, RAW and HTML result.

## 7.5 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.

## 7.6 Register T30 IMU via Survey Master

Normally, the register code is like this:

*ID:03401012 $$:49-0B-79-23-00-00-00-95-85*

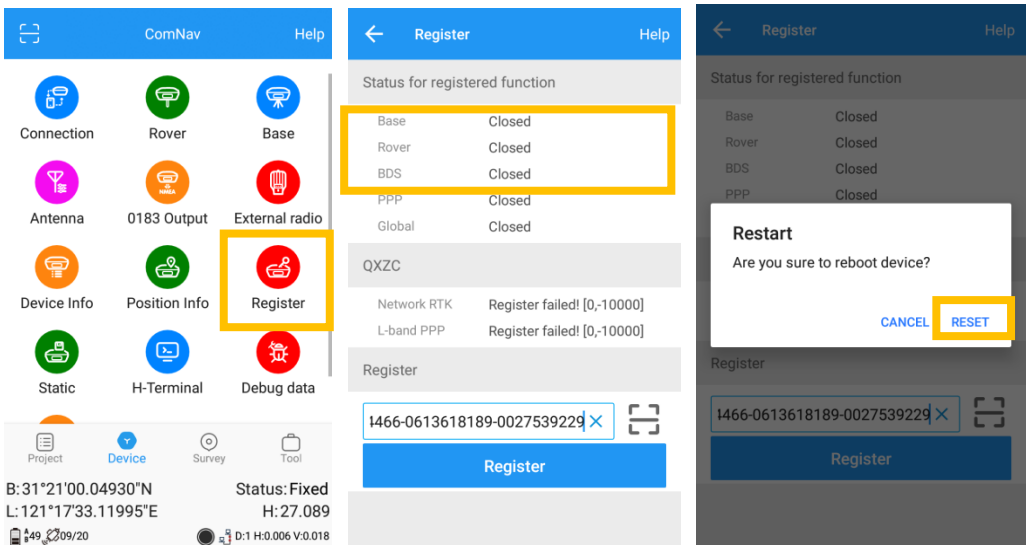
*FUNCTIONREG:2207453726-3851620954-0949162572-0697504466-0613618189-0027539229*

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

Following shows two methods to register the receiver.

- **Register function**

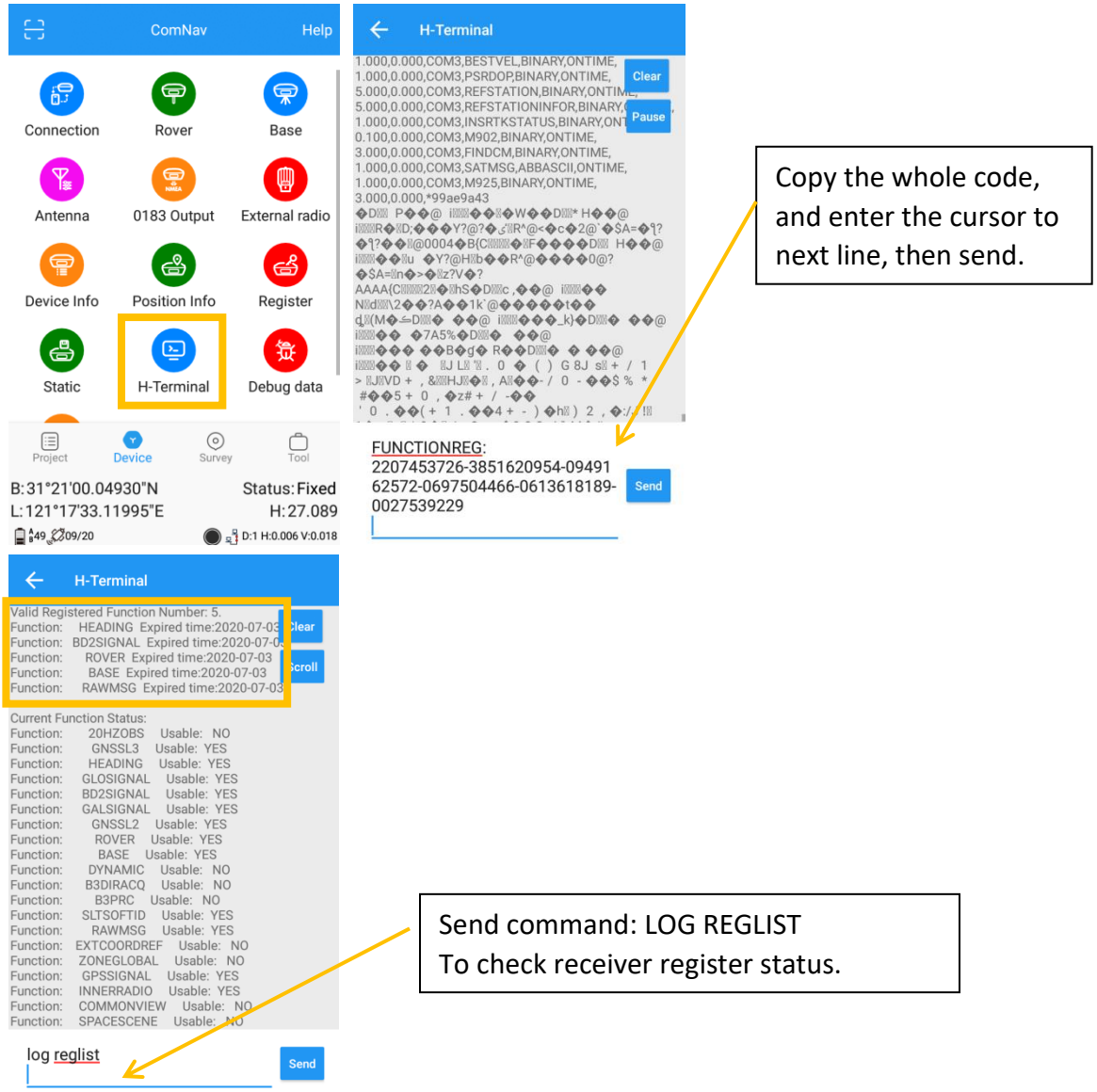
For Register function, you need only enter the number: *2207453726-3851620954-0949162572-0697504466-0613618189-0027539229*



➢ **Register via commands**

You need copy the whole code, include the word 'FUNCTIONREG:'

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

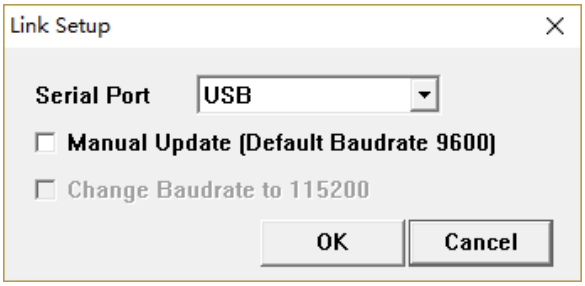



# 8 Firmware Upgrade

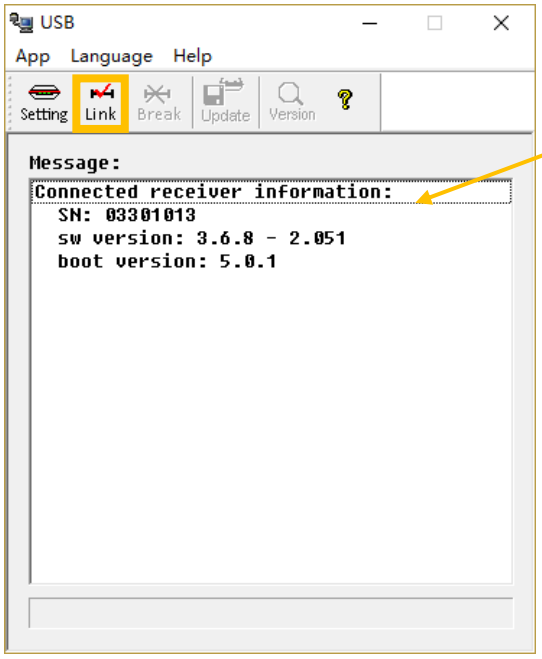
Prepare a Lemo to USB cable.

1. Copy the firmware software to your PC.

2. Open the firmware program, choose "APP->Link setup", select ***USB*** to connect with receiver, and then click "OK".

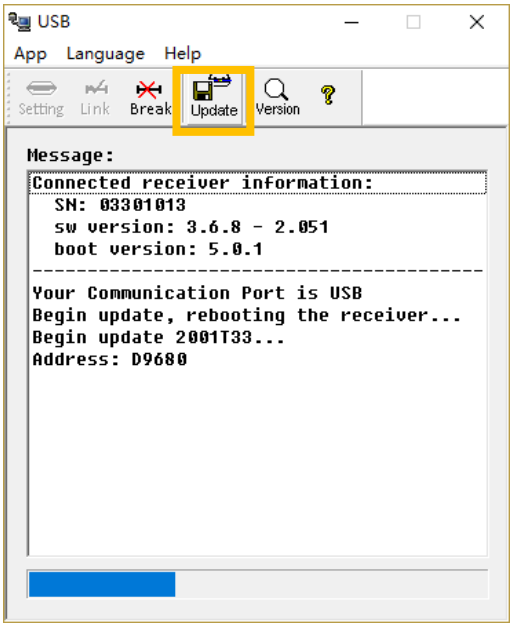



3. Click "***Link***" icon to build the connection(this is important to check if the T30 IMU is connect to PC successful)

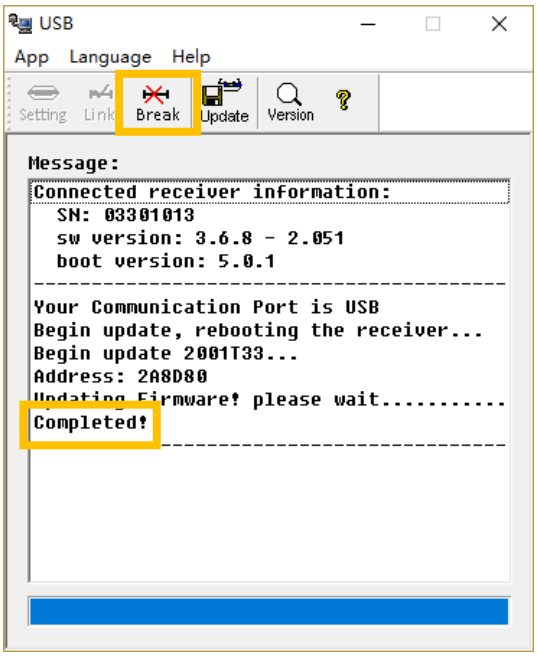



If output this receiver information means it connection correctly

4. Then click"***Update***" icon to start the update (a few seconds are needed), during update, the T30 IMU will restart automatically and all Leds on T30 IMU should be on.



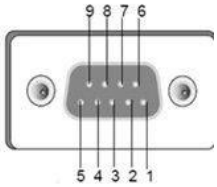
5. When the progress bar is full, and "***Completed!***" appears below, it means the update has been completed and then you can click "***Break***" to finish the update.



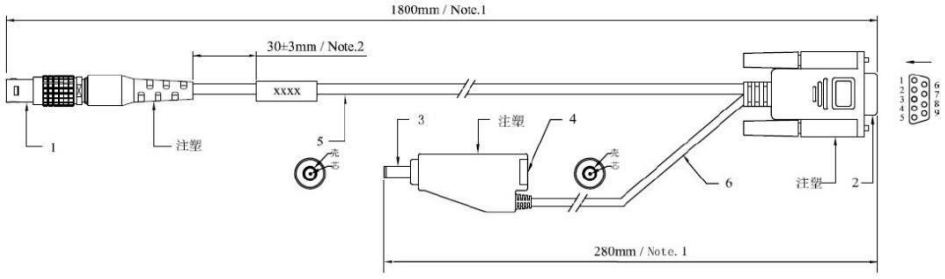

## Appendix A: 7-Pin Lemo definition

The following figures show the definition of 7-pin lemo, and the structure of 7-pin Lemo to RS232 Cable:




| 7 pin Lemo | Description |
|---|---|
| 1 | Signal GND |
| 2 | GND |
| 3 | TX data out (TXD) |
| 4 | NONE |
| 5 | NONE |
| 6 | Power In (+) |
| 7 | Serial data in (RXD) |




# Appendix B: Physical Parameter of Modules inside of T30 IMU

- **Radio:**

| Radio parameter | Specifications |
|---|---|
| Frequency range | 410-470MHz |
| Protocol | Transmit mode: Transparent/TT450S<br>Receiving mode: TT450S, Transparent, MAC |
| Airlink rate | 9600 bps |
| Bandwidth | 12.5kbps |
| Power | 0.5, 1, 2 Watt adjustable |
| Work distance | 1-5km, depends on power supply and environment condition |
| Modulation | GMSK |

- **Bluetooth:**
  - Frequency Range: 2.402Ghz-2.480Ghz
  - RF Power(Max): 4dBm
  - Band Width: 2Mhz