GPS 16/17 SERIES TECHNICAL SPECIFICATIONS

GARMIN®

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RECORD OF REVISIONS

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1 INTRODUCTION

1.1 Caution

The GPS system is operated by the government of the United States, which is solely responsible for its accuracy and maintenance. Although the GPS 16/17 is a precision electronic NAVigation AID (NAVAID), any NAVAID can be misused or misinterpreted, and therefore become unsafe. Use these products at your own risk. To reduce the risk, carefully review and understand all aspects of these Technical Specifications before using the GPS 16/17. When in actual use, carefully compare indications from the GPS to all available navigation sources including the information from other NAVAIDs, visual sightings, charts, etc. For safety, always resolve any discrepancies before continuing navigation.

1.2 FCC Compliance

The GPS 16/17 complies with Part 15 of the FCC interference limits for Class B digital devices FOR HOME OR OFFICE USE. These limits are designed to provide reasonable protection against harmful interference in a residential installation, and are more stringent than “outdoor” requirements.

Operation of this device is subject to the following conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The GPS 16/17 does not contain any user-serviceable parts. Unauthorized repairs or modifications could result in permanent damage to the equipment, and void your warranty and your authority to operate this device under Part 15 regulations.

1.3 Limited Warranty

This Garmin product is warranted to be free from defects in materials or workmanship for one year from the date of purchase. Within this period, Garmin will at its sole option repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor, provided that the customer shall be responsible for any transportation cost. This warranty does not cover failures due to abuse, misuse, accident, or unauthorized alteration or repairs.

THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED OR STATUTORY, INCLUDING ANY LIABILITY ARISING UNDER ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, WHICH MAY VARY FROM STATE TO STATE.

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Garmin retains the exclusive right to repair or replace the unit or software or offer a full refund of the purchase price at its sole discretion. SUCH REMEDY SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

To obtain warranty service, contact your local Garmin authorized dealer or call Garmin Product Support at one of the numbers listed below for shipping instructions and an RMA tracking number. The unit should be securely packed with the tracking number clearly written on the outside of the package. The unit should then be sent, freight charges prepaid, to any Garmin warranty service station. A copy of the original sales receipt is required as the proof of purchase for warranty repairs.

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International Purchases: A separate warranty is provided by international distributors for units purchased outside the United States. This warranty is provided by the local in-country distributor and this distributor provides local service for your unit. Distributor warranties are only valid in the area of intended distribution. Units purchased in the United States or Canada must be returned to the Garmin service center in the United Kingdom, the United States, Canada, or Taiwan for service.

1.4 Overview

The GPS 16/17 series products are complete GPS sensors including embedded receiver and antenna, designed for a broad spectrum of OEM (Original Equipment Manufacture) system applications. Based on the proven technology found in other Garmin 12-channel GPS receivers, the GPS 16/17 tracks up to 12 satellites at a time while providing fast time-to-first-fix, one-second navigation updates, and low power consumption. This generation of GPS sensors adds the capability of FAA Wide Area Augmentation System (WAAS) differential GPS. The GPS 16/17's far-reaching capability meets the sensitivity requirements of land navigation as well as the dynamics requirements of high-performance aircraft.

The GPS 16/17 design uses the latest technology and high-level circuit integration to achieve superior performance while minimizing space and power requirements. All critical components of the system including the RF/IF receiver hardware and the digital baseband are designed and manufactured by Garmin to ensure the quality and capability of the GPS. The hardware capability combined with software intelligence makes the GPS 16/17 easy to integrate and use.

The GPS 16/17 series products are designed to withstand rugged operating conditions and are waterproof to IEC 60529 IPX7, immersion in 1 meter of water for 30 minutes. These complete GPS receivers require minimal additional components to be supplied by an OEM or system integrator. A minimum system must provide the GPS with a source of power and a clear view of the GPS satellites. The system may communicate with the GPS via two full-duplex communication channels. Internal FLASH memory allows the GPS to retain critical data such as satellite orbital parameters, last-known position, date, and time. End user interfaces such as keyboards and displays are the responsibility of the application designer.

1.5 Features

- 12-channel GPS receiver tracks and uses up to 12 satellites for fast, accurate positioning and low power consumption.
- Differential DGPS capability using real-time WAAS or RTCM corrections yielding 3 to 5 meter position accuracy (see Section 1.7 Technical Specifications).
- Compact, rugged design ideal for applications with minimal space.
- May be remotely mounted in an out-of-the-way location.
- Receiver position information can be displayed directly on a chartplotter or PC.
- User initialization is not required. Once the unit is installed and has established a location fix, the unit automatically produces navigation data.
- User-configurable navigation mode (2-dimensional or 3-dimensional fix).
- Highly accurate one-pulse-per-second (PPS) output for precise timing measurements. Pulse width is configurable in 20 millisecond increments from 20 ms to 980 ms with 1 µs accuracy.
- Configurable for binary format carrier phase data output on COM 1 port.
- Flexible input voltage levels of 3.3 VDC to 6.0 VDC with over-voltage protection in the GPS 16LVS, and 8.0 VDC to 40 VDC in the GPS 16HVS and GPS 17HVS.
- FLASH-based program and non-volatile memory. New software revisions available through Web site download. Non-volatile memory does not require battery backup.
- Waterproof design allows continuous exposure to the prevailing weather conditions at most locations.
- GPS 17HVS can be flush mounted or pole mounted on the enclosed 1" marine mast mount.

1.6 GPS 16/17 Series

There are several different products in the GPS 16/17 product series, as described below.

1.6.1 GPS 16LVS & 16HVS

Both the GPS 16LVS and GPS 16HVS are black with a white logo.

GPS 16LVS & 16HVS

1.6.2 GPS 17HVS

The GPS 17HVS is white with a blue logo. GPS 17HVS can be flush mounted or pole mounted on the enclosed 1" pole mount (also called a marine mount). You can also use the GPS17HVS on a standard one-inch, 14 threads-per-inch marine mount.

GPS17HVS with Pole Mount

GPS 17HVS Flush Mount

1.7 Technical Specifications

Specifications are subject to change without notice.

1.7.1 Physical Characteristics

1.7.1.1 Size

- GPS 16: 3.58” (91.0 mm) diameter, 1.65” (42 mm) high
- GPS 17: 3.58” (91.0 mm) diameter, 3.60” (91.5 mm) high

1.7.1.2 Weight

- GPS 16LVS & 16HVS only: 6.4 oz (181 g)
- GPS 16LVS & 16HVS with 5-meter cable: 11.7 oz (332 g)
- GPS 16LVS & 16HVS cable alone: 5.3 oz (151 g)
- GPS 17HVS only: 7.1 oz (201 g)
- GPS 17HVS with 30-foot cable: 16.8 oz (465 g)
- GPS 17HVS with pole mount adapter & cable: 18.2 oz (516 g)
- GPS 17HVS pole mount adapter alone: 1.4 oz (40 g)
- GPS 17HVS cable alone: 9.7 oz (275 g)

1.7.1.3 Cable

- GPS 16LVS & 16HVS: Black PVC-jacketed, 5-meter, foil-shielded, 8-conductor 28 AWG with RJ-45 termination
- GPS 17HVS: White PVC-jacketed, 30-foot, foil-shielded, 8-conductor 28 AWG with JST connector termination

1.7.1.4 Color

- GPS 16LVS & 16HVS: Black with white logos
- GPS 17HVS: White with blue logos

1.7.1.5 Case Material

Polycarbonate thermoplastic that is waterproof to IEC 60529 IPX7 level (immersion in 1 meter of water for 30 minutes).

1.7.1.6 GPS 17HVS Thread Specifications

Standard one-inch, 14 threads-per-inch

1.7.2 Electrical Characteristics

1.7.2.1 Input Voltage

- GPS 16LVS: 3.3 VDC to 6.0 VDC regulated, <100 mV ripple
- GPS 16HVS & 17HVS: 8.0 VDC to 40 VDC unregulated

1.7.2.2 Input Current

- GPS 16HVS, GPS 17HVS: 60 mA @ 8 VDC
40 mA @ 12 VDC
15 mA @ 40 VDC
- GPS 16LVS: 65 mA typical

1.7.2.3 Standby Current

<1mA for all GPS 16 and GPS 17 models

1.7.2.4 GPS Receiver Sensitivity

-165 dBW minimum

1.7.3 Environmental Characteristics

- Operating Temperature: -30°C to +80°C
- Storage Temperature: -40°C to +80°C

1.7.4 GPS Performance

1.7.4.1 Receiver

WAAS Enabled™; 12 parallel channel GPS receiver continuously tracks and uses up to 12 satellites (up to 11 with PPS active) to compute and update your position.

1.7.4.2 Acquisition Times

- Reacquisition: Less than 2 seconds
- Warm: Approx. 15 seconds (all data known)
- Cold: Approx. 45 seconds (initial position, time, and almanac known; ephemeris unknown)
- AutoLocate®: 5 minutes (almanac known; initial position and time unknown)
- SkySearch: 5 minutes (no data known)

1.7.4.3 Sentence Rate

1 second default; NMEA 0183 output interval configurable from 1 to 900 seconds in 1-second increments

1.7.4.4 Accuracy

- GPS Standard Positioning Service (SPS)
  Position: <15 meters, 95% typical (100 meters with Selective Availability on)
  Velocity: 0.1 knot RMS steady state
- DGPS (USCG/RTCM)
  Position: 3–5 meters, 95% typical
  Velocity: 0.1 knot RMS steady state
- DGPS (WAAS)
  Position: <3 meters, 95% typical
  Velocity: 0.1 knot RMS steady state
- PPS Time: ±1 microsecond at rising edge of PPS pulse (subject to Selective Availability)
- Dynamics: 999 knots velocity (only limited at altitude greater than 60,000 feet), 6g dynamics

1.7.5 Interfaces

- True RS-232 output, asynchronous serial input compatible with RS-232 or TTL voltage levels, RS-232 polarity.
- User selectable baud rate: 300, 600, 1200, 2400, 4800, 9600, 19200, or 38400.

1.7.5.1 Port 1

- Configurable between NMEA 0183 Versions 2.00 and 3.00
- ASCII output sentences GPALM, GPGGA, GPGLL, GPGSA, GPGSV, GPRMC, GPVTG (NMEA-approved sentences); PGRMB, PGRME, PGRMF, PGRMM, PGRMT, and PGRMV (Garmin proprietary sentences)
- NMEA 0183 Outputs (see Section 4.2 Transmitted NMEA 0183 Sentences for full protocol specifications)
  Position, velocity, and time
  Receiver and satellite status
  Differential Reference Station ID and RTCM Data age
  Geometry and error estimates
- NMEA 0183 Inputs (see Section 4.1 Received NMEA 0183 Sentences for full protocol specifications)
  Initial position, date, and time (not required)
  Earth datum and differential mode configuration command, PPS Enable, GPS satellite almanac
- Configurable for binary data output including GPS carrier phase data

1.7.5.2 Port 2

Real-time Differential Correction input (RTCM SC-104 message types 1, 2, 3, 7, and 9)

1.7.5.3 PPS

1 Hz pulse, programmable width, 1 µs accuracy

1.7.5.4 Power Control

- Off: Open circuit
- On: Ground, or pull to low logic level <0.3 volts

2 GPS 16/17 WIRING AND PINOUTS

2.1 GPS 16/17 Pinout

The GPS 16LVS and GPS 16HVS sensors utilize an 8-pin RJ-45 plug. The GPS 17HVS terminates in a JST connector, which is mainly for factory testing; you can remove the JST connector without voiding your warranty. The following is a functional description of each wire in the cable assembly.

RJ-45 Pin #	Wire Color	Signal Name	Description
1	Red	POWER	GPS 16LVS: Regulated +3.3 to +6 VDC. Typical operating current is 80 mA. An internal 6.8 V transient zener diode and a positive temperature coefficient thermistor protect from transients and over-voltages. With voltages greater than 6.8 VDC the zener will draw several amps of current through the thermistor, causing it to heat rapidly and eventually power the unit off, unless an external fuse blows first. When proper supply voltages are returned, the thermistor will cool and allow the GPS 16LVS to operate. GPS 16HVS & GPS 17HVS: Vin can be an unregulated 8.0 VDC to 40 VDC, optimized for 12 VDC. Typical operating power is 800 mW. This voltage drives a switching regulator with a nominal 5.0 VDC output, which powers an internal linear regulator, producing the system Vcc.
2	Black	GROUND	Power and Signal Ground
3	Yellow	REMOTE POWER ON/OFF	External Power Control Input. Active (ON) if less than 0.3 VDC. Inactive (OFF) if open-circuit. Pulling this pin to ground enables the unit; leaving the pin open-circuited powers the internal regulators off and drops the supply current to less than 1 mA. This input is intended to be driven by an open-collector output.
4	Blue	PORT 1 DATA IN	First Serial Asynchronous Input. RS-232 compatible with maximum input voltage range -25 < V < 25. This input may also be directly connected to standard 3 to 5 VDC CMOS logic. The low signal voltage requirement is <0.6 V, and the high signal voltage requirement is >2.4 V. Input impedance is between 3.0 and 7.0 kΩ. This input may be used to receive serial initialization/ configuration data as specified in Section 4.1 Received NMEA 0183 Sentences.
5	White	PORT 1 DATA OUT	First Serial Asynchronous Output. This RS-232 compatible output normally provides serial data which is formatted per NMEA 0183, Version 3.0. This output is also capable of outputting phase data information; see Appendix C for details. The NMEA 0183 baud rate is switchable in the range of 300 to 38400 baud. The default baud rate is 4800.
6	Gray	PPS	One-Pulse-Per-Second Output. Typical voltage rise and fall times are 300 ns. Impedance is 150 Ω. Open circuit output voltage is low = 0 V and high = Vin in the GPS 16LVS, and low = 0 V and high = 5.0 V in the GPS 16HVS and GPS 17HVS. The default format is a 100 ms wide active-high pulse at a 1 Hz rate; the pulse width is configurable in 20 ms increments. Rising edge is synchronized to the start of each GPS second. This output provides between 800 mVp-p to 1.7 Vp-p for GPS 16LVS and 1.4 Vp-p for the GPS 16HVS and 17HVS into a 50 Ω load. The pulse time measured at the 50% voltage point will be about 50 ns earlier with a 50 Ω load than with no load.
7	Green	PORT 2 DATA IN	Second Serial Asynchronous Input, electrically identical to PORT 1 DATA IN. This input may be used to receive serial differential GPS data formatted per RTCM SC-104 Recommended Standards For Differential Navstar GPS Service, Version 2.2 (see Section 4.5 Received RTCM Data for details).
8	Violet	PORT 2 DATA OUT	Second Serial Asynchronous Output, electrically identical to PORT 1 DATA OUT. Reserved for future use.

Table 1: GPS 16/17 Wire Pinout

2.2 GPS 16/17 Wiring Diagrams

Figure 1: Computer Serial Port Interconnection

Figure 2: PDA Serial Port Interconnection

Figure 3: Basic NMEA Device Interconnection

3 MECHANICAL CHARACTERISTICS & MOUNTING

3.1 GPS 16 and GPS 17 Flush Mount

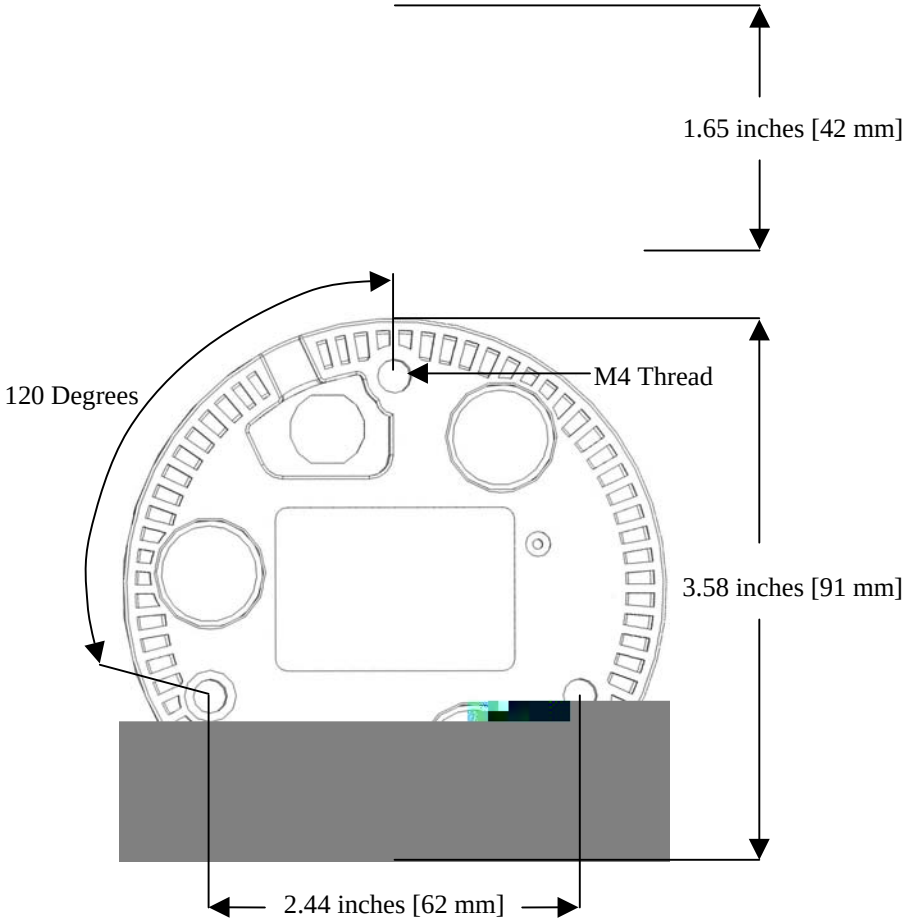

Figure 4: GPS 16 & GPS 17 Flush Mount Dimensions