TYMSERVE 2000
NETWORK TIME SERVER

Operation and Technical Manual

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CHAPTER 1

INTRODUCTION

1.0 GENERAL

The TYMSERVE 2000 Network Time Server Operation and Technical Manual provides the following information:

- General Information and Specifications
- Installation
- Operation and Network Interface
- Input/Output Connectors

1.1 TYMSERVE 2000 FEATURES

The salient features of the TYMSERVE 2000 include:

- User selectable time sources (-GPS, -IRIG versions):
  - GPS Satellite Receiver (-GPS version only)
  - IRIG B time code
  - Free running internal clock (time set by user)
  - External 1 PPS input

- -ACTS version uses the NIST Automated Computer Time Service via telephone for timing.

- Compatible with NTP (Network Time Protocol) Version 2 and 3.

- Supports both the DIX Ethernet and IEEE 802.3 (w/802.2 headers) ethernet frame format. Connection via an AUI connector.

- Provides remote status and configuration with both SNMPv1 and SNMPv2 using MIB-II and a custom MIB extension.

- Provides a menu driven interface for setting up the Internet address and various other parameters.

- Front panel time display (UTC or local time.)

- Provides rear panel Ethernet AUI and signal in/out.

- Provides IRIG B Time Code Output synchronized to the input time source (-GPS, -IRIG versions only).

- Provides a 1 PPS (Pulse Per Second) output synchronized to the input time source (-GPS, -IRIG versions only).

- Provides a 1, 5, or 10 MHz TTL output synchronized to the input time source (-GPS, -IRIG versions only).

- Flywheels through loss of the timing signal to provide continuous NTP time service and output time code.

- Optional rack mount ears. 1 3/4" high.

- Optional 8 time code output buffer (-TDM).

1.2 TYMSERVE 2000 OVERVIEW

The TYMSERVE 2000 is a self-contained primary time server which uses GPS (-GPS version only), IRIG B time code, an internal free running clock, an external 1 PPS input, or (-ACTS only) the NIST Automated Computer Time Service (ACTS) as its time source. Utilizing the NTP protocol (version 2 RFC-1119 and version 3 RFC-1305) over an Ethernet, the user can maintain time synchronization among all computers connected to the network. The NTP Server provides the time server function which synchronizes other hosts on the network, and is never synchronized by these other hosts. Utilizing NTP, synchronization of hosts to within 1 millisecond of the input time source is achievable under the best conditions. The -ACTS version provides timing accuracies to within 10 ms of UTC, but will still synchronize hosts to within 1 ms of the TYMSERVE.

The -GPS and -IRIG versions of the NTP Server provide an IRIG B time code output synchronized to the input time source. By using a time code reader module installed in the users computer, time can be obtained (from the reader) to accuracies on the order of 20 µsec. Bancomm offers time code reader modules for the IBM PC bus, VMEbus, Qbus, STD bus, and SBX bus.

The principal performance characteristics are listed in Table 1-1.

Table 1-1: TYMSERVE 2000 Performance Specifications

Item	Description
Network Interface	
Ethernet Frame Format	DIX Ethernet (Ethernet II, Bluebook) or IEEE 802.3 with 802.2 headers.
Connection	AUI Connector
Time Server Protocol	NTP Version 2 (RFC-1119) NTP Version 3 (RFC-1305)
SNMP Protocol	SNMPv1 (RFC-1157) SNMPv2 (RFC-1451 and associated RFCs)
Time Code Input	
Format	IRIG B
Amplitude	500 mVpp to 5 Vpp
Input Impedance	10K Ohms
Flywheeling	< 2ms per hour (during loss of time code)
Time Code Output	
Format	IRIG B, modulated and DCLS
Amplitude	3 Vpp (nominal for modulated output)
GPS Receiver (-GPS version only)	
Channels	6
Frequency	1.575 GHz, C/A Code
Digital Outputs	
Drive	TTL, > 2.5V into 75 Ohms
-ACTS Timing	
Accuracy	± 10 ms (to UTC) at time of call
Drift Rate	10 ms / hour @ 23º C ± 5º C
Chassis	
AC Power In	110-120/220-240 VAC, 20W, 50/60 Hz (factory configured for 110 or 220)
Size	1.75"(H) X 14.25"(W) X 12"(D) (19"(W) with rack mount ears)
Operating and Storage Environments	
Temperature	
Operating	0º C to 55º C
Non-Operating	-50º C to 125º C

Relative Humidity	
Operating	10% to 80% (non-condensing)
Non-Operating	5% to 95% (non-condensing)

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CHAPTER 2

INSTALLATION

2.0 GENERAL

The NTP Server is a self-contained chassis (desk top or rack mount) equipped with a bc620AT Time and Frequency Processor, CPU Module and an Ethernet Module. This section details the steps required to install the TYMSERVE 2000 Network Time Server.

2.1 ETHERNET CONNECTION

The Server provides a standard AUI connector on the rear panel of the unit. The Server is connected to the network via this AUI connector. The connection can be made directly to a multiport transceiver, or to a thick net or thin net MAU provided by the user.

The Internet address, subnet mask, default gateway, and Ethernet frame format of the TYMSERVE must be changed by the user. Refer to Chapter 4 (Menu System) for details on changing the TYMSERVE network parameters.

2.2 TIMING SOURCE

The TYMSERVE 2000 can use its internal clock as the timing source, but most applications will require an external timing source such as time code or GPS. Refer to Chapter 4 for details on selecting a timing source. Refer to Chapter 5 for details on connecting an external timing source to the TYMSERVE 2000.

2.3 ANTENNA INSTALLATION (-GPS version only)

The most common difficulty encountered using GPS equipment is antenna position. The GPS antenna must be located in an area which has a clear view of the sky. The GPS signals cannot penetrate foliage or structures. It is strongly recommended that the user take the time to properly position the antenna.

The GPS antenna is connected to the TYMSERVE 2000 rear panel connector labeled 'GPS ANTENNA'. The GPS antenna connector is a 15 pin high density 'D' type connector.

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CHAPTER 3

OPERATION AND NETWORK INTERFACE

3.0 GENERAL

The TYMSERVE 2000 time data is accessed via the Ethernet connection by hosts utilizing NTP (Network Time Protocol) over UDP/IP. Time is also available via the IRIG B time code signal provided as a rear panel output (see Chapter 5 Input/Output Connectors.)

3.1 OPERATION

The operation of the TYMSERVE is quite simple. First, use the menu system (See Chapter 4 Menu System) to set the Internet address and various other parameters. Connect the timing signal (GPS, time code, etc.) to the unit. Then connect to the Ethernet. On the user's host machines, make the host NTP daemon aware of the TYMSERVE's Internet address. The NTP daemon will then take care of maintaining time synchronization.

The front panel LCD display of time can be monitored to verify that the TYMSERVE is maintaining time properly. When a loss of time source occurs, the time display will show the word 'FLY' to indicate that it is flywheeling (i.e. maintaining time when the time source is lost).

Once time is initially acquired, the TYMSERVE will continue to provide time even if the timing signal is lost. The NTP message returned by the TYMSERVE will indicate (via the Reference Timestamp) when it last obtained time updates from the timing signal.

3.2 NETWORK INTERFACE

The TYMSERVE 2000 is compatible with NTP versions 2 and 3 as described in RFC-1119 and RFC-1305 by David L. Mills of the University of Delaware. Hosts wanting to be synchronized should be running a copy of the public domain NTP daemon (or some equivalent program.) If an NTP daemon is not available on your system the user can obtain a copy of RFC-1119 (available via FTP or E-Mail from the Network Information Center NIC) in order to implement an NTP daemon for their system. Details of the NTP protocol and synchronization techniques are beyond the scope of this manual.

3.3 SERIAL PORT DATA FORMAT

The TYMSERVE transmits UTC time via the rear panel serial port connector once per second as

an ASCII string (-IRIG, -GPS only). The Carriage Return character is transmitted on-time. The format of the serial port data is shown below. To start the time transmissions send the TYMSERVE a 'c' or 'C' character via the serial port. To stop the time transmissions send an 'r' or 'R' character. Refer to Chapter 4 for information on setting up the serial port protocol. Refer to Chapter 5 for a description of the Serial Port connector.

The following time information string is transmitted once per second (when started with the 'c' or 'C' character). The 'DDD' field represents 3 ASCII digits of days (001 - 366), etc. The Quality Indicator indicates the validity of the time. The Carriage Return character is transmitted on-time. The first rising edge of the Carriage Return character occurs within 200 μsec after the TYMSERVE 1 PPS signal transitions from low to high.

(SOH)DDD:HH:MM:SSQ(CR)(F)

FIELD	DESCRIPTION
(SOH) (0x01)	ASCII Start of Header
DDD	Day of year
HH	Hours (24-hour clock)
MM	Minutes
SS	Seconds
Q	Quality Indicator (space = normal operation)
(CR) (0x0D)	ASCII Carriage Return (transmitted on-time)
(LF) (0x0A)	ASCII Line Feed

QUALITY CHAR	DESCRIPTION
space	Normal operation, time set and not flywheeling
X	Time not set yet
F	Time was set, but currently flywheeling

3.4 NTP DATA FORMAT

The format of the NTP message data area, which immediately follows the UDP header, is shown in Figure 3-1. The NTP message fields are described below. The TYMSERVE 2000 does not implement the optional Authenticator field.

NTP timestamps are represented as a 64-bit unsigned fixed-point number, in seconds relative to 0^h on 1 January 1900. The integer part is in the first 32 bits and the fraction part in the last 32 bits.

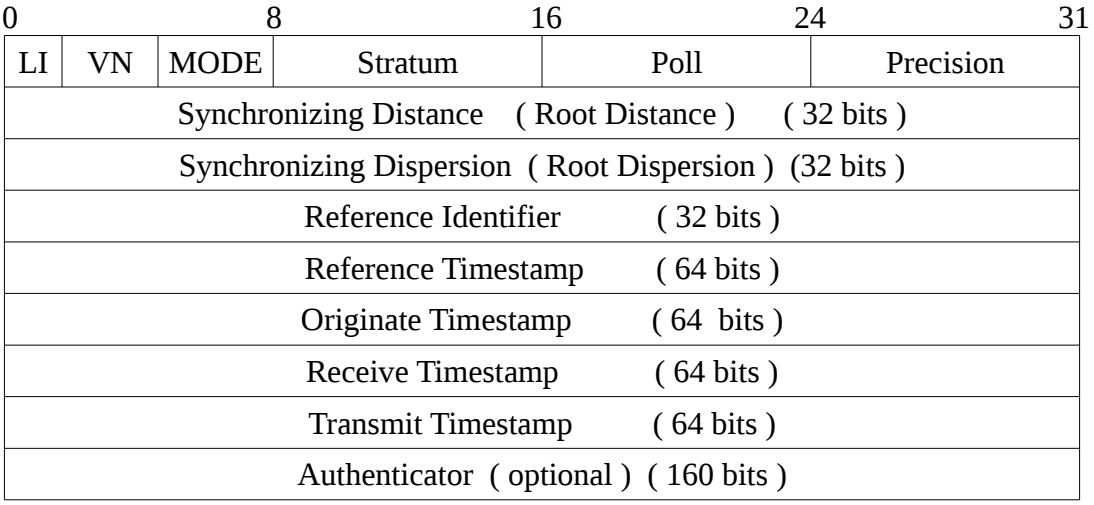

Figure 3-1: NTP Message Data

Leap Indicator (LI): This is a two-bit code warning of an impending leap second to be inserted/deleted in the last minute of the current day, with bit 0 and bit 1, respectively, coded as follows:

00: no warning
01: last minute has 61 seconds
10: last minute has 59 seconds
11: alarm condition (clock not synchronized)

When the TYMSERVE 2000 is first powered on (i.e. before time is initially acquired from the timing signal) and when the timing parameters are changed, the alarm condition will be indicated. This condition will persist until the TYMSERVE acquires time and should not be set again until the unit is powered off and on.

Version Number (VN): This is a three-bit integer indicating the NTP version number. The TYMSERVE will return the version number from the incoming NTP message.

Mode: This is a three-bit integer indicating the mode. For the TYMSERVE this field is set to four (4) indicating the server mode. The TYMSERVE always operates in server mode which means that it will synchronize hosts but will never be synchronized by hosts.

Stratum: This is an eight-bit integer indicating the stratum level of the local clock. For the TYMSERVE 2000 this field is set to one (1) indicating a primary reference.

Poll Interval: This is an eight-bit signed integer indicating the maximum interval between successive messages, in seconds to the nearest power of two. The TYMSERVE will return the poll interval from the incoming NTP message.

Precision: This is an eight-bit signed integer indicating the precision of the local clock, in

seconds to the nearest power of two. For the TYMSERVE this field is set to -19 which is the value closest to the 1 μsec precision of the TYMSERVE.

Synchronizing Distance (Root Distance Version 3): This is a 32-bit fixed-point number indicating the estimated roundtrip delay to the primary synchronizing source, in seconds, with fraction point between bits 15 and 16. Set to 0 in the TYMSERVE.

Synchronizing Dispersion (Root Dispersion Version 3): Synchronizing Dispersion is a 32-bit fixed-point number indicating the estimated dispersion to the primary synchronizing source, in seconds. Root Dispersion indicates the maximum error relative to the primary reference source. Currently set to 0 in the TYMSERVE.

Reference Clock Identifier: This is a 32-bit code identifying the particular reference clock. In the case of stratum 1 (primary reference), this is a four-octet, left justified, zero-padded ASCII string. For the TYMSERVE the four-octet string is dependent on the time source selected as follows:

Time Source	Four-octet String
GPS	'GPS'
IRIG B Time Code	'IRIG'
Free Running Clock	'FREE'
Ext. 1 PPS Input	'1PPS'
NIST ACTS	'NIST'

Reference Timestamp: This is the local time at which the local clock was last set or corrected, in 64-bit timestamp format. With the TYMSERVE the Reference Timestamp is the last time that a valid timing signal was detected. Therefore, the Reference Timestamp will indicate the time at which the timing signal was lost. When the timing signal returns, the Reference Timestamp will be updated.

Originate Timestamp: This is the local time at which the request departed the client host for the service host, in 64-bit timestamp format.

Receive Timestamp: This is the local time at which the request arrived at the service host, in 64-bit timestamp format.

Transmit Timestamp: This is the local time at which the reply departed the service host for the client host, in 64-bit timestamp format.

Authenticator: This field contains 4 bytes of key identifier followed by 16 bytes of MD5 digest. The data is validated when authentication is enabled.

CHAPTER 4

MENU SYSTEM

4.0 GENERAL

The TYMSERVE 2000 provides a menu system accessible via the front panel keyboard and LCD display for setting the Internet address and other parameters. These parameters are stored in EEPROM (-ACTS version also uses battery backed SRAM for some parameter storage) to sustain these settings during loss of power to the Server.

4.1 TYMSERVE 2000 FRONT PANEL

The TYMSERVE 2000 front panel (shown in Figure 4-1) provides a 2 line by 40 character LCD backlit display, a keyboard, and the power on/off switch. The main display screen shown in Figure 4-1 displays the user's local time. If the timing source is lost, the word 'FLY' (-GPS, -IRIG) is also displayed to indicate that the TYMSERVE is 'flywheeling'. The -ACTS version displays call and phone line status on the front panel.

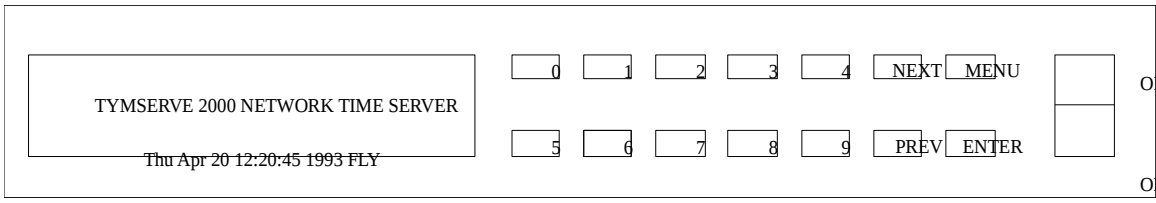

Figure 4-1:
TYMSERVE 2000
Front Panel

LCD DISPLAY: 2 line by 40 character LCD backlit display.

NUMERIC KEYS: Used for entering numeric data and for menu selections.

NEXT, PREV: Used for traversing the menu areas. The NEXT key is also used as an auxiliary character key (i.e. '.' or '-') for parameter entry. The PREV key is also used as a backspace key for parameter entry.

MENU: Used to enter the menu system, and to escape parameter entry.

ENTER: Used to enter parameters.

4.2 ENTERING THE MENU SYSTEM

The menu system may be entered at any time by pressing the <MENU> key. The TYMSERVE (-GPS, -IRIG) continues to provide the Network Time Server functions while the menu system is active. This allows the user to look at parameter settings without affecting time server operation. The -ACTS version, however, stops the NTP server function while in the menu system.

When the <MENU> key is pressed the following main menu is displayed:

```
<1> NETWORK   <2> TIMING   <3> FEATURES
<4> INFO      <5> SAVE     <6> EXIT
```

To enter a submenu (e.g. NETWORK) press the numeric key shown. The submenus are described below.

<1> NETWORK

The NETWORK submenu allows you to set the TYMSERVE's Internet address, subnet mask, default gateway, and the Ethernet frame format. The changes made here will not take effect until you EXIT the menu system.

<2> TIMING

The TIMING submenu allows you to set the TYMSERVE's timing source, time code format, current year, timing source's UTC offset/DST, time code generators UTC offset/DST, the propagation delay compensation (-GPS, -IRIG), and the call reference time/interval (-ACTS). The changes made here will not take effect until you EXIT the menu system.

<3> FEATURES

The FEATURES submenu allows you to change TYMSERVE features which do not affect the NTP time server functionality such as, the local time UTC offset, output frequency, the periodic rate
(-GPS, -IRIG), serial port protocol, and the modem speaker volume, NIST phone number (-ACTS). The changes made here take effect immediately.

<4> INFO

The INFO submenu allows you to examine information about the TYMSERVE such as the firmware version, specialized internal timing parameters, and (for the -GPS version only) GPS packets for position, satellite use, GPS receiver status. Some of the information can be saved in the EEPROM as described later in this chapter.

<5> SAVE

The SAVE function allows you to save the parameter settings in EEPROM so that they are sustained during loss of power to the server. EEPROMs have a limited number of write cycles (10,000) so the TYMSERVE will only save parameters when they have been changed. The TYMSERVE will not 'waste' a write to the EEPROM if the parameters have not changed, so it is safe to press <5> SAVE at any time.

<6> EXIT

EXIT returns the system to the main display, and causes the TYMSERVE to reconfigure itself with the new NETWORK and TIMING parameters if they have changed. During reconfiguration, the NTP time server function will necessarily be interrupted.

4.3 MODIFYING NETWORK, TIMING, AND FEATURE PARAMETERS

To modify the network, timing, or feature parameters, go to the main menu, press <1> (for NETWORK), <2> (for TIMING), or <3> (for FEATURE), then use the <NEXT> and <PREV> keys to display the parameter of interest. When the parameter of interest is displayed, press <ENTER> to modify it. While modifying a parameter, the <MENU> key can be used to escape the modification without making changes.

Some parameters (e.g. Internet Address) are entered in the 'dotted decimal' format. Use the <NEXT> key for the '.' and the <PREV> key for backspacing.

Some parameters (e.g. UTC offsets) are entered as signed integer values. Use the <NEXT> key for the '-' and the <PREV> key for backspacing.

Some parameters (e.g. Time Code Format) are set by selecting one option from a list of options. Use the numeric keys for selecting the desired option.

4.4 VIEWING AND SAVING INFO

To view information about the TYMSERVE 2000, go to the main menu, then press <4>. Press <MENU> to return to the main menu or press <NEXT> to display more information. The information displayed is dependent on the timing source in use. For the -GPS and -IRIG versions the firmware version and the VCXO Voltage (DAC setting) are shown. For GPS only, position, satellite use, and GPS status are also shown. The -ACTS version shows the 'last on/off times' and the 'last sync time'.

Some of the information found here can be saved in the EEPROM (-GPS, -IRIG.) Savable information is shown as two lines on the display, one line shows the 'NEW' information (i.e. that which is current) and the other line shows the 'OLD' information (i.e. that which is saved in the EEPROM.) At the end of the information list, you will be prompted to save the 'NEW' information. To save the new information press <ENTER>, or press any other key to skip the save. It is not necessary to save the 'NEW' information, but it may make the TYMSERVE

synchronize to the timing source faster if the newest information is saved since this information is used to initialize the TYMSERVE.

4.5 SAVING PARAMETERS

All programmable parameters can be saved in EEPROM inside the TYMSERVE 2000. It is obviously desirable to save your setup parameters so that they will be retained during loss of power. To save the parameters, press <5> SAVE at the main menu. If the TYMSERVE detects changes in the parameters then the new parameters will be saved, and the number of writes to the EEPROM will be displayed. If you press <5> SAVE and the parameters have not been changed then the TYMSERVE will not 'waste' a write to the EEPROM, and a message to this effect will be displayed. The EEPROM can be written up to 10,000 times.

4.6 EXITING THE MENU SYSTEM

To exit the menu system press <6> EXIT from the main menu. **You must exit the menu system before the NETWORK and TIMING parameter changes will take effect.** The TYMSERVE will automatically exit the main menu if no key is pressed for about 10 seconds.

4.7 NETWORK PARAMETER DESCRIPTION (all versions)

This section describes the NETWORK parameters for all TYMSERVE versions.

Internet Address: The Internet address is the address at which the TYMSERVE will respond to NTP messages. The 'well known' UDP port number for NTP is 123.

Subnet Mask: The subnet mask allows you to break up your network into sub-networks.

Default Gateway: The TYMSERVE will route packets destined for remote networks through the default gateway at this address.

Ethernet Frame Format: Most of the world is using the DIX Ethernet format (aka Ethernet II, Bluebook), but more and more networks are starting to use the IEEE 802.3 (with 802.2 headers) frame format. The TYMSERVE will work with either of these two Ethernet frame formats.

> **NOTE:** Your Ethernet format is probably DIX, so if the TYMSERVE fails to respond to pings or time requests then you probably have selected the wrong Ethernet frame format.

SNMPv1 R/O: This sets the SNMPv1 read-only community name. The value is a 1 to 8 character ASCII string. The default value is "public".

SNMPv1 R/W: This sets the SNMPv2 read-write community name. The value is a 1 to 8 character ASCII string. The default value is "bancomm".

Party4 TAddress: The Party4 TAddress is the IP address (in dotted decimal format) of the

SNMPv2 manager using the Party3/Party4 pair.

MD5(1): The Party3/Party4 MD5 secret key is a 32 character ASCII representation of a 16 byte hex value. The allowed characters are 0-F and the space character. Any space characters will be converted to an ASCII 0 in the string.

Party6 TAddress: The Party6 TAddress is the IP address (in dotted decimal format) of the SNMPv2 manager using the Party5/Party6 pair.

MD5(2): The Party5/Party6 MD5 secret key is a 32 character ASCII representation of a 16 byte hex value. The allowed characters are 0-F and the space character. Any space characters will be converted to an ASCII 0 in the string.

Party8 TAddress: The Party8 TAddress is the IP address (in dotted decimal format) of the SNMPv2 manager using the Party7/Party8 pair.

MD5(3): The Party7/Party8 MD5 secret key is a 32 character ASCII representation of a 16 byte hex value. The allowed characters are 0-F and the space character. Any space characters will be converted to an ASCII 0 in the string.

NTP Authentication: Enables or disables the use of NTP Authentication per RFC-1305.

NTP Authentication ONLY: Enables or disables the NTP Authentication ONLY mode which restricts access to the TYMSERVE.

NTP Authentication Key ID: The Key ID identifies the NTP Authentication key currently in use on the TYMSERVE.

NTP Authentication Key: The Authentication Key is a MD5 secret key used for NTP Authentication. It is programmed as an 8 character ASCII value.

4.8 TIMING PARAMETER DESCRIPTION (-GPS, -IRIG)

This section describes the TIMING parameters for the -GPS and -IRIG versions.

Timing Source: This parameter sets the timing source for the TYMSERVE. When using time code, be sure to select the time code format, and connect the time code source to the rear panel (see Chapter 5). When using the internal clock, you must set the time manually from the FEATURE area. When using the external 1 PPS source, you must set the time manually, and connect the external 1 PPS to the rear panel. To use the GPS source you must have the -GPS option which consists of a GPS antenna and cable.

Time Code Format: Selects one of several time code formats. Also selects between modulated and DCLS (DC Level Shift) forms of time code.

Current Year: For all timing sources except GPS you must tell the TYMSERVE what year it is because this information is not present with any timing source except GPS.

Auto Year Inc Mode: For all timing sources except GPS the 'auto year increment mode' can be enabled so that the TYMSERVE will automatically increment the year when the day transitions from 365 (366 for leap years) to 1. You can also cause the TYMSERVE to automatically save the new year in the EEPROM with this parameter. If you are running test times and not UTC time, you may not want to save the new year information, especially if it changes often.

NOTE: Automatic year incrementing will take place only if the TYMSERVE is in the main display (i.e. displaying local time) when the year transitions.

Timing Source UTC Offset: For all timing sources except GPS, this parameter indicates the offset from UTC (in hours) of the timing source. This parameter is specified as hours EAST of UTC (e.g. Pacific Standard Time PST is -8 hours) This parameter is very important because NTP timestamps are always relative to 0 hours on 1 Jan 1900 no matter what time zone you are in.

Time Code Source Observes DST: Enable this parameter if you use a time code source that observes DST. Because standard time code signals do not indicate the DST condition, it is not possible for the TYMSERVE to convert the time code time to UTC during the 2 hour period between 01:00:00 and 02:00:00 (this hour occurs twice) on the last Sunday in October (the DST "fall-back" day). The TYMSERVE therefore stops responding to NTP time requests during this 2 hour period.

Propagation Delay: This parameter is used to compensate for long cable delays between the timing source and the TYMSERVE, and is normally used for time code sources only. This parameter can usually be left at 0. Positive values compensate for long cable delays.

Time Code Generator Offset: The TYMSERVE generates an IRIG B time code signal synchronized to the timing source. Use this parameter to add an offset to the time code generator output. This is useful when it is necessary to generate an IRIG B time code signal that carries local time instead of UTC.

Generator Observes DST: This parameter is used in conjunction with the 'Time Code Generator Offset' parameter to cause the generated IRIG B time code signal to compensate for DST.

4.9 FEATURE PARAMETER DESCRIPTION (-GPS, -IRIG)

This section describes the FEATURE parameters for the -GPS and -IRIG versions.

Set time manually: This feature allows you to set the time manually for the Internal Clock and External 1 PPS timing sources only.

Local Time UTC Offset: This feature allows you to set the UTC time offset for your local time and does not affect the NTP timestamps, it only affects the display of time on the LCD display. This parameter is specified as hours EAST of UTC (e.g. Pacific Standard Time PST is -8 hours.)

Daylight Saving Time: This feature works in conjunction with the Local Time UTC Offset to

provide a display of the correct local time in those areas where Daylight Saving Time is observed (most of USA). This feature does not affect the NTP timestamps, it only affects the display of time on the LCD display.

Output Frequency: The rear panel Output Frequency signal can set to either 1, 5, or 10 MHz.

Periodic: The rear panel Periodic Output signal is programmable from 2.5 MHz to less than 1 Hz. The Periodic Output rate is determined by the following:

Periodic Rate = 10 MHz / N1 / N2

where 2 < = N1, N2 < = 65535

The periodic can be synchronized to the TYMSERVE 1 PPS signal for periodic rates greater than or equal to 1 Hz.

Serial Port Protocol: This parameter selects the serial port protocol. Current choices are 9600 baud, 8-N-1 or 9600, 8-O-1.
The serial port is used to transmit UTC once per second using the format described in Chapter 3.

Set parameters to the factory defaults: Use this feature to return all TYMSERVE operational parameters (network, timing, features) to the factory defaults.

4.10 INFORMATION DESCRIPTION (-GPS, -IRIG)

This section describes the information found in the <4> INFO area for the -GPS and -IRIG versions.

Firmware Version: This is the version of the TYMSERVE firmware.

VCXO Voltage (DAC setting): The TYMSERVE synchronizes to the selected timing source by controlling a Voltage Controlled Crystal Oscillator (VCXO). The control voltage is set by a 16-bit Digital to Analog Converter (DAC). The value of the DAC is displayed here. This value is savable, and is used to initialize the DAC at power on and when the timing source is changed. The TYMSERVE will synchronize to the timing source faster (after power on) if the DAC is initialized to the right value. You should let the TYMSERVE synchronize to the timing source for at least 10 minutes before saving this value.

-GPS VERSION ONLY

The following information pertains to the GPS mode only.

Satellite Usage: This display shows the position fix mode and a list of satellites (by number) that the TYMSERVE is currently using for timing and position fixes. The mode essentially shows how many satellites are being used. A satellite number of 00 indicates that no satellite is being used.

GPS Status: This display shows the status and error code for the GPS receiver. The status is coded as follows (in hex):

00	doing position fixes
01	don't have GPS time yet
03	PDOP is too high
08	no usable satellites
09	only 1 usable satellite
0A	only 2 usable satellites
0B	only 3 usable satellites

The error code is bitwise encoded and displayed as two hex digits. The coding is as follows:

bit 0 (LSB)	battery back-up failed
bit 1	signal processor error
bit 2	alignment error, channel or chip 1
bit 3	alignment error, channel or chip 2
bit 4	antenna feed line fault
bit 5	excessive ref frequency error
bit 6	unused
bit 7 (MSB)	unused

Position: The position of the GPS receiver is shown here in degrees and minutes of latitude and longitude. This parameter should be saved anytime the TYMSERVE is moved an appreciable distance (1 mile or more) after the new position has been acquired. Though the GPS receiver will always find its new position even if it is not saved, saving the correct position will result in quicker time acquisition. The GPS receiver can maintain time more accurately when only one satellite is available if it knows its position.

Leap Seconds: GPS time is maintained relative to an atomic clock. UTC, however, is adjusted to compensate for perturbations in the earth's rotation. The difference between GPS time and UTC is maintained as some number of 'leap seconds' which is added to or subtracted from GPS time. The GPS receiver can obtain the leap second data from the satellites, but it may take several minutes to get this information. To expedite this process, the TYMSERVE initializes the GPS receiver with this information. When leap seconds are adjusted, the adjustment takes place either at midnight on July 31 or midnight on December 31. When leap seconds change, the new leap second value should be saved as soon as possible or the TYMSERVE may be off by a second for the period of time that it takes for it to acquire the new leap second value.

4.11 TIMING PARAMETER DESCRIPTION (-ACTS)

This section describes the TIMING parameters for the -ACTS version.

Make call to NIST now: Press <ENTER> at this screen to force an immediate call attempt to NIST. Once a call attempt is made, you must wait for the attempt to complete before attempting another call. While a call attempt is in progress, configuration parameters cannot be changed. A successful call to NIST will synchronize the TYMSERVE's timing. Unsuccessful calls may

indicate a problem with the phone line (the main display will indicate that a call attempt has failed.)

Call Reference Time: The Call Reference Time determines when the next automatic call to NIST will be placed. **This parameter must be entered in UTC time.** To disable automatic calling, set all fields to zero.

Call Interval: The Call Interval determines how often the TYMSERVE will automatically call NIST. The interval can be as short as 1 hour or as long as 1 year. When the Call Reference Time is reached, the Call Interval time will be added to the Call Reference Time to determine when the next call will take place. The more often a call to NIST occurs, the more accurate the time will be. To disable automatic calling, set all fields to zero.

Call On Reset: If Call On Reset is enabled, then at reset when the Call Reference Time has expired, a call will be placed immediately.

4.12 FEATURE PARAMETER DESCRIPTION (-ACTS)

This section describes the FEATURE parameters for the -ACTS version.

Set time manually: This feature allows you to set time manually.

The time must be set to UTC. Setting the time manually will overwrite the time set by NIST, and any call to NIST will overwrite the time set manually.

Local Time UTC Offset: This feature allows you to set the UTC time offset for your local time and does not affect the NTP timestamps, it only affects the display of time on the LCD display. This parameter is specified as hours EAST of UTC (e.g. Pacific Standard Time PST is -8).

Daylight Saving Time: This feature works in conjunction with the Local Time UTC Offset to provide a display of the correct local time in those areas where Daylight Saving Time is observed (most of USA). This feature does not affect the NTP timestamps, it only affects the display of time on the LCD display.

Modem Speaker Volume: This feature controls the volume of the modem speaker which is turned on during the call's dialing and connect phases. The speaker is automatically turned off once the connection to NIST is established.

Phone Prefix: This parameter sets the dialing prefix for NIST. The prefix may include any dialing sequence that is required to reach an outside line, and also must include the NIST area code (currently 303). The comma character provides a 2 second delay, use multiple commas if necessary. The 'W' character instructs the TYMSERVE to wait for a dial tone.

NIST Phone Number: This parameter sets the 7-digit NIST phone number (no area code) and is currently set to 494-4774 and should never require a change.

4.13 INFORMATION DESCRIPTION (-ACTS)

This section describes the information found in the <4> INFO area for the -ACTS version. There is no information to be saved in the -ACTS version.

Firmware Version: This is the version of the TYMSERVE firmware.

bc640AT Firmware Version: This is the version of the firmware for the bc640AT (TYMDIAL) board inside the TYMSERVE.

Last Computer Off Time: This is the last time available before a reset of the TYMSERVE (in UTC.)

Last Computer On Time: This is the first time available following a reset of the TYMSERVE (in UTC.)

Last Time Sync: This is the last time that time was set either manually or by NIST.

CHAPTER 5

INPUT/OUTPUT CONNECTORS

5.0 GENERAL

The TYMSERVE Input/Output connectors are located on the rear panel of the unit. These connectors provide inputs for timing sources, general purpose timing outputs, the Ethernet AUI connector, GPS connector (-GPS version only), an RS-232 serial port, and AC power entry.

5.1 ETHERNET AUI CONNECTOR

The Ethernet AUI connector provides the network connection. The connector is labeled "ETHERNET AUI".

5.2 SERIAL PORT CONNECTOR

The RS-232 serial port connector is a 9 pin 'D' connector (male) with pinouts which are equivalent to an IBM PC (Tx on Pin 3, Rx on Pin 2, Ground on Pin 5).

5.3 RJ11 CONNECTORS

The RJ11 connector labeled 'RJ2' is used on the -ACTS version as the phone line connection, and RJ1 is not used. These connectors are not currently used on the -GPS or -IRIG versions.

5.4 AC POWER ENTRY MODULE

The AC power entry module accepts a standard 3-prong detachable power cord and also houses the AC power fuse. The fuse is housed in a pull-out drawer which has room for a spare fuse. Be sure to replace the fuse with the same rating as the one found there.

5.5 TIME CODE IN BNC (-GPS, -IRIG)

The time code input BNC accepts the input time code signal when time code is used as the timing source.

5.6 DCLS OUT AND TIME CODE OUT BNC (-GPS, -IRIG)

The DCLS output and time code output BNCs carry the time code signals generated by the TYMSERVE. The time code output is a modulated IRIG B time code signal. The DCLS output is a TTL signal representing the envelope of the modulated IRIG B time code signal.

5.7 1 PPS OUT BNC (-GPS, -IRIG)

The 1 PPS output is a 200 ms wide pulse (rising edge on-time), generated by the TYMSERVE and synchronized to the timing source.

5.8 FREQ OUT BNC (-GPS, -IRIG)

The frequency output signal is a TTL output set to either 1, 5, or 10 MHz. This output is synchronized to the timing source.

5.9 PERIODIC OUT BNC (-GPS, -IRIG)

The periodic output signal is a TTL output whose rate is user programmable from 2.5 MHz to less than 1 Hz.

5.10 1 PPS IN BNC (-GPS, -IRIG)

The 1 PPS input BNC accepts an external 1 PPS signal which can be used as the TYMSERVE's timing source.

5.11 10 MHz IN BNC (-GPS, -IRIG)

The 10 MHz input BNC is not currently used.

5.12 SPARE1 AND SPARE2 BNC (-GPS, -IRIG)

Two spare BNC holes are provided for special applications which may require extra input/output connectors.

5.13 GPS ANTENNA CONNECTOR (-GPS)

The GPS antenna connector is installed on the -GPS version only. This 15 pin high density 'D' connector (male) carries the signals from the GPS antenna to the TYMSERVE.

5.14 CHANNEL 1 - 8 OUTPUT BNCs (-GPS, -IRIG with -TDM option)

The 8 BNCs labeled 'CH 1 OUT' through 'CH 8 OUT' are the 8 buffered time code outputs for those systems equipped with the -TDM option only. The TIME CODE OUT BNC also carries the time code output, but this output also drives the buffer's input, so if it gets shorted out then all 8 buffered outputs will be lost.

APPENDIX A

TROUBLESHOOTING GUIDE

A.0 GENERAL

This Appendix provides a troubleshooting guide for user's of the TYMSERVE 2000 Network Time Server. The TYMSERVE is a line-replaceable-unit (LRU), meaning that most users will replace the entire unit with a spare unit (or return the unit to the factory for repairs) should a hard failure occur. This guide will help the user find common problems that occur due to external equipment failures or incorrect TYMSERVE setup.

A.1 TIMING SOURCE PROBLEMS

Front panel displays 'FLY' always:

The word 'FLY' on the front panel display indicates that the timing source is either not present or is unusable. Make sure that you have selected the correct timing source from the TIMING menu. You must exit the menu system before a new timing source selection will take effect. Verify that the timing source (i.e. time code, external 1 PPS, GPS) is connected properly to the TYMSERVE and that the timing signal is actually present on the connector carrying the timing source. When using time code, be sure that the correct time code format has been selected.

Front panel displays incorrect time:

The front panel time display can be setup to display local time or UTC (Universal Time Coordinated) time. The time displayed can be offset from UTC with the Local Time Offset and Daylight Saving Time menu selections (FEATURE menu). If the Local Time Offset is set to 0 and DST is set to 'Not Observed', then the time displayed should be UTC. If not, then the Timing Source Offset menu selection (TIMING menu) may need to be set in order to remove any offset from UTC that the timing source contains. Be sure to set the Current Year parameter (TIMING menu) when using a timing source that does not provide year information (e.g. time code). You may want to review the TYMSERVE Manual in regards to the time offset parameters.

A.2 NETWORK CONNECTION PROBLEMS

TYMSERVE does not respond to NTP queries or pings:

The most common problem with the network interface is with the selection of the Ethernet

Frame Format in the NETWORK menu area. Virtually every Ethernet network in the world, which runs TCP/IP protocols, is using the DIX Ethernet format (aka Ethernet II or Bluebook) and *not* the IEEE 802.3 format. If you are in doubt about what format to select, first try the DIX format, but be sure to exit the menu system to allow the change to take place. Verify that the Internet address, subnet mask, and default gateway settings are correct.

Since the TYMSERVE provides an AUI network connection, you are probably using some kind of MAU (or transceiver) to connect the TYMSERVE to your network. Make sure that your MAU is working properly by swapping it with a known good MAU. The TYMSERVE will respond to a 'ping', so be sure to try pinging it. If the TYMSERVE can be pinged, but it still doesn't appear to respond to NTP queries, then verify that the NTP software on your computers is setup properly, particularly, that it has the correct Internet address of the TYMSERVE.

A.3 MISCELLANEOUS PROBLEMS

The TYMSERVE parameters are changed when power is lost:

The TYMSERVE setup parameters can be saved in EEPROM memory. If you want the TYMSERVE to remember the parameter settings you set, then you must use the SAVE menu selection. Since the EEPROM memory has a limited number of write cycles (10,000 minimum), the TYMSERVE will check the currently set parameters against those stored in EEPROM memory before writing to the EEPROM. If the parameters have not changed, then the TYMSERVE will not *waste* an EEPROM write cycle, so it is safe to use SAVE if you aren't sure whether a parameter change has been made.

There is no output from the serial port:

The serial port provides an ASCII broadcast of UTC time that is often used by computers that can't or don't use NTP. Be sure that your computer is setup with the proper serial port parameters (i.e. baud rate, data bits, stop bits, parity) as setup in the FEATURE menu area. The serial port will start broadcasting the time only after it receives a 'c' or 'C' character, and it will stop the broadcast when it receives an 'r' or 'R' character.

APPENDIX B

NTP AUTHENTICATION

B.0 GENERAL

NTP authentication provides a mechanism which allows a ntp client to ensure that the timestamp received has come from a trusted source and has not been modified in transit. We have extended the authentication mechanism so that it can also be used to deny service to those clients who submit ntp timestamp requests without valid authentication information. The ntp protocol includes space for two variables related to authentication; an authentication key identifier field and a cryptochecksum field.

B.1 AUTHENTICATION MECHANISM

The mechanism used to generate the authentication data must be shared by both the client and the server. The popular public domain implementation of ntp, known as xntp, allows for the use of either DES (Digital Encryption Standard) or MD5 (Message Digest version 5). Due to export restrictions on cryptographic techniques, the TS2000 supports only the MD5 encryption algorithm. MD5 provides an adequate level of security for ntp transmissions.

MD5 is a one-way hash function which processes the input data and produces 128 bits (16 bytes) of hash value. This cryptochecksum is then placed in the packet. Since the data itself is not encrypted, anyone could theoretically capture the packet, modify the data and put a new cryptochecksum into the packet. What makes the cryptochecksum secure is that a mutually agreed upon, secret key is loaded into the MD5 algorithm before the ntp data is loaded. This produces a cryptochecksum which cannot be reproduced without knowledge of the secret key.

B.2 PROGRAMMING AND STORAGE OF KEY IDENTIFIER/KEY PAIR

The TS2000 allows for the programming and storage of one key identifier/key pair. Although it is possible to have over 4 billion keys, one is sufficient for the TS2000 as it only has 1 level of access, requesting timestamps. While there is only 1 key identifier/key pair, the key identifier itself can have any value from 1- 4,294,967,296. The format of the MD5 secret key is based on the approach taken by the public domain xntp package. The key is an 8 character alphanumeric string. This key identifier/key pair is stored in a flash eprom and need only be programmed from the front panel once.

B.3 PUBLIC DOMAIN XNTP PACKAGE

A note should be made for those clients **not** using the public domain xntp package. As defined by RFC1305, the cryptochecksum takes up 64 bits (8 bytes) in the ntp message. Because the MD5 algorithm produces 128 bits (16 bytes) of cryptochecksum, the ntp packet is enlarged by 8 bytes to handle the entire cryptochecksum. As this field is the last in the packet, it should not present any difficulty.

B.4 NTP AUTHENTICATION ONLY

The NTP Authentication ONLY mechanism is an added feature in the TS2000 and not part of the ntp specification as detailed in RFC1305. This mechanism provides a way to restrict access to the TS2000. To understand this mechanism, it is pertinent to first understand the way ntp (RFC1305) defines the authentication process. If authentication is enabled, and a valid authentication key identifier and cryptochecksum is received, then the ntp packet is filled in and a new cryptochecksum is computed and added to the packet. The packet is then sent back to the client. However, if authentication is enabled, and an authentication failure occurs, either because the key identifier is 0 (defined as no encryption) or unrecognized, or the cryptochecksum is invalid, the ntp packet is STILL RETURNED, but will contain no authentication data. Many of our customers have expressed an interest in somehow adapting the authentication mechanism to allow them to restrict access to the TS2000, for security or administrative purposes. The NTP Authentication ONLY mechanism provides that capability. If NTP Authentication has been enabled, and the customer enables the NTP Authentication ONLY mode, the TS2000 will discard any incoming ntp packet which does not contain both a valid key identifier (not equal to 0) and a valid cryptochecksum. In this way, the customer can limit access to the TS2000 to only those clients who have been given the key identifier/secret MD5 key pair.

APPENDIX C

SNMP

C.0 GENERAL

The TS2000 provides remote configuration and status monitoring through the use of SNMP (Simple Network Management Protocol). The TS2000 supports both SNMPv1 and SNMPv2 packets through the use of a bilingual SNMP agent.

C.1 DATUM MIB EXTENSION

The data available from the TS2000 through SNMP is based on the MIB-II variable set which has been enhanced with a custom MIB extension to provide data unique to ntp and the TS2000. Manufacturer specific, or enterprise, MIB extensions are given a unique identifier which defines where the extension is located in the MIB tree. Datum Inc has been assigned an enterprise number of 601. Datum Inc is currently in the process of compiling a RFC to define a standardized ntp variable set and allocate space in MIB-II. Due to this ongoing process, the current MIB extension is defined as experimental (volatile). If you have any input regarding the RFC, or changes to the MIB extension, send email to info@datum.com. Please include datumMIB in the subject. A definition of the MIB extension in shown.

```
 DATUM DEFINITIONS ::= BEGIN

IMPORTS
   MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,
   ObjectName, Integer32, Counter32, snmpModules
         FROM SNMPv2-SMI
   TruthValue, DisplayString, TestAndIncr, TimeStamp
         FROM SNMPv2-TC
   MODULE-COMPLIANCE, OBJECT-GROUP
         FROM SNMPv2-CONF;

datumMIB MODULE-IDENTITY
   LAST-UPDATED "951025"
   ORGANIZATION "Datum Inc."
   CONTACT-INFO
            "
                  Greg Dowd
                  Datum Inc., Bancomm Div.
                  6541 Via del Oro
```

San Jose, CA 95119-1294 US

Tel: +1 408 578 4161
Fax: +1 408 578 4165

```
            E-mail: info@datum.com Please include datumMIB
                        in the subject."
    DESCRIPTION
            "The MIB module for datum entities."
    ::= { private 601 }

bancomm      OBJECT IDENTIFIER ::= {datumMIB 1}
timing       OBJECT IDENTIFIER ::= {datumMIB 2}
austron      OBJECT IDENTIFIER ::= {datumMIB 3}
fts          OBJECT IDENTIFIER ::= {datumMIB 4}
efratom      OBJECT IDENTIFIER ::= {datumMIB 5}
experiment   OBJECT IDENTIFIER ::= {datumMIB 99}

ntpVars      OBJECT IDENTIFIER ::= {experiment 1}
ts2Vars      OBJECT IDENTIFIER ::= {experiment 2}

ntpLeapIndicator OBJECT-TYPE
        SYNTAX INTEGER {
                nowarning(0),         --No warning
                insertion(1),         --last minute has 61 secs
                deletion(2),          --last minute has 59 secs
                alarm(3)              --alarm, clock not sync'd
                }
        MAX-ACCESS read-write
        STATUS current
        DESCRIPTION
                "NTP Leap Indicator.  This is a two-bit code
                warning of an impending leap second to be inserted
                into the NTP timescale.  The bits are set before
                23:59 on the day of insertion and reset after 00:00
                on the following day.  This causes the number of
                seconds (rollover interval) in the day of insertion
                to be increased or decreased by one.  In the case
                of primary servers the bits are set by operator
                intervention, while in the case of secondary servers
                the bits are set by the protocol.  The two bits,
                bit 0 and bit 1, respectively, are coded as follows:
                ================================================
                00      no warning
                01      last minute has 61 seconds
                10      last minute has 59 seconds
                11      alarm condition(clock not synchronized)
                ================================================
                In all except the alarm condition(11), NTP itself
                does nothing with these bits, except pass them on to
                the time-conversion routines that are not part of
                NTP.  The alarm condition occurs when, for whatever
                reason, the local clock is not synchronized, such
```

```
                as when first coming up or after an extended period
                when no primary reference source is available."
        ::= {ntpVars 1}

ntpMode OBJECT-TYPE
        SYNTAX INTEGER {
                unspecified(0),
                symmetricactive(1),
                symmetricpassive(2),
                client(3),
                server(4),
                broadcast(5),
                reservedcontrol(6),
                reservedprivate(7)
                }
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "NTP association mode.  This is an integer
                indicating the association mode, with values
                coded as follows:
                ==========================================
                0       unspecified
                1       symmetric active
                2       symmetric passive
                3       client
                4       server
                5       broadcast
                6       reserved for NTP control messages
                7       reserved for private use
                ==========================================
                NOTE:  In the Datum TS2000 series, this value is
                currently ALWAYS set to 4 (server only)."
        ::= {ntpVars 2}

ntpStratum OBJECT-TYPE
        SYNTAX INTEGER (0..255)
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "Current NTP stratum level.  This is an integer
                indicating the stratum of the local clock with
                values defined as follows:
                ================================================
                0       unspecified
                1       primary reference (e.g., calibrated atomic
                                        clock, radio clock)
                2-255   secondary reference (via NTP)
```

```
                ================================================
                NOTE:  In the Datum TS2000 series, this value is
                currently ALWAYS 1 (primary reference)."
        ::= {ntpVars 3}

ntpPrecision OBJECT-TYPE
        SYNTAX INTEGER (-127..127)
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "Current NTP precision value.  This is a signed
                integer indicating the precision of the various
                clocks, in seconds to the nearest power of two.
                The value must be rounded to the next larger power
                of two; for instance, a 50-Hz (20ms) or 60-Hz (16.17ms)
                power-frequency clock would be assigned the value
                -5 (31.25ms), while a 1000-Hz (1ms) crystal-controlled
                clock would be assigned the value -9 (1.95ms)."
        ::= {ntpVars 4}

ntpRefClkID OBJECT-TYPE
        SYNTAX DisplayString (SIZE (0..255))
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "NTP Reference Clock Identifier.  This is a
                32 bit code identifying the particular reference
                clock.  In the case of stratum 0 (unspecified) or
                stratum 1 (primary reference), this is a four-
                octet, left-justified, zero-padded ASCII string.
                While not enumerated as part of the NTP spec, the
                following are suggested ASCII identifiers:
                ==========================================
                DCN             DCN routing protocol
                NIST            NIST public modem
                TSP             TSP time protocol
                DTS             Digital Time Service
                ATOM            Atomic clock (calibrated)
                VLF             VLF radio (OMEGA,etc.)
                callsign        Generic radio
                LORC            LORAN-C radionavigation
                GOES            GOES UHF environment satellite
                GPS             GPS UHF satellite positioning
                ==========================================
                The following ref ids are used by the TS2000:
                GPS             TS2000-GPS (GPS satellite)
                IRIG            TS2000-IRIG (IRIG B timecode)
                NIST            TS2000-ACTS (NIST ACTS service)
```

```
                FREE            TS2000-ALL (INTERNAL CLOCK)"
        ::= {ntpVars 5}

ntpRefTime OBJECT-TYPE
        SYNTAX DisplayString (SIZE(0..255))
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "NTP Reference Timestamp.  This is the time,
                in timestamp format (converted to octet string),
                when the local clock was last updated.  If the
                local clock has never been synchronized, the value
                is zero."
        ::= {ntpVars 6}

ntpVersion OBJECT-TYPE
        SYNTAX INTEGER (0..127)
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "NTP Version.  This is an integer indicating the
                version number of the sender.  NTP messages will
                always be sent with the current version number
                NTP.VERSION and will always be accepted if the
                version number matches NTP.VERSION.  Exceptions
                may be advised on a case-by-case basis at times
                when the version number is changed.
                ===========================================
                NOTE:  The TS2000 series was implemented using
                NTP version 3.  However, the TS2000 series will
                accept a version of 2 or 3 and return the same
                version number in the packet.  This behavior is
                subject to change."
        ::= {ntpVars 7}

ts2TimeSrcUTCOffset OBJECT-TYPE
        SYNTAX INTEGER (-11..12)
        MAX-ACCESS read-write
        STATUS current
        DESCRIPTION "This variable is valid for the TS2000-IRIG
                or the TS2000-GPS when operating in IRIG decoder
                mode.  The variable represents the offset of the input
                timecode from UTC in signed hours.  The allowable
                values for this variable are -11 through 12.If this
                variable is queried on the TS2000-ACTS it will
                return 0."
        ::= {ts2Vars 1}
```

```
ts2TFPStatus OBJECT-TYPE
        SYNTAX DisplayString (SIZE(0..15))
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "This variable reflects the current status information
                on the TS2000 Time and Frequency Processor.  This info
                is only available on the IRIG and GPS versions.  The
                string will indicate either Tracking or Flywheeling.
                This is a direct reflection of bit 0 of the TS2000
                status bit 0.  Bits 1 & 2 are not relevant for network
                users.
                Status Register Definitions
                ===================================================
                bit 0   1 = flywheeling(not locked)
                          0 = locked(to selected reference)

                bit 1   1 = time offset > X microseconds
                          0 = time offset < X microseconds
                          (X = 5 for IRIG | X = 2 for GPS)

                bit 2   1 = frequency offset > 5E8
                          0 = frequency offset < 5E8
                ==================================================="
        ::= {ts2Vars 2}

ts2GPSPosition OBJECT-TYPE
        SYNTAX DisplayString (SIZE(0..255))
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION "This variable returns a position fix.  It is
                     only valid on the TS2000-GPS.  The returned
                     string will contain the latitude & longitude
                     expressed in degrees & minutes and the
                     altitude in meters.  If this variable is
                     queried on the TS2000-IRIG or TS2000-ACTS the
                     returned value will be N/A."
        ::= {ts2Vars 3}

ts2GPSVelocity OBJECT-TYPE
        SYNTAX DisplayString (SIZE(0..255))
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION "This variable returns a velocity fix.  It is
                     only valid on the TS2000-GPS.  The returned
                     string will contain the East-North-Up velocity
                     expressed in meters/second.  If this variable
                     is queried on the TS2000-IRIG or TS2000-ACTS
```

```
                the returned value will be N/A."
        ::= {ts2Vars 4}

    ts2GPSUTCOffset OBJECT-TYPE
        SYNTAX INTEGER (0..127)
        MAX-ACCESS read-write
        STATUS current
        DESCRIPTION "This variable returns the current offset
                between the monotonic time maintained by the
                GPS satellite constellation and UTC time.
                This value is commonly referred to as the leap
                second count.  It is only valid on the TS2000-GPS.
                This value is obtained from the GPS receiver but
                there may be a time lag between the incidence of
                a leap second correction and the capture of that
                correction by the TS2000-GPS.  For this reason
                the user is allowed to program the leap second
                value which will be used until the TS2000-GPS
                receives the leap second count from the GPS
                satellite constellation.  If this variable is
                queried on the TS2000-IRIG or TS2000-ACTS the
                value returned will be 0."
        ::= {ts2Vars 5}

    ts2ForceACTSCall OBJECT-TYPE
        SYNTAX INTEGER {
                abort(0),
                call(1)
                }
        MAX-ACCESS read-write
        STATUS current
        DESCRIPTION "The variable is used to either initiate a call
                to the NIST ACTS service or abort a call that is
                in progress.  It is only valid on the TS2000-ACTS.
                Reading this value will return abort(0) if offline
                and call(1) if online.
                Sending a set of this value to 0 or 1 will cause
                the TS2000-ACTS to take the appropriate action."
        ::= {ts2Vars 6}

    ts2CallRefTime OBJECT-TYPE
        SYNTAX DisplayString (SIZE(0..10))
        MAX-ACCESS read-write
        STATUS current
        DESCRIPTION "FORMAT: MM/DD/HH.  All 8 digits are required
                for set requests.  Use \ or / as delimiters.
                The variable is used to read or set the call
                reference time.  It is only valid on the
```

```
                    TS2000-ACTS.  For more information on this
                    variable, refer to the TS2000 Users Manual. If
                    this variable is queried on the TS2000-GPS or
                    TS2000-IRIG it will return N/A."
            ::= {ts2Vars 7}

        ts2CallInterval OBJECT-TYPE
            SYNTAX DisplayString (SIZE(0..10))
            MAX-ACCESS read-write
            STATUS current
            DESCRIPTION "FORMAT: MM/DD/HH.  All 8 digits are required
                    for set requests.  Use \ or / as delimiters.
                    The variable is used to read or set the call
                    interval time.  It is only valid on the
                    TS2000-ACTS.  For more information on this
                    variable, refer to the TS2000 Users Manual. If
                    this variable is queried on the TS2000-GPS or
                    TS2000-IRIG it will return N/A."
            ::= {ts2Vars 8}

        ts2CallOnReset OBJECT-TYPE
            SYNTAX INTEGER {
                    nocall(0),
                    call(1)
                    }
            MAX-ACCESS read-write
            STATUS current
            DESCRIPTION "The variable is used to read or set the TS2000-
                    ACTS Reset behavior.  It is only valid on the
                    TS2000-ACTS.  For more information on this
                    variable, refer to the TS2000 Users Manual. If
                    this variable is queried on the TS2000-GPS or
                    TS2000-IRIG it will return 0."
            ::= {ts2Vars 9}

        ts2ACTSPrefix OBJECT-TYPE
            SYNTAX DisplayString (SIZE(0..15))
            MAX-ACCESS read-write
            STATUS current
            DESCRIPTION "The variable is used to read or set the NIST
                    ACTS dial prefix.  It is only valid on the
                    TS2000-ACTS.  For more information on this
                    variable, refer to the TS2000 Users Manual. If
                    this variable is queried on the TS2000-GPS or
                    TS2000-IRIG it will return N/A."
            ::= {ts2Vars 10}

        ts2ACTSPhone OBJECT-TYPE
```

```
        SYNTAX DisplayString (SIZE(0..15))
        MAX-ACCESS read-write
        STATUS current
        DESCRIPTION "The variable is used to read or set the NIST
                ACTS phone number.  It is only valid on the
                TS2000-ACTS.  For more information on this
                variable, refer to the TS2000 Users Manual. If
                this variable is queried on the TS2000-GPS or
                TS2000-IRIG it will return N/A."
        ::= {ts2Vars 11}

ts2NumberNTPRequests OBJECT-TYPE
        SYNTAX INTEGER (0..32768)
        MAX-ACCESS read-write
        STATUS current
        DESCRIPTION "This variable is a rollover counter which
                reflects the number of ntp packets received
                by the TS2000.  It is valid for all versions
                of the TS2000.  The counter may be set to 0."
        ::= {ts2Vars 12}

END
```

C.2 ADDITIONAL STORED MIB VARIABLES

The first 16 characters of the sysName, sysContact and sysLocation will be stored in flash eprom and load during any subsequent initialization or powerup. The only method of setting these variables is to use SNMP set packets.

C.3 MIB COMPILATION

Most SNMP management platforms are capable of reading MIB-II data. The Datum specific MIB extension needs to be added to the manager. Typically, these MIB extensions are defined using a syntax known as ASN.1. The Datum MIB extension is provided on a DOS format floppy disk and is defined using ASN.1. The user should consult their SNMP manager documentation in order to determine how to compile the Datum MIB extension into their SNMP software package.

C.4 SECURITY

Once the SNMP management software has been configured to recognize data from the TS2000, the security parameters on the manager need to be defined to match those set on the TS2000. These parameters are different dependent on whether SNMPv1 or SNMPv2 messages will be sent.

C.4.1 SNMPv1

The security parameters for SNMPv1 are based on a community name, which is a string of ASCII characters (i.e. "public"), and an IP address. The TS2000 defines the IP address such that SNMPv1 packets will be accepted from any IP address which has a valid community name. The community name in SNMPv1 packets defines the level of access. The TS2000 allows for the definition of 2 community names, one which is read-only and another which has read-write privileges. The design of the SNMPv1 section of the agent defines that the view (which section of the MIB tree) the incoming SNMPv1 packet acts upon must be the same for both the read-only and the read-write communities. With this in mind, the view of SNMPv1 packets is from internet (OID 1.3.6.1) down with the modifier that the snmpParties (OID 1.3.6.1.6.3.3.2.1) is excluded to prevent SNMPv1 packets from modifying the SNMPv2 Party Table. The user should consult their SNMP manager documentation in order to determine how to create an object and set the community names. Typically, the information required will be the IP address of the TS2000 and the community names which were set through the front panel of the TS2000.

C.4.2 SNMPv2

NOTE: The IETF is currently reviewing SNMPv2. There is a very strong possibility that SNMPv2 will be abandoned before 1996 in favor of a version of SNMP which provides a higher level of security than SNMPv1 and yet removes much of the complex security structure of SNMPv2. Datum Inc provides no warranty than SNMPv2 will be supported in future versions of the TS2000 or other Datum products.

IT IS STRONGLY SUGGESTED THAT YOU USE SNMPv1 TO COMMUNICATE WITH THE TS2000.

The security mechanism for SNMPv2 is complex and an explanation of how the various parts interact is beyond the scope of this manual. The following presentation of SNMPv2 configuration to access the TS2000 assumes that the user is knowledgeable about SNMPv2 parties, contexts and views.

C.4.2.1 SNMPv2 PARTIES

The TS2000 SNMPv2 agent has 10 parties in its party table. The entries are arranged in pairs. The party id follow the standard SNMP format, using initialPartyId.IPaddress.#, where # is a cardinal number from 1-10. The IP address is read from flash EPROM when the party table is initialized. Entries 9 & 10 in the party table are "pseudo-parties" or parties which handle the SNMPv1 requests. Parties 1, 3, 5 & 7 identify the TS2000 while parties 2, 4, 6 & 8 identify the corresponding remote entities.

Parties 1 & 2 handle the noAuth/noPriv packets. The TAddress field in party 2 is not checked as it is defined noAuth/noPriv. This means that any SNMPv2 manager may send requests using party1 as the destination and party2 as the source. If you correlate these parties with the context and view tables, it becomes apparent that this does not present a security concern as the only supported operations are get, getnext and getbulk.

Set operations require the use of an authentication mechanism, MD5. For set operations, the IP address of the remote party is checked against its TAddress field and the cryptochecksum transmitted in the packet is validated. As a separate party pair is required for each SNMPv2 manager, the TS2000 allows party entries for up to 3 remote SNMPv2 managers to access the TS2000 using set requests. The three remote parties are 4, 6 & 8. For security reasons, you must program the TAddress and MD5 key values for these parties from the front panel of the TS2000. When the MD5 key is programmed, its value will be copied to the corresponding local party.

Note that due to export restrictions on cryptographic techniques, the use of DES privacy, the encryption of the data inside an authenticated packet, is not supported. The purpose of the DES encrypted packets is to prevent sensitive data inside the packets from being viewed by unauthorized personnel. As the TS2000 SNMP agent does not transmit or receive sensitive data, full functionality is preserved.

Many of the fields in the party table entries are the same for parties 1- 8. Those fields which are common to these parties are shown below.

Common Party Members	
partyTDomain	1.3.6.1.6.1.1 (snmpUDPDomain)
partyMaxMessageSize	1458
partyAuthClock	0
partyAuthPublic	NULL
partyAuthLifetime	300
partyPrivProtocol	noPriv
partyPrivPrivate	NULL
partyPrivPublic	NULL

The definition of the remainder of each party entry is shown below. Note that an extra member is defined as "partyLocation". This takes a value of "local" or "remote" to help identify the parties. This information would be reversed on the management platform.

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Party Table Entry 1	
Party Field	Defined Value
partyIdentity	1.3.6.1.6.3.3.1.3.**TS2000IPAddress**.1
partyTAddress	127.0.0.1
partyAuthProtocol	noAuth
partyAuthPrivate	NULL
partyLocation	local

Party Table Entry 2	
Party Field	Defined Value
partyIdentity	1.3.6.1.6.3.3.1.3.**TS2000IPAddress**.2
partyTAddress	0.0.0.0
partyAuthProtocol	noAuth
partyAuthPrivate	NULL
partyLocation	remote

Party Table Entry 3	
Party Field	Defined Value
partyIdentity	1.3.6.1.6.3.3.1.3.**TS2000IPAddress**.3
partyTAddress	127.0.0.1
partyAuthProtocol	v2md5AuthProtocol
partyAuthPrivate	**Same as party 4 partyAuthPrivate setting**
partyLocation	local

Party Table Entry 4	
Party Field	Defined Value
partyIdentity	1.3.6.1.6.3.3.1.3.**TS2000IPAddress**.4

Party Table Entry 4	
partyTAddress	**User programmed on TS2000 Front Panel**
partyAuthProtocol	v2md5AuthProtocol
partyAuthPrivate	**User programmed on TS2000 Front Panel**
partyLocation	remote

Party Table Entry 5	
Party Field	Defined Value
partyIdentity	1.3.6.1.6.3.3.1.3.**TS2000IPAddress**.5
partyTAddress	127.0.0.1
partyAuthProtocol	v2md5AuthProtocol
partyAuthPrivate	**Same as party 6 partyAuthPrivate setting**
partyLocation	local

Party Table Entry 6	
Party Field	Defined Value
partyIdentity	1.3.6.1.6.3.3.1.3.**TS2000IPAddress**.6
partyTAddress	**User programmed on TS2000 Front Panel**
partyAuthProtocol	v2md5AuthProtocol
partyAuthPrivate	**User programmed on TS2000 Front Panel**
partyLocation	remote

Party Table Entry 7	
Party Field	Defined Value
partyIdentity	1.3.6.1.6.3.3.1.3.**TS2000IPAddress**.7
partyTAddress	127.0.0.1
partyAuthProtocol	v2md5AuthProtocol

Party Table Entry 7	
partyAuthPrivate	**Same as party 8 partyAuthPrivate setting**
partyLocation	local

Party Table Entry 8	
Party Field	Defined Value
partyIdentity	1.3.6.1.6.3.3.1.3.**TS2000IPAddress**.8
partyTAddress	**User programmed on TS2000 Front Panel**
partyAuthProtocol	v2md5AuthProtocol
partyAuthPrivate	**User programmed on TS2000 Front Panel**
partyLocation	remote

C.4.2.2 SNMPv2 ACCESS CONTROL

Acl Table Entries				
Index	Target Party (by Entry Number)	Subject Party (by Entry Number)	Resources-Context (by Entry Number)	Privileges
1	1	2	1	0x35
2	2	1	1	0x04
3	3	4	2	0x35

Acl Table Entries				
4	4	3	2	0x04
5	3	4	1	0x43
6	4	3	1	0x04
7	5	6	2	0x35
8	6	5	2	0x04
9	5	6	1	0x43
10	6	5	1	0x04
11	7	8	2	0x35
12	8	7	2	0x04
13	7	8	1	0x43
14	8	7	1	0x04

C.4.2.3 SNMPv2 CONTEXTS

Context Table Entries		
Index	Context Id	View (by Index)
1	1.3.6.1.6.3.3.1.4.**TS2000IPAddress**.1	1
2	1.3.6.1.6.3.3.1.4.**TS2000IPAddress**.2	2

C.4.2.4 SNMPv2 VIEWS

View Table Entries		
Index	MIB View OID	View Modifier
1	1.3.6.1	included
1	1.3.6.1.6.3.3.2.1	excluded
2	1.3.6.1	included

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