MODEL 8189 NETCLOCK/NTP

NETWORK TIME PROVIDER

INSTRUCTION MANUAL

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MANUAL REVISION 1.2
DECEMBER 2002

TIME OF DAY PRODUCT FIVE YEAR WARRANTY

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EXTENDED WARRANTY COVERAGE

Extended warranties can be purchased for additional periods beyond the standard five year warranty. Contact Spectracom during the last year of the standard five year warranty for extended coverage.

6/1/98

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SECTION 1: GENERAL INFORMATION

GENERAL INFORMATION

1.0 INTRODUCTION

The Spectracom NetClock/NTP Network Time Provider, shown in Figure 1-1, is a precise, traceable time provider. The NetClock/NTP receives and recovers time information from the Global Positioning System (GPS) constellation of satellites. The GPS constellation consists of 24 satellites placed in 6 orbital planes spaced equally around the equator and inclined at a 55-degree angle. This design assures reliable worldwide coverage 24 hours a day. Each satellite contains a redundant system of highly accurate and stable atomic clock sources. The satellite's timing, orbital position and other system parameters are monitored and controlled by ground stations maintained by the US Department of Defense and US Naval Observatory.

The NetClock/NTP is ideally suited as a Master Clock in all applications requiring an accurate and traceable time source. Typical applications include computer network timing, utility billing, financial transactions, public safety and transportation.

A variety of time code outputs are available to meet the requirements of numerous systems. The NetClock/NTP Network Time Provider provides timing outputs accurate to within 100 microseconds of UTC.

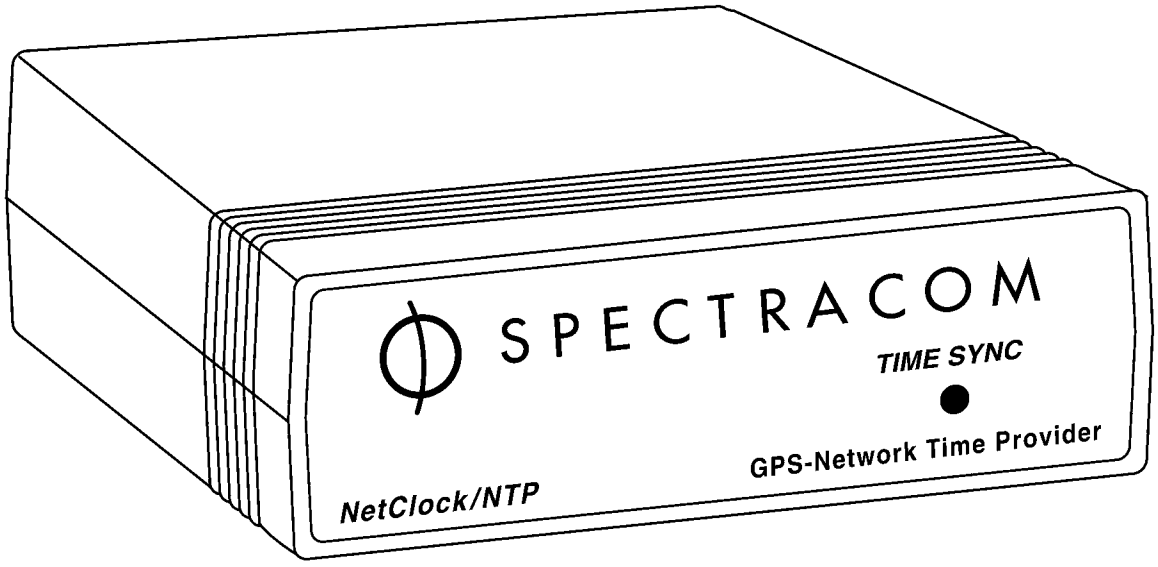


FIGURE 1-1 NETCLOCK/NTP NETWORK TIME PROVIDER

1.1 FEATURES

The Spectracom NetClock/NTP offers the following features:

- **RELIABLE WORLD WIDE COVERAGE**: The NetClock/NTP can receive and track up to eight satellites simultaneously.
- **TRACEABILITY**: GPS Satellite time is continuously monitored and precisely controlled by the U. S. Department of Defense and the U.S. Naval Observatory.
- **ACCURACY**: The NetClock/NTP time data outputs are within 100 microseconds of UTC.
- **AUTOMATIC ADJUSTMENT FOR LOCAL TIME**: Time zone and Daylight Saving Time corrections can be applied to the output time data streams.
- **EASY INSTALLATION**: Indoor window mount antenna simplifies installation.
- **MULTIPLE TIME DATA PORTS**: Each NetClock/NTP includes an ethernet port for network synchronization, and an RS-232 and RS-485 port for non-networked applications.

1.2 UNPACKING

Upon receipt, carefully examine the carton and its contents. If there is damage to the carton that results in damage to the unit, contact the carrier immediately. Retain the carton and packing materials in the event the carrier wishes to witness the shipping damage. Failing to report shipping damage immediately may forfeit any claim against the carrier. In addition, notify Spectracom Corporation of shipping damage or shortages, to obtain replacement or repair services.

Remove the packing list from the envelope on the outside of the carton. Check the packing list against the contents to be sure all items have been received.

Each NetClock/NTP is shipped with an instruction manual and ancillary kit. Each ancillary kit includes mating connectors for the RS-485 and Alarm outputs and a 115 VAC to 12 VDC wall adapter.

A Model 8228 window mount GPS antenna is also provided with each NetClock/NTP shipment. A mounting bracket and 50 feet of antenna coax is provided to simplify installation.

1.3 WARRANTY INFORMATION AND PRODUCT SUPPORT

Warranty information is found on the leading pages of this manual. The Model 8189 contains GPS receiver and network interface cards that are not manufactured by

Spectracom Corporation. These items shall carry a one-year warranty. In addition, the AC power adapter carries a one-year warranty. Should it become necessary to exercise the warranty, contact Spectracom Corporation to obtain a replacement or service.

Spectracom continuously strives to improve its products and therefore greatly appreciates any and all customer feedback given. Please participate in Spectracom's Customer Satisfaction Survey found on our web site at:

http://www.spectracomcorp.com

The online survey is also used for warranty registration of your new Spectracom products. All completed entries are automatically entered into a monthly prize give away drawing.

Technical support is available by telephone. Please direct any comments or questions regarding application, operation, or service to Spectracom Customer Service Department. Customer Service is available Monday through Friday from 8:30 A. M. to 5:00 P.M. Eastern time.

Telephone Customer Service at: **585-381-4827**.

In addition, please contact customer service to obtain a Return Material Authorization Number (RMA#) before returning any instrument to Spectracom Corporation. Please provide the serial number and failure symptoms. Transportation to the factory is to be prepaid by the customer. After obtaining an RMA# ship the unit back using the following address:

Spectracom Corporation
Repair Department, RMA# xxxxx
101 Despatch Drive
East Rochester, NY 14445

Product support is also available by e-mail. Questions on equipment operation and applications may be e-mailed to Spectracom Sales Support at:

mailroom@spectracomcorp.com

Repair or technical questions may be e-mailed to Spectracom Technicians at:

techsupport@spectracomcorp.com

Visit our web page for product information, application notes and upgrade notices as they become available at:

http://www.spectracomcorp.com

1.4 MANUAL ERRATA AND SPECIAL DOCUMENTATION

Information concerning manual corrections or product changes, occurring after printing, are found in the Errata Section. An erratum, when required, is found at the end of this manual. Please review and incorporate changes into the manual whenever an Errata Section is included.

Spectracom will make instrument modifications upon special request. The documentation associated with any modification is also located in the back of the manual.

1.5 SPECIFICATIONS

This section contains specifications for the Model 8189 NetClock/NTP and the Model 8228 GPS Antenna.

1.5.1 Receiver

Received standard:	L1 C/A Code transmitted at 1575.42 MHz.
Satellites tracked:	Up to eight simultaneously.
Acquisition time:	Typically <15 minutes from a cold start.
Acquisition sensitivity:	-105 dBm to -137 dBm.
Tracking sensitivity:	-139 dBm.
Antenna connector:	SMA, female.
Holdover:	Typically ≤50 milliseconds over 24 hours.

1.5.2 RS-232 Setup Port

Function:	Accepts commands to configure output signal options, set operational parameters, and monitor receiver performance.
Connector:	DB9 female, pin assignments conform to EIA/TIA-574 standard, data communication equipment (DCE). XON/XOFF flow control is supported.
Character structure:	ASCII, 1 start, 8 data, 1 stop, no parity.

1.5.3 10 Base-T Port

Function:	Networked NTP Stratum 1 Time Server.
Protocols supported:	NTP (RFC 1305), SNTP (RFC 1361), Telnet, SNMP (with MIB II support), MD5 Security and TFTP.
Security Features:	Up to 16-character Telnet password, Telnet Disable, TFTP Disable, SNMP Disable and MD5 Authentication.
Connector:	RJ-45, Network IEEE 802.3.
Clients supported:	Up to 128 users may be supported in a single sub-network. A gateway greatly increases the number of users.
Loading:	300 requests per second without encryption. 20 requests per second with encryption.

1.5.4 RS-232 Communication Port

Signal:	Selected time data format in RS-232 levels when interrogated by the connected device. This port may also be configured to provide a continuous once-per-second output.
Connector:	DB9 female, pin assignments conform to EIA/TIA-574 standard, data communication equipment (DCE). No flow control.
Character structure:	ASCII, 1 start, 8 data, 1 stop, and no parity.
Accuracy:	Data stream on time marker within ± 100 microseconds of UTC in Formats 0, 1, and 3. Formats 2 and 4 within ±1 millisecond of UTC.
Configuration:	Baud rate and output data formats are selected using the RS-232 Setup port. Bit rate selections are 1200, 2400, 4800 and 9600 baud. There are six data format selections available.

1.5.5 RS-485 Output

Signal:	Selected time data format in RS-485 levels, output once per second.
Connector:	Removable 3-position terminal block (supplied).
Character structure:	ASCII, 1 start, 8 data, 1 stop, and no parity.
Accuracy:	Data stream on time marker within ± 100 microseconds of UTC.
Configuration:	Baud rate and output data formats are selected using the RS-232 Setup port. Bit rate selections are 1200, 2400, 4800, and 9600 baud. There are six data format selections available.

1.5.6 Time Sync Indicator

Front panel bi-color LED indicates the time data accuracy.

Green:	Indicates the outputs are within 100 microseconds of UTC when tracking at least one satellite. If the receiver is currently not tracking any satellites, the output accuracy is within 500 microseconds of UTC. The lamp remains green until the period allotted for the Time Sync Alarm expires. Default period is 2 hours.
Red:	Indicates the receiver is not tracking satellites. Time data accuracy may not be within published specifications.

1.5.7 Alarm Output

Alarm relay contacts allow remote monitoring of operational status. A power failure, CPU failure or loss of Time Sync cause the alarm relay to de-energize. The alarm relay returns to normal operation (energized) when the fault condition is corrected.

Alarm conditions:	Power failure, CPU, Antenna Problem, Invalid SmartWatch and loss of Time Sync.
Relay contacts:	NO, NC, and Common.
Contact rating:	30 VDC, 2 amps.
Connector:	3-position terminal block (supplied).

1.5.8 Input Power

Power source:	115 VAC / 60 Hz.
DC input:	12 to 36 VDC, 10 watts.
Connector:	Barrel, 5.5mm O.D., 2.1mm I. D.
Polarity:	Positive shell, negative center.
Optional power:	International Power Supply, Part Number PS00142, operates from a 100-250 VAC, 50-60 Hz power line.

1.5.9 Mechanical and Environmental

Dimensions:	2.0 H x 6.0 W x 7.0 D inches (51 H x 153 W x 178 D mm).
Weight:	2.0 lbs. (0.9 kg).
Temperature:	32° to 122°F (0° to 50°C) operating range.

1.5.10 Model 8228 GPS Antenna Specifications

Type:	Active, 28dB gain.
Frequency:	1575.42 MHz.
Temperature range:	-40° to 212°F (-40° to 100°C).
Connector:	SMA, male.
Antenna cable:	50-foot (15 meters) antenna cable is provided.
Power:	5 Volts, 20 milliamps, powered by receiver.
Dimensions:	2.0L x 1.7W x .7H inches (50L x 43W x 18H mm).
Weight:	1.4 oz. (40 grams), less cable.
Mounting:	Window bracket is secured using double-sided adhesive foam tape.

1.5.11 Declaration of Conformity

EMC Directive 89/336/EEC: 1989

Emissions Unit meets all requirements for a Level B Group 1 device as specified in documents EN55022: 1994 + A1: 1995 + A2: 1997 using test methodologies described in: Cispr22: 1997,

EN61000-3-3: 1995, EN61000-3-2: 1995

Immunity EN55024: 1998, Cispr24: 1997, EN61000-4-8, EN61000-4-11, EN61000-4-2: 1995, EN6100-4-3:1997,EN61000-4-4: 1996, EN61000-4-6 Part 4 section 6

SAFETY Directive 93/42/96: 1996 Low Voltage directive, Directive 92/59/EEC General Product Safety Directive, EN 60950: 1992 Safety of Information Technology Equipment, and UL60950 3rd Edition Safety of Information Technology Equipment. Safety Compliance Certification Number SAF3259A.02.

SUPPLEMENTAL INFORMATION

The product herewith complies with the requirements of the Marking Directive 93/68/EEC: 1993 and carries the CE mark accordingly. The Technical File required by this directive is maintained at Spectracom Corporation.

SECTION 2: INSTALLATION

INSTALLATION

2.0 INSTALLATION OVERVIEW

The installation of the Model 8189 can be broken down into the following seven steps:

1) Select a location for the NetClock/NTP meeting the following criteria:
   - Within 50 feet of a window to allow indoor antenna installation.
   - Access to a network hub connection.
   - Access to an AC power receptacle.

   A 19-inch rack mount kit is available for the Model 8189. Contact Spectracom for additional information on the Option 03 Rack Mount Kit.

2) Install the indoor GPS antenna as described in Section 2.1. Refer to Appendix A for installation information on the Model 8225 Outdoor GPS Antenna.

3) Apply power to the NetClock/NTP and allow 20 minutes to GPS time synchronize.

4) Configure the 10 Base-T port network parameters such as IP address, gateway IP address, net mask, security features, etc. using an RS-232 or Telnet connection. Review the network parameters as described in Section 2.3 with your network administrator to avoid improper setup. Section 2.3.1 describes the RS-232 configuration method. Telnet configuration is described in Appendix B.

   Connect to a 10 Base-T hub or switch on the network using a straight through RJ-45 cable. Verify the 10 Base-T port operation using the ping command.

5) Install and configure the NTP or SNTP software on the servers and workstations where required. Refer to Section 3.2.3 for NTP application information.

6) Configure the NetClock/NTP RS-232 and RS-485 ports as required. The RS-232 port can be used to synchronize an isolated network or stand-alone PC. The RS-485 port is typically used to synchronize Spectracom TimeView wall clocks. Refer to Section 2.4 for configuration information when these ports are used in your application.

7) Qualify the GPS reception quality as described in Appendix C.

2.1 MODEL 8228 GPS ANTENNA

The Model 8228, shown in Figure 2-1, is an active antenna tuned to receive the GPS 1575.42 MHz L1 band satellite broadcasts. The received signals are passed through a narrow bandpass

filter and a preamplifier within the antenna. The active antenna circuitry provides 28 dB of gain and requires +5 VDC at 20 milliamps. The GPS receiver provides power over the antenna coax. Each antenna is terminated with an SMA male connector and includes a 50-foot interconnecting coax cable.

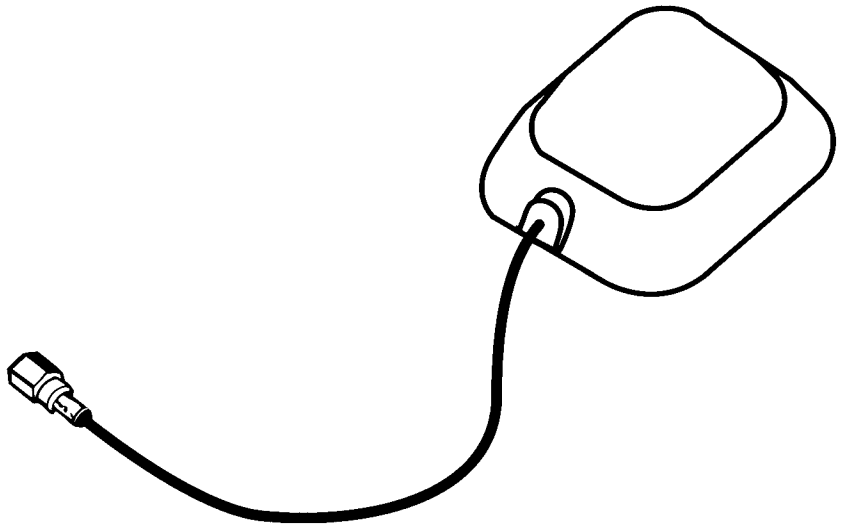


FIGURE 2-1 MODEL 8228 GPS ANTENNA

2.1.1 Antenna Installation

There are two factors to consider when installing the Model 8228 GPS Antenna:

1. Select a window having the best view of the sky as possible.
2. Make certain the selected window does not require more than the supplied 50-foot coax to connect to the NetClock/NTP.

Avoid selecting windows having nearby trees, tall shrubs or other obstructions that may block the antenna's view of the sky. Installing the antenna behind metal screens or blinds may reduce signal reception. Refer to Figure 2-2 for additional mounting guidelines.

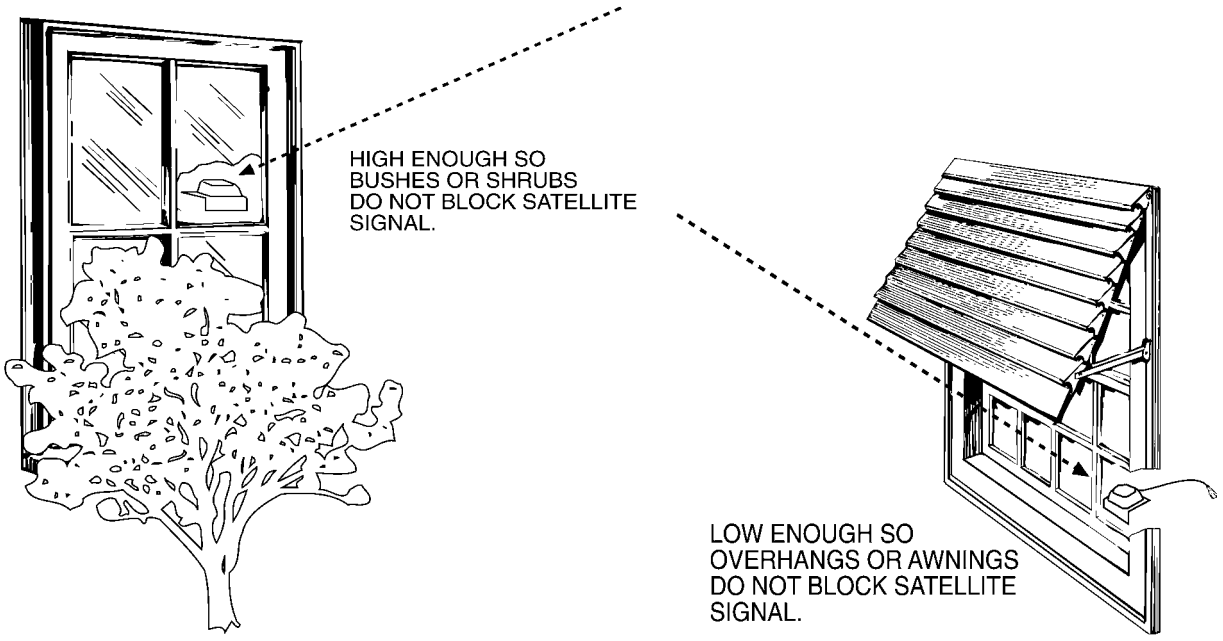


FIGURE 2-2 ANTENNA MOUNTING GUIDELINES

The supplied mounting bracket adheres to the window using double-sided adhesive foam tape. Affix the bracket to a clean window, oriented as shown in Figure 2-2.

In some installations the required antenna cable may exceed the supplied 50-foot length. NEVER add cable to extend the cable length beyond 50 feet. Lower loss cable or an inline amplifier must be used to assure proper operation. Contact Spectracom Tech Support at 585.381.4827 for recommendations.

2.2 POWER AND GROUND CONNECTION

An external AC to DC power adapter powers the NetClock/NTP. The standard clock is provided with a 115 VAC, 60-Hz wall mount adapter.

An International Power Adapter is available from Spectracom. Specify Part Number PS00142. This tabletop power adapter operates from a 90 to 240 VAC, 47 to 63 Hz power line. The international power adapter is shipped with a line cord compatible with AC receptacles (NEMA 5-15R) commonly found in the United States and Canada. Alternate type line cords or adapters may be obtained locally.

If you are providing your own power adapter, refer to Section 1.5.8 for adapter specifications.

The chassis ground stud allows the NetClock/NTP chassis to be connected to an earth ground or single point ground. Connecting the chassis to a single point ground system may be required in some installations to ensure optimum lightning protection. An earth ground is also recommended in installations where excessive noise on the power line degrades receiver performance.

2.3 10 BASE-T PORT CONFIGURATION

When configuring the Model 8189, there are parameters that will be unique to each network. Please review the following configuration parameters A through F with your network administrator. Record the desired configuration parameters in Table 2-3.

A. IP Address - This is the unique 32-bit address assigned to the Model 8189 by the network administrator. The default IP address is 194.039.078.253.

Note: The reserved Network and Broadcast addresses cannot be assigned to the Model 8189 (host address). For example, the host address of .000 is used to identify the entire network and .255 identifies the broadcast address.

B. Gateway Address - The gateway/router address is needed if communication to the Model 8189 is made outside the local network. By default, the gateway is disabled.

C. Subnet Mask - A subnet mask allows routers and gateways to handle packets quicker by eliminating the need to process the host bits contained in the IP address. The subnet mask defines the number of bits taken from the IP address that are used in the host portion.

The default host bit value is 00. Setting the host bit value to 00 allows automatic selection of the appropriate default net mask based on the IP address used. The default subnet mask for each of the common network classes is shown in Table 2-1.

Network Class	IP Address Range	Host Bits	Default Subnet Mask
A	1.x.x.x to 127.x.x.x	24	255.0.0.0
B	128.0.x.x to 191.255.x.x	16	255.255.0.0
C	192.0.0.x to 223.255.255.x	8	255.255.255.0

TABLE 2-1 DEFAULT NET MASKS

The number of host bits used in the net mask can range from 2 to 24 bits. Table 2-2 provides the complete list of the number of host bits and the corresponding subnet mask.

Host Bits	Equivalent Net	Host Bits	Equivalent Net mask
2	255.255.255.252	14	255.255.192.0
3	255.255.255.248	15	255.255.128.0
4	255.255.255.240	16	255.255.0.0
5	255.255.255.224	17	255.254.0.0
6	255.255.255.192	18	255.252.0.0
7	255.255.255.128	19	255.248.0.0
8	255.255.255.0	20	255.240.0.0
9	255.255.254.0	21	255.224.0.0
10	255.255.252.0	22	255.192.0.0
11	255.255.248.0	23	255.128.0.0
12	255.255.240.0	24	255.0.0.0
13	255.255.224.0		

TABLE 2-2 EQUIVALENT NET MASK TABLE

D. SNMP Address - Simple Network Management Protocol allows monitoring of the NetClock/NTP status over the network. Up to two IP addresses for SNMP managers can be specified. By default the SNMP IP addresses are set to 0.0.0.0. When the SNMP feature is enabled a SNMP Community Name of up to 13 characters can be assigned. Refer to Section 3.2.3 for a complete description of the SNMP traps.

E. Encryption - When authentication is required, up to six MD5 or DES keys can be set. All key inputs are in hexadecimal format. Each key number (1...6) consists of up to eight 8-bit groups. Factory default disables encryption. Refer to Section 3.2.3 for additional information on Encryption.

NOTE: The Encryption feature does not mean that the time packet will be encrypted. This feature is used to authenticate that the received time packet came from the desired time-server. To use this feature, both the 8189 and the NTP client use the same MAC key. When the NTP client requests the time, the Model 8189 appends the time packet with the authentication key.

F. Security Settings- The Model 8189 offers the following security features:

Telnet Password - A Telnet password may be implemented to prevent unauthorized access of the NetClock/NTP configuration over the network. A password can be up to 16 characters long and may be any combination of letters, numbers or keyboard symbols. The default is "No Telnet Password Selected".

NOTE: The RS-232 setup port is not password protected. Password protection is only applicable for Telnet connections.

Telnet Disable- This feature prevents any telnet configuration session. Future configuration changes must be made using the RS-232 Setup port when this feature is selected. By default, telnet configuration is enabled.

TFTP Disable- Firmware upgrades are made using a binary file from a TFTP client. If the TFTP port is disabled no firmware downloads are possible. By default TFTP operation is enabled.

Parameter	*Default Value*	*Desired Value*
IP Address	*194.039.078.253*	
Gateway IP	*000.000.000.000*	
Netmask Host Bits	*00 (Auto Default)*	
SNMP Feature	*Enabled*	
SNMP Community Name	*No Name Specified*	
SNMP #1 IP	*000.000.000.000*	
SNMP #2 IP	*000.000.000.000*	
Encryption Feature	*Disabled*	
Key #1 *Key #2* *Key #3* *Key #4* *Key #5* *Key #6*	*No Keys Specified*	
Telnet Password	*None Specified*	
Telnet Setup	*Enabled*	
TFTP Download	*Enabled*	

TABLE 2-3 NETWORK CONFIGURATIONS

2.3.1 RS-232 NTP Setup

The 10 Base-T port can be configured using the RS-232 setup port or through a Telnet connection. Since the default IP address of 194.039.078.253 will probably not match the actual IP address used in the application, Spectracom recommends using the RS-232 setup port for initial configuration.

Connect a terminal or computer running a terminal emulation program (HyperTerminal, ProComm, etc.) to the RS-232 Setup port. Connect using a straight through (1 to 1 pinning) RS-232 serial cable. Configure the terminal for ANSI emulation, 9600 baud, 8 data, 1 stop, no parity and XON/OFF flow control.

To view the current configuration of the Ethernet 10 Base-T port, connect a terminal to the RS-232 setup port and issue the NTP command as shown below:

Type: ***NTP <ent>***

Default Response:

ETHERNET Interface Configured as follows:
8189 IP Address = 194.039.078.253
Gateway Address = 000.000.000.000
NETMASK Number of HOST Bits = 00
SNMP Features = ENABLED
No SNMP Community Name Specified
SNMP IP Address 1 = 000.000.000.000
SNMP IP Address 2 = 000.000.000.000
Syslog IP Address 1 = 000.000.000.000
Syslog IP Address 2 = 000.000.000.000
Syslog File Number = 0
Encryption = DISABLED
No TELNET Setup Password Specified
TELNET Setup = ENABLED
WEB Manager = DISABLED
WEB Server = DISABLED
TFTP Download = ENABLED

To configure the NTP port, place the unit in Set Mode and issue the NTP setup command as shown below:

Type: ***SM ON <ent>***
Response: *Set Mode ON*

Type: ***NTP SETUP <ent>***
Response: *SETTING UP NTP INTERFACE PARAMETERS.*
<enter> to KEEP, 0 to CLEAR, <esc><enter> to QUIT without save

The NTP Setup command steps through the configuration variables in the order shown in the above NTP Default Response.

NOTE: The Model 8189 does not support The Sys Log, Web Manager and Web Server functions. To assure proper operation leave the SYS Log parameters in the default settings of all zeroes and the Web Manager and Server functions disabled.

After each parameter, the current configuration is shown in parentheses. To accept the variable, press the Enter key. To reset or clear the setting, press 0 (used to remove a password). To exit from the setup without saving changes, depress the escape and enter keys.

Address variables are entered in a decimal dot notation format. It is not necessary to type leading zeroes in the address. For example, an IP address of 192.000.023.007 can be entered using 192.0.23.7.

Invalid or improperly formatted entries are rejected, requiring the parameter to be entered again. Upon completion of the NTP Setup, an option (Yes / No) to load the changes is given. After the configuration is loaded (or re-loaded), the current configuration of the NTP port is echoed back. Connect the NetClock/NTP to the network and verify its connection by pinging to it. The NTP port is now ready for use.

2.3.2 Example NTP Port Configuration

In this example, the NTP port will be configured as follows:

IP Address:	129.070.101.137
Gateway Address:	129.070.205.002
Netmask # of Host Bits:	16
Telnet Password:	Secret Word
Telnet Setup:	Enabled
TFTP Download:	Enabled

SNMP and Encryption are not used in this example configuration.

Begin by placing the unit in Set Mode to allow configuration changes.

Type: ***SM ON <ent>***
Response: *Set Mode ON*

Issue the NTP Setup command as shown below:

Type: ***NTP SETUP <ent>***

Load the example configuration as shown below. The responses from the NetClock/NTP are shown in *italics*. Configuration entries or keystrokes are shown in ***bold italics***.

SETTING UP NTP INTERFACE PARAMETERS
<enter> to KEEP, 0 to CLEAR, <esc><enter> to QUIT without save

8189 IP Address (194.039.078.253) = ***129.70.101.137<enter>***
Gateway Address (000.000.000.000) = ***129.70.205.2<enter>***
NETMASK Number of HOST Bits (00) = ***16<enter>***
Disable SNMP Features (N) = ***y<enter>***
*Syslog IP Address 1 (000.000.000.000) =****<enter>***
*Syslog IP Address 2 (000.000.000.000) =****<enter>***
*Syslog File Number (0) =****<enter>***
*Encryption Enabled (N) =****<enter>***
TELNET Setup Password ( ) = ***Secret Word<enter>***
*TELNET Setup Disabled (N) =****<enter>***
*WEB Manager Disabled (Y) =****<enter>***
*WEB Server Disabled (Y) =****<enter>***
*Disable TFTP Download (N) =****<enter>***
Load Changes (Y/N) = ***y<enter>***

UPDATING NTP PARAMETERS ...

ETHERNET Interface Configured as follows:
8189 IP Address = 129.070.101.137
Gateway Address = 129.070.205.002
NETMASK Number of HOST Bits = 16
SNMP Features = DISABLED
Syslog IP Address 1 = 000.000.000.000
Syslog IP Address 2 = 000.000.000.000
Syslog File Number = 0
Encryption = DISABLED
TELNET Setup Password = Secret Word
TELNET Setup = ENABLED
WEB Manager = DISABLED
WEB Server = DISABLED
TFTP Download = ENABLED

2.4 RS-232 COM AND RS-485 PORT CONFIGURATION

The NetClock/NTP has several time data formats available to suit various applications. Time data formats are selected using the RS-232 Setup port. Data Formats 0, 1 and 3 can be configured to provide local time with or without Daylight Savings Time corrections. Data formats 2, 4, and 90 always reflect UTC time. Bit rate can be programmed from 1200 to 9600 baud.

The default configuration for the RS-232 Comm and RS-485 ports is Format 0, 9600 baud, no offset from UTC, and no DST corrections.

The output data streams are configured by commands issued through the RS-232 Setup port. Connect a terminal or computer running a terminal emulation program (Hyper Terminal, ProComm, etc.) to the RS-232 Setup port. Connect using a straight through (1 to 1 pinning) RS-232 serial cable. Configure the terminal for ANSI emulation, 9600-baud, 8 data, 1 stop bit, no parity, and XON/XOFF flow control.

To allow configuration changes, place the clock in Set Mode as shown below:

Type: ***SM ON <ent>***
Response: *SET MODE ON*

The RS-232 Comm port is configured by the command ***SER1***. The command structure is shown below:

SER1 [BAUD] [FMT] [REQ] [TD] [DST] <ent>

Where: ***BAUD*** = Baud Rate: 1200, 2400, 4800, 9600

FMT = Data Format: 00, 01, 02, 03, 04, 90: Refer to Section 3.3 for a complete description of the data formats.

REQ = Request Character. Any symbol, number or letter can be configured as the request character. The Serial Comm port will output the selected data format upon receiving this character.
Most applications use a capital letter "T". The RS-232 Comm port can also be configured to output continuously once-per-second by typing the word ***NONE*** as the request character.

TD = Time Difference from UTC, ±00:00...±12:00

Where: -00:00 = UTC
-04:00 = Atlantic
-05:00 = Eastern
-06:00 = Central
-07:00 = Mountain
-08:00 = Pacific
Refer to Figure 4-1, UTC Time Difference Map, for additional offsets.

DST = DST rule number, 0...6.

Where: 0 = No DST, always Standard Time
1 = North America
2 = United Kingdom
3 = Continental Europe
4 = China
5 = Australian 1
6 = Australian 2

Example: Set the RS-232 Comm Port to respond with Data Format 02 whenever a T is received. Set the bit rate at 9600 Baud and time reflecting UTC time without DST corrections.

Type: ***SM ON <ent>***
Response: *SET MODE ON*
Type: ***SER1 9600 02 T -00:00 0 <ent>***
Response: *SERIAL PORT 1*
BAUD RATE = 9600 FORMAT # = 02 REQUEST CHAR = T
TIME DIFF = -00:00 DST = 0

The RS-485 Output Port is configured by the command ***REM1***. The command structure is shown below:

Type: ***REM1 [BAUD] [FMT] [TD] [DST] <ent>***

Where: ***BAUD*** = Baud Rate: 1200, 2400, 4800, 9600.

FMT = Data Format: 00, 01, 02, 03, 04, 90: Refer to Section 3.3 for a complete description of the data formats.

TD = Time Difference from UTC , ±00:00...±12:00;

Where: -00:00 = UTC
-04:00 = Atlantic
-05:00 = Eastern
-06:00 = Central
-07:00 = Mountain
-08:00 = Pacific
Refer to Figure 4-1, UTC Time Difference Map, for additional offsets.

DST = DST rule number, 0...6.

Where: 0 = No DST, always Standard Time
1 = North America
2 = United Kingdom
3 = Continental Europe
4 = China
5 = Australian 1
6 = Australian 2

Example: Configure the RS-485 Output to provide Format 0, 1200 baud, Eastern time with DST corrections.

Type: ***SM ON <ent>***
Response: *SET MODE ON*
Type: ***REM1 1200 00 -05:00 1 <ent>***
Response: *REMOTE PORT 1*
BAUD RATE = 1200 FORMAT # = 00
TIME DIFF = -05:00 HOURS DST = 1

NOTES: The entire command line must be entered when configuring an output port.

The time contained in Data Formats 02, 04, and 90 always reflect UTC time. The time difference parameter in the configuration command has no effect on output time.

2.5 INITIAL OPERATION

Upon completing antenna and power connections, plug the adapter into an AC receptacle. At power ON, the TIME SYNC lamp is red. The initial clock time is derived from the nonvolatile RAM/Timekeeping integrated circuit. The receiver will now acquire and lock to GPS satellites currently in view of the antenna. The clock provides GPS synchronized time when the receiver has acquired the complete system almanac from at least one satellite. Typically this requires 20 minutes to accomplish. At this point, the TIME SYNC lamp turns green and the NetClock/NTP shall operate in accordance to specifications published in this manual.

Refer to Appendix C for site qualifying and reception troubleshooting information.

SECTION 3: OPERATION

OPERATION

3.0 INTRODUCTION

This section describes the front and rear panel functions and operational information for the NetClock/NTP.

3.1 FRONT PANEL FUNCTIONS

Refer to Figure 3-1, NetClock/NTP Front Panel, and the following paragraphs for front panel functions.

FIGURE 3-1 NETCLOCK/NTP FRONT PANEL

3.1.1 Time Sync Lamp

This bi-color LED indicates the time synchronization status to GPS. At power on this lamp is red, indicating that the clock is not synchronized and time data accuracy does not meet specification.

The lamp turns green when the receiver has acquired at least one satellite and recovered the GPS system almanac. The entire GPS system almanac takes 12.5 minutes to transmit. The time data accuracy shall now conform to specifications. The lamp remains green if the receiver continues to track, or has tracked, at least one qualified satellite within the period allotted for the Time Sync Alarm. The default period is two hours. The duration of the Time Sync Alarm period is dependent on the accuracy requirement of the application. The Time Sync Alarm period can be configured up to 24 hours using the ***SYNC*** command. Refer to Section 4 for a complete description of the ***SYNC*** command.

The lamp turns red when the receiver is unable to track any satellites and the Time Sync Alarm period has expired. At this point the Alarm relay activates to warn that time data accuracy may be compromised.

The lamp returns to green only upon acquiring and qualifying at least one satellite for 1 minute. The Alarm relay is reset and timing accuracy shall meet specification. Refer to Section 3.2.5 for additional information on the Alarm relay.

3.2 REAR PANEL FUNCTIONS

Refer to Figure 3-2, NetClock/NTP Rear Panel, and the following paragraphs for rear panel functions.

3.2.1 GPS Antenna

This SMA connector is the antenna input to the GPS receiver. The Model 8228 GPS Antenna receives operational power, +5 VDC, from this connector.

The GPS receiver is equipped with an antenna sense circuitry which detects current draw on the antenna connector. The sense circuit provides warning of a cable open or short or when no antenna is currently connected. A Minor Alarm is asserted and an "Antenna Problem" message is included in the RS-232 Status response. Refer to Section 4 for additional information on the ***STAT*** command.

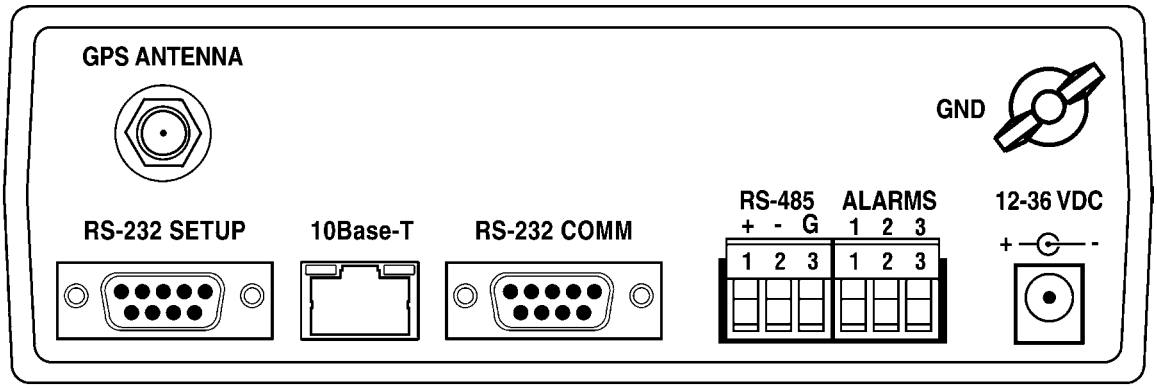


FIGURE 3-2 NETCLOCK/NTP REAR PANEL

3.2.2 RS-232 Setup

Commands to configure output signal options, set operational parameters, view receiver performance and clock configuration are entered here. Refer to Section 4, Software Commands, for a complete description of the NetClock/NTP command set.

The RS-232 Setup connector is a 9-pin series D female. Connector pin numbering is shown in Figure 3-3. Pin assignments are listed in Table 3-1.

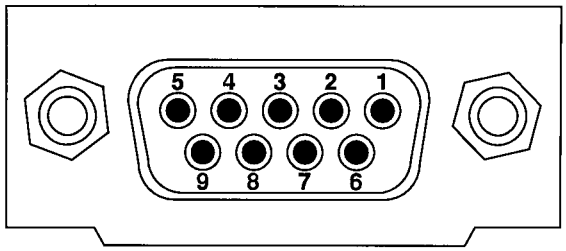


FIGURE 3-3 PIN NUMBERING

PIN	SIGNAL	I/O	DESCRIPTION
2	RXD	O	Receive Data
3	TXD	I	Transmit Data
5	GND	-	Signal Common
6	DSR	O	Data Set Ready
7	RTS	*	Request to Send
8	CTS	*	Clear to Send

*Pins 7 and 8 are connected together internally.

TABLE 3-1 PIN ASSIGNMENTS

The RS-232 Setup Port communicates at 9600 baud with a character structure of 8 data bits, no parity, and 1 stop bit. Per EIA/TIA 574 standard, the setup port is classified as a data circuit-terminating equipment or DCE. Data is output on Pin 2, RXD and commands are input on Pin 3, TXD. When connecting to a data terminal equipment, DTE, (i.e. a personal computer) a one to one cable is used. Interfacing to another DCE device (i.e. a modem) requires a null modem connection. Flow control is not required, though XON/XOFF is supported. The Request to Send (RTS) and Clear to Send (CTS) lines are internally connected together. Data Set Ready, DSR, is continuously held high whenever power is applied.

The RS-232 Setup Port is also used to update the flash memory with new code. This feature allows implementation of new features or code changes into field installed units. Upgrade announcements are posted on the Spectracom web page as they become available (www.spectracomcorp.com).

3.2.3 10 Base-T Port

The 10 Base-T Port functions as the network Stratum 1 NTP time server. The port supports NTP, SNTP, and UDP/Time protocols. The 10 Base-T Port,shown in Figure 3-4, connects to a network hub or switch using a straight through RJ-45 cable. The upper left LED illuminates when a Good Link (GL) is detected.

Note: The upper left LED indicates Good Link when illuminated. The right side LED is not used.

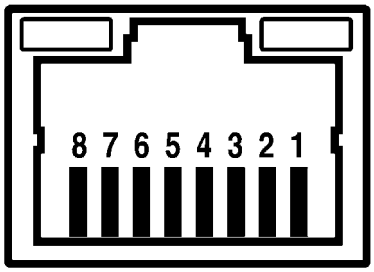


FIGURE 3-4 10 BASE-T PORT

The NetClock/NTP default IP address is 194.029.078.253. The hardware address is found on a label affixed to the bottom cover.

The 10 Base-T port can be configured using the RS-232 setup port or a Telnet connection. Since the default IP address will not match the desired IP address, Spectracom recommends using the RS-232 Setup port for initial configuration. Refer to Section 2.3.1 for configuration instructions.

Once the NetClock/NTP is operational on the network, Telnet may be used to implement future configuration changes. Refer to Appendix B for information on Telnet configuration.

To prevent unauthorized access of the Telnet setup menus a password of up to 16 characters may be enabled or optionally the Telnet session can be totally disabled. In addition TFTP firmware downloads may also be disabled.

Port status can be monitored using SNMP with MIB II support. Up to two SNMP managers can be specified in the configuration menu along with a SNMP Community name of up to 13-characters. The Model 8189 generates the following traps:

NTS_start_up This message is generated at power on.

NTS_unsynch'ed This message warns that the NetClock/NTP is not synchronized GPS.

NTS_synched This message is generated when the NetClock/NTP acquires GPS synchronization.

NTS_sig. Lost This message is generated when the NetClock/NTP has lost time synchronization to its GPS reference.

Secure data transfer can be enabled using MD5 Security Protocol. Up to six keys of 8 bytes may be selected when the encryption feature is enabled.

NOTE: The Encryption feature does not mean that the time packet will be encrypted. This feature is used to authenticate that the received time packet came from the desired time-server. To use this feature, both the 8189 and the NTP client use the same MAC key. When the NTP client requests the time, the Model 8189 appends the time packet with the authentication key.

An MD5 key entry in an ntp.keys file uses the following format:

<ID> M <keystring>

The NTP documentation indicates that <keystring> may be from 1 to 31 characters in length. In order to interoperate with the Model 8189, however, <keystring> must be no more than eight characters in length, and the <ID> must be a number from 1 to 6 inclusive.

Enter the following command string for Cisco Routers:

set ntp key public_keynum { trusted | untrusted } [md5 secret_keystring]

where: ***public_keynum*** is the selected Mac Key 1…6.
trusted is used to activate the key, ***untrusted*** disables the key***.***
md5 is the type of key.
secret_keystring is the printable key value.

For example: to define key id number 3 with the keystring "TICKTOCK" would require the following entry in the ntp.keys file:

```
3 M TICKTOCK
```

In order to enter this same information into the Model 8189, the characters in <keystring>, in this case "TICKTOCK," must be translated into a sequence of ASCII codes written in hexadecimal format. Using a character-to-ASCII table such as the one available at www.asciitable.com, a character capital T has the ASCII code '54' (in hex). Similarly, capital I has the ASCII code '49' (in hex). Continue this process for the remaining characters in TICKTOCK to obtain "54 49 43 4B 54 4F 43 4B."

The following example loads TICKTOCK into key number 3 when Encryption is enabled in the configuration menu.

Note: The "!" and the characters that follow are comments and are not to be entered into the equipment.

```
sm on                    ! to enter the set mode state
ntp setup                ! to perform an NTP setup
...                      ! for you to define IP address's etc,
...                      ! or press enter to keep them the same
...
Encryption (N) = Y       ! type Y to turn on MD5 feature
MAC Key #1 (00 00 00 00 00 00 00 00) =       ! press enter
MAC Key #2 (00 00 00 00 00 00 00 00) =       ! press enter
MAC Key #3 (00 00 00 00 00 00 00 00) =  54 49 43 4B 54 4F 43 4B
! the hex codes for the ASCII string   "T  I  C  K  T  O  C  K"
MAC Key #4 (00 00 00 00 00 00 00 00) =       ! press enter
MAC Key #5 (00 00 00 00 00 00 00 00) =       ! press enter
MAC Key #6 (00 00 00 00 00 00 00 00) =       ! press enter
Load Changes (Y/N) = Y        ! yes to load the changes into the device
UPDATING NTP PARAMETERS.......
```

3.2.3.1 NTP Software

Several variants of Network Time Protocol (NTP) exist to support Unix-compatible and Windows NT operating systems. NTP software can be downloaded for free.

For Unix-based machines running AIX, HP-UX, IRIX, Linux, SCO UNIX, OSF/1, Solaris or System V.4, go to the following web site:

www.eecis.udel.edu/~ntp

Windows NT machines can use the popular TimeServ program included in the Windows NT resource kit. Several free versions of NTP programs can be found at this Microsoft web page:

www.microsoft.com/NTServer/nts/exec/vendors/freeshare/iclient.asp#time

3.2.3.2 NTP Support

Spectracom cannot provide technical assistance for configuring and installing NTP on Unix-based applications. Please refer to the following web page for NTP information and FAQs:

www.eecis.udel.edu/~NTP/ntpfaq/NTP-s-def.htm

Another good source for support is the Internet News Group at

news://comp.protocols.time.ntp

Spectracom can provide support for the Windows NT and Windows 2000 time synchronization. Refer to the Spectracom Web page for application notes at:

http://www.spectracomcorp.com/computernetworks.html

3.2.4 RS-232 Comm Port

This port provides an ASCII RS-232 data stream in the selected data format. There are five time data format selections and one position data stream in NMEA 0183 format available. Refer to Section 3.3 for a complete description of each data format. In addition to data formats, baud rate, UTC time difference and operation mode are selectable. The Comm port may be enabled to output when interrogated by the connected device or continuously every second.

When using the RS-232 Comm port in the interrogation mode, any keyboard symbol, number or letter may be configured to request the time. The factory default request character is a capital letter T. The NetClock/NTP responds with an asterisk (*) to all invalid commands or characters received. Do not follow a time request character with a line terminator (carriage return, enter, etc.).

The RS-232 Comm Port is configured by the ***SER1*** command. Refer to Section 4, *Software Commands*, for a complete description of this command.

The RS-232 Comm connector is a 9-pin series D female. Connector pin numbering is shown in Figure 3-5. Serial Comm pin assignments are listed in Table 3-2.

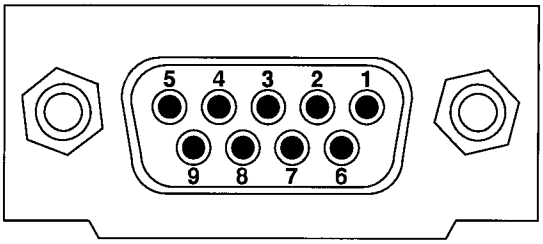


FIGURE 3-5 RS-232 COMM PIN NUMBERING

PIN	SIGNAL	I/O	DESCRIPTION
2	RXD	O	Receive Data
3	TXD	I	Transmit Data
5	GND	-	Signal Common
6	DSR	O	Data Set Ready
7	RTS	*	Request to Send
8	CTS	*	Clear to Send

*Pins 7 and 8 are connected together internally.

TABLE 3-2 RS-232 COMM PIN ASSIGNMENTS

Per EIA/TIA-574 standard, the NetClock/NTP RS-232 Comm port is classified a data circuit-terminating equipment or DCE. Data is output on Pin 2, RXD and time commands are input on Pin 3, TXD. When connecting to data terminal equipment, DTE, (i.e. a personal computer) a one-to-one cable is used. Interfacing to another DCE device (i.e. a modem) requires reversing Pins 2 and 3 or a null modem. Flow control is not required. The Request to Send and Clear to Send signals are internally connected together, and the DSR signal is held high through a pull-up resistor. Character structure is 8 data bits, 1 stop bit, and no parity.

3.2.5 RS-485 Output

This output provides a continuous once-per-second time data stream in the selected data format. There are five time data format selections and one position data stream in NMEA 0183 format available. Refer to Section 3.3 for a complete description of the data format structures.

In addition to data format, baud rate and UTC time difference is selectable. The command REM1 configures the port setup. Refer to Section 4 for a complete description of this commands.

A mating 3-position terminal block is supplied in the ancillary kit. Connector pin assignments are shown in Figure 3-6.

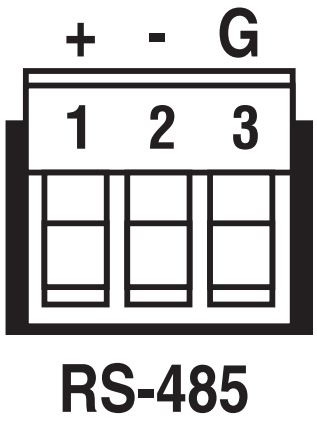


FIGURE 3-6 RS-485 OUTPUT

RS-485 is a balanced differential transmission requiring twisted pair cabling. RS-485 characteristics make it ideal to distribute time data throughout a facility. This output can provide time to 32 devices at cable lengths up to 4000 feet.

Spectracom offers many devices which accept the RS-485 data stream as an input reference. These products include display clocks, RS-485 to RS-232 converters, talking clocks and radio link products to meet various time applications and requirements. For information on RS-485 Output usage refer to Section 3.4 of this chapter.

3.2.6 Alarm Outputs

The operational status of the NetClock/NTP can be monitored remotely using ALARMS output connector. This connector, shown in Figure 3-6, provides the common, NO and NC contacts from the alarm relay. These contacts can be connected to an alarm lamp, horn, or other indicator to warn when the clock accuracy or operation has been affected. The relay contacts are rated at 2.0 amps, 30 VDC. The mating 3-position terminal block is furnished in the ancillary kit.

FIGURE 3-7 ALARMS OUTPUT

An alarm is asserted whenever any of the following conditions exist:

Time Sync Alarm:	The period of time allotted for operation without tracking a satellite has expired. Factory default period is 2 hours. The time sync period is programmable from 1 minute to 23 hours: 59 minutes: 59 seconds using the ***SYNC*** command described in Section 4, Software Commands.
CPU Fault:	The CPU is unable to communicate with the GPS receiver.
Power Failure:	The NetClock/NTP has lost power.
Antenna Problem:	The antenna sense circuitry warns when the antenna is not connected or a cable short or open is detected.
SmartWatch Invalid:	A failure has been detected with the non-volatile RAM / Timekeeping integrated circuit. Memory is retained using lithium batteries having a minimum life expectancy of ten years. Contact Spectracom for IC replacement.

The alarm relay resets when the fault condition is corrected. Table 3-3 provides the contact status under Normal and Alarm operation.

Operational Status	Closed	Open
Normal	1-3	1-2
Alarm	1-2	1-3

TABLE 3-3 ALARM OPERATION

In addition to the alarm relay, operational status and alarm log history can be monitored using the RS-232 Setup commands ***STAT*** and ***DAL***. These commands are described in Section 4 of this manual.

3.2.7 DC Power

The standard NetClock/NTP is powered by a 115 VAC to 12 VDC wall mount adapter. The power jack accepts barrel-type plugs with 5.5 mm O.D. shell and 2.1 I.D. center. Replacement adapters are available from Spectracom, specify part number T00058.

An International Power Supply option is available for the clock. Specify Spectracom Part Number PS00142. The International Power Supply operates over a wide voltage, 90-240 VAC, and line frequency range, 47-63 Hz, to allow operation nearly anywhere in the world.

This table top power adapter is shipped with a detachable line cord. The supplied line cord is compatible with AC receptacles (NEMA 5-15R) commonly found in the United States and Canada. Alternate type line cords or adapters may be obtained locally.

3.2.8 Chassis Ground

The chassis ground stud allows the clock chassis to be connected to a single point grounding system. Connecting the chassis to a single point ground system may be required in some installations to ensure optimum lightning protection. A separate earth ground is also recommended in installations where excessive noise on the power line degrades the GPS receiver performance.

3.3 DATA FORMAT DESCRIPTION

This section describes each of the time data formats available on the NetClock/NTP RS-232 Comm and RS-485 Outputs. Most applications utilize Data Format 0 or Data Format 2.

3.3.1 Format 0

Format 0 includes a time sync status character, day of year, time reflecting time zone offset and DST corrections when enabled. Format 0 also includes the DST/Standard Time indicator, and the time zone offset value. Format 0 data structure is shown below:

CR LF I ^ ^ DDD ^ HH:MM:SS ^ DTZ=XX CR LF

where:

CR	=	Carriage Return
LF	=	Line Feed
I	=	Time Sync Status (space, ?, *)
^	=	space separator
DDD	=	Day of Year (001 - 366)
HH	=	Hours (00-23)
:	=	Colon separator
MM	=	Minutes (00-59)
SS	=	Seconds (00- 60)
D	=	Daylight Savings Time indicator (S,I,D,O)
TZ	=	Time Zone
XX	=	Time Zone offset (00-23)

The leading edge of the first character (CR) marks the on-time point of the data stream.

The time sync status character I is defined as described below:

(Space)	=	Whenever the front panel Time Sync lamp is green.
?	=	When the receiver is unable to track any satellites and the Time Sync lamp is red.
*	=	When the receiver time is derived from the battery backed clock or set manually through the RS-232 Setup port.

The Daylight Saving Time indicator D is defined as:

S = During periods of Standard time for the selected DST schedule.
I = During the 24-hour period preceding the change into DST
D = During periods of Daylight Saving Time for the selected DST schedule
O = During the 24-hour period preceding the change out of DST

Example: 129 12:45:36 DTZ=08

The example data stream provides the following information:

Sync Status:	Time synchronized to GPS
Date:	Day 129
Time:	12:45:36 Pacific Daylight Time D = DST, Time Zone 08 = Pacific Time

3.3.2 Format 1

This format provides the fully decoded time data stream. Format 1 provides a date consisting of day of week, month, and day of the month. Format 1 also contains a time sync status character, year, and time reflecting time zone offset and DST correction when enabled. Format 1 data structure is shown below:

CR LF I ^ WWW ^ DDMMMYY ^ HH:MM:SS CR LF

where:

CR	=	Carriage Return
LF	=	Line Feed
I	=	Time Sync Status (space, ?, *)
^	=	space separator
WWW	=	Day of Week (SUN, MON, TUE, WED, THU, FRI, SAT)
DD	=	Numerical Day of Month (^1-31)
MMM	=	Month (JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC)
YY	=	Year without century (99, 00, 01 etc.)
HH	=	Hours (00-23)
:	=	Colon separator
MM	=	Minutes (00-59)
SS	=	Seconds (00 - 60)

The leading edge of the first character (CR) marks the on-time point of the data stream.

The time sync status character I is defined as described below:

(Space)	=	Whenever the front panel Time Sync lamp is green.
?	=	When the receiver is unable to track any satellites and the Time Sync lamp is red.
*	=	When the receiver time is derived from the battery backed clock or set manually through the RS-232 Setup port.

Example: * SUN 9MAY99 12:45:36

The example data stream provides the following information:

Sync Status:	The clock is not time synchronized to GPS. Time is derived from the battery backed clock or set manually
Date:	Sunday, May 9, 1999
Time:	12:45:36

3.3.3 Format 2

This format provides a time data stream with millisecond resolution. The Format 2 data stream consists of indicators for time sync status, time quality, leap second and Daylight Saving Time. Time data reflects UTC time and is in the 24-hour format. Format 2 data structure is shown below:

CR LF IQYY ^ DDD ^ HH:MM:SS.sss ^ LD

where:

CR	=	Carriage Return
LF	=	Line Feed
I	=	Time Sync Status (space, ?, *)
Q	=	Quality Indicator (space, A, B, C, D)
YY	=	Year without century (99, 00, 01 etc.)
^	=	space separator
DDD	=	Day of Year (001 - 366)
HH	=	Hours (00-23 UTC time)
:	=	Colon separator
MM	=	Minutes (00-59)
SS	=	Seconds (00-60)
.	=	Decimal Separator
sss	=	Milliseconds (000-999)
L	=	Leap Second Indicator (space, L)
D	=	Daylight Saving Time Indicator (S,I,D,O)

The leading edge of the first character (CR) marks the on-time point of the data stream.

The time sync status character I is defined as described below:

(Space)	=	Whenever the front panel Time Sync lamp is green.
?	=	When the receiver is unable to track any satellites and the Time Sync lamp is red.
*	=	When the receiver time is derived from the battery backed clock or set manually through the RS-232 Setup port.

The quality indicator Q provides an inaccuracy estimate of the output data stream. When the receiver is unable to track any GPS satellites, a timer is started. Table 3-4 lists the quality indicators and the corresponding error estimates based upon the GPS receiver 1PPS stability and the time elapsed not tracking satellites. The Tracking Zero Satellites timer and the quality indicator reset when the receiver reacquires a satellite.

Inaccuracy Code	Time Error (mSec)	Time Since Unlock (Hours)
Space	<1	Locked
A	<10	<10
B	<100	<100
C	<500	<500
D	>500	>500

TABLE 3-4 QUALITY INDICATORS

The leap second indicator L is defined as:

(Space) = When a leap second correction is not scheduled for the end of the month.
L = when a leap second correction is scheduled for the end of the month.

The Daylight Saving Time indicator D is defined as:

S = During periods of Standard time for the selected DST schedule.
I = During the 24-hour period preceding the change into DST.
D = During periods of Daylight Saving Time for the selected DST schedule.
O = During the 24-hour period preceding the change out of DST.

Example: ?A99 129 12:45:36.123 D

The example data stream provides the following information:

Sync Status: The clock has lost GPS time sync. The inaccuracy code of “A” indicates the expected time error is <10 milliseconds.

Date: Day 129

Time: 12:45:36 UTC time, Daylight Saving time is in effect.

3.3.4 Format 3

Format 3 provides a format identifier, time sync status character, year month day, time with time zone and DST corrections, time difference from UTC, standard time/DST indicator, leap second indicator and on-time marker. Format 3 data structure is shown below:

FFFFI^YYYY*MMDD*^HHMMSS±*HHMM*D L # CR LF

where:

FFFF	=	Format Identifier (0003)
I	=	Time Sync Status (Space, ? *)
^	=	space separator
YYYY	=	Year (1998, 1999, 2000 etc.)
MM	=	Month Number (01-12)
DD	=	Day of the Month (01-31)
HH	=	Hours (00-23)
MM	=	Minutes (00-59)
SS	=	Seconds (00-60)
±	=	Positive or Negative UTC offset (+,-) Time Difference from UTC
HHMM	=	UTC Time Difference Hours, Minutes (00:00-23:00)
D	=	Daylight Saving Time Indicator (S,I,D,O)
L	=	Leap Second Indicator (space, L)
#	=	On time point
CR	=	Carriage Return
LF	=	Line Feed

The time sync status character I is defined as:

(Space)	=	Whenever the front panel Time Sync lamp is green.
?	=	When the receiver is unable to track any satellites and the Time Sync lamp is red.
*	=	When the receiver time is derived from the battery backed clock or set manually through the RS-232 Setup port.

The time difference from UTC, ±*HHMM*, is selected when the Serial Comm or Remote port is configured. A time difference of -0500 represents Eastern time. UTC is represented by +0000.

The Daylight Saving Time indicator D is defined as:

S = During periods of standard time for the selected DST schedule.
I = During the 24-hour period preceding the change into DST.
D = During periods of Daylight Saving Time for the selected DST schedule.
O = During the 24-hour period preceding the change out of DST.

The leap second indicator L is defined as:

(Space) = When a leap second correction is not scheduled at the end of the month.
L = When a leap second correction is scheduled at the months end.

Example: 0003 19990509 124536-0500D #

The example data stream provides the following information:

Data Format:	3
Sync Status:	Time Synchronized to GPS
Date:	May 9, 1999
Time:	12:45:36 Eastern DST, The time difference is 5 hours behind UTC
Leap Second:	No leap second is scheduled for this month.

3.3.5 Format 4

Format 4 provides a format indicator, time sync status character, modified Julian date, time reflecting UTC with 0.1 millisecond resolution and a leap second indicator. Format 4 data structure is shown below:

FFFFIMJDXX^HHMMSS.SSSS^L CR LF

where:

FFFF =	Format Identifier (0004)
I =	Time Sync Status (Space, ? *)
MJDXX =	Modified Julian Date
HH =	Hours (00-23 UTC time)
MM =	Minutes (00-59)
SS.SSSS =	Seconds (00.0000-60.0000)
L =	Leap Second Indicator (^, L)
CR =	Carriage Return
LF =	Line Feed

The start bit of the first character marks the on-time point of the data stream.

The time sync status character I is defined as:

(Space) =	Whenever the front panel Time Sync lamp is green.
? =	When the receiver is unable to track any satellites and the Time Sync lamp is red.
* =	When the receiver time is derived from the battery backed clock or set manually through the RS-232 Setup port.

The leap second indicator L is defined as:

(Space) =	When a leap second correction is not scheduled at the end of the month.
L =	when a leap second correction is scheduled at the months end.

Example: 0004 51307 124536.1942 L
The example data stream provides the following information:

Data format:	4
Sync Status:	Time synchronized to GPS.
Modified Julian Date:	51307
Time:	12:45:36.1942 UTC
Leap Second:	A leap second is scheduled at the end of the month.

3.3.6 Format 90

Format 90 provides a position data stream in NMEA 0183 GPGGA GPS Fix data format. The Format 90 data structure is shown below:

$GPGGA,HHMMSS.SS,ddmm.mmmm,n,dddmm.mmmm,e,Q,SS,YY.y,+AAAAA.a,M,,,,*CC CR LF

where:
- $GP = GPS System Talker
- GGA = GPS Fix Data Message
- HHMMSS.SS = Latest time of Position Fix, UTC. This field is blank until a 3D fix is acquired
- ddmm.mmmm,n = Latitude
  - dd = degrees, 00...90
  - mm.mmmm = minutes, 00.0000....59.9999
  - n = direction, N = North, S = South
- dddmm.mmmm,e = Longitude
  - ddd = degrees, 000...180
  - mm.mmmm = minutes, 00.0000....59.9999
  - e = direction, E = East, W = West
- Q = Quality Indicator,
  - 0 = No 3D fix
  - 1 = 3D fix
- SS = Number of satellites tracked, 0...8
- YY.Y = Dilution of precision, 00.0...99.9
- +AAAAA.a,M = Antenna height in meters, referenced to mean sea level
- ,,,, = Fields for geoidal separation and differential GPS not supported
- cc = Check sum message, HEX 00...7F
  Check sum is the exclusive OR of all bytes between $ and *.
- CR = Carriage Return
- LF = Line Feed

Example:
$GPGAA,151119.00,4307.0241,N,07729.2249,W,1,06,03.2,+00125.5,M,,,,*3F

The example data stream provides the following information:

Time of Position Fix:	15:11:19.00 UTC
Latitude:	43° 07.0241’ North
Longitude:	77° 29.2249’ West
Quality:	3D fix
Satellites Used:	6
Dilution of Precision:	3.2
Antenna Height:	+125.5 meters above sea level
Check Sum:	3F

3.4 RS-485 OUTPUT USAGE

The RS-485 Output provides a continuous once-per-second time data stream in the selected format. RS-485 is a balanced differential transmission which offers exceptional noise immunity, long cable runs and multiple loading. These characteristics make RS-485 ideal for distributing time data throughout a facility. The RS-485 Output can drive 32 devices over cable lengths up to 4000 feet. Spectracom manufactures wall clocks, talking clocks, RS-485 to RS-232 converters and radio link products which utilize the RS-485 data stream as an input. Figures 3-8 and 3-9 illustrate typical RS-485 time data bus inter-connections. Follow the guidelines listed below when constructing the RS-485 data bus.

3.4.1 Cable Selection

Low capacitance, shielded twisted pair cable is recommended for installations where the RS-485 cable length is expected to exceed 1500 feet. Table 3-5 suggests some manufacturers and part numbers for extended distance cables. These cables are specifically designed for RS-422 or RS-485 applications. They have a braided copper shield, nominal impedance of 120 ohms, and a capacitance of 12 to 16 picofarads per foot.

RS-485 cable may be purchased from Spectracom. Specify part number CW04xxx, where xxx equals the length in feet.

MANUFACTURER	PART NUMBER
Belden Wire and Cable Company 1-800-BELDEN-1	9841
Carol Cable Company 606-572-8000	C0841
National Wire and Cable Corp. 232-225-5611	D-210-1

TABLE 3-5 CABLE SOURCES FOR RS-485 LINES OVER 1500 FEET

For cable runs less than 1500 feet, a lower-cost twisted pair cable may be used. Refer to Table 3-6 for possible sources.

MANUFACTURER	PART NUMBER
Alpha Wire Corporation 1-800-52ALPHA	5471
Belden Wire and Cable Company 1-800-BELDEN-1	9501
Carol Cable Company 606-572-8000	C0600

TABLE 3-6 CABLE SOURCES FOR RS-485 LINES UNDER 1500 FEET

3.4.2 Connection Method

The RS-485 transmission line must be connected in a daisy chain configuration as shown in Figure 3-8. In a daisy chain configuration, the transmission line connects from one RS-485 receiver to the next. The transmission line appears as one continuous line to the RS-485 driver.

A branched or star configuration is not recommended. This method of connection appears a taps or stubs to the RS-485 transmission line. Stub lengths affect the bus impedance and capacitive loading which could result in reflections and signal distortion.

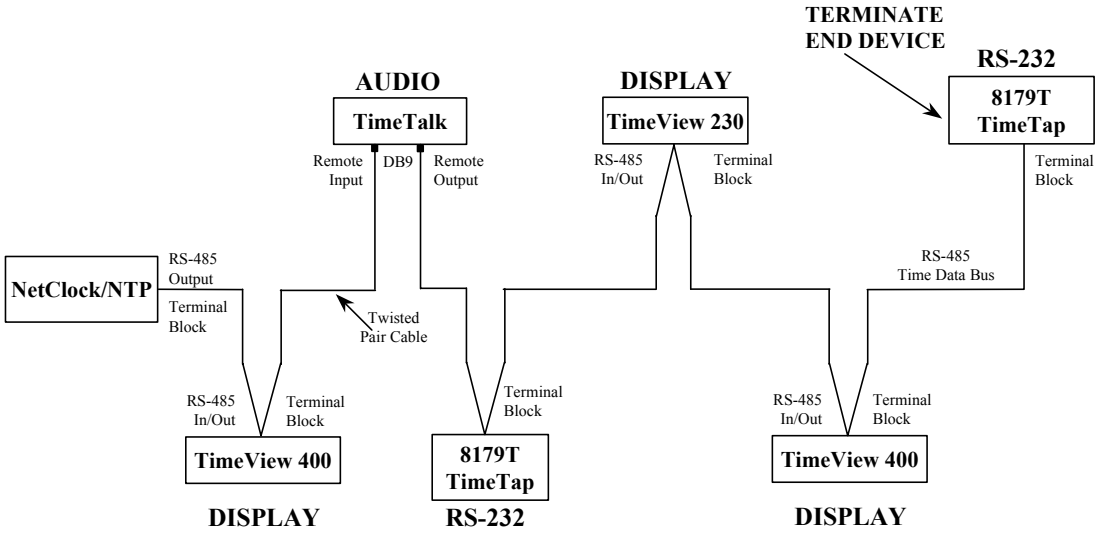


FIGURE 3-8 ONE-WAY BUS INSTALLATION

The RS-485 Output can be split in two directions as shown in Figure 3-9. This allows the NetClock/NTP to be centrally located. Connecting in this method can simplify installation and possibly reduce the amount of cable required.

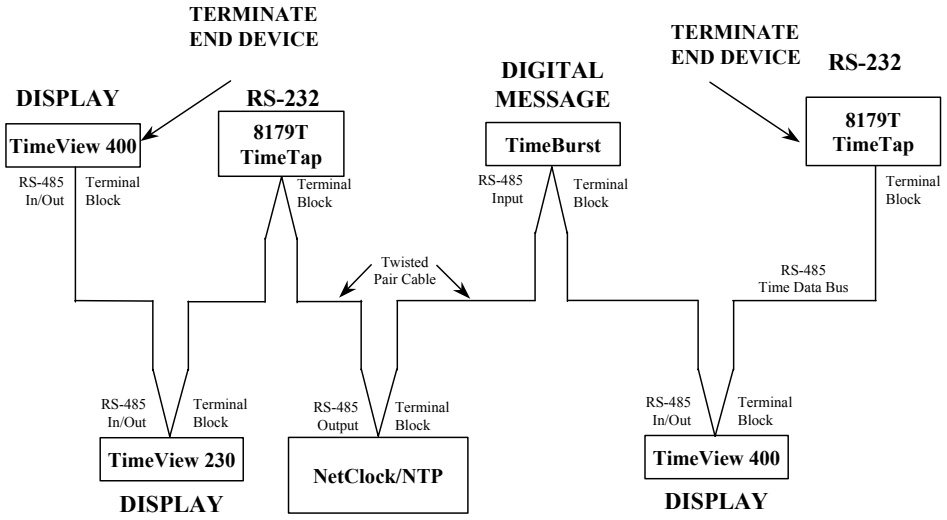


FIGURE 3-9 SPLIT BUS CONFIGURATION

Most RS-485 connections found on Spectracom equipment are made using a removable terminal strip. Wires are secured by a jaw which compresses the wires when tightened. When using small diameter wire, 22-26 gauge, a strain relief can be fashioned by wrapping the stripped wire over the insulating jacket as shown in Figure 3-10. Wrapping the wires in this manner prevents smaller gauge wires from breaking off when exposed to handling or movement.

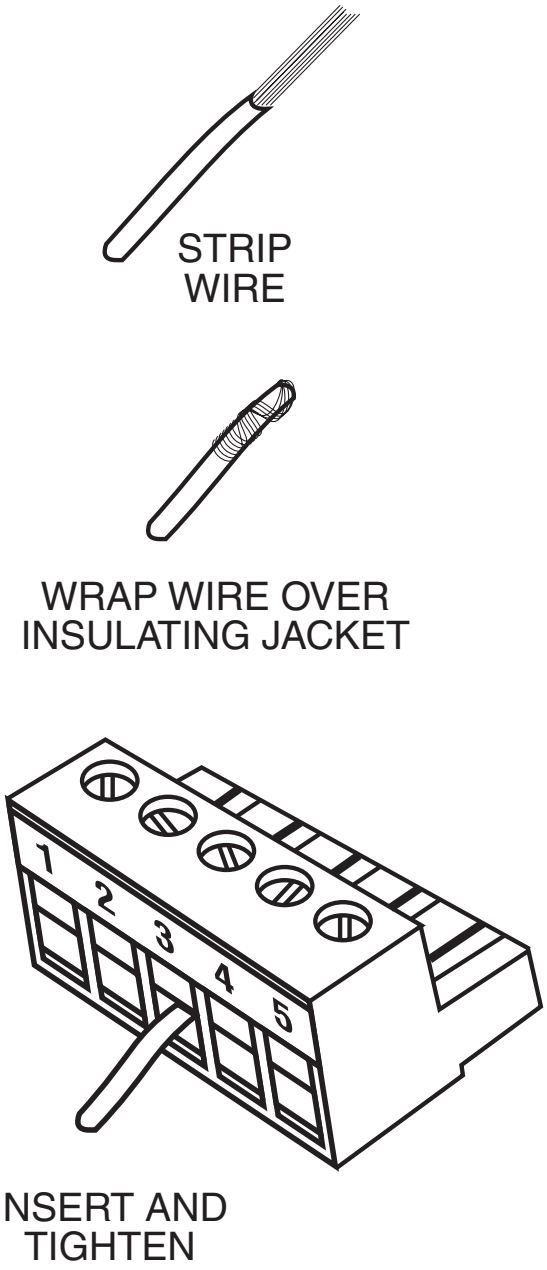


FIGURE 3-10 WIRE STRAIN RELIEF

The Spectracom Model 8175, TimeView 230, is a display clock with 2.3 inch high digits. The Model 8177 TimeView 400 features 4.0 inch display digits. TimeView display clocks use a 6-position terminal block to connect to the RS-485 data bus. Connect the TimeView to the NetClock/NTP RS-485 Output as shown in Figure 3-11.

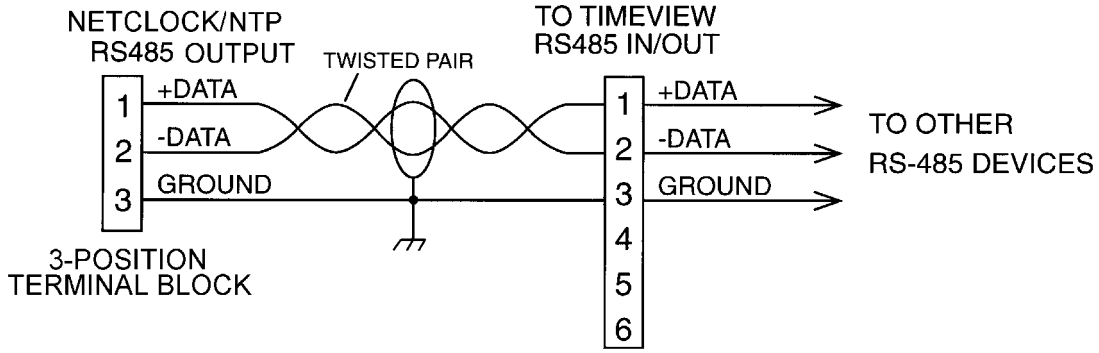


FIGURE 3-11 TIMEVIEW RS-485 INTERFACE

The Spectracom Model 8179T, TimeTap, is an RS-485 to RS-232 converter. The Model 8179T has a DB9 RS-232 interface which receives operational power from the RS-232 flow control pins RTS or DTR. Connect the TimeTap to the RS-485 Output as shown in Figure 3-12.

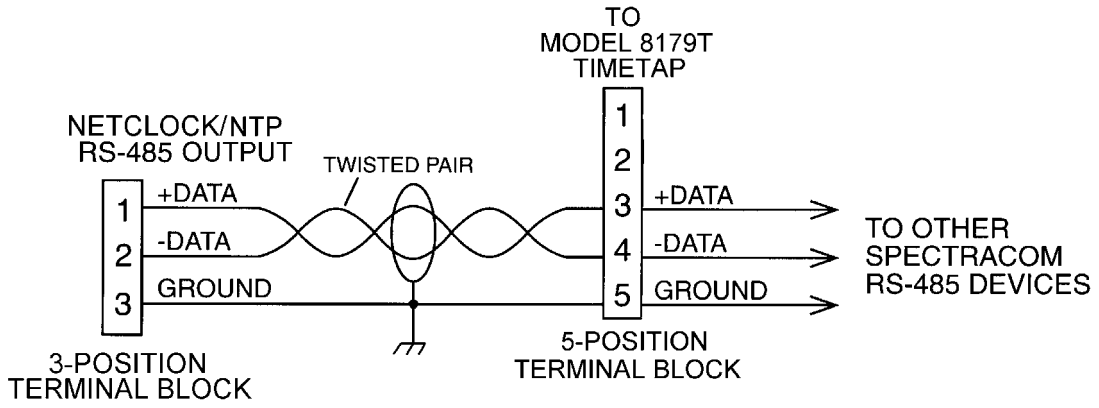


FIGURE 3-12 MODEL 8179T TIMETAP INTERFACE

The Model 8180 TimeTalk provides an audio time of day announcement to time stamp voice recorders or for broadcast over radio transmitters. The TimeTalk accepts only Data Formats 0 or 1. Connect the TimeTalk to the RS-485 time data bus as shown in Figure 3-13. The synchronizing data stream is input on the TimeTalk Remote Input connector (DB9 male) and passed through to the Remote Output connector (DB9 female).

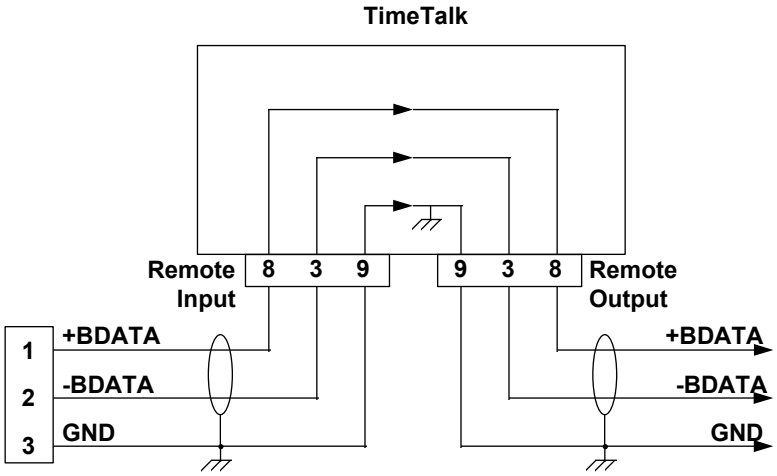


FIGURE 3-13 TIMETALK RS-485 INTERFACE

The Model 8185, TimeBurst™, provides a digital time-of-day data burst to a radio transmitter. The TimeBurst, when used with the Spectracom Model 8186 TimeBridge™, provides community-wide time synchronization from a single NetClock/NTP. The TimeBurst accepts only Format 0.

TimeBurst connects to the RS-485 data bus using a 3-position terminal block. Connect as shown in Figure 3-14.

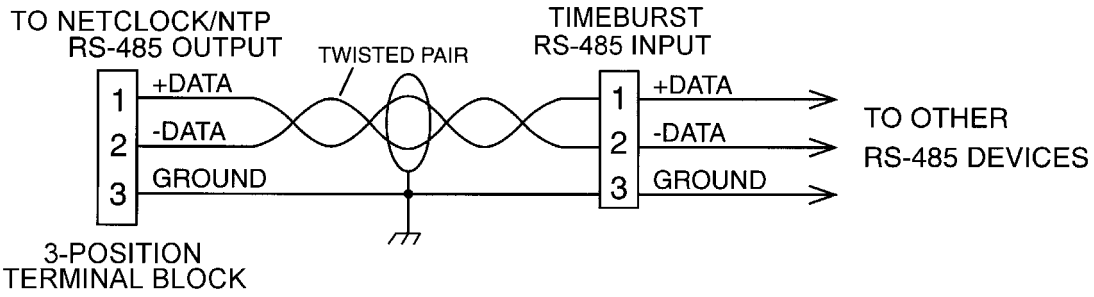


FIGURE 3-14 TIMEBURST RS-485 INTERFACE

3.4.3 Termination

A termination resistor is required on devices located at the ends of the RS-485 transmission line. Terminating the cable end preserves data integrity by preventing signal reflections.

For a one-way bus installation (shown in Figure 3-8), terminate the last device on the bus. The RS-485 data bus can be split in two directions as shown in Figure 3-9. In a split bus configuration, terminate the devices installed on each end of the bus. Most Spectracom products include a built in termination switch to terminate the RS-485 bus when required.

SECTION 4: SOFTWARE COMMANDS

SOFTWARE COMMANDS

4.0 INTRODUCTION

From the rear panel RS-232 Setup port the user may configure, control and monitor the NetClock/NTP. Table 4-1 provides a listing of the command set in alphabetical order, and the page where you can find the description of the command. These commands contain a hierarchy of *Read* and *Set Modes*. *Read* Mode is the base level; when in *Read Mode* the user may only view responses to commands. From *Read Mode* the user may select to enter *Set Mode*. *Set Mode* allows the user to not only view command responses, but configure changes to certain NetClock/NTP functions. After entering *Set Mode*, the unit will "time out" and return to *READ Mode* after 15 minutes of inactivity.

TABLE 4-1 ALPHABETICAL LIST OF COMMANDS

NOTE: The commands shown in this section are all in upper case format. The NetClock/NTP accepts commands in upper or lower case formats.

4.1 ANTENNA CABLE DELAY

The command, ***ACD***, reads or sets the antenna cable delay value expressed in microseconds. The on-time point is offset by the delay value entered to compensate for antenna cable and in-line amplifier delays. The expected cable and amplifier delays are typically negligible. The ***ACD*** command is intended for advanced user setup. The advanced user can calculate the delay based upon the cable manufacturer's specifications.

Range:	0.000 to 999.999 microseconds
Default Value:	0.000 microseconds
Resolution:	1 nanosecond

To read the antenna cable delay, issue the ***ACD*** command as shown below:

Type:	***ACD <ent>***
Response:	*Antenna Cable Delay = XXXXXX.XXX microseconds*
Where:	*XXXXXX.XXX* = 000000.000 to 000999.999 microseconds.

To enter a cable delay, place the clock in *Set Mode* operation, issue the ***ACD*** command as follows:

Type:	***ACD XXXXXX.XXX <ent>***
Where:	***XXXXXX.XXX*** = 000000.000 to 000999.999 microseconds.

NOTE: It is not necessary to fill every digit space when entering a delay value. The delay value can range from 1 to 9 digits long.

The clock then responds with the antenna cable delay value entered.

Example, The calculated cable delay for 140 feet of RG-213 cable is 216 nanoseconds. Follow the example below to compensate the on-time point by the antenna cable delay.

Type:	***SM ON <ent>***
Response:	*Set Mode ON*
Type:	***ACD 0.216 <ent>***
Response:	*Antenna Cable Delay = 000000.216 microseconds*

Cable delay can be calculated using the formula:

$$D = \frac{LxC}{V}$$

Where: D = Cable delay in nanoseconds.
L = Cable length in feet.
C = Constant derived from velocity of light; 1.016.
V = Nominal velocity of propagation expressed as a decimal, i.e. 66% = .66
Value is provided by cable manufacturer.

4.2 DISPLAY OUTPUT CONFIGURATION

The command, ***CONF***, displays the current settings for the clocks outputs. To view the output configurations, issue the ***CONF*** command as shown below:

Type: ***CONF<ent>***

Default response:

Serial Port 1
BAUD Rate= 9600 Format #= 00 Request CHAR= T
Time Diff= +00:00 DST= 0

Remote Port 1
BAUD Rate= 9600 Format #= 00
Time Diff= +00:00 DST= 0

4.3 DISPLAY ALARM LOG

The command, ***DAL***, causes the clock to output the alarm history log. Each time a change in alarm status occurs an alarm log is created. An alarm log includes the UTC time and date of the log, alarm relay status and lists the conditions causing the alarms. The alarm log can be displayed a page at a time by adding the letter ***P*** to the command. At the end of each page the option to display more or quit will be given.

Type: ***DAL <ent>***

- OR -

DAL P <ent> (paged output)

Example response:

Time= 10:17:19 Date= 2000-03-21 Status Change
Alarm Relay= OFF
Active Alarms: NONE
Time= 13:51:29 Date= 2000-05-05 Status Change
Alarm Relay= ON
Active Alarms: MINOR
Antenna Problem
Time= 15:51:30 Date= 2000-05-05 Status Change
Alarm Relay= ON
Active Alarms: MAJOR and MINOR
Time Sync Alarm
Antenna Problem
Time= 18:23:39 Date= 2000-05-05 Status Change
Alarm Relay= ON
Active Alarms: MAJOR
Time Sync Alarm
Time= 18:24:44 Date= 2000-05-05 Status Change
Alarm Relay= OFF
Active Alarms: NONE

END OF LOG

In the example above, the antenna cable was damaged at 13:51:29 on May 5, 2000. Note that a Minor Alarm was asserted at that time due to an "Antenna Problem". Since no GPS signal could be received, the Sync Time-out counters expired, causing a Major Alarm due to loss of time sync. The cable was repaired at 18:23:39, clearing the Minor and Antenna Problem messages. The receiver then reacquired and qualified at least one satellite for one minute which cleared all alarms at 18:24:44.

4.4 DATE

The ***DATE*** command reads or sets the date of the NetClock/NTP. To retrieve the current UTC date, issue the ***DATE*** command as shown below:

Type: ***DATE <ent>***
Response: *Date = YYYY - MM - DD*
Where: *YYYY* = Year value, 2000, 2001, 2002, etc.
MM = Month value, 01 to 12, 01= January, 04= April
DD = Day of the month, 01 to 31
- = Hyphen

To set the date, place the clock in *Set Mode*, then issue the ***DATE*** command as follows:

Type: ***DATE YYYY-MM-DD <ent>***
Where: ***YYYY-MM-DD*** = As defined above.

The clock responds with the date message reflecting the date entered.

NOTE: The date can not be set on clocks tracking GPS satellites. The set date is overwritten with the received date information.

Example: Set the date for May 9, 2000.

Type: ***SM ON <ent>***
Response: *Set Mode ON*
Type: ***DATE 2000-05-09 <ent>***
Response: *Date =2000-05-09*

4.5 DISPLAY TRACKING HISTOGRAM

This command outputs the tracking histogram. The histogram records the number of qualified satellites tracked each second. At the end of every hour a log entry is created and the counters start again. The command responds with the last four hourly entries of the histogram and current histogram in process. The tracking histogram is useful in verifying receiver and antenna performance.

Type: ***DH <ent>***

The tracking histogram is output in the following format:

TIME= HH:MM:SS DATE= YYYY-MM-DD QUALIFIED HISTOGRAM

0= XXXXX 1= XXXXX 2= XXXXX 3= XXXXX 4= XXXXX
5= XXXXX 6= XXXXX 7= XXXXX 8= XXXXX Q=QQQQQ

Where:	*HH:MM:SS* =	UTC time log was created.
	YYYY-MM-DD =	Date log was created.
	XXXXX =	Number of seconds the receiver tracked the listed quantity of satellites since the beginning of the hour, 0...3600.
	QQQQQ =	Number of seconds since the beginning of the hour the GPS signal was qualified, 0…3600.

Typically, the receiver tracks two to three satellites when using a Model 8228 Window Mount GPS Antenna. When using the Model 8225 Outdoor antenna, the receiver will typically track five or more satellites. The NetClock/NTP needs to track only one qualified satellite to provide accurate and traceable time.

There may occasionally be short periods when the receiver is unable to track any satellites. When this occurs, the Time Sync alarm count down timer is started. The Sync Alarm Timer resets whenever the receiver reacquires and qualifies at least one satellite for one minute. If a receiver is unable to receive and qualify any satellites within the sync alarm period (default is two hours), a Time Sync Alarm is asserted.

Satellites are qualified as valid when the received vehicle ID number is greater than 1 and the satellite is available for Position Fix usage. The qualification count "Q" is incremented for each second these conditions are met. Typically, the Q value for each hour should exceed 3000.

Example: To view the satellite tracking histogram type the following:

Type: ***DH <ent>***

Typical response:

Time= 10:00:00 Date= 2000-05-05 Qualified Histogram
0= 00000 1= 00150 2= 01324 3= 02035 4= 00091
5= 00000 6= 00000 7= 00000 8= 00000 Q= 03600

Time= 11:00:00 Date= 2000-05-05 Qualified Histogram
0= 00685 1= 01065 2= 01024 3= 00775 4= 00051
5= 00000 6= 00000 7= 00000 8= 00000 Q= 02858

Time= 12:00:00 Date= 2000-05-05 Qualified Histogram
0= 00003 1= 01077 2= 02216 3= 00304 4= 00000
5= 00000 6= 00000 7= 00000 8= 00000 Q= 03578

Time= 14:00:00 Date= 2000-05-05 Qualified Histogram
0= 00000 1= 00327 2= 01628 3= 01555 4= 00090
5= 00066 6= 00037 7= 00340 8= 00913 Q= 03600

Time= 14:56:19 Date= 2000-05-05 Qualified Histogram
0= 00027 1= 00672 2= 01938 3= 00742 4= 00000
5= 00000 6= 00000 7= 00000 8= 00000 Q= 03232

END OF LOG

4.6 DISPLAY OPERATIONAL LOG

The Operational History Log may be viewed by sending the ***DOL*** command. The operational log response begins with a header containing all firmware version levels and the time and date since power up. Entries are made to this log when the following events occur:

1. **Power On Reset**: The power ON reset log contains a UTC time and date stamp and flash memory page selected. This log is created when power is restored to the clock. An example of the Power On Reset log is shown below:

   Time = 13:21:20 Date = 1999-03-20 POWER ON RESET
   USING FLASH PAGE = 00

2. **First Satellite Acquired**: This log time stamps when the receiver acquires a satellite for the first time. An example log entry is shown below:

   Time = 13:21:34 Date = 1999-03-20 FIRST SATELLITE ACQUIRED

3. **GPS Signal Qualified**: This log entry records when the receiver acquires or re-acquires and qualifies at least one satellite for one minute. A satellite is considered qualified if the received vehicle ID number is greater than 1 and if the satellite can be used for Position Fix. The time and date contained in the log reflect UTC time. An example of this log is shown below:

   Time = 22:58:00 Date = 1999-03-23 GPS SIGNAL QUALIFIED

The ***DOL*** response can be output in a continuous format or a paged format by adding the ***P*** parameter to the command. The ***DOL*** response can be up to 25 entries or two pages long.

Type: ***DOL <ent>***

- OR -

DOL P <ent> (paged output)

Sample response:

Spectracom Corporation Netclock/NTP Model 8189
Software Version 1.05 Date: June 14, 2002 15:20:18
Unit Started 13:13:02 2002-09-03
Serial Port 1 Version 2.05
Remote Port 1 Version 2.05
NTP Version 04.63 Card Number 0144-101
GPS Receiver = 8 Channel GT Version 2
Time= 13:11:09 Date= 2002-09-03 POWER ON RESET
USING FLASH PAGE= 00
Time= 13:12:03 Date= 2002-09-03 FIRST SATELLITE ACQUIRED
Time= 13:13:02 Date= 2002-09-03 GPS SIGNAL QUALIFIED
Time= 16:35:57 Date= 2002-09-07 GPS SIGNAL QUALIFIED
Time= 09:53:44 Date= 2002-09-10 GPS SIGNAL QUALIFIED

END OF LOG

4.7 DAYLIGHT SAVING TIME

Daylight Saving Time corrections can be implemented on the time data outputs. Each output has a configuration command which allows selection of a DST rule applied to that output. There are six DST rules to choose from numbered 1 through 6.

> Note: To select always Standard Time place a 0 (zero) in the command space reserved for the DST rule number.

The factory default rules are as follows:

North America - DST RULE #1
INTO DATE= 1RST SUN APR TIME= 02:00 ADJ= 01:00
OUT-OF DATE= LAST SUN OCT TIME= 02:00

United Kingdom - DST RULE #2
INTO DATE= LAST SUN MAR TIME= 02:00 ADJ= 01:00
OUT-OF DATE= LAST SUN OCT TIME= 02:00

Continental Europe - DST RULE #3
INTO DATE= LAST SUN MAR TIME= 02:00 ADJ= 01:00
OUT-OF DATE= LAST SUN SEP TIME= 02:00

China - DST RULE #4
INTO DATE= 04-12 TIME= 02:00 ADJ= 01:00
OUT-OF DATE= 09-12 TIME= 02:00

Australian 1 - DST RULE #5
INTO DATE= LAST SUN OCT TIME= 02:00 ADJ= 01:00
OUT-OF DATE= LAST SAT MAR TIME= 02:00

Australian 2 - DST RULE #6
INTO DATE= LAST SUN OCT TIME= 02:00 ADJ= 01:00
OUT-OF DATE= 1ST SAT MAR TIME= 02:00

To review the current list of DST rules, issue the ***DST*** command as shown below:

Type: ***DST <ent>***

Specific rules can be viewed by adding the DST rule number to the command as shown below:

Type: ***DST# <ent>***

Where: **#** = DST rule, 1...6

Any of the six DST rules can be modified to keep up with changes in DST implementation. Rules are structured in a week # - day of week - month or a month - day format.

To change when DST begins (into date), issue the following command:

Type: ***DSTX IN WWWW DDD MMM HH:MM HH:MM <ent>***

Where:
- ***X*** = Rule number, 1...6
- ***WWWW*** = Week number, 1rst, 2nd, 3rd, 4th, LAST
- ***DDD*** = Day of week, SUN, MON, TUE, WED, THU, FRI, SAT
- ***MMM*** = Month, JAN, FEB, MAR, APR, JUN, JUL, AUG, SEP, OCT, NOV, DEC.
- ***HH:MM*** = Time of change hours:minutes
- ***HH:MM*** = Amount of change hours:minutes

- OR -

Type: ***DSTX IN MM DD HH:MM HH:MM <ent>***

Where:
- ***X*** = Rule number, 1...6
- ***MM*** = Month 01...12
- ***DD*** = Day of month 01...31
- ***HH:MM*** = Time change, hours:minutes
- ***HH:MM*** = Amount of change, hours:minutes

To change when DST ends (out-of date), issue the following command:

Type: ***DSTX OUT WWWW DDD MMM HH:MM <ent>***

Where:
- ***X*** = Rule number, 1...6
- ***WWWW*** = Week number, 1rst, 2nd, 3rd, 4th, LAST
- ***DDD*** = Day of week, SUN, MON, TUE, WED, THU, FRI, SAT
- ***MMM*** = Month, JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC.
- ***HH:MM*** = Time of change, hours:minutes

- OR -

Type: ***DSTX OUT MM DD HH:MM <ent>***

Where:
- ***X*** = Rule number, 1...6
- ***MM*** = Month, 01...12
- ***DD*** = Day of month, 01...31
- ***HH:MM*** = Time of change hours:minutes

Example: Congress has decided to extend Daylight Saving time by 2 weeks. DST will now start the last Sunday in March and end on the first Sunday in November. The time of the change (2:00am), and the amount of the change (1 hour) remains unchanged.

Follow the steps below to implement the new North American DST rule.

Type: ***SM ON <ent>***
Response: *SET MODE ON*

Type: ***DST1 IN LAST SUN MAR 02:00 01:00***
Response: *DST Rule #1*
Into Date = LAST SUN MAR Time = 02:00 ADJ = 01:00
Out-of-Date = LAST SUN OCT Time = 02:00

Type: ***DST1 OUT 1RST SUN NOV 02:00***
Response: *DST Rule #1*
Into Date = LAST SUN MAR Time = 02:00 ADJ = 01:00
Out-of-Date = 1RST SUN NOV Time = 02:00

4.8 GPS SIGNAL STATUS

The GPS signal strength command, ***GSS***, provides an indication of receiver operation and quality of the received GPS signal. This command is useful in verifying proper antenna placement and receiver performance during installation.

The ***GSS*** response provides overall tracking status, position solution and a table containing individual satellite data.

Issue the ***GSS*** command as shown below:

Type: ***GSS <ent>***

Example Response is shown below:

Tracking 3 Satellites
GPS State= 2D-FIX DOP= 04.3
Latitude= N 43 07 01.541 Longitude= W 077 29 15.136 Height= +00102.85 meters
Quality= PASSED

CHAN	*VID*	*MODE*	*STREN*	*STAT*
01	*09*	*08*	*048*	*A2*
02	*00*	*00*	*000*	*00*
03	*00*	*00*	*000*	*00*
04	*00*	*00*	*000*	*00*
05	*00*	*00*	*000*	*00*
06	*24*	*08*	*038*	*A2*
07	*02*	*08*	*022*	*A2*
08	*00*	*00*	*000*	*00*

The overall tracking status and position information is presented in the format shown below:

TRACKING X SATELLITES

GPS STATE= SSSS DOP = 33.3

LATITUDE=[N:S][DD MM SS.SSSS] LONGITUDE=[E:W][DDD MM SS.SSSS] HEIGHT=+HHHH.HH METERS

QUALITY= QQQQQ

Where: *X* = Number of satellites currently tracking; 0…8. Typically the window antenna tracks two to three satellites. The NetClock/NTP requires only one satellite to provide accurate and traceable time.

SSSS = Fix Mode; SEARCHING, 2D-FIX, 3D-FIX. Searching is the typical mode when using the window mount antenna.
2D-FIX is possible if the receiver is tracking at least three qualified satellites. The receiver latitude and longitude can be determined from a 2D-Fix.
3D-FIX is possible if the receiver is tracking at least four qualified satellites. The receiver location and elevation can be solved from a 3D-Fix.

##.# = Dilution of precision; 00.0…99.9.
This value indicates the degree of uncertainty of a Position Fix due to the geometry of the satellites used in the solution. The lower the DOP value, except 00.0, the lower the degree of uncertainty.

N = North Latitude

S = South Latitude

DDD MM SS.SSS = Latitude Degrees:Minutes:Seconds

E = East Longitude

W = West Longitude

DD MM SS.SSS = Longitude Degrees:Minutes:Seconds

HHHH.HH = Height of GPS antenna expressed in meters. The height solution is relative to the GPS reference ellipsoid and not sea level.

QQQQQ = Results of GPS qualification, Passed, Failed. The GPS signal is considered qualified when at least one satellite is received having a vehicle ID greater than 1 and is available for Position Fix usage.

NOTE: Position data contained in this response shall be all zeroes until a 2D-Fix is acquired. Elevation data is available when a 3D-Fix is acquired.

Information on each satellite the receiver is currently tracking is presented in table form. The table columns are described below:

CHAN = Channel Number of the GPS receiver, 01...08

VID = Vehicle (satellite) Identification Number, 01...37

MODE = Channel Tracking Mode, 01...08.

Where:

00 - Code Search	05 - Message Sync Detect
01 - Code Acquire	06 - Satellite Time Avail
02 - AGC Set	07 - Ephemeris Acquire
03 - Freq Acquire	08 - Avail for Position
04 - Bit Sync Detect	

STREN = Signal strength value relative to SNR, 000... 55. The higher the number, the greater the received signal.

STAT = Channel status flag. Convert the hexadecimal code word to binary to find the status flags set.

(MSB)
- Bit 7: Using for Position Fix
- Bit 6: Satellite Momentum Alert Flag
- Bit 5: Satellite Anti-Spoof Flag Set
- Bit 4: Satellite Reported Unhealthy
- Bit 3: Satellite Reported Inaccurate (>16 meters)
- Bit 2: Spare
- Bit 1: Spare

(LSB)
- Bit 0: Parity Error

Example: HEX code word A0 translates to the following flags set.

- Bit 7: Using for Position Fix
- Bit 5: Satellite Anti-Spoof Flag Set

4.9 HELP DISPLAY

The ***HELP*** command lists the commonly used commands and command structure. ***HELP*** is available by using the following commands:

Type: ***HELP <ent>***

- OR -

? <ent>

Response:

Spectracom Corporation Netclock/NTP Model 8189
Command List Follows
(Set Mode Must be ON to change parameters - NOT case sensitive)
Time [HH:MM:SS] = current UTC Time
Date [YYYY-MM-DD] = current UTC Date
Loc [D DD MM SS.sss D DDD MM SS.sss] = current Location
Stat= Display Status Information
GSS= GPS Signal Status
NTP [SETUP]= Network Time Provider Setup
Conf= show port settings
Ser1 [BAUD FMT REQ TD DST]= set up serial port
Rem1 [BAUD FMT TD DST]= set up remote port
Sync [HH:MM:SS]= Time Sync Alarm Time-Out
DSTx [RULE PARAMETERS] = set up DST Rules
ACD [XXXXXX.XXX]= Antenna Cable Delay
DAL [P] = Display Alarm Log
DOL [P] = Display Operational Log
DH [P] = Display Histogram Log
SM [ON|OFF]= Set Mode
For further information please consult your manual

4.10 LOCATION

The command, ***LOC***, is for reading or setting the current location of the receiver. This command displays the current latitude and longitude calculated by the GPS receiver. During initial installation it may speed up the time to first fix if the user inputs an approximate position using this command. The GPS receiver constantly calculates its position based on the satellites it is receiving. Once the unit has acquired its first fix, entering a new position using this command has no effect.

To view the current receiver location, issue the ***LOC*** command as shown below:

Type: ***LOC <ent>***

Example Response: *Current Location:Latitude = N 43 07 00.407 Longitude = W 077 29 13.442*

To enter a new location place the clock in *Set Mode* and issue the ***LOC*** command as follows:

Type: ***LOC [N:S] [DD MM SS.SSS][E:W] [DDD MM SS.SSS] <ent>***

Where:

N = North Latitude

S = South Latitude

DD MM SS.SSS = Latitude Degrees:Minutes:Seconds

E = East Longitude

W = West Longitude

DDD MM SS.SSS = Longitude Degrees:Minutes:Seconds

NOTE: The receiver must acquire at least a 2D-fix to provide a position solution. If the receiver cannot acquire a 2D-fix, the position shall be shown as all zeros.

4.11 10 BASE-T PORT CONFIGURATION

The ***NTP*** command reads or sets the configuration of the NTP Time Server Port.

To view the current configuration of the 10 Base-T port, issue the NTP command as shown below:

Type: ***NTP <ent>***

Default Response:
ETHERNET Interface Configured as follows:
8189 IP Address = 194.039.078.253
Gateway Address = 000.000.000.000
NETMASK Number of HOST Bits = 00
SNMP Features = ENABLED
No SNMP Community Name Specified
SNMP IP Address 1 = 000.000.000.000
SNMP IP Address 2 = 000.000.000.000
Syslog IP Address 1 = 000.000.000.000
Syslog IP Address 2 = 000.000.000.000
Syslog File Number = 0
Encryption = DISABLED
No TELNET Setup Password Specified
TELNET Setup = ENABLED
WEB Manager = DISABLED
WEB Server = DISABLED
TFTP Download = ENABLED

To configure the NTP port, place the unit in Set Mode and issue the NTP setup command as shown below:

Type: ***SM ON <ent>***
Response: *Set Mode ON*

Type: ***NTP SETUP <ent>***
Response: Setting Up NTP Interface Parameters.
<enter> to KEEP, 0 to CLEAR, <esc><enter> to QUIT without save

The NTP Setup command steps through the configuration variables in the order as shown in the above NTP Default Response.

NOTE: The Model 8189 does not support The Sys Log, Web Manager and Web Server functions. To assure proper operation leave the SYS Log parameters in the default settings of all zeroes and the Web Manager and Server functions disabled.

After each parameter, the current configuration is shown in parentheses. To accept the variable, press the Enter key. To reset or clear the setting, press 0 (used to remove a password). To exit from the setup without saving changes, depress the escape and enter keys.

Address variables are entered in a decimal dot notation format. It is not necessary to type leading zeroes in the address. For example, an IP address of 192.000.023.007 can be entered using 192.0.23.7 <ent>.

Invalid or improperly formatted entries are rejected, requiring the parameter to be entered again.

The subnet mask defines the number of bits taken from the IP Address to be used as the host portion. The default subnet mask for each of the common network classes is shown in Table 2-1 in Section 2 of this manual.

The number of host bits used in the netmask can range from 0 to 24 bits. The default host bit value is 00. Setting the host bit value to 00 allows automatic selection of the appropriate netmask based on the IP address used. Refer to Table 2-2 in Section 2 of this manual for the complete list of subnet masks.

When authentication is required, up to six MD5 or DES keys can be set. All key inputs are in hexadecimal format. Each key number (1...6) consists of up to eight 8-bit groups. Factory default disables encryption.

Upon completion of the NTP Setup, an option (Yes/No) to load the changes is given. After the configuration is loaded (or re-loaded), the current configuration of the NTP port is echoed back. The NTP port is now ready for use. Refer to Section 3.2.3.1 for information on NTP applications.

An example NTP port configuration may be found in Section 2.3.2 of this manual.

4.12 RS-485 OUTPUT CONFIGURATION

The command ***REM1*** reads or sets the configuration of the RS-485 Output. RS-485 Output configuration options include: baud rate, data format, UTC or local time with or without DST corrections.

To view the current RS-485 Output configurations, issue the command ***REM1*** as shown below:

Type: ***REM1 <ent>***
Default Response: *Remote Port 1*
BAUD Rate= 9600 Format #= 00
Time Diff= +00:00 DST= 0

To change the RS-485 Output configuration, place the clock in *Set Mode* and issue the ***REM1*** command as follows:

Type: ***REM1 [BAUD] [FMT] [TD] [DST] <ent>***
Where: ***BAUD*** = Baud Rate: 1200, 2400, 4800, 9600.
FMT = Data Format: 00, 01, 02, 03, 04, 90: Refer to Section 3.3 for a complete description of the data formats available.
TD = Time Difference from UTC, ±00:00...±12:00.
Where: -00:00 = UTC
-04:00 = Atlantic
-05:00 = Eastern
-06:00 = Central
-07:00 = Mountain
-08:00 = Pacific
Refer to Figure 4-1, UTC Time Difference Map, for additional offsets.
DST = DST rule number, 0...6.
Where: 0 = No DST, always Standard Time
1 = North America
2 = United Kingdom
3 = Continental Europe
4 = China
5 = Australian 1
6 = Australian 2

NOTES: The time contained in Data Formats 2, 4 and 90 always reflect UTC time. The time difference parameter in the Remote Output configuration command has no effect on output time.

Example: Configure RS-485 Output port for Data Format 1, 1200 baud, Mountain time with DST corrections.

Type: ***SM ON <ent>***
Response: *Set Mode ON*
Type: ***REM1 1200 01 -07:00 1 <ent>***
Response: *Remote Port 1*
BAUD Rate= 1200 Format #= 01
Time Diff= -07:00 DST= 1

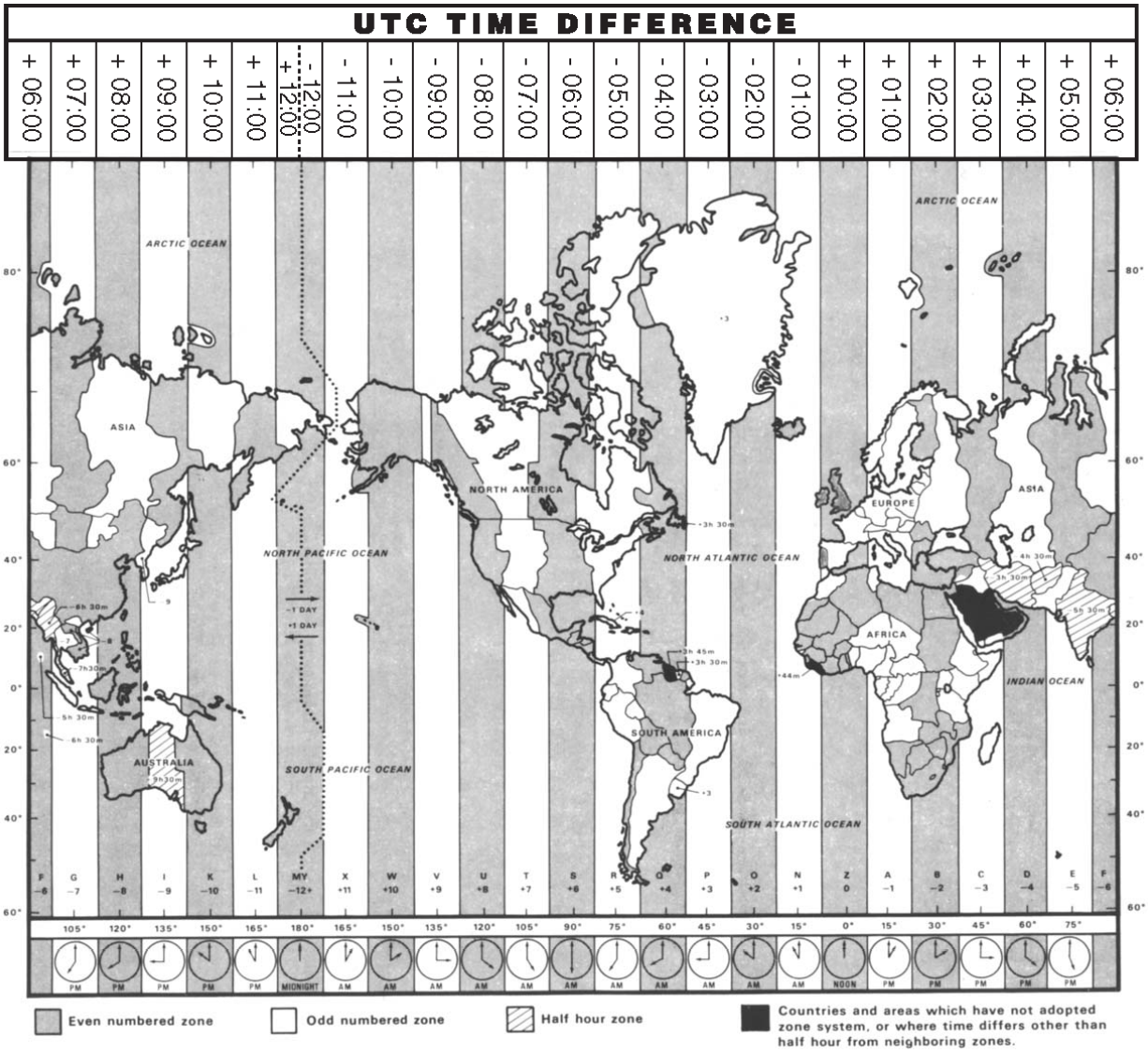


FIGURE 4-1 TIME DIFFERENCE MAP

4.13 RS-232 COMM CONFIGURATION

The command ***SER1*** reads or sets the configuration of the RS-232 Comm port. Configuration options include baud rate, data format, request character, UTC or local time with or without DST corrections.

To view the current RS-232 Comm configurations issue the ***SER1*** command as shown below:

Type: ***SER1 <ent>***

Default Response: *Serial Port 1*
BAUD Rate= 9600 Format #= 00 Request CHAR= T
Time Diff= +00:00 DST= 0

To change a serial comm port configuration, place the clock in *Set Mode* and issue the ***SER1*** command as follows:

Type: ***SER1 [BAUD] [FMT] [REQ] [TD] [DST] <ent>***

Where: ***BAUD*** = Baud Rate: 1200, 2400, 4800, 9600.

FMT = Data Format: 00, 01, 02, 03, 04, 90: Refer to Section 3.3 for a complete description of the data formats available.

REQ = Request Character. Any symbol, number or letter can be configured as the request character. **MOST APPLICATIONS USE A CAPITAL LETTER T.** The RS-232 Comm port will output the selected data format upon receiving this character. The RS-232 Comm port can also be configured to output continuously once-per-second by typing the word ***NONE*** as the request character.

TD = Time Difference from UTC, ±00:00...±12:00.

Where: -00:00 = UTC
-04:00 = Atlantic
-05:00 = Eastern
-06:00 = Central
-07:00 = Mountain
-08:00 = Pacific

Refer to Figure 4-1, UTC Time Difference Map, for additional offsets.

DST = DST rule number, 0...6.

Where: 0 = No DST, always Standard Time
1 = North America
2 = United Kingdom
3 = Continental Europe
4 = China
5 = Australian 1
6 = Australian 2

NOTES: A once-per-second output is enabled when the request character is set for ***NONE***.

The time contained in Data Formats 02, 04, and 90 always reflect UTC time. The time difference parameter in the RS-232 Comm configuration command has no effect on output time.

Example: Configure RS-232 Comm port to respond with Data Format 03 whenever a ? is received. Set the bit rate at 4800 Baud and time reflecting Pacific Standard time (no DST corrections).

Type: ***SM ON <ent>***
Response: *SET MODE ON*
Type: ***SER1 4800 03 ? -08:00 0 <ent>***
Response: *Serial Port 1*
BAUD Rate= 4800 Format #= 03 Request CHAR= ?
Time Diff= -08:00 DST= 0

4.14 SET MODE

This command is used to read or enter *Set Mode* operation. As a safeguard, the unit must be placed into *Set Mode* whenever operational parameters are entered. The unit "times out" of *Set Mode* and returns to *Read Mode* operation if no commands are issued for 15 minutes. To read the *Set Mode* status (ON or OFF), issue the ***SM*** command as shown below:

Type: ***SM <ent>***
Response: *Set Mode ON*
or
Set Mode OFF

To place the unit into *Set Mode*:

Type: ***SM ON <ent>***
Response: *Set Mode ON*

To return the unit to *Read Mode*:

Type: ***SM OFF <ent>***
Response: *Set Mode OFF*

4.15 STATUS COMMAND

The ***STATUS*** command provides the current UTC time and date, Time Sync status, GPS Signal Status, Alarm Time Out and active alarms.

To retrieve the operational status, issue the ***STAT*** command as follows:

Type: ***STAT <ent>***

An example below is a sample response from a clock in Time Sync and receiving a qualified GPS signal:

Time= 18:29:44 Date= 2000-05-05
Time Sync Status= OK
GPS Signal= QUALIFIED NTP Status= OK
Alarm Relay= OFF
Active Alarms: NONE

The response below is from a clock that is currently not receiving any qualified satellites. Note that the Time Sync Alarm count down timer has started and no alarms are yet asserted.

Time= 18:30:51 Date= 2000-05-05
Time Sync Status= OK
GPS Signal= NOT QUALIFIED NTP Status= OK
Time Remaining to Time Sync Alarm= 01:59:29
Alarm Relay= OFF
Active Alarms: NONE

The response below is from a clock that has lost GPS time sync. Note that the Time Sync Alarm counter has expired and a Time Sync Alarm is asserted.

Time= 18:32:42 Date= 2000-05-05
Time Sync Status= NONE
GPS Signal= NOT QUALIFIED NTP Status= NO SYNC
Time Remaining to Time Sync Alarm= 00:00:00
Alarm Relay= ON
Active Alarms: MAJOR
Time Sync Alarm

4.16 SYNC TIME OUT

The ***SYNC*** command reads or sets the Sync time out period. A timer is started whenever the receiver is not tracking any satellites. The timer is reset when the receiver reaquires a satellite. A Time Sync Alarm is asserted if the receiver fails to reaquire satellites within the allotted time out period. The front panel Time Sync lamp turns red and the rear panel Alarm relay contacts indicate an alarm condition is present. To view the current sync time out period, issue the ***SYNC*** command as shown below:

Type: ***SYNC <ent>***
Default Response: *Time Sync Time-Out = 02:00:00*

The Sync Time Out period can be set from 00:00:00 to 24:00:00 hours. The default sync period is two hours. This guarantees that the time data accuracy shall be within ±100 microseconds whenever the Time Sync lamp is green. In applications where lower accuracy is acceptable, the sync period can be extended. Table 4-2 lists the required accuracy value and the corresponding Sync Time Out period.

Required Accuracy	Sync Period
100 microseconds	02:00:00
1 millisecond	10:00:00
5 milliseconds	24:00:00

TABLE 4-2 SYNC TIME OUT PERIODS

To change the sync time out value, place the clock in *Set Mode* and issue the ***SYNC*** command as follows:

Type: ***SYNC HH:MM:SS <ent>***
Where: ***HH:MM:SS*** = Hours:Minutes:Seconds

Example: Change the SYNC time out period to 3-1/2 hours.

Type: ***SM ON <ent>***
Response: *Set Mode ON*
Type: ***SYNC 03:30:00 <ent>***
Response: *Time Sync Time-Out = 03:30:00*

NOTE: The Time Sync alarm period is rarely changed. The default Time Sync period of 2 hours guarantees the output accuracy shall be within ±100 microseconds UTC whenever the Time Sync lamp is green.

4.17 TIME

The command, ***TIME***, reads or sets the time of the NetClock/NTP.

To retrieve the current UTC time, issue the ***TIME*** command as shown below:

Type: ***TIME <ent>***
Response: *TIME = HH:MM:SS*
Where: *HH* = UTC hours 00...23
MM = Minutes 00...59
SS = Seconds 00...60

To set the time, place the clock in *Set Mode* and issue the ***TIME*** command as follows:

Type: ***TIME HH:MM:SS <ent>***
Where: ***HH:MM:SS*** = As defined above.
Response: *Time message reflecting the time entered.*

NOTE: Clocks tracking GPS satellites can not be set using this command. The received time data overwrites the set time.

Example: Manually set the TIME to 13:45:00

Type: ***SM ON <ent>***
Response: *SET MODE ON*
Type: ***TIME 13:45:00 <ent>***
Response: *TIME = 13:45:00*

4.18 VERSION COMMAND

This command provides all the software version levels of the programs contained in the clock. The time and date the unit was first powered ON is recorded. To retrieve version information, issue the ***VER*** command as shown below:

Type: ***VER <ent>***

Example Response:
Spectracom Corporation Netclock/NTP Model 8189
Software Version 1.05 Date: June 14, 2002 15:20:18
Unit Started 13:13:02 2002-09-03
Serial Port 1 Version 2.05
Remote Port 1 Version 2.05
NTP Version 04.63 Card Number 0144-101
GPS Receiver = 8 Channel GT Version 2

APPENDIX A: OUTDOOR ANTENNA

APPENDIX A: OUTDOOR ANTENNA

A.0 INTRODUCTION

This section describes the installation of Model 8225 GPS Antenna and related accessories. The outdoor antenna can be used in NetClock/NTP applications where the window mount antenna was not desired or could not provide reliable reception. Upon completion of the antenna installation, refer to Appendix C for information on verifying the reception quality.

A.1 MODEL 8225 GPS ANTENNA

The Model 8225 is an active antenna tuned to receive the GPS 1575.42 MHz L1 band satellite broadcasts. The received signals are passed through a narrow bandpass filter and a preamplifier within the antenna. The active antenna circuitry provides 30 dB of gain and requires +5 VDC at 27 milliamps. The GPS receiver provides power over the antenna coax. Each antenna is terminated with a type "N" female connector. The Model 8225 features a compact weatherproof design measuring 3.5 inches in diameter.

A.1.1 Antenna Installation

The GPS antenna **MUST BE INSTALLED OUTDOORS** in a location where an unobstructed view of the sky exists. Rooftops generally make good locations due to clear overhead sky with views to the horizon. This type of location allows the antenna to see and track the maximum number of satellites throughout the day. Installations with obstructed views may prove operational, but can experience reduced reception quality and the inability to simultaneously track the maximum number of satellites. In addition to clear sky coverage, select a site that would not allow the antenna to become buried in drifted or accumulated snow. Avoid placing the GPS antenna in close proximity to broadcast antennas whenever possible.

Each antenna includes a mating two-foot long PVC mast assembly and two hose clamps to simplify installation. The hose clamps affix the mast assembly to a vent pipe or other vertical member. Spectracom offers an antenna base, Model 8213, for installations where vent pipe mounting is not practical or desired. The Model 8213 is constructed of aluminum and is furnished with ballast for stability. Both mounting methods are illustrated in Figure A-1.

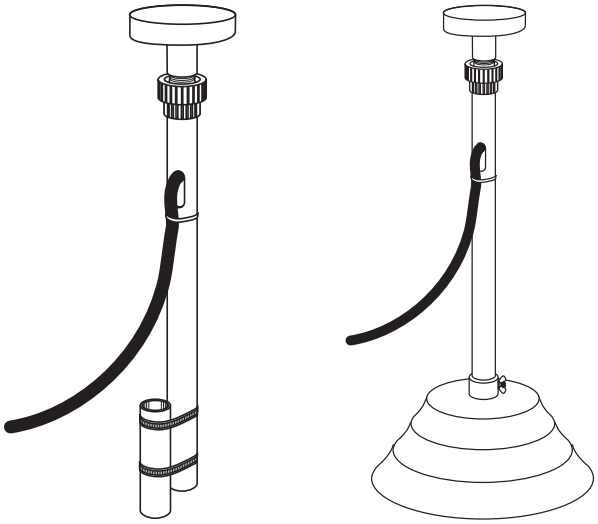


FIGURE A-1 ANTENNA MOUNTING METHODS

A. 2 ANTENNA CABLE

Spectracom recommends RG-213 type coax, such as Belden 8267, for the GPS antenna cable. To simplify the installation process, Spectracom offers GPS cable assemblies terminated with Type N Male connectors. Specify Part Number CA07xxx, where xxx equals the length in feet.

If antenna cable is purchased locally, select cable suitable for outdoor usage. Consider the cable's weatherability, temperature range, UV resistance, and attenuation characteristics.

Do not allow the antenna cable to be placed in standing water, as water may permeate through the coax jacket over time. On flat roof installations, the coax can be suspended by cable hangers or placed in sealed PVC conduit. Apply a weather proofing sealant or tape over all outdoor connections.

Installation of a surge protection device in the antenna line is recommended to protect the NetClock/NTP receiver and connected devices from lightning damage. Spectracom offers the Model 8226 Impulse Suppressor to shunt potentially damaging voltages on the antenna coax to ground. Refer to Section A.3 for a complete description of the Model 8226.

A Type N to SMA adapter cable is available from Spectracom. Specify part number CA11001. This cable adapts the heavy, rigid RG-213 type cable to the NetClock/NTP rear panel.

A. 2.1 Cable Lengths

Using Spectracom CA07xxx or Belden 8267 coax, the maximum cable length between the antenna and receiver is 200 feet. These cables attenuate the GPS signal by 10 dB per 100 foot of coax. Installations requiring longer antenna cables may use the Model 8227 Inline Amplifier or lower loss cable. Refer to Section A.4 for additional information on the Model 8227.

When selecting alternate antenna cable sources, the attenuation characteristics at the GPS frequency of 1575.42 MHz must be known. To ensure optimum receiver performance, the total antenna cable attenuation must not exceed 20 dB. Cable attenuation greater than 20 dB requires the use of a Model 8227 Inline Amplifier.

A.3 MODEL 8226 IMPULSE SUPPRESSOR

Spectracom recommends the use of an inline coaxial protector for all products with an outside antenna. Spectracom offers the Model 8226, Impulse Suppressor, to protect the receiver from damaging voltages occurring on the antenna coax. Voltages exceeding the impulse suppressor trip point are shunted to the system ground. The Model 8226 is designed to withstand multiple surges.

Mount the suppressor indoors where the coax enters the building to grounding panel or bulkhead as shown in Figure A-2. Each Model 8226 includes two clamp type Male N connectors. These connectors can be used to splice the Model 8226 into the antenna coax. The connectors are compatible with RG-213 type coax such as Spectracom CA07xxx or Belden 8267. Connector assembly instructions are shown in Figure A-3.

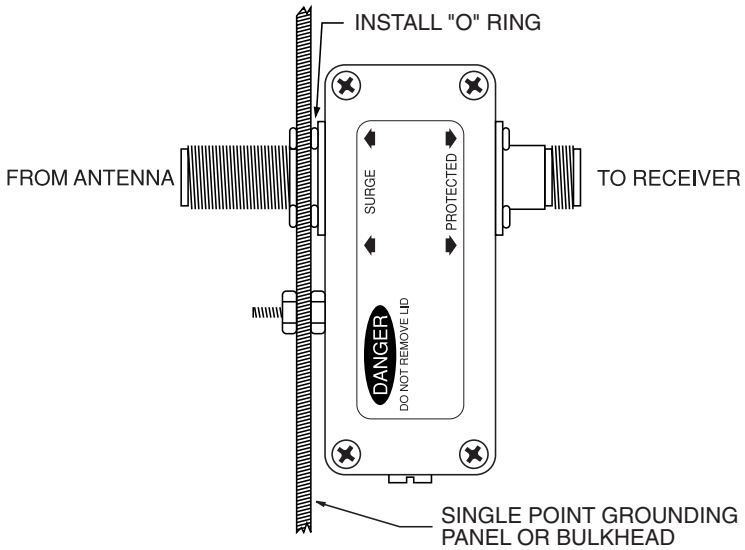
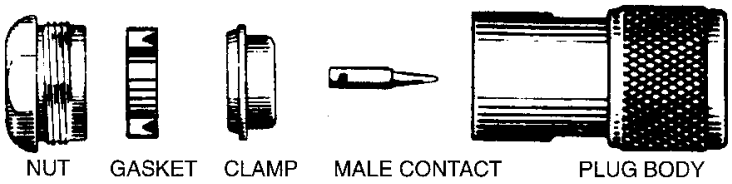
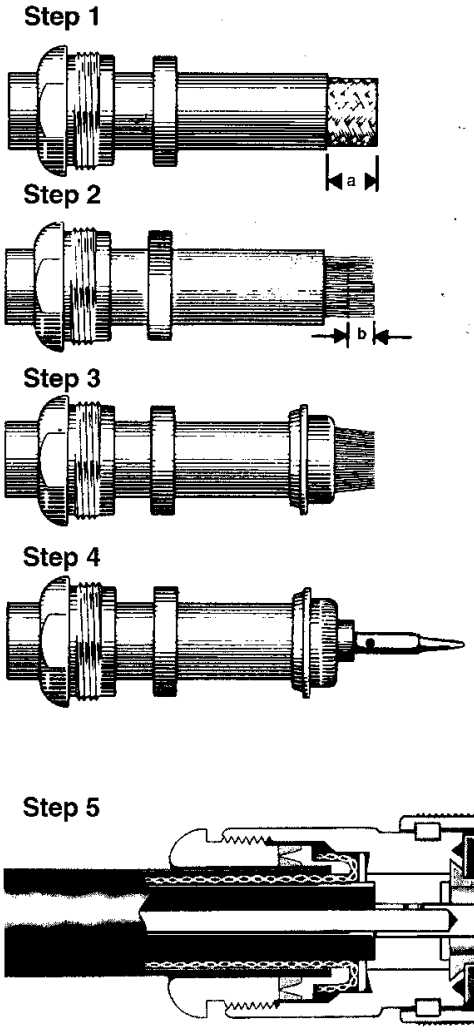


FIGURE A-2 MODEL 8226 IMPULSE SUPPRESSOR



Tools Required:

1	Sharp knife
1	Cable cutter
1	Soldering iron, solder
1	Ruler
1	Wire cutters/scissors
2	5/8" Open end wrench or adjustable wrench
1	Multimeter



Step 1 Place the nut and gasket, with "V" groove toward clamp, over cable and cut off jacket to 0.359 inches (a).

Step 2 Comb out braid and fold out. Cut off center dielectric to 0.234 inches (b) from end of center conductor.

Step 3 Pull braid wires froward and taper toward center conductor. Place clamp over braid and push back to cable jacket.

Step 4 Fold back braid wires over clamp and trim to proper length. Solder contact to center conductor.

Step 5 Insert cable and parts into connector body. Make sure sharp edge of clamp seats properly in gasket. Tighten nut.

Step 6 Using the multimeter, measure continuity from center conductor of the other end of cable. It should be very close to 0 ohms. Measure continuity of center conductor to connector body. It should be open.

FIGURE A-3 CONNECTOR ASSEMBLY INSTRUCTIONS

A.4 MODEL 8227 GPS INLINE AMPLIFIER

An inline amplifier is required whenever GPS antenna cable lengths cause greater than 20 dB attenuation. Using Spectracom CA07xxx or Belden 8267 coax, an amplifier is needed whenever antenna cable lengths exceed 200 feet.

The Model 8227 GPS Inline Amplifier, shown in Figure A-4, extends the maximum cable length to 400 feet. The Model 8227 provides 20 dB of gain and is powered by the NetClock/NTP receiver.

FIGURE A-4 MODEL 8227 INLINE AMPLIFIER

Each Model 8227 includes two clamp type Male N connectors. These connectors can be used to splice the Model 8227 into the antenna coax. The connectors are compatible with RG-213 type coax such as Spectracom CA07xxx or Belden 8267. Refer to Figure A-3 for connector assembly instructions.

A five-foot long coaxial cable is also provided with each Model 8227. This cable connects the amplifier to the surge suppressor. This cable is rated for indoor usage only.

Refer to Figure A-5 for Model 8227 installation guidelines. The cable lengths shown in Figure A-5 represent Spectracom CA07xxx cable. The equivalent cable loss expressed in dB, is provided for use with other cables.

Place the inline amplifier within 100 feet (10 dB cable loss) of the antenna for optimum signal-to-noise ratio. Whenever possible, install the inline amplifier indoors after the impulse suppressor using the supplied 5-foot cable. The amplifier can be installed outdoors, providing care is taken to weatherproof the connections. Due to unique system dynamics of the antenna, amplifier, and receiver, a minimum of cable length of 200 feet (20 dB cable loss) is required to prevent overloading the receiver.

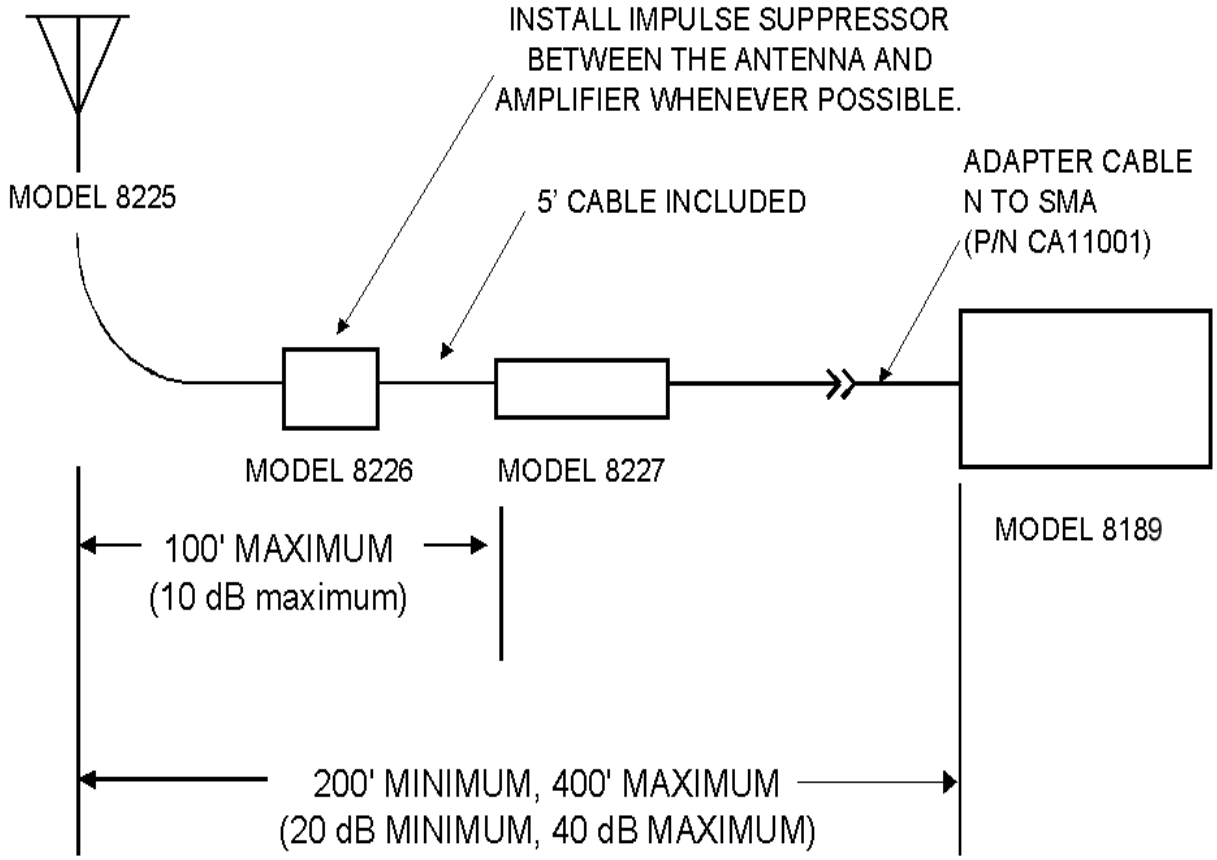


FIGURE A-5 CABLE GUIDELINES

APPENDIX B: TELNET CONFIGURATION

APPENDIX B: TELNET CONFIGURATION

B.0 INTRODUCTION

The NetClock/NTP 10 Base-T port can be configured using the RS-232 Setup port or through a Telnet connection. Section B.1 describes how to make an initial Telnet connection using the hardware address and desired IP address to establish a network connection. Section B.2 describes the Telnet 10 Base-T port configuration menus.

B.1 SETTING INITIAL IP ADDRESS

This section describes how to set a static ARP using the hardware address and the desired IP address. The hardware address is found on the label affixed to the bottom cover. The ARP command is available with UNIX and Windows 2000, NT, 95 or 98 using the DOS or Command prompt. This procedure is used if the Model 8189 has not been previously configured using either RS-232 or Telnet to the appropriate IP address.

If the Model 8189 has been previously configured and the IP address of the 8189 is known, skip to Section B.2 to begin the Telnet configuration session.

NOTE: There must be at least one entry in the ARP table, other than the local machine, for the ARP command to work in Windows. To view the current ARP table, type ARP -A at the DOS command prompt. If only the local machine is listed, build the ARP table by pinging to another IP address in your network.

In the following example, the desired IP address is 192.168.0.34 and the Model 8189 hardware address is 00 20 4A 72 34 02. The initial Telnet session is shown in Figure B-1.

1. Issue the ***ARP -S*** command using the desired IP address and hardware address. From the DOS or Command prompt enter the IP address in decimal dot notation format and the hexadecimal hardware address separated by hyphens (-).

   c:\ >arp -s 192.168.0.34 00-20-4a-72-34-02 <ent>

   In UNIX enter the desired IP address in decimal dot notation format and the hexadecimal hardware address separated by colons (:).

   arp -s 192.168.0.34 00:20:4a:72:34:02 <ent>

2. Open a Telnet connection of the desired IP address to Port Number 1. Note that this connection will fail, but the Model 8189 IP address will be forced to the desired value.

   c:\>telnet 192.168.0.34 1 <ent>

3. Open a Telnet connect using the desired IP address and Port Number 9999. This time, the connection will be successful, allowing access to Telnet configuration menu.

   c:\>telnet 192.168.0.34 9999

NOTE: If the Telnet connection is unsuccessful repeat the connection to Port 9999 and the desired IP address. If the connection continues to fail the Telnet feature may have been disabled or been password protected. Use the RS-232 connection to configure the NetClock/NTP.

Once a successful connection is made, you will be prompted to press the enter key or type in the Telnet password if previously set. Your response must occur within 5 seconds or the Telnet connection will time out. Refer to Section B.2 for a description of the Telnet menus.

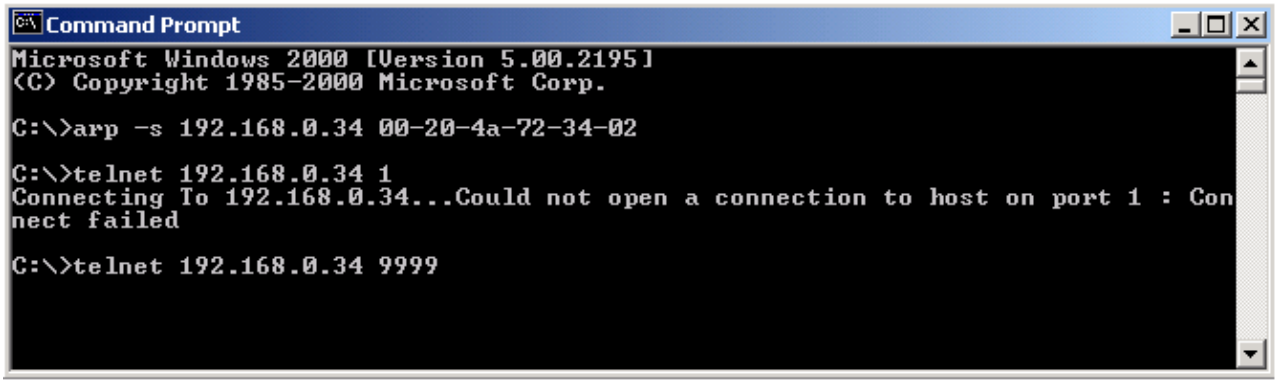


FIGURE B-1 INITIAL TELNET CONNECTION EXAMPLE

B.2 CONFIGURATION USING TELNET

To access the Setup menu, establish a Telnet connection using Port 9999 and the appropriate IP address. From a DOS or Command prompt issue the following command using the appropriate IP address:

c:\>telnet 192.168.0.34 9999

Once a successful connection is made, you will be prompted to press the enter key or type in the Telnet password. Your response must occur within 5 seconds or the Telnet connection will time out. If the Telnet password was forgotten, you must use the RS-232 Setup port to make configuration changes.

Upon entering the current configuration and menu options are given as shown in Figure B-2. The configuration menus are divided into three categories; Basic Configuration, NetClock Configuration and Security options. Upon completion of each menu an option is given to select another configuration menu or to save and exit with or without saving the configuration. The following paragraphs describe each of the menu selections.

```
*** basic configuration
Hardware: Ethernet Autodetect
IP addr : 194.39.78.253, no gateway set

*** NetClock configuration
  Antenna type                  : Spectracom Type 2
  SNMP                  : enabled
  SNMP Community Name           :
  SNTP Ref Identifier           : GPS
  SNMP manager IP's             : --- not set ---  --- not set ---
  Syslog IP addr                : --- not set ---  --- not set ---
  Syslog file           : LOCAL0
  Encryption                    : disabled

*** Security
  Telnet Setup                  : enabled
  TFTP Download                 : enabled
  WEB Manager                   : disabled
  Web Server                    : disabled
  Password                      : disabled

Change Setup :  0 Basic configuration
                1 NetClock configuration
                6 Security
                7 Factory defaults
                8 Exit without save
                9 Save and exit          Your choice ?
```

FIGURE B-2 SETUP MENU SELECTIONS

B.2.1 Basic Configuration Menu

Select ***0*** for Basic Configuration. After each parameter, the current configuration is shown in parentheses. To accept the variable, press the Enter key. To change the variable simply type in the new value then press the Enter key. The configuration menu will advance to the next parameter. It is not necessary to depress the Enter key when a Yes or No option is given, type y for yes and n for no.

Address variables are entered in a decimal dot notation format. It is not necessary to type leading zeroes in the address. For example, an IP address of 192.000.023.007 can be entered using 192.0.23.7.

Invalid or improperly formatted entries are rejected, requiring the parameter to be entered again. Upon completion of the Setup, an option to load and save the changes is given (option 9). After the configuration is loaded (or re-loaded), the current configuration of the Model 8189 is echoed back.

The Basic configuration menu includes the following setup parameters:

IP Address - This is the 32-bit address assigned to the Model 8189 by the network administrator. The default IP address is 194.039.078.253. The IP address is divided into four octets with the current value shown in parentheses. Enter each octet in decimal dot notation as shown in the example below to change the IP address to 131.123.070.146:

IP Address: (194) 131. (039) 123. (078) 70. (253) 146 <ent>

Gateway Address - A Yes/No option is given to enable a gateway address. If the application does not require a gateway, select ***N***. To set a gateway, type **Y** and edit the address prompts as described above.

Subnet Mask - The subnet mask defines the number of bits taken from the IP address that are used in the host portion. The default host bit value is 00. Setting the host bit value to 00 allows automatic selection of the appropriate net mask based on the IP address used. Refer to Table B-1 for the default subnet masks for the standard network classes.

Network Class	IP Address Range	Host Bits	Default Subnet Mask
A	1.x.x.x to 127.x.x.x	24	255.0.0.0
B	128.0.x.x to 191.255.x.x	16	255.255.0.0
C	192.0.0.x to 223.255.255.x	8	255.255.255.0

TABLE B-1 DEFAULT NET MASKS

The number of host bits used in the net mask can range from 2 to 24 bits. Table B-2 provides the complete list of the number of host bits and the corresponding subnet mask.

Host Bits	Equivalent Net	Host Bits	Equivalent Net mask
2	255.255.255.252	14	255.255.192.0
3	255.255.255.248	15	255.255.128.0
4	255.255.255.240	16	255.255.0.0
5	255.255.255.224	17	255.254.0.0
6	255.255.255.192	18	255.252.0.0
7	255.255.255.128	19	255.248.0.0
8	255.255.255.0	20	255.240.0.0
9	255.255.254.0	21	255.224.0.0
10	255.255.252.0	22	255.192.0.0
11	255.255.248.0	23	255.128.0.0
12	255.255.240.0	24	255.0.0.0
13	255.255.224.0		

TABLE B-2 EQUIVALENT NET MASK TABLE

B.2.2 NetClock Configuration Menu

Select ***1*** to enter the NetClock Configuration menu. This configuration menu includes the following setup parameters:

Spectracom Format: This parameter selects the Spectracom Data Format provided to the Model 8189 network card assembly. The Model 8189 accepts only Format 2.

NOTE: The Model 8189 accepts only Format 2. If Format 0 is selected it will be overwritten to Format 2 when the configuration is saved.

Enter Current Year: This parameter only appears if Data Format 0 was incorrectly selected in the previous step. Do not select Format 0.

Disable SNMP: A Yes / No option is given to enable SNMP with MIB II support per RFC 1213. Select ***Y*** if SNMP is not utilized. To enable SNMP type ***N.***

When the SNMP feature is enabled a prompt to enter the SNMP community name is given. The community name can be up to 13 characters long. Access to the NetClock/NTP database is limited to this name.

Change Reference Identifier: A Yes / No option is given to change the SNTP Reference Identifier. The Reference Identifier can be up to 4 characters and appears in the NTP header to identify the NetClock/NTP as the time source.

NOTE: By default the SNTP Reference Identifier is set to "GPS". Other names entered will be overwritten to GPS when the configuration is saved.

SNMP Address: Up to two SNMP Manager IP addresses can be specified. Upon completion of the first SNMP IP address a prompt is given to enable the second SNMP manager. Each IP address is divided into four octets with the current value shown in parentheses. Enter each octet in decimal dot notation as shown in the example below to configure the IP address to 131.123.090.005:

IP Address: (000) 131. (000) 123. (000) 90 (000) 5 <ent>

NOTE: The SNMP feature must be Enabled in previous steps to fully implement the function.

Syslog Address: A Yes / No option is given to enable up to two Syslog IP addresses.

NOTE: The Syslog feature is not supported in the Model 8189 NetClock/NTP. Select No to disable this feature.

Encryption: A Yes / No option is given to enable MD5 DES authentication algorithms. Type ***N*** to disable encryption or ***Y*** to enable. Up to six keys of 8 bytes can be configured when prompted.

MAC Keys: If encryption was enabled in the previous step, up to six keys may be configured. All key inputs are in hexadecimal format. The keys are divided into eight bytes with the current byte value shown in parentheses. Enter each byte followed by a space as shown in the example below:

Enter Mac Key #1 (00) A1 (00) 3F (00) 01 (00) 2D (00) 33 (00) ED (00) 60 (00) BF <ent>

Upon completion of the NetClock Configuration setup, the current configuration is echoed back and the option to continue or exit is given. Select 6 to enter the Security Menu if configuration changes are required. Select 9 to save the Basic and NetClock configurations and exit from the setup mode.

B.2.3 Security Options

Select ***6*** to enter the Security Configuration menu. This configuration menu includes the following parameters:

Disable Telnet: A Yes / No option is given to disable Telnet configuration sessions. Type ***Y*** to disable Telnet or select ***N*** to permit Telnet sessions. If Telnet is disabled future configuration changes must be made using the RS-232 Setup port. By default, Telnet configuration is enabled.

Disable TFTP: A Yes / No option is given to disable TFTP port operation. Firmware upgrades are made using a binary file from a TFTP client. If the TFTP port is disabled no firmware downloads are possible. Type ***Y*** to disable TFTP or ***N*** to enable firmware downloads. By default TFTP operation is enabled.

Disable Web Manager and Disable Web Server: A Yes / No option is given to disable Web Manager and Server functions. These functions are reserved for future implementation and are currently unsupported. Select ***Y*** to disable these features.

Note: The Web Manager and Web Server functions are not supported in the Model 8189 NetClock/NTP. To assure proper operation select Y to disable these features.

Telnet Password: A Yes / No option is given to enable a Telnet password. The password prevents unauthorized access of the NetClock/NTP configuration over the network. By default the Telnet port is not password protected.

NOTE: The RS-232 setup port is not password protected. Password protection is only applicable for Telnet connections.

To enable a password type ***Y*** then enter the desired password. A password can be up to 16 characters long and may be any combination of letters, numbers or keyboard symbols.

To change a password type ***Y*** in the Enable Password option. A Yes / No option is given to Change the Password, type ***Y*** and enter the new password.

To remove password protection type ***N*** in the Enable Password option.

This completes the NetClock/NTP configuration, select option 9 to Save and Exit the configuration. The Model 8189 will update and store the selected parameters into non-volatile memory. The 10 Base-T port is now ready for use.

APPENDIX C: SERVICE INFORMATION

APPENDIX C: SERVICE INFORMATION

C.0 INTRODUCTION

Section C.1 describes a method used to qualify the GPS reception of the indoor Model 8228 antenna or the Model 8225 outdoor antenna. Section C.2 provides reception-troubleshooting guidelines.

C.1 QUALIFYING THE INSTALLATION

Typically, the front panel Time Sync lamp turns green within 20 minutes of turn on. This lamp indicates that receiver is tracking at least one qualified satellite. If the Time Sync lamp does not change from red to green, a cable or reception problem may exist. Refer to Section C.2 for troubleshooting assistance.

Reception quality can be evaluated using the performance and status logs provided by the receiver. Commands to retrieve operational information are issued through the rear panel RS-232 Setup port. To communicate with the receiver, a terminal or computer with terminal emulation software (i.e. ProComm Plus, Hyper-Terminal, etc.) is required. Configure the terminal for ANSI emulation, 9600 baud and a character structure of 1 start, 8 data, 1 stop with no parity. XON/XOFF flow control is supported.

C.1.1 GPS Signal Status

The **G**PS **S**ignal **S**tatus command, **GSS**, provides an instantaneous view of the GPS reception quality. This command is used to verify proper antenna placement and receiver performance of an installation. The GSS response indicates the number of satellites the receiver is currently tracking and their relative signal strength. The resulting GPS quality and Position Fix Status are also included.

Issue the GSS command as shown below.

Type: ***GSS <ent>***

An example response is shown below:

TRACKING 4 SATELLITES
GPS STATE= 3D-FIX DOP= 03.7
LATITUDE= N 43 06 59.746 LONGITUDE= W 077 29 15.242 HEIGHT= +00110 METERS
QUALITY= PASSED

CHAN	*VID*	*MODE*	*STREN*	*STAT*
01	*24*	*08*	*043*	*A2*
02	*04*	*08*	*029*	*A2*
03	*10*	*00*	*000*	*00*
04	*05*	*08*	*053*	*A2*
05	*18*	*00*	*000*	*00*
06	*30*	*00*	*000*	*00*
07	*01*	*08*	*047*	*A2*
08	*06*	*00*	*000*	*00*

Tracking: The receiver must track at least one qualified satellite to operate. Typically the receiver shall track 4 or more satellites with the Model 8228 GPS Window Mount Antenna. If the Model 8225 outdoor antenna is used, the receiver will typically track 6 or more satellites.

GPS State: Under normal operation the receiver will indicate 3-D Fix. A Searching or 2-D Fix message indicates that fewer than 4 qualified satellites are currently tracked.

DOP: Dilution of Precision indicates the degree of uncertainty of a Position Fix. The DOP value shall be $0 \leq DOP < 10$ when in 3-D Fix mode.

Quality: A PASSED message indicates the receiver is tracking at least one qualified satellite. A FAILED message indicates the received GPS signals did not meet minimum requirements.

Satellite Data: Data on each satellite currently tracked is provided in table form.

The CHAN column represents the GPS Receiver Channel Number, 1 through 8.

VID is the Vehicle (satellite) Identification Number, 1 through 37.

The MODE column provides the Channel Tracking Mode for each satellite. The GPS qualifying algorithm accepts only satellites having a Mode value of 08.

The relative signal strength of each satellite currently tracked is found in the STREN column. The maximum signal level is 55. Typically, the signal strength is between 30 and 40.

The satellite status flag code is found in the STAT column. Typically the STAT value is A2.

If the receiver does not meet the minimum requirements described above, refer to Section C.2 for troubleshooting assistance.

C.1.2 Tracking Histogram

The **D**isplay Tracking **H**istogram command, **DH**, is used to evaluate the long-term reception quality. The tracking histogram records the number of satellites tracked and qualified every second. At the end of the hour, a log is created and the counters are restarted. The command responds with the last four hourly entries and the histogram currently in process. A complete description of the **DH** command is found in Section 4 of this manual.

Allow the receiver to operate for at least 5 hours before evaluating the tracking histogram. Issue the DH command as shown below:

Type: ***DH <ent>***

An example response is shown below:

TIME= 16:00:00 DATE= 2002-05-11 QUALIFIED HISTOGRAM
0= 00000 1= 00026 2= 00287 3= 03287 4= 00000
5= 00000 6= 00000 7= 00000 8= 00000 Q= 03600

TIME= 17:00:00 DATE= 2002-05-11 QUALIFIED HISTOGRAM
0= 00000 1= 00000 2= 00429 3= 02292 4= 00879
5= 00000 6= 00000 7= 00000 8= 00000 Q= 03600

TIME= 18:00:00 DATE= 2002-05-11 QUALIFIED HISTOGRAM
0= 00000 1= 00087 2= 00693 3= 02761 4= 00059
5= 00000 6= 00000 7= 00000 8= 00000 Q= 03600

TIME= 19:00:00 DATE= 2002-05-11 QUALIFIED HISTOGRAM
0= 00026 1= 00382 2= 00947 3= 02245 4= 00000
5= 00000 6= 00000 7= 00000 8= 00000 Q= 03574

TIME= 19:49:45 DATE= 2002-05-11 QUALIFIED HISTOGRAM
0= 00000 1= 00267 2= 01374 3= 01344 4= 00000
5= 00000 6= 00000 7= 00000 8= 00000 Q= 02985

In this example, the receiver tracked one satellite for 26 seconds, two satellites for 287 seconds and three satellites for 3287 seconds for the hour ending 16:00:00. The "Q" value of 3600 indicates the receiver had tracked at least one qualified satellite for the entire hour (3600 seconds). Note the partial histogram shown in the time stamp of 19:49:45.

For optimum performance, the receiver should consistently track three or more satellites. The Q value should typically be 3600 for most entries. Occasional drops below 3600 are considered acceptable. If the majority of the histograms show tracking less than three satellites, or Q values less than 3000, the receiver may not provide reliable operation. Refer to Section C.2.2 for recommendations.

C.2 RECEPTION TROUBLESHOOTING

Please review this section prior to calling the Spectracom Customer Service Department. If the reception problem cannot be solved following the guidelines outlined in this section, please call for Customer Service at 585.381.4827.

C.2.1 No Reception

Cable or connector problem: Measure the antenna cable resistance to verify the integrity of the cable and connectors. Remove the antenna cable from the rear panel of the receiver and measure the resistance from the coax center to shield. Refer to Table C-1 for typical resistance values of the antenna and inline amplifier alone and when combined.

DEVICE	DESCRIPTION	RESISTANCE
8228	Indoor Antenna	140 ohms
8225	Outdoor Antenna	180 ohms
8227	In-line Amplifier	165 ohms
8225 and 8227	Antenna/Amplifier	85 ohms

TABLE C-1 TYPICAL ANTENNA CABLE RESISTANCE VALUES

Failed impulse suppressor: The Model 8226 provides lightning protection when the outdoor GPS antenna is used. The Model 8226 has a high impedance when measuring from the center conductor to ground and a low throughput resistance. A failing impulse suppressor may be tripping prematurely. The easiest way to test the Model 8226 is to temporarily replace it with a Type N barrel connector. If the receiver begins tracking satellites within 20 minutes, the impulse suppressor has failed and must be replaced.

Cable length: The Model 8228 Indoor Antenna is supplied with 50 feet of antenna cable. Do not add cable. Excessively long or improper cable type may prevent the receiver from tracking satellites. Refer to Section A.2 for cable recommendations when using the Model 8225 Outdoor Antenna.

Antenna location: The antenna must have a good view of the sky. Refer to Section 2.1 for indoor antenna guidelines and Section A.1 for outdoor antenna guidelines.

Window Type: Windows with metal film coatings, metal screens or blinds may impede GPS reception.

GPS reset: In rare occasions, the GPS receiver may require a reset to set the receiver to default values. The receiver must be placed in Test Mode to issue the GPS Reset command. Issue the GPS Reset command, **RGPS**, as shown below:

Type: ***TM ON <ent>***

The unit will respond with a message stating Test Mode has been enabled. During Test Mode operation, the Major and Minor alarms are asserted.

Type: ***RGPS <ent>***

After an approximate 10 second delay, the receiver responds with a reset status message. Allow 20 minutes for the receiver to begin tracking satellites.

Receiver location: Setting the current receiver position may assist in obtaining a satellite fix. To enter a new location place the clock in *Set Mode* and issue the ***LOC*** command as follows:

Type: ***SM ON <ent>***

Response: *SET MODE = ON*

Type: ***LOC [N:S] [DD MM SS.SSS][E:W] [DD MM SSS.SSS]<ent>***

where:	N =	North Latitude
	S =	South Latitude
	DD MM SS.SSS =	Latitude Degrees:Minutes:Seconds
	E =	East Longitude
	W =	West Longitude
	DDD MM SS.SSS =	Longitude Degrees:Minutes:Seconds

NOTE: The approximate location is adequate, zeros may be used for the seconds values.

Allow 20 minutes for the receiver to begin tracking satellites.

C.2.2 Low GPS Quality

Cable Length: Excessively long or improper cable type may cause low GPS quality due to cable attenuation. Long GPS antenna lengths may require an inline amplifier or lower loss cable. Refer to Section A.2 for GPS cable recommendations and Section A.4 for inline amplifier information when using the Model 8225 Outdoor Antenna

The Model 8228 Indoor Antenna is provided with a 50-foot antenna cable. Do not substitute or add coax to the provided cable.

Antenna location: The antenna must have a view of the sky with views to the horizon. Nearby obstructions can reduce the receiver's ability to track the maximum number of satellites available.

Window Type: Windows with metal film coatings, metal screens or blinds may reduce GPS reception.