



Atop Technologies, Inc.

***IEEE1588v2
Precision Time Protocol
Grandmaster Clock
NTP server***

User Manual

V0.4

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Preface

This manual contains some advanced network management knowledge, instructions, examples, guidelines, and general theories. The contents are designed to help users manage the device and use its software, a background in general theory is a must, when reading it. Please refer to the Glossary for technical terms and abbreviations.

Who Should Use This User Manual

This manual is to be used by qualified network personnel or support technicians who are familiar with network operations, and might be useful for system programmers or network planners as well. This manual also provides helpful and handy information for first time users. For any related problems, please contact your local distributor. If they are unable to assist you, please redirect your inquiries to www.atop.com.tw.

Warranty Period

Atop technology provides a limited 5-year warranty for PTP products.

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Note:

Throughout the manual, the symbol * indicates that more detailed information of the subject will be provided at the end of this book or as a footnote.

1 Introduction

1.1 Product Introduction

NTS7X00 is a modular, Industrial, Substation-Grade and Telecom-Grade IEEE1588v2 Grandmaster Clock and NTP server. The device is designed to withstand harsh environments with fanless, stable operation in temperatures ranging from -40 to +85 Degrees Celsius.

The device is equipped with

- 2x redundant power module input slots (modules not included, one power module to be purchased separately)
- 2x output module slots (modules not included)
- 1x PPS output BNC
- 1x GNSS (GPS/GLONASS/BEIDOU/GALILEO compatible) input BNC
- 2x 10/100/1000Mbps RJ45 and 2x 100/1000Mbps SFP Combo ports
- 1x LCM matrix used to display status and time

The available optional accessories are:

- NTS7X00-P1 : 88~264 VAC input + 1 Relay Alarm output
- NTS7X00-P2 : 20~72 VDC input + 1 Relay Alarm output
- NTS7X00-S1 : 8x Serial protocol (including IRIG-B) outputs – 16-pin Terminal block, sw selectable
- NTS7X00-S2 : 5x Serial protocol (including IRIG-B) outputs – BNC, sw selectable
- NTS7X00-T1 : 8x TTL (including 10MHz) outputs – 16-pin Terminal block, sw selectable
- NTS7X00-T2 : 5x TTL (including 10MHz) outputs – BNC, sw selectable
- GNSS Outdoor Antenna
- Coaxial cable

1.2 Time protocol Introduction

When do we consider time as precise? In daily life, it would be fair to say that having a watch showing the time that is one or two minutes off the official time would be absolutely acceptable. Much better if it would be off by just few seconds. Nice to have, but not necessary.

IEEE1588v2 is the latest Time Synchronization standard. It allows devices to be synchronized with each other with a nanosecond level accuracy. One nanosecond is 10^{-9} s, 0.000000001s. And usually there is one or more than one Synchronization happening every second, this means that the precision is preserved. Why do we need this kind of accuracy? Or is the human being overcomplicating things?

The reality is that in the daily life of the 21st century, IEEE 1588v2 (also known as Precision Time Protocol or PTP), affects us deeply. Every time we use our smartphone, every time we drain power from the grid, every time we carry out a transaction online, every time something is manufactured with a robot we are relying on technology that couldn't work without accurate Synchronization.

In the foreseeable future, when we'll be carried around by automated cars, PTP will be the backbone that makes everything work.

Synchronization was necessary also years ago, even before NTP (Network Time Protocol) and SNTP (Simple Network Time Protocol) existed. The retrofitting of some legacy equipment may still require to use these outdated,

older time protocols. Integrating legacy substations in a IEC61850-based substation network may require, for instance, to provide IRIG-B time code to older RTUs.

1.2.1 Legacy Protocols

- **IRIG-B - Inter-range instrumentation group time codes**, commonly known as IRIG time codes, are standard formats for transferring timing information. The standards were created by the Telecommunications Working Group of the U.S. military. Work on these standards started in October 1956, and the original standards were accepted in 1960. Many reviews of the standard followed. The signal is carried through a differential signal, usually through a coaxial cable with BNC connectors. The limitations given by the physical layer don't allow the signal to be delivered through long distance, and there is no embedded algorithm that allows the calculation of the signal latency, allowing accuracy at the 10th of a second only. Being the most popular standard used in legacy devices, it is common to find it in present days during old equipment retrofitting. Selected ATOP devices support IRIG-B time signalling.
- **DCF77** – is a German longwave time signal that started operation in 1959. The station that issues DCF77 signal is located in Mainflingen in Hesse, near Frankfurt am Main and is directly connected to atomic clocks and the signal can be received up to 2000 km away. Even though atomic clocks are behind the origination of DCF77 signal, the accuracy is still behind other Atomic clocks in Germany (<5.5 microseconds).
- **BCD, ST, ST with Checksum, BJT** – are differential-signal based time protocols that are less commonly used. BJT is the old reference time standard in China. Selected ATOP devices support these time signalling through BNC Connectors or Terminal Block interfaces.
- **10 MHz output**: it is a square pulse TTL output that is normally used in Telecom applications. A must if your device is used in SONET or SDH. Synchronous Optical Networking (SONET) and Synchronous Digital Hierarchy (SDH) are standardized protocols that transfer multiple digital bit streams synchronously. Selected ATOP devices support TTL 10MHz output through BNC connectors or Terminal Block.
- **PPS output** – Pulse Per Second (PPS) is a square wave signal that is normally used in calibration or time variation analysis in high-precision-timing applications. Precision clocks are sometimes manufactured by interfacing a PPS signal generator to processing equipment that aligns the PPS signal to the UTC second and converts it to a useful display. Atomic clocks usually have an external PPS output, although internally they may operate at 9,192,631,770 Hz. PPS signals have an accuracy ranging from a 12 picoseconds to a few microseconds per second, or 2.0 nanoseconds to a few milliseconds per day based on the resolution and accuracy of the device generating the signal. Comparing two different PPS output waves from two different reference clocks allows the user to monitor and calibrate the precision of the clock. Selected Atop devices include TTL output PPS, PPM, PPM output through BNC connectors or Terminal Block.

1.2.2 Time Synchronization over Ethernet

- **Network Time Protocol (NTP)** is a networking protocol for clock synchronization between computer systems over packet-switched, variable-latency data networks. In operation since before 1985, NTP is one of the oldest Internet protocols in current use. NTP is intended to synchronize all participating computers to within a few milliseconds of Coordinated Universal Time (UTC). It uses a special algorithm, to select accurate time servers and is designed to mitigate the effects of variable network latency. NTP can usually maintain time to within tens of milliseconds over the public Internet, and can achieve better than one millisecond accuracy in local area networks under ideal conditions. Asymmetric routes and network congestion can cause errors of 100 ms or more. The protocol is usually described in terms of a client-server model, but can as easily be used in peer-to-peer relationships where both peers consider the other to be a potential time source. Each clock,

hierarchically are categorized in Strata, where a Stratum 0 clock is a high-precision timekeeping device (usually and atomic clock or a GPS clock) and Stratum 1 clock is a precision clock that is Synchronized within few microseconds to the main reference clock.

There are different versions of NTP protocol, described in RFC 1119 (NTPv2), RFC 1305 (NTPv3) and RFC 5905 (NTPv4). NTP has been introduced on Windows Systems starting from Windows 2000 and in MacOS and Linux.

Given its low-accuracy, this can be used to Synchronizes devices over the internet or over Local Area Network where no high-precision is necessary.

- **SNTP (Simple Network Time Protocol)** is a less complex implementation of NTP, using the same protocol but without requiring the storage of state over extended periods of time. It is used in some embedded devices and in applications where high accuracy timing is not required. According to the standards, described in RFC 1769 (SNTPv3) and RFC 2030 (SNTPv4), "It is strongly recommended that SNTP be used only at the extremities of the synchronization subnet. SNTP clients should operate only at the leaves (highest stratum) of the subnet and in configurations where no NTP or SNTP client is dependent on another SNTP client for synchronization. SNTP servers should operate only at the root (stratum 1) of the subnet and then only in configurations where no other source of synchronization other than a reliable radio or modem time service is available. The full degree of reliability ordinarily expected of primary servers is possible only using the redundant sources, diverse subnet paths and crafted algorithms of a full NTP implementation."
- **IEEE1588v2: Precision Time Protocol.** IEEE1588v2 is the only protocol that allows Synchronization in the nanosecond-range. None of the legacy protocols or the existing networking protocols allows such a timestamp resolution. IEEE1588-2008 (v2) derives from an earlier version issued by IEEE in 2002 that is not backward compatible. IEEE1588v1 is now generally abandoned. Being timestamp resolution and timekeeping so detailed, IEEE1588v2 timestamps are required to be hardware generated, since no software (no matter the computing power), could be able to keep up with some stringent requirements. Like NTP, 1588 is a hierarchical protocol, where Stratum 1 Clocks –or Grandmasters- are directly Synchronized with Stratum 0 Primary Reference Clocks such as GNSS/ GPS Systems or Atomic Clocks and where intermediate layers can coexist till reaching the slaves. PTP packets are timestamped with a nanosecond resolution, where the time is calculated from EPOCH, Midnight January 1st 1970 TAI (International Atomic Time). The UTC time (Coordinated Universal Time, former GMT), that differs from TAI by the leap seconds accumulated in the years, is calculated automatically by the slave. PTP requires specific compatible hardware to be setup on the whole Synchronization chain in order to preserve the timestamp accuracy. In order to reach the necessary accuracy, PTP works well only on Local Area Networks without passing through the internet since latencies and paths are uncertain and heavily influence the latency. The recommendation is to make sure that the PTP packets travel always through the same path during each Synchronization phase, in order to increase accuracy. Atop, as your reliable partner, provides solutions from the top to the bottom of the chain.

The 1588 protocol is designed to work on Ethernet transport, Layer-2 (Data-link Layer) or Layer-3 (both on IPv4 and IPv6). There are two methods to calculate the link delay: in End to End mode, the link delay is calculated from the source of the PTP packet till the end, while in Peer to Peer mode, it is calculated during each network node.

When used in **End to End** mode, Synchronization happens with an exchange of three or four PTP packets (depending whether one or two-step clock is selected). The *Sync* and *Follow_Up* packets generated from the GM include the precise timestamp, while *Delay_Req* (originated by the slave) and *Delay_Resp* (originated by the GM) are used by the slave to compute the link latency and calculate its time correctly from End-to-End, this means from the Slave to the Master summing up all link delays happening in each network element in Between.

In **Peer to Peer** mode, the delay is calculated by exchanging *Pdelay_Req*, *Pdelay_Resp* and *Pdelay_Resp_Follow_Up* packets, where both slave and master can generate the packets.

While different grandmaster clocks can coexist on the same network, the protocol defines an algorithm called **BMCA - Best Master Clock Algorithm** (based on both fixed and variable parameters) to define

which is the most accurate clock on the network that will act as a designed grandmaster. Grandmasters not selected as “best GMC” will be silent, in passive mode, unless selected.

1.2.3 PTP Profiles

Precision time Protocol implementations differ heavily from application to application and there are plenty of options available that allow tailored applications to be made. The selection of one or the other topology depends from the degree of accuracy desired, the number of slaves to be synchronized, and the needed frequency of Synchronization. Recommendations of default parameters to be used for each common application are defined in the so called PTP-profiles. The user can refer to the guideline to set up the Grandmaster Clock PTP settings, or simply pre-select which profile it would like to be used. PTP profiles also define the ideal and standard Network Architecture and sets limits of accuracy of GM, BCs and of the network as a whole.

Atop proudly supports Default and Power Profiles, Telecom (both for Frequency, Time and Phase Synchronization) and Enterprise Profiles

| Profile | Default Profile | Power Profiles (IEEE) | | Telecom Profiles (ITU-T) | | | Enterprise Profile |
|--------------------------|-----------------|-----------------------|-----------|--------------------------|-----------|---------------------|--------------------|
| | | C38.238 | 61850-9-3 | G.8265.1 | G.8275.1 | G.8275.2 | |
| PTP Domain | 0 | 0 | 0 | Free | Free | 44 | |
| Transport | L2 | L2 | L2 | Layer-3 | Layer-3 | Layer-3 | L3 – IPv4/6 |
| Multicast/UC | Multicast | Multicast | Multicast | Unicast | Unicast | Unicast negotiation | MC + UC |
| Link Delay | E2E | P2P | P2P | E2E | E2E | E2E / P2P | E2E |
| Sync interval (per sec) | 1 | 1 | 1 | not defined | 16 | 16 | |
| Delay interval (per sec) | 1 | 1 | 1 | not defined | 16 | 16 | |
| Other | Standard | VLAN Opt. | VLAN Opt. | Modified BMCA | SyncE | SyncE | |
| Supported | Yes | Yes | Yes | Partially | Partially | Partially | Partially |

1.3 Working principle

All output modules and power modules should be connected to the device when it is powered off.

Once assembled, configured, and connected to GNSS Antenna the device will Synchronize with GNSS’s Primary Time reference clock. This may take up to 30 minutes. Once the device is Synchronized, it will start acting as a PTP Grandmaster and as an NTP server.

NTS7X00 is equipped with a high-performance OCXO (oven-controlled oscillator). The purpose of this high-accuracy component is to keep accurate time even in the even the GNSS Synchronization is lost. The more the device remains connected to GNSS, the more the Oscillator will learn and adjust his own frequency, further minimizing the drifting (holdover) when GNSS signal is lost.

- PTP Grandmaster NTS7500 OCXO can achieve 1 μ s/ 24 hrs drifting when in holdover mode after being Synchronized to GNSS for 1 day
- NTP server NTS7500 OCXO can achieve 1 μ s/24 hrs drifting when in holdover mode after being Synchronized to GNSS for 1 day

Once Synchronized, the device can start to issue outputs based on the protocol selected via Web interface.

Note:

Please install the GNSS Antenna on the roof or anyway in a position with clear visible sky. Even though only four satellites are necessary to be in-sight to get a successful synchronization, this will happen faster if more satellites are visible and will heavily reduce the risk of losing GNSS lock. In order to avoid problems, it is strongly recommended to equip the Antenna with a Surge preventer.

1.4 Hardware Features

NTS7X00 features a dual-core 1.0GHz Freescale CPU and an industrial-grade fanless design, conceived to withstand the harshest environments.

Section to be completed

1.5 Software Features

NTS7X00 supports the following protocols:

- Configuration and Monitoring
 - IPv4, IPv6 (not available by default, contact ATOP or more information)
 - RFC 2616 (HTTP/ HTTPS),
 - RFC 1157 (SNMPv1)
 - RFC 1901-1908 (SNMPv2c)
 - RFC 3411-3418 (SNMPv3)
- Network Synchronization
 - RFC 868 (Time Protocol),
 - RFC 867 (Daytime Protocol),
 - RFC 1119 (NTPv2) Server,
 - RFC 1305 (NTPv3) Server,
 - RFC 5905 (NTPv4) Server,
 - RFC 1769 (SNTPv3) Server,
 - RFC 2030 (SNTPv4) Server,
 - IEEE1588v2 Grandmaster (NTS7500-CPU-PTP only)
 - Supported PTP Modes:
 - L2: Multicast, Unicast, Unicast Negotiation
 - L2 VLAN Tagging: Supported
 - L3 IPv4: Multicast, Unicast, Unicast Negotiation
 - One or two-step clock modes supported
 - End-to-End or Peer-to-Peer supported
 - Supported PTP Profiles:
 - PTP default profile
 - C37.238 -2001 Power Profile
 - IEC/ IEEE61850-9-3 Power Profile (2016)
 - VLAN setting for Power Profile
 - Partially supported profiles
 - ITU-T G.8265.1 Telecom Profile (Frequency)
 - ITU-T G.8275.1 Telecom Profile (Phase/Time)
 - ITU-T G.8275.2 Telecom Profile (Phase/Time)
 - User can modify the detailed PTP settings
 - Maximum number of slaves: maximum 3,000 PTPpps (PTP packets per seconds). It is suggested to have less than 1,000 PTPpps.

2 Configuring with a Web Browser

Chapter 2 explains how to access the Grandmaster clock and configure it for the first time. NTS7X00 can be easily set-up by an user-friendly web interface.

2.1 Web-based Management Basics

Users can access the device easily using their web browsers (Internet Explorer 8 or 11, Firefox 44, Chrome 48 or later versions are recommended). We will proceed to use a web browser to introduce the device's functions.

2.1.1 Default Factory Settings

Below is a list of default factory settings. This information will be used during the login process. Make sure that the computer accessing the device has an IP address in the same subnet and the subnet mask is the same.

- Default Credentials:
User Name: admin
Password: default

- LAN 1 (Combo 10/100/1000 Mbps RJ45 and 100/1000 Mbps SFP slot)
IPv4 default Address: 10.0.50.1
IPv4 default Gateway: 0.0.0.0
Subnet Mask: 255.255.0.0
DNS: 0.0.0.0
Fiber speed: 1000 Mbps
IPv6 default Address: 2001::1
IPv6 default Prefix: 64
IPv6 default Gateway: 2001::ffff
VLAN: disabled

- LAN 2 (Combo 10/100/1000 Mbps RJ45 and 100/1000 Mbps SFP slot)
IPv4 default Address: 192.168.1.1
IPv4 default Gateway: 0.0.0.0
Subnet Mask: 255.255.255.0
DNS: 0.0.0.0
Fiber speed: 1000 Mbps
IPv6 default Address: 2001::21
IPv6 default Prefix: 64
IPv6 default Gateway: 2001::ffff
VLAN: disabled

2.1.2 Login Process and Main Window Interface

In order to access the configuration, please log in. This can simply be done in two steps.

1. Launch a web browser.
2. Type in the device's IP address (e.g. `http://10.0.50.1`), as shown in
3. Figure 2.1

Note: When the user name and password is left empty, the login prompt will not show.

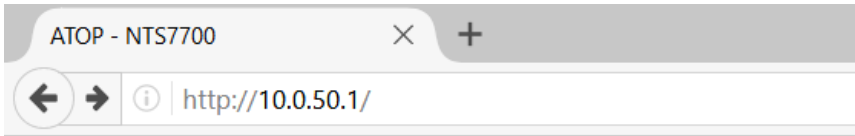


Figure 2.1 IP Address for Web-based Setting

After the login process, the main interface will show up, as shown in Figure 2.2. The main menu (left side of the screen) provides the links at the top level links of the menu hierarchy and by clicking each item allows lower level links to be displayed. The default landing page is the device overview page.

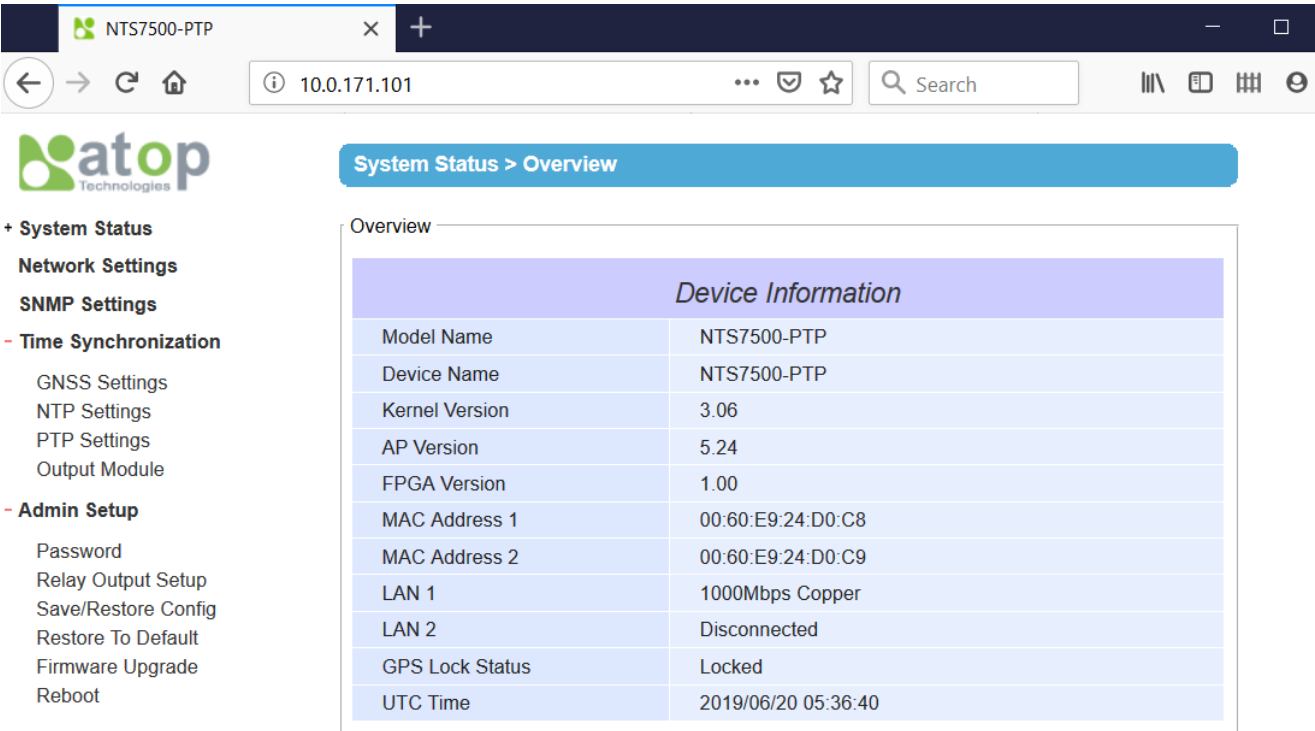


Figure 2.2 Default Web Interface

On the left hand side of the screen, the settings menu is shown. As replicated here in Figure 2.3



+ **System Status**

Network Settings

SNMP Settings

- **Time Synchronization**

GNSS Settings

NTP Settings

PTP Settings

Output Module

- **Admin Setup**

Password

Relay Output Setup

Save/Restore Config

Restore To Default

Firmware Upgrade

Reboot

- Network Settings allows the modification of all network related settings, such as IPv4 and IPv6 address, Fiber Port speed, Virtual LAN (VLAN), Gateway and DNS Servers. Detailed explanation is available in Chapter 2.3

- SNMP Settings allow the configuration of SNMP, that makes the device manageable through Simple Network Management Protocol. Detailed explanation is available in Section 0

- Time Synchronization, including NTP and PTP settings allow the configuration of Network Synchronization Protocols (IEEE1588v2 and NTP). Detailed explanation is available in Section 0

- Administration Setup, including configuration backup and restore, reboot, restore to default, user name and password settings and Relay output settings are explained in detail in section 0

Figure 2.3 Expanded Menu of NTS7X00-PTP

2.2 System Status Information

To help users become familiar with the device, the **System Status** section provides important details of the device. This is also the main welcome screen once the user has logged in. The details make it easier to identify different devices connected to the network. An overview is shown in the figure below.

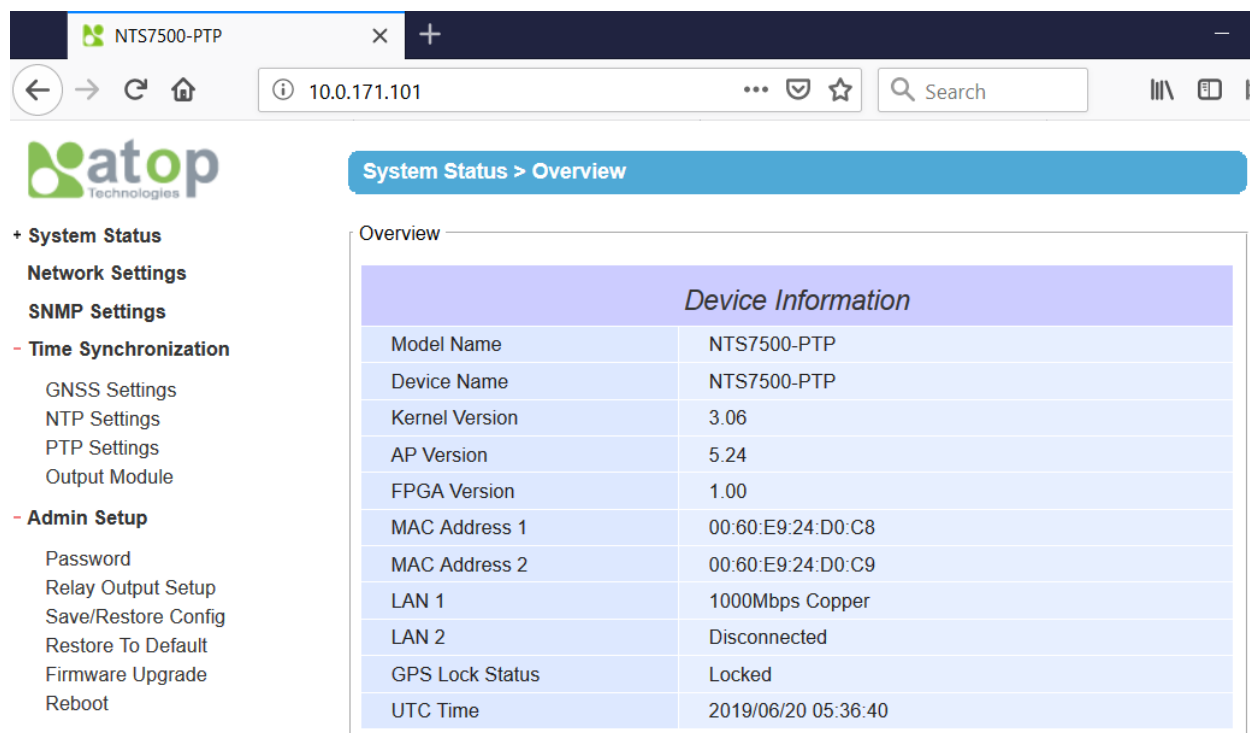


Figure 2.4 Basic Information Dropdown Menu

From this page, check the model name, device description, Kernel Version, Application version, MAC address, LAN connection status, GNSS Lock status and the UTC time at the moment of loading the page. The UTC time is not refreshed every second. Table 2.1 summarizes the description of each basic information.

Table 2.1 Descriptions of the Basic information

| Label | Description |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Model name | The device 's complete model name (including options) |
| Device Name | The model type of the device |
| Kernel Version | The current kernel version of the device. |
| Application Version | The current application version of the device. |
| MAC address 1 | The MAC address of the LAN 1 interface (copper or fiber) |
| MAC address 2 | The MAC address of the LAN 2 interface (copper or fiber) |
| LAN 1 | Speed, medium and link status of LAN 1 |
| LAN 2 | Speed, medium and link status of LAN 2 |
| GPS Lock Status | Current status of GNSS module inside of the device. Initializing: When the device is still waiting to have its GNSS module to be Synced to a GNSS System |

| | |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | <p>Locked: When connected to a GNSS antenna and locked to a GNSS System as Primary Time Reference Clock. Beware that once connected, to the Antenna and turned on, the device may take up to 30 minutes to Sync.</p> <p>Holdover: When the Synchronization of a GNSS System as PTRC was lost and the device is running on its internal oscillator. When in holdover mode, this page will also show the date/time of the last time the device was Synced to GNSS</p> |
| UTC Time | UTC Time at the moment the page was loaded. |

2.3 Network Settings

In this subsection, it is possible to modify the port settings, network settings of Internet Protocol version 4 (IPv4) and Internet Protocol version 6 (IPv6), as well as Virtual Local Area Network (VLAN) and Domain Name Servers (DNS). The configuration of DNS is necessary only if NTP/SNTP client function is used, since the device will have to access the internet to recover time information. A detailed explanation of the fields is provided in Table 2.2. This subsection is divided for Port 1 and Port 2. LAN1/SFP1 and LAN2/SFP2 are Combo ports. When both LAN1/SFP1 or LAN2/SFP2 are plugged, the Fiber interface will take the priority over the Copper interface. Figure 2.5 below shows the Network configuration for Port 1. On the same page the form is replicated for Port 2.

Since Fiber Standard does not support auto-negotiation, please set the Fiber speed. If you're using VLAN, check "Enable VLAN" checkbox and the disabled field will be enabled for input. After entering the desired information, please click **Update** button to change the Network Settings.

Note: after IP address and VLAN is enabled and System is booted up again, please make sure that your computer's IP configuration and VLAN configuration allows the device to be reached on the Local Area network. Otherwise, the device will not be reachable.

Network Settings

Network Settings

LAN Interface 1

Fiber Speed ☐ 100 Mbps ☒ 1000 Mbps

IPv4 Settings

IP Address

Subnet Mask

Gateway

IPv6 Settings

IPv6 Address

IPv6 Prefix

IPv6 Gateway

VLAN Settings

☐ Enable VLAN

VLAN ID

VLAN IPv4 Address

VLAN IPv4 Subnet Mask

VLAN IPv4 Gateway

VLAN IPv6 Address

VLAN IPv6 Prefix

VLAN IPv6 Gateway

Figure 2.5 Network settings example for Port 1

The second part of IP Setting section is the **Domain Name Server (DNS)** part that appears in the bottom of the Network settings page as shown in Figure 2.6. DNS setting is necessary only if NTP/SNTP client is going to be used. After inputting DNS server's IP address, please click Update button to change the Network Settings.

| DNS Server Settings | |
|---------------------|-------------------------------------------|
| Primary DNS | <input type="text" value="168.95.1.1"/> |
| Secondary DNS | <input type="text" value="168.95.192.1"/> |

Figure 2.6 DNS Settings

Table 2.2 Descriptions of IP Settings

| Label | Description | Factory Default |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| Fiber Speed | Use the Radio button to select the Fiber speed suitable to the SFP transceiver that is in use | 1000 Mbps |
| IPv4 Address | The IPv4 address to which the device is associated and reachable on the related port. | LAN1: 10.0.50.1 LAN2: 192.168.1.1 |
| Subnet Mask | Display current Subnet Mask or set a new subnet mask. | LAN1: 255.255.0.0 LAN2: 255.255.255.0 |
| IPv4 Gateway | Show current IPv4 Gateway or set a new one. | LAN1: 10.0.0.254 LAN2: 192.168.1.254 |
| IPv6 Address | The IPv6 address to which the device is associated and reachable on the related port. | LAN1: 2001::1 LAN2: 2001::21 |
| IPv6 Prefix | Defines the IPv6 Prefix | 64 |
| IPv6 Gateway | Show current IPv6 Gateway or set a new one. | 2001::ffff |
| Enable VLAN | Defines whether VLAN is enabled on that port or not | Disabled |
| VLAN ID | Virtual local area network identification number is the ID value for VLAN that need to be configured with IPv4 address. | NULL |
| Primary DNS | Set the primary DNS IP address to be used by your network. | NULL |
| Secondary DNS | Set the secondary DNS IP address. The device will locate the secondary DNS server if it fails to connect to the Primary DNS Server. | NULL |

2.4 SNMP Settings

Simple Network Management Protocol (SNMP) is a protocol for managing devices on IP networks. It exposes management data in the form of variables on the managed systems which describe the system configuration. These variables can then be queried or defined by the users. The SNMP is used by network management system or third-party software to monitor devices such as managed switches in a network to retrieve network status information and to configure network parameters. NTS7X00 support SNMP and can be configured in this section.

> SNMP Settings

SNMP Settings

The SNMP is used in network management systems to monitor network-attached devices for conditions that warrant administrative attention.

Basic Data Objects

| | |
|-----------------|----------------------------------|
| System Contact | www.atop.com.tw |
| System Name | NTS7500 PTP Grandma |
| System Location | GMC's Location |
| SNMP | <input type="checkbox"/> Enabled |
| Trap Server | |

Save & Apply

Cancel

Figure 2.7 SNMP Settings page

To enable SNMP agent on the device, please check the **Enable** box and click **Save & Apply** button as shown in Figure 2.7. The SNMP version 1 (V1), version 2c (V2c) and version 3 are supported. Basically, SNMP V1 and SNMP V2c have simple community string based authentication protocol for their security mechanism, while SNMP V3 is improved with cryptographic security.

SNMP V1 and SNMP V2c use a community string matching for authentication. This authentication will allow network management software to access the information or data objects defined by Management Information Bases (MIBs). Note that this simple authentication is considered a weak security mechanism. It is recommended to use SNMP V3, if possible. There are two levels of authentications/communities or permission type in NTS7X00, which are read-all-only or read-write-all.

The *Read Community*, has read-only authorization, while the *write* community has read-write authorizations. Once SNMP has been enabled, write into the Read and Write community fields the authentication string. Table 2.3 Descriptions of SNMP Settings describes the function of each field and the allowed parameters.

Figure 2.8 below shows extended SNMP settings, that are visible once the “enabled” checkbox has been set.

> SNMP Settings

SNMP Settings

The SNMP is used in network management systems to monitor network-attached devices for conditions that warrant administrative attention.

| Basic Data Objects | |
|--------------------|---------------------------------------------|
| System Contact | www.atop.com.tw |
| System Name | NTS7500 PTP Grandmas |
| System Location | GMC's Location |
| SNMP | <input checked="" type="checkbox"/> Enabled |
| SNMP Version | v1 / v2c / v3 ▾ |
| Read Community | public |
| Write Community | private |
| User Name | admin |
| Password | ●●●●●●●● |
| Encrypt | DES ▾ |
| Encrypt Key | encrypt123 |
| Trap Server | |

Save & Apply

Cancel

Figure 2.8 SNMP Enabled Settings page

Table 2.3 Descriptions of SNMP Settings

| Label | Description | Factory Default |
|------------------------|----------------------------------------------------------------------------------------------------------|-----------------|
| System Contact | The name of the contact person responsible for System administration. Freely selectable | NULL |
| System Name | The name of the System that will be visible from SNMP management tool. Freely selectable | NULL |
| System Location | The name of the Location of the System that will be visible from SNMP management tool. Freely selectable | NULL |
| SNMP | Checkbox that enables/disables SNMP Agent | Unchecked |
| Read Community | Read community Authentication string | NULL |
| Write Community | Read-Write community Authentication string | NULL |
| Trap Server | SNMP trap server | 10.0.50.1 |

2.5 Time Synchronization

Time Synchronization sub-menu contains all options necessary to configure IEEE1588v2 Precision Time Protocol (PTP), Network Time Protocol (NTP) and Optional Output modules output. The section related to the management of the output modules is still in development.

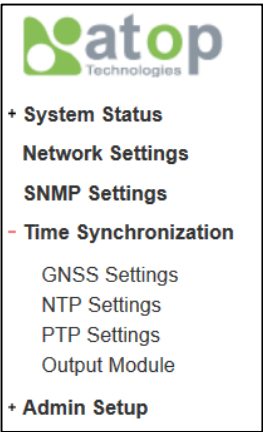


Figure 2.9 Time Synchronization Sub-Menu

2.5.1 GNSS Settings

NTS7X00 embeds a high-precision GNSS Module allowing it to use different GNSS Systems, based on the user Preference. It supports American GPS, Russian GLONASS, Chinese BEIDOU and European GALILEO. In the GNSS Settings page the user can choose the primary GNSS constellation and set some offset because of the length of the cable separating the device from the external Antenna.

Time Synchronization > GNSS Settings

GNSS Settings

Use this page to select the default GNSS System to be used for time reference, and the backup GNSS in case of failure of the primary for redundancy.

Warning: GPS is the only GNSS system that is designed to support leap second

| | |
|----------------------------|---------------------------------------------------------------------------------------|
| GNSS Settings | |
| Cable Latency | <input type="text" value="0"/> meters x <input type="text" value="4.10"/> ns/m = 0 ns |
| Primary GNSS Constellation | <input type="text" value="GPS"/> |

Save & Apply Cancel

Figure 2.10 GNSS Settings page

Table shown below explains the meaning of the fields.

Table 2.4 Description of GNSS Setting Parameters

| Label | Description | Factory Default |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Cable latency | User can input in this field the cable-specific latency per meter. Please note that using of RG-58 cable is suggested, which latency is 4.1 ns/m. Not mandatory | 4.1 ns/m |
| Cable length | The cable length. The System will calculate the total offset in PTP time by deducting the cable/specific latency multiplied times the cable length in meters from the GPS Time | 50 m |
| Primary GNSS Constellation | Allows the user to choose what is the constellation to be used as reference. When making this setting, please consider that the messages related to a change in leap-second (+1 or -1, happening either on 12/31 st or on 6/30 th) are broadcasted only via GPS and therefore GPS is the recommended setting | GPS |

2.5.2 NTP Settings

NTS7X00 supports both NTP client and NTP server. When not connected to a Primary Time Reference Clock (PTRC), or the so-called Stratum 0 clock (in this case the GNSS time), NTS7X00 can obtain its current time automatically through NTP client. NTP client will update its clock based on the NTP server defined in the configuration page that follows.

When Synced to GNSS, NTS7X00 can act as a precise NTP server on the local Area network, taking the role of a Stratum 1 clock. The Synchronization accuracy inside the LAN itself will be in the Millisecond range.

Note:

- The accuracy of NTP Client Synchronization happening through the public internet is ~20/30 ms.
- Since NTP Client requires an internet connection, make sure that the network is also connected to the internet and that the Domain Name Server field in Network Settings is set correctly.
- Given the bad accuracy of time delivered through the Internet (NTP), when the System time is obtained this won't be available for time Synchronization on PTP on then Local Area Network.

NTS7X00 allows to have its internal calendar (date) and clock (or system time) set automatically through NTP (Network Time Protocol) or SNTP (Simple Network Time Protocol) Client, until the GNSS is locked to UTC. Once this happens, this takes the priority over the time obtained from NTP/SNTP service, since it is more accurate than any time Synchronization protocol that is happening through the Internet.

NTS7X00 also supports NTP server. Once the device is locked to GNSS, NTS7X00 can act (if NTP server is enabled) as a stratum 1 NTP server. Stratum 0 time server is always the primary time reference clock (GNSS System).

The webpage shown in NTP Settings webpage (Figure 2.11) allows simultaneous settings of both NTP client and NTP server.

For setting date and time automatically upon start-up, enable Network Time Protocol Client (NTP) or Simple Network Time Protocol Client (SNTP) by checking the **Enable NTP** or **Enable SNTP** radio button (see note below for explanation). Then, the users must enter the NTP/SNTP Server 1 and NTP/SNTP Server 2 which will be used as the reference servers to synchronize date and time to. The users can specify the Time Server Query Period for synchronization which is in the order of seconds. The value for this period will depend on how much clock accuracy the users want the device to have.

A detailed explanation of the parameters is available in Table 2.5

Note: make sure the DNS are properly set in "Network Settings". For more information, refer to Section 2.3 above

Time Synchronization > NTP Settings

NTP Settings

NTP (Network Time Protocol) and SNTP (Simple Network Time Protocol) are used to Synchronize the date/time of devices on the network. NTP/SNTP Client will have NTS7X00 System time to be automatically set during startup. NTP Server will allow NTS7X00 to become the Stratum 1 NTP Clock on the local network, once Synchronized and locked to GNSS. Note: NTP/SNTP Client require DNS to be set in the Network settings page.

| | |
|---------------------|-----------------------------------------------------------------------|
| NTP Server Settings | |
| NTP Server | <input type="radio"/> Disable <input checked="" type="radio"/> Enable |
| NTP Client Settings | |
| NTP Client | <input checked="" type="radio"/> Disable <input type="radio"/> Enable |
| SNTP Client | <input checked="" type="radio"/> Disable <input type="radio"/> Enable |
| NTP/SNTP Server 1 | time.windows.com |
| NTP/SNTP Server 2 | time.windows.com |
| Query Period | 60 seconds (60 - 3600) |
| Holdover Threshold | 72 hours (1 - 2400) |

Save & Apply

Cancel

Figure 2.11 Webpage for Setting System Time and SNTP/NTP Client/Server

Table 2.5 Descriptions of the NTP/SNTP Client/Server

| Label | Description | Factory Default |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| NTP Server | Enables or Disables NTP Server function. NTP Server will become active only when NTS7X00 is locked to GNSS. The NTP server is reachable at the IP address set in the network page. | Disabled |
| NTP Client | Enables or Disables NTP Client function. See note below. | Disabled |
| SNTP Client | Enables or Disables SNTP Client function. See note below. | Disabled |
| NTP/SNTP Server 1 | Sets the first IP or Domain address of NTP Server . | time.nist.gov |
| NTP/SNTP Server 2 | Sets the 2 nd IP or Domain address of NTP Server. NTS will locate the 2 nd NTP Server if the 1 st Server fails to connect. | time-A.timefreq.bldrdoc.gov |
| Time Server Query Period | This parameter determines how frequently the time is updated from the NTP server. If the end devices require less accuracy, longer query time is more suitable since it will cause less load to the device. The setting value can be in between 60 – 259200 (72 hours) seconds. | 60 seconds. |
| Holdover Threshold | Time, in hours defining the moment after which the System time should be referred to NTP and no longer to the synchronized GNSS time. In the event of NTS7X00 synchronizing to GNSS, its internal time would be considered more accurate than relying to external NTP servers. In the event of a connection to GNSS loss (antenna damage, cable damage, etc..), the NTS7X00 will maintain its reference to GNSS time for “Holdover | 72 hours |

| | | |
|--|---------------------------------------------------------------------------------------|--|
| | threshold" hours. After elapsing, the system time will be replaced by NTP client time | |
|--|---------------------------------------------------------------------------------------|--|

Note:

- **NTP:** Network Time Protocol is used to synchronize the computer systems' clocks with a standard NTP server. Examples of two NTP servers are *time.nist.gov* and *time-A.timefreq*
- **SNTP:** Simple Network Time Protocol is used to synchronize the computer systems' clocks with a standard SNTP server. Examples of two SNTP servers are *time.nist.gov* and *time-A.timefreq*
.blldrdoc.gov.

2.5.3 PTP Settings

The IEEE1588v2 settings of Grandmaster Clock NTS7X00 can be set from the PTP Settings Webpage. The page is divided in three sections:

- 1) PTP Master Settings: used to specify Device-specific property to offset the cable latency
- 2) Gigabit Combo Port 1 PTP settings
- 3) Gigabit Combo Port 2 PTP settings

Each port can be configured in a different way and with different PTP profiles coexisting on the same machine, in the event different networks have different Synchronization requirements.

The Grandmaster clock will start the Synchronization process only after the GNSS module successfully locked to a Primary Time Reference Clock (GPS, GLONASS or BEIDOU). Please note that once powered on and connected through the BNC cable to the GNSS Antenna, the device will take approximately 30 minutes to Synchronize.

Once Locked to GNSS, the PPS Led will start to blink with 1s frequency and the GNSS Lock LED will be turned on. The display will show the current UTC date and time, as well as the GNSS Lock status.

If, after Synchronization, the link to GNSS is lost for any reason, NTS7X00 will switch to holdover mode and will continue to issue Synchronization packets according to the settings made but it will rely on its internal high-accuracy oscillator for issuing PPS output and for timekeeping. The holdover performance is for NTS7500: <1 µs/ 24 hours.

Below in Figure 2.12 the PTP settings are displayed for Port 1. Port 2 replicate the same settings. Note that after setting the desired PTP options, please click Save & Apply button to allow the new configuration to take effect. The device will then reboot. Please allow around 1 minute for complete System startup. IEEE1588v2 allows a wide range of settings to be made. Recommended settings for specific applications are called profiles. Each profile contains a recommendation of settings. For example:

- IEEE1588v2 Default Profile requires Layer-2 transport, Multicast, End-to-End delay detection, One-step clock and announce/Sync frequency of 1 packet every second
- IEC/IEEE61850-9-3 Power Profile requires Layer-2 Transport with or without VLAN tagging, Multicast, Peer-to-Peer delay detection, one or two-step clock and announce/sync/delay frequency of 1 packet every second.
- ITU-T G.8275.2 requires Layer-3 Transport over IPv4 or IPv6*, Unicast or Unicast Negotiation, End-to-End delay detection and variable announce/sync frequencies based on the application.

*** Note:** IPv6 synchronization is not enabled by default on ATOP NTS7X00 family. For more information, please inquire the headquarter

Table 2.6 shows the meaning and the impact of each setting.

Time Synchronization > PTP Settings

PTP Settings

The PTP (Precision Time Protocol) is used to synchronize clocks throughout a computer network.

| LAN 1 PTP Settings | |
|----------------------|----------------------------------------------------|
| Status | <input checked="" type="checkbox"/> Enabled |
| Profile | No Profile |
| Transport Type | IPv4 |
| Mode | Multicast |
| Delay Detection Mode | End-to-End |
| Clock Accuracy | 100 ns <input checked="" type="checkbox"/> Dynamic |
| Synchronization Mode | Two-Step-Clock |
| Domain | 0 |
| Clock Class | 6 <input checked="" type="checkbox"/> Dynamic |
| Priority1 | 128 |
| Priority2 | 128 |
| Announce Interval | 1 (2^n seconds, n = -4 to 7) = 1 seconds |
| Sync Interval | 0 (2^n seconds, n = -4 to 7) = 1 seconds |

Figure 2.12 PTP Setting Webpage, port 1

Table 2.6 Description of PTP Setting Parameters

| Label | Description | Factory Default |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Status | Enabled/Disable the PTP function on Port X. This is the main option that needs to be enabled so that the port's PTP function will work according to other parameters defined in this table. | Unchecked |
| Transport | Select Ethernet (layer 2) or layer 3 (UDP/IPv4 or UDP/IPv6*) transports for PTP (Precision Time Protocol) messages. | Ethernet |
| Mode [hidden] | This field is shown only when for "Transport" IPv4 or IPv6* is selected. When operating in Layer-3 mode, the user can select whether it uses a unicast or a multicast address. See Figure 2.14 for an example. | Hidden (multicast) |
| IPv6 Primary Scope [hidden] | This field is shown only when for "Transport" IPv6* is selected and when as "mode" Multicast is selected. This field allows the selection of the IPv6 multicast address to be used for Synchronization. See Figure 2.15 for an example | Hidden (FF05::181) |
| Unicast Negotiation [hidden] | This field is shown only when for "Transport" IPv4 or IPv6* is selected and when as "Mode", unicast is selected. Set the radio button as "Enabled" to allow the GM to allow automatically negotiation of a Synchronization contract with the slave requesting it. See Figure 2.16 for an example Set the radio button as "Disabled" to manually list the IP addresses of the slaves that should be Synchronized. When Disabled is selected, the IP address field is enabled. To add an IP address, type it in the IP address Field and click Add . To remove a specific IP address, select it from the list and click on the Remove button. See Figure 2.17 for an example. | Hidden (Enabled) |

| | | |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| Delay Detection Mode | Select the delay detection mode of the PTP (Precision Time Protocol). The device allows two modes: End-to-End or Peer-to-Peer. In End-to-End mode, the delay is measured between the end node (Slave) and the grandmaster, where the Slave issues <i>Delay_Req</i> packet and Grandmaster issues <i>Delay_Resp</i> packet. In Peer-to-Peer mode, the delay is measured at each node of the network, where the peer device (normally a Peer-to-Peer transparent clock) issues a <i>PDelay_Req</i> message and the Grandmaster replies with <i>PDelay_Resp</i> / <i>PDelay_Resp_FollowUp</i> | End-to-End |
| Clock Accuracy | The grandmaster clock issues according to the standard, an <i>announce</i> packet describing its properties. This is relevant for BMCA (Best master clock algorithm) to correctly designate the best clock on the network. Inside this field, the System informs other GMs on the network about its current estimated offset to UTC, based on its status. If "Dynamic" is checked, NTS7X00 will automatically adjust its accuracy based on the Oscillator's properties and on how long the device has been running in holdover mode [recommended setting]. If "Dynamic" is not checked, NTS7X00 will statically use the defined value. | Dynamic checked 100ns accuracy (static) |
| Synchronization Mode | Defines whether the GM is operating in one-step clock or in two-step clock mode. When "one-step" is set, the timestamp will be added by the hardware during egress of the Sync packet. When "two-step" is set, the timestamp related to the <i>Sync</i> packet egress time will be added in the <i>Follow_Up</i> packet | Two-Step Clock |
| Domain | Defines the clock Domain | 0 |
| Clock Class | Clock Class represents clock's accuracy level and it is relevant for BMCA clock selection. The PTP standard defines the meaning of each clock class (example: class 6 is assigned to a Master clock locked to GNSS, class 7 is assigned to a Master clock in holdover mode). It is an attribute of a clock. It denotes time traceability or frequency distributed by the grandmaster clock. Please refer to IEEE 1588-2008, Table 5 for definitions, allowed values, and interpretation. | Dynamic Checked |
| priority 1 | Set the clock priority 1 field, relevant to BMCA. The lower values take precedence to be selected as the master clock in the best master clock algorithm, 0 = highest priority, 255 = lowest priority. | 128 |
| priority 2 | Set the clock priority 2 field, relevant to BMCA. The lower values take precedence to be selected as the master clock in the best master clock algorithm, 0 = highest priority, 255 = lowest priority. | 128 |
| Announce Interval | Defines the frequency of the <i>Announce</i> packets (containing Priority 1, Priority 2, Clock class, Clock accuracy and all other fields relevant for BMCA) to be sent out as a power of 2. The value 0 ($2^0 = 1$) defines 1 <i>Announce</i> packet per second. The value 2 ($2^2 = 4$) defines 4 <i>Announce</i> packets per second (one packet every 0.25 s) | 0 |
| Sync Interval | Defines the frequency of the <i>Sync</i> and <i>Follow_Up</i> packets and defines the actual Synchronization frequency as a power of 2. The value 0 ($2^0 = 1$) defines 1 <i>Sync</i> (and <i>Follow_Up</i> , if two-step clock is selected) packet per second. The value 2 ($2^2 = 4$) defines 4 <i>Sync</i> (and <i>Follow_Up</i> , if two-step clock is selected) packets per second (one packet every 0.25 s) | 0 |

Time Synchronization > PTP Settings

PTP Settings

The PTP (Precision Time Protocol) is used to synchronize clocks throughout a computer network.

| LAN 1 PTP Settings | |
|----------------------|------------------------------------------------------|
| Status | <input checked="" type="checkbox"/> Enabled |
| Profile | IEC/IEEE61850-9-3 Power Profile ▾ |
| Transport Type | Ethernet ▾ |
| Delay Detection Mode | Peer-to-Peer ▾ |
| Clock Accuracy | 100 ns ▾ <input checked="" type="checkbox"/> Dynamic |
| Synchronization Mode | Two-Step-Clock ▾ |
| Domain | 0 |
| Clock Class | 6 <input checked="" type="checkbox"/> Dynamic |
| Priority1 | 128 |
| Priority2 | 128 |
| Announce Interval | 0 (2 ⁿ seconds, n = -4 to 7) = 1 seconds |
| Sync Interval | 0 (2 ⁿ seconds, n = -4 to 7) = 1 seconds |

Figure 2.13 PTP Setting Webpage, IEC/IEEE61850-9-3 Power Profile (Ethernet/Multicast/P2P) Example

| LAN 1 PTP Settings | |
|----------------------|------------------------------------------------------|
| Status | <input type="checkbox"/> Enabled |
| Transport Type | IPv4 ▾ |
| Mode | Multicast ▾ |
| Delay Detection Mode | End-to-End ▾ |
| Clock Accuracy | 100 ns ▾ <input checked="" type="checkbox"/> Dynamic |
| Synchronization Mode | Two-Step Clock ▾ |
| Domain | 0 |
| Clock Class | 6 <input checked="" type="checkbox"/> Dynamic |
| Priority1 | 128 |
| Priority2 | 128 |
| Announce Interval | 0 2^x seconds (1 seconds) |
| Sync Interval | 0 2^x seconds (1 seconds) |

Figure 2.14 PTP Setting Webpage, IPv4 Multicast Example

| LAN 1 PTP Settings | |
|----------------------|------------------------------------------------------|
| Status | <input type="checkbox"/> Enabled |
| Transport Type | IPv6 ▾ |
| IPv6 Primary Scope | FF05::181 ▾ |
| Mode | Multicast ▾ |
| Delay Detection Mode | End-to-End ▾ |
| Clock Accuracy | 100 ns ▾ <input checked="" type="checkbox"/> Dynamic |
| Synchronization Mode | Two-Step Clock ▾ |
| Domain | 0 |
| Clock Class | 6 <input checked="" type="checkbox"/> Dynamic |
| Priority1 | 128 |
| Priority2 | 128 |
| Announce Interval | 0 2^x seconds (1 seconds) |
| Sync Interval | 0 2^x seconds (1 seconds) |

Figure 2.15 PTP Setting Webpage, IPv6* Multicast Example

| LAN 1 PTP Settings | |
|----------------------|-------------------------------------------------------------------------|
| Status | <input type="checkbox"/> Enabled |
| Transport Type | IPv4 |
| Mode | Unicast |
| Delay Detection Mode | End-to-End |
| Unicast Negotiation | <input checked="" type="radio"/> Enabled <input type="radio"/> Disabled |
| | IP: <input type="text"/> |
| | <div>AddRemove</div> |
| | <div></div> |
| Clock Accuracy | 100 ns <input checked="" type="checkbox"/> Dynamic |
| Synchronization Mode | Two-Step Clock |
| Domain | 0 |
| Clock Class | 6 <input checked="" type="checkbox"/> Dynamic |
| Priority1 | 0 |
| Priority2 | 0 |
| Announce Interval | 0 2^x seconds (1 seconds) |
| Sync Interval | 0 2^x seconds (1 seconds) |

Figure 2.16 PTP Setting Webpage, IPv4 Unicast Negotiation Example

| LAN 1 PTP Settings | |
|----------------------|-------------------------------------------------------------------------|
| Status | <input type="checkbox"/> Enabled |
| Transport Type | IPv4 |
| Mode | Unicast |
| Delay Detection Mode | End-to-End |
| Unicast Negotiation | <input type="radio"/> Enabled <input checked="" type="radio"/> Disabled |
| | IP: <input type="text"/> |
| | <div>AddRemove</div> |
| | <div></div> |
| Clock Accuracy | 100 ns <input checked="" type="checkbox"/> Dynamic |
| Synchronization Mode | Two-Step Clock |
| Domain | 0 |
| Clock Class | 13 <input checked="" type="checkbox"/> Dynamic |
| Priority1 | 0 |
| Priority2 | 0 |
| Announce Interval | 0 2^x seconds (1 seconds) |
| Sync Interval | 0 2^x seconds (1 seconds) |

Figure 2.17 PTP Setting Webpage, IPv4 Unicast Example

2.5.4 Output Module Settings

NTS7X00 can be equipped with optional output modules. These output modules support multiple legacy standards, such as IRIG-B, BCD, BJT, ST, ST with Checksum. Please see Figure 2.18 for reference on the UI.

Note: the output module should be installed with the device powered off. If no output module is installed, or only one of the two modules is installed, then this page will display no module or one module only respectively.

Time Synchronization > Output Module

Output Module Settings

Please use this webpage to configure the Serial or TTL outputs from the installed output modules.

| Slot 1 | |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Port 1 | <input type="radio"/> Disabled <input type="radio"/> IRIG-B <input checked="" type="radio"/> BCD <input type="radio"/> BJT <input type="radio"/> ST <input type="radio"/> ST with Checksum |
| Port 2 | <input checked="" type="radio"/> Disabled <input type="radio"/> IRIG-B <input type="radio"/> BCD <input type="radio"/> BJT <input type="radio"/> ST <input type="radio"/> ST with Checksum |
| Port 3 | <input type="radio"/> Disabled <input checked="" type="radio"/> IRIG-B <input type="radio"/> BCD <input type="radio"/> BJT <input type="radio"/> ST <input type="radio"/> ST with Checksum |
| Port 4 | <input type="radio"/> Disabled <input type="radio"/> IRIG-B <input type="radio"/> BCD <input checked="" type="radio"/> BJT <input type="radio"/> ST <input type="radio"/> ST with Checksum |
| Port 5 | <input type="radio"/> Disabled <input checked="" type="radio"/> IRIG-B <input type="radio"/> BCD <input type="radio"/> BJT <input type="radio"/> ST <input type="radio"/> ST with Checksum |
| Port 6 | <input type="radio"/> Disabled <input type="radio"/> IRIG-B <input type="radio"/> BCD <input type="radio"/> BJT <input checked="" type="radio"/> ST <input type="radio"/> ST with Checksum |
| Port 7 | <input type="radio"/> Disabled <input type="radio"/> IRIG-B <input type="radio"/> BCD <input type="radio"/> BJT <input type="radio"/> ST <input checked="" type="radio"/> ST with Checksum |
| Port 8 | <input type="radio"/> Disabled <input type="radio"/> IRIG-B <input checked="" type="radio"/> BCD <input type="radio"/> BJT <input type="radio"/> ST <input type="radio"/> ST with Checksum |

| Slot 2 | |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Port 1 | <input type="radio"/> Disabled <input type="radio"/> IRIG-B <input type="radio"/> BCD <input type="radio"/> BJT <input type="radio"/> ST <input checked="" type="radio"/> ST with Checksum |
| Port 2 | <input type="radio"/> Disabled <input type="radio"/> IRIG-B <input type="radio"/> BCD <input type="radio"/> BJT <input type="radio"/> ST <input checked="" type="radio"/> ST with Checksum |
| Port 3 | <input type="radio"/> Disabled <input type="radio"/> IRIG-B <input type="radio"/> BCD <input type="radio"/> BJT <input type="radio"/> ST <input checked="" type="radio"/> ST with Checksum |
| Port 4 | <input type="radio"/> Disabled <input type="radio"/> IRIG-B <input type="radio"/> BCD <input type="radio"/> BJT <input type="radio"/> ST <input checked="" type="radio"/> ST with Checksum |
| Port 5 | <input type="radio"/> Disabled <input type="radio"/> IRIG-B <input type="radio"/> BCD <input type="radio"/> BJT <input type="radio"/> ST <input checked="" type="radio"/> ST with Checksum |
| Port 6 | <input type="radio"/> Disabled <input type="radio"/> IRIG-B <input type="radio"/> BCD <input type="radio"/> BJT <input type="radio"/> ST <input checked="" type="radio"/> ST with Checksum |
| Port 7 | <input type="radio"/> Disabled <input type="radio"/> IRIG-B <input type="radio"/> BCD <input type="radio"/> BJT <input type="radio"/> ST <input checked="" type="radio"/> ST with Checksum |
| Port 8 | <input type="radio"/> Disabled <input type="radio"/> IRIG-B <input type="radio"/> BCD <input type="radio"/> BJT <input type="radio"/> ST <input checked="" type="radio"/> ST with Checksum |

Save & Apply

Cancel

Figure 2.18 Output Module Settings Webpage - Example

Please select the standard applicable on each port, and click “Save and Apply” to make the changes operational. The device will reboot. IRIG-B, BCD, BJT, ST and ST with Checksum are delivered in RS-485 standard

2.6 Admin Settings

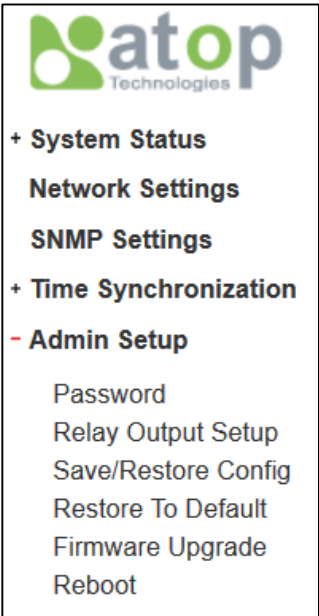


Figure 2.19 Admin Settings Sub-Menu

2.6.1 Password

Password “default” is set for the device when it is manufactured. Users can modify it password to ensure overall system security. The user name and password can be updated in this page as shown in Figure 2.20. Setting for a local authentication is introduced in this subsection, while setting for a remote authentication is described in later sections. The user name and password set here are applied to all types of access to ATOP’s GM: web management user interface (UI) and secure shell (SSH). Please click on the “Save & Apply” button to update the user name and password information on the device.

Table 2.7 summarizes the description of each field.

Admin Setup > Password

Admin Settings

Set up the login user name and password.

| Account Settings | |
|---------------------|------------------------------------|
| User name | <input type="text" value="admin"/> |
| Old password | <input type="password"/> |
| New password | <input type="password"/> |
| Repeat new password | <input type="password"/> |

Figure 2.20 Password Setting Webpage

Table 2.7 Descriptions of Password Setting

| Label | Description | Factory Default |
|---------------------|---------------------------------------------------------------------------------------------------------------------|-----------------|
| User name | Username (not changeable) | admin |
| Password | Old Password to log-in. Max. 15 characters. | default |
| New Password | New Password. Max.15 characters. | NULL |
| Repeat New Password | Repeat new Password. This has to be exactly the same as the password entered in the above field. Max.15 characters. | NULL |

2.6.2 Relay Output settings

Figure 2.21 below shows the Relay Output Setup webpage. Different events can be configured to trigger different actions, such as activate Relays, generate an SNMP Trap or turn on the Alarm LED. Flag the related event and click "Save & Apply" to make the settings changes operational.

Admin Setup > Relay Output Setup

Alarm Settings

Please use this webpage to define the Relay and Device's alarm features behavior when specific conditions are met

| Alarm Settings | |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| PWR1 or PW2 not intsalld | <input type="checkbox"/> Relay 1 <input type="checkbox"/> Relay 2 <input type="checkbox"/> Trap <input type="checkbox"/> Alarm LED |
| Warm Start | <input type="checkbox"/> Relay 1 <input type="checkbox"/> Relay 2 <input checked="" type="checkbox"/> Trap <input type="checkbox"/> Alarm LED |
| GNSS Signal Lost | <input type="checkbox"/> Relay 1 <input type="checkbox"/> Relay 2 <input type="checkbox"/> Trap <input type="checkbox"/> Alarm LED |

Save & Apply

Cancel

Figure 2.21 Relay output and alarm settings

2.6.2.1 Save/Restore config

Admin Setup > Save/Restore Config

Save/Restore Configuration

Click **Save** to save the system configuration. Click **Restore** to restore saved system configuration.

Save

Restore

Figure 2.22 shows the webpage for Backup/Restore the configuration via HTTP. It is divided into two parts: **Backup the Configuration** and **Restore the Configuration**. When clicking on the **Save** button (**Backup the Configuration**), the users will be prompt to **Opening** the file name save_config.tar by an application or to **Save File** to a destination. Choosing to Save File will back up the Grandmaster's current configuration to your local drive on the local computer. The device's password won't be saved.

To restore a configuration file to NTS7X00, please click the **Restore** button. A pop-up will inform you that the password won't be imported during the restore phase as shown in Figure 2.23. After clicking **OK**, select the configuration file to import in the device and click open as shown in Figure 2.24. The system will reboot.

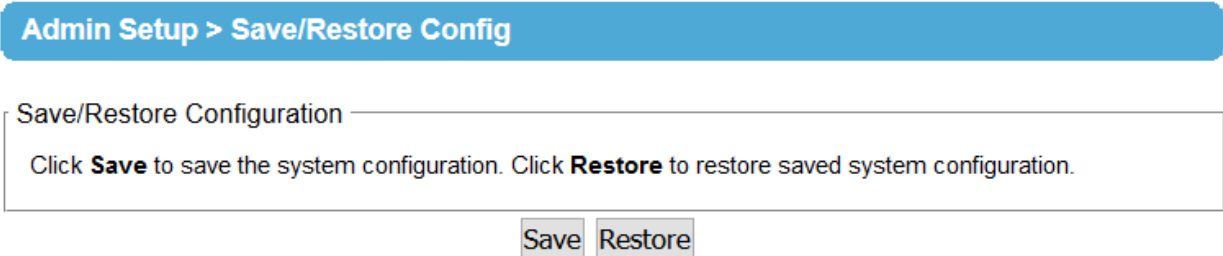


Figure 2.22 Backup/Restore Configuration via HTTP

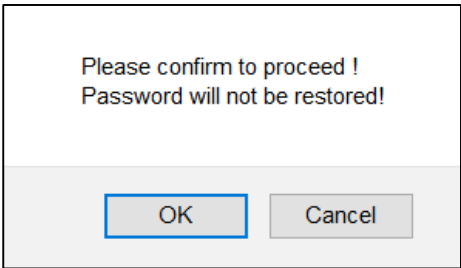


Figure 2.23 Configuration restore warning

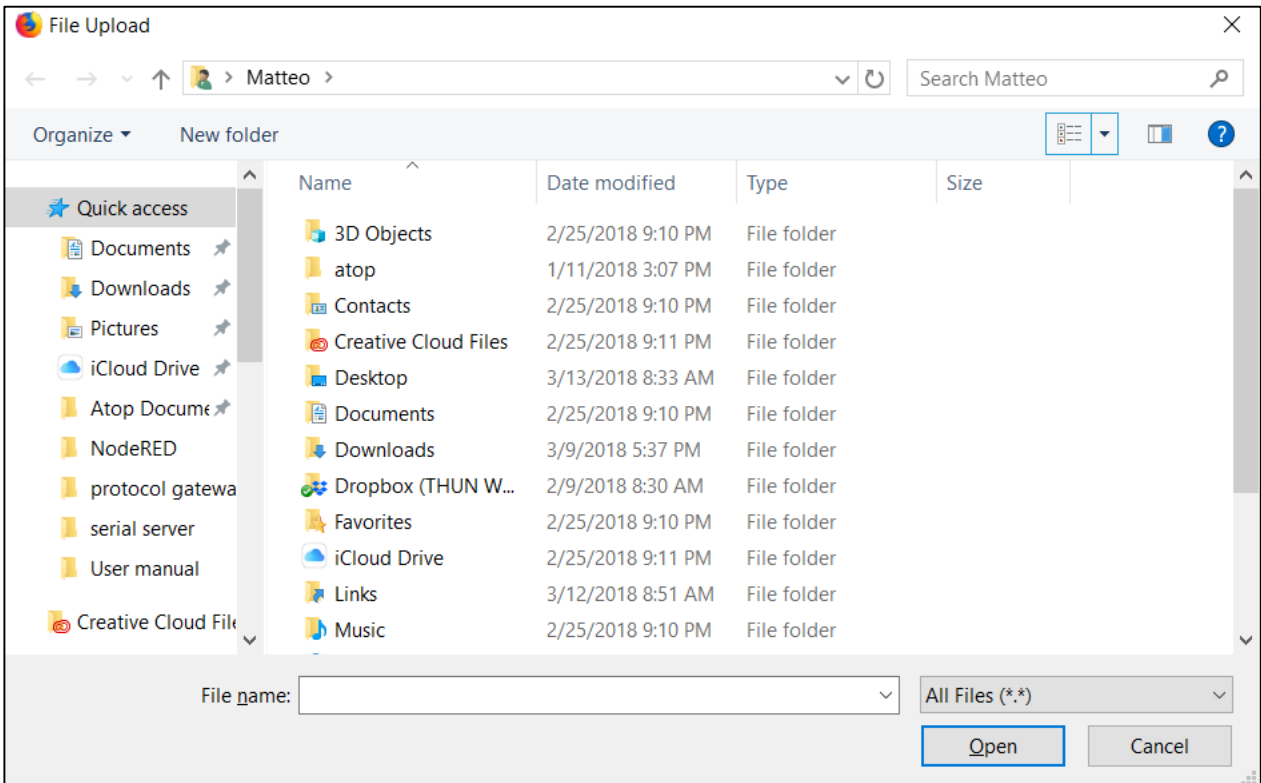


Figure 2.24 Restore configuration file window

2.6.3 Firmware Update

The users can update the device firmware via web interface as shown in Figure 2.25. To update the firmware, the users can download a new firmware from ATOP's website and save it in a local computer. Then, the users can click **Browse...** button and choose the firmware file that is already downloaded. The device's firmware typically has a ".dld" extension such as NTS7500-K306.dld. After that, the users can click **Update** button and wait for the update process to be done. Alternatively, the firmware update can also be performed using the Device Management Utility.

Note: please make sure that the device is plug-in all the time during the firmware upgrade.

Admin Setup > Firmware Upgrade

Firmware Upgarde

Click on the browse buttons to select the new firmware images and click on "Submit" to start the upgradation process.

| | | |
|-------------|-----------------------------------------------|---------------------------------------|
| Kernel | <input type="text" value="No file selected"/> | <input type="button" value="Browse"/> |
| Application | <input type="text" value="No file selected"/> | <input type="button" value="Browse"/> |

Figure 2.25 Firmware Update Webpage

2.6.4 Factory Default Setting

When the device is not working properly, the users can reset it back to the original factory default settings by clicking on the **Reset** button as shown in Figure 2.26.

Admin Setup > Restore To Default

Restore

Click **Restore** to restore the factory default settings.
Wait a minute before logging into the device again.
Adjust your PC LAN setting according to the new device's configuration if needed.

Figure 2.26 Factory Default Setting Webpage

2.6.5 Reboot

An easy reboot function is provided in this webpage requiring only one single click on the **Reboot** button as shown in Figure 2.27.

Admin Setup > Reboot

Reboot

Click **Reboot** to have the device performing a software restart.
Wait a minute before logging into the device again.
Adjust your PC LAN setting according to the new device's configuration if needed.

Figure 2.27 Reboot Webpage



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