411-2133-919

CDMA

GPSTM GUI

User Guide

NBSS10.1 Preliminary 01.01 June 2001

What's inside...

NORTEL NETWORKS™

CDMA

GPSTM GUI

User Guide

Document number: 411-2133-919
Product release: NBSS10.1
Document version: Preliminary 01.01
Date: June 2001

Publication history

June 2001

NBSS10.1, Preliminary, 01.01. This is a new manual resulting from a modularization of the 411-2133-550, Metro Cell and Minicell Maintenance and Troubleshooting Guide. The following new manuals were created for NBSS101.1:

411-2133-550, *Metro Cell Maintenance and Troubleshooting Procedures*

411-2133-551, *Metro Cell Expansion and Reconfiguration Procedures*

411-2133-552, *Metro Cell Cell Site Functional Testing Procedure*s

411-2133-918, *ECM GUI User Guide*

411-2133-919, *GPSTM GUI User Guide*

The 411-2133-509, *BSS Manager Operating Procedure*s acts as a complement to the above manuals.

Contents

About this document

The GPSTM (Global Positioning Satellite Timing Module) is a GPS disciplined oscillator which provides outputs of Even_Second, 10 MHz, 9.8304MHz, and serial data using the SCPI protocol.

This document describes the operation and features of the GPSTM including the module's LEDs, antenna system, and basic use of the monitor tool.

This user guide results from changes made to the 411-2133-550 for NBSS10.1 in which modules were broken out into the following new manuals:

411-2133-550, *Metro Cell Maintenance and Troubleshooting Procedures*

411-2133-551, *Metro Cell Expansion and Reconfiguration Procedures*

411-2133-552, *Metro Cell Cell Site Functional Testing Procedure*s

411-2133-918, *ECM GUI User Guide*

411-2133-919, *GPSTM GUI User Guide*

The 411-2133-509, *BSS Manager Operating Procedure*s acts as a complement to the above manuals.

Audience for this document

This document is intended for cell site technicians who are experienced with a CDMA Metro Cell system and who have knowledge of the Windows™ operating environment.

Organization of this document

This document contains the following sections:

- GPTSM GUI maintenance tool description
- Preparing the GPSTM

- Using the GPS_Monitor GUI program

Related documents

411-2133-509, *BSS Manager Operaing Procedures*

411-2133-550, *Metro Cell Maintenance and Troubleshooting Procedures*

411-2133-551, *Metro Cell Expansion and Reconfiguration Procedures*

Indication of hypertext links

Hypertext links in this document are indicated in blue. If viewing a PDF version of this document, click on the blue text to jump to the associated section or page.

GPTSM GUI maintenance tool description

The GPSTM (Global Positioning Satellite Timing Module) is a GPS disciplined oscillator which provides outputs of Even_Second, 10 MHz, 9.8304MHz, and serial data using the SCPI protocol. This section describes the operation and features of the GPSTM including the module's LEDs, antenna system.

GPSTM antenna and antenna feed cable

The GPSTM uses an active antenna and a low loss feed cable to receive a 1575.42MHz ±1.023MHz signal from GPS satellites. The antenna input connector is a female type-SMB connector, and is located on the front panel of the GPSTM (J1).

The GPSTM supplies current to the active antenna using the feed cable center conductor. The GPSTM can source up to 50 mA at 5 Vdc for this purpose.

The GPSTM is designed to anticipate a net gain of +10 dB at the input type-SMB connector. For example, if the antenna gain is 30 dB, then the allowable cable loss is 20 dB. Table 2-1 summarizes the cable loss and time delay characteristics of cable types commonly used with the GPSTM.

Table 2-1
GPSTM cable loss (1575 MHz) and delay characteristics

Cable Type	Cable Loss (approx.)	Time Delay
LMR-400	0.05 dB / foot 0.167 dB / meter	1.33 nanoseconds / foot 4 nanoseconds / meter
RG-213	0.1 dB / foot 0.33 dB / meter	1.67 nanoseconds / foot 5 nanoseconds / meter
LDF2-50	0.0443 dB / foot 0.145 dB / meter	1.155 nanoseconds/foot 3.79 nanoseconds / meter

Note: Cable losses greater than 20 dB require the use of in-line amplification. Cable time delay is compensated using the GPS_Monitor. (See "Using the GPS_Monitor GUI program" on page 4-19)

WARNING
The GPSTM antenna cable propagation delay should only be set **before** the GPSTM enters into the "locked" mode of operation. If the delay is set while the unit is in lock, the subsequent timing shift may cause a momentary performance impact such as dropped calls and/or access failures until the GPSTM can adjust internally to reflect the change. The GPSTM **does not** need to be reseated for the delay change to take effect.

Once an antenna delay value has been entered using the Trimble GPS Monitor Tool, it immediately takes effect. In addition, the new delay value is stored in non volatile memory and will be used on all subsequent power-ups of the GPSTM. This parameter only needs be adjusted upon initial commissioning of the GPSTM and when the GPS antenna cabling is changed.

GPSTM LED indicators

Table 2-2 lists the GPSTM front panel LEDs and their meanings.

Table 2-2
GPSTM front panel LEDs

Name	Color	Control	Function
Comm Fault	Yellow Circular	GPSTM User	It is turned 'ON' by the GPSTM if no activity is sensed between the GPSTM and the system for more than 60 seconds. This LED can also be toggled by the system firmware
GPSTM Fault	Red Triangle	GPSTM User	If the GPSTM senses an internal fault, the LED is turned 'ON'. This LED can be toggled by the system firmware if there is no internal GPSTM fault detected by the GPSTM. Also, it designates that the GPSTM may be removed from shelf
GPSTM Normal	Green Rectangle	GPSTM User	'ON' indicates normal module operation. This LED can be toggled by the system software
Lock	Green Circular	GPSTM	On when GPSTM tracking/using satellites (is locked to GPS).

Table 2-2
GPSTM front panel LEDs

Holdover	Yellow Circular	GPSTM	On when GPSTM is in holdover state. This LED flashes at 0.5Hz (1 second on, 1 second off) when the unit is in Free-Run Mode.

GPSTM power

Power is supplied to the GPSTM through the rear panel PCB edge connector. Power is derived from the backplane of the digital shelf. It is recommended that the GPSTM not be powered from an external supply.

GPSTM front panel

The GPSTM front panel with all latches open is shown in Figure 2-1. Shown are the five front panel LED indicators, the four input/output SMB connectors, and the serial I/O connector.

Figure 2-1
GPSTM front panel

Preparing the GPSTM

Powering up the GPSTM

Follow the steps in Procedure 3-1 to power-up and synchronize the GPSTM.

Procedure 3-1
Powering up and synchronizing the GPSTM

Step	Action
1	Connect the antenna to the GPSTM front panel SMB connector labeled ‘GPS Ant’.
2	Apply power by sliding the module into slot #2 or #3 of the digital shelf. The application of power results in the following actions internal to the GPSTM. a. All front panel lights illuminate; internal diagnostics are performed (less than 15 seconds). The yellow (circular), green (rectangle), and red (triangular) LEDs are controlled by the system software in the GPSTM as described in “GPSTM LED indicators” on page 2-12. b. Satellite acquisition process is initiated. Acquisition times up to 60 minutes may be anticipated depending on satellite availability and antenna location. c. If the GPSTM has no stored position, a self-survey is performed (2000 averages default). The GPSTM performs approximately one position fix per second in the survey mode. d. 9.8304 MHz and Even_Second outputs are locked to GPS. The “lock” LED illuminates when this occurs. e. GPSTM reverts to time only mode when survey is complete. If the GPSTM has an accurate position stored it uses this position immediately. The time only mode is the most accurate timing state of the GPSTM. In this mode the GPSTM uses all available satellites to derive the best time solution using the assumption that the current location is static and accurate.
3	Connect the GPSTM to a host PC running the Trimble GPS_Monitor Program. Refer to “GPSTM serial interface cable” on page 3-17 for interface details. This step can be done at any time, and yields useful information relative to the tracking status of the GPSTM. Note that nothing is displayed until GPSTM internal diagnostics are completed.

—sheet 1 of 2—

Procedure 3-1
Powering up and synchronizing the GPSTM (continued)

4	Start the monitor program. (This program lets you control and monitor the status of the GPSTM.) "Using the GPS_Monitor GUI program" on page 4-19 for details on the installation and use of the monitor program.
5	 **WARNING** The GPSTM antenna cable propagation delay should only be set **before** the GPSTM enters into the "locked" mode of operation. If the delay is set while the unit is in lock, the subsequent timing shift may cause a momentary performance impact such as dropped calls and/or access failures until the GPSTM can adjust internally to reflect the change. The GPSTM **does not** need to be reseated for the delay change to take effect.
6	Program the correct antenna delay corresponding to the length and cable type used in the antenna system. The accuracy of the timing signals requires this step, although the frequency stability of the GPSTM itself is not affected by cable delay. An incorrect cable delay (including a delay of 0ns) can cause call problems on the Metro Cell system. Once an antenna delay value has been entered using the Trimble GPS Monitor Tool, it immediately takes effect. In addition, the new delay value is stored in non volatile memory and will be used on all subsequent power-ups of the GPSTM. This parameter only needs be adjusted upon initial commissioning of the GPSTM and when the GPS antenna cabling is changed.

—sheet 2 of 2—

Operational tips

There are many user selectable parameters that affect the operation of the GPSTM. The most important of these parameters are:

1. Antenna Delay (refer to "Powering up the GPSTM" on page 3-15 and "GPSTM antenna and antenna feed cable" on page 2-11)
2. Antenna location—the satellite orbits are inclined at approximately 55° relative to the equator. If you examine the geometry resulting from this orbital plane it is clear that site locations in the Northern Hemisphere should give preference to antenna locations which have a clear view to the South. Likewise site locations in the Southern Hemisphere should give preference to a northern view of the sky. This effect becomes more pronounced as the latitude increases in absolute value.
3. Input Position—GPSTM performance relies on the accuracy of the input position relative to the actual location of the antenna. Several position integrity functions are included in the GPSTM firmware:

— If, during power-up, the GPSTM senses that no position is stored, it performs a self-survey; 2000 position averages are used for the survey.

— If, during power-up, the stored position produces pseudo-range residuals that are beyond a preset threshold, the GPSTM assumes that the stored position is no longer accurate, and performs a self-survey.

— If the GPSTM has a stored position at power-on, but is not able to track satellites for thirty minutes, a self-survey is performed.

GPSTM serial interface cable

The serial interface cable is used to connect the GPSTM to the PC running the monitor. The output connector of the GPSTM used for this purpose is a female DB-9 located on the front panel of the GPSTM and labeled RS-232. The pinouts associated with this connector are provided in Table 3-1 and Table 3-2.

Table 3-1
GPSTM connector pinouts RS-232 (front panel)

Signal Name	Connector Pins	Description
Tx data (output)	2	RS-232 TX
Rx data (input)	3	RS-232 RX
DTE (input	4	RS-232 Data Set Ready
Ground	5	Signal Ground

Table 3-2
GPSTM connector pinouts PC COM ports

Signal name	DB-9 Pin Number	DB-25 Pin Number
Receive (into PC)	2	3
Transmit (out of PC)	3	2
DTR (out of PC)	4	20
Ground	5	7

A standard nine pin to nine pin cable can be used to connect the GPSTM to a PC without the use of null-modem adapter hardware.

Using the GPS_Monitor GUI program

The GPS_Monitor program, referred to from here on as “the monitor” runs under both the Windows 95® and Windows NT® Operating Systems. The monitor exchanges information with the GPSTM using the SCPI protocol and an RS-232 compatible physical layer. Table 4-1 shows the serial interface parameters needed to communicate with the GPSTM.

Table 4-1
GPSTM serial interface parameters

Parameter	Value
Baud rate	19.2 kbps
Data format	1 start, 1 stop, 7 data, odd parity
Communication Standard	RS-232

The program file name is GPS_Monitor.exe. The program may be installed by using Windows Explorer® to copy the monitor from the appropriate drive to a hard drive on the PC. At this point the program can be used like any other Windows executable.

> ***Note:*** The monitor program will run under Windows 95® or Windows NT®. The monitor program will not run under DOS or Windows 3.X®.

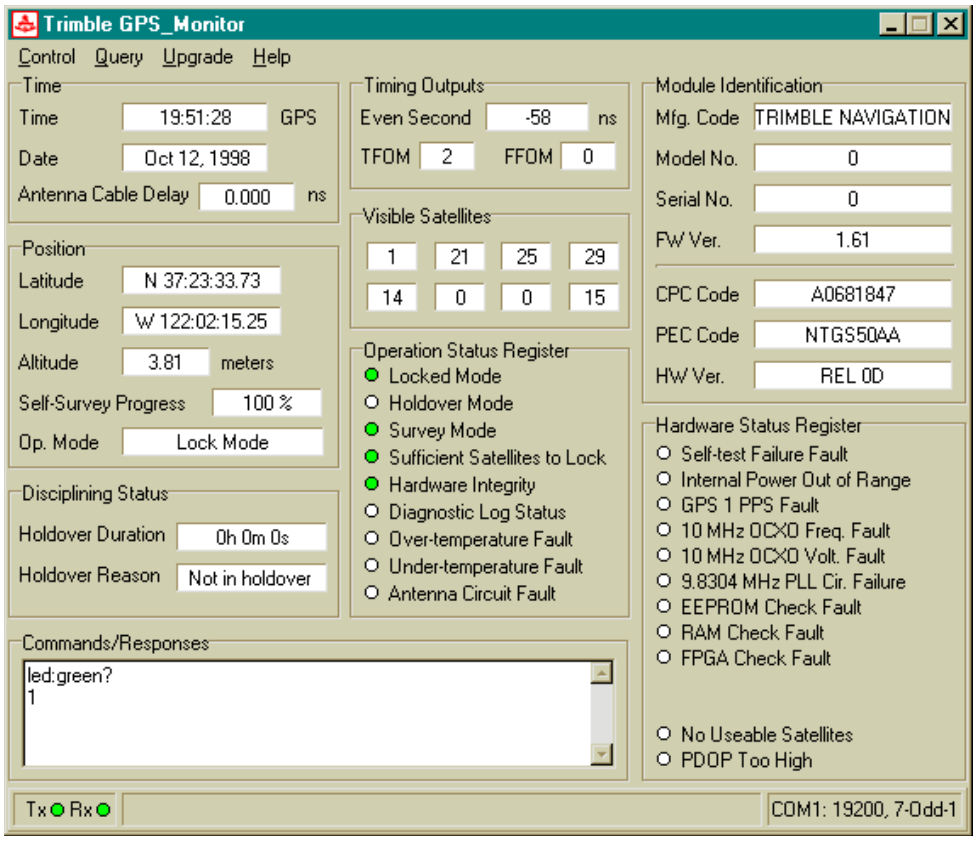
The monitor supports either COM1 or COM2 of the host PC. Take care when installing the interconnect cable that connects the host PC to the GPSTM. The key details related to this cable are listed below.

1. GPSTM physical layer—the GPSTM serial output is RS-232 compatible. Table 4-1 lists the serial data parameters.
2. Signal Connection—the GPSTM may be connected to a PC using a readily available DB-9 to DB-9 cable. No signal line swapping of any kind is necessary. Likewise, if the hosting PC is equipped with a 25 pin connector, a commercially available 25 to 9 pin adapter should function correctly.

Using the program

The monitor main program screen is shown in Figure 4-1. The first part of this section describes the main screen. This screen (with different or missing data fields) is what you see when the monitor program is invoked (after the COM port select screen in which you pick COM1 or COM2 on the host PC).

Figure 4-1
GPSTM Monitor main menu screen



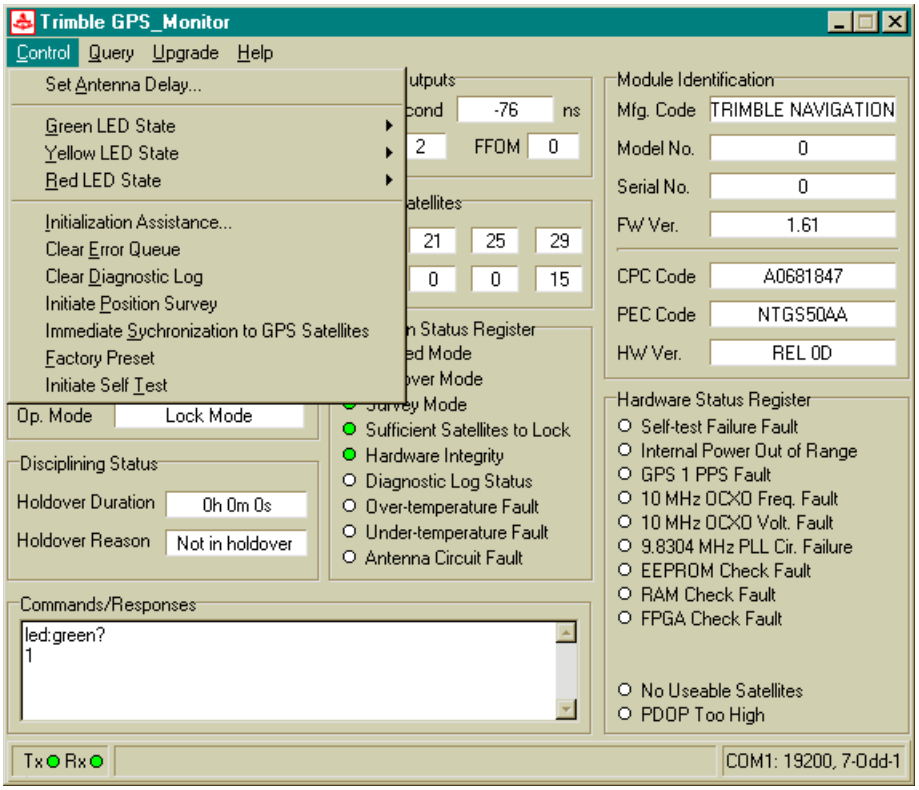
The main screen has a number of labeled data fields. The field label generally give enough information as to its purpose; additional details are provided in "GPSTM monitor 'Help' menu" on page 4-26. Subsequent subsections detail pull-down menu fields for controlling the GPSTM. These fields are accessed by using the cursor to select the item of interest on the menu bar (located immediately below the program title bar). The common alternative selection method of holding down the 'alt' key while depressing the underlined letter of the desired action keyword is also supported throughout this program.

The 'Commands/Responses' window shows the commands sent to the GPSTM and the GPSTM's response. This window can be used as a diagnostic tool.

The monitor ‘Control’ menu

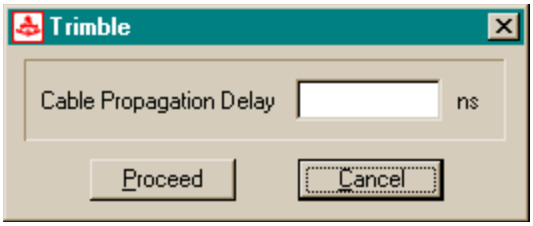
The monitor display changes as shown in Figure 4-2 when the ‘Control’ pull-down menu is selected. The cursor is not shown in any of the screens.

Figure 4-2
GPSTM monitor ‘Control’ pull-down menu



The purpose of each item in the ‘Control’ pull-down menu is clearly labeled. For example, to change the antenna delay, select the ‘Set Antenna Delay’ field. Doing so results in the dialogue box shown in Figure 4-3, located in the middle of the display screen.

Figure 4-3
GPSTM cable propagation dialogue box

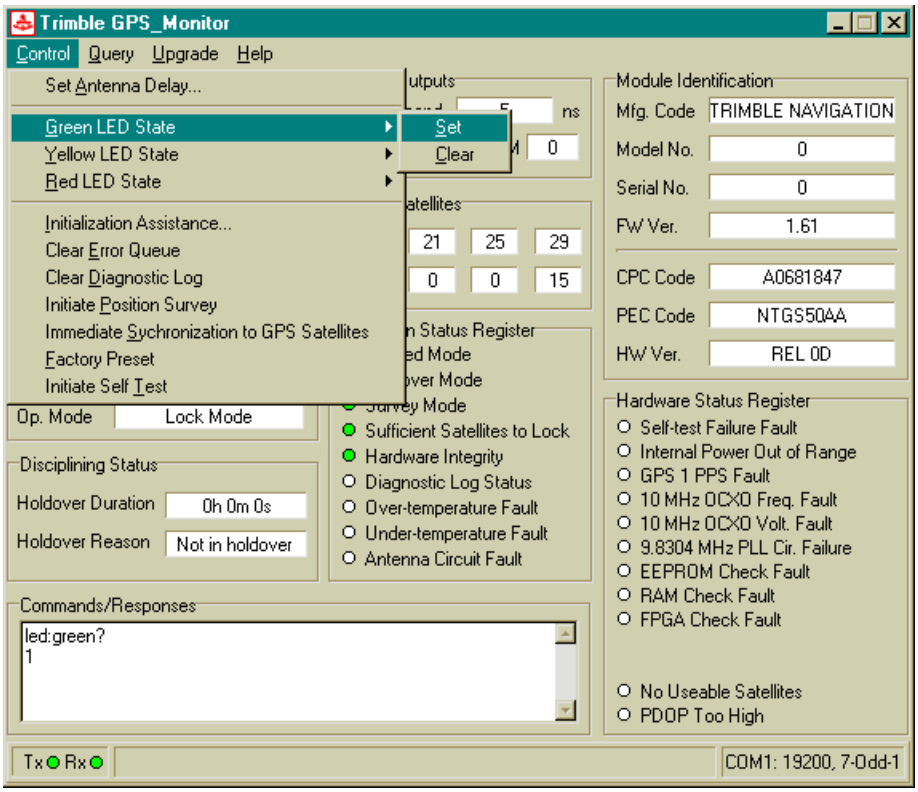


WARNING
The GPSTM antenna cable propagation delay should only be set **before** the GPSTM enters into the "locked" mode of operation. If the delay is set while the unit is in lock, the subsequent timing shift may cause a momentary performance impact such as dropped calls and/or access failures until the GPSTM can adjust internally to reflect the change. The GPSTM **does not** need to be reseated for the delay change to take effect.

Once an antenna delay value has been entered using the Trimble GPS Monitor Tool, it immediately takes effect. In addition, the new delay value is stored in non volatile memory and will be used on all subsequent power-ups of the GPSTM. This parameter only needs be adjusted upon initial commissioning of the GPSTM and when the GPS antenna cabling is changed.

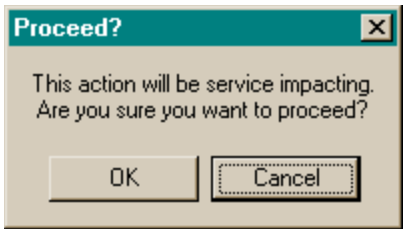
Selecting the ‘Green LED State’ menu item results in the screen shown in Figure 4-4. Use this menu item to set or clear the LED.

Figure 4-4
Using the main menu to set and clear the GPSTM LED



Entering data in some data field selections requires confirmation. One such field is the “Initiate Position Survey” field. The screen shown in Figure 4-5 is displayed when you make this selection. You are issued a warning and given a chance to change your mind.

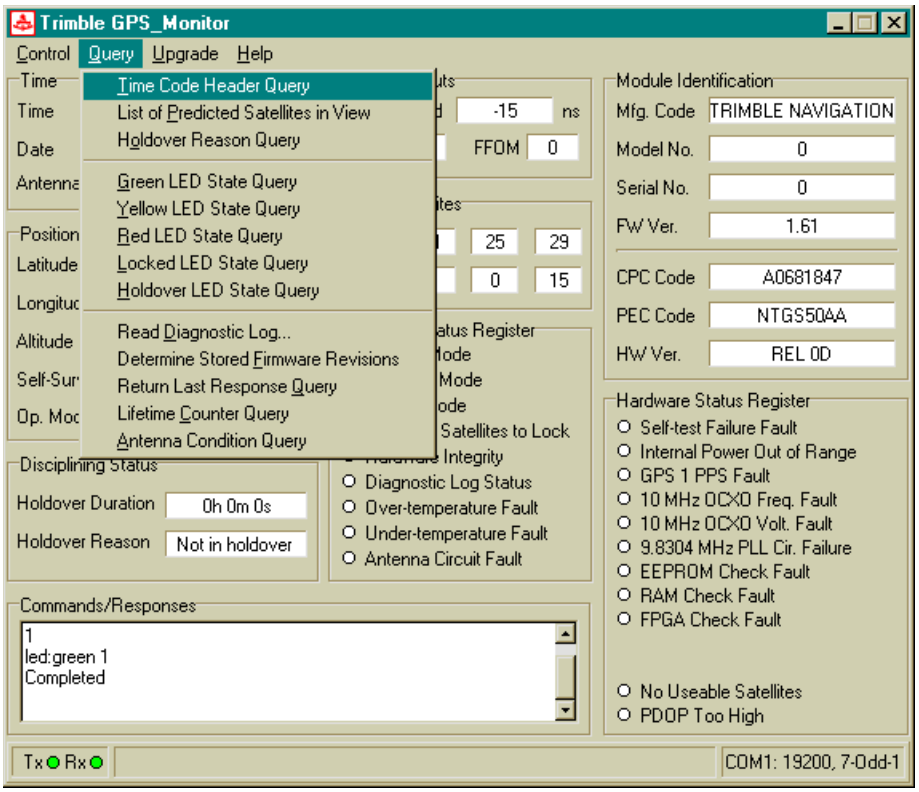
Figure 4-5
Typical confirmation dialogue box



The monitor ‘Query’ menu

Selecting the ‘Query’ pull-down menu produces the screen shown in Figure 4-6.

Figure 4-6
GPSTM monitor 'Query' pull-down menu



Selecting an option from the 'Query' menu leads to additional self-descriptive screens.

GPSTM monitor 'Upgrade' menu

The 'Upgrade' menu item leads to the screen shown in Figure 4-7. If you invoke the 'Load Firmware' menu item, the monitor program transfers control to a field loading tool. This tool is used to change the firmware resident in the GPSTM.

> ***Note:*** This action is service impacting since it requires cycling power to the GPSTM; it is not an "in-service" download.

Figure 4-7
GPSTM monitor 'Upgrade' pull-down menu

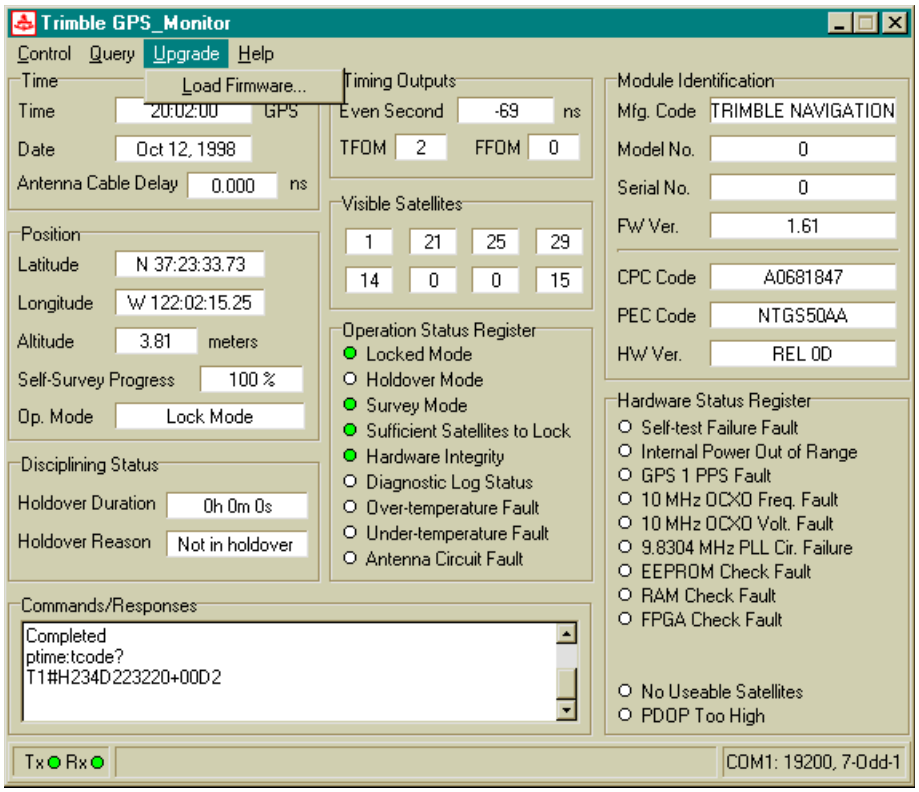
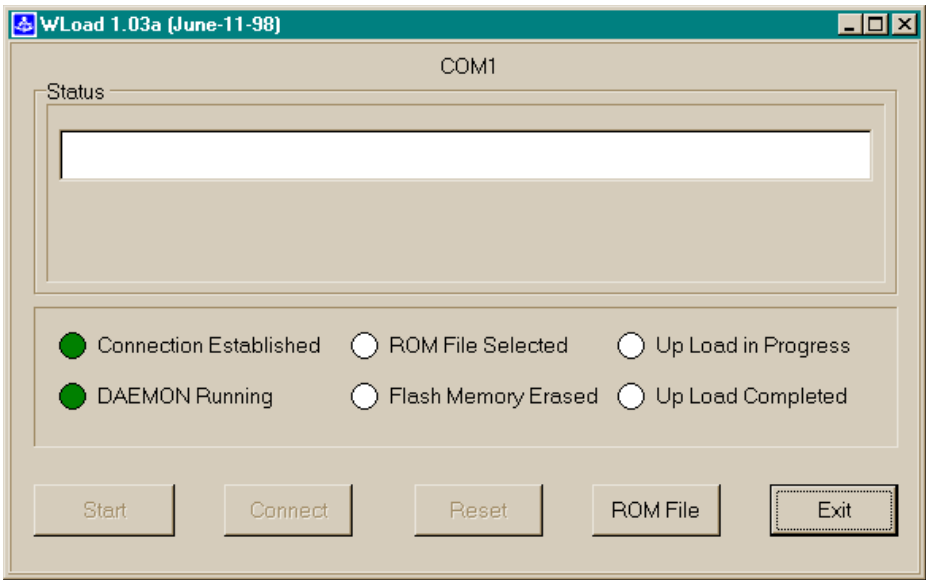


Figure 4-8 shows the dialogue invoked by the 'Load Firmware' menu item.

Figure 4-8
'Upgrade' menu 'Load Firmware' menu item



The loader tool takes you through the following sequence:

1. It automatically starts and downloads a Daemon to the GPSTM.
2. After Daemon loading is complete click on the 'ROM File' button to select the firmware version to be downloaded.
3. The flash memory is then erased removing the current GPSTM firmware.
4. The new firmware is then uploaded (a progress bar is shown).

   Note: If download is interrupted during the upgrade and the laptop crashes, reboot, cycle the power and attempt the upgrade (flash Process) again. If the problem persists replace the unit.

5. When the 'Up Load Completed' indicator is illuminated, click on the 'Exit' button to return to the monitor program.
6. The loader tool prompts you to cycle power on the GPSTM which must be done before the new firmware can be used.

GPSTM monitor 'Help' menu

Use this menu item to retrieve information about the monitor pedigree, code revision, date, and other fields.

Main screen items

Many of the information fields on the main program screen are self-evident such as position, holdover mode, and others. This section provides additional information on some fields that require it. Fields are described as they appear from top to bottom starting at the left.

— Holdover Duration

This field contains a simple clock that starts when the GPSTM enters holdover mode, either manual or auto, and stops when the GPSTM returns to the normal mode. The clock retains the time in holdover until a new holdover event occurs.

- Command/Response Window

  This window is a scrolling display of the commands sent to the GPSTM and the responses sent from the GPSTM.

- Timing Outputs – Even Second

  This field contains the instantaneous difference between GPS time and the GPSTM time. Because GPS is subject to selective availability the GPSTM will always be more accurate than a "snapshot" GPS timing fix, and this output will appear to be noisy.

- Timing Outputs – TFOM

TFOM is “time figure of merit”, and is a byte field containing an integer between 0 and 9. The TFOM is defined as {log(estimated time error in nanoseconds) + 1}.

- Timing Outputs -FFOM

  FFOM is “frequency figure of merit”, and is a byte field that describes the relationship of the GPS engine to the precision oscillator. Four values are defined.

  0 - GPSTM is locked to GPS, oscillator is in specification

  1 - GPSTM is locked to GPS, oscillator is not yet stabilized

  2 - GPSTM is in holdover mode

  3 - GPSTM is unlocked, and not in holdover (just powered up)

- Satellite Info

  These fields display the PRN numbers (unique identifier) of satellites (SVs) currently being tracked.

- Operation Status Register

  Table 4-2 lists all operation status registers, their indicator modes, and their meanings.

Table 4-2
GPSTM monitor program operation status registers

Register	On =	Off =
Locked mode	green = locked (normal)	yellow = not locked
Holdover mode	yellow = in holdover	white = otherwise
Survey mode	green = survey complete	yellow = otherwise
Sufficient Satellites	green = sufficient SVs	yellow = otherwise
Hardware Integrity Detected	red = fault detected	green = no fault
Diagnostic Log Status	yellow = log almost full	white = otherwise
Over-temperature Fault	yellow = internal temp >70°C	white = otherwise
Under-temperature Fault	yellow = internal temp <0°C	white = otherwise
Antenna Fault	red = open or short	white = otherwise

- Module Identification

  Data in these fields contain information relative to the pedigree of the GPSTM. Field contents consist of both Trimble and Nortel Networks identification codes.

- Hardware Status Register

  Table 4-3 lists all hardware status registers, their indicator modes, and their meanings.

Table 4-3
GPSTM monitor program hardware status registers

Register	On =	Off =
Self-test Failure	red = self-test failed	white = otherwise
Power Out of Range	red = power range fault	white = otherwise
GPS PPS Fault	yellow = limit exceeded	white = otherwise
10MHz Freq. Fault	yellow = limit exceeded	white = otherwise
10MHz voltage Fault	yellow = DAC at limit	white = otherwise
9.8304MHz Failure	red = 9.8304MHz failure	white = otherwise
EEPROM Fault	red =checksum failed	white = otherwise
RAM Fault	red = RAM fault detected	white = otherwise
FPGA Fault	red = FPGA fault detected	white = otherwise
No Usable Satellites	yellow = no sats usable	white = otherwise
PDOP Too High[a]	yellow = PDOP > threshold	white = otherwise

a. Only applicable during self-survey mode of operation

- Tx Rx indicators

  These indicators at the bottom left of the monitor screen flash during serial port transmit (Tx) and serial port receive (Rx) respectively.

- 19200,7-odd-1

  This field at the lower right of the monitor screen indicates the monitor baud rate (19200), number of data bits (7), parity (Odd), and number of stop bits (1). Currently these settings are static; you cannot alter them.

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Document number: 411-2133-919
Product release: NBSS10.1
Document version: Preliminary 01.01
Date: June 2001
Printed in the United States of America/Canada

NORTEL NETWORKS™