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58540A
GPS Time and Frequency Reference Receiver

User's Guide

This manual describes a Symmetricom GPS time and frequency reference receiver, including its system hardware and software.

This operating manual is the primary document for the 58540A GPS Time and Frequency Reference Receiver.

This manual applies to the 58540A GPS Time and Frequency Reference Receiver you have received unless update information is included with the equipment.

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Warning Symbols That May Be Used In This Book

Instruction manual symbol; the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual.

Indicates hazardous voltages.

Indicates earth (ground) terminal.

or

Indicates terminal is connected to chassis when such connection is not apparent.

Indicates Alternating current.

Indicates Direct current.

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In This Guide

Guide Organization

Table of Contents

In This Guide (this preface) introduces you to the User's guide.

Chapter 1, "**Introduction**," introduces and describes the 58540A GPS Time and Frequency Reference Receiver.

Chapter 2, "**Serial Interface and Commands**," describes the serial interface and how to use SCPI (Standard Commands for Programmable Instruments) commands in order to set up, control, and monitor the 58540A.

Chapter 3, "**Specifications**," lists all of the 58540A specifications and characteristics.

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1

Introduction

Chapter Contents

This chapter introduces you to the 58540A GPS Receiver.

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Overview

58540A GPS Time and Frequency Reference Receiver

The 58540A (shown in the section "The 58540A at a Glance" on page 1-6) is a cost-effective source of GPS time and frequency. Designed to be an off-the-shelf product that is easily integrated into system equipment, the 58540A is a compact unit that operates on +24 Vdc power and has all connections easily accessible on the front panel. The 58540A is also suitable to be used in both laboratories and manufacturing facilities where precision and synchronized timing references are required.

An RS-232C serial port has been provided for the system-level interface. Through the use of SCPI command set, you can both set up and monitor the different operations of the product via a data terminal. The product also features a high number of satellite (GPS) health monitoring and reporting functions. For example, both the T-RAIM and Self-Survey Mode are two of the many features offered in the product.

To meet the challenging demand of ever evolving space reduction in wireless and telecom equipment, the product has been packaged in an extremely compact box. Being the size of only 50 mm (H) by 100 mm (W) and by 125 mm (L), and with a weight of only 420 grams for a standard unit, the box can be conveniently mounted to an existing pc board, a system rack or any available anchoring locations of an electronic enclosure. Signal and power connections are straightforward.

Standard Configuration: 10 MHz, 1PPS

In its standard configuration, this GPS-based reference receiver produces 10 MHz frequency and 1PPS outputs. Phase coherency is maintained between the frequency and timing outputs — a feature essential for some specific system timing applications. When the crystal oscillator is locked to the GPS signal, the frequency accuracy of the 10 MHz signal is better than 1×10^{-11}(one-day average), and the 1PPS signal is synchronized to UTC (USNO MC) within 110 ns, typical.

Antenna System Accessories

Symmetricom recommends the use of Symmetricom GPS antenna system accessories in conjunction with the 58540A. Part numbers for a variety of Symmetricom accessories are included in the section “Accessory Products” on page 3-10 of Chapter 3, “Specifications.”

Options

- Option 001 DCE Configuration RS-232C and DB-9 (Female) Connector, see tables 3-1 and 3-2 for more details.

Additional Accessories Available

- 58531A GPS Timing Receiver Analysis and Control Software

About the 58531A GPS Timing Receiver Analysis and Control Software

The 58531A GPS Timing Receiver Analysis and Control Software is a PC Windows®-based program (for Windows NT 4.0 or Windows 95); this program controls the 58540A GPS Time and Frequency Reference Receiver, and processes and displays information received from it. The program has tools to help in analyzing the receiver data, and can log the information to a file for analysis using other tools.

The 58531A GPS Timing Receiver Analysis and Control Software program includes these features:

- convenient configuration of the software and 58540A GPS Time and Frequency Reference Receiver
- real-time information update
- control and query of the 58540A GPS Time and Frequency Reference Receiver via menu-driven commands
- generate a data log file for analysis
- generate an error log file for analysis
- plot instant or average position in real time
- plot satellite history, such as PRN, C/N, elevation, DOP
- calculate and display average or maximum C/N and associated elevation and azimuth angles

Service and Repair Information

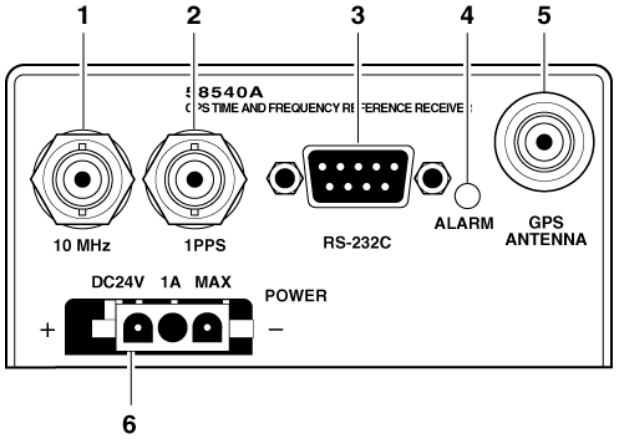
This product is not field repairable. Contact your local Symmetricom sales or service center to arrange for repairs.

Information Roadmap for Product Specifications

Specification data have been presented in this guide in a categorized manner. For quick access of information, please refer to the following:

- For commands to control and to monitor the instrument, see Chapter 2, “Serial Interface and Commands.”
- Electrical performance characteristics of the 58540A instrument are summarized in Table 3-1 on page 3-3 of Chapter 3, “Specifications”.
- Connector information, such as types and pin assignments, etc., are listed in Tables 3-2 and 3-3 starting on page 3-7.
- Accessory product numbers for antenna and cables are listed in Table 3-4.
- A functional block diagram for the instrument is included in Figure 3-1 on page 3-13.
- A diagram for the instrument external dimensions of the Standard configuration is included in Figure 3-2 on page 3-14.

The 58540A at a Glance



1 10 MHz BNC female connector for outputting 10 MHz for user-specific applications.

2 1PPS BNC connector for outputting a continuous One-Pulse-Per-Second signal.

3 RS-232C, DB-9 (female) serial interface port for remote control, monitoring, and downloading of the Receiver's memory data and upgrading Receiver software. Standard configuration is DTE. Option 001 provides a DCE configuration.

4 When the **ALARM** indicator illuminates green, there are no alarms. When it illuminates red, the Receiver is in an alarm or error state.

See the section "Alarm LED Description" on page 3-9 in Chapter 3 for details.

5 GPS ANTENNA TNC-type (female) connector for GPS Antenna connection.

6 POWER 24V dc input connector (AMP part number 643228-1).

2

Serial Interface and Commands

Chapter Contents

This chapter provides a description for each command that can be used to operate the 58540A GPS Time and Frequency Reference Receiver.

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About the Serial Interface

Establishing Communication with the Instrument

The serial interface allows control and monitoring of instrument operation. Signal levels conform to the RS-232C standard. The default communication settings for the instrument are:

Baud Rate: 9600

Parity: None

Data Bits: 8

Stop Bits: 1

Pacing: None (not a changeable setting)

Echo: OFF (not a changeable setting)

The easiest way to communicate with the instrument is via a terminal emulator, such as the Terminal application in Windows® NT (or Windows® 95). The steps are:

1. In Windows NT (or Windows 95), main window, click the **Start** button then select **Programs**.
2. Select **Accessories**, **Hyperterminal**, and **Hyper Terminal**.

   The **Connection Description** dialog box is displayed.
3. In the “Name” window, type **58540A** (for example), select one of the icons (the first one will do), then click **OK**.

   The **Connect To** dialog box is displayed.
4. In the “Connect using” window, select the appropriate port or connector (COM1 or COM2), then click **OK**.

   The **COM1** (or **COM2**) **Properties** dialog box is displayed. This dialog box allows you to configure the RS-232 port of your PC.
5. Set the RS-232 port of your PC to match the default values of the 58540A.

Once you've enabled the correct COM port from your PC, a prompt should appear each time you press the enter (or return) key.

NOTE — Set: PTIMe:TCODe:CONTinuous Command to "0" for Prompt to Appear

When shipped from the factory, the 58540A is defaulted to continually output date and time of day (TOD) information without an intervening prompt. To stop this and to get a prompt, type:

:PTIMe:TCOD:CONT 0

This can be typed and it does not matter if it is interrupted by the output each second. Continue until the entire command is typed and press the enter (or return) key. This will stop the continuous TOD information, and a prompt will appear.

The prompt will look either like **scpi >** or something like **E-113>** if an error has occurred. To send commands you must have the **scpi>** prompt. If an **E-113>** or similar prompt appears, type the *cls command to return to the **scpi>** prompt.

Following the **scpi>** prompt you can type the command you want to send. For commands that produce a response, the reply will appear on screen. For example, sending *idn? asks the instrument to identify itself. The transaction might look something like this:

scpi > *idn?

58540A,JP38400000,3840-A

scpi >

You can change the instrument communication settings using the commands listed in Table 2-1.

Use Caution When Changing Communication Settings

Be careful using the commands in Table 2-1 because programming a communications setting to something your terminal or computer doesn't support will prevent further communication with the instrument. The settings are retained when the instrument is powered-down; therefore, there is no need to re-program following a power-up.

Boolean Values

Several boolean values are accepted in the SCPI interface.

A true boolean value may be entered using any of the following:

TRUE, ON, or 1.

A false boolean value may be entered using any of the following:

FALSE, OFF, or 0.

Boolean values are always returned in their numeric form (0 or 1).

SCPI Interface Limitations

The length of any one SCPI command entered is limited to 128 bytes. Also, only 10 commands can be processed in a second by the GPS instrument. If any command entered is longer than 128 bytes, it will be discarded and a 363 error (Internal buffer Overflow) error will be recorded. Additionally, if more than 10 commands are entered in any processing second, they will also be discarded and a 363 error will be recorded.

Serial Port Commands

You can change the instrument communication settings using the commands listed in Table 2-1. Be careful using these commands because programming a communications setting to something your terminal or computer doesn't support will prevent further communication with the instrument. The settings are retained when the instrument is powered-down; therefore, there is no need to re-program following a power-up.

Table 2-1. Serial Port Commands

Command	Definition
:SYSTem:COMMunicate:SERial:BAUD …	Sets the baud rate. Valid settings are 1200, 2400, 9600, or 19200. For example, to set the baud rate to 19200, send:SYST:COMM:SER:BAUD 19200. The factory default setting is 9600.
:SYSTem:COMMunicate:SERial:BAUD?	Returns the current baud rate setting.
:SYSTem:COMMunicate:SERial:BITS …	Sets the number of data bits. Valid entries are 7 or 8.
:SYSTem:COMMunicate:SERial:BITS?	Returns the number of data bits being used.
:SYSTem:COMMunicate:SERial:PARity …	Sets parity. Choices are EVEN, ODD, or NONE. For example, to set parity to even, send :SYST:COMM:SER:PAR EVEN.
:SYSTem:COMMunicate:SERial:PARity?	Returns the current parity setting.
:SYSTem:COMMunicate:SERial:SBITs …	Sets the number of stop bits. Choices are 1 or 2. For example, to set stop bits to 1, send :SYST:COMM:SER:SBIT 1.
:SYSTem:COMMunicate:SERial:SBITs?	Returns number of stop bits being used.

Operational Commands

Once communication with the instrument has been established, there are other commands you can use to change states or query for information. These commands are listed and summarized in the following sections.

Basic Commands

Table 2-2. Basic Commands

Command	Definition
*CLS	Clear errors. For example, if the prompt shows **E-113>**, sending *CLS will return it to **scpi>**. To read out the error message, use:SYST: ERR?.
*IDN?	Identifies the instrument. This is an IEEE 488.2 standard command. The response is: Manufacturer, Model, Serial Number, Software Revision.
*TST?	Executes an internal selftest and reports the results. A value of 0 indicates that tests passed, a non-zero value indicates that selftest was not completed or was completed with errors detected. The bit assignment is: Bit 0: ROM error Bit 1: RAM error Bit 2: Not used Bit 3: NVRAM error
:SYSTem:ERRor?	Returns an integer and a quoted string. The integer is an error number. The quoted string is a description of the error.
:SYSTem:LANGuage …	Valid parameters are "PRIMARY" and "INSTALL". PRIMARY is the normal execution mode. INSTALL is used for firmware downloads only.
:SYSTem:LANGuage?	Returns "PRIMARY" or "INSTALL".
:SYSTem:PRESet	Returns the Receiver's parameters to factory settings. Serial port parameters are not affected by a preset.
:SYSTem:PON	Causes a software reset in the instrument.

Date and Time Commands

Table 2-3. Date and Time Commands

Command	Definition
:GPSystem:INITial:DATE …	Sets an approximate date for faster initial GPS acquisition (e.g., :GPS:INIT:DATE <four-digit year>,<month>,<day>.). Following power-up, the Receiver obtains the current date from satellite data. This process occurs automatically. Providing an approximate date, however, reduces the time to initial GPS tracking by assisting the Receiver in finding satellites.Thus, If you know the approximate date, use this command by typing in the known values; for example, :GPS:INIT:DATE 1998,6,24. Note that the initial date and time needs to be within 3 minutes of the actual date and time to be effective in enabling faster initial GPS acquisition.
:GPSystem:INITial:TIME …	Sets an approximate time for faster initial GPS acquisition (e.g., :GPS:INIT:TIME <hour>,<minute>,<second>). Following power-up, the Receiver obtains the current time from satellite data. This process occurs automatically. Providing an approximate time, however, reduces the time to initial GPS tracking by assisting the Receiver in finding satellites. Thus, If you know the approximate time, use this command by typing in the known values; for example, :GPS:INIT:TIME 11,45,30. Note that the initial date and time needs to be within 3 minutes of the actual date and time to be effective in enabling faster initial GPS acquisition.
:PTIMe:DATE?	Returns the current calendar date. The response is year, month, day.
:PTIMe:LEAPsecond:ACCumulated?	Returns the leap second difference accumulated between GPS time and UTC time since the beginning of GPS time. The time units are seconds. An example response is +10.
:PTIMe:TIME?	Returns the current time in hour, minute, second. A typical response would be +23,+33,+8. The time is either GPS or UTC (depending on :PTIMe:UTC setting) and is adjusted for the time zone offset.
:PTIMe:TZONe ...	Sets the local time zone offset to provide an offset from GMT to serve as the basis for all reported time (e.g., :PTIM:TZON <hour>, <minute>). The minute argument is optional.
:PTIMe:TZONe?	Returns the local time zone offset.
:PTIMe:UTC ...	A Boolean value can be entered in this command. If TRUE, then UTC time will be used. If FALSE, then GPS time will be used. Default is UTC time.
:PTIMe:UTC?	Returns a 1 if the unit is in UTC time mode. Returns a 0 if the unit is in GPS time mode.

Timecode Commands

Table 2-4. Timecode Commands

Command	Definition
:PTIMe:TCODe?	This is the Time-of-Day command. The Time of Day message is output within 100 ms after its corresponding 1 PPS output edge. The form of the response is T2YYYYMMDDHHMMSSMFLRVcc, where: T indicates a time code message, and 2 is the time code format setting. YYYYMMDD is the calendar date at the next 1PPS on-time edge. HHMMSS is the 24 hour time at the next 1PPS on-time edge. M is the time figure of merit as described in the SYNC:TFOM query. F is the frequency figure of merit. 10 MHz Reference Stability values: 0 – Stable 1 – Stabilizing signal 2 – Holdover mode; frequency will drift 3 – Unstable L is the leap second indicator. Either “+”, “–”, or “0”. R is the request for service bit. Currently always set to 0. V is the validity byte. 1 indicates that time-related information isn’t valid; 0 indicates that it is valid. cc is the character-by-character checksum of the previous twenty-two characters, output as two hex digit characters. A typical response to :PTIM:TCOD? is: T219941202230439400007B, which represents the date December 12, 1994 and UTC time of 23:04:39.
:PTIMe:TCODe:CONTinuous …	Sets whether or not the :PTIMe:TCODe? output will be automatically generated. If set to 1 (ON) the output will be automatically generated upon every second. If set to 0 (OFF) the output will be generated only once, in response to a :PTIM:TCOD? query. Examples: :PTIM:TCOD:CONT 1 – automatically causes output of the “:PTIM:TCOD?” message every second. :PTIM:TCOD:CONT 0 – causes output of the :PTIM:TCOD? message only when queried. **The only SCPI command that is recognized while time codes are being automatically displayed is PTIM:TCODE:CONT, for purposes of turning the time code display off. See the NOTE on page 2-4 for information on how to type in the command.**

Satellite Tracking Commands

Table 2-5. Satellite Tracking Commands

Command	Definition
:GPSystem:SATellite:TRACking?	Returns a list of all satellites being tracked. Each satellite is identified by its pseudorandom noise code (PRN).
:GPSystem:SATellite:TRACking:COUNt?	Returns the number of satellites currently being tracked.
:GPSystem:SATellite:TRACking:DETail?	Returns a comma separated list of PRN's on the first line, followed by comma separated lists of C/N level, Elevation, and Azimuths. Each list is on a separate line and the data contained in each corresponds in position to the PRN listed on the first line.
:GPSystem:SATellite:TRACking:EMANgle …	Sets the GPS elevation mask angle value (in degrees). This command instructs the Receiver to allow the tracking of satellites whose elevation angle is greater than this elevation mask angle. Satellites below this elevation that are visible, will not be tracked. 0 degrees is the horizon. The range is 5 to 90 degrees. The initial degrees value is 5. For example, to set the mask angle to 20 degrees, send :GPS:SAT:TRAC:EMAN 20.
:GPSystem:SATellite:TRACking:EMANgle?	Returns the GPS elevation mask angle value.
:GPSystem:SATellite:TRACking:IGNore …	Adds the specified satellites to the list that the Receiver ignores for tracking. Each satellite is identified by its pseudorandom noise code (PRN). Multiple satellites can be used in this command by entering a comma separated list of PRNs as the argument. (For example: GPS:SAT:TRAC:IGN 2,4,8).
:GPSystem:SATellite:TRACking:IGNore?	Returns the list of satellites that are not available to be tracked (Ignored).
:GPSystem:SATellite:TRACking:INCLude …	Adds the specified satellites to the list that the Receiver considers for tracking. Actual satellite selection is based on satellite visibility, geometry, and health. Multiple satellites can be used in this command by entering a comma separated list of PRNs as the argument. (For example: GPS:SAT:TRAC:INCL 2,4,8).
:GPSystem:SATellite:TRACking:INCLude?	Returns the list of satellites that are available for tracking (Included).
:GPSystem:SATellite:VISible:PREDicted?	Returns the list of satellites (PRN) that the almanac predicts should be visible, given date, time, and location.

1PPS Related Commands

Table 2-6. 1 PPS Related Commands

Command	Definition
:GPSystem:REFerence:ADELay …	Sets the GPS antenna delay value in seconds. It instructs the Receiver to output its 1PPS output pulse earlier in time to compensate for antenna delay. As an alternative to a fraction of a second, the antenna delay may be entered in nanoseconds. For example, to account for a antenna cable delay of 77 nanoseconds, send :GPS:REF:ADEL 77 NS. The antenna delay has a range of ± 999.9 microseconds and nanosecond precision.
:GPSystem:REFerence:ADELay?	Returns the GPS antenna delay value in seconds.
:GPSystem:REFerence:VALid?	Identifies whether date and time are valid. Returns 0 or 1; 1 indicates date and time are valid.
:SYNChronization:STATe?	Returns POW (Power-up), LOCK, HOLD (Holdover), or REC (Holdover Recovery) to indicate the current mode of the Receiver.
:SYNChronization:TFOMerit?	Returns a numeric “Time Frequency Figure of Merit” from 0 to 9 that indicates the accuracy of the Receiver’s 1PPS relative to GPS. The TFOM number denotes a timing error of $10^{(TFOM-1)}$ to 10^{TFOM} nanoseconds.

Position, Position Survey, and Position Hold Commands

Table 2-7. Position, Position Survey, and Position Hold Commands

Command	Definition
:GPSystem:INITial:POSition …	Sets an approximate position for faster initial GPS acquisition. Following power-up, the receiver refines its position from the satellite data. This process occurs automatically. This command is most effective when the retained position differs significantly from the Receiver's true position. POSition Format: [N or S], lat_degrees, lat_min, lat_sec, [E or W], long_deg, long_min, long_sec, height (m) Valid Latitude Ranges and Precisions: 0 to 90, 0 to 59, 0 to 59.999 Valid Longitude Ranges and Precisions: 0 to 90, 0 to 59, 0 to 59.999 Valid Height Ranges and Precisions: –999.9 m to 17999.9 m
:GPSystem:POSition …	Defines the position of the Receiver. The Receiver uses this position to predict satellites visibility and to determine time. An accurate position is necessary for precise time transfer. POSition Format: [N or S], lat_degrees, lat_min, lat_sec, [E or W], long_deg, long_min, long_sec, height (m) Valid Latitude Ranges and Precisions: 0 to 90, 0 to 59, 0 to 59.999 Valid Longitude Ranges and Precisions: 0 to 90, 0 to 59, 0 to 59.999 Valid Height Ranges and Precisions: –999.9 m to 17999.9 m LAST denotes the last specified position. This parameter is provided to cancel surveying (automatic position computation) and restore the last position setting. SURVey directs the Receiver to stop surveying and use the computed position. This position is the average of individual position computations. **Context Dependencies** **Error -221** is generated if this command is sent as SURV and no valid survey calculation has ever been computed. **Side Effects** This command stops position surveying. The computed position is retained and applied only when SURVey is specified.

Table 2-7. Position, Position Survey, and Position Hold Commands (continued)

Command	Definition
:GPSystem:POSition?	**The position that is reported by the instrument may not exactly match a user set position (via :GPS:POS)**. Discrepancies between requested and programmed position coordinates are primarily attributable to the GPS engine and have a negligible effect on timing precision.
:GPSystem:POSition:ACTual?	Returns the current instantaneous position of the GPS antenna.
:GPSystem:POSition:SURVey:STATe …	Initiates survey mode during which the Receiver determines its position from satellite data. The Receiver refines successive positional estimates to obtain a final position, transitions from survey to position-hold mode. Send :GPS:POS:SURV:STAT ONCE to initiate survey mode.
:GPSystem:POSition:SURVey:STATe?	Identifies whether the Receiver is in survey or position-hold mode. In survey mode, the Receiver continually refines its position. In position-hold mode, the position does not change. A response of ONCE indicates that the Receiver is in survey mode. A response of 0 indicates the Receiver is in position-hold mode.
:GPSystem:POSition:SURVey:STATe:POWerup …	Selects the position mode to be used at power-up. This command specifies whether the Receiver always surveys at power-up or restores its last position at power-up. The command's parameter is a Boolean value. False values set the Receiver to use the last valid position on power-up. True values initiate a position survey on power-up.
:GPSystem:POSition:SURVey:STATe:POWerup?	Returns the position mode to be used at power-up. A value of 0 indicates the Receiver is set to power up in the last valid position. A value of 1 indicates the Receiver is set to survey on power-up.

Diagnostic Commands

Table 2-8. Diagnostic Commands

Command	Definition
:DIAGnostic:ACURrent:STATe?	Returns NORM if the antenna current is okay; otherwise, MIN or MAX is returned to indicate an open or short condition, respectively.
:DIAGnostic:DOWNload …	Used to download a quoted Motorola® S-record to the EEPROM.
:DIAGnostic:ERASe	Erases the flash EEPROM.
:DIAGnostic:ERASe?	Verifies flash EEPROM has been erased.
:STATus:OPERation?	Returns the contents of the diagnostic information register. Each bit in the diagnostic register represents an alarmed condition for a specific monitored event. The bit assignment for the alarmed conditions in the diagnostic register is: Bit 0: Internal PLL error Bit 1: EFC within 5% limit Bit 2: No satellites tracked Bit 3: Antenna current error Bit 4: 1PPS output error Bit 5: 10 MHz output error

Production and Test Commands

Table 2-9. Production and Test Commands

Command	Definition
:SYNChronization:HOLDover:INITiate	Places the Receiver in holdover mode. The Receiver will stay in holdover until you send :SYNC:HOLD:REC:INIT.
:SYNChronization:HOLDover:RECovery:INITiate	Initiates a recovery from manually initiated holdover. Use this command to take the Receiver out of *a manually selected holdover.*

3

Specifications

Chapter Contents

The specifications and characteristics of the 58540A GPS Time and Frequency Reference Receiver are provided in this chapter.

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Electrical Specifications

Table 3-1. 58540A Electrical Specifications

Parameters	Specifications	Comments
GPS Receiver Input	L1 Carrier (1575.42 MHz), C/A Code.	
	Up to eight channel tracking of GPS satellite signals with C/N of 35 to 60 dB Hz typical.	See Note 1.
	RF interference immunity with a CW signal is: L1 −101 dBm L1 ± 2 MHz −75 dBm L1 ± 5 MHz −60 dBm L1 ± 10 MHz −37 dBm	See Note 2.
	Noise figure less than 12 dB.	
	VSWR less than 3:1.	
	Maximum RF input levels at frequencies which are 100 MHz or more from the L1 frequency is up to one watt received power at the product's antenna input connector.	
10 MHz Sine Wave Output	Frequency: 10.000000 MHz	Output always.
	Frequency Accuracy: $\leq 1 \times 10^{-11}$ for a one day average	Locked to GPS.
	Output Level: 13 dB ± 3 dB	Into 50Ω load.

Table 3-1. 58540A Electrical Specifications (continued)

Parameters	Specifications	Comments
10 MHz Sine Wave Output (Continued)	Time Domain Stability: Root Allan Variance ≤ 5 x 10^{-10} for a one second averaging time.	Locked to GPS. See Note 3.
	Frequency Domain Stability (Phase Noise): ≤ –120 dBc/Hz @ 10 Hz from carrier ≤ –130 dBc/Hz @ 100 Hz from carrier ≤ –140 dBc/Hz @ 1 kHz from carrier ≤ –145 dBc/Hz @ 10 kHz from carrier ≤ –145 dBc/Hz @ 100 kHz from carrier	Locked to GPS.
	Harmonics: ≤ –30 dBc	
	Spurious: ≤ –80 dBc from 0 to 2 GHz	
	Oscillator Performance:	
	Aging: ≤ 7 x 10^{-10} per day average frequency change, typical	Not locked to GPS. See Note 4.
	Temperature Stability: ≤ 2 x 10^{-8}, typical 0° to +55° C	Not locked to GPS. See Note 5.
1PPS Output	Frequency: 1 pulse per second.	Output always.
	Time Accuracy (absolute): ≤ 110 nsec with respect to UTC (USNO MC) — 95% probability when unit is properly installed, calibrated and locked to GPS.	See Note 3.
	Time Accuracy (relative): ≤ 30 nsec with respect to like-kind 58540A receivers, for a one day average, typical. Units must be receiving the same satellites.	Locked to GPS. See Note 3.
	Pulse-to-Pulse Jitter of leading edge: ≤ 25 nsec rms, typical	Locked to GPS. See Note 3.

Table 3-1. 58540A Electrical Specifications (continued)

Parameters	Specifications	Comments
1PPS Output (Continued)	Holdover: ≤ 100 µsec accumulated time error in one hour of unlocked operation.	Not locked to GPS. See Note 6.
	Output Level: ≥ 2.4V, TTL compatible	Into 50Ω load.
	Polarity: Positive pulse	
	Event: Rising edge of pulse	
	Pulse Width: 20 µsec, nominal	
	Rise Time: ≤ 5 nsec	10% to 90%, 50Ω load.
	Fall Time: ≤ 5 nsec	10% to 90%, 50Ω load.
1PPS/10 MHz Synchronism	The 1PPS rising edge and the positive going zero crossings of the 10 MHz reference are coincident within ± 3 nsec. Option 001: The 1PPS rising edge is 8 nsec ± 3 nsec after the positive going zero crossings of the 10 MHz reference.	
Input Power	Operating Voltage: +24 Vdc, nominal Range: +18 to +32 Vdc Power Consumption: Warm Up: ≤ 15 W Steady State: ≤ 10 W Damage Level: +60 Vdc max	
Environmental	Operating Temperature: 0° C to +55° C Storage Temperature: -40° C to +85° C Operating Humidity: 10% to 95%, non-condensing	See Note 7.

Notes:

1. C/N is a measure of the strength of a GPS satellite signal.
2. The RF immunity threshold is defined to be when the GPS receiver can no longer lock to satellites. The L1 signal amplitude is –126 dBm nominal. All L1 and CW signal levels are referenced to the product's antenna input connector.
3. Achieved one hour after initial GPS satellite lock.
4. Obtained after two weeks of continuous operation.

5. Other unlocked performances available upon request.
6. This specification is based on the availability of four or more GPS satellites during two days locked operation with a fixed antenna location.
7. Maximum rate of change is 3° C per hour.

Signal and Power Connections

For the Standard Configuration:

Table 3-2. 58540A Connector Types and Pin Assignments

Designation	Function/Pin Assignment	Connector Type	Comments
RS-232C Data Bus	Serial datacomm for control and status inquiry.	DB-9, Female	See Note 1.
	Standard Configuration (DTE): Pin assignments: 1. N/C 2. RxD 3. TxD 4. Alarm 5. GND 6. External Reset 7. N/C 8. N/C 9. N/C Option 001 Configuration (DCE): Pin assignments: 1. N/C 2. TxD 3. RxD 4. Alarm 5. GND 6. External Reset 7. N/C 8. N/C 9. N/C		See Note 2. See Note 3.
Input from GPS Antenna	—	Standard: TNC, Female	Power supplied to antenna: 5V ±10% at 50 mA.
10 MHz Output	10 MHz Output Connector	BNC, Female	

Table 3-2. 58540A Connector Types and Pin Assignments (continued)

Designation	Function/Pin Assignment	Connector Type	Comments
1PPS Output	1PPS Output Connector	BNC, Female	
Input Power	Pin 1: 24 Vdc Pin 2: NC Pin 3: 24 V Return	Amp-Mate-N-Lok Female (Type 643228-1)	Mating connector is AMP 350766-1 (male shell). Wires should be rated at least 1A. Pins are AMP 350690-1.

Notes:

1. Serial protocol is SCPI. Time code output is available to a computer immediately preceding the 1PPS signal for the current second. Factory defaults are: baud rate 9600, 8 data bits, 1 start bit, stop bit, no parity.

2. Alarm pin is active (+3V to +12V) when unit is in the alarmed state (see “Alarm LED Description” on page 3-10 for details).

3. Unit is reset when +3V to +12V is applied on pin 6.

Alarm LED Description

LED OFF

The **ALARM** LED is off when no power is applied to the unit. It is off for about one second after power is applied while the unit performs an internal self-test.

LED ON (Red)

On initial power-on, the LED will be red because of lack of GPS satellite data (receiver alarm). The **ALARM** LED illuminates *red* for any one of the following status listed in Table 3-3:

Table 3-3. Alarm LED Description

Status	Description
Antenna Alarm	Antenna current is less than 5 mA (open) or greater than 50 mA (short).
Receiver Alarm	Insufficient satellite data for positioning.
Holdover	Receiver is in alarm mode, or is forced into holdover mode via the appropriate command.
PLL Abnormal	Hardware detects the phase drift between OCXO and reference.
D/A Converter Setting Out of Range	The value set by the D/A converter is out of range.
1PPS Abnormal	Hardware detects an abnormal 1PPS output.
10 MHz Abnormal	Hardware detects an abnormal 10 MHz output.
ROM Error	The ROM checksum test failed.
RAM Error	The write/verify RAM test failed.
NVRAM Error	NVRAM test failed.

LED ON (Green)

The **ALARM** LED illuminates *green* when there are no alarms.

Accessory Products

Table 3-4. Part Numbers for 58540A Accessories (For order information, contact factory.)

Part Numbers	Description	Comments
58532A	GPS L1 Reference Antenna	Recommended to ensure specified performance of 58540A.
58538A/58539A	Lightning Arrestors	Provides protection against nearby lightning strikes.
58520A/AA* *AA = Kit Part	GPS Antenna Cable Assembly — LMR 400, N to TNC Connectors	Available in a selection of lengths.
58521A/AA* *AA = Kit Part	GPS Antenna Cable Assembly — LMR 400, N to N Connectors	Available in a selection of lengths.
58529A	GPS Line Amplifier with Filter	Provides gain to overcome cable loss and protection against noise and interference signals.
58530A	GPS L1 Bandpass Filter	Provides protection against noise and interference signals.
58535A	1 x 2 GPS L1 Distribution Amplifier	Allows *two* receivers to share one antenna.
58536A	1 x 4 GPS L1 Distribution Amplifier	Allows *four* receivers to share one antenna.
58517A	1 x 8 GPS L1 Distribution Amplifier	Allows *eight* receivers to share one antenna.
58502A	Broadband Distribution Amplifier	Provides *twelve*-channel broadband distribution (0.1 to 10 MHz) sine wave distribution.

Product Illustrations

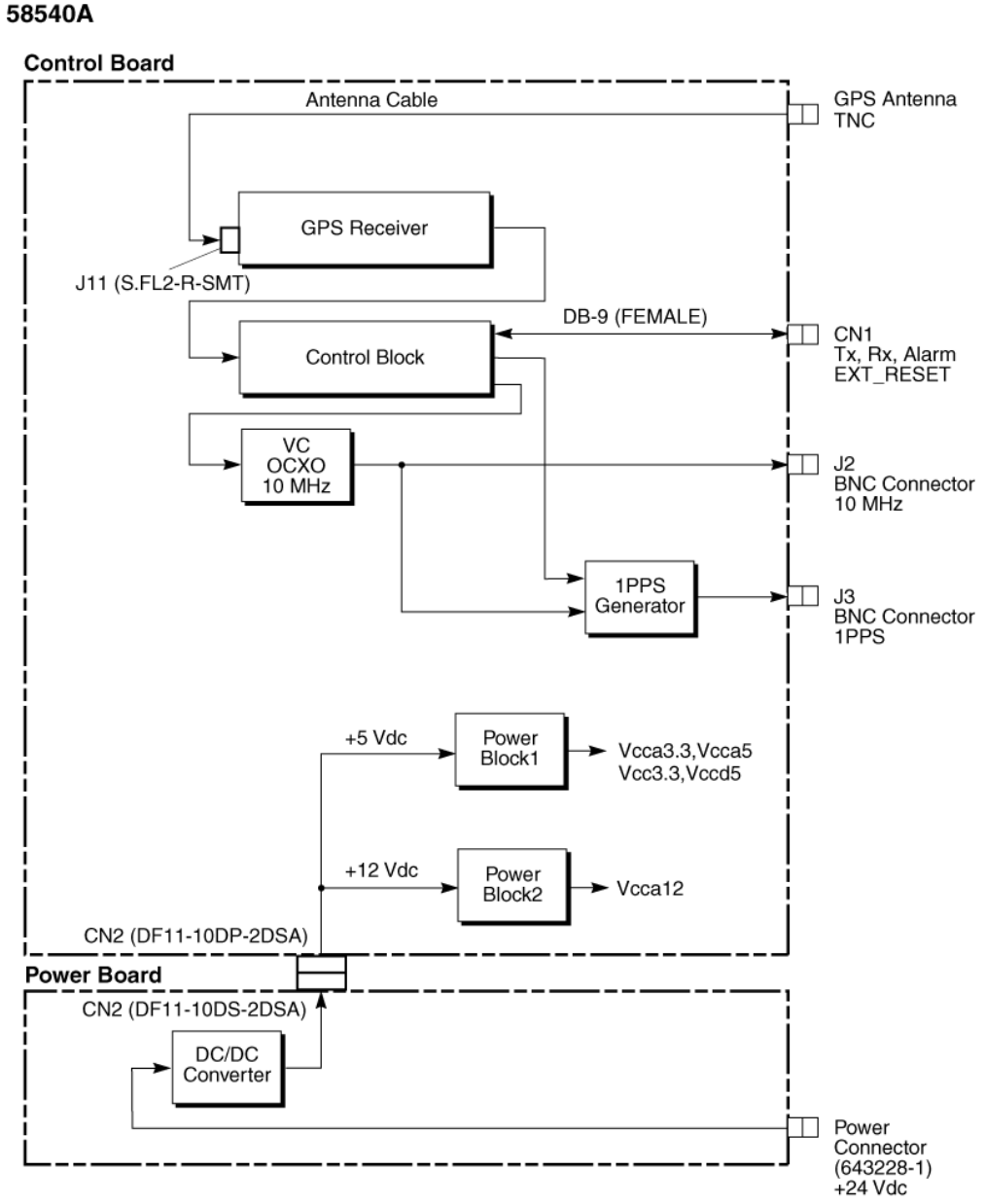

Figure 3-1. 58540A Functional Block Diagram

Product Illustrations

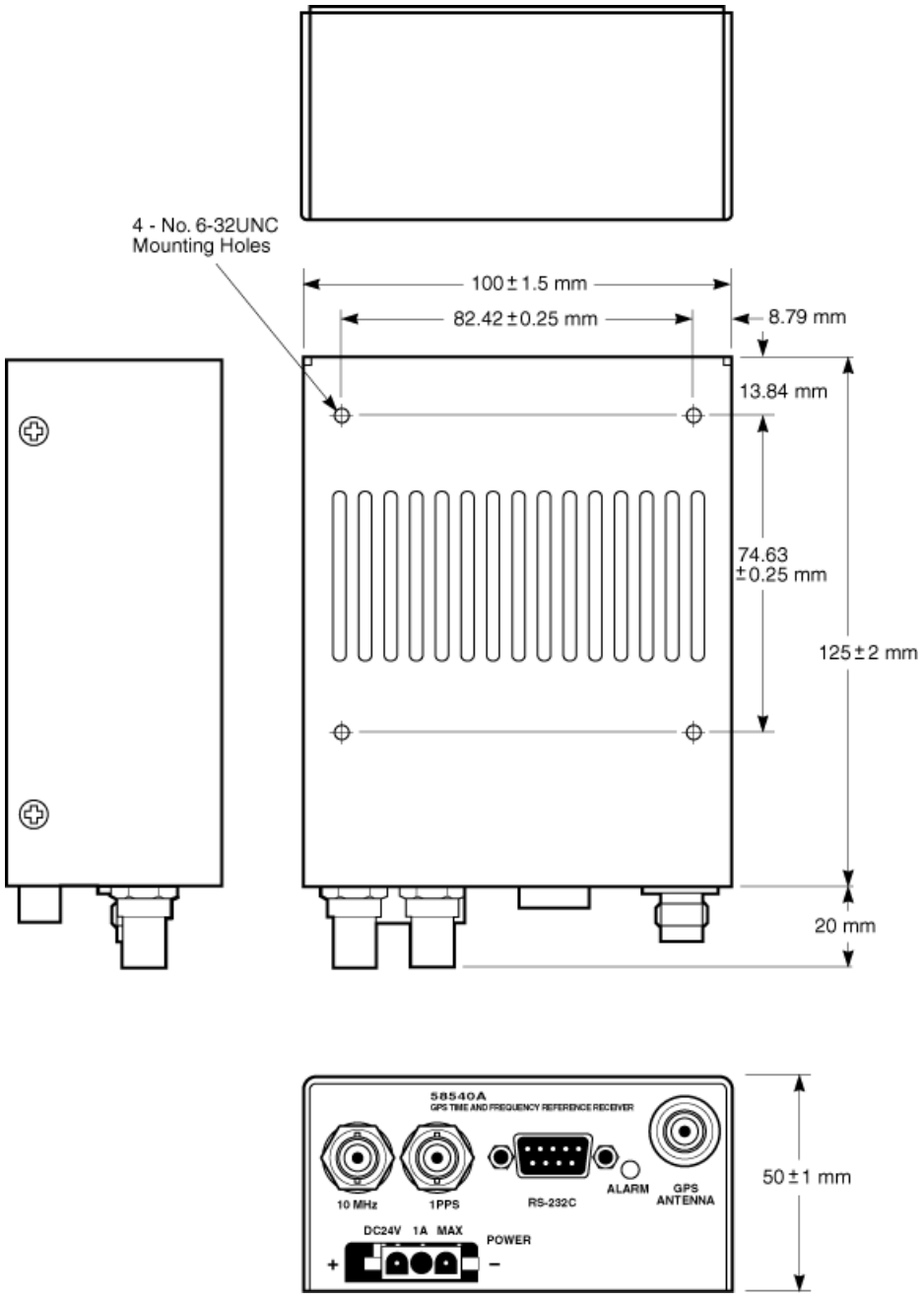

Figure 3-2. 58540A External Diagram (Standard Configuration)

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