

User Manual

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User Manual

For Tersus GeoBee30

Cost-effective Solution for CORS

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Revision History

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1.0	20210113	Initial Release
2.0	20210722	Add section 5
2.1	20211130	Add section 4.4 & section 4.5
2.2	20211208	Upgrade section3.1
2.3	20231110	Add User Agreement Update section 2.1.2
2.4	20240702	Update section 2.1.2

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1. Introduction

This chapter mainly introduces the overview, system structure, package list, and installation guide of the Tersus GeoBee30, which is an upgraded version of Tersus GeoBee.

1.1 Overview

The Tersus GeoBee30 is a dedicated and cost-effective solution to establish a permanent reference station. With Tersus Ntrip Caster Service, Ntrip Modem and David30 Receiver, the GeoBee30 opens the possibility for users to transmit Real Time Kinematic (RTK) corrections via Internet (Ethernet or 2G/3G/4G) in a simple, user-friendly way, just using a SIM card or Ethernet cable without any need of a static IP. GeoBee30 can also work as GNSS Rover to receive RTK corrections from Tersus Ntrip Caster or any CORS service.

Ntrip server mode: use David30 GNSS receiver to create a base station. This temporary base or CORS are for surveying, agriculture, UAV, machine control, and etc. It is also ideal for deformation monitoring. Tersus GNSS Inc. provides Ntrip Caster to transfer data.

Ntrip client mode: connect David30 or other Tersus GNSS receivers to Tersus Ntrip Caster or any Ntrip/CORS service. David30 is mainly used for surveying, and also used as a GNSS sensor in various applications, such as mobile mapping, UAV, machine control, agriculture, and etc.

1.2 System Structure

Set up the GeoBee30 system according to the figure below.



Figure 1.1 GeoBee30 System Structure

No.	Name
1	Antenna (AX4E02 in the figure above, customizable)
2	TNC-J to TNC-J cable (25m by default, customizable)
3	David30 GNSS Receiver
4	Power Adapter (short for 'DC-5pin AC Power Adapter with 1.2m cable')
5	COMM1 cable (short for 'COMM1-7pin to DB9 male cable')
6	COMM2 cable (short for 'COMM2-7pin to TR600-DC-2pin & DB9 female & USB cable')
7	Ntrip Modem TR600
8	4G antenna for TR600
9	Wi-Fi antenna for TR600
10	Ethernet cable 1.5m

Note:

- 1) There are two configuration modes for GeoBee30. GeoBee30 system is zero configuration if customer adopts GeoCaster provided by Tersus GNSS Inc., as GeoBee30 is pre-configured when shipped out of factory. GeoBee30 system needs to be configured if customers demand to set up caster by themselves.

- 2) David30 GNSS receiver uploads RTCM stream to the NTRIP caster using Ethernet (default) or Wi-Fi or 2G/3G/4G sorted by priority.
 - a. When using Ethernet to configure TR600, use Ethernet cable to connect the LAN2 port of TR600 to your computer, connect LAN1/WAN port to a router to access internet. Make sure the IP address of your computer is set as "Obtain an IP address automatically". Type **192.168.100.1** in your browser, use username "**root**" and "**1234**" to enter web config page, make sure the DHCP is on in LAN setting so that TR600 can automatically obtain an IP address.
 - b. When using Wi-Fi to configure TR600, search SSID "TR-600" on your computer and connect it use password **12345678**. Type **192.168.100.1** in the browser of your computer or mobile phone or tablet, use username "**root**" and "**1234**" to enter web config page.

Please note, both Wi-Fi client and Wi-Fi hotspot of Ntrip Modem TR600 are supported, however they cannot be enabled simultaneously. Wi-Fi hotspot function is to share internet connection to other devices or configure TR600 via Wi-Fi. Wi-Fi client function is to use Wi-Fi connection to communicate with caster when Ethernet connection is not available.

When using Wi-Fi to communicate with caster, choose Wi-Fi Client to access internet in Network Settings of TR600. Select a SSID to be used and type the Wi-Fi password in the PSK pin area, click [Save] to save this setting.

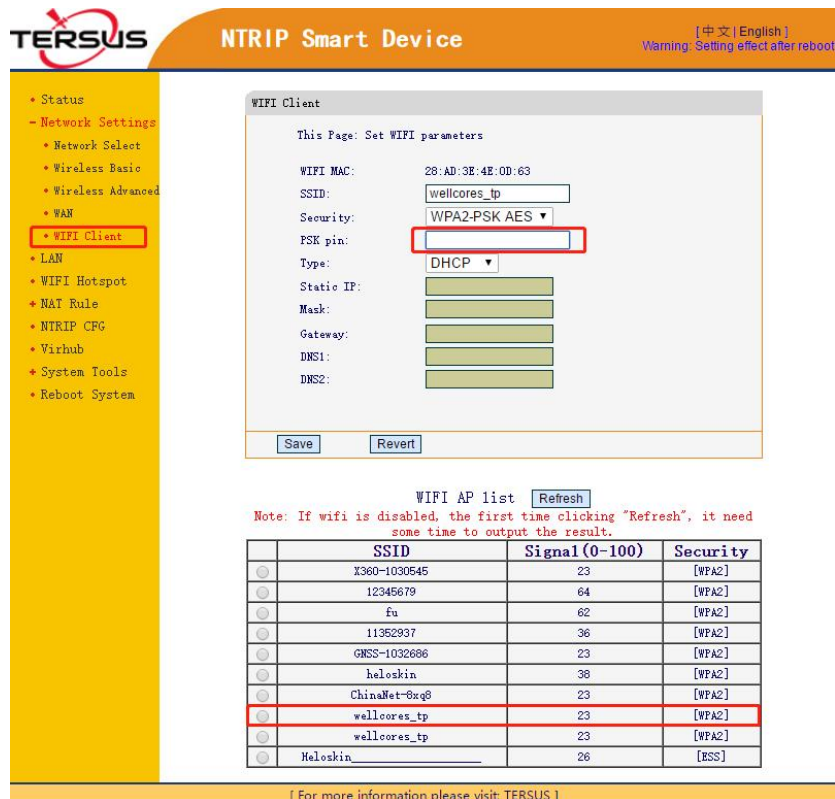


Figure 1.2 Wi-Fi client setting

- c. When using 2G/3G/4G network for data transmission, GeoBee30 will consume no more than **3GB** mobile data per month. Please contact with your local mobile carrier if there is any restrictions on wap or data usage.
- 3) Place the antenna (AX4E02 in the Figure 1.1) in the outdoor open environment. Install Wi-Fi antenna when Wi-Fi connection is for data communication, and set TR600 as Wi-Fi client. Install 4G antenna when 2G/3G/4G SIM card is used for data communication.
 - 4) GeoBee30 starts to work in auto start mode by default once it is powered up. According to the autonomous positioning (without RTK or DGPS), it smoothes out the average value to be the base coordinate. GeoBee30 outputs the RTCM32 corrections data and sends to the Ntrip server through LAN, WIFI or 2G/3G/4G mobile network.
 - 5) For the **known** phase center coordinates of the AX4E02 antenna, the two configuration methods are as follows:
 - a. Use the COMM1-Bluetooth module in the package, unplug the COMM1 cable and insert the Bluetooth module to the COMM1 port of David30 GNSS receiver. Launch Nuwa app on an android device, connect David30 by pairing Bluetooth. Create a base configuration with manual start in radio mode¹, fill in the base coordinates, antenna height and Ntrip network information. Detailed operation refers to *User Manual for*

David30 GNSS Receiver. After completing the configuration, disconnect the Bluetooth connection, disconnect the Bluetooth module and connect back the COMM1 cable.

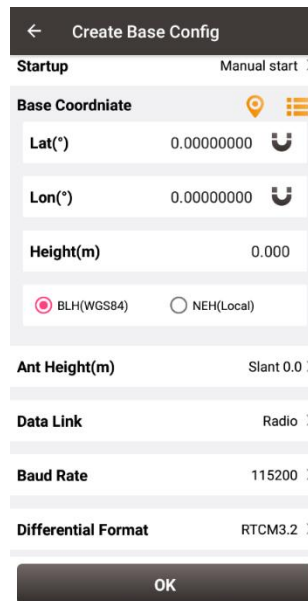


Figure 1.3 Configure David30 using Nuwa app

Note1: Use Radio Mode in Nuwa when configuring GeoBee30. Because the external radio and TR600 are both external data link, the principal is the same (log the data from David30 to external data link).

- b. Use the 'DB9 Female to USB Type A Male converter cable' to connect the COMM1 cable in Figure 1.1 and a computer, open Tersus GNSS Center application on the computer, and type commands in the command window, please refer to section 2.1.2.1 for details.
- 6) The known phase center coordinates of the AX4E02 antenna can be obtained from surveying and mapping department of local government, or calculated from commercial software such as Bernese or Gamit.
 - 7) If customer needs GeoBee30 work with local CORS system, calculate the accurate coordinate of the base station under the local CORS framework and configure the base station with this accurate coordinate. The calculation to obtain this accurate coordinate can be PPP method and coordinate conversion via point correction using Nuwa app. You can contact Tersus technical support for detailed method.

1.3 Devices in GeoBee30 Package

1.3.1 David30 GNSS Receiver

David30 has four interfaces which is shown below.



Figure 1.5 David30 GNSS Receiver

The DC port of David30 is for power input and CAN port, COMM1 port is for COM1, PPS and Event, and COMM2 port is for COM2 and USB ports, refer to section 3.1 for detailed specification of David30.

Table 1 Definition of LEDs

LED	Colour	Description
RTK	Red	ON: David30 in Fixed solution. Blink: David30 in Float and DGPS solution. OFF: David30 in other position types.
SV	Red	ON: normal state. Blink: David30 is searching satellites.
PWR	Blue	ON: the David30 is power on.

1.3.2 AX4E02 GNSS Antenna

AX4E02 GNSS antenna is used to receive the RF signal from the satellites, and it must be connected to the David30 with the GNSS antenna cable in the package.



Figure 1.6 AX4E02 GNSS Antenna



If an antenna from other companies is used, contact Tersus to obtain permission, or the David30 receiver may not work as expected.



Figure 1.7 TNC-J to TNC-J Cable (GNSS antenna cable, 25m by default)

1.3.3 TR600 Ntrip Modem



Figure 1.8 TR600 side view 1



Figure 1.9 TR600 side view 2

1.3.4 Other accessories



Figure 1.10 COMM1-Bluetooth Module



The Bluetooth can only be installed to the COMM1 port of David30.

This Bluetooth module is used to connect to the COMM1 port of David30 receiver.

The SSID of this Bluetooth module is BT420R-xxxxx_xxxxxx, where the first xxxxx is the last 5 digits of the Bluetooth serial number, which is printed on the Bluetooth module. No password is needed to pair with it.



Figure 1.11 DC-5pin AC Power Adapter with 1.2m cable



Figure 1.12 COMM2-7pin to TR600-DC-2pin & DB9 female & USB cable

!	The circular connector of the COMM2-7pin to TR600-DC-2pin & DB9 female & USB cable can only be installed into the COMM2 port of David30 GNSS Receiver.
---	--

The COMM2-7pin to TR600-DC-2pin & DB9 female & USB cable has two functions:

- 1) Connect to the USB port of a computer to download the file saved on the internal eMMC, refer to section *Download Files from Internal eMMC* in David30 user manual;
- 2) Connect to USB Type A Female to USB (Micro +Type C) OTG cable (refer to Figure 1.14) to connect the Android phone or controller with David30.



Figure 1.13 COMM1-7pin to DB9 male Cable

!	The circular connector of the COMM1-7pin to DB9 male cable can only be installed into the COMM1 port of David30 GNSS Receiver.
---	--



Figure 1.14 RS232 to RS485 converter



Figure 1.15 DB9 female to TR600-RS485-5pin cable



Figure 1.16 DB9 Female to USB Type A Male converter cable



Figure 1.17 USB Type A Female to USB (Micro +Type C) OTG cable



Figure 1.18 4G antenna for TR600



Figure 1.19 Wi-Fi antenna for TR600



Figure 1.20 Ethernet cable 1.5m

1.4 Installation Guide

1.4.1 Install bottom plate for fixing David30



Figure 1.21 Bottom plate for fixing David30

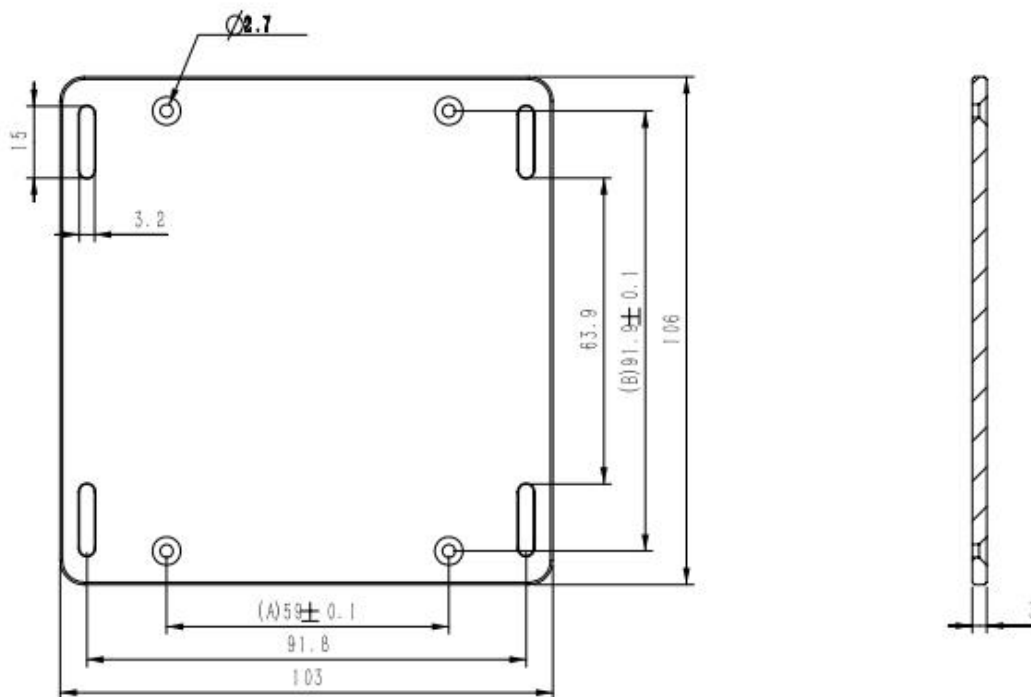


Figure 1.22 Dimension of bottom plate

Use the screws in the package to secure the bottom plate to the back of the David30 GNSS receiver. Hence it can be fixed to the places required.

1.4.2 Install bracket and slide rail for TR600

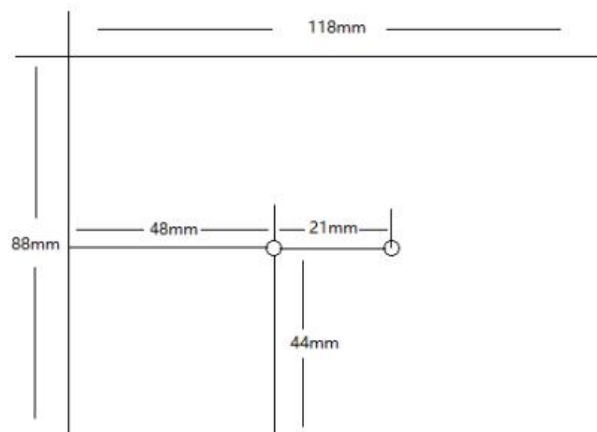


Figure 1.23 TR600 dimension



Figure 1.24 Bracket for TR600



Figure 1.25 Slide rail for TR600 (20cm)



Figure 1.26 TR600 with bracket and slide rail

Fix the bracket to the back of the TR600 with two screws, slide the rail into the bracket, and then use screws to fix the whole set to the places required.

2. General Operation

This chapter introduces how to use GeoBee30, configuration parameters, factory reset and firmware upgrade.

2.1 Configurations

2.1.2 Configure David30

Configuring David30 is able to be done using Tersus GNSS Center via cables or using Nuwa app via Bluetooth.

2.1.2.1 Configuring David30 using Tersus GNSS Center

The detailed steps of configuring David30 using Tersus GNSS Center via cables are listed below:

- 1) Use the 'DB9 Female to USB Type A Male Converter cable' to connect the COMM1 cable (COMM1-7pin to DB9 male cable) and a computer;
- 2) Open Tersus GNSS Center application on the computer and type below commands in the command window:

(1)using the position average to get the base coordinate:

```
POSAVE ON 0.02 //Turn on position average for 0.02 hour (72s)
UNDULATION USER 0.0 //Set user specified undulation value for ellipsoid height3
LOG COM2 RTCM1006 ONTIME 10 //output the base coordinate
LOG COM2 RTCM1074 ONTIME 1 //output GPS observations
LOG COM2 RTCM1084 ONTIME 1 //output GLONASS observations
LOG COM2 RTCM1094 ONTIME 1 //output Galileo observations
LOG COM2 RTCM1114 ONTIME 1 //output QZSS observations
LOG COM2 RTCM1124 ONTIME 1 //output BeiDou observations
LOG COM2 RTCM1230 ONTIME 10 //output GLONASS bias information
```

```

LOG COM2 RTCM1033 ONTIME 10 //output antenna, receiver information
LOG COM2 RTCM1019 ONTIME 300 //output GPS ephemerides
LOG COM2 RTCM1020 ONTIME 300 //output GLONASS ephemerides
LOG COM2 RTCM1042 ONTIME 300 //output BeiDou ephemerides
LOG COM2 RTCM1044 ONTIME 300 //output QZSS ephemerides
LOG COM2 RTCM1046 ONTIME 300 //output Galileo ephemerides
SAVECONFIG //save configuration
  
```

The receiver averages positions after every power on or reset, which will cause a change in the base coordinate.

Suppose you have already obtained the base coordinate and want to maintain it for the next power on or reset. Please enter the command below.

```

POSAVE OFF //Turn off position average
SAVECONFIG //save configuration
  
```

(2)using the coordinate of a known point:

```

POSAVE OFF //Turn off position average2
UNDULATION USER 0.0 //Set user specified undulation value for ellipsoid height3
FIX POSITION B L H //B: latitude (degree), L: longitude (degree), H: ellipsoid height (m)
  
```

For example: FIX POSITION xx.xxxxxx xx.xxxxxx xx.xx

```

LOG COM2 RTCM1006 ONTIME 10 //output the base coordinate
LOG COM2 RTCM1074 ONTIME 1 //output GPS observations
LOG COM2 RTCM1084 ONTIME 1 //output GLONASS observations
LOG COM2 RTCM1094 ONTIME 1 //output Galileo observations
LOG COM2 RTCM1114 ONTIME 1 //output QZSS observations
LOG COM2 RTCM1124 ONTIME 1 //output BeiDou observations
LOG COM2 RTCM1230 ONTIME 10 //output GLONASS bias information
  
```

```
LOG COM2 RTCM1033 ONTIME 10 //output antenna, receiver information
LOG COM2 RTCM1019 ONTIME 300 //output GPS ephemerides
LOG COM2 RTCM1020 ONTIME 300 //output GLONASS ephemerides
LOG COM2 RTCM1042 ONTIME 300 //output BeiDou ephemerides
LOG COM2 RTCM1044 ONTIME 300 //output QZSS ephemerides
LOG COM2 RTCM1046 ONTIME 300 //output Galileo ephemerides
SAVECONFIG //save configuration
```

Note 2: By default, GeoBee30 is set to base mode with the command POSAVE ON. If you want to use the command FIX POSITION B L H to enter the coordinate of a known point, you must first enter POSAVE OFF to turn off position averaging. Otherwise, during the next power cycle, the position average will be turned on, which can cause a change in the base coordinate.

Note 3: If customer needs to use global geoidal height model EGM96 for mean sea level height, type below command to replace the undulation command above.

```
UNDULATION EGM96 //Set EGM96 geoidal height model
```

More details about logs and commands refer to *BX40C Log & Command* document.

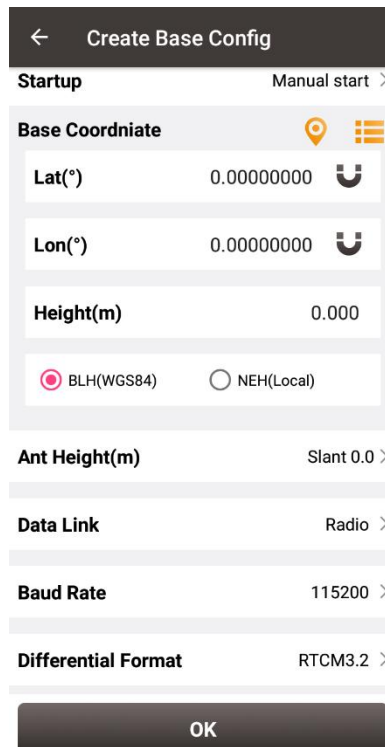
3) Power cycle the receiver or input RESET command to make the above configuration effective.

2.1.2.2 Configuring David30 using Nuwa app

The detailed steps of configuring David30 via Bluetooth are listed below:

- 1) Unplug the COMM1 cable on the COMM1 port of David30;
- 2) Insert the 'COMM1-Bluetooth module' into the COMM1 port of David30 GNSS receiver;

- 3) Connect the AX4E02 GNSS antenna to David30 with the GNSS antenna cable;
- 4) Power on the David30 GNSS receiver by plugging the AC power adapter;
- 5) Run Nuwa app, click [Device] -> [Connect];
- 6) Select [David] in the option list of Device Type;
- 7) Select [Bluetooth] in the option list of Connect Type;
- 8) Click [Connect Config] -> [Search]. The SSID is BT420R-xxxxx_xxxxxx. No password is needed to pair with it;
- 9) Click [Connect] to enable the communication with David30;
- 10) After the Bluetooth module is connected with David30 successfully, configure David30 as a base with manual start in radio mode, fill in the base coordinates and antenna height, and set Baud Rate as 115200 bps and Differential Format as RTCM3.2. Detailed operation about David30 and Nuwa app refers to the *User Manual for David30 GNSS Receiver* and *User Manual for Nuwa app* which can be downloaded on Tersus website.







Create Base Config	
Startup	Manual start >
Base Coordinate  	
Lat(°)	0.00000000 
Lon(°)	0.00000000 
Height(m)	0.000
<input checked="" type="radio"/> BLH(WGS84) <input type="radio"/> NEH(Local)	
Ant Height(m)	Slant 0.0 >
Data Link	Radio >
Baud Rate	115200 >
Differential Format	RTCM3.2 >
OK	

Figure 2.1 Configure David30 using Nuwa app

11) After completing the David30 configuration via Nuwa, disconnect the Bluetooth connection, disconnect the Bluetooth module and connect back the COMM1 cable.

!	A Bluetooth device can be removed from the Available Device list by pressing it for a few seconds.
	Use Radio Mode in Nuwa when configuring GeoBee30. Because the external radio and TR600 are both external data link, the principal is the same (log the data from David30 to external data link).

2.1.1 Accessories Required

The accessories required are listed below:

- 1) One Power Adapter (DC-5pin AC Power Adapter with 1.2m cable);
- 2) One COMM1 cable (COMM1-7pin to DB9 male cable);
- 3) One DB9 Female to USB Type A Male Converter cable;
- 4) One COMM1-Bluetooth module;
- 5) One Ethernet cable for connecting TR600 and PC or customized device.

2.1.3 Configure TR600

The detailed steps of configuring TR600 are listed below:

- 1) Set IP address of the PC as ‘Automatically obtain IP address’;

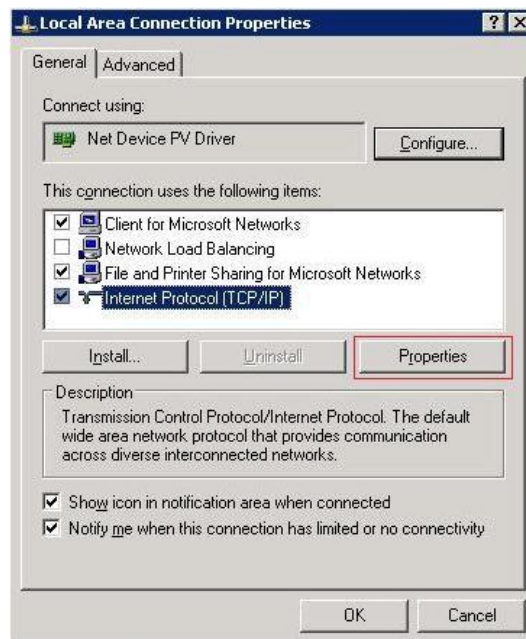


Figure 2.2 Properties for Internet Protocol (TCP/IP)

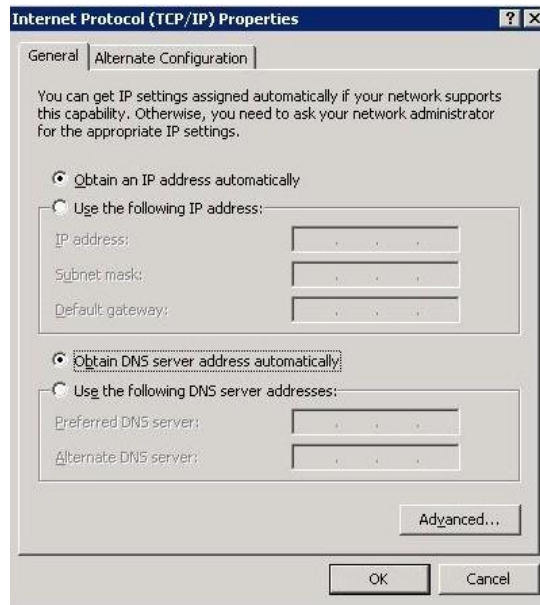


Figure 2.3 Set IP address as 'Obtain an IP address automatically'

- 2) Using Ethernet cable to connect the LAN1/WAN port to a router to access Internet, connect the LAN2 port of TR600 to your PC;



Figure 2.4 Connect Ethernet cables

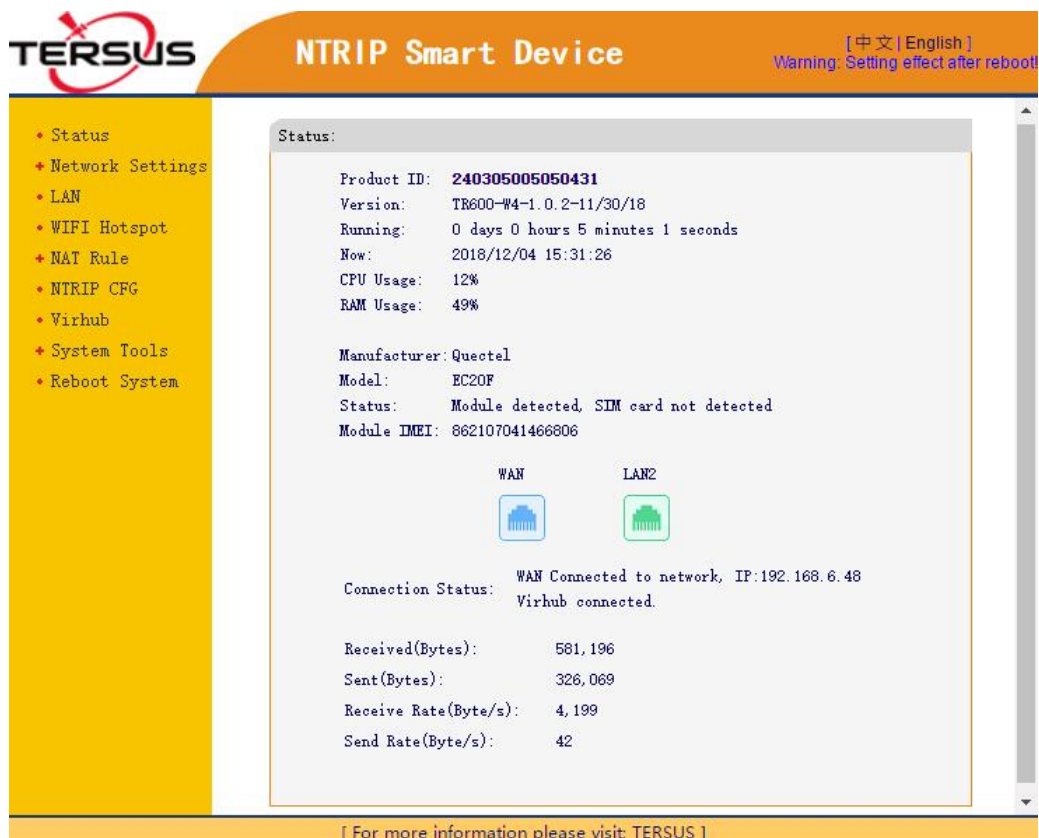
- 3) Type in 192.168.100.1 or 192.168.1.1 in the browser of PC to enter the web configuration login page;
- 4) Type in username 'root' and password '1234' in the login page;

TR-600		TERSUS
用户名 (username):	<input type="text"/>	
用户密码 (passwd):	<input type="password"/>	
语言 (language):	ENGLISH ▾	
<input type="button" value="登陆(login)"/>		

天硕导航

Figure 2.5 Login TR600 configuration interface

- 5) In the web configuration interface, check the current connection status.



The screenshot shows the TERSUS NTRIP Smart Device web configuration interface. The top navigation bar includes the TERSUS logo, the device name "NTRIP Smart Device", and language options "[中文 | English]". A warning message "Warning: Setting effect after reboot" is displayed. A left sidebar contains a menu with options: Status, Network Settings, LAN, WIFI Hotspot, NAT Rule, NTRIP CFG, Virhub, System Tools, and Reboot System. The main content area displays the "Status" page with the following information:

```

Status:
Product ID: 240305005050431
Version: TR600-W4-1.0.2-11/30/18
Running: 0 days 0 hours 5 minutes 1 seconds
Now: 2018/12/04 15:31:26
CPU Usage: 12%
RAM Usage: 49%

Manufacturer: Quectel
Model: EC20F
Status: Module detected, SIM card not detected
Module IMEI: 862107041466806

WAN LAN2
[Icons for WAN and LAN2]

Connection Status: WAN Connected to network, IP:192.168.6.48
Virhub connected.

Received(Bytes): 581,196
Sent(Bytes): 326,069
Receive Rate(Byte/s): 4,199
Send Rate(Byte/s): 42
    
```

At the bottom of the interface, there is a footer link: "[For more information please visit: TERSUS]".

Figure 2.6 Check the current connection status

- 6) Select 'WAN&WIFI&MOBILE' for Network option in Network Settings, and click [Save] to save this setting.

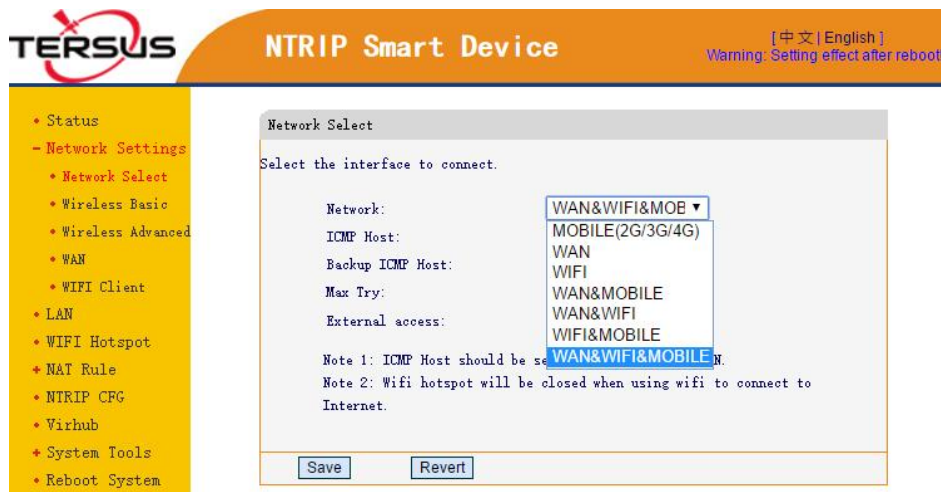


Figure 2.7 Select network in Network Settings

7) For Wireless Basic, it is to configure 2G/3G/4G network parameters. Consult your local mobile carrier for the APN settings. Below screenshot is taking Telstra from Australia for example, Telstra.wap is auto selected as the APN. The APN mode can also be manually selected, prepare your local APN info and fill in manually.

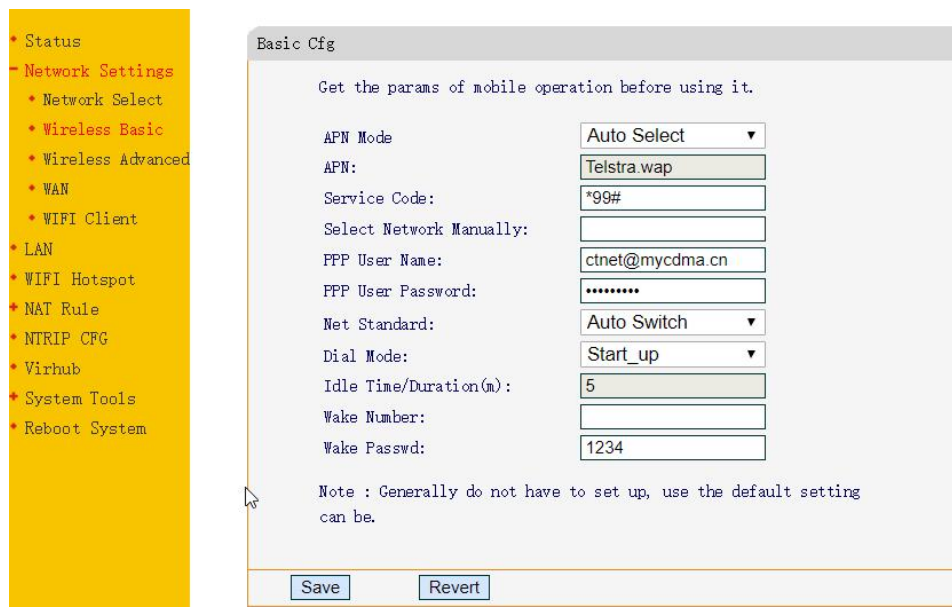


Figure 2.8 Mobile communication network settings

8) For the WAN setting, use the default DHCP as most routers support DHCP. The WAN is connected to your router's LAN, then the router will assign an IP address to the TR600 modem.

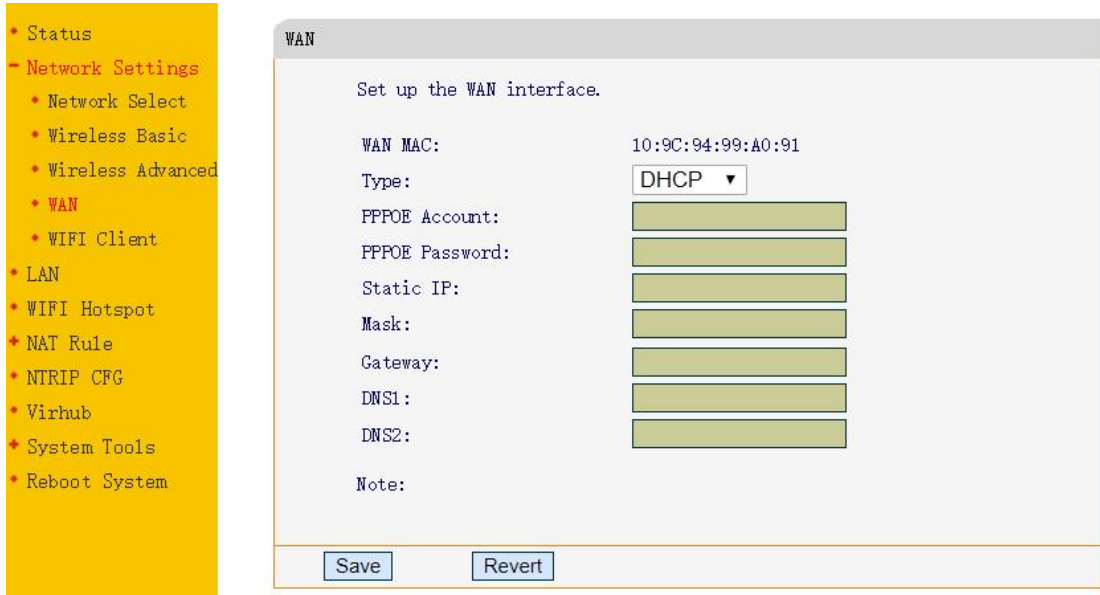


Figure 2.9 WAN setting

- 9) If WIFI Client is chosen to access internet, click WIFI Client in Network Settings, select a SSID to be used and type in the WIFI password in the PSK pin area, click [Save] to save this setting.

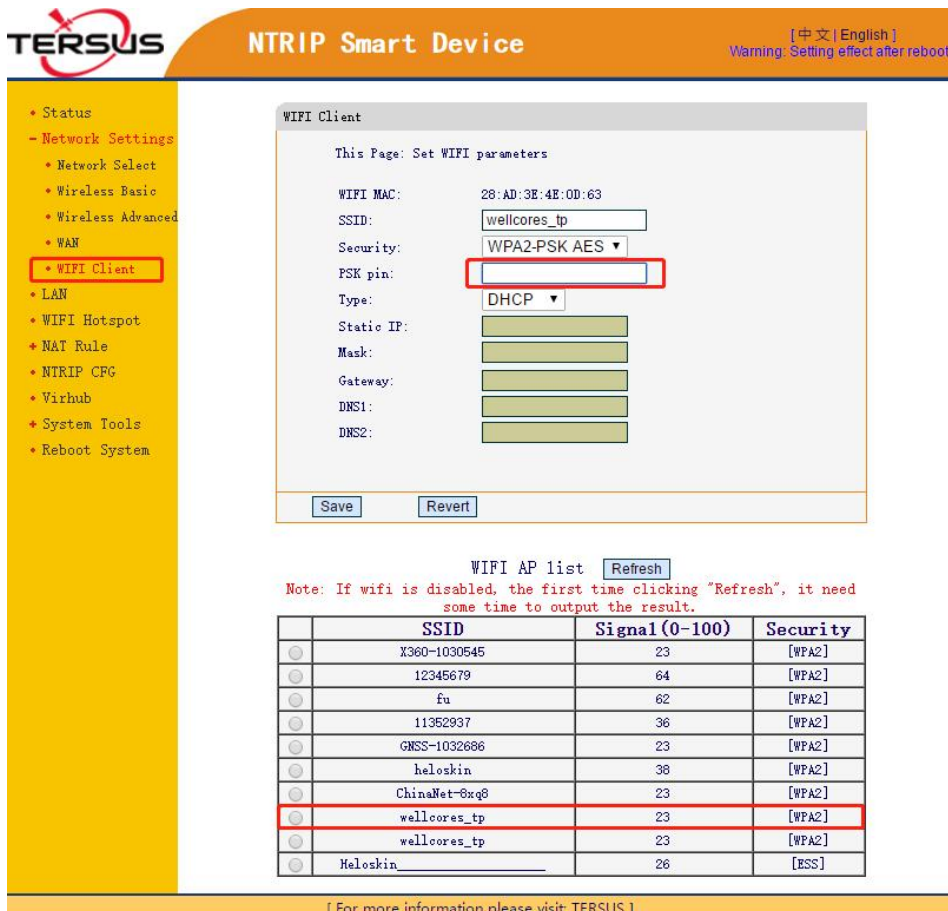


Figure 2.10 WiFi Client setting

10) For LAN setting, the LAN configuration is obtained automatically when the TR600 modem is connected to the router.

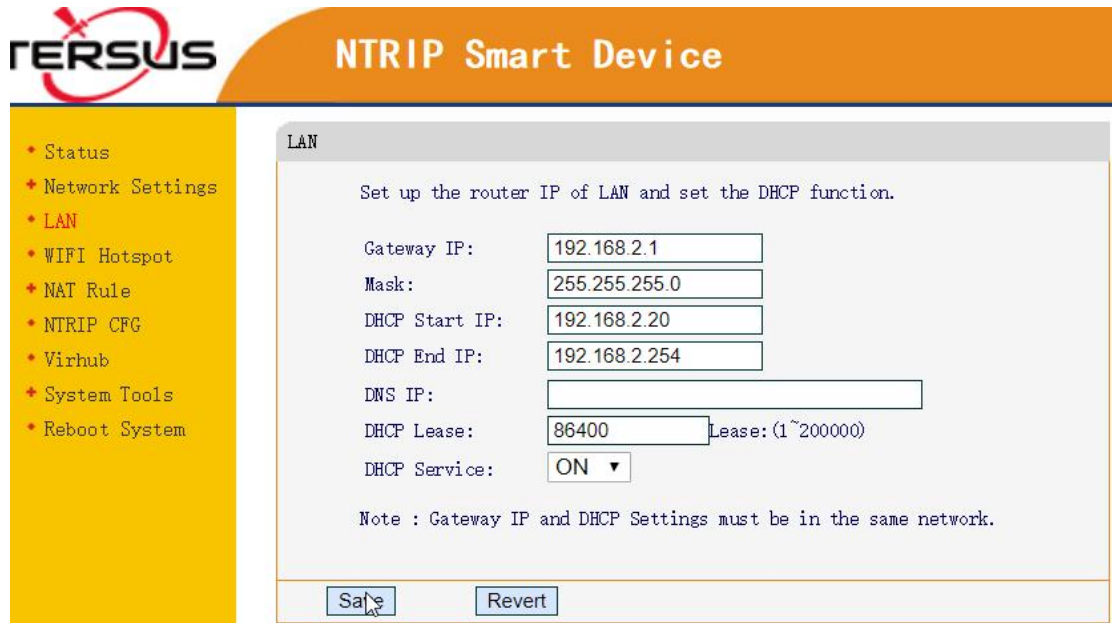


Figure 2.11 LAN setting

11) Set corresponding NTRIP information in NTRIP configuration interface as shown in the upper red box according to the NTRIP information attached as a label on the Ntrip Modem TR600. The information for Data Center 1 in the lower red box is pre-configured as default if Tersus mserver is used. Contact Tersus Technical Support if users need other server for Data Center.

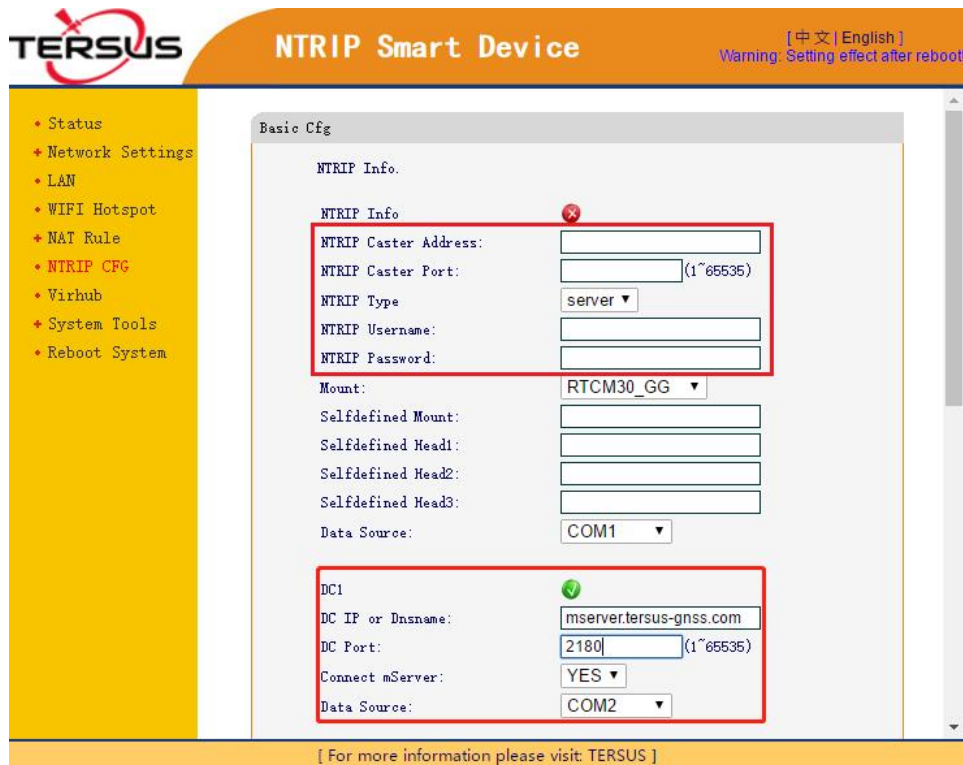


Figure 2.12 Set Ntrip info in Ntrip configuration interface

12) Turn on the virtual hub function and configure Virhub according to the information which is shown below. It is pre-configured as default. Contact Tersus Technical Support if users need other server for the Virhub configuration.

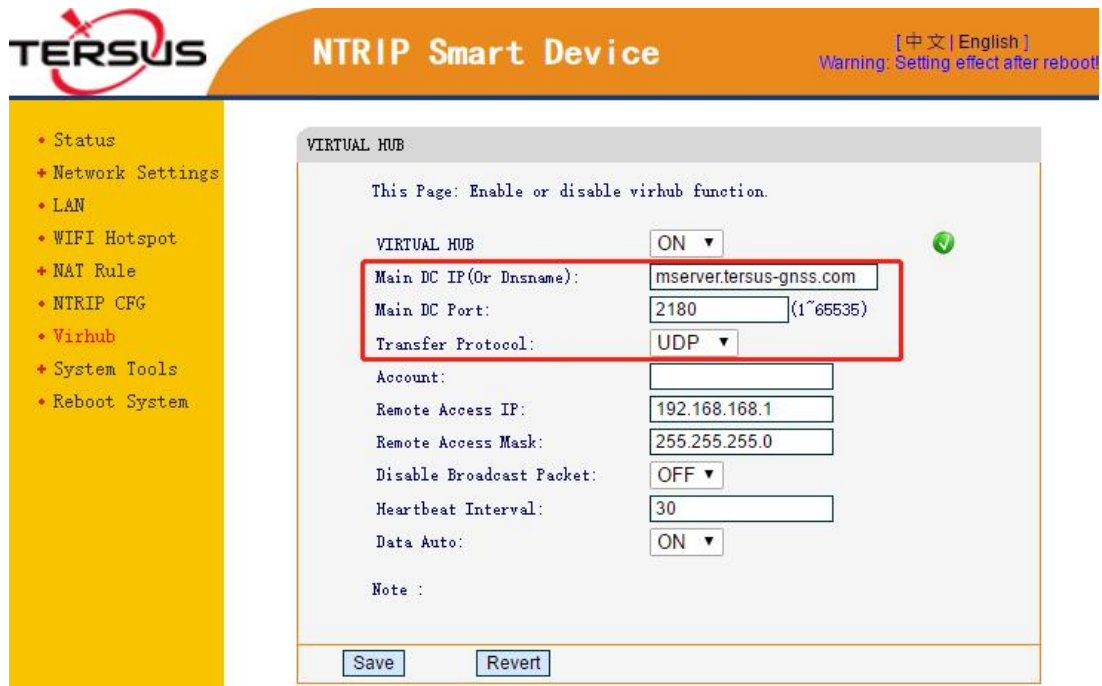


Figure 2.13 Set Virhub configuration

13) After setting the above configurations, click [Save] and reboot the device to active the configuration. The configuration becomes effective only after the Ntrip Modem TR600 is restarted.

Note: the mserver software and Verhub software are under development, stay tuned.

2.2 Configuration Parameters

The configuration menu of David30 GNSS receiver can be viewed on Nuwa app, the detailed usage of Nuwa app refers to the user manual of Nuwa app which can be downloaded on Tersus official website

<https://www.tersus-gnss.com/document/david30-gnss-receiver>

under the User Manual section.

Each configuration menu of Ntrip Modem TR600 has multiple parameters, and some of them have sub-menus. The detailed configuration parameters refer to section 2.2 of the user manual of Ntrip Modem TR600.

2.3 Factory Reset

The factory reset of David30 GNSS receiver can be completed on Nuwa app by clicking [Reset] on the Device Info interface. The detailed usage of Nuwa app refers to the user manual of Nuwa app which can be downloaded on Tersus official website

<https://www.tersus-gnss.com/document/david30-gnss-receiver>

under the User Manual section.

In the TR600 configuration interface, select 'Restore Set' under 'System Tools', click [Restore Set] to reset to factory settings; or long press the RESET button to reset.

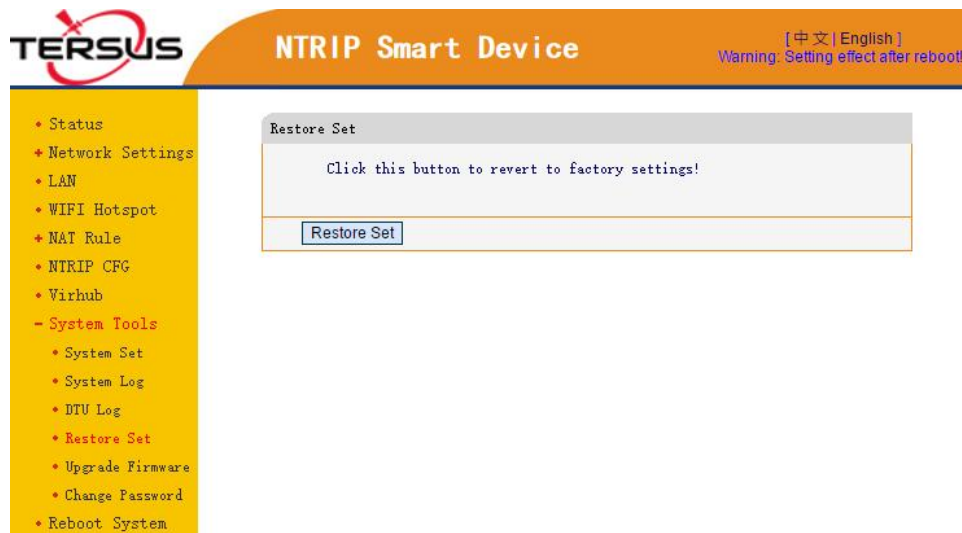


Figure 2.14 Factory Reset for TR600

2.4 Firmware Upgrade

The updated firmware is released and available for downloading on Tersus web site <https://www.tersus-gnss.com/software> , or it can be obtained from Tersus technical support. After completing the hardware connection mentioned in 2.1.2 Configure David30, launch the TersusUpdate software on the desktop or click [Tools] -> [UpdateFirmware] in Tersus GNSS Center software.

In the TersusUpdate interface, the software recognizes the serial port and scans the baud rate automatically. Select the Port which is connected to David30 receiver, browse the location for the updated firmware file, and click [Next] to update the firmware.

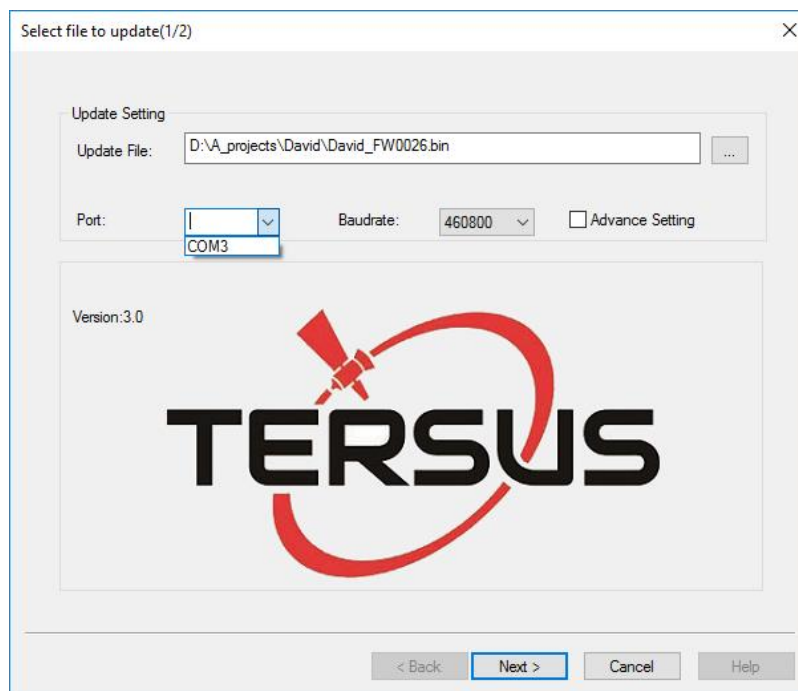


Figure 2.15 Update firmware for David30

Contact Tersus Support for firmware file to upgrade Ntrip Modem TR600. Select 'Upgrade Firmware' under 'System Tools' in the TR600 configuration interface, choose the firmware file, and click [Upload/Download] to upload the firmware.



Figure 2.16 Update firmware for TR600

Wait for a few minutes until 'Update' is shown, choose 'Delete the former file'. Click [Update], it will prompt that the file system has been updated, the original setting is cleared, and the system is rebooting.

2.5 Observation Data Storage

Since it is not supported to download observation data remotely, it is recommended using RTKLIB, an open source program for GNSS positioning, to store the observation data as a file in the computer.

The detailed steps of how to store observation data into a computer are as follows:

- 1) Download RTKLIB software from its official website <http://www.rtklib.com/> , unzip the zip file and find the application rtklaunch.exe
- 2) Double click rtklaunch.exe and then click the third icon to launch STRSVR function.



Figure 2.17 Launch STRSVR in RTKLIB

- 3) In the STRSVR interface, select 'NTRIP Client' as input type, click the Opt button on the right, fill all the information for NTRIP Client Options and then click [OK].

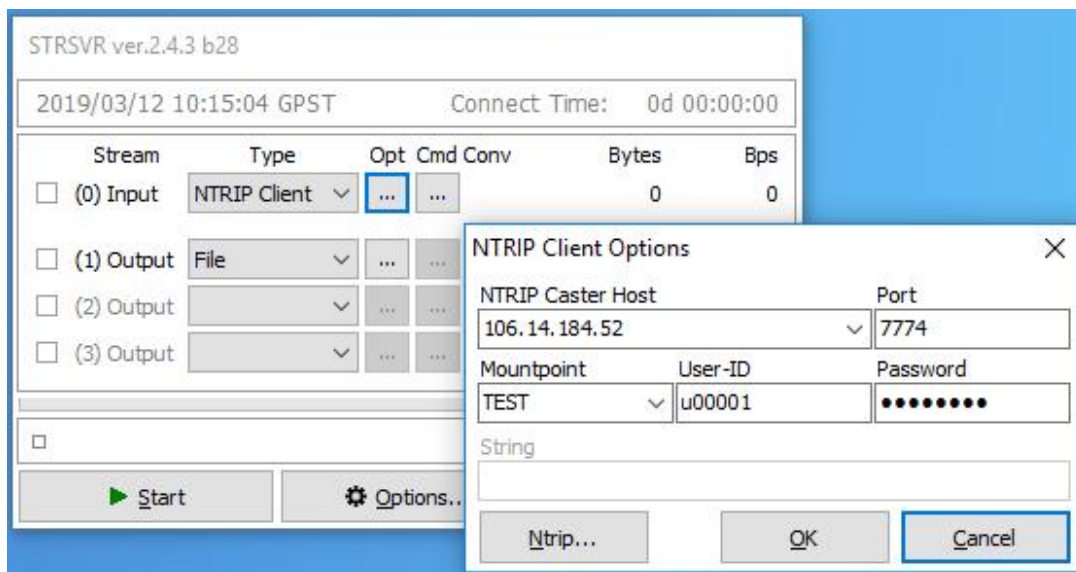


Figure 2.18 Input NTRIP Client information

- 4) Select 'File' as output type, click the Opt button on the right, browse a location for the Output File Path, and click [OK].

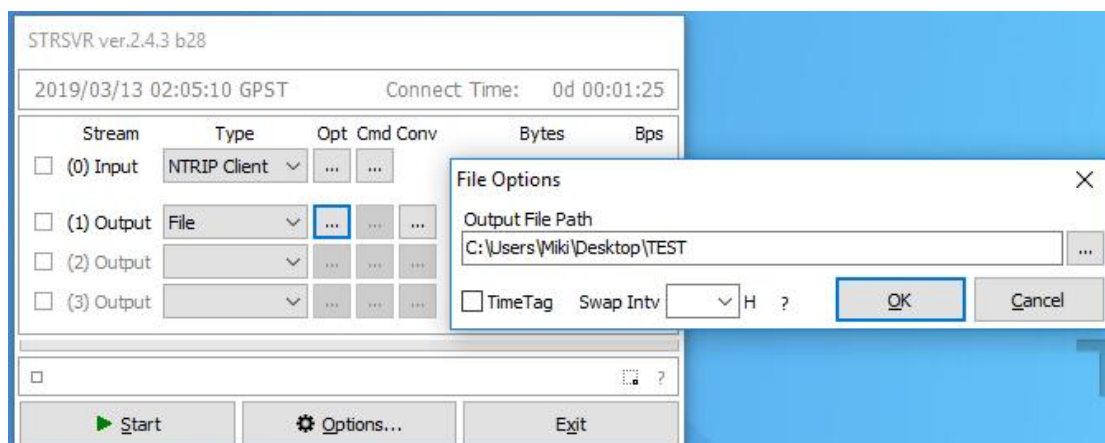


Figure 2.19 Output information

- 5) Go back to the main page, and click [Start]. The observation data will be

stored in file of the designated folder. The file is being saved as shown below.

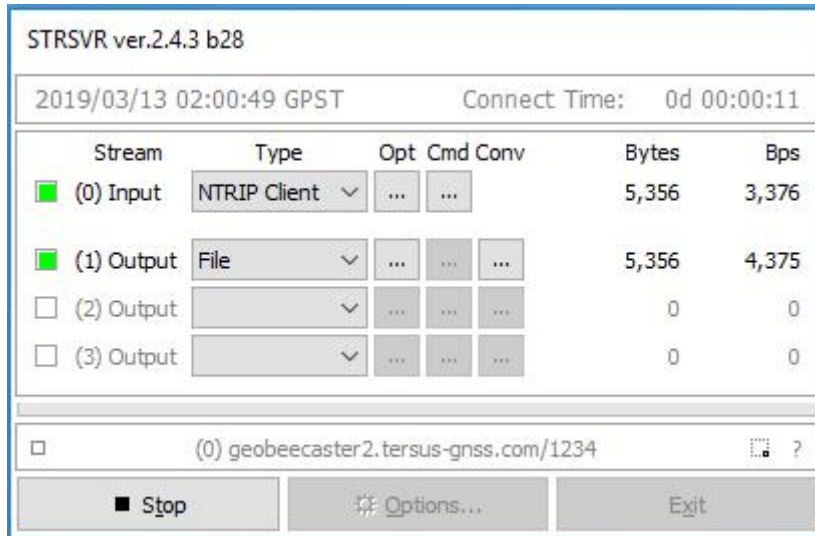


Figure 2.20 Start saving observation data

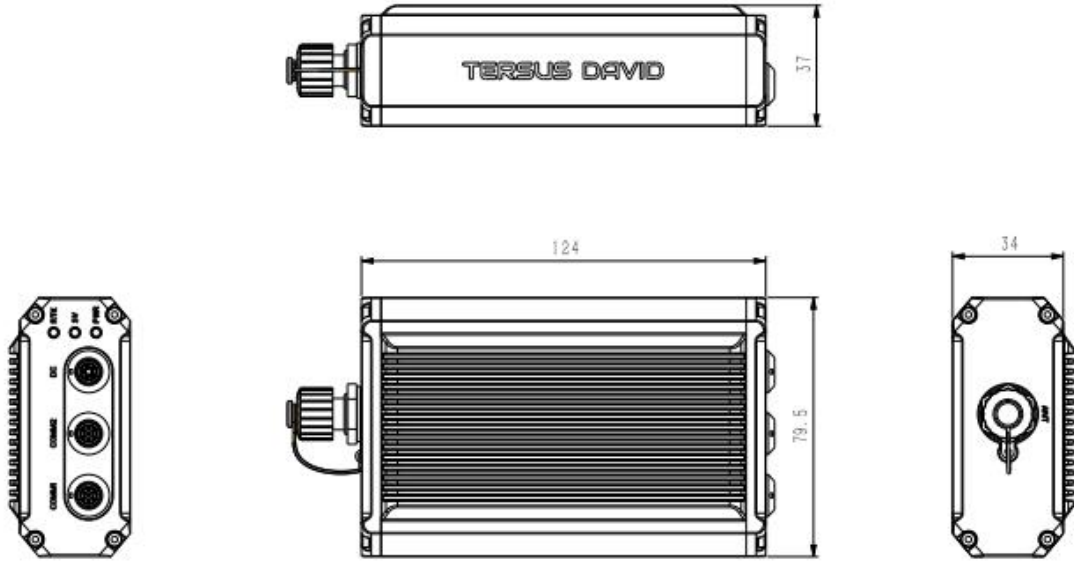
3. Specifications

This chapter includes the specifications of David30 GNSS Receiver, AX4E02 GNSS Antenna and TR600 Ntrip Modem.

3.1 David30 GNSS Receiver

Table 2 David30 GNSS Performance

GNSS Performance		
Signal tracking	GPS L1 C/A, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A; BeiDou B1, B2, B3, support BDS-3; Galileo E1, E5a, E5b; QZSS L1 C/A, L2C, L5; SBAS Supports WAAS, EGNOS, GAGAN, SDCM, MSAS	
GNSS channels	576	
Position Accuracy	Single positioning (RMS)	1.5m (Horizontal)
		3.0m (Vertical)
	RTK Positioning (RMS)	8mm+1ppm (Horizontal)
		15mm+1ppm (Vertical)
	DGPS (RMS)	0.25m (Horizontal)
		0.5m (Vertical)
High-Precision Static (RMS)	2.5mm+0.1ppm (Horizontal)	
	3.5mm+0.4ppm (Vertical)	
Time to First Fix	Cold Start: <50s Warm Start: <30s	
Data Rate	Measurements	20Hz
	Position	5Hz
Time Accuracy	20ns RMS	
Velocity Accuracy	0.03m/s RMS	
Measurement Precision	C/A Code	10cm
	P Code(zenith direction)	10cm

	Carrier Phase (zenith direction)	1mm
Reacquisition	< 2.0s (typical)	
Storage	In-built 8GB memory	
Physical Description		
Dimension	124*79.5*37 mm (David30 only)	
Weight	≈360g (David30 only)	
Mechanical Drawing		
		
Environmental		
Operating Temperature	-40°C to +70°C	
Storage Temperature	-40°C to +85°C	
Humidity	95% non-condensing	
Water & dust proof	IP67	
Power Requirement		
Input Voltage	+5 ~ 36 VDC	
Power Consumption	3.6W	

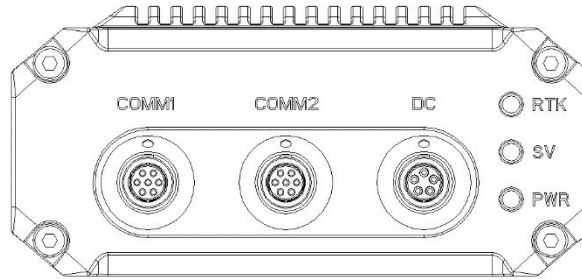


Figure 3.1 Panel of David30

Table 3 Pin Definition of connectors on David30

Connector Pin No.	COMM1 RS-232	COMM2 RS-232	DC
1	PWR	PWR	GND
2	GND	GND	GND
3	TXD1	TXD2	PWR
4	RXD1	RXD2	CAN_L
5	GND	GND	CAN_H
6	PPS	USB D+	
7	EVENT	USB D-	

The pin definition's view from outside to David30 is as below.

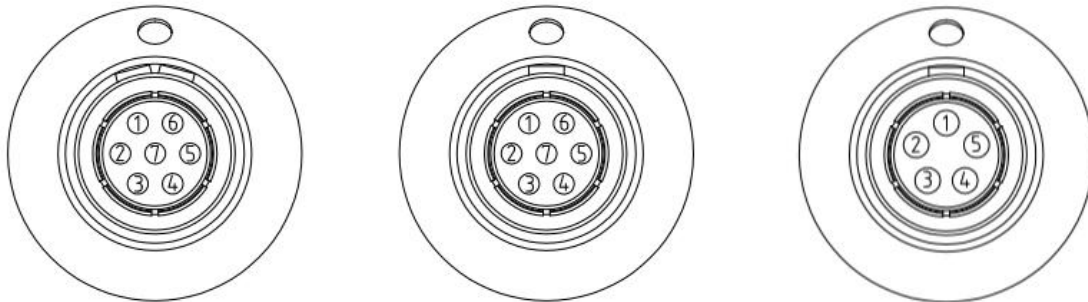
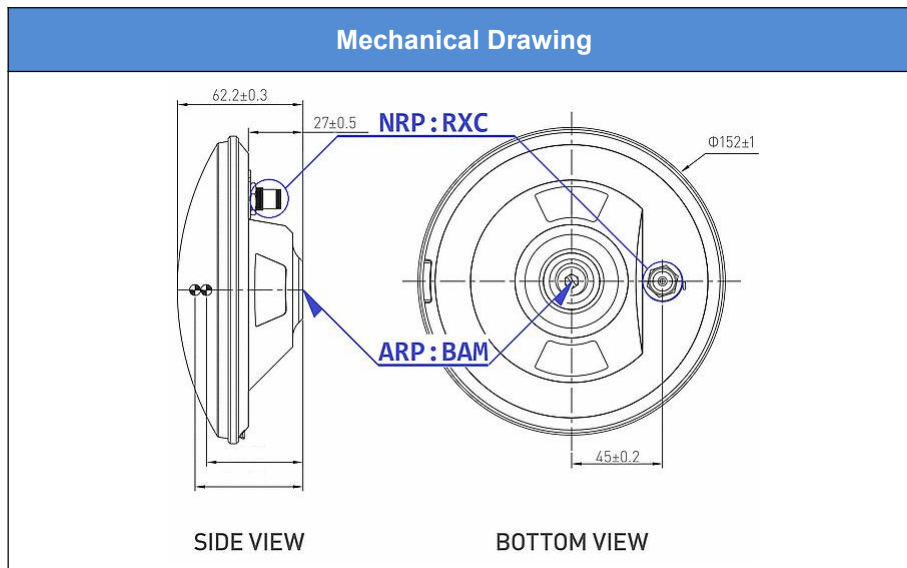


Figure 3.2 Pin Definition of the COMM1/COMM2/DC ports

3.2 AX4E02 GNSS Antenna

Table 4 AX4E02 GNSS Antenna

Antenna Specification	
Tracking signals	GPS L1/L2/L5/L-Band, GLONASS L1/L2/L3, BeiDou B1/B2/B3, Galileo E1/E5a/E5b/E6, QZSS L1/L2/L5/L6, SBAS L1/L5 and IRNSS L5
Impedance	50 Ohm
Polarization	RHCP
Axial Ratio	≤ 3dB
Output VSWR	≤ 2.0
Peak Gain	≤ 5.5dBi
LNA Gain	40dB (typical)
Noise Figure	≤ 2.0dB
Operation Voltage	3.3~12V DC
Operating Current	≤ 45mA
Group Delay Ripple	< 5ns
Phase Center Offset	59.14mm
Phase Center Error	± 2mm
Physical Description	
Dimension	Φ152*62.2mm
Weight	≤ 500g
Signal Connector	TNC Female
Installation connector	BSW 5/8"×11, 12-14mm
Environmental	
Operating temperature	-45°C - +85°C
Storage temperature	-55°C - +85°C
Humidity	95% non-condensing
Dust & waterproof	IP67



3.3 TR600 Ntrip Modem

Table 5 Ntrip Modem TR600 specifications

Electrical	
Input Voltage	+12 ~ +48V DC
Operating Current	350mA @ +12V DC
Standby Current	250mA @ +12V DC
Power Consumption	4.2W (typical)
Network	
Chinese version	2G: GSM/GPRS/EDGE/CDMA2000 1x 3G: UMTS/WCDMA/HSPA/HSPA+/TD-SCDMA/CDMA2000 EVDO 4G: TDD-LTE/FDD-LTE
Eurasian version (Europe, Middle East, Africa, South Korea, Thailand)	2G: GSM/GPRS/EDGE 3G: UMTS/WCDMA/HSPA/HSPA+ 4G: TDD-LTE/FDD-LTE
North American version	3G: UMTS/WCDMA/HSPA/HSPA+ 4G: FDD-LTE
Australian version (New)	2G: GSM

Zealand, Australia, South America)	3G: WCDMA 4G: FDD-LTE/TDD-LTE
Operating Frequency Band	
Chinese version	TDD-LTE B38/B39/B40/B41 FDD-LTE B1/B3/B8 UMTS/HSDPA/HSPA+ B1/B8 TD-SCDMA B34/B39 CDMA2000 1x/EVDO BC0 GSM/GPRS/EDGE 900/1800 MHz
Eurasian version	TDD-LTE B38/B40 FDD-LTE B1/B3/B7/B8/B20 UMTS/HSDPA/HSPA+ B1/B8 GSM/GPRS/EDGE 900/1800 MHz
North American version	FDD-LTE B2/B4/B5/B17 UMTS/HSDPA/HSPA+ B2/B5
Australian version	FDD-LTE B1/B2/B3/B4/B5/B7/B8/B28 TDD-LTE B40 WCDMA B1/B2/B5/B8 GSM 850/900/1800/1900
Interfaces	
Serial Port	RS232 x1, RS485 x1
Ethernet	RJ45 x2 (LAN, LAN/WAN)
Antenna Connector	SMA Female x1
Physical	
Dimension	118x91x34mm (w/o connectors)
Weight	335g
Operating Temperature	-30°C ~ +80°C
Relative Humidity	95% @ +40°C

4. Typical Application

Typically, GeoBee30 can work under both Ntrip server mode and Ntrip client mode. The system structure for them is the same, the configuration of Ntrip Modem TR600 is different.

4.1 GeoBee30 working under Ntrip server mode

If GeoBee30 is configured to work under Ntrip server mode, fill in the Ntrip information under the [NTRIP CFG] sub menu of TR600 configuration page. Select [server] in the drop-down menu of Ntrip Type, type in the Ntrip password and click [Save] at the bottom of this page to complete the configuration.

The Ntrip information can be found on Ntrip Modem TR600. If there is any question, please contact Tersus Technical Support by email support@tersus-gnss.com without any hesitate.



Figure 4.1 GeoBee30 under Ntrip server mode

4.2 GeoBee30 working under Ntrip client mode

If GeoBee30 is configured to work under Ntrip client mode, fill in the Ntrip information under the [NTRIP CFG] sub menu of TR600 configuration page. Select [client] in the drop-down menu of Ntrip Type, type in the Ntrip Username and Ntrip password, and click [Save] at the bottom of this page to complete the configuration.

The Ntrip information can be found on Ntrip Modem TR600. If there is any question, please contact Tersus Technical Support by email support@tersus-gnss.com without any hesitate.



Figure 4.2 GeoBee30 under Ntrip client mode

4.3 Check Link Status using Web portal

Open any browser on your computer (accessible to the Internet) and enter the following URL in the address bar:

<http://GeoBeecaster2.tersus-gnss.com:2101/>

In the login window, type the (Ntrip) Client User and (Ntrip) Client Password which are shown on the label of the Ntrip Modem TR600.

```

NtripName:
geobeecaster2.tersus-gnss.com
NtripPort: 2101
Client User: geobeetest1
Client Password: s65uhkJd
Default Mount Point: 240305085154981
    
```

Figure 4.3 the login window

After a successful login, the link status and statistics are shown in the figure below:

Current Time:19-03-19 03:56:19(-0000)

Server/Client Current Status

S/C	From IP	MountPoint	StartTime	Data Bytes(KB)	Data Type	lat/long/ellipsoid height
Server	221.178.124.152	2403050050	19-03-19 02:02:35(-0000)	2896.824	RTCM3	594690/107.883409/107.4092

Statistics

MountPoint	First Start Time	PAS Count/ideal	total online rate(%)	Error/Valid Package	lat/long/ellipsoid height
2403050050	18-12-13 02:52:14(-0000)	2569/4610	55.74	0/15265991	594690/107.883409/107.4092

240305005050828 Hourly online rate from 03/17 to 03/19(-0000)

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
03/17	100	100	99	100	100	97	87	98	99	100	97	100	99	100	100	100	100	100	100	100	100	100	100	100
03/18	100	100	100	100	100	100	100	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
03/19	100	100	99	93																				

Figure 4.4 the link status and statistics

4.4 Group User Management Function

The Group User function is mainly used for regional agent to manage and configure Client end-users with different privileges after using GeoBee30 builds a certain number of base stations in a region.

Specifically, under previous versions of Caster software, after the regional agent sends data from the GeoBee30 base station (NtripServer) in the region to the Caster software (NtripCaster) using the username and password distributed by Tersus, the end-user (NtripClient) in the region can only get the differential correction data using corresponding user name and password with the GeoBee30 base station, and the regional agent can not realize the configuration of the end-user's duration, limit days, available base station and other permissions. The new version of Caster software's Group User management function will make up for this weakness. The operation is as follows.

1)Log in to the specified web page and use the designated password to log in to the Group User management function.



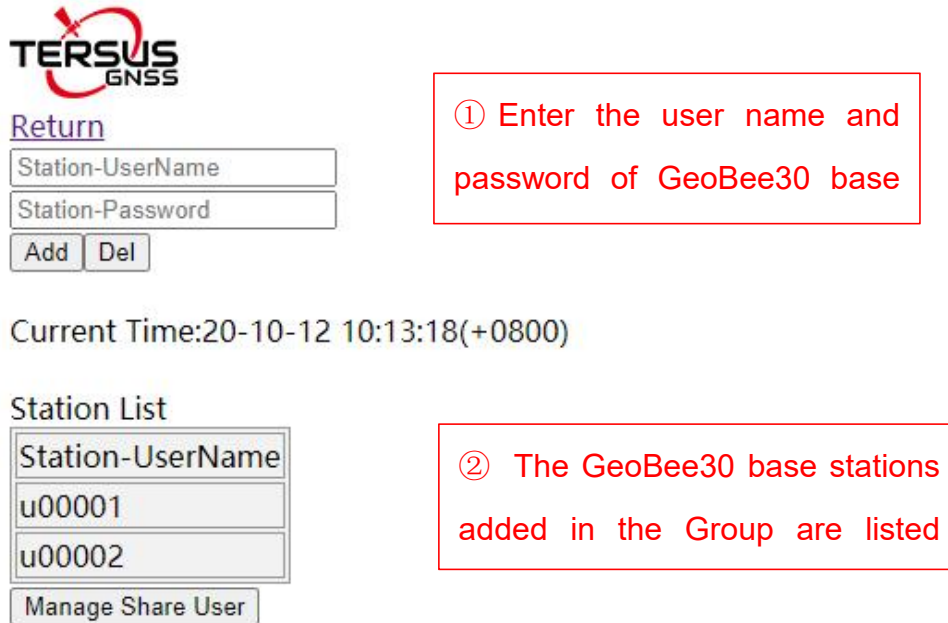
TERSUS
GNSS

USER
PASSWORD
Query

Group User
Group User
Group Password
Login/Register

Figure 4.5 login interface for group user

2)After logging into Group User, enter the Group User interface, Group means the area where the regional agent is located. The next step is to pull the GeoBee30 base stations in the area into Group, by entering the user name and password of the GeoBee30 base stations distributed by Tersus and clicking Add.



TERSUS
GNSS

[Return](#)

Station-UserName

Station-Password

Add Del

Current Time:20-10-12 10:13:18(+0800)

Station List

Station-UserName
u00001
u00002

Manage Share User

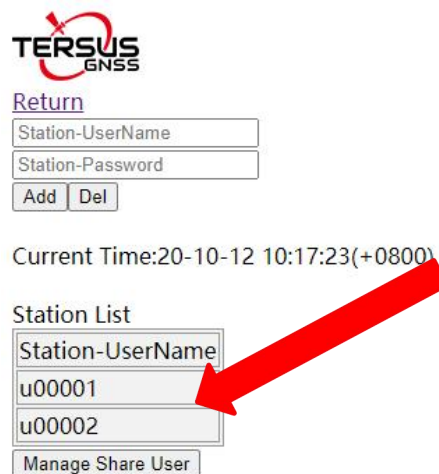
① Enter the user name and password of GeoBee30 base

② The GeoBee30 base stations added in the Group are listed

Figure 4.5 base station list

If you want to remove a GeoBee30 base station that has been added to the Group, you need to enter the corresponding username and password and click the Del button. We need to make sure that the username and password are correct to prevent the base station from being accidentally removed.

3) Start to configure the client end-users in the regional group. Click the Manage Share User button, and enter the ShareUser configuration interface.



TERSUS
GNSS

[Return](#)

Station-UserName

Station-Password

Add Del

Current Time:20-10-12 10:17:23(+0800)

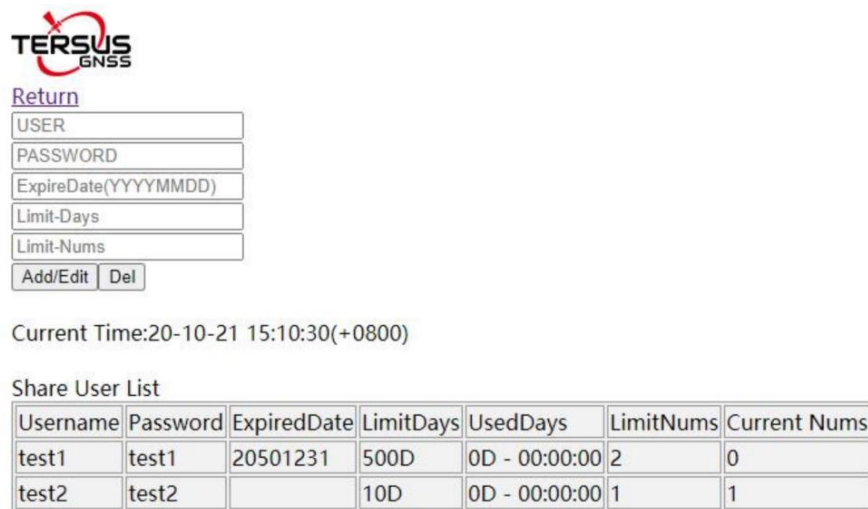
Station List

Station-UserName
u00001
u00002

Manage Share User

Figure 4.6 manage share user

4)The regional agent inputs the username, password, expired date, limit days and limit numbers of the Client end-user to be configured. Please try to set a complex username and password according to the recommended rules to avoid the cases that different regional agents set the same username and password to cause end-users to connect to different regional base stations. The password is recommended to set a string consisting of letters or numbers.



TERSUS
GNSS

[Return](#)

USER

PASSWORD

ExpireDate(YYYYMMDD)

Limit-Days

Limit-Nums

Add/Edit Del

Current Time:20-10-21 15:10:30(+0800)

Share User List

Username	Password	ExpiredDate	LimitDays	UsedDays	LimitNums	Current Numms
test1	test1	20501231	500D	0D - 00:00:00	2	0
test2	test2		10D	0D - 00:00:00	1	1

Figure 4.7 the share user list

After setting the expired date of an end-user, once the end-user expires, the end-user will not be able to connect to Caster software to get the differential data. If not setting expired date, the Caster system will have no limit for the user's expired date.

After setting the limit days of end-user, the used days of end-user will be refreshed every time the end-user disconnects. When the used days reaches the limit days, the end-user will not be able to connect to Caster software to get the differential data. If more than one NtripClient uses the same user name and password to get the differential data at the same time, the used days of this user will be accumulated. If the limit days is not set, the Caster system will have no limit for the user's limit days.

After setting the limit number of concurrent online users, when every end-user

connects to the Caster system with this username and password, the current connection number will increase by 1. When the current number of connection reaches the limit number of concurrent online user allowed, the system will not be able to connect using this username and password. If the limit number of concurrent online users is not set, the Caster system will have no limit for the concurrent online user using this username and password.

It should be noted that after this update of Caster software, Client end-users are still allowed to use the username and password of GeoBee30 base station to connect and get differential data, and the username and password has no limitation of expiration date, allowable days or concurrently online users. In other words, if the regional agent does not use the new Group User management function, the end-users in the region can keep the previous login method unchanged.

4.5 Nearest Base Station Function

This version of Caster software adds the Nearest Base Station function which will automatically select the nearest base station among all the base stations that is allowed to connect to according to the GGA uploaded by the NtripClient end-user and establish the connection.

The Nearest Base Station operation is very simple, NtripClient end-user can select NearBy mount point when obtaining the Mountpoint. The distance calculation and selection of Nearest Base Station will be done inside Caster software.

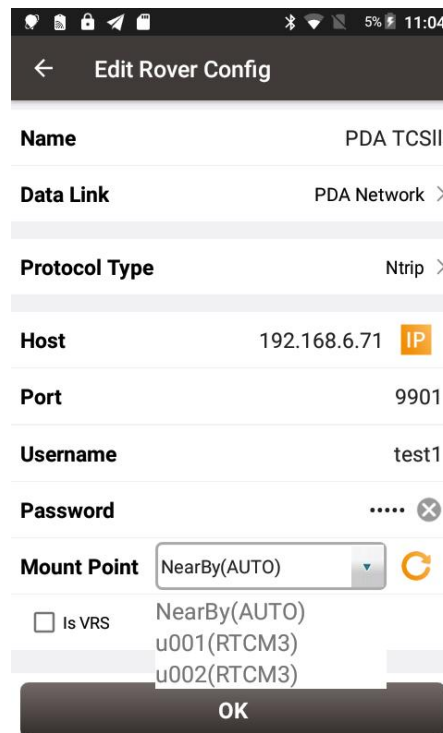


Figure 4.8 select nearby mount point

5. Lightning-Proof Design

The regional surface displacement monitoring system of the ground disaster monitoring uses lightning rods for direct lightning protection, single power supply arrester and communication cable arrester for inductive lightning protection.

5.1 Direct lightning protection

As the specific lightning protection method required, the distance between the lightning rod and the protected object must be not less than 3m. The height of lightning rod is determined in accordance with the 'Rolling Ball Rule' and can be roughly calculated.



Figure 5.1 Schematic diagram of direct lightning prevention

ZGZ-200-2.1 type is selected as the lightning rod:



Figure 5.2 Lightning rod

Technical Parameters

- 1) Lightning current capacity(KA): 200;
- 2) Resistance(Ω): ≤ 1 ;
- 3) Height(m): 2.1;
- 4) Weight(kg): 4.8;
- 5) Maximum wind resistance(m/s): 40;
- 6) Installation size(mm): $\phi 70 \pm 0.26$.

5.2 Inductive lightning protection

5.2.1 Power lightning protection

Metal cabinet is used to shield inductive lightning, and the power unit is additionally assisted with lightning protection socket and single power supply arrester.

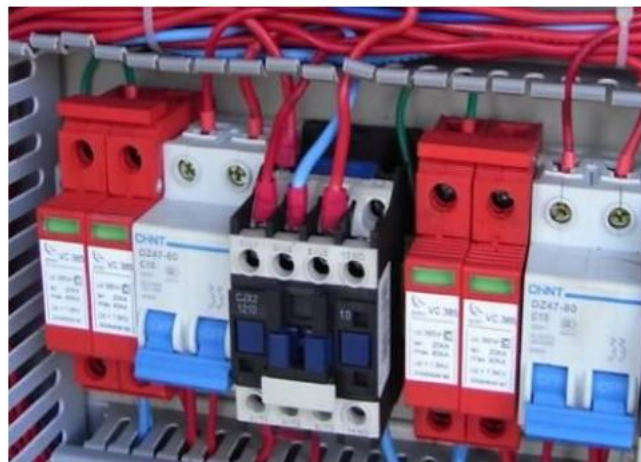


Figure 5.3 Single power lightning arrester

5.2.2 Lightning protection for communication cables

Install lightning protection devices at both ends of the communication cable. One end is close to the sensor to avoid current damage to the sensor due to the inductive lightning. And the other device is as close as possible to the data processing equipment.

The grounding terminal of the arrester is connected to the lightning protection net, with anti-rust paint on the connection to ensure conductivity, and the grounding resistance is less than 4Ω .

The lightning arrester has certain insertion loss, which has an impact on the strength of the data signal. So as to be necessary to equip the signal amplifier and other related equipment according to the actual situation.



Figure 5.4 The lightning arrester for communication cable

5.2.3 Grounding net

For the construction of grounding net, four $50*50*5\text{mm}$ hot dip galvanized angle steels are used as vertical poles $L=2.5\text{m}$, which are inter connected by $40*4\text{mm}$ hot dip galvanized flat steels, and the buried depth of the ground pole is more than 0.7 meters. The base of the lightning rod is $500*500*60\text{mm}$ reinforced concrete, which is connected with ground net by two $40*4\text{mm}$ hot dip galvanized flat steels(the connection must be welded). The ground resistance is less than 10Ω .

6. Terminology

APN	Access Point Name
BDS	BeiDou Navigation Satellite System
DC	Direct Current
eMMC	Embedded Multi Media Card
EXIF	Exchangeable Image File Format
GLONASS	GLObal NAVigation Satellite System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
MSL	Mean Sea Level
LAN	Local Area Network
PC	Personal Computer
PPK	Post-Processing Kinematic
PPS	Pulse Per Second
RINEX	Receiver Independent Exchange format
RMS	Root Mean Squares
RTK	Real-Time Kinematic
RTCM	Radio Technical Commission for Maritime Services
UAV	Unmanned Aerial Vehicle, drone
USB	Universal Serial BUS
WAN	Wide Area Network

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