

Oscar-TAP GNSS Receiver

User Manual



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Revision History

| Version | Revision Date | Change Summary |
|----------------|----------------------|-----------------------|
| 1.0 | 20230711 | Initial Release |
| 1.1 | 20240607 | Update TAP parameters |

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The Declaration of Conformity may be obtained from Tersus GNSS Inc.

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R-C-Tgn-51820301133

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Make sure that you have read and understood all safety requirements before you start using Tersus product.

Conventions


The following conventions are used in this manual:


| | |
|---|---|
| ! | Information that supplements or clarifies text. |
|---|---|


| | |
|---|---|
|  | A caution that actions, operation or configuration may lead to incorrect or improper use of the hardware. |
|---|---|

| | |
|---|---|
|  | A warning that actions, operation or configuration may result in regulatory noncompliance, safety issues or equipment damage. |
|---|---|

The following notices apply to all three versions of Oscar-TAP GNSS receivers.

| | |
|---|--|
|  | Operating or storing the receiver outside the specified temperature range can damage it. |
|---|--|

| | |
|---|---|
|  | Changes or modifications to this equipment not expressly approved by Tersus could void the user's authority to operate this equipment or even has risk to damage the receivers. |
|---|---|

| | |
|---|---|
|  | DO NOT use the receiver in a thunderstorm as there is increasing risk of being struck by lightning. |
|---|---|



Install the radio antenna before switching the radio transceiver to transmit mode, or the radio transceiver may be damaged due to overheating. The energy to be transmitted cannot be emitted out without the antenna, which may cause the temperature rise and overheat of the radio module.



Safety: exposure to radio frequency (RF)

Exposure to RF energy is an important safety consideration. Although our product is compliance with the safety standard released by various standard organizations, the following precautions are recommended to ensure low exposure to radio frequency radiation.

- DO NOT operate the transmitter when someone is within the following distances of the antenna:
 - Bluetooth, Wi-Fi, GSM/UTMS – less than 20cm
 - 410-470MHz UHF radio – less than 47cm
- DO NOT operate the transmitter unless all RF connectors are secured and any open connectors are properly terminated.
- DO NOT operate the equipment near electrical blasting caps or in an explosive atmosphere.
- All equipment must be properly grounded.
- All equipment should be serviced only by a qualified technician.

Related Documentation

Table 0.1 Document and software used in this user manual

| Name | Description | Link |
|-------------------------|--|---|
| Log & Command document | Document providing all the loggings output from BX series receivers and all the commands to the receivers. | https://www.teresus-gnss.com/document under GNSS OEM Board / User Manual |
| Tersus Tool Suite | Tersus Tools including TersusDownload, TersusGeoPix, TersusGNSSCenter, TersusUpdate, TersusRinexConverter | https://www.teresus-gnss.com/software |
| Nuwa | Survey application running in the Android platform, David, Oscar-TAP and other NMEA devices can be configured with Nuwa. | https://www.teresus-gnss.com/software/TAP |
| Tersus Geomatics Office | Post processing tool for static data. | https://www.teresus-gnss.com/software/david-receiver |

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If there is any problem and the information needed cannot be found in the product documentation, log a technical support ticket in our tracking system

<https://teresus.supportsystem.com/> , or mail to support@teresus-gnss.com.

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1. Introduction

This chapter includes overview, receiver features, and devices in the package.

1.1 Overview

The Oscar-TAP GNSS receiver is a new generation GNSS RTK system. It supports calibration-free tilt compensation function which is immune to magnetic disturbances, leveling pole is not required. Easy configuration with 1.54 inch interactive screen on Ultimate versions. With an internal high-performance multi-constellation and multi-frequency GNSS board, the Oscar-TAP GNSS receiver can provide high accuracy and stable signal detection. The high-performance antenna can speed up the time to first fix (TTFF) and improve anti-jamming performance. The built-in large capacity battery is detachable, two batteries support up to 16 hours of field work in 4G/3G/2G network and Rover radio mode. The built-in UHF radio module supports long distance communication. The rugged housing protects the equipment from harsh environments.

The Oscar-TAP GNSS receiver has three versions: Ultimate and Basic. It provides selectivity for the requirement from different users.

1.2 Receiver features

The Oscar-TAP GNSS receiver has following features:

- Supports multiple constellations & frequencies
 - GPS L1C/A, L2C, L2P, L5
 - GLONASS L1C/A, L2C/A
 - Beidou B1, B2, B3 , support BDS-3
 - Galileo E1, E5a, E5b
 - QZSS L1C/A, L2C, L5
 - SBAS supports WAAS, EGNOS, GAGAN, SDCM, MSAS (Optional for Oscar-TAP Basic)
 - L-Band
- Supports 576 channels.
- Supports 410-470MHz UHF radio, 4G network, Wi-Fi, Bluetooth, NFC.
- Tilt compensation without calibration, immune to magnetic disturbances (1).
- 16GB/8GB internal storage
- Up to 16 hours⁽²⁾ working in 4G/3G/2G network and Rover radio mode
- IP68-rated dust- & waterproof enclosure, for reliability in harsh environmental conditions
- Free subscription of Tersus Caster Service (TCS): transmit the correction data from Oscar-TAP Base to Rover

Note:

(1) Tilt compensation is only applicable for Ultimate version.

(2) One battery lasts up to 8 hours when Oscar-TAP works in 4G/3G/2G network and Rover radio mode. Two batteries add up to total 16 hours use.

1.3 Devices in the package

The devices in the package may vary according to the customer requirement. Here describes the major parts in the package.

1.3.1 Oscar-TAP GNSS receiver

The Oscar-TAP GNSS receiver has three versions which are shown as below.




Figure 1.1 Oscar-TAP GNSS receiver - Ultimate



Figure 1.2 Oscar-TAP GNSS receiver - Basic

Buttons

Two buttons are equipped on each version of Oscar-TAP GNSS receiver.

[]: Power ON/OFF button. When the device is off, long press it for 2 seconds to power on the receiver. When the receiver is on, long press it for over 3 seconds to power off the receiver. In addition, for Ultimate versions, in normal operation state this button is used as function selection confirmation button working with the FN button which is explained below.


[]: Function (FN) button. This button has different functions for different versions which is listed in the table below.

Table 1.1 Usage of FN button for three versions

| FN button | Ultimate | Basic |
|-----------------------|--|--|
| Selecting / Switching | On the Device Config page, press it once to lead the cursor jump to the next row or next page or previous page. When the cursor stops at an item, pressing the power button enters the sub menu of this item for function selecting or return. | Switch static survey. After pressing it for 3s to turn on the static recording function. Then press it to turn on the static mode. Press and hold it for 3s to turn off the static function. |
| Wake up | Tap the power button or FN button to wake up the OLED screen when the OLED screen is off. | N/A |

Combination Function of the two buttons

Press and hold the FN button, continuously tap the ON/OFF button 5 times to reset the GNSS module and make it re-search the satellites. Detailed LED flash status related to this operation refers to the LED flash patterns table.

LED Indicators

Four LED indicators and **one** OLED display screen are for Ultimate version. **Six** LED indicators are for Basic version of Oscar-TAP GNSS receiver. The LEDs on the front panel indicate various operating conditions. The detailed LED Descriptions are shown in the tables below.

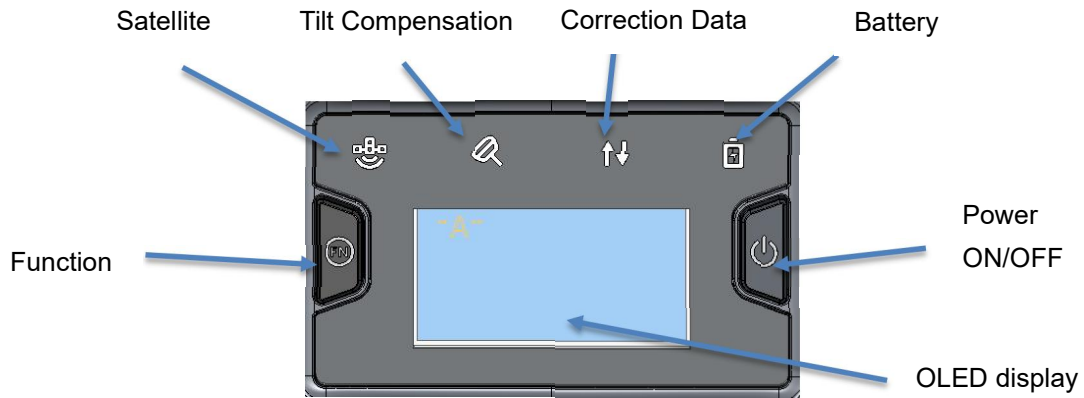






Figure 1.3 Buttons and display on Oscar-TAP Ultimate

Table 1.2 LED indicators on Ultimate version

| LED indicator | Description |
|--|--|
|  Satellite | Green LED. Flashing every 5 seconds indicates that it is searching satellites. After satellites are searched, it flashes N times every 5 seconds, in which N indicates N satellites are found. |
|  Tilt compensation | Green & Red LED. When tilt compensation is turned on, it is steady red; when it is preparing for tilt compensation, it flashes red; when tilt compensation is valid, the LED is steady green. |
|  Correction data | Green and Red LED. Green indicates correction data, and red indicates solution status. |
|  Battery | Green LED. Steady green in normal operation. Slow flash indicates the battery level is between 30% and 10%. Fast flash indicates the battery level is below 10% and reminds users to change battery. |

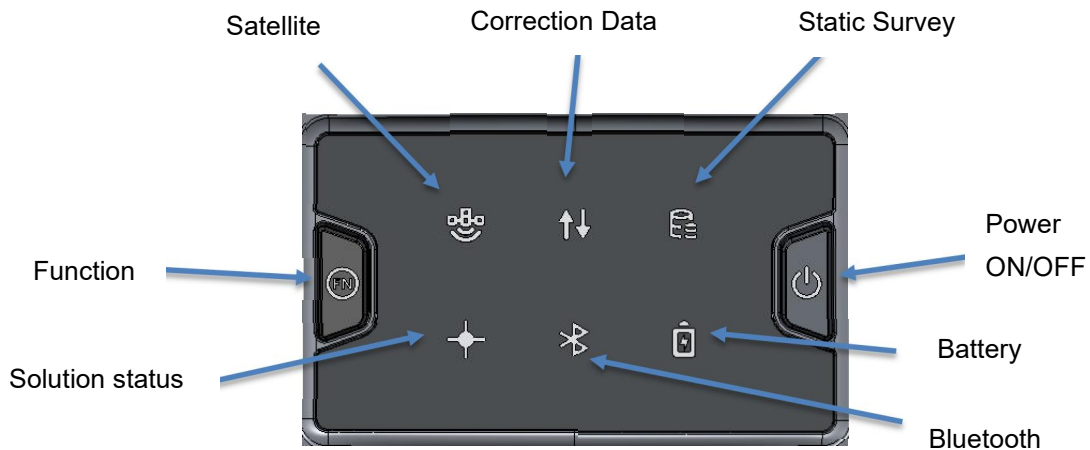








Figure 1.4 Buttons and LEDs on Oscar-TAP Basic

Table 1.3 LED indicators on Basic version

| LED indicator | Description |
|--|--|
|  Satellite | Green LED. Flashing every 5 seconds indicates that it is searching satellites. After satellites are searched, it flashes N times every 5 seconds, in which N indicates N satellites are found. |
|  Correction data | Green LED indicates correction data. |
|  Static Survey | Green LED indicates static survey mode. |
|  Solution status | Green LED. Steady green indicates fixed solution, flashing 1Hz indicates floating solution, off light for other solutions. |
|  Bluetooth | Green LED indicates Bluetooth status. Steady green indicates successful Bluetooth pair, off light indicates no Bluetooth paired. |
|  Battery | Green LED. Steady green in normal operation. Slow flash indicates the battery level is between 30% and 10%. Fast flash indicates the battery level is below 10% and reminds users to change battery. |

LED Flash Patterns

The possible flash patterns of various states of receiver operation are listed in the table below.

Table 1.4 Possible LED flash patterns

| Receiver mode | Button operation | LED flash patterns |
|-----------------------------|--|---|
| Receiver OFF | N/A | All LEDs are off. |
| Receiver ON | Long press the power button for 2s | All LEDs are on, then all off, and each LED starts to indicate current status after initialization. |
| Low power | N/A | Battery LED flashes slow. |
| Battery exhausting | N/A | Battery LED flashes fast. |
| Searching satellites | N/A | Satellite LED flashes every 5s |
| Satellites tracked | N/A | Satellite LED flashes N times every 5s, in which N is the quantity of satellites tracked. |
| Receiving valid data packet | N/A | Correction data LED flashes green at 1Hz |
| Fixed solution | N/A | Correction data LED is steady red for Ultimate versions, Solution status LED is steady green for Basic version. |
| Floating solution | N/A | Correction data LED flashes red at 1Hz for Ultimate versions, Solution status LED flashes green at 1Hz for Basic version. |
| Reset GNSS module | Press and hold the FN button, continuously tap the ON/OFF button 5 times | All LEDs light up for 5 seconds. |
| Turn on static mode | Press FN button for 3s | Static/Tilt LED flashes 3 times continuously. |
| Turn off static mode | Press FN button for 3s | The correction data LED flashes 3 times continuously. |
| Firmware upgrade | N/A | For Basic version, all six LEDs are on for 1s thereafter only power LED lights up, then all LEDs light up when upgrading, lights off when restarting. Then all six LEDs light up for 1s thereafter only power LED lights up means it restarts successfully with updated firmware. |

Note: N/A means Not Applicable.

Receiver Ports

The bottom of Oscar-TAP receiver is shown as below.

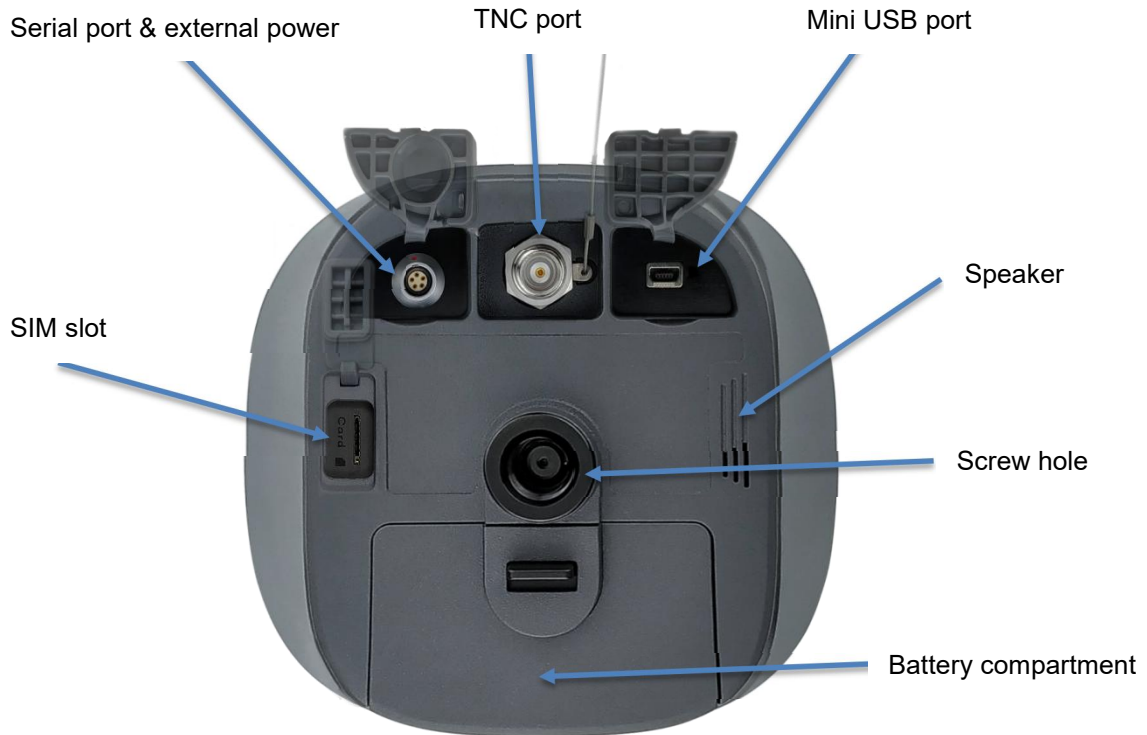
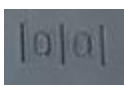








Figure 1.5 Bottom of Oscar-TAP GNSS receiver

Table 1.5 Receiver ports on the bottom side

| Icon | Connector | Name | Connections |
|---|---|------------------------------|--|
|  |  | Serial port & external power | External power, RS-232 communication, external radio |
|  |  | Mini USB port | Device, computer, USB drive |
| SIM |  | SIM slot | Nano SIM card |
| - |  | TNC port | 410-470MHz radio antenna |
| - |  | Screw hole | 5/8" x 11 UNC-2B connector for corresponding connector and pole. |

1.3.2 Battery and charger

Oscar-TAP equips smart lithium batteries which can detect electricity and display the power level intelligently. The Oscar-TAP GNSS receiver can also be powered by external power source via serial data port. The built-in large capacity battery is detachable, two batteries support up to 16 hours of field work in 4G/3G/2G mode and rover radio mode.

The BN20 battery is shown as below. Press the button on the top, it shows the power level left to be consumed.



Figure 1.6 BN20 Battery

The CN20 Charger is able to charge two BN20 batteries at the same time which is shown in the figures below.



Figure 1.7 CN20 Charger

Place two BN20 batteries in the slots of CN20 charger.



Figure 1.8 CN20 Charger with two BN20 batteries

Insert the DC Jack connector of the adapter to the CN20 charger, then make the adapter with cable plug in the local AC outlet (100~240V AC) to start charging.



Figure 1.9 CN20 Charger Adapter

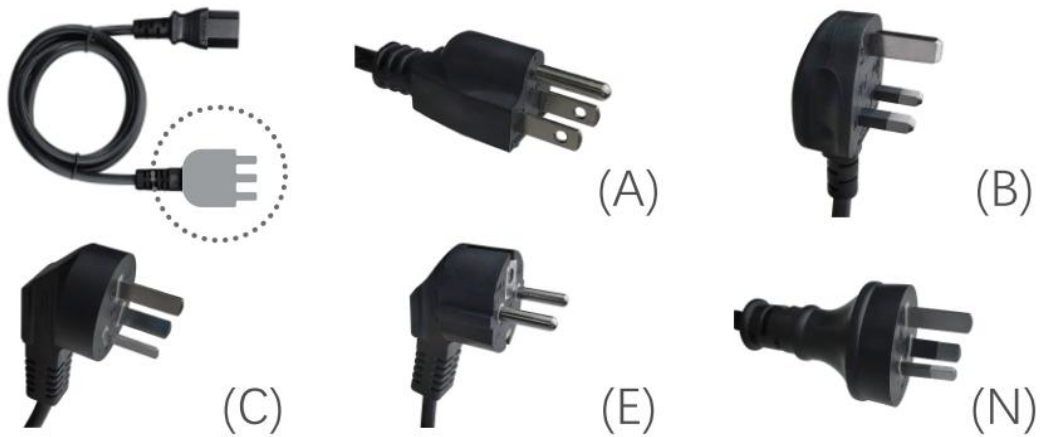


Figure 1.2 CN20 Charger Adapter Cable (A/B/C/E/N)

Note: The model of the CN20 charger adapter cable will be delivered according to customer requirements.

A: American, B: British, C: Chinese, E: European, N: Australian

Charge the battery completely before using it for the first time. The charging takes approximately 3 hours per battery at room temperature. If the battery has been stored for longer than three months, charge it before use.

1.3.3 TC20 controller

The Tersus TC20 Controller is a rugged android smart phone with design of 4.3" touch screen and an alphanumerical keypad. Equipped with powerful processor, it is perfect to adapt with Tersus Survey software. With professional IP68 rating, it is robust and reliable for harsh operating conditions.

Features:

- Rugged smart phone 4.3" display
- 4G GSM unlocked Android 6.0
- Quad-Core 1.3GHz CPU
- 2GB RAM + 16GB ROM
- 8 MP Auto Focus camera
- IP68 certified grade, water/shock/dust proof
- 6500 mAh battery
- Wi-Fi, Bluetooth, NFC
- Two color options: red and yellow

Note: Although the TC20 controller uses chemical and impact resistant materials, precision instruments require careful use and maintenance and should be kept as dry as possible. In order to improve the stability and life cycle of the TC20 controller, avoid exposing the TC20 controller to extreme environments such as moisture, high temperatures, low temperatures, corrosive liquids or gases.



TC20 must be in the specified temperature range -20 °C ~ 55 °C when used and stored.

Power on: Press and hold the power button for 3 seconds. Short press to wake up the screen.

Power off: Press and hold the power button for 3 seconds, select 'power off' in the menu option.



Figure 1.3 Four sides of TC20 controller

Menu key: Select to show the available menu in current screen.

Home key: Return to home screen. Press and hold it to view recent application.

Back key: Return to previous screen.

APP key: launch Nuwa app.

Point key: collect point manually under survey interface.

FN key: shift keypad language under some input method.

OK key: confirm or wrap to the next line.

Accessories of TC20 controller:

TC20 lithium battery (3.7V/6500mAh)



Figure 1.4 TC20 lithium battery

TC20 charger adapter (5V/1A) with one USB port



Figure 1.5 TC20 charger adapter



Figure 1.6 TC20 charger adapter plugs

A: American, B: British, C: Chinese, E: European, N: Australian

Put the plug in in the back of the adapter to assemble the TC20 charger.

The hand strap below is for easy handling of TC20 controller.



Figure 1.7 TC20 controller hand strap

The stylus pen below is for easy touch of screen on TC20 controller.



Figure 1.8 Stylus pen for TC20

1.3.4 TC50 controller

The Tersus TC50 Controller is a rugged multi-functional data controller with design of 5 inch sunlight readable HD touch screen and an alphanumerical keypad. Equipped with powerful processor and android operating system, it is perfect to adapt with Tersus survey software. With professional IP68 rating, it is robust and reliable for harsh operating conditions. The large capacity lithium battery guarantees more than 10 hours of field working for a whole day of multiple surveying tasks.

Features:

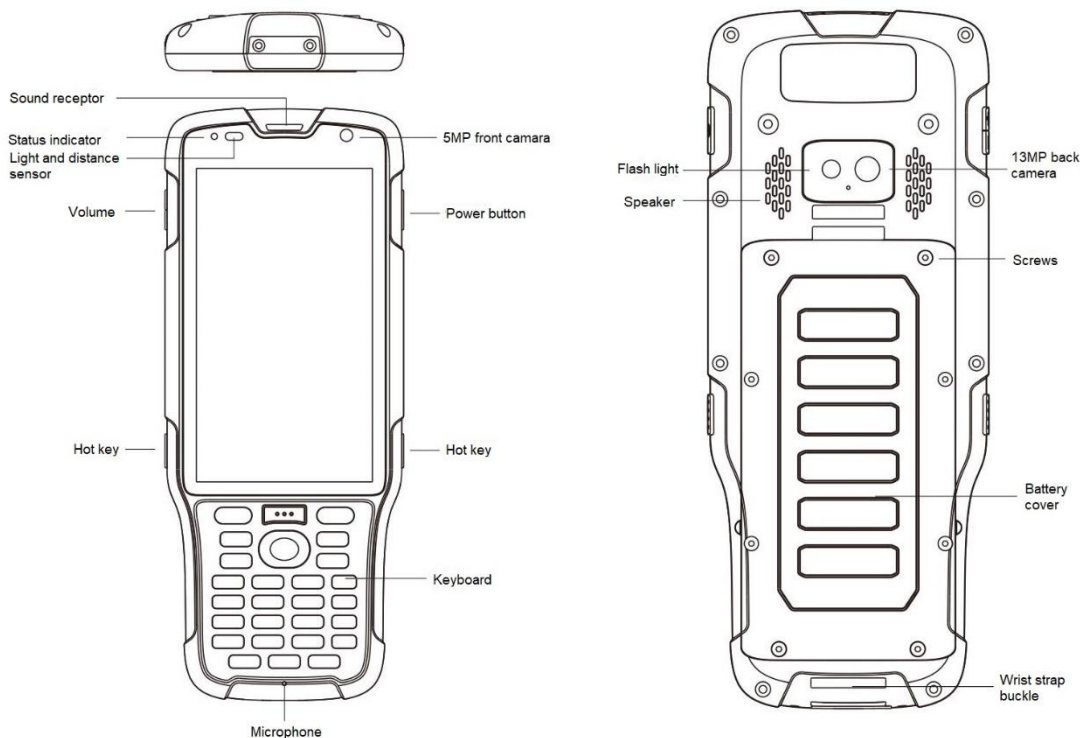
- 5 inch sunlight readable HD touch screen
- Octa-core 2.0GHz CPU
- Android 8.1 operating system
- 4GB RAM + 64GB ROM

- 5MP front camera and 13MP rear camera
- IP68 certified grade, water/shock/dust proof
- 7000mAh battery
- Wi-Fi, Bluetooth, NFC, 4G
- USB Type-C

Note: Although the TC50 controller uses chemical and impact resistant materials, precision instruments require careful use and maintenance and should be kept as dry as possible. In order to improve the stability and life cycle of the TC50 controller, avoid exposing the TC50 controller to extreme environments such as moisture, high temperatures, low temperatures, corrosive liquids or gases.



TC50 must be in the specified temperature range -20 °C ~ 55 °C when used and stored.




Power on: Press and hold the power button for 3 seconds

Power off: Press and hold the power button for 3 seconds, select 'Power Off' in the menu option.

Reboot: Press and hold the power button for 2 seconds and click "Restart" in the menu option.

Forced restart: Press and hold the power button for 8 seconds to force the controller to restart.

Introduction of functional keys:

- **Menu Key:** Select to show applications that was used recently.
- **Home Key:** Return to home screen. To view recent application, press and hold the home key.
- **Back Key:** Return to previous screen.
- **APP Key:** Quick start Nuwa application.
- **Blue Positioning  Key:** Perform the function of starting measurement in the Survey and Stakeout interface of Nuwa application.
- **Yellow Bulb Key:** Control the screen on and off.

ENTER Key: Execute the function of confirming in Nuwa application.

The accessories of TC50 Controller are listed below.

TC50 Lithium Battery (3.8V/7000mAh)



TC50 Charger (5V/1.67A, 7V/1.67A, 9V/1.67A)



Type-C Cable



Functions:

1. Connect to the USB port of computer for data downloading;
2. Connect to the charger to charge TC50 controller.

1.3.5 External radio for Oscar-TAP

The external radio RS400H3 for Oscar-TAP below is to be installed via serial data port, and it can help Oscar-TAP transmitting signals farther than internal radio.



Figure 1.9 External radio for Oscar-TAP

When using external radio for Oscar-TAP as a base, a high gain radio antenna and a telescopic pole are needed which are shown as below.



Figure 1.18 High gain radio antenna



Figure 1.19 Telescopic pole for radio antenna

The following Serial-5pin to External-Radio-DC-5pin & Bullet-DC Cable and Bullet-DC to Alligator Clips are used to communicate with Oscar-TAP and connect to external power supply.



Figure 1.10 Serial-5pin to External-Radio-DC-5pin & Bullet-DC Cable



Figure 1.11 Bullet-DC to Alligator Clips

1.3.6 Other accessories

Other accessories may be packed according to customer requirements.

The GNSS antenna connector is used to install Oscar-TAP to a tripod.



Figure 1.12 GNSS antenna connector

The height measure accessory is used to determine the height of Oscar-TAP with higher accuracy.



Figure 1.13 Height measure accessory

The tape measure below is to help measure height.



Figure 1.14 Tape measure

The 410-470MHz radio whip antenna is to be installed on the TNC port to transmit or receive signal for the internal radio.



Figure 1.15 410-470MHz radio whip antenna



Figure 1.16 Mini USB cable

Mini USB cable functions:

1. Connect Oscar-TAP to the USB port of computer for data downloading;
2. Connect the mini USB port of TC20 to charge TC20 controller.

When upgrading firmware with a wire, you need a Mini-USB OTG cable. The detailed usage refers to section 2.4.1.



Figure 1.17 Mini-USB OTG cable

When installing 410-470MHz radio whip antenna on Oscar-TAP, it is necessary to use a 30cm extension pole to heighten Oscar-TAP and avoid bending the 410-470MHz radio whip antenna.



Figure 1.28 Extension pole 30cm

This metal fixing plate is used to fixate the high gain radio antenna to the tripod.



Figure 1.29 Metal fixing plate

When using Oscar-TAP as a rover, you need a ranging pole.



Figure 1.18 Ranging Pole

The bracket for TC20 controller is to fix the TC20 controller on a ranging pole.



Figure 1.19 Bracket for TC20

A yellow carrying case is to store all the devices and accessories except ranging pole, high gain radio antenna and telescopic pole.



Figure 1.20 Carrying Case

The tool bag below is to store high gain radio antenna and telescopic pole for radio antenna.



Figure 1.21 Tool bag

The Serial-5pin to DC JACK & DB9 Male cable and the DC JACK male with two wires (the brown wire connects to power and the blue wire connects to ground) below are optional. It is to power Oscar-TAP using external power source instead of the BN20 battery.



Figure 1.22 Serial-5pin to DC JACK & DB9 male cable



Figure 1.23 DC JACK male with two wires

The DB9 Female to USB Type A Male converter cable is to convert DB9 male to USB Type A male connector, so that it can connect to the USB port of a

computer.



Figure 1.24 DB9 Female to USB Type A Male converter cable

The configuration cable for 25W radio below is used to configure parameters of the 25W radio instead of the default setting.



Figure 1.25 Configuration cable for 25W radio

2. General Operations

This chapter includes setting up, configuration and other related operations.

2.1 Setting up Oscar-TAP

2.1.1 Insert the battery

Open the battery cover, notice the metal contact on the bottom, put one battery align the metal contact position, and make sure the button end is close to the battery compartment.






Figure 2.1 Open the battery cover

Push the battery in the direction of the arrow on the top, the battery is properly installed after a 'click', then close the cover and lock it.



Figure 2.2 Put one battery in Oscar-TAP

More details about batteries refer to section 1.3.2 Battery and charger.

| | |
|---|--|
|  | <p>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.</p> <p>To prevent injury or damage:</p> <ul style="list-style-type: none"> – 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 in hot weather. – DO NOT drop or puncture the battery. – DO NOT open the battery or short-circuit its contacts. |
|  | <p>DO NOT contact with the rechargeable Lithium-ion battery if it appears to be leaking. Battery fluid is corrosive, and contact with it can result in personal injury and/or property damage.</p> |
|  | <p>Discharge a Lithium-ion battery before disposing of it. Dispose of batteries in an environmentally sensitive manner, and adhere to any local and national regulations concerning battery disposal or recycling.</p> |

To remove the battery, slide the battery in the opposite direction of the arrow and then take out the battery from the battery compartment.

2.1.2 Insert the SIM card

When 4G/3G/2G network is chosen for survey operation, you need to insert a nano SIM card into Oscar-TAP GNSS receiver. Insert the nano SIM card with the contacts facing outside which is shown as below.



Figure 2.3 Insert the SIM card

To eject the nano SIM card, slightly push it in to trigger the spring-loaded release mechanism.

Note: The SIM card is provided by your cellular network service provider.

2.1.3 Fix Oscar-TAP on a tripod or ranging pole

Oscar-TAP GNSS receiver has a standard 5/8" x 11 UNC-2B connector and it can be fixed on a tripod or a ranging pole to be a base or rover according to customer requirement.



Figure 2.4 Oscar-TAP as a base without radio antenna

Table 2.1 Devices to set Oscar-TAP as a base without radio antenna

| Device Name | Quantity | Items in the figure |
|--------------------------|----------|-----------------------------------|
| Oscar-TAP GNSS receiver | 1 | 1, details refer to section 1.3.1 |
| Height measure accessory | 1 | 2, details refer to section 1.3.5 |
| GNSS antenna connector | 1 | 3, details refer to section 1.3.5 |
| Tribrach | 1 | 4 |
| Tripod | 1 | 5 |



Figure 2.5 Oscar-TAP as a rover without radio antenna

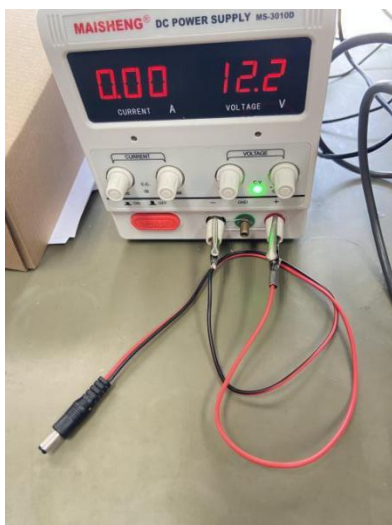
Table 2.2 Devices to set Oscar-TAP as a rover without radio antenna

| Device Name | Quantity | Items in the figure |
|-------------------------|----------|-----------------------------------|
| Oscar-TAP GNSS receiver | 1 | 1, details refer to section 1.3.1 |
| Ranging pole | 1 | 2, details refer to section 1.3.5 |
| Bracket for TC20 | 1 | 3 |
| TC20 Controller | 1 | 4, details refer to section 1.3.3 |

2.1.4 Oscar-TAP external power supply

Oscar-TAP uses two power supply modes. One is powered by a special 7.4V/6400mAh lithium battery, and the other is powered by an external 12V DC power supply. Both can power Oscar-TAP alone or simultaneously. When connected at the same time, Oscar-TAP will automatically select the external 12V DC power supply for power supply, and the battery is in the standby state. Once the external power supply is disconnected, the battery will continue to provide power for Oscar-TAP to ensure that Oscar-TAP will not shut down or restart due to the disconnect of external DC power supply; When connected at the same time, if the external DC power supply voltage of 12V can be guaranteed to supply power, then remove the battery at this time, Oscar-TAP can continue to work without shutting down or restarting.

Taking the external DC power supply as an example, the detailed steps are as follows. Connect the DC male plug with two wires (see Figure 1.36) to the DC power supply (pay attention to the distinction between positive and negative poles), It is then connected to the Oscar-TAP along with a 5-pin serial to DC jack and DB9 male cable (Fig. 1.35). Press the power button for 2 seconds to power on.



2.2 Oscar-TAP configuration

You can configure Oscar-TAP GNSS receiver via buttons, TC20 controller or other android devices.

2.2.1 Configure via buttons

2.2.1.1 Button configuration

The detailed definition of buttons on Oscar-TAP GNSS receiver refers to Table 1.1, and related context. The OLED screen is display for Ultimate versions, and no display for Basic version. Therefore the button configurations are different which are listed below.

Table 2.3 Button configuration for Oscar-TAP Ultimate

| Action | Button operation | Description |
|-----------------------|---|---|
| Turn on the receiver | Press the power button for 2s | All four LEDs light up and remain for 3s, then all go off and battery LED is steady green if battery level is >30%. |
| Turn off the receiver | Press the power button for 3s | All four LEDs light off. |
| Wake up | Tap the power button or FN button to wake up the OLED screen when the OLED screen is off. | Screen off to on. |
| Select | Press FN button | |
| Confirm | Press the power button | Confirm, cancel, or return. |
| Reset GNSS module | Press and hold the FN button, continuously tap the power button 5 times | All LEDs light up for 5 seconds. |

Table 2.4 Button configuration for Oscar-TAP Basic

| Action | Button operation | Description |
|---------------------------|---|--|
| Turn on the receiver | Press the power button for 2s | All six LEDs light up and remain for 3s, then all go off and battery LED is steady green if battery level is >30%. |
| Turn off the receiver | Press the power button for 3s | All six LEDs light off. |
| Turn on static recording | Press and hold FN button for 3s | Static LED light on |
| Turn off static recording | Press and hold FN button for 3s | Static LED light off |
| Reset GNSS module | Press and hold the FN button, continuously tap the power button 5 times | All LEDs light up for 5 seconds. |

2.2.1.2 Panel options and operation introduction

- SV & BAT

Press the power button to enter the next level of display interface.

| Home Screen | Display | Description | |
|------------------------------|------------|---|---|
| Satellite Solution & Battery | Solution | NONE | No satellite searched. |
| | | SINGLE | The receiver is in single point solution state. |
| | | FLOAT | The receiver is in float point solution state. |
| | | FIXED | The receiver is in fixed solution state. |
| | Satellites | Quantity of all visible satellites and satellite quantity of each constellation. G means GPS, R means GLONASS, B means Beidou, E means Galileo, S means SBAS, Q means QZSS. | |

| | | |
|--|---------|---------------------------|
| | Battery | Shows battery percentage. |
|--|---------|---------------------------|

- Mode

The current working mode of the receiver is displayed.

| Home Screen | Display | Description |
|-------------|---------|---------------------------------|
| Mode | Single | The receiver is in Single mode. |
| | Base | The receiver is in Base mode. |
| | Rover | The receiver is in Rover mode. |

- Mode Configuration

Press the power button to enter the next level of display interface.

| Home screen | Level 1 | Level 2 | Level 3 |
|-------------|-----------|--------------------------------|--|
| Mode Config | Base Mode | TCS (Tersus Caster Service) | Set Format: RTCMv2.3/ RTCMv3/ RTCMv3.2/ RTD/ CMR |
| | | | Check Device ID |
| | | | Set Server |
| | | Ntrip Server | Set Format: RTCMv2.3/ RTCMv3 / RTCMv3.2/ RTD/ CMR |
| | | | Check historical IP address & Port |
| | | | Set Protocol: TRANSEOT/ TT450/ SOUTH/ SATEL/ TRIMMK3 |
| | | Internal Radio | Set Air-Baud-Rate: 9600/ 19200/ 4800 |
| | | | Set Format: RTCMv2.3/ RTCMv3 / RTCMv3.2/ RTD/ CMR |

| | | | |
|---|-------------|--------------------------------|--|
| | | | Set Power: 0.5W(Low) / 1W(Medium) / 2W(High) |
| | | | Set Channel: 0--9 |
| | | | Set Customize Freq. |
| | | External Radio | Set Serial Port Baud Rate: 9600/ 19200/ 38400/ 57600/ 115200/ 460800 |
| | | | Set Data Speed (Full/ High/ Medium/ Low) |
| | | | Set Format: RTCMv2.3/ RTCMv3 / RTCMv3.2/ RTD/ CMR |
| | Rover Mode | TCS (Tersus Caster Service) | Set Base ID: ***** |
| | | | Set Server |
| | | NTRIP Client | Check historical IP Address & Port |
| | | TCP Client | Check History & Add Address |
| | | Internal Radio | Set Protocol: TRANSEOT/ TT450/ SOUTH/ SATEL/ TRIMMK3 |
| | | | Set Air-Baud-Rate: 9600/ 19200/ 4800 |
| | | | Set Channel: 0--9 |
| | | Set Customize Freq. | |
| | Single Mode | Confirm/ Cancel | / |
| Tilt.: ON/OFF (Oscar-TAP Ultimate only) | ON/OFF | / | |
| | Pole Height | Input Pole Height | |

| | | | |
|--|----------------|-----------------|--|
| | Static: ON/OFF | Static: | AUTO/ MANUAL/ OFF |
| | | Recording: | Check recording time(**min) |
| | | Frequency: | Select 1Hz/5Hz/10Hz/20Hz/ 60s/30s/15s/10s/5s as Freq. |
| | | Mask Elevation: | Input Mask Elevation Angle |
| | | Duration: | Set recording duration(**min) |
| | | Ant. Height: | Input Antenna Height(*.**m) |
| | | Measure Type: | Select Vertical/ Pole/ Slant |
| | | Data Format: | Select TRS/ OFF |
| | | RINEX Format: | Select 2.10/ 3.02/ 3.04/ OFF |

- Device Information

Press the power button to enter the next level of display interface.

| Home screen | Level 1 | Level 2 | Level 3 |
|-------------|------------|---|---|
| Device Info | GNSS INFO | Constellation | Select GPS& GLONASS& BEIDOU& GALILEO& QZSS ON/ OFF |
| | | RTK Mode | Select Mode: Normal/ Never Wrong |
| | | Reset RTK | Reset GNSS module |
| | | Hardware | Hardware Version |
| | | Firmware | Firmware Version |
| | Voice | ON/ OFF | / |
| | Change BAT | ON/ OFF | / |
| | WIFI | WIFI: | Select AP/ OFF/ STA |
| | | SSID/ IP/ MAC | Check Address |
| | Cellular | SIM card | Inserted/ Not Inserted |
| | | IMEI/Network/Signal | / |
| | Int.Radio | Check Freq.& Power& Protocol& Air Baud& Channel | / |

| | | | |
|--------------|-----------------|---------------------|---|
| | Bluetooth | Name | TersusGNSS - ***** (Device ID) |
| | | Status | Connected/ Unconnected |
| | | MAC | Address: **.*.*.*.*.*.* |
| | Disk Management | DiskUse: **%, Empty | / |
| | | Disk, Download Log | |
| | Data Broadcast | Bluetooth | ON/ OFF |
| | | Serial Port | Serial Port: ON/ OFF |
| | | | Baud Select: 9600/ 19200/ 38400/ 57600/ 115200/ 460800 |
| | | TCP Cast | ON/ OFF |
| | | | Set Port |
| | | TCP Push | ON/ OFF |
| | | | Set IP Address |
| | | | Set Port |
| | | NMEA Select | Set GGA、GSA、GSV、GST、GLL、RMC、ZDA、VTG output Freq. |
| | Tilt Data | ON/ OFF | |
| | Diff Data | ON/ OFF | |
| | Debug Mode | ON/ OFF | / |
| | | Debug Info Select | GNSS INFO ON/ OFF |
| | | | Tilt. ON/ OFF |
| | | | Int. Radio ON/OFF |
| | | | NTRIP ON/ OFF |
| | Language | Switch Language | Switch among 中文/繁體中文/日本語/ Français / Español / Türkçe / English |
| | Registration | Registered | / |
| Unregistered | | / | |

| | | | |
|--|----|------------------|---|
| | SN | Serial Number | / |
| | PN | Product Number | / |
| | FW | Firmware Version | / |
| | HW | Hardware Version | / |

2.2.2 Configure via TC20/TC50 controller

The detailed introduction of TC20 controller refers to section 1.3.3 and technical specification refers section 3.2. The detailed introduction of TC50 controller refers to section 1.3.3 and technical specification refers section 3.2. Here in this section describes how to configure Oscar-TAP via Nuwa app which is installed in TC20/TC50 controller.

2.2.2.1 Connect Oscar-TAP in Nuwa

The general operations of Nuwa app refer to *User Manual for Nuwa App* which can be downloaded on Tersus official website.

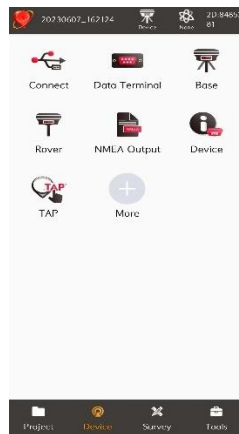


Figure 2.6 Device functional group

When Oscar-TAP GNSS receiver is powered on, to connect Oscar-TAP, put TC20/TC50 controller near the NFC logo on Oscar-TAP, the TC20/TC50 controller pair Bluetooth with Oscar-TAP automatically; or click [Device] -> [Connect] under an opened project, and select [Oscar-TAP] for the Device

Type which is shown as below.

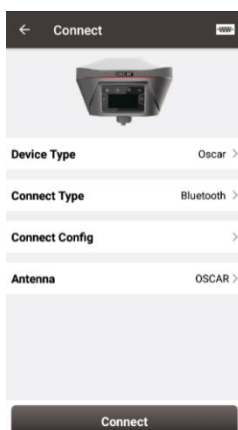



Figure 2.7 Connect Oscar-TAP via Bluetooth

Select [Bluetooth] for the Connect Type. Click [Connect Config] to search and pair the Bluetooth address of Oscar-TAP. The antenna is selected as [Oscar-TAP] by default. Then click [Connect] to enable the communication between TC20/TC50 controller and Oscar-TAP.

2.2.2.2 Electronic Bubble (eBubble)

Make the body of Oscar-TAP stand on a leveled Tribrach before eBubble calibration. Click the device information icon  on the top tool bar of Nuwa, the Oscar-TAP info is shown as below.

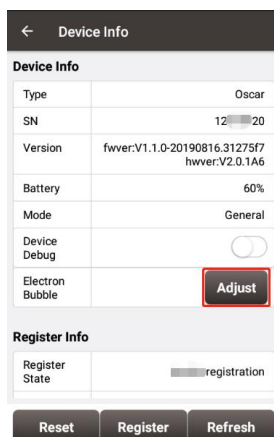


Figure 2.8 Device info of Oscar-TAP

Click **Adjust** on the right of electronic bubble to adjust bubble. On the screenshot below, the eBubble is not in the black circle and its color is red for warning purpose.

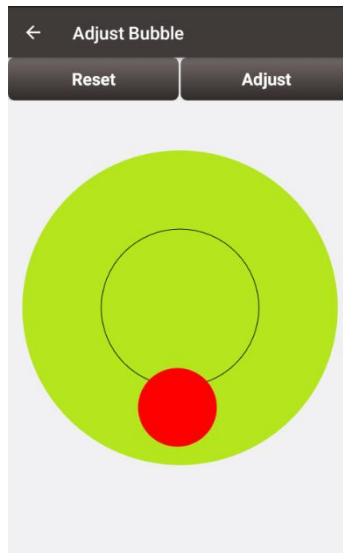


Figure 2.9 eBubble before adjusting

Click **Adjust** on the right, the eBubble is calibrated to the center inside the black circle and the bubble color turns blue.

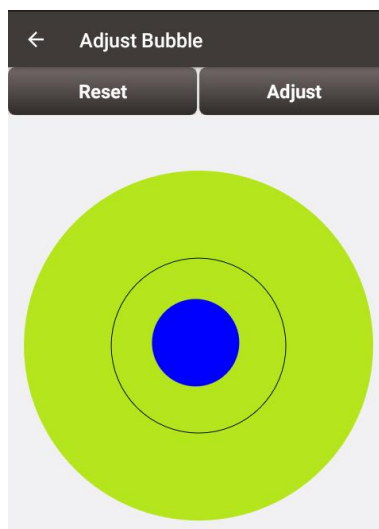


Figure 2.10 eBubble after adjusting

2.2.2.3 Registration

When the registration is not effective, follow below steps to complete the registration.

- 1) Connect the TC20/TC50 controller to your computer with a mini USB cable, and choose "Use USB for Transfer files" on the TC20/TC50 screen.
- 2) Click TC20/TC50 -> Internal storage -> TersusSurvey on the computer,

then copy the license file obtained from Tersus Technical Support to the "TersusSurvey" folder.

- 3) Open Nuwa app on TC20/TC50, click [Register] in Device information interface. Click [Refresh] to update the registration status.

Note:

- a) The registration file is text format file saved as xxx.txt.
- b) The registration file name consists of the first three digits and the last five digits of the SN number. The example is as below.



Figure 2.11 Example of Oscar-TAP's registration file

The other method is registering using QR code.

Click the scan button at the top right of the device information interface and directly scan the QR code provided by Tersus to complete the registration.

2.2.2.4 Configure base or rover

To configure Oscar-TAP as a base or rover, back to Device interface which is shown in Figure 2.6 Device functional group, click [Base] or [Rover], then create a work mode of detailed configurations for base or rover which are shown as below.

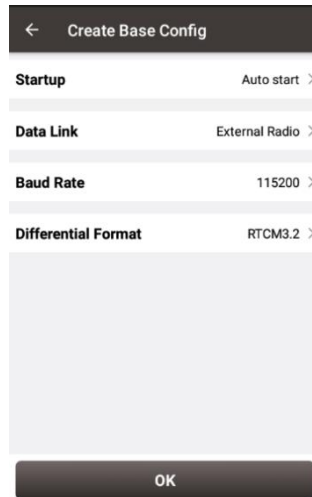


Figure 2.12 Base configuration

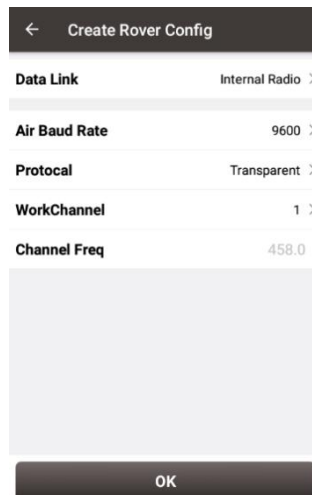


Figure 2.13 Rover configuration

Fill in the detailed information of base configuration or rover configuration, then click [OK] and back to the work mode list, select this configuration to start data transmission for base or rover which are shown as below.

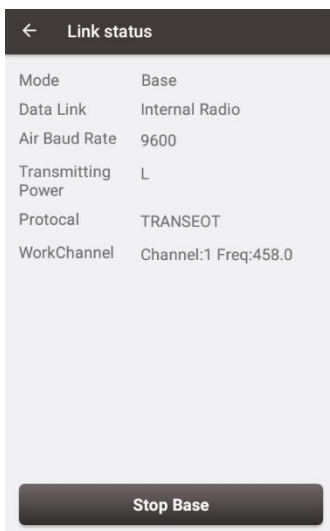


Figure 2.14 Link status of Base

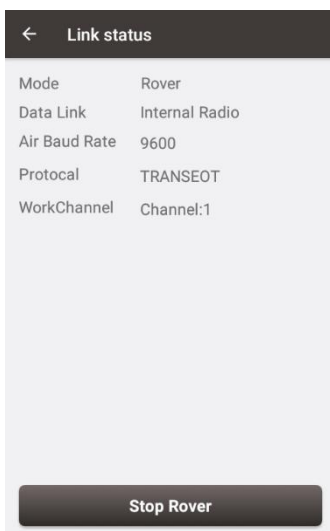
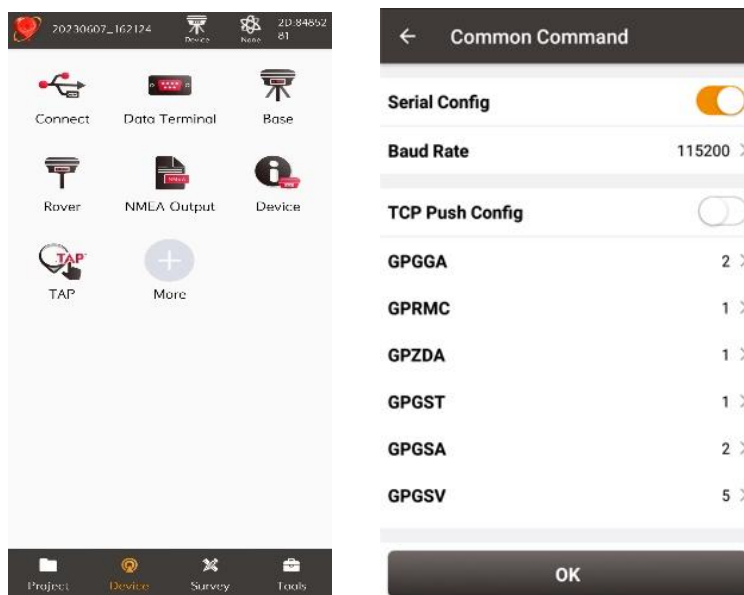


Figure 2.15 Link status of Rover

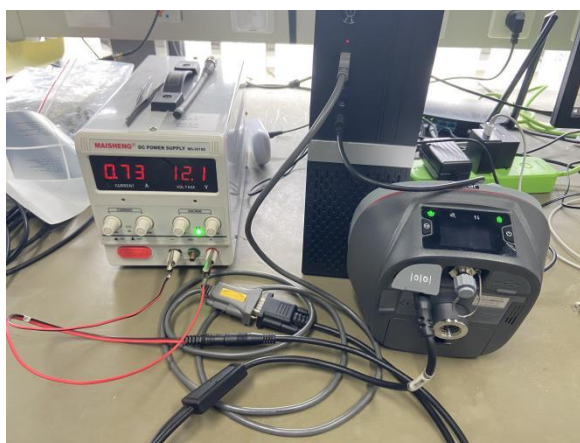
2.2.2.5 Configure NMEA output via serial port

To configure NMEA output via serial port, set [Device]--[NMEA output] in the NUWA interface, open the serial port configuration, the serial port baud rate is 115200 by default, and then select the detailed configuration of NMEA output, as shown below.

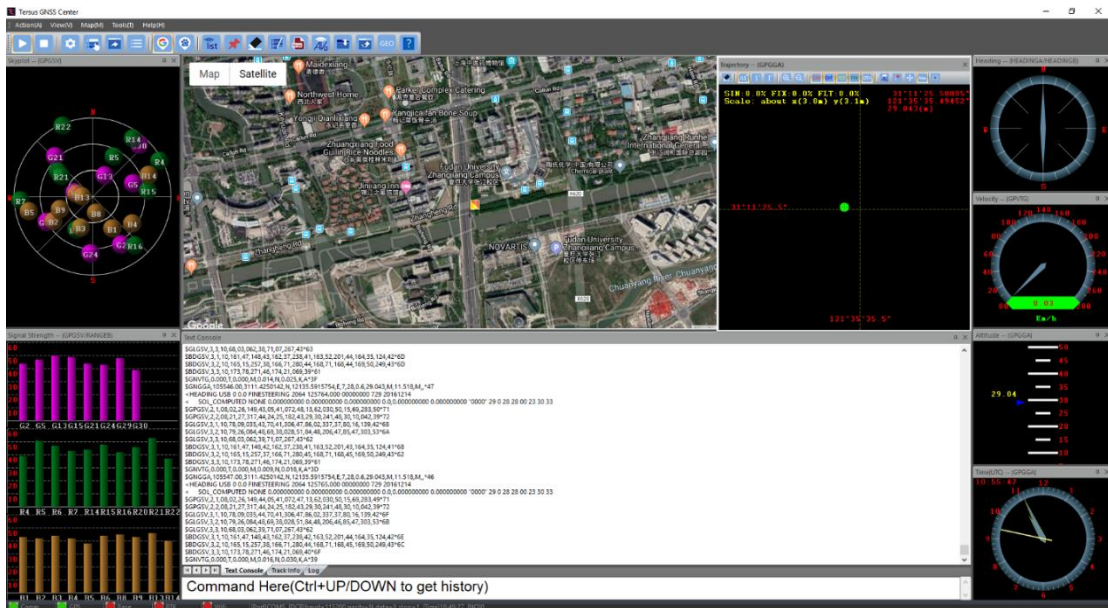
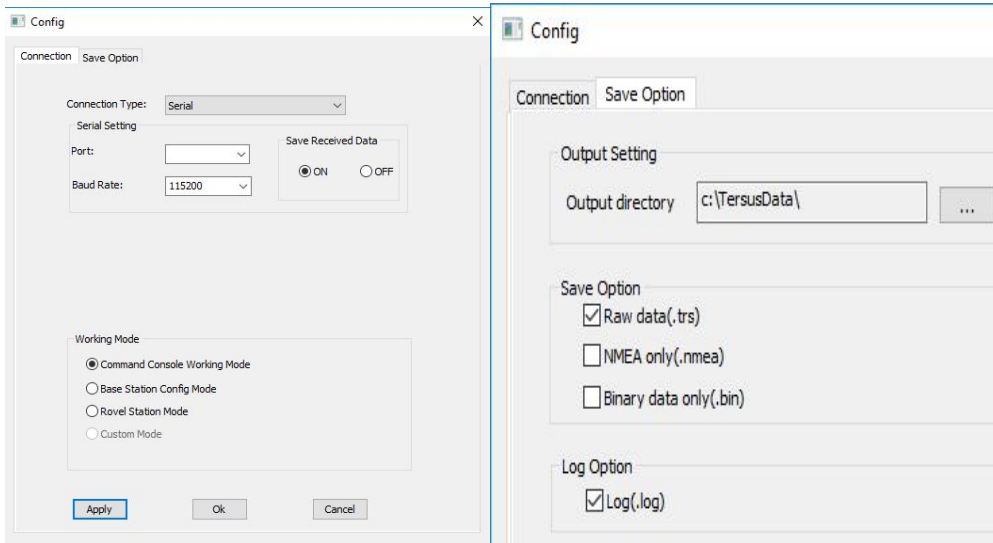
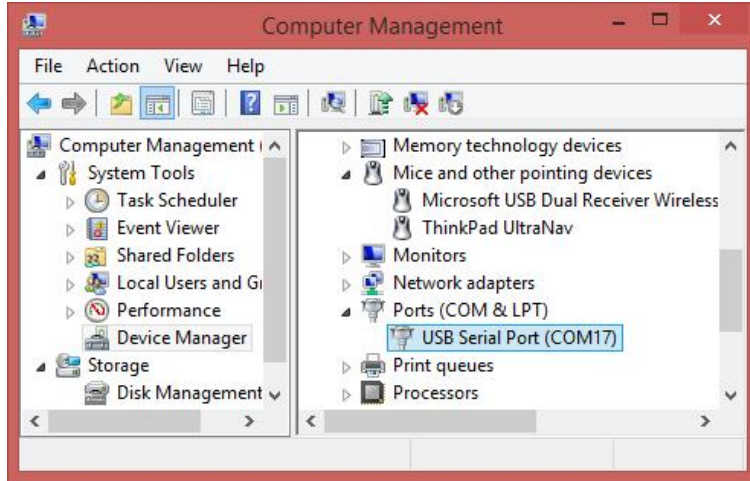


After selecting the NMEA messages to be output, click [OK].

Connect the DB9 male in the 5-pin serial to DC jack and DB9 male cable (错误!未找到引用源。) to the DB9 female in the DB9 female to USB Type A male adapter cable (错误!未找到引用源。), and connect the USB to the computer. If using an external DC power supply, please refer to section 2.1.4 (Oscar-TAP external power supply), as shown below.



Turn on the computer, find the corresponding port of the DB9 female to USB A male adapter cable on the computer, and open TersusGNSSCenter software, create a corresponding port, select the corresponding baud rate(115200 by default) and related information, click [Apply] or [Ok], and NMEA information will pop up, as shown below.



2.3 Data download

2.3.1 Connection

Oscar-TAP can be used as an USB storage device when connecting with a computer. Before connecting Oscar-TAP to a computer, ensure Oscar-TAP is powered on. Use the Mini USB cable in the package to connect Oscar-TAP to the USB port of a computer which is shown as below.



Figure 2.16 Connect Oscar-TAP to a computer

After completing the connection, a USB device is listed in the file browser of the computer. Find the data file needed to download, copy and paste it to a designated folder in your computer.

2.3.2 Download static data

If you want to download the recorded static data for post processing, find F:\record folder in the USB drive shown as below, and then copy the specific file you need to your computer.

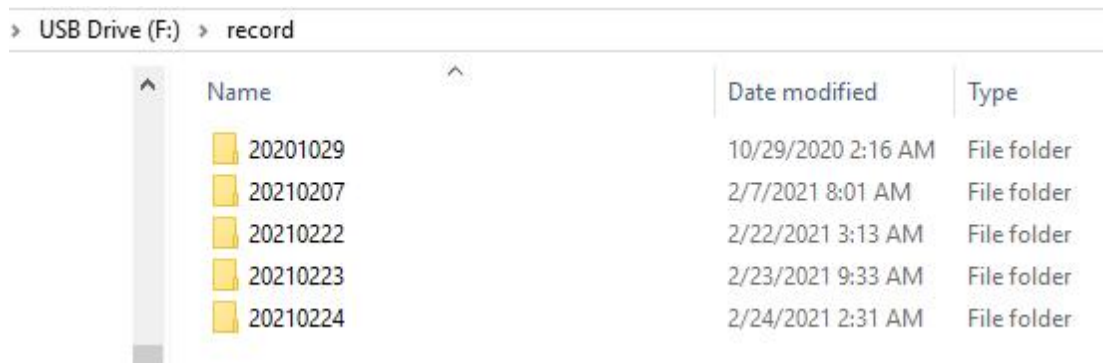


Figure 2.17 Static record folder

Each folder named after the date contains rinex format and tersus binary data, which can be downloaded and processed as you need.



Figure 2.18 Static data for one day

2.3.3 Download debug data

When you don't turn on the debug mode, find F:\debug\LOG folder and you can see rtkmain.log file which includes all the operation information of the receiver.



Figure 2.19 rtkmain.log file location

Turn on debug mode using the FN and power button on the Oscar-TAP panel (Oscar-TAP Ultimate only), find [Device Info] -> [Debug Mode], select the debug info you want to record and turn on the debug mode. The debug

information includes GNSS, tilt, internal radio and NTRIP information. For Oscar-TAP Basic version, you can click [Device] -> [Device Debug] -> [Set] in Nuwa app. After you select some debug info to turn on and confirm, Oscar-TAP will record them when you are doing survey work.

If your Oscar-TAP hardware version is 2 in [Device Info] -> [GNSS INFO] -> [Hardware], you can click [Device Info] -> [Disk Management] -> [Download Log] on Oscar-TAP panel (Oscar-TAP Ultimate versions) or click [Device] -> [Inner Log] -> [Sync] in Nuwa app (Oscar-TAP Basic version), then connect the receiver and PC via a Mini USB cable, download inner data of the GNSS board in the F:\debug\INNER folder on your computer for issue debugging.

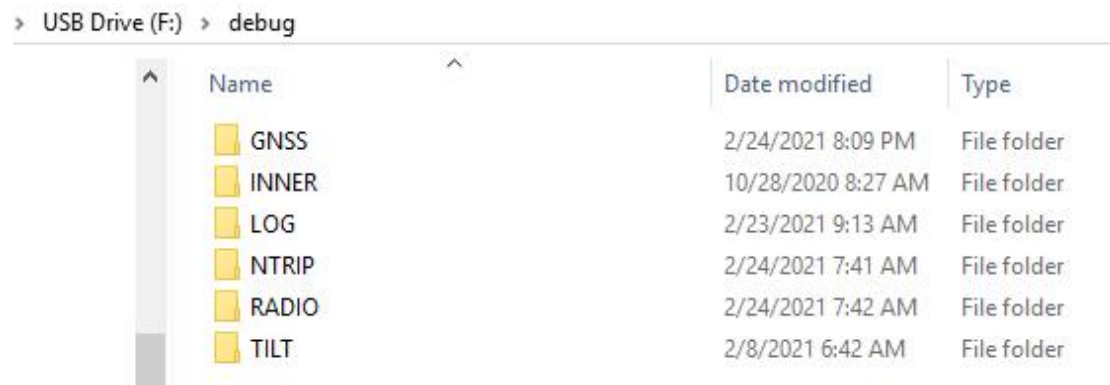


Figure 2.20 Debug info folders

Send these debug info to Tersus technical support team to help solve the problems you encountered.

2.4 Firmware upgrade

You have two methods to upgrade firmware for Oscar-TAP GNSS receiver: wired upgrade and wireless upgrade.

2.4.1 Wired upgrade

View Oscar-TAP firmware version. When Oscar-TAP GNSS receiver is powered on, to connect Oscar-TAP, put controller near the NFC logo on Oscar-TAP, the controller pair Bluetooth with Oscar-TAP automatically; or click [Device] -> [Connect] under an opened project, and select [Oscar-TAP] for the Device Type, select [Bluetooth] for the Connect Type. Click [Connect Config] to search and pair the Bluetooth address of Oscar-TAP. The antenna is selected as [Oscar-TAP] by default. Then click [Connect] to enable the communication between controller and Oscar-TAP.

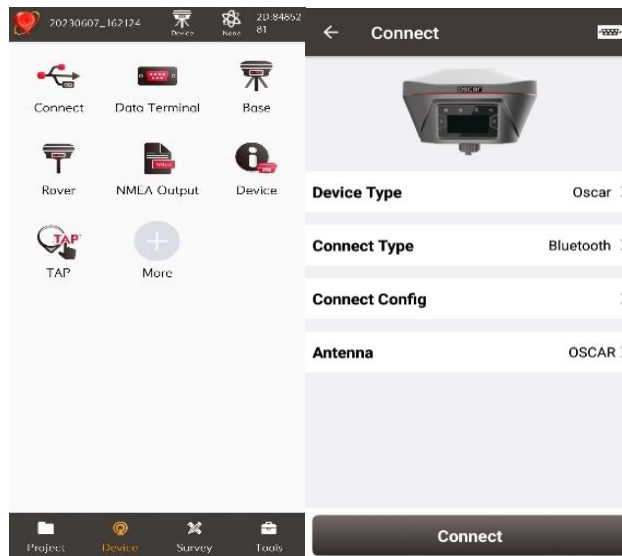



Figure 2.21 Connect to Oscar-TAP via Bluetooth

Click the device information icon  on the top tool bar of Nuwa, the Oscar-TAP info is shown as below. You can view Oscar-TAP firmware version.

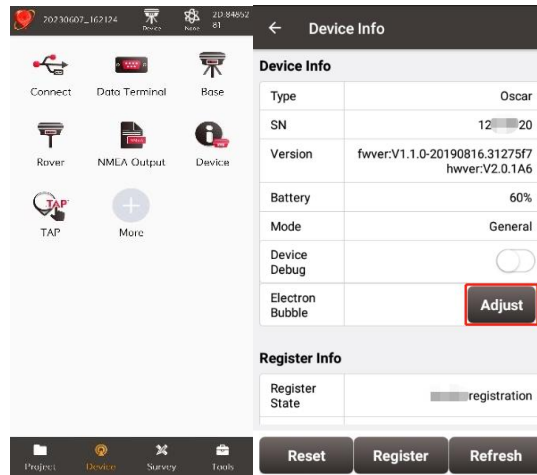


Figure 2.22 View Oscar-TAP firmware version

For Ultimate versions, you can also check the firmware version by switching the button. In the [device information] -[GNSS information]- [firmware version], you can view the firmware version of the GNSS board inside Oscar-TAP. In the [device information] - [software version], you can view Oscar-TAP firmware version.

2.4.1.1 Upgrade the firmware through a USB flash drive

The detailed steps are as follows.

- 1) Download the latest firmware file from Tersus website <https://www.tersus-gnss.com/software/TAP>
- 2) Prepare a USB flash drive, ensure the file system of this drive is **FAT32**. Create a folder named "**OscarUpdate**" under the root directory of the USB flash drive, then put the latest firmware file in it . Make sure there is only **one** firmware file in this folder.

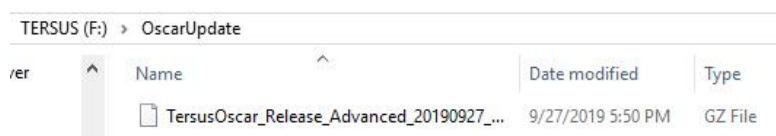


Figure 2.23 Copy the .GZ firmware file to a USB flash drive

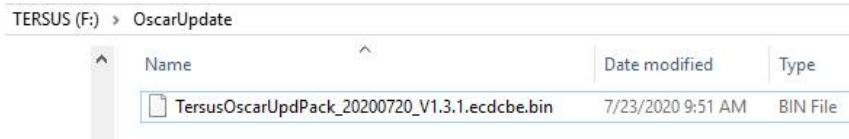


Figure 2.24 Copy the .BIN firmware file to a USB flash drive

3) Ensure Oscar-TAP is powered off, and use the Mini-USB OTG cable to connect Oscar-TAP to the USB flash drive.



Figure 2.25 Connect Oscar-TAP to a USB flash drive

4) Steps for Ultimate versions:

Press and hold the power button and the FN button at the same time. When the TERSUS icon appears on the LED panel, release the power button. Only hold down the FN button and keep pressing the FN button until the LED panel displays "SYSTEM UPGRADE". Release the FN button and wait for the upgrade. "SYSTEM UPGRADE" means starting to upgrade the firmware, "SYSTEM REBOOT" means the receiver starts to restart automatically, please wait for this process until the LED panel displays the operation interface. After the LED panel displays the operation interface, you can check whether the Oscar-TAP firmware upgrade is successful. If the Oscar-TAP firmware version is consistent with the latest firmware version in the USB flash drive, it means the firmware upgrade is successful.

Steps for Basic version:

Press and hold the power button and the FN button at the same time, release the power button when the six indicators on the LED panel are all on. Only hold down the FN button and keep pressing the FN button until the six indicators on the LED panel are all on again. Release the FN button and wait for the

upgrade. After the firmware upgrade is completed, the power LED light is on and the satellite light flashes. At this time, you can check the Oscar-TAP firmware version. If it is consistent with the latest firmware version in the USB flash drive, the firmware upgrade is successful.

Note: Please make sure the battery has enough power for the firmware upgrade. The GNSS board inside Oscar-TAP will upgrade when the firmware is upgrading, any forced power failure will cause the system crash.

2.4.1.2 Upgrade the firmware through the built-in storage of the host

The detailed steps are as follows.

1) Download the latest firmware file from Tersus website <https://www.tersus-gnss.com/software/TAP>.

Please be noted that the downloaded file is a .zip file, unzip this file to find the firmware file of .BIN format.

2) Prepare a Mini USB cable, when OSCAR-TAP is turned on, connect the Mini USB port of OSCAR-TAP to the computer with a Mini USB cable.



Figure 2.26 Mini USB cable connect the computer and OSCAR-TAP

3) The computer interface will automatically pop up two removable disks. As shown in the figure below.



Figure 2.27 Two Removable Disks

4) Choose the Oscar-TAPUpdate removable disk and put the firmware file in the .BIN format on this removable disk. As shown in the figure below.

| OscarUpdate (F:) | | | |
|--|------------------|--------|-----------|
| 名称 | 修改日期 | 类型 | 大小 |
| TersusOscarUpdPack_20221026_V2.0.3RC2.4b42ee.bin | 2022/10/26 11:26 | BIN 文件 | 20,026 KB |

Figure 2.28 The FW is placed in the OscaUpdate removable disk

5) Unplug the Mini USB cable, press and hold the power button for 3 seconds to shut down OSCAR-TAP .

6) Make sure that OSCAR-TAP is turned off, then press and hold the power button for 2 seconds to turn on OSCAR-TAP. For Ultimate versions, when the TERSUS icon appears, the boot is successful. Release the button and OSCAR-TAP enters the upgrade mode. The LED panel displays "SYSTEM UPGRADE" and waits for the upgrade to complete.



Figure 2.29 Upgrading(Ultimate versions)

After the LED panel displays the operation interface, you can check whether the Oscar-TAP firmware upgrade is successful. If it is consistent with the latest firmware version in the removable disk, it means the firmware upgrade is successful.

For Basic version, when the six indicators on the LED panel are all on, the boot is successful, release the power button. OSCAR-TAP enters the upgrade mode when the six indicators on the LED panel are all on again, and waits for the upgrade to complete.



Figure 2.30 Upgrading(Basic version)

After the firmware upgrade is completed, the power LED light is on and the satellite light flashes. At this time, you can check the Oscar-TAP firmware

version. If it is consistent with the latest firmware version in the removable disk, the firmware upgrade is successful.

Note: Please make sure the battery has enough power for the firmware upgrade. The GNSS board inside Oscar-TAP will upgrade when the firmware is upgrading, any forced power failure will cause the system crash.

2.4.2 Wireless upgrade

You have two methods for wireless upgrade: one is a one-click firmware upgrade via NUWA, and the other is a web upgrade via WiFi.

2.4.2.1 Upgrade the firmware through NUWA

The detailed steps of Oscar-TAP upgrade are as follows.

1) View Oscar-TAP firmware version.

When Oscar-TAP GNSS receiver is powered on, to connect Oscar-TAP, put controller near the NFC logo on Oscar-TAP, the controller pair Bluetooth with Oscar-TAP automatically; or click [Device] -> [Connect] under an opened project, and select [Oscar-TAP] for the Device Type, select [Bluetooth] for the Connect Type. Click [Connect Config] to search and pair the Bluetooth address of Oscar-TAP. The antenna is selected as [Oscar-TAP] by default. Then click [Connect] to enable the communication between controller and Oscar-TAP. As shown in Figure below.

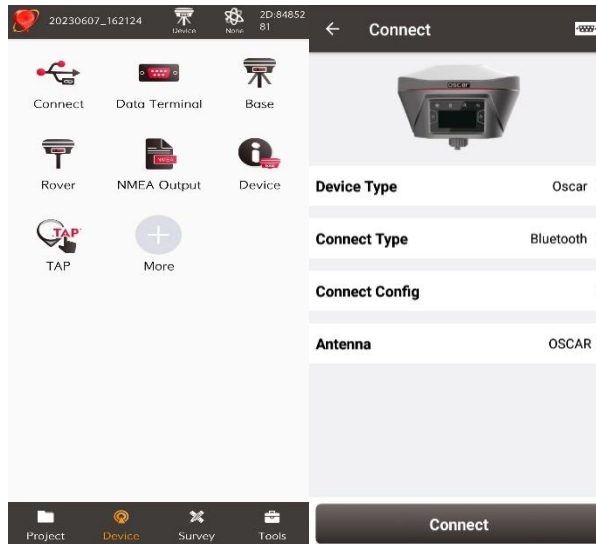



Figure 2.31 Connect to Oscar-TAP via Bluetooth

Click the device information icon  on the top tool bar of Nuwa, the Oscar-TAP info is shown as below. You can view Oscar-TAP firmware version.

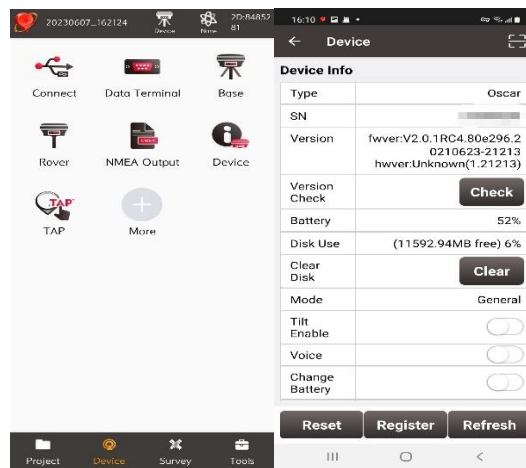


Figure 2.32 View Oscar-TAP firmware version

For Ultimate versions, you can also check the firmware version by switching the button. In the [device information] -[GNSS information]- [firmware version], you can view the firmware version of the GNSS board inside Oscar-TAP. In the [device information] - [software version], you can view Oscar-TAP firmware version.

2) The one-click firmware upgrade through NUWA can only be done through Oscar-TAP host network at present now, so we need to confirm whether Oscar-TAP is connected to the Internet, as shown in the picture.

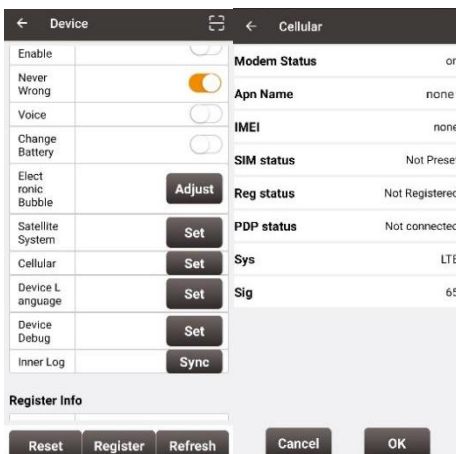


Figure 2.33 check Oscar-TAP Networking status

3) [Version update] -- Click [Check] in the interface. When there is a version update, a dialog box will pop up automatically. Click "Update Now" and the receiver will automatically download the new Oscar-TAP firmware, as shown below.

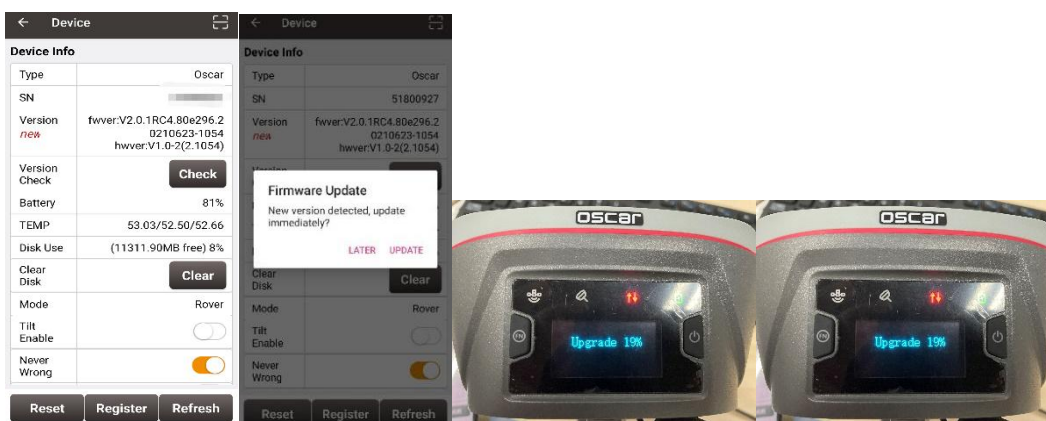


Figure 2.34 Status after Version Check

4) After the LED panel displays the operation interface, you can check whether the Oscar-TAP firmware upgrade is successful. Refer to step 1 to check the Oscar-TAP firmware version. If it is consistent with the latest firmware version, it means the firmware upgrade is successful.

For Basic version, when the six indicators on the LED panel are all on, the boot is successful, release the power button. OSCAR-TAP enters the upgrade mode when the six indicators on the LED panel are all on again, please wait for the upgrade to complete.



Figure 2.35 Upgrading(Basic version)

After the firmware upgrade is completed, the power LED light is on and the satellite light flashes. At this time, refer to step 1 to check the Oscar-TAP firmware version. If it is consistent with the latest firmware version, the firmware upgrade is successful.

2.4.2.2 Upgrade the firmware via a WiFi web page

The specific steps are as follows:

1) Check the Oscar-TAP firmware version. When Oscar-TAP GNSS receiver is powered on, to connect Oscar-TAP, put controller near the NFC logo on Oscar-TAP, the controller pair Bluetooth with Oscar-TAP automatically; or click [Device] -> [Connect] under an opened project, and select [Oscar-TAP] for the Device Type, select [Bluetooth] for the Connect Type. Click [Connect Config] to search and pair the Bluetooth address of Oscar-TAP. The antenna is selected as [Oscar-TAP] by default. Then click [Connect] to enable the communication between controller and Oscar-TAP.

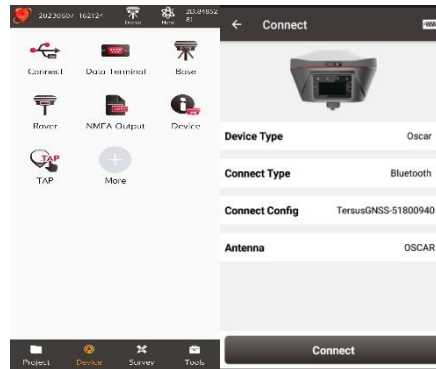



Figure 2.36 Oscar-TAP connected via Bluetooth

Click the device information icon  on the top tool bar of Nuwa, the Oscar-TAP info is shown as below. You can view Oscar-TAP firmware version.

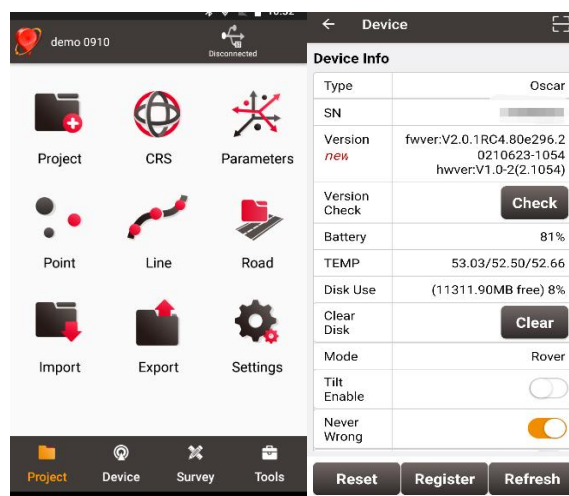


Figure 2.37 check the Oscar-TAP firmware version

For Ultimate versions, you can also check the firmware version by switching the button. In the [device information] -[GNSS information]- [firmware version], you can view the firmware version of the GNSS board inside Oscar-TAP. In the [device information] - [software version], you can view Oscar-TAP firmware version.

2) Turn on the WIFI function of Oscar-TAP GNSS receiver.

Switch to [Device] -- [WIFI Setting] -- [Set] -- [Mode Config], select [AP] -- [confirm] via NUWA, as shown below.

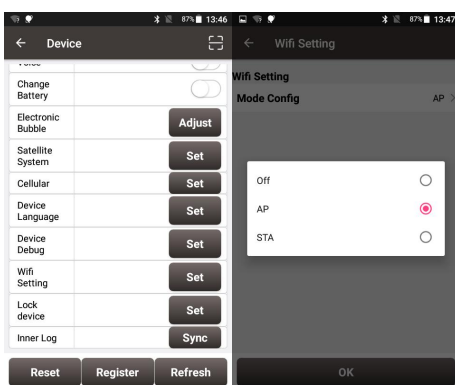


Figure 2.38 Open WIFI function

Note: the version of NUWA app must be upgraded to V2.2.9 or above.

For Ultimate versions, we can also open WIFI through the button on the host: switch to [Device info] -- [GNSS info]-- [WIFI] and ensure that the WIFI mode screen is displayed. Click [confirm] after WIFI mode to switch to [AP] mode. As shown in the figure below.



Figure 2.39 Open WIFI function

3) Connect Oscar-TAP GNSS receiver WIFI and upgrade. Turn on your computer WiFi and find the connection (TersusGNSS- "SN") in the WiFi list.



Figure 2.40 Connecting to Oscar-TAP WIFI

4) Open the browser, enter the URL (192.168.2.1), and enter the account password (admin) in the pop-up. After login, enter the sub-menu, Firmware -- Firmware Info -- select file (load the latest Firmware) -- Upgrade, do not perform any operations after clicking. Wait patiently for the receiver to restart automatically.

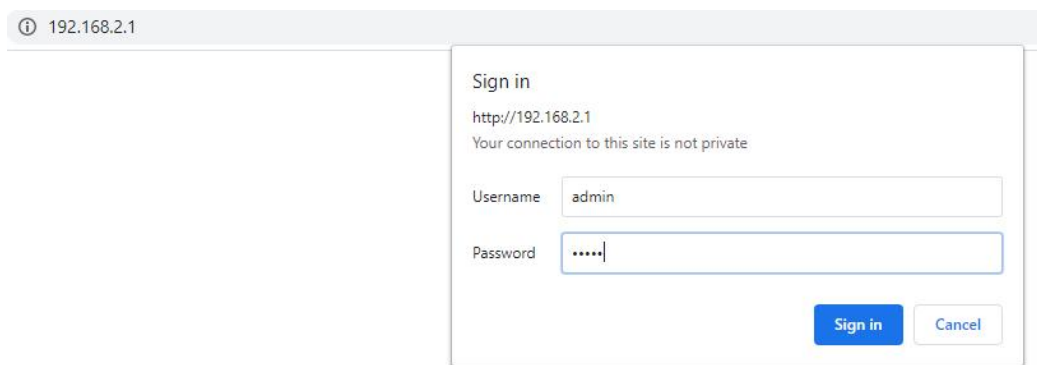


Figure 2.41 Oscar-TAP WIFI page

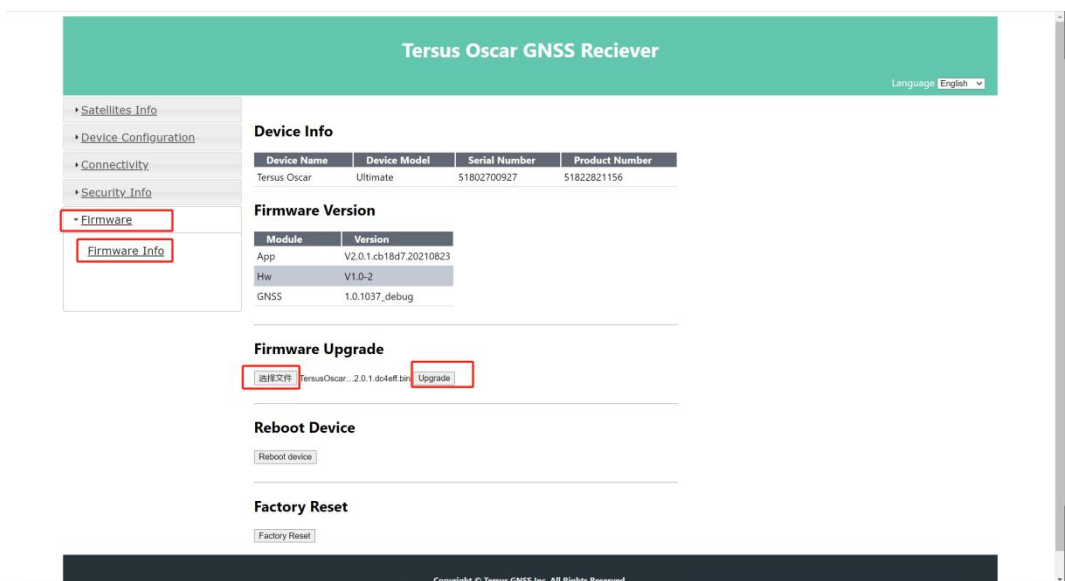


Figure 2.42 Upgrade via the Oscar-TAP WIFI page

5)After the LED panel displays the operation interface, you can check whether the Oscar-TAP firmware upgrade is successful. Refer to step 1 to check the Oscar-TAP firmware version. If it is consistent with the latest firmware version in the removable disk, it means the firmware upgrade is successful.

2.5 Web UI

Oscar-TAP GNSS receiver supports being a Wi-Fi hot spot and connect with a computer or a smart terminal within five meters. You can read coordinate information, configure the receiver and upgrade the firmware through the web UI (user interface) on the browser of the computer or the smart terminal.

Follow below steps to enter the web user interface on a computer with Windows 10 operating system.

a. Upgrade the receiver to the latest firmware, and then open Wi-Fi .

Switch to [Device] -- [WIFI Setting] -- [Set] -- [Mode Config], select [AP] -- [confirm] via NUWA, as shown below.

Note: the version of NUWA app must be upgraded to V2.2.9 or above.

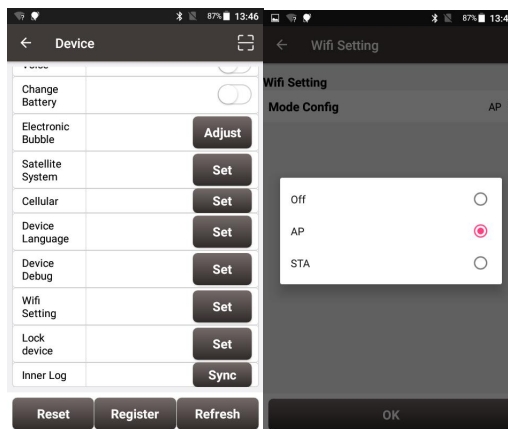


Figure 2.43 WiFi interface

For Ultimate versions, you can open WiFi through switching the power button and the FN button, [Device Info]--[WiFi:OFF] --select [WiFi: AP]--Confirm. SSID & IP & MAC will be automatically set. Please refer to 1.3.1 for detailed button function.



Figure 2.44 Open WiFi (Ultimate versions)

- b. Click the Internet connection icon on the lower right corner of the desktop. Turn on Wi-Fi connection and search the SSID of Oscar-TAP GNSS receiver which is composed of TersusGNSS and an eight digit number such as below. Click [Connect] to complete the Wi-Fi connection.

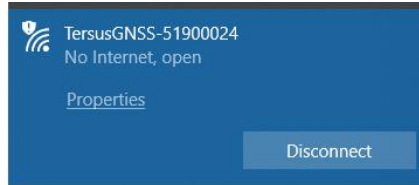


Figure 2.45 Make Wi-Fi connection

- c. Open a web browser and type 192.168.2.1 in the address bar. Type “admin” for the username and password, then click [Sign in] to enter the web UI.

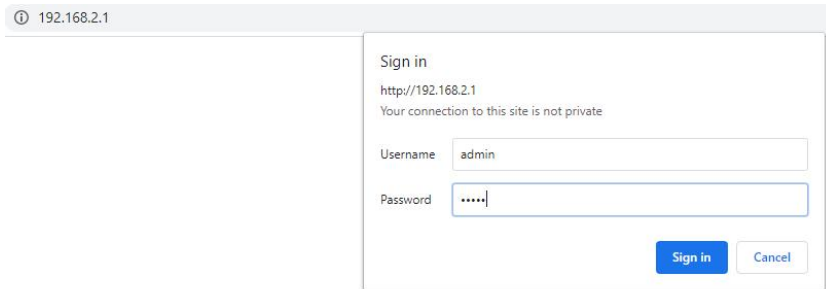


Figure 2.46 Sign in the web UI

- d. When you entered the web UI of Oscar-TAP GNSS receiver, you can see five tabs on the left and make corresponding operations such as view positioning info, view satellites info, make device settings, make connectivity settings, and upgrade firmware. [Satellites Info] - [Position Info] - view position information.

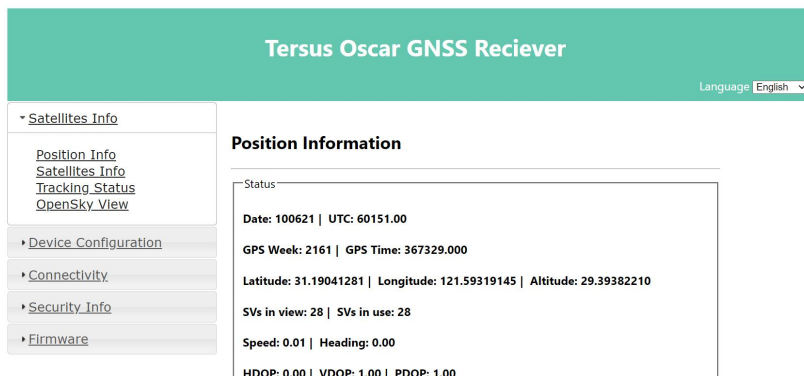


Figure 2.47 Main interface of Oscar-TAP's web UI

- e. configure the working mode and related parameters of the equipment .
 [Device Configuration] - [Mode Configuration] - select working mode - next - next - set.

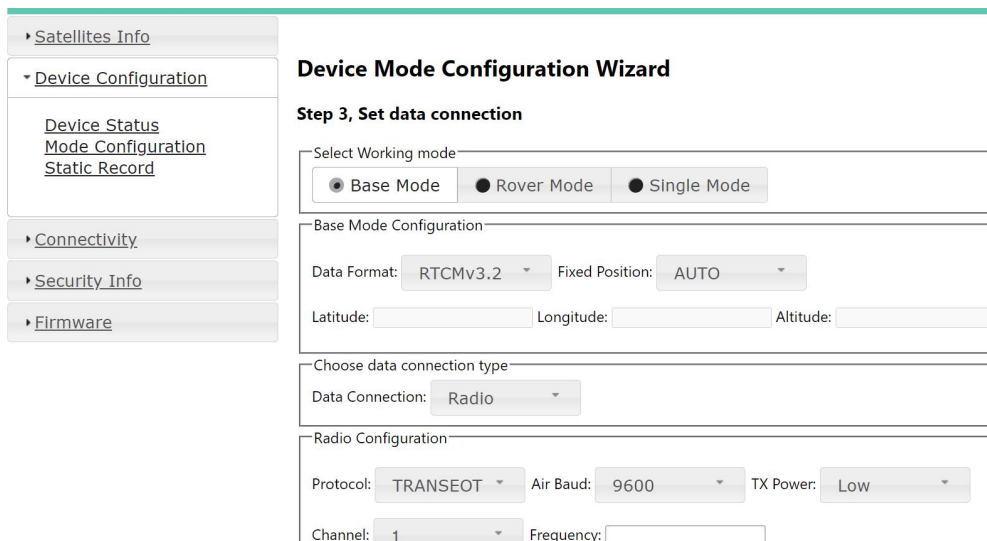


Figure 2.48 configure a working mode

- f. upgrade device firmware version via web page. [Firmware] - [Firmware Info] - [Firmware Upgrade] - click 【选择文件】 - click [upgrade].
 you can use this function to upgrade after the next official version is released.

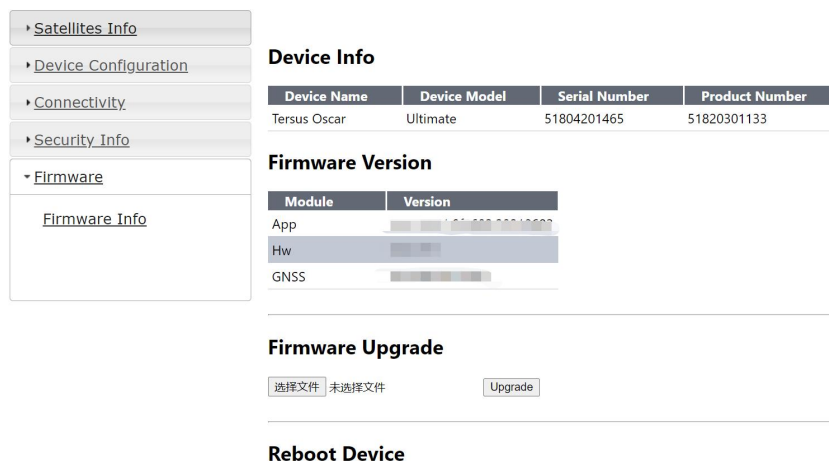


Figure 2.49 upgrade the firmware

- g. manage user logins through web pages.
 [Security Info] - [Account Info] - [Add User] - [Add User Dialog] - input Login Name&Alias Name&Password.

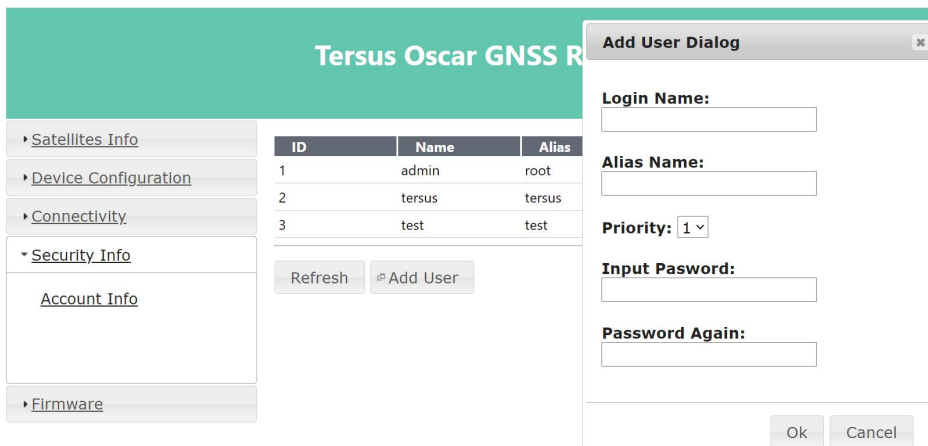


Figure 2.50 add user login


2.6 Battery change mode

Oscar-TAP GNSS receiver Ultimate can config the battery change mode through the panel options. [Device Info] - [Change BAT] - select [ON]. The interface for opening battery change mode is shown in the figure below.



Figure 2.51 change bat

Oscar-TAP GNSS receiver Basic can config the battery change mode through controller. NUWA connects to the Oscar-TAP receiver via NFC or Bluetooth (see 2.4.1 for the connection method).

Click the device information icon  on the top tool bar of Nuwa to enter the device information interface. Click the button on the right side of the battery change mode row, and a prompt appears: succeed to config battery change mode, and the battery change mode can be successfully opened, as shown in the figure below.

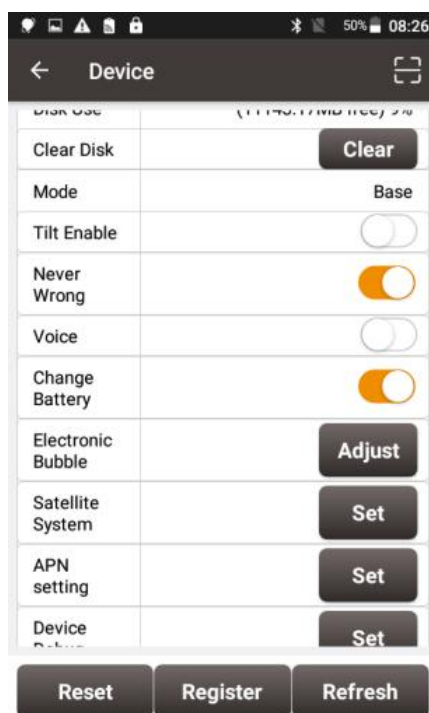


Figure 2.52 the battery change mode

When the battery change mode is turned on, turn off the receiver, replace the battery and restart the device, and it will maintain the working mode before shutting down; if the base station is in auto start mode before shutting down, the original auto-start base station coordinates will be maintained; if the base station is started at a known point before shutting down, it will keep the mode of starting at the known point; if it was at rover mode before shutting down, it will keep the rover mode after changing battery.

2.7 Operations of TC20 controller

2.7.1 Insert SIM card and Micro SD card

1. **Remove the back cover:** Loosen the screws on the back side - to rotate the screws anti-clockwise until open the back cover shown as below.



Figure 2.53 Remove the back cover

2. **Take off the back cover:** Remove the back cover by lifting it up from the bottom part shown as below.



Figure 2.54 Take off the back cover

- Put the **SIM card in the holder**: Put the SIM card into the slot touching the SIM contacts of the phone shown as below.



Figure 2.55 Put the SIM card in the holder

- Insert Micro SD card**: Open Micro SD card holder and insert Micro SD card into the slot, then close Micro SD card holder shown as below.



Figure 2.56 Insert Micro SD card

5. **Insert the back cover:** Insert the back cover and rotate screws clockwise to lock the back cover shown as below.



Figure 2.57 Insert the back cover

Note: Please power off the phone before plug in or pull out the SIM card.

2.7.2 Micro SD Card

1. Connect USB, turn on USB storage.

It automatically pops up USB connected interface after connecting USB, and then click “Turn on USB storage” to use the Micro SD as USB storage.

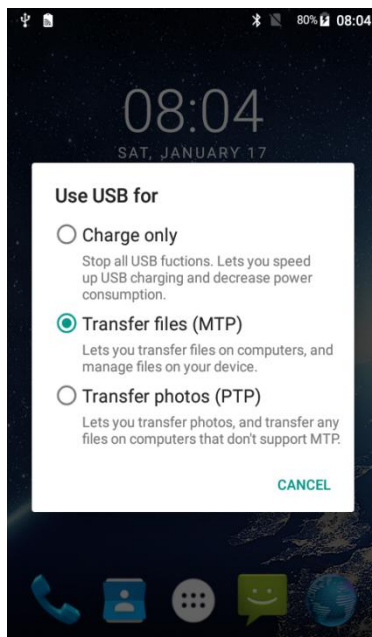


Figure 2.58 Select USB function

2.7.3 Using of touch screen

Single click: To select an icon. For example, click dial to open the keypad which will be displayed on the screen.

Double click: To zoom-in or zoom-out. For example, to zoom-in or out of a photo, click twice when viewing a photo or browsing on the internet.

Hold: Click and hold the screen, icon or input box to get more operation options.

- a) Long-time click a picture in the gallery list interface, the status bar prompts to select a picture, you select to share or delete.
- b) Long-time click the blanks of home screen to add home screen shortcut.
- c) Long-time click the blanks of home screen wallpaper sources can be selected.

Drag the screen: You can drag the screen to view more applications which are not displayed in one screen.

Scratch the screen: A screen of information cannot be displayed, scratch scrolling display the hidden information.

Stylus pen: you can use stylus pen for the touch screen after turning on the function via Settings -> Accessibility -> Handwriting Pen.

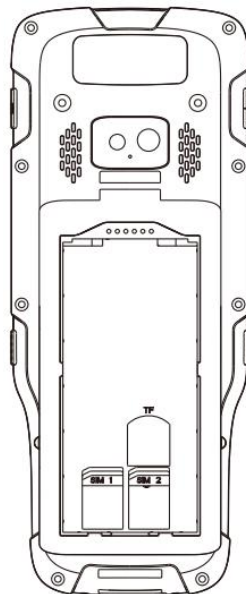
2.8 Operations of TC50 controller

2.8.1 Insert SIM card and SD card

Please note the direction of the card notch when inserting the card, inserting a non-standard card may cause damage to the SIM card slot of the controller.

The controller cannot support two CDMA cards at the same time, when two CDMA cards are installed at the same time, only one card can use the 4G network, the other card will not be able to register the network.

To install the SIM card you need to open the battery cover, remove the battery and open the SIM card cover.



Note: Please power off the controller before plug in or pull out the SIM card.

2.8.2 Using of touch screen

Single Click: To select an icon. For example, click dial to open the keypad which will be displayed on the screen.

Double Click: To zoom-in or zoom-out. For example, to zoom-in or out of a photo, click twice when viewing a photo or browsing on the internet.

Hold: press and hold the screen, icon or input box to get more operation options.

a) Long-Time Click a picture in the gallery list interface, the status bar prompts to select a picture, you select to share or delete it.

b) Long-Time Click the blanks of home screen to add home screen widgets.

c) Long-Time Click the blanks of home screen wallpaper sources can be selected.

d) Long-Time Click the blanks of home screen to home settings.

Slide Upward: Slide up on the main screen (or click the upward arrow icon) to view more applications.

Slide Downward: Slide down on any interface to open the status bar and message board.

Slide Left and Right: Slide left and right on the main screen to switch the desktop interface.

3. Technical Specifications

This chapter mainly introduces the technical specifications of Oscar-TAP GNSS receiver, TC20&TC50 Controller , external radio and internal radio whip antenna.

3.1 Oscar-TAP GNSS receiver

Table 3.1 Oscar-TAP GNSS receiver performance

| GNSS Performance | | |
|--|--------------------------|---------------------------|
| Position accuracy(RMS) | Single Point Positioning | 1.5m (Horizontal) |
| | | 3.0m (Vertical) |
| | DGPS Positioning | 0.25m (Horizontal) |
| | | 0.5m (Vertical) |
| | High Precision Static | 2.5mm+0.1ppm (Horizontal) |
| | | 3.5mm+0.4ppm (Vertical) |
| | Static & Fast Static | 2.5mm+0.5ppm (Horizontal) |
| | | 5mm+0.5ppm (Vertical) |
| | Post Processed Kinematic | 2.5mm+1ppm (Horizontal) |
| | | 5mm+1ppm (Vertical) |
| | Real Time Kinematic | 8mm+1ppm (Horizontal) |
| | | 15mm+1ppm (Vertical) |
| Network Real Time Kinematic | 8mm+0.5ppm (Horizontal) | |
| | 15mm+0.5ppm (Vertical) | |
| TAP | 15mm (Horizontal) | |
| | 30mm (Vertical) | |
| Observation accuracy (zenith direction) | C/A code | 10cm |
| | P code | 10cm |
| | Carrier phase | 1mm |
| Time To First Fix (TTFF) | Cold start | <35s |
| | Warm start | <10s |
| Reacquisition | <1s | |
| Tilt compensation accuracy (within 60°) | ≤2cm | |
| Timing accuracy (RMS) | 20ns | |
| Velocity accuracy (RMS) | 0.03m/s | |
| TAP convergence time | 3 minutes | |

| | | |
|--------------------------------------|---|--|
| Initialization (typical) | <10s | |
| Initialization reliability | >99.99% for Ultimate, >99.9% for Basic | |
| System & Data | | |
| Operating system | Linux | |
| Storage | built-in 16GB/8GB | |
| Data format | CMR, CMR+ (GPS only), RTCM 2.3, RTCM3.0, RTCM3.1, RTCM3.2 | |
| Data output | RINEX, NMEA-0183, Tersus Binary | |
| Software Support | | |
| Tersus Nuwa, MicroSurvey FieldGenius | | |
| Communication | | |
| Cellular | 4G LTE/WCDMA/GSM | |
| Cellular bands | FDD LTE 1,3,7,8,20,28A 2,4,5,12,13 TDD LTE 38,40,41 WCDMA 1,8 2,5 GSM3,8 | |
| Network protocols | Ntrip Client, Ntrip Server, Tersus Caster Service (TCS) | |
| Wi-Fi | 802.11b/g | |
| Bluetooth | 4.1 | |
| Internal radio | RF transmit power | 0.5W/1W/2W |
| | Frequency | 410MHz ~ 470MHz |
| | Operating mode | Half-duplex |
| | Channel spacing | 12.5KHz / 25KHz |
| | Modulation type | GMSK, 4FSK |
| | Air baud rate | 4800/9600/19200 bps |
| | Distance (typical) | >5km |
| | Radio protocols | TrimTalk450, TrimMark 3, South, Transparent, Satel |
| USB OTG | USB 2.0 x1 | |
| Serial ports | RS232 x1 | |
| COM baud rate | Up to 921600bps | |
| Electrical | | |
| Input voltage | +9 ~ 28V DC | |
| Power consumption | Network or radio receive mode | ≈ 5W |
| | Radio transmit mode (0.5W) | ≈ 8W |
| | Radio transmit mode (1W) | ≈ 9W |
| | Radio transmit mode (2W) | ≈ 11W |
| Lithium battery | 7.4V 6400mAh x2 | |
| Battery charging temperature: | +10°C ~ +45°C | |
| Battery working time | Up to 8 hours | |
| Physical | | |

| | |
|-------------------------|---|
| Display | 1.54" OLED for Ultimate versions |
| Dimension | 157*157*103 mm |
| Weight | ≈ 1.2kg (without battery), ≈ 1.4kg (with a battery) |
| Screw hole for assembly | 5/8"x11UNC-2B |
| Vibration | MIL-STD-810G,FIG.514.6C-1 |
| Environmental | |
| Operating temperature | -40°C to +70°C |
| Storage temperature | -55°C to +85°C |
| Relative humidity | 100% not condensed |
| Water & dust proof | IP68 |
| Pole drop onto concrete | 2m |

The pin definition's view from outside to the serial port is as below.

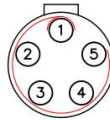


Figure 3.1 Serial data port of Oscar-TAP

Table 3.2 Pin definition of the serial data port

| Connector Pin No. | Pin Definition |
|-------------------|----------------|
| 1 | GND |
| 2 | GND |
| 3 | PWR |
| 4 | TXD |
| 5 | RXD |

The pin definition of the TNC connector is as below:

Table 3.3 Pin definition of the TNC connector

| Connector Pin No. | Pin Definition |
|-------------------|----------------|
| Inside | Signal |
| Outside | Ground |

The pin definition of the battery contacts is as below:

Table 3.4 Pin definition of the battery contacts

| Connector Pin No. | Pin Definition |
|-------------------|----------------|
| 1 | + Positive |
| 2 | Data |
| 3 | Clock |
| 4 | - Negative |

Table 3.5 Default factory configuration for internal radio

| Channel | Frequency |
|----------------------|------------|
| 00 | 457.550MHz |
| 01 | 458.050MHz |
| 02 | 458.550MHz |
| 03 | 459.050MHz |
| 04 | 459.550MHz |
| 05 | 460.550MHz |
| 06 | 461.550MHz |
| 07 | 462.550MHz |
| 08 | 463.550MHz |
| 09 | 464.550MHz |
| Customized frequency | 410~470MHz |

Table 3.6 Detailed configuration information for internal radio

| Protocol | Modulation type | Channel band | Air baud rate | COM baud rate |
|-------------|-----------------|--------------|---------------|----------------------------|
| TrimTalk450 | GMSK | 12.5 KHz | 4800 bps | 9600/19200/38400/115200bps |
| | GMSK | 25 KHz | 9600 bps | 9600/19200/38400/115200bps |
| TrimMark3 | GMSK | 50 KHz | 19200 bps | 9600/19200/38400/115200bps |
| Transparent | GMSK | 12.5 KHz | 4800 bps | 9600/19200/38400/115200bps |
| | GMSK | 25 KHz | 9600 bps | 9600/19200/38400/115200bps |
| Satel | 4FSK | 12.5 KHz | 9600 bps | 9600/19200/38400/115200bps |
| | 4FSK | 25 KHz | 19200 bps | 9600/19200/38400/115200bps |
| South | GMSK | 12.5 KHz | 4800 bps | 9600/19200/38400/115200bps |
| | GMSK | 25 KHz | 9600 bps | 9600/19200/38400/115200bps |
| | GMSK | 50 KHz | 19200 bps | 9600/19200/38400/115200bps |

3.2 TC20 controller

Table 3.7 TC20 technical specification

| System | |
|------------------------|---|
| Operating system | Android 6.0 |
| CPU | MTK MT6735 Quad-Core 1.3GHz |
| Memory | 2GB RAM + 16GB ROM |
| External flash | Micro SD , up to 64GB |
| Keypad backlight | White |
| Display | 4.3" capacitive touch screen |
| Resolution | 480x800 |
| Camera | 8M pixel, auto focus |
| Flash light | High light flash LED |
| Language | 47 languages including Chinese, English, Filipino, French, Greek, Italian, Japanese, Korean, Malay, Portuguese, Romanian, Russian, Spanish, Thai, Turkish, etc. |
| GNSS | |
| Signal tracking | GPS, GLONASS |
| Communication | |
| Wi-Fi | IEEE 802.11a/b/g/n |
| Cellular mode | Dual SIM dual standby |
| SIM1 & SIM2 | FDD-LTE 800 / 1800 / 2100 / 2600MHz TD-LTE 1900 / 2300 / 2500 / 2600MHz WCDMA 850 / 900 / 1900 / 2100MHz GSM 850 / 900 / 1800 / 1900MHz |
| Bluetooth | V4.1 |
| USB | Micro USB for charging and data (OTG) |
| Audio Jack | 3.5mm Audio Jack for audio |
| NFC | Standard |
| Sensors | G-sensor, Compass, Barometer, Light-sensor, Gyro |
| Electrical | |
| Power | 5V DC, 1.0A |
| Battery | 3.7V 6500mAh |
| Battery life | 10 hours operation, 720 hours standby |
| Charging time | 4.5 hours (5V 2A input), 8 hours (5V 1A input) |
| Physical | |
| Dustproof & Waterproof | IP68 |
| Shock | 0.8m drop onto concrete |
| Dimension | 210mmx87mmx31mm |
| Weight | 495g (include battery) |
| Operating temperature | -20 °C ~ +55 °C |

| | |
|---------------------|-----------------|
| Storage temperature | -30 °C ~ +65 °C |
|---------------------|-----------------|

3.3 TC50 controller

Table 3.8 TC50 technical specification

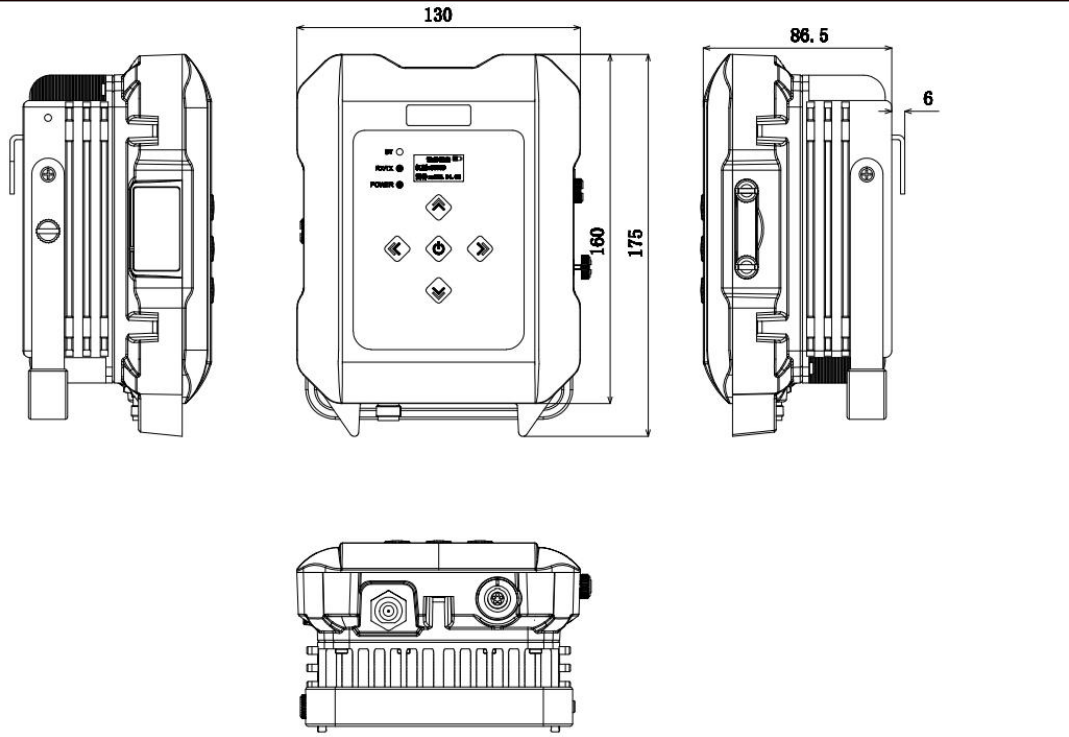
| System | |
|------------------|--|
| Operating System | Android 8.1 |
| CPU | MT6763 Octa-Core 2.0GHz |
| Memory | 4GB RAM + 64GB ROM |
| External storage | Micro SD, up to 128GB |
| Display | 5" sunlight-readable capacitive touch screen |
| Resolution | 720x1280 |
| Camera | 5MP front, 13MP rear |
| Flash Light | High light Flash LED |
| Electrical | |
| Battery | 7000mAh 3.8V |
| Battery Life | 14 hours |
| Charging Time | <4 hours (fast charge) |
| Communication | |
| Wi-Fi | IEEE 802.11a/b/g/n 2.4G&5G |
| Cellular Mode | Dual SIM Dual Standby |
| SIM1 & SIM2 | FDD-LTE B1/B3/B5/B7/B8 TD-LTE B38/B39/B40/B41 TDSCDMA B34/B39 WCDMA B1/B2/B5/B8 CDMA1x/CDMA2000 BC0/BC1 GSM B2/B3/B5/B8 |
| Bluetooth | BT4.1 (BLE) |
| USB | USB Type-C (supports OTG) |

| | |
|------------------------|--|
| NFC | Protocol of ISO14443A/B, and ISO15693 Readable Distance 0~5cm |
| GNSS | GPS/GLONASS/BeiDou |
| Sensors: | G-Sensor, Compass, Light-Sensor, Gyro |
| Physical | |
| Dimension | 207mmx84mmx20mm |
| Weight | 370g (include battery) |
| Reliability | |
| Operating Temperature | -20°C ~ +55°C |
| Storage Temperature | -30°C ~ +70°C |
| Humidity | 5% ~ 95% |
| Dustproof & Waterproof | IP68 |
| Shock | 1.5m drop onto concrete |

3.4 External radio for Oscar-TAP

Table 3.9 External radio RS400H3 technical specification

| General Specification | | |
|------------------------------|--------------------|----------------------|
| Frequency range | 410~470MHz | |
| Operating mode | Simplex | |
| Channel width | 25KHz, 12.5KHz | |
| Modulation Type | GMSK/4FSK | |
| Operating voltage | 9~16V DC | |
| Power consumption | High power (28W) | 78W @ DC 12V |
| | Medium power (22W) | 60W @ DC 12V |
| | Low power (5W) | 35W @ DC 12V |
| | Standby | 2W @ DC 12V |
| Frequency stability | ≤ ±1.0ppm | |
| Transmitter | | |
| RF output power | High level (28W) | 44.5±0.5dBm @ DC 12V |
| | Medium level (22W) | 43.4±0.5dBm @ DC 12V |
| | Low level (5W) | 37±1dBm @ DC 12V |
| Power stability | ±1dBm | |

| | | |
|--|--|-------------|
| Adjacent channel power | >50dB | |
| Distance(Typical) | 14-16KM | |
| Antenna | | |
| Antenna Impedance | 50 Ohm | |
| Antenna Interface | TNC female | |
| Modem | | |
| Air baud rate | 4800bps, 9600bps, 19200bps | |
| Modulation Type | GMSK/4FSK | |
| Serial port baud rate | 9600bps, 19200bps, 38400bps, 57600bps, 115200bps | |
| Protocol | TRIMTALK, TRIMMK3, TRANSEOT,SOUTH, SATEL | |
| Environmental | | |
| Temperature | Operating | -40 ~ +65°C |
| | Storage | -50 ~ +85°C |
| Dustproof and waterproof | IP67 | |
| Physical Description | | |
| Dimension | 175 x 130 x 86.5 mm | |
| Weight | About 2.0kg | |
| Data & Power interface | LEMO 5pin | |
| Installation | Hook | |
| Mechanical Drawing | | |
|  | | |
| Signal Definition | | |

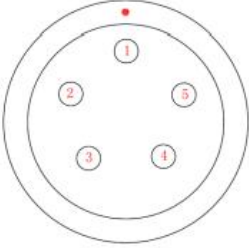
| | | |
|------------------------|---|--|
| Data & power interface |  <p style="text-align: center;">View from outside to radio</p> | Pin 1: PWR (9~16V DC) Pin 2: Power GND Pin 3: RXD Pin 4: Signal GND Pin 5: TXD |
|------------------------|---|--|

Table 3.10 Default factory configuration for Radio RS400H3

| Channel | Frequency |
|----------------------|------------|
| 00 | 457.550MHz |
| 01 | 458.050MHz |
| 02 | 458.550MHz |
| 03 | 459.050MHz |
| 04 | 459.550MHz |
| 05 | 460.550MHz |
| 06 | 461.550MHz |
| 07 | 462.550MHz |
| 08 | 463.550MHz |
| 09 | 464.550MHz |
| Customized frequency | 410~470MHz |

3.5 Radio whip antenna

The 410-470MHz radio whip antenna is to be installed on the TNC port to transmit or receive signal for the internal radio. This antenna is elastic whip structure, resistant to bending.




Table 3.11 Radio whip antenna technical specification

| Technical Specification | |
|-------------------------|------------|
| Frequency Range | 410~470MHz |
| Bandwidth | 60MHz |
| Polarization Mode | Vertical |
| Gain | 2dBi |
| Input Impedance | 50Ω |
| VSWR | ≤2.5 |
| Maximum Power | 20W |
| Connector | TNC Male |
| Antenna Length | 168mm |
| Antenna Weight | About 50g |
| Extreme Wind Speed | 120 Km/h |

4. Typical Applications

This chapter introduces typical applications of Oscar-TAP GNSS receiver, and solutions for some possible issues.

| | |
|---|--|
|  | <p>Install the radio antenna before switching the radio transceiver to transmit mode, or the radio transceiver may be damaged due to overheating. The energy to be transmitted cannot be emitted out without the antenna, which may cause the temperature rise and overheat of the radio module.</p> |
|---|--|

4.1 Base station operation



Figure 4.1 Oscar-TAP as a base - network mode

Table 4.1 Devices of Oscar-TAP as a base network mode

| NO. | Device Name |
|-----|--------------------------|
| 1 | Oscar-TAP GNSS receiver |
| 2 | Height measure accessory |
| 3 | GNSS antenna connector |
| 4 | Tribrach |
| 5 | Tripod |

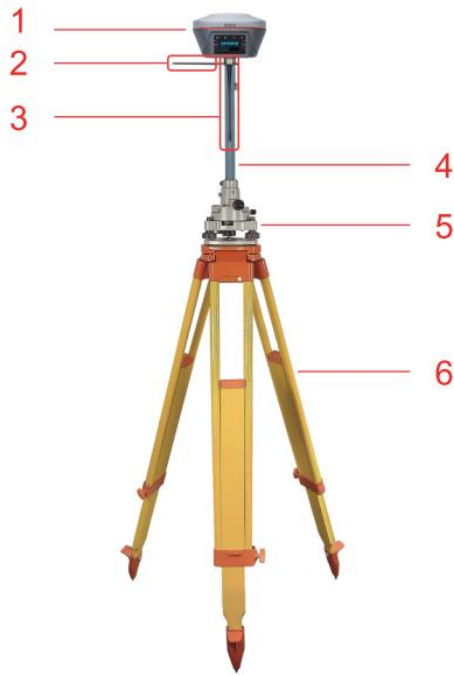


Figure 4.2 Oscar-TAP as a base - internal radio

Table 4.2 Devices of Oscar-TAP as a base internal radio mode

| NO. | Device Name |
|-----|-------------------------------|
| 1 | Oscar-TAP GNSS receiver |
| 2 | Height measure accessory |
| 3 | 410-470MHz radio whip antenna |
| 4 | Extension pole 30cm |
| 5 | Tribrach |
| 6 | Tripod |

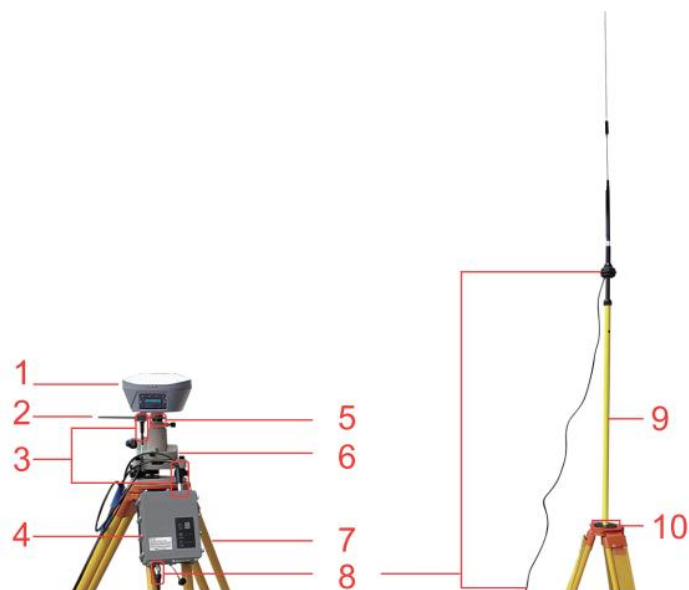


Figure 4.3 Oscar-TAP as a base – external radio

Table 4.3 Devices of Oscar-TAP as a base external radio mode

| NO. | Device Name |
|-----|---|
| 1 | Oscar-TAP GNSS receiver |
| 2 | Height measure accessory |
| 3 | Serial-5pin to External-Radio-DC-5pin & Bullet-DC |
| 4 | External Radio RS400H2 |
| 5 | GNSS antenna connector |
| 6 | Tribrach |
| 7 | Tripod |
| 8 | High Gain Radio Antenna |
| 9 | Telescopic pole for radio antenna |
| 10 | Metal plate for radio antenna |

Note: Bullet-DC connects to ‘Bullet-DC to Alligator Clips’, and then clip to the external power supply with 12V output.

Detailed steps of button operation:

1. Set up Oscar-TAP according section 2.1 Setting up Oscar-TAP after all the components above are ready, ensure one battery is installed in Oscar-TAP and insert one SIM card when 4G/3G/2G network is required for operation;

2. Long press the power button to power on Oscar-TAP;
3. Press FN button to select [Mode Config], press the power button to enter the work mode options;
4. Select [Base Mode] and press the power button;
5. If using Tersus Caster Service, select [TCS] and press the power button to enter TCS network settings; Set the format, server and press the power button to confirm.
6. If using internal radio, select [Internal Radio] and press the power button to enter radio setting; Set protocol, format, power, channel, frequency and press the power button to confirm.
7. If using external radio, select [External Radio] and press the power button to configure; Set Baud rate as 115200, format and press the power button to confirm.
8. Above all, setting Oscar-TAP as a base is completed.

Detailed steps of software operation:

1. Set up Oscar-TAP according section 2.1 Setting up Oscar-TAP after all the components above are ready, ensure one battery and one SIM card are installed in Oscar-TAP;
2. Long press power button to power on Oscar-TAP;
3. Use NFC function to launch Nuwa app. While the screen of TC20/TC50 Controller is unlocked, put TC20/TC50 Controller close to the Oscar-TAP NFC logo. The Bluetooth pairs automatically after a beep and Nuwa is launched requesting to open the latest project. Click [OK] and start configuring Oscar-TAP from step 7. Also you can click [Cancel] to create a new project or open an existing project, and then start configuring Oscar-TAP from step 7.
4. If using an android device without NFC function, ensure Oscar-TAP is

powered on, and launch Nuwa application on the android device. Click [Project] in the main interface to create a new project or open an existing project and connect Oscar-TAP manually.

5. Back to the main interface of Nuwa app, click [Device] -> [Connect] under an opened project.
6. Select [Oscar-TAP] for the Device Type, select [Bluetooth] for the Connect Type, click [Connect Config] to search and pair the Bluetooth address of Oscar-TAP, select [Oscar-TAP] for the Antenna and click [Connect] to enable communication between the android controller and Oscar-TAP.
7. Back to [Device] - > [Base], click [New] to create a new configuration for base.

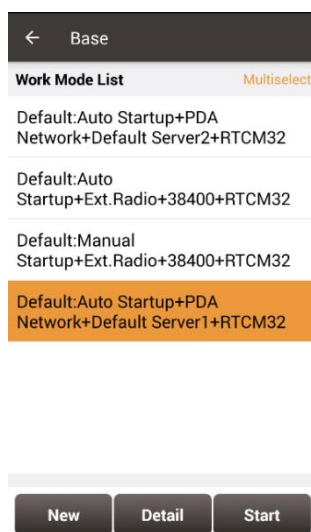
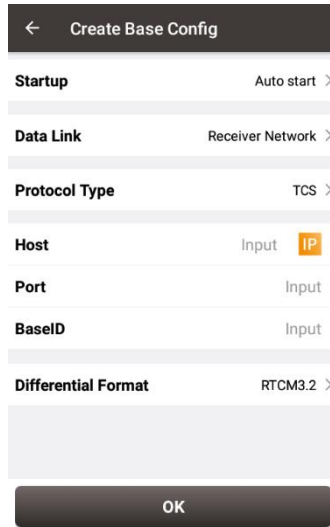


Figure 4.4 Base setting interface

8. Edit the base configuration for Oscar-TAP GNSS receiver. The startup mode can be chosen from auto start and manual start. If you choose manual start the base, you can manually type the base coordinate, or click the location icon to obtain the current base coordinate, or select a point from the control point library. The data link has four options: Receiver Network, PDA Network, Internal Radio and External Radio. Both the

Receiver Network and PDA Network have three protocol options: Tersus Caster Service (TCS), Ntrip and TCP.

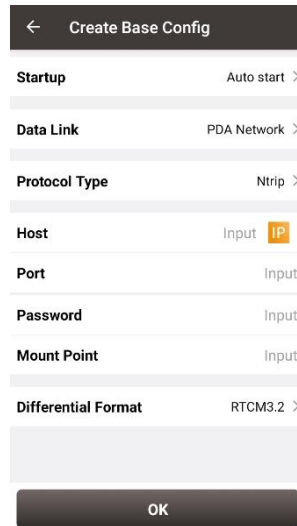


The screenshot shows the 'Create Base Config' screen with the following settings:

- Startup:** Auto start >
- Data Link:** Receiver Network >
- Protocol Type:** TCS >
- Host:** Input IP
- Port:** Input
- BaselD:** Input
- Differential Format:** RTCM3.2 >

An 'OK' button is located at the bottom of the screen.

Figure 4.5 Base configuration - Receiver Network (TCS)



The screenshot shows the 'Create Base Config' screen with the following settings:

- Startup:** Auto start >
- Data Link:** PDA Network >
- Protocol Type:** Ntrip >
- Host:** Input IP
- Port:** Input
- Password:** Input
- Mount Point:** Input
- Differential Format:** RTCM3.2 >

An 'OK' button is located at the bottom of the screen.

Figure 4.6 Base configuration – PDA Network (Ntrip)

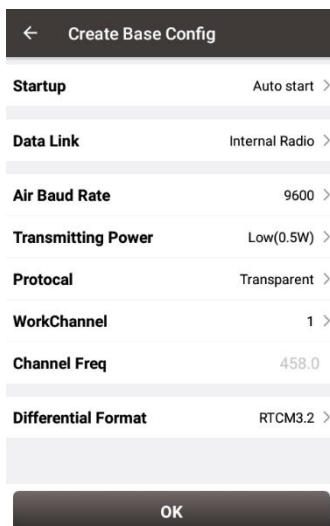


Figure 4.7 Base configuration - Internal Radio

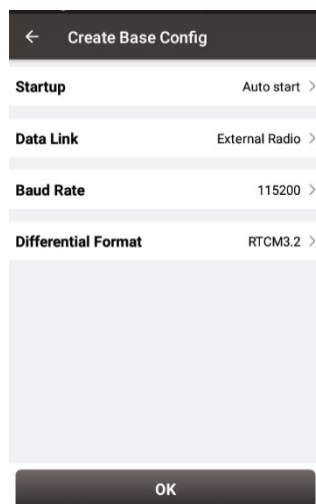


Figure 4.8 Base configuration - External Radio

9. After filling the information for the above configuration, click [OK]. Select this configuration in the work mode list and click [Start] to start data transmission for base which is shown as below.

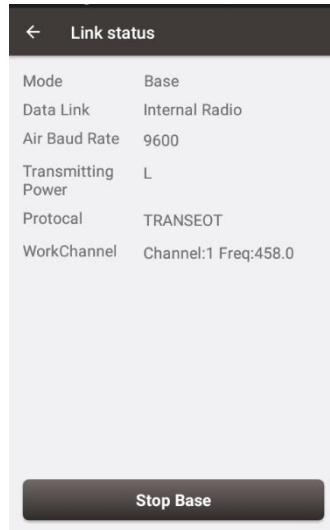


Figure 4.9 Link status of base using internal radio

4.2 Rover operation



Figure 4.10 Oscar-TAP as a Rover - Network Mode

Table 4.4 Devices of Oscar-TAP as a rover network mode

| NO. | Device Name |
|-----|-------------------------|
| 1 | Oscar-TAP GNSS receiver |
| 2 | Ranging pole |
| 3 | Bracket for TC20/TC50 |
| 4 | TC20/TC50 Controller |



Figure 4.11 Oscar-TAP as a Rover - Internal Radio

Table 4.5 Devices of Oscar-TAP as a rover internal radio mode

| NO. | Device Name |
|-----|-------------------------------|
| 1 | Oscar-TAP GNSS receiver |
| 2 | 410-470MHz radio whip antenna |
| 3 | Bracket for TC20/TC50 |
| 4 | Ranging pole |
| 5 | TC20/TC50 Controller |

Detailed steps of button operation:

1. Set up Oscar-TAP according section 2.1 Setting up Oscar-TAP after all the components above are ready, ensure one battery and one SIM card are installed in Oscar-TAP;
2. Long press the power button to power on Oscar-TAP;
3. Press FN button to select [Mode Config], press the power button to enter the work mode options;
4. Select [Rover Mode] and press power button;
5. If using Tersus Caster Service, select [TCS] and press the power button to enter TCS network settings; Set the Base ID, server and press the power button to confirm.

6. If using internal radio, select [Internal Radio] and press the power button to enter radio setting; Set protocol, channel and frequency same as Base, press the power button to confirm.
7. If using NTRIP Client, select [NTRIP Client] and press the power button to enter NTRIP setting; set IP address with correct port and press the power button to confirm.
8. Above all, setting Oscar-TAP as a rover is completed.

Detailed steps of software operation:

1. Set up Oscar-TAP according section 2.1 Setting up Oscar-TAP after all the components above are ready, ensure one battery and one SIM card are installed in Oscar-TAP;
2. Long press the power button to power on Oscar-TAP;
3. Use NFC function to launch Nuwa app. While the screen of TC20/TC50 Controller is unlocked, put TC20/TC50 Controller close to the Oscar-TAP NFC logo. The Bluetooth pairs automatically after a beep and Nuwa is launched requesting to open the latest project. Click [OK] and start configuring Oscar-TAP from step 7. Also you can click [Cancel] to create a new project or open an existing project, and then start configuring Oscar-TAP from step 7.
4. If using an android device without NFC function, ensure Oscar-TAP is powered on, and launch Nuwa application on the android device. Click [Project] in the main interface to create a new project or open an existing project and connect Oscar-TAP manually.
5. Back to the main interface of Nuwa app, click [Device] -> [Connect] under an opened project;
6. Select [Oscar] for the Device Type, select [Bluetooth] for the Connect Type, click [Connect Config] to search and pair the Bluetooth address of

Oscar-TAP, select [Oscar] for the Antenna and click [Connect] to enable communication between the android controller and Oscar-TAP.

7. Back to [Device] - > [TAP], click [Start] to start TAP.
8. Click [TAP Link Type] to select Satellite, Satellite + PDA Network, or Satellite + Receiver Network. Satellite + PDA Network and Satellite + Receiver Network require ntrip-TAP account number to be used.

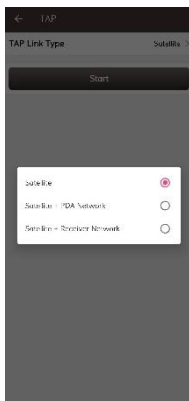


Figure 4.12 TAP setting interface

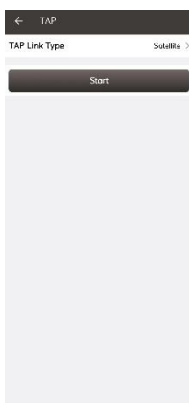


Figure 4.13 TAP setting - Satellite

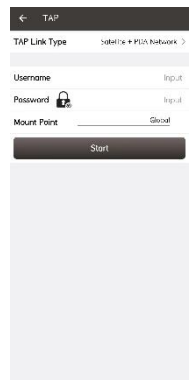


Figure 4.14 TAP setting - Satellite + PDA Network

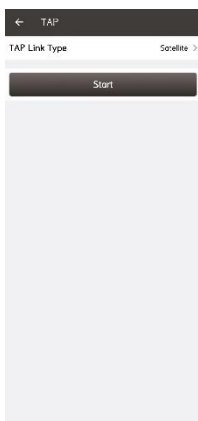


Figure 4.15 TAP setting - Satellite + Receiver Network



Figure 4.16 Link status of Rover using TAP

- Back to [Device] -> [Rover], click [New] to create a new configuration for rover.

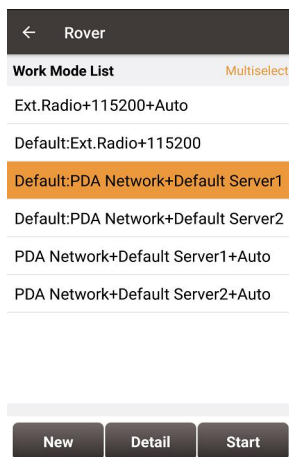


Figure 4.17 Rover setting interface

- Edit rover configuration for Oscar-TAP GNSS receiver under different data link selections. The Receiver Network and PDA Network have three protocol options respectively: Ntrip, TCP and Tersus Caster Service (TCS).

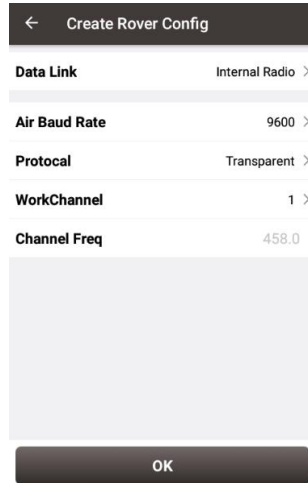


Figure 4.18 Rover configuration - Internal Radio

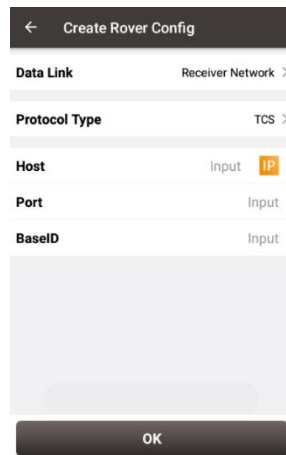


Figure 4.19 Rover configuration - Receiver Network (TCS)

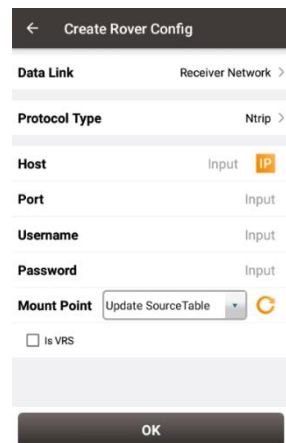


Figure 4.20 Rover configuration - Receiver Network (Ntrip)

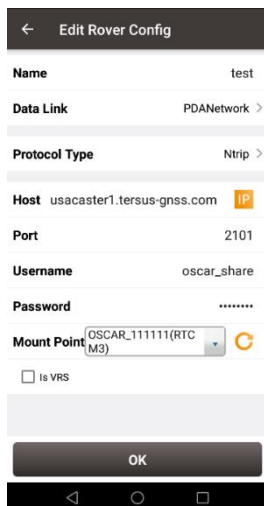


Figure 4.21 Rover configuration - PDA Network (Ntrip)

Note: Select PDANetwork when using cellular or Wi-Fi network of a PDA such as TC20 Controller.

11. After filling the information for the above configuration, click [OK]. Select this configuration in the work mode list and click [Start] to start data transmission for rover which is shown as below.

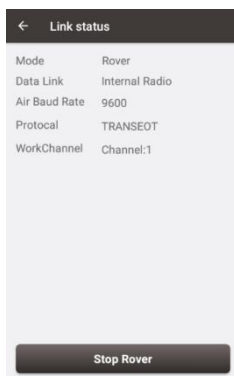


Figure 4.22 Link status of Rover using internal radio

4.3 Static survey

Before performing static survey, ensure one battery is installed in Oscar-TAP GNSS receiver.

Detailed steps of button operation:

1. Long press the power button to power on Oscar-TAP;
2. Press FN button to select [Mode Config], press the power button to enter the work mode options;
3. Select [Static: OFF] and press the power button to enter configuration options for static survey;
4. Set Frequency, Mask Elevation, Duration, Antenna Height, Measure Type, Data Format and RINEX Format;
5. Turn on static when the cursor is on 'STATIC: OFF', then it becomes 'STATIC: ON', press the power button to confirm;
6. Above all, setting static survey is completed.

Detailed steps of software operation:

1. Long press the power button to power on Oscar-TAP;
2. Use NFC function to launch Nuwa app. While the screen of TC20 Controller is unlocked, put TC20 Controller close to the Oscar-TAP NFC logo. The Bluetooth pairs automatically after a beep and Nuwa is launched requesting to open the latest project. Click [OK] and start configuring Oscar-TAP from step 6. Also you can click [Cancel] to create a new project or open an existing project, and then start configuring Oscar-TAP from step 6.
3. If using an android device without NFC function, ensure Oscar-TAP is powered on, and launch Nuwa application on the android device. Click

[Project] in the main interface to create a new project or open an existing project and connect Oscar-TAP manually.

4. Back to the main interface of Nuwa app, click [Device] -> [Connect] under an opened project;
5. Select [Oscar-TAP] for the Device Type, select [Bluetooth] for the Connect Type, click [Connect Config] to search and pair the Bluetooth address of Oscar-TAP, select [Oscar-TAP] for the Antenna and click [Connect] to enable communication between the android controller and Oscar-TAP.
6. Click [Survey] -> [Static Survey], fill in the parameters of interval, cutoff angle, and etc. Then click [Start] to start static survey.

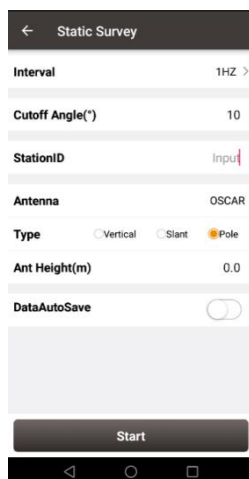


Figure 4.23 Static Survey configuration

7. If the DataAutoSave function is turned on, the static data is recorded automatically in the internal storage when power up Oscar-TAP next time. You can download data file refer to section 2.3.


4.4 Tilt survey and stakeout

Tilt function is only applicable for Oscar-TAP GNSS receiver Ultimate version

under rover mode.

4.4.1 Tilt initialization

The tilt compensation of Oscar-TAP GNSS receiver Ultimate version is free of complex calibration. The tilt compensation will be initialized when the surveyor walks forward naturally for several meters after turning on the tilt compensation function. You can start tilt survey right after you walk to the survey point.

There are two methods to turn on or off tilt compensation. One is turning on or off tilt compensation on Device Info on the OLED via buttons. Another method is through Nuwa app. After the Oscar-TAP GNSS receiver Ultimate version is connect in Nuwa app, and we configure it working as a Rover. Click the device icon  on the top or click [Device] under the device functional group to enter the device information interface. Turn on the [Tilt Enable] on the device interface.

When tilt function is turned on, the tilt LED on the Oscar-TAP Ultimate OLED display lights on with steady red, a few seconds later it starts flashing red. At this time, walk a few steps ahead, tilt the pole at any direction, then the tilt LED turns steady green which indicates tilt compensation is valid. Now you can start tilt survey.

When the tilt compensation is valid, click the Satellite info icon to view the detailed information of tilt compensation including tilt status, tilt direction, tilt angle, heading and their quality index. Among them, the tilt direct indicates which direction is tilted, that is, the angle between the projection of the ranging pole on the ground and the north direction after tilting; the tilt angle indicates the degree of tilt, that is, the angle between the tilted pole and the vertical direction; Heading indicates the surveyor's orientation (the facing of

Oscar-TAP's back, we consider Oscar-TAP's panel is always facing the surveyor).



Figure 4.24 Detailed information of tilt compensation

4.4.2 Tilt survey

After turning on [Tilt Enable] and tilt initialization is finished, enter Survey interface and start tilt survey.

The tilt status is displayed at the top of the survey interface. When the tilt status is ON, it is considered that the tilt compensation accuracy is high and it is in a usable state. You can start survey using the tilted ranging pole. Please ensure that the antenna height setting is correct which will affect the tilt measurement results.

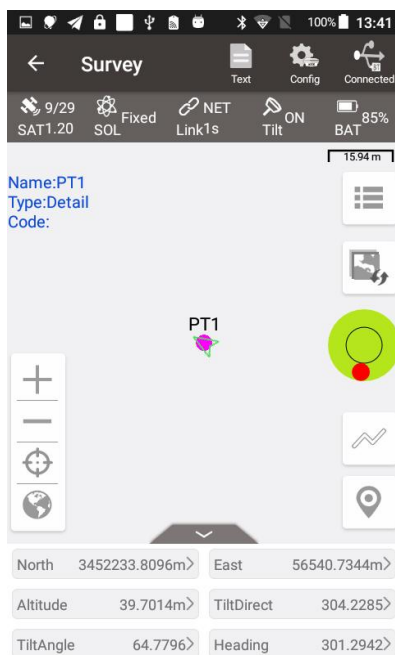


Figure 4.25 Tilt status is ON

When the status is displayed as N/A and blinking, it is considered that the accuracy of tilt compensation is reduced and it is in a state that is not recommended. At this time, the tilt indicator of the Oscar-TAP Ultimate OLED display turns flashing red. This may be caused by the surveyor standing for too long, rotating the ranging pole, or hitting the ranging pole to the ground. When the status is N/A, you need to redo the initialization. Generally, you do not need to stand still, just hold the ranging pole and walk forward to the next point, the initialization is complete automatically.

Note: during the tilt survey, please keep the Oscar-TAP OLED display facing the surveyor as much as possible. Please do not rotate the pole or hit the pole to the ground, which will invalidate the initialization or affect the accuracy of the tilt compensation. In addition, during the tilt point survey, if it does not continue at the third epoch reached when it is set smoothing 5 epochs for surveying points, please check whether the tilt compensation is invalid. It is not allowed to continue to complete the survey in the case where the tilt initialization accuracy is low.

4.4.3 Tilt stakeout

After turning on [Tilt Enable] and tilt initialization is finished, enter the Point Stakeout or Line Stakeout interface and start tilt stakeout. The tilt state is also added at the top of the stakeout interface to indicate the current tilt available state.

During the tilt stakeout process, if you enter the threshold range of the stakeout setting, the software will display a virtual tilt ranging pole along with the beep sounds. It is drawn according to the tilt direction angle. When the pole is tilted in a certain direction among east, west, south and north, the virtual tilt ranging pole on the interface will also tilt in a certain direction.

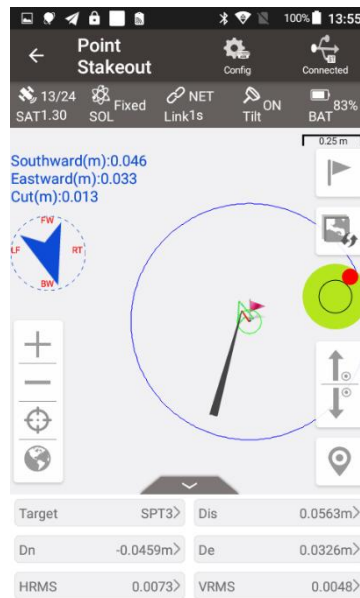


Figure 4.26 Point stakeout when tilt compensation is on

4.5 Issues and solutions

This section lists possible issues and effective solutions to solve them. Please read this section before contacting Tersus technical support.

1. Oscar-TAP GNSS receiver cannot receive satellite signals.

Solution:

- (1) Change the survey environment, and restart Oscar-TAP in an open space.
- (2) Reset the GNSS module by pressing and holding the FN button, continuously tapping the power button 5 times.

2. The internal UHF radio does not transmit data.

Solution:

- (1) Check whether the receiver is searching satellites normally;
- (2) Check whether the 2W/460MHz radio antenna is installed properly;
- (3) Check whether the radio module's protocol and channel are configured correctly and consistent with the configuration of rover's radio.

3. CORS network is not able to be logged in.

Solution:

Check whether the 4G SIM card is properly installed, and whether it can be used normally.

4. The communication between Nuwa and Oscar-TAP fails.

Solution:

- (1) Check whether the Oscar-TAP is powered on;
- (2) Re-search and pair the Bluetooth;
- (3) Upgrade Nuwa to the latest version.

5. There is no correction data for rover when using Ntrip work mode.

Solutions:

- (1) Check whether the IP address, port, user name, password is correct;
- (2) Check network. Try to use PDA/controller network to compare. Make sure there is no issue on the contact between the SIM card slot and the SIM card.
- (3) Obtain the SourceTable to check the receiver network module, ensure there is no issue on CORS service.
- (4) Try to log in with the same configuration and get a compared result if there is an extra receiver.
- (5) If still cannot log in, consult your CORS service provider.

6. How to export static observation data from Oscar-TAP?

Solutions:

- (1) Connect Oscar-TAP receiver with a computer through a mini USB cable.
- (2) The computer detects the Oscar-TAP receiver as an external disk.
- (3) Open the Record folder, find the trs file and rinex file in its storage according to recording date.
- (4) Copy the static observation data and paste them to the designated folder in your computer.

7. How to calibrate the E-Bubble of Oscar-TAP receiver?

Solutions:

- (1) Firstly, install Oscar-TAP receiver on the tribrach of a tripod. Adjust the tribrach to enable the bubble to the center.
- (2) Next step, select <Adjust> in the Nuwa under Device Info -> E-Bubble to complete the calibration.

8. How to apply Geoid model file correctly?

Solutions:

- (1) Prepare the Geoid file at first and placed in the path of Internal storage\TersusSurvey\Geoid.
- (2) Next step, launch Nuwa and go to select Project - Current Project and edit Coordinate System. Find the Height Fitting-Adjust Method and select Geoid.
- (3) Last, select the file under Geoid List and apply it.

9. How to configure Oscar-TAP serial port output NMEA log?

Solutions:

There are two ways to realize the NMEA sentences output which you'd like to.

- (1) Nuwa can configure to output NMEA by the NMEA option. It can be specified the Baud Rate, the kind of sentence.
- (2) Variable bonus, it can be directly configured on the panel. NMEA can be turned on through Device Info -> Serial.

10. A base receiver is working well, the rover receiver cannot get correction data, how to fix this?

Solutions:

- (1) Check whether the radio antenna connects well with receiver. Carefully check whether the interface is tightened.
- (2) Check whether the air baud rate, Protocol, Bandwidth, Frequency match right with that of the base receiver.
- (3) Switchover the radio frequency to avoid the possible interference from nearby devices.

11. The Oscar-TAP rover works at a short distance (not normal distance) at

the radio mode?

Solutions:

- (1) Check whether the rover connects a radio antenna.
- (2) Adjust the radio of base at the high power gear.
- (3) Check the environment if there exists radio interference along the propagation line.

5. Terminology

| Abbreviation | Description |
|---------------------|--|
| AC | Alternating Current |
| BDS | BeiDou Navigation Satellite System |
| CMR | Compact Measurement Record |
| DC | Direct Current |
| eMMC | Embedded Multi Media Card |
| GLONASS | GLObal NAVigation Satellite System |
| GNSS | Global Navigation Satellite System |
| GPS | Global Positioning System |
| GSM | Global System for Mobile Communications |
| LED | Light Emitting Diode |
| OLED | Organic Light-Emitting Diode |
| PDA | Personal Digital Assistant |
| PPK | Post-Processing Kinematic |
| PPS | Pulse Per Second |
| QZSS | Quasi-Zenith Satellite System |
| RINEX | Receiver Independent Exchange format |
| RMS | Root Mean Squares |
| RTK | Real-Time Kinematic |
| RTCM | Radio Technical Commission for Maritime Services |
| SIM | Subscriber Identification Module |
| TCP | Transmission Control Protocol |
| UAV | Unmanned Aerial Vehicle, drone |
| UMTS | Universal Mobile Telecommunications System |
| USB | Universal Serial BUS |
| UTC | Universal Time Coordinated |

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