TrueTime

Model 820-501
GPS-605 / NMC-100

FCC Notice and Compliance Statement

Model:

XL-DC, 151-600	**RD-05, 820-500**
XL-DC, 151-601	**NTS-90, NTS-305**
XL-DC, 151-601-178-1	**NTS-90, NTS-405**
XL-DC, 151-602	**NTS-90, 600-210**
XL-DC, 151-650	**NTS-90, 600-310**
XL-DC, 151-652	**NTS-90, 600-410**
XL-DC, 151-652-382	**NTS-90, NIC-205**
GPS-PC, 560-5500	**NTS-90, NIC-305**
PC-SG2, 560-5503	**NTS-90, NIC-405**
GPS-VME, 560-5600	**NTS-100, 600-201**
VME-SG2, 560-5608	**NTS-100, 600-301**
PCI-SG, 560-5900	**NTS-100, 600-401**
GPS-PCI, 560-5900-3	**NTS-100i, NIC-215**
GPS-PCI, 560-5901	**NTS-100i, NIC-315**
GPS-PCI, 560-5901-1	**NTS-100i, NIC-415**
GPS-605, 820-501-000	**NTS-200-101 (48 VDC)**
NMC-100, 820-501-001	**TIMEVAULT 6000-100**
GPS-605, 820-501-003	**56000 DRC, 560-197-10**

FCC Notice

This device has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial installation. This device generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Caution: Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment.

FCC Compliance Statement

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation

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Rev. H

TrueTime, Inc. • 2835 Duke Court • Santa Rosa, CA 95407   PHONE 707-528-1230 • FAX 707-527-6640
www.truetime.com   E-MAIL truetime@truetime.com

Declaration of Conformity

Model: GPS-605   GPS Synchronized Clock and
Time Code Generator

RD-05   1/2" Time Display

This product complies with the following European Union Directives:

89/392/EEC Safety of Machinery
as amended by 91/368/EEC, 93/44/EEC, 93/68/EEC

89/336/EEC Electromagnetic Compatibility
as amended by 92/31/EEC

73/23/EEC Low Voltage Safety
as amended by 93/68/EEC, 94/C199/03, 95/C214/02

The following standards were used to verify compliance with the Directives:

EN50082-1 Class A, EN55011 Class A, EN55014, EN61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-5, EN61000-4-11, ENV50204, EN60950
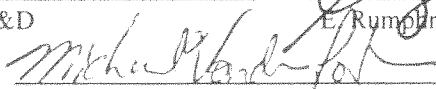
Approved by

_____
R. Dielman, Vice President, Sales

_____
H. Patnaik, Vice President, R&D

_____
M. Tope, Vice President, Marketing

_____
E. Rumphrey, Operations Manager

_____
M. Von der Porten, Manager of Administrative Services

25 May 1998

Addendum for 142-603
Antenna Downconverter Assembly

PHYSICAL SPECIFICATIONS

Antenna Downconverter Size: 4.4 in. dia. x 2.1 in.
(11.17 cm. dia. x 6.85 cm.)

Note: Antenna DownConverter Units are mounted on a 12-inch long PVC nipple with a 3/4-inch Male Pipe Thread (MPT) on both ends. The above specified overall lengths of the Antenna DownConverter Units are therefore increased by approximately 11.25 inches, when the mounting nipple is included.

Antenna DownConverter Weight: 0.60 lb (.272 Kg)
(Including Mtg. Nipple)

Antenna DownConverter   Available lengths = 150 - 1500 ft. (standard length 50 ft.)
Cable, RG-58:   2.7 lb (1.23 Kg) per 100 ft.

ANTENNA CABLE DELAY ENTRY/REQUEST

The as shipped default antenna cable delay is +60 nS. **When the downconverted antenna is being used, 150 nS should be <u>added</u> to the cable delay entered.**

Addendum for 142-612
Antenna Assembly

PHYSICAL SPECIFICATIONS

Antenna Size: 2.625 in. dia. x 1.5 in.
                                       (6.67 cm. dia. x 3.81 cm.)

Note: The Antenna is mounted on a 12-inch long PVC nipple with a 3/4-inch Male Pipe Thread
(MPT) on both ends. The above specified overall length of the Antenna. Units are therefore
increased by approximately 11.25 inches when the mounting nipple is included.

Antenna Weight: 0.55 lb (.250 Kg)
(Including mtg. nipple)

Antenna Cable, RG-59   Standard length = 50 ft.
                                       1.2 lb (.545 Kg)

Optional Antenna Cable, RG-59   Available lengths to 200 ft.
                                       2.7 lb (1.23 Kg) per 100 ft.

OPERATING SPECIFICATIONS

Antenna Power Regulated   +5 Volts DC @ <25mA

Antenna Frequency (L1)   1575.42 MHz
Code   Coarse Acquisition (C/A) Code

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: -40° to +70°C (-40° to +158°F)
Storage Temperature: -55° to +85°C (-67° to +185°F)
Humidity: 100%, condensing

NOTICE ON
SCHEMATICS

Please be advised that there may or may not be references in the text of this manual to schematic drawings. TrueTime's general policy is to not include schematics because they may contain proprietary information. If you require copies of any schematic, please contact:

Customer Service
Service@Truetime.com
Phone: (707) 528-1230
Fax: (707) 527-6640

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SECTION ONE

GENERAL INFORMATION

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1.1 <u>**SCOPE OF MANUAL**</u>

This manual contains the information necessary to operate and maintain a TrueTime model GPS-605 GPS receiver and time code generator or a model NMC-100 Network Master Clock.

1.2 <u>**PURPOSE OF EQUIPMENT**</u>

The GPS-605/NMC-100 tracks the GPS satellite transmissions. From this time reference the time can be displayed in terms of days through seconds and 1 PPS (one pulse per second) is output. Serial port communication is available through the COM1 connector. The GPS-605 is also equipped to output IRIG-B time code.

1.3 <u>**PHYSICAL SPECIFICATIONS**</u>

Height:	1.6 in.
Width:	7.5 in. (9.0 in. with mounting bracket and knobs)
Depth:	3.6 in
Weight	1.5 lb.
Numeric Digit Size:	0.6 in.

1.4 <u>**ENVIRONMENTAL SPECIFICATIONS**</u>

Operating Temperature:	$0°$ to $+50°$C ($+32°$ to $+122°$F)
Storage Temperature:	$-17°$ to $+100°$C ($0°$ to $+212°$F)
Humidity:	95% relative, non-condensing
Cooling:	Radiation

1.5 <u>**POWER SPECIFICATIONS**</u>

Voltage:	+8 to +30 Vdc
Power:	<3 Watts
Mating Connector:	5.5 mm by 2.0 mm (MCM Elect 27-130)

(Wall mount 115 Vac adapter is provided with the unit, 220 Vac adapter optionally available.)

1.6 <u>**SIGNAL SPECIFICATIONS**</u>

<u>Oscillator</u>

Accuracy	5×10^{-8} when disciplined to GPS input
Stability	1 PPM, $0°$C to $+50°$C

<u>1 PPS Output</u>

1 PPS:	TTL levels
Connector:	BNC
Pulse width:	50%
Accuracy	$\pm$ 2 microseconds

<u>Amplitude Modulated Reference Code Output (GPS-605 only)</u>

Format:	Amplitude-modulated IRIG-B122
Amplitude:	0.5 to 10.0 Vpp
Impedance:	10k Ω to GND
Ratio:	2:1 to 5:1
Phase Accuracy:	<$\pm$20 µs
Connector:	BNC "CODE OUT"

<u>DC Shift Code Output (GPS-605 only)</u>

IRIG B RS-422:	RS-422 levels
Rate:	100 bps
Connector:	RJ11 "CODE I/O"
	Code out +, pin 2
	Code out -, pin 3
Accuracy:	$\pm$ 2 microseconds

1.7   **SERIAL CONNECTOR WIRING DIAGRAM**

Included with the clock as a ship kit item is a DB9F (female) to RJ11 adapter. The adapter is not null-modemed. The adapter fits into the standard COM1 or COM2 connectors on a PC.

The clock needs to be connected to the RJ11 side of the adapter with an RJ11 communication cable. The RJ11 telephone cable will not work.

Pinout detail:
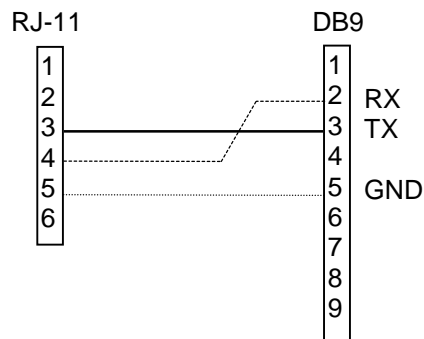
1.8   LIMITED WARRANTY

Each new product manufactured by TrueTime is warranted for defects in material or workmanship for a period of one year from the date of shipment ("Limited Warranty"). Defects in material or workmanship found within that period will be replaced or repaired, at TrueTime's option, without charge for material or labor, provided the customer returns the equipment, freight prepaid, to the TrueTime factory under this limited warranty. TrueTime will return the repaired equipment, freight prepaid, to the customer's facility. This one-year Limited Warranty does not apply to any software or to any product not manufactured by TrueTime. Unless otherwise stated, TrueTime provides new components, new or previously-integrated assemblies which have been fully evaluated, and finished products which are fully tested to data sheet or customer specifications. If on-site warranty repair or replacement is required, the customer will be charged the then-current field service rate for portal-to-portal travel time plus actual portal-to-portal travel charges. There is no charge for on-site warranty repair labor.

Products not manufactured by TrueTime but included as integral parts of a system (e.g. peripherals, options) are warranted for 90 days or longer, as provided for by the original manufacturer, from the date of shipment. Aside from the Limited Warranty set forth above, TrueTime makes no other warranties, express or implied, of merchantability, fitness for purpose or of any other kind of description whatsoever.

By purchasing any product manufactured by TrueTime, the buyer consents to and agrees with TrueTime that as a result of the exclusion of all warranties, expressed or implied, or merchantability, fitness for purpose, or otherwise, except for the limited one-year warranty for defects in material and workmanship for products manufactured by TrueTime, that the Buyer has the sole responsibility to assess and bear all losses relating to (1) the ability of the product or products purchased to pass without objection under the contract description among merchants and buyers in the trade; (2) the conformity of the product or products to fair average quality within its contract description; (3) the fitness of the product for the ordinary purposes for which such product is used; (4) the consistency of quality and quantity within each unit of product or products and among all units involved; (5) the adequacy of containers, packaging and labeling of the product or products; (6) the conformity of the product, promises or affirmations of fact (if any) made on its label or container; and (7) the conformity of the product to standards of quality observed by other merchants in the trade with respect to products of similar description.

1.9   LIMITATION OF LIABILITY

By purchasing any product from TrueTime the Buyer consents to and agrees that the Buyer's sole and exclusive remedy for any damages or losses incurred by the Buyer as a result of TrueTime's breach of its one-year Limited Warranty for defects in materials and workmanship or otherwise in connection with any claim respecting the product shall be limited to the repair or replacement of the product or a refund of the sales price of the product.

In no event shall the Buyer be entitled to recover consequential damages or any other damages of any kind or description whatsoever.

1.10   **PROPRIETARY NOTICE**

This document, whether patentable or non-patentable subject matter, embodies proprietary and confidential information and is the exclusive property of TrueTime, Inc. It may not be reproduced, used, or disclosed to others for any purpose except that for which it is purchased or loaned.

SECTION TWO

INSTALLATION AND OPERATION

2.1   INTRODUCTION

The clock is a GPS referenced display that provides time information using seven segment LED display digits, IRIG B, 1 PPS, and serial I/O. If the GPS signal becomes unavailable the clock will continue to flywheel using the internal crystal time base.

2.2   INSTALLATION

Unpack the unit and carefully inspect it for shipping damage. Any damage must be reported to the carrier immediately.

The clock is held in place by the mounting bracket provided. This bracket is suitable for desktop, wall, or ceiling installations. Install mounting bracket using two #8 wood or toggle screws depending on the installation requirements (screws are not provided). The unit attaches to the mounting bracket using the threaded mounting knobs provided.

Fabricate any necessary cables (RG-58 coax with BNC connectors for analog reference code). Connect input GPS signal from the GPS antenna to the rear panel BNC identified as ANTENNA. The clock is powered by an external DC wall mount AC adapter. Connect the power plug into the rear panel. The user may use their own DC power as long as it complies with the specifications described under Power Specifications in SECTION ONE. The power mating connector part number is also listed.

2.3   OPERATION

The clock autodetects, decodes and phase locks its time to the GPS satellite signal that is input on the rear panel BNC connector labeled ANTENNA. The unit will maintain time during loss of the input signal using an internal crystal time base. If input code is lost the decimal points will illuminate but time will continue to increment each second. The unit will continue to output IRIG B and 1 PPS during time of signal loss. No user intervention other than applying power and input GPS reference signal is required to display the input reference time.

2.3.1 MANUAL SWITCH CONTROLS

The clock has two bi-directional, center-off toggle switches located on the rear panel. These switches control menu choices and input parameters to customize the functions of the clock. At anytime during the adjustment of parameters, a pause of 20 seconds with no switch toggled will revert the unit back to displaying time. Any parameter or digit changed on the display will be retained immediately. This includes when the unit reverts back to displaying time.

Switch Operation

SELECT: Use to switch from time display to menu and sub-menu display, or to position the cursor to edit parameters.

ENTER: Use to cycle through menu choices.

↑↓ arrows: Use to change parameter values.

Toggling SELECT (inside switch up) will display the first menu choice for the unit. ENTER (inside switch down) will cycle through the different menus. Any time three dots appear after a menu choice indicates there is a sub-menu for the current selection. The first sub-menu choice is displayed using SELECT. ENTER is used to cycle through the sub-menu options. Once a sub-menu has been cycled through the unit will return to the originating, higher level, main menu choice.

The ↑↓ arrows (outside switch) are used to index a parameter value up or down. Parameter values differ in how they are edited. For example, the ↑↓ arrows will adjust the Intensity value between 1 and 15. However, in the local offset, each digit of the P hh:mm is edited individually. Digits are selected by using SELECT and changed using the ↑↓ arrows. The selected digit will flash on and off. Once the parameters are satisfactorily set, the ENTER switch will advance the display to the next menu item.

To effectively use the switches, press and hold the switch in the desired direction until the front panel display changes. Do not quickly toggle the switch on and off, or it may not be recognized.

Display Control Options

INtENSItY LED display intensity can be adjusted in a range from 1 to 15 in integer increments. Lowest setting is 1. Use ↑↓ arrows.

dISPLAY... Display is the top level menu to enter into the time format related sub-menu. Toggling SELECT (inside switch up) will display the first Display sub menu option.

t dSP GPS/UtC/Std/LCL ↑↓ arrows toggle between displaying GPS time, UTC time, standard time, or local time. Note that both standard and local time add/subtract the local offset from UTC. Local time enables daylight savings time and is the same as setting dSt to ON in the t COrrECt menu. Setting the unit to GPS, UTC, or Standard time turns dSt OFF. Toggling dSt to OFF in the t COrrECt menu set the unit to display standard time.

12-24 H 12/24 ↑↓ arrows toggle between 12 hour or 24 hour time format (e.g. 3:30 or 15:30).

dAYS dSP ON/OFF ↑↓ arrows toggle between displaying the day of year or not.

t COrrECt... Time correct is the top level menu to enter into the time correction related sub-menu. Toggling SELECT (inside switch up) will display the first Time Correct sub-menu option.

LCL OFF-hhmm Local offset from input reference time. Range is plus or minus 12 hours and 59 minutes. "P" is plus, "-" is minus.

YEAr yyyy Specifies the current year. Range is 0000 to 9999.

dSt ON/OFF ↑↓ arrows toggle between correcting for daylight savings time (dSt) or not. Start and Stop times are defined below. Setting dSt to ON causes the unit to display local time. Setting dSt to OFF causes the unit to display standard time.

dSt StArt... Daylight savings time start sub-menu header. Toggling SELECT will display the daylight savings time input parameters one at a time.

    HOUr hh The hour of the day for the time change to start is selected. Use ↑↓ arrows to choose between 0 and 23.

    0-4 x The week of the month for the time change to start is selected. Use ↑↓ arrows to choose between 0 and 4. *Zero is the last week of the month.*

    dAY d The day of week for the time change to start is selected. Use ↑↓ arrows to choose between 1 and 7. Sunday is day 1.

    1-12 xx The month of the year for the time change to start is selected. Use ↑↓ arrows to choose between 1 and 12.

dSt StOP... Daylight savings time stop sub-menu header. Toggling SELECT will display the daylight savings time input parameters one at a time.

    HOUr hh The hour of the day for the time change to stop is selected. Use ↑↓ arrows to choose between 0 and 23.

    0-4 x The week of the month for the time change to stop is selected. Use ↑↓ arrows to choose between 0 and 4. *Zero is the last week of the month.*

    dAY d The day of week for the time change to stop is selected. Use ↑↓ arrows to choose between 1 and 7. Sunday is day 1.

    1-12 xx The month of the year for the time change to stop is selected. Use ↑↓ arrows to choose between 1 and 12.

IO CONFIG... This is the top level menu to enter into the configuration settings for the COM1 port related sub-menu. Toggling SELECT (inside switch up) will display the first IO Config sub-menu option. NOTE: COM2 is not enabled in this unit.

      POrt 1... Port 1 configuration sub-menu heading. Toggling SELECT will display the serial port parameters one at a time.

            bAUD xxx Baud rate for port. Use ↑↓ arrows to choose between 1200, 2400, 4800, 9600, 19200, and 38400.

            dAtA 7/8 Data bits for port. Use ↑↓ arrows to choose between 7 or 8 data bits.

            StOP 1/2 Stop bits for port. Use ↑↓ arrows to choose between 1 or 2.

            PArItY x Parity setting for port. Use ↑↓ arrows to choose between N, O, or E. Where:
                      N = none
                      O = odd
                      E = even

VErSION x.xx Displays the firmware version installed in the unit.

GPS SAtS x Displays the number of GPS satellites currently being tracked.

t brdCSt ON/OFF Turns the automatic time broadcast out COM1 on or off. The details of this transmission are documented in the F08 command. This is also known as the TrueTime Mode C time transmission.

LCL LOC OFF This menu item indicates the switch menu local lock-out is off. To enable the switch lock-out the series of switch commands below are executed when this menu is displayed. When local lock-out is enabled the control menu cannot be activated. Only by repeating the "password" switch sequence can the local lock-out be disabled and the menu controls accessed.

Local Lock-out Password: ↓ ↑ SELECT ↑

Local Lock-out ON example:
1) Display the Lcl Loc Off menu.
2) Toggle the ↓ ↑ SELECT ↑ switches.
3) The time is displayed and the menu cannot be accessed.

Local Lock-out OFF example:
1) Toggle the ↓ ↑ SELECT ↑ switches.
2) The time continues to be displayed. Local Lock-out is now off.
3) Toggle the SELECT switch to enter menu.

Example Switch Operation

Below is an example demonstrating the use of the manual switch controls. The task is to adjust the local offset to minus 10 hours and 30 minutes. Default setting is plus zero hours. Plus zero and Minus zero are the same time.

Switch Action	Display Response
SELECT	INtENSItY xx
ENTER	dISPLAY...
ENTER	t COrrECt...
SELECT	LCL OFF**P**0000 *(Bold & Underline= flashing)*
↑	LCL OFF**-**0000
SELECT	LCL OFF-**0**000
↑	LCL OFF-**1**000
SELECT	LCL OFF-0**0**00
SELECT	LCL OFF-00**0**0
↑	LCL OFF-00**1**0
↑	LCL OFF-00**2**0
↑	LCL OFF-00**3**0
ENTER	YEAr **X**XXX
	ENTER can be pressed repeatedly until time is displayed or the unit will return to time after 20 seconds if no switch activity.

SECTION THREE

SERIAL COMMANDS

3.1   SERIAL FUNCTION LIST

At power-up, the Serial port outputs time once per second as described in Function F08 until it receives a CTRL-C character (Hex 03) or is manually turned off via the time broadcast off switch control (t brdcst). Then any of the following commands may be used:

			POWER-UP
FUNCTION	DESCRIPTION	AS SHIPPED	DEFAULT
F01	Time Zone	-00:00	Last Entry
F02	12/24 Hour Format	24	Last Entry
F06	Keypad Lockout	Off	Last Entry
F08	Continuous Time Once Per Second	On	On
F09	Time on Request	Off	Off
F18	Software Version	--	--
F50	Antenna Position	--	--
F60	Satellite List	--	--
F66	Daylight Savings Setup	Off	Last Entry
F68	Year Entry (GPS Epoch Management)	Current Year	Last Entry
F69	UTC / Standard / Local /GPS Time	UTC	Last Entry
QD	TL3 Current Date		
QT	TL3 Current Time		
QC	TL3 Current Date and Time		

The following symbols apply to all serial commands:

<CR>	ASCII carriage return (hex 0D).
<LF>	ASCII linefeed (hex 0A).
<LT>	Line Terminator: The clock output is a carriage return and a linefeed. Input to the clock is a carriage return only.
<SEP>	one or more separator characters: The clock output separator is always an ASCII space. Input to the clock can be a comma, a tab, or a space.
<SOH>	ASCII start of header (hex 01)
<SPC>	ASCII space (hex 20).

3.2 COMMAND DEFINITIONS

F01 - TIME ZONE

Use Serial Function F01 to set or read the time zone offset. To request the offset send F01<CR> to the serial port. The port will respond with the following character string:

F01<SEP><SIGN><HH>:<MM><LT>

where:

F	=	ASCII character F.
01	=	function number.
<SEP>	=	separator character.
<SIGN>	=	ASCII + for positive offsets or ASCII - for negative offsets.
<HH>	=	two-digit hour offset from +12 to -12 hours.
:	=	ASCII character for a colon.
<MM>	=	two-digit minute offset.
<LT>	=	line terminator.

Sample request: F01<CR>
Response: F01<SPC>-04:30<CR><LF>

To set the time zone offset send a string with the response format given above.

Sample entry: F01<SPC>-8:00<CR>
Response: OK<CR><LF>

Sample request: F01<CR>
Response: F01<SPC>-08:00<CR><LF>

F02 - 12/24 HOUR FORMAT

Use Serial Function F02 to set or read the time display format. To determine the format send F02<CR> to the serial port. The port will respond with the following character string:

F02<SEP><HH><LT>

where:

F	=	ASCII character F.
02	=	function number.
<SEP>	=	separator character.
<HH>	=	12 or 24.
<LT>	=	line terminator.

Sample request: F02<CR>
Response: F02<SPC>12<CR><LF>

To set the hour format, send a string with the response format given above.

Sample entry: F02<SPC>24<CR>
Response: OK<CR><LF>

F06 - SWITCH LOCKOUT ENABLE

Use Serial Function F06 to enable or disable the switch lockout feature. To determine the state of the switch lockout, send F06<CR> to the serial port. The port will respond with the ASCII character string:

     F06<SEP><STATE><LT>

where:

F	=	ASCII character F.
06	=	function number.
<SEP>	=	separator characters.
<STATE>	=	ON or OFF.
<LT>	=	line terminator.

Sample request:	F06<CR>
Response:	F06<SPC>OFF<CR><LF>

To set the switch lockout state, send a string with response format given above.

Sample entry:	F06<SPC>ON<CR>
Response:	OK<CR><LF>

F08 - CONTINUOUS TIME ONCE PER SECOND ENABLE

Internal time will output once per second at the Serial port prior to acquisition of satellite signals. Time-of-year will output once per second after acquisition of satellite signals. Character transmission is continuous with the end of the stop bit of one character coinciding with the beginning of the start bit of the next character. The output string format is:

     <SOH>DDD:HH:MM:SSQ<CR><LF>

where:

DDD	=	day-of-year.
HH	=	hours.
MM	=	minutes.
SS	=	seconds.
:	=	an ASCII colon.
Q	=	time quality character.

Sample entry:	F08<CR>
Response:	<SOH>128:20:30:04Q<CR><LF>

The time quality character may be a:

SPACE	which indicates the unit is locked to GPS.
?	which indicates the unit is not locked to GPS.

The time quality character prior to satellite signal acquisition will be "?". The carriage return character <CR> start bit begins on the second, +0 to +1 bit time or +1 ms, which ever is larger.

Time will continue to output once per second until the port receives a CTRL-C character (Hex 03). The port will ignore all other input until it receives a CTRL-C.

F09 - TIME ON REQUEST

When the serial port receives the command string F09<CR> it waits for a request in the form of an upper-case ASCII character T to output the time-of-year string. After a T is received, the current time is saved (with a resolution of 1 ms) in a buffer and is transmitted to the port. The default output string is as follows:

<SOH>DDD:HH:MM:SS.mmmQ<CR><LF>

where:

DDD	=	day-of-year.
HH	=	hours.
MM	=	minutes.
SS	=	seconds.
mmm	=	milliseconds.
:	=	an ASCII colon.
Q	=	time quality character. Refer to Function 08 for values.

Sample entry:	F09<CR>
Second entry:	T
Response:	<SOH>128:20:30:04.357 <CR><LF>

The port will continue to respond with time-of-day each time it receives a T until this function is canceled by sending a CTRL-C character (Hex 03) to the port (all other input will be ignored until then). The maximum query rate is 350 milliseconds.

F18 - SOFTWARE VERSION

Use Serial Function F18 to obtain information about the current version of the software installed in the unit. Send the string F18<CR> and the clock will respond with a string no longer that 80 characters.

Sample request:	F18<CR>
Response (GPS-605):	F18 TRUETIME GPS-605 Version 1.0 Config 0b<CR> <LF>
Response (NMC-100):	F18 TRUETIME NMC-100 Version 1.0 Config 03<CR><LF>

The GPS-605 response indicates the system software is version 1.0 with a configuration of 0b. The NMC-100 response indicates the system software is version 1.0 with a configuration of 03.

F50 - ANTENNA POSITION

Use Serial Function F50 to read the current antenna position. Function F50 returns the most recent fix computed by the GPS core module.

To determine the present position send F50<CR> and the Serial port will respond with the following continuous one line string:

F50<SPC><LAT><SPC><DEG>d<MIN>'<SEC>"<SPC><LONG><SPC><DEG>d<MIN>'
<SEC>"<SPC><SPC><SPC><SIGN><ALT>m<LT>

where:

F	=	ASCII character F (f or F for input string).
50	=	function number.
<LAT>	=	N or S for North Latitude and South Latitude.
<LONG>	=	E or W for East Longitude and West longitude.
<DEG>	=	two-digit degrees for latitude or three-digit degrees for longitude.
d	=	ASCII character d.
<MIN>	=	two-digit minutes.
'	=	ASCII character '.
<SEC>	=	two-digit seconds + 1 digit 10ths of seconds (XX.X).
"	=	ASCII character ".
<SIGN>	=	ASCII + or - for above sea level and below sea level.
<ALT>	=	altitude in meters.
m	=	ASCII character m (m or M for input string).
<LT>	=	line terminator.

Sample request: F50<CR>
Response: F50 N 38d23'51.3" W 122d42'53.2"   58.3m<CR><LF>

F60 - SATELLITE LIST

Use Serial Function F60 to read the status of the satellites that the clock is tracking. To request the status list send the string F60<CR> to the serial port. The serial port will respond with up to six strings of the form:

F60 prn <NN> sig level = <LEVEL><CR><LF>

where:

<NN>	=	two-digit satellite number.
<LEVEL>	=	satellite signal quality.
<CR>	=	carriage return character.
<LF>	=	line feed character.

Sample request: F60<CR>
Response: F60 prn 25 sig level = 3.83<CR><LF>
F60 prn 6 sig level = 10.88<CR><LF>
F60 prn 24 sig level = 9.38<CR><LF>
F60 prn 5 sig level = 15.50<CR><LF>
F60 prn 17 sig level = 3.80<CR><LF>
F60 prn 30 sig level = 13.55<CR><LF>

If no satellites are being tracked, the serial port will respond with F60<SPC>NONE<CR><LF>

F66 - DAYLIGHT SAVING SETUP

Use Serial Function F66 to disable DST, or enable DST and set the entry and exit times.

To request the present status of the daylight saving enable, send F66<CR> to the Serial port. If DST is turned off, the port will respond with the ASCII character string:

F66<SEP>OFF<LT>

where:

F	=	ASCII character F.
66	=	function number.
<SEP>	=	separator character.
OFF	=	Indicates DST is turned off.
<LT>	=	line terminator.

If DST is turned on (in manual mode), the port will respond with the ASCII character string:

F66<SEP>MANUAL<SEP><INHOUR><SEP><INWEEK><SEP><INDAY><SEP><INMONTH>
<SEP><OUTHOUR><SEP><OUTWEEK><SEP><OUTDAY><SEP><OUTMONTH><LT>

where:

MANUAL	=	Indicates DST is turned on (in manual mode).
<INHOUR>	=	time to enter DST in 24-hour format.
<INWEEK>	=	week of month to enter DST, 1, 2, 3, 4 or 0 (for last).
<INDAY>	=	day of week to enter DST, 1 through 7 where Sunday is 1.
<INMONTH>	=	month to enter DST, 1 through 12 where 1 is January.
<OUTHOUR>	=	hour to exit DST, in 24 hour format.
<OUTWEEK>	=	week of month to exit DST, 1, 2, 3, 4 or 0 (for last).
<OUTDAY>	=	day in to exit DST, 1 through 7 where Sunday is 1.
<OUTMONTH>=		month to exit DST, 1 through 12 where 1 is January.
<LT>	=	line terminator.

Sample request:	F66<CR>
Response:	F66 OFF<CR><LF>
Sample entry:	F66<SP>Off<CR>
Response:	OK<CR><LF>

To place the DST function in Manual and set the DST entry and exit times send a continuous string of the form given above. Any entry or exit item may be replaced with a semicolon, which will leave its value unchanged. However, any semicolon must be preceded and followed by a space. If any of the items in an input string are invalid, an error message will be returned.

Sample Request:	F66<CR>
Response:	F66 MANUAL 02 1 1 04 02 0 1 10.
Meaning:	Manual settings are in effect. The entry time is 02 a.m. on the first. Sunday of April and the exit time is 02 a.m. on the last Sunday in October.

Sample Entry:	F66 MANUAL ; 0 ; ; ; ; ; ;<CR>
Response:	OK<CR><LF>
Meaning:	DST will now be entered on the last week of the month.
	All other parameters remain unchanged.

Sample Entry:	F66 MANUAL 4 2 2 3 13 4 6 11<CR>
Response:	OK<CR><LF>
Meaning:	DST will now be entered 04 a.m. on the 2nd Monday in March
	and exit DST at 01 p.m. on the 4th Friday in November.

F68 - YEAR ENTRY (GPS EPOCH MANAGEMENT)

The GPS week number sent from the satellites has only 10 bits of precision, so that every 1024 weeks it rolls back to 0. The rollover occurs about every 19 1/2 years. Since GPS week 0 was in January 1980, the first rollover occurs in August, 1999. The clock needs to know the current year to construct an absolute, non-rolling week number since January 6, 1980.

The clock will properly handle dates through the year 9999, provided the current year is entered. In addition, as the clock advances to each new year, the current year is updated and used in future calendar calculations.

To request the current year, send the string F68<CR> to the serial port. The serial port will respond with the string:

> F68<SEP><YEAR><CR><LF>

where:

F	=	ASCII character F.
68	=	function number.
<SEP>	=	separator character.
<YEAR>	=	the current year.
<LT>	=	line terminator.

To set the current year, send a string with the format given above.

Sample entry:	F68 1999<CR>
Response:	OK<CR><LF>

F69 - GPS / UTC / STANDARD / LOCAL TIME

Four time types are available for use.

GPS Time is defined by and derived directly from the GPS constellation with no leap second or other GPS to UTC corrections.

UTC Time is Universal Coordinated Time and differs from GPS Time by the number of leap seconds that have occurred since January 6, 1980.

Standard Time modifies UTC time to include the Time Zone adjustment if enabled by the user.

<u>Local Time</u> modifies UTC time to include the Time Zone and Daylight Saving Time adjustments, if enabled by the user.

Standard and Local time require the setting of the local Time Zone offset either manually or with F01.

Local time requires the setting of Daylight Saving Time either manually or with F66.

Use Serial Function F69 to request or set the clock time format. To request the current time type used, send F69<CR> to the serial port. The port will respond with the following character string:

    F69<SEP><TT><LT>

where:
    F   =   ASCII character F.
    69   =   function number.
    <SEP>   =   separator character.
    <TT>   =   the time type (either UTC, STANDARD, or LOCAL).
    <LT>   =   line terminator.

Sample request: F69<CR>
Response: F69 GPS<CR><LF>
                 or   F69 UTC <CR><LF>
                 or   F69 STANDARD <CR><LF>
                 or   F69 LOCAL <CR><LF>

To set the Time Type send a character string in the format given above.

Sample request: F69 STANDARD<CR>
Response: OK<CR><LF>

Sample request: F69 UTC<CR>
Response: OK<CR><LF>

QD - TL3 CURRENT DATE

This command allows the clock to respond to the QD command the same as a TrueTime model TL3 WWV receiver. Note that this command is valid only when continuous time once per second is disabled (see F08).

Use Serial Function QD to read the current date in the TL3 format. To request the current date, send QD<CR> to the serial port. The date returned is the date at the receipt of the "Q" character. The maximume query rate is 350 milliseconds. The port will respond with the following character string:

    YY/MM/DD/JJJ<CR><LF>

where:
    YY   =   the last two digits of the current year.

MM	=	the two digit month of year (01 -12; leading 0 if needed).
DD	=	the two digit day of month (01 - 31; leading 0 if needed).
JJJ	=	the Julian day (day of year; 001 - 366; leading 0's if needed).

Sample request: QD
Response: 98/08/09/214<CR><LF>

QT - TL3 CURRENT TIME

This command allows the clock to respond to the QT command the same as a TrueTime model TL3 WWV receiver. Note that this command is valid only when continuous time once per second is disabled (see F08).

Use Serial Function QT to read the current time in the TL3 format. To request the current time, send QT<CR> to the serial port. The time returned is the time at the receipt of the "Q" character. The maximum query rate is 350 milliseconds. The port will respond with the following character string:

      CHH:MM:SS.mmmD<CR><LF>

where:

C	=	clock mode; if 12 hour mode is active, "A" for am, and "P" for pm, if 24 hour mode is active, a space is transmitted.
HH	=	the two digit hour (00 -23; leading 0 if needed).
MM	=	the two digit minute (00 -59; leading 0 if needed).
SS	=	the two digit second (00 - 59; leading 0 if needed).
mmm	=	milliseconds (leading 0's if needed).
D	=	a "D" is sent if daylight savings time is enabled and active, otherwise a space is transmitted.

Sample request: QT
Response: <SPC>17:53:19.147D<CR><LF>

QC - TL3 CURRENT DATE AND TIME

This command allows the clock to respond to the QC command the same as a TrueTime model TL3 WWV receiver. Note that this command is valid only when continuous time once per second is disabled (see F08).

Use Serial Function QC to read the current date and time in the TL3 format. To request the current date and time, send QC<CR> to the serial port. The date and time returned are the date and time at the receipt of the "Q" character. The maximum query rate is 350 milliseconds. The port will respond with the following character string:

      YYMMDDHHNNSSmmmLW<CR><LF>

where:

YY	=	the last two digits of the current year.
MM	=	the two digit month of year (01 -12; leading 0 if needed).
DD	=	the two digit day of month (01 - 31; leading 0 if needed).
HH	=	the two digit hour (00 -23; leading 0 if needed).
NN	=	the two digit minute (00 -59; leading 0 if needed).
SS	=	the two digit second (00 - 59; leading 0 if needed).
mmm	=	milliseconds (leading 0's if needed).
L	=	Y if locked, N if unlocked.
W	=	Day of week, Sunday = 0, Saturday = 6

Sample request: QC
Response: 980809175319147Y0<CR><LF>

SECTION FOUR

MAINTENANCE AND TROUBLESHOOTING

4.1 **INTRODUCTION**

Effective maintenance and troubleshooting of this equipment requires a thorough knowledge of equipment characteristics, operating procedures, and theory of operation. Equipment characteristics and operating procedures are provided in SECTION ONE and SECTION TWO. It is recommended that this material be thoroughly read by all personnel responsible for maintenance and troubleshooting of this equipment.

4.2 **PREVENTIVE MAINTENANCE**

Preventive maintenance consists of a systematic routine that maintains the operating efficiency and reduces the possibility of a malfunction. This routine includes inspection and cleaning of the equipment.

Equipment should be inspected at periodic intervals for loose or frayed connections. In the event damage is discovered it should be corrected immediately. As the equipment is inspected and tested, it should also be cleaned. A soft cloth and commercial cleaner may be used to clean the case and lens. Be careful not to get cleaner into any switches.

4.3 **CORRECTIVE MAINTENANCE**

Often what appears to be a malfunction is the result of improper operation or application of the equipment. Upon encountering a problem, thoroughly evaluate the operating procedures used when the malfunction occurs. Use the display as a troubleshooting aid.

If the display does not illuminate, verify that the AC wall adapter is properly connected and that AC power is available. Verify that the AC wall adapter is providing DC power. If DC power is provided from some other source be sure that the voltage level is satisfactory and that proper polarity has been observed (see section one for input power specifications).

If the time is incrementing but the decimal points are always illuminated, this is an indication that the input reference code is bad. Verify that the GPS antenna cable is properly connected or that the GPS antenna is properly installed.

If the display does not illuminate when power is applied or the time will not increment this is an indication that a malfunction has occurred. Under these conditions consult TrueTime customer service for help.