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Vnet series User Guide

Hi-Target Surveying Instrument Co., Ltd.

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Preface

Introduction

Welcome to Vnet series User Guide. This introduction describes how to use this product.

Experience Requirement

In order to help you use Hi-Target series products better, Hi-Target suggests you carefully read the instruction. If you are unfamiliar with the products, please refer to www.hi-target.com.cn or contact Hi-Target Technical Group.

Tips for safety use

Notice: The contents here generally are special operations, and need your special attention. Please read the contents carefully.

Warning: The contents here generally are very important. Such wrong operation may make the machine damaged, make the data lost, even breaks down the system and endangers personal safety.

Exclusion

Before using the products, please carefully read the operating instruction, and it will help you better use it. Hi-Target Surveying Instrument Co., Ltd will not assume the responsibilities if you fail to operate the product according to the requirements in operating instruction, or operate the product wrongly because of failing to understand the operating instruction.

Hi-Target is committed to constantly perfect product functions and performance, improve service quality and reserve the rights to change the contents in operating instruction without separate notice.

We have checked the consistency between contents in instruction and software & hardware, without eliminating the possibility of deviation. The pictures in operating instruction are only used for reference. In case of inconformity with products, the products shall prevail.

Technology and Service

If you have any technical issues, you can call Hi-Target technology department for help, we will answer your question in time.

Advice

If you have any comments and suggestions, please call us or Dial the national hotline: +86 400-678-6690. Your feedback information will help us to improve the quality of the product and service.

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Chapter1 Introduction

1.1 Introduction

HI TAGET GNSS receiver VNet series (referred to as "receiver" or "GNSS receiver") products include: VNet6, Vnet6 Plus, VNet8 and so on. This manual mainly introducing GNSS receiver Vnet8.

The VNet Series GNSS reference receiver installed with the high-performance microprocessors, high-capacity, high-speed flash memory and battery, multi-communication port and military grade industrial standard design level. With built-in firewall, data encryption transmission protocol, make the GNSS receiver more accurate, easy to use, better availability, more stable operation. On the strength of Hi-Target's sophisticated GNSS technology and the years of experiences in establishing CORS/VRS system, the VNet series GNSS reference receiver will provide you with reliable communication, better performance, stronger stability and safety.

Notice:

1. The specific configuration is write on the list.
2. Please carefully open the box to confirm. If you find any loss of this product and accessories, damages, please contact your local office or dealer immediately.
3. Please read the instruction manual carefully before carrying, using and handling.

1.2 Features

1.Based on the Linux operating system

Based on the embedded Linux operating system kernel, is a real multi-user, multi-tasking, multi-platform operating system. With its system stability, management functions, powerful network; the Vnet8 is suitable for a long time unattended continuous work.

2. Excellent GNSS multi-constellation tracking performance

220 Channels with Trimble OEM mainboard, support GPS, GLONASS, BDS, GALILEO and other global satellite navigation and positioning system, can maximize the tracking ability of all visible GNSS satellite signals, thereby improving the measurement accuracy and real-time RTK measurement performance.

3. 50 Hz updating rate

Support high frequency data updating, data updating rate up to 50 Hz, and maintain the best observation quality of the data and the independence of the observation value;

4.Multi-task function

The GNSS receiver can deal with multiple task operations at the same time and simultaneously download, release different types of RTK or RTD data while continuously tracking and recording satellite data.

5. Multi transmission mode

With UHF radio, data line Modem, broadband port, Fax Modem, TCP / IP,

built-in 3G / 2G wireless communication function, can use the Internet, wireless network for data transmission and broadcast differential data.

6.Massive data management function

Built-in 64GB high-performance storage and can support the maximum of less than 1TB industrial-grade U disk storage or external USB storage devices; support U disk download, FTP download and remote download; and the receiver also has a loop storage function.

7.High-precision measurement technology

The Hi-Target's sophisticated GNSS technology make sure the accuracy reaches millimeter, make sure the data have the reliable quality.

8. Excellent compatibility

With excellent compatibility, real-time output CMR, RTCM, RTCMV3, RTCM32, and other formats of correction data to compatible with third part CORS system seamlessly, which can be used to new and extend enhance CORS system. Also output high-precision real-time GNSS raw data.

9. Remote access function

Easy to using the Network for remote access the reference stations, easy for remote control.

10. Multi data interface

Equipped with three RS232 ports, two USB ports, one Wi-Fi, one Bluetooth communication port, one 3G / 2G communication port, one

Ethernet port, one RS485 port, one external clock port, one PPS output port, fully meet the reference Station requirements.

11.Multi-mode power supply

Built-in large capacity lithium battery, can work for 24 hours (related to configuration); external voltage power supply: 7VDC ~ 36VDC; support battery, solar and wind power supply.

1.3 Use and precautions

Although the VNet series (ground-based) GNSS receiver is based on military standard design, it is anodized with an aluminum alloy, but the precision instruments require careful use and maintenance.

WARNING: The receiver must be used and stored within the specified environment. Please refer to the Appendix: VNet product technical performance parameters table.

Avoid using the receiver in extreme environments.

The Vnet8 (ground-reinforced) GNSS receiver uses anodized aluminum alloy for the shell, but should also be kept as dry as possible. And in order to improve the stability of the receiver and extend the service life, please avoid the receiver exposed to extreme environments, such as:

1. Damp
2. The temperature is higher than 75 ℃
3. The temperature is less than -40℃
4. Corrosive liquid or gas

Do not place the GNSS antenna near sources of electricity and strong interfering signals:

1. Oil (spark plug)

2. TV and computer monitors

3. Generator

4. Electric motorcycle

5. DC - AC power conversion equipment

6. Fluorescent light

7. Power switch

When selecting the position of the GNSS reference station for continuous operation, notice the following:

The site should be easy to place the receiving device and have a wide field of vision. Field height above 10 degrees should not have obstacles, so as not to absorb or block the GNSS signal, as shown in Figure 1-1:

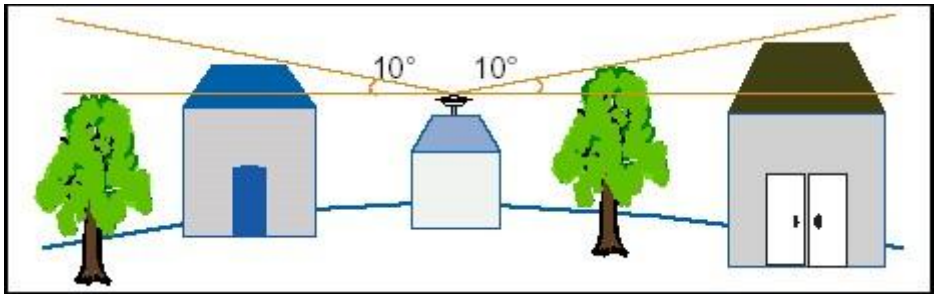


Figure 1-1

1.Near the site should avoid the large area of water or strong interference with the satellite signal, to reduce the impact of multi-path effect.

2.The site should be away from high-power radio transmission sources (such as television stations, microwave stations, etc.,) it's better to keep a

distance more than 200m; away from high-voltage transmission lines, the distance should more than 50m to avoid electromagnetic interference on the GNSS signal.

3.To provide a stable device to fix the antenna.

4.To provide reliable and stable power supply and communication network.

5. Suitable placement and protection of GNSS reference station equipment.

6.Select the traffic developed place, easy to arrive for inspection and maintenance.

Chapter 2 GNSS receiver Introduction

2.1 Front Panel

Figure 2-1 Overall appearance of the receiver

Figure 2-2 Front panel

1. MiniUSB port: Reserved

2. TF Card slot：Install TF(micro SD) card to Expand storage capacity

3.SIM Card slot：Install standard SIM card for 3G / 2G wireless network communication

4.LCD: Display receiver status information

5.Indicator light：Indicates information such as receiver tracking status, network status, power status, and so on

6.USB port：Connect a USB flash drive or USB storage device for storing / downloading data and upgrading the firmware

7. Button panel: For query and configure the receiver.

2.2 Back Panel

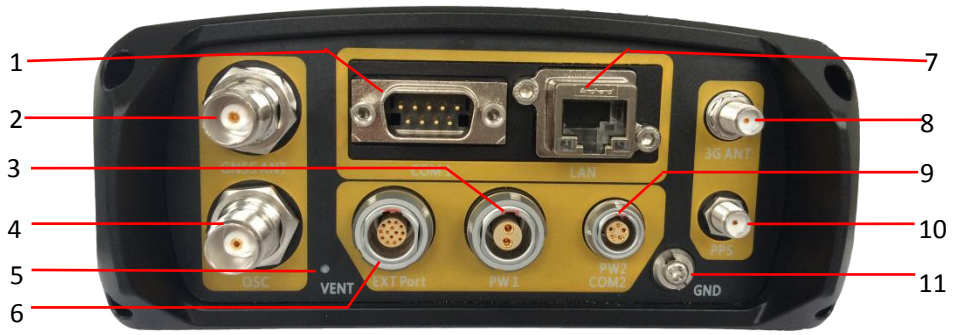


Figure 2-3 back panel

1.DB9 port: Data output and connect to external devices

2.GNSS antenna: For connect the antenna

3.Power port: Power input port

4. External clock: TNC Socket for connecting external atomic clocks

5. Ventilation holes: Waterproof ventilation holes

6.External extension:12V DC power output, RS232 debugging port, RS485/RS422 Communication port, hardware restart port

7.LAN port： Wire network connection port

8.3G antenna: Connect the 3G / GPRS antenna port

9.Five-core socket: Differential data output, external data link connection; auxiliary power supply input

10.PPS output: PPS output port

11.Ground Point: Lighting protection grounding port

2.3 Mainframe

The mainframe uses an all-aluminum alloy metal housing and uses an anodizing process, as shown in Figure 2-4:

Figure 2-4 Mainframe

2.4 Button Function

Table 2.1 Button Description

Operation	Description
Click	button operation< 0.5 s
Double Click	button operation interval <1 s
Long Press	button operation>6 s

Table 2.2 Button Function Description

Button	Name	Function	status
	Power button	Double-click：turns off / on the LCD	See in the LCD
		Single click：Boots, modify the parameters and confirm	
		Long Press：turn off	
	Left button	Single click：Move left or up	

	Right button	Single click： Move right or down	
	Function Button	Cancels or interface switch	See in the LCD
	Combination Button	Press the Fn button and click the power button To upgrade the kernel;	The satellite lights are flashing

2.5 Indicator lights

LCD information	Status	Function
Satellite light	Always bright	Satellite tracked
	Always off	Satellite untracking
Record light	Quick flashing	Record interval <1 second
	Slow flashing	Recording interval≥1 s
	Always off	Recording stops
Network light	Always bright	Connected
	Always off	No network connection
	Quick flashing red	Alarm

Power / Alarm Light	Always yellow	External power supply
	Always green	Battery powered

Notice: double-click the power button to open the LCD display, the lights will turn off except for the network light.

2.6 LCD

Status display normally will show the Status of satellites, IP, port and Network connection status.

1.Status Display

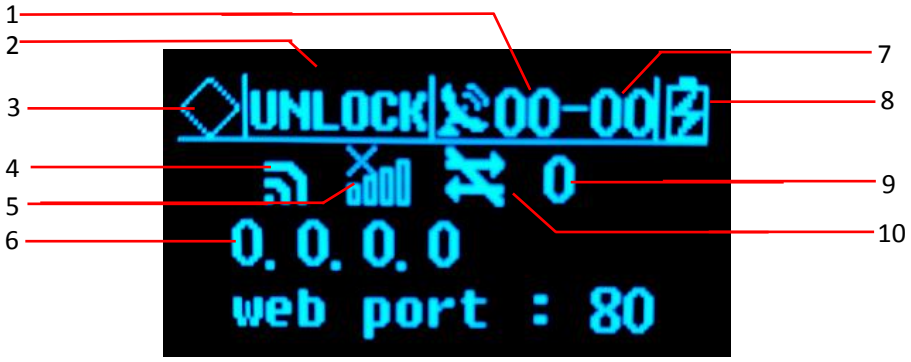


Figure 2-5 Main parameter information

1-Common satellite Number; 2-satellite Lock Status;3-Alarm Status;4 - Wi-Fi Status; 5-3G Network Status; 6-IP Address; 7-Total satellite number ;8-Power supply / battery power; 9-3G Signal strength;10-3G Network transmission status;

LCD status	Shows	meaning
Alarm status		Normal status
		Alarm
Wi-Fi status		Wi-Fi is off

		Wi-Fi is on
3G network status		The 3G module is off
		The 3G module is on
3G network status Power supply		Connected to a public network
		External power supply
		Battery powered
3G network transmission status		No data transmission
		Data transmission

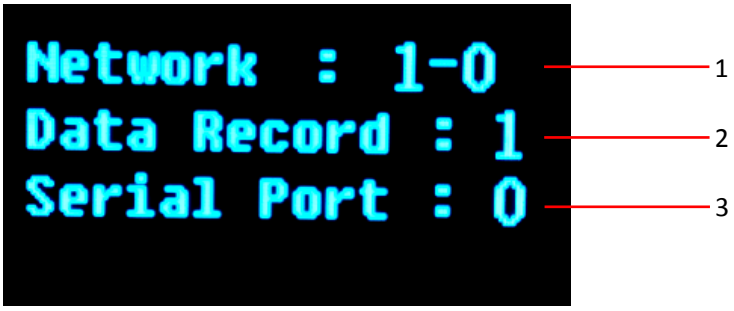


Figure 2-6 Data transfer status

1- Total network stream– Enabled network stream; 2- Enabled data record stream; 3- Enabled serial port number

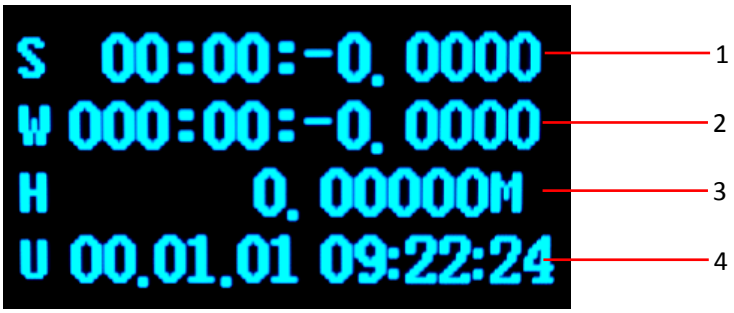


Figure 2-7 Coordinate information

1 Latitude -;2- Longitude;3-Elevation;4-UTC time

Figure 2-8 Satellite information

1-Satellite number of BDS;2- Satellite number of GPS;3- Satellite number of GLONASS;4- Satellite number of other;5- Satellite map of the sky

Figure 2-9 Receiver status information

1-Receiver SN number;2-Version;3-Motherboard version;4-Expire data;

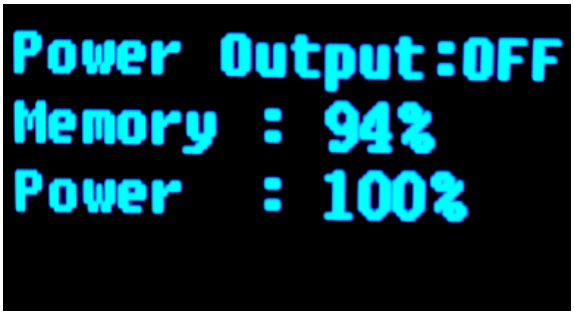


Figure 2-10 Status information

2.Display setting

Figure 2-11 Setup menu

1- Data record;2- Network settings;3- Data download;4- System settings;

Figure 2-12 System settings

1- Firmware Upgrade;2- Restore the default IP;3- reset;4- Reset the motherboard;

2.7 External port

Table 2.5 External port descriptions

Panel	Panel Name	Panel instructions	Physical port	Function
Front Panel	Mini USB port	/	Mini USB	/
	USB port	/	USB-A	Data storage / download, upgrade firmware ,available for U disk and USB removable storage
	TF/ SIM Card slot		TF/SIM Card slot	TF card: storage data and ROM; SIM card: 3G / 2G wireless network communication;
Back Panel	GNSS antenna	GNSS ANT	TNC	Connect the GNSS antenna

	External clock input	OSC	TNC	Connect with external atomic clock
	3G antenna	3G ANT	SMA	Connect the 3G / GPRS antenna
	PPS output	PPS	SMA	PPS seconds pulse output
	DB9 Serial port	COM1	DB9	GNSS data output and external sensor access port
	LAN port	LAN	RJ45	Wired access to local area networks, support 10M/100M
	External extension	EXT Port	Fourteen core port（LEMO）	RS485: GNSS data output and external sensor access; RS232: debug serial port; EX12: 12VDC output; PW_RST: hardware reboot; EVT: external event input (reserved);
	power input	PW1	Two core port（LEMO）	Main power supply input;
	Five-core socket	PW2 COM2	Small five core port（LEMO）	Auxiliary power supply input; Differential data output;
	Ground point	GND	/	Grounding lightning protection interface

Chapter 3 WEB Administration

3.1 User login

After network setting, GNSS receiver can be remote access in LAN or WWW through the IP Address.

For the convenience of management, all users are categorized into three groups.

A. Guest: users can log in without the enter of ID and password. They are authorized to basic status check only.

B. Normal users: Must provide ID and password to log in, being authorized to check system status, change parameters, browse, download, and delete data file. Users are prioritized while the amount of online users reach the maximum supported.

C. Administrator: Must log in with ID and password. Holding the highest level of authority and able to add, delete accounts and change password of other users. It is prioritized while the amount of online users reach the maximum supported.

Table 3.1 authority class with different user groups

Authority	Guest	Normal user	Administrator
Check status	○	○	○
Check position info and satellite status	○	○	○
Check logging file	○	○	○
Check data transmission status	○	○	○

Modify configuration	×	○	○
Set coordinate system and observation parameters	×	○	○
Control and modify log files	×	○	○
Download or delete observation file	×	○	○
Modify data output configuration	×	○	○
Modify password	×	○	○
Add or delete account	×	×	○
Disconnect other user	×	×	○
Restart the system	×	×	○
Restart the device	×	×	○
Upgrading OS and Apps	×	×	○

When accessing the WEB administration page of VNet, a login page would show as the figure 3-1 below.

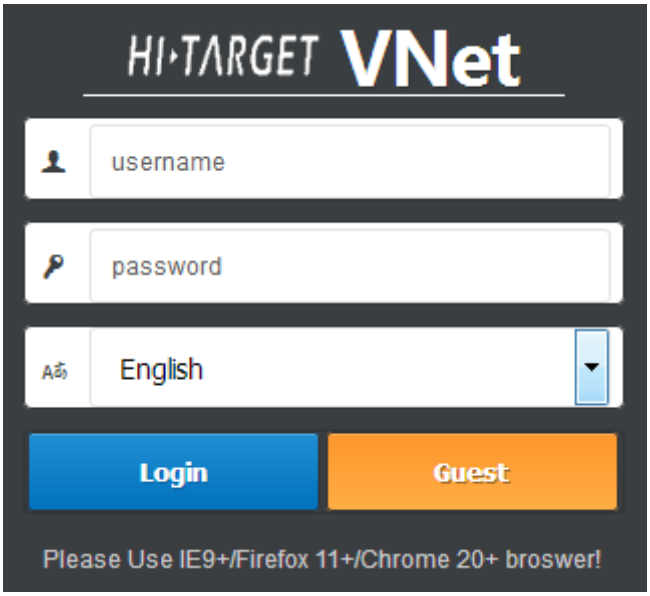


Figure 3-1. Login interface

Note: WEB administration of VNet series support PC, server, tablet, smart phone, etc. Please use IE 9+/Firefox 11+/Chrome 20+ to access the WEB system.

Input ID and password and click【log in】to enter the WEB system. Or just click 【Guest】to log in as guest with elementary authority.

After initialization, the system creates an administrator account automatically with username 'zhdgps' and password 'zhdgps' (exclude quotation marks). Normal user accounts could be created by administrator for the benefit of user management with different authority level.

Note: only one administrator account is allowed and password can be changed. If you forget the password, please contact with Hi-Target for administrator account or contact with administrator for normal users' password reset.

3.2 WEB interface for administration

Web interface including Home page, System info, Receiver settings, Record and File management etc. Detail information see below pictures.

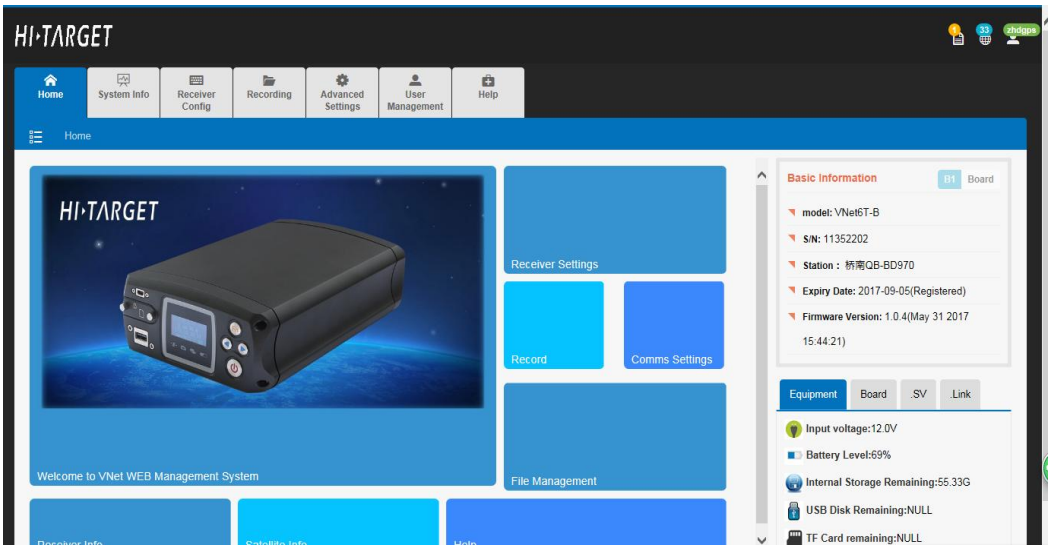


Figure 3-2. WEB interface

3.3 Elementary info

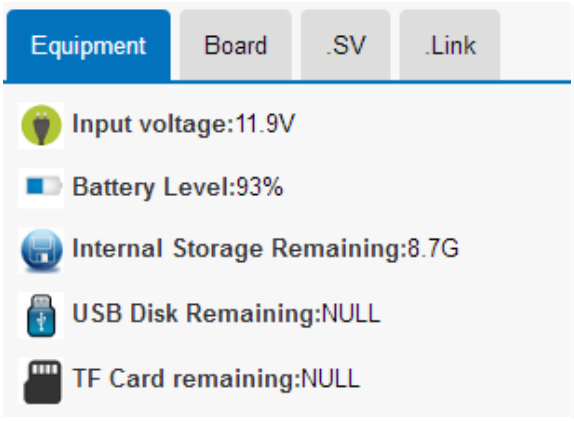
This sector located on the right hand part of WEB interface with the display of instrument ID of receiver, firmware version, registration, instrument status, motherboard info, amount of observing satellite, communication of receivers, etc.

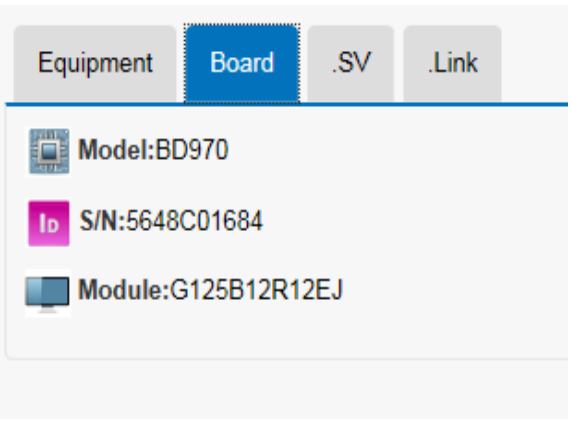
Receiver model with suffix.

SN, display in red when registration code expires.

Current station, revisable in Advanced setting/ System setting

Registration status and valid time





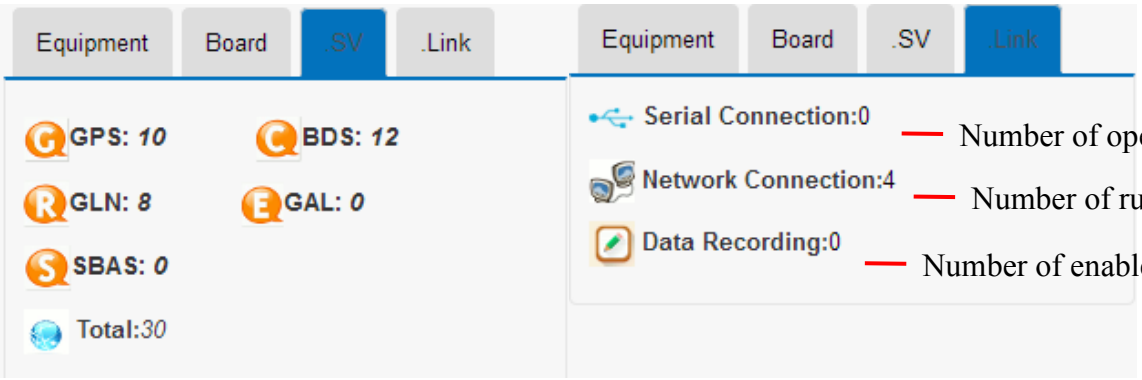


Figure 3-3 Basic information

Note：system limits the display of satellite amount and data transmission for unregistered GNSS receiver and expired registration code. To prevent this inconvenience, please contact with Hi-Target for new code before it expires.

Status bar

Satellite status, login account and language setting are shown in this sector (refer to figure 3-4).

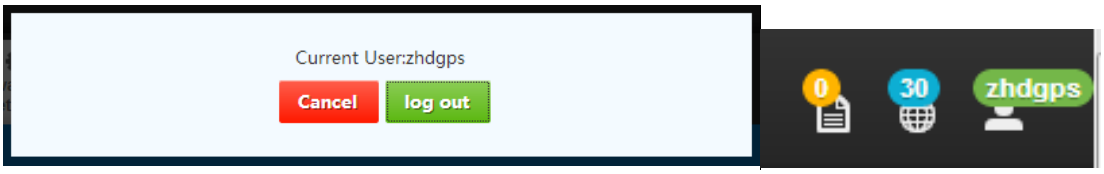


Figure 3-4 Status bar

Satellite status: this icon shows the amount of observing satellites, click it to show the satellite info page.

Current account: this icon shows current login information.

Language setting: change language between English and other language.

3.4 Home page

This interface is comprised of welcome page, reference station configuration, data recording, online transmission, files downloading, instrument info, satellite view, hyperlink option. By clicking the icon in hyperlink option sector, users can directly reach the corresponding page for further operation.

Figure 3-5. Main page

3.5 System info

This sector contains three modules: instrument info, satellite info and position info for the more detailed display of GNSS receiver status and observation.

Displaying current status of system including instrument info, motherboard info, storage device, power supply, network info as shown in figure 3-6.

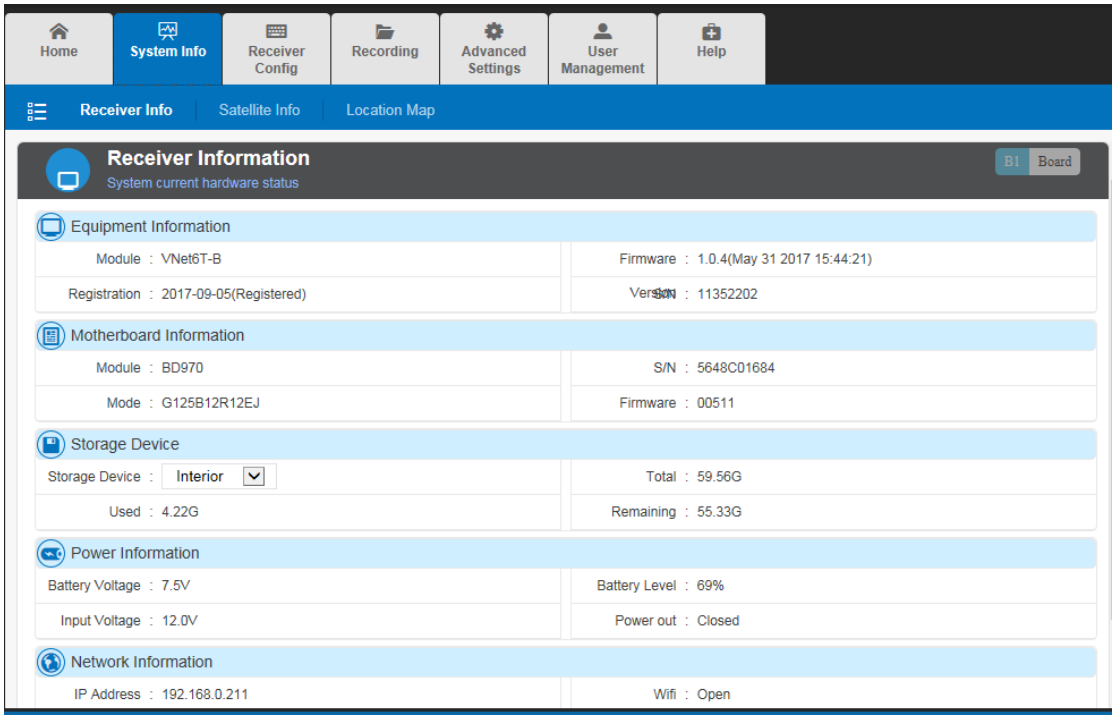
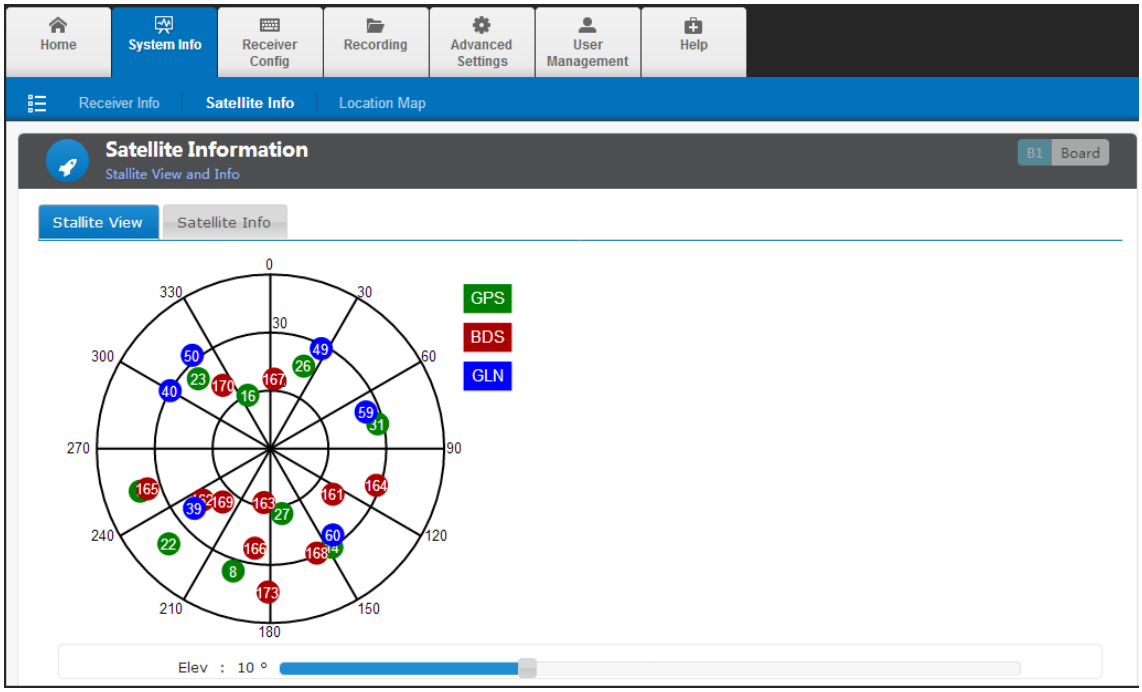


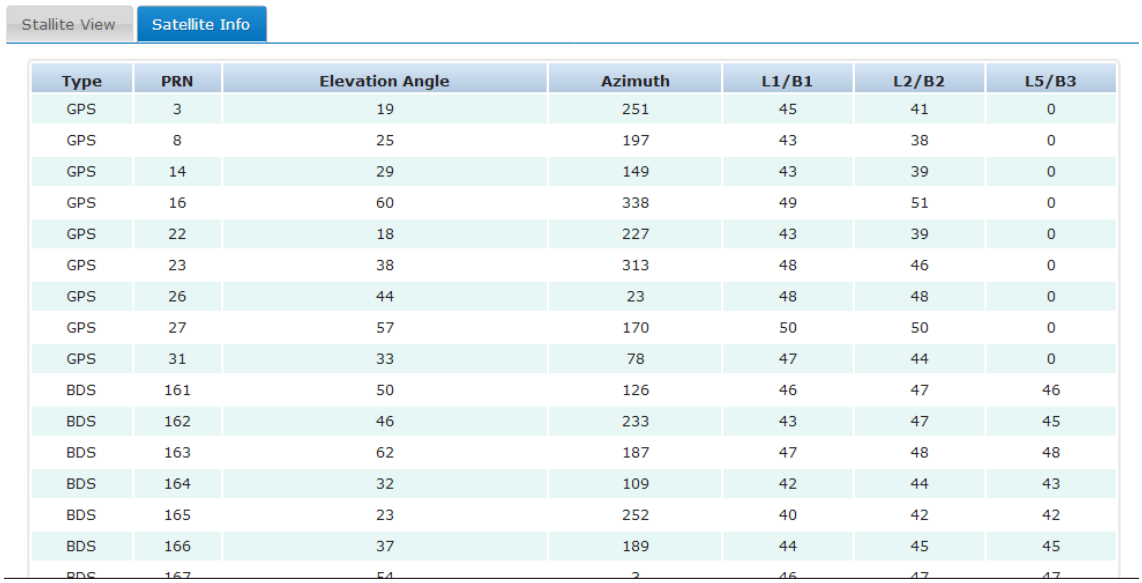
Figure 3-6. Equipment info

In the storage device tab, different storage address (internal storage, U-disk, TF card) could be chosen by clicking the inverted triangle on the right of dialog. When changing the storage address, storage information will be updated and displayed automatically.

Satellite info

This sector shows the sky plot of satellites, satellite ID, altitude angle, azimuth, signal-noise ratio (SNR), etc.





Stallite View | Satellite Info

Type	PRN	Elevation Angle	Azimuth	L1/B1	L2/B2	L5/B3
GPS	3	19	251	45	41	0
GPS	8	25	197	43	38	0
GPS	14	29	149	43	39	0
GPS	16	60	338	49	51	0
GPS	22	18	227	43	39	0
GPS	23	38	313	48	46	0
GPS	26	44	23	48	48	0
GPS	27	57	170	50	50	0
GPS	31	33	78	47	44	0
BDS	161	50	126	46	47	46
BDS	162	46	233	43	47	45
BDS	163	62	187	47	48	48
BDS	164	32	109	42	44	43
BDS	165	23	252	40	42	42
BDS	166	37	189	44	45	45

figure 3-7. Satellite info

Position info

The exact location of device is shown in this sector and displayed with base map (satellite image as default, refer to figure 3-8).

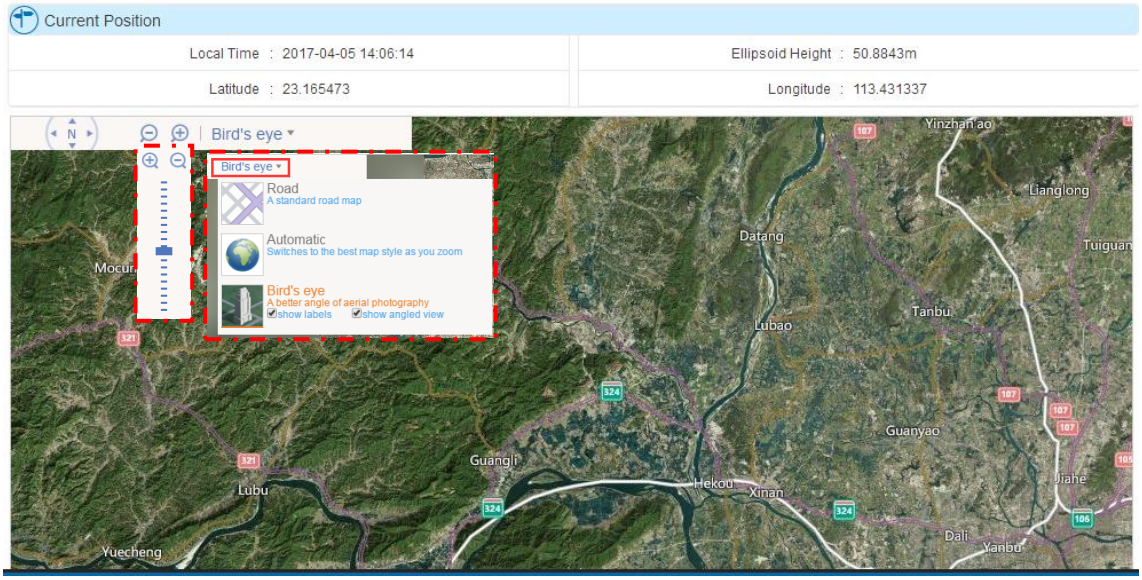


figure 3-8. Position info

Under the display with base map, press the arrow key (on the icon of) to move the screen with corresponding direction. Zoom in/out with pressing icon of . Besides, 2D digital map and satellite image are available options in the dialog of Bird's eye .

3.6 working mode

This sector will introduce configuration of satellite, reference station, serial ports as well as online transmission and data recording module.

Satellite setting

Satellite system switch on/off and cut-off angle setting: 【OFF】means system is turn off. whereas 【ON】indicates working status is turn on. Dragging the icon can change the value of cut-off angle (decreasing with left drag and right to increase). Clicking 【OK】to confirm parameter setting and reset to default by 【reset】. The interface was shown as figure

3-9 below.

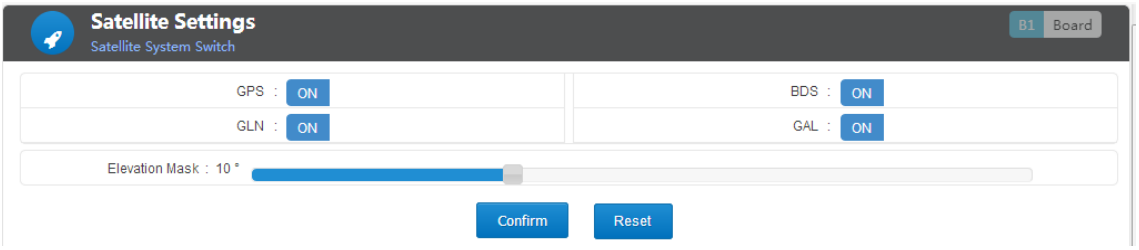


figure 3-9. Satellite setting

Receiver setting

This sector will display the positioning status, antenna parameters and working mode. The local time, latitude/longitude, elevation, HDOP, PDOP, VDOP are displayed in present positioning status and reference station configuration is categorized into antenna setting and working mode setting.

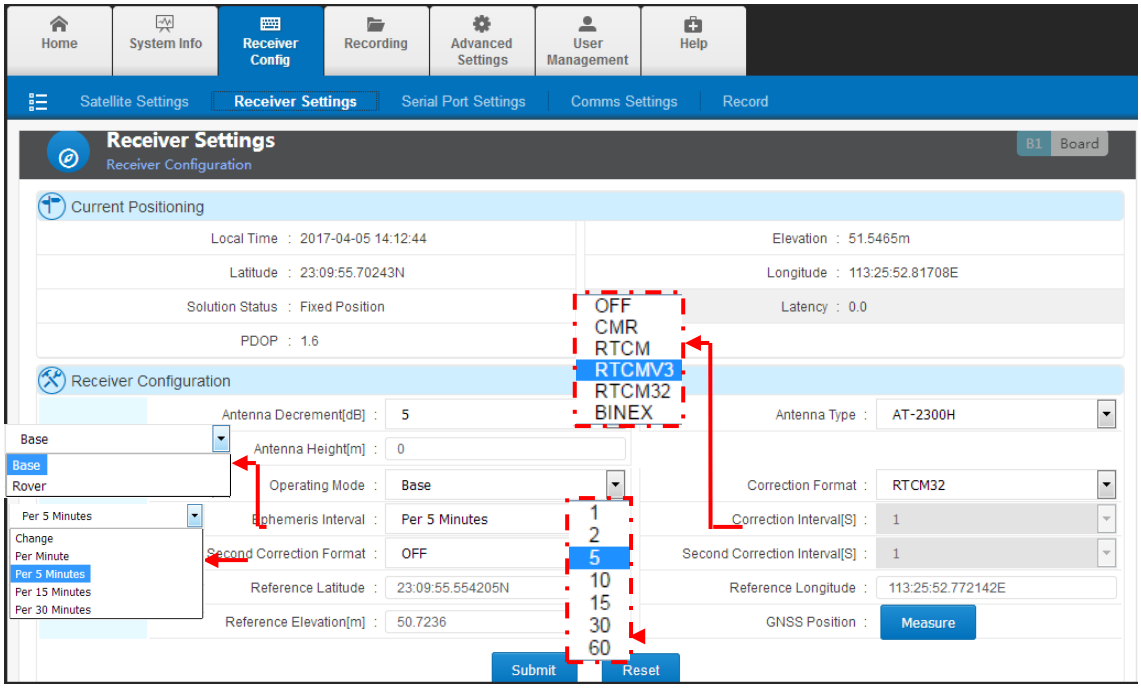


figure 3-10. Reference station setting

Antenna model, height and antenna decrement could be configured in

‘Antenna setting’.

Antenna decrement：the value could be set in the range of 5dB to 20dB according to the motherboard model and antenna model. Here is the calculating formula below:

Antenna decrement = antenna gain- motherboard gain- cable gain

Antenna model: in base station mode, choosing right antenna model to calibrate the phase center position.

Antenna height: in base station mode, input the height to calibrate measured elevation value.

Receiver could be set as base station or rover station. other settings in terms of data recording, GNSS data output via serial port, network transmitted data are various as the different mode setting.

Table 3.2 reference station setting and data output

Working mode	Second correction	Time tab	Raw data option	Correction option
Base	off	off	Output raw data	Output correction
	on	off	Output correction	Output correction
	off	on	Output raw data	Output time tab
	on	on	Output correction	Output time tab
Rover	-	off	Output raw data	Output GGA data
	-	on	Output raw data	Output time tab

Base station

Base station setting contains correction data format, correction interval, ephemeris output interval, 2nd correction output and station coordinates setting & auto-acquire.

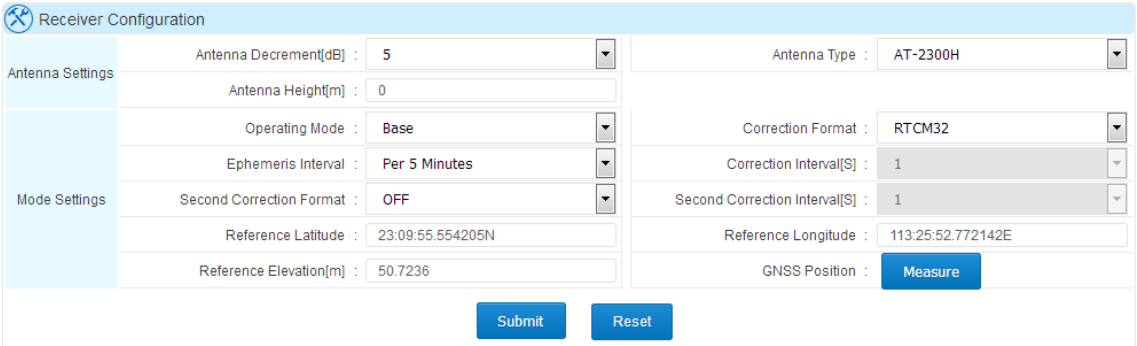


Figure 3-11 Base station setting

Ephemeris interval：setting interval as 1min, 5mins, 15mins or 30mins.

Correction data format/2nd correction output： setting as OFF （no correction data output），CMR，RTCM(RTCM2.3)，RTCMV3（RTCM3.0），RTCM32（RTCM3.2）.

Coordinates input manually：following the format DD:MM:SS, second could be set as decimals with no more than 8 decimal places.

Coordinates auto-acquire: average measure coordinates. Press 【submit】 to finish the setting.

Rover Station

In rover station working mode, correction data format, ephemeris interval and GGA output should be set. Refer to the base station setting, correction data format, ephemeris interval is the same as the Base.GGA messages outputs by correction message channel.

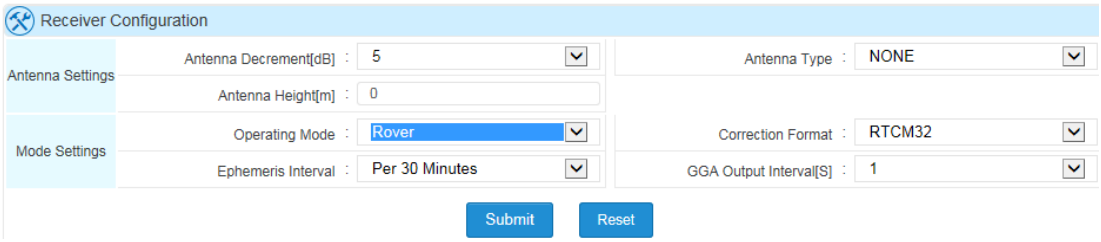


Figure 3-12 Rover setting

Note: 1. On base station mode, set correction format as RTCM if RTD correction is needed.

2. Raw data cannot be recorded and transmitted if turn on 2nd correction output. The raw data displayed on the data transmission page is virtually the 2nd correction data.

Serial port setting

RS232 and RS485 port possess identical function that could be used for GNSS data output and sensor data input. They two share the same setting method e.g. Serial port Baud rate, Data bits, stop bits, check bits, etc.

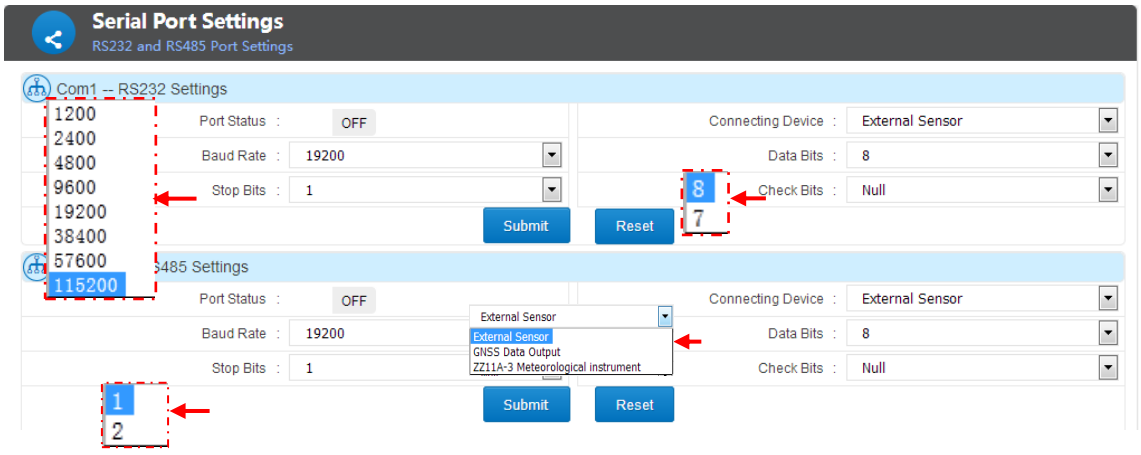


Figure 3-13. Serial port setting

The introduction below follows setting RS232 as sensor data input and RS485 as GNSS data output.

External sensor: setting 【serial port status】 as 【ON】. In 【equipment connecting】, choose 【external sensor】. Then set baud rate, data bits,

stop bits and check bits according to the equipment parameters and confirm by clicking 【submit】.

GNSS data output：setting 【port status】 as 【ON】, In 【connecting device】, set as【external sensor】and choose corresponding【data type】, set baud rate, data bits, stop bits and check bits and confirm by clicking 【submit】.

Note： 1. Make sure set right baud rate, data bits, stop bits and check bits, otherwise, would reveal wrong message.

2. 'Correction data' is in connection with reference station working mode. In base station mode, the correction data is the correction received by receivers whereas GGA data outputted from receivers in rover mode.

Comms transmission (Network transmission)

Transmission table consists of:

Serial number: the order code for online transmission.

Utilization: showing the status of chosen online transmission (on/off).

Status: this status contains 'connecting' and 'connected' two options. 'connecting' indicates this transmission is trying to connect or cannot connect. While 'connected' means the transmission is connected.

Network type: consists of cable line, Wi-Fi, 2G/3G.

Protocol: the network protocol adopted, consists of Ntrip Client、TCP/IP Client、ZHD Client、UDP Client、SG Client、Ntrip Server、TCP/IP Server and UDP in which Server ZHD Client and SG Client are Hi-Target protocols.

IP address: displaying IP and port of receiver when set as server and displaying server's when set as client side.

Operation: contains switch on/off, editing and deleting transmission.

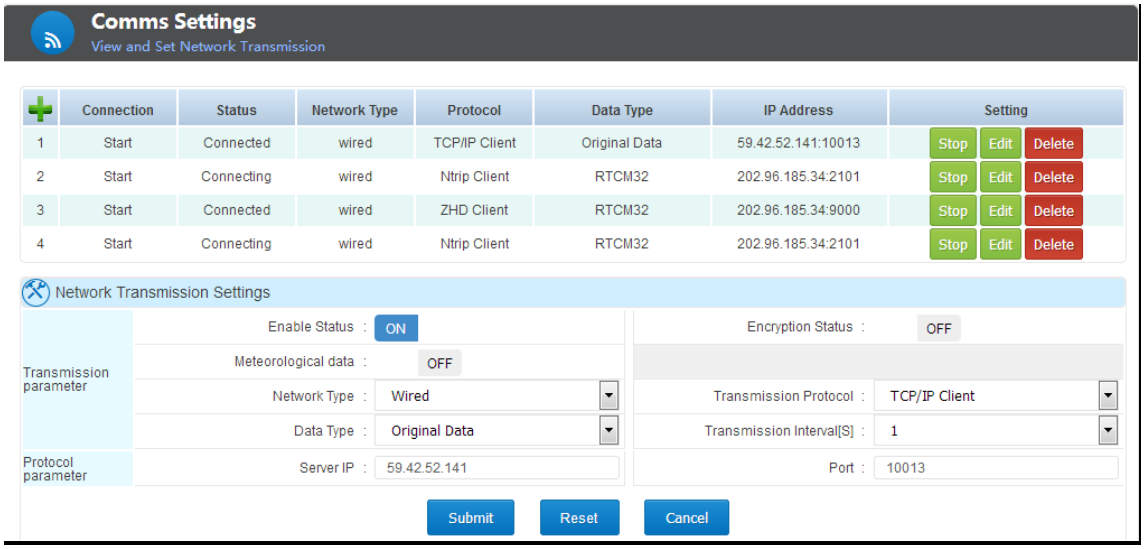


figure 3-14. Comms transmission

Click button to add an online transmission. Click 【edit】to edit current online transmission. The online transmission configuration dialogue (refer to figure 3-14) shown when adding or editing the transmission. Refer to the chapter 【adding online transmission】 in chapter 【basic operation】 for more details.

Encryption status: when this function is switched on, the data can be only processed using Hi-Target software or software integrated with Hi-Target protocol.

Relevant definitions in【Comms transmission setting】

Network Type： cable, Wi-Fi, 2G/3G are available.

Data type: NMEA-0183, correction data, raw data, RS232 data, RS485

data. Raw data output could set【transmission interval】(0.05s, 0.1s, 0.2s, 0.5s, 1s, 2s, 5s, 10s, 15s, 30s, 60s).

There are 8 protocols available with options of network setting and data type. Detail settings as below shows.

Ntrip Client, Ntrip Server share the same setting, define the parameters according to the local network setting (refer to figure 3-15).

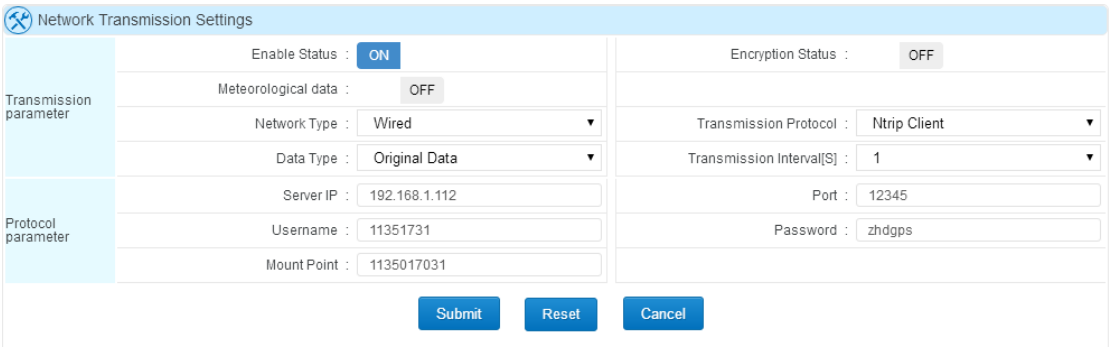


Figure 3-15 Ntrip Client and Ntrip Server setting

TCP/IP Client、UDP Client share the same setting, define IP address and port (shown as figure 3-16).

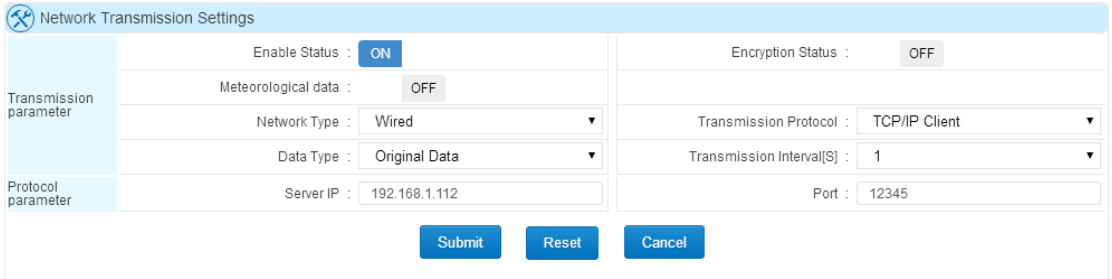


Figure 3-16 TCP/IP Client and UDP Client setting

ZHD Client is Hi-Target defined transparent transport protocol, setting IP address, port and Mount Point (refer to figure 3-17).

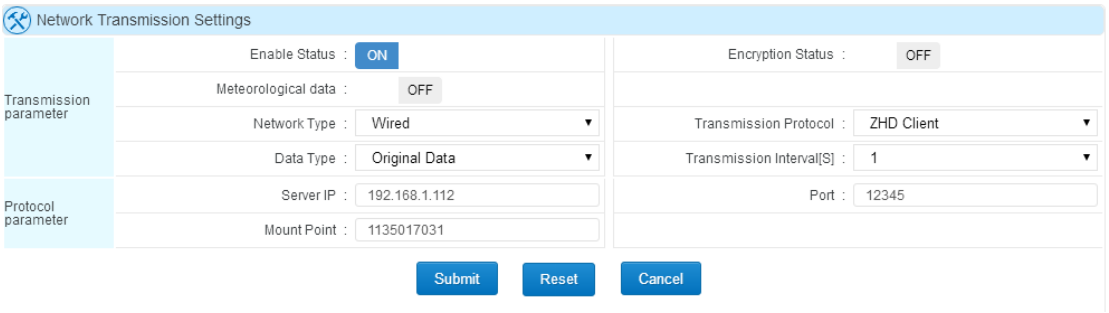


Figure 3-17 ZHD Client setting

TCP/IP Server、UDP Server transport protocol are applied with receivers as server. Under this configuration, IP address is the one of receiver address so that only receiver port settings are needed.

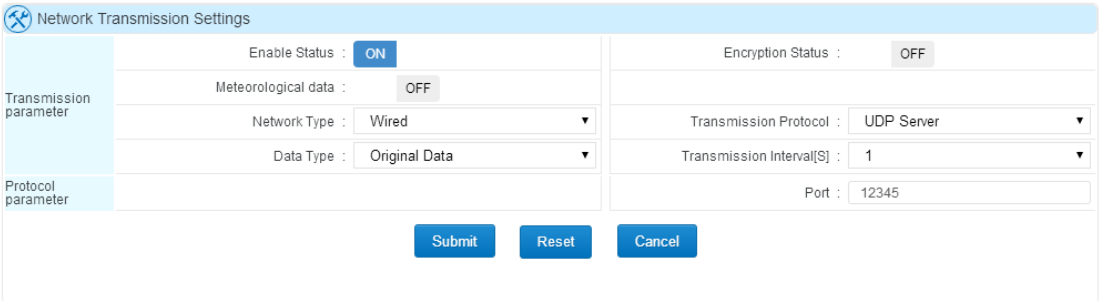


图 3-18 TCP/IP Server and UDP Server setting

Notice： 1. For network transmission, different protocol cannot be set connecting to the same server IP and port.

2. Correction data output is related to receiver working mode. In Base mode, it outputs correction message whereas GGA data would be output for Rover mode.

3. While transmitting data via RS232 or RS485 port, turn on the port first and connecting 'External Sensor' as device.

Data logging

Click to add a new data record, set up the data type, recording interval ,etc. shown as blow.

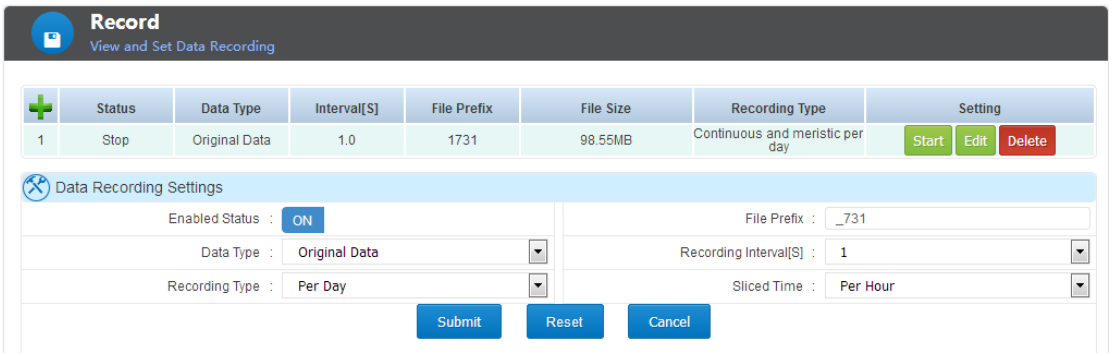


Figure 3-20 data logging

Enable the data record and then set the flag name (the file name of data file header, the default setting is _zhd), select the record data type, we provide the original data and Rinex formats. At the same time data records can be set to a different recording interval.

Recording methods are recorded every day, manual recording and planning time records, etc., when the daily record mode is enabled to record the file can also choose a file every day, every hour, every two hours split a file The Select the data record format as needed. After setting, click the [Submit] button.

【Start】【Stop】is for the status switch of existing transmission.

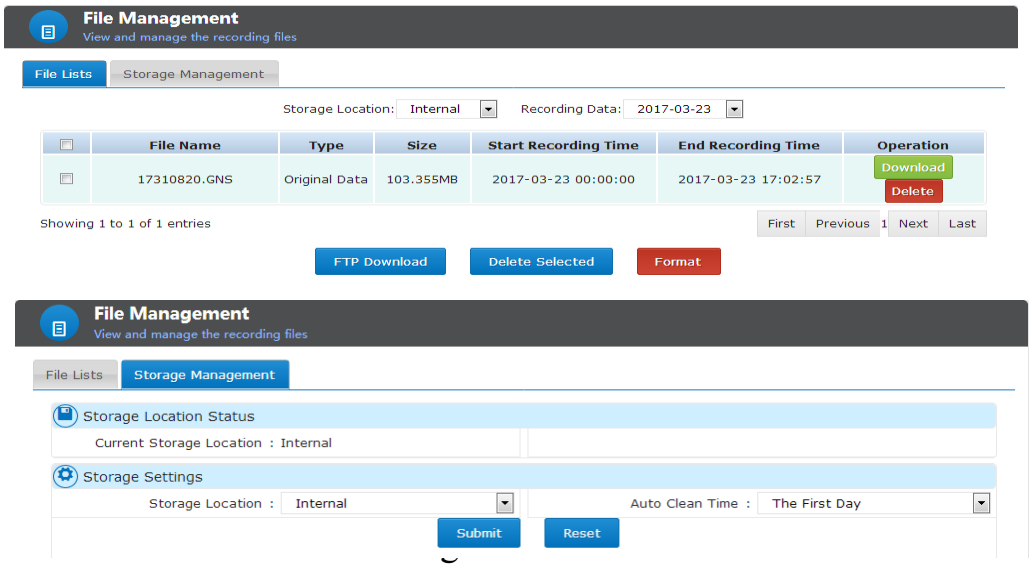
【Delete】means to erase one item from existence

3.7 File management

File management including File list and FTP push function. Users are able to storing, checking, downloading, deleting all data files. This function is only accessible for Normal users and Administrator.

File list

In this function, users can check and manage the recording files stored in different device. Those files could be auto deleted via setting 'Auto clean time'.



Stored directory could be selected internal (internal storage), U-disk and TF card. Once the record date is chosen, the page will refresh automatically.

File name: the name of recorded data files.

Type: the data type of files, normally they are RINEX file or Original data (RAW data) file.

Size: Disk storage space.

Start recording time: the beginning time of this recording, usually the moment when file was created.

End recording time: the ending time of this recording, that is the moment when this recording stop.

Operation: To download or delete this data record.

The downloading function of file list could be conducted by ordinary download or FTP download. Refer to chapter ‘data downloading’ in ‘basic operation’.

There are three ways to go for data deleting action.

Simple delete: only for deleting single file, directly clicking 【Delete】 button on the recording form.

Selective delete: when delete more than one file, select by ticking them on the row head then click 【Delete selected】. All items could be selected by tick the header tick box.

Format: deleting all data file.

FTP push

FTP push function could send the data file recorded between 00:00 and fixed time point to the server. Detailed configuration displayed below:

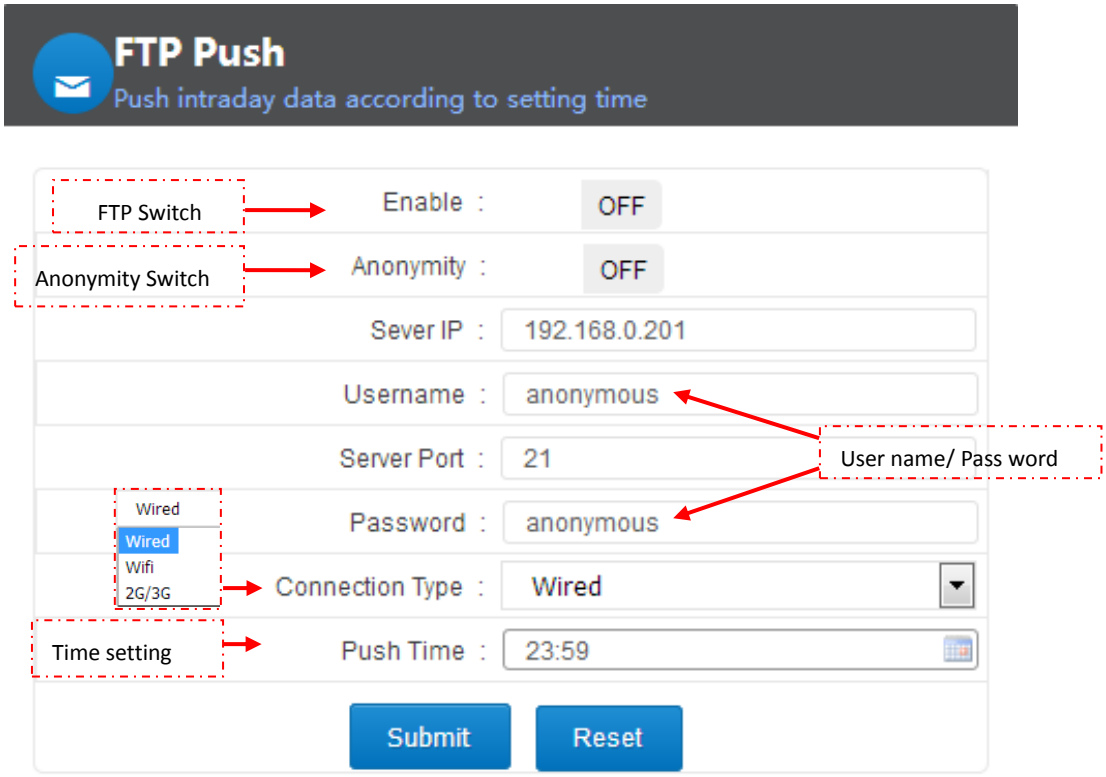


Figure 3-22 FTP push

【Reset】button would reset the setting as factory default, click【Submit】to apply the setting.

3.8 Advanced setting

The Advanced page provides advanced commands and operations for the device, including host settings, motherboard settings, network settings, and log management viewing.

Advanced pages are only open to administrators and others are not allowed to view.

System Settings

System settings is composed of system settings, data download password and system control.

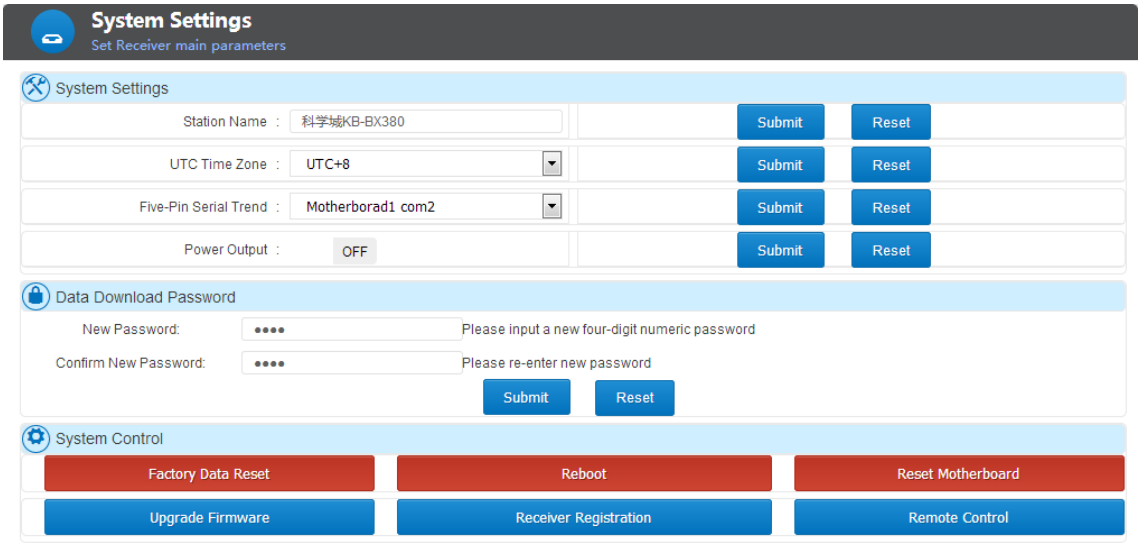


Figure 3-23 system settings

1. System settings

a. Station name settings: set the station name, the default value is "Station A". To change it, just directly input the name and then click 【submit】 button.

b. UTC time zone: from there are 25 zones in total from UTC -12 to UTC + 12, the default value is UTC +8; to change it, select the right one and click 【submit】.

c. Five-pin serial Trend: this five-pin serial port has been directly connected with motherboard. That makes it possible to obtain data from motherboard but limited from sending command or message to motherboard. To change it, select the port and click 【submit】.

Note: COM1 is used for data output e.g. GGA, GSV, etc whereas correction message/ time tag are output via COM2. As for COM3, raw data/ second correction message output through it.

d. Power output: This function could supply power with 12VDC，5W devices.

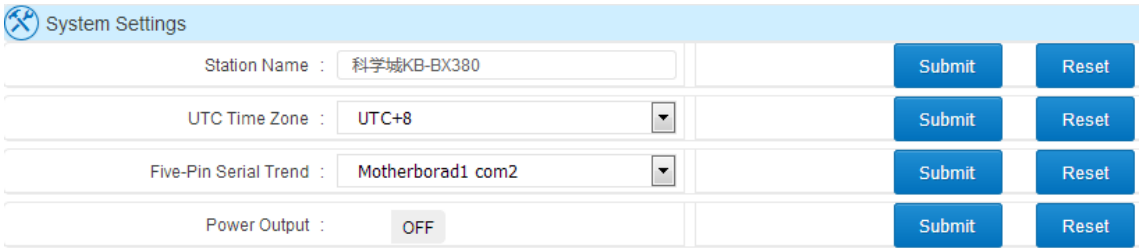


Figure 3-24 System settings

2. Data download password

The password is designed for security of local data downloading. Applying for data file downloading within the use of LED button. This string is composed of four digits with default setting 1234; to change it, enter the new password and click 【submit】. Clicking 【Reset】 and 【submit】, the password would be reset back to 1234.

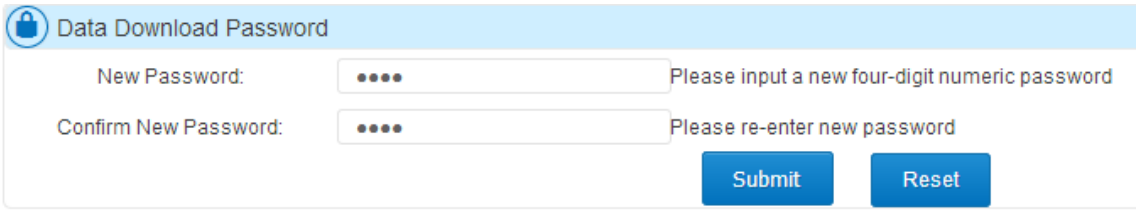


Figure 3-25 Data download password

3. System control

Users can remotely control the receiver via this web page. Mainly include: restore factory settings, restart, and reset the motherboard, upgrading firmware, receiver registration and remote control.

Restore factory settings: Click 【Restore Factory Settings】, the dialog box will pop up, click 【OK】; The receiver will return to the factory default value and restart automatically. After the restart to delete all the data and settings, see Annex [restore factory settings];

b. Reboot: Receiver restart, click【restart】, pop-up dialog box to select [OK]. The receiver will restart within 10 seconds and restart for approximately 1 minute.

c. Reset the motherboard: GNSS board will restore to the factory settings, click [reset motherboard], and pop-up dialog box to select [OK]. After reset, the data record re-creates the log file.

d. Upgrade the firmware: Upgrade the receiver firmware, pay attention to its file name "Vnet8_Update.bin", cannot be modified. Click 【Upgrade Firmware】 to expand the following interface, click [Browse] to select the file and click【Upload】. For details, see【Basic Operation】→【Firmware Upgrade】.

Figure 3-26 Upgrading the firmware

e. Receiver registration: Input the code and submit. Receiver Registration Detail Operation See 【Basic Operation】 Chapter 【Registration Receiver】.

f. Remote control: Click [Remote control] and the interface display shown as below.

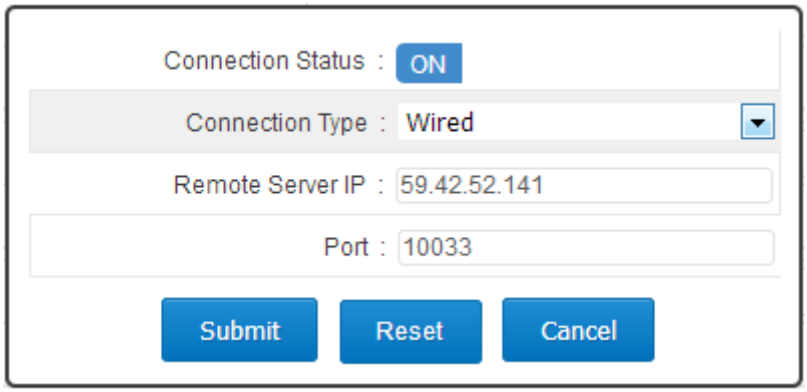


Figure 3-27 Remote control

Event settings

This sector will introduce Event marker setting and PPS setting.

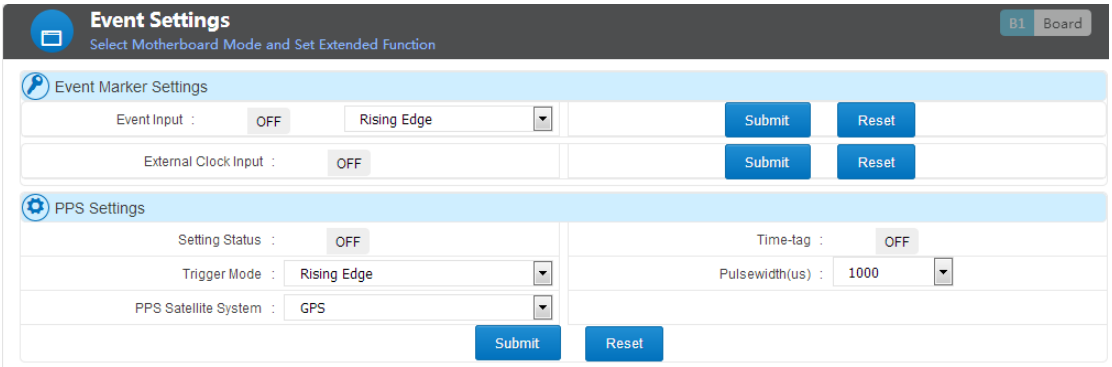


Figure 3-28. Event settings

- External Clock input: to input the external clock, please make sure you have get device connected then switch on and click 【Submit】. Contrarily, the switch should to be off before disconnecting the hardware.

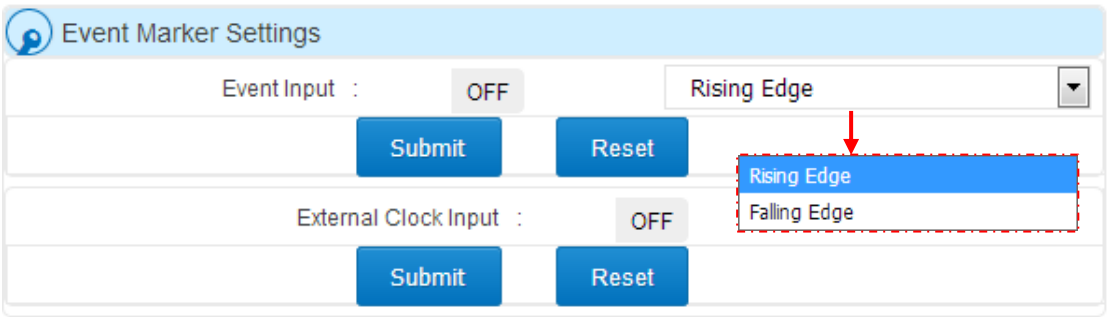


Figure 3-30 Event Marker Setting

PPS setting: the output frequency is per second. This tab is capable of setting PPS switch on/off, trigger mode (Rising Edge or Falling Edge), PPS Satellite System (GPS, BDS, GLONASS), Time-tag, Pulse width.

When turning on the time-tag, this data will be output as correction message. If you prefer get that info from five-pin serial port, the 【Five-pin serial trend】 should be set as COM2. Pulse width is optional among 1000us, 5000us and 10000us. Users can also customize the value with the range of 1000 to 500000us.

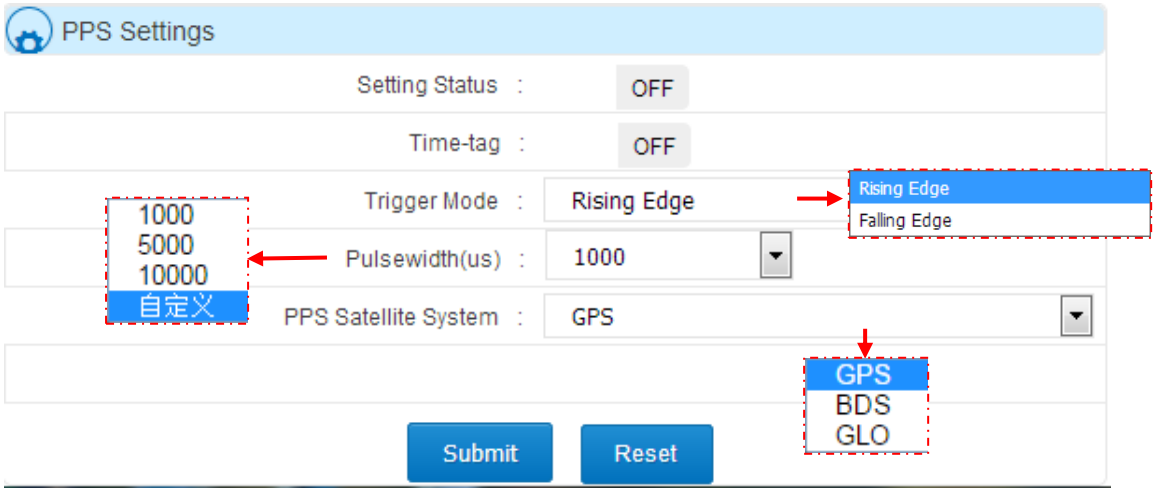


Figure 3-31 PPS setting

Network Status and Setting

Network setting consists of Wired setting, WiFi Hotspot setting, 2G/3G setting, server port setting and Firewall switch.

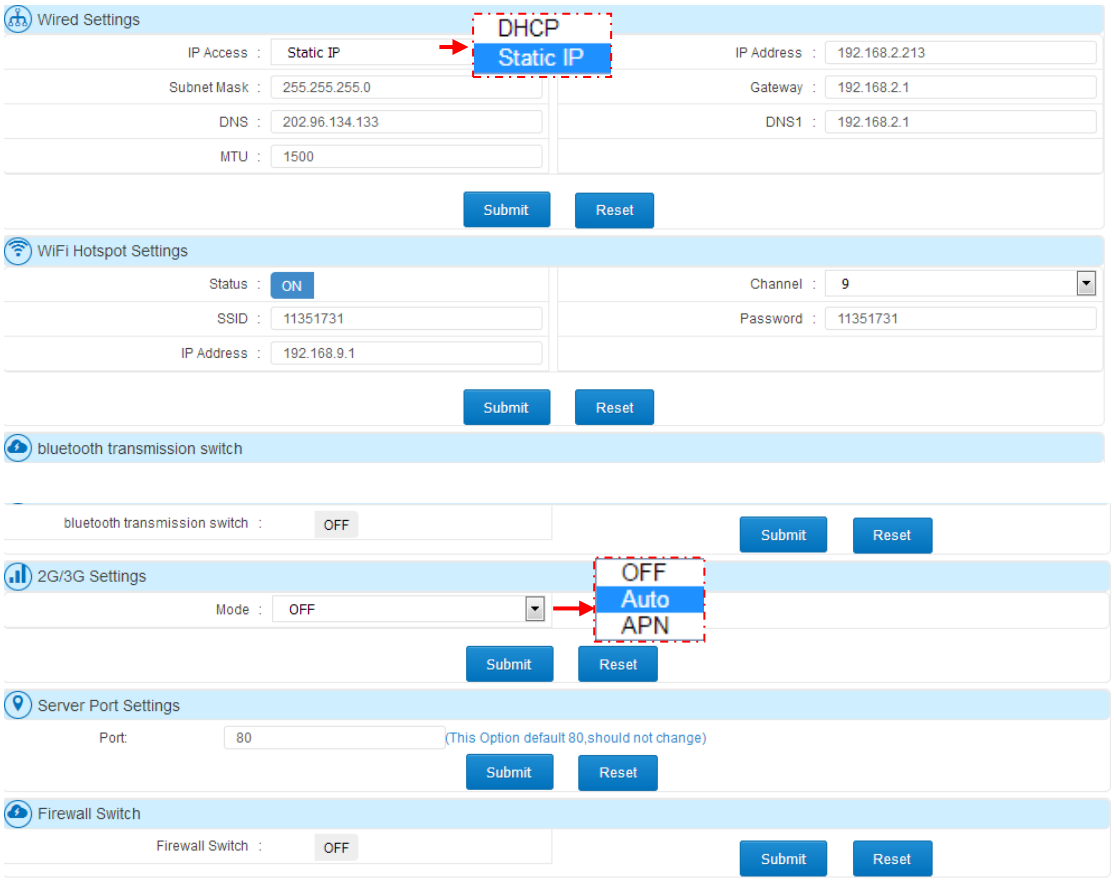


Figure 3-32 Network Status and Setting

Wired setting: There are two ways to obtain IP address via wired connection, DHCP (automatic detecting) and static IP (set manually). The machine will automatically set all parameters under DHCP mode while all parameters have to be set manually in Static IP. Such as IP address, subnet mask, Gateway, DNS, etc. The configuration page is shown as figure 3-33.

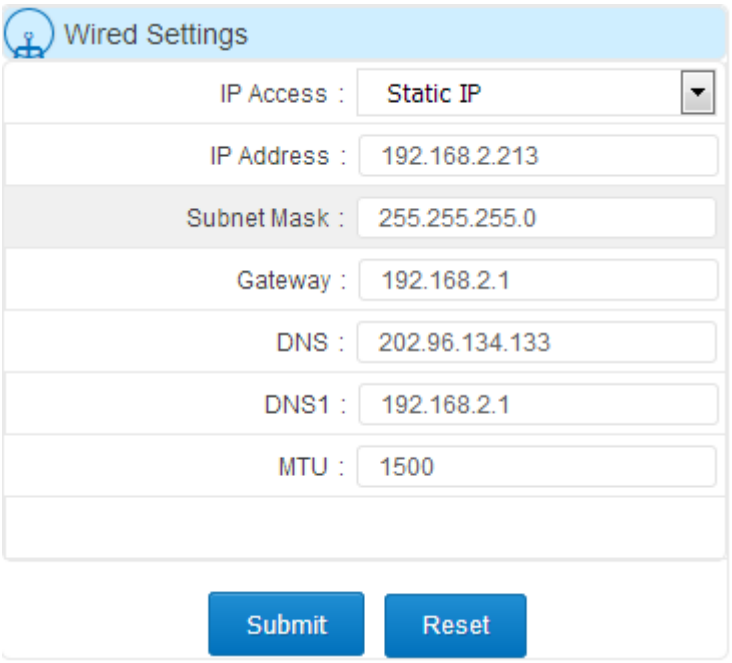


Figure 3-33 Wired settings

Wi-Fi Hotspot Setting: several parameters could be configured in this tab including channel, password, IP address of receiver. The default setting for SSID and Password are SN and '192.168.9.1'. Users are able to visit Web administration page after connecting Wi-Fi.

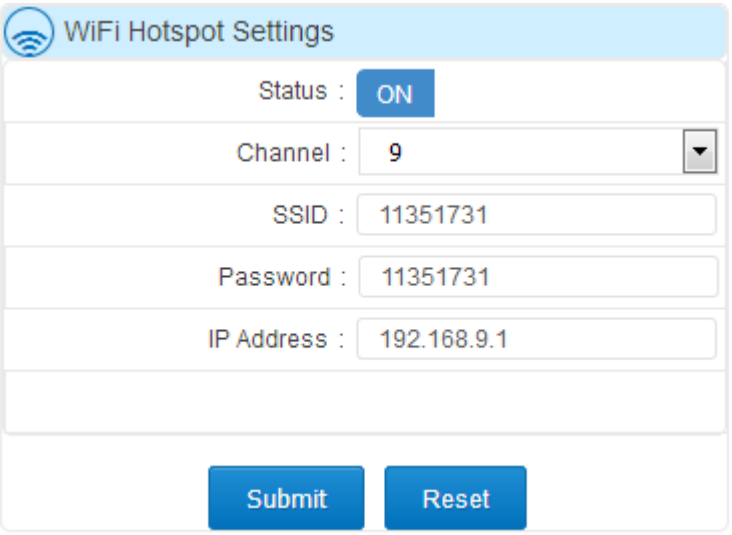


Figure 3-34 Wi-Fi Hotspot Setting

2G/3G setting: this tab is about switch on/off 2G/3G function and settings (APN or Auto mode). Access point, Username and Password must be input

manually in APN mode whereas everything could be set automatically under Auto mode.

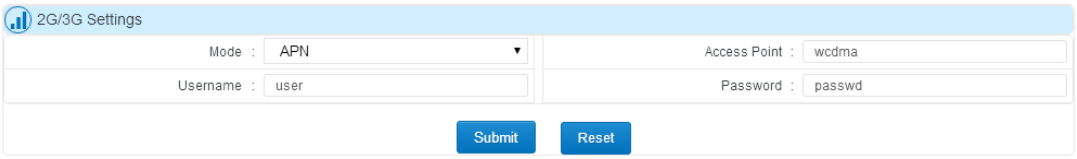


Figure 3-35 2G/3G Setting

Log Files

System log files records all user operation logging file during the running period and they list following time sequence. The content mainly contains users logging in, page switching, setting changing, data file downloading, transmitting, deleting. As well as the network setting, restart and FW upgrading, etc.

On the log files page, setting time zone above the table to inspect all the log files generated during this time zone.【Delete】button is used to delete all the files shown on the form.

Fields on the list:

1. Time: the time point of record under 24-hour system.
2. User: the logged user of corresponding operation.
3. IP: the IP address of recorded user.
4. Event: recorded event.

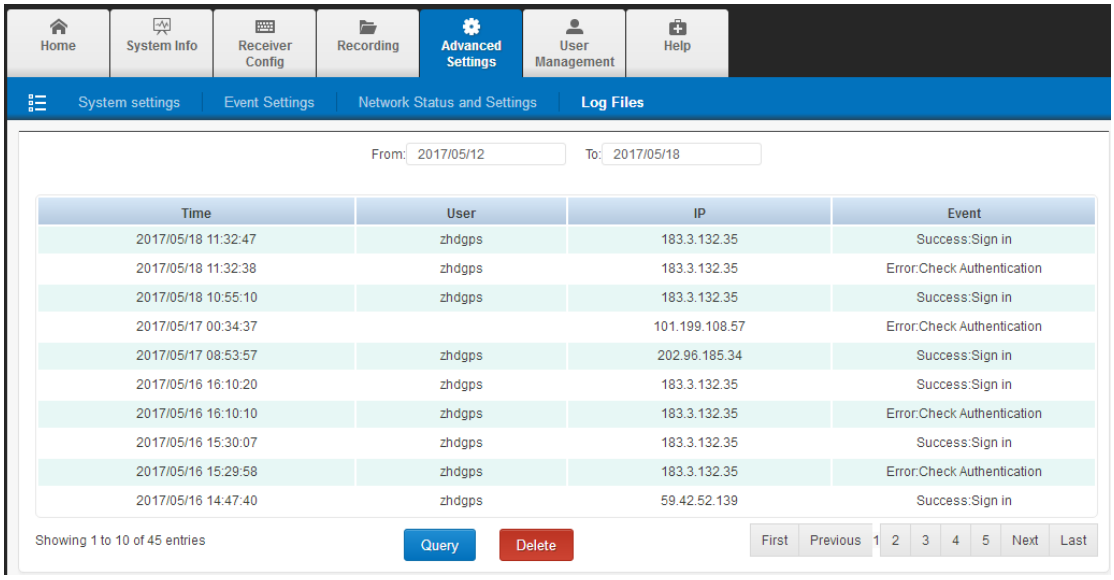


Figure 3-36 Log files

3.9 User management

This page is composed of Users and Admin.

Users

Changing current user's password.

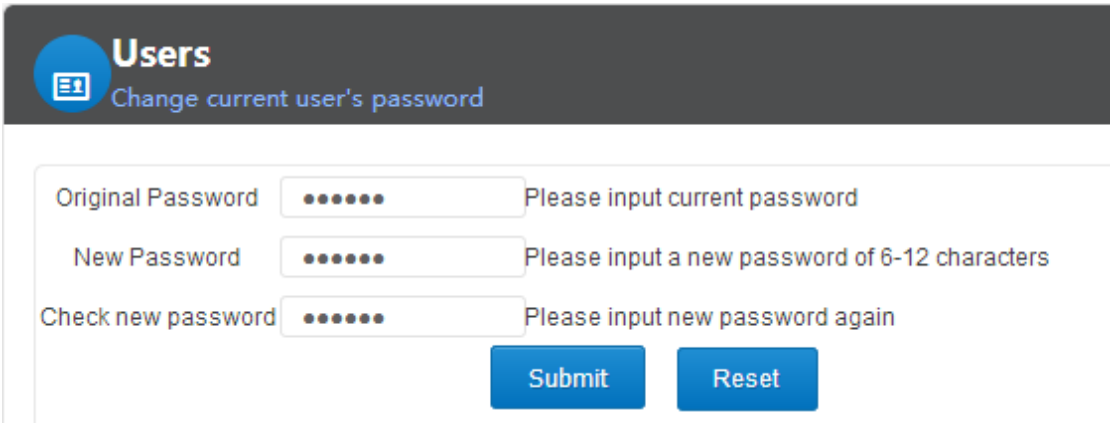


Figure 3-37 Users

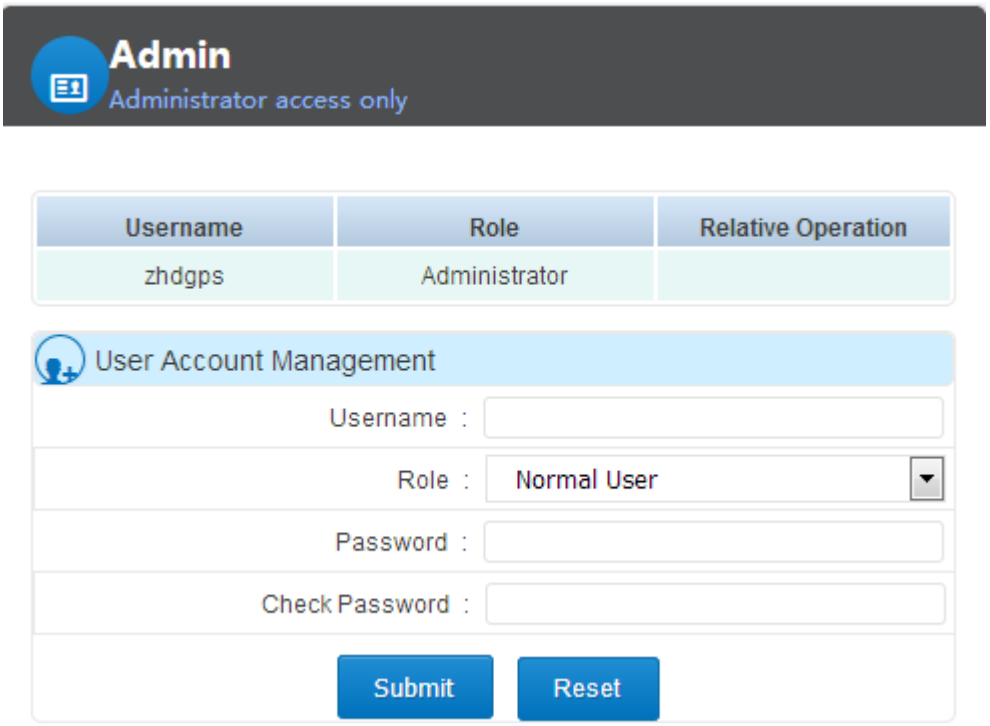
Admin

This tab is authorized to administrator (zhdgps) only and being allowed to

add/delete normal users only. Refer to chapter【User log in】 for more details.

Adding new user: define user name and password on the User Account Management tab (user name muse be composed of numbers, letters and underline, starts with letters with the length of 5~16 digits. The password must be 6~12 digits long). Clicking【Submit】 to finish the creating.

Deleting user: Deleting account by clicking 【Delete】button.



Chapter 4 Basic operations

4.1 Architecture model

GNSS receiver products can be used for ground enhancement systems and CORS and other fields. Receiver can connect to weather sensor and other sensors, and connect to central service area through the network cable or 3G / 2G network. Its architecture is generally shown in Figure 4-1:

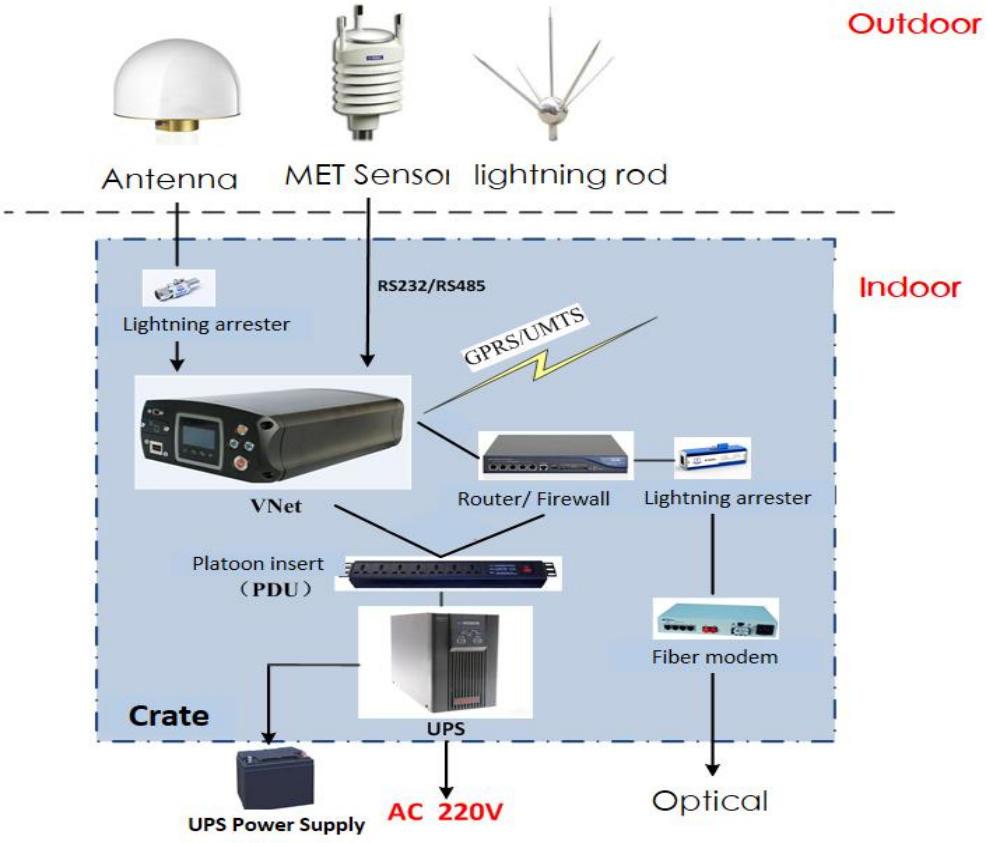


Figure 4-1. Architecture model

4.2 Basic composition and connection

The kit includes: GNSS receiver, VNet data cable (VS-3P), 3G / 2G antenna, GNSS antenna cable, power adapter (CL-1233), cable. The connection is shown in Figure 4-2

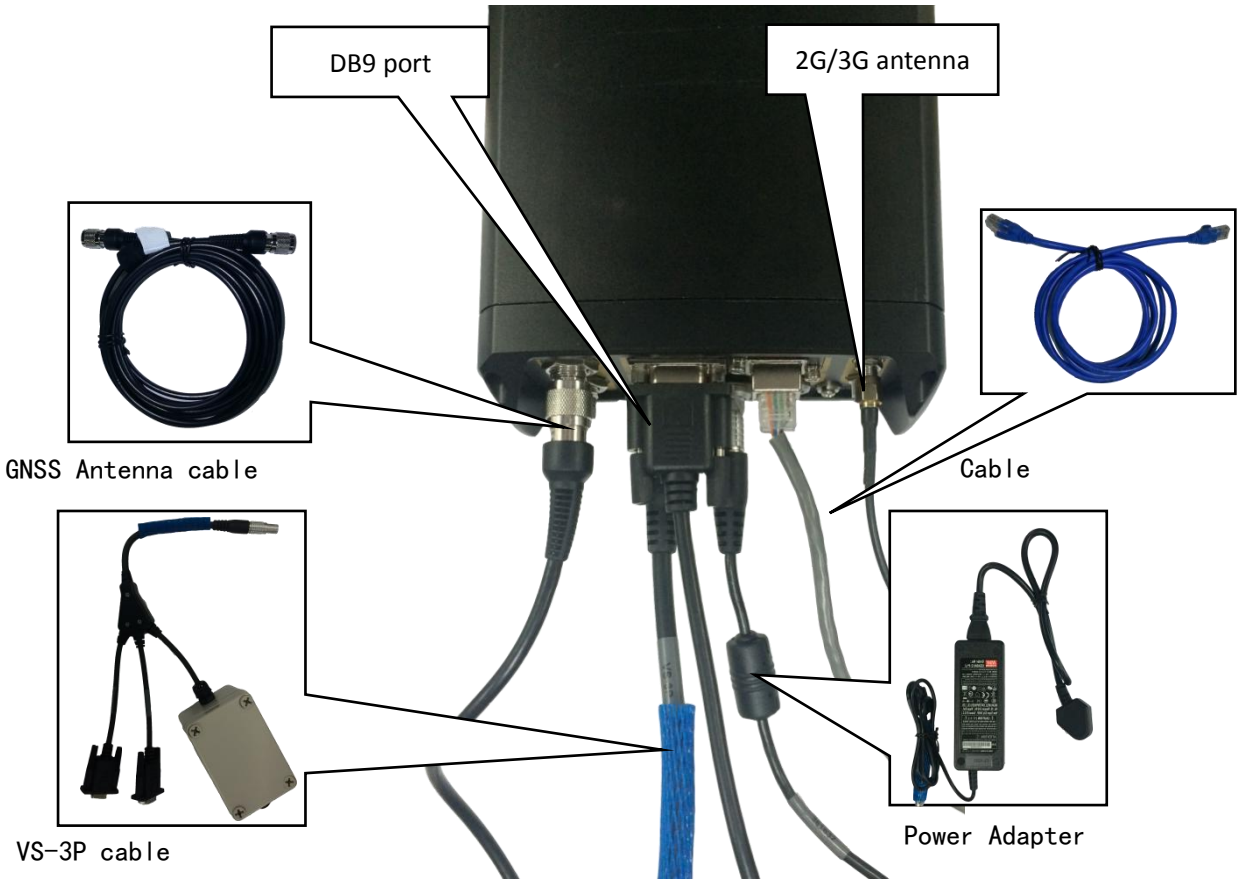


Figure 4-2 Receiver connection

4.3 Connector installation

The GNSS receiver have three self-locking socket, respectively, five-pin socket, external expansion socket, power input socket; shown as below, ensure the red dot on cable connector is aligned with the red dot on receiver socket, or cause damage to the receiver and cable connector; Figure 4-3:

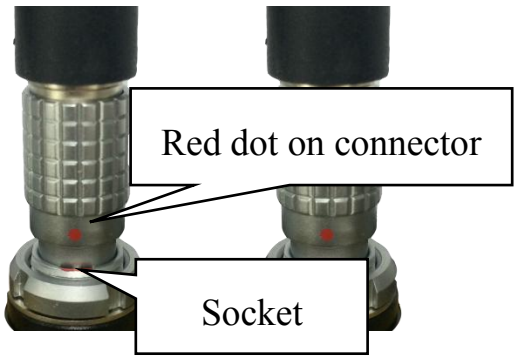


Figure 4-3 Connector installation

Install, take SIM / TF card

1. Under the front panel is SIM / TF card installation slot, clockwise tighten the screws, counterclockwise to loosen the screws.

2. Install SIM / TF card: SIM card chip is in the up layer, TF card chip is in the second layer, oblique angle inward directly into; when you hear a sound, installation finished.

3. take SIM / TF card: push the card, then the card pops up;

Figure 4-4 Installation / taking SIM / TF card

4.4 Network connection

1.LAN network connection

You can use the cable to connect the GNSS receiver with the LAN, input GNSS receiver wired network IP address (default: 192.168.0.200) in the browser, then enter the VNet series Web management system login interface.

Notice: GNSS receiver default wired local IP is 192.168.0.200. If the local area network segment is 192.168.0. ×, and the LAN does not use 192.168.0.200IP, the GNSS receiver can be directly connected to the LAN, LAN access through the IP 192.168.0.200 login; if the local network segment is not 192.168.0. ×, such as LAN network segment 192.168.1. × or other (that is, GNSS receiver IP different from network segment), you must add the network which segment is 192.168.0.x.

At present, often use optical fiber or ADSL to connect the network. Optical fiber is usually with a fixed IP, and ADSL is usually a dynamic IP. Please refer to the local telecommunications department for specific charges for optical fiber or ADSL Internet access.

GNSS receiver and INTERNET can be directly accessed, you can also map through the LAN external network IP to access.

Directly access method is relatively simple, in the local connection under the Internet protocol, click 【Advanced】, in the pop-up interface, input the IP address and gateway into WAN IP and gateway, as shown in Figure 4-5 below.

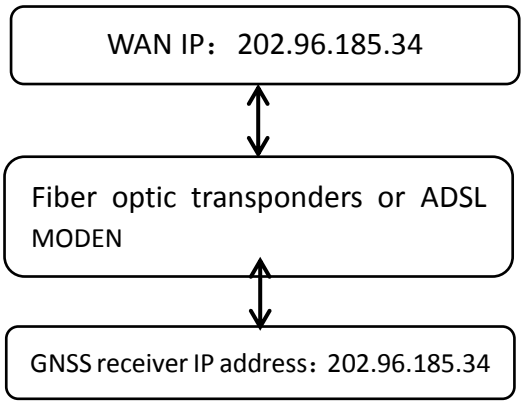


Figure 4-5 Line connection method

The GNSS receiver base station connects to the network by mapping the external network IP. As shown in Figure 4-6:

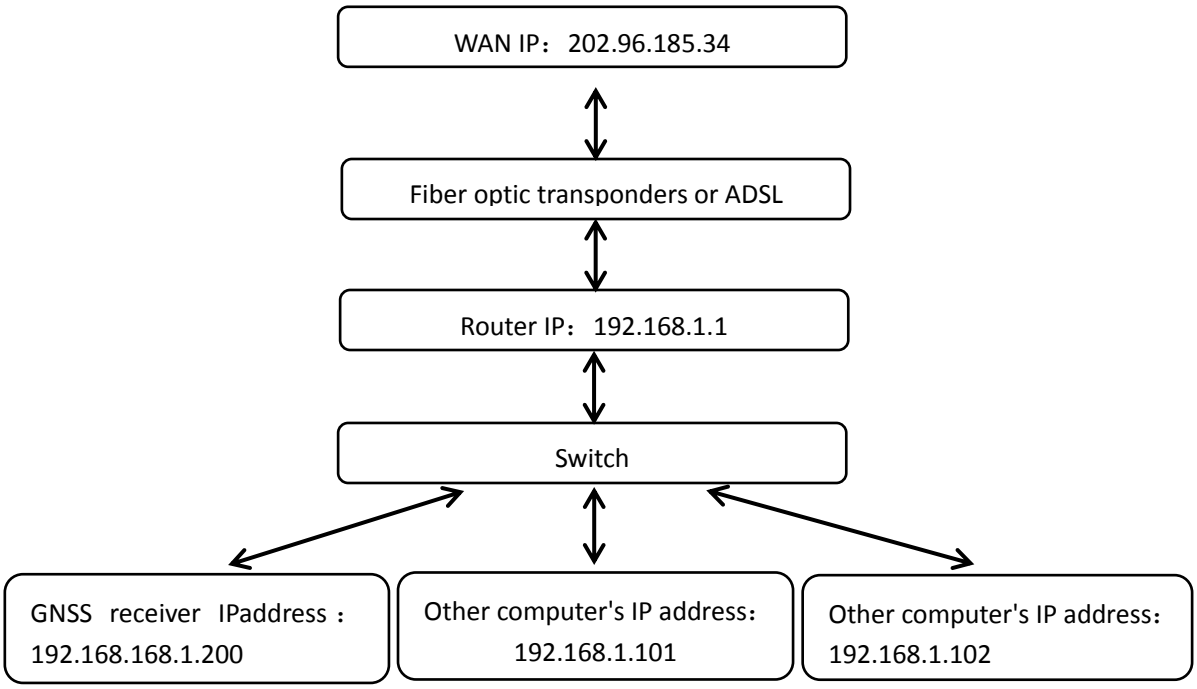


Figure 4-6 Mapping to the external network connection

1.Change the IP of the GNSS receiver

There are two ways to change the IP address of a GNSS receiver: Manual settings and match automatically acquire settings;

A. Manual settings

Firstly, obtain GNSS receiver's local IP, such as the default value is 192.168.0.200 (if you do not know the receiver's IP, double-click the "power button" to open the LCD, then see the receiver IP address). Use a network cable to connect PC and GNSS receiver, set PC IP and GNSS receiver IP in the same network segment, but different IP; such as 192.168.0.148, then the PC login and access the GNSS receiver WEB management system using IP 192.168 .0.200, at the 【Advanced Settings】- 【Network Settings】 -【Cable Settings】, set the GNSS receiver's IP address, subnet mask, gateway, DNS (DNS no need to set), and Click【submit】; as shown in Figure 4-7:

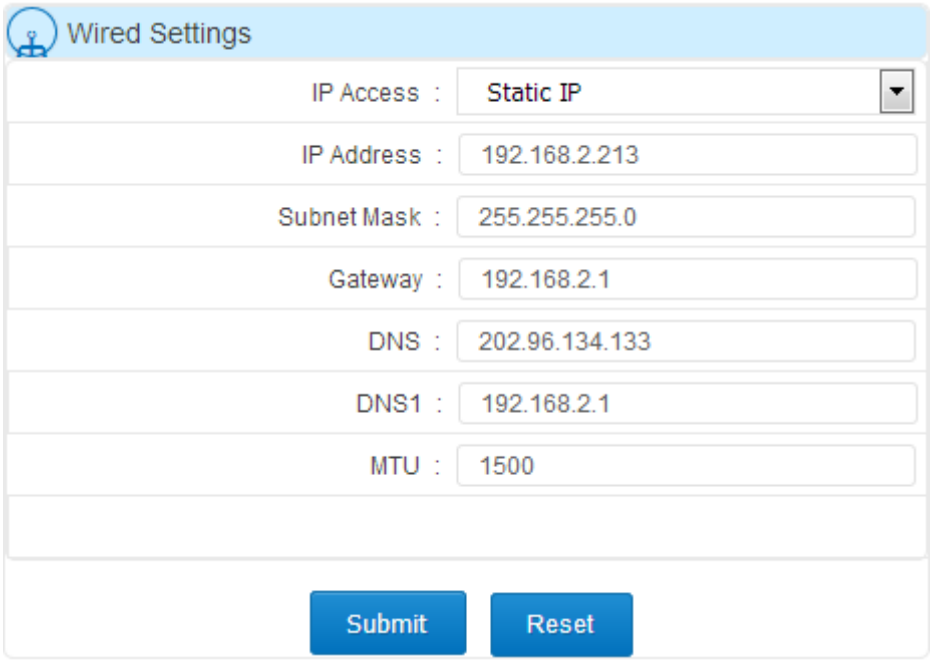


Figure 4-7 Set the IP address settings manually

B. Match automatically acquire settings

Double-click the "power button" to open the LCD, click the "Fn button" to enter the menu options, click "right" select【network settings】, click the "power button" to enter and select【wired network】, click the "power button" to set the Receiver wired network mode changed as【DHCP】The system will automatically obtain the IP and wired network-related parameters; then press the "Fn button" to return to the status display main interface, check the IP, and record it; Then the PC can access the GNSS receiver web management system through the automatically obtained IP address. Go to【Advanced Settings】-【Network Settings】- 【Cable Settings,【IP Acquisition Mode】select【Static IP】, and set the receiver IP address, subnet mask, gateway, DNS (DNS no need to set), and click【submit】; Figure 4-8:

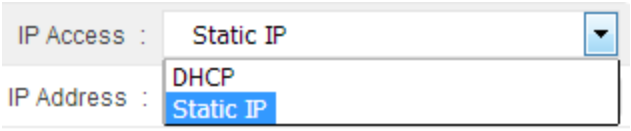


Figure 4-8 Automatically obtain the IP address settings

2. Mapping the external network IP

Open the page and enter the address: http: //192.168.1.1 (default IP address) pop up following dialog box (if you can't enter the login interface, please consult network administrator).

Enter the user name and password, the general TP-LINK initial default user name: admin, password: admin.

Set the local LAN LAN port, and set the IP address as the GNSS receiver IP address.

Wi-Fi network

Wi-Fi network can be operated by LCD with button operation and WEB management system, WEB management system also can set the Wi-Fi network password, channel and login IP address;

A. LCD display and key operation: double-click the "power button" to open the LCD display, click the "Fn button" to enter the menu options, click the "right button" to select【network settings】, click the "power button" to enter and select【WIFI】, Click the "power button" to control the Wi-Fi network switch; as shown in Figure 4-9:

Figure 4-9 LCD button operation Wi-Fi network on / off

B.WEB management system: log in WEB management system, set the【Advanced Settings】-【Network Settings】-【Wifi hot set】; shown in Figure 4-10:

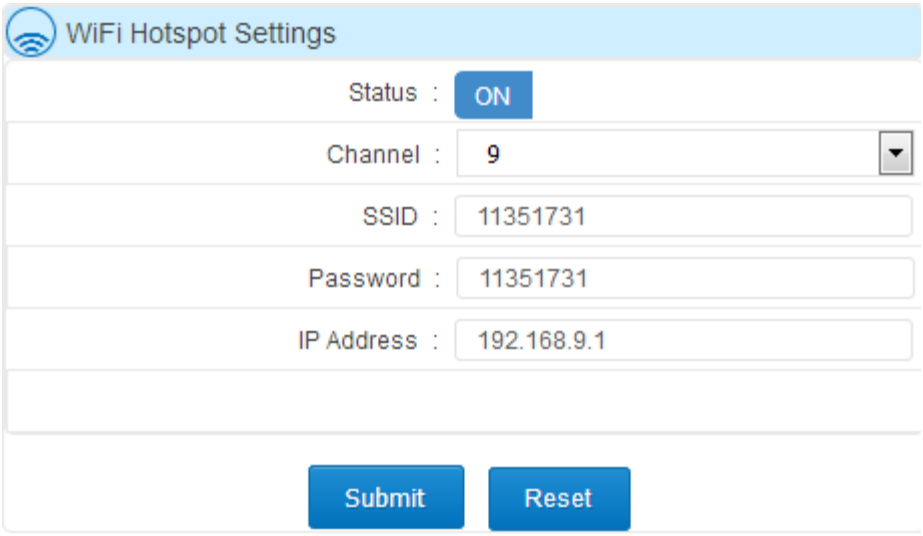


Figure 4-10 Web management system Wi-Fi settings

After opening VNet's Wi-Fi hotspot, users can use mobile device to search the Wi-Fi account then enter the password (default: SN number). And then enter the IP address of the GNSS receiver (default: 192.168.9.1) The mobile terminal interface after logging in is shown in Figure 4-11 (Account and password same with the PC side)

Figure 4-11 Mobile device home page interface

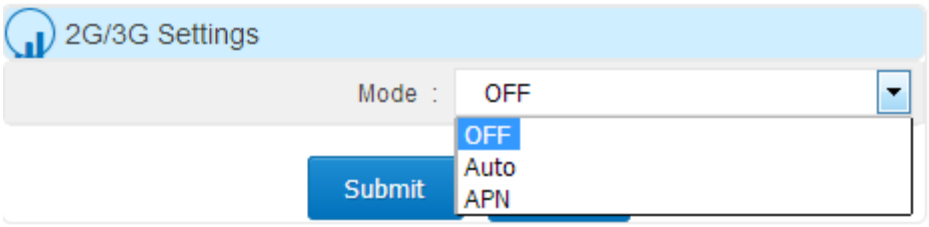
2G / 3G network

FTP push, remote control and network transmission using 2G / 3G network, you need to connect the 3G antenna, install the SIM card, under the【Advanced Settings】-【Network Settings】, open 2G / 3G network.

If using Non-APN (green line) phone card, select【2G / 3G settings】-【Auto】and submit, the system will automatically dial and connect;

APN line card, the users need to obtain the access point, user name and password from the network operator, and select 【APN】 mode to fill in the access point, user name and password (as shown below), click 【submit】, system Will automatically load the data and connect the data; shown in Figure 4-12:

Figure 4-12 2G / 3G network settings



4.5 LCD and button operation

Table 4-1 LCD and button operation

Function	Operation	Content
Turn on / off the LCD	Double-click the power button	Display the home page of the status information
Switch status information	Click the left/right button	View the status information of the receiver
Switch status and settings	Click the Fn button	Status and setting interface loop switch

display		
Return to the upper menu / Cancel	Click the Fn button	
Switch the menu	Click the left/right button	Menu page: Data record, network setting, data download, system setting; System Settings menu page: Firmware upgrade, restore the default IP, reset, restoring the motherboard, the language selection; operating cycle through the menu;
Go to the menu subordinate	Click the power button	The main menu: Data record, network setting, data download, system setting System Setup menu: Upgrade firmware, restore default IP, restore factory settings, restore motherboard, language selection;
Data record	Click the left/right button	Move options
	Click the power button	Modify the record mode or confirm the settings
Network settings	Click the left/right button	Move options
	Click the power button	Modify the parameter value
Data download	Click the power button	Set, move to the next step and confirm the settings
	Click the left/right button	Password: left button plus 1, right minus 1; number of days: switch the number of days options;
U disk upgrade	Click the power button	Upgrade firmware, firmware to be placed in the root directory of U disk;

language selection	Click the power button Click the left/right button	
Restore the default IP; Reset; Reset the motherboard	Click the power button	Reset: Click the "Power button" to enter the confirmation reset prompt page, click the "power button"; Reset the motherboard and restore the default IP the same.

Notice:

1, if 60s without operation, the system automatically shut down the LCD and open the indicator light;

2, button set data record is temporary record, the record setting will be deleted after restart; but the data will not lost.

3, when the text or icon is surrounded by a box, which means that the current was selected, you can modify or enter the subordinate settings;

4, If the interface does not have confirm option, that means Immediately take effect after modification, such as network settings.

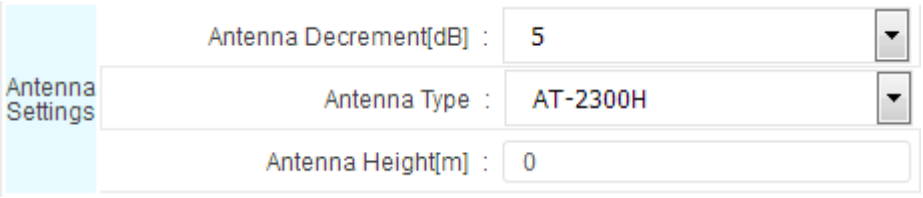
4.6 Set the base station

Login WEB management interface, just click the Reference station settings link or Click 【work mode】-【Settings】to set;

1. Antenna settings

According to the actual parameters of the antenna information, set the antenna attenuation, antenna type, and antenna height (refer to 【WEB management system introduced】-【work mode】-【reference station settings】); Figure 4-13:

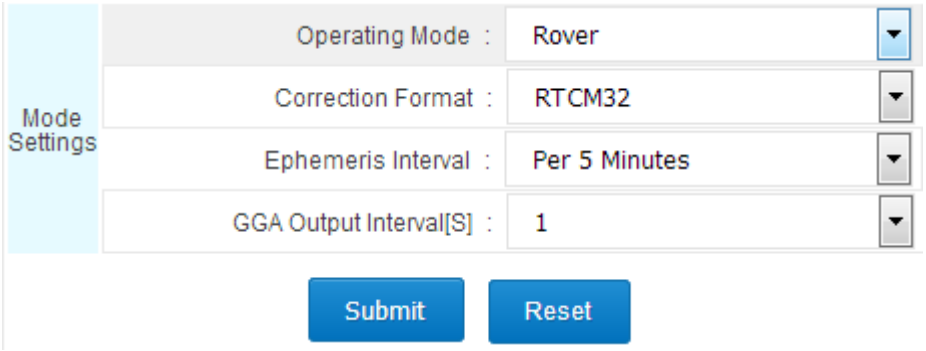
Figure 4-13 Antenna settings



2. Base settings

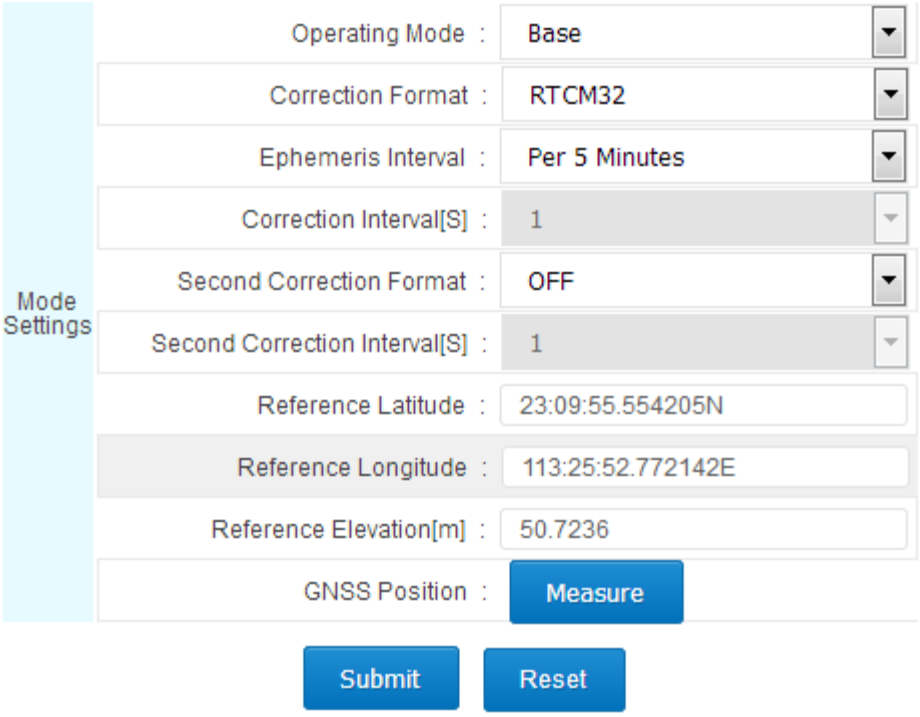
Set the work mode of the reference station as【rover】 and submit it; as shown in Figure 4-14:

Figure 4-14 Rover Settings



Set the work mode of the reference station as 【Base Station】, choose 【Correction Format】according to actual needs (OFF, CMR, RTCM, RTCMV3, RTCM32, BINEX for selection), ephemeris interval is recommended to select 【every 30 minutes】 (Every 1 minute, every 5 minutes, every 15 minutes, every 30 minutes for selection), manually enter the known latitude and longitude and elevation, and click 【submit】; Figure 4-15:

Figure 4-15 Base settings



4.7 Add data record

Log in WEB management system interface, click on the data record quick link or click 【work mode】 - 【data record】to set;

Click the button in the upper left corner of the interface to pop up【Data Logging

Settings】dialog box, enable the status dial to 【ON】, set the file 【Identification name】 (the first four digits and the last four of the file is serial numbers added by the system) 【Data type】 Select【raw data】 or 【Rinex】 according to actual needs,【record interval [S]】is recommended 1.【record】are daily, manual and planned ways, just click【submit】. Record ways are shown below:

Record every day (24 hours record without break up, or record a file every hour, or record a file every two hours), as shown in Figure 4-16:

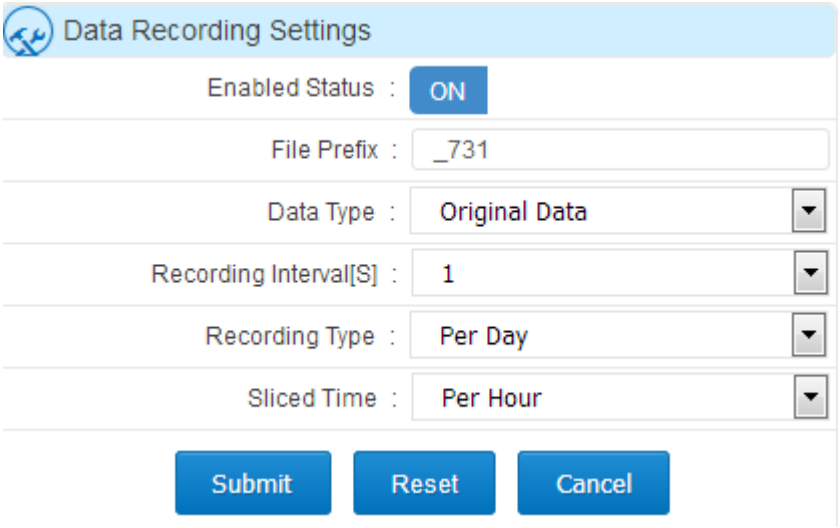


Figure 4-16 Daily Data Logging Settings

Manual recording (manual control data records to enable or disable), shown in Figure 4-17:

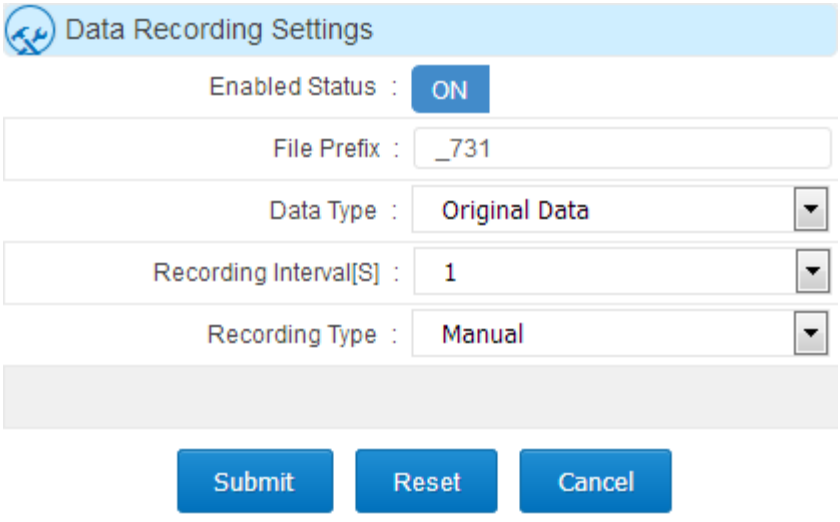


Figure 4-17 Manual data logging settings

Disposable plan records (according to the needs to set the time start and end), shown in Figure 4-18:

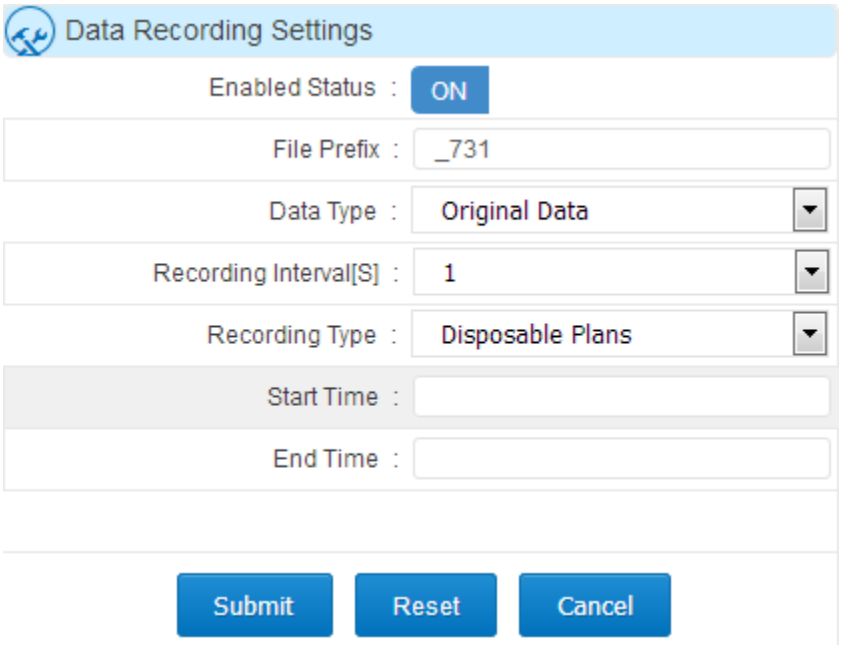


Figure 4-18 Disposable plan data logging settings

4.8 Add network transmission

Log in WEB management system interface, click the network transmission quick link or click 【work mode】 - 【network transmission】to set;

Click the button in the upper left corner of the interface, the 【Network Transfer Settings】dialog box will pop up, put the state dial to 【ON】, 【Encryption state】 sets According to the actual need , 【Network】 Recommended 【Wired】(wired、Wi- Fi、2G / 3G), 【transmission protocol】sets according to the actual need（to understand the transmission protocol, please go to the 【work mode】 - 【network transmission】of the【WEB management system introduction】）, 【data type】

sets According to the actual needs (choose from raw data, NMEA-0183, correction data, RS232 serial data, RS485 serial port data) 【Transmission interval [S]】 only the raw data have This option, recommend to use 1 (0.05,0.1,0.2,0.5,1,2,5,10,15,30,60 transmission interval [S] for the user to choose), the server IP , Port, user name and other settings are related to transmission protocol, see the specific【work mode】 -【network transmission】 of the【WEB management system introduced】; set as shown in Figure 4-19:

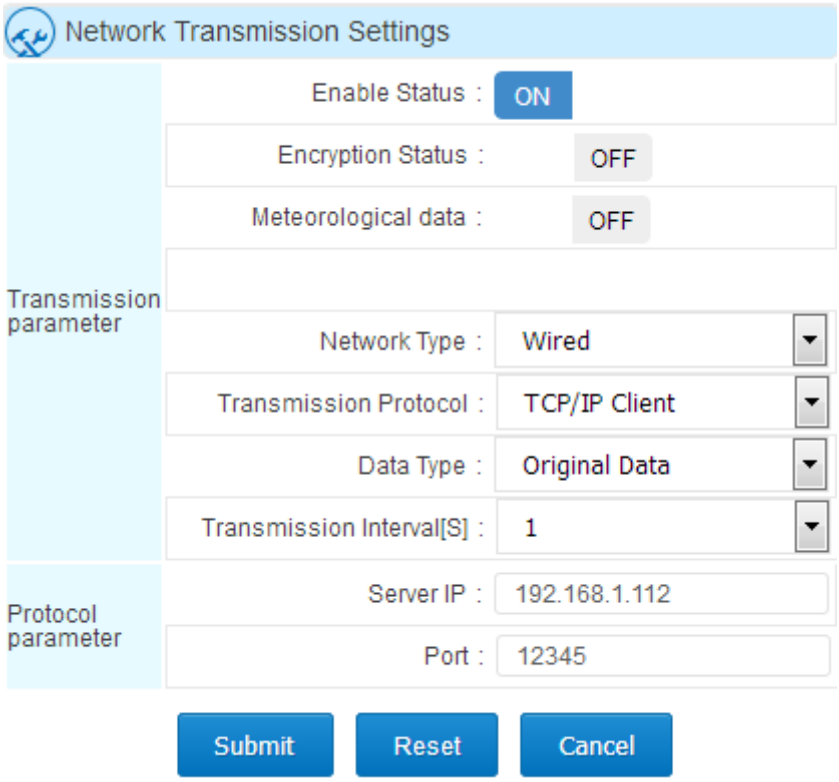


Figure 4-19 Add network transmission

Notice:

1. Three kinds of network modes can exist at the same time, but the IP

address transmitted to the server can not be the same.

2.when opening the second correction output, the 【original data】turn into the second correction.

4.9 Data download

Normal download

In the WEB management system 【File Management】 - 【File List】, select the location of the data storage and the date of the record; pop up intraday data list, click the right side of data list 【operation】-【download】 then download the corresponding data; as shown in Figure 4-20:

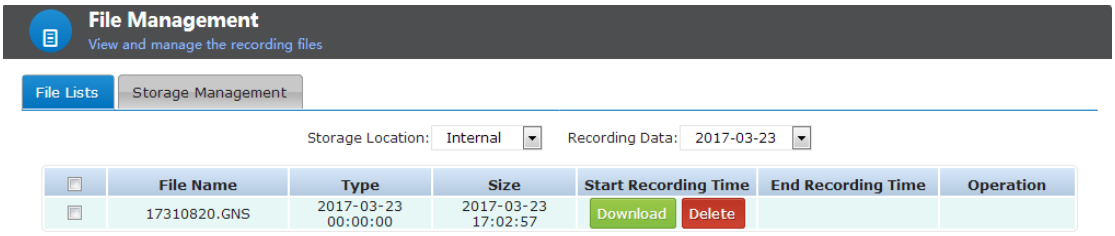


Figure 4-20 Normal data download

FTP download

Before FTP download data, make sure the routing and LAN has opened the FTP port; In the WEB management system 【file management】- 【file list】,click 【FTP download】button, automatically go to the FTP download list; the home page download list shown in Figure 4-21:

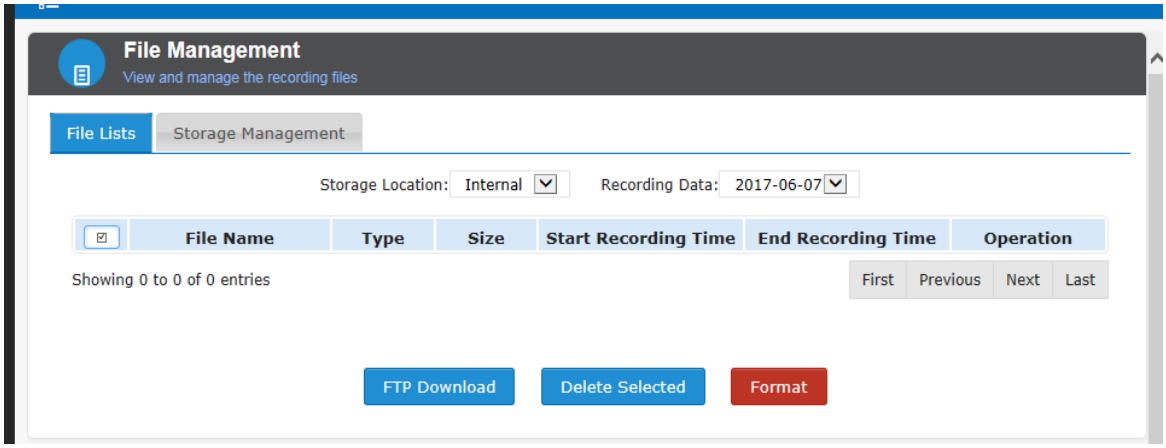
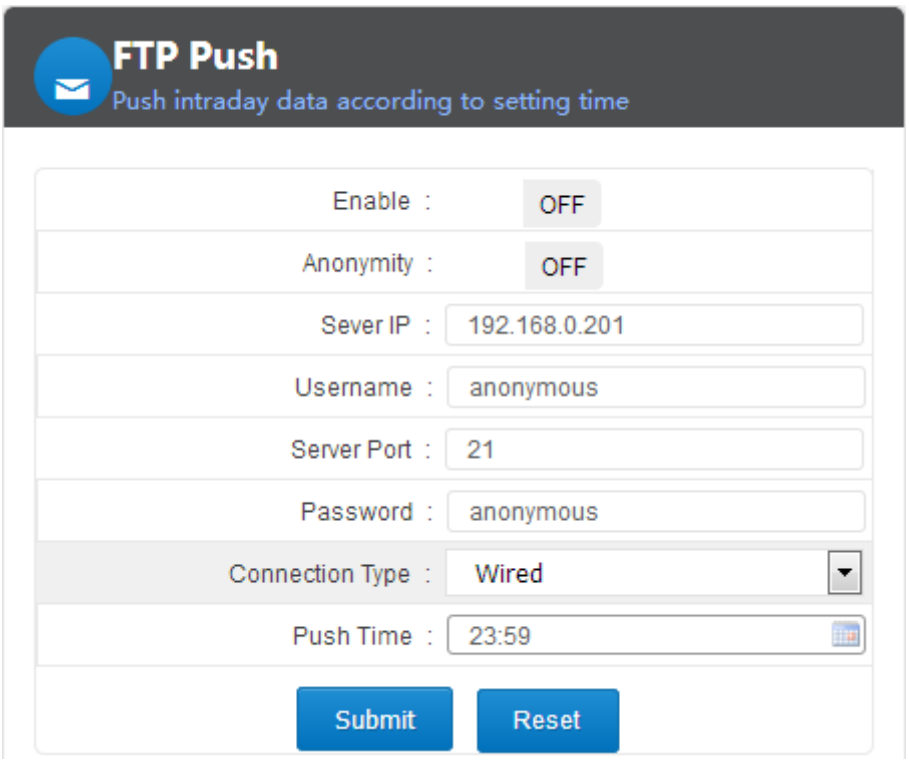


Figure 4-21 FTP download directory

Click the catalog folder of the storage (select it according to the actual requirements), enter the date list, and then click the corresponding date

FTP push

FTP push can periodically push the data file to the server. Set the parameters as



shown in Figure 4-22:

Figure 4-22 FTP push

First, enable the FTP push function, set anonymous or non-anonymous user, server IP and port (data be pushed to FTP server IP and port), push mode (select cable, Wi-Fi or 3G) and push time, as shown above.

Push time interface for quick selection of time and customization. When the first click, pop-up time check box; you can click hour to modify hour, pop up hour selection box, select the desired hour; modify second is the same, and finally click "OK"; finally，click【submit】. Shown in Figure 4-23:

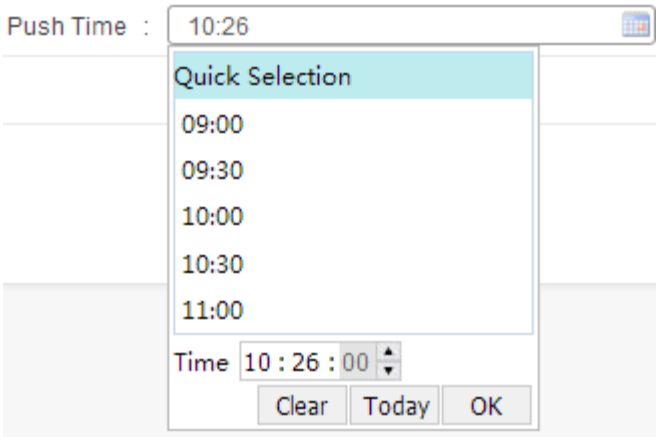


Figure 4-23 FTP push time selection

U disk download

In order to protect the security of data, a password is needed（the default password is: 1234. This password can be modified in【advanced settings】-【Data download password】）

In the LCD menu, select【Data Download】, click the "Power button" to enter the password input interface; enter the password, click the "power button", then display the box into the first underlined, then can modify the first figure of the password, click the "right button" plus 1, click the "left button" minus 1, after that, click the "power button" to modify the second password, until password input

completely, click the "power button" to enter the download interface, click the "power button", go to the download days selection, click the left / right button to change the number of days, click the "Power button" to confirm, and then click the "power button" to download (before U disk data downloading, make sure the U disk has been properly installed, or "no U disk"), After the download is done, the LCD shows "Download Complete";

Notice:

1, When downloading the Rinex file data, you need to download". 15p" and" .15o" file to a same folder, or the solution will be abnormal;

2, In FTP server local (internal memory) folder, the folder named by date is for the receiver to collect the raw data and Rinex data; log is the system log folder; mail folder is the mailbox receive the corresponding file; lost + found Folder is the system folder;

3, prohibit of use download tools to download.

4, download time is related to the size of file and your network's connection speed, please be patient. When downloading, you can close the page and browser, do not disconnect the network or reboot the device.

4.10 Firmware upgrade

Web page upgrade firmware

In the WEB management system select 【advanced settings】-【Host settings】-【System control】click 【Upgrade the firmware】Expand the dialog box as shown in Figure 4-24

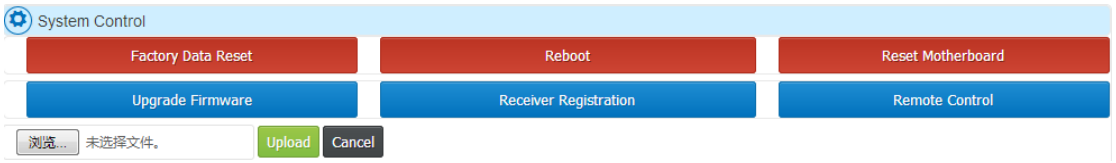


Figure 4-24 Firmware upgrade

Notice:

1.Update the firmware package was named "Vnet8 Update.bin" (without the quotation marks). Please do not modify this file name, or upgrade the firmware fails;

2.upload firmware package, please do not close the browser, or upgrade the firmware fails.

3.the time of uploading the firmware package related to your network environment, long pass under LAN is about 10 seconds.

U disk upgrade firmware

Firstly, copy the firmware package "VNet8_Update.bin" that needed to be upgraded to the U disk root directory, and then insert the U disk into the UAB-A port at the front panel of the receiver; as shown in Figure 4-25:

Figure 4-25 U disk installation diagram

In the LCD menu select【System settings】-【Upgrade the firmware】, click "Power button", Pop-up prompt box "Please confirm the insertion of U disk" after confirmation, Click the "Power button" prompt sending successfully (if U disk is not inserted identify as error, it will prompt "no U disk" and return to 【upgrade

firmware】selection interface) about 1 minute later, the receiver restart that represents the success of the upgrade.

4.11 Register the receiver

In the WEB management system select 【advanced settings】-【Host settings】-【System control】click 【Receiver registration】Expand the dialog box as shown in Figure 4-26

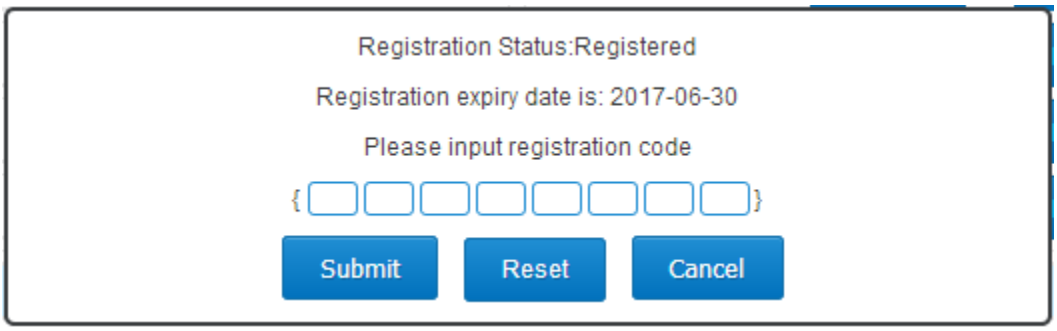


Figure 4-26 Receiver Registration

The receiver License format is 24 digits, divided into 8 groups, each group contains 3. After entering the registration code just enter the registration code (the system will ignore blanks of the registration code while entering), confirm it and click 【submit】.

Diagnosis analysis and troubleshooting of common faults

5.1 The system starts normally, while lock star light SV is off

1.Check the environment of GNSS external antenna, GNSS external antenna installation is downward, whether reference to the instructions in the overview and precaution for distribution and installation;

2.Check the registration code is expired or not, such as the validity of WEB management system and if the body number become red, means the registration code has expired, please contact related staff of HI-TARGET to apply for registration code, and log VNet series Web management system registered receiver;

3.Check the GNSS antenna cable at both ends and check the connection between GNSS receiver and GNSS antenna is tight or not, if loose please tighten, and wait for about 30 seconds;

4. Monitor whether the GNSS antenna cable is connected to the GNSS ANT port, not the WIFI ANT port.

5.2 The GNSS receiver is working properly and the terminal software has been deployed, but the network transmission status is connecting

1.Check the connected network mode, network protocol and IP address and port is correct;

2.Such as the network mode for the 3G, check the network parameters of the 3G network is open; and make sure the local network environment is right, you can use your mobile phone to check it. Make sure the SIM card is Unicom 3G / 2G or mobile 2G card, and the data traffic is normal, that is activated and no arrears.

5.3. GNSS receiver is working properly, network transmission is connected, but the raw data output frequency is incorrect

Use the network debugging assistant to receive data to check the data output frequency is correct or not, such as the output frequency is less than the seted

frequency， make sure whether to open a record of a data record, and record the frequency is greater than or equal to the network transmission of raw data frequency, and open the automatic removal function.

Establish several data records, at the beginning the recording is normal, but become not normal later

1. The late record is intermittent; make sure whether the power supply is normal, if the battery is 12V power supply, the battery voltage should not less than 10.5V; if use switching power supply , make sure the output power is greater than 15W.

2. No record later; check whether the registration is expired, if not, check whether the GNSS receiver lock satellites, if so check the space of storage capacity.

5.4 Network cable connection is normal, but can not log on and visit the VNet series (ground enhancement) Web management system;

1.Make sure whether the computer settings are set according to the network settings and wired network settings in the manual.

2. The computer can ping the GNSS receiver, but can not access; turn off the firewall and anti-virus software.

3.Make sure the IP inputted is correct. If can't just double-click the [power button] to see the current IP address.

Chapter 5 Appendix

5.1 Reset

Major items	content	The parameters after recovery
Reference station	Site name	HI-TAGET High precision GNSS receiver
	UTC Time zone	UTC+8
	Antenna attenuation [dB]	5
	Antenna model	AT-1200B
	Antenna high [m]	0
	Reference station work mode	Rover
	Ephemeris interval	Every 30min
	Correction data format	RTCMV3
	Satellite system	All open
	Height cutoff angle	10°
Receiver function	Storage device	Internal storage
	2G/3G internet	OFF
	RS232/RS485 Serial port	OFF
	Server port settings	80
	Firewall	OFF
	Time input	OFF
	External clock input	OFF
	PPS output	OFF
	FTPPush	OFF
	User	Only retain administrator privileges, and restore the default password
	Automatic cleaning time after full	1 day
	Small five-core serial port pointing	Motherboard 1COM2
	Power output	OFF
Data management	Network transmission	Delete all
	Data record	Delete all
	Internal data	Delete all
	Log management	Delete all

5.2 VNet product technical performance parameters table

Model	VNet8	
GNSS characteristic	Number of channels： 550	
	GPS：L1、L2、L5 GLONASS: L1、L2 BDS:B1、B2 GALILEO:L1BOC,E5A, E5B,E5AltBOC SBAS:L1C/A,L5	
	positioning accuracy	RTK Horizontal accuracy：±(8mm+1X10-6D) RTK Vertical accuracy：±(15mm+1X10-6D) Static Horizontal accuracy ：±(2.5mm+1X10-6D) Static vertical precision：±(5.0mm+1X10-6D)
	Initialization time	typical <10S
	Initialize reliability	＞99.9%
Port	3 RS232 port 1 USB port 1 WiFi、Bluetooth communication port 1 3G/2G Communication port 1 RS485/RS422 port 1 Ethernet interface 1 External clock interface 1 PPS Output Interface	
Internal storage	64GB	
External storage	Maximum support is not less than 1TB	
Correction data format	CMR、RTCM2.x、RTCM3.0、RTCM3.2	
Human-computer interaction	WEB Web management system	
	LCD、Indicator, button operating system	

Battery	External power supply：7VDC~36VDC（2） Built-in battery：24h Continuous work (related to configuration) Power consumption: ≤ 4W	
Environmental adaptability	Working temperature	-40℃～75℃
	storage temperature	-40℃～80℃
	Relative humidity	100%
	Protection class	IP67
	Anti-corrosion	Satisfy GJB150.11
	vibration	Satisfy GJB_1032
	Impact	Satisfy JB/T 9329 30g 3 Times / axis
	collision	Satisfy JB/T 9329 10g 1000 Times
	Drop	Satisfy GB-T2423.8 protect from 1 meter's drop

5.3 Standard configuration table

Item Name	Number
GNSS Receiver	1
Power Adapter	1
AC power cord	1
Vnet Data cable	1
Direct cable	1
Vnet Packaging cartons	1
Vnet10 Packing lining	1
Ground reinforcement system product manual	1
Aluminum lugs	3

Cross plate head machine wire [M3*6]	3
Warranty Card	1
Factory inspection certificate	1