

**User Manual
Quad Port Network Time Server
NTP-800**

P/N 040600202

**900000200 Revision A
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Safety Warnings



WARNING:

The lightning flash with an arrowhead inside of an equilateral triangle is intended to alert the user to the presence of un-insulated “dangerous voltage” within the product’s enclosure. The “dangerous voltage” may be of sufficient magnitude to constitute a risk of electrical shock to people.



WARNING:

This unit contains dual power supplies. Isolate BOTH power supplies from power before removing the top cover.



CAUTION:

Observe all necessary precautions for handling electrostatic discharge sensitive devices when handling component modules. Improper handling will damage internal circuitry.

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Quad Port Network Time Server (NTP-800)

1 System Overview

1.1 Introduction to the NTP800 Multiport Time Server

This manual shows you how to install, configure and operate your NTP800 to provide an NTP time server for your network. Once up and running the NTP800 will provide accurate time synchronization for your computer clients to within microseconds on a LAN and tens of milliseconds over a WAN,

Prior to installing the NTP800 please read the site preparation section first to ensure the smooth operation of your NTP800 when it is installed. Then follow the quick setup guide to get your NTP800 up and running. The remaining sections give more details on the configuration and operation of the NTP800.

1.2 NTP-800 system overview

The NTP800 time server is a stratum 1 NTP server that can synchronize from up to three external reference sources; GNSS, IRIG and serial time of day with PPS. There is also a 10MHz input to maintain the timescale during periods of holdover.

The user can choose to select which of the reference sources is in use or allow the unit to arbitrate amongst the available sources by using the TimeWall™ time validation & verification algorithm. In this mode the sources have a default priority order of GNSS, IRIG, Time of Day and 10MHz. Any of the reference sources can be promoted to the top priority, the remaining ones demoted in the same order. All the sources are continually monitored to ensure that they are the best source of time synchronization.

In addition, if the reference source is removed or not present, the unit can operate in peer to peer mode with up to four NTP peer servers defined, the NTP stratum level changing accordingly.

The network interfaces to NTP800 allow either an SFP module to be fitted or the RJ45 associated with a port to be used. If an SFP module is fitted the RJ45 connection is disabled. The four network ports are entirely isolated from each other.

The NTP800 provides frequency output of 1pps and 10MHz and time outputs of IRIG DCLS or AC (depending on model) and serial time of day in RS422 and RS232.

Figure 1 - NTP-800 Block Diagram

1.3 Specifications (Basic Unit)

1.3.1 Reference Inputs

Commercial GNSS

GPS Pulse-per-second (1PPS) Input
 GPS Have Quick Time Code Input
 External IRIG B Input
 External Sync Input (applicable when internal GPS option is installed)
 External 10MHz Reference Input

Connector IEC 320 standard, optional
 MS3102A-10SL-3P

Physical Dimensions

Length (depth)
 Width 17.00" (Chassis) – 19.00" (Front Panel)

Height
 Weight

Cooling Requirements

Air Temperature -15°C to +53°C
 Altitude Conditions 1500 ft to +11,000 ft.

Shock and Vibration Requirements or Sensitivities

Functional (operating) Shock
 MIL-STD 810F Method 516.5
 Procedure I

Bench Handling Shock
 MIL-STD 810F Method 516.5
 Procedure VI

Vibration, Functional (operating)
 MIL-STD-167-1

EMI EN55022, EN55024, FCC Part 15
Safety CE Certified

1.3.2 Outputs

Pulse-per-second (1PPS) Output 1
 Have Quick Time of Day Output
 BCD Time Code Output
 IRIG B Time code Output
 Alarm Output
 Reference Frequency Outputs
 NTP Output
 Management

Power and Environmental Specifications

Power

No of Inputs 1 standard, 2 redundant optional
 Voltage 90-250VAC ±10% 50/60 Hz

2 Setup

Remove the NTP-800 from the shipping carton. The following items should be included in the shipment:

- 1x NTP-800
- 2x Power supply cables
- 1x CD-ROM containing User Manual and Utility Software

2.1 Installation

2.1.1 Site Preparation

2.1.1.1 Antenna

To prepare the site for the NTP800 installation a suitable antenna location has to be found.

The antenna is a sealed unit. It should be located outside where there is good sky-coverage (e.g. on a roof) and away from high frequency electrical interference sources. It is highly recommended to use the fixings supplied and not to make any additional holes for fixing since this compromises the IP65 rating of the antenna.

The antenna is supplied with 30m/100ft of RG58 cable. If longer cable runs are required, it is possible to use a higher quality cable such as RG213 or LMR-500, or the long reach GPS antenna option P/N 100DG000C. The long reach antenna allows the antenna to be connected via low cost CAT5 cable, at distances of up to 2000ft/1800m

Type of Cable	Maximum Length of Cable	Cable P/N
RG58	34m/120ft	002-037 (included)
LMR-500	100m/330ft	002-0108

2.1.1.2 Power

The NTP800 requires 90-240V AC @ 50-60Hz for power.
Power Consumption is <30W

2.1.1.3 Network

The NTP800 has four RJ45/SFP network connections. If an SFP module is fitted for a port, the associated RJ45 port is disabled.

2.1.1.4 Reference sources

The NTP800 requires a source of time in order to provide a traceable reference to NTP clients. The unit's time at power on is from a battery backed Real Time Clock. The available references are:

- GNSS (GPS/Glonass/Beidou) from the included GNSS receiver. This requires an antenna to be installed with appropriate view of the sky.
- Serial Time Code. The time code supported is IRIG B. Either the 1kHz modulated code (IRIG B127) or the DC Level Shift variant is supported (IRIG B007) depending on model and jumper settings.
- ASCII Serial time of day message (both RS422 or RS232 levels) with the support for the following protocols
 - NMEA0183 protocol \$GPZDA
 - TFS message 1 and 1pps.

2.1.2 Mounting

The NTP-800 can be installed into a 19" rack mount cabinet using rack slides. Slides are installed using 10-32 UNF-2B hardware.

Optional Rack Mount Slides:

P/N 002000123, SLIDE, RACK, 24", 21" TRAVEL, 85 LB

P/N 002000150, SLIDE, RACK, 28", 27" TRAVEL, 80 LB

Original Manufacturer: General Devices Chassis Trak Type C300.

2.1.3 Power

Insert the power cord of the NTP-800 into an electrical socket to power up the unit.

If dual redundant power is required, connect both power sources to independent power sources

2.1.4 Antenna

Connect the antenna to the BNC connector J17 labeled "GPS Antenna" on the rear of the unit.

2.1.5 Ethernet

Connect one end of an Ethernet patch cable to one of the Ethernet ports located on the rear of the unit (J1 – J8) . Connect the other end of the Ethernet cable to the network with an Ethernet hub or switch.

The network ports are supplied with default IP addresses of:

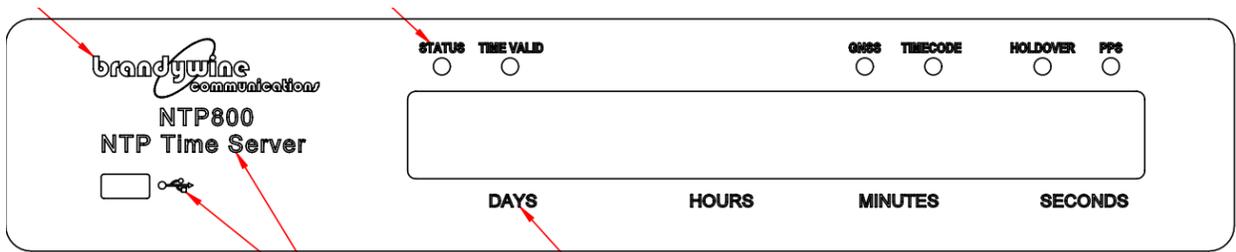
ETH1	192.168.102.92	J1/J2
ETH2	192.168.103.92	J3/J4

ETH3	192.168.104.92	J5/J6
ETH4	192.168.105.92	J7/J8

3 Configuration

Power on the NTP-800 by switching the rear Power Supply Module to the upwards “On” position.

To view the IP address depress the reset button on the rear of the unit for a maximum of 5 seconds and release. The 4 IP addresses are then rolled across the display for 10s each in sequence, expressed in the standard dot decimal format, with the left most digit indicating the port number 1 to 4



3.1 Accessing the NTP-800

Once the NTP-800 is powered on and connected to the network, open up a web browser on a device connected to the same network as the NTP-800. If prompted, enter the username and password for the device.

NOTE

The NTP-800’s factory settings have no default username and password for the system. Ensure you configure appropriate security settings for your environment after setting it up.

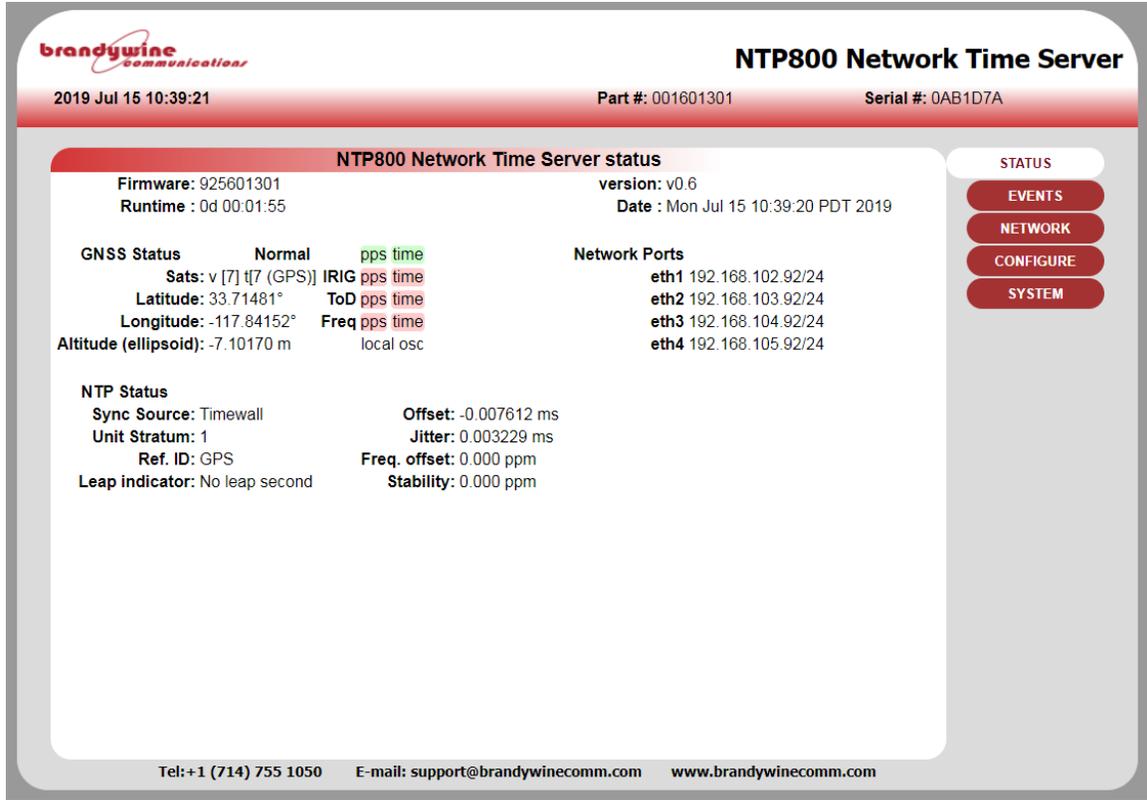


Figure 2 - NTP-800 Status Screen

Table 1 - NTP-800 Status Screen

Field	Description
Firmware	Displays the name of the NTP-800's firmware.
Runtime	The length of time that the NTP-800 has been powered on.
Version	Displays the current version of the NTP-800's firmware
Date	Displays the current date and time of day. This can either be the local time in the current time zone or UTC, depending on user settings.
GNSS Status	Displays the current status of the GNSS receiver.
Sats	Displays the current number of satellites tracked and satellites in view.
Latitude	Displays the current latitude of the GNSS receiver.
Longitude	Displays the current longitude of the GNSS receiver.
Altitude (ellipsoid)	Displays the current Altitude of the GNSS receiver.

Once connected, the NTP800 web page interface will show the status of the system.

3.1.1 Network Configuration

Use the network button on the right to select the network configuration page. This provides configuration for all the network settings, IP addresses, SNMP and service selection for the network ports.

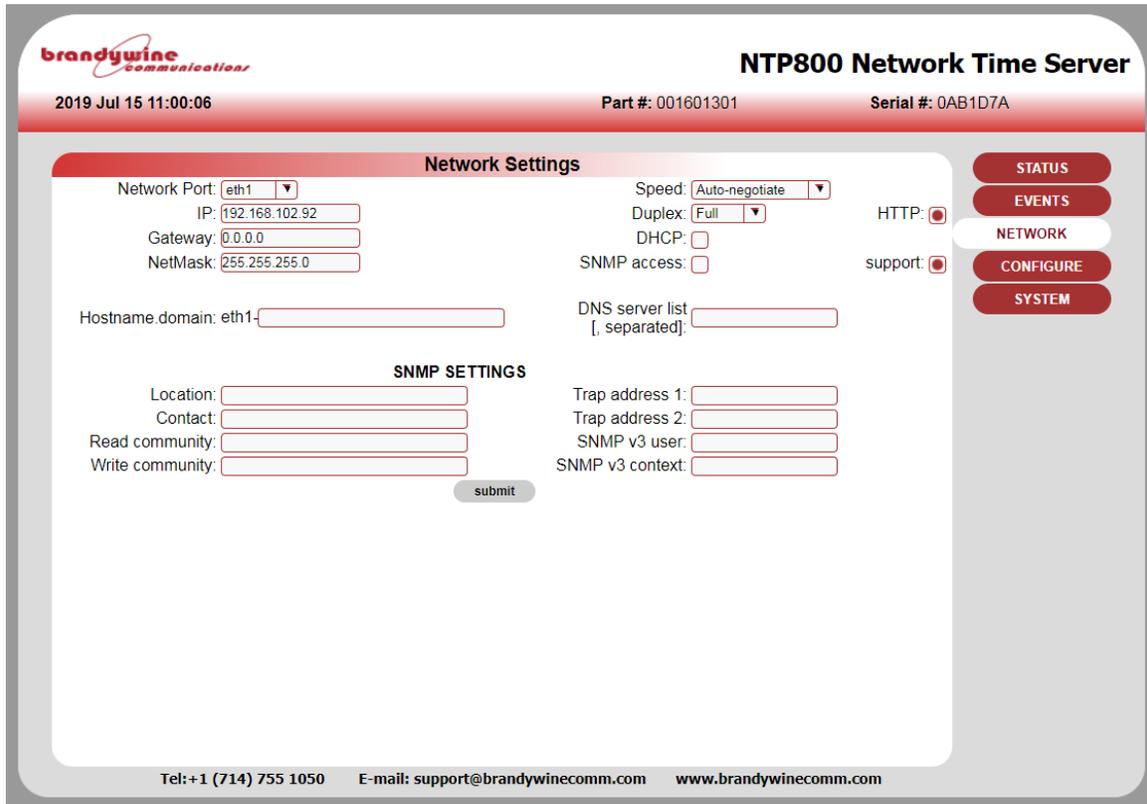


Figure 3. NTP800 Network Settings

Configure each port as required. Note that **submit** must be pressed for each port modified. Changing ports without submitting will lose any changes.

Select the services required for the port, SUPPORT provides SSH access and is used for factory support and firmware update when using SCP.

Once the settings have been made, press the **submit** button.

Depending on whether the IP address of the port being accessed is being changed the page will show either some reconfiguration information or a link to the new address. Click this link to return to the status page otherwise use the STATUS button. These steps are shown in more detail in section 5.2.

3.1.2 NTP Configuration

The supplied configuration will run the auto-arbitration mechanism between all the sources, GNSS, IRIG, Time of Day. With these initial settings and a GNSS antenna fitted the NTP800 will synchronize with GNSS and provide accurate time.

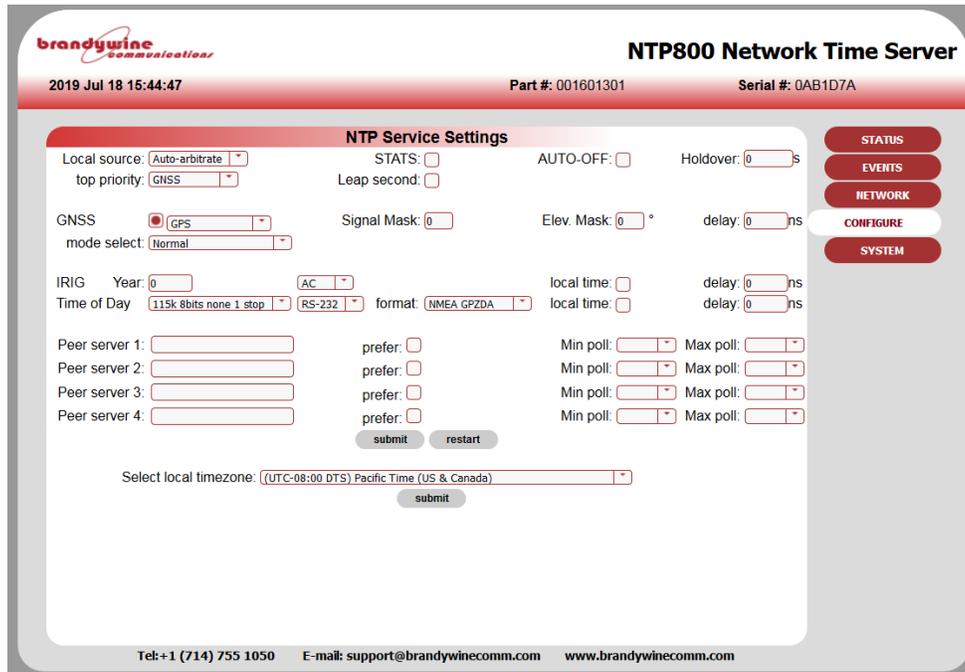


Figure 4 NTP800 Configuration Screen

When using peer to peer mode add the NTP peers' IP addresses as required along with a polling interval range this should be from 64s, the NTP standard.

Press **submit** to make the changes. Reconfiguration information is displayed. The STATUS button can be used to return to the status page.

Further details on the NTP configuration can be found in section 5.3.1

The NTP800 will now be configured and able to serve time on your network.

The following sections give further and more detailed descriptions on configuring and running the NTP800.

4 NTP800 Connections



Figure 5 NTP800 Rear Panel

4.1 Input Signal Connections

4.1.1 GNSS Antenna Connections (GNSS Version)

4.1.1.1 Standard GPS Antenna for NTP800 P/N 040002XX

The antenna is connected to the BNC port marked J17 GPS Antenna on the rear of the NTP800. The antenna connector is a BNC Socket (50 ohm) and its connections are;-

Center Pin: GPS Signal 1.6GHz (& +5v antenna amplifier power)
Shield: GPS Return.

4.1.1.2 Long Reach GNSS Antenna for NTP800 P/N 040003XX

The Long Reach Antenna P/N 100DG000C is connected to the RJ-45 connector labeled J16 Remote GPS.

Table 2 Long Reach Antenna Connections J16

Pin	Signal
1	+15 V /200mA max power
2	GND
3	1PPS-
4	Data In -
5	Data In +
6	1PPS+
7	Data Out -
8	Data Out +

4.1.2 IRIG B Time Code input

The IRIG B time code input is connected to BNC connector J15.
The pin connections are as follows

Center Pin: Time Code input
Shield: Time Code Return

This is internally configured for either Modulated (IRIG B12X) or IRIG DCLS (IRIG B00X)

Configuration for IRIG B12X Install JP23 Remove JP24

Configuration for IRIG B00X Install JP24 Remove JP23

4.1.3 ASCII Serial Time Of Day Input

Time of day input is available on RJ45 connector J9 using the pin out shown below. Either RS422 or RS232 electrical connections can be used and must be selected from the CONFIGURE->NTP webpage.

Table 3 J9 Pin Connections

Pin	Signal
1	No Connection
2	No Connection
3	RS422 RX-
4	GND
5	RS232 RX
6	RS422 RX+
7	No Connection
8	No Connection

4.1.4 1 PPS input

This 1PPS input is used to provide the on-time mark for the time of day. Time of day message will follow the PPS to which it is associated. The 1PPS input is connected to BNC connector J13.

The pin connections are as follows

Center Pin: 1PPS input, rising edge

Shield: 1PPS Return

Impedance: 50ohm

Voltage: 2.5 to 5.5V max

4.1.5 10MHz Input

The NTP800 can accept a 10MHZ sinewave output on BNC connector J11. The 10MHZ input can be used as a frequency reference input, and selected to provide holdover capability in the event that other references are lost.

The pin connections are as follows

Center Pin: 10MHz Input

Shield: 10MHz Return

Impedance: 50 ohm

Amplitude: 8 -15dBm

4.2 Output Connections

4.2.1 1 PPS output

The 1 Pulse per second (1PPS) output is directly generated from the NTP800 internal oscillator. This 1PPS output is the on-time mark for the NTP800 and can be used to measure the accuracy of the NTP800. The 1PPS output is connected to BNC connector J14. The 1PPS output may be enabled or disabled by means of a webpage setting as shown in Figure 6. The PPS output box should include the button highlighted as shown to enable the 1PPS output.

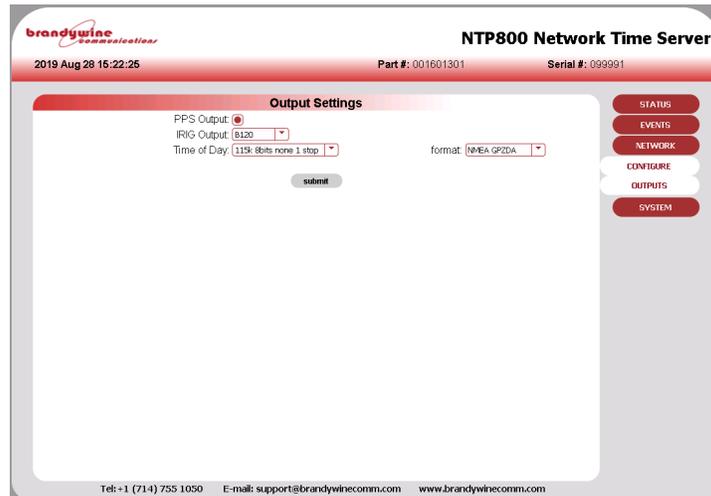


Figure 6 1PPS Output Enable/Disable

The pin connections are as follows

Center Pin: 1PPS output, rising edge
Shield: 1PPS Return
Voltage: >2.5V into 50ohm

NOTE

If enabled The 1PPS output will be available from initial power on, although it should be noted until the NTP800 has synchronized the 1 PPS will not be within the quoted accuracy specifications. Upon synchronization of the NTP800 to the selected reference, the 1PPS will be accurate to the quoted specifications.

4.2.2 IRIG Time Code Output

The NTP800 generates IRIG B serial time code in either carrier modulated (AC) or Unmodulated (DCLS) format. The code format is selected on the Output Setting webpage (Figure 7) and output on connector J16

The hardware selection for modulated code or DCLS code formats is made by hardware link selection internally.

Configuration for IRIG B12X Install JP25 Remove JP26

Configuration for IRIG B00X Install JP26 Remove JP25

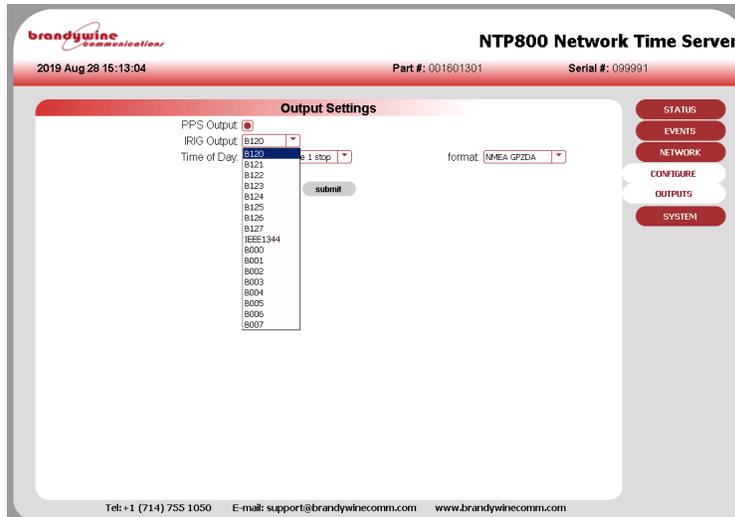


Figure 7 Configuring IRIG B output format

4.2.3 Time of day output

The time of day output is an RJ45 connection J10 with the following pin out. RS422 and RS232 are available from the pins shown below:

Table 4 J10 Pin Connections

Pin	Signal
1	RS422 TX+
2	RS422 TX-
3	No Connection
4	GND
5	RS232 RX
6	RS232 TX
7	No Connection
8	No Connection

The output format is defined in the CONFIGURE->OUTPUTS webpage. The Baud Rate may be set with the selections shown in Figure 8.

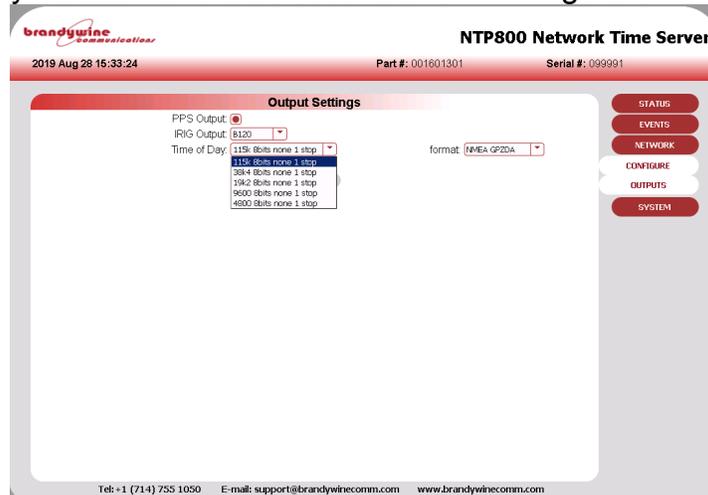


Figure 8 Baud Rate Selection for Time of Day Output

Currently the NTP800 supports two different message formats:

4.2.3.1 NMEA0183 Message format GPZDA

UTC day, month, and year, and local time zone offset

An example of the ZDA message string is:

\$GPZDA,172809.456,12,07,1996,00,00*45

4.2.3.1.1 ZDA message fields

Field	Meaning
0	Message ID \$GPZDA
1	UTC
2	Day, ranging between 01 and 31
3	Month, ranging between 01 and 12
4	Year
5	Local time zone offset from GMT, ranging from 00 through ± 13 hours
6	Local time zone offset from GMT, ranging from 00 through 59 minutes
7	The checksum data, always begins with *

Fields 5 and 6 together yield the total offset. For example, if field 5 is -5 and field 6 is +15, local time is 5 hours and 15 minutes earlier than GMT.

4.2.3.2 TFS Message1

Field	Meaning
1	BCD centiseconds
2	BCD seconds
3	BCD minutes
4	BCD hours
5	BCD Day of Week (00 = Sunday)
6	BCD Day of Month
7	BCD Month
8	BCD Year
9	0x00 = not leap year <i>or</i> 0x0F = leap year
10	0x00 = not Daylight Saving <i>or</i> 0x03 = Daylight Saving
11	0x00 = not synchronized <i>or</i> 0x3F =synchronized
12	0xFF

4.2.4 10MHz Output

The NTP800 provides a 10MHz sinewave output on BNC connector J12.

The pin connections are as follows

Center Pin:	10MHz output
Shield:	10MHz Return
Amplitude:	13 ±2dBm into 50ohm
Harmonics	<-35dBc
Non Harmonic	<-70dBc

The phase noise and stability of the 10MHz output are dependent upon the type of oscillator installed and also the stability of the reference being used.

4.3 Network Ports

Four independent Ethernet ports are available for interfacing to your network(s) and can use either the standard Ethernet RJ45 connections or and SFP module. If an SFP module is fitted the associated RJ45 connection port is disabled. The unit is also configured and monitored via a web GUI through a network connection.

The Network ports are labeled ETH1 ETH2 ETH3 ETH4.

Port characteristics are:

Speed: 10/100/1000BaseT
Electrical: RJ45 connection
SFP: 1Gbps

4.4 Power Connection

The AC power connector is suitable for 90-240V AC at 50/60Hz.

Use the power cord appropriate to the country of use. A locking cord is available for applications where the power cord must remain securely attached when the power cord may experience tension – typical examples are in integrated rack systems where the NTP800 is mounted on slide rails.

Table 5 Figure 9 Power Cord Ordering Information

Country	Power Cord Part Number
USA	415000044
UK	415000110
Europe	415000111
Australia	415000112
India/S Africa	415000113
Locking Cord (US)	415000073

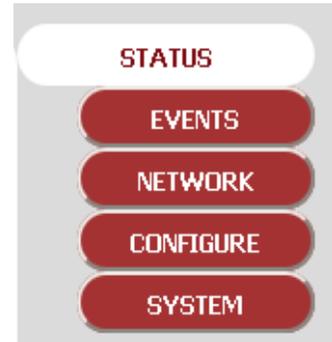
4.5 Default Setting / IP address button

Pressing this button for less than 5 seconds and releasing it causes the unit to display its four IP address in sequence for 10 seconds each. The 4 IP addresses are then given for 10s each in sequence, expressed as hexadecimal numbers. For example, “1C0 A8 67 5C” gives the IP address of Ethernet Port 1 as “192.168.103.92”

Pressing this button for more than 5 seconds and releasing it causes the unit to restore its default settings at the next power cycle.

5 Web-based configuration

The main configuration method is via the web interface. There are five main pages, two for status information and three for configuration. Access to any of these is via the navigation bar shown right.



The three pages that configure the unit are

- Network Set the network configuration for each of the three Ethernet ports and also the SNMP parameters.
- Configure Set up the operating parameters. There are two subpages, NTP for the input parameters and NTP parameters along with the local time zone and OUTPUTS to configure the unit output signals.
- System Set up all the unit's security credentials; web security to access the NTP800, SNMP v3 credentials and the NTP authentication keys.

The NTP800 is delivered with all the web security disabled so access to the unit for the first time does not require login details. It is highly recommended that these are set on first use to avoid unauthorised access.

All security credentials are case sensitive.

Login is not required for the STATUS and EVENT pages of the web interface.

Access the NTP800 with any browser, providing the configured credentials and select the SYSTEM page from the navigation menu.

The NTP800 uses a secure HTTPS protocol to access the webpages. There is an automatic redirection from the standard HTTP port to HTTPS.

Note that the security certificates used by the NTP800 are self-signed and created for each port. The certificates are not signed by a root CA and therefore on initial connection a browser will complain, however the exception should be approved and then the unit can be used without issue over the secure connection. On inspection of the certificate the browser should only complain that the certificate is self-signed and cannot be verified.

5.1 System Security

System security is managed using the System Setup Screen, shown in Figure 9. There are three protocols that this page allows security to be individually tailored for

1. Login credentials
2. Simple Network Management Protocol (SNMP)
3. Network Time Protocol

Correct configuration of these protocols is critical to the secure operation of the NTP800. Since misconfiguration can result in disabling access to the NTP800, it is strongly recommended that the user reads this section of the manual prior to making setup changes.

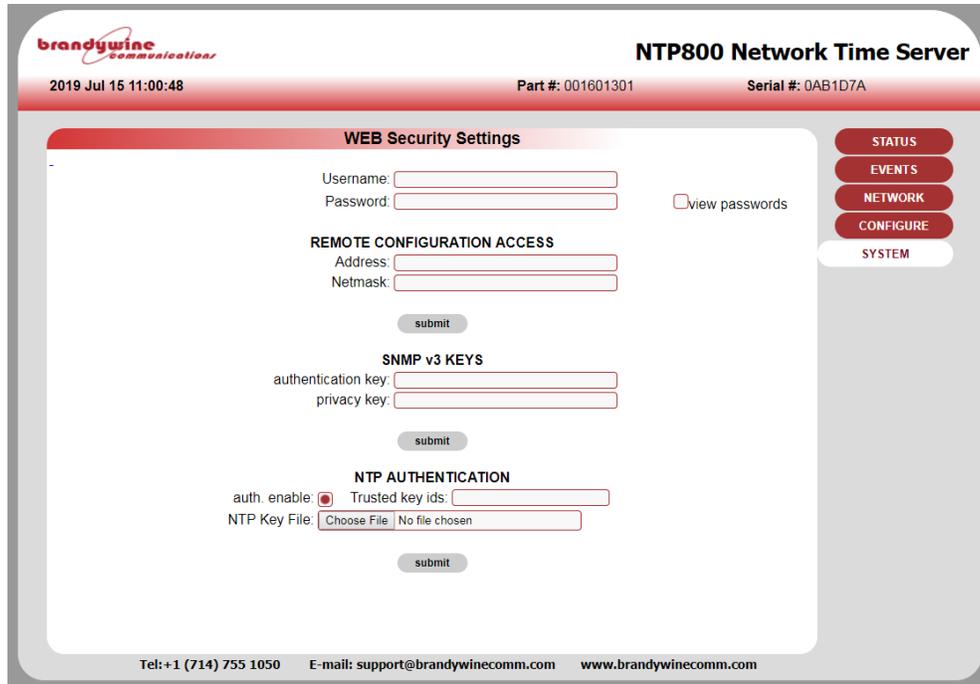
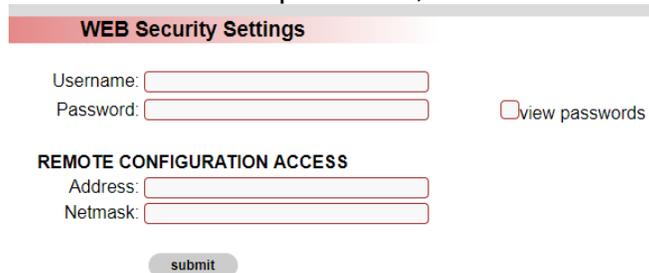


Figure 9 - NTP-800 System Screen

This page sets security configuration for the following items:

5.1.1 Login credentials:

Use these fields to set a username and password, and to control access to the NTP800.



This image shows a close-up of the 'WEB Security Settings' section of the web interface. It includes the following elements:

- A header bar with the text 'WEB Security Settings'.
- Input fields for 'Username:' and 'Password:'.
- A checkbox labeled 'view passwords'.
- A section header 'REMOTE CONFIGURATION ACCESS'.
- Input fields for 'Address:' and 'Netmask:'.
- A 'submit' button.

Enter the desired User name and Password and click on [Submit]
 If the [view passwords] box is checked, then the typed password is visible.

If the user name and password are left blank, then the login security is disabled (supplied default).

NOTE

Do not lose the details of the user name and password. If they are lost then the unit will have to be restarted and the factory defaults restored.

5.1.2 Remote Configuration Access

The remote configuration access limits access of the web interface to a single IP address or a range of IP addresses. Be extremely careful when setting these values since it is possible to lock out all access. The **address** and the **subnet** mask **MUST** agree.

To restrict access to a **subnet**, for example 192.168.102.x then **192.168.102.0/255.255.255.0** can be entered for the address and netmask. For the default factory network settings this would mean that only users on port ETH1 could access the web interface.

To restrict access to a **single host**, for example 192.168.101.1 then **192.168.102.1/255.255.255.255** can be entered for the address and netmask. Then only this host can use the web interface.

NOTE



There must not be any discrepancy with subnet mask and IP address, for example if 192.168.101.1 had been entered with a subnet mask of 255.255.255.0 all access would be denied as there are no addresses that can meet this configuration. To recover from lock-out the NTP800 will have to be restarted and the factory defaults restored.

5.1.3 SNMP v3 credentials

Use this section of the webpage to configure SNMP V3 with the authentication and privacy keys.



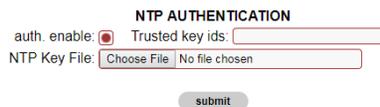
SNMP v3 KEYS
authentication key:
privacy key:

Enter the desired keys and click on [Submit]. Note that

5.1.4 NTP authentication

This section of the Webpage allows the three following items to be configured

- Enable/disable NTP authentication
- The keys to be trusted
- Upload of NTP ntp.keys file



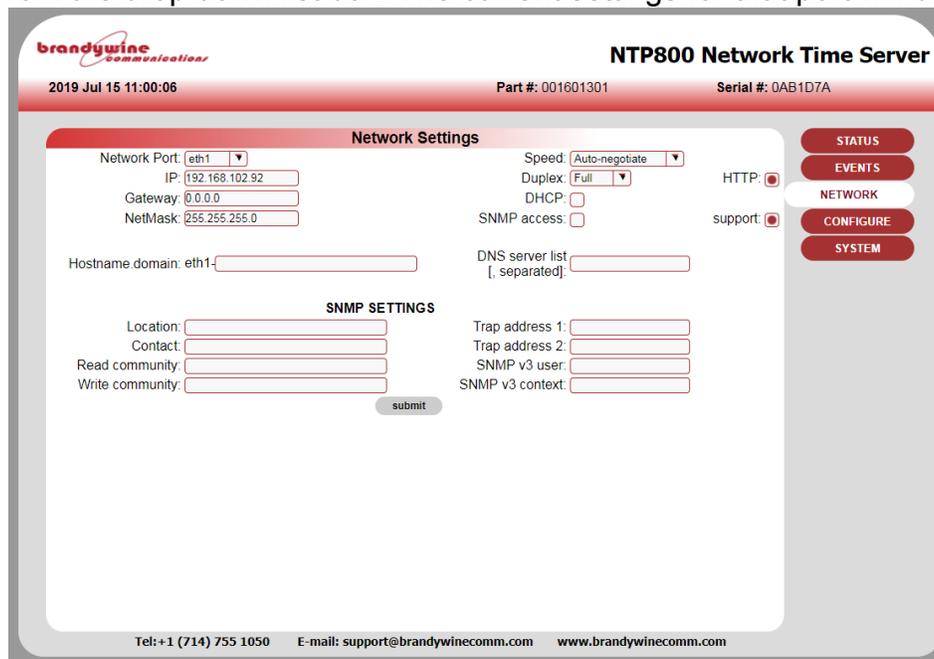
NTP AUTHENTICATION
auth. enable: Trusted key ids:
NTP Key File: No file chosen

The facility provides to enable and disable authentication in NTP packets and affects the NTP configuration page. The unit accepts a standard NTP ntp.keys file

specifying keys and the authentication type. This file is uploaded in its entirety. It is up to the user to manage this file and maintain appropriate secure copies. Once uploaded the file cannot be directly accessed in any way. If a change to it is required it must be done to the file externally and reloaded. It will then replace the existing file. The file is not used if NTP authentication is disabled. It will be removed if factory defaults are applied.

5.2 Network Configuration

This page allows the configuration of each of the Ethernet ports. Select the port to configure from the drop down list box. The current settings for that port will be shown.



The screenshot shows the configuration page for an NTP800 Network Time Server. At the top, it displays the brandywine logo, the device name 'NTP800 Network Time Server', and system information including the date '2019 Jul 15 11:00:06', Part #: 001601301, and Serial #: 0AB1D7A. The main content area is titled 'Network Settings' and contains several configuration fields: 'Network Port' (a dropdown menu set to 'eth1'), 'IP' (192.168.102.92), 'Gateway' (0.0.0.0), 'NetMask' (255.255.255.0), 'Speed' (Auto-negotiate), 'Duplex' (Full), 'DHCP' (unchecked), 'SNMP access' (unchecked), 'Hostame domain' (eth1), and 'DNS server list' (empty). Below this is the 'SNMP SETTINGS' section with fields for 'Location', 'Contact', 'Read community', 'Write community', 'Trap address 1', 'Trap address 2', 'SNMP v3 user', and 'SNMP v3 context'. A 'submit' button is located at the bottom of the settings area. On the right side, there is a vertical navigation menu with buttons for 'STATUS', 'EVENTS', 'NETWORK' (highlighted), 'CONFIGURE', and 'SYSTEM'. At the bottom of the page, contact information is provided: Tel: +1 (714) 755 1050, E-mail: support@brandywinecomm.com, and www.brandywinecomm.com.

Figure 10 - NTP-800 Network Screen

The following settings are port specific:

IP , Gateway, Netmask, Speed, Duplex

DHCP

- Permit port to acquire its address via DHCP. This will be shown on the status page. This can only be applied to one port of the unit.

Note a DHCP server must be present and the port must be connected to the network. If not, the configuration access for this port will be lost. The unit then either needs to be rebooted with a network connection and an available DHCP server or return the unit to factory defaults to set the port (and all the others) back to their defaults.

Hostname

- The unit must be provided with a hostname for the DHCP enabled port. If changed or set independently of the DHCP flag, it must be submitted for the port that DHCP has been enabled for.

SNMP Access

- Allows SNMP queries and traps to be generated.

- HTTP** - Enable the web service on this interface. Note that it is not possible to disable the web interface from all ports with this setting.
- Support** - Allow for firmware upload with SCP protocol and remote access for factory support if there are any problems.

Note that any changes must be submitted prior to changing the port selection otherwise they will be lost. This includes the non-port specific settings.

The following settings are not port specific:

DNS server list - comma separated list of DNS server IP addresses.

SNMP parameters - These are effective on the ports that have SNMP access enabled.

The NTP80 will send traps when a trap address is set. There are rules as to where these traps will be sent depending on the port configurations.

If the trap address is on a subnet of a particular SNMP enabled port then the trap will only be sent to that port. If the trap address is not on any subnet of the defined ports then the trap will be sent to all SNMP enabled ports that have a gateway address defined. If the network is such there are two routes to the trap address destination it will be received twice.

If an *SNMPv3 user* is set the SNMP protocol used will be SNMP v3 for both queries and traps. For SNMPv3 traps the engine ID associated with the user is defined in the user context, this takes the form of ENGINEID:user context. Currently user context is not supported. If no colon present in the user context box then the content is taken as an ENGINEID. This field must be configured to enable SNMP v3 traps to be sent and successfully received.

The NTP800 routing is such that all ports are isolated from each other.

Pressing **Submit** will apply the changes.

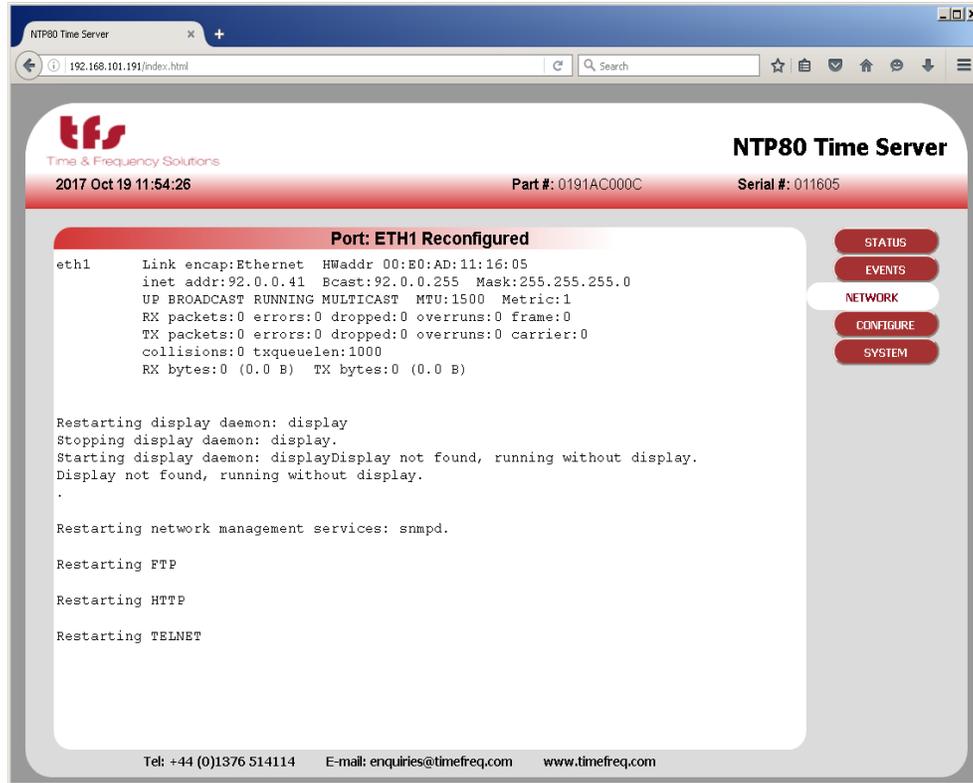


Figure 11 - NTP-800 Network Screen Showing Configuration Changes

Note that if you change the IP address of the port through which the web page is being accessed the following will be shown, the link 'Click here to redirect to STATUS PAGE' is created to connect to the new address. The navigation panel at this point will not work as it has links to the old address.

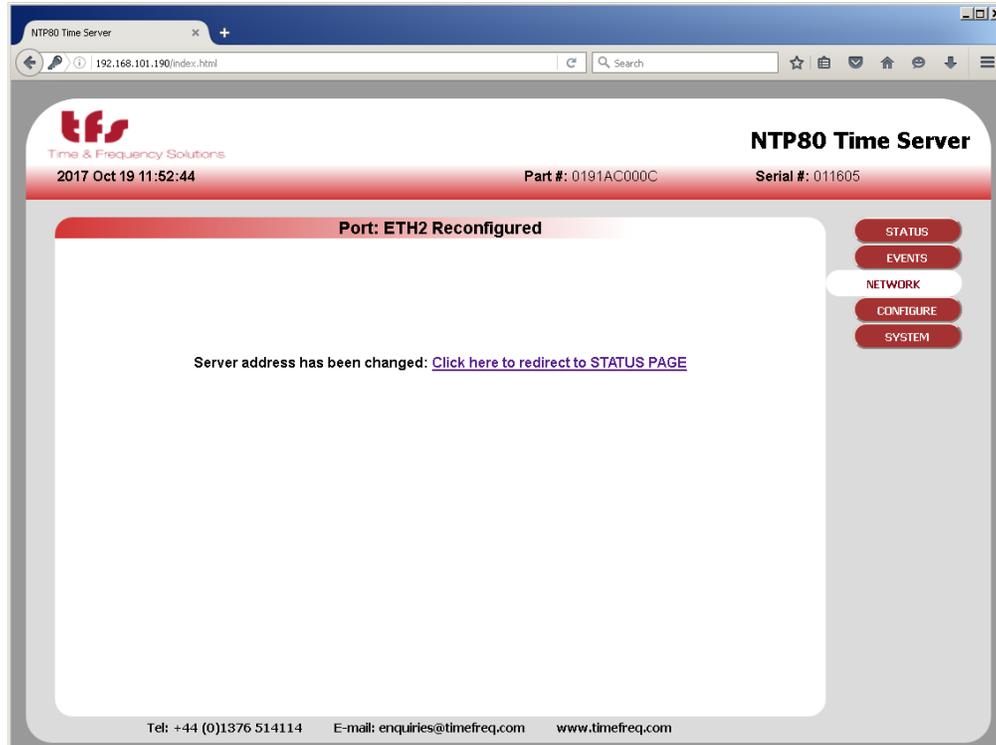


Figure 12 - NTP-800 Network Screen After IP Change

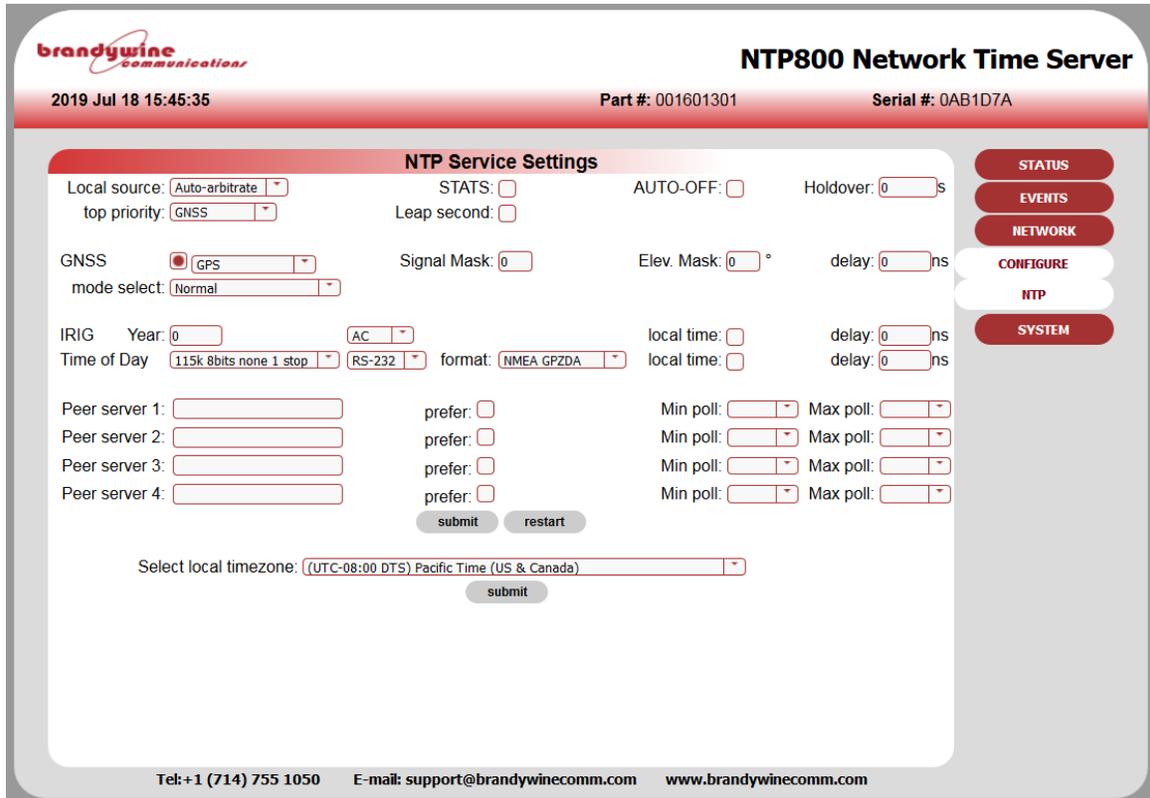
5.3 Configure

This page sets up the NTP service and input and output sources.

The NTP800 has three possible external reference sources, GNSS, IRIG and Time of Day (with PPS). The use of these sources can be either as manual selection or under the TimeWall™ arbitrator.

5.3.1 NTP

The default configure page is the NTP service and input source configuration page.



brandywine communications **NTP800 Network Time Server**

2019 Jul 18 15:45:35 Part #: 001601301 Serial #: 0AB1D7A

NTP Service Settings

Local source: STATS: AUTO-OFF: Holdover: s

top priority: Leap second:

GNSS Signal Mask: Elev. Mask: ° delay: ns

mode select:

IRIG Year: local time: delay: ns

Time of Day format: local time: delay: ns

Peer server 1: prefer: Min poll: Max poll:

Peer server 2: prefer: Min poll: Max poll:

Peer server 3: prefer: Min poll: Max poll:

Peer server 4: prefer: Min poll: Max poll:

Select local timezone:

Tel: +1 (714) 755 1050 E-mail: support@brandywinecomm.com www.brandywinecomm.com

Figure 13 - NTP-800 NTP Configuration Screen

The top two lines configure TimeWall™ to control how to use the external reference sources. The user can either select any of the individual references or auto-arbitrate for TimeWall™ to decide which to use. TimeWall™ can be adjusted to pick one of those sources as top priority which it will revert to whenever it is deemed to be good. The default priority order is GNSS, IRIG and Time of Day. Without any available reference time then if an external 10MHz is available this will be used to maintain the timescale established from the last available reference source.

STATS

This is used for diagnostic purposes and should normally **NOT** be enabled.

AUTO-OFF / Holdover

This provides a mechanism for non-standard NTP or SNTP clients that do not properly adhere to NTP protocols such as RFC1305. In particular where the leap indicator flags

are not used or the monitoring of reference time is not taken into account. For these situations the auto-off mechanism will stop the NTP80 servicing NTP requests after a period specified, in seconds, from the time that synchronization is lost. Initially when this is enabled the holdover time will be set to 86400s, i.e. 24 hours. This will mean that any NTP client will not be able to use this server after this time regardless of how that client is implemented. Note that the Holdover time specified should take into account the oscillator that is fitted to the NTP80. The reliability of time will be greater for longer for a Rubidium unit than one with a TCXO. All can be within the NTP Stratum 1 specification of 1ms after 1 day of holdover assuming good GPS reception for a significant period of time prior to loss of synchronization.

Leap second

A reference source will indicate a leap second pending by setting the leap second checkbox. If there is no reference source this can be manually set if it is known that a leap second will occur at the next insertion time. These times are fixed at June 30 23:59:59 UTC and December 31 23:59:59. The unit cannot accept leap second indication beyond 3 months in advance. Note that if this is manually set and a reference source is available. The reference source will override the manual setting.

The **GNSS** checkbox will be ticked if a GNSS receiver is detected. The drop down list selects the GNSS constellation used for resolving time. This is after position is resolved in which all satellites in all constellations will be considered.

The constellation choices are: GPS, GPS+GLONASS, GPS+BEIDOU, GLONASS, BEIDOU.

The tracked satellites on status page will show the satellites used in each constellation.

Signal Mask

A signal level value below which satellites ignored for timing, this is an integer between 0 and 55. The default value is 35, reduce this if there are problems with GNSS synchronization.

Elevation Mask

Elevation below which satellites will not be used for timing. The default value is 10°.

Cable delay

Enter the time delay associated with the antenna cable length.

Mode

Under normal conditions and a reasonable GNSS satellite visibility this should be set to **normal**.

If there are problems with satellite reception then the **fixed position** mode can be used. This allows the position to entered manually and will the fields will be populated with the last acquired position. This will give the GNSS receiver a better chance to establish timing with fewer satellites. In extreme cases then **fixed posn. unprotected** can be used which removes the anti-jamming protection and effectively allows time from just one satellite. This is not recommended. Prior to using the fixed position modes it is

recommended that the signal and elevation masks are reduced to help improve GNSS satellite visibility.

IRIG year

For IRIG formats that do not contain a year, enter the current year. This will be provided by other reference sources if they are available.

AC/DCLS

Set to agree with the configuration of the unit for the IRIG input; either AC IRIG or DCLS. This is a jumper selection within the unit.

Local time

Check this box if the time in the reference source message is in local time and not UTC. If it is in local time the NTP800 must be configured for that same timezone.

Cable delay

Enter the time delay associated with the cable length between the reference source output and the NTP800 input.

Time of Day

Select the serial port parameters from the list along with whether the input is RS232 or RS422.

Select the message protocol to be expected either GPZDA standard NMEA message or TFS message 4, defined in appendix C.

Local time

Check this box if the time in the reference source message is in local time and not UTC. If it is in local time the NTP800 must be configured for that same timezone.

Cable delay

Enter the time delay associated with the cable length between the reference source output and the NTP800 input

Peer Servers 1-4

The configuration then allows for up to four NTP servers to synchronize with. These are specified in peer server 1 to 4. They can either be a DNS name (if DNS server is set on the NETWORK page) or an IP address. The min and max poll indicate the minimum and maximum rate of NTP requests. The NTP standard for min poll rate is 64s, recommended settings for this and max poll are 64s.

The NTP server follows the standard NTP protocol to determine the best of the specified clocks to synchronize to. One may be selected as preferential by setting the **prefer** option radio button for that server.

When the peer NTP servers are set up alongside external reference sources they can take over following the loss of all the synchronization sources. Note that depending on the oscillator fitted and the period for which synchronization is lost, the performance

when synchronizing to another NTP server will not be as good as running in holdover. If peer NTP servers are available in this configuration the AUTO-OFF will not function until all possible synchronization sources have failed.

Multicast (or Broadcast) Address

The NTP80 can be used as a broadcast NTP server. A broadcast address or multicast address can be specified in the multicast address box along with the poll interval. The unit will then transmit NTP messages at this interval to the multicast or broadcast address.

For network-wide broadcast the address would be 255.255.255.255, for a subnet set the host part of the address to the last host address, so for network 192.168.102.0 that would be 192.168.102.255

Submit/Restart

Press submit to save all the changes, if these are deemed to change the NTP settings then the NTP service will be restarted. The NTP service can be restarted manually by pressing restart. This is required if the NTP authentication mode is changed on the security page.

Local Time Zone

The local time zone allows the front status page and the front panel display to show local time rather than UTC. Note that all NTP operations are performed with UTC. Setting this parameter has no effect on NTP operation. The factory configured GPRMC serial output options of the NTP80 provide a local-time message, that local time is also defined by this parameter.

Press submit to change this value.

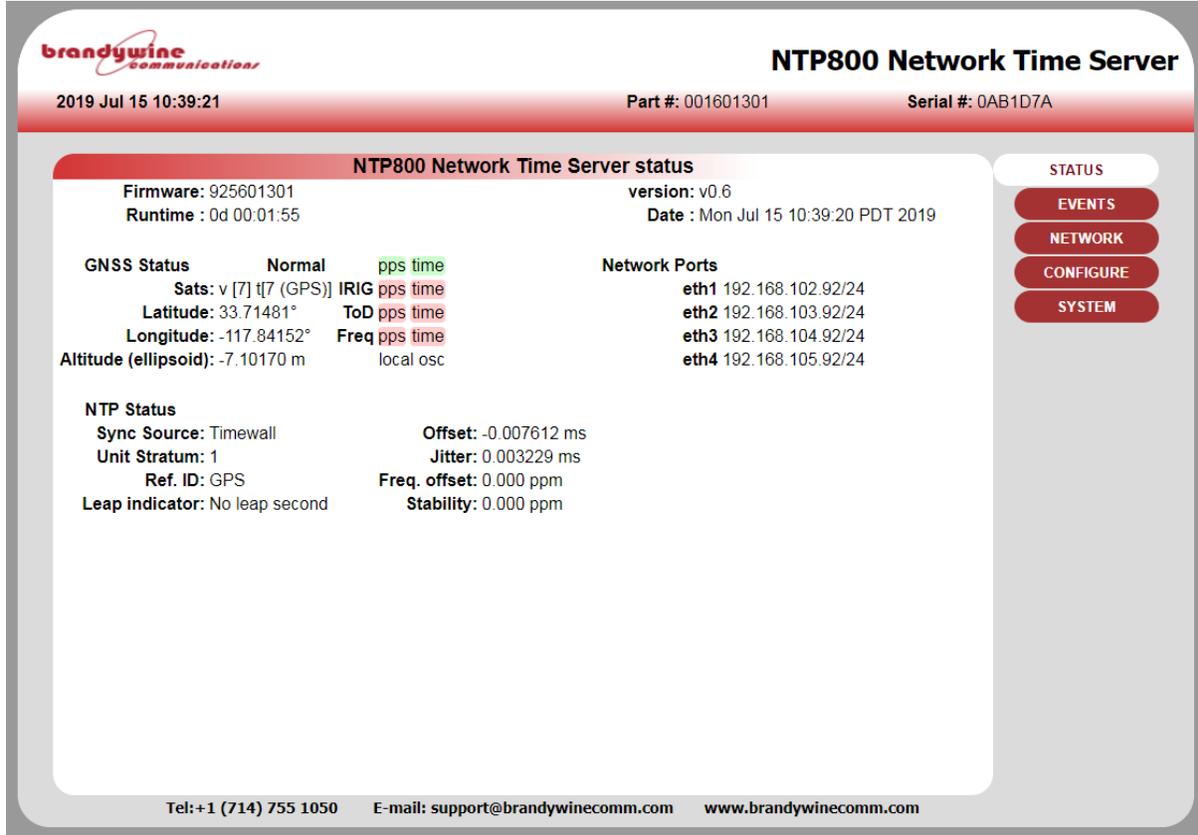
The NTP80 is now configured.

5.3.2 Outputs

PPS	Enable/disable PPS output
IRIG format	Select the required IRIG output format. DCLS or AC IRIG output is dependent on the hardware jumper configuration (part number or details?).
Time of day	Select the serial port parameters and the output message format as required.

5.4 Status

The status page shows the current running state of the NTP80. The top section shows the system state including how long it has been running and the currently loaded date and time.



brandywine communications **NTP800 Network Time Server**

2019 Jul 15 10:39:21 Part #: 001601301 Serial #: 0AB1D7A

NTP800 Network Time Server status

Firmware: 925601301		version: v0.6
Runtime : 0d 00:01:55		Date : Mon Jul 15 10:39:20 PDT 2019

GNSS Status Normal pps time Sats: v [7] t[7] (GPS)] IRIG pps time Latitude: 33.71481° ToD pps time Longitude: -117.84152° Freq pps time Altitude (ellipsoid): -7.10170 m local osc	Network Ports eth1 192.168.102.92/24 eth2 192.168.103.92/24 eth3 192.168.104.92/24 eth4 192.168.105.92/24	<div style="text-align: center; border: 1px solid #ccc; padding: 2px; margin-bottom: 5px;">STATUS</div> <div style="text-align: center; border: 1px solid #ccc; padding: 2px; margin-bottom: 5px; background-color: #f00; color: white;">EVENTS</div> <div style="text-align: center; border: 1px solid #ccc; padding: 2px; margin-bottom: 5px; background-color: #f00; color: white;">NETWORK</div> <div style="text-align: center; border: 1px solid #ccc; padding: 2px; margin-bottom: 5px; background-color: #f00; color: white;">CONFIGURE</div> <div style="text-align: center; border: 1px solid #ccc; padding: 2px; margin-bottom: 5px; background-color: #f00; color: white;">SYSTEM</div>
--	--	---

NTP Status	
Sync Source: Timewall	Offset: -0.007612 ms
Unit Stratum: 1	Jitter: 0.003229 ms
Ref. ID: GPS	Freq. offset: 0.000 ppm
Leap indicator: No leap second	Stability: 0.000 ppm

Tel: +1 (714) 755 1050 E-mail: support@brandywinecomm.com www.brandywinecomm.com

Figure 14 - NTP-800 Status Screen

The GNSS status shows position and the satellite status. The status will reflect the condition of the GNSS receiver with its pps and time. The status of the other reference sources, IRIG, Time of day and the frequency input are shown. If no source is available and NTP is running the local oscillator show that the unit is effectively in holdover. See **Events** for details of entries in the event log.

Where multi-constellation mode has been selected then the satellites tracked from each constellation are identified.

The NTP status indicates the current NTP service synchronization source and the stratum level. Normally these will show TimeWall™ and stratum 1. For a peer-to-peer server, the Sync Source will show the IP address of the synchronization source and the NTP80 stratum will be dependent on the stratum of that source. Sync source will also show the status of the NTP service when not synchronized. These events are recorded in the event log. If the unit is in holdover the status will state *No System Peers*. See **Events**, below, for further details.

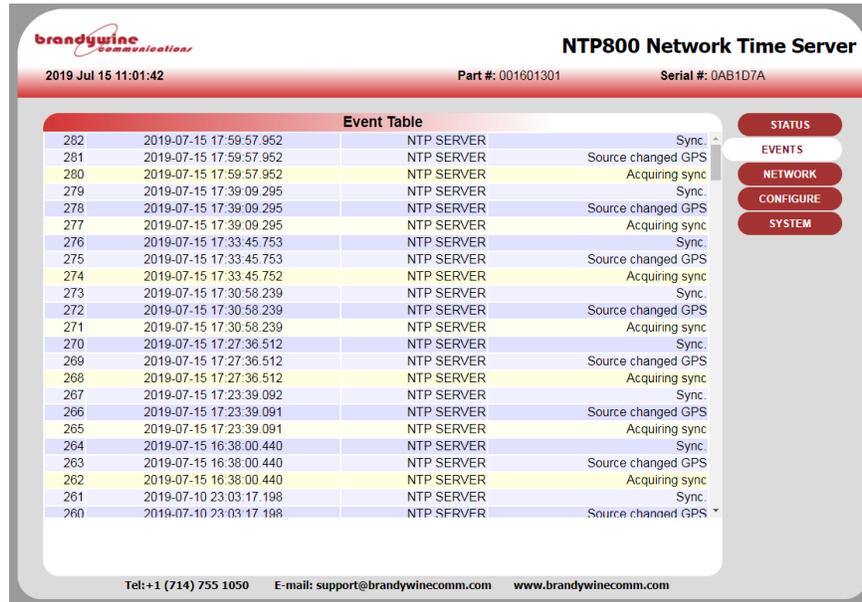
The REFID indicates the reference ID in use on the NTP packets when the sync source is TimeWall™ and it will reflect the current reference source in use, GPS, IRIG, ToD. If the source is an NTP peer REFID reflects the **peer's** reference source.

Offset, jitter, freq offset and stability indicate the performance of the NTP service. The closer to zero these values, the better the performance.

The page updates automatically every second.

The events that are shown in the status page are recorded in the event log and can be seen by selecting EVENTS from the navigation panel.

5.5 Events



The screenshot shows the NTP800 Network Time Server web interface. At the top, it displays the date and time (2019 Jul 15 11:01:42), the part number (001601301), and the serial number (0AB1D7A). Below this is a table titled "Event Table" with columns for event ID, timestamp, event type, and status. The table lists various events such as "NTP SERVER Sync.", "Source changed GPS", and "Acquiring sync". On the right side of the interface, there are navigation buttons for STATUS, EVENTS, NETWORK, CONFIGURE, and SYSTEM. At the bottom, contact information is provided: Tel: +1 (714) 755 1050, E-mail: support@brandywinecomm.com, and www.brandywinecomm.com.

Event ID	Timestamp	Event Type	Status
282	2019-07-15 17:59:57.952	NTP SERVER	Sync.
281	2019-07-15 17:59:57.952	NTP SERVER	Source changed GPS
280	2019-07-15 17:59:57.952	NTP SERVER	Acquiring sync
279	2019-07-15 17:39:09.295	NTP SERVER	Sync.
278	2019-07-15 17:39:09.295	NTP SERVER	Source changed GPS
277	2019-07-15 17:39:09.295	NTP SERVER	Acquiring sync
276	2019-07-15 17:33:45.753	NTP SERVER	Sync.
275	2019-07-15 17:33:45.753	NTP SERVER	Source changed GPS
274	2019-07-15 17:33:45.752	NTP SERVER	Acquiring sync
273	2019-07-15 17:30:58.239	NTP SERVER	Sync.
272	2019-07-15 17:30:58.239	NTP SERVER	Source changed GPS
271	2019-07-15 17:30:58.239	NTP SERVER	Acquiring sync
270	2019-07-15 17:27:36.512	NTP SERVER	Sync.
269	2019-07-15 17:27:36.512	NTP SERVER	Source changed GPS
268	2019-07-15 17:27:36.512	NTP SERVER	Acquiring sync
267	2019-07-15 17:23:39.092	NTP SERVER	Sync.
266	2019-07-15 17:23:39.091	NTP SERVER	Source changed GPS
265	2019-07-15 17:23:39.091	NTP SERVER	Acquiring sync
264	2019-07-15 16:38:00.440	NTP SERVER	Sync.
263	2019-07-15 16:38:00.440	NTP SERVER	Source changed GPS
262	2019-07-15 16:38:00.440	NTP SERVER	Acquiring sync
261	2019-07-10 23:03:17.198	NTP SERVER	Sync.
260	2019-07-10 23:03:17.198	NTP SERVER	Source changed GPS

Figure 15 - NTP-800 Event Log Screen

The following lists all the events and their causes that can appear in the event log. They will cause an SNMP v1 trap to be sent to SNMP enabled ports. GPS events are also shown on the front panel of the NTP80, and these events will be shown in the relevant status field on the web status page.

The events are divided into three sections. SYSTEM, GPS and NTP.

SYSTEM

- System startup. Initialization of event log. Not visible after first 800 events.
- Manual restart Remote reboot has been applied.

GPS

- Normal* GPS operating normally.
- No PPS - in holdover* GPS not tracking – NTP80 in holdover.
- PDOP too high* Tracked satellite constellation too poor for good position resolution. NTP80 in holdover.
- Only 3 usable sats*
- Only 2 usable sats* Satellites tracked, requires at least 4 for time to load initially.
- Only 1 usable sat*
- No useable sats*
- No time yet* GPS start up.

<i>Antenna shorted</i>	There is a fault with the antenna connection.
<i>No antenna present</i>	No antenna is connected. Check antenna is connected.
<i>Not detected</i>	Initial start-up condition.

All the above are decoded from the status value visible on the web page and relate to the GPS operating status. If all is well then the last event will be Normal. Any single event will be cleared by returning to Normal - so if the antenna is disconnected then the minimum event sequence will be 'No antenna present' and then after reconnection 'Normal'. In reality some intermediate messages will occur as the number of satellites tracked increases. In most cases, if any state other than normal is seen persistently then the likelihood is that there is an issue with the GPS reception either due to antenna placement, operation or cable length.

NTP SERVER

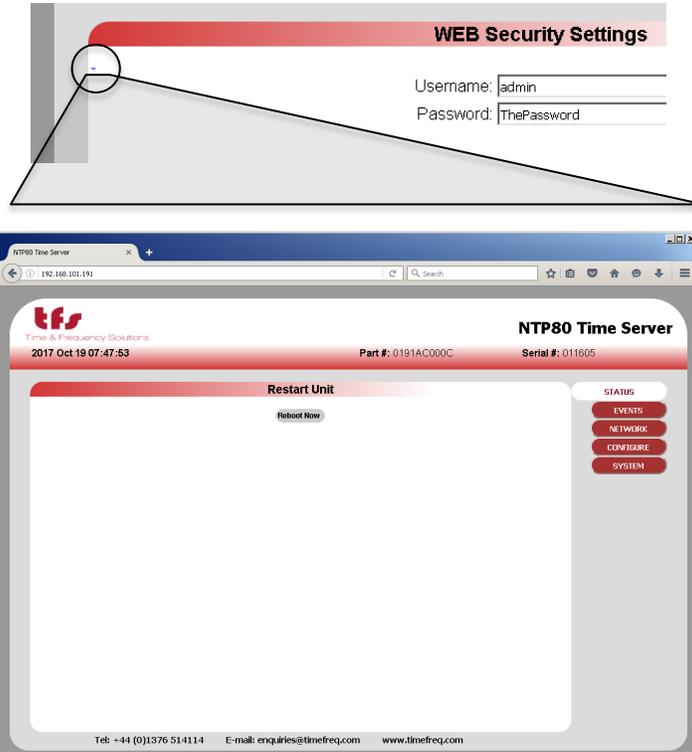
<i>Sync.</i>	Synchronized to source & serving time.
<i>System peer <ip address></i>	Synchronization source found. When this is the GPS engine the IP address will be shown as 127.127.46.0
<i>Acquiring sync</i>	Locking to time source
<i>No system peers</i>	no valid synchronization sources. Unit in holdover.
<i>NTP suspend</i>	NTP service suspended & will no longer answer NTP requests. Part of the AUTO-OFF process.
<i>NTP resume</i>	NTP service resumed. Part of the AUTO-OFF process.
<i>Initialising</i>	Indicated on web status page only at startup before initial time is loaded. This status is not logged and does not cause a trap.

As long as there is a system peer then there should be no problem with the NTP service. If “no system peers” is seen with a GNSS receiver then the GPS status will indicate the problem (see above) otherwise with the peer-to-peer model the network connection to specified NTP servers should be checked.

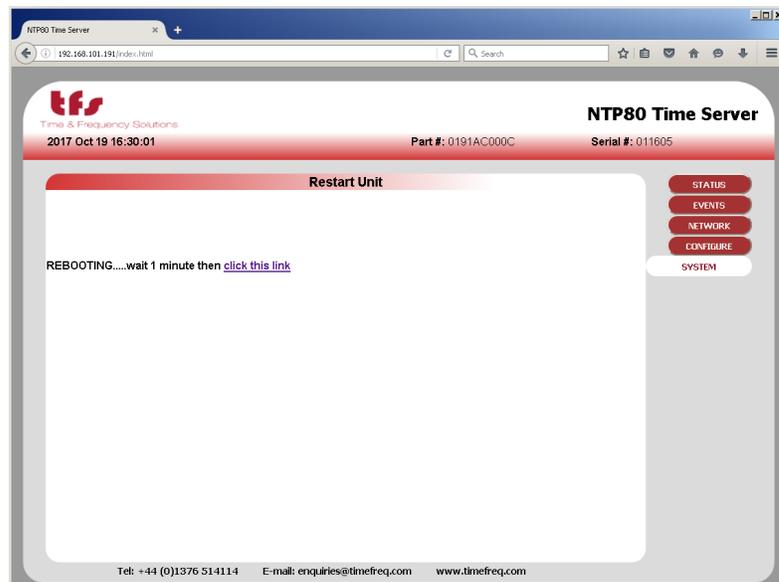
There is one other trap that can be issued, the cold-start trap. This will appear to be issued from the ETH2 address.

5.6 Remote restart

There is a mechanism to remotely reboot the NTP80. From the SYSTEM page notice the small ‘_’ on the top left side of the page.



Pressing the reboot now button will cause the unit to do a complete restart. It will take



approximately 1 minute to reboot.

Clicking the link shown will take you back to the status page. The reboot is recorded in the event log.

6 Working with the Clock Management System

The status of the NTP800 will be shown on the status tab for the particular time server. There are five sources of possible alarm states. These relate to the status elements NTP overall state, GPS system state and the ETHx ifOperState for each port.

For the NTP overall state the following will indicate a fault and turn the indicator red:

- | | |
|----------------------------------|--|
| NTP not loaded | NTP not loaded will be the case at start up, prior to first time synchronization. After this, unless the NTP service is reconfigured this alarm will not be set. |
| NTP GPS no GPS | Not synchronizing to GPS. Check GPS status for reason. This will be permanently set with a Peer-to-peer NTP800 but will not cause an alarm. |
| NTP Peer to Peer no peer | Disabled for GPS NTP800. For peer to peer NTP800 indicates that NTP service has no peers to synchronize to and will therefore cause an alarm. |
| NTP service not present . | NTP service fault. Consult Time & Frequency Solutions. |

For GPS system state (applicable only to GPS NTP800) alarms caused by:

- | | |
|---------------------------|--|
| Time Not loaded | NTP800 GPS engine has not yet loaded time. Should only occur at start-up of NTP800. After time has been set the alarm will clear. It can then never be set again without power-down. |
| GPS Acquiring sync | GPS is not currently synchronized. The likelihood is that there are not enough tracked satellites. |
| GPS Not present | Should only occur and NTP800 start-up. |

For ETHx:

- | | |
|--------------------------|---|
| ifOperStatus down | Network connection is not active. Check connectivity. |
|--------------------------|---|

7 Understanding the Network Time Protocol.

7.1 Why use the Network Time Protocol

Accurate Time has always been an important issue, especially in today's world where computer systems are required to precisely time stamp events and occurrences. However, computers are notorious for poor time keeping because they use a basic watch crystal as their internal timebase. This means that the computer's internal clock will drift significantly over time, an effect exacerbated by changes in temperature. A computer in an office environment can lose or gain up to 40 seconds in a week.

Computers are normally set manually to a known time source such as a speaking clock or broadcast time signal. Once set, most users leave the computer timebase to drift, resetting the operating system clock only on an ad-hoc basis.

Network Time Protocol (NTP) is an Internet Protocol, which propagates time throughout the network and is referenced to UTC. The NTP Time Server acquires UTC time by a direct UTC time scale source, such as GPS. Other options such as IRIG or LF receiver are available.

7.2 Understanding NTP

The client computer obtains the NTP protocol by requesting a NTP packet from the NTP Server. The Software that requests the packet handles reception, maintenance and distribution of the time on the computers where it is installed. All Time & Frequency Solutions NTP Time Servers are supplied, with client software as standard for a range of operating systems & platforms.

Most client software compensates for the delays over the network, and synchronizes the computers with an accuracy of typically 1ms to the NTP Server. For larger networks such as WANs delays of up to 10ms can be expected.

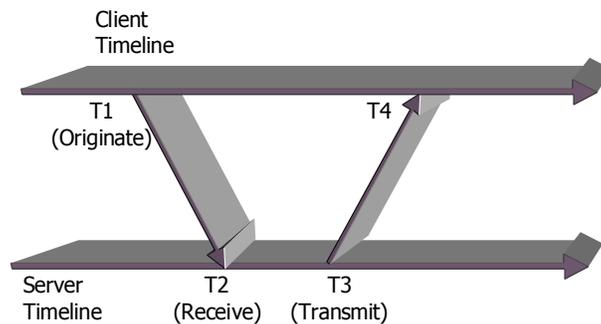


Figure 16 - Basic Method of Delay Calculation Over a Network

Another commonly used protocol is the SNTP (Simple Network Time Protocol). As the name suggest this is a simpler way of obtaining time over a network, but this method does not compensate for delays and therefore is not as accurate.

All Time & Frequency Solutions supplied client software uses the NTP protocol, and therefore provides a more reliable solution than SNTP.

7.3 NTP Hierarchical Structure

The NTP protocol supports a hierarchical structure to ensure the availability of time, allowing the user to monitor their position in the hierarchy and thus the quality of the time service available.

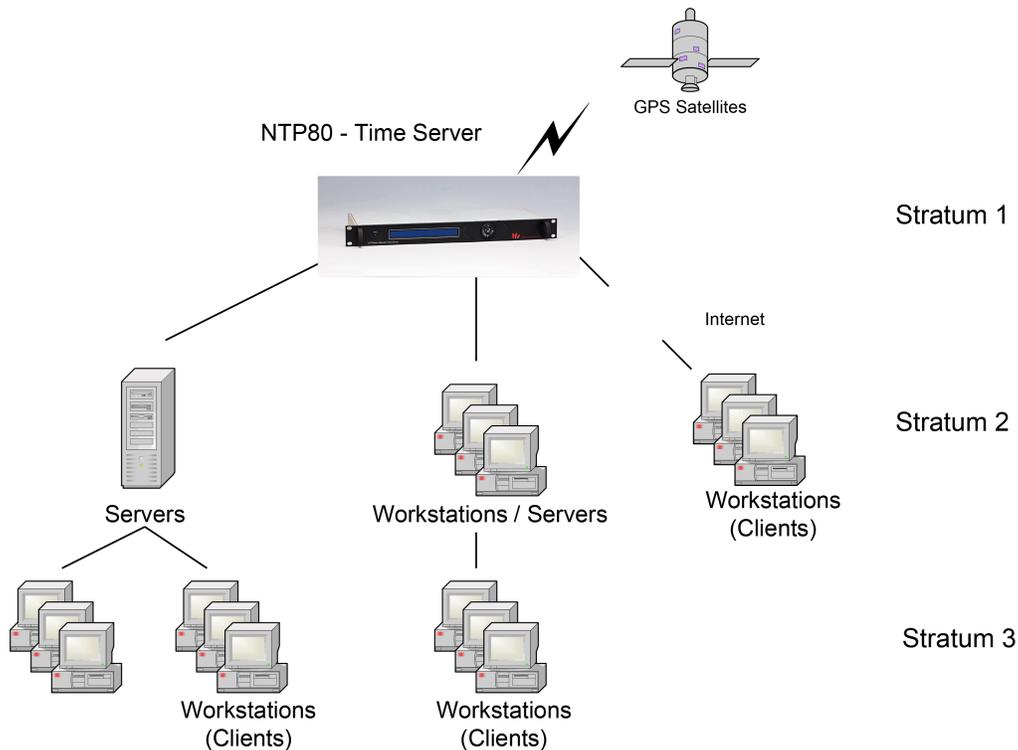


Figure 17 – Explanation of Hierarchical Stratum Structure

The timeserver's hierarchy is classed as Stratum, where a Stratum 1 time server that is directly synchronized to a traceable standard source such as UTC. A server synchronized to a Stratum 1 server is classed as a Stratum 2 server, and so on. This hierarchical structure allows sub partitioning of groups of networks.

Up to 512 Computers may synchronize to a single NTP800 Time Server. We do not recommend increasing the number of clients beyond this limit, as the performance will become degraded due to non-responses.

8 Frequently Asked Questions

The following is a list of commonly asked questions by our customers. If the question that you wished to be answered is not in the list please contact us. Contact details are found at the end of this manual under Chapter 0.

Q *Can the NTP800 act as a stratum 1 server?*

A Yes, Once the NTP800 has synchronized to a traceable GPS or Off-Air source it will automatically become a stratum 1 server. In the event of loss of synchronization this will be maintained for up to 24 hours at stability in accordance with the internal oscillator specified.

Q *What packet types will the NTP800 respond to?*

A ARP requests - to find Ethernet addresses given the TCP/IP address.
ICMP echo requests - to allow 'pings' of the NTP server.
UDP connections to port 123 – the defined NTP server port, SNMP V1, V2c
TIME & DAYTIME (port 13 and 37)
FTP for firmware update.

No other packets are accepted.

Q *Can a client have two sources of stratum 1 server so if one server loses the time or is offline the client can receive time from the second server?*

A Yes, in most cases the client software will allow the configuration for two IP addresses; one IP address will be the "preferred" server.

Q *How do I know if the NTP800 is free running? ie the NTP800 has synchronized to GPS at some point but has now lost synchronization?*

A The webpage status and the NTP800 front panel will indicate that the GPS status is no longer Normal. The "STATUS" LED on the NTP800 will be off.

Q *What causes the NTP800 – GPS Version to loose synchronization and free run?*

A If the installation of the GPS antenna was originally correct, free running is commonly caused by the faults such as GPS cable feeder integrity or Water ingress to the antenna or feeder cable

Satellites' visibility has been reduced through new building structures, or the new installation of other equipment above the antenna.

Q *How many Clients may I connect to one NTP800 Time Server?*

A The NTP800 can handle up to 512 packets per second, which equates to a theoretical 512 x 64 (32,000+) clients assuming standard NTP operation. We do however recommend not exceeding 1000 clients as good practise in designing NTP networks. If more clients are used in heavy traffic then not all packets will be answered.

Q *I am not using the Time & Frequency Solutions Network Management System and using a third party software package. Where can I obtain the SNMP trap information?*

A See Appendix B for the SNMP MIBS for the NTP800.

9 Maintenance

9.1 Preventive Maintenance

The NTP-800 does not require scheduled preventative maintenance during normal operation.

9.2 Uploading New Firmware to the NTP-800

See the section titled “Updating Firmware and FPGA” for the instructions on how to do this.

10 Troubleshooting

The NTP-800 is capable of alarm and status reporting. These alarms are listed in Table 6 together with likely causes, and potential solutions.

10.1 Status LED meanings

POWER LED on PSUs

STATUS – On

TIME VALID

On=unit has obtained time from a time source since power on and holdover has not expired

Flashing = unit time invalid but advancing with 10MHz input

Off=unit has not obtained time from a time source since power on

GNSS

On=GNSS receiver pps and time data both present

Flashing=only one of GNSS receiver pps or time data present

Off = no GNSS receiver pps or data present

TIMECODE

On=IRIG signal and derived PPS both decoded

Flashing=ether IRIG signal or derived PPS not present

Off = IRIG signal not decoded

HOLDOVER

On=unit has had time since power on but now has no time source

Off=unit has had no time since power on, or has valid time, or the holdover has expired

PPS

Table 6 - Faults/Troubleshooting guide

11 Updating Firmware and FPGA

The file for system update and a checksum will be supplied by Brandywine

Either set up an ftpserver onto which the update file is placed and from which from which the unit can retrieve it.

or under instruction from Brandywine ftp the provided file to the unit

Browse to <ipaddress>/update.html and supply either the ftpserver details or the file's location on the unit, and the checksum.

Click 'Update Firmware' and wait, for up to 2 minutes. An outline of the actions that have taken place is given at the end of the process.

12 Support Information

All Brandywine Communications products come with a one-year warranty.

If the unit is still exhibiting problems not covered by the above troubleshooting guide, contact us for technical support at support@brandywinecomm.com or call us at 714-755-1050.

If it becomes necessary to return the unit to the factory for repairs, call us at 714-755-1050 extension 113 to arrange an RMA.

13 Front Panel Drawing

14 Rear Panel Drawings

15 Parts Lists