SPECTRACOM

PUBLIC SAFETY | SECURITY | GOVERNMENT

MODEL 8183A NETCLOCK/GTP

GPS MASTER CLOCK

INSTRUCTION MANUAL

SPECTRACOM CORPORATION
95 Methodist Hill Drive
Suite 500
Rochester, NY 14623

PHONE 585-321-5800
FAX 585-321-5219

www.spectracomcorp.com

REVISIONS, IF ANY, ARE LOCATED AT THE END OF THE MANUAL

MANUAL REVISION 1.2
July 2003

5-Year Warranty

LIMITED WARRANTY

Spectracom warrants each new product manufactured and sold by it to be free from defects in material, workmanship, and construction, except for batteries, fuses, or other material normally consumed in operation that may be contained therein, for five years after shipment to the original purchaser (which period is referred to as the "warranty period"). This warranty shall not apply if the product is used contrary to the instructions in its manual or is otherwise subjected to misuse, abnormal operations, accident, lightning or transient surge, repairs or modifications not performed by Spectracom.

The GPS receiver is warranted for one year from date of shipment and subject to the exceptions listed above. The power adaptor, if supplied, is warranted for one year from date of shipment and subject to the exceptions listed above.

The Rubidium oscillator, if supplied, is warranted for two years from date of shipment and subject to the exceptions listed above.

All other items and pieces of equipment not specified above, including the antenna unit, antenna surge suppressor and antenna pre-amplifier are warranted for 5 years, subject to the exceptions listed above.

WARRANTY CLAIMS

Spectracom's obligation under this warranty is limited to in-factory service and repair, at Spectracom's option, of the product or the component thereof, which is found to be defective. If in Spectracom's judgment the defective condition in a Spectracom product is for a cause listed above for which Spectracom is not responsible, Spectracom will make the repairs or replacement of components and charge its then current price, which buyer agrees to pay.

Spectracom shall not have any warranty obligations if the procedure for warranty claims is not followed. Users must notify Spectracom of the claim with full information as to the claimed defect. Spectracom products shall not be returned unless a return authorization number is issued by Spectracom. Spectracom products must be returned with the description of the claimed defect and identification of the individual to be contacted if additional information is needed. Spectracom products must be returned properly packed with transportation charges prepaid.

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Spectracom shall have no liability or responsibility to the original customer or any other party with respect to any liability, loss, or damage caused directly or indirectly by an Spectracom product, material, or software sold or provided by Spectracom, replacement parts or units, or services provided, including but not limited to any interruption of service, excess charges resulting from malfunctions of hardware or software, loss of business or anticipatory profits resulting from the use or operation of the Spectracom product or software, whatsoever or howsoever caused. In no event shall Spectracom be liable for any direct, indirect, special or consequential damages whether the claims are grounded in contract, tort (including negligence), or strict liability.

EXTENDED WARRANTY COVERAGE

Extended warranties can be purchased for additional periods beyond the standard five-year warranty. Contact Spectracom no later than the last year of the standard five-year warranty for extended coverage.

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SECTION 1: GENERAL INFORMATION

GENERAL INFORMATION

1.0 INTRODUCTION

The Spectracom NetClock/GTP Master Clock, shown in Figure 1-1, is a precise, traceable Global Time Provider. The NetClock/GTP receives and recovers time information from the **G**lobal **P**ositioning **S**ystem (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/GTP Master Clock provides timing outputs accurate to within 100 microseconds of UTC. Standard Master Clock outputs include RS-232, RS-485, FAA Modified IRIG B and a one pulse per second. The NetClock/GTP 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.

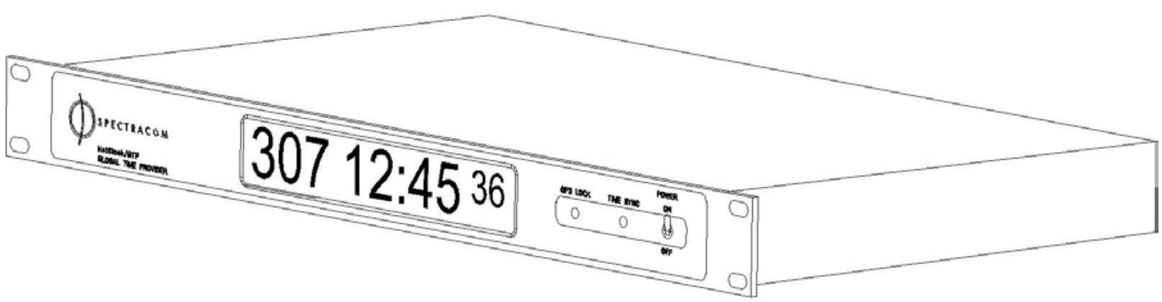


FIGURE 1-1 NETCLOCK/GTP MASTER CLOCK

1.1 FEATURES

The Spectracom NetClock/GTP offers the following features:

- **RELIABLE WORLDWIDE COVERAGE**: The NetClock/GTP can receive and track up to eight satellites simultaneously.

- **ACCURACY**: The NetClock/GTP 1PPS output is within ± 500 nanoseconds of UTC. The time data outputs are within 100 microseconds of UTC.

- **MULTIPLE TIME DATA OUTPUTS**: Each clock includes four FAA modified pulse width coded IRIG B outputs. Two RS-232 and one RS-485 time data ports are also provided. Output data formats and baud rates are configured using the RS-232 Setup port.

- **REFERENCE FREQUENCY OUTPUT:** The NetClock/GTP provides a 10 MHz output disciplined to received GPS signal. Output accuracy is specified to within $\pm 1 \times 10^{-8}$.

1.2 WARRANTY INFORMATION AND PRODUCT SUPPORT

Warranty information is found on the leading pages of this manual. 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 greatly appreciates any and all customer feedback. Please direct any comments or questions regarding application, operation, or service to Spectracom's Customer Service Department. Customer service is available Monday - Friday from 8:30 A. M. to 5:00 P.M. Eastern Time at 585-321-5800.

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.

Product support is also available by e-mail. Questions on equipment operation and applications may be e-mailed to Spectracom at:
techsupport@spectracomcorp.com.

Visit our web page for product information, warranty registration, and upgrade notices as they become available at:
http://www.spectracomcorp.com

1.3 MANUAL ERRATA AND SPECIAL DOCUMENTATION

Information concerning manual corrections or product changes occurring after printing is 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 provided in addition to this manual.

1.4 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, including an instruction manual and ancillary kit. Table 1-1 lists the items included in the NetClock/GTP ancillary kit.

Description	Part Number	Quantity
Terminal Block, 3-position	P13003	1
Fuse, 1.0 Amp, 3AG	F001R0	1

TABLE 1-1 MODEL 8183A ANCILLARY KIT

1.5 SPECIFICATIONS

This section contains specifications for the Model 8183A NetClock/GTP, Model 8225 GPS Antenna and antenna accessory products available from Spectracom.

1.5.1 Receiver

Received Standard:	L1 C/A Code transmitted at 1575.42 MHz.
Satellites Tracked:	Up to eight simultaneously.
Acquisition Time:	Typically <20 minutes from cold start.
Acquisition Sensitivity:	-105 dBm to -137 dBm.
Tracking Sensitivity:	-139 dBm.
Timing Accuracy:	<500 nanoseconds with Selective Availability “SA” on.
Antenna Connector:	BNC female.

1.5.2 Display

Display Type:	Red LED.
Digit Height:	0.8 inches for day of the year, hours and minutes. 0.56 inches for seconds.
Display Options:	12 or 24-hour format, UTC or local time, enable DST/STD time changes.

1.5.3 Status Indicators

Front panel bi-color LED’s indicates operational status.

GPS Lock:	Indicates GPS satellite tracking status. Lamp is green when the receiver has tracked at least one satellite within the period allotted for the GPS Lock Alarm. The lamp is red during initial operation or whenever a GPS Lock Alarm or CPU Alarm is asserted. The GPS Lock Alarm period is programmable up to 23 hours: 59 minutes: 59 seconds in 1-second increments. Factory default is 15 minutes.

Time Sync:	Indicates accuracy of time data outputs. Lamp is green when the receiver has tracked at least one satellite within the period allotted for the Time Sync Alarm. The lamp is red during initial operation and when a Time Sync Alarm is asserted. A red lamp indicates the time data output accuracy may not be within published specifications. Time Sync Alarm period is programmable up to 23 hours: 59 minutes: 59 seconds in one-second increments. Factory default is two hours.

1.5.4 RS-232 Serial Communication Ports

Signal:	Selected data format in RS-232 levels when interrogated by the connected device. The port may also be configured for continuous once-per-second output.
Connector:	DB9 female, pin assignments conform to EIA/TIA-574 standard, data communication equipment (DCE). Flow control is not supported.
Character structure:	ASCII, 1 start, 8 data, 1 stop, and no parity.
Accuracy:	Data stream on time marker within ± 100 microseconds of UTC for Formats 0, 1, 3, and 90 selected. Formats 2 and 4 are within ±1 millisecond of UTC.
Configuration:	Baud rate and output data formats are selected using the Serial Setup Interface. Bit rate selections are 1200, 2400, 4800 and 9600 baud. There are six data format selections available. In addition, time zone offset, DST rule and interrogation character can be configured. Each RS-232 Serial Comm port is independently configurable.

1.5.5 RS-485 Remote Output

Signal:	Selected 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 for Formats 0, 1, 3, and 90 selected. Formats 2 and 4 are within ±1 millisecond of UTC.
Configuration:	Baud rate and output data formats are selected using the Serial Setup Interface. Bit rate selections are 1200, 2400, 4800, and 9600 baud. There are six data format selections available. In addition, time zone offset and DST rule can be configured.

1.5.6 FAA IRIG B Outputs

Signal:	Pulse-width-coded FAA modified IRIG B in RS-422/485 levels. Four buffered outputs provided. FAA IRIG B modifications include satellite lock indicator and error flags between Position Identifiers P5 and P6 and removal of the straight binary seconds data.
Accuracy:	±2 microseconds of UTC when locked to GPS.
Connector:	DB25 Male. Connector pin-out is listed below: Output 1: Pin 2 (IRIG-B+) Pin 9 (IRIG-B-) Output 2: Pin 3 (IRIG-B+) Pin 10 (IRIG-B-) Output 3: Pin 4 (IRIG-B+) Pin 11 (IRIG-B-) Output 4: Pin 5 (IRIG-B+) Pin 12 (IRIG-B-) Ground: Pins 1,7,24 and 25.
Configuration:	The IRIG time data can be configured to reflect local time. UTC time zone offset and DST rule selections are applied to all four IRIG outputs.

1.5.7 1PPS Output

Signal:	One pulse-per-second square wave derived from the GPS receiver.
Signal Level:	TTL compatible into high impedance loads, 1.5 V base-to-peak into 50 ohms.
Pulse Width:	200 milliseconds.
Accuracy:	Positive edge within ± 500 nanoseconds of UTC when locked to GPS.
Connector:	BNC female.

1.5.8 Standard 10 MHz Output

Signal:	10 MHz sinewave.
Signal Level:	350 mVrms into 50 ohms.
Harmonics:	Better than 30 dB down.
Spurious:	Better than -35 dB down.
Accuracy:	± 1 x 10^{-8} when tracking GPS and under constant temperature and humidity.
Connector:	BNC female.

1.5.9 Input Power

DC Input:	12 to 36 VDC, 6 Watts.
Connector:	Banana jacks
Polarity:	Red is positive (+V), Black is negative (-V).

1.5.10 Mechanical and Environmental

Dimensions:	1.75 H x 19.0 W x 10.0 D inches (44 H x 483 W x 254 D mm).
Rack mount:	EIA 19”, front panel mounting holes for one standard rack unit.
Weight:	4.25 lbs. (2.0 kg).
Temperature:	0° to 50°C operating range.

1.5.11 Model 8225 GPS Antenna Specifications

1.5.11.1 Electrical Specifications

Type:	Active, 30dB gain.
Frequency:	1575.42 MHz.
Temperature Range:	-30° to 80° C (-22° to 176°F).
Connector:	N type, Female.
Recommended Cable:	RG-213.
Maximum Cable Length:	200 feet. Longer cable lengths require the Model 8227 Inline Amplifier.
Power:	5 Volts, 27 milliamps, powered by receiver.

1.5.11.2 Mechanical Specifications

Assembled Length:	24 inches (61 cm)
Housing Diameter:	3.5 inches (8.9 cm).
Housing Material:	PVC.
Assembled Weight:	1.3 lbs. (.60 kg).
Mounting:	Hose clamps (furnished) on vent pipe.

1.5.12 Model 8226 Impulse Suppressor

Connectors:	Type N Female.
Turn On Time:	4 nanoseconds for 2 kV/ns.
Turn On Voltage:	+7 V, -1 VDC.
Frequency Range:	1.2 to 2.0 GHz.
VSWR:	1.1:1 or better.
Insertion Loss:	0.1 dB maximum.

1.5.13 Model 8227 Inline Amplifier

Connectors:	Type N Female.
Gain:	20 $\pm$3 dB.
VSWR:	$\leq$1.5:1.
Power:	3 - 9 VDC, 7.5 $\pm$1 milliamps.

1.5.14 MP10-0000-0001 Grounding Panel

Overall Size:	12.0 L x 18.0 W x 0.75 D inches (305 H x 457 W x 19 D mm).
Ground Plate Size:	10.0 L x 15.0 W x 0.063 D inches (254 H x 381 W x 1.6 D mm).
Ground Strap:	20 feet (6 m) of 1.5 inch (38 mm) wide copper strap.
Mounting:	Mounting hardware, self-drilling screws, copper clamps and copper paste are included.

1.5.15 CA07xxx GPS Antenna Coax

Connectors:	Type N male both ends. -FAA suffix changes one end to BNC male.
Cable Jacket:	UV resistant, black non-contaminating PVC.
Temperature Range:	-40° to 80° C (-40° to 176°F).
Min. Bend Radius:	5.0 inches (127 mm).

SECTION 2: INSTALLATION

INSTALLATION

2.0 INTRODUCTION

This section describes the installation of the Model 8225 GPS Antenna and related accessories. This section also describes the NetClock/GTP preparation for use, initial operation, installation, qualification and configuration. To ensure proper operation, please read this section prior to equipment installation and usage.

2.1 MODEL 8225 GPS ANTENNA

The Model 8225 is an active antenna tuned to receive the GPS 1575.42 MHz L1 band satellite broadcast. The received signals are passed through a narrow bandpass filter and preamplifier within the antenna. The active antenna circuitry provides 30 dB of gain and requires +5 VDC at 27 milliamps. This is provided by the NetClock/GTP receiver 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.

2.1.1 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 or ice. Avoid placing the GPS antenna in close proximity to broadcast antennas whenever possible.

Each antenna includes a mating PVC mast assembly and two hose clamps to simplify installation. The hose clamps can be used to affix the mast assembly to a vent pipe. 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 2-1.

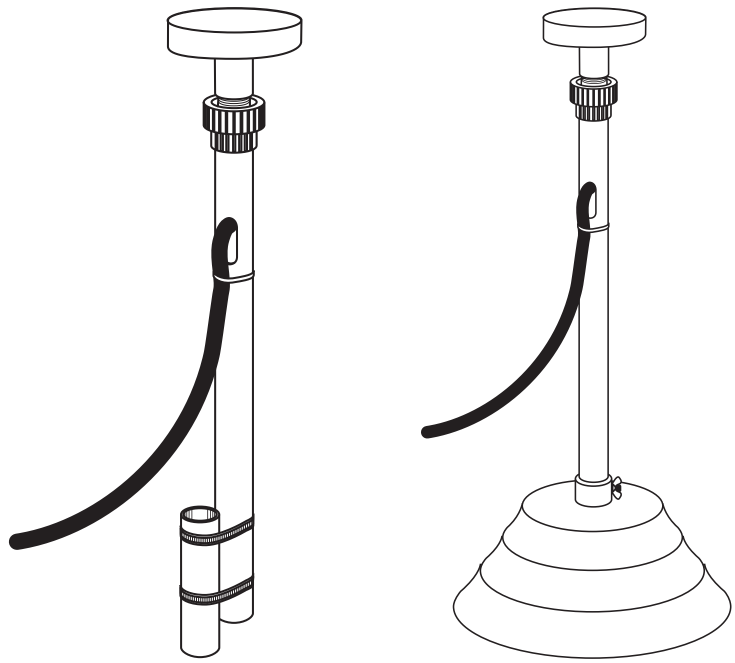


FIGURE 2-1 ANTENNA INSTALLATION

2.2 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 or BNC male connectors. Specify part number CA07xxx, where xxx equals the length in feet, for a cable terminated with Type N connectors. Adding the suffix –FAA changes one end of the antenna cable assembly to a BNC male connector.

If the antenna cable is purchased locally, select coax suitable for outdoor use. Consider the cable's weather resistance, 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/GTP 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 2.3 for a complete description of the Model 8226.

2.2.1 Cable Lengths

Using Spectracom CA07xxx or Belden 8267 coax, the maximum antenna cable length permitted is 200 feet. These cables attenuate the GPS signal by 10 dB per 100 feet of coax. Installations requiring longer antenna cables may use the Model 8227 Inline Amplifier, or lower loss cable. Refer to Section 2.5 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 of greater than 20 dB requires the use of a Model 8227 Inline Amplifier.

2.3 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 suppresser trip point are shunted to the system ground. The Model 8226 is designed to withstand multiple surges.

Mount the suppressor indoors, preferably where the coax enters the building. Install the suppressor on a grounding panel or bulkhead using the BF adapter bracket (Spectracom part # MP10-0000-0002) as shown in Figure 2-2.

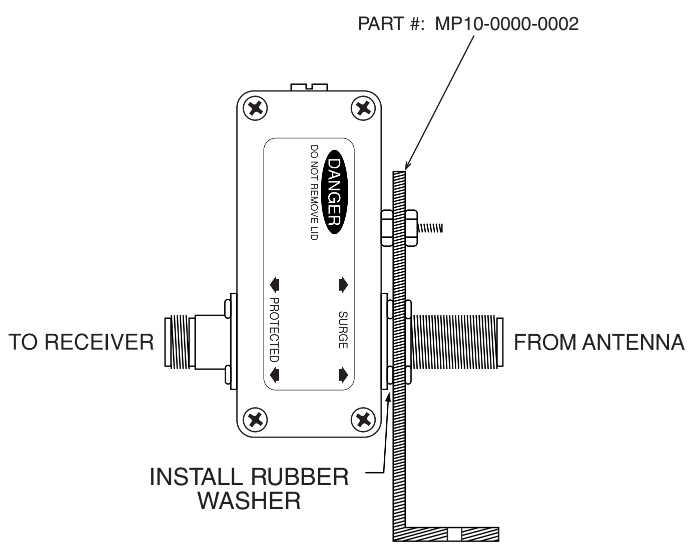
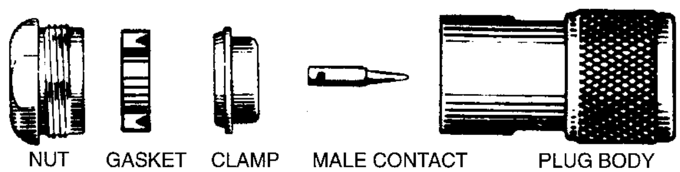


FIGURE 2-2 MODEL 8226 IMPULSE SUPPRESSOR

Refer to Section 2.4 for additional information on the copper grounding panel (part # MP10-0000-0001) offered by Spectracom.

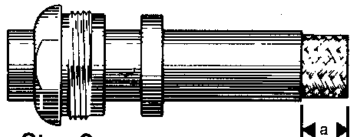
Each Model 8226 includes two clamp type male N connectors. These connectors can be used to splice the Model 8226 into the antenna coax. The connectors are compatible with RG-213 type coax such as Spectracom CA07xxx or Belden 8267. Connector assembly instructions are shown in Figure 2-3.



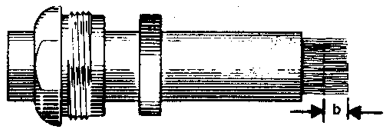
Tools Required:

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

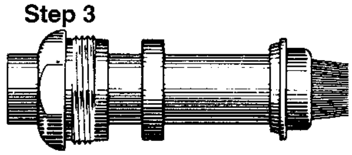
Step 1



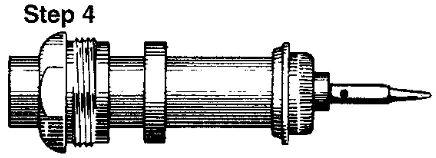
Step 2



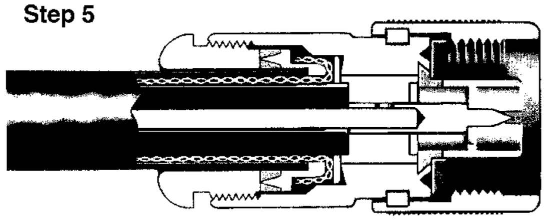
Step 3



Step 4



Step 5



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 2-3 CONNECTOR ASSEMBLY INSTRUCTIONS

2.4 MP10-0000-0001 COPPER GROUNDING PANEL

A single point ground system is recommended to provide optimum protection from lightning strikes. Spectracom offers a copper grounding panel, part number MP10-0000-0001, as a single point ground connection for the antenna surge suppressor, equipment rack, GPS receiver and other surge protection devices to a perimeter ground system.

Each grounding panel includes mounting hardware, hardware to secure protective devices to the copper plate, 20 feet of 1.5 inch wide copper strap, two strap clamps and copper paste.

Mount the grounding panel indoors, preferably close to where the antenna coax enters the building and direct access to the system ground is available. Refer to Figure 2-4 for installation guidelines. The ground panel must be connected to a low impedance (both low resistance and low inductance) ground system to assure proper operation of the surge protection equipment. To minimize the inductance between the ground plate and system ground interconnection keep the copper grounding strap as straight as possible, limit bends to a radius of 8 inches or larger. Thoroughly clean the copper panel to remove any oxidation or contaminants prior to installation. Apply the supplied copper paste to all junctions on the copper panel to maintain a low impedance connection.

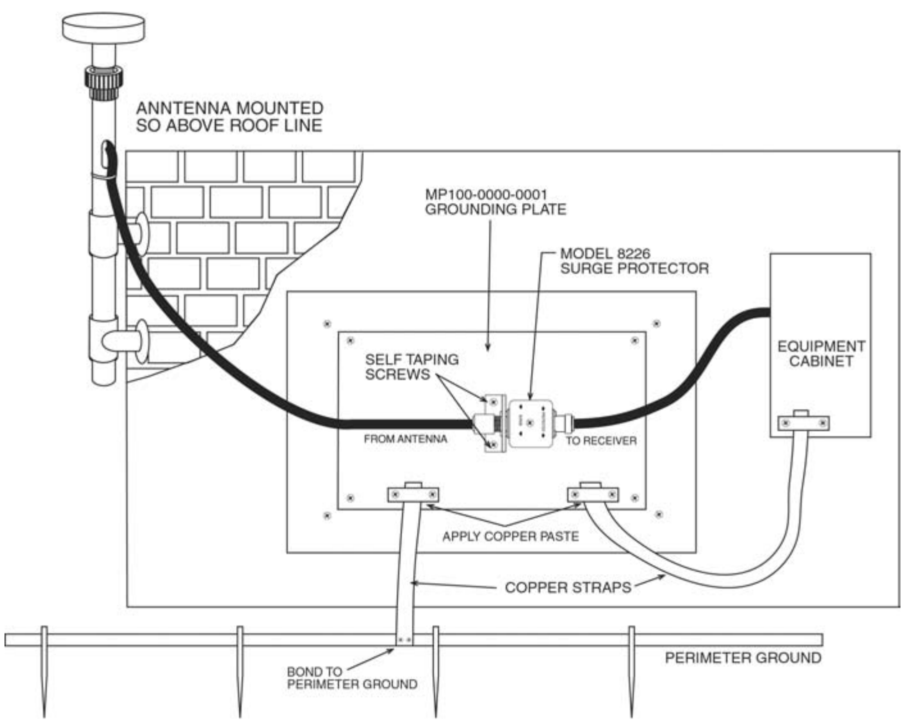


FIGURE 2-4 GROUNDING PANEL INSTALLATION

2.5 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 2-5, extends the maximum cable length to 400 feet. The Model 8227 provides 20 dB of gain and is powered by the NetClock/GTP receiver.

FIGURE 2-5 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 2-3 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 2-6 for Model 8227 installation guidelines. The cable lengths shown in Figure 2-6 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 to optimize the 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.

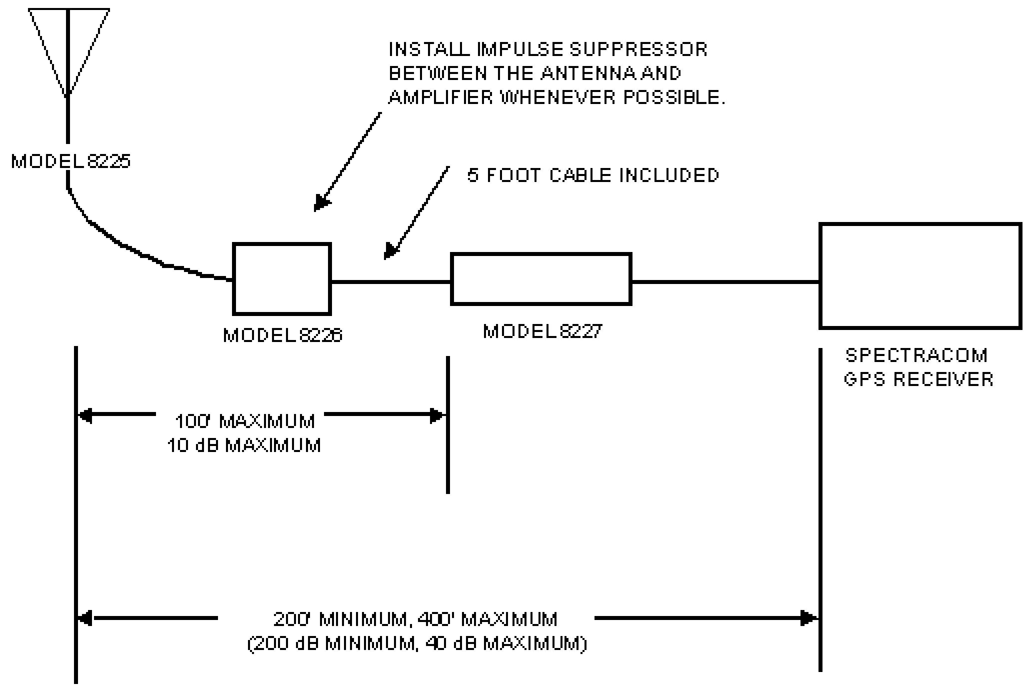


FIGURE 2-6 CABLE GUIDELINES

2.6 NETCLOCK/GTP PREPARATION FOR USE

This section outlines the set-up procedure to prepare the NetClock/GTP for operation.

2.6.1 Antenna Connection

Install the Model 8225 Antenna as outlined previously in this section. Connect the antenna cable to the rear panel GPS ANTENNA connector.

2.6.2 Power Connection

The NetClock/GTP can be powered from a 12 to 36 VDC power source. Power consumption is 6 Watts. Power is applied to the rear panel banana jacks; Red is for positive polarity and Black is negative. Place the front panel power switch in the OFF position before applying power.

Note: The NetClock/GTP utilizes a locking toggle power switch. To actuate the switch, first pull on the switch knob, then move to the desired position ON or OFF, then release.

2.6.3 Chassis Ground

The chassis ground lug allows the NetClock/GTP 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.

2.6.4 Configuration

The NetClock/GTP time outputs and operational parameters are configurable to meet the requirements of many applications. Baud rate and time data format selections of the RS-232 and RS-485 ports, front panel display format, Daylight Saving Time and time difference from UTC are just some of the configuration selections.

Most applications of the NetClock/GTP will set the clock display and time data outputs to reflect local time. The default settings for all outputs are UTC time with no Daylight Saving Time rule implemented.

Commands to configure the clock are entered through the RS-232 Serial Setup Interface port. Connect a computer running a terminal emulation program (HyperTerminal, ProComm, etc.) to the Serial Setup Interface 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 NetClock/GPS display and time data outputs issue the configuration command, ***CONF*** as shown below:

Type: ***conf <ent>***

Default Response:

FRONT PANEL FORMAT= 24 HOUR
TIME DIFF= +00:00 DST= 0

IRIG FORMAT= FAA
TIME DIFF= +00:00 DST= 0

SERIAL PORT 1
BAUD RATE= 9600 FORMAT #= 00 REQUEST CHAR= T
TIME DIFF= +00:00 DST= 0

SERIAL PORT 2
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

The following paragraphs contain configuration examples of the front panel display, IRIG, RS-232 serial communication ports and the RS-485 Remote Output. Configuration entries or keystrokes are shown in ***BOLD ITALICS***. Commands are terminated or executed by the enter key ***<ent>***. The responses from the NetClock/GTP are shown in *ITALICS.*

2.6.4.1 Front Panel Display Configuration

The command, ***FPF***, reads and sets the front panel display configuration. Display options include 12 or 24 hour display format, UTC or local time with or without DST corrections.

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

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

The front panel display format is configured using the ***FPF.*** The command structure is shown below:

Type: ***FPF [12:24] [±HH:MM] [DST] <ent>***

Where: ***12*** = 12 Hour Display Format
24 = 24 Hour Display Format
±HH:MM = 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 4-2, UTC Time Difference Map, for additional offsets.

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

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

Example: Configure the front panel display for 24 hour format, Eastern Time with Daylight Saving Time.

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

Response: *SET MODE ON*

Type: ***FPF 24 -05:00 1 <ent>***

Response: *FRONT PANEL FORMAT = 24 HOUR*
TIME DIFF = -05:00 DST = 1

2.6.4.2 IRIG Configuration

Time data contained in the IRIG outputs can be configured to provide local time with or without DST corrections using the command ***IRIG.***

Note: The ***IRIG*** command programs all four IRIG outputs to the same configuration.

The ***IRIG*** command structure is shown below:

Type: ***IRIG [TD] [DST] <ent>***

Where: ***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 4-2, UTC Time Difference Map, for additional offsets.

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

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

Example: Configure the time contained in the IRIG outputs to reflect Pacific Time with DST corrections.

Type: ***SM ON <ent>*** (Set Mode may already be enabled)

Response: *SET MODE ON*

Type: ***IRIG -08:00 1 <ent>***

Response: *IRIG FORMAT= FAA*
TIME DIFF = -08:00 DST = 1

2.6.4.3 RS-232 Serial Comm and RS-485 Remote Output Configuration

The NetClock/GTP has several time data formats available to suit various applications. 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. Refer to section 3.3 for a complete description of available data formats. Bit rate can be programmed from 1200 to 9600 baud. In addition, the serial ports can be configured to output the selected dated format upon receiving a time request character or continuously once-per-second. The Remote Output always outputs the selected data format once-per-second.

The two RS-232 Serial Comm ports are individually programmable. The command ***SER1*** reads or sets the Serial Comm 1 configuration and ***SER2*** configures Serial Comm 2. The command ***REM1*** configures the RS-485 Remote Output port. The ***SER*** and ***REM1*** command structures are shown below:

SER[X] [BAUD] [FMT] [REQ] [TD] [DST] <ent>
REM1 [BAUD] [FMT] [TD] [DST] <ent>

Where: ***X*** = Serial Comm Number:1,2

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

FMT = Data Format: 00, 01, 02, 03, 04, 90. Most applications use Format 00 or 02. 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 4-2, 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 Serial Comm 1 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>*** (Set Mode may already be enabled)
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

Example: Set the Remote Output to provide Format 00 at 9600 baud and time reflecting Central Time with DST corrections.

Type: ***SM ON <ent>*** (Set Mode may already be enabled)
Response: *SET MODE ON*
Type: ***REM1 9600 00 -06:00 1 <ent>***
Response: *REMOTE PORT 1*
BAUD RATE = 9600 FORMAT # = 00
TIME DIFF = -06:00 DST = 1

2.7 INITIAL OPERATION

During initial operation, the GPS LOCK and TIME SYNC lamps are 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. If the receiver is unable to acquire a satellite within 15 minutes a GPS Lock Alarm is asserted causing an RS-232 alarm log entry.

The GPS LOCK lamp turns green after tracking at least one satellite for one minute. The TIME SYNC lamp remains red until the receiver has acquired the complete system almanac from at least one satellite. Typically, the entire process of acquiring satellites and retrieving the almanac requires 20 minutes to accomplish. Once the GPS LOCK and TIME SYNC lamps turn green the NetClock/GTP shall operate in accordance with the specifications published in this manual.

2.8 QUALIFYING THE INSTALLATION

Typically, the front panel TIME SYNC lamp turns green within 20 minutes of power on. This lamp indicates that receiver is tracking at least one qualified satellite. If the GPS LOCK lamp does not change from red to green, a cable or reception problem may exist. Refer to Section 5.1 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 Serial Setup Interface 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 and no parity. XON/XOFF flow control is supported.

2.8.1 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. A complete description of the **GSS** command can be found in Section 4 of this manual.

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 6 or more satellites with the Model 8225 GPS Antenna. If the Model 8228 indoor window mount antenna is used, the receiver will typically track 4 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.

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 5, *Service Information*, for troubleshooting assistance.

2.8.2 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= 2000-05-11 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= 2000-05-11 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= 2000-05-11 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= 2000-05-11 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= 2000-05-11 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 5.1, *Reception Troubleshooting*, for recommendations.

SECTION 3: OPERATION

OPERATION

3.0 INTRODUCTION

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

3.1 FRONT PANEL FUNCTIONS

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

3.1.1 Display

The front panel display provides GPS synchronized time. The display characters are red LED digits measuring 0.8 inches high for the day of year, hours and minutes, and 0.56 inches for the seconds. The display area features a red filter with an anti-glare surface for optimum viewing.

Day of the year value is displayed in the three left-hand digits. The day values range from 001 to 366 for leap years. Leading zeroes are not suppressed.

The time display can be configured for 12 or 24 hour format, Coordinated Universal Time (UTC) or local time with or without Daylight Saving Time corrections. The command ***FPF*** configures the front panel display format options. Refer to Section 4, *Software Commands*, for a complete description of this command.

In addition to providing time, the display communicates when an adjust oscillator alarm is activated by displaying all 8's every three seconds. This alarm warns that the GPS disciplined TCXO time base requires an adjustment to ensure proper operation. The adjustment compensates for crystal aging and centers the TCXO within its control range. Typically, this adjustment is not necessary until after many years of operation. Refer to Section 5, *Service Information*, for the TCXO adjustment procedure.

3.1.2 GPS Lock Lamp

This bi-color LED indicates the receiver lock status to GPS. At power on this lamp is red. The lamp turns green after the receiver has tracked and qualified at least one satellite for one minute.

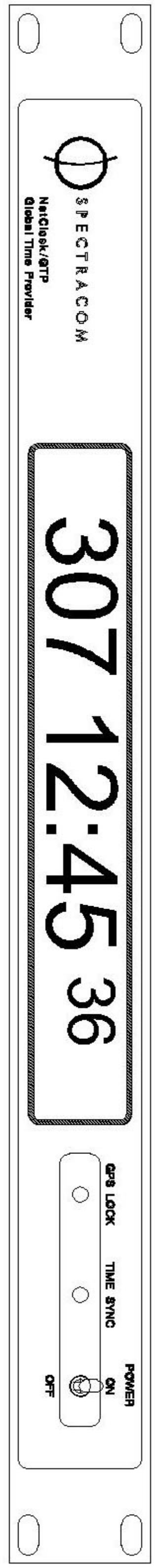


FIGURE 3-1 NETCLOCK/GTP FRONT PANEL

The lamp remains green if the receiver continues to track, or has tracked, at least one qualified satellite within the period allotted for the GPS Lock Alarm. The default period is set for 15 minutes. The GPS Lock Alarm period can be configured up to 24 hours using the ***LOCK*** command. Refer to Section 4 for a complete description of the ***LOCK*** command.

The lamp turns red when the receiver is unable to track any satellites and the GPS Lock period has expired. At this point a GPS Lock Alarm message is output on the Serial Setup port.

After the receiver reacquires at least one qualified satellite for one minute, the GPS Lock lamp turns green. Another status message is sent to the Serial Setup port that the GPS Lock Alarm has been cleared.

Refer to Section 3.2.8 for additional information on the GPS Lock Alarm.

3.1.3 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 has 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, a Time Sync Alarm message is output on the Serial Setup port 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 if the almanac data is still valid. If the almanac is invalid or lost due to a power failure, the clock will have to again recover the complete almanac (12.5 minutes). When the receiver reacquires Time Sync, a status message is sent to the Serial Setup port that the Time Sync Alarm has been cleared and timing accuracy shall meet specification. Refer to Section 3.2.8 for additional information on the Time Sync Alarm.

3.2 REAR PANEL FUNCTIONS

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

3.2.1 GPS Antenna

This BNC connector is the antenna input to the GPS receiver. The Model 8225 GPS Antenna and the Model 8227 Inline Preamplifier receive operational power, +5 VDC, from this connector.

3.2.2 Standard 10 MHz Output

The STD 10 MHz Output BNC connector provides a 10 MHz sinewave derived from the GPS disciplined TCXO time base. Frequency accuracy is better than 1×10^{-8} (±0.1 Hz). Signal level is 350 mVrms into 50 ohms. The 10 MHz output may be used as a time base for signal generators, frequency counters or other devices accepting an external reference frequency.

3.2.3 1PPS Output

This BNC connector provides a GPS derived one pulse-per-second output. The leading edge of this TTL compatible signal is within ± 500 nanoseconds of UTC with selective availability (SA) on. The leading edge can be adjusted to compensate for antenna cable delays using the command ***ACD***.

Refer to Section 4, *Software Commands*, for additional information on the ***ACD*** command.

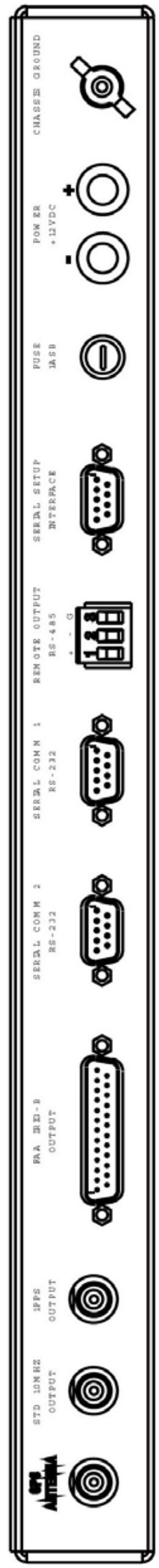


FIGURE 3-2 NETCLOCK/GTP REAR PANEL

3.2.4 FAA IRIG-B Outputs

IRIG is an acronym for Inter-Range Instrumentation Group. In the late 1950's this group created a series of time code standards suitable for use with recording oscillographs, magnetic tape and real time transmission. Each IRIG code specifies a carrier frequency that is modulated to encode date and time, as well as control bits to time stamp events. Initially, IRIG applications were primarily military and government associated. Today, IRIG is commonly used to synchronize voice loggers, Mode-S radar and sequential event loggers found in emergency dispatch centers, air traffic control towers and power utilities.

The NetClock/GTP provides four pulse-width-coded FAA modified IRIG B in RS-422/485 levels. FAA IRIG B modifications include satellite lock indicator and error flags between Position Identifiers P5 and P6 and removal of the straight binary seconds data. Refer Appendix A of this manual for detailed information on the FAA modified IRIG B code.

The IRIG time data can be configured to reflect local time using the command ***IRIG***. UTC time zone offset and DST rule selections are applied to all four IRIG outputs. Refer to Section 4, *Software Commands*, for a complete description of this command.

The four FAA modified IRIG B signals are output on the 25-pin series D male connector. Connector pin numbering is shown in Figure 3-3. Pin assignments are listed in Table 3-1.

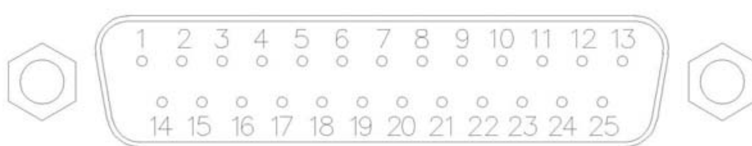


FIGURE 3-3 IRIG CONNECTOR

OUTPUT #	IRIG +	IRIG -
Output 1	Pin 2	Pin 9
Output 2	Pin 3	Pin 10
Output 3	Pin 4	Pin 11
Output 4	Pin 5	Pin 12

Pins 1, 7, 24 and 25 are grounded.

TABLE 3-1 IRIG PIN OUT

3.2.5 RS-232 Serial Communication Ports

The NetClock/GTP has two serial communication ports labeled Serial Comm 1 and Serial Comm 2. These ports provide 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 of both ports are selectable. A port may be enabled to output when interrogated by the connected device or continuously every second.

When using the Serial Comm ports in the interrogation mode, any keyboard symbol, number or upper case letter may be configured to request the time. The factory default request character is a capital letter T. NetClock/GTP 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 serial communication ports are configured by the commands ***SER1*** and ***SER2***. Refer to Section 4, *Software Commands*, for a complete description of these commands.

The Serial Comm connectors are 9-pin series D females. Connector pin numbering is shown in Figure 3-4. Serial Comm pin assignments are listed in Table 3-2.

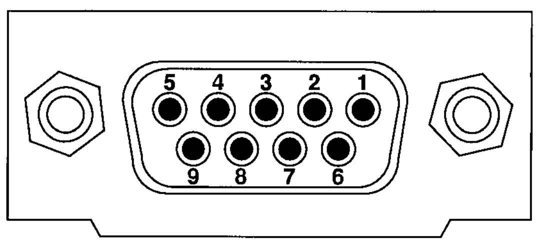


FIGURE 3-4 SERIAL COMM PIN NUMBERING

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 SERIAL COMM PIN ASSIGNMENTS

Per EIA/TIA-574 standard, the NetClock/GTP Serial Comm ports are 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 a DCE requires reversing Pins 2 and 3 or a null modem. The Serial Comm ports require no flow control. 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. The character structure is set for no parity, 8 data bits and 1 stop bit.

3.2.6 RS-485 Remote Output

The NetClock/GTP Remote Output provides a continuous RS-485 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 formats, baud rate and UTC time difference of each output is selectable. The command ***REM1*** configures the port setup. Refer to Section 4 for a complete description of this command.

The mating 3-position terminal block is supplied in the ancillary kit. Connector pin assignments are shown in Figure 3-5.

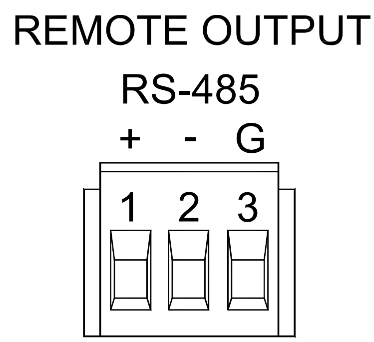


FIGURE 3-5 REMOTE OUTPUT

RS-485 is a balanced differential transmission requiring twisted pair cabling. RS-485 characteristics make it ideal to distribute time data throughout a facility. The Remote Output can provide time to 32 devices at cable lengths up to 4000 feet. Refer to Figure 3-6 for a schematic representation of the RS-485 output driver. Relative to RS-485 specifications, the A terminal (Pin 2) is negative with respect to the B terminal (Pin 1) for a mark or binary 1. The A terminal is positive to the B terminal for a space or binary 0.

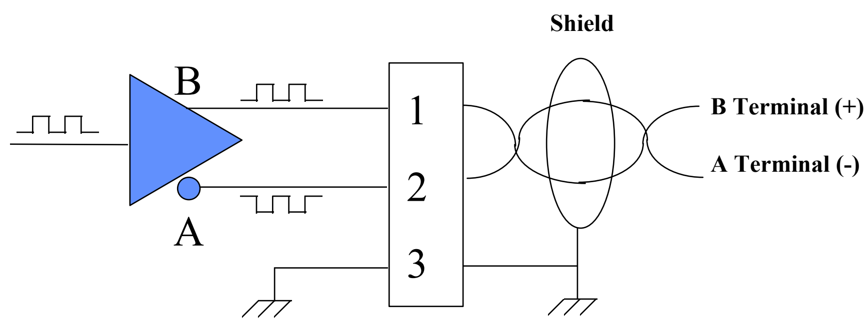


FIGURE 3-6 RS-485 OUTPUT

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

3.2.7 Serial Setup Interface

The Serial Setup Interface is an RS-232 communication port. Commands to configure output signal options, set operational parameters, perform test functions, view receiver performance and clock configuration are entered here. Refer to Section 4, *Software Commands*, for a complete description of the NetClock/GTP command set.

The Serial Setup Interface connector is a 9-pin series D female. Connector pin numbering is shown in Figure 3-7. Pin assignments are listed in Table 3-3.

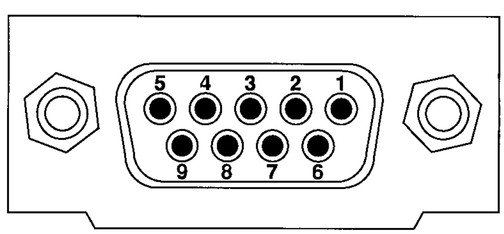


FIGURE 3-7 PIN NUMBERING

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 3-3 PIN ASSIGNMENTS

The Serial Setup Interface 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 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 by a pull up resistor.

The Serial Setup Interface 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. The Internet address is www.spectracomcorp.com. A read me file is included in the batch file to provide the necessary instructions. Upgrades may also be provided on disk on a request basis only. Contact Spectracom customer service for upgrade requests and information.

3.2.8 Status Messages

Changes in operational status messages are automatically provided to the Serial Setup port. The NetClock/GTP divides alarm conditions into two categories, Major and Minor. A Major Alarm is asserted when fault conditions exist which affect the operation or accuracy of the unit. A Minor Alarm warns of conditions having no immediate effect on total operation, but may require corrective action.

In addition to the automatic status messages, operational status and alarm log history can be monitored using the Serial Setup Interface commands ***STAT*** and ***DAL***. These commands are described in Section 4 of this manual.

A status message classified as a Major Alarm is output when the following alarms and conditions exist:

Frequency Alarm: Measured oscillator frequency error exceeds 1×10^{-7}.

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.

Test Mode: Unit is placed in Test Mode operation.

Power Failure: The NetClock/GTP has lost power.

A status message classified as a Minor Alarm is output when the following alarms and conditions exist:

Oscillator Adjust: Warns that oscillator is operating within 10% of the minimum or maximum control setting. The oscillator requires manual adjustment.

GPS Lock Alarm: The period of time allotted for operation without tracking a satellite has expired. Factory default is 15 minutes. The GPS lock period is programmable from 1 minute to 23 hours: 59 minutes: 59 seconds using the ***LOCK*** command described in Section 4, *Software Commands*.

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.

Test Mode: Unit is placed in Test Mode operation.

3.2.9 DC Power

The NetClock/GTP can be powered from a 12 to 36 VDC power source. Power consumption is 6 Watts. Connect the positive power connection to the red bannana jack and the negative to the black.

The unit is fuse protected and controlled by the front panel locking toggle power switch.

3.2.10 Chassis Ground

The chassis ground lug 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 data format selections available on the NetClock/GTP Serial Comm and RS-485 Outputs. Format selection is made as part of the Serial Comm and Remote port configuration. 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 Serial Setup Interface.

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: 271 12:45:36 DTZ=08

The example data stream provides the following information:

Sync Status:	Time synchronized to GPS
Date:	Day 271
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 converts the received day of year data (001-366) to 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 Serial Setup Interface.

Example: * FRI 20APR01 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:	Friday, April 20, 2001
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 Serial Setup Interface.

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 1 PPS stability and the time elapsed tracking no 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: ?A01 271 12:45:36.123 S

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 271 of year 2001.

Time: 12:45:36 UTC time, Standard 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^YYYYMMDD^HHMMSS±*HHMM*D L # CR LF

where:

FFFF	=	Format Identifier (0003)
I	=	Time Sync Status (Space, ? *)
^	=	space separator
YYYY	=	Year (1999, 2000, 2001 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 Serial Setup Interface.

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 20010415 124536-0500D #

The example data stream provides the following information:

Data Format: 3

Sync Status: Time Synchronized to GPS.

Date: April 15, 2001.

Time: 12:45:36 EDT (Eastern Daylight Time), 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 Serial Setup Interface.

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 50085 124536.1942 L
The example data stream provides the following information:

Data format:	4
Sync Status:	Time synchronized to GPS.
Modified Julian Date:	50085
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 = degress, 00...90
	mm.mmmm = minutes, 00.0000....59.9999
	n = direction, N = North, S = South
dddmm.mmmm,e =	Longitude
	ddd = degress, 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 calculated by Xoring 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 REMOTE OUTPUT USAGE

The Remote Output provide a continuous once-per-second time data stream in RS-485 levels. 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 Remote Output can drive 32 devices over cable lengths up to 4000 feet. Spectracom manufactures wall clocks, talking clocks, NTP time providers, RS-485 to RS-232 converters and radio link products that utilize the RS-485 data stream as an input. Figures 3-8 and 3-9 illustrate typical RS-485 time data bus interconnections. Follow the guidelines listed below when constructing the RS-485 data bus.

3.4.1 RS-485 Guidelines

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 as stubs to the RS-485 transmission line. Stub lengths affect the bus impedance and capacitive loading which could result in reflections and signal distortion.

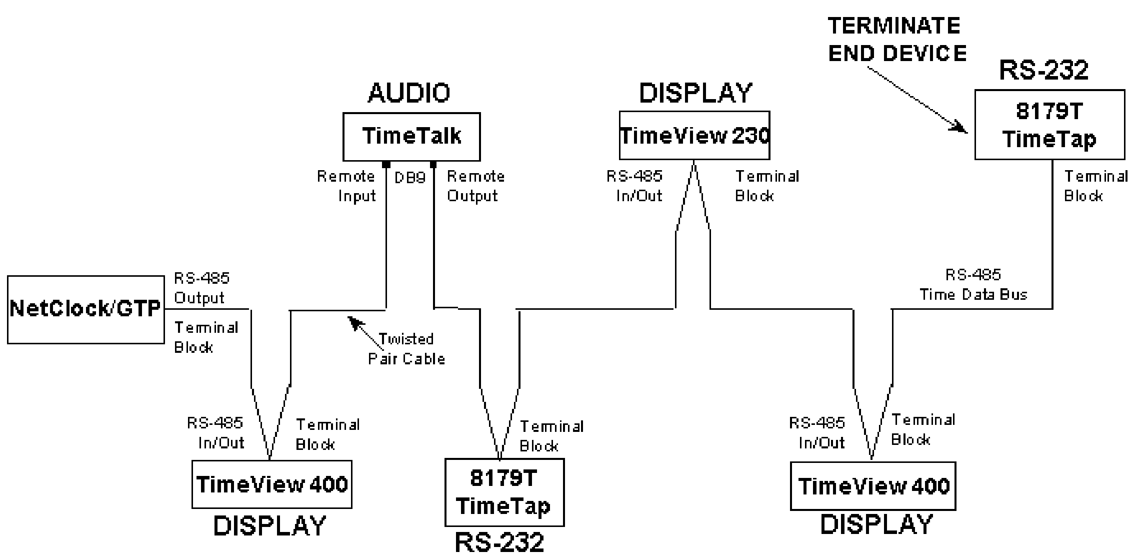


FIGURE 3-8 ONE-WAY BUS INSTALLATION

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

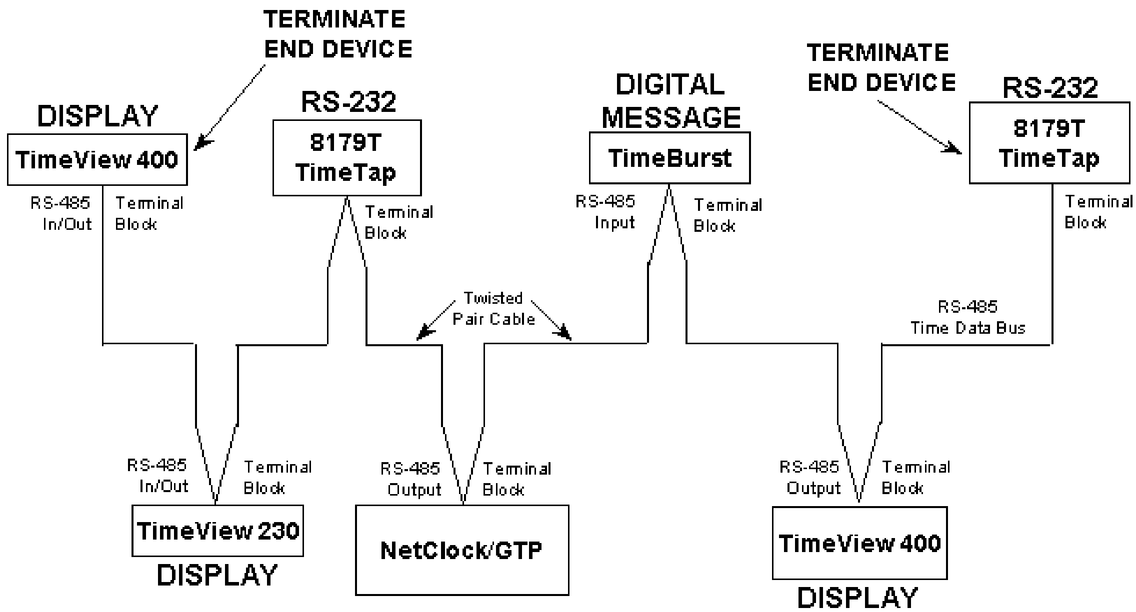


FIGURE 3-9 SPLIT BUS CONFIGURATION

Most RS-485 connections found on Spectracom equipment are made using a removable terminal strip. Wires are secured by a jaw that 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.

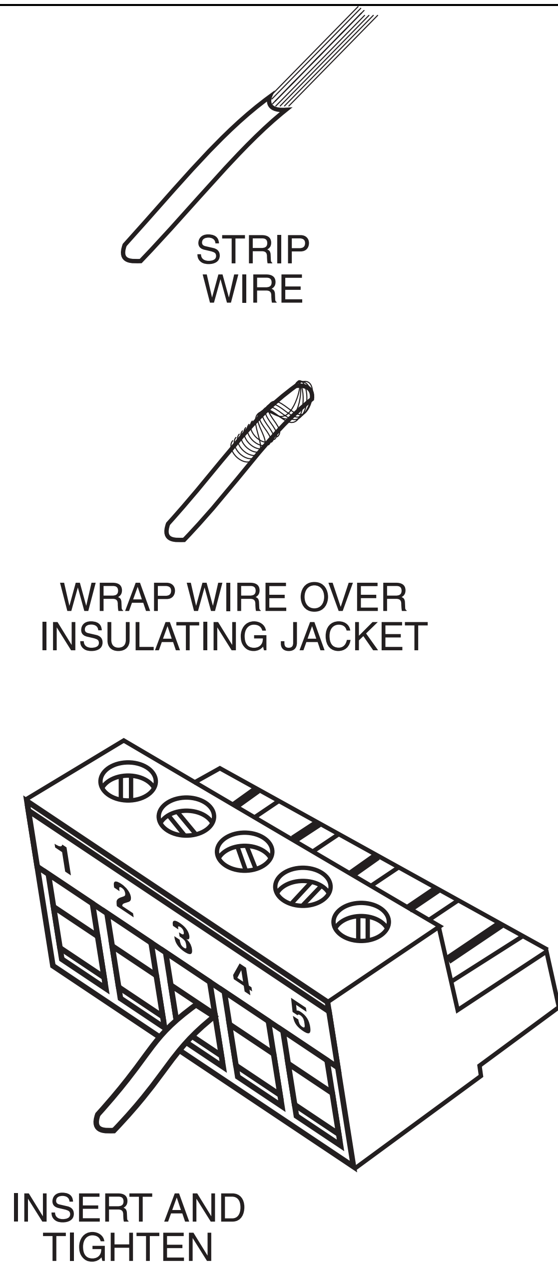


FIGURE 3-10   WIRE STRAIN RELIEF

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/GTP RS-485 Output as shown in Figure 3-11. The TimeView display clocks accept only Data Formats 0 or 1.

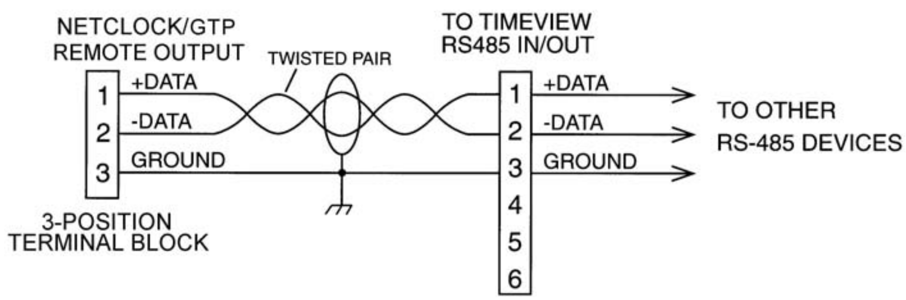


FIGURE 3-11 TIMEVIEW RS-485 INTERFACE

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

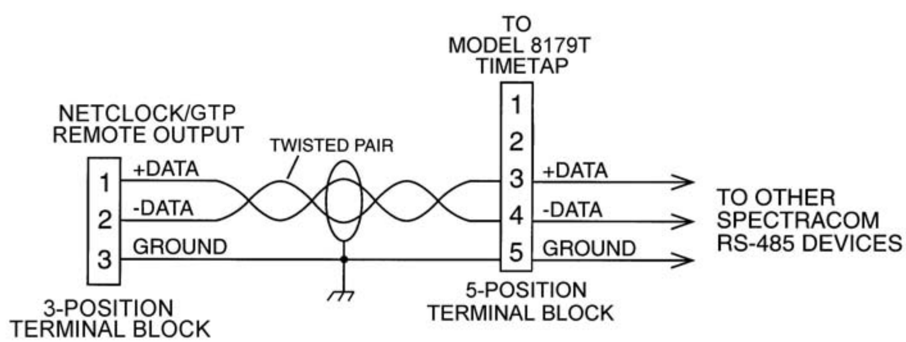


FIGURE 3-12 MODEL 8179T TIMETAP RS-485 INTERFACE

Spectracom Model 8188 is an Ethernet Time Server that supports NTP and SNTP time protocols. The Model 8188 accepts either Format 0 or Format 2 and connects to the RS-485 data bus through a terminal block to DB25 adapter. Connect the Model 8188 to the NetClock/GTP as shown in Figure 3-13.

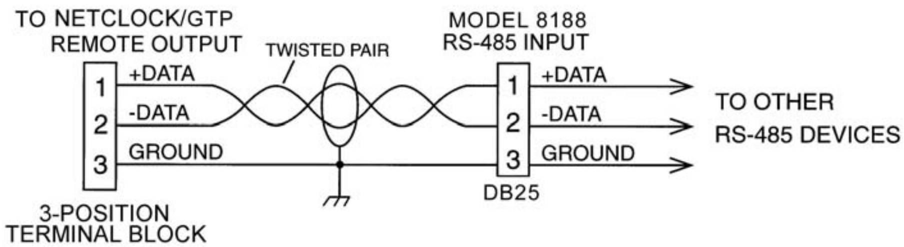


FIGURE 3-13 MODEL 8188 RS-485 INTERFACE

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 3-14. The synchronizing data stream is input on the TimeTalk Remote Input connector (DB9 male) and passed through to the Remote Output connector (DB9 female).

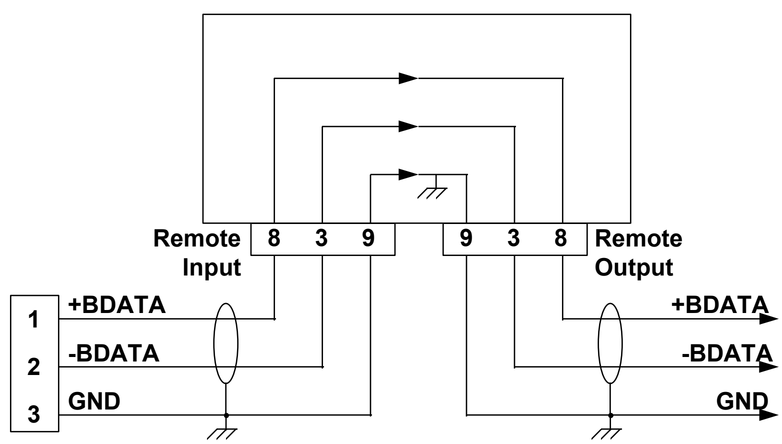


FIGURE 3-14 TIMETALK RS-485 INTERFACE

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/GTP. The TimeBurst accepts only Format 0. Connect the TimeBurst to the RS-485 data bus using a 3-position terminal block as shown in Figure 3-15.

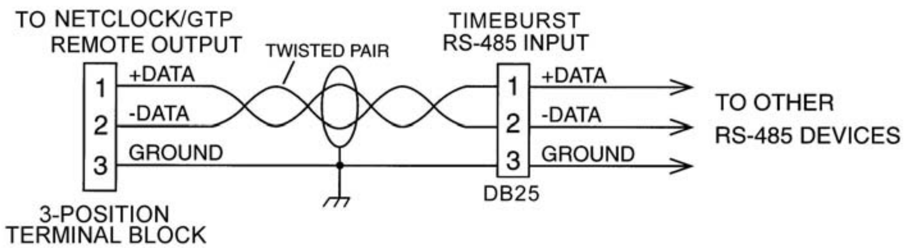


FIGURE 3-15 TIMEBURST RS-485 INTERFACE

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 Serial Setup Interface port the user may configure, control and monitor the NetClock/GTP. Table 4-1 provides a listing of the command set in alphabetical order. These commands contain a hierarchy of *Read*, *Set* and *Test Modes*. Figure 4-1 illustrates the command structure. *Read Mode* is the base level, this mode the user may only view responses to commands. From *Read Mode,* the user may select to enter *Test* or *Set Mode*. *Set Mode* allows the user to not only view command responses, but configure changes to certain NetClock/GTP functions. *Test Mode* allows the user access to special test commands, as well as all *Read* and *Set Mode* commands. After entering *Set Mode* or *Test Mode*, the unit will "time out" and return to *Read Mode* after 15 minutes of inactivity.

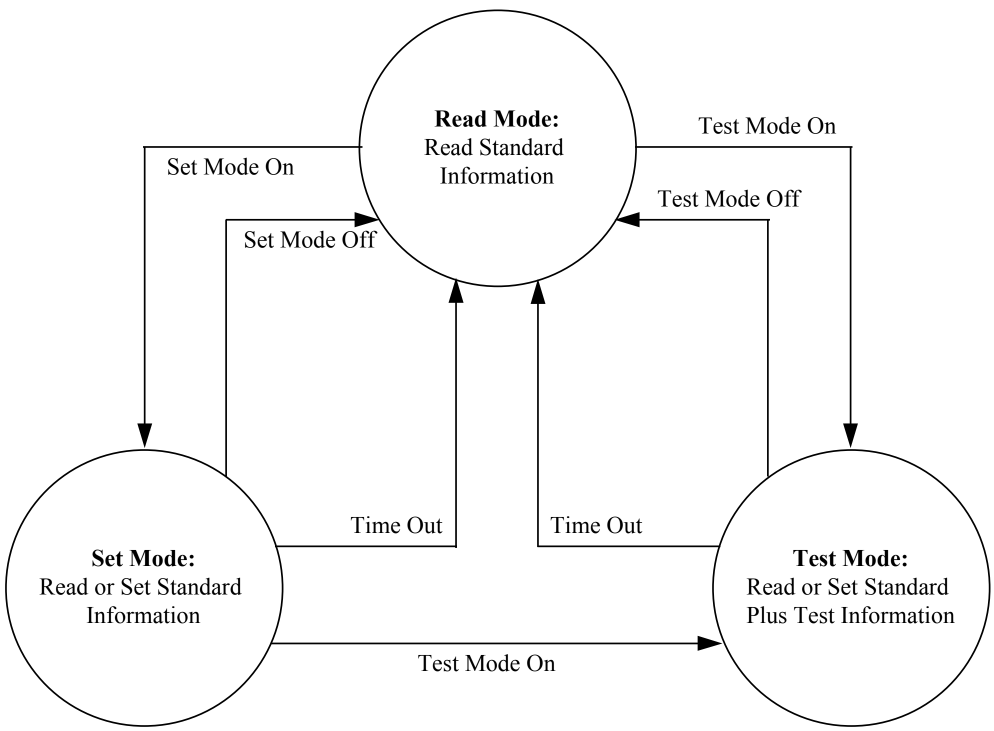


FIGURE 4-1 COMMAND STRUCTURE

COMMAND	Description	Mode	Section
ACD	Antenna Cable Delay	Set	4.1
CONF	Display Output Configuration	Read	4.2
DAL	Display Alarm Log	Read	4.3
DATE	Date	Set	4.4
DEF	Set to Factory Defaults	Test	4.5
DH	Display Tracking Histogram	Read	4.6
DST	Display DST rules	Read	4.7
FPF	Front Panel Display format	Set	4.8
GSS	GPS Signal Strength	Read	4.9
HELP	Help Display	Read	4.10
IRIG	IRIG Output Setup	Set	4.11
LOC	Location	Set	4.12
LOCK	GPS Lock time-out	Set	4.13
REMx	Setup Remote Outputs	Set	4.14
RGPS	Reset GPS receiver	Test	4.15
SERx	Setup Serial Comm Ports	Set	4.16
SM	Set Mode		4.17
STAT	Display Status	Read	4.18
SYNC	Time Sync time-out	Set	4.19
TIME	Time	Set	4.20
TM	Test Mode		4.21
VER	Version	Read	4.22

TABLE 4-1 ALPHABETICAL LIST OF COMMANDS

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:	*ANT 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:	*ANT CABLE DELAY = 000000.216 MICROSECONDS*

Cable delay can be calculated using the formula:

$$D = \frac{L \times C}{V}$$

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:

FRONT PANEL FORMAT= 24 HOUR
TIME DIFF= +00:00 DST= 0

IRIG FORMAT= FAA
TIME DIFF= +00:00 DST= 0

SERIAL PORT 1
BAUD RATE= 9600 FORMAT #= 00 REQUEST CHAR= T
TIME DIFF= +00:00 DST= 0

SERIAL PORT 2
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, event relay status, 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)

An example of a paged alarm log is shown below:

TIME = 14:01:03 DATE = 2001-04-12 STATUS CHANGE
ACTIVE ALARMS: MAJOR AND MINOR
FREQUENCY
IN TEST MODE
ADJUST OSCILLATOR
TIME = 14:01:11 DATE = 2001-04-12 STATUS CHANGE
ACTIVE ALARMS: MAJOR AND MINOR
FREQUENCY
IN TEST MODE
TIME = 14:02:13 DATE = 2001-04-12 STATUS CHANGE
ACTIVE ALARMS: MAJOR
FREQUENCY
TIME = 14:03:39 DATE = 2001-04-12 STATUS CHANGE
ACTIVE ALARMS: NONE
MORE <ANY KEY> QUIT <ESC>
TIME = 14:09:50 DATE = 2001-04-12 STATUS CHANGE
ACTIVE ALARMS: MINOR
ANTENNA PROBLEM

END OF LOG

4.4 DATE

The ***DATE*** command reads or sets the date of the NetClock/GTP. 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, 1999, 2000, 2001, 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, 2001.

Type: ***SM ON <ent>***
Response: *SET MODE ON*
Type: ***DATE 2001-05-09 <ent>***
Response: *DATE =2001-05-09*

4.5 RESTORE FACTORY DEFAULTS

The ***DEF*** command returns all selectable parameters to the factory default settings. The clock must be placed in *Test Mode* to execute the ***DEF*** command. The factory default settings are listed below:

FRONT PANEL FORMAT= 24 HOUR
TIME DIFF= +00:00 DST= 0

IRIG FORMAT= FAA
TIME DIFF= +00:00 DST= 0

SERIAL PORT 1
BAUD RATE= 9600 FORMAT #= 00 REQUEST CHAR= T
TIME DIFF= +00:00 DST= 0

SERIAL PORT 2
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

LOCK TIME OUT= 00:15:00
SYNC TIME OUT= 02:00:00

To restore the clock to factory default settings enter the following:

Type: ***TM ON <ent>***
Sample response: *TIME= 15:31:57 DATE= 2001-04-18 STATUS CHANGE*
ACTIVE ALARMS: MAJOR AND MINOR
IN TEST MODE
Type: ***DEF <ent>***
Response: *ALL PARAMETERS SET TO FACTORY DEFAULTS*

4.6 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/GTP needs to track only one qualified satellite to provide accurate and traceable time.

Occasionally, there may be periods when the receiver is unable to track 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= 16:00:00 DATE= 2001-04-08 QUALIFIED HISTOGRAM
0= 00000 1= 00000 2= 00000 3= 00000 4= 00000
5= 00000 6= 00000 7= 01109 8= 02491 Q= 03600

TIME= 17:00:00 DATE= 2001-04-08 QUALIFIED HISTOGRAM
0= 00000 1= 00000 2= 00000 3= 00000 4= 00000
5= 00000 6= 00414 7= 03186 8= 00000 Q= 03600

TIME= 18:00:00 DATE= 2001-04-08 QUALIFIED HISTOGRAM
0= 00000 1= 00000 2= 00000 3= 00000 4= 00000
5= 00000 6= 00067 7= 02919 8= 00614 Q= 03600

TIME= 19:00:00 DATE= 2001-04-08 QUALIFIED HISTOGRAM
0= 00000 1= 00000 2= 00000 3= 00000 4= 00000
5= 00000 6= 00000 7= 00254 8= 03346 Q= 03600

TIME= 19:18:50 DATE= 2001-04-08 QUALIFIED HISTOGRAM
0= 00000 1= 00000 2= 00000 3= 00000 4= 00000
5= 00000 6= 00000 7= 00000 8= 01130 Q= 01130

END OF LOG

4.7 DAYLIGHT SAVING TIME

Daylight Saving Time corrections can be implemented on the NetClock/GTP display, IRIG, Serial Comm and Remote Outputs. Each output has a configuration command that 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 FRONT PANEL FORMAT

The command, ***FPF***, reads and sets the front panel display configuration. Display options include 12 or 24 hour display format, UTC or local time with or without DST corrections.

To view the current display configuration, issue the ***FPF*** command as shown below:

Type: ***FPF <ent>***

Default Response: *FRONT PANEL FORMAT= 24 HOUR*
TIME DIFF= +00:00 DST= 0

To change the front panel display format, place the clock in *Set Mode* and issue the ***FPF*** command as follows:

Type: ***FPF [12:24] [±HH:MM] [#] <ent>***

Where:
12 = 12 Hour Display Format
24 = 24 Hour Display Format
±HH:MM = Time Difference from UTC, ±00:00...±12:00; Refer to Figure 4-2 for UTC time difference map.
= DST rule number, 0...6.

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

Example, configure the front panel display for 12 hour format, Eastern Time with Daylight Saving Time.

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

Response: *SET MODE ON*

Type: ***FPF 12 -05:00 1 <ent>***

Response: *FRONT PANEL FORMAT = 12 HOUR*
TIME DIFF = -05:00 DST = 1

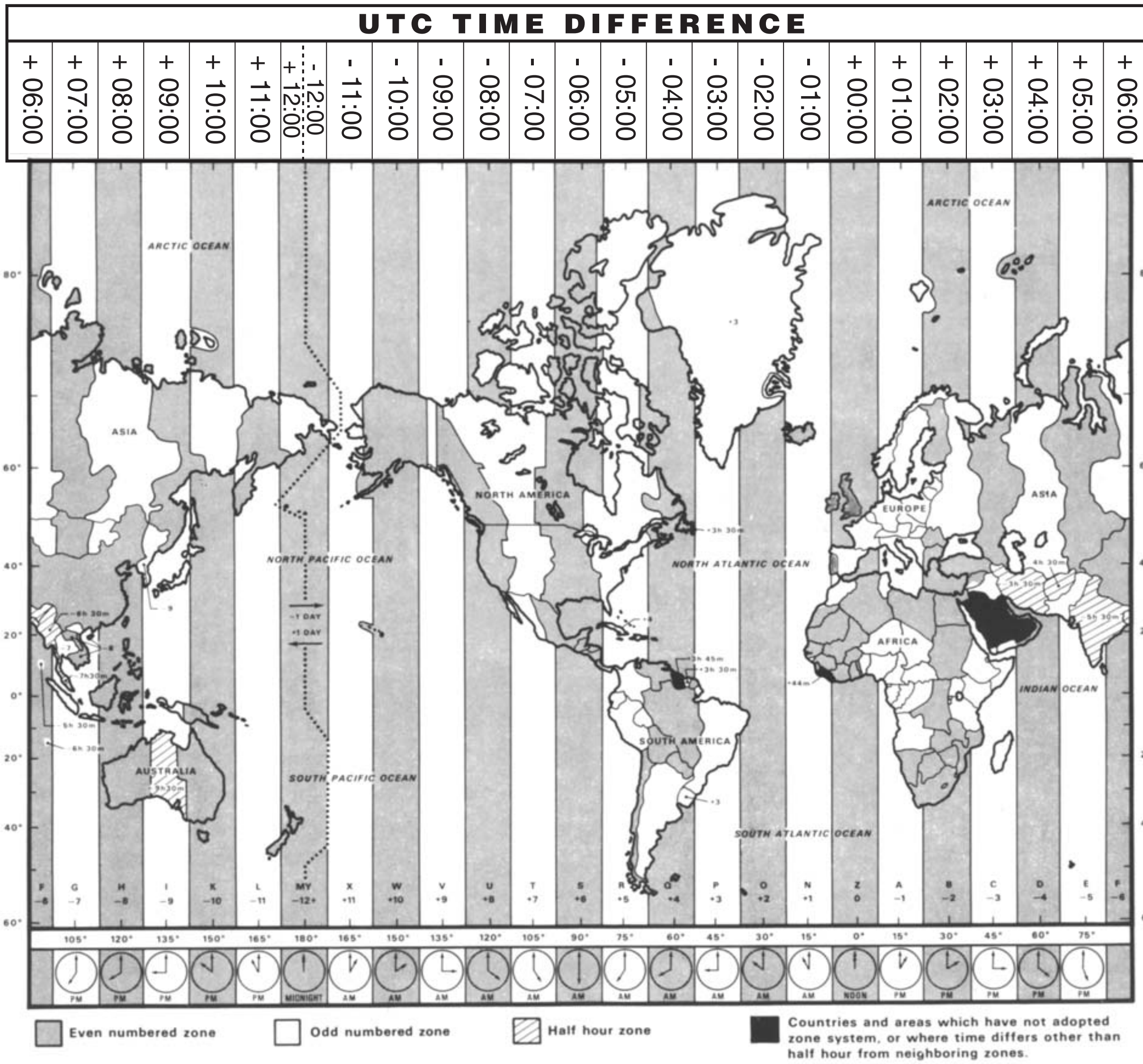


FIGURE 4-2   TIME DIFFERENCE MAP

4.9 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/GTP 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 currently being 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

4.10 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/GTP
COMMAND LIST FOLLOWS (SET MODE MUST BE ON TO CHANGE PARAMETERS)
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 STRENGTH
CONF= SHOW SETUP INFO FOR ALL OUTPUTS
SERx [BAUD FMT REQ TD DST]= SET UP SERIAL PORT
REMx [BAUD FMT TD DST]= SET UP REMOTE PORT
IRIG [TD DST]= SET UP IRIG
FPF [FMT TD DST]= FRONT PANEL SET UP
LOCK [HH:MM:SS]= GPS LOCK ALARM TIME OUT
SYNC [HH:MM:SS]= TIME SYNC ALARM TIME OUT
DSTx [RULE PARAMETERS] = SET UP DST RULES
EVNT [# CMD PARAM] = SET UP THE EVENT TIMER
ACD [XXXXXX.XXX]= ANTENNA CABLE DELAY
DAL [P] = DISPLAY ALARM LOG
DH [P] = DISPLAY HISTOGRAM LOG
SM [ON:OFF]= SET MODE
FOR FURTHER INFORMATION PLEASE CONSULT YOUR MANUAL

Additional information on the command structure is found by retrieving the command usage message. To obtain the usage message, type the command followed by a question mark (?). The IRIG usage message is shown below.

Type: ***IRIG ?<ent>***

Response: *USAGE>*
IRIG [TD] [DST]

4.11 IRIG CONFIGURATION

The command, ***IRIG***, reads and sets the IRIG output configuration. IRIG time can be set for UTC or local time with or with DST corrections. The current IRIG output configuration can be viewed using the ***IRIG*** command as shown below:

Type: ***IRIG <ent>***

Default Response: *IRIG FORMAT= FAA*
TIME DIFF= +00:00 DST= 0

To change the IRIG output configuration, place the clock in *Set Mode* and issue the appropriate ***IRIG*** command shown below.

Type: ***IRIG [TD] [DST] <ent>***

Where: ***TD*** = Time difference from UTC, ± 00:00...±12:00, refer to Figure 4-2, UTC Time Difference Map.

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 IRIG port for Eastern time with automatic DST corrections.

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

Response: *SET MODE ON*

Type: ***IRIG -05:00 1***

Response: *IRIG FORMAT = FAA*
TIME DIFF = -05:00 DST = 1

4.12 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, time to first fix may be decreased 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. Also, after initial installation the receiver will keep its current position in Non-Volatile RAM so that on subsequent power cycles the unit will reach first fix much faster than at initial installation.

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

4.13 GPS LOCK TIME OUT

The ***LOCK*** command reads or sets the GPS lock time out period. A timer is started whenever the receiver is not tracking any satellites. The timer is reset when the receiver reacquires a satellite. A GPS lock alarm is asserted if the receiver fails to reacquire satellites within the allotted time out period. A GPS Lock alarm actuates the Minor Alarm relay and removes outputs placed under Lock Signature Control.

To view the current GPS lock time out period issue the ***LOCK*** command as shown below:

Type:	***LOCK <ent>***
Default Response:	*GPS LOCK TIME OUT= 00:15:00*

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

Type:	***LOCK [HH:MM:SS] <ent>***
Where:	HH:MM:SS = Hours:Minutes:Seconds

NOTE: Due to alarm sequencing, Minor escalating to Major, the LOCK time out period must be shorter than the SYNC time out period.

Example: Change the lock time out period to 1 Hour and 30 Minutes.

Type:	***SM ON <ent>***
Response:	*SET MODE ON*
Type:	***LOCK 01:30:00 <ent>***
Response:	*GPS LOCK TIME OUT= 01:30:00*

4.14 REMOTE OUTPUT CONFIGURATION

The command ***REM 1*** reads or sets the configuration of the RS-485 Remote Output. Remote Output configuration options include: baud rate, data format, UTC or local time with or without DST corrections.

To view the current Remote 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 Remote 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; Refer to Figure 4-2, UTC Time Difference Map.

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 Remote 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: *BAUD RATE = 1200 FORMAT # = 01*
TIME DIFF = -07:00 HOURS DST = 1

4.15 RESET GPS RECEIVER

The command, ***RGPS***, completely resets the GPS receiver. This is a radical procedure and should only be done if the receiver fails to acquire satellites. The ***RGPS*** command returns the receiver to default values. Next, a self-test is performed on the receiver. If the self-test is successful, a pass message is included in the response. An unsuccessful self-test will provide a numeric code in the self-test status message. The entire process takes about 10-12 seconds. At this point, the receiver will perform as if it has just arrived from the factory. It may take 20 to 30 minutes to achieve first fix. This command is only available in *Test Mode*. To issue a GPS reset, follow the example below:

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

Response: *TEST MODE ON*
- OR -
TIME = 20:42:11 DATE = 2001-04-21
ACTIVE ALARMS: MAJOR AND MINOR
IN TEST MODE

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

Response: *TIME= 20:42:32 DATE= 2001-04-21 RESET GPS RECEIVER*
SELF-TEST= PASS

4.16 SERIAL COMM CONFIGURATION

The commands, ***SER1*** and ***SER2***, read or set the configuration of the Serial Comm outputs. Serial Comm configuration options include baud rate, data format, request character, UTC or local time with or without DST corrections.

To view the current Serial Comm configurations issue the ***SERx*** command as shown below:

Type: ***SERX <ent>***

Default Response:
SERIAL PORT x
BAUD RATE = 9600 FORMAT# = 00 REQUEST CHAR = T
TIME DIFF = +00:00 DST = 0

Where: ***X*** = Serial Comm Number 1, 2

To change a Serial Comm port configuration, place the clock in *Set Mode* and issue the ***SERx*** command as follows:

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

Where:
X = Serial Comm Number 1,2
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 uppercase letter can be configured as the request character. The Serial Comm port will output the selected data format upon receiving this character. The Serial 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; Refer to Figure 4-2, UTC Time Difference Map.
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 Serial Comm configuration command has no effect on output time.

Example: Configure Serial Comm 1 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

4.17 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* operations 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*

4.18 STATUS COMMAND

The ***STAT*** command provides the current UTC time and date, Time Sync status, GPS Lock status, time remaining in GPS Lock and Time Sync timers and Oscillator Lock status.

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

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

The sample response below is from a clock currently Time Synchronized and receiving a qualified GPS signal:

TIME= 18:29:44 DATE= 2000-05-05
TIME SYNC STATUS= OK GPS LOCK STATUS= OK
GPS SIGNAL= QUALIFIED
OSCILLATOR STATUS= LOCKED

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

TIME= 18:47:51 DATE= 2000-05-05
TIME SYNC STATUS= OK GPS LOCK STATUS= OK
GPS SIGNAL= NOT QUALIFIED
TIME REMAINING: GPS LOCK= 00:10:53 TIME SYNC= 01:55:53
OSCILLATOR STATUS= LOCKED

The response below is from a clock that has lost GPS Lock and Time Sync. Note that both counters have expired and a GPS Lock and Time Sync has changed to “NONE”. The Oscillator Status is changed to “Not Locked” whenever a loss of Time Sync occurs.

TIME= 20:37:41 DATE= 2000-05-05
TIME SYNC STATUS= NONE GPS LOCK STATUS= NONE
GPS SIGNAL= NOT QUALIFIED
TIME REMAINING: GPS LOCK= 00:00:00 TIME SYNC= 00:00:00
OSCILLATOR STATUS= NOT LOCKED

4.19 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 reacquires a satellite. A Time Sync Alarm is asserted if the receiver fails to reacquire satellites within the allotted time out period. A Time Sync Alarm causes a Major Alarm and removes outputs placed under SYNC Signature Control. 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*

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

NOTE: Due to alarm sequencing, Minor elevating to Major, the SYNC time out period must be longer than the LOCK time out period.

Example: Change the SYNC time out period to 8 hours.

Type: ***SM ON <ent>***
Response: *SET MODE ON*
Type: ***SYNC 08:00:00 <ent>***
Response: *TIME SYNC TIME OUT= 08:00:00*

4.20 TIME

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

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 13:45:00.

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

4.21 TEST MODE

This command is used to read or enter *Test Mode* operation. *Test Mode* commands are used in factory testing and field troubleshooting. The unit “times out” of *Test Mode* and returns to *Read Mode* if no commands are issued for 15 minutes. Major and Minor alarms are asserted whenever the clock is in *Test Mode*.

To read the *Test Mode* status (ON or OFF), issue the ***TM*** command as shown below:

Type: ***TM <ent>***
Response: *TEST MODE ON*
- OR -
TEST MODE OFF

To place the clock into *Test Mode* operation, issue the ***TM*** command as follows:

Type: ***TM ON <ent>***
Response: *TIME = HH:MM:SS DATE = YYYY-MM-DD STATUS CHANGE*
ACTIVE ALARMS: MAJOR AND MINOR
IN TEST MODE
- OR -
TEST MODE ON

4.22 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/GTP Model 8183A
Software Version 1.0.0 Date: May 18, 2001 09:14:48
Unit Started 20:42:39 2001-05-15
Front Panel Version 2.00
IRIG Version 9.01
Serial Port 1 Version 2.03
Serial Port 2 Version 2.03
Remote Port 1 Version 2.03
GPS Receiver = 8 Channel GT Version 2

SECTION 5: SERVICE INFORMATION

SERVICE INFORMATION

5.0 INTRODUCTION

This section provides information on troubleshooting GPS reception problems and instructions for adjusting the TCXO oscillator.

5.1 RECEPTION TROUBLESHOOTING

Please review this section prior to calling the Spectracom Customer Service Department. If the reception problem can not be solved by following the guidelines outlined in this section, please call for Customer Service at 585-321-5800.

5.1.1 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 5-1 for typical resistance values of the antenna and inline amplifier alone and when combined.

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

TABLE 5-1 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: Excessively long or improper cable type may prevent the receiver from tracking satellites. Refer to Section 2.2 for cable recommendations when using the Model 8225 GPS Antenna

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

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.

5.1.2 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 2.2 for GPS cable recommendations and Section 2.4 for inline amplifier information when using the Model 8225 Antenna

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.

Local Interference: Another reason for poor reception is harmonics from a local broadcast interfering with the GPS L1 carrier of 1575.42 MHz. Certain television or FM radio broadcasts, while operating within their frequency allocation, can cause GPS jamming due to harmonics of the carrier. Television interference presents a greater challenge due to higher output power, typically 2-3 MW. Table 5-2 lists the potentially problem television stations and their respective GPS harmonic.

CHANNEL	HARMONIC
66	2nd
23	3rd
10	8th
7	9th
6	18th & 19th
5	20th

TABLE 5-2 TELEVISION STATIONS WITH GPS JAMMING POTENTIAL

FM radio stations, while lower in radiated power, can cause GPS jamming also. Table 5-3 lists the potentially problem radio frequencies and their respective GPS harmonic.

FREQUENCY	HARMONIC
104.8 - 105.2	15th
98.3 - 98.7	16th
92.5 - 92.9	17th
87.3 - 87.7	18th

TABLE 5-3 FM RADIO FREQUENCIES WITH GPS JAMMING POTENTIAL

If relocating the antenna away from the interfering source does not solve the problem or if relocation is not possible contact Spectracom Tech Support for assistance.

5.2 OSCILLATOR ADJUSTMENT

Over time the NetClock/GTP TCXO oscillator may require an adjustment to compensate for crystal aging. The NetClock/GTP warns when this adjustment is needed by asserting an Adjust Oscillator Alarm. This condition causes the front panel display to flash all 8's every three seconds and activates the Minor Alarm relay. An Adjust Oscillator Alarm is asserted when the frequency controlling D/A converter approaches a control range limit. Typically, this alarm provides a two to three month warning before a control range end is reached.

On rare occasions, an oscillator may experience a sudden shift in frequency, causing an Adjust Oscillator and a Frequency Alarm. When this occurs, both Major and Minor alarms are activated. The D/A is set to a control range end unable to correct the oscillator frequency. Frequency error shall exceed 1×10^{-7}

This section describes the oscillator adjustment procedure using a frequency counter and an RS-232 terminal. The frequency counter must have a time base accuracy and measurement resolution of at least 1×10^{-7} (1.0 Hz at 10 MHz).

A PC running terminal emulation software (HyperTerminal, ProComm Plus, etc.) can be used as an RS-232 terminal. Configure the terminal for ANSI emulation, 9600 baud and a character structure of 1 start, 8 data, 1 stop and no parity. Flow control is not required, although XON/XOFF is supported.

5.2.1 Adjustment Procedure

Perform the steps listed below to adjust the TCXO oscillator.

1. If the unit is rack mounted, remove it from the rack.

2. Disconnect the GPS antenna.

3. Remove the top cover.

4. Connect the terminal to the Serial Setup Interface port.

5. Place the NetClock/GTP in Test Mode by sending the TM command as follows:

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

   Response: *TIME= 19:22:03 DATE= 2001-04-08 STATUS CHANGE*
   ACTIVE ALARMS: MAJOR AND MINOR
   IN TEST MODE
   ADJUST OSCILLATOR

6. Set the D/A to the center of it's control range by setting the D/A to 8000 as shown below:

   Type: ***DA 8000<ent>***

7. Connect the frequency counter to the rear panel FREQ output connector. Locate the TCXO oscillator, labeled Y010-0106-0H00, in the front right corner of the circuit board. Adjust the TCXO in very small amounts until a frequency of 10 MHz ±5 Hz is obtained.

8. Set the D/A control voltage to its maximum value by sending the SHI command as shown below:
   Type: ***SHI<ent>***
   Response: *D/A = CCCC*

   Record the upper limit oscillator frequency.
   F_{HI} = _________________________ Hz.

9. Set the D/A control value to its minimum value by sending the SLO command as shown below:
   Type: ***SLO<ent>***
   Response: *D/A = 3333*

   Record the lower limit oscillator frequency
   F_{LO} = _________________________ Hz.

10. Subtract the lower limit frequency, F_{LO}, from the upper limit frequency, F_{HI}, to determine the pull range of the oscillator. This difference is entered as the Hertz Range Value.

   F_{HI} minus F_{LO} = HR

   Enter the hertz range value by sending the HR command as shown below:
   Type: ***HR XXX.XXX***
   where XXX.XXX = Hertz Range Value

   Response: *Hertz Range = XXX.XX D/A = 8000*

12. Return the unit to normal operation by taking it out of Test Mode.

   Type: ***TM OFF<ent>***

The oscillator adjustment procedure is now complete. Replace the top cover and reinstall the unit. The NetClock/GTP will require a 20-minute period to reacquire and lock to the GPS reference.

APPENDIX A: IRIG CODE DESCRIPTION

FAA IRIG CODE DESCRIPTION

A.0 INTRODUCTION

This Appendix contains a detailed description of the FAA modified IRIG B code. The FAA modifies the IRIG B code by including satellite lock status and time error flags in the Control Function Field. The error flags provide an inaccuracy estimate based on the time elapsed since loss of GPS lock. In addition, the Straight Binary Seconds (SBS) data was removed from the data stream. The SBS time is the number of seconds elapsed since midnight.

The Netclock/GTP can be configured to provide IRIG timing reflecting Universal Coordinated Time (UTC) or local time, with or without daylight saving time corrections. The ***IRIG*** command configures the IRIG time structure and is described in Section 4, *Software Commands*.

A.1 FAA IRIG B OUTPUT

The FAA IRIG B code contains the Binary Coded Decimal (BCD) time of year and a Control Function (CF) field containing satellite lock status and time error flags. With the exception of the position identifiers, all remaining code elements are set to a binary 0. Figure A-1 illustrates the FAA IRIG B data structure. The BCD time of year provides the day of the year, 001-366, and the time of day including seconds. The hour of the day is expressed in 24-hour format.

A.1.1 FAA IRIG B General Description

1. Time frame: 1.0 seconds.

2. Pulse rates:

   A. Element rate: 100 per second.

   B. Position identifier rate: 10 per second.

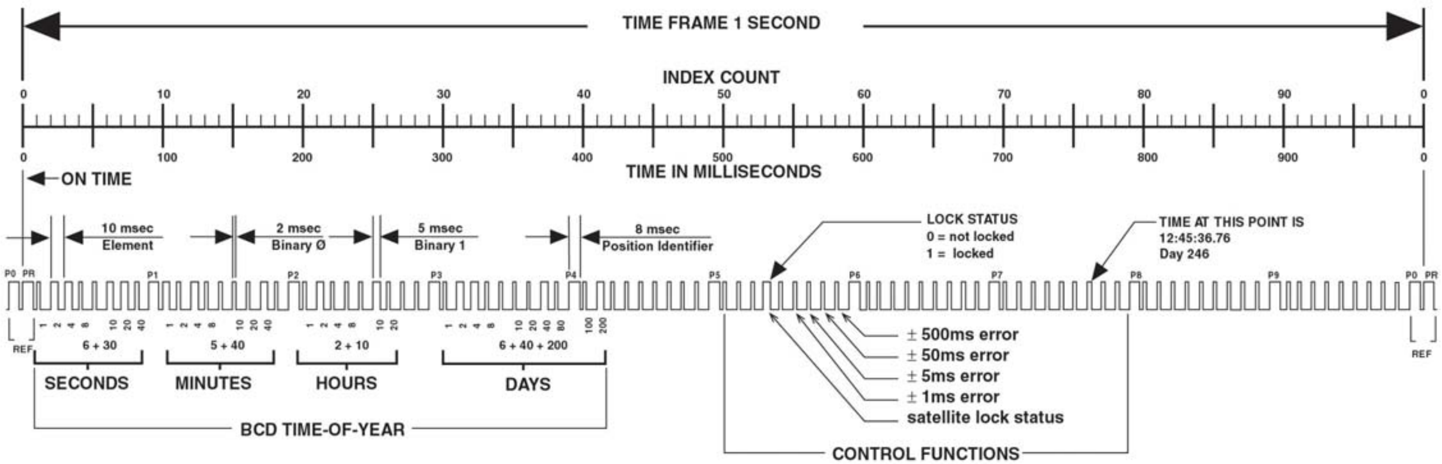
   C. Reference marker rate: 1 per second.

3. Element identification: The "on time" reference point for all elements is the pulse leading edge.

   A. Index marker (Binary 0 or uncoded element): 2 millisecond duration.

   B. Code digit (Binary 1): 5 millisecond duration.

FAA MODIFIED IRIG B



Specific

The beginning of each 1.0 second time frame is identified by two consecutive 8.0 ms elements (P_0 and P_8). The leading edge of the second 8.0 ms element (P_R) is the "on time" reference point for the succeeding time code. 10 pps position identifiers P_0, P_1, ...P_8 (8.0 ms duration) occur 10 ms before 10 pps "on time" and refer to the leading edge of the succeeding element.

The time code word and the control functions presented during the time frame are pulse width coded. The binary "zero" and index markers have a duration of 2.0 ms, and the binary "one" has a duration of 5.0 ms. The leading edge is the 100 pps "on time" reference point for all elements.

The binary coded decimal (BCD) time-of-year code word consists of 30 digits beginning at index count 1. The binary coded subword elements occur between position identifiers P_0 and P_5 (7 for seconds; 7 for minutes; 6 for hours; 10 for days) until the code word is complete. An index marker occurs between the decimal digits in each subword to provide separation for visual resoution. The least significant digit occurs first. The BCD code recycles yearly.

Twenty-seven control functions occur between position identifiers P_5 and P_8. FAA uses this field to communicate satellite lock status and time error and indicators. The first flag element is at 530 ms which indicates satellite lock. The +/- 1ms error flag occurs at 550 ms. The +/- 5 ms error flag occurs at 560 ms. The +/- 50 ms error flag occurs at 570ms. The +/- 500 ms error flag occurs at 580 ms.

The straight binary (SB) time-of-day code word normally found between position identifiers P_8 and P_0 is eliminated for FAA IRIG B. All elements between position identifiers P_8 and P_0 are set to Binary 0.

FIGURE A-1   FAA IRIG B TIME CODE

C. Position identifier: 8 millisecond duration.

D. Reference marker, 1 per second. The reference marker appears as two consecutive position identifiers. The second position identifier marks the on-time point for the succeeding code word.

4. Resolution: 10 milliseconds.

5. Code word structure:

BCD: Word seconds digits begin at index count 1. Binary coded elements occur between position identifier elements P_0 and P_5 (7 for seconds, 7 for minutes, 6 for hours, and 10 for days) until the code word is complete. An index marker occurs between decimal digits in each group to provide separation for visual resolution. Least significant digit occurs first.

CF: IRIG formats reserve a set of elements known as Control Functions (CF) for the encoding of various control, identification, or other special purpose functions. IRIG B has 27 Control Functions located between elements 50 and 78. The FAA IRIG B code uses five of the Control Function elements to encode satellite lock status and time error flags. For a description of the status and error flag implementation, refer to Table A-1 and the paragraphs below.

Element 53 (530 ms) is the time sync status bit. Element 53 is a Binary 1 when the receiver locked to GPS, and a Binary 0 when the receiver is not locked to GPS.

Element 55 (550 ms) is the +/- 1.0 millisecond error flag. Element 55 is set to Binary 1 when the expected time error is within +/- 1.0 millisecond, and a Binary 0 during all other conditions of operation.

Element 56 (560 ms) is the +/- 5.0 millisecond error flag. Element 56 is set to Binary 1 when the expected time error is within +/- 5.0 milliseconds. and a Binary 0 during all other conditions of operation.

Element 57 (570 ms) is the +/- 50 millisecond error flag. Element 57 is set to Binary 1 when the expected time error is within +/- 50 milliseconds, and a Binary 0 during all other conditions of operation.

Element 58 (580 ms) is the +/- 500 millisecond error flag. Element 58 is set to Binary 1 when the expected time error is within +/- 500 milliseconds, and a Binary 0 during all other conditions of operation.

Time Since Loss of Lock	Status/Error	Lock Indicator	±1 msec	±5 msec	±50 msec	±500 msec
N/A	Locked Error< 2us	1	0	0	0	0
< 00:16:40	Unlocked Error < 1 ms	0	1	0	0	0
00:16:41 to 01:23:39	Unlocked Error < 5 ms	0	0	1	0	0
01:23:40 to 13:53:19	Unlocked Error < 50 ms	0	0	0	1	0
13:53:20 to 5 days 18:53:19	Unlocked Error < 500 ms	0	0	0	0	1
>5 days 18:53:20	Unlocked Error Unknown	0	0	0	0	0
N/A	Power On	0	0	0	0	0

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TABLE A-1 FAA TIME ERROR INDICATORS