NAVMAN

GPS1240 Rugged Sensor

Data sheet

Features

- 12-channel GPS receiver for an all-in-view solution with very high accuracy
- IP67 waterproof housing
- standard NMEA 0183 (v2) data output
- optimised for best performance in dense urban environments
- battery-backed memory for faster acquisition
- compact, high-temperature and UV-resistant rugged case
- input power range of 7 to 32 VDC
- minimal power requirement, only 30 mA at 12 VDC (typical)
- RS-232 serial interface
- versatile mounting options

Related documents

- Product brief LA10094
- Installation Manual MN000183
- GPS1240 Development Kit adapter
- SiRF NMEA protocol reference manual
- SiRF binary protocol reference manual

Contents

Figures

Tables

1.0 Introduction

Based on the SiRFstarIIe navigation engine, the GPS1240 Rugged Sensor provides OEMs and System Integrators with an ideal solution for GPS based navigation and tracking systems.

The GPS1240 continuously tracks all satellites in view and uses enhanced filtering to provide fast and accurate positioning information, even in dense urban environments. The sensor combines advanced performance, compact housing and very low current consumption in an economically priced package.

Part Number	Description
AA006300R	GPS1240 Sensor

Table 1-1 Part description

2.0 Technical description

2.1 General information

The GPS1240 provides a 12-channel GPS receiver and patch antenna in a rugged waterproof casing. It can be mounted externally in a wide variety of vehicles working on 12 or 24 VDC power supplies.

Protocols supported are selected National Marine Electronics Association (NMEA) data messages and binary, NMEA-0183 being the default setting.

2.1.1 Receiver architecture

The functional architecture of the GPS1240 receiver is shown in Figure 2-1.

2.1.2 Description of parts

The major components of the GPS1240 Sensor are described as follows.

Antenna

The antenna is a passive patch antenna that receives the GPS signals.

LNA (Low Noise Amplifier)

This amplifies the GPS signal and provides enough gain for the receiver to use a passive antenna. A very low noise design is utilised to provide maximum sensitivity.

Filter

This filters the GPS signal and removes unwanted signals caused by external influences that would corrupt the operation of the receiver.

RFIC (Radio Frequency Integrated Circuit)

The RFIC (and related components) converts the GPS signal into an intermediate frequency, and then digitises it for use by the baseband processor.

TCXO (Temperature Compensated Crystal Oscillator)

The RFIC block requires a highly stable oscillator to perform the down conversion process. Stability in this frequency is required to achieve a fast TTFF (Time To First Fix).

Baseband processor (GSP 2e/LP)

The main engine of the GPS receiver, this runs all GPS signal measurement code, navigation code, and other ancillary routines such as power saving modes and DGPS. The normal I/O of this processor is via the two serial ports.

Flash memory

Software is stored in Flash memory. Some long term data is also stored in Flash memory.

RTC (Real Time Clock) crystal

This operates in conjunction with the RTC inside the baseband block, and provides an accurate time clock function when main power has been removed.

Regulators

The regulators provide a clean and stable supply to the components in the receiver and to the backup battery charger.

2.1.3 Product applications

The GPS1240 Sensor is suitable for a wide range of modular OEM GPS design applications such as:

- fleet/transport management
- industrial automation
- land/marine navigation

Figure 2-2 shows a sample application of a fleet management/tracking system.

2.2 Mechanical specification

Dimensions: 97.4 mm (dia) x 26 mm (h) (radome)
Weight: 165 g without cable, 490 g with cable
Cable length: 10 m

2.3 Physical characteristics

Enclosure: UV-stable rugged plastic radome
Weather resistant: to IP67 standard

2.4 Environmental

Operating temperature: 0°C to +60°C
Humidity: up to 95% (non-condensing)
Altitude: –300 m to 18 000 m

2.5 Compliances

The GPS1240 meets the requirements of the following standards: FCC: Part 15, Class B; CE: EU EMC Directive EN55022; C-Tick.

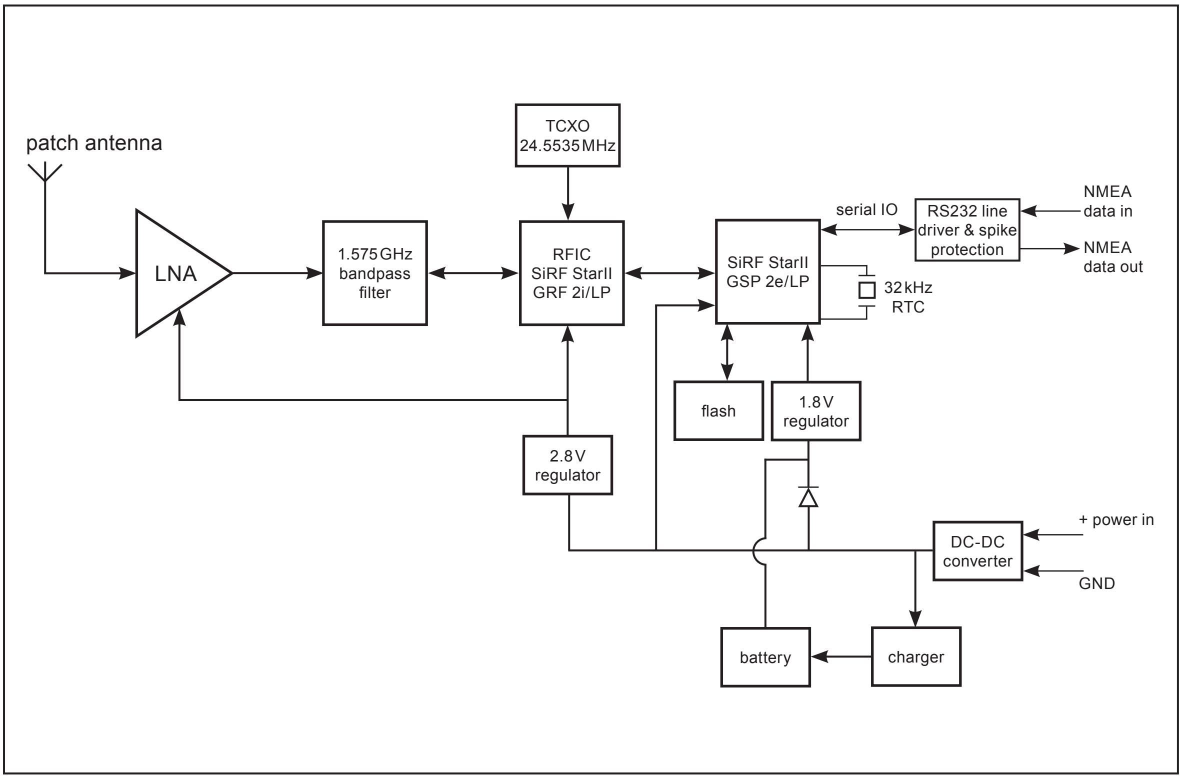

Figure 2-1 GPS1240 block diagram

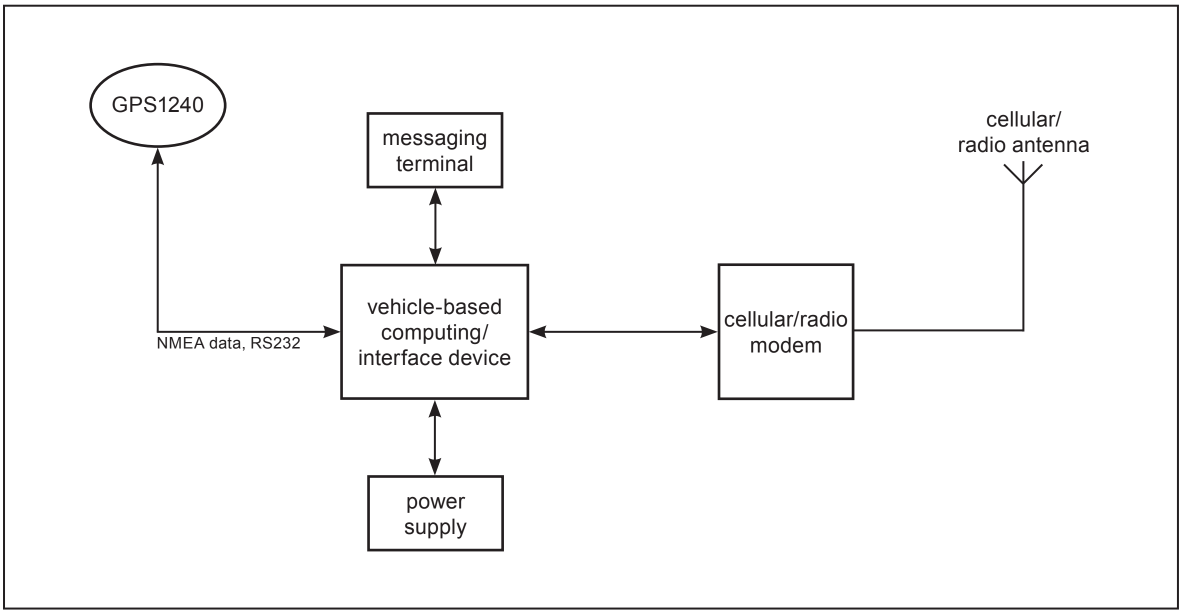

Figure 2-2 Sample application of a fleet management/tracking system

3.0 Performance characteristics

3.1 TTFF (Time To First Fix)

TTFF values can be affected by changing the values of maximum EHPE validity (Expected Horizontal Position Error), maximum EVPE validity (Expected Vertical Position Error), criterion for the minimum number of satellites used for a solution and use of held attitude. Default conditions are: 100 m EHPE, 150 m EVPE, number of satellites zero and held altitude enabled.

3.1.1 Hot start

A hot TTFF results from a software reset after a period of continuous navigation or a return from a short idle period (i.e. a few minutes) that was preceded by a period of continuous navigation. In this state, all of the critical data (position, velocity, time and satellite ephemeris) is valid to the specified accuracy and available in SRAM.

3.1.2 Warm start

A warm TTFF typically results from user-supplied position and time initialisation data or continuous RTC operation with an accurate last known position available from Flash memory. In this state, position and time data are present and valid but ephemeris data validity has expired. This is the normal mode of operation with battery backup.

3.1.3 Cold start

A cold TTFF acquisition state results when position and time data is unknown, either of which results in an unreliable satellite visibility list. Almanac information is used to identify previously healthy satellites.

3.2 Acquisition times

Table 3-1 shows the corresponding TTFF times for each of the acquisition modes.

Mode	Max	Conditions
TTFF hot*	8 s	valid almanac, position, time & ephemeris
TTFF warm*	38 s	valid almanac, position & time
TTFF cold*	45 s	no information
re-acquisition	2 s	<10 s obstruction with valid almanac, position, time & ephemeris
*Figures provided for TTFF are for 90% or better for 1st fix.		

Table 3-1 Acquisition times

3.3 Backup battery

The internal backup battery continues to provide power to the RTC and Flash memory even when the main power input is removed.

A fully charged battery is able to provide memory backup for a power interruption of approximately 200 hours. The time taken to recharge a fully discharged battery is approximately 90 minutes.

A cold start will occur if the battery has reached a discharged state.

3.4 Navigation modes

The GPS receiver supports two types of navigation mode operation: three-dimensional (3D) and two-dimensional (2D).

3.4.1 Three-dimensional navigation (3D)

The receiver defaults to 3D navigation when at least four GPS satellites are being tracked. In 3D navigation, the receiver computes latitude, longitude, altitude, and time information from satellite measurements.

3.4.2 Two-dimensional navigation (2D)

When less than four GPS satellite signals are available, or when a fixed altitude value can be used to produce an acceptable navigation solution, the receiver will enter 2D navigation using a fixed value of altitude determined by the host. Forced operation in 2D mode can be commanded by the host.

In 2D navigation, the navigational accuracy is primarily determined by the relationship of the fixed altitude value to the true altitude of the antenna. If the fixed value is correct, the specified horizontal accuracies apply. Otherwise, the horizontal accuracies will degrade as a function of the error in the fixed altitude.

3.5 Dynamic performance

Velocity: 500 m/s max
Acceleration: 4 G (39.2 m/s/s) max

3.6 Static accuracy

Horizontal CEP: 5 m full accuracy C/A code
Vertical VEP: 10 m full accuracy C/A code

4.0 Electrical requirements

4.1 Power supply

The GPS1240 is designed to operate off a wide supply voltage, as follows:

Input voltage range	7 to 32 VDC
Power consumption	30 mA at 12 VDC (typical)

Table 4-1 Operating power for the GPS1240

4.2 Data input/output

The serial data complies with RS232.

5.0 Interfaces

5.1 External interface connection

The GPS1240 has a 10 m cable fitted with an 8-pin female waterproof connector. Figure 5-1 shows the pin layout of the connector.

Part number	Manufacturer
LTW-8FM	Liang Tei

Table 5-1 Connector part description

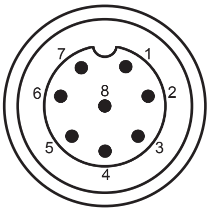

Figure 5-1 Pinout diagram for the LTW-8FM connector

Pin number	Description
1	ground
2	power input (+7 to 32 VDC)
3	not used
4	NMEA data in (RS232)
5	not used
6	NMEA data out (RS232)
7	not used
8	not used

Table 5-2 LTW-8FM connector pinout descriptions

The LTW-8FM connector is compatible for use with the male 8-pin connector LTW-8MF (refer to www.ltw-tech.com for further details).

6.0 Software protocol

The following sections describe the GPS1240 software protocol, including the default NMEA-0183 (v2) protocol.

6.1 NMEA output

The GPS1240 has a data transmission speed of 4800 Baud. The update rate is once per second, continuous.

NMEA sentence	Factory default
GGA – global positioning system fix data	on
GLL – geographic position - latitude/ longitude	off
GSA – DOP and active satellites	on
GSV – satellites in view	on
RMC – recommended minimum specific GNSS data	on
VTG – course over ground and ground speed	on
ZDA – time & date	off

Table 6-1 NMEA default settings

6.2 NMEA sentence control

The proprietary NMEA command sentence to enable or disable NMEA sentences is:

$<proprietary header>,<source device>,<sentence>,< query | enable | disable>,<sentence rate>*CKSM<CR><LF>

Note: *Sentence rate field may be omitted, in which case a period of 1 s is assumed.*

6.2.1 Examples of communication with a host device

To query the status of the GLL sentence:

$PTTK,TK,GLL,Q*CKSM<CR><LF>

To enable GLL sentence output every 2 seconds:

$PTTK,TK,GLL,A,2*CKSM<CR><LF>

To disable ZDA sentence output:

$PTTK,TK,ZDA,V*CKSM<CR><LF>

To enable all NMEA sentences:

$PTTK,TK,NME,A*CKSM<CR><LF>

To disable all sentences (except RMC):

$PTTK,TK,NME,V*CKSM<CR><LF>

Note: *The RMC sentence is always output, it can not be disabled.*

When command sentences are entered, the GPS1240 will acknowledge the command with a message. An example of this message format is shown below.

The GLL message will be output at 1 Hz:

$PTTK,GP,GLL,A,1*CKSM<CR><LF>

The configuration parameters set via the NMEA command sentences are stored in battery backed memory and will be used at power up. If the battery backup is unavailable, the default settings shown in Table 6-1 will be used.

Refer to the SiRF NMEA protocol reference manual for a full list of the NMEA commands.

6.3 SiRF binary output

The NMEA command format to change the data protocol to SiRF binary can be found in the SiRF NMEA protocol reference manual. For a full list of the SiRF binary commands, refer to the SiRF binary protocol reference manual.

6.4 SBAS (Satellite Base Augmentation System) control

The SBAS feature is active by default. It can be disabled by user command.

The configuration parameters, set via the NMEA command sentences to enable SBAS, are stored in battery backed memory and are used at power-up.

The proprietary NMEA command sentence to check, enable or disable SBAS feature is:

$<proprietary header>,<source device>,<augmentation system>,<query | enable | disable>*CKSM<CR><LF>

6.4.1 Examples of communication with a host device

The command sentences required to check, enable or disable the SBAS feature are listed as follows.

query the GPS1240 setting:

$PTTK,TK,AS,Q*CKSM<CR><LF>

enable augmentation:

$PTTK,TK,AS,A*CKSM<CR><LF>

disable augmentation:

$PTTK,TK,AS,V*CKSM<CR><LF>

The acknowledgement messages returned by the GPS1240 are formatted as shown in the following examples.

augmentation enabled:

$PTTK,GP,AS,A*CKSM<CR><LF>

augmentation disabled:

$PTTK,GP,AS,V*CKSM<CR><LF>

7.0 Mounting options

The GPS1240 Rugged Sensor can be installed on a flat surface or on a pole mount (provided). All mounting hardware is supplied (see Section 8.0 Packaging Configuration).

For further details on how to install the GPS1240, refer to the Installation Manual.

7.1 Surface mounting

The GPS1240 can be mounted on a suitable level surface which allows for affixing nuts. The GPS1240 must be mounted in a safe position where the drilled holes will not weaken the structure of the vehicle.

7.2 Pole mounting

The GPS1240 can be mounted on a 25.4 mm diameter pole with a thread of 14 TPI UNB.

8.0 Packaging configuration

Each GPS1240 Sensor is individually packaged in its own gift box, accompanied with the required mounting accessories.

The GPS1240 is supplied with the following parts:
- installation manual
- 10 m cable
- surface mount gasket
- 4 threaded rods: thread M4 x 40 mm
- 4 washers & nuts
- pole mount adaptor
- 4 screws

8.1 Product delivery

The GPS1240 Sensor is packaged as part of a shipped carton containing 18 gift boxes (see Figure 8-1).

Figure 8-1 GPS1240 gift box

Glossary and acronyms

Almanac: a set of orbital parameters that allows calculation of approximate GPS satellite positions and velocities. The almanac is used by a GPS receiver to determine satellite visibility and as an aid during acquisition of GPS satellite signals. The almanac is a subset of satellite ephemeris data and is updated weekly by GPS Control.

DGPS: Differential GPS. A technique to improve GPS accuracy that uses pseudo-range errors recorded at a known location to improve the measurements made by other GPS receivers within the same general geographic area.

EHPE: Expected Horizontal Position Error.

EVPE: Expected Vertical Position Error.

Ephemeris: a set of satellite orbital parameters that is used by a GPS receiver to calculate precise GPS satellite positions and velocities. The ephemeris is used to determine the navigation solution and is updated frequently to maintain the accuracy of GPS receivers.

GPS: Global Positioning System. A space-based radio positioning system which provides suitably equipped users with accurate position, velocity, and time data. When fully operational, GPS will provide this data free of direct user charge worldwide, continuously, and under all weather conditions. The GPS constellation will consist of 24 orbiting satellites, four equally spaced around each of six different orbital planes.

I/O: Input/output.

NMEA: National Marine Electronics Association.

OEM: Original Equipment Manufacturer.

RFIC: Radio Frequency Interference Converter.

RTC: Real-Time Clock.

Re-acquisition: The time taken for a position to be obtained after all satellites have been made invisible to the receiver.

SBAS: Satellite Base Augmentation System.

SRAM: Static Random Access Memory.

TCXO: Temperature Compensated Crystal Oscillator.

TTFF: Time To First Fix. The actual time required by a GPS receiver to achieve a position solution. This specification will vary with the operating state of the receiver, the length of time since the last position fix, the location of the last fix, and the specific receiver design.