DIGITAL YACHT

SAIL BOAT   **SPORT FISHING**   **MOTOR BOAT**

GPS160USB POSITIONING SENSOR

Installation and instruction Manual

1. Introduction

Congratulations on the purchase of your TriNav™ GPS160USB Global Navigation Satellite System (GNSS) Positioning Sensor. It is recommended that this product is installed by a professional installer. You will need to purchase a suitable 1" x 14 TPI thread mounting bracket for the GPS160USB.

To coincide with the imminent "Full Operational Capability" (FOC) of the European Galileo system, Digital Yacht's release of their TriNav™ GPS160USB smart positioning sensor will provide boat owners with a single sensor that will automatically read satellite data from the GPS, GLONASS and GALILEO constellations, choosing the best signals from over 80 satellites.

Wherever you are in the world you now have three times the number satellites to choose from, resulting in the GPS160USB receiver having much better coverage, time to first fix and positional accuracy. Add to this the new high sensitivity receiver design, selectable baud rate and up to 18Hz position update rate and you have a GNSS receiver that is significantly better than every previous marine GPS receiver on the market.

The performance of this new TriNav™ technology is particularly noticeable when the sensor is mounted below deck/inside the wheelhouse or when there are obstructions blocking the view of the sky, such as a wet sail shadowing the antenna or when sailing in rivers or close to cliffs.

On larger boats, it is now possible to have three completely separate position sources, by setting one GPS160USB to GPS mode, a second to GLONASS mode and a third to Galileo mode – giving you triple redundancy with three independent positioning systems.

The GPS160USB also supports SBAS (Satellite-Based Augmentation System) which is the generic name given to the differential signal transmitted by various local geo-stationary satellites. SBAS allows the GPS160USB receiver to remove errors in the position due to environmental conditions and improves accuracy down to <1m. Using WAAS in the US and EGNOS in Europe the GPS160USB will automatically switch to differential SBAS mode when available.

The GPS160USB utilises the latest in GNSS technology, but is also designed to be as compatible as possible with the hundreds of thousands of older systems still providing reliable service, on boats around the world. Featuring dedicated "Legacy" modes that output older NMEA 0183 V2.30 data and reduce the update rates, number of decimal places and satellite status information, the GPS160USB can be configured to work with the newest and oldest systems on the market.

ⓘ **Before operating the unit you should also familiarise yourself again with the user manual of the Navigation Software that you will be using the GPS160USB with. Pay particular attention to the GPS Interfacing section and any settings that need to be configured for correct operation.**

2. Before you start

Carefully consider where you wish to mount the GPS160USB and how you will feed the 5m USB cable through to the PC. Specialist cable glands are available online, that will allow cables with USB connectors to fit through them and we would definitely recommend using these, rather than cutting, joining or fitting other connectors to the USB cable.

The maximum length of standard USB cables is 5m but special powered extension cables are available if it is necessary to extend the GPS160USB cable. Digital Yacht can supply a 5m Powered USB Extension cable if required.

IMPORTANT: The GPS160USB should be connected directly to the computer's USB port and not via a USB Hub.

To display the GNSS data you will need:

- Suitable Windows/Mac/LINUX PC with a spare USB port.
- The Digital Yacht Software and Drivers CD (supplied with the GPS160USB)
- Suitable Navigation software running on the Windows/Mac/LINUX PC that can read GPS data.

3. Installation

Before starting installation select a suitable location for the GPS160USB Receiver. The unit features a very sensitive GNSS receiver and in many boats the GPS160USB will operate quite happily below deck or in a wheel house. If you find that you are getting good performance with the GPS160USB mounted below deck, then installation is simple and you just need to find a suitable location where the GPS160USB can be firmly fixed.

For absolute optimum performance, then on-deck mounting is recommended and the unit is fully water proof and designed for permanent mounting outside. The GPS160USB antenna has the popular 1" x 14 TPI thread mount, found in many VHF antennas. A wide variety of different brackets are available for this type of threaded mount, consult your local marine electronics dealer or chandlery for more information.

The 1" x 14 TPI thread mount can also be removed by unscrewing the three hex bolts with a suitable Allen Key, allowing the GPS160USB to be flush mounted on a flat horizontal surface. A mounting kit (as shown in the diagram below) is available from Digital Yacht (Part# X500.400). In this situation, a bead of silicone sealant should be applied around the antenna, after mounting it, to avoid standing water accumulating under the antenna.

Dimensions;
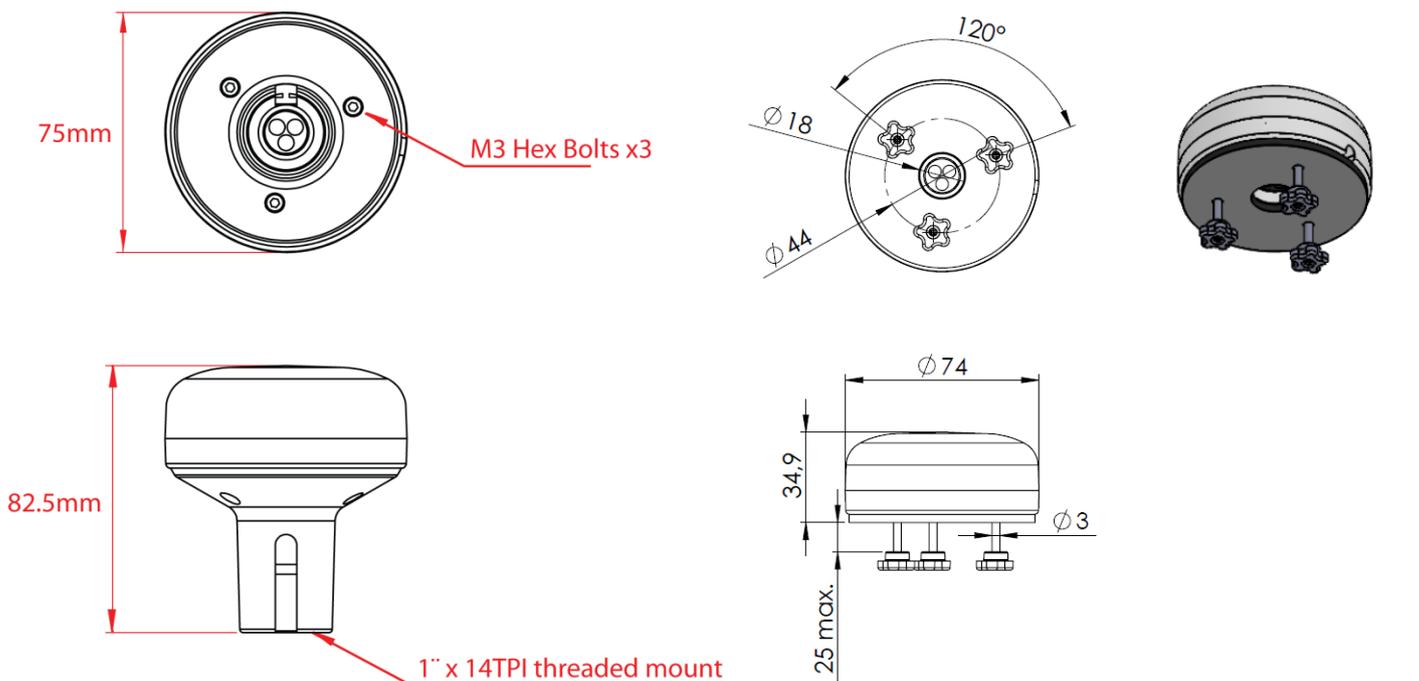
The GPS160USB is supplied with 5m of USB cable and this should be routed through the vessel to a suitable dry internal location where it can be connected to the Windows/Mac/LINUX PC which will provide power to the GPS160USB and receive the GNSS data from the GPS160USB.

The GPS160USB has a number of operating modes that can be set by adjusting four DIP switches inside the unit. Section 4 of this manual explains how to select the different modes. By default the GPS160USB will output;

- ***GLL, GGA, RMC, VLW, VTG and ZDA once per second at 4800 baud (TriNav™ Mode)***

This default mode is good for most applications and uses all of the available satellites from the GPS, GLONASS and GALILEO constellations.

Before connecting the GPS160USB to the PC, it is necessary to install the USB drivers. The exact procedure varies between Operating Systems, but the following section details the procedure for the popular operating systems;

Windows XP

On the **Digital Yacht Software and Drivers CD**, there is a folder called "USB Drivers for AIS units" which contains the drivers required for the GPS160USB. Double click on the "USB Driver Setup" program and make sure that a DOS Command window opens and a series of commands are executed – normally takes 10-15secs to complete.

Once the program has finished, insert the cable of the GPS160USB in to a spare USB port and the Windows "Found New Hardware" wizard should briefly appear while the PC completes the installation.

You may need to enter the Windows Device Manager to find out what COM Port the GPS has been allocated by Windows. In the Device Manager, the GPS160USB should appear in the **Ports COM & LPT** section as a "USB Serial Port (COMx)" where x = the COM Port number allocated by Windows to the GPS160USB. This is the COM port number that you will need to enter in your Navigation Software to tell it where to get the GPS data from.

Windows Vista/7/8

The easiest way to install the drivers on these operating systems, is to plug the GPS160USB in to your PC when you have a good internet connection. Windows will see the new hardware and automatically search online for the latest drivers, download them and then install them. The whole process takes about 2-3 minutes and is completely automatic.

If you are on the boat with no internet connection, then insert the **Digital Yacht Software and Drivers CD** in to your PC and browse to the folder called "USB Drivers for AIS units" which contains the drivers required for the GPS160USB USB. Right click on the "USB Driver Setup" program and select the option "Run as administrator". The program should now open a DOS Command type window and execute a series of commands – normally takes 10-15secs to complete.

Once the program has finished, insert the cable of the GPS160USB in to a spare USB port on the PC and the Windows "Found New Hardware" wizard should briefly appear while the PC completes the installation.

You may need to enter the Windows Device Manager to find out what COM Port the GPS has been allocated by Windows. In the Device Manager, the GPS160USB should appear in the **Ports COM & LPT** section as a "USB Serial Port (COMx)" where x = the COM Port number allocated by Windows to the GPS160USB. This is the COM port number that you will need to enter in your Navigation Software to tell it where to get the GPS data from.

Mac Os X

If you are using the GPS160USB with a Mac, you will need to install the drivers before connecting the GPS160USB to a spare USB port on the Mac.

On the **Digital Yacht Software and Drivers CD**, there is a folder called "USB Drivers for AIS units" which contains a sub-folder called "Mac OSX" in here is one DMG file that you need to double click on to run. Follow the instructions that are displayed and at the end of the installation the USB drivers for the GPS160USB should be installed.

LINUX

The good news for LINUX users is that the USB drivers for the GPS160USB are already included in the Kernel and it is simply a case of plugging the GPS160USB in to a spare USB port on the PC.

However, recently we have received reports of changes to the way Ubuntu handles COM ports which has caused some problems for our customers. Please visit our blog at www.digitalyacht.net and search for "Ubuntu". You should see an article that explains this issue and how to fix it.

4. Mode Selection

The GPS160USB can be operated in a number of different modes, designed to satisfy different installation scenarios and optimise performance with older systems.

By selecting different modes, you can change the baud rate, the NMEA 0183 sentences transmitted, the sentence update rate, satellites used for navigation and

- GPS at 4800 baud for legacy systems
- TriNav™ reception at 38400 baud for new plotters
- "Turbo Mode" at 115K baud for PC race software

Selection of the operating mode is via four "DIP" switches inside the unit. Changes to the switches will become active when the GPS160USB is power cycled (turned off/on).

There is a green LED on the PCB that indicates if the GPS is working correctly and a red LED that illuminates if there is a fault. The photo of the PCB shows the location of the LEDs and switches.

Within 2-3 seconds of applying power to the GPS160, the LED should illuminate as follows;

LED State	Description
Green LED ON	Configured correctly for 4800 baud
Green LED Slow Flash	Configured correctly for 38400 baud
Green LED Quick Flash	Configured correctly for 115K baud (Turbo Mode)
Red LED ON	Unused Mode Selected (check DIP switches)
Red LED briefly flashes	A Man Over Board sentence has been transmitted

To access the DIP switches, it is necessary to open the GPS160. It is recommended that this operation is only carried out by an approved Digital Yacht Dealer/Distributor, any physical damage to the PCB will not be covered by warranty.

Before opening the GPS160, turn off all DC power to the unit and then remove the threaded mount by unscrewing the 3xM3 hex bolts using a suitable Allen Key. Then using a Torx T6 screwdriver, remove the three screws that hold the GPS enclosure together. Gently pull the enclosure apart being careful not to lose the O-Ring seals (1 large outer and 3 small screw pillar O-Rings).

Once the GPS160USB PCB is exposed, set the four switches to the relevant positions for the required operating mode as shown in the table on the next page.

(i) **To protect the switches during the surface mount production process, a yellow transparent film is placed over them. This should be carefully removed using tweezers before attempting to change them.**

Operating Modes

SWITCHES	MODE	SATELLITES	BAUD	RATE	NMEA DATA	VER
	Tri-Nav Legacy Mode (default)	GPS+GLONASS+GALILEO	4800	1 HZ	GGA/GLL/RMC/VLW/VTG/ZDA	2.3
	Tri-Nav 6Hz Mode	GPS+GLONASS+GALILEO	4800	6 HZ	RMC	4.1
	Tri-Nav All Satellite Info 4800 Baud	GPS+GLONASS+GALILEO	4800	1 HZ	GSA**/GSV**/RMC/	4.1
	Tri-Nav All Sentences 1Hz	GPS+GLONASS+GALILEO	38400	1 HZ	DTM/GGA/GLL/GSA/GSV/RMC/VLW/VTG/ZDA	4.1
	Tri-Nav All Sentences 6Hz	GPS+GLONASS+GALILEO	38400	6 HZ	DTM*/GGA/GLL/GSA*/GSV*/RMC/VLW*/VTG/ZDA	4.1
	Tri-Nav Standard Sentences 10Hz	GPS+GLONASS+GALILEO	38400	10 Hz	DTM*/GGA/GLL/GSA*/GSV*/RMC/VLW*/VTG/ZDA	4.1
	GLONASS 1Hz All Sentences	GLONASS	4800	1 HZ	DTM/GGA/GLL/GSA**/GSV**/RMC/VLW/VTG/ZDA	4.1
	GPS 1Hz All Sentences	GPS	4800	1 HZ	DTM/GGA/GLL/GSA**/GSV**/RMC/VLW/VTG/ZDA	4.1
	GALILEO 1Hz All Sentences	GALILEO	4800	1 HZ	DTM/GGA/GLL/GSA**/GSV**/RMC/VLW/VTG/ZDA	4.1
	Tri-Nav "Professional" Mode 1Hz	GPS+GLONASS+GALILEO	38400	1 Hz	DTM/GBS/GNS/GRS/GSA/GST/GSV/RMC/VLW*/VTG/ZDA	4.1
	Tri-Nav "Professional" Mode 10Hz	GPS+GLONASS+GALILEO	38400	10 Hz	DTM*/GBS*/GNS/GRS*/GSA*/GST*/GSV*/RMC/VLW*/VTG/ZDA	4.1
	GPS Only Legacy mode	GPS	4800	1 HZ	GGA/GLL/GSA***/GSV***/RMC/VLW/VTG/ZDA	2.3
	Future Use					
	Future Use					
	Future Use					
	Full "Turbo" Mode	GPS+GLONASS+GALILEO	115000	18HZ	DTM*/GGA/GLL/GSA*/GSV*/RMC/VLW*/VTG/ZDA	4.1
	* These sentences output at 1HZ					
	** These sentences output every 4 secs					
	*** These sentences only include GPS satellites output every 4 secs					

After changing the DIP switches, it is necessary to power cycle the GPS160USB (unplug then plug back in) before the new operating mode becomes active. Check the Green LED to make sure that the expected baud rate is active and that the Red Error LED is not illuminated.

5. Technical Specification

Receiver	72-channel U-Blox M8 engine
	GPS L1C/A, SBAS L1C/A, QZSS L1C/A, QZSS L1 SAIF,
	GLONASS L1OF, Galileo E1B/C
Sensitivity	-165 dBm typical
Update Rate	1Hz by default (configurable up to 18Hz)
Accuracy Position	<1m with SBAS and 3.0-5.0m without SBAS typically (67%)
Accuracy Velocity	0.05m/sec typically (50%)
Time	± 60ns
Differential GPS	SBAS (WAAS, EGNOS, MSAS, GAGAN and QZSS)
Time to First Fix	26sec (typical)
Technology Supported	GPS, GLONASS and GALILEO
Maximum Altitude	50,000m
Maximum Velocity	500m/s
Operating Temperature	-40°C to +85°C degrees Celsius
Maximum Current	30mA (@12Volts)
Dimensions	75mm diameter, 82.5mm high (with mount), 32mm high (no mount)
Weight	300g
Protocols	NMEA-0183 Version 2.3 or 4.1
NMEA messages	DTM, GBS, GNS, GRS, GSA, GST, GSV, RMC, VLW, VTG and ZDA
Power Input	VDC +9v to 34v
Cable	White 10m Shielded Cable (4.5mm OD)