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**5: Function Reference**

**Function Summary**

The following summary lists all the GPS functions, identifies the user interfaces from which each one is available, and provides a brief description of the function.

Available from: K = keypad, N = Network Port (Telnet), S = Serial Port, W = Web

**Function** Available From

**Description**

F1 – Time Zone Offset K,N,S,W Set the time offset for Standard and Local time

F2 – 12/24 Hour Format K,N,S,W Apply a 12 or 24-hour format to the Front Panel Display, to

F8, F9, and F90.

F3 – Time & Date K,N,S,W Set the time and date (when not already provided by a reference source)

F4 – Serial Port Configuration K,N,W Configure the main serial port settings

F5 – Time-Quality Setup K,N,S,W Set the thresholds for each of the four time quality flags

F6 – Keypad Lock K\*,N,S Lock keypad access to the GPS’s functions. (When locked,

F6 is the only function available from the keypad.)

F8 - Continuous Time Once-per-

Second N,S Output the time once-per-second (to the command line)

F9 - Time On Request N,S Output the time when triggered (to the command line)

F11 - Time Output Format N,S Change the format of the time output by F8 and F9

F13 – Time Error K,N,S,W View the current estimated worst case time error

F18 – Software Version Request K,N,S,W View the GPS’s software version information

F27 – FTM III Configuration K,N,S,W Manage the Frequency and Time Deviation Monitor card

F42 – Multicode Output Configuration K,N,S,W Set the time code type and time reference for specific ports on the optional Multicode Output card(s)

F44 – N.8 Frequency Synthesizer K,N,S,W Set the frequencies generated by specific ports on the optional N.8 Frequency Synthesizer card(s)

F50 – GPS Receiver LLA/XYZ Position K,N,S,W View the Latitude/Longitude/Altitude or geodetic X/Y/Z coordinates of one or more GPS antennas.

F51 – GPS Antenna Cable Delay K,N,S,W Compensate for the delay caused by the length of the GPS antenna cable. (Use F52 to adjust timing *outputs*.)

F52 – Distribution Cable Delay K,N,S,W Compensate for the length of the distribution cable on J2.

F53 – GPS Operation Mode K,N,S,W Operate specific GPS receivers in Auto Mode for static applications, or in Dynamic Mode for mobile applications.

F60 – GPS Receiver Satellite List K,N,S,W View a list of current and tracked satellites.

F66 – Daylight Saving Time (DST)

Mode K,N,S,W Schedule when DST starts and ends (Local time only)

F67 – Manual Leap Second Entry K,N,S,W Manually schedule in section of leap seconds.

F69 – Time Mode K,N,S,W Set the type of time (GPS, UTC, Standard, Local) displayed on the front panel of the GPS

F71 – Oscillator Statistics K,N,S,W Display the GPS oscillator’s phase, offset, drift, and DAC values

F72 – Fault Status K,N,S,W View clock and power supply fault status

F73 – Alarm Control / Status K,N,S,W View the status of all the alarm indicators. Enable/ disable alarms for each indicator. Set alarm thresholds. Enable or disable LED blink

F74 – Clock Source Control K,N,S,W Select the pattern of switching between reference sources

F77 - PTTI Output Configuration K,N,S,W Configure and display status of PTTI card.

F78 - Parallel BCD Output Configuration K,N,S,W Configure and display status of Parallel BCD Output board.

F90 – Code Output Configuration K,N,S,W Configure settings for CODE – time code output

F100 – Network Port Configuration & GPS Firmware K,N,S,W Configure the standard network port settings

F100 EA – Ethernet Address K,N,S,W Display the Ethernet (MAC) address

F100 IP – IP Address K,N,S,W Configure the IP address

F100 SM – Subnet Mask K,N,S,W Configure the subnet mask

F100 G – Gateway K,N,S,W Configure the default gateway

F100 IC – Network Port Settings K,N,S,W Display all the standard network port’s settings

F100 BASET – 10/100 BASE- T K, N, S View network port setting

F100 L/LOCK/UNLOCK – Remote

Lockout K,N,S Lock remote access to the GPS’s standard network port

F100 L – Remote Lockout K,N\*,S Display the status of F100 LOCK

\*Locked through the network port, serial port, and keypad.

Can be unlocked only through the keypad or serial port.

F100 ST – Self Test Status K,N,S Display the GPS’s self test results for Flash CRC, RAM,

Serial Port, and NVRAM

F100 BH – Burn Host N,S\*b Upgrading system firmware: select the FTP host, path, and filename of the system firmware

F100 BUB – Burn BootLoader N,S\*b Upgrading system firmware: ‘burn’ the bootloader file (\*.bt) selected using F100 BH to flash memory

F100 BU – Burn N,S\*b Upgrading system firmware: ‘burn’ the system firmware file

(\*.bin) selected using F100 BH to flash memory

F100 BF – Burn File System N,S\*b Upgrading system firmware: ‘burn’ the file system file (\*.fs) selected using F100 BH to flash memory

F100 BUFP – Burn FPGA Firmware N,S\*b Upgrading system firmware: burn the FPGA program file

(\*.bin) selected using F100 BH to the flash memory

F100 CONFIG – Configure NTP &

SNMP N,S,W\*a Transfer the NTP and SNMP configuration files between the GPS and an FTP server for editing

F100 J – Factory Mode Jumper N,S View the status of the factory mode jumper, which is used by factory technicians. Not of interest to most end users.

F100 K I L L – Reboot N,S Reboot the GPS

F100 P – Change User Password N,S,W Change the GPS password

F100 PI – PING N,S Ping from the GPS to another host on the network

F100 PN – Change User Name N,S,W Change the User Name

F108 – Oscillator Configuration K,N,S,W View the oscillator type

F110 – J1 Input (Time Code, TIET) K,N,S,W Configure the J1 input connector

F111 – J2 Output (Rate, PPO) K,N,S,W Configure the J2 output connector

F113 – J3 Input (Aux Ref, Freq Meas) K,N,S,W Configure the J3 input connector

F116 – Display Brightness Level K Set the brightness of the display on the GPS’s front panel

F117 – Factory Configuration K,N,S,W View some of the factory settings such as the serial number or NTP state

F118 – Option Board Configuration K,N,S,W View the contents of each option bay. Only recognizes certain cards

F119 – GPS Receiver Configuration K,N,S,W Configure and display status for GPS Receivers

F120 - N.1 Frequency Synthesizer K,N,S,W Configure and display status of the N.1 card

F123 – Have Quick Input/1 PPS Sync

Configuration K,N,S,W Configure and display status of Have Quick/1 PPS card

F126 – Options Key Entry K,N,S Enable an GPS option by entering a software key

F128 – Have Quick Output Configuration K,N,S,W Configure and display status of Have Quick Output board.

a. The web interface makes it convenient to edit the SNMP and NTP configuration files directly in the browser. Manufacturer recommends this approach versus the more complicated approach of transferring configuration files to an FTP server.

b. The web interface makes it convenient to upgrade system firmware directly from the web browser. Manufacturer recommends this approach versus the serial/network command line method.

**F1 – Time Zone Offset**

Use function F1 to display and set the time zone offset between your Standard Time zone and Universal Time Coordinated (UTC). Refer to “F: World Map of Time Zones:” on page 301. F1 is the basis for Standard Time and Local Time used by F69. For an expanded explanation of Local, Standard, UTC, and GPS time, see “F69 – Time Mode” on page 94.

For example, to set the time zone for Pacific Standard Time (UTC –8 hours), set the value in F1 to – 08:00. *Do not include the 1-hour Daylight Saving Time (DST) offset in this value*. DST is handled separately by “F66 – Daylight Saving Time (DST) Mode” on page 88.

Because the front panel display and Multicode Output card can be configured to display/distribute Local or Standard time, we recommended configuring F1 as described in the “3: Installation/Configuration” on page 17.

The factory setting for F1 is UTC –8:00 hours (Pacific Standard Time).

Related topics:

• “F2 – 12/24 Hour Format” on page 53

• “F11 - Time Output Format” on page 63

• “F27 – FTM III Configuration” on page 67

Command Line

To display the time zone offset, enter “**F1<CR>”** on the command line. The GPS responds with the following character string:

F1<S><SIGN><HH>:<MM><CR><LF>

where:

F = ASCII character F

01 = function number

<S> = ASCII space character (one or more)

<SIGN> = either no character or + for positive offsets or – for negative offsets

<HH> = one – or two-digit hours offset from 00 to12 hours

: = ASCII character for a colon

<MM> = two-digit minutes offset

<CR> = carriage return character

<LF> = line feed character

For example, to set the time zone offset, enter:

**F1 –8:00<CR>**

GPS responds:

OK<CR><LF>

To verify the change, enter:

**F1<CR>**

GPS Responds:

F1 –8:00<CR><LF>

**F2 – 12/24 Hour Format**

Use function F2 to apply a 12 or 24-hour format to the time output by:

• “Keypad/Display Interface” on page 38

• “F8 - Continuous Time Once-per-Second” on page 60

• “F9 - Time On Request” on page 62

• “F90 – Code Output Configuration” on page 121

F2 affects how all four types of time (Local, Standard, UTC, GPS) appear when displayed or output.

The 12-hour format counts hours from 1 to 12 twice per day, like a conventional wall clock. The 24-hour format counts hours from 0 to 23 once per day. For example, in the 24 hour format, 18:00 is equivalent to

6:00 PM in the 12-hour format (i.e., 18:00 – 12:00 = 6:00 PM).

*Note:* Local time is commonly displayed in both 12 and 24 formats. The specifications for Standard,

UTC, and GPS call for using the 24-hour format. Applying the 12-hour format to any time type leads to ambiguous time notation. For example, if the 12-hour format is applied to UTC, the clock will display “249:10:21:34” once in the morning, and once at night.

The factory settings for F2 are 24-hour format for the display and 24-hour format for IRIG (F90)

Command Line

To display the current hour format, send:

**F2<CR>**

The GPS responds:

F2<S>D<HH><SEP>I<HH><CR><LF>

where:

F = ASCII character F.

02 = Function number.

<S> = ASCII space character (one or more).

D = ASCII character for Display format.

<HH> = 12 or 24.

I = ASCII character for IRIG format

<CR> = Carriage return character.

<LF> = Line feed character.

For example, to display the current hour format, send:

**F2<CR>**

The GPS responds:

F2 D24 I24<CR><LF>

To set the hour format, send:

**F2 D12 I24<CR>**

GPS responds:

OK<CR><LF>

**F3 – Time & Date**

Use function F3 to set the GPS system clock’s time and date. If the GPS is using GPS as its primary reference source, setting F3 manually is unnecessary. At startup, the GPS synchronizes its time and date to GPS. If the GPS is using IRIG is the primary reference source, use F3 to set the year. (Some IRIG time code does not contain year information).

F3 prompts the user for the Time Mode, the Date in mm/dd/yyyy format, and the Time in hh:mm:ss format. The hours in hh:mm:ss should be given using 24-hour notation (e.g., 6 pm = 18:00).

TIME MODE selects which type of time (Local/Standard/GPS/UTC) is being entered by the user. The GPS, translates the user entry into its equivalents in other types of time. For example, entering LOCAL - 07/14/2002 - 15:47:10 in F3 shows up on the front keypad display as UTC 198:10:47:10. TIME MODE in F3 defines only the entry of time in F3; it does not control the type of time displayed or output by the GPS. F3’s Time Mode should not be confused with F69 (see “F69 – Time Mode” on page 94). F69 controls the type of time displayed/output on the front panel display, F8 - Continuous Time Once-per-Second, F9 - Time On Request, and F90 – Code Output Configuration.

*Notes:*

• Most IRIG time code doesn’t contain “year” information. For this reason, use F3 to set the year before setting IRIG up as a primary reference source.

• The year in F3 rolls over automatically at the end of the year *if the unit is operating during the transition*. If it is not operating during the transition, the user must manually set the year the nexttime the unit is operating. This is important for scenarios where time code that does not provideyear information is being used as a reference source. Should the clock switch, for example, from GPS to the time code reference, and the year is set incorrectly in F3, any time outputs or displays that use year information will be correspondingly affected.

• Avoid saving new F3 settings while the GPS is locked to a reference source and distributing time information. Doing so allows the GPS to distribute the potentially incorrect time set by F3 for up to 8 seconds until the GPS re-synchronizes to the reference source’s time. The GPS will make this switch to and from F3’s time without generating an alarm. In NTP, for example, this means that incorrect time information could be distributed in NTP packets that are marked as having the valid time.

Command Line

To display the time and date, send:

**F3<CR>**

GPS responds:

F3<S><TT><SEP><MM>/<DD>/<YYYY><SEP><hh>:<mm>:<ss><CR><LF>

where:

F3 = ASCII string for function F3.

<S> = ASCII space character (one or more).

<TT> = time type, the entered time refers to; LOCAL/STANDARD/GPS/UTC

<SEP> = one or more separator characters: either space, comma or tab

<MM> = two-digit month

<DD> = two-digit day of month

<YYYY> = four-digit year

/ = ASCII character for slash delimiter

: = ASCII character for a colon delimiter.

<hh> = one- or two-digit hours.

<mm> = two-digit minutes.

<ss> = two-digit seconds.

<CR> = carriage return character.

<LF> = line feed character.

For example, to display the date and time, send:

**F3<CR>**

GPS responds:

F3 UTC 01/01/2002 00:05:34<CR><LF>

To set the time and date, send:

**F3 UTC 07/14/2002 18:20:30<CR>**

Only valid times and dates are accepted. The GPS responds:

OK<CR><LF>

**F4 – Serial Port Configuration**

Use function F4 to change or display the serial port settings. The factory settings are:

• Interface – RS-232

• Baud rate – 9600

• Data bits – 8

• Parity – NONE (only available/valid when Data Bits is set to 8)

• Stop bits – 1

Command Line

To display the Serial Port settings, send:

**F4<CR>**

GPS responds:

F4<S><RS><SEP><BR><SEP><DB><SEP><P><SEP><SB><CR><LF>

where:

F = ASCII character F.

04 = function number.

<S> = ASCII space character (one or more).

<SEP> = One or more separator characters: either space, comma or tab.

<RS> = Interface type, RS-232 or RS-422

<BR> = Baud Rate, with possible values 1200, 2400, 4800, 9600, or 19200

<DB> = Data Bits, with possible values 7 or 8

<P> = Parity, with possible values “even” or “odd” or “none”

<SB> = Stop Bits, with possible values 1 or 2.

<CR> = Carriage return character.

<LF> = Line feed character.

*Note:* Parity - NONE is only available/valid when Data Bits is set to 8.

*Note:* Setting the serial port to RS-422 requires an RS-422 adaptor installed, or the GPS will halt.

For example, to display the serial port settings, send:

**F4<CR>**

The GPS responds:

F4 232 9600 8 none 1<CR><LF>

To set the serial port settings, send:

**F4 422 9600 7 even 1<CR>**

GPS responds:

OK<CR><LF>

**F5 – Time-Quality Setup**

Use function F5 to enable/disable reporting, and to set the thresholds of the four time-quality flags.

How time quality reporting works in the GPS: When a reference source becomes unavailable, the GPS uses its own oscillator to keep track of time. Without the reference source, the GPS can no longer adjust, or steer, the oscillator to remain synchronized with the reference source. The rate at which the oscillator counts time is slightly faster or slower than the reference source. The resulting difference, *time error*, accumulates over time.

The GPS estimates the time error based on the oscillator-type and on the degree of steering (DAC value) applied to the oscillator before the reference source became unavailable. As time error grows and exceeds the thresholds of each *time-quality flag*, the GPS generates a different *time-quality indicator*. The time-quality indicator is represented as a *time quality character* in the following text-based time outputs:

• “F8 - Continuous Time Once-per-Second” on page 60

• “F9 - Time On Request” on page 62

In addition, a time quality indicator is encoded in IRIG-B time code generated by the following functions:

• “F27 – FTM III Configuration” on page 67

• “F90 – Code Output Configuration” on page 121

For more information on time quality indicators, see “IRIG Standard Format A” on page 300.

The GPS accepts threshold values from 200 nS to 40000000000 nS.

The factory settings for F5 are as follows:

• Time quality reporting - enabled

• First time quality flag 1000 nS

• Second time quality flag 10000 nS

• Third time quality flag 100000 nS

• Fourth time quality flag 1000000 nS

Related topics (Time Error):

• “F13 – Time Error” on page 65 displays the current time error

• “F71 – Oscillator Statistics” on page 96 provides the DAC value

Command Line

To determine if the time quality characters are enabled and what the thresholds are, enter:

**F5<CR>**

GPS responds The GPS responds:

F5<S><STATE><SEP><FLAG><SEP><FLAG><SEP><FLAG><SEP><FLAG><CR><LF>

where:

F = ASCII character F

05 = function number

<S> = ASCII space character (one or more)

<SEP> = one or more separator characters; either space, comma or tab

<STATE> = ENABLE or DISABLE

<FLAG> = one error threshold in nanoseconds, 1 to 11 digits with or without leading zeros

<CR> = carriage return character

<LF> = line feed character

For example, to display the time quality status and flags, enter:

**F5<CR>**

GPS responds:

F5 DISABLE 00000001000 00000010000 00000100000 00001000000<CR><LF>

To enable time quality reporting, and change the thresholds of the time quality flags, enter:

**F5 ENABLE 2000 20000 200000 2000000<CR>**

GPS responds:

OK<CR><LF>

**Note:** Leading zeros aren’t required for to enter new settings, but are included in readouts of the settings.

**F6 – Keypad Lock**

F6 – Keypad Lock enables or disables the keypad, preventing accidental changes to the GPS’s settings. When enabled, the display responds ‘KEYPAD LOCKOUT BY FUNC 6’ when the user attempts to access any function other than F6. F6 remains available through the keypad at all times. The factory setting for F6 – Keypad Lock is disabled.

Command Line

To display the Keypad Lock status, send:

**F6<CR>**

GPS responds:

F6<S><STATE><CR><LF>

where:

F = ASCII character F

6 = function number

<S> = ASCII space character (one or more)

<STATE> = ENABLE or DISABLE

<CR> = carriage return character

<LF> = line feed character

For example, to display the Keypad Lock status, send:

**F6<CR>**

GPS responds:

F6 DISABLE<CR><LF>

To enable Keypad Lock, send the following string:

**F6 ENABLE<CR>**

GPS responds:

OK<CR><LF>

To disable Keypad Lock, send the following string:

**F6 DISABLE<CR>**

GPS responds:

OK<CR><LF>

**F8 - Continuous Time Once-per-Second**

This function is available through the command line interface only - it is not available through the keypad.

F8 generates time-of-year information (e.g., 199:10:41:08) once-per-second over the GPS's command line interface (available from the serial or network ports). The format and type of time can be modified using F2, F11, and F69.

The command line (standard out) outputs the <CR> character at the end of the time-of-year string at the 1 PPS mark, +/- 1 millisecond. If F8 is used following startup, while the GPS is acquiring a reference source, F8's displays time-of-year information from the GPS's unsynchronized system clock. When the system clock acquires a reference source and synchronizes with it, F8 displays the new time-of-year information. The transition looks like this:

365:16:00:14?

365:16:00:15?

365:16:00:16

365:16:00:17

199:13:56:03

199:13:56:04

...

In the first two lines above, the unsynchronized time is followed by a "?" time quality character. In this case, the "?" indicates that the GPS system clock is not locked to a reference source. As the GPS locks to the reference source, the "?" disappears. After a couple seconds, the new synchronized time-of-year information appears. If the reference source becomes unavailable, F8 continues generating time-of-year information based on the synchronized time, and the character for the first time quality flag typically appears as the time error starts increasing.

199:11:19:31

199:11:19:32

199:11:19:33.

199:11:19:34.

...

The format of time output can be changed using "F11 - Time Output Format" (described in the GPS manual). The default output string format is:

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

where:

<SOH> = ASCII Start-of-Heading character

<CR> = ASCII Carriage Return character

<LF> = ASCII Line Feed character

DDD = day-of-year.

HH = hours.

MM = minutes.

SS = seconds.

mmm = milliseconds.

: = colon separator.

Q = time quality character (see the following table)

The time quality character, "Q", is one of the following characters:

SPACE = Time error is less than time quality flag 1's threshold

. = Time error has exceeded time quality flag 1's threshold

\* = Time error has exceeded time quality flag 2's threshold

# = Time error has exceeded time quality flag 3's threshold

? = Time error has exceeded time quality flag 4's threshold or a reference source is unavailable

The four time quality thresholds are set by F5 - Time-Quality Setup. See "F13 - Time Error" in the standard GPS User Guide for more information.

Command Line

For example, to initiate Continuous Time once-per-second, enter:

**F8<CR>**

The GPS replies:

199:11:19:30<CR><LF>

199:11:19:31<CR><LF>

199:11:19:32<CR><LF>

To stop F8 Continuous Time Once-Per-Second, press Ctrl-C on your keyboard (hex 03).

**F9 - Time On Request**

This function is available through the command line interface only. It is not available from the keypad.

Use function F9 to record the exact time the GPS receives a request from the user.

Enter the command "F9<CR>" to prepare the GPS for the user's request. At the desired moment, send the request to the GPS by entering an upper case "T". The GPS saves the current time-of-day, accurate to within 1μS, to a buffer, and then outputs it to the command line interface. The GPS continues to provide the time-of-day each time it receives a "T" until F9 is cancelled. To cancel F9, enter Ctrl-C on your keyboard. The command line disregards all input other than SHIFT-T and Ctrl-C (hex 03).

The time-of-day output is only available on the network or serial port used to give the F9 command.

F9’s default output string is as follows:

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

where:

<SOH> = ASCII Start-of-Heading character

<CR> = ASCII Carriage Return character

<LF> = ASCII Line Feed character

YYYY = year

DDD = day-of-year.

HH = hours.

MM = minutes.

SS = seconds.

mmm = milliseconds.

: = colon separator.

Q = time quality character (see the following table)

The time quality character, "Q", is one of the following characters:

SPACE = Time error is less than time quality flag 1's threshold

. = Time error has exceeded time quality flag 1's threshold

\* = Time error has exceeded time quality flag 2's threshold

# = Time error has exceeded time quality flag 3's threshold

? = Time error has exceeded time quality flag 4's threshold, or a reference source is unavailable

For example, to prepare Time on Request, enter:

**F9<CR>**

Then, to request the current time, enter SHIFT-T on your keyboard. ("T" does not appear). GPS responds:

<SOH>128:20:30:04.357\*<CR><LF>

To exit F9 press Ctrl-C on your keyboard.

**F11 - Time Output Format**

Use function F11 to change the format of the F8 and F9 time output strings. The factory setting for F11 format is null, which enables the default time output formats for F8 and F9:

<SOH>DDD:HH:MM:SSQ<CR><LF> (for F8)

<SOH>DDD:HH:MM:SS.mmmQ<CR><LF> (for F9)

To display the default format for F11, enter:

**F11**

F11 responds:

F11 DDD:HH:MM:SS.mmmQ

where:

<SOH> = ASCII Start-of-Heading character

<CR> = ASCII Carriage Return character

<LF> = ASCII Line Feed character

DDD = day-of-year.

HH = hours.

MM = minutes.

SS = seconds.

mmm = milliseconds.

: = colon separator.

Q = time quality character (see the following table)

The time quality character, "Q", is one of the following characters:

SPACE = Time error is less than time quality flag 1's threshold

. = Time error has exceeded time quality flag 1's threshold

\* = Time error has exceeded time quality flag 2's threshold

# = Time error has exceeded time quality flag 3's threshold

? = Time error has exceeded time quality flag 4's threshold, or a reference source is unavailable

*Note:* F8 does not display milliseconds, regardless of the format defined in F11.

Suppress the “DDD”, “HH”, “MM”, “SS”, “mmm”, and “Q” segments of F11 by placing an “X” (Shift-X) in the leading position of any segment, followed by any placeholder characters, and the following separator. For example, to suppress “DDD”, enter:

**F11 X--:**

To see the resulting change to F11, enter:

**F11**

F11, with “DDD” suppressed, responds:

F11 XDD:HH:MM:SS.mmmQ

With “DDD” suppressed, the output of F8 would look like this example: :16:23:32\*

Ending a format string early (no “:” or “.” separator at the end) with a carriage return, enables the remaining un-typed characters. This makes it easy to restore the default F11 formatting.

To return F11 to its default format, enter:

**F11 D**

To display the restored defaults, enter “F11” again. F11 responds:

F11 DDD:HH:MM:SS.mmmQ

The “DDD”, “HH”, “MM”, “SS”, “mmm”, and “Q” segments can not be replaced with characters, they can only be suppressed.

The “:” and “.” separators *can be replaced with ASCII characters* or suppressed using “X”. For example, to replace the separators with characters, enter:

**F11 ---D--H--M--S**

When you check the results by entering “F11”, F11 responds:

F11 DDDDHHHMMMSSSmmmQ

With the new formatting, F8 displays:

128D16H41M27\*

And F9 displays:

365D16H45M22S680\*

**F13 – Time Error**

Use function F13 to request the estimated worst-case time error due to oscillator drift during periods of unlock from a reference source. See “System Time & Frequency Accuracy” on page 6 for more information on time error for different reference sources. Time error begins to accumulate when the receiver loses lock to a reference source. The GPS calculates the worst-case time error based on the stability of system clock’s oscillator type, and the time elapsed since loss of lock.

Command Line

The Command line interface will report time error when it receives the following string:

**F13<CR>**

The GPS responds:

F13<S><ERROR><CR><LF>

where:

F13 = ASCII string for function F13

<S> = ASCII space character

<ERROR> = calculated worst-case error in seconds

<CR> = carriage return character

<LF> = line feed

For example, to display the time error, enter:

**F13<CR>**

GPS responds (example):

F13 TIME ERROR -0.002932863<CR><LF>

**F18 – Software Version Request**

Use function F18 to display the current firmware version numbers of the firmware in the GPS:

• Bootloader

• Software (firmware)

• File System

• Project Rev #

• FPGA

Command Line

Use Command Line Function F18 to obtain the system’s firmware version information.For example, enter:

**F18<CR>**

The GPS responds:

F18 BOOTLOADER 192-8000

SOFTWARE 192-8001

FILE SYSTEM 192-8002v1.80

PROJ REV # 2-1

FPGA # 184-8000V50

*Note:* The values will be different from this example representing the current values.

**F27 – FTM III Configuration**

Use F27 to manage the Frequency and Time Deviation Monitor (87-8023) option card (page 200).

Keypad

The UP ARROW DOWN ARROW keys are used to scroll between the selections, and the ENTER key is used to access the currently displayed selection (numeric keys are placed in <> brackets for clarity).

After accessing a particular selection, information can be entered by scrolling to a desired value via UP ARROW and DOWN ARROW keys or by directly entering the desired value. The specific data entry method is dependent upon the particular selection.

Pressing the TIME or STATUS keys aborts the keypad function without affecting the current entry value.

Operation of Keypad F27 is detailed in the following paragraphs.

Press ENTER <2> <7> to access the FTM. The front panel 2-line VFD displays the following title.

FTM Availability

OPTION BAY <N>

Use UP ARROW and DOWN ARROW to select an FTM, and press ENTER.

***Time and Frequency Deviation Display***

This display is only informational. ENTER to continue to the next display or CLR to begin again.

***Time Deviation Offset Entry***

This display shows the current preset value for time deviation offset. This value is set by the user and does not change until changed by the user. Press UP to edit the value and/or reset the accumulated time deviation.

UP followed by ENTER does not change the time deviation offset, but resets the accumulated time deviation to that value. The four arrow keys and the numeric keys are used to edit the time deviation offset entry. ENTER exits this display and steps to the next.

• Time Deviation

• Entry

• Front Panel

• VFD Setup

• Front Panel

• Display Port

• RS-422 Setup

• Display Port

• Data Addr Setup

• Continue With Current Setup

If the ENTER key is pressed at this time, the FTM will begin displaying information using the current user configuration.

***Line Frequency Entry***

Pressing ENTER at this point allows the user to scroll between 50 or 60 Hz for the Line Frequency to be measured. The selection process is performed by pressing the UP ARROW or DOWN ARROW until the desired frequency is displayed. At that time, pressing the ENTER key selects the displayed frequency and returns to the Line Frequency Entry display.

***Time Deviation Entry***

Pressing ENTER at this display allows the user to input a Time Deviation Preset value. The range is +99.999 to -99.999 s. The number keys are used to enter the desired value, the LEFT ARROW and RIGHT ARROW keys may be used to move the cursor, and the UP ARROW and DOWN ARROW keys are used to change the sign of the value. Pressing the ENTER key will load the displayed Time Deviation Preset into the FTM and reset the accumulated Time Deviation to the newly entered value. THIS FUNCTION PERFORMS A RESET OF ACCUMULATED TIME DEVIATION. If this function has been entered in error, simply press the TIME or STATUS buttons to exit the function without changing the preset value.

***Front Panel Display Setup***

Pressing ENTER at this display allows the user to select which data is to be displayed on the GPS’s front panel display. The three selections are Time and Frequency Deviation, System Frequency, and Local Time. Scroll to display the desired data then press ENTER to select.

***FTM RS-422 Display Port Setup***

Press ENTER at this display to configure the FTM RS-422 display port. The factory default values are:

• Baud Rate - 9600

• Data Bits - 8

• Parity - none

• Stop Bits - 1

The default values on subsequent power-ups will be those in use prior to the previous power-down. Using the UP ARROW and DOWN ARROW keys, scroll to the desired setting then press the ENTER key to accept the currently displayed setting. When all parameters are entered, the display returns to FTM RS-422 Display Port Setup.

NOTE: Stop Bits is **1** when data bits is 8 and parity is selected.

***Display Port Data Address Setup***

Pressing ENTER at this display allows the user to set data addresses for all five data values transmitted out the FTM Display Port.

At each data value prompt, enter the desired address for that data value. A negative sign preceding the address indicates that the data value is not to be transmitted.

Disabling data transmission is a useful feature if a non-addressable display is connected to the display port. By placing a minus (-) sign in front of 4 of the 5 data value addresses, only one data value will be transmitted, thus allowing the user to select a value to be displayed on the non-addressable display. The UP ARROW or DOWN ARROW key is used to change the sign of the address. The LEFT ARROW and RIGHT ARROW keys may be used to move the cursor. Prior to accepting the displayed value, if the originally displayed value was the correct value, pressing the CLR button will restore it. Pressing the

ENTER button accepts the displayed value. The next data value address is then displayed until all five addresses have been entered. The address range is from 0 to 255. Placing a (+) in front of the address enables the data for transmission, while placing a (-) in front of the address inhibits the data from being transmitted.

The settings should be set as follows:

PORT DATA ADDR CONFIG

TIME DEVIATION ADDR +022

PORT DATA ADDR CONFIG

FREQ DEVIATION ADDR +021

PORT DATA ADDR CONFIG

SUYSTEM FREQUENCY ADDR +020

PORT DATA ADDR CONFIG

LOCAL TIME ADDR +024

PORT DATA ADDR CONFIG

SYSTEM TIMEADDR +023

Command Line

The FTM can output the following data once-per-second or on demand:

• Local Time

• Time Deviation

• Frequency Deviation

• System Frequency

• System Time

Additionally, the user can configure which data is included in the once-per-second output.

In the following paragraphs <cr><lf> represents the carriage return and linefeed characters, and single ' and double " quotes are used to delimit character strings. The single ' and double " quotes are for text clarity and are not to be sent to the FTM F27.

To exit once-per-second or Time On Demand Output, a <^C> (Ctrl+C) character must be sent to the command line. All other commands automatically exit after completion.

The command line (standard out) outputs the <CR> character at the end of the once-per-second string at the 1 PPS mark, +/- 1 millisecond.

Serial Port Commands:

**F27 B<N> <cr><lf>** User formatted once-per-second output

**F27 B<N> FS<cr><lf>** Request user format string

**F27 B<N> FS X,X,X,X,X<cr><lf>** Set user format string

**F27 B<N> TD<cr><lf>** FTM data on demand output

**F27 B<N> PS<cr><lf>** Request Time Deviation Preset value

**F27 B<N> PS +99.999<cr><lf>** Set Time Deviation Preset value

Where: B<N> is the option Bay Number where the FTM card is installed.

***F27 B<N> <cr><lf> User formatted once-per-second output***

When the GPS receives the "F27 B<N> <cr><lf>" string, the FTM card begins sending user selected data at a once-per-second rate. The rising edge of the start bit of the last <CR> in the string is sent on time. If all information is enabled for transmission, the formatted string is as follows:

DDD:HH:MM:SSQTsDS.thmFsU.thmSFDU.thmSTHH:MM:SS.thm<CR><LF>

For example:

068:12:17:55?T-01.537F+0.123SF+60.095ST12:17:53.463<CR><LF>

where:

DDD:HH:MM:SS Local Time of Day through seconds

Q GPS Time Quality Indicator TsDS.thm Time Deviation Through milliseconds.’T' begins the accumulated Time Deviation in seconds.

FsU.thm Frequency Deviation through millihertz. ‘F’ begins Frequency Deviation in Hz from nominal, where a positive (+) value represents a frequency higher than nominal.

SFDU.thm System Frequency through millihertz. ‘SF’ begins the System Frequency, Hz. System frequency is measured over a 1 second period.

STHH:MM:SS.thm System Time through milliseconds. ‘ST’ begins System Time, Day of Year through milliseconds, the time a clock would display if the line voltage were used as its timing reference.

<CR><LF> End of line carriage return at 1 PPS mark, +/- 1 millisecond.

To exit F27 once-per-second mode, transmit a <^C> (Ctrl+C) character to the GPS.

***F27 B<N> FS<cr><lf> FORMAT SELECT once-per-second DATA***

The data that is transmitted once-per-second via the "F27 B<N> <cr><lf>" command can be selected by the user. Using this command, all FTM-II and FTM-I formatted strings can be emulated. Data transmitted out the serial port is in the following order: Local Time, Time Deviation, Frequency Deviation, System Frequency, and System Time. Each datum can be deselected for output using the format string (X,X,X,X,X). e.g.,

Local

Time

Time

Deviation

Frequency

Deviation

System

Frequency

System

Time

X ,X ,X ,X ,X

Entering an "F27 B<N> FS<cr><lf>" requests the current format string in use by the FTM serial port. The serial port responds with the current format string. An example follows:

**F27 B<N> FS<cr><lf>user entry (requests current format)**

F27 B<N> FS X,X,X,X,X<cr><lf>FTM response

The X's represent data enabled for output. A format string with Local Time and System Time deselected would be ",X,X,X,". Note the absence of X's in those positions.

To deselect all but Time Deviation and Frequency Deviation, the following command line and FTM card response is as follows:

**"F27 B<N> FS ,X,X,<cr><lf>"**

"F27 B<N> OK<cr><lf>"

The commas are necessary placeholders and the X's are in the Time Deviation and Frequency Deviation positions.

Subsequently, when "F27 B<N> <cr><lf>" is sent requesting the once-per-second Mode, only Time

Deviation and Frequency Deviation is transmitted once-per-second.

T-00.432F-0.003<cr><lf>

T-00.432F-0.003<cr><lf>

***F27 B<N> PS<cr><lf> REQUEST TIME DEVIATION PRESET VALUE***

To request accumulated Time Deviation, enter:

**F27 B<N> PS<cr><lf>**

***F27 B<N> PS +99.999<cr><lf> SET TIME DEVIATION PRESET VALUE***

Accumulated Time Deviation can be preset to a given value in the range of +99.999 to -99.999 seconds.

When executed, this command presets the accumulated Time Deviation value to the entered value. All previously accumulated Time Deviation is lost. Example sessions follow:

Preset accumulated Time Deviation to -1.0 seconds. Enter:

**F27 B<N> PS -1.00<cr><lf>**

Response:

OK<cr><lf>

Request current Time Deviation Preset Value. Enter:

**F27 B<N> PS <cr><lf>**

Response:

**F27 B<N> PS= -1.00<cr><lf>**

Preset accumulated Time Deviation to 0.0 seconds. Enter:

**F27 B<N> PS 0<cr><lf>**

Response:

OK<cr><lf>

Preset accumulated Time Deviation to 100.0 seconds. Enter:

**F27 B<N> PS 100<cr><lf>**

Response:

ERROR 01 VALUE OUT OF RANGE<cr><lf>

***F27 B<N> TD<cr><lf> DATA ON DEMAND OUTPUT***

The Data On Demand Output allows the user to request a single measurement by sending an upper case "T<cr><lf>" while in the "F27 B<N> TD" mode. Subsequent receipts of the letter T (without the carriage return linefeed combination) are responded to with the current data values.

Local Time of receipt of the 'T' to the millisecond is recorded, System Time is calculated from the recorded Local Time, and the complete FTM data string is transmitted back to the user. An example session follows:

F27 B<N> TD<cr><lf>

T

069:15:25:27.545QT+00.477F-0.011SF+59.989ST15:25:28.022

T

069:15:25:31.932QT+00.477F-0.013SF+59.987ST15:25:32.409

T

069:15:25:32.524QT+00.476F-0.012SF+59.988ST15:25:33.000

^C

OK<cr><lf>

The Time On Demand string contains an additional four characters representing the decimal point and milliseconds of the Local Time at the time of receipt of the 'T'.

Exit F27 B<N> TD mode by entering a ^C or Ctrl+C.

**F42 – Multicode Output Configuration**

Use function F42 to view or set up the time-code outputs of the Multicode Output (87-6002-

XL1) (page 179).

• **Board #**: Identifies the card to which the following settings will apply. (Select between multiple cards using the UP/DOWN ARROWs buttons on the keypad). The card number is determined by the position of DIP switches on the Multicode card. Each card must have a unique number. (See

“Installation” on page 179)

• **Output #**: Identifies the output to which the settings apply (e.g., J1 through J4)

• **Code**: The time code output by the port. The note below provides a complete list of all the time code types available.

• **Time Reference**: The type of time (e.g., UTC, Standard, Local, GPS) output by ***all ports*** on the card. Even though this setting is shown for a specific output, *it sets the type of time for all ports*.

*Notes:*

• The code output types include: IRIG-A 130, IRIG-A 133, IRIG-B 120, IRIG-B 123, IRIG-E 111,

IRIG-E 112, IRIG-E 121, IRIG-E 122, IRIG-G 141, IRIG-G 142, IRIG-H 111, IRIG-H 112, IRIG-H

121, IRIG-H 122, 2137, XR3, NASA 36.

• If IRIG-A 130 or IRIG-A 133 is selected as the output type for a specific port, all other ports set for IRIG-A will be ‘bumped’ to the same type (130 vs. 133). Ports set to other time code types (e.g., IRIG-B) are not affected.

• The same is true for IRIG-G. If IRIG-G 141 or IRIG-G 142 is selected as the output type, all the other ports set for IRIG-G will be ‘bumped’ to the same type (141 vs. 142). Ports set to other time code types (e.g., IRIG-B) are not affected.

• For more information on the code output types, see “E: Time Code Formats” on page 297.

• For Time Reference, the following is a summary explanation of the different types of time:

- **UTC** (Coordinated Universal Time) differs from GPS Time by the addition of leap-second corrections to compensate for variations in the earth’s rotation.

- **GPS** time is derived directly from the GPS constellation. It doesn’t contain leap-second adjustments or other GPS-to-UTC corrections.

- **Standard** time is UTC plus a time zone adjustment. For example, Pacific Standard Time is

UTC minus 8 hours. See “F: World Map of Time Zones:” on page 301 for more information.

- **Local** time is UTC plus a time zone adjustment and a Daylight Saving Time adjustment.

• See “F69 – Time Mode” on page 94 for an *expanded explanation* of the different types of time.

*Note, however, that F69 does not affect F42 or the Multicode Output card*.

Command Line

***Requesting the board number of installed cards***

Use F42 to set up the output on the Multicode Output card(s). Use the following format to request the board number(s) of the installed card(s):

**F42<CR><LF>**

The GPS responds using the following format:

F42<S>B<S><N><CR><LF> (one board installed)

or

F42<S>B<S><N><S><N>...<CR><LF> (two or more boards installed)

where:

F42 = ASCII string representing the Function Number

<CR> = carriage return character.

<LF> = line feed character.

<S> = space character

B = ASCII character B

N = the board number of a multi code card, 1 to 10

... = Multiple occurrences of <S><N> corresponding to the number of boards present

For example, enter:

**F42<CR>**

The GPS responds that one board, board 2 in this case, is present:

F42 B 2<CR><LF>

Or, that multiple boards, boards 2 and 4 in this case, are present:

F42 B 2 4<CR><LF>

Or, that no boards are present:

NO MULTICODE BOARDS

***Requesting the time code settings of a specific output port***

Use the following format to request the time code settings of a specific output on a specific card:

**F42<S>B<N>O<S><C><CR>**

Where

F42 = ASCII string representing the Function Number

<S> = one or more separator characters, space, tab or comma

B = ASCII character indicating board number to follow

<N> = the board number, 1 to 10

O = ASCII letter “ohh” indicating output port (not zero)

<C> = output number, 1 to 4

<CR> = carriage return

For example, to request the time code on board 1, output 1, enter:

**F42 B1O 1<CR>**

Or, optionally:

**F42 B1 O1<CR>**

The GPS responds with the time code of the output:

F42 B1 1 IRIG-B 120<CR><LF>

If the time code is IRIG-A or IRIG-G, the response includes a parenthetical reminder that ***all outputs*** set to that time code (e.g., IRIG G) are also set to the same time code type (e.g., 141):

F42 B1 1 IRIG-G 141(ALL "G" PORTS)

***Setting the time code of a specific output port***

Use the following format to set the time code for a specific output port:

**F42<S>B<N><S>O<S><C><S><CODE><CR>**

where:

F42 = string representing the Function Number

<S> = separator

B = ASCII letter indicating board number follows

<N> = board number, 1 to 10

O = ASCII letter indicating output port

<C> = channel number, 1 to 4

<CODE> = IRIG-A 130, IRIG-A 133, IRIG-B 120, IRIG-B 123, IRIG-E 111, IRIG-E 112, IRIG-E 121, IRIG-E

122, IRIG-G 141, IRIG-G 142, IRIG-H 111, IRIG-H 112, IRIG-H 121, IRIG-H 122, 2137, XR3,

NASA 36

*Note*: A dash is required when entering IRIG types. NASA 36 is entered without a dash. 2137 and

XR3 have no dashes or spaces when entered.

<CR> = Carriage Return

For example, to set board 1, output 1, to IRIG-B 123, enter:

**F42 B1 O 1 IRIG-B 123<CR>**

The GPS responds:

OK<CR><LF>

Setting a port to IRIG-A switches all output ports set to IRIG-A to the same IRIG-A type (e.g., IRIG-A 133). The same is true for IRIG-G. Therefore the following example would set ***all*** of board 1’s IRIG-A outputs, not just output 1, to IRIG-A 133 time code:

**F42 B1 O 1 IRIG-A 133<CR>**

The GPS responds:

OK<CR><LF>

***Requesting the time reference of a specific board***

Use the following format to request the Time Reference of a specific board:

**F42<S>B<N>T<CR>**

Where

<N> = board number, 1 to 10.

<S> = ASCII space character.

T = ASCII letter requesting Time Reference.

The GPS responds with the Time Reference for the selected board.

For example, to requests the time reference from board 1, enter:

**F42 B1 T<CR>**

The GPS responds:

F42 B1 UTC<CR><LF>

***Setting the time reference of a specific board***

Use the following format to set the type of time output by the boards (For an explanation of the different types, see “F69 – Time Mode” on page 94):

**F42<S>B<N><S>T<S><TREF><CR>**

Where

F42 = string representing the Function Number

B = ASCII character indicating board number to follow.

<N> = the board number, 1 to 10

<S> = one or more separator characters, space, tab or comma.

<TREF> = Time Reference, UTC, LOCAL, STANDARD, or GPS

For example, to have board 1 (all ports) output local time instead of UTC, enter:

**F42 B1 T LOCAL<CR>**

The GPS responds:

OK<CR><LF>

**F44 – N.8 Frequency Synthesizer**

Use function F44 to select the N.8 rate for a specific output port on a specific N.8 Frequency Synthesizer

(86-708-1) (page 182). The N.8 output frequencies range from 8 kPPS to 8192 kPPS.

Command Line

Use the following format to enter the F44 command. In response, the GPS displays the card addresses of the installed N8 cards:

F44<CR>

GPS responds with the card numbers in using the following format:

F44<S><N><S><N><CR><LF>

where

For example, enter:

F44<CR>

GPS responds with the card numbers:

F44 02 04<CR><LF>

To see the frequency settings of all port settings on a specific card, enter:

F44 B3<CR>

GPS responds (card #3 –- example settings):

F44 B3 1 2048 2 1000 3 0512 4 0008<CR><LF>

To display the frequency of a specific output ports (card #3, port #4), enter:

F44 B3 4<CR>

GPS responds:

F44 B3 4 0008<CR><LF>

To set the frequency of one of the output ports use the following format:

F44<S>B<N><SEP><C><SEP><FREQ><CR>

where

F44 = ASCII string indicating function 44

<S> = space or separator

<N> = the card numbers of one or more N.8 cards separated by spaces

<CR> = Carriage return

<LF> = Line feed

<S> = ASCII space character one or more

B = ASCII “B” character

<N> = The card number

<SEP> = Space separator

<C> = The port number

<FREQ> = The N.8 frequency (from 8 to 8192 kPPS in 8 kPPS steps)

<CR> = Carriage Return

To set the frequency of one of the output ports (card #2 port #1 to 8 kPPS), enter:

F44 B2 1 8<CR>

GPS responds:

OK<CR><LF>

To set all four ports on a card with one serial string, enter:

F44 B1 1 1000 2 2000 3 2048 4 16<CR>

This sets the ports on card #1 as follows:

• Port #1 to 1000 kPPS

• Port #2 to 2000 kPPS,

• Port #3 to 2048 kPPS,

• Port #4 to 16 kPPS.

F50 – GPS Receiver LLA/XYZ Position

Use function F50 to display the current GPS position. Specifically, Use function F50 to:

• Display the option bay location of the GPS receiver(s). If multiple GPS receivers are available, use the UP/DOWN ARROW keys to select a receiver.

• Select the positional coordinate system, Latitude Longitude Altitude (LLA) or XYZ (Earth-

Centered, Earth-Fixed XYZ coordinates).

• If LLA is selected, Altitude Mode shows the elevation in given meters.

Command Line

Use the following format to display the current settings display the current position for the GPS receiver in LLA coordinates:

F50<S>B<N><SEP>LLA<CR>

GPS responds with the coordinate information in the following format:

F50<S>B<N><SIGN><S><DEG>d<MIN>'<SEC>"<S><SIGN><S><DEG>d<MIN>'<SEC>"<S><ALT><UNITS><CR

><LF>

where:

F50 = Function 50

<S> = ASCII space character one or more.

B = ASCII letter to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

<SEP> = Separator

LLA = LLA mode

<CR> = carriage return character.

<SIGN> = N or S for latitude; E or W for longitude; – for negative altitude and <S> or + for positive altitude.

<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.

" = ASCII character "

<ALT> = altitude in meters

<UNITS> = unit of altitude, “m” for meters

<LF> = line feed character.

For example, to display the LLA coordinates of the antenna connected to card #2, enter:

F50 B2 LLA<CR>

GPS responds:

F50 B2 N 38d23'51.3" W 122d42'53.2" 58m<CR><LF>

To display the present antenna position using ECEF XYZ coordinates in meters, use the following format:

F50<S>B<N><SEP>XYZ<CR>

GPS responds using the following format:

F50B<N><S><SIGN><S><MX>m<S><SIGN><S><MY>m<S><SIGN><MZ>m<CR><LF>

where:

F = ASCII character F

50 = function number

<S> = ASCII space character

B = ASCII letter to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

<SIGN> = Either + or - for the position of the ECEF XYZ coordinates

<MX> = Antenna X-position in meters to tenths of a meter

<MY> = Antenna Y-position in meters to tenths of a meter

<MZ> = Antenna Z-position in meters to tenths of a meter

m = ASCII character m for Meters

<ALT> = altitude in meters

<CR> = carriage return character

<LF> = line feed character

For example:

F50 B2 XYZ<CR>

GPS responds:

F50 B2 X –4474331m Y 2668899m Z –3668099m<CR><LF>

F51 – GPS Antenna Cable Delay

Use function F51 to display or configure the GPS antenna cable delay. Setting a positive value for F51 compensates for the time the signal takes to travel the length of the cable from the GPS antenna to the receiver. When multiple GPS receivers are installed, a separate value can be set for each unique receiver. The factory setting for F51 is +60 nS (50 feet of RG-59). If using an optional Down/Up

Converter, consult that product’s documentation for directions on setting the correct cable delay.

F51 Guidelines:

• For RG-59: multiply the cable length by 1.24 nS/ft. to get the value for F51.

• For RG-58: multiply the cable length by 1.4 nS/ft. to get the value for F51.

• Avoid using function F51 to adjust the GPS’s timing outputs; use F52 Distribution Cable Delay instead.

Command Line

Use the following format to display the current Antenna Cable Delay setting:

F51<S>B<N><CR>

The GPS responds using the following format:

F51<S>B<N><SEP><SIGN><DELAY>ns<CR><LF>

where:

F = ASCII character F (f or F for input string).

51 = the function number.

<S> = ASCII space character one or more.

B = ASCII letter to denote Option Bay number follows

<N> = Option Bay Number of the GPS option card, 1 through 10.

<CR> = carriage return character.

<SEP> = one or more space characters.

<SIGN> = either + or blank

<DELAY> = 1 to 6 digit delay from 0 nS to 999999 nS.

ns = nanoseconds (ns or NS for input string).

<LF> = line feed character.

For example, to see the antenna cable delay for the GPS card in option bay 4, enter:

F51 B4<CR>

GPS responds:

F51 B4 +000060ns<CR><LF>

To set the antenna cable delay for an option card, use the following format:

F51<S>B<N><S><DELAY>NS<CR>

For example, to set the antenna cable delay for the GPS card in option bay 4 to 100 nS, enter:

F51 B4 100NS<CR>

GPS responds:

OK<CR><LF>

F52 – Distribution Cable Delay

Use function F52 to display or set the distribution cable delay for the time code and 1 PPS outputs. F52 compensates for the signal’s travel time from the GPS to its point of use. The distribution cable delay applies uniformly to all output ports. The as-shipped factory setting is +0 ns. The range of possible values is +999,999 ns to –999,999 ns. Positive values advance the timing signals, while negative values retard them.

To calculate what the setting should be, multiply the delay/foot by the length of the cable in feet. The typical delays for the following cable types are:

• RG-58 – approximately 1.4 ns/foot

• RG-59 – approximately 1.24 ns/foot

Command Line

To display the current distribution cable delay, enter:

**F52<CR>**

The GPS responds using the following format:

F52<SEP><SIGN><DELAY>ns<CR><LF>

where:

F = ASCII character F (f or F for input string).

52 = the function number.

<S> = one or more space characters.

<SIGN> = either + or –

<D> = 1 to 6 digit delay from +999999 nS to –999999 nS

ns = nanoseconds (ns or NS for input string)

<CR> = carriage return character

<LF> = line feed character

For example, to display the current distribution cable delay, enter:

**F52<CR>**

GPS responds:

F52 +000000ns<CR><LF>

To set the distribution cable delay to 60 nS, enter:

**F52 +000060nS<CR>**

GPS responds:

OK<CR><LF>

F53 – GPS Operation Mode

Use function F53 to set the operation mode for all receiver types except the 86-8013, which doesn’t have modes. (If the 86-8013 is the only receiver available, F53 reports “GPS Availability, Not Available”.) The GPS C/A Receiver (87-8028-2) has two modes:

• Select “Dynamic Mode” if the position of the receiver is subject to frequent change, or if it is in continuous motion. For example, use Dynamic Mode when the GPS is used in mobile vehicles such as ships, land vehicles, or aircraft. With Dynamic Mode selected, the receiver updates the position information repeatedly to arrive at the best time calculations for a mobile environment.

• Select “Time Mode” if the receiver used in a static environment such as a server room. With Time Mode, the receiver averages the position data over time to determine the antenna position and calculate the time precisely and accurately. TRAIM is also supported in Time Mode only.

Keypad

While viewing the Status screen on the GPS front panel display, press the following keypad buttons:

ENTER 53 ENTER

If an GPS C/A Receiver (87-8028-2) is available, F53 displays:

GPS C/A AVAILABILITY

OPTION BAY #

Where # is the option bay number the card is located in. (If no GPS is available, F53 displays “GPS AVAILABILTY, NOT AVAILABLE”). If more than one GPS is present, use the UP/DOWN ARROW buttons to select the option bay location of a specific card.

To view the mode the GPS is in, press ENTER again, and F53 displays the current mode:

GPS MODE SELECT AUTO MODE (or DYNAMIC MODE) To change the mode, use the UP/DOWN ARROW buttons and press ENTER. F53 asks:

SAVE CHANGES?

YES

To save changes, press ENTER.

Command Line

To request the GPS operation mode of an GPS C/A Receiver (87-8028-2), enter:

F53 B<N>

F53 responds using the following format:

F53<SP>B<N><SEP><STATUS><CR><LF>

where:

F = ASCII character F (f or F for input string).

53 = the function number.

<SP> = ASCII space character one or more.

B = ASCII letter to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

<SEP> = one or more space characters.

<STATUS> = DYNAMIC MODE or AUTO MODE

<CR> = carriage return character.

<LF> = line feed character.

For example, enter:

**F53 B1**

Example response:

F53 B1 AUTO MODE (or DYNAMIC MODE)

To set the GPS Operation Mode, enter a command using the following format:

**F53<SP>B<N><SEP><MODE><CR><LF>**

where <MODE> equals “DYNAMIC MODE” or “AUTO MODE”.

For example, enter:

**F53 B1 DYNAMIC MODE**

F53 responds:

OK<CR><LF>

**F60 – GPS Receiver Satellite List**

Use function F60 to display the identification number and signal strength of tracked or current satellites. ‘Tracked’ means a satellite’s signal is being received and interpreted by the receiver (or that the GPS has GPS data that suggests this satellite should be visible to the antenna).

GPS satellite are grouped into the following categories:

• Tracked: the GPS is receiving the GPS signal, but isn’t using it to calculate time and position.

• Current: the GPS is using the satellite’s GPS signal to calculate time and position.

• Bad: the GPS satellite is transmitting information that it has been removed from service.

• Rejected: the GPS GPS receiver’s TRAIM feature has detected anomalous signals from this satellite and has quarantined it from the timing solution for 12 hours.

GPS satellite signal strengths are reported in units of dBW. Signals below -170 dBW (e.g., -171 dBW) are not usable by the GPS receiver. See “GPS Signal Strength Requirements” on page 23.

If multiple GPS receivers are installed in the GPS, F60 identifies the GPS receiver by the option bay number in which it is located. For a diagram of option bay numbers, see “F118 – Option Board Configuration” on page 157. If you’re using the keypad/display interface, use the UP/DOWN ARROWs to scroll through the list of satellites.

Command Line

Use Serial Function F60 to request a list of all, current, and tracked satellites. To display the list, enter a string using the following format:

F60<S>B<N><SEP><TYPE><CR>

GPS responds with approximately 32 lines that use the following format:

F60<S>B<N><S>prn<NN><S><STATE> tracked current<LEVEL><CR><LF>

where:

F60 = ASCII string indicating function F60.

<S> = ASCII space character one or more.

B = ASCII letter to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

<SEP> = One or more separator characters; either space, comma or tab.

<TYPE> = ALL, CURRENT, or TRACKED.

<CR> = Carriage return character.

prn = Pseudo Random Number

<NN> = 1 through 32 (prn<NN> identifies specific GPS satellites)

<STATE> = Good, Bad, or Unknown

tracked = Either “tracked” or blank

current = Either “current” or blank

<LEVEL> = Satellite signal strength in dBW

<LF> = Line feed character

For example, to display the complete GPS satellite list, enter:

**F60 B1 ALL<CR>**

GPS responds:

F60 B1 prn1 good current -159dBW

F60 B1 prn2 good current -162dBW

F60 B1 prn3 good current -163dBW

F60 B1 prn4 unknown

F60 B1 prn5 unknown

F60 B1 prn6 unknown

F60 B1 prn7 unknown

F60 B1 prn8 good current -161dBW

F60 B1 prn9 unknown

F60 B1 prn10 unknown

F60 B1 prn11 unknown

F60 B1 prn12 unknown

F60 B1 prn13 good current -159dBW

F60 B1 prn14 unknown

F60 B1 prn15 unknown

F60 B1 prn16 unknown

F60 B1 prn17 unknown

F60 B1 prn18 unknown

F60 B1 prn19 unknown

F60 B1 prn20 unknown

F60 B1 prn21 unknown

F60 B1 prn22 good current -164dBW

F60 B1 prn23 unknown

F60 B1 prn24 unknown

F60 B1 prn25 unknown

F60 B1 prn26 unknown

F60 B1 prn27 good current -156dBW

F60 B1 prn28 unknown

F60 B1 prn29 unknown

F60 B1 prn30 unknown

F60 B1 prn31 unknown

F60 B1 prn32 unknown

Similarly, to display a list of the current or tracked satellites, enter:

**F60 B1 CURRENT<CR>**

Or

**F60 B1 TRACKED<CR>**

**F66 – Daylight Saving Time (DST) Mode**

Use function F66 to enable or disable Daylight Saving Time (DST), and to schedule when *Local time* enters and leaves DST. The factory setting for F66 is Manual (i.e., DST On). The hour for entering/leaving DST is given in the 24-hour format. Entering/leaving DST can be scheduled for any hour of theday, any day of the year. However, transitions scheduled within 24 hours of the beginning/end of the yearmay not occur at the desired time. This function also works for locations in the southern hemisphere,where the DST period span the New Year.

Command Line

To display the current status of F66, enter a command using the following format:

**F66<CR>**

GPS responds using the following format:

F66<S><STATE><ENTER/EXIT><CR>

where:

F = ASCII character F

66 = function number

<S> = ASCII space character one or more.

<STATE> = Off or Manual.

<ENTER/EXIT> = If <STATE> is Manual, <ENTER/EXIT> are the dates it enters and exits DST.

<CR> = carriage return character.

<LF> = line feed character.

For example, to disable DST, enter:

**F66 Off<CR>**

GPS responds:

OK<CR><LF>

To enable DST and set the DST entry and exit times, use the following format:

**F66 MANUAL<INHOUR><SEP><INWEEK><SEP><INDAY><SEP><INMONTH><OUTHOUR>**

**<SEP> <OUTWEEK><SEP><OUTDAY><SEP><OUTMONTH><CR>**

where:

<INHOUR> = time to enter DST in 24-hour format.

<SEP> = one or more separator characters, either space comma or tab characters. For output strings this will be a single space character.

<INWEEK> = which week 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> = which week 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

<CR> = carriage return character.

<LF> = line feed character.

For example, enter:

**F66 MANUAL 02 2 1 03 02 1 1 11**

Meaning:

• Manual settings are in effect.

• The entry time is 02 a.m., week 2 (second), day 1 (Sunday), month 3 (March)

• The exit time is 02 a.m., week 1 (first), day 1 (Sunday), month 11 (November).

To leave the value of any item unchanged, insert a semicolon in its place. For example, to change the week DST begins, enter:

**F66 MANUAL ; 0 ; ; ; ; ; ;<CR>**

GPS responds to all changes with:

OK<CR><LF>

Meaning that Local time will enter DST on the last week of the month. All other parameters remain unchanged.

The GPS automatically reboots when the user changes the DST entry/exit times in F66.

If any of the items in an input string are invalid, an error message will be returned.

**F67 – Manual Leap Second Entry**

Use Serial/Network Function F67 to manually enable a leap second insertion into the GPS clock time structure. To request the present status of the manual leap seconds settings, send F67<CR> to the Serial/Network port. The port will respond with the ASCII character string:

F67<SP><LS><SP><SELECT><SP><DATE><CR><LF>

where:

F = ASCII character F.

67 = function number

<SP> = ASCII space character one or more.

<LS> = current leap seconds value in seconds, for GPS Epoch / TAI Epoch

<SELECT> = NONE, ADD or SUB.

<DATE> = Date of next leap second insertion, or blank if <SELECT> is NONE.

<CR> = carriage return character.

<LF> = line feed character.

If the Manual Leap Second function is set with leap second event values, the port will respond with the string described below.

Sample request: F67 <CR>

Response: F67 -14/-33 ADD 12/31/2007 <CR><LF>

To set the current leap second value for UTC / GPS , enter a continuous string of the form:

F67 <SEP>GPSLS<SEP><-nn>

where:

GPSLS= ASCII string indicating a GPS Epoch leap second value will be entered.

<-nn> = Leap second valued entered, -00 to –30.

Sample entry: F67 GPSLS -14<CR>

Response: OK<CR><LF>

To set the current leap second value for UTC / TAI , enter a continuous string of the form:

F67 <SEP>TAILS<SEP><-nn>

where:

TAILS = ASCII string indicating a TAI Epoch leap second value will be entered.

<-nn> = Leap second valued entered, -19 to –49.

Sample entry: F67 TAILS -33<CR>

Response: OK<CR><LF>

**Adding a Leap Second:**

To set the next leap second insertion time for adding a leap second, enter a continuous string of the form:

F67 <SEP>ADD<SEP><MONTH><SEP><YEAR>

where:

ADD = ASCII string indicating a leap second will be added.

<MONTH> = Month number that the leap second will be added, on the last day of the month, MAR, JUN, SEP, DEC or NONE.

<YEAR> = Year that the leap second will be added, 2000 to 2030 or NONE.

**Subtracting a leap second:**

To set the next leap second insertion time for subtracting a leap second, enter a continuous string of the form:

F67 <SEP>SUB<SEP><MONTH><SEP><YEAR><CR>

where:

SUB = ASCII string indicating a leap second will be subtracted.

<MONTH> = Month number that the leap second will be subtracted, on the last day of the month MAR, JUN, SEP, DEC or NONE.

<YEAR> = Year that the leap second will be subtracted, 2001 to 2030 or NONE.

Sample entry: F67 SUB DEC 2007<CR>

Response: OK<CR><LF>

**Setting the manual leap second function to no event:**

To select no leap second insertion event, enter a continuous string of the form:

F67 <SEP>NONE<CR>

where:

NONE = ASCII string indicating a manual leap second insertion function will be disabled.

*Note:* The Serial/Network port will respond with the message “ERROR 01 VALUE OUT OF RANGE” if the input string was in the correct format but contained a value, probably numeric, that was out of the range of acceptable values.

*Note:* The Serial/Network port will respond with the message “ERROR 02 SYNTAX” if it receives a string in an incorrect format, for example the second field should be ADD, SUB or NONE.

*Note:* The Serial/Network port will respond with the message “ERROR 03 BAD/MISSING FIELD” if the input string lacks a required field. For example the second field should be ADD, SUB or NONE.

The third field should be MONTH or NONE, and the fourth field YEAR or NONE. It is possible to set fields two, three, and four to NONE. However, be careful when setting a field to NONE, when a valid value is required. Here are two examples where a field is set to NONE, instead of a valid value.

For example, for adding a leap second, the format is:

F67 <SEP>ADD<SEP><MONTH><SEP><YEAR>

If the following is enterred.

>F67 ADD JUN NONE

ERROR 03 BAD/MISSING FIELD!, is returned.

Similarly,

>F67 ADD NONE 2001

ERROR 03 BAD/MISSING FIELD!, is returned.

*Note:* For the IRIG-B120 1344, if manual leap seconds are entered, at the time of the Leap Second event, only 1 leap second will be added or subtracted. The manual and IRIG 1344 introduced leap second are not cumulative. In the case of the IRIG-B120 1344, the IRIG Leap Second data will overwrite the F67 entered data when the IRIG 1344 Leap Second information becomes active. The IRIG 1344 Leap Second data becomes active around 1 minute before the leap second event.

*Note:* Your reference source (either IRIG 1344 or GPS), will override your manual settings.

**F69 – Time Mode**

Use function F69 to select the time type displayed by:

• The GPS’s front panel display

• “F8 - Continuous Time Once-per-Second” on page 60

• “F9 - Time On Request” on page 62

• “F90 – Code Output Configuration” on page 121

Select between the following types of time:

• **UTC (Coordinated Universal Time)** differs from GPS Time by the addition of leap-second corrections to compensate for variations in the earth’s rotation.

• **GPS Time** is derived directly from the GPS constellation and doesn’t contain any leap-second adjustments or other GPS-to-UTC corrections.

• **Standard Time** is UTC plus a time zone adjustment. For example, Pacific Standard Time is UTC minus 8 hours

• **Local Time** is UTC plus a time zone and a daylight saving time adjustment.

The factory setting is UTC.

*Note:* A time error can be created when switching to GPS time when the reference is Time Code (non IRIG 1344). IRIG 1344 resolves this problem.

Related functions:

• “F1 – Time Zone Offset” on page 52

• “F66 – Daylight Saving Time (DST) Mode” on page 88

• “F8 - Continuous Time Once-per-Second” on page 60

• “F9 - Time On Request” on page 62

Command Line

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

Use the following format to display the time mode currently used:

**F69<CR>**

The GPS responds using the following format:

F69<SEP><TT><CR><LF>

where:

F = ASCII character F.

69 = Function number.

<SEP> = One or more separator characters, either space comma or tab characters. For output strings this will be a single space character.

<TT> = Time Type. Either GPS, UTC, LOCAL, or STANDARD.

<CR> = Carriage return character.

<LF> = Line feed character.

For example, enter:

**F69<CR>**

GPS gives one of the following responses:

F69 GPS <CR><LF>

F69 UTC <CR><LF>

F69 LOCAL <CR><LF>

F69 STANDARD <CR><LF>

To set the time mode, enter a command using the following format:

**F69<S><TT><CR>**

where:

F = ASCII character F.

69 = Function number.

<S> = ASCII space character.

<TT> = Time Type. Either GPS, UTC, LOCAL, or STANDARD.

<CR> = carriage return character.

<LF> = line feed character.

For example, to change the time mode to local time, enter:

**F69 LOCAL<CR>**

Or, to change the time mode to UTC, enter:

**F69 UTC<CR>**

GPS responds to these changes with:

OK<CR><LF>

**F71 – Oscillator Statistics**

Use F71 to display the phase, frequency offset, drift rate, and DAC value of an internal or optional external oscillator.

Definitions:

The *phase* is the instantaneous error in seconds between the oscillator and the control loop zero servo point. The *frequency offset* is computed using an averaging time that is equal to the effective averaging time of the oscillator controller. The *oscillator Drift Rate* is computed using a 24-hour average and is the daily Drift Rate of the oscillator. The *oscillator DAC value* is the signed 16-bit integer that controls the DAC output voltage. It ranges from 0 to 65536.

Command Line

To display the F71 settings, enter:

**F71<CR>**

GPS responds using the following format:

F71<S>phase=<SIGN><MULT>E<SIGN><EXP><S>s<S><S>offset=<SIGN><MULT>E<SIGN><EXP><S><S>dr

ift=<SIGN><MULT>E<SIGN><EXP>/DAY<S><S>DAC=<SIGN><INT><CR><LF>

where:

F = ASCII string indicating function F71

<S> = ASCII space character one or more.

<MULT> = multiplier, 4 digits with decimal point.

E = ASCII character E for exponent.

s = ASCII character s for seconds abbreviation

<SIGN> = - for negative or <S> for positive.

<EXP> = 2 digit exponent.

/DAY = ASCII characters, units of Drift Rate

<INT> = integer, 5 digits

<CR> = carriage return.

<LF> = line feed.

For example, enter:

**F71<CR>**

GPS responds:

F71 PHASE=-5.678E-09 s OFFSET=-1.986E-07 DRIFT= 6.013E-08/DAY DAC=24567<CR><LF>

**F72 – Fault Status**

Use function F72 to display the fault status of the clock.

• Clock PLL *(Phase Locked Loop)* – Locked or unlocked

• Clock Status – Locked or unlocked, followed by the clock reference source

• Primary power supply – OK or failed

• Secondary power supply – OK or failed

• Rubidium oscillator, if installed – OK or fault

Command Line

To display the status of the fault detectors, enter:

**F72<CR>**

The GPS responds:

F72<SP>PLL: <CLK PLL ><SP> CLK: <CLK STATUS><SP><CLK REF:><SP> PWR1:<PWR1 STATUS><SP>

PWR2: <PWR2 STATUS><SP>OSC: <OSC STATUS> <CR><LF>

where:

F = ASCII character F

72 = function number

<SP> = ASCII space character one or more.

<CLK PLL> = Clock PLL (Phase Loop Lock) status, LOCKED or UNLOCKED

<CLK STATUS> = Clock Status, LOCKED or UNLOCKED to the reference source shown. When the value of the oscillator's predicted worst-case time error ("F13 - Time Error" on page 51) exceeds the user-configurable value for F73 Time Threshold, F72 CLOCK STATUS becomes UNLOCKED. Otherwise the F72 CLOCK STATUS remains LOCKED. \*

<CLK REF> = Clock reference source GPS PRI, GPS SEC, IRIG A, IRIG B, NASA 36, AUX

REF, HQ/PPS PRI or HQ/PPS SEC.

<PWR1 STATUS> = Primary Power Supply status, OK or FAILED

<PWR2 STATUS> = Secondary Power Supply status, OK or FAILED

<OSC STATUS> = Rubidium oscillator status, OK or FAILED (if installed)

<CR><LF> = output line terminator

\* Please note:

• Clock Status in F72 and F73 function similarly, but use different thresholds to determine whether the status is LOCKED or UNLOCKED.

- F72 Clock Status uses the F73 Time Threshold value.

- F73 Clock Status uses 150 nS when the reference source is GPS, and 15 uS when the reference source is non-GPS (i.e., IRIG A, IRIG B, NASA 36, AUX REF, HQ/PPS PRI or HQ/PPS SEC).

• Neither F72 nor F73 require that F73 Time Error is enabled.

• The Status Display (page 32) on the front panel shows F73 Clock Status.

For example, enter:

**F72<CR>**

The GPS responds:

F72 CLOCK PLL LOCKED

CLOCK STATUS LOCKED GPS PRI

PRIMARY POWER SUPPLY OK

SECONDARY POWER SUPPLY OK

*Note:* It is recommended that the Time Threshold is set to zero for the following reasons. If the Time Threshold is set to zero, default values of Time Threshold for each type of reference source are associative to their respective reference sources. For example, the GPS reference source will have 150 nS Time Threshold associated with it, and the IRIG/Time Code reference source would have 15 uS Time Threshold associated with it. When a reference source is changed, it will have its associated Time Threshold associated with it. This prevents errors being generated by having one Time Threshold applied to several different reference sources as would happen as follows. If the Time Threshold is set to any value other than zero, the value that has been selected, is then applied to every reference source. For example, if the Time Threshold is set to 200 nS, all reference sources will alarm when they exceed 200 nS.

**F73 – Alarm Control / Status**

Use function F73 to do the following:

• See the state of an indicator (“Locked/Unlocked” or “OK/Fault”)

• Enable or disable the alarm for each indicator

• See the state of the Alarm Latch for each indicator and clear the Alarm Latch for all indicators

• Enable or disable blinking of the Alarm Status LED on the front panel while it is green or amber

• Set the values for Time Threshold, Timeout Delay, and Power-On Alarm Suppress

The following table summarizes F73’s alarm indicators and parameters, as well as the factory settings for an GPS without options. The factory settings vary depending on the options included at the GPS at the time it ships from the factory. For example, for an GPS with an optional GPS receiver, the GPS Primary Receiver indicator setting would be Alarm Enabled.

Upate the alarm settings when adding or removing option cards from the GPS.

**Indicator/Parameter Name Status Factory Setting (for GPS without option cards)**

Clock Status Locked/Unlocked Always Enabled

PLL Locked Locked/Unlocked Alarm Enabled

Low Phase Noise (LPN) PLL Locked Locked/Unlocked Alarm Enabled

GPS Primary Receiver OK/Fault Alarm Disabled

GPS Secondary Receiver OK/Fault Alarm Disabled

IRIG Fault OK/Fault Alarm Enabled

Aux Ref Fault OK/Fault Alarm Disabled

Primary Power OK/Fault Alarm Enabled

Secondary Power OK/Fault Alarm Disabled

Rubidium oscillator

(GPS w. optional Rubidium oscillator)

OK/Fault Alarm Disabled

DAC OK/Fault Alarm Disabled

First Time Lock OK/Fault Alarm Enabled

Time Error OK/Fault Alarm Enabled

Time Threshold (Range 0 to 99,999 nS) 0000 nS

Alarm LED Blink n/a Enabled

Timeout OK/Fault Alarm Enabled

Timeout Delay (Range 0 to 86,400 sec.) 300 sec.

Power-On Alarm Suppress (Range 0 to 86,400 sec.) 300 sec.

NTP Fault

(GPS w. NTP option)

OK/Fault Alarm Enabled

Clear Alarm Latch Yes/No No

**Alarms - General Information**

With Alarm Disabled, an F73 indicator does not trigger an alarm when it enters an Unlocked or Fault state.

With Alarm Enabled, an F73 indicator triggers an alarm when it enters an Unlocked or Fault state, and the following events take place:

• The Alarm Status LED changes color from green to amber or red (See “In the user interfaces, the card positions are referred to by Option Bay number (see Figure 6).” on page 37.)

• The ALARM output on the rear panel changes from low Z to high Z (impedance).

• If configured, SNMP sends a trap out over the network port. (See “C: SNMP” on page 255.)

The following items may delay an unlocked or fault state from triggering an alarm immediately:

• Timeout and Timeout Delay postpone Time Error alarms for a user-configured interval. See

“Timeout and Timeout Delay” on page 106.

• Power-on Alarm Suppress prevents alarms from being triggered for a user-configured interval after the GPS boots and starts. See “Power-On Alarm Suppress” on page 106.

The following sections provide detailed information about each of the alarm indicators and settings available in function F73.

*Table B* gives the following information:

• The name of the indicator or setting

• The factory default setting for an GPS with a single GPS receiver installed

• The status reported by each indicator, or the range for each setting

**Table B: Indicators and Settings under function F73**

**Name Default Status**

Clock Status Enabled Locked or Unlocked

PLL Locked Enabled Locked or Unlocked

LPN PLL Locked Disabled - \*A Locked or Unlocked

GPS Primary Receiver Enabled - \*A OK or Fault

GPS Secondary Receiver Disabled - \*A OK or Fault

IRIG Fault Disabled - \*B OK or Fault

Aux Ref Fault Disabled - \*B OK or Fault

Primary Power Enabled OK or Fault

Secondary Power Disabled - \*A OK or Fault

Rubidium oscillator Disabled - \*A OK or Fault

DAC Disabled - \*C OK or Fault

First Time Lock Disabled - \*C OK or Fault

Time Error Enabled OK or Fault

Time Threshold 0 nS (Range 0 to 99,999 nS)

Alarm LED Blink Enabled (Enabled or Disabled)

Timeout Disabled OK or Fault

Timeout Delay 300 sec. (Range 0 to 86,400 sec.)

Power-On Alarm Suppress 300 sec. (Range 0 to 86,400 sec.)

NTP Fault Disabled - \*A OK or Fault

Clear Alarm Latch No Yes or No

Note:

• \*A: This indicator is enabled when the GPS is purchased with the corresponding option. Enable this indicator if performing a field installation of the corresponding option.

• \*B: Enable this indicator when configuring the GPS with the corresponding reference source.

• \*C: Enable this indicator for troubleshooting purposes.

**Clock Status**

Status: Locked or Unlocked

The Clock Status indicator reports “Locked” when the GPS clock is locked to a reference source (e.g., GPS, IRIG, AUX REF, etc.). This is the normal operational state of the clock. While locked, the GPS clock steers its internal oscillator to the reference source.

The Clock Status indicator reports “Unlocked” when the GPS clock is not locked to a reference source. This may be because the reference source is unlocked or unstable. While unlocked from a reference source, the GPS uses its internal oscillator to keep time until a reference becomes available again.

Note: There are two uses of the word “unlocked” here: one refers to the GPS system clock when it doesn’t have a reference source, the other refers to the reference source (e.g., GPS, IRIG) when it doesn’t have a valid signal.

The GPS can provide stable and accurate time while the Clock Status indicator is “Unlocked”. *How long* depends on a number of factors including the stability of the internal oscillator and the acceptableamount of time error for the application. The Time Error indicator and the Time Threshold setting can beused to trigger an alarm when the time error exceeds customer-defined limit.To prevent the Clock Status indicator from coming unlocked, apply the following recommendations:

• Configure the GPS with multiple reference sources. For example, two GPS receiver cards and/or an Aux Ref input from a Cesium primary frequency reference.

• Follow the standard procedures and guidelines for installing and configuring the reference sources (such as for GPS antenna installation).

To investigate and solve a persistent “Unlocked” Clock Status indicator, perform the following steps:

Investigate the reference sources. Determine whether they are “Locked” or “Unlocked” and whether they are “Primary”, “Secondary”, or “Standby”. For Aux Ref, which doesn’t have Primary/Secondary setting, check F113. For GPS, check F119. For IRIG, use F110. For Have Quick/PPS, use F123. For further guidance, read the Function Reference section for each function in this User Guide.

• Investigate F74, which determines how the GPS switches between Primary and Secondary reference sources. For further guidance, read the Function Reference section for F74 in this User Guide.

• Even though the Aux Ref input is a reference source, it is not treated as a Primary or Secondary reference source by the GPS. If Aux Ref is available, the GPS clock uses it in place of its internal oscillator while no reference source is available.

**PLL**

Status: Locked or Unlocked

The PLL indicator reports “Locked” during normal operation while the system clock’s PLL is locked to the internal oscillator.

The PLL indicator reports “Unlocked” if the GPS clock’s hardware PLL has failed. While the PLL indicator is “Unlocked”, all GPS clock timing parameters are unreliable and should not be used. Contact Manufacturer Global Customer Assistance.

**LPN PLL**

Status: Locked or Unlocked The LPN (Low Phase Noise) PLL indicator reports “Locked” during normal operation while the LPN oscillator on an LPN Card is locked to the GPS’s internal oscillator.

The LPN PLL indicator reports “Unlocked” for several minutes after the unit is started while the LPN oscillator on the card warms up. This is not a significant error, and if needed, can be prevented by extending the duration of the Power-On Alarm Suppress.

If the LPN PLL indicator reports “Unlocked” at any time other than the warm-up period, the LPN card’s PLL has failed or the LPN card’s oscillator can no longer be steered to the internal GPS oscillator. All outputs from the LPN card are unreliable and should not be used. Contact Manufacturer Global Customer Assistance. When multiple LPN cards are present, an LPN PLL fault on any one of the LPN cards will change the LPN PLL indicator to “Unlocked”. If so, all *LPN card outputs* should be considered unreliable and should not be used until the faulty card has been identified. All other outputs, unless in an alarm condition, continue to be available for use. Contact Manufacturer Global Customer Assistance.

**GPS Primary Receiver and GPS Secondary Receiver**

Status: OK or Fault GPS Primary Receiver and GPS Secondary Receiver indicators report “OK” when the corresponding GPS receiver card is tracking satellites, has a valid position, and is providing time to the clock without faults. They report “Fault” if any of the preceding conditions aren’t met. This can be due to poor visibility of the GPS satellites, a failed antenna, an open or shorted antenna cable, or a failed GPS receiver card.

The GPS Primary Receiver indicator corresponds to the GPS receiver configured as “Primary” in F119. The GPS Secondary Receiver indicator corresponds to the GPS receiver configured as “Secondary” in F119.

The GPS Receiver indicators report “OK” if the corresponding GPS receiver card is configured as “Disabled” in F119 or if the card is physically removed from the GPS.

With good conditions and excellent visibility of the sky, the GPS receiver should track multiple GPS satellites on a continuous basis—faults from the GPS Receiver should be very infrequent and short in duration. Under more difficult conditions and with poorer visibility of the sky, faults will be more frequent and last longer, but they should still be intermittent—coming and going as GPS satellites come in and out of view. As long as the Clock Status doesn’t alarm, these brief GPS faults will have little effect on the GPS clock and corresponding outputs. The person operating the GPS should characterize the frequency and duration of faults for a given installation, and should investigate and take action if the pattern of faults changes significantly or doesn’t meet requirements.

When the indicator reports a fault, use F60 to check the number of visible satellites and F119 to check if the GPS antenna cable is showing an “open” or “short” condition. Check that the GPS antenna installation conforms to the guidelines given in the GPS Antenna installation section. Check the antenna, antenna cable, and connections for problems.

*Note:* Note: When using the GPS receiver with an antenna splitter, an antenna fault may occur due to a DC block in the antenna path. The antenna fault can be avoided by using a splitter that provides a load resistor to simulate the antenna current draw.

If a GPS receiver reports a continuous fault, and the GPS antenna and antenna cable have been tested and found to be good, contact Manufacturer Global Customer Assistance.

**IRIG**

Status: OK or Fault

The IRIG indicator reports “OK” when an IRIG input on J1 is providing valid time. It reports a “Fault” if one of the following is true:

• The time code signal isn’t connected to J1 on the main CPU card.

• F110 isn’t configured correctly for a given time code format or impedance configuration.

• There are high noise levels in the AM code.

• The DC level shift code level is inadequate or has too much jitter.

To solve a fault from the IRIG indicator, check that the preceding items are configured/set up correctly.

Depending on how F74 is configured, the user may need to take additional steps to control which reference the GPS uses. See the F74 function reference section in this user guide.

**Aux Ref**

Status: OK or Fault

The Aux Ref indicator reports “OK” when a valid frequency is connected to the J3 input connector and

F113 is configured for the Aux Ref input. It reports Fault if the J3 input isn’t getting a valid Aux Ref input or function F113 isn’t configured for the Aux Ref input.

**Primary Power**

Status: OK or Fault

The Primary Power indicator reports “OK” when the power supply voltages are normal. It reports “Fault” when the power supply voltages exceed +/-10% of nominal supply regulation.

While the Primary Power indicator reports a fault, all outputs from the GPS are unreliable and should not be used unless a Secondary Power supply is available and operating normally.

When seen from the rear of the GPS, the Primary Power indicator corresponds to the power supply module in the lowest, left-most bay.

**Secondary Power**

Status: OK or Fault

The Secondary Power indicator reports “OK” when the power supply voltages are normal. It reports

“Fault” when the power supply voltages exceed +/-10% of nominal supply regulation.

While the Secondary Power indicator reports a fault, all outputs from the GPS are unreliable and should not be used unless a Primary Power supply is available and operating normally.

*Note:* If the Secondary Power Supply is not present or plugged in, no fault will be reported.

When seen from the rear of the GPS, the Secondary Power indicator corresponds to the power supply module in the following locations:

• For the 1U chassis, the Secondary Power supply is located in Option Bays 3 & 4, which are the two vertical bays to the left of the center of the unit.

• For the 2U chassis, the Secondary Power supply is located in the upper, left most bay, directly above the primary power supply.

**Rubidium Oscillator**

Status: OK or Fault

The Rubidium Oscillator indicator reports “OK” when the Rubidium Oscillator is operating normally. It reports “Fault” when the Rubidium Oscillator is warming up or has a PLL fault.

Faults that occur during the warm up period after the unit is started up are not significant and can be prevented by extending the duration of the F73 Power-On Alarm Suppress feature.

Note: When using F73 in the front panel/display interface, the Rubidium Oscillator indicator is only present if the unit is equipped with a Rubidium Oscillator. Otherwise, this indicator is hidden.

**DAC**

Status: OK or Fault

The DAC indicator reports “OK” when the DAC that steers the GPS’s internal oscillator is operating normally.

The DAC indicator reports “Fault” when the DAC is operating at or near its limits. This can occur if the oscillator is near its aging rate, has been exposed to extreme temperatures, or if the reference source is intermittent, in error, or changes phase significantly.

If the DAC indicator reports a continuous fault, contact Manufacturer Global Customer Assistance. This indicator can be enabled for troubleshooting oscillator, environmental, and reference source problems.

**First Time Lock**

Status: OK or Fault

First Time Lock reports “OK” when the clock has locked one or more times since the unit was powered on. It reports a “Fault” if the clock has not locked once since the unit was powered on.

If this fault persists, contact Manufacturer Global Customer Assistance. While operating with a First Time Lock fault, all outputs from the GPS are unreliable and should not be used.

This indicator can be enabled for troubleshooting to determine if the unit locks at all during an extended testing period.

**Time Error and Time Threshold**

Status: OK or Fault Time Threshold sets a limit, measured in nanoseconds, for the GPS clock’s accumulated time error. While the accumulated time error remains below the Time Threshold limit, the Time Error indicator reports “OK”. If the accumulated time error exceeds the Time Threshold limit, the Time Error indicator reports fault. Typically, the GPS doesn’t experience Time Error faults while locked to a reference source and steering its oscillator. When GPS comes unlocked from its reference source(s) the system clock uses the internal oscillator to keep time. It also starts calculating an estimate of the worst case time error from the last reference. The length of time before this condition triggers a Time Error fault depends on the Time Threshold setting and type of internal oscillator, as well the DAC setting and the estimated worst case time error at the time the reference source became unavailable. The accumulated time error typically remains below the default values for the given reference source, but may exceed the Time Threshold for brief periods of time. These ‘excursions’ are usually non-critical and can be ignored. For this reason, it is good practice to set the Time Threshold at the maximum time error value that can be tolerated for each application.

The Timeout indicator and Timeout Delay setting can be used to suppress alarms that are caused by ‘excursions’ while still allowing more significant Time Error to trigger an alarm. If the reference source is GPS, Time Error should be set to 350 nS. For other reference source types, or for a mix of GPS and other reference source types, set Time Error to 15 μS.

**Note:** The accumulated error that drives this indicator is close to, but not the same as the predicted worst-case time error given by “F13 – Time Error” on page 65.

**Alarm LED Blink**

Alarm LED Blink is a setting that enables or disables the *Alarm Status LED* from blinking while it is green or yellow. If the Alarm Status LED is red, it remains on continuously, regardless of the Alarm LED Blink setting. Some users disable Alarm LED Blink to ensure that the color of the Alarm Status LED is visible without interruption.

**Timeout and Timeout Delay**

Status: OK or Fault

Timeout and Timeout Delay add the dimension of time to the *Time Error* indicator. With Timeout disabled, a Time Error fault triggers an alarm immediately. With Timeout enabled, a Time Error fault starts counting down the number of seconds specified by Timeout Delay. When the Timeout Delay countdown finishes, the Time Error fault triggers an alarm. (Note: the Alarm Status LED on the front panel turns amber while the Timeout Delay is counting down). If the Time Error fault returns to an OK state during the Timeout Delay countdown, the countdown clears. A new Time Error fault starts the Timeout Delay countdown from the beginning. In other words, Timeout Delay countdown does not keep track of the cumulative duration of multiple Time Error faults.

**Power-On Alarm Suppress**

The Power On Alarm Suppress setting prevents all F73 faults/alarms for a user-determined period of time after the GPS is started. The factory default setting is 300 seconds (five minutes). When that interval ends, current and new faults/alarms are reported normally. The operator may need to adjust this interval for options or operating conditions that require more time for the GPS to warm up after starting. Note that a system with a GPS reference will typically lock in less than 20 minutes.

**NTP**

Status: OK or Fault

Please note: This alarm indicator is only visible on the keypad/display interface when the NTP software option is installed and enabled.

The NTP indicator reports “OK” if the F13 Worst Case Error is under 1 mS. It reports “Fault” if the F13 Worst Case Error exceeds 1 mS. When the NTP indicator reports “Fault”, the NTP “leap indicator” value is set to:

• 3 - Alarm condition (the clock is not synchronized)

The other values for the system leap indicator field are:

• 0 - No warning (the clock is synchronized)

1 - Last minute has 61 seconds (the clock is synchronized and the last minute of the day will have an extra second)

• 2 - Last-minute has 59 seconds (the clock is synchronized and the last minute of the day will lose one second)

Note: When using F73 in the front panel/display interface, the NTP indicator is only present if the NTP option is installed. Otherwise, this indicator is hidden.

**Clear Alarm Latch**

Clear Alarm Latch does not report any errors.

Each F73 indicator has an Alarm Latch that is raised by a “Fault” or “Unlocked” condition. When the indicator returns to a *“Locked” or “OK”* state, the alarm latch remains raised. This is useful for identifying and troubleshooting transient alarms.

The operator typically decides to clear the alarm latch after attempting to fix the cause of some transient alarm so that new transient faults can be identified after they occur.

Note: An indicator must be *enabled* for the fault/unlock state to raise the latch state. If disabled, a fault or unlocked state will not raise the corresponding latch.

The keyboard/display interface shows the Alarm Latch as an asterisk next to an indicator, as follows:

GPS PRI OK ∗

ALARM ENABLED

Keypad

*Note:* The Alarm Latch asterisk is not the same as the “reference source unavailable” asterisk that can sometimes be seen on the STATUS display.

Command Line

To see the fault status of the alarm indicators, enter the following command:

**F73<CR>**

GPS replies:

F73<S>S<STATUS><SOURCE><S><123456789ABCDEFGHIJ><CR><LF>

where:

F = ASCII character F

7 = ASCII character 7

3 = ASCII character 3

<SP> = ASCII space character one or more.

<SEP> = one or more separators characters, space, tab, or comma.

S = ASCII character S, Status delimiter

<STATUS> = 'L' Locked

'U' Unlocked

<SOURCE> = 'A' Clock IRIG A

'B' Clock IRIG B

'N' lock NASA 36

'P' Clock Primary

'S' Clock Secondary

'R' Clock to Aux Ref

'F' None

1 = '-' PLL Synthesizer Locked

'C' PLL Synthesizer Unlocked

2 = '-' LPN PLL Locked

'L' LPN PLL Unlocked

3 = '-' Primary OK

'P' Primary Fault

4 = '-' Secondary OK

'S' Secondary Fault

5 = '-' IRIG OK

'I' IRIG Fault

6 = '-' Aux Ref OK

'A' Aux Ref Fault

7 = '-' Primary Power OK

'W' Primary Power Fault

8 = '-' Secondary Power OK

'w' Secondary Power Fault

9 = '-' Rb oscillator OK

'R' Rb oscillator Fault

A = '-' DAC OK

'X' DAC Fault

B = '-' First time lock OK

'a' Clock Status has locked since power on but still within the user defined power on time out

To see the states the Alarm Latches for all of the indicators, enter:

**F73<S>LATCH<CR>**

GPS replies:

F73<S>LATCH<SEP><123456789ABCDEFGHIJ><CR><LF>

To clear the Alarm Latches, enter:

**F73<S>CLEAR<SEP>ALARM<SEP>LATCH<CR>**

GPS replies:

OK

The command line uses a ‘mask’ to enable or disable each indicator’s alarm. To see which indicators are Alarm Enabled, enter:

**F73<S>MASK<CR>**

GPS replies:

F73<S>MASK<SEP>M<12346789ABCDEFGHIJ><CR><LF><LF>

where:

'A' Clock Status has not locked since power on

C = '-' Time error OK

'U' Time error Fault

D = '-' Timeout OK

'T' Timeout Fault

E = '-' NTP OK

'N' NTP Fault

F Future Use

G Future Use

H Future Use

I Future Use

J Future Use

‘E’ = enabled

‘D’ = Disabled

The following reference table identifies the indicators that correspond to each position in F73 mask syntax. Use this table when entering or reviewing MASK settings. This table also provides the factory default settings for a unit with one or two GPS receivers:

One GPS receiver Two GPS receivers

1 = PLL Synthesizer Alarm Enabled E E

2 = LPN PLL Alarm Enabled E E

3 = Primary Alarm Enabled E E

4 = Secondary Alarm Enabled D E

5 = IRIG Alarm Enabled D D

6 = Aux Ref Alarm Enabled D D

7 = Primary Power Alarm Enabled E E

8 = Secondary Power Alarm Enabled D D

9 = Rb Oscillator Alarm Enabled E E

A = DAC Alarm Enabled D D

B = First time lock Alarm Enabled E E

C = Time error Alarm Enabled E E

D = Time out Alarm Enabled E E

E = NTP Alarm Enabled (if NTP present) E E

F Future Use

G Future Use

H Future Use

I Future Use

J Future Use

Note: Alarm Mask provides a setting for LED BLINK. This is not an alarm on or off, but whether the alarm LED will blink or not. Also, the Rb Oscillator Alarm Enabled setting is available even if a Rubidium oscillator is not present.

To change the Alarm Enabled setting for each indicator, enter to E (Enable), D (Disable), or “-”

(Unchanged) using this format:

**F73<S>MASK<SEP><123456789ABCDEFGHIJ><CR>**

For example, to enter new mask settings, enter:

**F73 MASK DDE-EEEEEEEEEEDDDDD**

GPS replies:

OK

To verify the changes, enter:

**F73 MASK**

GPS replies:

**F73 MASK DDE-EEEEEEEEEEDDDDD**

To view the Time Threshold setting, enter:

**F73<S>THRESHOLD<CR>**

GPS replies:

F73<S>THRESHOLD<S><nanoseconds><S>ns<CR><LF>

where <nanoseconds> is the time error threshold in nS

To set a new Time Threshold, enter a new value for <nanoseconds> (Range 0 to 99,999 nS), as follows:

**F73<S>THRESHOLD<SEP><nanoseconds><CR>**

GPS replies:

OK<CR><LF>

To view Timeout Delay, enter:

**F73<S>TIMEOUT<CR>**

GPS replies:

F73<S>TIMEOUT<SEP><seconds><S>s<CR><LF>

To enter a new Time Delay, enter a value for <seconds> (Range 0 to 86,400 nS), as follows:

**F73<S>TIMEOUT<SEP><seconds><CR>**

GPS replies:

OK<CR><LF>

To enable LED Blink, enter:

**F73<S>BLINK<SEP> ENABLE<CR>**

GPS responds:

OK<CR><LF>

To disable LED Blink, enter:

**F73<S>BLINK<SEP> DISABLE<CR>**

To view the Power-On Alarm Suppress setting, enter:

**F73<S>SUPPRESS<CR>**

The GPS responds:

**F73 POWER-ON MINOR ALARM SUPPRESS 300**

To set a new Power-On Alarm Suppress value, enter the following string, replacing <SEC> with the number of seconds (Range 0 to 86,400 seconds), enter:

**F73 SUPPRESS <SEC>**

The GPS responds:

OK<CR><LF>

**F74 – Clock Source Control**

Use function F74 to select the primary and secondary reference sources and configure the fail-over sequences. The switching modes are:

• **PRI** or “Primary”: Ensures the unit remains connected to the primary source and doesn’t attempt to switch.

• **SEC** or “Secondary”: Ensures the unit remains connected to the secondary source and doesn’t attempt to switch.

• **PRI – SEC – SEC** or “Primary – Secondary – Secondary”: the clock synchronizes with the primary source. If the primary source becomes unavailable, it switches to the secondary source and stays there, even if the primary source becomes available again. It stays on secondary even if the secondary source becomes unavailable.

• **PRI – SEC – PRI** or “Primary – Secondary – Primary”: the clock synchronizes with the primary source. If the primary source becomes unavailable, it switches to the secondary source. When the primary source becomes available again, it switches back to the primary.

• **PRI – NSEC – PRI** or “Primary – No Secondary – Primary”: the clock synchronizes with the primary source. If the primary source becomes unavailable, it switches to the secondary source.

If the secondary source becomes unavailable, **AND** the primary is available, switches back to the primary.

The default setting is PRI for a single reference source and PRI-SEC-SEC for a dual reference source.

Clock source switching is affected by the setting in F73 Timeout. When a reference source becomes unavailable, or unlocked, the number of seconds set in F73 Timeout must elapse before the switch occurs. While the reference source is unavailable the clock relies on a frequency source, such as its own oscillator or Aux Ref, to keep time. (If Aux Ref is available and enabled, the GPS will use Aux Ref as its frequency source. See “F113 – J3 Input (Aux Ref, Freq Meas)” on page 151 for more information.) After the timeout has elapsed, the switching sequence begins. Note: the switching mode for time out takes place before each switch.

When a time reference becomes unavailable, the GPS switches to the other time reference, if available.

The configuration of the time reference (e.g., Primary or Secondary) and the settings in F74 – Clock Source Control (page 112) determine if and how switching takes place. If no other time reference is available, the GPS will use an Aux Ref frequency input on J3 (“F113 – J3 Input (Aux Ref, Freq Meas)”, page 151) as its reference. If references are available, the GPS “freewheels” on its internal oscillator.

Command Line

To display the current settings, enter:

**F74<CR>**

GPS responds, using the following format:

F74<S><CLK SOURCE><CR><LF>

where:

F = ASCII character F.

74 = function number.

<S> = Space

<CLK SOURCE> = Clock Source:

• PRI

• SEC

• PRI-SEC-SEC

• PRI-SEC-PRI

• PRI-NSEC-PRI

<CR> = carriage return character.

<LF> = line feed character.

For example, enter:

**F74<CR>**

GPS responds (example):

F74 PRI<CR><LF>

To select PRI-SEC-SEC as the new clock source/fail-over pattern, enter:

**F74 PRI-SEC-SEC<CR>**

GPS responds:

OK<CR><LF >

**F77 - PTTI Output Configuration**

The Precision Time and Time Interval (PTTI) with BCD/PPS/PPM Output option board status can be determined via the Serial or Network port using Function F77. Use Serial/Network Function F77 to obtain information about the part number and the current version of the FPGA installed on the PTTI with BCD/PPS /PPM option board. To obtain board status information, send the following string to the Serial/ Network port:

F77<SP>B<N><SEP>S<CR><LF>

where:

F = ASCII character F.

77 = function number.

<SP> = ASCII space character one or more.

B = ASCII character to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

S = ASCII character for “Status Request”

<LT> = line terminator; for output strings (a carriage return and line feed ) or for input strings (a carriage return only).

The GPS Serial/Network port will respond with a two-line replay for status request similar to the following example:

Sample request: F77 B2 S<CR><LF>

Response: F77 B2: <CR><LF>

PTTI OUTPUT PART NUMBER 87-8045<CR><LF>

FPGA 230-01510-37v01<CR><LF>

To obtain the PTTI Output option board BCD Time Mode information, send the following string to the

Serial/Network port:

F77<SP>B<N><SEP>TM<CR><LF>

where:

F = ASCII character F.

77 = function number.

<SP> = ASCII space character one or more.

B = ASCII character to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

TM = ASCII character for TM selection request

<LT> = line terminator; for output strings (a carriage return and line feed ) or for input strings (a carriage return only).

Sample request: F77 B2 TM<CR><LF>

Response: F77 B2 TM LOCAL <CR><LF>

To change the PTTI Output option card BCD Time Mode selection, send the following send the following string to the Serial/Network port:

F77<SP>B<N><SP>TM<SP><OUT><LT>

where:

F = ASCII character F.

77 = function number.

<SP> = ASCII space character.

B = ASCII character to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

TM = ASCII character to denote “Time Mode” selection.

<OUT>= UTC, LOCAL, STANDARD or GPS.

<LT> = line terminator; for output strings (a carriage return and line feed ) or for input strings (a carriage return only).

Sample entry: F77 B2 TM LOCAL<CR>

Response: OK<CR><LF>

To obtain the PTTI Output option board BCD output format information, send the following string to the

Serial/Network port:

F77<SP>B<N><SEP>BCD<CR><LF>

where:

F = ASCII character

77 = function number.

<SP> = ASCII space character one or more.

B = ASCII character to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

BCD = ASCII character for BCD output format request

<LT> = line terminator; for output strings (a carriage return and line feed ) or for input strings (a carriage return only).

Sample request: F77 B2 BCD<CR><LF>

Response: F77 B2 BCD ABBREV <CR><LF>

To change the PTTI BCD output selection, send the following send the following string to the Serial/

Network port:

F77<SP>B<N><SP>BCD<SP><OUT><LT>

where:

F = ASCII character F.

77 = function number.

<SP> = ASCII space character.

B = ASCII character to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

BCD = ASCII character to denote “Binary Coded Decimal” selection.

<OUT>= FULL or ABBREV. For definitions see PTTI BCD Output (87-8045)

<LT> = line terminator; for output strings (a carriage return and line feed ) or for input strings (a carriage return only).

Sample entry: F77 B2 BCD ABBREV<CR>

Response: OK<CR><LF>

*Note:* Note: The PTTI output signal may stop for one second when the output format is changed.

**F78 - Parallel BCD Output Configuration**

The Parallel BCD Output option board status can be determined via the Serial or Network port using

Function F78. Use Serial/Network Function F78 to obtain information about the part number and the current version of the FPGA installed on the Parallel BCD Output option board. For more information on the option cards that use this function:

• see “Parallel BCD mSec Output with Time Quality (87-8090)” on page 207

• see “Parallel BCD uSec with Time Quality (87-8090-1)” on page 210

• see “Parallel BCD mSec Output with Unlock Status (87-8090-2)” on page 213

To obtain board status information, send the following string to the Serial/Network port:

F78<SP>B<N><SEP>S<CR><LF>

where:

F = ASCII character F.

78 = function number.

<SP> = ASCII space character one or more.

B = ASCII character to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

S = ASCII character for “Status Request”

<LT> =line terminator; for output strings (a carriage return and line feed ) or for input strings (a carriage return only).

The GPS Serial/Network port will respond with a two-line replay for status request similar to the following example:

Sample request: F78 B2 S<CR><LF>

Response: F78 B2: <CR><LF>

PARALLEL BCD PART NUMBER 87-8090<CR><LF>

FPGA 230-01510-38v01<CR><LF>

To obtain the Parallel BCD Output option board BCD Time Mode information, send the following string to the Serial/Network port:

F78<SP>B<N><SEP>TM<CR><LF>

where:

F = ASCII character

78 = function number.

<SP> = ASCII space character one or more.

B = ASCII character to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

TM = ASCII character for TM selection request

<LT> = line terminator; for output strings (a carriage return and line feed ) or for input strings (a carriage return only).

Sample request: F78 B2 TM<CR><LF>

Response: F78 B2 TM LOCAL <CR><LF>

To change the Parallel BCD Output option card BCD Time Mode selection, send the following send the following string to the Serial/Network port:

F78<SP>B<N><SP>TM<SP><OUT><LT>

where:

F = ASCII character F.

78 = function number.

<SP> = ASCII space character.

B = ASCII character to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

TM = ASCII character to denote “Time Mode” selection.

<OUT>= UTC, LOCAL, STANDARD or GPS.

<LT> = line terminator; for output strings (a carriage return and line feed ) or for input strings (a carriage return only).

Sample entry: F77 B2 TM LOCAL<CR>

Response: OK<CR><LF>

Response: OK<CR><LF>

To obtain the Parallel BCD option board test mode information, send the following string to the Serial/

Network port:

F78<SP>B<N><SEP>TEST<CR><LF>

where:

F = ASCII character

78 = function number.

<SP> = ASCII space character one or more.

B = ASCII character to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

TEST = ASCII character for test mode request

<LT> = line terminator; for output strings (a carriage return and line feed ) or for input strings (a carriage return only).

Sample request: F78 B2 TEST<CR><LF>

Response: F78 B2 TEST DISABLE <CR><LF>

To change the Parallel BCD test mode selection, send the following send the following string to the

Serial/Network port:

F78<SP>B<N><SP>TEST<SP><SEL>

where:

F = ASCII character F.

78 = function number.

<SP> = ASCII space character.

B = ASCII character to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

TEST = ASCII character to denote test mode selection.

<SEL> = ENABLE or DISABLE.

<LT> = line terminator; for output strings (a carriage return and line feed ) or for input strings (a carriage return only).

Sample entry: F78 B2 TEST ENABLE<CR>

Response: OK<CR><LF>

The Serial/Network port will respond with the message “ERROR 01 VALUE OUT OF RANGE” if the input string was in the correct format but contained a value, probably numeric, that was out of the range of acceptable values.

The Serial/Network port will respond with the message “ERROR 02 SYNTAX” if it receives a string in an incorrect format.

The Serial/Network port will respond with the message “ERROR 03 BAD/MISSING FIELD” if the input string lacks a required field.

The Serial/Network port will respond with the message “ERROR 04 BAD DATA / TIMEOUT

CONDITION” if option card does not respond to the GPS fast enough. Re-enter the command to receive the data.

**F90 – Code Output Configuration**

Use function F90 to configure the time code output format (IRIG-A, IRIG-B, IRIG-B120 IEEE 1344 or NASA 36) and modulation type (AM or DC) on the GPS’s standard CODE output.

The factory settings for F90 are IRIG-B and AM. Although the factory configuration outputs UTC time in 24-hour format, the following can be used to modify the code output of F90 for non-standard applications:

• “F2 – 12/24 Hour Format” on page 53 selects between a 12 or 24-hour time format.

• “F69 – Time Mode” on page 94 selects between the following timescales: Local, Standard, GPS,

UTC, and TAI.

Command Line

To display the current settings, enter:

**F90<CR>**

GPS responds using the following format:

F90<S><CODE OUTPUT><TYPE><CR>

where:

F = ASCII character F.

90 = function number.

<S> = Space

<CODE OUTPUT> = IRIG-A, IRIG-B, IRIG-B120 1344, NASA 36

<TYPE> = AM, DC

<CR> = carriage return character.

<LF> = line feed character.

For example, enter:

**F90<CR>**

GPS responds (example):

F90 IRIG-B AM<CR><LF>

To change the Code Output selection enter:

**F90 IRIG-B DC<CR>**

GPS responds:

OK<CR><LF>

Sample request for Time Code Out with IEEE 1344 extensions: F90<CR>

Response: F90 IRIG-120 1344

To enter the Code Output selection, send the following character string to the Serial/

Network port:

Sample entry: F90<SP>IRIG-B DC<CR>

Response: OK<CR><LF>

To enter the Code Output selection for Time Code with IEEE 1344 extensions, send the following character string to the Serial/Network port:

F90<SP><CODE OUTPUT><CR>

where:

F = ASCII character F.

90 = function number.

<SP> = space

<CODE OUTPUT> = IRIG-B120 1344 or IRIG-B000 1344

<CR> = carriage return character.

<LF> = line feed character.

Sample entry: F90<SP>IRIG-B120 1344<CR>

Response: OK<CR><LF>

The Serial/Network port will respond with the message “ERROR 01 VALUE OUT OF RANGE” if the input string was in the correct format but contained a value, probably numeric, that was out of the range of acceptable values.

The Serial/Network port will respond with the message “ERROR 02 SYNTAX” if it receives a string in an incorrect format.

The Serial/Network port will respond with the message “ERROR 03 BAD/MISSING FIELD” if the input string lacks a required field.

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**F100 – Network Port Configuration & GPS Firmware**

F100 provides two groups of commands:

• Group 1, available through the keypad/display and the command line, provides access to network port settings and hardware/Firmware status information.

• Group 2, available through the command line only, provides commands for changing system firmware, changing NTP & SNMP parameters, changing the user name/password, resetting the unit, and pinging other network devices.

**Warning**: The F100 commands have the capacity to remove the GPS from the network and disable the GPS’s system firmware. Use judiciously.

**Reboot Warning**: Saving changes to any F100 parameter using the keypad/display will reboot the GPS. Some of the F100 command line commands also reboot the GPS. These are identified in the following documentation.

***Group 1***

You can use both the keypad/display and the command line interface to access the following parameters:

• **Ethernet address:** GPS contains a unique Ethernet or Media Access Control (MAC) address comprised of a unique number assigned to the manufacturer, and a unique number assigned to the unit. This is factory set and cannot be changed.

• **IP Address**: Sets a static Internet Protocol (IP) address for the unit.

• **Subnet Mask**: Sets a valid subnet-mask used in IP addressing. Subnetting allows for the more efficient allocation of network addresses and management of network traffic.

• **Default Gateway**: The address of the router that handles packets addressed to IP devices outside the local-area network.

• **10 100 BASE-T**: View network port setting: 10 or Auto (100 Base-T if available).

• **Remote Lockout**: Enables or disables TELNET access through the GPS’s standard network port.

Enabling Remote Lockout limits users to the front-panel keypad, Serial I/O port, or the web interface (HTTP).

• **Flash CRC**: Status - Passed or failed.

• **RAM**: Status - Passed or failed.

• **Serial**: Status - Passed or failed.

• **Version Test**: Status - Passed or failed

The following table gives the command line equivalents for each of the preceding parameters:

**Description “F100” followed by: Comments**

Ethernet address

(MAC address)

EA Displays information

IP Address IP Displays, configures and reboots

Subnet Mask SM Displays, configures and reboots

Default Gateway G Displays, configures and reboots

IP Address, Subnet Mask, and Default Gateway

IC Displays several IP parameters

10 100 BASE-T BASET Displays network port setting

Remote Lockout L (for status), LOCK, UNLOCK Displays and configures

Flash CRC ST Displays information

RAM ST Displays information

Serial ST Displays information

Version Test (NVRAM Ver) ST Displays information

***Group 2***

The following expanded command set is available through the command line interface:

**Description “F100” followed by: Comments**

Burn Host BH Configure

Burn BU Commit action

Burn Bootloader BUB Commit action

Burn Filesystem BF Commit action

Burn FPGA BUFP Commit action

Configure NTP & SNMP Parameters CONFIG Move files

Factory Mode Jumper J Display only

Reboot K I L L Commit action – reboot the GPS

Change User Password P Configure

Ping PI Commit action

Change User Name PN Commit action

You can reconfigure two or more network parameters in a single entry by sending the F100 command and entering new values. Leading zeros may be omitted when entering IP Address, Subnet Mask, and Default Gateway. Any field may be omitted and order is not significant. Blanks are allowed on either side of a colon. The unit reboots after any network parameter is changed.

**F100 EA – Ethernet Address**

Use function F100 EA to display the Ethernet Address (MAC Address) (**Note**: An Ethernet or MAC

Address is not the same thing as an IP Address), a fixed, six-byte, hexadecimal value specific to the unit’s standard network port. The first three bytes are registered to Manufacturer Inc.; the last three bytes are the hex value identifying the network port.

To display the Ethernet address of the unit standard network port, enter:

**F100 EA<CR>**

The GPS responds:

F100 EA:00-A0-69-xx-xx-xx<CR><LF>

where “00-A0-69” is the portion of the address assigned to the manufacturer, and “xx-xx-xx” is unit’s unique address (in hexadecimal).

An example of the response is:

F100 EA:00-A0-69-99-00-37

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

**F100 IP – IP Address**

Use function F100 IP to display or change the unit’s IP Address.

Use the following format to display the IP address:

**F100<S>IP<CR>**

Use the following format to set the IP address and restart the unit, enter:

**F100<S>IP<S><nnn.nnn.nnn.nnn><CR>**

where:

F = ASCII character F

100 = unit function number

<S> = space

IP = specify IP command

<nnn.nnn.nnn.nnn> = dotted decimal address (0 to 255)

<CR> = input line terminator

For example, enter:

**F100 IP 206.54.0.21<CR>**

GPS responds:

OK<CR><LF>

RESETING THE UNIT<CR><LF>

PLEASE WAIT…<CR><LF>

To obtain the IP address of the unit Standard network port, enter:

**F100 IP<CR>**

The GPS responds (example):

F100 IP 206.54.0.21<CR><LF>

The three commands, F100 IP, F100 SM, and F100 G, can be concatenated to set all three values simultaneously. To do so use the following format:

**F100<S>IP<S><nnn.nnn.nnn.nnn><S>SM<S><nnn.nnn.nnn.nnn><S>G<S><nnn.nnn.nnn.nnn><CR>**

*Note:* The three commands (i.e., IP, SM, G) can be used in any order relative to each other. A colon separator “:” can be used instead of <S> following IP, SM, and G (e.g., IP:192.168.46.150)

For example, using appropriate values for your network, enter something similar to:

**F100 IP 192.169.46.150 SM:255.255.255.0 G 192.168.46.1<CR>**

GPS responds:

OK<CR><LF>

RESETING THE UNIT<CR><LF>

PLEASE WAIT…<CR><LF>

**F100 SM – Subnet Mask**

*Note:* F100 SM can be used concurrently with F100 IP and F100 G. See the last example provided in the F100 IP – IP Address section, directly above this one.

Use function F100 SM to display or configure the Subnet Mask. To set the Subnet Mask and restart the unit, enter:

**F100<S>SM<S><nnn.nnn.nnn.nnn><CR>**

where:

F = ASCII character F

100 = unit function number

<S> = space

IP = specify IP command

<nnn.nnn.nnn.nnn> = dotted decimal address (0 to 255)

<CR> = input line terminator

For example, enter:

**F100 SM 255.255.255.240<CR>**

GPS responds:

OK<CR><LF>

RESETING THE UNIT<CR><LF>

PLEASE WAIT…<CR><LF>

To obtain the Subnet Mask of the unit Standard network port, enter:

**F100 SM<CR>**

The GPS responds:

F100 SM <nnn.nnn.nnn.nnn><CR><LF>

where “<nnn.nnn.nnn.nnn>” is the dotted decimal address notation.

An example of the response is:

F100 SM:255.255.255.125<CR><LF>

**F100 G – Gateway**

*Note:* F100 G can be used concurrently with F100 IP and F100 SM. See the last example provided in the F100 IP – IP Address section, which starts on page 125.

Use function F100 G to display or configure the Default Gateway. To set the Default Gateway and restart the unit, enter:

**F100<S>G<S><nnn.nnn.nnn.nnn><CR>**

where:

F = ASCII character F

100 = unit function number

<S> = space

IP = specify IP command

<nnn.nnn.nnn.nnn> = dotted decimal address (0 to 255)

<CR> = input line terminator

For example, enter:

**F100 G 206.54.0.17<CR>**

GPS responds:

OK<CR><LF>

RESETING THE UNIT<CR><LF>

PLEASE WAIT…<CR><LF>

To obtain the Default Gateway of the unit Standard network port, enter:

**F100 G<CR>**

The GPS responds:

F100 G <nnn.nnn.nnn.nnn><CR><LF>

where “<nnn.nnn.nnn.nnn>” is the dotted decimal address notation.

An example of the response is:

F100 G:206.54.0.1<CR><LF>

**F100 IC – Network Port Settings**

Use function F100 IC to review the entire configuration of the standard network port, enter:

**F100<S>IC<CR>**

An example of the response is:

F100 IP:206.54.0.21 SM:255.255.255.240 G:206.54.0.17<CR><LF>

**F100 BASET – 10/100 BASE- T**

The BASET command displays the data rate of the Ethernet port. On the current version of the Main CPU card (86-8000) running the current system software version, the user also has the option of selecting between 10 Base-T and Auto, which provides a 100 Base-T connection where appropriate. If you have questions about your unit, contact H: Sales and Customer Assistance (page 305).

To display the current Base-T setting, enter:

**F100<S>BASET<CR>**

Where

F = ASCII character F

100 = unit function number

<S> = Space

BASET = specify Base-T command

<CR> = input line terminator

The GPS responds:

F100 BASET 10T<CR><LF>

To set the Ethernet port to automatically negotiate the maximum connection speed, enter:

**F100<SP>BASET<SP>AUTO<Enter>**

To set the Ethernet port’s connection speed to 10/100 Base-T, enter:

**F100<SP>BASET<SP>10<Enter>**

GPS responds:

OK <CR><LF>

RESETING THE UNIT<CR><LF>

PLEASE WAIT…<CR><LF>

**F100 L/LOCK/UNLOCK – Remote Lockout**

Use function F100 LOCK or UNLOCK to enable/disable TELNET access to the command line interface through the network port. Use function F100 L to display the status of Remote Lockout. Remote Lockout can also be set using F100 on the keypad/display interface. The factory setting is “Unlocked”. To unlock remote lockout, use the keypad/display, the serial port command line interface.

*Warning:* **F100 L and F100 LOCK terminates any active TELNET sessions and prevents future TELNET sessions. To unlock F100 L or F100 LOCK, use the serial port command line interface or the keypad display.**

To lock the unit from a remote location, enter:

**F100 LOCK<CR>**

where:

For example, enter:

**F100 LOCK<CR>**

To users on the serial port, GPS responds:

OK<CR><LF>

Or, to users on the network port, GPS gives the following response and then closes the port:

GOODBYE. <CR><LF>

To unlock remote lockout, use the command line interface on the serial port to enter:

**F100 UNLOCK<CR>**

Or use the keypad/display’s F100.

**F100 L – Remote Lockout**

Command Line Only – Not available in display.

Use function F100 L to display the status of the remote lock. For more information, see F100 LOCK above.

To view the lock setting for remote access, enter:

**F100 L<CR>**

where:

F = ASCII character F

100 = unit function number

<S> = space

LOCK = specify LOCK command

<CR> = input line terminator

F = ASCII character F

100 = unit function number

<S> = space

L = specify L command

<CR> = input line terminator

GPS responds:

F100 L LOCKED<CR><LF>

or

F100 L UNLOCKED<CR><LF>

**F100 ST – Self Test Status**

Use function F100 ST to display whether the Self Test Status parameters passed or failed. The parameters include: flash-memory checksum test, nonvolatile (NV) RAM, Serial Port, and version check.

To query the self-test status, enter:

**F100<S>ST<CR>**

where:

F = ASCII character F

100 = unit function number

<S> = space

ST = specify ST command

<CR> = input line terminator

The GPS responds:

F100<S>ST<S>FLASH/CRC:<S><STATUS>,<S>RAM:<S><STATUS>,<S>SERIAL:<S><STATUS>,

<S>NVRAM<S>VER:<S><STATUS><CR><LF>

where:

F = ASCII character F

100 = Unit function number

<S> = Space

ST = Specify ST command

FLASH/CRC: = Specify flash checksum result

RAM: = Specify RAM test result

SERIAL: = Specify Serial Port test result.

NVRAM VER: = Specify version test result. This test compares the version of the code against the version recorded in Non-Volatile memory

<STATUS> = Is either ASCII PASS or FAIL

, = ASCII comma

: = ASCII colon

<CR><LF> = Output line terminator

An example of the response is:

F100 ST FLASH/CRC : PASS, RAM : PASS, SERIAL : PASS, NVRAM VER : PASS<CR><LF>

**F100 BH – Burn Host**

*Note:* Manufacturer recommends using the web Interface (versus F100 commands) as the most convenient method for upgrading GPS firmware.

Use function F100 BH, when upgrading firmware, to select the FTP host and the file to be transferred.

To select the FTP host and file for upgrading, enter:

**F100 BH <FTP HOST IP ADDRESS><S><UPGRADE FILE PATH>/<FILE NAME><CR>**

Use UNIX style forward slashes ‘/’ in path and do not describe the drive (for example, ‘C’) in the path.

For example:

**F100 BH 10.1.7.20 truetime/GPS/192-8001.bin<CR>**

The GPS responds:

BURN HOST IS READY!!!<CR><LF>

**F100 BUB – Burn BootLoader**

*Note:* See “B: Upgrading System Firmware” on page 249.

When upgrading the system firmware, use function F100 BUB to burn the BootLoader, to write the

BootLoader to flash memory.

To write the BootLoader to the flash, send the F100 BH command with the FTP host, file path and name, and then enter:

**F100 BUB<CR>**

GPS responds:

OK<CR><LF>

For example:

>f100 bub

OK

BURNING FILE 192-8000.bt WITH SIZE 452164 TO PARTITION:0 SECTOR:0

SEC: 0 RE: 0

SEC: 1 RE: 0

SEC: 2 RE: 0

SEC: 3 RE: 0

SEC: 4 RE: 0

SEC: 5 RE: 0

SEC: 6 RE: 0

FLASH SUCCESSFULLY PROGRAMMED CRC32 = 0x9EFBE60A

If more than ten flash sectors are written during this process, you must rewrite both the bootloader sectors (0 to 9) and the program binary sectors (10 to 93).

**F100 BU – Burn**

*Note:* See “B: Upgrading System Firmware” on page 249.

Use function F100 BH when upgrading firmware, to write the file selected with F100 BH to the flash memory. Flash memory is checked to ensure that the correct file is used.

To write the file to the flash, send the F100 BH command with the FTP host, file path and name, and then enter:

**F100 BU<CR>**

GPS responds:

OK<CR><LF>

And, for example, displays the following text:

>f100 bu

OK

BURNING FILE 192-8001.bin WITH SIZE 803016 TO PARTITION:1 SECTOR:10

SEC: 10 RE: 0

SEC: 11 RE: 0

SEC: 12 RE: 0

SEC: 13 RE: 0

SEC: 14 RE: 0

SEC: 15 RE: 0

SEC: 16 RE: 0

SEC: 17 RE: 0

SEC: 18 RE: 0

SEC: 19 RE: 0

SEC: 20 RE: 0

SEC: 21 RE: 0

SEC: 22 RE: 0

FLASH SUCCESSFULLY PROGRAMMED CRC32 = 0x2D9A260A

**F100 BF – Burn File System**

*Note:* See “B: Upgrading System Firmware” on page 249.

Use function F100 BF to burn file system when upgrading firmware, to write a file system to the flash memory.

To write the file system to the flash, send the F100 BH command with the FTP host, file path and name, and then enter:

**F100<S>BF<CR>**

GPS responds:

OK<CR><LF>

For example:

>f100 bf

OK

BURNING FILE 192-8002.fs WITH SIZE 2096640

SEC: 94

SEC: 95

SEC: 96

SEC: 97

SEC: 98

SEC: 99

SEC: 100

SEC: 101

SEC: 102

.

.

.

SEC: 125

FILE SYSTEM FLASH BURN COMPLETED

**F100 BUFP – Burn FPGA Firmware**

*Note:* See “B: Upgrading System Firmware” on page 249.

F100 BUFP - Burn FPGA firmware from host to target flash

Use Serial/Network port F100 BUFP when upgrading FPGA firmware - to write the FPGA program file selected with F100 BH to the flash memory. Prior to issuing the F100 BUFP command, the host computer must be setup as an FTP server with the new FPGA program file stored on the FTP server.

The existence of the FPGA program file on the FTP server and an Ethernet connection is checked when the command is issued.

To write the FPGA program to the flash, send the F100 BH command with the FTP host, file path and name, and then send the following command:

**F100 BUFP<Enter>**

This command is only valid for GPS with an 86-8000 Rev. G or higher CPU board. If the CPU board is of the wrong version, an error message “ERROR: INVALID COMMAND!” will be displayed.

This command is valid only via the command line interface in the following scenarios: (1) the terminal is communicating to the GPS directly via the serial port, or (2) the terminal is connected to the GPS network port and the user is logged in as an “operator”. If the terminal is connected to the GPS network port and the user is logged in as a “guest”, this command will be deemed invalid and an error message, “ERROR: ACCESS DENIED!” will be displayed.

Prior to burning the FPGA program to the target flash, another error checking step is performed. The new FPGA program size is checked against the designated memory sector in the target flash. If the memory sector is not big enough to store the FPGA program, the command will be aborted, an error message, “FILE FN, EXT (yyy BYTES) TOO LARGE FOR PARTITIONING (zzz BYTES), LOAD ABORTED” will be displayed, and the new program will not be loaded to the flash.

After all the requirements for burning the FPGA program are met, GPS will proceed to burn the FPGA program from the FTP host computer to the target flash by responding with the following output string.

OK<CR><LF>

Then, during the file burning process, output strings will be displayed on the terminal to provide status to the operator. The following is an example of a successful F100 BUFP command execution.

BURNING FILE 184-8000.bin WITH SIZE 97652 TO PARTITION:3 SECTOR:10

FILE: 97652 BYTES, PARTITION: 393204 BYTES (24% used)

SEC: 10 RE: 0

SEC: 11 RE: 0

FLASH SUCCESSFULLY PROGRAMMED

To load the FPGA program from the target flash to the FPGA, a reboot of the GPS is required for the new FPGA program to take effect. The GPS can be rebooted via power cycle or by issuing the F100 K I L L command on the serial port interface.

**F100 CONFIG – Configure NTP & SNMP**

**Note: Manufacturer recommends using the Web Interface (versus than F100 CONFIG) as the most convenient method for editing the SNMP and NTP configuration files.**

*Notes:*

• See “A: Using F100 Configuration” on page 245.

• NTP is an optional feature. If purchased at the same time as the GPS, it comes enabled on the system. To purchase this option after you have purchased the GPS, contact Manufacturer Sales.

See “H: Sales and Customer Assistance” on page 305.

F100 CONFIG GET instructs the GPS unit to transfer its NTP and SNMP configuration files to an FTP server. After editing the NTP and SNMP configuration files on the FTP server, the user transfers them back to the GPS using the F100 CONFIG SET command.

Open a Telnet session with the GPS and enter the commands below. Replace <*IP Address*> with that of the workstation/FTP Server. Leave *<subdir>* blank (unless you have a specific reason for placing the files in a subdirectory of the anonymous user’s home directory). To get the NTP config files, type:

**>f100 config ntp get host:<*IP Address*> dir:<*subdir*><CR>**

To get the SNMP config file, type:

**>f100 config snmp get host:<*IP Address*> dir:<*subdir*><CR>**

To get both the SNMP and NTP config files, type:

**>f100 config ntp snmp get host:<IP Address> dir:<subdir><CR>**

Here’s an example of a successful SNMP and NTP config file transfer:

>f100 config ntp snmp get host:192.168.0.1 dir:

Host config ip 192.168.0.1 already configured

Source file /config/snmp.conf bytes read: 1275

Dest file snmp.conf bytes written: 1275

Source file /etc/ntp.conf bytes read: 1166

Dest file ntp.conf bytes written: 1166

Source file /etc/ntp.keys bytes read: 44

Dest file ntp.keys bytes written: 44

Configuration files transferred successfully!

*Note:* The following steps cause the GPS to reboot.

Using the command line, enter the commands, replacing <*IP Address*> with the workstation/FTP server’s IP address.

To move the NTP config files back onto the GPS, type:

**>f100 config ntp set host:<*IP Address*> dir:<*subdir*><CR>**

To move the SNMP config file back onto the GPS, type:

**>f100 config snmp set host:<IP Address> dir:<subdir><CR>**

To move the NTP and SNMP config files back onto the GPS, type:

**>f100 config ntp snmp set host:<IP Address> dir:<subdir>**

Here’s an example of a successful SNMP and NTP config file transfer:

>>f100 config set ntp snmp host:192.168.0.1 dir:

Host config ip 192.168.0.1 already configured

Are you sure(y/N)?y

Source file snmp.conf bytes read: 1275

Dest file /config/snmp.conf bytes written: 1275

Source file ntp.conf bytes read: 1166

Dest file /etc/ntp.conf bytes written: 1166

Source file ntp.keys bytes read: 44

Dest file /etc/ntp.keys bytes written: 44

Configuration files transferred successfully!

Resetting...

After GPS receives the configuration files, it reboots, and goes through the normal startup process.

**F100 J – Factory Mode Jumper**

Use function F100 J command to test the state of the ‘factory mode’ jumper. A value of 1 means the jumper is installed and a value of 0 means the jumper is not. The factory mode jumper can be identified because it is the only three-prong jumper on the CPU card, and is labelled “J3”.

Units are shipped to the customer with no jumper installed. The jumper is used by Manufacturer technicians to test and configure the unit. With this jumper installed, the operation and integrity of the GPS are compromised.

*Warning:* **Do not run the GPS with the jumper, unless specifically directed to do so by a qualified**

**Manufacturer technician.**

To test the state of the factory mode jumper:

**F100<S>J<CR>**

where:

F = ASCII character F

100 = unit function number

<S> = space

J = specify User Name command

<CR> = input line terminator

The GPS responds:

F100 J FACTORY MODE=1<CR><LF> Or F100 J FACTORY MODE=0<CR><LF>

**F100 K I L L – Reboot**

Use function F100 K I L L to reboot the unit. Use F100 K I L L after upgrading the system firmware.

K I L L is a case-sensitive command. When entering this command, ***use all capital letters*** and ***put spaces between each letter***.

To reboot the unit, enter:

**F100 K<S>I<S>L<S>L<CR>**

For example:

**F100 K I L L<CR>**

GPS responds:

OK <CR><LF>

RESETING THE UNIT<CR><LF>

PLEASE WAIT…<CR><LF>

In a network port session, rebooting the GPS terminates the network port session; open a new network port session when the GPS has finished rebooting. In a serial port session, the GPS displays text *similar* to the following example when the GPS has finished rebooting and is ready to receive additional commands:

>SYSTEM POWER ON SELF TEST RESULTS:

SERIAL LOOPBACK TEST PASSED.

RAM TEST PASSED.

PROG CRC TEST PASSED

NETWORK INTERFACE 192-8001 (c) 1998 - 2008 MANUFACTURER

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FLASH FILE SYSTEM MOUNTED.

SOURCE FILE /config/truetime.conf BYTES READ: 1210

FILE SYSTEM REV # 1.80

SCAN\_FOR\_OPT\_CARD BEGINS.

FOUND @ ADDR 30004000H, ID NUM= 86H

SCAN\_FOR\_OPT\_CARD ENDS.

INSTALL\_SMART\_OPTIONS BEGINS.

FOUND GPS CARD; QTY=1, ID#=8013H.

INSTALL\_SMART\_OPTIONS ENDS.

QUERYING FOR MANUFACTURER DEVICE. PLEASE WAIT...

MANUFACTURER GPS DEVICE.

GPS

INITIALIZATION SUCCESSFULLY COMPLETED.

>

**F100 P – Change User Password**

Use function F100 P to change a user password. In a network port session, F100 P changes the password of the user you logged in as; *operator* or *guest*. In a serial port session, F100 P changes the password of the *operator* user. See “Command Line Interface” on page 42.

Valid password size is from no characters to 64 characters. If more than 64 characters are entered, F100 P truncates the string to 64 characters. When selecting a password, use appropriate levels password security for the GPS’s operating environment. Examples include:

• Mixing random alpha and numeric characters

• Avoiding words or word combinations that can be found in a dictionary

To change the user password, enter:

**F100<S>P<CR>**

where:

F = ASCII character F

100 = unit function number

<S> = space

P = specify Password command

<CR> = input line terminator

The GPS responds:

ENTER NEW USER PASSWORD:

When you enter the new password, the GPS responds:

CONFIRM NEW USER PASSWORD:

Enter the same new password again, to confirm the spelling. If the same new password has been entered twice, The GPS responds:

OK<CR><LF>

In this case, the new password will be used for the next login. However, if the new password is entered differently the second time, The GPS responds:

ERROR: DO NOT MATCH. NEW PASSWORD REJECTED.

**F100 PI – PING**

Use function F100 PI to ping a remote host to see if it is reachable. If no IP Address is provided, F100 PI uses the GPS’s own IP Address, and tests whether the GPS’s network port has a good network connection.

To ping a known host, enter:

**F100 PI<S><IP Address><CR>**

For example:

**F100 PI 206.254.000.021<CR>**

The unit responds (example):

PING 206.254.000.021: REMOTE HOST FOUND.<CR><LF>

or

PING 206.254.000.021 : REMOTE HOST NOT FOUND.<CR><LF>

To test if the GPS’s network port has a good connection, enter the following using in a serial port session:

**>f100 PI<CR>**

The GPS responds:

PING : REMOTE HOST FOUND.<CR><LF>

or it responds:

PING : REMOTE HOST NOT FOUND.<CR><LF>

**F100 PN – Change User Name**

Use function F100 PN to change a user name. In a network port session, F100 PN changes the name of the user you logged in as; *operator* or *guest*. In a serial port session, F100 PN changes the name of the *operator* user. See “Command Line Interface” on page 42.

To change the user name, enter:

**F100<S>PN<CR>**

where:

F = ASCII character F

100 = unit function number

<S> = space

PN = specify User Name command

<CR> = input line terminator

The GPS responds:

ENTER NEW USER NAME:

When you enter a new user name, The GPS responds:

CONFIRM NEW USER NAME:

Enter the same new user name again, to confirm the spelling. If the same new user name has been entered twice, The GPS responds:

OK<CR><LF>

In this case, the new user name will be used for the next login using the command line interface.

However, if the new user name is entered differently the second time, The GPS responds:

ERROR: USER NAMES DO NOT MATCH. NEW USERNAME REJECTED!<CR><LF>

In this case, the old user name will be used for the next login using the command line interface.

If you have forgotten the operator or guest user name and/or password, use “Bootloader Mode” to change them. In Bootloader Mode, log in using the default user names (“operator”,”guest”) and (See “Using the Command Line Interface” on page 28.). Then use F100 PN and F100P to set the new user names and . Once this has been completed, reboot the unit and log in using the new username or password. See “F100 P – Change User Password” on page 139.

***Bootloader Mode***

To enter Bootloader Mode when resetting a forgotten user name (F100 PN) or password (F100 P):

• Reboot the GPS using the F100 K I L L – Reboot command.

• Immediately press the MENU key on the keypad and hold down while the GPS is rebooting. The

GPS display will ‘hang’ while displaying “BOOTING”.

• After a few moments, release the MENU key.

• Open a command line session with the GPS.

• Use the F100 PN or F100 P commands as needed and then reboot the GPS again.

**F108 – Oscillator Configuration**

Use function F108 to display the type of oscillator being used:

• TCVCXO

• OCXO

• HIGH (High Stability OCXO)

• RUBIDIUM

For more descriptions of the oscillator types, see “P7: Oscillators” on page 231.

Command Line

The oscillator type is defined by the hardware configuration of the clock, and is not configured through the command line or keypad/display user interfaces. To request the oscillator configuration, enter:

**F108<S><CR>**

The GPS responds:

F108<S>OSCILLATOR<S>CONFIG<S><OSC><CR><LF>

where:

F = ASCII character F

108 = Function number

<S> = ASCII space character one or more

<CR> = Carriage Return, equivalent to pressing the Enter key on a keyboard

<OSC> = Oscillator type: TCVCXO, OCXO, HIGH\_STAB\_OCXO), or RUBIDIUM

For example, enter the following string:

F108<CR>

The GPS responds (example):

F108 OSCILLATOR CONFIG HIGH\_STAB\_OCXO<CR><LF>

**F110 – J1 Input (Time Code, TIET)**

*Note:* Time Interval - Event Time (TIET) is an optional feature. If purchased at the same time as the GPS, it comes enabled on the system. To purchase this option after you have purchased the GPS, contact Manufacturer Sales. See “H: Sales and Customer Assistance” on page 305.

F110 can configure the J1 input port on the main CPU card as a time code reference source for the system clock, or it can configure J1 as the input for TIET operation.

Keypad

• **J1 Configuration**: (IRIG-A, **IRIG-B**, NASA 36, TIET) Set to match the type of time code input.

• **J1 Time Reference** (Available when J1 Configuration is IRIG-A, **IRIG-B**, NASA 36, not for TIET):

(**Primary**, Secondary, Standby) Identify the time code input as a primary or secondary reference source. The function, “F74 – Clock Source Control” on page 112, uses this designation to for reference source switching. Standby disables and removes J1 Input as a valid reference source.

Selecting Primary or Secondary automatically bumps another reference source with the same setting (e.g. F119 – GPS Receiver Configuration) to Standby.

*Note:* Configuring F110 for TIET forces **J1 Time Reference** to Standby. When reconfiguring the J1 as a time code reference source input, be sure to set J1 Time Reference to Secondary or Primary.

• **Configure Code**: (**AM**, DC) Set to the time code input signal type: AM for amplitude modulated, or DC level shift. See the time code definitions in “E: Time Code Formats” on page 297 for more information.

• **Input Impedance**: Always use 50Ω coaxial cable and terminate it into a 50Ω load.

• **Input Polarity**: Positive, Negative

• **Propagation Delay**: (Range 0 to 99999 μS in 1 μS steps) (Factory setting: **1** μ**S**) Compensates for delay caused by cable length on the J1 input.

• **IRIG Mode**: (Sync Gen)

• **Error Bypass**: (Off, 1-10 Frames) (Factory setting: **3 frames**) Is used when the IRIG input is intermittent or has a low signal to noise ratio (SNR). This allows the time code input to ‘flywheel’ for the specified number of invalid time code frames before F110 generates an alarm. **Off** means the F73 IRIG input alarm will alarm on the first invalid time code frame. **1-10** means the F73 IRIG input alarm will alarm after it detects 1-10 *consecutive* invalid time code frames.

When TIET is selected for J1 Input Configuration, F110 presents the following series of choices:

• **Input Impedance**: 50Ω / 100κΩ.

• **Input Polarity**: Positive only

Upon changing the settings, the last display prompt asks:

• Save Changes?: (Yes, No) Yes applies the changes. No cancels the changes.

For J1 specifications, see “J1 Input – Time Code or Time Interval - Event Time” on page 9.

*Notes:*

• Time Code: The GPS expects time code input that provides UTC in 24-hour format. If the time code does not provide UTC in 24-hour format (e.g., it uses standard, local, or GPS time, or is in

12-hour format), the GPS’s internal clock will be set to the wrong time when it uses the time code reference, and its time outputs will be similarly affected.

• Time Code: IRIG and NASA 36 time code don’t contain “year” information. Enter the current year using F3 before using IRIG as a primary or secondary reference source. Failure to do so can cause the incorrect time information to be distributed. See “F3 – Time & Date” on page 54.

• At the end of the year, the year increments by one (e.g., 2004 -> 2005), provided the GPS is operating during the transition. If it is not operating during the transition, the time code reasserts the preceding year when used as a reference source.

• TIET: Put the F110 time code input on STANDBY first before configuring F110 for TIET.

• TIET: Stray capacitance loading on the J1 input adversely impacts TIET measurements.

Command Line

F110 can configure the J1 input port to IRIG-A, IRIG-B, NASA 36, TIET Time or TIET Event. Use F110 to enter or request the J1 Input Configuration.

To request the J1 Input Configuration, enter:

**F110<CR>**

The function responds with the ASCII character string:

F110<S><Code><S><Source><S><Impedance><S><Type><S><Sign><S><Delay><S><Mode>

<S><Bypass><CR><LF>

Or

F110<S>TIET<S><Impedance><S><Sign><CR><LF> (when TIET option is enabled and J1 is set to TIET)

Where the F110 entry and request formats are defined as:

F = ASCII character F.

110 = function number.

TIET = ASCII character string “TIET” for configuring J1 for TIET measurement

<S> = ASCII space character one or more

<Code> = Input Code: IRIG-A, IRIG-B, NASA 36

**Note:** F110 Input Code Notes: (1) IRIG doesn't contain “year” information. Enter the current date using F3 before using IRIG as a primary reference source. Failure to do so can cause the incorrect time information to be distributed

<Source> = Clock source: PRIMARY, SECONDARY, STANDBY (Set IRIG to STANDBY for TIET)

<Impedance> = 100K, 50 (50 Ω impedance is selectable with DC type only)

**Note:** If 50 Ω impedance is specified with AM modulation format, GPS will overwrite the impedance input 50 Ω with 100 kΩ.

<Type> = Code Type: AM, DC (AM type is selectable for 100 kΩ impedance only)

**Note:** For DC code, set the appropriate level for the length of the input cable. Short runs (<200 ft.) get 100 kΩ, and long runs (>200 ft.) get 50 Ω.

<Sign> = Code Sign: POSITIVE, NEGATIVE (Note: negative not supported with TIET)

<Delay> = Propagation Delay: 0-99999 μS

<Mode> = IRIG Mode: SYNC GEN

F = ASCII character F.

<Bypass> = Error bypass: OFF, 1 FRAME, 2 FRAMES, 3 FRAMES, 4 FRAMES, 5 FRAMES, 6

FRAMES, 7 FRAMES, 8 FRAMES, 9 FRAMES, 10 FRAMES

<CR><LF> = line terminator, either a carriage return and line feed for output strings or a carriage return only for input strings.

Sample request:

**F110<CR>**

The GPS responds (example):

F110 IRIG B PRIMARY 50 DC NEGATIVE 66161 us SYNC GEN OFF<CR><LF>

Or

F110 TIET 50 POSITIVE<CR><LF>

To set the J1 Input Configuration, make a command line entry using the same format as the GPS response above. Only valid values are accepted. For example:

**F110 IRIG A SECONDARY 50 DC POSITIVE 1234 US SYNC GEN 1 FRAME<CR>**

Or, if the TIET option is available, first put the time code input on standby (example):

**F110 IRIG A STANDBY 50 DC POSITIVE 1234 US SYNC GEN 1 FRAME<CR>**

And then configure TIET (example):

**F110 TIET 100K POSITIVE<CR>**

The GPS responds:

OK<CR><LF>

*Note:* Note: If the TIET is configured, the timestamp(s) of the rising edge of the J1input signal will be displayed each second. Up to 100 time stamps can be spooled.

To obtain TIET measurement from J1, enter:

**F110 TIET TIME<CR>**

The GPS responds:

OK<CR><LF>

.xxxxxxxxx<CR><LF>

(Time Interval (display continues until function termination with Ctrl+C)

Or, (example):

**F110 TIET EVENT<CR>**

The GPS responds:

OK<CR><LF>

ddd:hh:mm:ss.xxxxxxxxx<CR><LF>

(Event Timing display continues until function termination with Ctrl+C)

For an IRIG Time Code with the IEEE 1344 extensions, enter F110<CR> to request the J1 Input

Configuration, and the port will respond with the ASCII character string:

F110<SP><Code><SP><Source><SP><Impedance><SP><SP><Sign><SP>

<Delay><SP><Mode><SP><Bypass><LT>

where:

F = ASCII character F.

110 = function number.

<SP> = ASCII space character one or more

<Code> = Input Code: IRIG-B120 1344 or IRIG-B000 1344

<Source> = Clock source: PRIMARY, SECONDARY, STANDBY

<Impedance>= 100K, 50 (50 ohm impedance is selectable with IRIG-B000/1344) type only)

<Sign> = Code Sign: POSITIVE, NEGATIVE

<Delay> = Propagation Delay: 0-99999uS

<Mode> = IRIG Mode: SYNC GEN

<Bypass> = Error bypass: OFF, 1 FRAME, 2 FRAMES, 3 FRAMES, 4 FRAMES, 5 FRAMES,

6 FRAMES, 7 FRAMES, 8 FRAMES, 9 FRAMES, 10 FRAMES

<LT> = line terminator; for output strings (a carriage return and line feed ) or for input strings (a carriage return only).

Sample request: F110<CR>

Response: F110 IRIG-B000 1344 PRIMARY 50 NEGATIVE 66161 us SYNC GEN OFF<CR><LF>

To set the J1 Input Configuration for an IRIG code with IEEE 1344 extensions, send a character string with the previously defined F110 entry format to the Serial/Network port. Only valid values are accepted.

Sample entry: F110 IRIG-B120 1344 SECONDARY 100 POSITIVE 1234 US SYNC GEN 1 FRAME

<CR>

Response: OK<CR><LF>

The Serial/Network port will respond with the message “ERROR 01 VALUE OUT OF RANGE” if the input string was in the correct format but contained a value, probably numeric, that was out of the range of acceptable values.

The Serial/Network port will respond with the message “ERROR 02 SYNTAX” if it receives a string in an incorrect format.

The Serial/Network port will respond with the message “ERROR 03 BAD/MISSING FIELD” if the input string lacks a required field.

**F111 – J2 Output (Rate, PPO)**

Use function F111 to configure the J2 Output to generate rates (listed below), or as an option, to generate Programmable Pulse Outputs (PPO). The following rates are available as a standard feature:

1 PPS, 10 PPS, 100 PPS, 1 kPPS, 10 kPPS, 1 MPPS, 5 MPPS, 10 MPPS. The default factory setting is 10 MPPS.

For J2 specifications, see “J2 Output – Rate Out or Programmable Pulse Output” on page 11. Notes on F111 PPO:

• PPO is an optional feature. If purchased at the same time as the GPS, it comes enabled on the

system. To purchase this option after you have purchased the GPS, contact Manufacturer Sales.

See “H: Sales and Customer Assistance” on page 305.

• PPO can provide a single pulse output or repetitive pulse outputs.

• PPO can start and stop the pulse at any time in the year, with a resolution of one microsecond.

• The repetition rates from PPO are based on “wildcards”. See “Repetitive PPO pulse outputs” on page 149 regarding usage of “wildcards” to specify PPO repetition rates.

• PPO can provide the following sub-second repetition rates: 100 PPS, 10 PPS, 1 PPS, 100 PPS, and 10 PPS.

• If PPO only specifies one time, it is the start time. The stop time is automatically set for one microsecond later.

Keypad

**Selecting one of the Standard Rates**: Using the keypad, press the **ENTER**, **111**, **ENTER** buttons.

Select one of the standard rates using the up/down arrow buttons and press the ENTER button again.

When prompted “**Save changes? Yes**”, press the ENTER button one more time.

**Programming the PPO option**: If available, “**PPO**” appears as the first option when you enter F111.

Press the **ENTER** button to start programming PPO (Otherwise, use the up/down arrow buttons to select one of the standard rates). The display shows the “PULSE START TIME” followed by the Time of Year and Time of Day fields. Program the PPO option as explained in the *Command Line* section, below. Use the **CLR** key to enter the “X” wildcards, if needed.

Command Line

***Requesting the Current Configuration***

To request the J2 Output Configuration, enter the following:

F111<CR>

The GPS responds in the following format:

F111<S><RATE><CR><LF>

Or, if the PPO option is active, it responds:

F111<S>PPO<S><START><S><STOP><CR><LF>

Where:

F = ASCII character F

111 = Function number

PPO = ASCII character string “PPO”

<S> = ASCII space character one or more

<RATE> = Output rate or type, RATE 1 PPS, RATE 10 PPS, RATE 100 PPS, RATE 1 kPPS, RATE

10 kPPS, RATE 100 kPPS, RATE 1 MPPS, RATE 5 MPPS, RATE 10 MPPS

<START> & <STOP> = Time-of-year with microsecond resolution in the format of yyy:hh:mm:ss.uuuuuu.

Range: [001:00:00:00.000000, 366:23:59:59.999999] Note: Wildcard character: 'X' or 'x' can also be entered. See the section regarding time string with wildcard character.

Colon separators (“:”) are required

<CR><LF> = Line terminator: a carriage return and line feed for output strings, or a carriage return for input strings

Depending what F111 is currently set up to do, the sample request:

**F111<CR>**

Displays a fixed 10 PPS rate output (example):

F111 RATE 10PPS<CR><LF>

Or displays the PPO settings (example):

F111 PPO 120:22:56:12.000000 120:22:56:12.000003<CR><LF>

***Setting the J2 Output Configuration***

To set the J2 Output Configuration, send a character string with the previously defined F111 entry format to the Serial/Network port. Only valid values are accepted. The J2 Output Configuration can be set to specify one of several predetermined rates, a single PPO pulse outputs, and repetitive PPO pulse outputs. The following sections provide examples (and some explanations) for each.

***Predetermined RATE output***

For example, to produce a fixed 100 kPPS rate output, enter:

**F111 RATE 100KPPS<CR>**

The GPS responds:

OK<CR><LF>

***Single PPO pulse output***

For example, to produce a a single pulse with duration of 1 second on January 1, enter:

**F111 PPO 001:00:00:00.000000 001:00:00:01.000000 <CR>**

The GPS responds:

OK<CR><LF>

Or, for example, to produce a single pulse with duration of 1 microsecond on January 1, enter:

**F111 PPO 001:00:00:00.000000<CR>**

The GPS responds:

OK<CR><LF>

***Repetitive PPO pulse outputs***

Repetitive PPO pulse output function can be used to produce repetitive pulses from once per year up to 100,000 per second.

To issue repetitive pulses using PPO, use “wildcards” in the *Start Time* and *Stop Time* fields. Through the command line interface, the user may place 'X' (or 'x') in the time fields of the F111 command. The 'X' (or 'x') character is referred to as the “wildcard” in the PPO time fields. The most significant non wildcard-digit in the time field is used to specify the Start (or Stop) Time of the repetitive pulses, which in turn specifies the pulse width of the repetitive pulses. The least significant “wildcard” character (the one to the immediate left of the most significant non-wildcard-digit) specifies the period of repetition.

When specifying repetitive rates, the Start Time must include the same number of significant digits as the Stop Time or an ambiguous output may occur.

Any time the clock reads a new time that matches the specified least significant digits, a pulse either starts or stops. For example, the following string produces a one-second pulse at midnight on every day of the year with a “1” in the least significant digit:

**F111 PPO XX1:00:00:00.000000 XX1:00:00:01.000000<CR>**

**Clock Reading Pulse**

001:00:00:00.000000 Start

001:00:00:00.000001 No Change

001:00:00:01.000000 Stop

001:01:00:00.000000 No Change

001:00:00:00.000000 Start (etc...)

For example, to produce a repetitive 5 microsecond pulse occurring every 10 microseconds (i.e., repetitive pulses with 100 kHz frequency with the start time or rising-edge on-time and the stop time or falling-edge at 5 μS- or 10 μS pulse period with 5 μS pulse width), enter:

**F111 PPO XXX:XX:XX:XX.XXXXX0 XXX:XX:XX:XX.XXXXX5<CR>**

The GPS responds:

OK<CR><LF>

Or, for example, to produce a repetitive 50-microsecond pulse occurring every 100 microseconds (i.e., repetitive pulses with 10 kHz frequency with the start time or rising-edge at 5 μS and the stop time or falling-edge at 55 μS - or 100 μS pulse period with 50 μS pulse width), enter:

**F111 PPO XXX:XX:XX:XX.XXXX05 XXX:XX:XX:XX.XXXX55<CR>**

The GPS responds:

OK<CR><LF>

Or, for example, to produce a repetitive 50-microsecond pulse occurring every 100 milliseconds (i.e., repetitive pulses with 10 PPS frequency with the start time or rising-edge at 5 μS and the stop time or falling-edge at 55 μS - or 100ms pulse period with 50 μS pulse width), enter:

**F111 PPO XXX:XX:XX:XX.X00005 XXX:XX:XX:XX.X00055<CR>**

The GPS responds:

OK<CR><LF>

Or, for example, to produce a repetitive one-minute pulse occurring every hour, enter:

**F111 PPO XXX:XX:10:00.000000 XXX:XX:11:00.000000<CR>**

The GPS responds:

OK<CR><LF>

Or, for example, to produce a repetitive one-microsecond pulse occurring on every hour, enter:

**F111 PPO XXX:XX:10:00.000000<CR>**

The GPS responds:

OK<CR><LF>

**F113 – J3 Input (Aux Ref, Freq Meas)**

*Note:* Frequency Measurement is an optional feature. If purchased at the same time as the GPS, it comes enabled on the system. To purchase this option after you have purchased the GPS, contact Manufacturer Sales. See “H: Sales and Customer Assistance” on page 305.

Use function F113 to configure the J3 Input on the GPS back panel (section 3, Figure 5) for one of the following settings:

• Auxiliary Reference (Aux Ref) input

• Frequency Measurement (Freq Meas) input

• Disable all J3 inputs

F113 offers the following keypad settings:

• J3 Input Configuration: Aux Ref, Freq Meas, **Disabled**

• J3 Input Frequency: 1 MHz, 5 MHz, **10 MHz**

• J3 Input Impedance: **1k**Ω, 50 Ω

The factory settings are Disabled, 10 MHz, and 1kΩ.

For J3 Input specifications, see “J3 Input – Auxiliary Reference or Frequency Measurement” on page 12.

**Auxiliary Reference (Aux Ref) Input:**

If an external frequency reference with better long-term stability than the GPS's own oscillator (e.g., a Cesium reference) is available, connect it to the J3 connector and enable Aux Ref using F113. Once this is done, the GPS will use the Aux Ref input (rather than its own oscillator) as its frequency source if the GPS's reference source(s) become unavailable.

For example, with a single GPS receiver card configured as PRIMARY in F119, and F74 Clock

Reference set to PRI, When the GPS reacquires a time reference source and is steering its own internal oscillator, it stops using

Aux Ref as its frequency reference.

For Aux Ref to work:

• The Aux Ref frequency source must be connected to the J3 input.

• F113 Input Configuration must be set to Aux Ref

• F113 Input Frequency must be set to the correct frequency

• F113 Input Impedance must be set to the correct impedance

**Frequency Measurement (Freq Meas) Input**

The Frequency Measurement (Freq Meas) option measures an external frequency applied to the J3 input relative to the disciplined GPS oscillator.

*Operation:* Measurements are displayed on the front panel display and on the command line at the specified measurement interval. The front panel displays the measured frequency offset (FREQ OFFSET) and a countdown (COUNT) to completion of the measurement interval. The command line states the measurement interval (e.g.,“Interval is 1 seconds”) on the first line, and then starts displaying each measurements; each one on a new line.

*Limitations:* Note that the accuracy of the frequency measurement is based on the accuracy and stability of the disciplined GPS oscillator over the measurement interval. Short interval measurements of external very high stability oscillators (e.g., Cesium) tend to measure the GPS oscillator instead. Refer to “System Time & Frequency Accuracy” on page 6, and to “P7: Oscillators” on page 231 for more information for the specifications of disciplined oscillators (while locked to a GPS reference source). *Theory of Operation:* Freq Meas uses a heterodyne phase error multiplier to achieve high resolution at short sample periods. Using its internal disciplined frequency, the GPS records or timestamps the zero crossing of the J3 input frequency once per measurement cycle with 240 picosecond resolution. The number of zero crossings between successive measurement intervals is also recorded.

When the measurement interval elapses, the previous measurement timestamp is subtracted from the current one and the difference is divided by the number of zero crossings between the two timestamps.

The result is the average period of the external frequency over the interval. The reciprocal of this period is compared to the nominal frequency to determine the fractional frequency offset. The timestamp reported with the resulting measurement is the ending timestamp of the two phase readings used to make the measurement. Since this ending timestamp is now the beginning timestamp for the next measurement, there is no “dead time” in the measurements.

The reported timestamp resolution is sufficient to allow integrating the fractional frequency offset measurements to fully recover the relative phase of the external frequency source being measured versus the disciplined GPS internal or external oscillator.

*Display:* Freq Meas appears as follows in the front panel display/keypad:

FREQ OFFSET COUNT

+x.xxxxxx -xx xxxxxx

Where FREQ OFFSET +x.xxxxxx-xx is the fractional frequency offset measurement divided by the

COUNT xxxxxxx measurement interval. These measurements are displayed until a new F113 configuration is selected, or another function performed.

Command Line

To display the J3 Input Configuration, enter:

**F113<CR>**

The GPS responds using the following formats:

F113<S>DISABLE<CR><LF>

Or:

F113<S>AUX REF<S><FREQ><S><IMP><CR><LF>

Or, when the Frequency Measurement option is enabled:

F113<S>FREQ MEAS<S><FREQ><S><IMP><S><INT><CR><LF>

Where the F113 entry and request formats are defined as:

F = ASCII character F.

113 = function number.

SHOW = ASCII character string “SHOW” for displaying frequency measurements.

DISABLE = ASCII character string “DISABLE” to disable J3 as input port

AUX REF = ASCII character string “AUX REF” to set J3 to take auxiliary reference input

FREQ MEAS = ASCII character string “FREQ MEAS” to set J3 to make frequency measurements

<S> = ASCII space character one or more.

<FREQ> = AUX REF or FREQ MEAS Input Frequency: 1MHZ, 5MHZ, 10MHZ

<IMP> = Input Impedance: 1K or 50

<INT> = Frequency Measurement Interval. This is the gate time of the measurement. Range: [000001,

999999] in seconds.

<CR><LF> = line terminator, either a carriage return and line feed for output strings or a carriage return only for input strings.

For example, enter:

**F113<CR>**

The GPS displays the current configuration (example):

F113 AUX REF 1MHZ 50<CR><LF>

Or

F113 DISABLE<CR><LF>

Or

F113 FREQ MEAS 1MHZ 50 000001<CR><LF>

To set the J3 Input Configuration, enter a character string ***using the same formats as the preceding GPS responses***. Only valid values are accepted.

For example, to enable an Aux Ref 5 MHz input frequency with 1 kΩ input impedance, enter:

**F113 AUX REF 5MHZ 1K<CR>**

Or, to disable F113, enter:

**F113 DISABLE<CR>**

Or, to enable Freq Meas of a 1 MHz input with a 50 Ω input impedance every 1 seconds, enter:

**F113 FREQ MEAS 1MHZ 50 1<CR>**

To all three of the above examples, the GPS responds:

OK<CR><LF>

If enabling Freq Meas, display the Freq Meas measurements using the following format:

**F113<S>SHOW<CR>**

The GPS responds using the following format:

Interval<S>is<S><INT><S>seconds<CR><LF> +#.######e-##<CR><LF>

Where

Interval is = ASCII character string “Interval is”

<S> = ASCII space character or separator.

<INT> = Frequency Measurement Interval seconds = ASCII character string “seconds”

+ = ASCII plus “+” or minus “-” character

# = ASCII integer from 0 to 9

e- = ASCII characters “e-”

<CR><LF> = line terminator, either a carriage return and line feed for output strings or a carriage return only for input strings

For example, enter:

**F113 SHOW<CR>**

The GPS responds (example):

Interval is 1 seconds<CR><LF>

+9.600000e-10<CR><LF>

+1.080000e-09<CR><LF>

+1.560000e-09<CR><LF>

To stop Freq Meas, enter Ctrl+C on the command line.

*Note:* Freq Meas is remains active while the function is displayed on the front panel or command line.

Changing the function on the front panel or command line terminates Freq Meas.

**F116 – Display Brightness Level**

Use function F116 to adjust the brightness of the front panel display on a range from 1 to 10, with 1 being the dimmest and 10 being the brightest.

*Note:* F116 is available from the keypad/display only. It is not available using the command line interface.

**F117 – Factory Configuration**

Use function F117 to display the GPS factory Serial Number and the availability of optional software features. Send the string:

**F117<CR>**

GPS responds:

F117<S>SN<S><SERIAL#><CR><LF>

NTP <STATE><CR><LF>

FREQ MEAS <STATE><CR><LF>

TIET <STATE><CR><LF>

PPO <STATE><CR><LF>

where:

F = ASCII character F.

117 = function number.

<S> = ASCII space character one or more.

NTP = NTP option

FREQ MEAS = FREQ MEAS option

TIET = TIET option

PPO = PPO option

<CR> = carriage return.

<STATE> = ENABLE or DISABLE

<LF> = line feed.

For example, enter:

**F117<CR>**

GPS responds:

F117 SN 31234<CR><LF>

NTP ENABLE<CR><LF>

FREQ MEAS ENABLE<CR><LF>

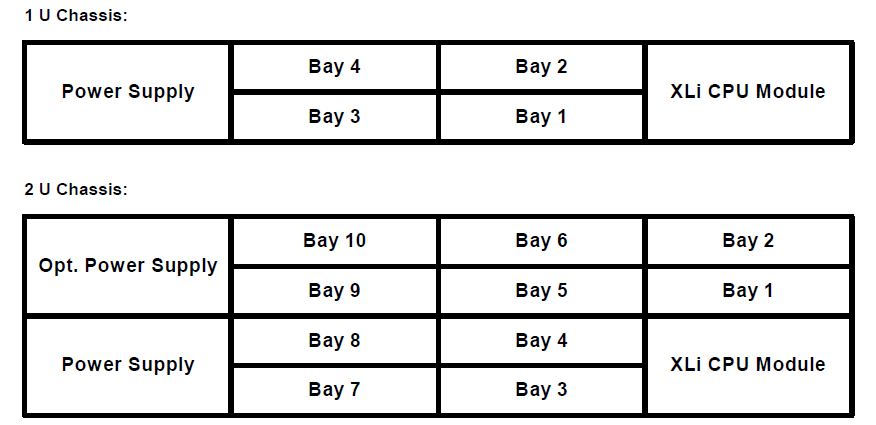
TIET ENABLE<CR><LF>

PPO ENABLE<CR><LF>

**F118 – Option Board Configuration**

Use function F118 to query the GPS for the option bay location of CPU-aware cards. The following figure shows the position of the option bays as seen when viewing the GPS from the rear.

*Figure 8: Option Bay Positions*

**

See Figure 9 for the cards recognized and not recognized by F118

*Figure 9: The cards recognized by F118 are as follows:*

• N.1 Frequency Synthesizer (87-8022)

• GPS C/A Receiver (87-8028-2)

• Frequency and Time Deviation Monitor (87-8023)

• HaveQuick/1 PPS Time and Frequency Reference(87-8016-3)

• Have Quick Output with selectable TFOM (87-8016-6)

• PTTI BCD Output (87-8045)

• Parallel BCD mSec Output with Time Quality (87-8090)

• Parallel BCD uSec with Time Quality (87-8090-1)

• Parallel BCD mSec Output with Unlock Status (87-8090-2)

• GPS Receiver (86-8013)

The cards *not recognized* by F118 are as follows:

• Expansion Module (87-8034-1, 87-8034-2)

• N.8 Frequency Synthesizer (86-708-1)

• Multicode Output (87-6002-XL1)

• Low Phase Noise 5 MHz Output (87-8009-5)

• Low Phase Noise 10 MHz Output (87-8009-10)

• Enhanced Low Phase Noise Module (87-8040)

• 1, 5, 10 MHz Sine/MPPS Square Output (86-8008)

• T1 Telecom Interface Output (87-6000T1-8)

• E1 Telecom Interface Output (87-6000E1-6)

• Second Serial Talker or T1 / E1 (87-8047)

Command Line

To display a summary of the GPS option bay information, enter the following command:

**F118**

The GPS responds:

F118<S>B<N><S><OC><CR><LF>

where:

F = ASCII character F.

118 = function number.

<S> = ASCII space character one or more.

B = ASCII letter to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

<OC> = Option Card Name:

• GPS RECEIVER or

• N.1 FREQ SYNTHESIZER or

• FTM III MONITOR or

• HAVE QUICK SYNC or

• HAVE QUICK OUT or

• PTTI BCD Output or

• Parallel BCD Output or

• NOT RECOGNIZED (if no Smart Option Card is installed)

<CR> = carriage return.

<LF> = line feed.

For example, enter:

**F118<CR>**

GPS responds:

F118 B1 GPS RECEIVER

F118 B2 N.1 FREQUENCY SYNTHESIZER

F118 B3 NOT RECOGNIZED

F118 B4 GPS RECEIVER

F118 B5 NOT RECOGNIZED

F118 B6 NOT RECOGNIZED

F118 B7 NOT RECOGNIZED

F118 B8 NOT RECOGNIZED

F118 B9 NOT RECOGNIZED

F118 B10 NOT RECOGNIZED

To specify a unique option bay, append the character “B” and the bay number. For example, enter:

**F118 B1<CR>**

GPS responds:

F118 B1 GPS RECEIVER

**F119 – GPS Receiver Configuration**

***Summary***

Use function F119 to select a specific GPS receiver, display its status information, and configure it as a reference source.

F119’s functions apply to all models of GPS receiver option cards available for the GPS. Where differences exist, this manual refers to the card by its name and part number.

In F119, a GPS receivers are identified *by number of the option bay where they are located*. See

Figure 1 on page 3 for a diagram of the option bay numbers.

F119 provides the following GPS receiver information and status:

• Availability (indicates the option bay location)

• Part Number

• Software Version

• FPGA Number

• GPS Status (Locked or Unlocked)

• GPS Antenna (Ok, Open, or Short)

• GPS Acquisition State (Dynamic Mode, Stop Site Survey, Stop TRAIM, Start Site Survey, Start

TRAIM, Survey Position, Position Hold)

• GPS Time Reference (Primary, Secondary, or Standby)

Each of F119’s information, status, and configuration items are explained below. Because F119 is an important function, this section explains the behavior of F119 and related functions in some detail.

***Part Number, Software Version, and FPGA Number***

This information is useful for identifying the option card.

***GPS Status (Locked or Unlocked)***

During normal operation, “Locked” means the GPS receiver has:

• A valid GPS solution (the position of the antenna)

• The current UTC time (the current UTC leap second data)

For additional information on “good current” GPS satellites, see “F60 – GPS Receiver Satellite List” on page 85.

Following power-up and initialization, the receiver requires at least four concurrent “good current” satellites to resolve its current position. In rare cases, when a pair of “good current” satellites are on intersecting paths, the receiver requires additional “good current” satellites or waits for the intersecting satellites to diverge before resolving the current position. Once resolved, the current position information is saved.

While resolving its current position, the GPS receiver also listens for the *UTC leap-second offset* periodically transmitted by GPS satellites along with GPS time and position information. Up to thirteenminutes may elapse from the time the receiver acquires its first “good current” satellite to the time itreceives the UTC leap-second offset. Once received, the UTC leap-second offset is saved. When the receiver has *the UTC leap-second value*, it starts providing valid time to the GPS system clock.

When the system clock is locked to the GPS time reference and is operating within specifications, the system status is locked. The interval from initialization to system status lock is typically under twenty minutes, under nominal conditions. This transition is illustrated below.

Following initialization, the front panel display of an GPS with only one GPS receiver (GPS Status:

Unlocked) would show the following:

UNLOCKED \* GPS PRI

LOCAL 365:16:01:05 1969

With the GPS receiver as a valid time reference, the following changes would take place:

• The asterisk (“\*”) indicating the absence of a valid reference would disappear

• The system status would change to locked

The front panel status display would look like this:

LOCKED GPS PRI

LOCAL 233:18:21:29 2004

Once the GPS receiver is a valid time reference, it requires at least one “good current” satellite to remain a valid time reference. If “good current” GPS satellites become temporarily unavailable, GPS status changes to unlocked and the GPS stops using the receiver as a valid time reference.

Typically, when a “good current” satellite becomes available again, GPS status locks and the receiver becomes a valid time reference almost immediately. Typically, the receiver does not need extra time to resolve its current position unless it is being used in a very mobile/dynamic environment such as an aircraft.

If the unit is powered-cycled, the receiver repeats the complete position and leap-second acquisition process before GPS status locks.

*Note:* GPS satellite visibility and signal strength affect the ability of the GPS receiver to lock and provide valid time to the GPS. Therefore, it is very important to select the best possible antenna site.

***GPS Antenna (Ok, Open, or Short)***

The GPS antenna is powered by 12 volts from the ANTENNA connector on the rear of the GPS. If this circuit is complete (e.g., connected to an antenna) GPS Antenna status is “OK”. If the circuit is incomplete (e.g., no antenna, a cable break, or a splitter) the GPS Antenna status is “Open”. If circuit detects a short, the GPS Antenna status is “Short”.

***GPS Time Reference (Primary, Secondary, or Standby)***

Configure the GPS receiver as a Primary or Secondary time reference. This setting is used by F74 – Clock Source Control to control switching between reference sources. Selecting Standby makes the receiver unavailable as a reference source.

If one time reference is configured as Primary or Secondary, and another time reference is assigned the same priority, the first time reference is reset to Standby. For example, with GPS receiver 1 configured as Secondary, when an operator configures GPS receiver 2 (or an IRIG input on J2) as Secondary and saves changes, GPS receiver 1 is reset to Standby.

The GPS front panel status display identifies the reference source and its priority (e.g. “GPS PRI”).

***GPS Acquisition State***

Please note that after starting the GPS receiver, F119 may report several acquisition states before settling on the one that was selected using F53.

With the GPS C/A Receiver (87-8028-2), F119 reports the following GPS acquisition states after a reboot when F53 is in *Time Mode*:

• **Start Site Survey**: The receiver is checking for changes in its saved static position (occurs after boot).

• **Survey Position**: The receiver is establishing an initial position following a reset. If the receiver had “current” satellites prior to being reset, it can establish the position in a matter of seconds; otherwise establishing the position takes a few minutes.

• **Stop Site Survey**: The receiver is ending site survey.

• **Position Hold**: The receiver has determined its most accurate position, and is using this static position to calculate its most accurate time solution.

• **Start TRAIM**: (for Time Receiver Autonomous Integrity Monitoring) The receiver is in Position

Hold and is monitoring the integrity of the time solution using redundant satellite measurements in order to eliminate unreliable signal information.

**• Stop TRAIM**: The receiver is ending TRAIM monitoring.

• **Dynamic Mode**: The user has determined that the position of the system could change and has set F53 GPS operation mode to Dynamic Mode (see “F53 – GPS Operation Mode”, page 84). The system is resolving its position so that it can compensate for position changes.

With the GPS C/A Receiver (87-8028-2), F119 does not report GPS acquisition states.

Command Line

To obtain the status of the GPS Receiver, enter:

**F119<S>B<N><SEP>S<CR>**

For example, enter:

**F119 B1 S**

GPS responds (example):

F119 B1:

GPS PART NUMBER 87-8028-02

SOFTWARE 230-01510-04v1.17

FPGA 184-8024v1

GPS STATUS UNLOCKED

GPS ANTENNA OK

GPS ACQUISITION STATE: SURVEY POSITION

To obtain the configuration of the GPS receiver, enter the following:

**F119<S>B<N><S>C<CR>**

where:

F = ASCII character F.

119 = function number.

<S> = ASCII space character one or more.

B = ASCII letter to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

C = ASCII character denotes reference configuration query

<CR><LF> = line terminator, either a carriage return and line feed for output strings or a carriage return only for input strings.

For example:

**F119 B1 C<CR>**

GPS responds:

F119 B1 PRIMARY<CR><LF>

To change the configuration of the GPS receiver as a primary or secondary reference source, enter:

**F119<S>B<N><S>C<S><CONFIG><CR>**

where:

F = ASCII character F.

119 = function number.

<S> = ASCII space character.

B = ASCII letter to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

<SEP> = one or more separator characters; either space, comma or tab.

C = ASCII letter denotes reference configuration to follow.

<CONFIG> = Reference Source Configuration: PRI, SEC or STBY

For example to make it a primary reference source, enter:

**F119 B1 C PRI<CR><LF>**

GPS responds:

OK<CR><LF>

**F120 - N.1 Frequency Synthesizer**

Use F120 to view the status and configuration of the N.1 Frequency Synthesizer (87-8022) (page 181) and to change the frequency of its outputs.

The N.1 Frequency Synthesizer card’s four independently programmable outputs generate frequencies from 1 PPS to 50 MPPS, with a tuning resolution of 1 PPS.

Keypad

Using the front panel keypad, enter F120 (ENTER, 120, ENTER).

Continue pressing ENTER to step through the following displays. (Use the up/down arrow buttons to select options):

• N.1 FREQ SYN AVAILABILITY - OPTION BAY # (Select from 1-10, or NOT AVAILABLE)

• N.1 PART NUMBER

• N.1 FPGA NUMBER

• N.1 PLL (LOCKED/UNLOCKED)

• OUTPUT PORT 1 (Enter a value from 1 Hz to 50,000,000 Hz)

• OUTPUT PORT 2 (Enter a value from 1 Hz to 50,000,000 Hz)

• OUTPUT PORT 3 (Enter a value from 1 Hz to 50,000,000 Hz)

• OUTPUT PORT 4 (Enter a value from 1 Hz to 50,000,000 Hz)

• SAVE CHANGES? (Select from YES or NO and press ENTER)

Command Line

Use Serial/Network Function F120 to obtain information about the current version of the software installed in the N.1 Frequency Synthesizer Option Board and to configure the N.1 Frequency

Synthesizer Option Board for frequencies to be generated. To obtain the N.1 Frequency Synthesizer

Option Board Status, enter:

**F120<SP>B<N><SEP>S<CR>**

where:

F = ASCII character F

120 = function number

<SP> = ASCII space character one or more

B = ASCII letter to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10

<SEP> = one or more separator characters; either space, comma or tab

S = ASCII letter to denote that N.1 Freq Synthesizer status is requested

<LT> = line terminator; for output strings (a carriage return and line feed) for input strings (a carriage return only)

The GPS Serial/Network port responds with an eight line response similar to the following example:

Sample request:

**F120 B2 S<CR><LF>**

Response:

F120 B2:<CR><LF>

PART NUMBER 87-8022<CR><LF>

FPGA 184-8016V0001<CR><LF>

N.1 PLL LOCKED<CR><LF> ( or UNLOCKED)

1 1234 HZ<CR><LF>

2 44444444 HZ<CR><LF>

3 59 HZ<CR><LF>

4 777 HZ<CR><LF>

The frequency of one of the output channels may be set as follows:

**F120<SP> B<N><SEP><C><SEP><FREQ> <CR>**

where:

F120 = string representing the Function Number

<SP> = ASCII space character one or more

B = ASCII letter indicating board number follows

<N> = board number, 1 to 10

<SEP> = separator

<C> = channel number, 1 to 4

<FREQ> = 0 to 50000000 (50 MPPS) A value of 0 terminates output to the port

An example of setting the frequency of one of the output channels follows:

Sample entry:

**F120 B2 1 60000<CR><LF>(sets card #2 channel #1 to 60000 MHZ)**

Response:

OK<CR><LF>

An example of setting all 4 channels on a card with one serial string:

Sample entry:

**F120 B1 1 100000 2 2000 3 2048 4 16<CR>**

(sets board #1 channel #1 to 100000 MPPS, channel #2 to 2000 MPPS, channel #3 to 2048 MPPS, channel #4 to 16 MPPS).

Response:

OK<CR><LF>

**F123 – Have Quick Input/1 PPS Sync Configuration**

Use F123 to configure or view the status of the Have Quick Input/1 PPS Sync option card (87-8016-3). (See “HaveQuick/1 PPS Time and Frequency Reference(87-8016-3)” on page 224.)

The Have Quick/1PPS Time and Frequency Reference option card is a time and frequency reference for synchronizing the GPS.

The Have Quick/1 PPS Sync card’s two BNC connectors take separate Have Quick time code and

1 PPS inputs. F123’s INPUT MODE determines how these inputs are used to synchronize the time:

• HAVE QUICK: The card gets major and minor time from the Have Quick time code input.

• 1PPS: The card gets minor time from the 1PPS input. Major time is determined by the GPS.

• HAVE QUICK 1PPS: The card gets major time from Have Quick time code input, and gets minor time from the 1PPS input.

F123’s HQ TIME REFERENCE setting identifies the Have Quick option card as a PRIMARY or

SECONDARY reference source for F74 CLOCK SOURCE CONTROL, or disables the card from being a reference source when STANDBY is selected.

Note: Do not confuse the 1 PPS input connector on this card with other main clock 1PPS.

Keypad

Using the front panel keypad, enter

(ENTER, 123, ENTER).

Press ENTER to step through the following displays. (Use the up/down arrow buttons to select options).

Continue pressing ENTER to display:

• HAVE QUICK SYNC AVAIL - OPTION BAY # (Select from 1-10, or NOT AVAILABLE)

• HQ PART NUMBER

• SOFTWARE VERSION

• FPGA VERSION

• HQ REF STATUS (LOCKED/UNLOCKED)

• HQ PPL (LOCKED/UNLOCKED).

• INPUT MODE (Select from: HAVE QUICK, 1PPS, HAVE QUICK 1PPS)

• HQ TIME REFERENCE, BAY N. Select from: PRIMARY, SECONDARY, STANDBY

• SAVE CHANGES? (Select from YES or NO and press ENTER)

Command Line

***Viewing Card Status***

For status of the Have Quick 1PPS option board, send a command using the following format:

**F123<SP>B<N><SEP>S<CR>**

For example, enter:

**F123 B3 S**

The GPS responds (example only):

F123 B3:

HQ PART NUMBER 87-8016-3

SOFTWARE 192-8008v1.6

FPGA 184-8016v02

HQ REF STATUS LOCKED (or UNLOCKED)

HQ PLL LOCKED (or UNLOCKED)

***Configuring INPUT MODE and HQ TIME REFERENCE***

To display the INPUT MODE and HQ TIME REFERENCE configuration of the card, send a command using the following format:

**F123<SP>B<N><SEP>C<CR>**

where:

F = ASCII character F

123 = function number

<SP> = ASCII space character one or more

B = ASCII character to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10

S = ASCII character for “Status Request”

C = ASCII character for “Configuration of Time Reference”

<LT> = line terminator; for output strings (a carriage return and line feed) for input strings (a carriage return only).

For example, enter:

**F123 B3 C**

The GPS responds, for example:

F123 B3 PRIMARY 1PPS

To change the INPUT MODE and HQ TIME REFERENCE, send a command using the following format:

**F123<SP>B<N><SP>C<SP><CONFIG><SP><REF><LT>**

where:

F = ASCII character F.

123 = function number.

<SP> = ASCII space character.

B = ASCII character B to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

C = ASCII character to denote “Configuration of Time Reference”

<CONFIG> = Option Board Configuration: PRI, SEC, or STBY

<REF> = Option Board Reference: 1PPS, HAVE QUICK, or HAVE QUICK 1PPS

<LT> = line terminator; for output strings (a carriage return and line feed) for input strings (a carriage return only).

For example, enter:

**F123 B3 C SEC HAVE QUICK 1PPS**

The GPS changes INPUT MODE to HAVE QUICK 1PPS, changes HQ TIME REFERENCE to

SECONDARY, and responds:

OK

**F126 – Options Key Entry**

Use function F126 to enter the Options Key, which enables certain functions (e.g., PPO, TIET, NTP, FREQ MEAS) if the correct key is entered. To check the status of these GPS options, see “F117 – Factory Configuration” on page 156. After entering the key code using F126, reboot the GPS.

To set the Options Key code, enter the following:

**F126<S><KC><CR><LF>**

where:

F = ASCII character F (f or F for input string).

126 = the function number

<S> = ASCII space character one or more

<KC> = Key Code, 0 to 999999999999999. A value of all nines will clear all Option enable flags.

If the code is less than 15 characters, insert leading “0”s to make the number of characters in the key code to 15.

<CR> = carriage return character

<LF> = line feed character

For example, enter:

**F126<S>005674397586090<CR>**

The GPS responds:

OK<CR><LF>

Use function F117 to verify that the correct code was entered. ***Then reboot the unit to activate the option.***

**F128 – Have Quick Output Configuration**

The Have Quick Out time code status can be determined via the Serial or Network port using Function

F128. Use Serial/Network Function F128 to obtain information about the current version of the software installed on the Have Quick Out option board. To obtain the Have Quick Out option board status information, send the following string to the Serial/Network port:

F128<SP>B<N><SEP>S<CR><LF>

where:

F = ASCII character F.

128 = function number.

<SP> = ASCII space character one or more.

B = ASCII character to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

S = ASCII character for “Status Request”

<LT> = line terminator; for output strings (a carriage return and line feed ) or for input strings (a carriage return only).

The GPS Serial/Network port will respond with a four-line replay for status request similar to the following example:

Sample request: F128 B2 S<CR><LF>

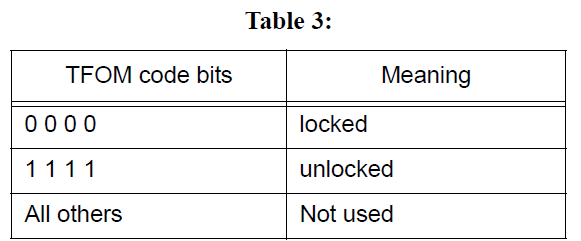
Response: F128 B2: <CR><LF>

HQ OUT PART NUMBER 87-8016-6<CR><LF>

SOFTWARE 230-01510-10v1.2<CR><LF>

FPGA 230-01510-09v01<CR><LF

The following table shows the Time Figure of Merit Codes



To obtain the Have Quick Out option board TFOM output format information, send the following string to the Serial/Network port:

F128<SP>B<N><SEP>TFOM<CR><LF>

where:

F = ASCII character F.

128 = function number.

<SP> = ASCII space character one or more.

B = ASCII character to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

TFOM = ASCII string for TFOM output format request.

<LT> = line terminator; for output strings (a carriage return and line feed ) or for input strings (a carriage return only).

Sample request: F128 B2 TFOM<CR><LF>

Response: F128 B2 TFOM ENABLE <CR><LF>

To change the Have Quick Time Figure of Merit output enable/disable selection, send the following send the following string to the Serial/Network port:

F128<SP>B<N><SP>TFOM<SP><OUT><LT>

where:

F = ASCII character F.

128 = function number.

<SP> = ASCII space character.

B = ASCII character to denote Option Bay number follows

<N> = Option Bay Number, 1 through 10.

TFOM = ASCII character to denote “Time Figure of Merit” selection.

<OUT>= TFOM Output selection, ENABLE or DISABLE

<LT> = line terminator; for output strings (a carriage return and line feed ) or for input strings (a carriage return only).

Sample entry: F128 B2 TFOM ENABLE<CR>

Response: OK<CR><LF>

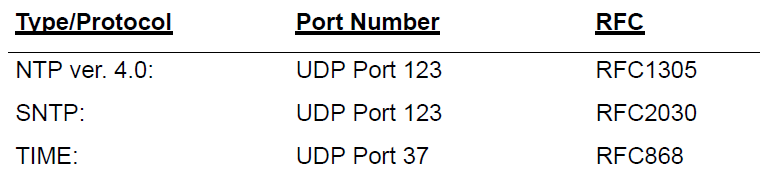
**D: Network Time Protocol (NTP)**

As an option, Manufacturer can factory configure the GPS to function as a Stratum 1 network time server.

Network time servers use Network Time Protocol (NTP) to synchronize computer clocks across a network.

Support for version 4.0 of the NTP, RFC 1305 as well as the Simple Network Time Protocol (SNTP), RFC2030 is available. In addition, the GPS responds to TIME protocol requests, RFC868.

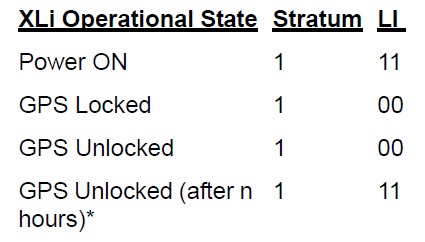
The Network Time Server responds to time synchronization requests from hosts using these User Datagram Protocol/Internet Protocols (UDP/IP):



NTP Packet Transmitted Timestamp Accuracy ±10 milliseconds

**Leap Indicator**

After the GPS has entered a holdover state (“flywheeling” on its internal oscillator or Aux Ref while a time reference is absent) for "n" hours, the Leap Indicator transitions to "11" and the Stratum Level stays at "1". "n" is dependent upon the GPS reference oscillator. When an internal phase error within the NTP server is greater than 1 millisecond the Leap Indicator will transition to unsynchronized ("11"). This can take a very long time when an OCXO or Rb is installed in the GPS.



\* n is dependent upon the GPS reference oscillator

**Editing ntp.conf**

*Note:* The GPS is a Stratum 1 NTP server. Therefore, it does not support NTP peering, in which a time server gets time information by sending an NTP query to another time server. Entering valid IP addresses for the ‘server’ parameters (e.g., “server 216.210.169.40”) in ntp.conf does not enable peering in the GPS.

The current text of “ntp.conf” is as follows:

# W A R N I N G ! ! ! Microsoft Internet Explorer complications...

# 1) Do not use a full colon character - even in comments!

# 2) If this file does not submit, it has too many characters in it and you

# must shorten this file. Do this by eliminating the pound sign comments.

# ALL servers are optional - when GPS is synchronized. The first server

# in the list is the "Trusted Server". The following are public Manufacturer NTP

# Timeservers.

#server 69.25.96.11

#server 69.25.96.12

# Private time servers (example only).

#server 192.168.1.35

# Uncomment the "broadcast" line below to enable NTP broadcast mode with MD5

# using key 1. The key may be omitted, but is less secure. If a key is used

# here, a corresponding entry for that key must appear in the NTP key file. A

# maximum of 20 keys for broadcast can be defined on this line.

#broadcast 192.168.1.255 key 1

# Command below lists trusted keys. See NTP keys file for the actual keys and

# key numbers. Keys ID's 1 and 2 are examples. A maximum of 20 trusted keys

# can be defined on this line.

#trustedkey 1 2

**Editing MD5 keys on the NTP Server**

NTP keys are needed if you are using NTP in broadcast mode with MD5 authentication. This (and the following) section provide configuration guidelines. For additional information, consult Dr. Mills NTP site at: http://www.ntp.org

Broadcast mode adjusts its periodicity according to feedback from its broadcast client. The periodicity will typically settle-out to about every 2 minutes. This activity is not adjustable.

MD5 private keys have to be edited on both the NTP server and the NTP client. The private keys are defined in the “ntp.keys” file.

The NTP client “ntp.keys” file is identical to the one on the NTP server. For the specific keys used by the NTP server, the NTP client must have the identical line in its version of the file. You’ll want to use your own hard-to-guess key names, using random letters. The critical lines of the “ntp.keys” file are:

1 M truetime

2 M TTGPS

where:

• “1” and “2” are the key identifiers

• “M” specifies MD5 authentication, the only type available

• “truetime” and “TTGPS” are the arbitrarily chosen keys

The first column is the key identification number, which may range in whole positive numbers from 1 to

65,535. The second column is the type of key, which is always set to the letter *M* when using MD5 authentication. The third column is the private key that is ASCII text from 1 to 32 characters in length.

Up to eight MD5 can be established.

**Editing MD5 keys on the NTP Client**

For NTP client authentication, the line trustedkey 1 2 in the “ntp.conf” file is required to enable the private keys 1 and 2 from the “ntp.keys” file. The line bclient is required for broadcast time packets to be processed by the NTP client. In this case, sample information from a client “ntp.conf” file might look like:

trustedkey 1 2

bclient

Network Time Protocol (NTP) does not permit comments in the ntp.keys files. Inserting comments will prevent the ntp.keys files from being parsed correctly and turns off authentication at initialization.

Sample information in a client “ntp.keys” file might look like:

1 M truetime

2 M TTGPS

When you invoke the NTP client at the command line, use the following options:

– b to turn on broadcast reception

– k /etc/ntp.keys to specify the name and location of the keys file

– d for debugging.

An example command line might look like:

**ntpd –d –d –d –b –k /etc/ntp.keys**

Important lines in the ntp.conf file of the ntp ***client*** (not server) are:

trusted key 1 2

If you do not use MD5 authentication, remove # from “#disable auth”.