Manual of NTP Server

High-Performance, Enhanced Security Network Time Server

Chapter 1   Basic Information of the Device

Modern networks require accurate, secure, and reliable time service. The security-hardened GlobalTime™ NTP Server is purpose- Built to deliver exact hardware-based Network Time Protocol (NTP) timestamps. The unparalleled accuracy and security is rounded out with outstanding ease-of- use features for reliable network time services ready to meet user network and business operation needs today and in the future. High Security and Capacity.

1.1. Features
• Stratum 1 operation via GPS/BeiDou/GLONASS satellites
• One/ two/ four standard GbE ports, all with patented NTP hardware timestamping
• Security-hardened NTP Reflector™ with firewall protection
• Web-based management with high-security cipher suite
• Exceptional time accuracy to UTC
• Extended environmental specifications
• IPv4 on all ports
• Rubidium atomic clock or OCXO oscillator upgrades
• Single power supply or dual power supply option
• Can be set as a slave time server to synchronize with host time server
• One 10M 100M 1000M adaptive network interface
• NTP Reflector option: 20000 NTP client mode three requests per second
• TOD/1PPS/10MHz out
• MTBF: 90000 Hours

1.2. Applications
• Synchronizes hundreds of thousands of NTP clients
• Security-hardened for peace-of-mind time service operations
• Multiple GbE NTP ports for easy network configuration and adaptation
• Best-in-class time accuracy for improved log file timestamp precision and usability
• Very reliable and easy-to-use network time appliance for modern networks and business operations

1.3. Network Protocols
RFC 1119 1305 NTP v2/v3/v4
RFC 1769 2030 SNTP v2/v3/v4
TIME
DAYTIME
SNMP v1/v2
SSH
HTTP
FTP

1.4. Mechanical/Environmental
• Size: 48cm x 30cm x 4.4cm, 5kg. 1U rack mount, including BNCs

- Power: 10W, 110-230V AC
- Operating temperature: -10℃~65℃
- Storage temperature: -40℃~85℃
- Operational humidity: 0~90%, non-condensing, IEC 60068-2-78Cb, IEC 60068-2-30Db

1.5. Packing List

1) Time Server
2) Power cord
3) GPS/BD Antenna and Cable
4) Lightning Arrester
5) GPS/BD Signal Receiver and accessories

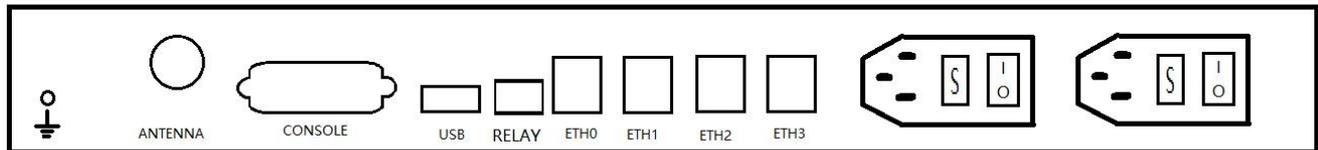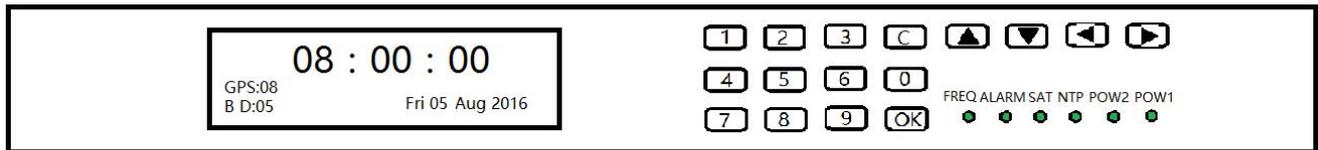## 1.6. An Overview of the Server

With the rapid development of modern society, higher demand on the time precision and frequency is put on the agenda. Nowadays with the development of modern digital communication networks and the information superhighway construction, the political,cultural, technological and social information coordination is based on a strict system of time synchronization, especially in the communications, electricity, financial securities, computer networks production line operation, administration and national defense and other fields urgently need the time synchronization equipment.

Global Positioning Satellite (GPS) signals act as the reference source of GTT-400 network time server. The time reference contained in the GPS satellite signals synchronizes with the universal time coordinated (UTC). The long-term frequency stability has achieved the10-13 level of magnitude of cesium atomic clock, which is equivalent to be only 1 second slower during 30 years. To adjust local time with this reference signal can eliminate the accumulation of deviation resulted from the low accuracy of local clock time and also can greatly improve the timing precision of the server.

GTT-400 network time server use the professional GPS timing receiver. It can receive and lock the satellite signal fast and reliably.

NTP protocol (Network Time Protocol) is a common international network timing protocol. Its principle is to launch a time polling to the server after an interval of time through the client. According to a certain filtering algorithm it can calculate the time deviation between the server and the client as well as the propagation delay caused by network transmission. Then according to these two parameters to adjust the client's local time and make it consistent with the server. Compared to other time calibration protocols, NTP protocol can eliminate the impact caused by network transmission delay, so it can provide high-precision timing services. Detailed description can be referred to the latest protocol standards documents RFC1305 and RFC2030. GTT-400 network time server can be compatible with NTP v2 / v3/v4 in various versions.

1.7. Front Panel and Rear Panel

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2

1) Font Panel

• OLED display in green, 64x256 resolution, to show the status of the device and the UTC time

• The keyboard for checking and configuration

• 6 indicator light

2) Back Panel

• Two power sockets with fuse . After opening the fuse base, there are a primary and a reverse fuse with specification of 0.5A on each side to facilitate users' replacement

• One antenna plug as well as 50 Ω BNC Socket on the panel

• Four 10/100M/1000M adaptive network ports

• One USBhost for upgrading the program and back up of the configuration

• One dry contact relay for alarming

Chapter 2   Installation and Commissioning of the Device

2.1. Structure of the Server

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3
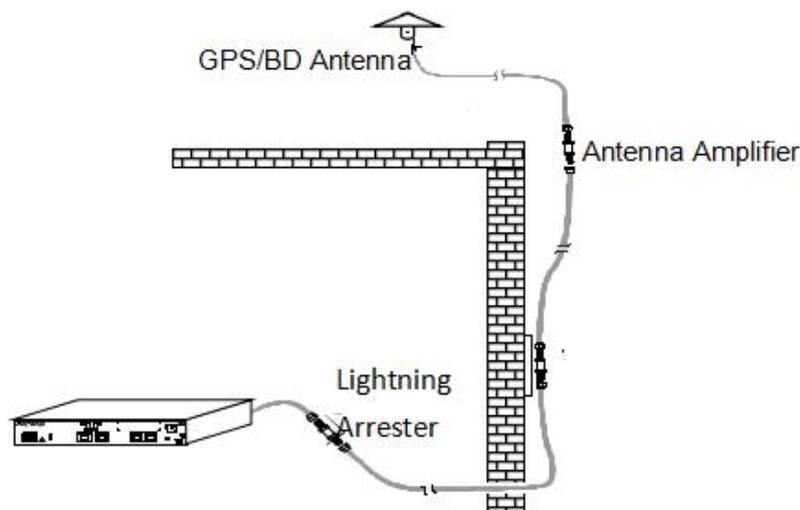
The server consists of the outdoor part and interior part. The outdoor part is composed of the GPS satellite receiving antenna, lightning arrester and antenna amplifier (optional). The function is to complete the reception of satellite signals.

The interior part is the master device of GTT-400 network time server to complete the functions of the satellite signal demodulation, the local clock calibration, achieving NTP protocol and so on. It provides NTP timing service to other network equipment by 10M network ports. Below is the detail installation method of the outdoor part and the interior part.

2.2. Outdoor installation

The outdoor part is composed of the GPS satellite receiving antenna, transmission cables and antenna amplifier. The installation attentions are as follows:

At first, the antenna installation location needs to be carefully selected, which will significantly influence function of equipment. The antenna should be installed in high position, and can not be blocked by, such as the roof, open top, etc. If you want to achieve better results, you'd better keep the elevation angle of 15 degrees from blocking. Please do not install the antenna inside the room, because GPS satellite signal is very weak and can not be received indoors. It does not matter if there are trees or plastic rain shelter above the antenna, but other block will influence the signal significantly. Actually, only a book above the the antenna can completely block out the satellite signal.

Second, antenna installation should be lower than the lightning rod or other constructions that can attract lightning stroke and the installation location should better be 10-15 meters away from them. GPS antenna itself is rarely struck by thunder blot but is often damaged by the strong induced electric field resulted from the stuck buildings (the lightning rod, tower, etc) around. In this circumstance, we should install the arrester in the cable. Normally the

arrester will be installed at the position where the cable goes through the wall. In this way, the arrester can be well earthed. The arrester should also be installed between the feeder and the server. Then lead the grounding wire from the arrester and connect it to the earth.

The earth resistance should be under 4 Ω and must be firmly connected to ensure the reliable discharge by lightning.

Sometimes the antenna can be installed outside the window, but the building must be located in the open

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4

fields with no corner. In this way, it can receive at least half of the satellite signal. But as a long-term using equipment , it is recommended that the antenna is installed in high places, while the outside installation can be only adopted for test.

The high-power microwave transmitting of the same band can not be around where the GPS antenna is installed. In addition, we should try to avoid the GPS antenna from the direct irradiation of high-power electromagnetic radiation.

If the length of the feeder is shorter than 100 meters, the antenna and equipment can be directly connected; for feeder between 100 meters to 200 meters, one amplifier is needed; for feeder between 200 meters to 300 meters, two amplifiers are needed. If you need longer feeder links, please contact us, GlobalTime Electronic Co., Ltd. We will provide the special program to you. The feeder usually adopt 1 / 2 inch RF cable whose loss is 12.8dB/100m from the United States Andrew's.

Special attention for setting up the feeder:

1. Do not bend the feeder too much, because it will result in a broken feeder conductor.

2. When we connect the feeder into the interior, it should be bent into U-shape to prevent t water from flowing backward.

Technique Index of Antenna

Frequency Range:	1575 +/- 50MHz	RF Connector:	N Type
Polarization Mode:	Right Handed circular polarization	Installation Method:	Screw (M24 x 1.5) Connector
Antenna Gain:	≥3.5dB	Volume:	Ø96 x 126mm
Amplifier Gain:	≥37dB	Operating Temperature:	-45℃ to 85℃
Noise Figure:	≤1.5dB	Storage Temperature:	-50℃ to 90℃
Interference Suppression:	25dB(f0+/- 100MHz)	Humidity:	0 to 100%
Power Consumption:	3V x 20mA		

2.3. Indoor installation

After connecting 220V AC to the master device, the indicator light "Power" on the front panel will light which indicates the running of power supply is normal. To measure the BNC antenna socket with a multimeter, the feed voltage should be up to 5V.

Then connect the antenna cable with the antenna socket.

Next, use a computer to pass through the IP address and network settings of the serial port configuration time server, save and exit, then restart the server to make the network settings take effect. After reboot, input the IP address of the PING server in another computer to check the network settings correct or not. Last, log on the network time server through Telnet to observe the satellite receiving state, the information on time tracking state of the server and so on. When the server locks the satellite time (The indicator light on the panel turns green), the server starts to provide time information to other clients within the network. The specific process of software configuration can refer to the following chapter.

Chapter 3   Operation of the Server

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5

3.1. Indicator Light

Indicator light Status

| Indicator	Status	Instruction
Power Supply	ON	The power supply is normal
	OFF	The power supply is abnormal
NTP	OFF	The server is unlock and is searching for time source
	GREEN	The time source is locked
SAT	OFF	The satellite signal is not received
	GREEN	The satellite signal is received
FREQ	OFF	No back-up frequency source or OCXO is not used currently
	GREEN	Back-up frequency source is working
Alarm	OFF	Normal
	GREEN	CPU occupation is beyong the limite (70%)

3.2. Keyboard

When the server is turned on, the default display is as below:

1. Password is needed to enter into the main menu. Click the key "OK" , then enter the password. The default password is "123456", the password can be changed under the main menu. When we enter the correct password, we can go to the main menu for configuration. We can click the back button to cancel the password.

2. Main Menu
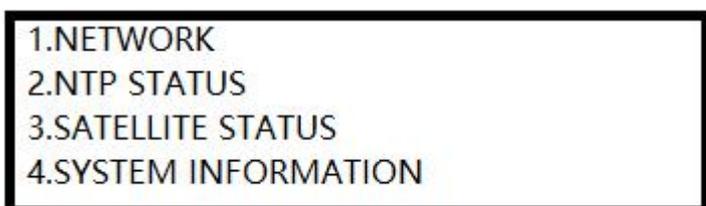
3. Click the key "up" and "down" to choose the menu and click the key "OK" to enter into the menu.

4. When we choose the menu "NETWORK", it will display (1) independent network (2) bound0. Please

choose (1) and click the key "OK" to set the network. We can click back button to go to the previous menu.
Remarks: (2) boud0 is not available currently.

4-1 Goes into independent network menu and click the "up" and "down" key to choose ETH0, ETH1, ETH2, ETH3 for configuration. We need to click the key "OK" to confirm the choice each time.

4-2 After we choose a ETH, it will display IP, netmask, gateway for configuration. We need to click the key "OK" to confirm the choice each time.

IP 192.168.2.8#

Remarks: Because the keyboard does not have ".", so when we enter IP, the key "up" will work as "." . Please click the key "OK" to save the configuration and input the next mask.

5. When we choose NTP STATUS, the menu will display as below

stratum=1
rootdisp=5.7
source=BD
reach=377

"Stratum" means the level of the server; "rootdisp" (ersion) means the accuracy of the time source; "source" means the current locked time; "reach" means if the recent 8 times of time source data is reliable.

6. When we choose SATELLITE STATUS, it will display the current numbers of the GPS and BeiDou satellites.

7. When we choose SYSTEM INFORMATION, it will display as below

SYSTEM INFORMATION
1.display time zone   3.service
2.change password   4.cpu load
SN:1608000001   version 1.2
Uptime: 100d 5h 44m

"Uptime" shows the lengths of time the server has been working.
"version" means the version of the software.

3.3. Configuration of the Server
The server GTT400 has four 10M/100M/1000M adaptable Ethernet interface. The default IP of ETH0, ETH1, ETH2, ETH3 is 192.168.0.8, 192.168.1.8, 192.168.2.8, 192.168.3.8. Every ETH support ping, thus we can check if the configuration is successful.

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7

We can manage the server trough the local serial cable connection or the remote ssh connection. We need to use a crossed serial cable with connectors on both ends (the 2, 3 feet of the two ends should be cross connected) to manage the server on the Hyper-terminal. The configuration of the Hyper-terminal is as below:
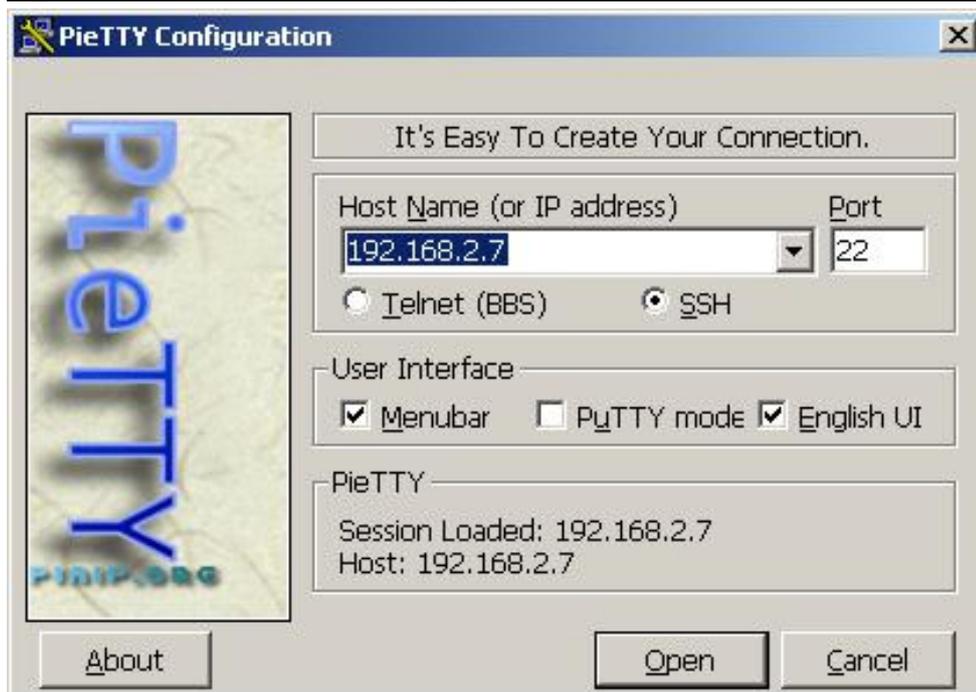

As to remote ssh connection, we only need to enter ssh <IP of the server> as command. We will introduce the method of management through local connection here. The remote management method is the same.

3.3.1. Login
It will display linux shell interface after login, we can manage and do configuration to the system.

3.4. Login Server by Internet
For security, the server support ssh login. The login interface is as the below picture shows

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8

3.5. Remote Dial-up Maintenance

We can use the MODEM to achieve remote dial-up maintenance with the serial monitoring port of the server. Please see the following steps:

Initially, set the MODEM to auto answer mode and connect the MODEM and a computer serial port with a serial cable. Set the Hyper-terminal like the below picture:

Enter the following three commands in the Hyper-terminal:

atS0=1

at&W0

at&Y0

Note: The commands are case sensitive.

Then connect the MODEM and GTT-400 network time server monitoring port with a serial cable. Then plug the telephone line. Finally, dial this number through the Hyper Terminal of another computer with MODEM and it can be connected with the server. The configuration is as introduced in section 3.2.

3.6. Configuration of Client Program

For WinXP/2003, the system contains NTP service, we can set directly like below:

First, double-click the time marks at the taskbar, then we can see the interface of date and time properties, we should choose internet time interface.

Second, modify the default windows time server. For example, we set it to be 192.168.2.8.

Third, click "apply" and then "update". Windows synchronizes once in a week under default settings. If the interface display that the PRC is not available, please open the control panel, choose "management tool"/"service", find "window time" and then choose opening the service automatically and start the service.

Fourth, we can modify the registry to change the synchronization frequency if we want. The specific registry info is at:

\HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\W32Time\TimeProviders\NtpClient\SpecialPollInterval.

The default is 604800 = 60 × 60 × 24 × 7, namely, a week.

synchronization once a day: The default is 86400

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10

synchronization once an hour: The default is 3600

synchronization once ten minutes: The default is 600

Fifthly, after modifying the registry, you should stop windows time service and restart it. Then the synchronization frequency can be updated.

If it has been installed with other time synchronization software, you need to uninstall the software and restart the computer. Then the windows time service can work normally.

For Win2000/98 operating system, the time synchronization software provided by our firm or

provided by the third-party are both available. The specific configuration can be referred to

the respective user manual.

For UNIX systems, in general, there is ntpd daemon or xntpd daemon. Create the ntp.conf configuration file under the / ETC directory and type "server ******" (time server IP) in it. Then starting the daemon will do. Regarding the details, please refer to the user manual or consult us.

3.7. Troubleshooting

3.7.1. Display Wrong Time When Power is on

After started, the server will display 1st, Jan, 2000. Only after it receives the satellite signal and lock, it will display correct time. So please make sure that the antenna is working properly.

3.7.2 All indicator Lights are off When Power is on

Please check if the power outlet is with electricity. There is a fuse socket in the device. We need to unplug it and check if the fuse is intact.

3.7.3 Can not Receive Satellite Signal for Long Time

Emphasis should be placed on verifying whether the feeder system is normal.

Firstly, unplug the feeder on the side at the device. Then measure the BNC socket with a multimeter. Normally there is 5V antenna supply voltage. Otherwise, it shows that the equipment has been damaged. Then verify the outdoor antenna is well connected, such as verifying the outdoor joints are tight, the connectors are waterproof, the antenna has no leakage problem and so on. You should troubleshoot the obvious problems one by one.

Then disconnect the antenna connector and measure the resistance of the feeder. When the remote end is open, the near-end resistance should be infinite. Besides, when the remote end is shorted, the near-end resistance will be only a few ohms. If it is shown abnormal, verify the feeder and the connector is intact. The normal faults: the quality of the line is not good; the connectors are not done well; lines are scratched or bitten by small animals, etc. If the feeder is added a lightning arrester or an antenna amplifier in the middle, you still need to verify the two components is intact.

After eliminating the above breakdown, if it still can not receive the satellite signal, please contact GlobalTime Electronic Co., Ltd. Our engineers will help you with the further processing.

3.7.4 Can not Ping the Server

First, verify the physical network connection. You can see if the corresponding connection-status light is normal by observing HUB or switch connected with the time server. And then check if there is something wrong with the network settings. You can use a crossing cable to connect the server to the computer

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11

directly to see if ping is ok. Then use HUB to test in the same network segment. Finally test the different segments. Following these steps, it is easy to troubleshoot. Some firewall software on your computer will provide a protective screen from ping operation. So it' s better to check the network after turning off the firewall.

3.7.5 Unstable Signal, and the Server is in hold mode sometimes

In general, it is caused by the improper site selection of the satellite receiver antenna. If this trouble occurs frequently, you should consider to select another site to install the antenna, that is, a place free of anything overshadowed and the surrounding microwave interference.

3.7.6 Clients can not Get Time Service

NTP protocol usually proceeds timing service through port 23 with UDP protocol and sometimes with TCP protocol. So port 23 service should be allowed to go through the intranets gateway and the firewall. Please check the gateway and the firewall configuration.

3.7.7 How to Make Network Devices Get Time Service

NTP protocol is an international standard protocol. The network equipment of many manufacturers can receive NTP protocol to adjust their own time. For example, the routers of Cisco, Avaya, Ascend and Huawei can all receive NTP services. Some series switches also support the NTP protocol. For instance, the configuration command of Cisco router is: ntp server <IP address> Regarding the specific configuration, please refer to the manual provided by the manufacturers. To unify the network time by NTP protocol can effectively improve the quality of network service. It can also judge the cause of the malfunction by checking the unified time Log files when the network goes wrong.
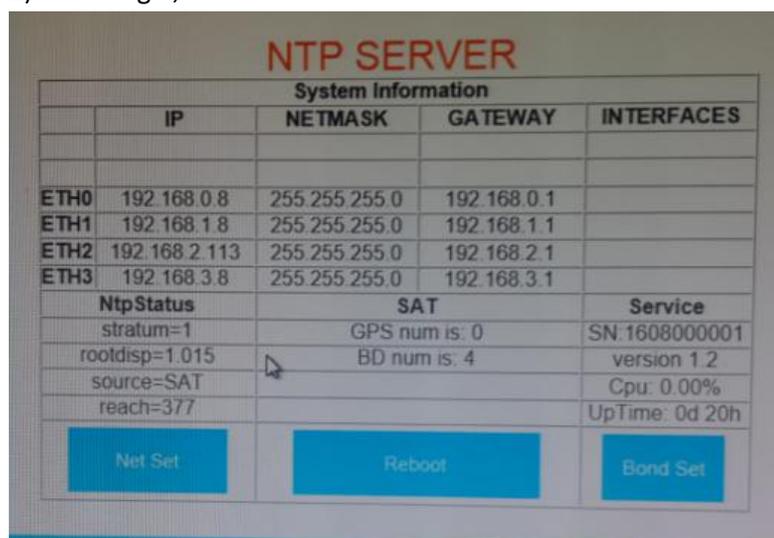
Chapter 4 Remote Login

4.1. Login via http

1) Enter http://192.168.2.8/, we will see the below interface, the username is **ntpuser**, the default password is **ntpuser2016**.
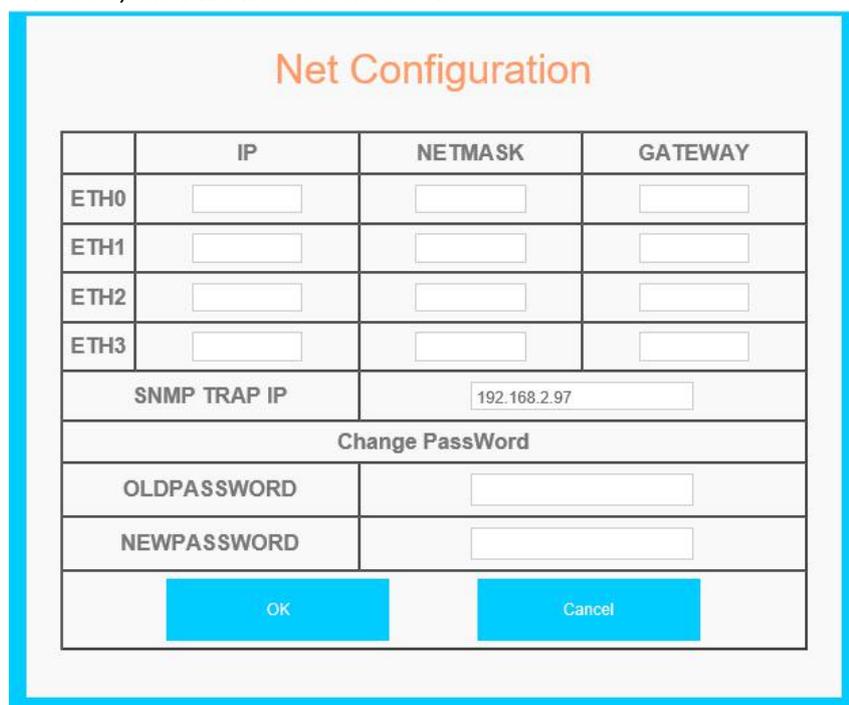
2) After login, we will see the below information:

Net Set:

If we want to do configuration for an individual network port or reset password, we should click the button "Net Set", then we will see the below

Bond Set:

If we want to do configuration for bond, we should click this button, then we will see the below

13

Remarks:

Netcard- choose bond 0 or bond 1 for configuration

Status- choose to open or close the chosen bond

Interfaces- choose the individual network ports for bonding

3) After the configuration, we need to reboot the sever.

4.2. Login via ssh

We can login via console port or network port. The username is **ntpuser**, the default password is **ntpuser2016**. The serial port for console login should be setted as 115200N81. If we want to use network port to login, we should login via SSH.

4.2.1. Main Login Interface

    1. Network Information

    2. NTP Configuration

    3. NTP Status

    4. BD/GPS Status

    5. System Information

    6. System funtion

    7. Change the password

    8. About

    Q. Exit

    Choice:

When we input the corresponding numbers and click the enter button, we will enter into the related interface, when we input "q" or "Q" and then click the enter button, we will go back to the previous menu.

4.2.2. How to change the configuration of network

When we choose Network Information, we will see the below information:

    eth0

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14

    ip: 192.168.0.8

    netmask: 255.255.255.0   gateway:192.168.2.1

    Do you want to change the configuration of network?

    Please input N or Y ?   Input Q: return.

4.2.3. NTP Configuration

When we choose NTP Configuration, we will see the below information:

    1. NTP server

    2. NTP broadcast

    3. MD5 keys

    4. Select NTP MD5 key

    Q.Exit

     choice:

When GPS / BD signal is available, NTP Server can work as stratum 1 server, when GPS/ BD signal is not available, it can work as stratus 2 server.

When there is many SNTP terminal in the network, we can do configuration for the NTP broadcast, the time service precision is lower than C/S.

MD5 cipher code is used to set the NTP timing service with authentication pattern, it is available in open environment.

No matter the timing service is with or without authentication pattern, the NTP server will react to it.

4.2.4 NTP Status

    stratum=1

    precision=-15

    rootdelay=0.000,

    rootdisp=1.2

    refid=GPS

Stratum 1 means the NTP server can get time from GPS/ BD well, if the number is not 1, then it means that there is something abnormal.

When time is locked, Rootdisp will be about 1ms, and keep stable. It the the number is getting bigger, it means that there is something abnormal.

4.2.5 BD/ GPS Status

GPS num is 0

BD num is 5

4.2.6 System Information

1. Time zone

2. Service

3. Cpu load

4.2.7. System Function

1. Ping
2. Time
3. Uptime
4. Reboot
5. Reset configuration

Ping function is not stable in a server which has more than 1 network ports of different network segment. We should only ping the IP of a specific network segment to check the network configuration.

Time refers to the UTC.

Uptime refers to how long the server has been working.

Chapter 5 SNMP Monitoring

5.1. Set SNMP TRAP IP Address

If there is client, we need to set the SNMP TRAP IP Address before we use SNMP.

5.1.1. Set SNMP TRAP IP Address via WEB

NTP SERVER

	IP	NETMASK	GATEWAY	INTERFACES
	System Information			
	IP	NETMASK	GATEWAY	INTERFACES
ETH0	192.168.0.8	255.255.255.0	192.168.0.1	
ETH1	192.168.1.8	255.255.255.0	192.168.1.1	
ETH2	192.168.2.139	255.255.255.0	192.168.2.1	
ETH3	192.168.3.18	255.255.255.0	192.168.3.1	

NtpStatus	SAT	Service
stratum=1	GPS num is: 0	SN:1701000082
rootdisp=1	BD num is: 0	Version-2.2
source=OCXO		Cpu: 5.00%
reach=377		UpTime: 0d 0h

Net Set	Reboot	Bond Set

After login, click Net Set, we can see the below interface, then we can input SNMP TRAP IP address. We need to reboot the server after we click OK.

5.1.2. Set SNMP TRAP IP via NTPSHELL

Login via console, the username is ntpuser, the password is ntpuser2016. After login, we can see the below options:

```
1.Network Information
2.NTP Configuration
3.NTP Status
4.BD/GPS Status
5.System Information
6.System funtion
7.Change the password
8.About
Q.Exit
choice:
```

We should input 1 and click enter button to get into the next menu:

```
1.independent network
2.bond
3.snmp trapip
Q.Exit
choice: █
```

Then we should input 3 and click enter button to set SNMP TRAPIP

```
NOW SNMP_TRAP_IP is:192.168.2.39
Do you want to change the trapip of SNMP?Please input 'Y' or 'N'
y
Please input the new trapip address.
NEW SNMP_TRAP_IP:█
```

After saving the configuration, we need to reboot the sever so that the configuration will take effect.

5.2. Introduction of SNMP OID

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17

5.2.1. TRAP OID

1.3.6.1.4.1.2354.1.3.1 means cold starting , it is character string. "TrapMsgColdStart" means the server is starting successfully for the first time.

1.3.6.1.4.1.2354.1.3.2 means NTP is alarming, it is charater string, "TrapMsgNtpAlarm" means changes from stratum 1 to other numbers, it refers to alarming status.

1.3.6.1.4.1.2354.1.3.4 means the satellite is losing lock, it is character string. "TrapMsgGpsUnlocked" means that the sever can not get satellite.

1.3.6.1.4.1.2354.1.3.8 means alarming, it is character string, "TrapMsgRootDisp" means the value of rootdisp is bigger than 100.

1.3.6.1.4.1.2354.1.3.12 means alarming of CPU, it is character string. "Trapcpualarm" means CPU load is more than 70%.

5.2.2 GET OID

1.3.6.1.4.1.2354.1.2.2.0 means the time of the NTP server's time source, it is character string, the time format is HH:MM:SS.

1.3.6.1.4.1.2354.1.2.4.0 means NTP time source, it is character string. It refers to satellite or OCXO. The format is "TimeSource:BD", TimeSource can be {BD, GPS/BD, OCXO}.

1.3.6.1.4.1.2354.1.2.8.0 means the status of CPU. The range is 0-100. The format is 6, means the usage rate of the server is 6%.

1.3.6.1.4.1.2354.1.2.9.0 means the memory. The range is 0-100. The format is 4, means the usage rate of the memory is 4%.

1.3.6.1.4.1.2354.1.4.7.0 means NTP stratum. The format is 1, means stratum=1, means the server is workingwell. It it is not 1, but other numbers, means something is abnormal.

1.3.6.1.4.1.2354.1.4.11.0 means root error. The format is 1, it the number is bigger than 100, there will be trap alarming.

1.3.6.1.4.1.2354.1.4.13.0 means how long the system has been working continually, the format is "0 Days 1 Hours 48 Minutes"

1.3.6.1.4.1.2354.1.5.2.0 means the QTY of the satellite signal. The format is "GPS num is: 0 , BD num is: 3".

We reserve the right to changes at any time.