User Manual

Version V1.0-20190613

User Manual
For Oscar Ultimate

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Revision History

Version	Revision Date	Change Summary
1.0	20190613	Initial Release

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Notices

FCC Notices

The Surveying GNSS Receiver has been tested and found to comply with the radiated and conducted emission limits for a Class A digital device (FCC Part 15B and Part 15C). The Class A limits are designed to provide reasonable protection against harmful interference in a residential installation.

CE Marking

Tersus GNSS Inc. declares that Surveying GNSS Receiver is in compliance with the essential requirements (radio performance, electromagnetic compatibility and electrical safety) and other relevant provisions of Radio Equipment Directive 2014/53/EU, Electromagnetic Compatibility (EMC) Directive 2014/30/EU, and Low voltage (LVD) Directive 2014/35/EU. Therefore the equipment is labeled with the following CE-marking.

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

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

⚠	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.

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.

In this manual, all the commands to a receiver are in capital letters, which is just for easy identification, the commands are not case-sensitive.

Table 0.1 Document / 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.tersus-gnss.com/document under GNSS OEM Board / User Manual
Tersus Tool Suite	Tersus Tools including TersusDownload, TersusGeoPix, TersusGNSSCenter, TersusUpdate, TersusRinexConverter	https://www.tersus-gnss.com/software
Nuwa	Survey application running in the Android platform, David, Oscar and other NMEA devices can be configured with Nuwa.	https://www.tersus-gnss.com/software/oscar-receiver
Mission Planner	A popular Ground Station software	http://firmware.ardupilot.org/Tools/MissionPlanner/

Support

If there is any problem and the information needed cannot be found in the product documentation, request technical support using the Tersus website at www.tersus-gnss.com, or mail to support@tersus-gnss.com

1. Introduction

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

1.1 Overview

The Surveying 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 big interactive screen on Ultimate and Advanced versions. With an internal high-performance multi-constellation and multi-frequency GNSS board, the Surveying 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 RTK mode. The built-in UHF radio module supports long distance communication. The rugged housing protects the equipment from harsh environments.

The Surveying GNSS Receiver has three versions: Ultimate, Advanced, and Basic. It provides selectivity for the requirement from different users.

1.2 Receiver Features

The Surveying GNSS Receiver has following features:

- Supports constellations & frequencies
  - GPS L1, L2
- Supports 410-470MHz UHF radio, 4G network, Wi-Fi, Bluetooth, NFC.
- Tilt compensation without calibration, immune to magnetic disturbances.
- Various working modes
- 16GB/8GB internal storage
- Up to 16 hours working in RTK mode
- IP67-rated dust- & waterproof enclosure, for reliability in harsh environmental conditions

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 Surveying GNSS Receiver

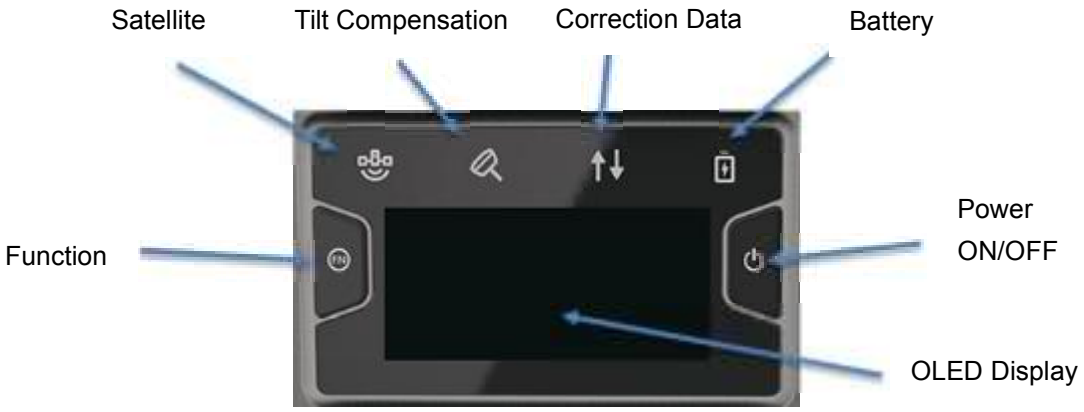

Figure 1.4 Buttons and Display on Oscar Ultimate

Buttons

There are two buttons on each version of Surveying GNSS Receiver

[]: Power ON/OFF button. When the device is off, long press it for 2 seconds to power on the receiver. When the device is on, long press it for 3 seconds to power off the Receiver. In addition, for Ultimate and Advanced 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	Advanced	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	Touch the power button or FN button to wake up the OLED screen when the OLED screen is light out.		NA

Combination Function of the two buttons

Press and hold the FN button, continuously touch 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

There are **four** LED indicators and **one** OLED display screen on Ultimate version and Advanced version. There are **six** LED indicators on Basic version of Surveying GNSS Receiver. The LESs on the front panel indicate various operating conditions. The detailed LED Descriptions are shown in the table below.

Table 1.2 Detailed description for LED indicators

LED indicator	Ultimate	Advanced	Basic
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 & Yellow LED. Steady green means tilt compensation is turned on.	N/A	N/A
Correction data	Green and Yellow LED. Green indicates correction data, and yellow indicates solution status.		Green LED indicates correction data.
Battery	Red LED. Steady red 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.		

Static Survey	N/A	Green LED indicates static survey mode.	
Solution status	N/A	N/A	Yellow LED. Steady yellow indicates fixed solution, flashing 1Hz indicates floating solution, off light for other solutions.
Bluetooth	N/A	N/A	Blue LED indicates Bluetooth status.

LED Flash Patterns

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

Table 1.3 Possible LED flash patterns

Receiver mode	Button operation	LED flash patterns
Receiver OFF	N/A	All LEDs are off.
Receiver ON	Long press 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 slowly.
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 yellow for Ultimate and Advanced versions, Solution status LED is steady yellow for Basic version.
Floating solution	N/A	Correction data LED flashes yellow at 1Hz for Ultimate and Advanced versions, Solution status LED flashes yellow at 1Hz for Basic version.
Reset GNSS module	Press and hold the FN button, continuously touch the ON/OFF button 5 times	The correction data LED and satellite LED flash 3 times simultaneously, the other LEDs remain in the original state during this process.
Turn on static mode for Basic version	Press FN button for 3s	Static LED flashes 3 times continuously.
Turn off static mode For Basic version	Press FN button for 3s	The correction data LED flashes 3 times continuously.
Firmware upgrade	N/A	All LEDs are on when downloading firmware. All LESs flash continuously 3s simultaneously after the upgrade is completed.

Note: N/A means Not Available.

Receiver Ports

The bottom of Oscar receiver is shown as below.

Figure 1.5 Bottom of Surveying GNSS Receiver

Table 1.4 Receiver ports on the bottom side

Icon	Connector	Name	Connections
		Serial Data port	External power, RS-232 communication, external radio
		Mini USB port	Device, computer, USB drive
SIM		SIM slot	Micro SIM card
-		TNC port	Radio antenna

1.3.2 Battery and Charger

Oscar equips smart lithium batteries which can detect electricity and display the power level intelligently. The Surveying 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 RTK 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 slot 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 plug in the local AC outlet (100~240V AC) to start charging.

Figure 1.9 CN20 Charger Adapter

Note: the product is not suitable for shipment with this adapter

Charge the battery completely before using it for the first time. 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 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 IP67 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
- IP67 certified grade, water/shock/dust proof
- 6500 mAh battery
- A-GPS supported
- 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

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

Figure 1.10 Four sides of TC20 controller FCC ID:2AMDJ-TC20

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

Home Key: Return to home screen. To view recent application, press and hold the home key.

Back Key: Return to previous screen.

Volume Key: Adjust the volume of the ringtone.

Reset Key: Shut down the phone when phone is abnormal.

Camera key: Short press to enter camera in home screen. Long press it to open torch.

Accessories of TC20 Controller:

TC20 Lithium Battery (3.7V/6500mAh)

Figure 1.11 TC20 Lithium battery

TC20 Charger (5V/1A)

Figure 1.12 TC20 Charger

Mini USB Cable

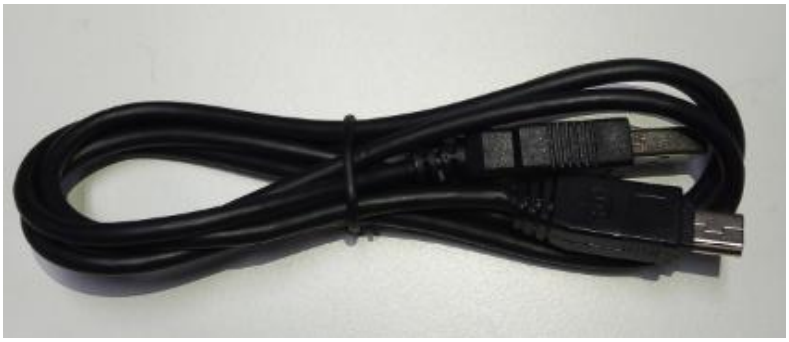

Figure 1.13 Mini USB cable

Functions: 1. Connect to the USB port of computer for data downloading;

2. Connect to the charger to charge TC20 controller.

1.3.4 Other Accessories

Other accessories may be packed according to customer requirement.

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

Figure 1.14 GNSS Antenna Connector

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

Figure 1.15 Height Measure Accessory

The 410-470MHz radio antenna is to be installed on the TNC port and receive radio signal.

Figure 1.16 410-470MHz radio antenna

When installing 410-470MHz radio antenna on Oscar, it is necessary to use an

extension pole to heighten Oscar and avoid bending the 410-470MHz radio antenna.

Figure 1.17 Extension pole

The 30W Radio for Oscar below is to be installed via Serial Data Port, and it can help Oscar transmitting signals farther than internal radio.

Figure 1.18 30W Radio for Oscar

When using 30W radio for Oscar as a base, a high gain radio antenna and a telescopic pole are needed which are shown as below.

Figure 1.19 High Gain Radio Antenna

Figure 1.20 Telescopic pole for radio antenna

When using Oscar as a rover, a ranging pole is needed.

Figure 1.21 Ranging Pole

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

Figure 1.22 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 1.23 Carrying Case

2. General Operations

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

2.1 Setting up Oscar

2.1.1 Insert the battery

Open the battery cover, notice the metal contact on the bottom and put one battery inside align the metal contact position.

Figure 2.1 Open the battery cover

Push the battery in the direction of the arrow on the top, then close the cover and lock it.

Figure 2.2 Put one battery in Oscar

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

⚠	DO NOT damage the rechargeable Lithium-ion battery. A damaged battery can cause an explosion or fire, and can result in personal injury and/or property damage. To prevent injury or damage: – DO NOT use or charge the battery if it appears to be damaged. Signs of damage include, but are not limited to, discoloration, warping, and leaking battery fluid. – DO NOT expose the battery to fire, high temperature, or direct sunlight. – DO NOT immerse the battery in water. – DO NOT use or store the battery inside a vehicle in hot weather. – DO NOT drop or puncture the battery. – DO NOT open the battery or short-circuit its contacts.
⚠	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.

⚠	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.

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

2.1.2 Insert the SIM card

Insert the SIM card with the contacts facing outside which is shown as below.

Figure 2.3 Insert the SIM card

To eject the 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 on a Tripod or Ranging Pole

Surveying GNSS Receiver has a standard 5/8'' x 11 UNC female connector and it can be fixed on a tripod or a ranging pole to be a base or rover according to customer requirement.

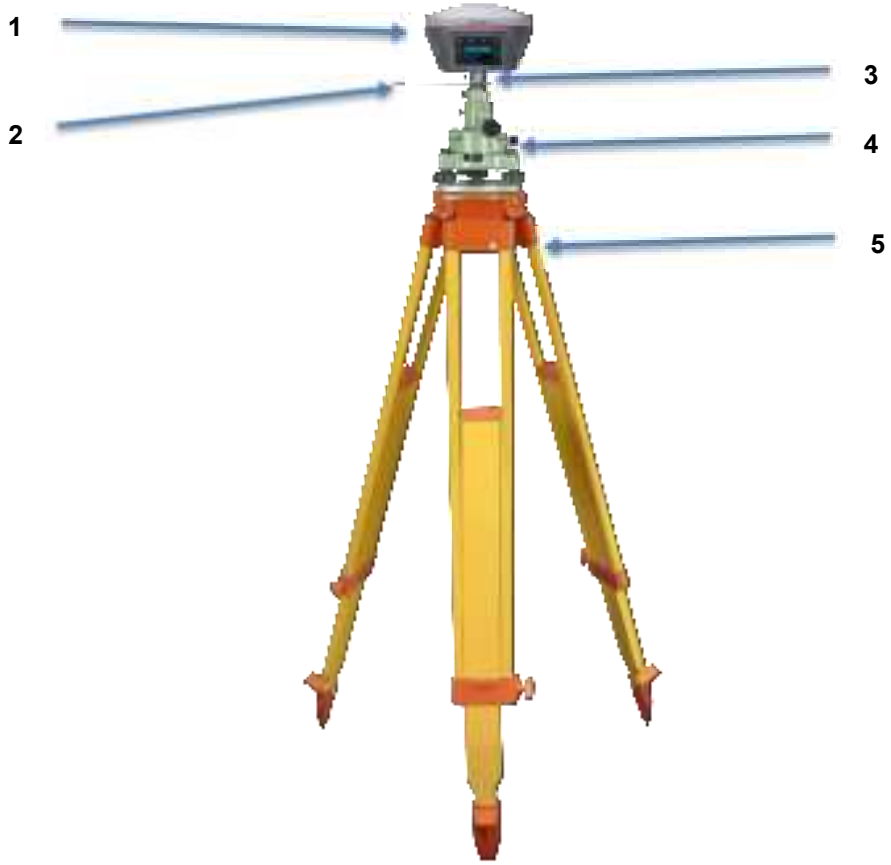

Figure 2.4 Oscar as a base without radio antenna

Table 2.1 Devices to set Oscar as a base

Device Name	Quantity	Items in the figure
Surveying GNSS Receiver	1	1, details refer to section 1.3.1
Height measure accessory	1	2, details refer to section 1.3.4
GNSS antenna connector	1	3, details refer to section 1.3.4
Tribrach	1	4
Tripod	1	5

Figure 2.5 Oscar as a rover without radio antenna

Table 2.2 Devices to set Oscar as a rover

Device Name	Quantity	Items in the figure
Surveying GNSS Receiver	1	1, details refer to section 1.3.1
Ranging pole	1	2, details refer to section 1.3.4
Bracket for TC20	1	3
TC20 Controller	1	4, details refer to section 1.3.3

2.2 Oscar Configuration

Surveying GNSS Receiver can be configured via buttons, TC20 Controller or other android devices, and web interface.

2.2.1 Configure via Buttons

The detailed definition of buttons on Surveying GNSS Receiver refers to Figure 1.4, Table 1.1, and related context. There are OLED display for Ultimate and Advanced versions, and no display for Basic version. Therefore the button configurations are different which are listed below.

Table 2.3 Button configuration for Oscar Ultimate and Advanced

Action	Button operation	Description
Turn on the receiver	Press power button for 2s	All four LEDs light up and remain for 3s, then all go off and battery LED is steady red if battery level is >30%.
Turn off the receiver	Press power button for 3s	All four LEDs light off.
Wake up	Touch the power button or FN button to wake up the OLED screen when the OLED screen is light out.	Screen off to on.
Select	Press FN button	
Confirm	Press power button	Confirm, cancel, or return.
Reset GNSS module	Press and hold the FN button, continuously touch the power button 5 times	The correction data LED and satellite LED flash 3 times simultaneously, the other LEDs remain in the original state during this process.

Table 2.4 Button configuration for Oscar Basic

Action	Button operation	Description
Turn on the receiver	Press power button for 2s	All six LEDs light up and remain for 3s, then all go off and battery LED is steady red if battery level is >30%.
Turn off the receiver	Press power button for 3s	All six LEDs light off.
Turn on static recording	Press and hold FN button for 3s	Static LED flashes 3 times continuously
Turn on static mode	Press FN button after static LED flashes 3 times continuously	Static LED flashes twice in succession
Turn off static recording	Press and hold FN button for 3s	Correction data LED flashes 3 times continuously.
Reset GNSS module	Press and hold the FN button, continuously touch the power button 5 times	The correction data LED and satellite LED flash 3 times simultaneously, the other LEDs remain in the original state during this process.

2.2.2 Configure via TC20 Controller

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

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 Surveying GNSS Receiver is powered on, to connect Oscar, put TC20 Controller near the NFC logo on Oscar, the TC20 controller pair Bluetooth with Oscar automatically; or click [Device] -> [Connect] under an opened project, and select [Oscar] for the Device Type which is shown as below.

Figure 2.7 Connect Oscar via Bluetooth

Select [Bluetooth] for the Connect Type. Click [Connect Config] to search and pair the Bluetooth address of Oscar. Select [Oscar] for the Antenna to use the internal antenna of Oscar. Then click [Connect] to enable the communication between TC20 Controller and Oscar.

To configure Oscar 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 2.8 Base configuration

Figure 2.9 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 2.10 Link status of Base

Figure 2.11 Link status of Rover

2.2.3 Configure via Web Interface

To be updated.

2.3 Data Download

Downloading data stored in Oscar to an office computer is very simple as Oscar can be used as an USB storage device when connecting with a computer.

Before connecting Oscar to a computer, ensure Oscar is powered on. Use the Mini USB Cable in the package to connect Oscar to the USB port of a computer which is shown as below.

Figure 2.12 Connect Oscar to a computer

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

2.4 Firmware Upgrade

There are two methods to upgrade firmware for Surveying GNSS Receiver: wired upgrade and wireless upgrade.

2.4.1 Wired Upgrade

Before connecting Oscar to a USB memory stick, ensure Oscar is powered on and the updated firmware is stored in the USB memory stick. Use the Mini USB to USB Type A female cable to connect Oscar to the USB memory stick.

Figure 2.13 Connect Oscar to a USB memory stick

After completing the connection, it will prompt out a notice on the screen of Oscar to show that a new firmware is detected. Press power button to confirm the firmware upgrade, it will upgrade automatically and restart after finishing the firmware upgrade.

2.4.2 Wireless Upgrade

This method is using Nuwa app to assist the firmware upgrade. To be updated.

2.5 Operations of TC20 Controller

2.5.1 Insert SIM card and T-Flash card

1. **Remove the back cover**: Loosen the screws on the back side – to rotate the screws anti-clockwise until open the bake cover as shown in Figure 2.14.

Figure 2.14 Remove the back cover

2. **Take off the back cover**: Remove the back cover by lifting it up from the bottom part as shown in Figure 2.15.

Figure 2.15 Take off the back cover

3. **Put the SIM Card in the holder**: Put the SIM card into the slot touching the SIM contacts of the phone as shown in Figure 2.16.

Figure 2.16 Put the SIM card in the holder

4. **Insert T-Flash card**: Open T-Flash card holder and insert T-Flash card into the slot, then close T-Flash card holder as shown in Figure 2.17.

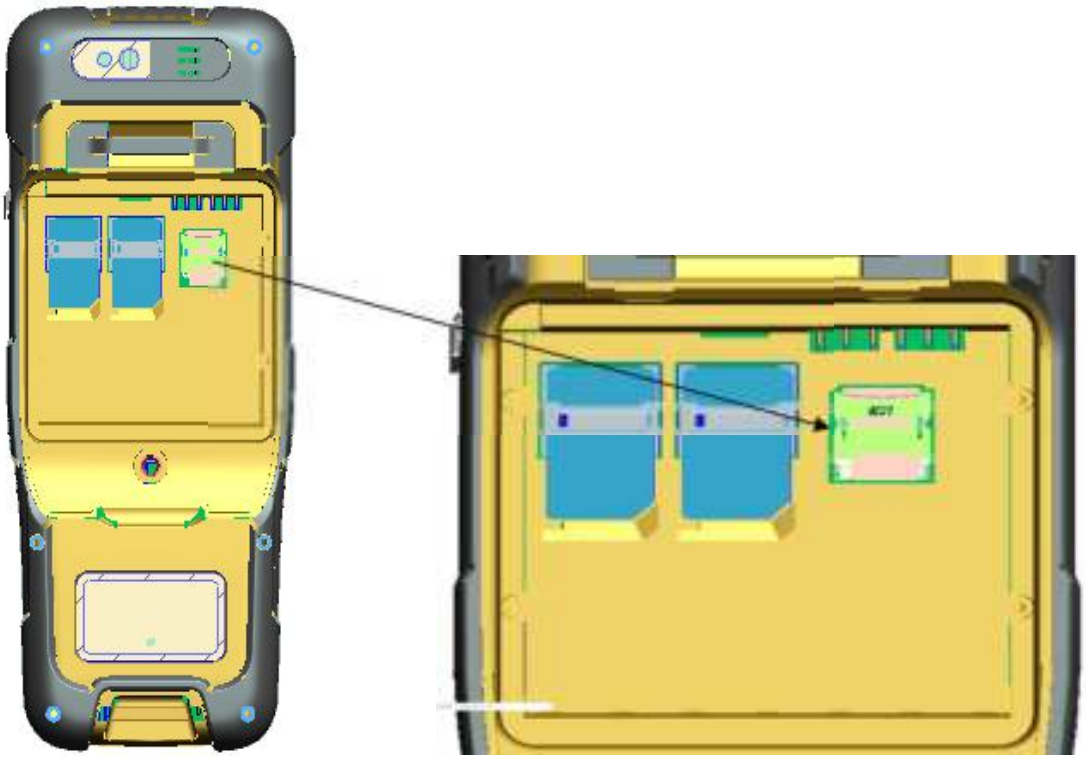

Figure 2.17 Insert T-Flash card

5. **Insert the back cover**: Insert the back cover and rotate screws clockwise to lock the back cover as shown in Figure 2.18.

Figure 2.18 Insert the back cover

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

2.5.2 T-Flash 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 T-Flash as USB storage.

Figure 2.19 Select USB function

2.5.3 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.

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

2） Long-Time Click the blanks of home screen to add home screen shortcut.

3） 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 hidden information.

3. Technical Specifications

This chapter mainly introduces the technical specifications of Surveying GNSS Receiver and TC20 Controller.

3.1 Surveying GNSS Receiver

Table 3.1 Surveying GNSS Receiver Performance

GNSS Performance		
Position Accuracy	High Precision Static	3mm+0.1ppm (Horizontal)
		3.5mm+0.4ppm (Vertical)
	Static & Fast Static	3mm+0.5ppm (Horizontal)
		5mm+0.5ppm (Vertical)
	Post Processed Kinematic	8mm+1ppm (Horizontal)
		15mm+1ppm (Vertical)
	Real Time Kinematic	8mm+1ppm (Horizontal)
		15mm+1ppm (Vertical)
	Network Real Time Kinematic	8mm+0.5ppm (Horizontal)
		15mm+0.5ppm (Vertical)
Initialization (typical)	<10s	
Initialization Reliability	>99.9%	
Tilt Compensation Accuracy (within 30°)	≤2cm	
System & Data		
Operating System	Linux	
Storage	built-in 16GB/8GB	
RTK Format	CMR, CMR+, RTCM 2.X/3.X	
Software Support		
Tersus Nuwa, MicroSurvey FieldGenius		

Communication		
Cellular	2G/3G/4G	
Wi-Fi	802.11b/g/n	
Bluetooth	4.1	
USB OTG	USB 2.0 x1	
Serial Ports	RS232 x1	
Internal Radio	Power	2W
	Frequency	410MHz ~ 470MHz
Distance (Typical)	5km	
Radio Protocols	TrimTalk450, TrimMark 3, South, Transparent, Satel	
Electrical Description		
Input Voltage	+9 ~ 28 VDC	
Power Consumption	Network or Radio Receiving Mode	≈ 5W
	Radio Transmitting Mode	≈ 8W
Lithium Battery	6400mAh 7.4V x2	
Physical Description		
Display	1.54'' OLED for Ultimate & Advanced versions	
Dimension	157*157*103 mm	
Weight	≈ 1.1kg (without battery) ≈ 1.3kg (with a battery)	
Environmental		
Operating Temperature	-40°C to +75°C	
Storage Temperature	-55°C to +85°C	
Relative Humidity	100% not condensed	
Water & dust proof	IP67	
Pole Drop onto Concrete	2m	

Figure 3.1 Serial Data port of Oscar

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

3.2 TC20 Controller

Table 3.3 TC20 technical specification

System	
Operating System	Android 6.0
CPU	MTK MT6735 Quad-Core 1.3GHz
Memory	2GB RAM + 16GB ROM
External Flash	T-Flash , up to 64GB
Keypad Backlight	White
LCD	4.3"
Touch Screen	Capacitive Touch Screen
Camera	8M pixel, Auto Focus
Flash Light	High light Flash LED
Language	47 languages including Chinese, English, Filipino, French, Italian, Japanese, Korean, Malay, Portuguese, Romanian, Russian, Spanish, Turkish, etc.

GNSS	
Signals supported	A-GPS
Communication	
Wi-Fi	IEEE 802.11a/b/g/n/ac
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 900 / 1800 MHz
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	6500 mAh
Battery Life	10 hours operation, 720 hours standby
Charging Time	4.5 hours (5V 2A input), 8 hours (5V 1A input)
Physical	
Dustproof & Waterproof	IP67
Shock	0.8m drop onto concrete
Dimension	210mmx87mmx31mm
Weight	495g (include battery)
Operating Temperature	-20 °C ~ +55 °C
Storage Temperature	-30 °C ~ +65 °C

4. Typical Applications

This chapter introduces typical applications of Surveying GNSS Receiver, and solutions for some possible issues.

4.1 Base Station Operation

Figure 4.1 Oscar as a Base – Network Mode

Table 4.1 Devices in Figure 4.1

NO.	Device Name
1	Surveying GNSS Receiver
2	Height measure accessory

3	GNSS antenna connector
4	Tribrach
5	Tripod

Figure 4.2 Oscar as a Base – Internal Radio

Table 4.2 Devices in Figure 4.2

NO.	Device Name
1	Surveying GNSS Receiver
2	Height measure accessory
3	410-470MHz radio antenna
4	Extension pole
5	Tribrach
6	Tripod

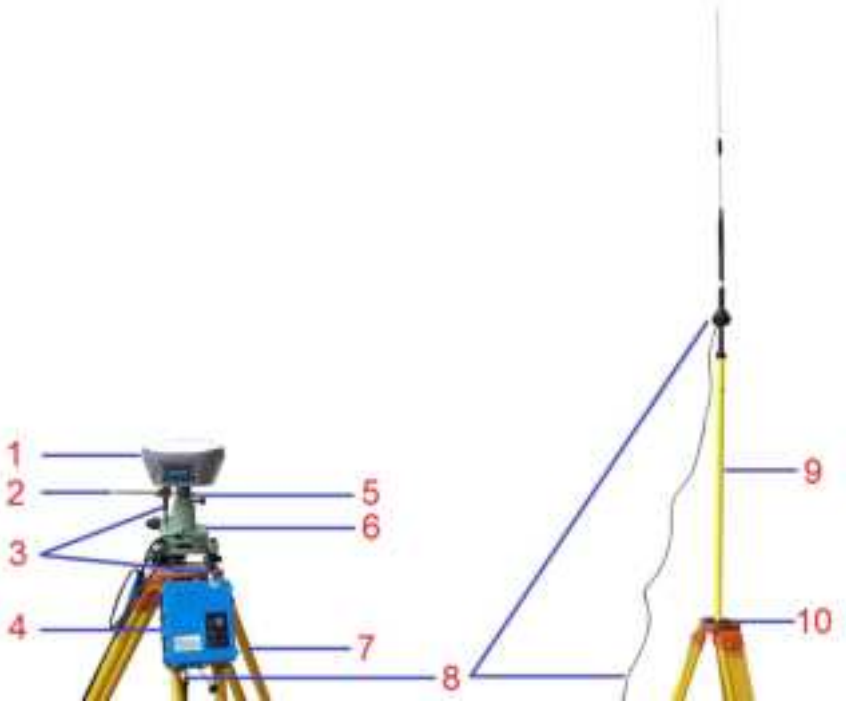

Figure 4.3 Oscar as a Base – External 30W Radio

Table 4.3 Devices in Figure 4.3

NO.	Device Name
1	Surveying GNSS Receiver
2	Height measure accessory
3	Serial-5pin to 30W-Radio-DC-5pin & Bullet-DC
4	30W Radio for Oscar
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 according section 2.1 Setting up Oscar after all the components above are ready, ensure one battery and one SIM card are installed in Oscar;

2. Long press power button to power on Oscar;
3. Press FN button to select [Device Settings], press power button to enter the work mode options;
4. Select [BASE Mode] and press power button to enter connection options;
5. If using Tersus Network, select [Tersus Network] and press power button to enter Network Settings; Set the format, server and press power button to confirm.
6. If using internal radio, select [Internal Radio] and press power button to enter radio setting; Set protocol, format, power, channel, frequency and press power button to confirm.
7. If using serial port to connect external radio, select [Serial Port] and press power button to enter serial settings; Set Baud Rate, format and press power button to confirm.
8. Above all, setting Oscar as a base is completed.

Detailed steps of software operation:

1. Set up Oscar according section 2.1 Setting up Oscar after all the components above are ready, ensure one battery and one SIM card are installed in Oscar;
2. Long press power button to power on Oscar;
3. Use NFC function to launch Nuwa app. While the screen of TC20 Controller is unlocked, put TC20 Controller close to the Oscar 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 from step 7. Also you can click [Cancel] to create a new project or open an existing project, and then start configuring Oscar from step 7.
4. If using an android device without NFC function, ensure Oscar 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 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, select [Oscar] for the Antenna and click [Connect] to enable communication between the android controller and Oscar.
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 Surveying GNSS Receiver under different data link selections. Select UART when using external 30W Radio.

Figure 4.5 Base configuration – TersusNetwork

Figure 4.6 Base configuration – Radio

Figure 4.7 Base configuration – UART

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 4.8 Link status of Base using TersusNetwork

4.2 Rover Operation

Figure 4.9 Oscar as a Rover – Network Mode

Table 4.4 Devices in Figure 4.9

NO.	Device Name
1	Surveying GNSS Receiver
2	Ranging pole
3	Bracket for TC20
4	TC20 Controller

Figure 4.10 Oscar as a Rover – Internal Radio

Table 4.5 Devices in Figure 4.10

NO.	Device Name
1	Surveying GNSS Receiver
2	Radio antenna for Oscar
3	Bracket for TC20
4	Ranging pole
5	TC20 Controller

Detailed steps of button operation:

1. Set up Oscar according section 2.1 Setting up Oscar after all the components above are ready, ensure one battery and one SIM card are installed in Oscar;

2. Long press power button to power on Oscar;
3. Press FN button to select [Device Settings], press power button to enter the work mode options;
4. Select [Rover Mode] and press power button to enter connection options;
5. If using Tersus Network, select [Tersus Network] and press power button to enter Network Settings; Set the Base ID, server and press power button to confirm.
6. If using internal radio, select [Internal Radio] and press power button to enter radio setting; Set protocol, format, power, channel, frequency and press power button to confirm.
7. If using CORS network, select [CORS Network] and press power button to enter CORS setting; set CORS address with correct port and press power button to confirm.
8. Above all, setting Oscar as a rover is completed.

Detailed steps of software operation:

1. Set up Oscar according section 2.1 Setting up Oscar after all the components above are ready, ensure one battery and one SIM card are installed in Oscar;
2. Long press power button to power on Oscar;
3. Use NFC function to launch Nuwa app. While the screen of TC20 Controller is unlocked, put TC20 Controller close to the Oscar 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 from step 7. Also you can click [Cancel] to create a new project or open an existing project, and then start configuring Oscar from step 7.
4. If using an android device without NFC function, ensure Oscar 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 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, select [Oscar] for the Antenna and click [Connect] to enable communication between the android controller and Oscar.
7. Back to [Device] - > [Rover], click [New] to create a new configuration for base.

Figure 4.11 Rover setting interface

8. Edit rover configuration for Surveying 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 4.12 Rover configuration – TersusNetwork

Figure 4.13 Rover configuration – PDANetwork

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

Figure 4.14 Rover configuration – Radio

Figure 4.15 Rover configuration – CORS Network

7. 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 4.16 Link status of Rover using PDA network

4.3 Static Survey

Before performing static survey, ensure one battery and one SIM card are installed in Surveying GNSS Receiver.

Detailed steps of button operation:

1. Long press power button to power on Oscar;
2. Press FN button to select [Device Config], press power button to enter the work mode options;
3. Select [Static Mode:OFF] and press power button to enter configuration options for static survey;
4. Press power button to turn on static when the cursor is on ‘Static:OFF’, then it becomes ‘Static:ON’;
5. Set Time Elapse, Sample Frequency, Elevation, Time Length, Antenna Height, Measure Type, Data Format and RINEX Format, then press power button to confirm.
6. Above all, setting static survey is completed.

Detailed steps of software operation:

1. Long press power button to power on Oscar;
2. Use NFC function to launch Nuwa app. While the screen of TC20 Controller is unlocked, put TC20 Controller close to the Oscar 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 from step 6. Also you can click [Cancel] to create a new project or open an existing project, and then start configuring Oscar from step 6.
3. If using an android device without NFC function, ensure Oscar 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 manually.

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

Figure 4.17 Static Survey configuration

7. If the DataAutoSave function is turned on, the static data is recorded in the internal storage of Oscar. You can download data file refer to section 2.3.

4.4 Issues and Solutions

This section lists possible issues and effective solutions to solve them. Please read this section contacting Tersus Technical Support.

1. Surveying GNSS Receiver cannot receive satellite signals.

Solution: Change the survey environment, and restart Oscar in an open space. Or reset the GNSS module by pressing and holding the FN button, continuously touching the power button 5 times.

2. The internal UHF radio does not transmit data.

Solution: Check whether the receiver is searching satellites normally; check whether the 2W/460MHz radio antenna is installed properly; 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 fails.

Solution: Check whether the Oscar is powered on; re-search and pair the Bluetooth; upgrade Nuwa to the latest version.

5. Terminology

AC	Alternating Current
BDS	BeiDou Navigation Satellite System
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
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
SBAS	Satellite-Based Augmentation System
SIM	Subscriber Identification Module
UAV	Unmanned Aerial Vehicle, drone
USB	Universal Serial BUS

1. Operating Frequency Band (RF):

WCDMA Band II: 1850-1910 MHz
WCDMA Band V: 824-849 MHz
LTE Band 2: 1850-1910MHz
LTE Band 4: 1710-1755MHz
LTE Band 5: 824-849MHz
LTE Band 12: 699-716 MHz
LTE Band 13: 777-787 MHz
LTE Band 17: 704-716 MHz
2.4G Wi-Fi: 2412~2462 MHz (802.11b/g/n20), 2422~2452 MHz (802.11n40)
BLE: 2402-2480 MHz
GPS:1575.42MHz(RX)
NFC: 13.56MHz (RX)

BT:2402-2480 MHz
UHF: 410MHz-470MHz

2. RF-Output Power:
WCDMA Band II: 24.5dBm
WCDMA Band V: 24.5dBm
LTE Band 2: 24dBm
LTE Band 4: 24dBm
LTE Band 5: 24dBm
LTE Band 12: 24dBm
LTE Band 13:24dBm
LTE Band 17: 24dBm
BLE:10dBm
BT: 12.5dBm
2.4G WIFI:
802.11b:20dBm;
802.11g:21.5dBm;
802.11n-HT20:18.5dBm;
802.11n-HT40:15.5dBm
UHF: 33.5dBm

Proprietary Notice

FCC Statement:

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

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

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for controlled environment .This equipment should be installed and operated with minimum distance 25cm between the radiator& your body.

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

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.