



**NTS-XL  
87-6003-XL  
Network Time Server**

**SERIAL NUMBER \_\_\_\_\_**  
**May 11, 2001**  
**Revision C**

## SECTION XXVII

### NTS-XL NETWORK TIME SERVER

#### SECTION ONE

##### GENERAL INFORMATION

###### 1-1 INTRODUCTION

1-2 This manual section provides the user of the NTS-XL Network Time Server (87-6003) all of the information necessary to properly install, operate, and utilize its features.

1-3 The information in this manual section includes any normal maintenance and adjustment data that may be required to facilitate field repairs.

1-4 The purpose of the Model NTS-XL is to provide Internet Protocol (IP) network time synchronization, over Ethernet connected networks, via the Network Time Protocol (NTP) developed by Dr. David Mills at the University of Delaware. In providing this synchronization, the NTS-XL operates as a "server". The NTS-XL currently supports version 3.0 of the NTP, RFC 1305 as well as the Simple Network Time Protocol (SNTP), RFC1361. In addition, the NTS-XL will respond to TIME protocol requests, RFC868. Refer to Appendices A and B of this manual section for details regarding these protocols.

1-5 The NTS-XL obtains its timing information from the internal GPS-XL Module.

1-6 through 1-38 reserved.

###### 1-39 INTERNAL TIMING PERFORMANCE SPECIFICATIONS

1-40 The absolute time and frequency characteristics of the NTS-XL are essentially those of the input synchronization source. The relative synchronization characteristics given here reflect the capabilities of the NTS-XL to preserve the time and frequency characteristics of the synchronization source being provided to the NTS-XL.

###### 1-41 NETWORK TIME PROTOCOLS

1-42 The NTS-XL will respond to time synchronization requests from hosts using these User Datagram Protocol/Internet Protocols (UDP/IP):

NTP ver. 3.0	UDP Port 123	RFC1305**
SNTP	UDP Port 123	RFC1361
TIME	UDP Port 37	RFC868

Refer to Appendices A and B of this manual section for detailed information regarding these protocols as implemented by the NTS-XL.

\*\* The NTS-XL does not implement the "authenticator field" of the NTP packet.

## 1-43 NETWORK TIME PROTOCOL SYNCHRONIZATION SPECIFICATIONS

1-44 The NTS-XL hardware is designed specifically to implement the NTP server function. As such it was carefully designed to operate with the TrueTime real time operating system to minimize the unknown latencies in timestamping the received and transmitted NTP packets. The timestamp accuracy specifications are:

NTP Packet Received Timestamp Accuracy	$\pm 10 \mu\text{s}$ , relative to synchronization source
NTP Packet Transmitted Timestamp Accuracy	$\pm 10 \mu\text{s}$ , relative to synchronization source

At these levels of accuracy, the realizable NTP synchronization accuracy of any client host is determined by the quality of the synchronization source and the repeatability of the network and client delays, *not* by the NTS-XL timestamp uncertainty.

## 1-45 INTERFACE SPECIFICATIONS

### 1-46 Ethernet Interface

Frame Format: DIX Ethernet (Ethernet II) or IEEE 802.3 with 802.2 headers  
Connector: AUI, female 15-pin D subminiature

Pin Assignment

Pin	Assignment
1	GND
2	CI+
3	DO+
4	GND
5	DI+
6	GND
7	NC
8	GND
9	CI-
10	DO-
11	GND
12	DI-
13	+12V
14	GND
15	NC

## SECTION TWO

### INSTALLATION

#### 2-1 OVERVIEW

2-2 The user must provide the NTS-XL with an Ethernet network connection and set-up parameters. The NTS-XL Network Time Server is capable of basic operation without any XL-DC KEYPAD or USER RS-232 connection once the essential network and operating parameters have been entered. The NTS-XL retains all configuration data in Electrically Erasable/Programmable Read Only Memory (EEPROM).

#### 2-3 PROCEDURE

2-4 The NTS-XL plug-in module is mounted in the Model XL-DC provided by TrueTime and therefore obtains its power through the Model XL-DC. It is necessary only to make the network input to the NTS-XL. The network connection is made via the AUI connector and any required Media Access Unit (MAU, also known as a transceiver). Once these connections have been made, turn on the unit and follow the instructions below.

#### 2-5 BASIC QUICK START INSTRUCTIONS

2-6 After powering up the XL-DC, connect a PC or other RS-232 terminal to the XL-DC USER port female DB9 connector. A null modem adapter is required.

2-7 Network configuration information must be sent to the NTS-XL using Serial I/O Function 36. The IP address, subnet mask, default gateway, and network packet type must be entered in order to interface with a network. See Section 3 for a detailed description of Serial I/O Function 36 and Appendix A for details of the NTP packet.

2-9 Verify that the XL-DC is running by starting Serial I/O Function 08, Continuous Time Once per Second. Send the string: F08<CR>. The days through seconds time being generated by the XL-DC will be output from the user port once per second. To stop the continuous output, send a CTRL-C to the USER port. The synchronization source is GPS, so allow at least five minutes for the XL-DC to acquire lock. Once the XL-DC is locked, the ? character in Serial I/O Function 08 will change to a space character.

2-10 Once the XL-DC is running properly, the unit should respond to PING, TIME, and NTP packets. If it does not, check the connection to the network and all Serial I/O Function 36 network configuration parameters.

#### 2-11 QUICK START INSTRUCTIONS FOR MULTIPLE MODULES

2-12 If multiple NTS-XL modules are installed in the XL-DC, repeat steps 2-6 through 2-10 to configure the first NTS-XL module. **Note:** Each NTS-XL module requires a unique IP address and set-up address.

Set up the second card as follows:

1. Change the internal address by moving SW1-1 (DIP switch on PCB) to OFF (i.e., for Port 14 SW1-0 is OFF and SW1-1, 2, 3 are ON).

2. Set up the card via RS 232 by entering the following script (be sure to change the IP address [shown in italics] to the desired address). **Note: The default setting from the vendor is 15 or F** (for Port 15 SW1-0, 1, 2, 3 are ON).

```
F36 15, IP: 10.1.10.20 SM: 255.255.0.0 G:10.1.10.254
```

```
F36 14, IP: 10.1.10.21 SM: 255.255.0.0 G:10.1.10.254
```

To check the addresses you have entered, type in the following commands:

**F36 15**

and the display should show **F36 15, IP: 10.1.10.20 SM: 255.255.0.0 G:10.1.10.254**

**F36 14**

and the display should show **F36 14, IP: 10.1.10.21 SM: 255.255.0.0 G:10.1.10.254**

**Note: The lowest address is displayed when only F36 is entered.**

3. Test each card using Winsntp, or ping the IP address. Remember to change the IP address in Winsntp to test each card.

## 2-13 ADDRESS SELECT SWITCH

2-14 Four-position DIP switch SW1 selects the address (0 - 15) of the NTS card. If more than one NTS card is installed, a different address setting must be used for each card. The NTS card shares the same address range as "SmartCard" options. In applications where a "SmartCard" option is also installed in the system, a unique address switch setting for the "SmartCard" is required. In situations where a particular NTS card address is desired, it can be set into the SW1 DIP switch as follows:

<u>SW1-3</u>	<u>SW1-2</u>	<u>SW1-1</u>	<u>SW1-0</u>	<u>Address (Port)</u>	<u>SW1-3</u>	<u>SW1-2</u>	<u>SW1-1</u>	<u>SW1-0</u>	<u>Address (Port)</u>
OFF	OFF	OFF	OFF	0	ON	OFF	OFF	OFF	8
OFF	OFF	OFF	ON	1	ON	OFF	OFF	ON	9
OFF	OFF	ON	OFF	2	ON	OFF	ON	OFF	10
OFF	OFF	ON	ON	3	ON	OFF	ON	ON	11
OFF	ON	OFF	OFF	4	ON	ON	OFF	OFF	12
OFF	ON	OFF	ON	5	ON	ON	OFF	ON	13
OFF	ON	ON	OFF	6	ON	ON	ON	OFF	14
OFF	ON	ON	ON	7	ON	ON	ON	ON	15 (Default)

**For example,** set the NTS card address to 1 (SW1-0 ON, SW1-1, 2, 3 OFF). Setting the card address to 1 will allow a field installation of a "SmartCard", which has a default card address of 0. If more than one NTS card is installed in the system, set the SW1 switch on each of the cards to the next available address. Change addresses to something other than 0, which is reserved.

## 2-15 NTS KEYPAD SETUP

2-14 The NTS card(s) may be setup with keypad function 36. See Section 3-21 for details on setup for a single card and Section 3-22 for details on setup with two or more cards.

## SECTION THREE

### OPERATION

#### 3-1 INTRODUCTION

3-2 The NTS-XL Module provides extremely accurate time over an Ethernet connection.

3-6 The NTS-XL module is synchronized by the use of the NAVSTAR Global Positioning System (GPS). This system requires no operator input to maintain accurate UTC time and automatically handles leap second events.

#### 3-7 BASIC OPERATION

3-8 This Section provides a complete description of the basic operation of the NTS-XL.

#### 3-9 NETWORK INTERFACE

3-10 TrueTime's NTS-XL module supports RFC-868, RFC-1305, and RFC-1361. An NTP or SNTP client daemon compatible with the user's computer platform is required for accurate network synchronization. The daemon must be told the NTS-XL IP address.

#### 3-11 START-UP

3-12 On power up, the NTS-XL module will check its EEPROM for valid configuration data. If configuration data is valid and present, then the NTS-XL will attempt to synchronize its internal time to the GPS synchronization source.

3-13 Once the NTS-XL has synchronized to GPS, it will then be ready to respond to any requests that it receives over the network from supported protocols. During interruptions of the synchronization input, the NTS-XL will estimate the quality of the time it is able to provide to clients and update the fields of the NTP packet appropriately. In addition, the time quality character of the Serial I/O Function 08 string and the "worst case time error" reported by Serial I/O Function 13 are also updated during such interruptions. The NTS-XL will provide NTP server operation until the Serial I/O Function 13 "worst case time error" has exceeded the value of the Root Dispersion field set in the NTP packet. See Appendix A for details on this behavior.

#### 3-14 GENERAL OPERATION

3-15 All functions are accessed via the XL-DC USER Serial I/O interface or the KEYPAD.

#### 3-18 FRONT PANEL KEYPAD FUNCTION LIST

3-19 The Serial I/O Function 36 network configuration parameters will be described in this manual section. All other functions listed here can be found in manual section III of the main manual. Any of the following commands may be used:

<u>COMMAND</u>	<u>FUNCTION</u>
F01	Time Zone Entry/Request
F03	Time/Date Entry/Request
F05	Time Quality Enable/Setup
F08	Continuous Time Once Per Second Enable
F09	Time on Request Enable
F11	Time Output Format Entry/Request
F13	Worst-case Time Error Request
F18	Software Version Request
F36	NTS-XL Configuration Entry/Request
F66	Daylight Savings Enable

### 3-20 KEYPAD FUNCTION F36 - NTS-XL CONFIGURATION ENTRY/REQUEST FOR ONE CARD

3-21 Use Function F36 to set the network parameters of the NTS-XL unit. If multiple NTS-XL units are installed in the XL-DC refer to section 3-22.

Press "FUNC/ENTR", then "3" "6". The display will show:

Display Ethernet  
Address

Use the up and down keys to scroll among the major selections for Function F36: Display Ethernet Address, Clock Type, Display/Setup Network Type, Display/Setup Default Gateway, Display/Setup Subnet Mask and Display/Setup IP Address. Pressing "FUNC/ENTR" while the desired action is displayed allows the user to view and/or modify the NTS-XL parameters. (When modifying parameters it is normal that they are displayed slower than usual). At any time a major selection is displayed, the Up and Down arrow keys can be used to move to another major selection. This eliminates the need to view each of the Function F36 parameters if it is only desired to change one parameter.

Pressing "FUNC/ENTR" on "Display Ethernet Address" displays the Ethernet Address of the unit as shown here:

Company:00-A0-69           *(Fixed)*  
Unit:00-00-0F           *(Example)*

Press "FUNC/ENTR" to move onto the next parameter, or the "STATUS" button to exit function 36 without saving any updated settings.

Pressing "FUNC/ENTR" on "Display/Setup IP Address" allows the user to view and/or change the IP Address of the NTS-XL unit. The format of the IP Address display is shown here:

IP Address:  
255.054.000.034           *(Example)*

The Left and Right arrow keys move the cursor beneath the digits of the address. The Up and Down arrow keys or the number keys can be used to modify the address. Upon completion, use the "FUNC/ENTR" key to enter the address shown and proceed to the next parameter, "CLR" to restore the original setting, or "STATUS" to exit function 36 without saving any updated settings.

Pressing "FUNC/ENTR" on "Display/Setup Subnet Mask" allows the user to view and/or change the Subnet Mask of the NTS-XL unit. The format of the IP Address display is shown here:

Subnet Mask:  
255.255.255.240           *(Example)*

The Left and Right arrow keys move the cursor beneath the digits of the mask. The Up and Down arrow keys or the number keys can be used to modify the mask. Upon completion, use the "FUNC/ENTR" key to enter the

mask shown and proceed to the next parameter, "CLR" to restore the original setting, or "STATUS" to exit function 36 without saving any updated settings.

Pressing "FUNC/ENTR" on "Display/Setup Default Gateway" allows the user to view and/or change the Default Gateway of the NTS-XL unit. The format of the Default Gateway display is shown here:

Default Gateway:  
255.054.000.033 (Example)

The Left and Right arrow keys move the cursor beneath the digits of the address. The Up and Down arrow keys or the number keys can be used to modify the address. Upon completion, use the "FUNC/ENTR" key to enter the address shown and proceed to the next parameter, "CLR" to restore the original setting, or "STATUS" to exit function 36 without saving any updated settings.

Pressing "FUNC/ENTR" on "Display/Setup Network Type" allows the user to view and/or change the Network Type of the NTS-XL unit. The format of the Network Type display is shown here:

Network Type:  
Ethernet II DIX (Example)

The Up and Down arrow keys toggle the Network Type between "Ethernet II DIX", and "IEEE 802.3". When the required type is shown, use the "FUNC/ENTR" key to enter the Network Type and proceed to the next parameter, "CLR" to restore the original setting, or "STATUS" to exit Function F36 without saving any updated settings.

Pressing "FUNC/ENTR" on "Clock Type" advances the display to the "Display Ethernet Address" display if no modifications were made. If any of the parameters were modified, the NTS-XL queries the user about saving the parameters, and, if necessary, rebooting the NTS-XL unit. The format of the Clock Type display is shown here:

Clock Type:  
GPS (Example)

Press "FUNC/ENTR" to display the Ethernet Address of the NTS-XL.

### 3-22 KEYPAD FUNCTION F36 - NTS-XL CONFIGURATION ENTRY/REQUEST FOR TWO OR MORE CARDS

If multiple NTS-XL modules are installed, Function F36 will request the user to select the port for configuration.

Press "FUNC/ENTR", then "3" "6". The display will show:

Select NTP  
Port 1 (Example)

Use the up and down keys to scroll among the options until the desired port for configuration is displayed. For example, press the up key and the display will show:

Select NTP  
Port 2 (Example)

Pressing "FUNC/ENTR" on "Select NTP" displays:

Display Ethernet  
Address

The remainder of the process matches what is done with one card, so refer back to Section 3-21.



### 3-23 SERIAL I/O INTERFACE

3-24 The Serial I/O port can be connected to a terminal or computer. It is configured as a DTE interface and will require a null modem for operation with a terminal or computer. The default factory settings for the Serial I/O port are:

Baud Rate: 9600  
Parity: Even  
Data Bits: 7  
Stop Bits: 1

### 3-24 SERIAL I/O FUNCTIONS

3-25 Initially at power-up the Serial I/O port outputs time once per second as described in Function F08 until it receives a control-C character (HEX 03). The Serial I/O Function F36 network configuration parameters will be described in this manual section. All other Serial I/O Functions listed here can be found in manual Section 3. After a control-C character has been sent, any of the following commands may be used:

<u>COMMAND</u>	<u>FUNCTION</u>
F01	Time Zone Entry/Request
F03	Time/Date Entry/Request
F05	Time Quality Enable/Setup
F08	Continuous Time Once Per Second Enable
F09	Time on Request Enable
F11	Time Output Format Entry/Request
F13	Worst-case Time Error Request
F18	Software Version Request
F36	NTS-XL Configuration Entry/Request
F66	Daylight Savings Enable

3-30 through 3-89 reserved.

### 3-90 SERIAL I/O FUNCTION F36 - NTS-XL CONFIGURATION ENTRY/REQUEST

3-91 Use Serial I/O Function F36 to obtain information about the current NTS-XL configuration or to change the setup. Changing the network related fields of the configuration will cause a reset of the NTS-XL module.

3-92 **Ethernet Address** - The ethernet address is a six byte, hexadecimal value specific to each NTS-XL module. The first three bytes are registered to TrueTime Inc., and the last three bytes are the hex value of the unit's unique number. The ethernet address of the NTS-XL is a fixed address established at the factory. To request the ethernet address of the NTS-XL module, send the string:

```
F36 EA<CR>
```

The unit will respond with:

```
F36 EA:00-A0-69-xx-xx-xx<CR><LF>
```

where "xx-xx-xx" are the six hex digits of the unit's unique address. Attempts to set this field will be rejected with a syntax error message.

3-93 **IP Address** - To obtain the IP address of the NTS-XL module, send the string:

```
F36 IP<CR>
```

The unit will respond with a string of the form:

```
F36 IP:nnn.nnn.nnn.nnn<CR><LF>
```

where "nnn.nnn.nnn.nnn" is the dotted decimal address notation. To set the IP address and restart the NTS-XL, send a string of the form:

```
F36 IP:nnn.nnn.nnn.nnn<CR>
```

Ex: F36 IP:206.54.0.21<CR>

*Changing this parameter will cause a software reset of the NTS-XL module.*

3-94 **Subnet Mask** - To return the subnet mask of the NTS-XL module, send the string:

```
F36 SM<CR>
```

The unit will respond with:

```
F36 SM:nnn.nnn.nnn.nnn<CR><LF>
```

To set the subnet mask and restart the NTS-XL, send the string:

```
F36 SM:nnn.nnn.nnn.nnn<CR>
```

Ex: F36 SM:255.255.255.240<CR>

*Changing this parameter will cause a software reset of the NTS-XL module.*

3-95 **Default Gateway** - To obtain the default gateway of the NTS-XL module, send the string:

```
F36 G<CR>
```

The unit will respond with:

```
F36 G:nnn.nnn.nnn.nnn<CR><LF>
```

To set the default gateway and restart the NTS-XL, send the string:

```
F36 G:nnn.nnn.nnn.nnn<CR>
```

Ex: F36 G:206.54.0.17<CR>

*Changing this parameter will cause a software reset of the NTS-XL module.*

3-96 **Network Packet Type** - To determine the type of network packets being used, send the string

```
F36 N<CR>
```

The unit will respond with one of two strings.

For Ethernet II DIX networks the unit will respond: F36 N:E<CR><LF>

or

For IEEE 802.3 networks the unit will respond: F36 N:I<CR><LF>

To set the type of network being used send the appropriate string shown below.

For Ethernet II DIX networks send: F36 N:E<CR> (most Cisco switches require this setting)

For IEEE 802.3 networks send: F36 N:I<CR>

Note that this setting affects only the packet type that the NTS-XL will transmit. *The NTS-XL will receive packets of either type, regardless of this setting.*

*Changing this parameter will cause a software reset of the NTS-XL module.*

3-97 Complete NTS-XL Network Configuration - To review the entire current network configuration of the NTS-XL module, send the string:

```
F36<CR>
```

The unit will respond with (example):

```
F36 IP:206.54.0.21 SM:255.255.255.240 G:206.54.0.17 N:E<CR><LF>
```

This response indicates the specific IP address, Subnet Mask, Default Gateway, and Network Type of the NTS-XL module. Note that the leading zeros within fields of the dotted decimal addresses are omitted from the IP address, Subnet Mask, and Default Gateway.

To set all settable network parameters and reset the NTS-XL card, send the string (example):

```
F36 IP:206.54.0.21 SM:255.255.255.240 G:206.54.0.17 N:E<CR>
```

This example provides the NTS-XL card with an IP address, Subnet Mask, Default Gateway and Network Type. Note that leading zeros may be omitted when entering IP address, Subnet Mask, and Default Gateway. Any field may be omitted and order is not significant. Blanks are allowed on either side of a colon. Any legal command set containing one of the four network parameters will cause a software reset of the NTS-XL.

3-98 **Clock Type** - The synchronization input option determines the clock type. To query the clock type, send the string:

F36 T<CR>

The unit will respond with:

**For GPS input operation:**

For IRIG B input operation:

For External 1 PPS input operation:

For ACTS input operation:

**F36 T:GPS<CR><LF>**

F36 T:IRIG<CR><LF>

F36 T:1PPS<CR><LF>

F36 T:ACTS<CR><LF>

Attempts to set this field will be rejected with a syntax error message.

3-100 The GPS system broadcasts information on leap seconds several days prior to the event. Leap seconds are added (or subtracted) only at the end of the days June 30 and December 31. The NTS-XL will automatically place the appropriate information in the Leap Indicator field of the NTP packet on the day of the event. The NTS-XL will also perform the leap second correction at the appropriate time.

## APPENDIX A

### NTP v 3.0 DATA FORMAT per RFC1305

A-1 The layout of the NTP data packet information following the UDP header is shown below.

Leap Indicator	Version Number	Mode	Stratum	Poll	Precision
Synchronizing Distance (Root Delay Version 3)					
Synchronizing Dispersion (Root Dispersion Version 3)					
Reference Clock Identifier					
Reference Timestamp					
Originate Timestamp					
Receive Timestamp					
Transmit Timestamp					
Authenticator					

A-2 Leap Indicator - The leap indicator is a 2 bit code which signals an impending leap second to be added or subtracted in the last minute of the current day. Leap second codes and their corresponding meanings are shown in the table below.

Bit 0	Bit 1	Meaning
0	0	Normal Operation
0	1	61 second last minute
1	0	59 second last minute
1	1	Clock not synchronized

The unsynchronized state is indicated by the NTS-XL whenever the estimated synchronization error is greater than the root dispersion. Such conditions typically occur following turn-on, until synchronization with the external source has been achieved or whenever the synchronization source (GPS) has been removed and the extrapolated time error has exceeded the value of the root dispersion.

A-3 Version Number - The version number is a three bit integer which specifies the NTP version. The NTS-XL will always set this field equal to 3.

A-4 Mode - The mode is a three bit integer that determines the functions the NTS-XL module will perform. TrueTime's NTS-XL module operates in mode four or server mode. Mode four operation allows the module to synchronize hosts but will not allow the module to be synchronized by another host.

A-5 Stratum - The stratum is an eight bit integer providing the stratum level of the local time source. TrueTime's NTS-XL module operates in stratum 1, denoting a primary reference.

A-6 Poll Interval - The poll interval is a signed eight bit integer used as the exponent of two to yield in seconds the minimum interval between consecutive messages. For example, a poll interval value of six implies a minimum interval of 64 seconds. The NTS-XL does not alter the setting of this field.

A-7 Precision - The precision is a signed eight bit integer used as the exponent of two to yield in seconds the precision of the local time source and any other hardware affecting the base level "jitter" of the time server. This field is set to approximate the time stamping resolution of the NTS-XL which is 10  $\mu$ s. So the precision byte is set to -16 which is equivalent to a precision of 15.26  $\mu$ s.

A-8 Synchronizing Distance (Root Delay Version 3) - The root delay is a signed 32 bit fixed point number representing the predicted round-trip delay in seconds to the primary synchronizing source. The fraction point is between bits 15 and 16. This value is set to 0 seconds in TrueTime's NTS-XL module.

A-9 Synchronizing Dispersion (Root Dispersion Version 3) - The root dispersion is a signed 32 bit fixed point number representing the maximum error in seconds relative to the primary synchronizing source. This value is a function of the precision and the quality of the synchronization input option. The synchronization input option is GPS so the NTS-XL will self determine the accuracy. Once the accuracy has been determined, then the NTS-XL sets the root dispersion equal to ten times the square root of the sum of the squares of the precision and the accuracy.

A-10 Reference Clock Identifier - The reference clock identifier is a 32 bit code identifying the particular type of timing source. Strata 0 and 1 use a four-octet, left justified, zero-padded ASCII string. TrueTime's NTS-XL module operates as Stratum 1 and uses this four-octet string based on the local time source input as shown in the table below. This setting is determined based on the NTS-XL synchronization input option.

Local Source Input	Reference Identifier String
GPS	"GPS"
IRIG B	"IRIG"
1 PPS	"1 PPS"
ACTS	"ACTS"

A-11 Reference Timestamp - The reference timestamp is a 64 bit timestamp format representing the local time at the last update. TrueTime's NTS-XL module's reference timestamp is the last time that a valid synchronization source signal was present.

A-12 Originate Timestamp - The originate timestamp is a 64 bit timestamp format representing the time that the request left the client host.

A-13 Receive Timestamp - The receive timestamp is a 64 bit timestamp format representing the time that the request arrived at the service host.

A-14 Transmit Timestamp - The transmit timestamp is a 64 bit timestamp format representing the time that the reply left the service host.

A-15 Authenticator - This is a 96 bit field containing the authenticator information as described in Appendix C of RFC-1305. This field is not implemented by the NTS-XL.

**SNTP v 3.0 DATA FORMAT per RFC1361**

When the NTS-XL replies to requests from SNTP clients, the packet format is the same as the NTP packet format described above, with these differences:

A-1S Leap Indicator - The NTS-XL will set these 2 bits to either 0 (normal) or 3 (unsynchronized) only

A-3S Version Number - The NTS-XL will copy this field from the client request packet and return it in this field.

A-11S Reference Timestamp - This field is set to the time that the reply left the NTS-XL server host

A-13S Receive Timestamp - This field is set to the time that the reply left the NTS-XL server host

A-14S Transmit Timestamp - This field is set to the time that the reply left the NTS-XL server host

A-15S Authenticator - This field is not used in SNTP

## APPENDIX B

### TIME PROTOCOL PER RFC868

B-1 This protocol provides a site-independent, machine readable date and time. The TIME service sends back to the originating source the UTC time in seconds since midnight on January 1, 1900.

B-2 This protocol may be used either above the Transmission Control Protocol (TCP) or above the User Datagram Protocol (UDP). The NTS-XL implements the TIME protocol only above the UDP.

When used via UDP the TIME service works as follows:

Server: Listen on port 37 (45 octal).

Client: Send an empty datagram to port 37.

Server: Send a datagram containing the UTC time as a 32 bit binary number.

Client: Receive the TIME datagram.

The server listens for a datagram on port 37. When a datagram arrives, the server returns a datagram containing the 32-bit time value. If the server is unable to determine the time at its site, it should discard the arriving datagram and make no reply.

#### B-3 The Time Format

The time is the number of seconds since 00:00 (midnight) 1 January 1900 UTC, such that the time 1 is 12:00:01 am on 1 January 1900 UTC; this base will serve until the year 2036.