

58540A

GPS Time and Frequency Reference Receiver



Symmetricom's 58540A GPS time and frequency reference receiver features:

- Eight-channel, parallel tracking GPS engine
- C/A Code, L1 Carrier
- GPS T-RAIM satellite error detection
- +24 Vdc power operation
- SCPI Command set
- $\leq 1 \times 10^{-11}$ frequency accuracy when locked to GPS
- $\leq 7 \times 10^{-10}$ per day average frequency change when not locked to GPS
- ≤ 110 ns time accuracy with respect to UTC (USNO MC)
- Compatible with 58531A GPS timing receiver analysis and control software

The 58540A is a cost-effective source of highly accurate time and frequency signals referenced to the global positioning system (GPS). Designed to be easily integrated into system equipment to meet the needs of a variety of applications including base station synchronization and E-911 wireless location, the 58540A is a compact unit that requires only 10 watts of power after warmup. All connections to the parent system are easily accessible from the front panel. The 58540A is also suitable for use in laboratories and manufacturing facilities when low-cost precision and synchronized timing references are required.

To meet the evolving demand for smaller wireless and telecom equipment, the 58540A is packaged in an extremely compact box. With a size of only 50 mm H × 100 mm W × 125 mm L, and a weight of 450 grams, the box can be easily and conveniently mounted to an existing PC board, to a system rack or in an electronics enclosure.

An RS-232C serial port provides the system-level interface. Through the use of the Standard Commands for Programmable Instruments (SCPI) command set or the 58531A GPS timing receiver analysis and control software (described on page 4), you can monitor the 58540A's operation.

The product also features a number of GPS satellite health monitoring and reporting functions. One of the many features offered in the 58540A is the Time Receiver Autonomous Integrity Monitor (T-RAIM) algorithm, which ensures that corrupt satellite data is ignored so it has no affect on the 58540A's timing accuracy.

Standard Configuration: 10 MHz and 1 PPS

In its standard configuration, the 58540A produces a 10 MHz and a one-pulse-per-second (1PPS) timing output. Phase coherency is maintained between the frequency and timing outputs — a feature essential in many 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} for a one-day average, and the 1PPS signal is synchronized to universal coordinated time, UTC (USNO MC) within 110 ns rms (95% probability).



Figure 1. 58540A as viewed without cover.

Other Configurations

Custom

Symmetricom may be able to customize the 58540A to your specifications, depending on volume and the complexity of the modification. Contact your local Symmetricom representative to discuss your specific needs.

Standard Options

Option 001 with the 58540A transforms the RS-232C serial port from the standard DTE configuration into the DCE configuration. In addition, Option 001 provides an antenna connector of Type-F (female) instead of the standard connector which is TNC.

Option 002 provides one pulse every other second (1PP2S), synchronized to the even seconds in GPS time, in place of the standard 1PPS output. The one-pulse-every-other-second signal, otherwise known as the even-second pulse, is the reference time used in CDMA base stations.

Antenna and Accessories

Symmetricom recommends the use of GPS antenna system accessories with the 58540A to ensure specified performance. Symmetricom offers a complete line of low-cost, durable, easy-to-install GPS accessories. These include the 58532A GPS L1 reference antenna, and the 58538A and 58539A lightning arrestors. Also available is the 58529A line amplifier with L1 bandpass filter which provides the gain to overcome cable loss as well as protection against noise and interfering signals. For systems needing protection from noise and interfering signals but not GPS signal gain, choose the 58530A GPS L1 bandpass filter.

Other accessories include a selection of RF cables, and a family of active GPS L1 signal splitters to allow more than one receiver to be connected to an antenna. The 58535A 1:2 GPS L1 distribution amplifier allows 2 receivers to share one antenna. The 58536A 1:4 GPS L1 distribution amplifier allows 4 receivers to share one antenna.

Symmetricom GPS antenna system accessories are sold separately from the 58540A.

58531A GPS timing receiver analysis and control software Version 1.2.

Evaluation of the 58540A is made easy with version 1.2 of the 58531A GPS timing receiver analysis and control software. The PC Windows[®] based program (for Windows NT or Windows 95) interfaces with the 58540A, 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 program includes these features:

- Conveniently configure the software and 58540A
- Receive real-time information updates
- Control and query the 58540A 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 signal strength (C/N), elevation, and dilution of precision (DOP)
- Calculate and display average or maximum C/N and associated elevation and azimuth angles

Version 1.2 is compatible with the 58540A and 58533A GPS receivers and the 58534A GPS timing antenna.

58531A software is sold separately from the GPS receivers.

Specifications and Characteristics of the 58540A GPS Time and Frequency Reference Receiver

10 MHz Sine Wave Output (locked to GPS)

Frequency Accuracy	$\leq 1 \times 10^{-11}$ for a one day average.	Locked to GPS.
Output Level	13 dBm \pm 2 dB.	Into 50 Ω load.
Time Domain Stability	Root Allan Variance $\leq 5 \times 10^{-10}$ for a one second averaging time.	Locked to GPS. See Note 1.
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	
Harmonics	≤ -30 dBc.	
Spurious	< -80 dBc from 0 to 2 GHz	
Oscillator Performance:		
Aging	$\leq 7 \times 10^{-10}$ per day average frequency change, typical.	Not locked to GPS.
Temperature Stability	$\leq 2 \times 10^{-8}$, typical. 0° to +55° C	Not locked to GPS.

1PPS Output

Frequency	1 pulse per second	Output always.
Time Accuracy (absolute)	≤ 110 ns with respect to UTC (USNO MC) –95% probability when unit is properly installed, calibrated and locked to GPS.	See Note 1.
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.	
Pulse-to-Pulse Jitter of leading edge	≤ 25 nsec rms, typical	
Holdover	≤ 100 μsec accumulated time error after 1 hour of unlocked operation.	Not locked to GPS. See Note 2.
Output level	≥ 2.4 V, TTL compatible	Into 50Ω load.
Polarity	Positive Pulse	
Time Mark	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.	Locked to GPS.
Option 001	The 1PPS rising edge is 8 nsec ±3 nsec after the positive going zero crossings of the 10 MHz reference.	Locked to GPS.

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	See Note 3.
Storage Temperature	-40°C to +85°C	
Operating Humidity	10% to 95%, non-condensing	

Note 1. Achieved one hour after initial GPS satellite lock.

2. This specification is based on the availability of 4 or more GPS satellites during 2 days of locked operation with a fixed antenna location.

3. Maximum rate of change is 5° C per hour.

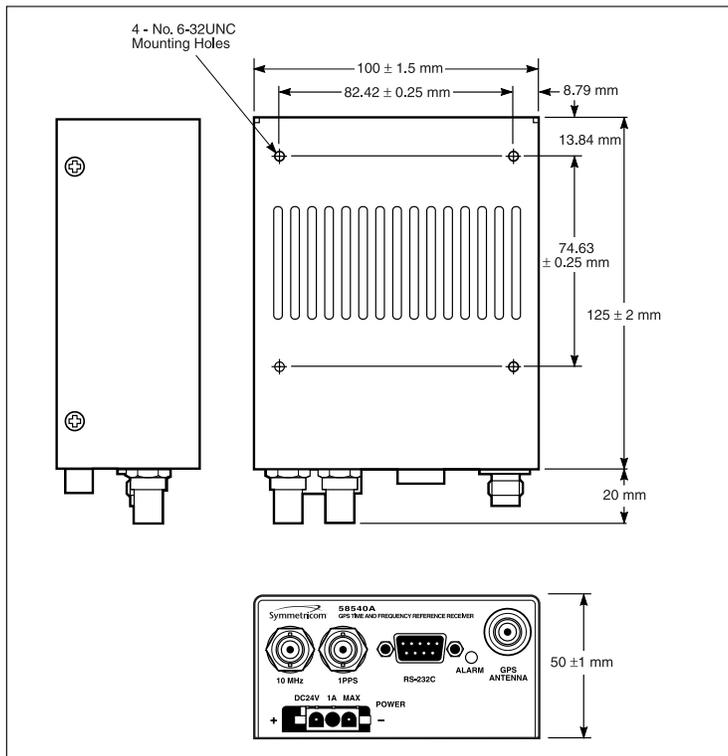
Signal and Power Connections

DESIGNATION	FUNCTION/PIN ASSIGNMENT	CONNECTOR TYPE	COMMENTS
RS-232C Data Bus	Serial datacomm for control and status inquiry. Standard Configuration (DTE): Pin assignment: 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): 1. N/C 2. TxD 3. RxD 4. Alarm 5. GND 6. External Reset 7. N/C 8. N/C 9. N/C	DB-9, female	Serial protocol is SCPI. Time code output is available to a computer immediately preceding the 1PPS signal for the current second. Factory defaults: baud rate 9600, 8 data bits, 1 start bit, stop bit, no parity.
Input from GPS Antenna		Standard: TNC, Female Option 001: Type F, Female	Power supplied to antenna: 5V ± 10% at 50 mA.
10 MHz Output	10 MHz Output Connector	BNC, Female	
1PPS Output	1PPS Output Connector	BNC, Female	
Input Power	Pin 1: 24 Vdc Pin Pin 2: NC Pin Pin 3: 24 V return	Amp-Mate-N-Lok Female (Type 643228-1)	Mating Connector is AMP 350766-1 (male shell). Pins are AMP 350690-1.

Alarm LED Description

The Alarm LED is off when no power is applied to the unit. It remains off for one second after power is applied while the unit performs an internal self-test. On initial power-on, the LED will be red due to lack of GPS satellite data (receiver alarm). The Alarm LED illuminates green when there are no alarms. The Alarm LED illuminates *red* for any one of the status conditions listed in the table below:

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 a 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.



Note 1. Mounting holes are on the underside of the 58540A. Maximum length of mounting screws is 15 mm.



Symmetricom
2300 Orchard Parkway
San Jose, CA 95131, USA
tel: 408-433-0910
fax: 408-428-7897
e-mail: info@symmetricom.com
<http://www.symmetricom.com>

Symmetricom Limited
2 The Billings
Walnut Tree Close
Guildford, Surrey
GU1 4UL, England
tel: 44-1483-510300
fax: 44-1483-510319

For more information:

Dependable Accessories for your
GPS Installation—Brochure

Designing Your GPS Antenna
System—Configuration Guide

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