
USER GUIDE

COMNAV T300+CGSURVEY



COMNAV

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FCC Notice

ComNav T300 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 and (2) this device must accept any interference received, including interference that may cause undesired operation.

Where to Find Information

This manual is designed to guide you through the basic T300 procedures and operations.

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1 Introduction

Thank you for choosing ComNav T300 GNSS Receiver.

This manual is designed to help you to rapidly familiarize with T300, and start your project with T300.

1.1 Technical Assistance

If you have any question and cannot find the information you need in the documentation, contact your local Dealer. Alternatively, please request technical support using the ComNav Website at (<http://www.comnavtech.com/>) or T300 receiver technical support email support@comnavtech.com.

1.2 Your Comments

Your feedback about the support documentation will help us to improve the products. Please e-mail your comments to support@comnavtech.com.

1.3 Safety Information

This manual describes ComNav T300 GNSS Receiver. Before you use T300, please make sure that you have read and understood this publication, as well as safety requirements.

1.3.1 Regulations and Safety

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. Bluetooth® operates in license-free bands.

1.3.2 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.

2 General Information

2.1 Overview

The ComNav T300 GNSS Receiver provides the following features:

- Ultra small and super light
 - Size (W × H): 15.8cm × 7.5cm
 - Weight: 0.95kg (including 2 batteries)
- 256 channels with simultaneously tracked satellite signals
- Increased measurement traceability with ComNav's unique QUAN™ algorithm technology
- Many user-friendly conveniences built in
- Hot swap battery design: low power consumption with hot swap battery design, when the warning sounds and LED flashes, put your second battery in place
- Bluetooth wireless technology for cable free
- Simple keypad with on/off buttons and LED indicators for power, radio, Bluetooth, and satellite tracking
- IP67, Absolutely waterproof
- Full base/rover interoperability
- Operates within a VRS™ network for conventional base station-free rover capability
- Integrated receive and transmit radio
- Integrate 3G module, support Ntrip and Point to Point/Points protocol
- Support long baseline E-RTK™, namely Beidou B3 signal used in RTK calculate engine; concern the current situation, this mode can be used in south east Asia

2.2 Technical Specifications

Signal Tracking

- 256 channels with simultaneously tracked satellite signals
 - GPS: L1 C/A, L1/L2 P, L5
 - BeiDou: B1, B2, B3
 - GLONASS: L1/L2

- SBAS: WASS, EGNOS, MASAS, GAGAN

Performance Specifications

- Cold start: < 50s
- Warm start: < 30s
- Initialization time: typically < 10s
- Initialization reliability: typically > 99.9%
- Signal reacquisition: < 2s

Positioning Specifications

- Post Processing Static
 - Horizontal: 2.5mm + 0.5ppm RMS
 - Vertical: 5mm + 0.5ppm RMS
- Real Time Kinematic (RTK)
 - Horizontal: 8mm + 1ppm RMS
 - Vertical: 15mm + 1ppm RMS
- E-RTK(< 100km)
 - Horizontal: 0.2m + 1ppm RMS
 - Vertical: 0.4m + 1ppm RMS
- Code differential GNSS positioning
 - Horizontal: .0.25m + 1ppm RMS
 - Vertical: 0.5mm + 1ppm RMS
- SBAS: Typically < 1m 3D RMS
- Standalone: < 1.5m RMS

Communications

- 1 Serial port(7 Pin Lemo), Baud rates up to 921600 bps
- Radio modem: Tx/RX with full frequency range from 410-470 Mhz
 - Transmit power: 0.5-2W adjustable
 - Range: 1-5km

- GPRS Modem: 3G module
 - 2 Bands GSM | GPRS DEDG 900/1800 MHz
 - 2 Bands UMTS | HSPA 900/2100 MHzSupport GSM, Point to Point/Points and NTRIP
- Position data out rates: 1Hz, 2Hz, 5Hz, 10Hz
- 5 LED Indicating light (indicating Power, Satellite Tracking, Differential Data and Data Recording)
- Bluetooth: V 2.X protocol, compatible with windows 7, Windows Mobile and Android

Data Format

- Data inputs/outputs
 - Correction data I/O: RTCM 2.x, 3.x, CMR (GPS only), CMR+ (GPS only)
- Position data outputs
 - ASCII: NMEA-0183 GSV, RMC, HDT, VHD, GGA, GSA, ZDA, VTG, GST, PJK, PTNL
 - ComNav Binary update to 20Hz

Physical

- Size (W×H): 15.8cm×7.5cm
- Weight: 0.95kg (include 2 batteries)

Environmental

- Operating temperature: -40°C to +65°C
- Storage temperature: -40°C to +85°C
- Humidity: 100% condensation
- Waterproof and dust proof: IP67 protected from temporary immersion to depth of 1 meter, floats
- Shock: survives a 2 meter drop on to concrete

Electrical

- Input Voltage: 5-27 VDC
- Power consumption: 2.85 W(3 constellations)

- Li-ion battery capacity: 2×1500 mAh, up to 8 hours typically
- Memory: 256 MB internal with up to 16GB pluggable memory card

Software (optional)

- ComNav CGSurvey field software
- ComNav Compass Receiver Utility Office software (CRU)
- SurvCE or Field Genius (optional)

2.3 Product Basic Supply

The tables in this section provide an overview of the different items of basic supply. Basic Supply is the standard accessories for each kit. We can also provide customized supply according to your requirement.

2.3.1 ComNav T300 GNSS Receiver Basic Supply Kit

ComNav T300 GNSS Receiver Basic Supply Kit contains two receivers and related accessories. With this kit, you can perform basic radio mode as described in [chapter 5](#).

| Items | Picture |
|------------------------|--|
| 2* Kits T300 Receiver |  |
| 2* Lemo to RS232 Cable |  |
| 2* Lemo to USB Cable |  |

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| | |
|---|--|
| External Power Cable |  |
| 2* Whip Antenna (UHF) |  |
| 1*2M Range Pole with yellow bag |  |
| 4* Lithium Battery |  |
| 2* Battery Charger |  |
| ALL STAR Controller (with battery and TF card inside) |  |
| USB Data Cable of Controller |  |
| Charger |  |

Optional accessories:

| | |
|---|--|
| Double Bubbles Tribrach with High Adapter |  |
|---|--|

| | |
|-----------------------|---|
| 1* 30cm Extension bar |  |
|-----------------------|---|

2.3.2 Datalink Optional Supply Kit

For long distance radio communication, you may need this Datalink Kit.

| Item | Picture |
|--|--|
| External Radio |  |
| Datalink cable from PDL to T300 |  |
| Configuration cable |  |
| Standard Datalink Antenna with 5 Meter Cable |  |
| External Power Cable |  |

2.3.3 Case and Pack

Transport Case and Carry Pack are designed for containing one ComNav T300 GNSS Receiver Basic Supply Kit. The default case is black color see below.



Optional case:

| Item | Picture |
|----------------|--|
| Transport Case |  |
| Carry Pack |  |

3 Products View



3.1 Parts of Receiver

All buttons and LEDs are located on the front panel. Serial port and connectors are located on the bottom of the unit.

❖ Front Panel

The Power button function is power on and power off the receiver.
The Function button is to enable or disable the raw data recording.

The indicator LEDs show the status of data logging/downloading, power, satellite tracking, Bluetooth, and radio transmit/receive.

❖ Lower Housing

The lower housing contains a communication/power supply port, radio antenna connector, two batteries and a fixing screw in the center.

3.2 Batteries

The receiver is equipped with two rechargeable Lithium-ion batteries, which can be removed for charging. The internal batteries typically provide about 8 hours of power for a rover operation. About 3.5 hours if it is operated as a base station using the internal 460-470 MHz Tx (transmit at 1-2 watt) radio. These times vary according to different operations and conditions.

In RTK mode, if the base station uses internal UHF to transmit correction data, which will enable the power consumption a lot, we strongly suggest to use external power supply for base station receiver. Refer to [chapter 3.4.2](#) for details about external

power supply.

❖ **Battery Safety**

Charge and use the battery only in strict accordance with the instructions provided.

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.

To prevent injury or damage:

- 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**

The rechargeable Lithium-ion battery is supplied partially charged. Charge the battery completely before using it for the first time. Charging 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.

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.

❖ **Battery Charger**

The charger has two slots and can charge two Lithium-ion batteries simultaneously, beside each slot there is a LED indicator to display the charging status. Refer to the table below for detailed information.

| Indicator status | Battery status |
|-------------------------|-----------------------|
| Blue | No battery in |
| Red | Charging |
| Blue | Fully charged |

❖ **Storing of the Lithium-ion Battery**

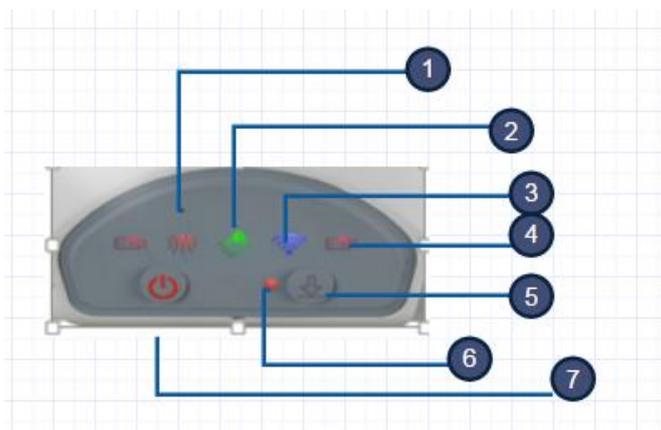
Do not keep batteries inside the receiver if the receiver not used for long time, take out the batteries from receiver for shipment.

❖ **Dispose of the 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.

3.3 Button and LED Operations

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. On the front panel, the LEDs stand for power, radio, satellite, Bluetooth, Data logging/downloading respectively. The following items define each possible LED state:



| Functions | States | Prompts |
|--------------------------|---|---|
| ① Differential LED | Flashing once per 1 second. | Receiving/transmitting differential data. |
| ② Satellite LED | Extinguishing ; Or flashing once per 5 seconds. | Searching satellites. |
| | Flashing N times per 5 seconds. | Received N satellites. |
| ③ Internal 3G LED | Flashing in blue color | Blue color flash mean GPRS is working |
| ④ Battery LED | Long bright. | Enough power. |
| | Flashing. | Low battery, please charge. |
| ⑤ Record button | Long press the key , Switching to static/RTK mode. | |
| ⑥ Raw Data record button | Flash X/seconds, x mean the sampling | |
| ⑦ power button | Long press the key, Turning on/off the T300 receiver. | |

❖ Differential LED(yellow color):

As a Base station: the differential LED flashes once per second when transmit differential data.

As a Rover station: the differential LED flashes when getting differential data from Base station or Network.

❖ Satellite LED(green color):

It will flash several times every 5 seconds, which means how many satellites locked by the receiver.

❖ Network LED(blue color):

The LED indicator flashes when internal GPRS module log on internet.

❖ Battery LED:

Those two LED shows T300 GNSS receiver is on or off and which battery is used. All the two battery LEDs will be on if you use the external power supply and only one is on if you use the internal batteries. The buzzer will alarm if the power is going to be run out.

❖ Switch button:

Switch to static mode: Log press until hear the beep from receiver, and release.

Shut down the datalink: press this button 2 times in short time continuously, then the Differential LED will on.

❖ Data logging:

The data logging button only flashes under the following situations:

A. In the static mode

The interval of flashing shows the sample interval of collecting data.

B. Internal memory is run out

When the internal memory of the receiver is run out, the data logging LED and differential LED both flash 1/s simultaneously.

❖ Power button:

To turn on the receiver, press the button for about 1 second, all the five LEDs above light up simultaneously and remain lit for 3 seconds.

To turn off the receiver, long press the power button until all the LEDs off.

The states of the LEDs under different conditions are listed in the table below:

3.4 Power Supply

We have two methods for T300 power supply: internal power supply and external power supply. They will be introduced in this section.

❖ Internal Power Supply

Two rechargeable Lithium-ion batteries are supplied with the receiver. The T300 receiver adopts the hot swap battery design which can effectively reduce the power

consumption and make the whole system work more efficiently.

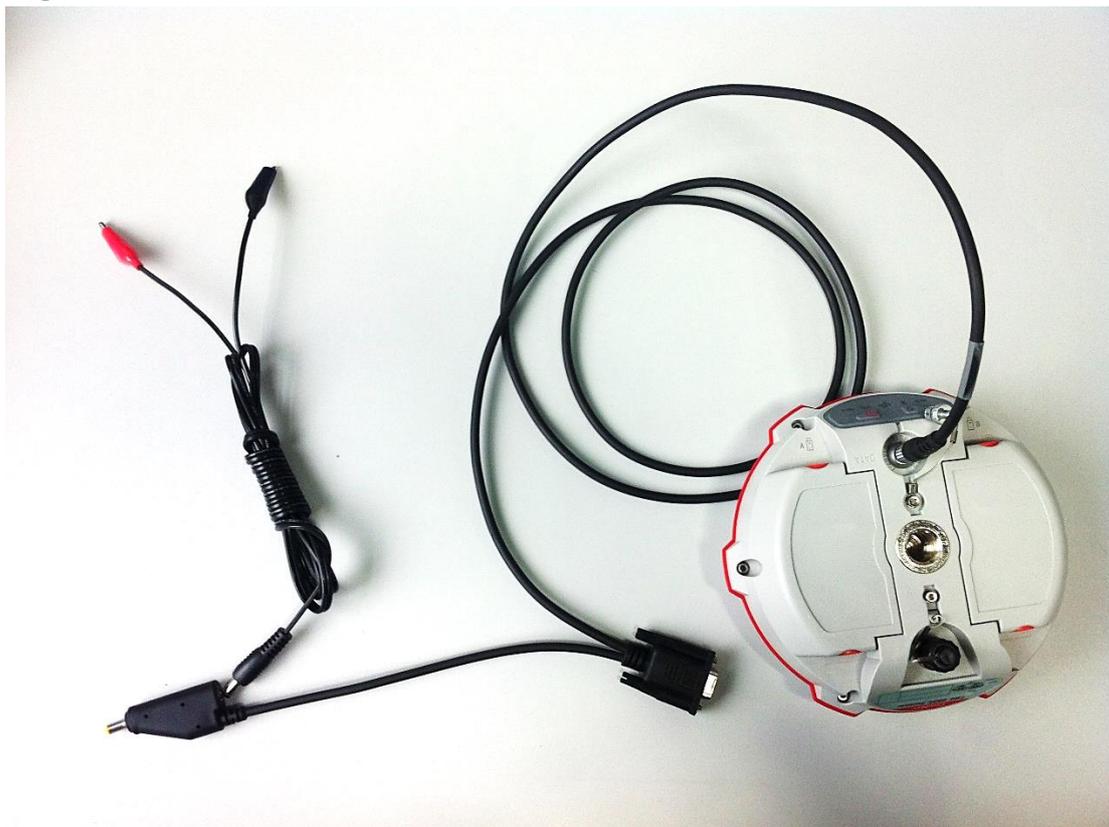
If you put one battery in T300, the corresponding battery LED will light; if you put two, receiver will use battery A first and the left battery LED will light; if battery A is run out, right battery LED for battery B will light.

When the warning sounds and LEDs flash, put another battery in the empty battery container or replace the battery whose light is off.

❖ External Power Supply

The base station uses internal UHF to transmit correction data, which will increase the power consumption a lot, therefore, ComNav strongly suggest you to use external power supply (7-28 volt DC) for base station receiver.

You can connect the receiver to an external power source through 7-pin Lemo port in the bottom of the receiver. As shown in the snapshot below, use Lemo to RS232 cable to connect with T300 and external power cable. Connect the red alligator clips of external power cable to the positive of external battery and the black one to negative.



Tips: Please use 7-28V external battery with high quality. T300 have the protection mechanism of reversed battery connection, but it cannot work if you reverse connection.

4 Static Mode

This chapter describes how to use T300 for static survey. According to the workflow of static survey, we will explain the operation in the following 5 sections--receiver configuration, default setting, static data download, convert data to Rinex format and receiver memory management.

4.1 Static Mode Configuration

Use CRU (Compass receiver utility) software to configure T300. You can download the software from the below link:

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

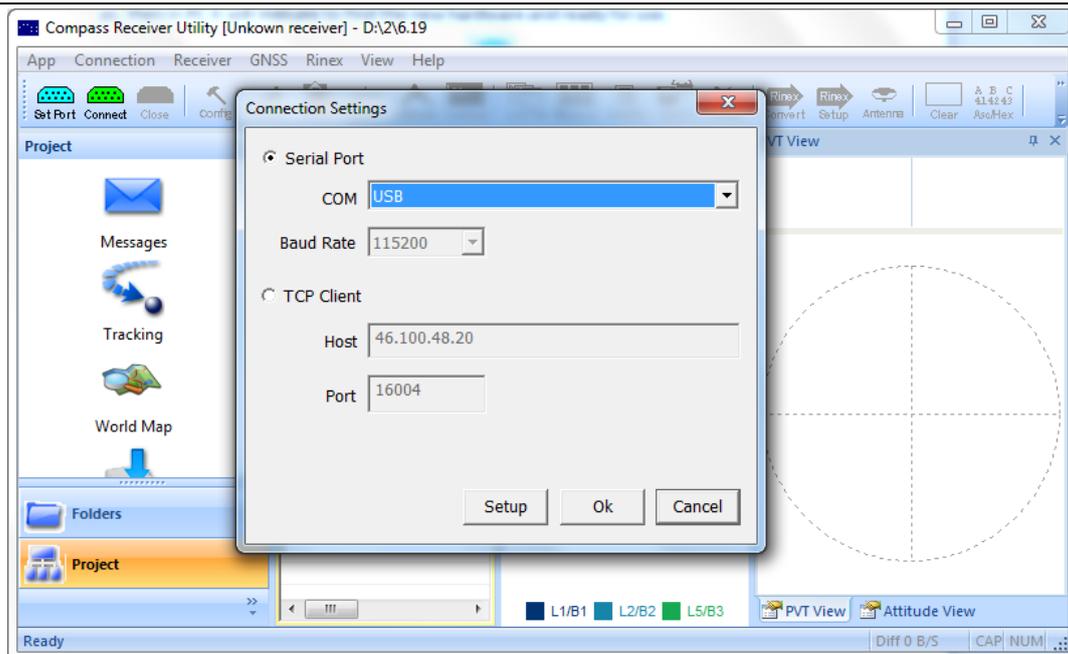
After download and install software (install the USB drive), please follow the step to configure T300.

Tips: *There are two kinds of cable can be used for static configuration, 7Pin Lemo to USB or 7 pin Lemo to RS232. Here we suggest use 7 pin Lemo to USB cable, it is more convenient.*

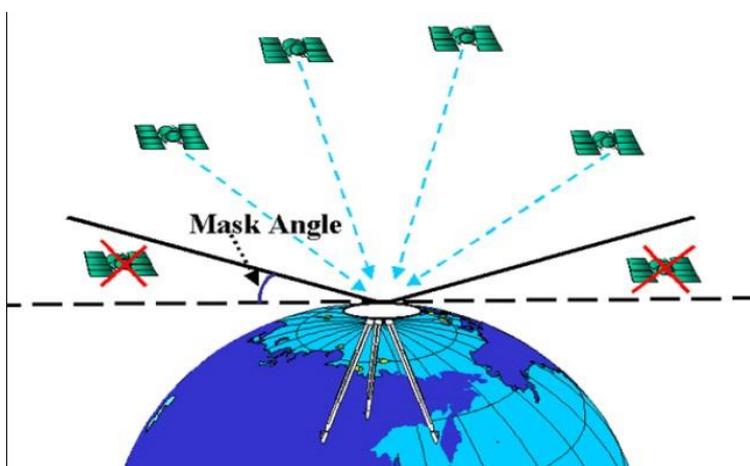
- Power on receiver, press the function panel twice shortly, and then the yellow LED will light on, it means the receiver in configuration mode.
- Use the 7 pin LEMO (link with T300 LEMO) to USB (link with PC) cable to build connection from receiver to pc, then in PC it will indicate to find the new hardware and ready for use.

Tips: *If failed when using Lemo to USB cable connect to PC, press the function button twice in short time, then the yellow LED will on(shut down the datalink and Bluetooth both), try to connection with PC again.*

- Run the software CRU and click icon  , in the Serial port Com option, you will find the USB option, and then click OK to make the receiver connect with your computer. If the connection is successful, you will see the SN No. of receiver in the left top icon of CRU software.



- Click icon  to configure:
 1. Sample interval: You can choose sample interval of observations. As the standard static survey use the default value 15 seconds. The maximum data rate is 20Hz, the minimum is one observation per minute.
 2. Mask angle: Mask angle means if you set the mask angle to N degree, the receiver doesn't track the satellite whose elevation angle is below N degree, just as shown in the figure below. Using CRU, you can directly input angle values such as 10 degree for different constellations. In this way, low elevation satellites, which may cause serious multipath or have low SNR, can be rejected.



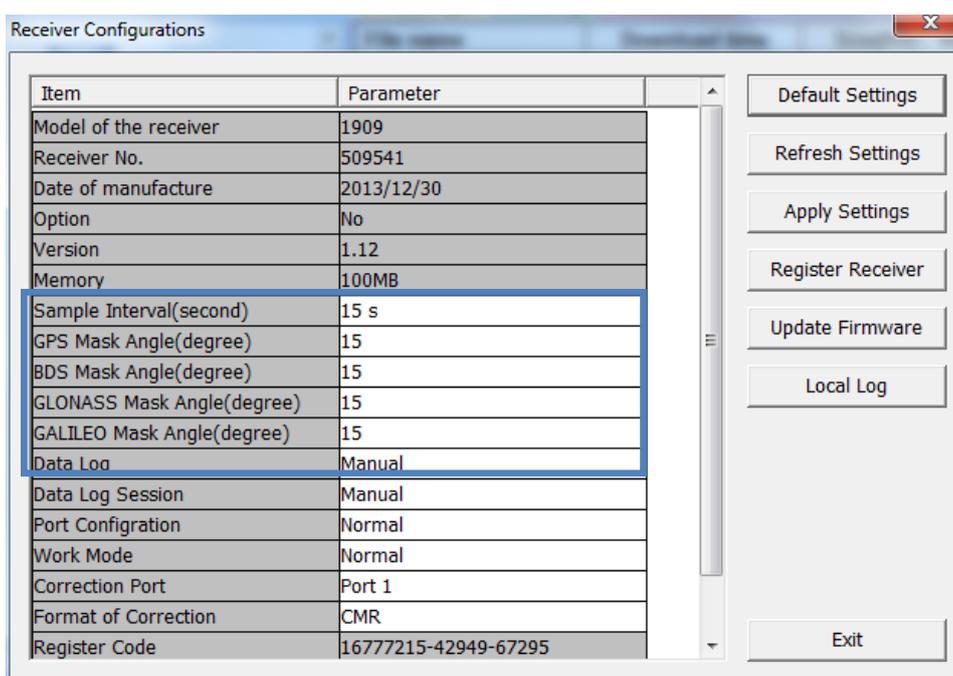
3. Data Log: You can choose logging data manually or automatically in this setting.

Manual mode: data is recorded or stopped by hand; hold on the record button until the radio LED off, the Record Led flashing shows the sample interval of collecting data.

Auto mode: record data continuously as long as satellites received.

Tips: if use T300 only for static survey, please set data log as auto, this will save your time in field work.

4. Data Log Session: If you set the Data Log Session to Auto, the receiver will keep recording data in one file until it is turned off or its memory is run out. If set to 1 hour, the data recorded will be saved in one file per 1 hour, it is the same for 2 hours, 3 hours, and 4 hours etc.



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

4.2 Default Receiver Settings

| Settings | Factory default |
|--------------------------|-----------------|
| Sample Interval (second) | 15 |
| GPS Mask Angle (degree) | 15 |

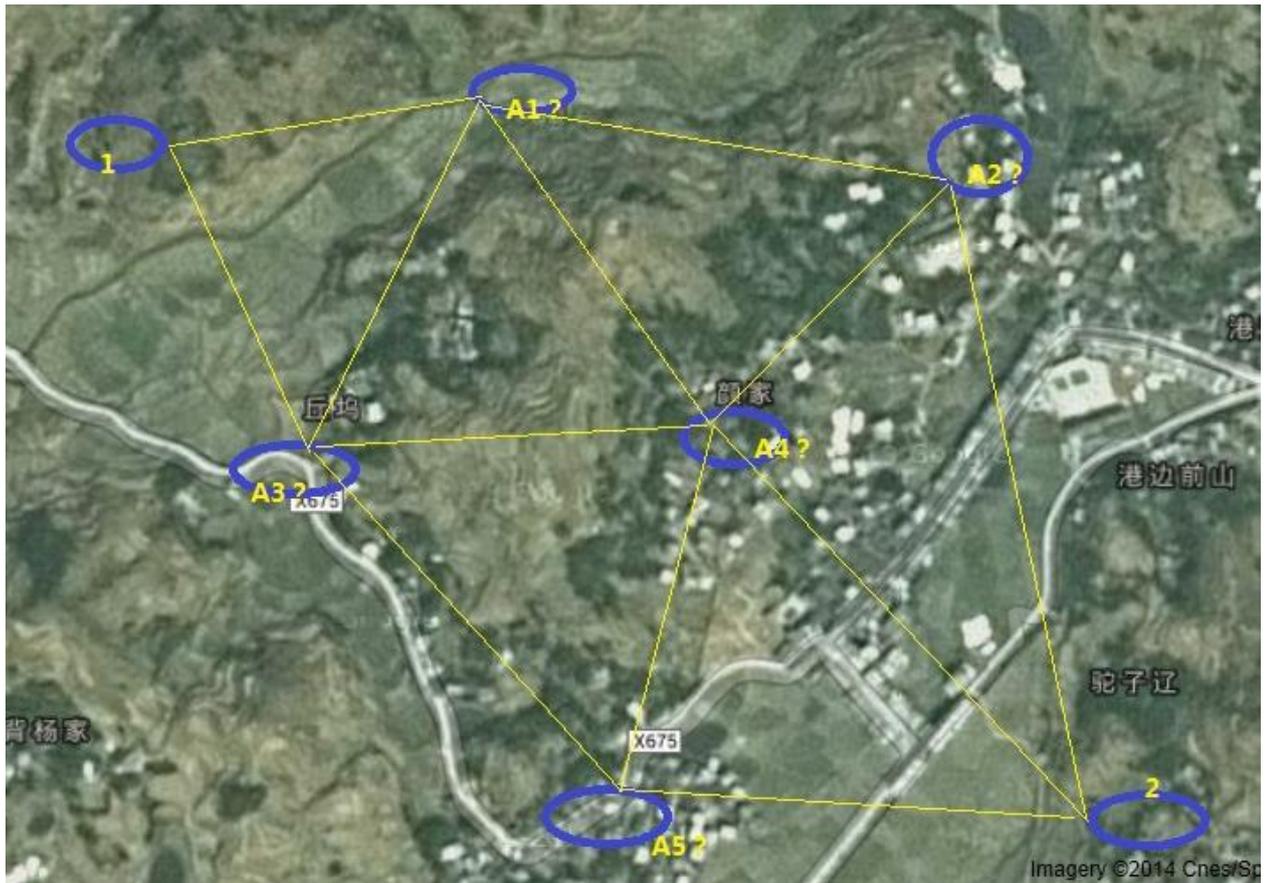
| | |
|-----------------------------|---------------|
| BDS Mask Angle (degree) | 15 |
| GLONASS Mask Angle (degree) | 15 |
| GALILEO Mask Angle (degree) | 15 |
| Data Log | Manual |
| Data Log Session | Manual |
| Port Configuration | Normal |
| Work Mode | Normal |
| Correction Port | Port1 |
| Format of Correction | CMR(not used) |

You can get these default receiver settings by clicking the button **Default Settings**.

4.3 Field Static Data Collection

Static survey is mainly used for control point survey. As control points, millimeter accuracy is required. The standard and requirement of static survey is different from countries to countries, we suggest doing in the following way:

- At least 3 GNSS receivers are needed, because 3 receivers can construct the triangular and stable net.
- Make plan and go to the project to make the point mark on the ground.
- For example, 1&2 points are the primary control points, they are the known points, we want to survey the secondary control points A1, A2, A3, A4 and A5; firstly mark the approximate position of 1 and 2 in Google Earth, then based on project request make the mark of points A1-A5 in Google Earth.



- Field data collection.
Go to the A1-A5 points and start the field data collection.
Each section of observation please write down the station name, receiver SN, start time and end time, also antenna height.
The data collect flow.
If you have 3 receivers, we suggest fixing them in 1,A1,A3, after the first section observation, power off the receiver on 1 and take it to the points A5(A2 or A4); after the second section, power off the receiver on A1 and move to A4; finally take 1 receiver on point 2.
If you have more than 3 receivers, we suggest you fix two receivers on point 1&2, and go to other points to collect data.

4.4 Raw Data Download

This section explains how to download data by CRU software.

The raw data is saved in T300 internal memory. So you need to download the data from receiver to your office computer.

There could be two types of cables can be used to export raw data in the memory of T300. 7-pin Lemo to RS232 cable can be used to link T300 to your office computer and with which CRU (Compass Receiver Utility) can perform full function (including downloading, setting and other serial port communication). But ComNav highly recommends 7-pin Lemo to USB cable (as shown below) which is designed especially for data download so that the speed is faster.



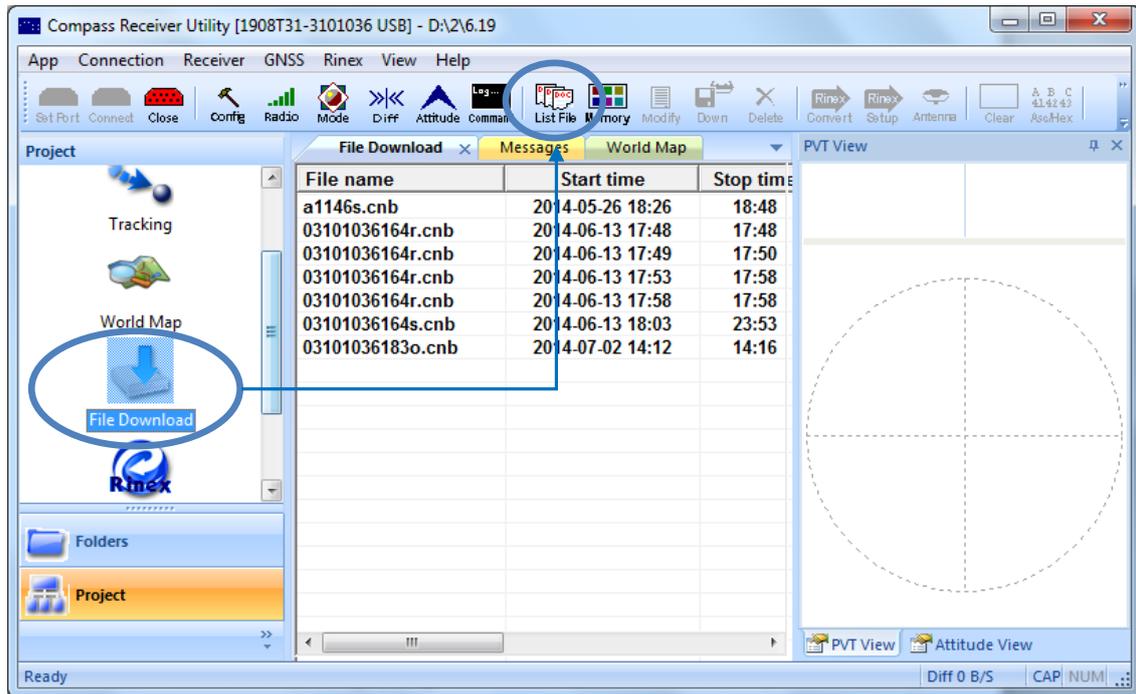
Firstly, connect T300 to your PC with Lemo to USB cable and power on receiver. PC will detect T300, but cannot recognize it at the first time. Use Device Manager (depending on your operating system) to update the driver of it, by choosing the path where there is driver we provided (**in the path of CRU software, a folder named driver**). Once the driver is installed, PC can automatically recognize T300.

Tips, if nothing happened after PC linked to T300 by USB cable, press the function key two times rapidly and continuously, the Datalink LED (yellow color) will always be lighting, in this mode Bluetooth and internal radio will stop working, and receiver is only used for downloading data. Then, you can download data as following steps:

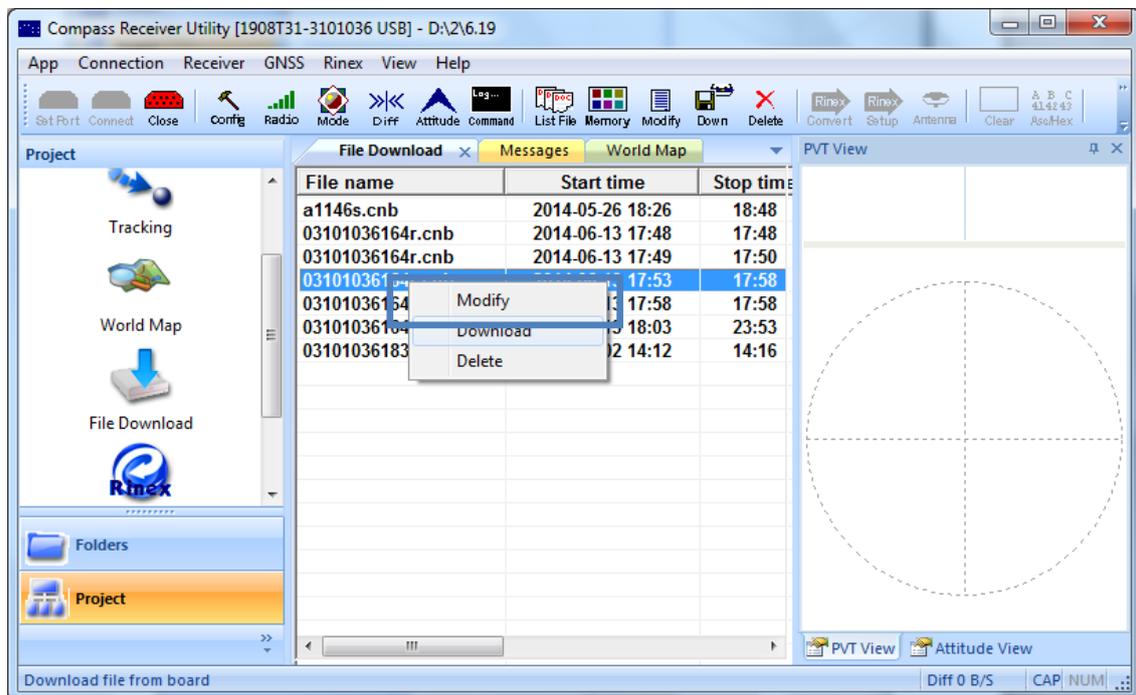
Please follow the steps below

1. Run CRU and click . Choose USB in the Serial Settings and click OK.
2. Use  **Folders** to choose the download path.
3. Click the function button **File Download** in the Project, then you can see the raw data on the right. If no data appear, you may click the button 

to refresh, as shown in figure below



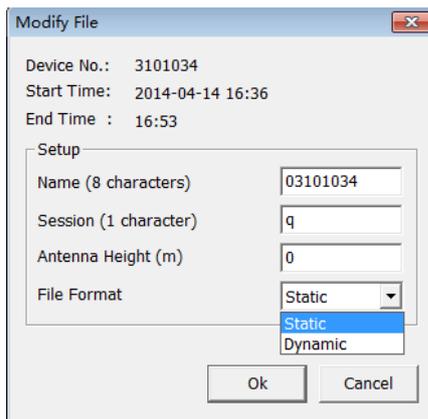
- Choose the corresponding data, right click and then you can edit the data by means of Modify, Download and Delete. You also can use the corresponding shortcut keys in the shortcut bar, as shown in below.



- Choose **Modify**, only two important information need to be modified. After that, click **OK**.

Name: station marker

Antenna: the antenna height of T300.



- After setting the storage path, you click **Download** and then the data can be downloaded and saved in corresponding path.
- If you click **Delete**, the data will be removed.

4.5 Convert to RINEX

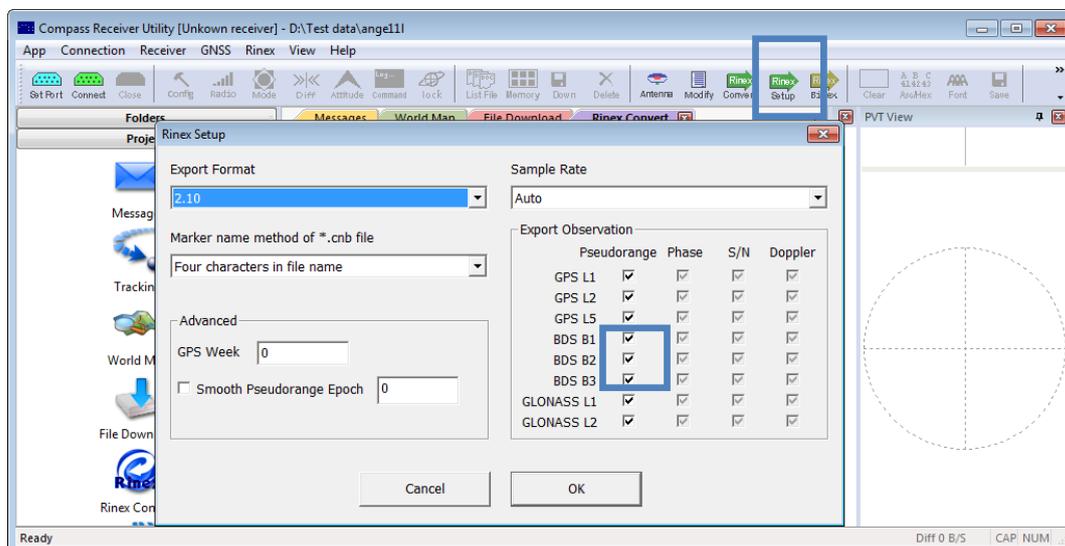
After downloading data on your office computer, you can convert the raw data in ComNav binary format (*.cnb) to Rinex format. Go to the function bar, click



Rinex Convert, you will see the raw data in current folder.

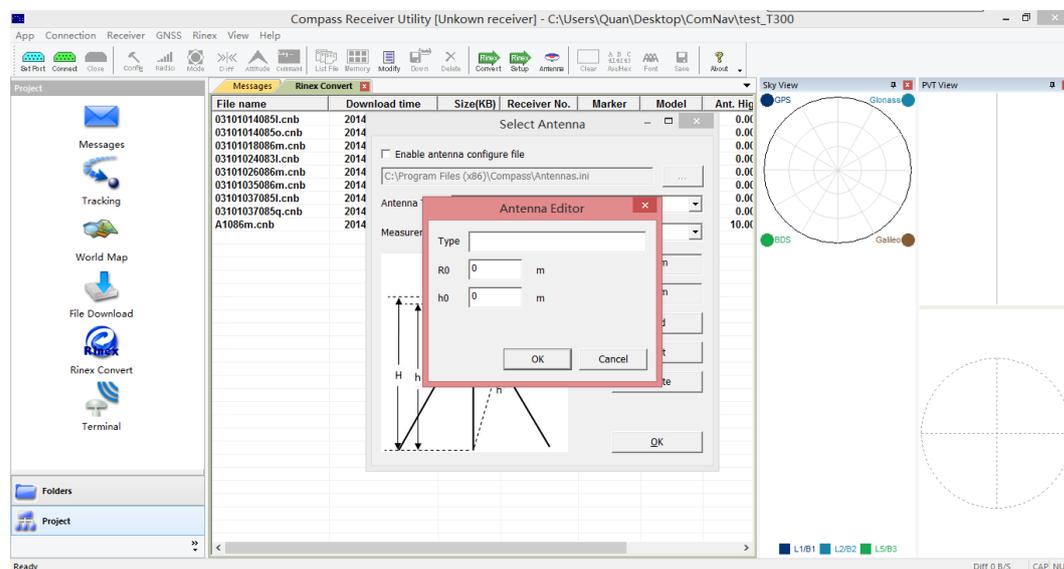


Go to the shortcut bar or Convert Settings in right click, define the Rinex version and export observation information. Then go to the main window, select the file and right click, convert to Rinex format. Go to the raw data files to check the RINEX format data.



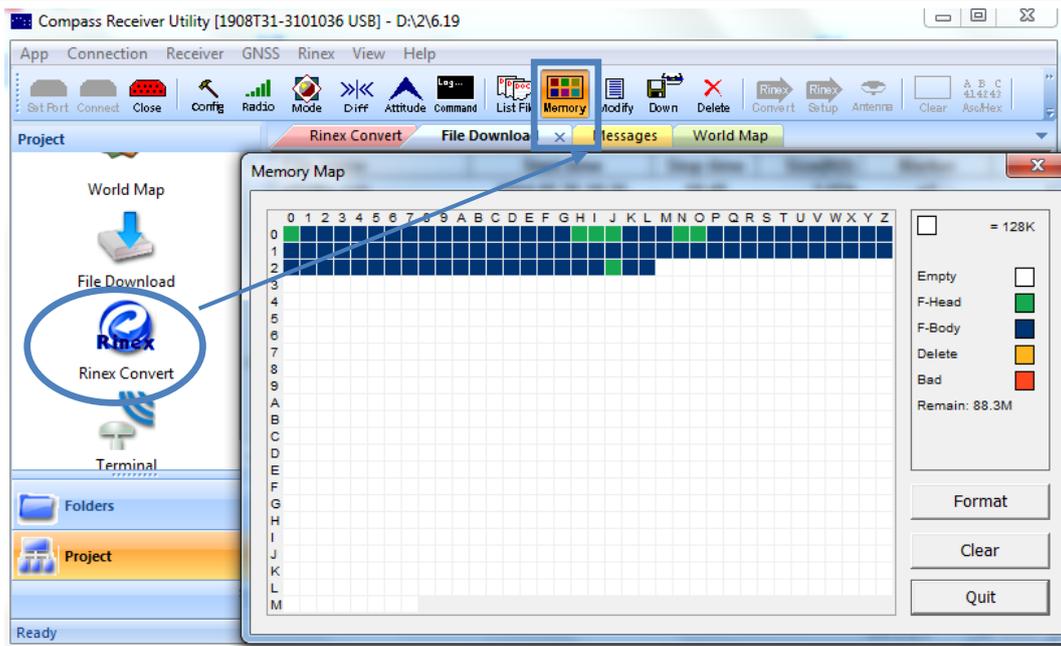
Tips: In some Post Processing software, the Beidou observations cannot be processed, you can uncheck the Beidou B1,B2,B3 observations.

Go to the shortcut bar  or Antenna in right click, select the Antenna Type and Measurement. If no existing antenna type for T300, add one. Input the value of R0 (horizontal offset from measurement mark to phase center, i.e., antenna radius) and h0 (horizontal offset from measurement mark to phase center). For T300 receiver, the values of R0 is 0.079m and h0 is 0.0274m respectively. You can also add, edit or delete one or more antenna types using the buttons **Add**, **Edit** and **Delete**.

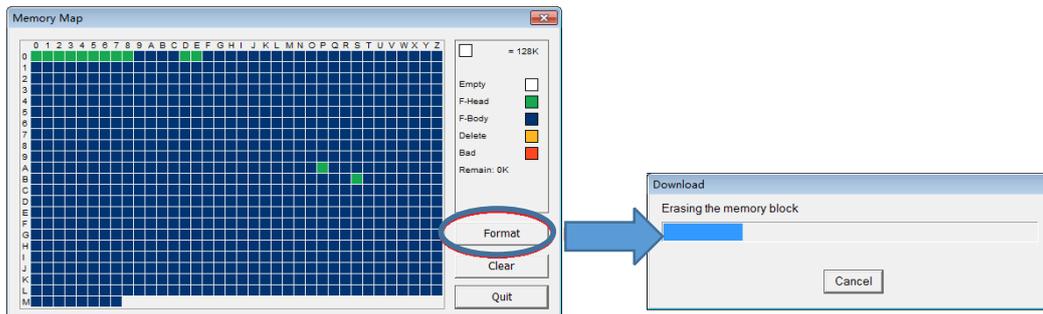


4.6 Memory Management

Go to the Shortcut Bar, go to , you can **format** the internal memory or **Clear** the files deleted to the recycle bin.



Note: If the internal memory is run out, the receiver will stop recording raw data, and the differential LED and data logging LED will flash simultaneously at 2-second interval. In this case, you need to format the internal memory before starting another static survey, as shown in figure below.



5 Real-Time Kinematic Mode

To conduct RTK (Real-Time Kinematic) survey, radio mode and CORS mode can be employed.

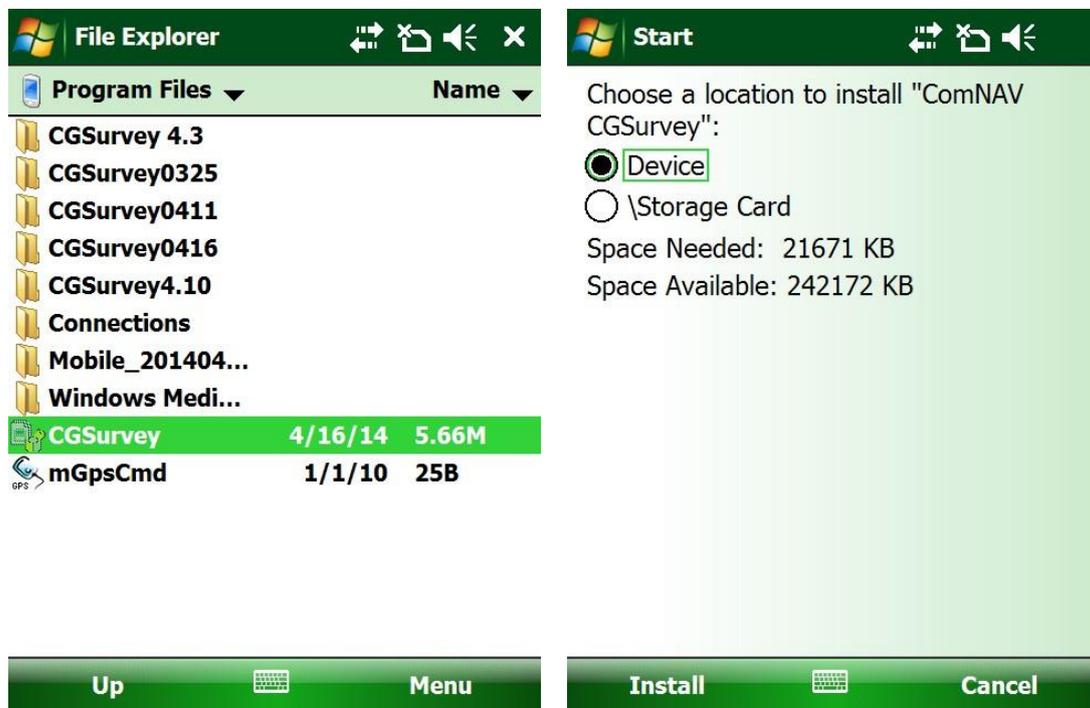
In RTK mode, you have to install RTK survey software firstly.

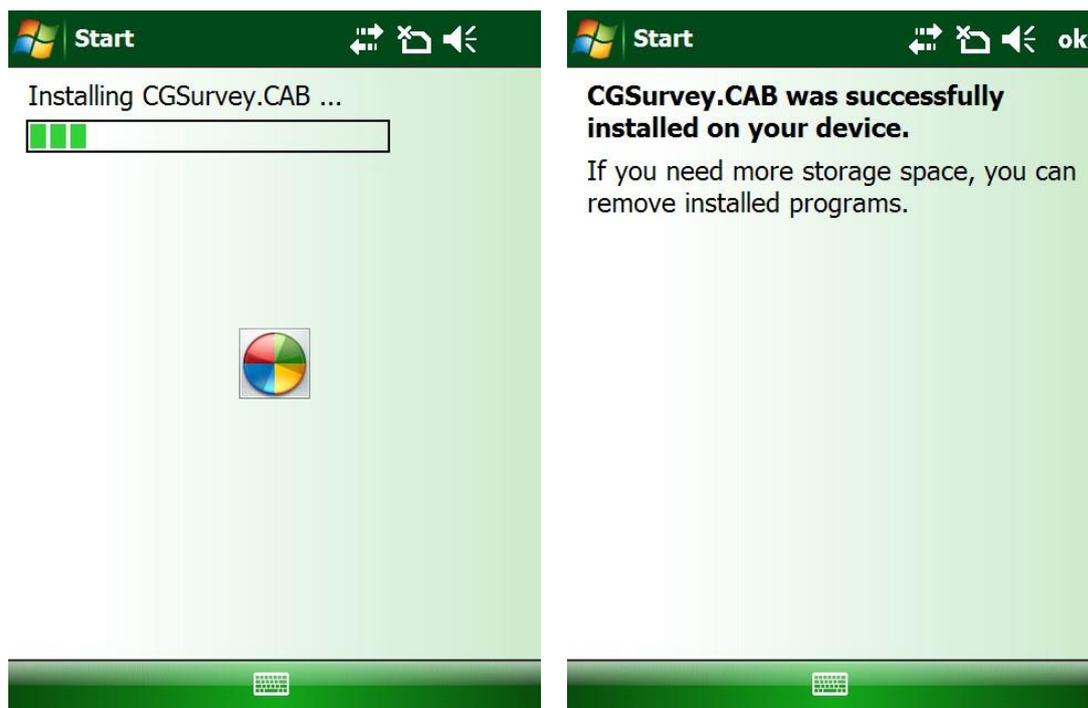
5.1 Installation of CGSurvey Software

If you use Windows 8 OS, Controller can be automatically recognized when you link it with your office computer. If not, make sure Microsoft Windows Mobile Device Center or Microsoft ActiveSync is installed on your computer and is allowed to perform USB connections (download Microsoft Windows Mobile Device Center or Microsoft ActiveSync via <http://windows.microsoft.com/en-us/windows/downloads>). Then, you can copy files between your office computer and controller.

Make sure the software package has been copied in a folder of controller before the installation; here we save it in the **Program Files**.

- Tap **Start**->**File Explorer**->**Program Files**, find the software package, tap it and choose a location to start the installation.





5.2 Radio Mode

Radio mode is that the correction data is transmitted via radio communication in real time. ComNav T300 GNSS Receiver is equipped with internal transmitting & receiving radio, the following will explain T300 T/x + T300 R/x RTK operation.

T300 Internal Radio Specifications:

| Radio parameter | Specifications |
|-----------------|--|
| Frequency range | Tx range: 458 MHz-469 MHz, Rx range: 450-470MHz |
| Protocol | Transmit mode: Transparent/TT450S Receiving mode: MAC (compatible with CHC protocol), TT450S, Transparent EOT and south protocol. |
| Airlink rate | 9600 bps |
| Bandwidth | 25kbps |
| Power | 0.5, 1, 2 Watt adjustable |
| Work distance | 1-5km, depends on environment and power setting |

Prerequisites

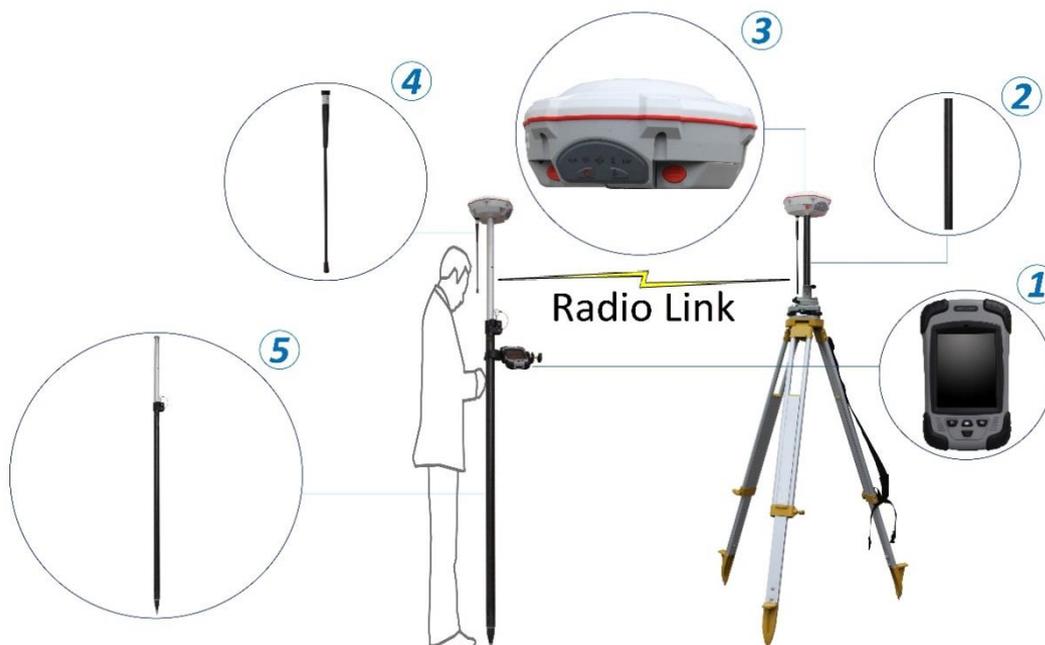
- Two kits T300 GNSS receiver
All T300 GNSS receivers can be worked as either Base or Rover.
- Use external power source and power cable to supply power to T300 Base station (When T300 in base mode and transmitting via internal radio, the

power consumption can be reached 5-6 watt, so we strongly suggest to use the external power source to supply power to base station.)

- Controller kit with software installed
- Tripod and tribrach

5.2.1 Radio Mode Setting-Up

- Internal radio setup, use the internal radio as transmits the correction data.



The hardware connection information of the radio mode is as follows:

Base station components: ③T300 ②Extension bar ④Whip Antenna

Connection relation in Base part: whip antenna is connected to TNC connector; extension bar is connected to fixing socket under T300; extension bar, tribrach and tripod are connected from top to bottom.

Rover components: ③T300 ④Whip Antenna ⑤Range Pole ① Controller and bracket.

Connection relation in Rover part: whip antenna is connected to UHF connector under T300; range pole is connected to fixing socket under T300; controller is mounted on range pole by a bracket support; controller and T300 communicate by Bluetooth.

- External radio setup, use the external big power radio to transmit correction data, which in increase the RTK work distance a lot.



5.2.2 Start Base Station by CGSurvey

First, run CGSurvey, **Files->New Job**, input the project name and choose a Datum (see chapter [6.1 new project](#)).

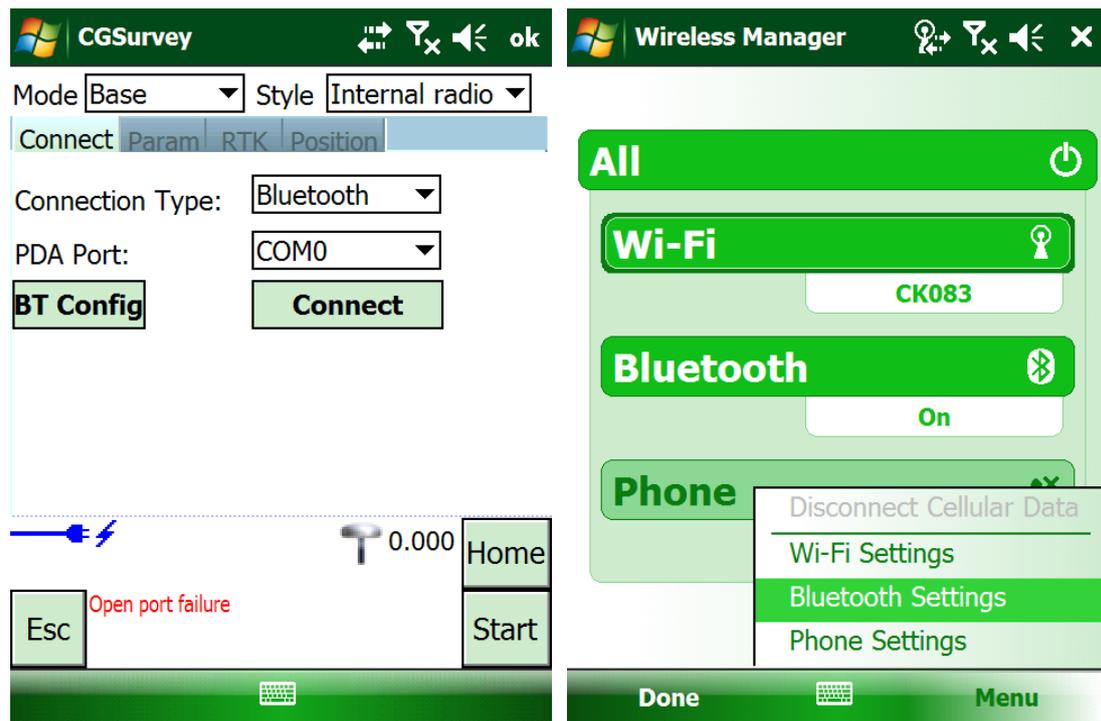
Second, click **Config->Work Mode**, choose **Base** and **Internal radio** on the top of the window.

Tip: if T300 is connected to external radio, please select the External radio; follow the guidance below to start base station.

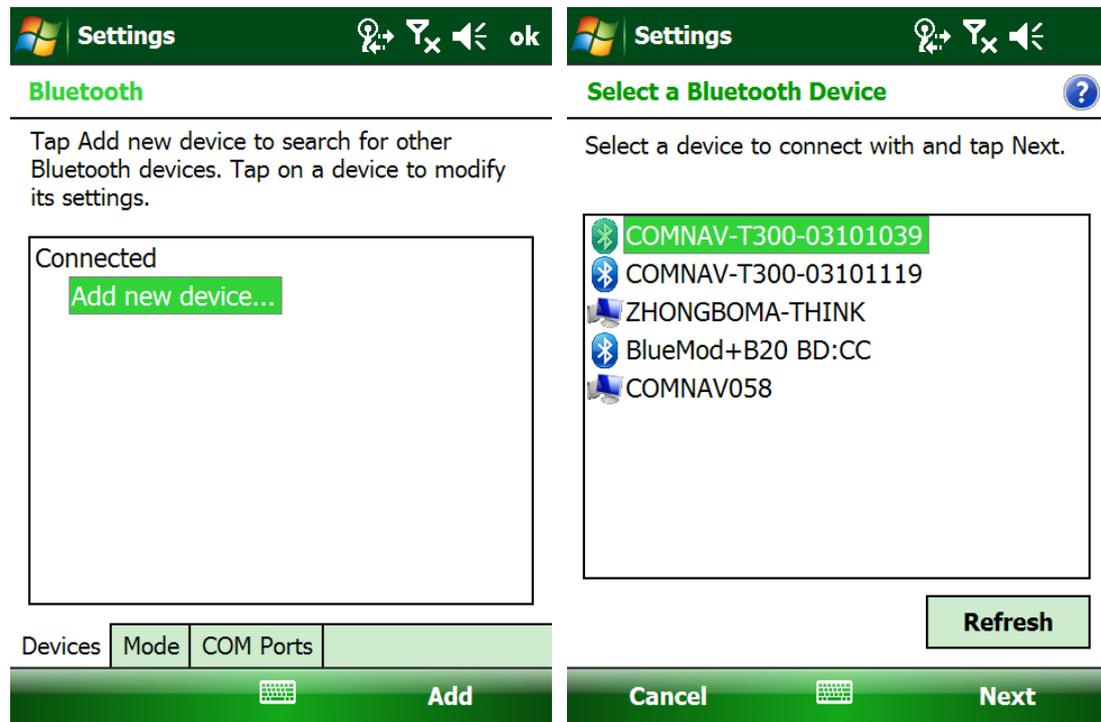
When T300 connect to external radio, you need the data cable from T300 lemo port to external radio port; these kinds of cable you can make by yourself if you know the pin definition of T300 lemo port, in the [Appendix A](#) explain the definition of T300 7 pin Lemo.

ComNav Provide the standard external radio is PDL radio, the detailed operation of PDL please go to [Appendix B](#).

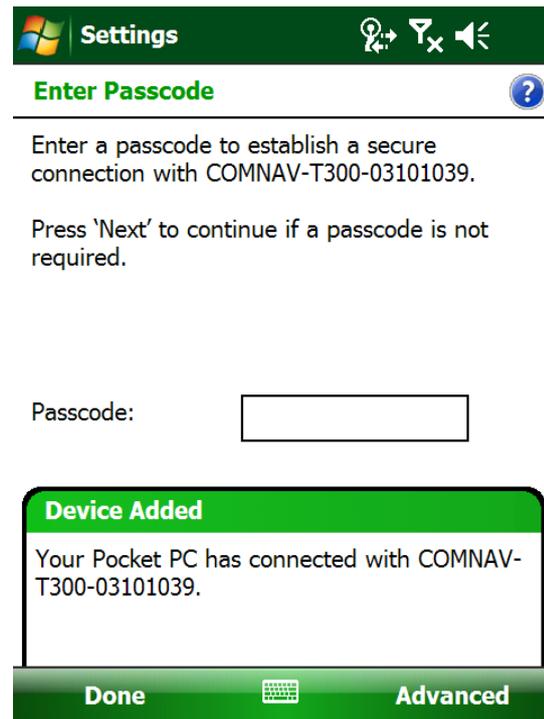
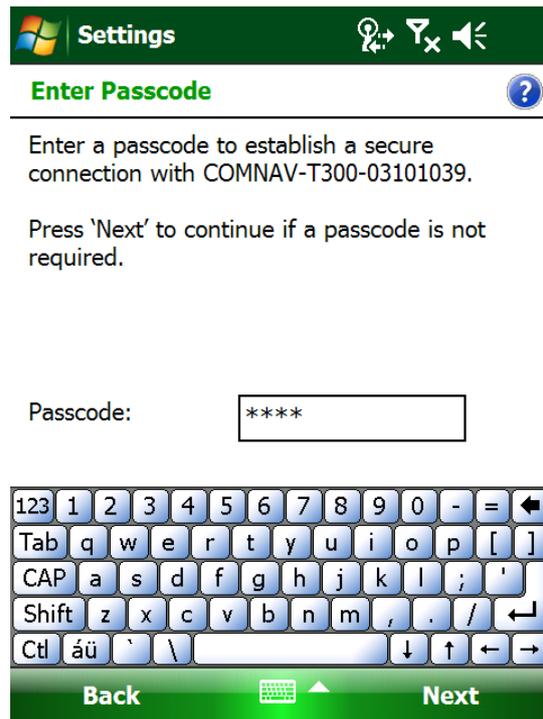
To build Bluetooth link between controller and T300, click **BT Config**. Then click **Menu->Bluetooth Setting**.



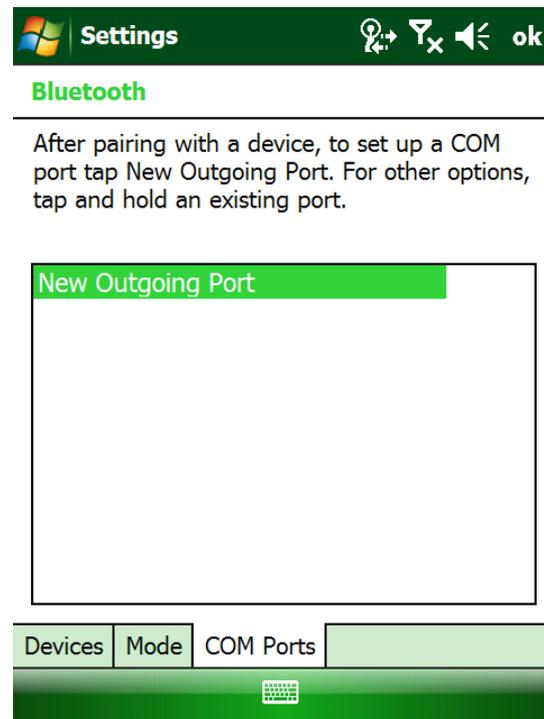
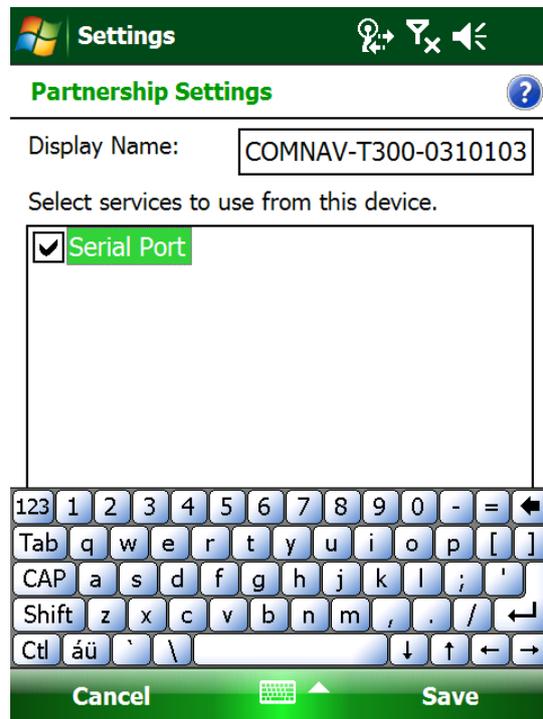
In Device tab, click **Add new device** to search the Bluetooth device (ensure T300 is power on). Choose the right device according to the SN number and click **Next**.



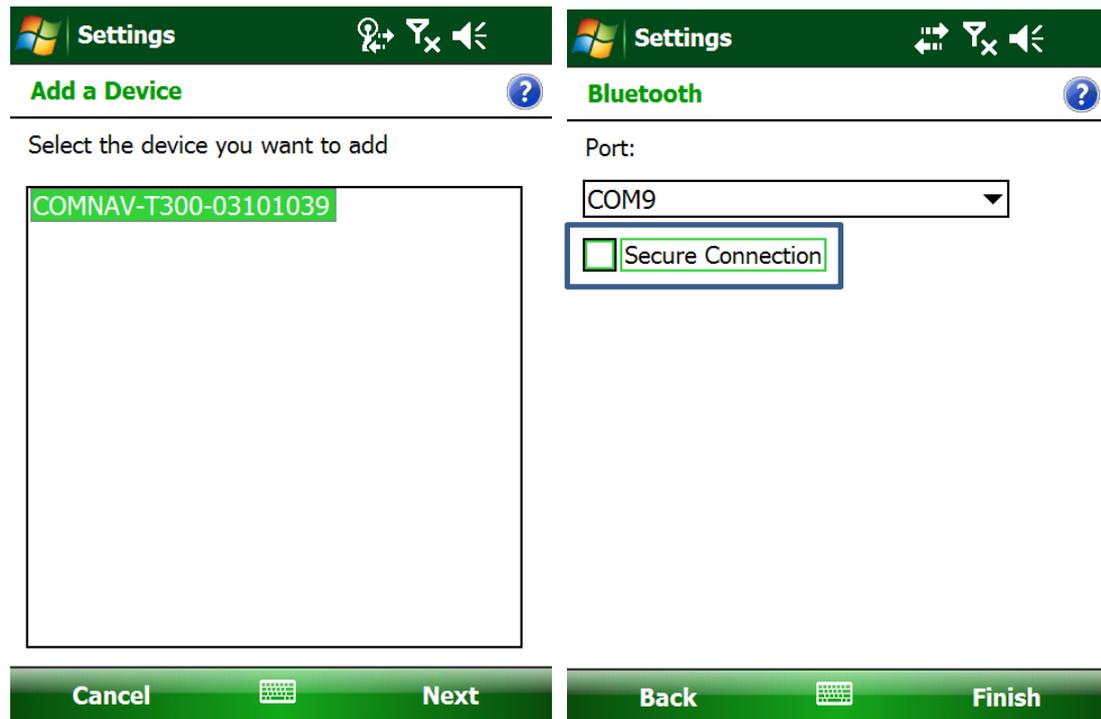
Input the passcode '0000' and click **Next**. Then click **Advanced**.



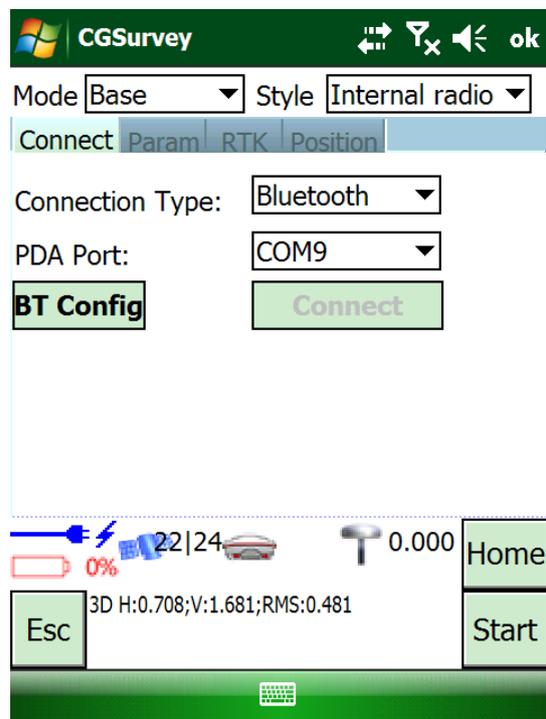
Choose **Serial Port** and click **Save**. Then go to COM Ports tab, and add **new outgoing port**.



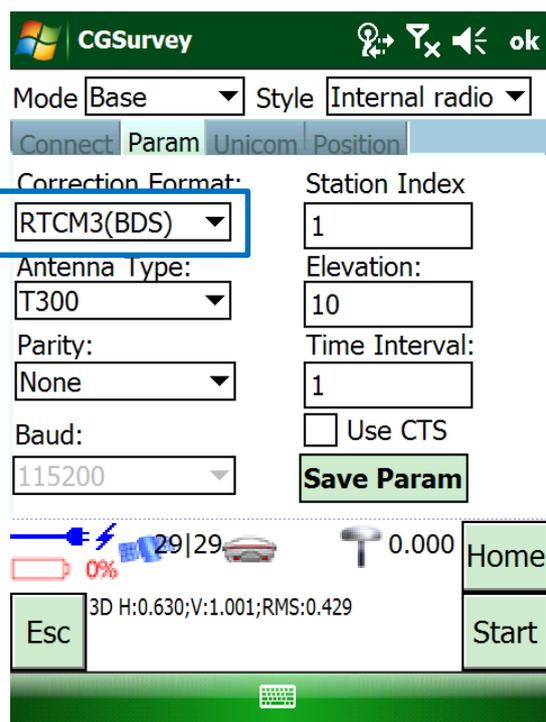
Choose the right device according to SN number and click **Next**, then choose a port number, do not taggle the Secure Connection, click **finish** and tap **ok**, this will go to the BT setting start menu, click **Done**, and go to the work mode window.



Firstly Choose the **corresponding COM** and then click **Connect**. Secondly in **Mode** option, select the **Base**, also style: **Internal radio**

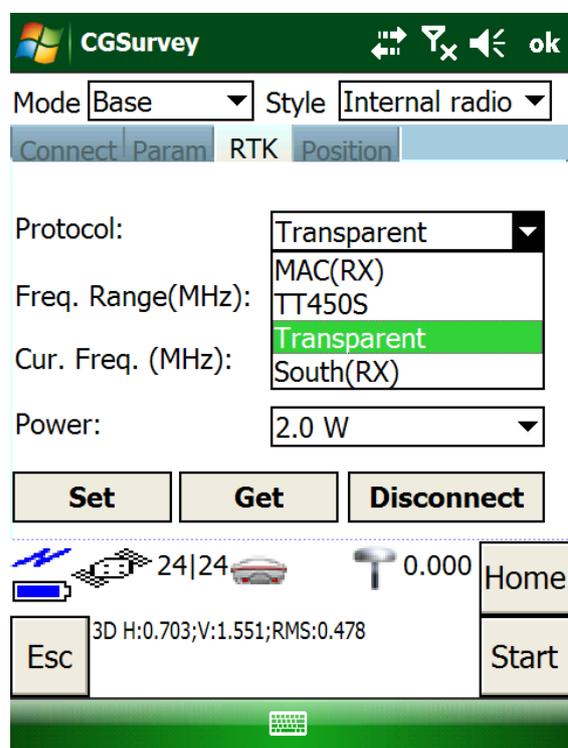


Then, modify parameters in **Param** tab, e.g. **correction format** and **antenna type**



Tip: If you are in the coverage area of Beidou and using three constellations, please use RTCM3(BDS). If not, choose RTCM 3

In RTK tab, set the radio parameters, e.g. **Protocol**(TT450S or Transparent) **frequency** and **power**, and click **Set**



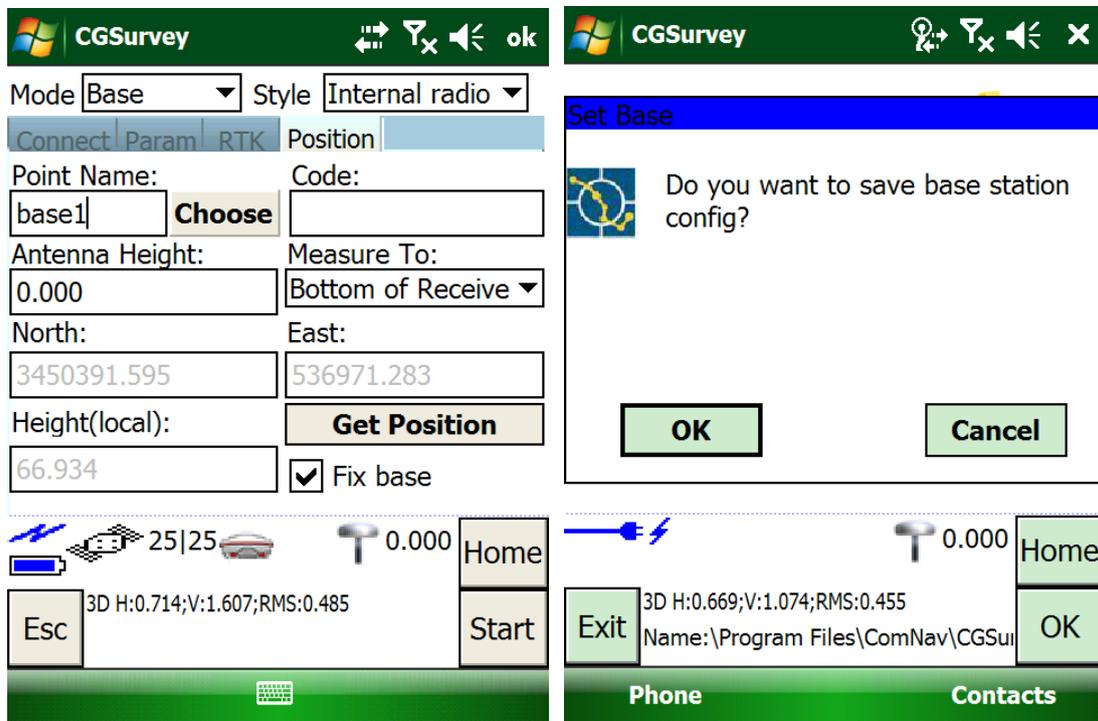
Finally, modify the parameters in Position tab.

Start base from known point, you must key in the know coordinate firstly, and tap **Choose** to select the point. To key in the coordinates, go to **Edit->Points**, input the value and toggle Control point menu.

Start base from unknown point, Key in point name, just tap **Get Position** to get the current position as base station coordinates, and Toggle the **Fix Base** menu. Click **Start** to complete the configuration.

Start base station use Auto Base mode: Base will read the current position (SPP mode) and started sending correction data. It means next time no need to use controller link with base to start base, the base will automatically broadcast data.

The operation is as same as start base from unknown pints, just uncheck the **fix base** in the last step.



Tip: after starting the base station successfully, please check the differential LED of T300. It will flash 1/s, meaning the base station is sending correction data.

5.2.3 Start Rover Station by CGSurvey

Click **Config->Work Mode**, choose **Rover** and **Internal radio** on the top of the window.

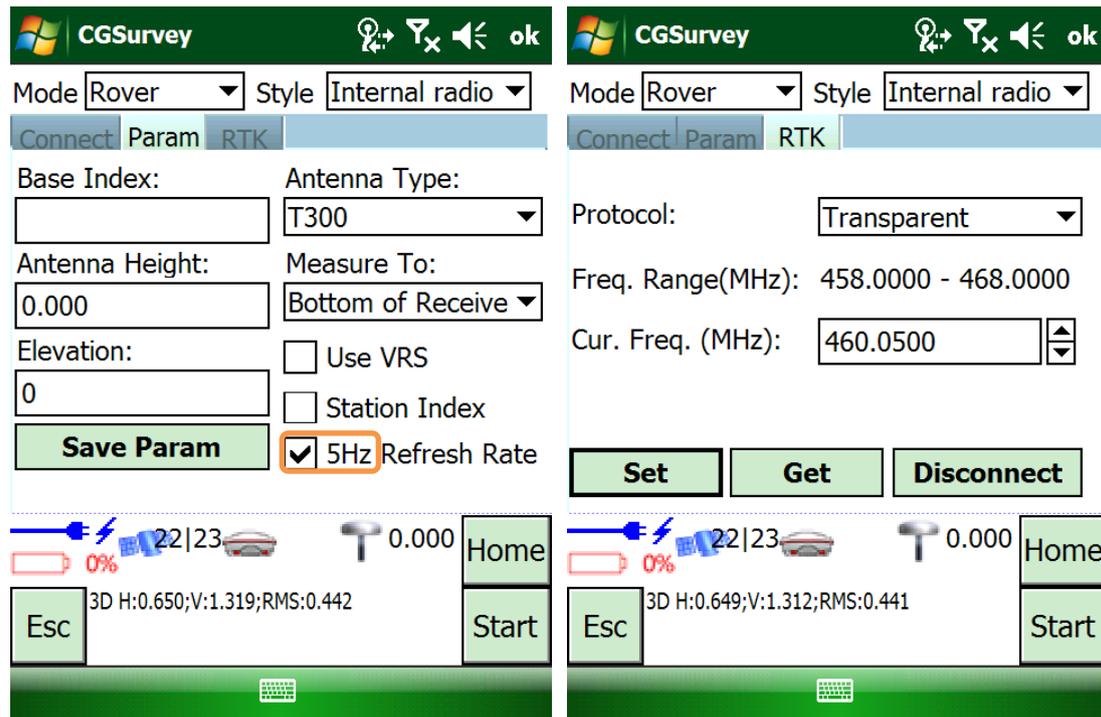
Build Bluetooth connection as showed in [Chapter 5.2.2](#).

Modify parameters in Param tab, e.g. **Antenna height**, **antenna type** and **Measure**

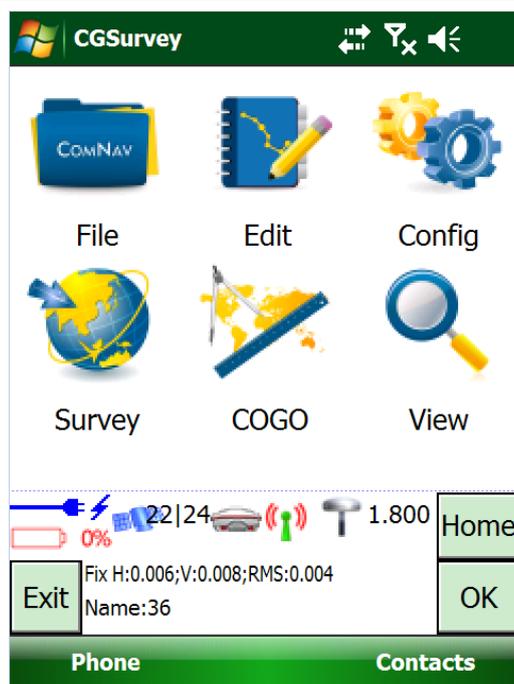
to.

Tips, 5Hz data refresh is used in continuous Topo survey and stake out, this will improve your work more efficiency; right now stake out can not reach 5HZ, it is 2.5 HZ, we will improve this in the next version.

In **RTK** tab, set the frequency and protocol and click **Set**, those settings must match with the Base setting. Finally, click **Start** to complete the configuration.



Tip: after starting rover, please check  in the software as show below; and the differential LED of T300. It will flash, meaning the rover is receiving correction data.



5.2.4 External radio mode

By using internal radio transmission the RTK work distance may range from 3-5km. To extend the RTK work distance, external big power radio is needed.

Use External radio

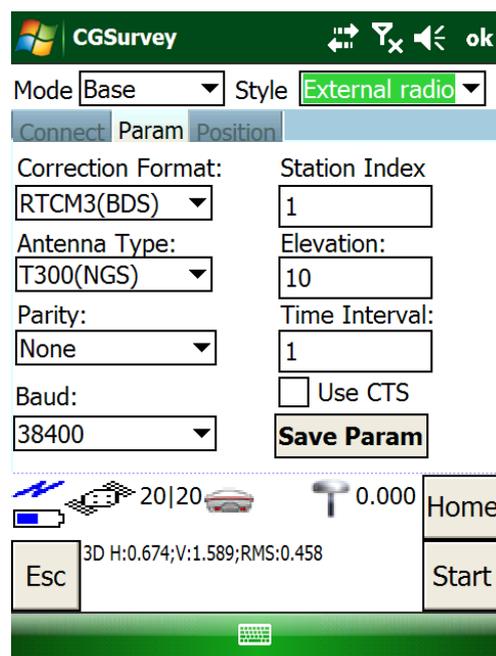
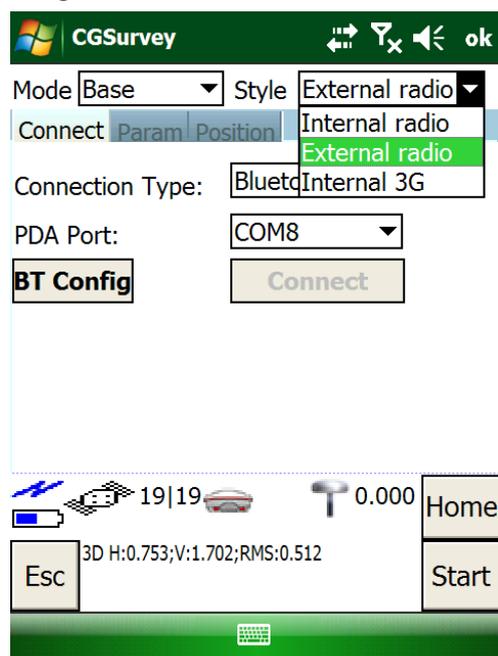
The Maximum transmit power of T300 is 2 Watt, in some case like mountain areas or urban, the radio signal will be easily weakened by high constructions and other powerful radio signal, then the external radio is a good solution for those cases. Here, we will introduce the settings and operations of PDL in [Appendix B](#)

To set up external radio mode, link the long whip antenna mounted highly on another tripod to PDL. Then Connect T300 to PDL with Lemo cable and connect the external battery with power cable. Finally, choose appropriate channel on PDL (see chapter 6.1.4 for software operation). The cable connection of PDL is shown in the figure below.



CGSurvey start base station to connect with external radio.

After connection Bluetooth with Base, configuration **Param** as bellow, the **Position** is as same as using internal radio



5.3 PDA CORS Mode

PDA CORS mode employs the network RTK technology with no need to set up your own base stations. The correction data is transmitted from Continuously Operating reference Station via Internet in real time. ComNav T300 GNSS Receiver can log on the Internet via WIFI or GSM/GPRS.

- ❖ R100 Controller GSM/GPRS Specifications
GSM/GPRS 850/900/1800/1900 MHz

- ❖ Prerequisites:
 - T300 GNSS receiver kit
 - Controller with SIM card, set Controller log on internet, [Appendix C](#).
 - Controller Kit with software installed
 - Range pole

5.3.1 PDA CORS Mode Setting-Up



The hardware connection information of the CORS mode is as follows:

Hardware components: ①T300 ②Controller ③Range Pole
Connection relation: range pole is connected to fixing socket under T300; controller is mounted on range pole by a bracket support; controller and T300 communicate by Bluetooth.

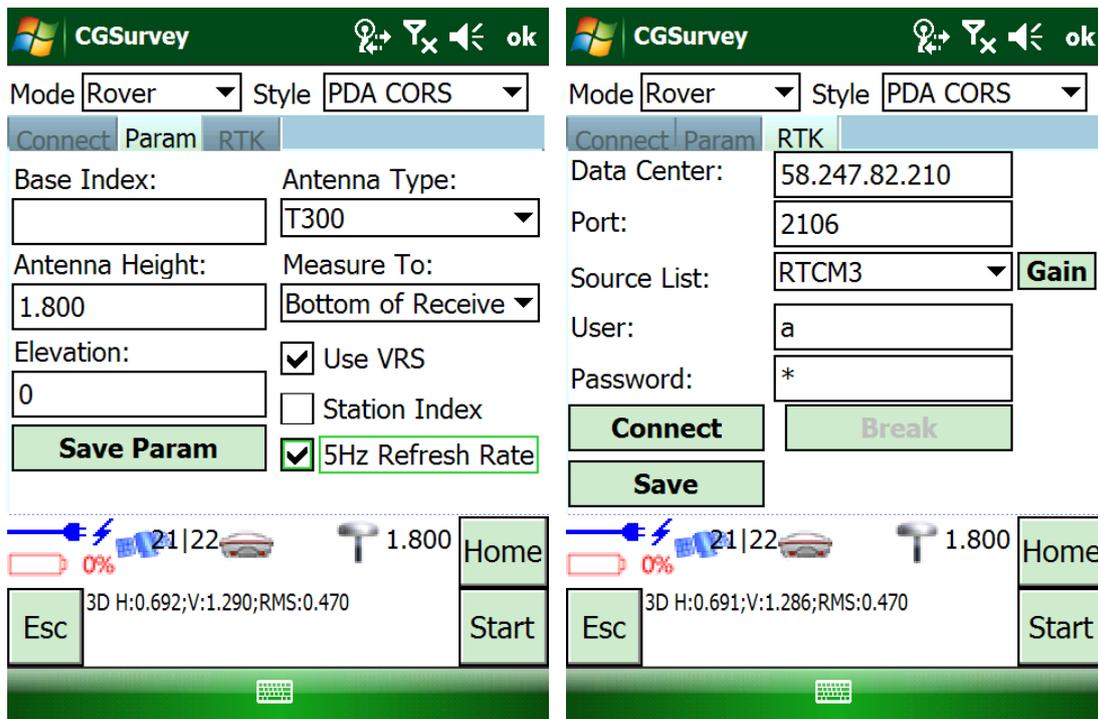
5.3.2 Start Rover by CGSurvey

Firstly, set the controller log on internet (see Appendix C). Run CGSurvey

Click **Config->Work Mode**, choose **Rover** and **PDA CORS** on the top of the window.

Build Bluetooth connection as showed in **Chapter 5.2.2**.

Modify parameters in Param tab, e.g. **Antenna height**, **antenna type** and **Measure to**. If you would like to use 5Hz refresh rate and VRS, tick them. In RTK tab, key in the IP and Port of CORS, and click **Gain** to get source list. Key in user Name and Password, and click **Connect** to finish setting. Finally, click **Start** to complete the configuration.



Tip: after starting PDA CORS mode, please check the differential LED of T300. It will flash, meaning the rover is receiving correction data.

Tip: ComNav T300 is compatible with CMR, RTCM 2.x and RTCM 3.x, but we suggest to use RTCM3.X which includes GPS, Glonass and Beidou correction message.

5.4 Internal GPRS Mode

Prepare the Sim card insert the receiver. Please try to get the APN(access point number) from the

mobile service provider.

The APN (Access point Number) you can get from the mobile network provide.

Or try to get those value from web bellow:

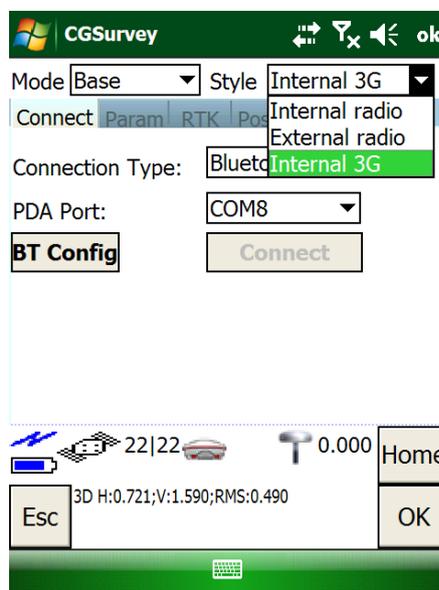
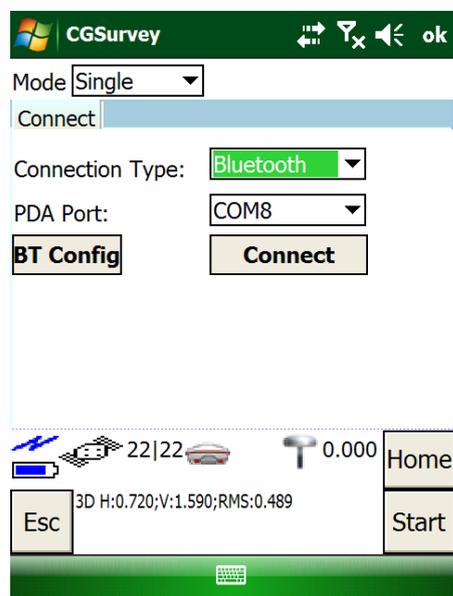
http://www.hw-group.com/products/HWg-Ares/HWg-Ares_GSM_APN_en.html#top

T300 internal GPRS support Point to Point/Points, Ntrip and GSM(GSM is under working) protocol. In the next 2 section will introduce two work mode.

5.4.1 Point to Point/Points mode (P to PS mode)

In this mode, both Base and Rover is needed and with 2 SIM card. The base transmit the correction data by GPRS network to the Server; As the rover log on server and binding with the base station, to get the correction data. You can use 1base+1 rover, also you can use 1base+ many rovers.

Base setup.



Select Internal 3G:

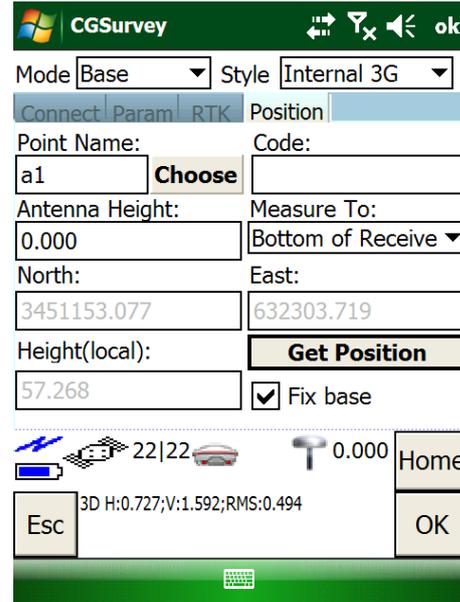
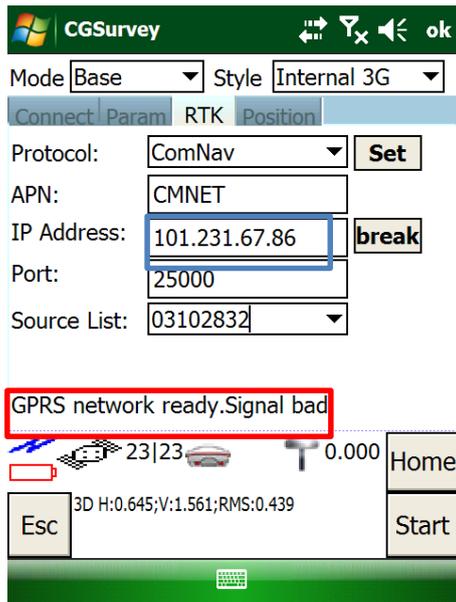
Protocol: ComNav

IP: 101.231.67.86 Port: 25000(25095)

Sourcelist: **we suggest use the SN number of Base**, key in the sourcelist, please remember the value. The Rover has to input the same value. After you see the GPRS network ready, then go to next step input (Get position) to start Base station.

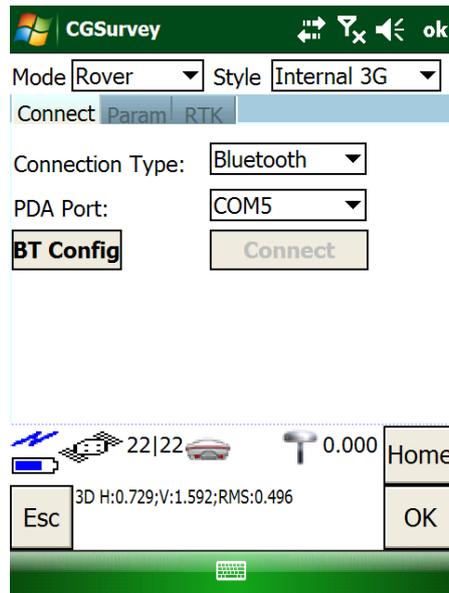
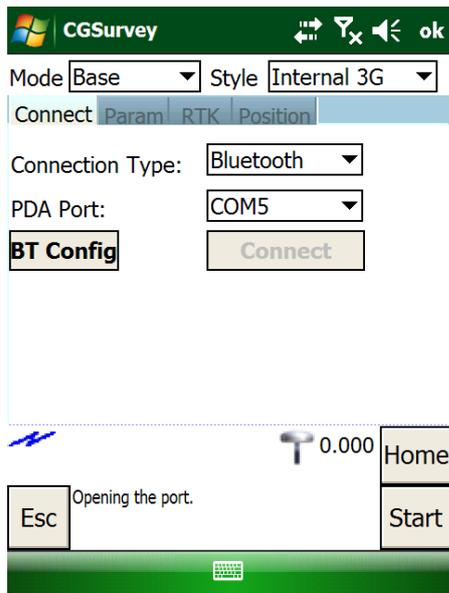
Tips; the server IP is located in ComNav office, in case some time the network not sable, please contact ComNav support (support@comnavtech.com).

After GPRS modem is connected to internet, the blue LED will flash 1/s.

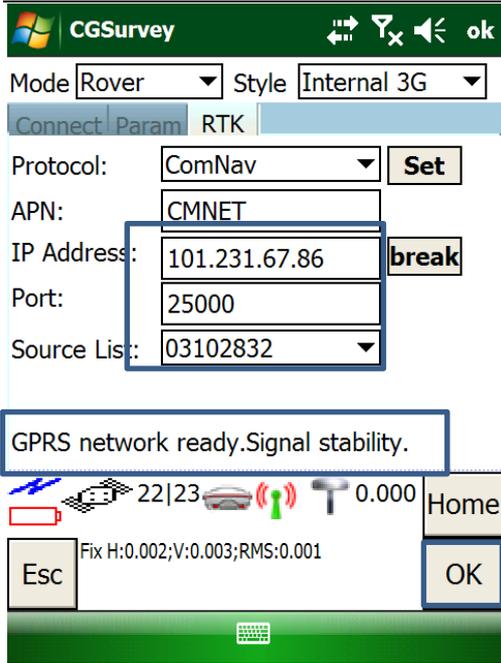


Rover configuration

Link BT with Rover, and change mode to Rover, style as internal 3G.



Set the same parameters as base, in the sourcelist, key in the same as Base. When you see the GPRS network ready, tap OK, then the Rover will received the correction data from base, and correction data Icon will show in the status bar.



5.4.2 Ntrip client mode

Ntrip mode—only need 1 rover get the correction data from Ntrip(CORS) server. The setting is similar to above, only few difference.

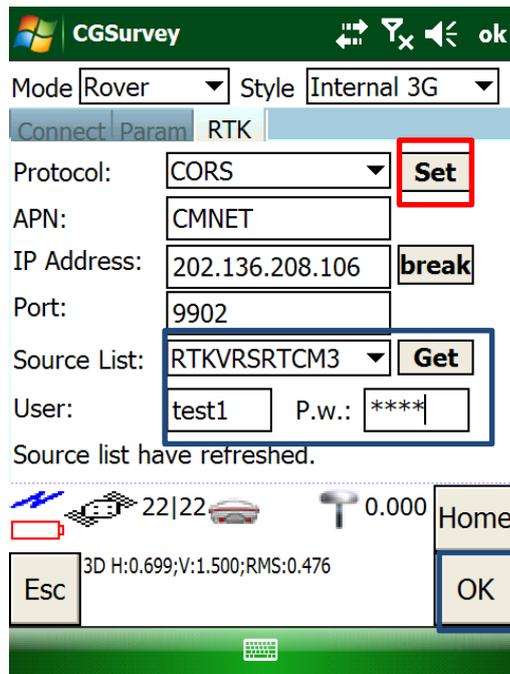
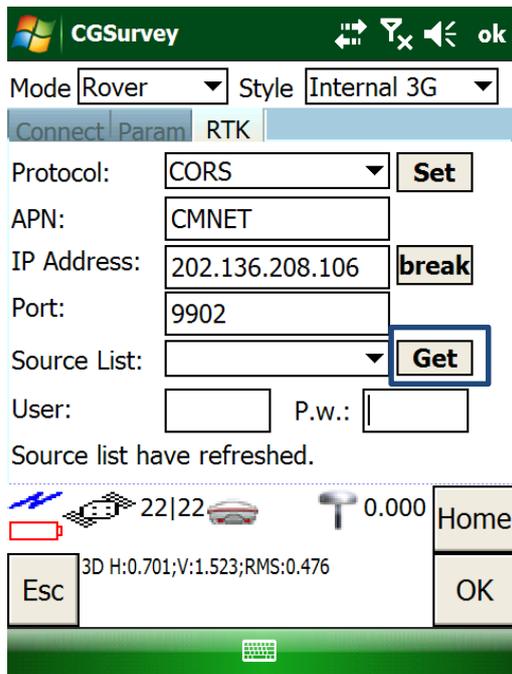
Protocol: CORS(P to Ps set ComNav)

Setting as APN and IP(CORS) and port is as same as P to PS mode.

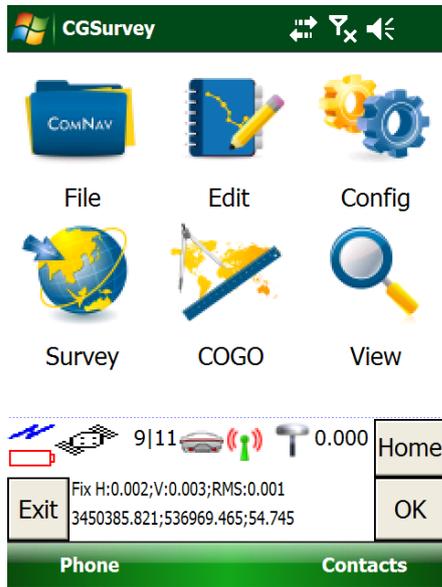
Source List: Tap Get the list, and select the suitable source list

User name and P.W: input those value

In the end, tap Set to save the parameter and click **OK** to get the correction data.



Receiver log on server and get the correction data



6 Start New Project and coordinate Localization

This chapter will explain how to start new job and coordinate localization functions in CGSurvey (ComNav Geodetic Survey software).

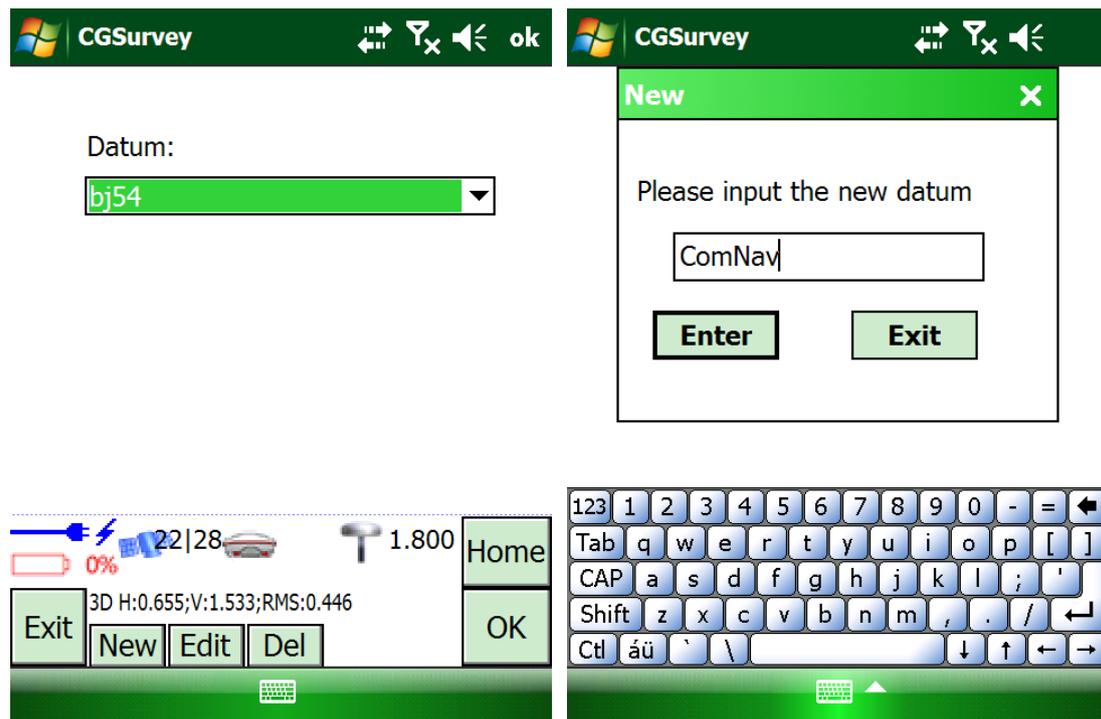
6.1 New Project

Launch CGSurvey first. Then tap **File->New Project**, key in project name, select a suitable **Datum** and the right Local Time Zone which three are most important parameters for a new job. Then key in Description, Operator and Notes, click **OK** to accept the inputting.

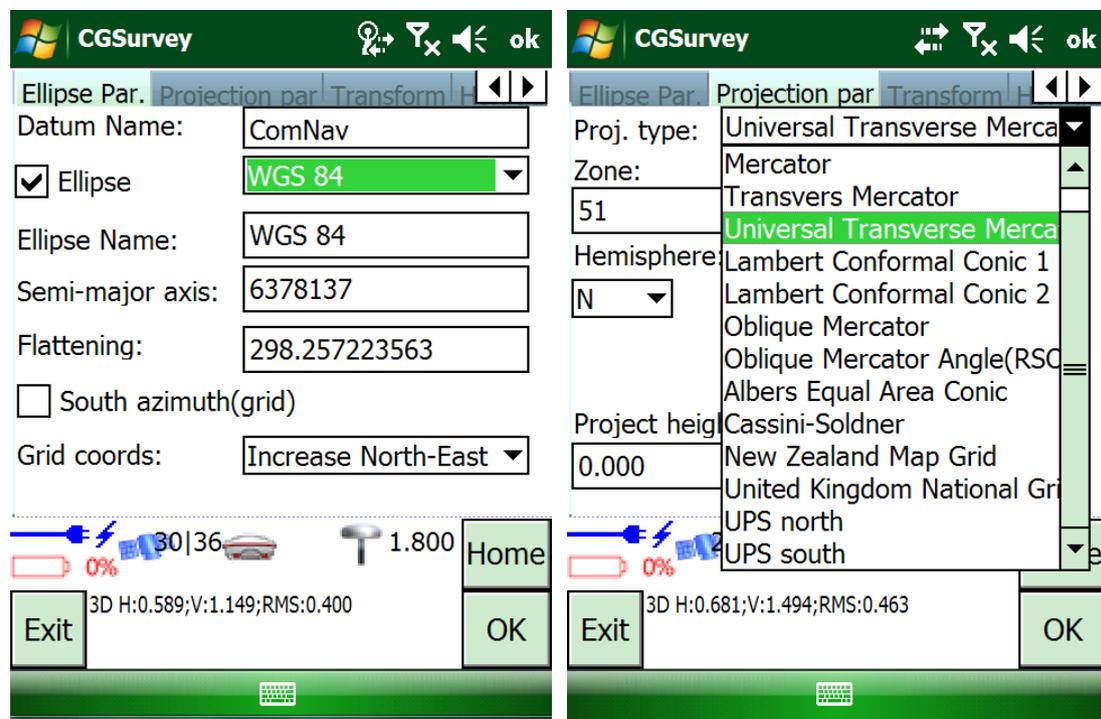
The screenshot shows the 'New Project' dialog box in the CGSurvey application. The dialog has a green header with the 'CGSurvey' logo and navigation icons. The main area contains several input fields: 'Project' (text box with 'ComNav'), 'Datum' (dropdown menu with 'bj54'), 'Time Zone' (dropdown menu with '8:00'), 'Description' (text box with 'ComNav T300'), 'Operator' (text box with 'Nick'), and 'Notes' (text area with 'This is for user manual'). At the bottom of the dialog, there are 'Esc' and 'OK' buttons. The background shows a Windows-style taskbar with icons for battery (0%), signal strength, and a clock showing 27:28. A 'Home' button is also visible on the right side of the dialog.

Tip: about the coordination system, if there is no suitable Coordination system existing, you need to establish a new one by choosing right map projection and relative parameters, see the following explanation.

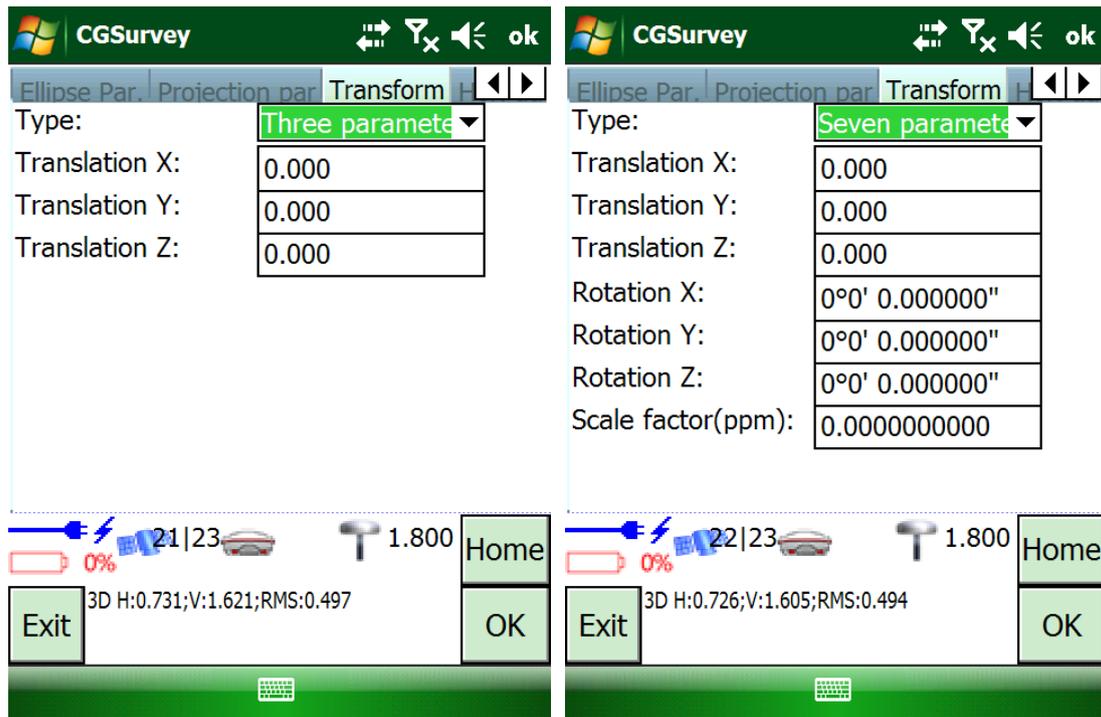
To establish a new datum, go to **Config->Datum Manager**, click **New**, and then key in a name of datum for distinction.



In **Ellipse Par.** Tab, you can modify the ellipsoid parameter by choosing the existing ellipsoid or input your own, and choose the mode of grid coordinates. In **Projection par** tab, choose a suitable projection type and input the corresponding parameters.

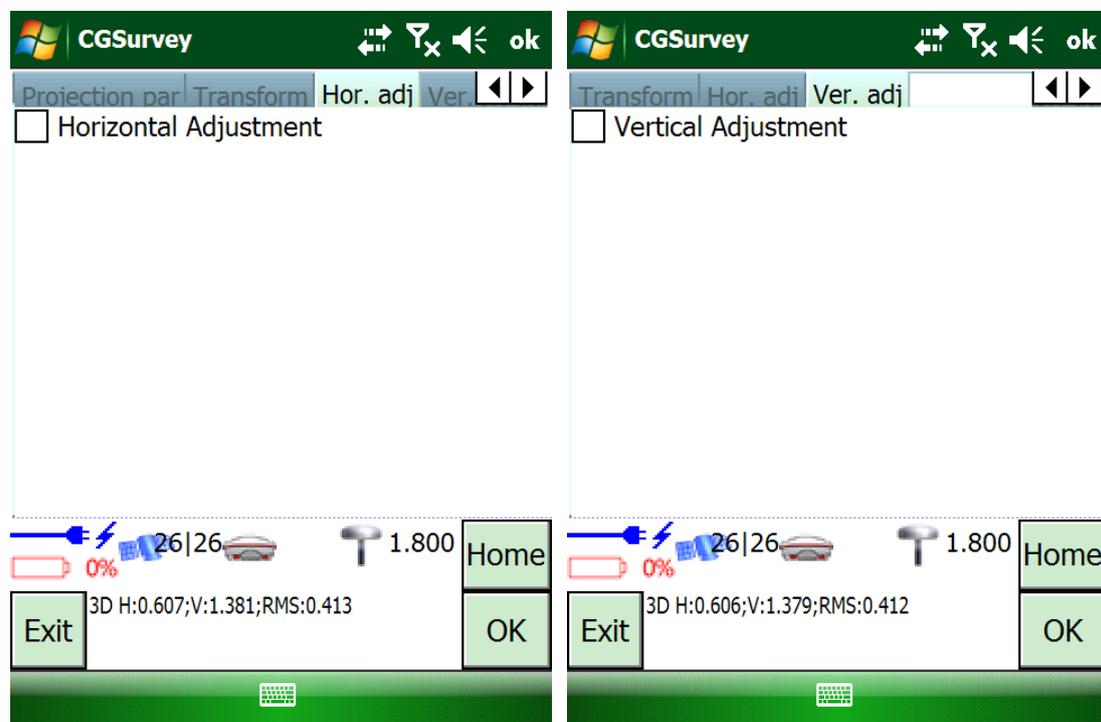


In transformation Tab: if using the three parameter or seven parameters, please key in the parameters here.



Tip: To use 3 or 7 parameters, you have to login as administrator. Go to **Config** -> **Administrator** -> **Login**. The user name and password are **admin**.

Do not toggle the Hor.adj and Ver.adj when start a new job. After doing **Site Calibration** (see chapter 6.2.1), the Hor.adj and Ver.adj information will appear.



Click **OK** to finish

6.2 Localization-- Site Calibration and Reset Grid

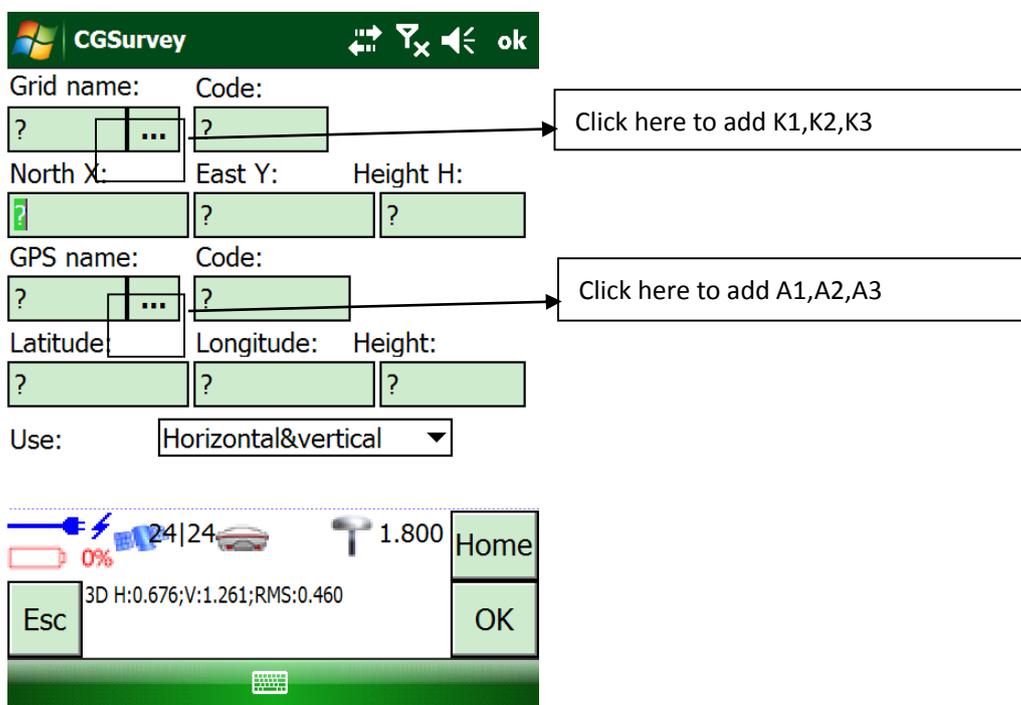
6.2.1 Site Calibration

Site Calibration: Convert WGS 84 to Local Coordinate, build the earth module of local area.

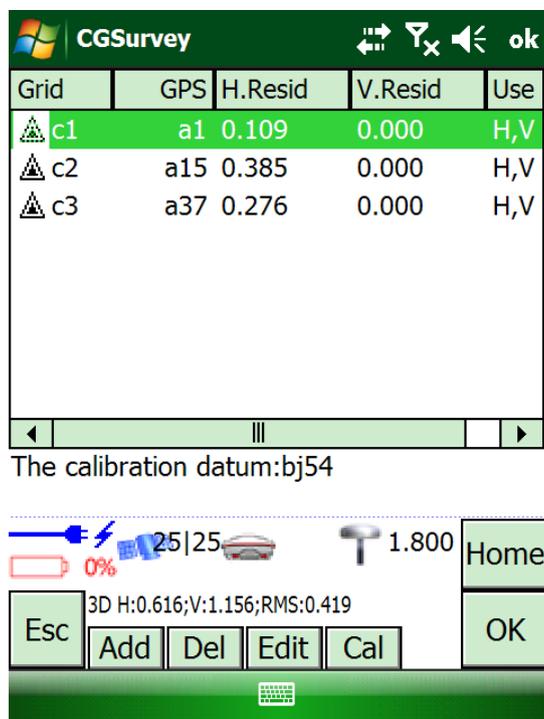
There are certain **mathematical models** between WGS84 and local coordinates, by using site calibration we can get the coordinates convert parameters, and apply all those parameters to current job.

Control points (known value) are used for site calibration. For example, start base station from known point is 1 way for site calibration; in fact there are more control points involved in 1 project, so you need to add all the control points together to do site calibration.

- After start base station successfully, take the Rover to survey all the control points, such as A1, A2, A3; then import (file-> import) or key in (edit->points) the relative K1, K2, K3 to current job.
- Carry out site calibration work: tap **Edit->Site Calibration** and then click the **Add** to add the Site calibration points. Input the point coordinates of the selected point, and paired with measured grid (K1->A1, K2->A2, K3->A3) .

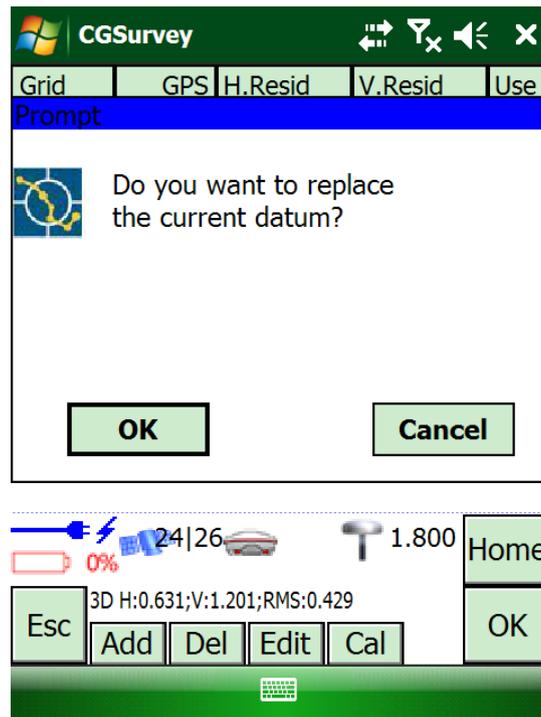


- After adding all the points in the list, click **Cal** button, the software will calibrate all the points inputted, and the "H.Resid" (3 points appear this value) and "V.Resid" (4 points appear the value) will be available.



CAUTION: The Max value of H.Resid has to be less than 0.015m
The Max value of V.Resid has to be less than 0.02m

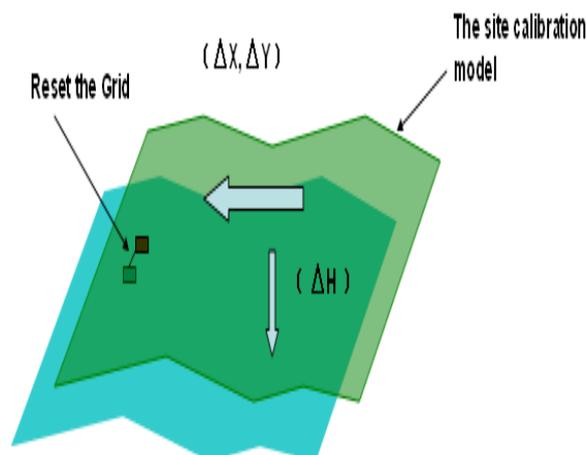
- If the Value of "H.Resid and V .Resid" meet the requirement of Max value, click **OK**, a pop box will appear "Do you want to replace the current datum? ", click **OK**, and finish the step.



6.2.2 Reset Grid Function

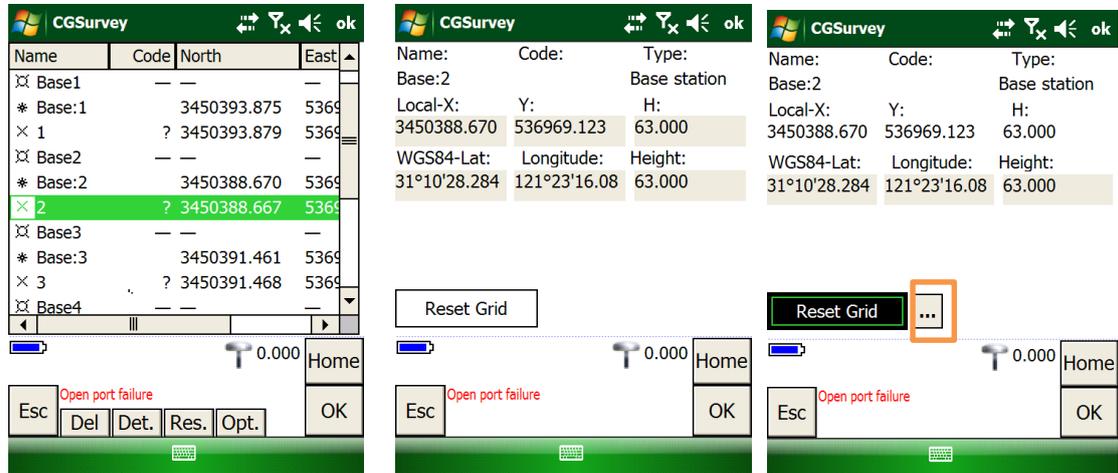
In one project, the site calibration function can be done in 1 time. All the points collected will be applied the site calibration parameters. The Reset grid function is used to shift the point's coordinates under the same base station, this function is often used when Base station work as **Auto base** mode.

Reset Grid option is also a unique function of CGSurvey. After doing site calibration, the relationship between WGS84 and local grid coordinate is fixed, later you start your work in different area on the same project, the base station will be moved to different places, so you need 1 point to shift your RTK coordinates between different base stations.

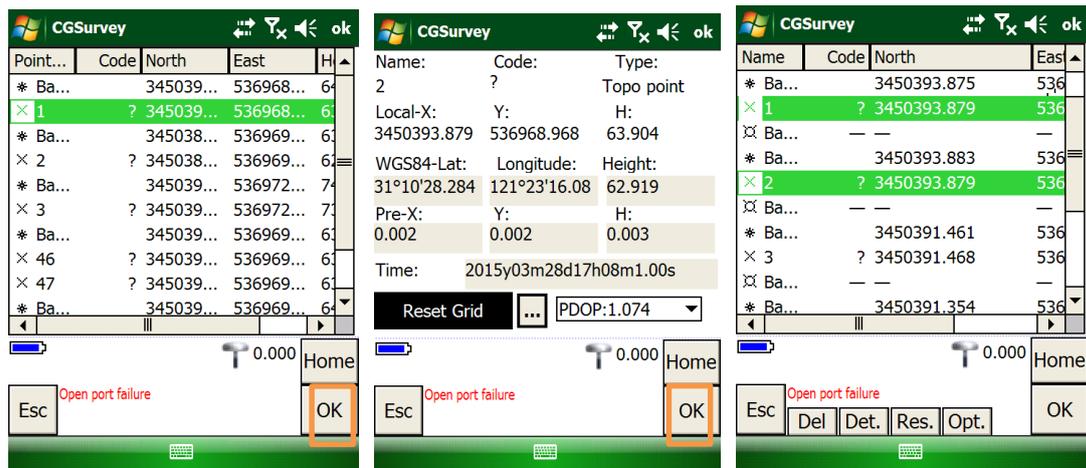


For example:

In this project, you have 3 base station (base moved to 3 different place and only point 1 is the know value), at each base you measure 1, 2, 3 points. Point 1 and 2 and 3 is the same position on the ground. How to shift point 2&3 to the know value? Select 2, and double click, you will see Reset Grid button.



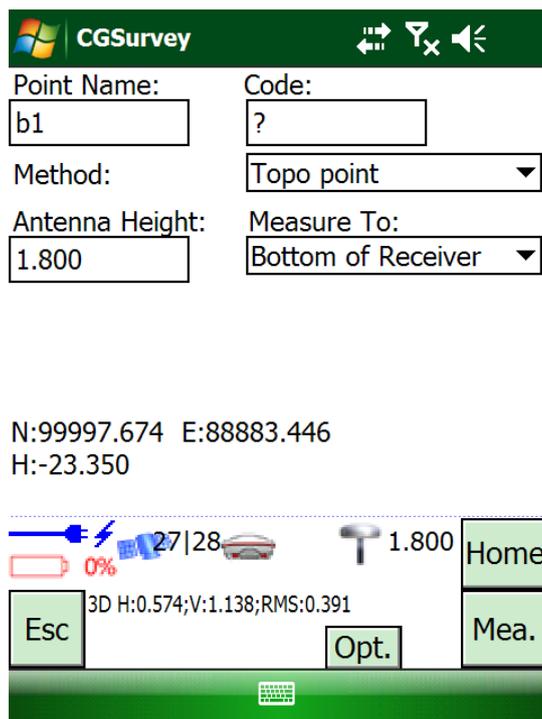
Chose 1 (related know value), and click ok. Check the points again, 2 and 1 is same coordinates but 3 is same as before.



7 CGSurvey Basic Function

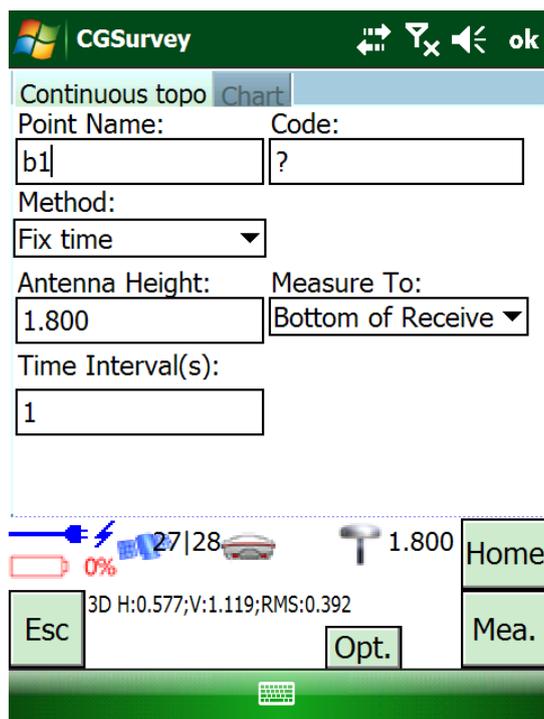
7.1 Measuring Points

- Tap **Survey**->**Measure**->**Measure Points**, then you can measure points.
- After setting all parameters, tap **Mea.** And the point coordinates will be saved in the Job.



7.2 Continuous Topo

The function of continuous topo is in **Survey**-> **Measure**->**Continuous Topo**.

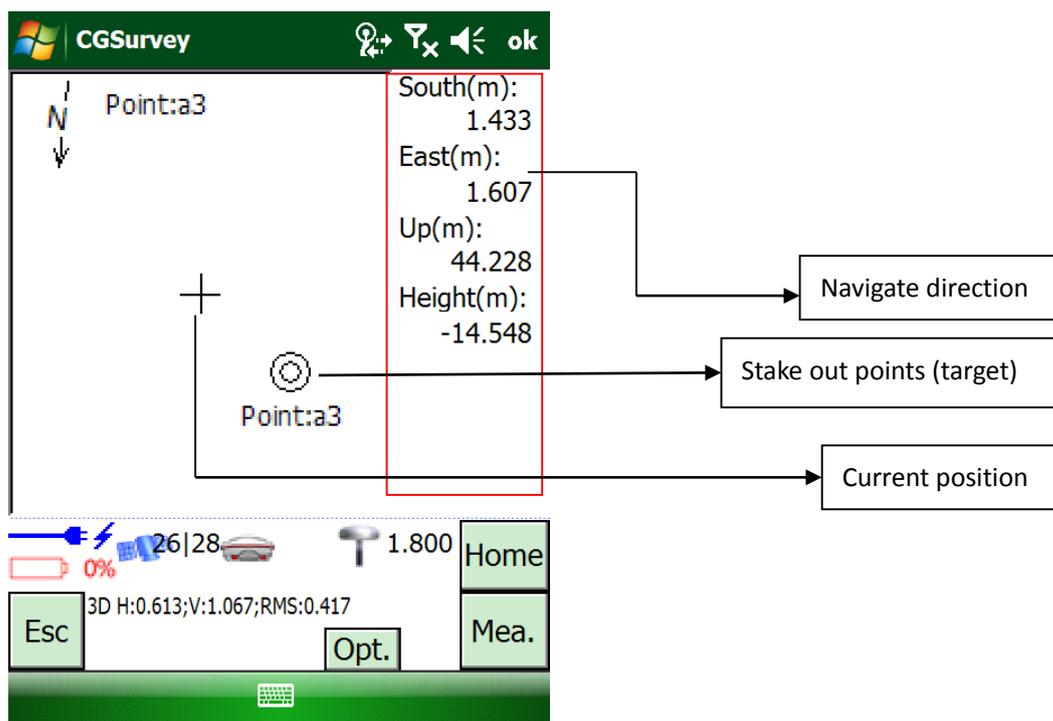
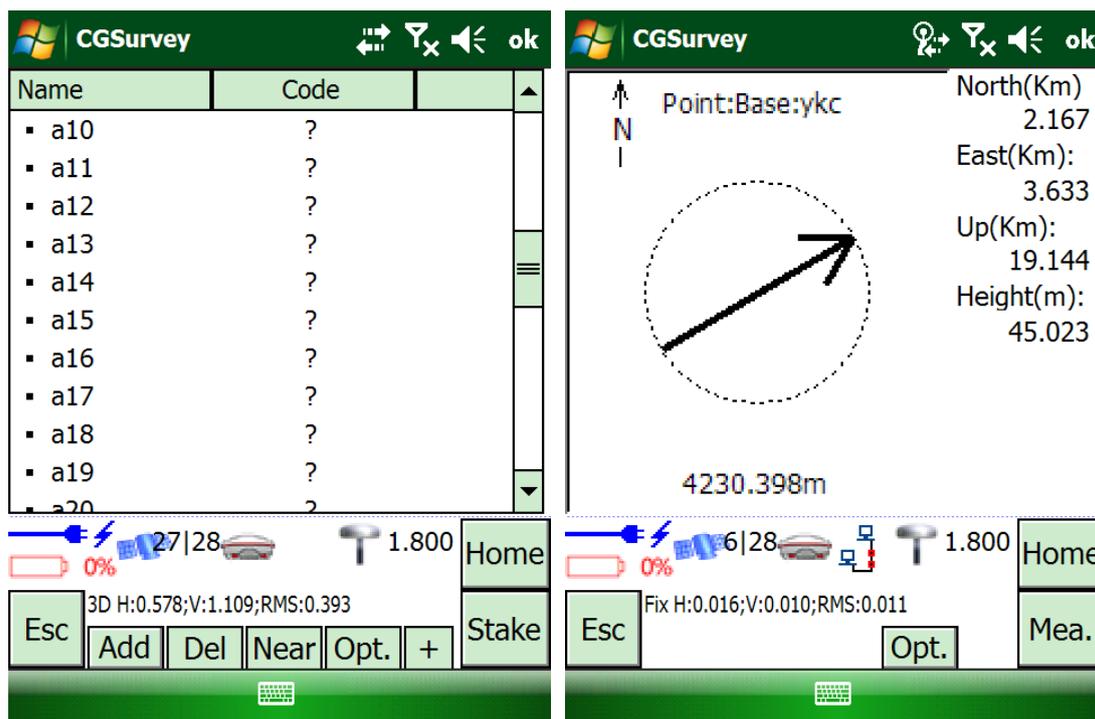


The same as Measure Points function but continuously. It offers 4 different ways to measure point: Fix Time, Fix Distance, Time and Distance and Time or Distance.

*Tip: if you use **5Hz interval** (see chapter 5.2.3), you will find it is refreshing rapidly. This function can also be used in stake out and can improve your efficiency.*

7.3 Staking out Points

- Uploading the stake out points to the current job, and do site calibrations.
- Tap **Survey**->**Stake Points**-> **Add** to add the stake out points to the points list. Then select the point name you want to stake and tap **Stake**.

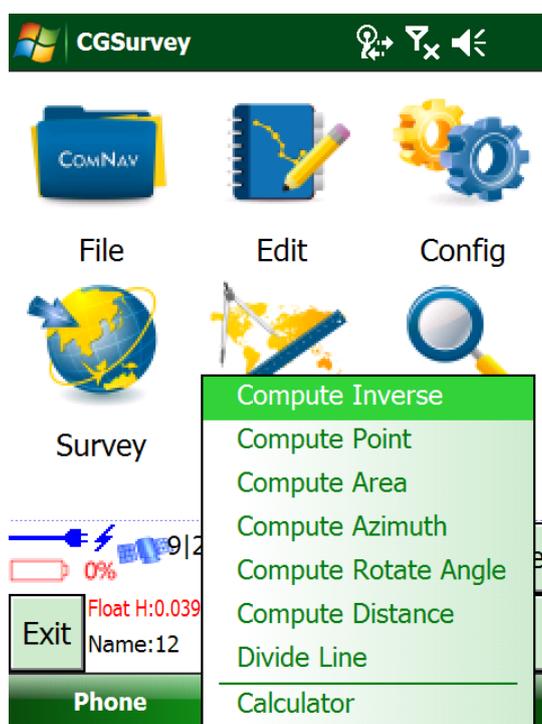


- When the receiver gets **near the target**: when you reached the target position exactly, CGSurvey will make a sound to show that you are on the target position. If you want to measure this point, tap **Mea.**

Tip: **5Hz interval** function (see chapter 5.2.3) can also be used in stake out and can improve your efficiency.

7.4 Cogo

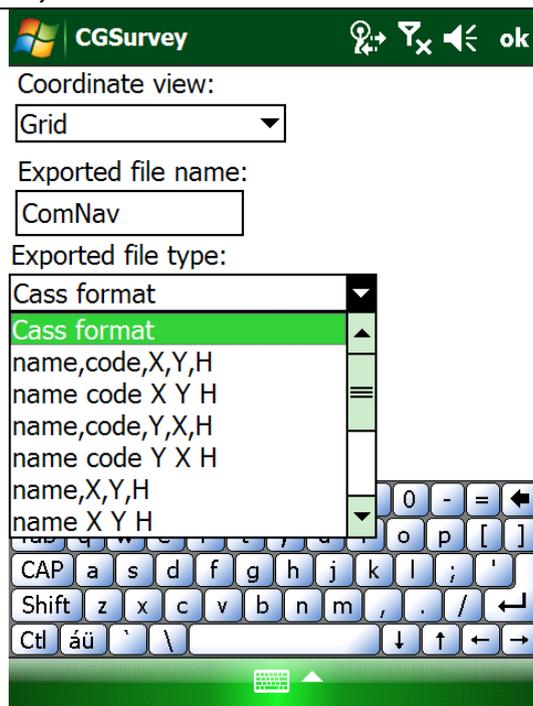
The function of COGO in CGSurvey is composed by **Compute inverse**, **Compute point**, **Compute area**, **Compute azimuth**, **Compute rotate angle**, **Compute distance**, **Divide line** and **Calculator**.



7.5 Export Points to PC

The data can be exported to PC after field work.

- Launch CGSurvey and open your Job. Then tap **File** -> **Export** -> **points**, select the coordinate frame, give the new file a name and choose a file type > **OK**.

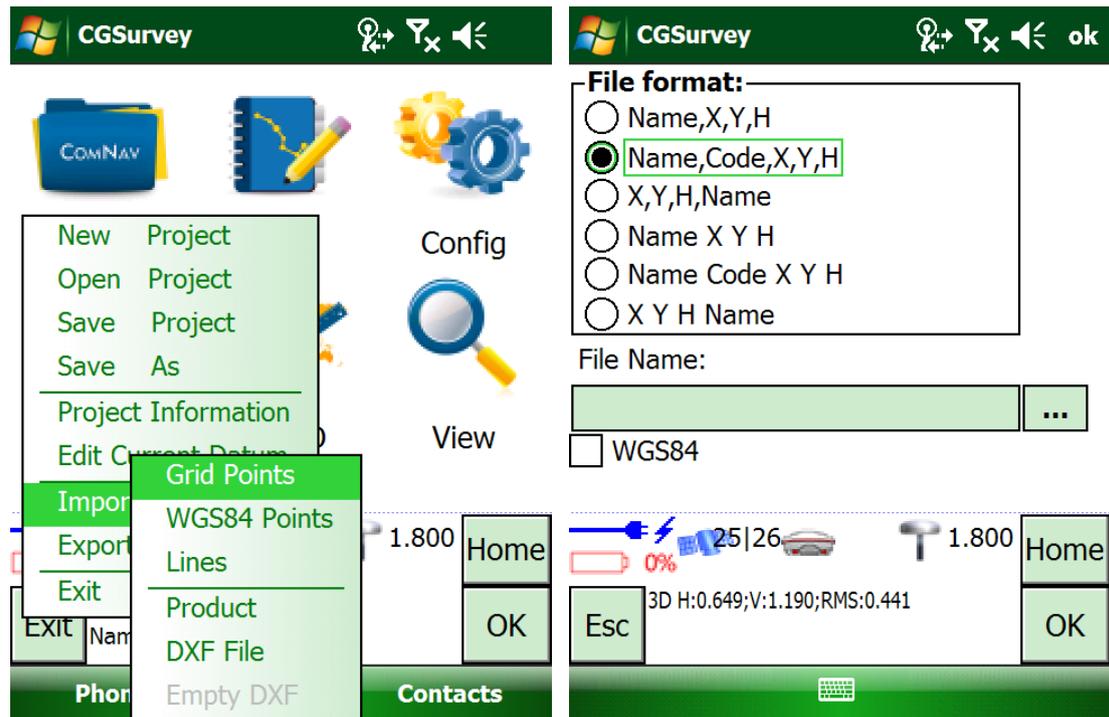


- Connect the Controller to PC using the USB cable. You can find your export result in the path: Your Controller\\Program Files\CGSurvey\Project

7.6 Import Points to Current Job

Do the followings issues indoor:

- Prepare the right format (*.txt or *.csv) coordinates files on your PC.
- Connect the Controller to your PC using the USB data cable.
- Copy the existing coordinates file to your Controller root directory.
- On the Controller, launch CGSurvey and tap **File->Import->Grid point** (local points coordinate), select the right format of the points according, choose the file copied to Controller, and click **“OK”**



Appendix A 7 Pin Lemo Definition

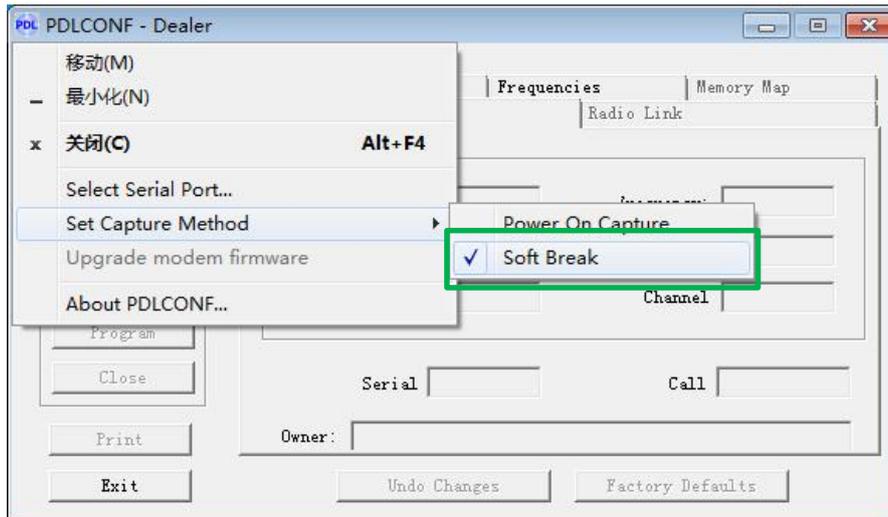


| 7 pin Lemo | Description |
|-------------------|----------------------|
| 1 | Signal GND |
| 2 | GND |
| 3 | TX data out (TXD) |
| 4 | NONE |
| 5 | NONE |
| 6 | Power In (+) |
| 7 | Serial data in (RXD) |

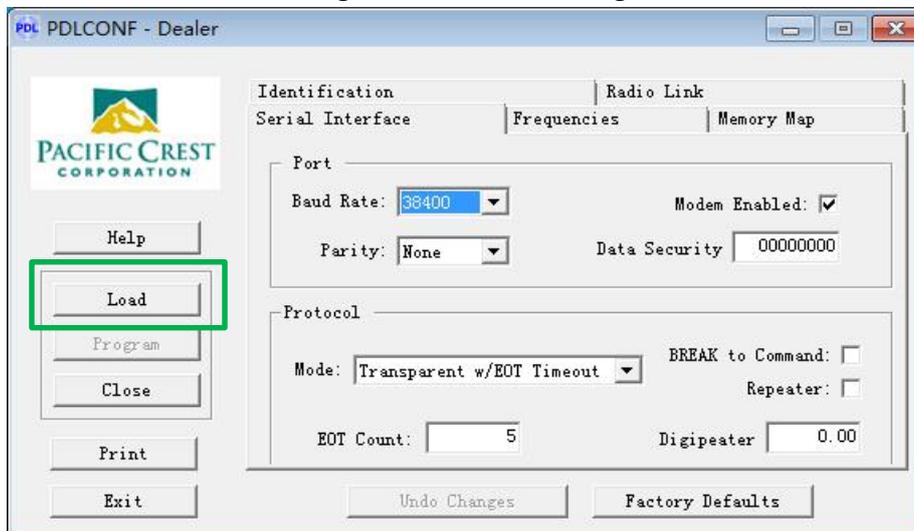
Appendix B Setting up of PDL

Please follow the steps below to configure PDL:

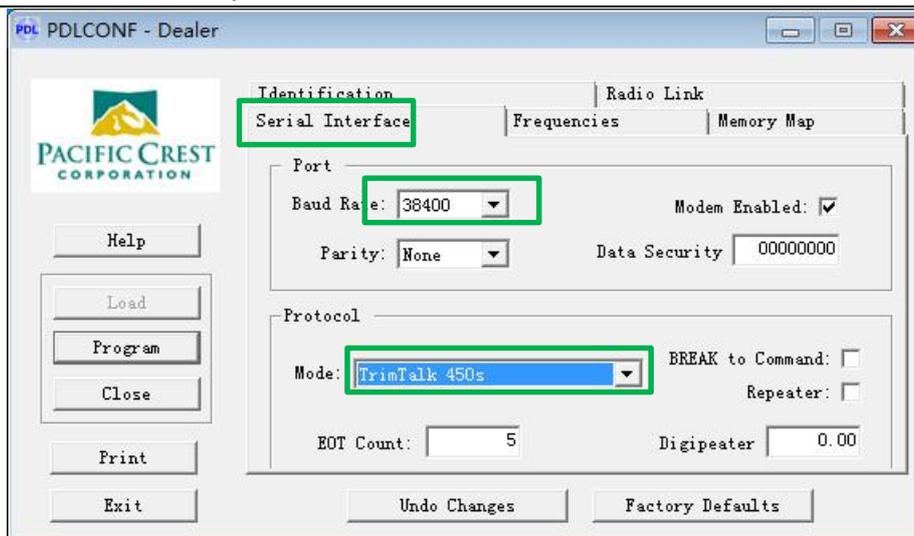
- 1) Connect PDL to your PC with Lemo to RS232 cable and connect the external battery with power cable.
- 2) Open the PDL configure software, select the serial port of PC, right click on the status bar and then tap **Set Capture Method->Soft Break**, just like the figure below.



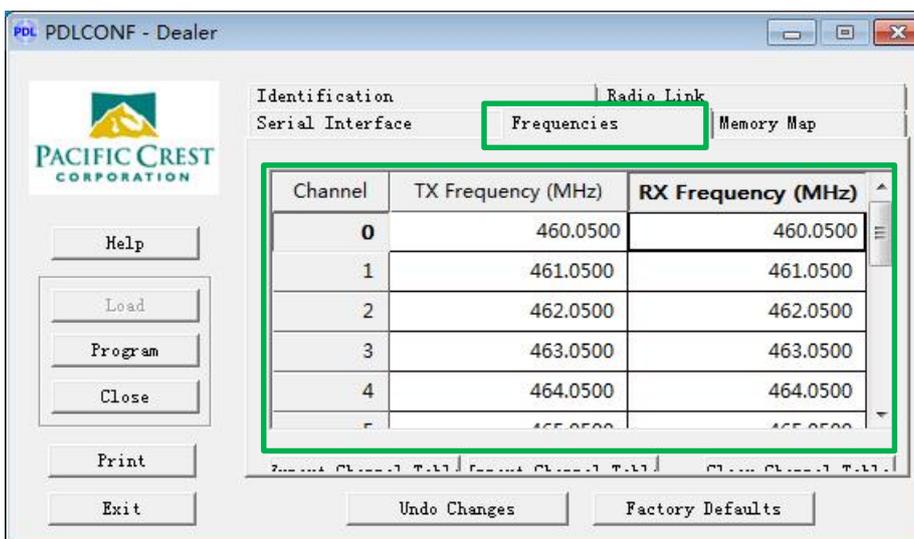
- 3) Click the button **Load** to get the current settings



- 4) Choose the term **Serial Interface** to set the Baud Rate (default 38400bps) and Protocol Mode. The T300 receiver supports two protocols: **Transparent w/EOT Timeout** and **TrimTalk 450s**. As shown in figure below.



- 5) Switch to term **Frequencies** to configure the output frequency of PDL, you can input the values of Tx/Rx frequencies for corresponding channel according to your own need. Just like the figure below.



- 6) After input all the frequencies, click the button **Program** to save all the settings, and then you have completed the configuring, click button **Exit** to exit.

To set up external radio mode, link the long whip antenna mounted highly on another tripod to PDL. Then Connect T300 to PDL with Lemo cable and connect the external battery with power cable. Finally, choose appropriate channel on PDL (see chapter 6.1.4 for software operation). The cable connection of PDL is shown in the figure below.



PDL Default Setting

Default Protocol: Transparent

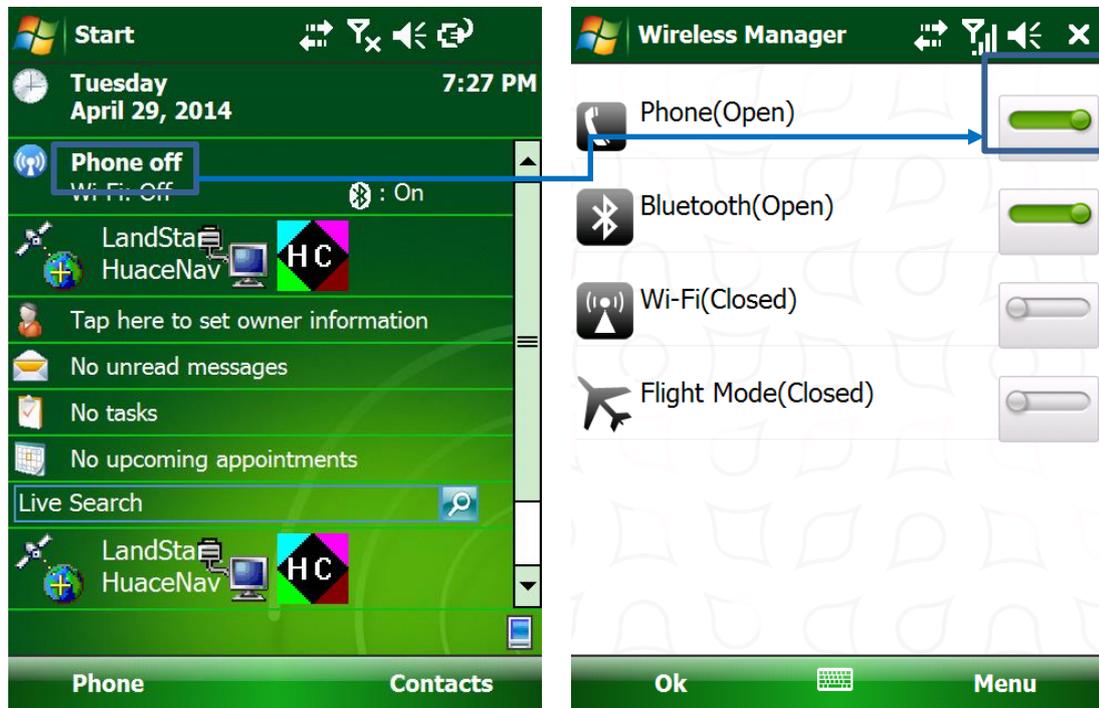
Default Baud rate: 38400

Default frequency of each channel:

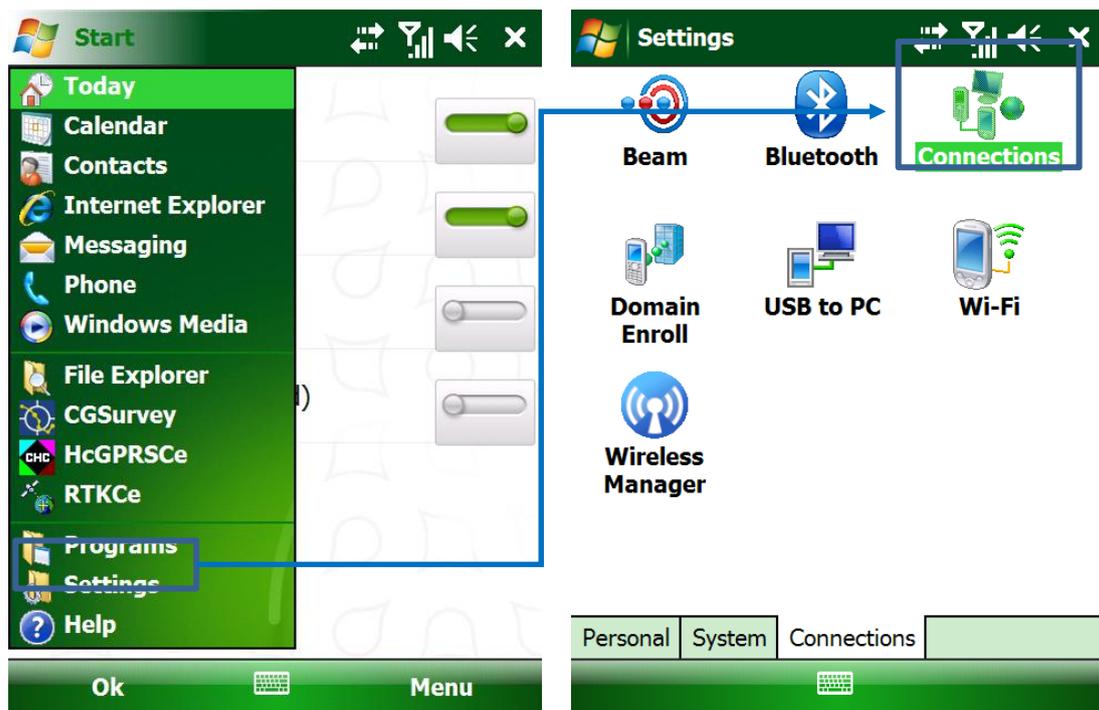
| Number on PDL | Frequency |
|---------------|-----------|
| 0 | 460.050 |
| 1 | 461.050 |
| 2 | 462.050 |
| 3 | 463.050 |
| 4 | 464.050 |
| 5 | 465.050 |
| 6 | 466.050 |
| 7 | 467.050 |
| 8 | 468.050 |
| 9 | 469.050 |

Appendix C Set Controller Log on the Internet

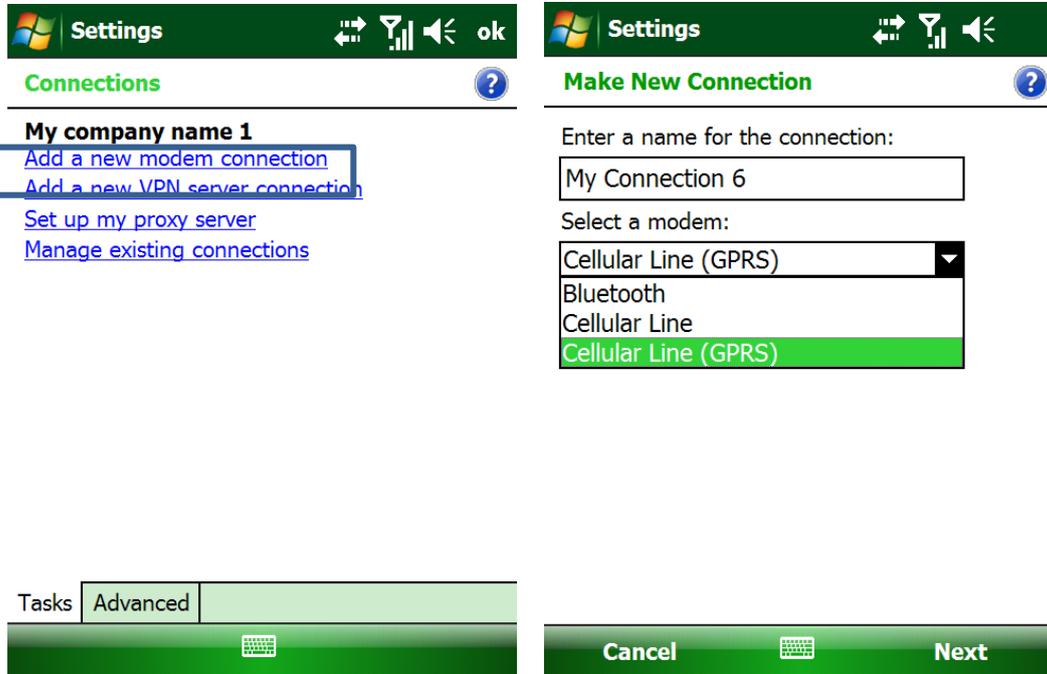
GSM/GPRS connection: Input SIM card into your controller, and you may find **Phone off** on controller screen. Then click it to turn on the Phone, you will see the mobile network signal.



Go to **Settings**, then **Connections**.



Add a new modem connection at first time, enter a name for the connection as you like and choose **Cellular Line (GPRS)**. Then click several **Next** and finish (no need to key in).



If there is existing GPRS connections, click **Manage existing connections**, then long

press on the existing GPRS connection and connect it. You will see  turn to . It means you have connected to the Internet.

