

GPS16 / GPS17

Compact GPS Satellite Receivers and Antenna Modules
Time and Date Reference for RUBIDIUM SERIES Modules



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A1 Revision History

No.	Date	Subject
0.n		Preliminary documents, changes without notice.
1.0	May 02, 2006	First released document.
2.0	September 06, 2006	GPS17 description added.
2.1	December 12, 2006	Chapter 1.4: pin compatibility changed.
3.0	September 19, 2008	GPS 17x replaces GPS17.
3.1	January 12, 2011	RJ45 pinning: Pin 3 has to be not connected.

A2 Copyright

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A3 Warranty

Alpermann+Velte warrants that their products will be free from defects in materials and workmanship for a period of two years from the date of shipment. If this product proves defective during the warranty period, Alpermann+Velte, at its option, will repair or replace the defective product without charge, provided this product are returned to Alpermann+Velte freight prepaid.

In order to obtain service under this warranty, Customer must notify Alpermann+Velte of the defect before expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to Alpermann+Velte, please notice the Shipping Information given below.

This warranty shall not apply to any defect, failure or damage caused by abuse, misuse, improper use, negligence, accident, modification, alteration, or improper or inadequate maintenance and care.

This warranty is given by Alpermann+Velte with respect to this product in lieu of any other warranties, express or implied. Alpermann+Velte and its vendors disclaim any implied warranties of merchantability or fitness for a particular purpose. Alpermann+Velte's responsibility to repair or replace defective products is the sole and exclusive remedy provided to the customer for breach of this warranty. Alpermann+Velte and its vendors will not be liable for any indirect, special, incidental, or consequential damages irrespective of whether Alpermann+Velte or the vendor has advance notice of the possibility of such damages.

A4 Unpacking/Shipping/Repackaging Information

This product has been carefully inspected, tested and calibrated before shipment to ensure years of stable and trouble-free service.

The shipping carton and pads provide protection for the product during transit. Retain the shipping cartons in case subsequent shipment becomes necessary.

Carefully unpack the product from its transit material and carefully check the product for signs of damage. In the event that the product has been damaged during transit, contact the carrier and your Alpermann+Velte dealer.

Please confirm that all items listed on the packing list have been received. Check the items against your original order to ensure that you have received the correct parts. If any item is missing, please contact your Alpermann+Velte dealer.

Ensure that all packaging material is removed from the product and its associated components before installing the unit.

Products returned to Alpermann+Velte for servicing or repair should have a tag attached showing:

- Name and complete address of the owner and the name of the person that can be contacted.
- Unit's serial number and a description of the service required or failure detected.

Products returned should be shipped prepaid in the original packaging material if possible. If the original packaging is not available or is unfit for use, supply an adequate packaging which should meet the following criteria:

- Packaging must be able to withstand the product weight.
- Product must be held rigid within the packaging.
- Allow at least two inches of space between the product and the container.
- The corners of the product must be protected.
- Seal the carton with shipping tape or an industrial stapler.

If the product is still within the warranty period, the product will be returned by prepaid shipment after servicing.

1 GPS Satellite Receiver Module

1.1 Overview

The GPS16/GPS17 modules are complete GPS receivers, including an internal antenna. They track multiple satellites at a time while providing fast time-to-first-fix.

The modules are designed to withstand rugged operating conditions and they are waterproof to IEC 60529 IPx7, immersion in 1 meter of water for 30 minutes.

The modules are only “plug and play” compatible when used in conjunction with Alpermann+Velte RUBIDIUM SERIES modules, as there are presently GL, GT, GI, SR, SL, SI, SV. The RUBIDIUM SERIES module provides the power and receives the serial time & date data string as well as the PPS for reference.

1.2 Placing the GPS Antenna

The housing includes the GPS receiver and the antenna.

The GPS satellites are not stationary but circle round the globe approximately every 12 hours. The GPS antenna must be installed outdoors where an unobstructed view of the sky exists. Rooftops generally make good locations due to clear overhead sky with views to the horizon, allowing the antenna to see and track the maximum number of satellites throughout the day. Installations with obstructed views may prove operational, but may experience reduced reception quality and the inability to simultaneously track the maximum number of satellites. In addition to clear sky coverage, select a site which would not allow the antenna to become buried in drifted or accumulated snow.

1.3 Configuration

Firmware set-up of the GPS module has been completed by an Alpermann+Velte specialist before delivery. The module is “plug and play” compatible when used in conjunction with Alpermann+Velte RUBIDIUM SERIES modules. If it becomes necessary to restore the default configuration, please notice the chapter “Restoring the Default Configuration”.

1.4 Connections

RJ45 pin assignments (n. c. = not connected):

Pin	Signal [colour coding]		Description
	GPS16/GPS17	GPS17x	
1	PPS Out [grey]	PPS Out [white/orange]	One-pulse-per-second output.
2	TXD1 Out [white]	TXA Out [orange]	Serial data output, RS232 compatible.
3	-	-	Not connected.
4	GND [black]	GND [blue]	Power and signal ground.
5	DC In [red]	DC In [white/blue]	DC voltage input, unregulated, 8 - 33 VDC. Typical operating power ≤ 800 mW.
6	RXD1 In [blue]	RXA In [green]	Serial data input, compatible with RS232 or TTL voltage levels.
7	ON/OFF [yellow]	ACC ON [white/brown]	Control input: connect to GND.
8	RXD2 In [green]	n. a. [brown]	Serial data input, reserved.

Pin compatibility with RUBIDIUM SERIES modules (n. c. = not connected):

RJ45 jack GPS16/GPS17	RJ45 jack REF IN at RUB GT/GI modules	RJ45 jack REF IN 1/2 at RUB SR module	RJ45 jack REF IN at RUB SL/SI/SV modules
1: PPS Out 2: TXD1/TXA Out 3: n. c. 6: RXD1/RXA In 4: GND 5: DC In 7: ON/OFF In 8: RXD2 In	1: PPS IN 2: RXD IN 3: REF_IN_A 6: REF_IN_B 4: GND 5: VCC24G_OUT 7: GND 8: VCC5G_OUT	1: PPS_1/2 IN 2: RXD_1/2 IN 3: n. c. 6: n. c. 4: GND 5: VCC24G_OUT 7: GND 8: VCC5G_OUT	1: PPS IN 2: RXD IN 3: n. c. 6: n. c. 4: GND 5: VCC24G_OUT 7: GND 8: VCC5G_OUT

The GPS module will be delivered ready to connect to the REF IN connectors of the RUBIDIUM SERIES modules.

To add length to the supplied (GPS16: 5 m, GPS17/GPS17x: 9 m) cable, use the included RJ45 coupler (female to female) with straight through configuration, then attach a standard RJ45 patch cable.

It is recommended not to add length of more than **100 m**. Please contact Alpermann+Velte if the distance between the GPS module and the RUBIDIUM SERIES module should exceed this limit.

2 Applications

2.1 Setup at the RUBIDIUM Module Configuration

The RUBIDIUM module (the following example refers to the RUB GT or GL module), which uses the GPS module as a time & date reference, must be configured in the following way utilising one of the RUBIDIUM configuration tools:

Select the source and the data format	At tab/page Reference : Select "Reference Source" = Serial Select "Reference Format" = \$GPRMC 4800/8n1 + PPS
Select the time zone of the reference (GPS16/GPS17 outputs UTC date and time of day)	At tab/page Reference : Select "Time Zone and DST Mode" of "Reference Input" = UTC At tab/page Time Zone : At "Reference Input" select "Offset from UTC" = + 00 : 00 "DST Bias" = 00 : 00

2.2 Receiver Status Indication at RUBIDIUM GT Module

Immediately after power-on GPS16/GPS17 transmits no valid time & date information, and no PPS signal. As soon as the receiver has been synchronised the PPS output becomes active and the time & date will be assigned as valid.

The RUBIDIUM GT (or GL) module provides a LED status indication, which can be used as a simple GPS monitor:

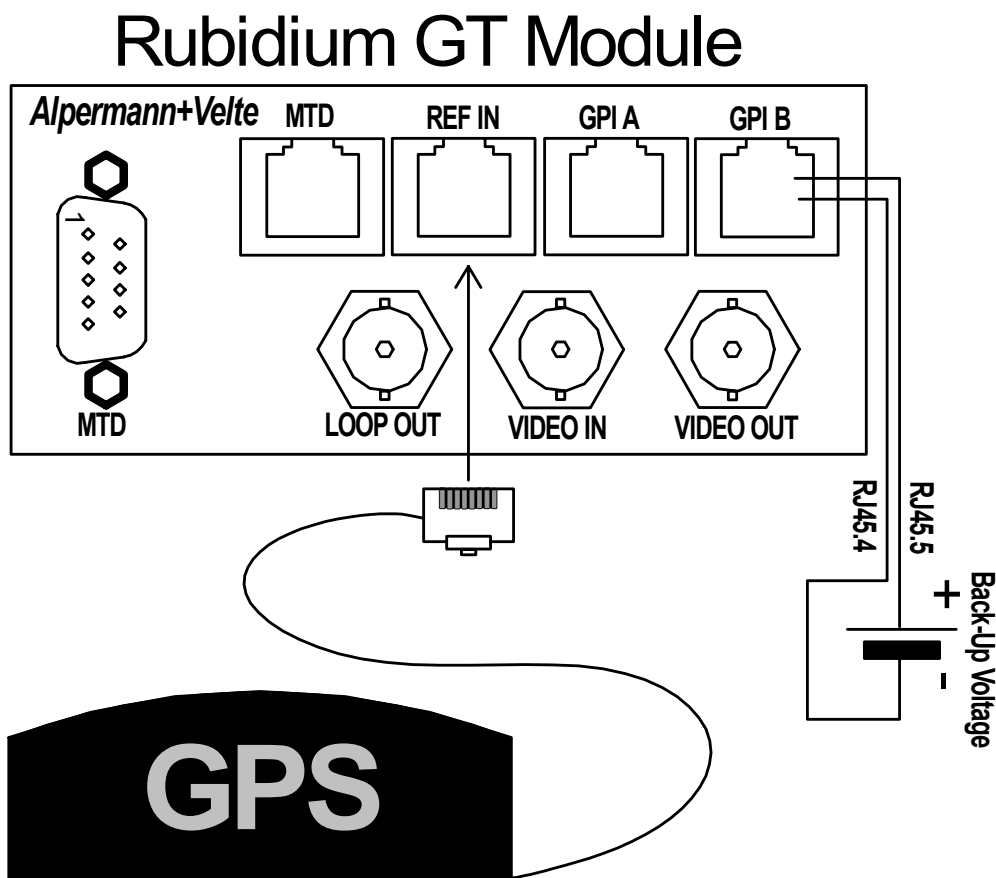
Name (LED function)	Functional description
Reference Input	LED lights up, if GT is operating. Every time a valid time & date reference data string has been received, the LED shortly goes out.
Reference Lock	The reference data string received may contain time, date and status information. This LED indicates the status of the <i>external clock</i> (GPS16/GPS17): LED lights up if "lock". LED flashes slowly if "lock after reset". LED goes out if status "unknown" or "unlock".

2.3 Utilizing the RUBIDIUM GT Back-Up Voltage Feature

After power-on of the GPS module, it transmits no valid time & date information, and no PPS signal. After power-on of the GT module, it monitors the reference input for valid data. If no valid data can be received for a few seconds, GT starts with the internal buffered time & date information of the built-in real time clock.

In a situation where both units (GPS and GT) always power-up at the same time, and the GPS receiver cannot synchronise to GPS satellites during several days, there may be no longer an accurate time base present. This situation can occur when an OB van is parked for a long period of time under a roof. If the OB vans position is at a location, where no unobstructed view of the sky exists, the only way to synchronise to the GPS satellites is when the vehicle is driving. This problem can be solved by utilizing the back-up voltage feature (when driving).

The RUBIDIUM GT modules back-up voltage feature, powers both the GPS module and the GT module. This is accomplished by connecting a separate 12-24 volt power supply to the GT module (described below). As soon as the GPS module has been locked, the internal built-in real time clock of the GT module will be automatically synchronised with the external reference. The built-in real time clock has a special TCXO for enhanced timekeeping accuracy, so after power-on of the GT module the built-in real time clock will deliver a very accurate time & date.



3 Technical Data

Specifications are subject to change without notice.

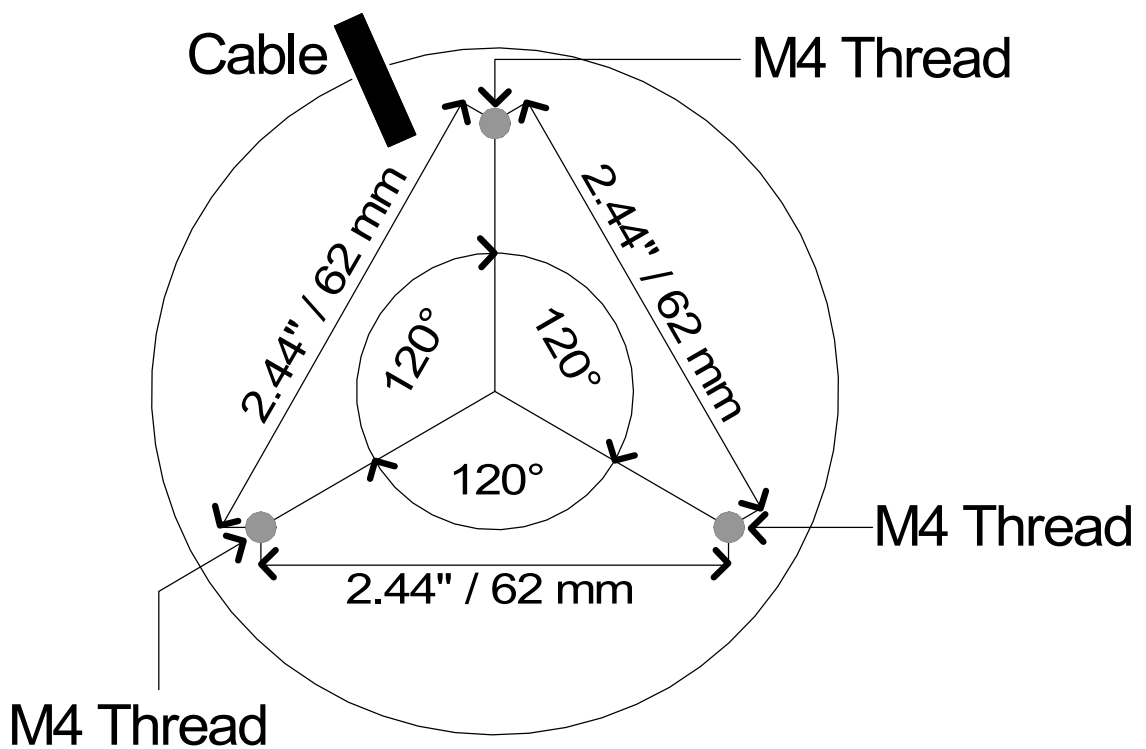
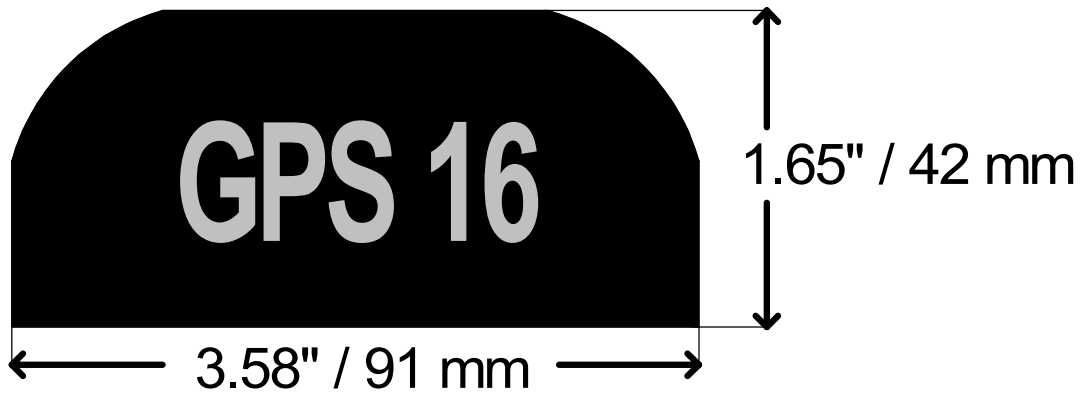
3.1 Specifications

GPS receiver and antenna modules	
GPS16	GARMIN GPS16x HVS, OEM, modified to connect to the REF IN connectors of the RUBIDIUM SERIES modules
GPS17	GARMIN GPS17 HVS, modified to connect to the REF IN connectors of the RUBIDIUM SERIES modules. This product is discontinued since summer 2008.
GPS17x	GARMIN GPS17x NMEA 0183 HVS, modified to connect to the REF IN connectors of the RUBIDIUM SERIES modules. This product replaces GPS17.
Physical characteristics	
Diameter	GPS16: 3.58"/91 mm GPS17: 3.58"/91 mm GPS17x: 3.62"/92mm
Height	GPS16: 1.65"/42 mm GPS17: 4.25"/108 mm (incl. pole mount adapter) GPS17x: 1,85"/47 mm (without pole mount adapter)
Weight (without cable)	GPS16: 180 g GPS17: 200 g GPS17x: 213 g
Cable	GPS16: black, 5 meter, AWG 28 GPS17: white, 30 foot/9 m, AWG 28 GPS17x: white, 30 foot/9 m, AWG 22, + 1 m DSUB9-RJ45 adapter PVC jacketed, foil shielded, 8 conductors, crimped RJ45. Extension by adding cable length up to 100 m possible.
Case	Polycarbonate thermoplastic. GPS16: black GPS17: white GPS17x: white
Electrical characteristics	
Input voltage	8 - 33 VCD unregulated
Input current	60 mA @ 8 VDC / 40 mA @ 12 VDC, 15 mA @ 40 VDC
Environmental characteristics	
Operating temperature	-30° C to +80° C
Storage temperature	-40° C to +80° C

Functional Description and Specifications GPS16 / GPS17

GPS performance	
Receiver sensitivity	GPS16/GPS17: -165 dBW minimum GPS17x: -185 dBW minimum
Receiver	12 parallel channel GPS receiver, with PPS active up to 11 satellites will be continuously tracked.
Acquisition times	Reacquisition: less than 2 seconds Warm: approx. 15 seconds Cold: approx. 45 seconds Sky search: 5 minutes
Interfaces	
Serial output	GPS16/GPS17: RS232 output GPS17x: RS422 output User selectable format. Alpermann+Velte default setting: 4800/8n1.
Serial input	Asynchronous serial input compatible with RS232 or TTL voltage levels GPS16/GPS17: RS232 polarity GPS17x: RS422 polarity
PPS output	1 Hz pulse, programmable width (Alpermann+Velte default setting: 100 ms) Accuracy: $\pm 1 \mu\text{s}$ (rising edge) Impedance: 150 Ω Open circuit output voltage: GPS16/17: 0 - 5.0 V GPS17x: 0 - 3.3 V Rise and fall times: 300 ns typically

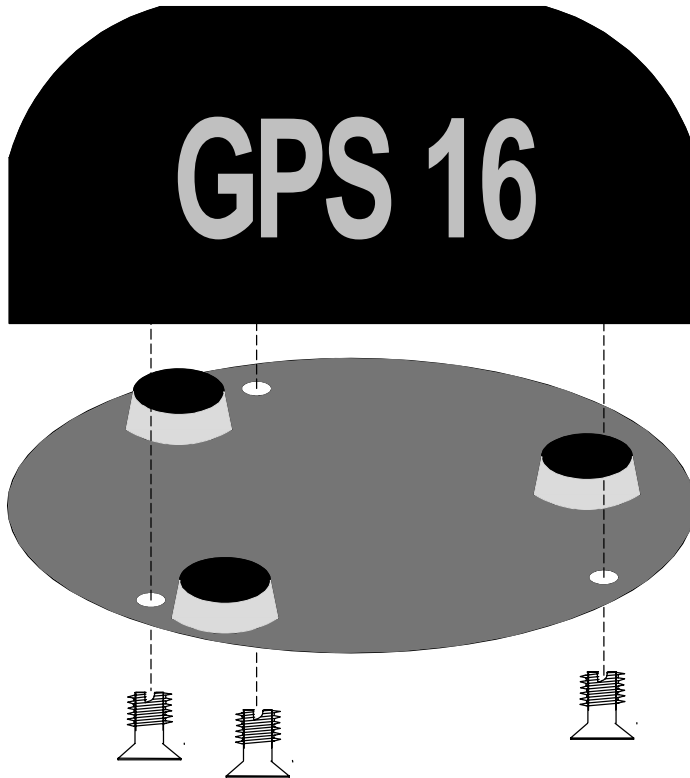
3.2 GPS16: Mechanical Characteristics and Mounting



Flush Mount Dimensions (bottom view)

Optional Magnetic Mount

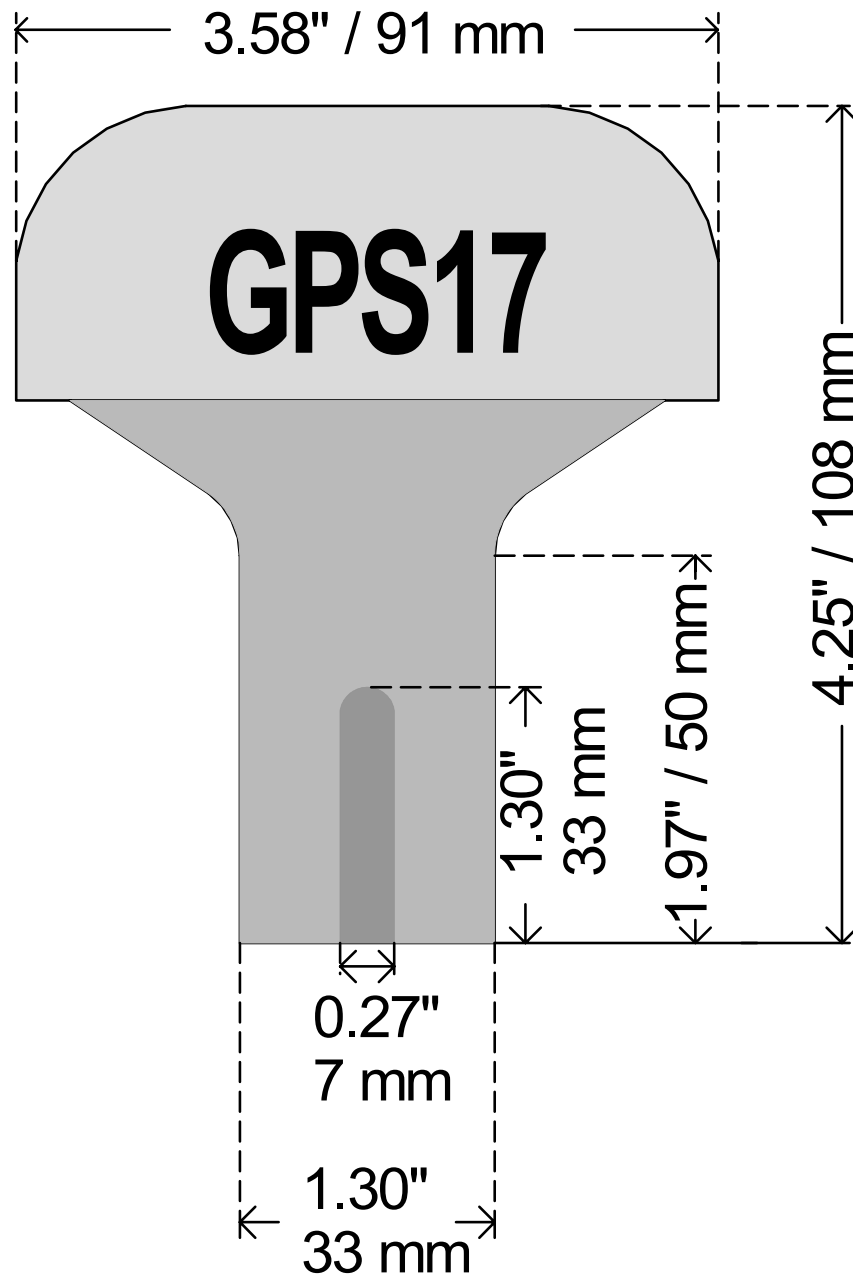
The magnetic mount provides a firm, removable mounting attachment to any ferrous metal surface. Attach the plate to the GPS 16 housing as shown in the diagram, using three screws (M4 x 8 mm flat head screws, included). The plate carries three magnets and has a protective rubber coating at the rear side.



Thickness of the plate: 0.1" (2.5 mm).

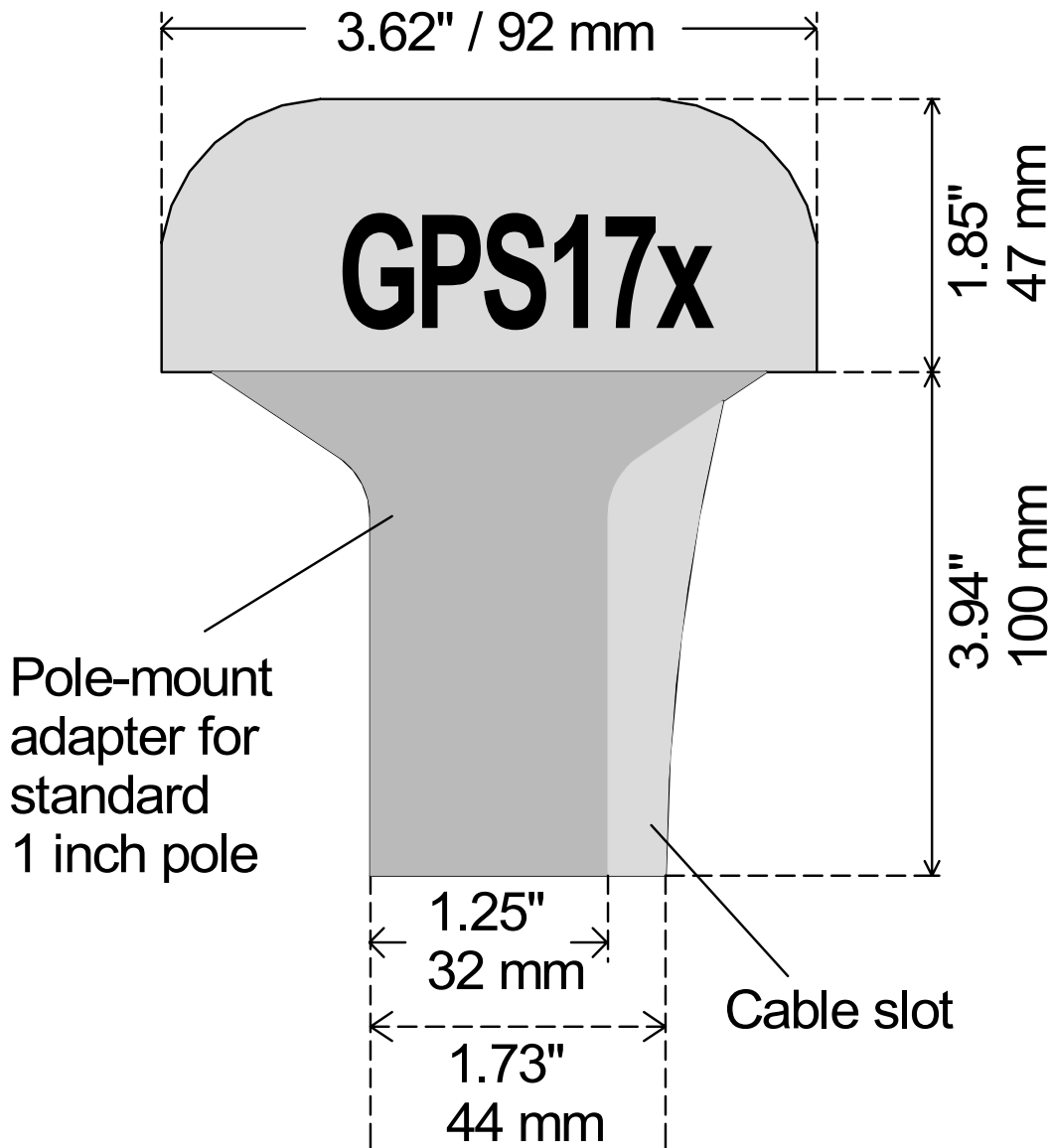
3.3 GPS17: Mechanical Characteristics and Mounting

This product is discontinued since summer 2008 and will be replaced by GPS17x.



The pole with its inside thread fits on a standard one-inch, 14 threads-per-inch, marine mount.

3.4 GPS17x: Mechanical Characteristics and Mounting



The pole with its inside thread fits on a standard one-inch, 14 threads-per-inch, marine mount. The pole is not included.

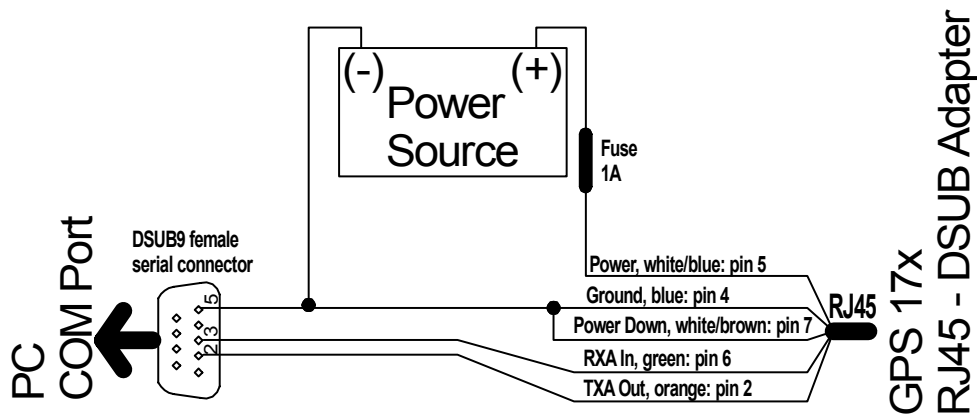
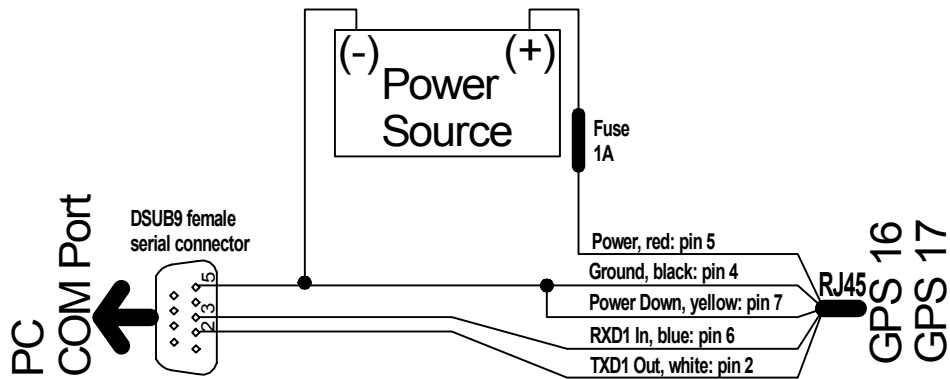
Surface mount and under-deck mount is possible as well. The necessary accessories are included.

Please notice the included GARMIN installation instructions.

3.5 Restoring the Default Configuration

If it becomes necessary to restore the default configuration, please follow these instructions:

- Connect to a power supply and a RS232 computer interface as shown:



- Transmit the following data strings, using a 4800/8n1 format:

Output Sentence Disable:

```
$PGRMO,,2*hh<CR><LF>
```

This disables all output sentences.

Sensor Configuration Information:

```
$PGRMC,A,,100,,,,,A,3,1,2,4,30*hh<CR><LF>
```

Basically this puts the unit into automatic mode, with NMEA baud rate 4800, PPS 1 Hz with 100 ms pulse length.

Additional Sensor Configuration Information:

```
$PGRMC1,1,1,1,0.0,0,1,1,N,N,,,,,1,2*hh<CR><LF>
```

Output Sentence Enable:

```
$PGRMO,GPRMC,1*hh<CR><LF>
```

This enables the GPRMC sentence.

Unit Reset:

```
$PGRMI,,,,,,R*hh<CR><LF>
```