

FUEL 3100 (Petrol) and DIESEL 3200 (Diesel)

F U E L M O N I T O R S

Installation and Operation Manual

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FUEL 3100



DIESEL 3200

NAVMAN

FCC Statement

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a normal installation. 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:

- Re-orient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an output on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced technician for help.
- A shielded cable must be used when connecting a peripheral to the serial ports.

Units

This instrument is set up with units of US Gallons, knots and nautical miles.

Please refer to section 2-7 to change the units.

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Important

It is the owner's sole responsibility to install and use the instrument and its sensor(s) in a manner that will not cause accidents, personal injury or property damage. The user of this product is solely responsible for observing safe boating practices.

Fuel type: Navman petrol flow sensors (plastic) and FUEL 3100 instruments have been specifically developed for use in marine applications with petrol (gasoline) inboard and outboard engines and are not warranted for any other type of application. These sensors and instruments must NOT be used with petrol EFI engines with a return line to the tank or with diesel engines.

Navman diesel flow sensors (metal) and DIESEL 3200 instruments have been specifically developed for use in marine applications with diesel engines and are not warranted for any other type of application. These sensors and instruments must NOT be used with petrol (gasoline) engines.

Fuel formulation: Every effort has been made by the manufacturer to ensure that the materials used in the Navman fuel flow sensor(s) will operate reliably with different fuel mixtures. The manufacturer or its distributors can not be held responsible for fuel formulation or any affect this may have on the performance and durability of the fuel flow sensor(s).

Back pressure: A fuel flow sensor will create additional back pressure in a fuel system:

- In a petrol system (FUEL 3100): 1/2" of mercury at 19.8 US gallons /hour (75 litres/ hour) and 1" of mercury at 39.5 US gallons per hour (150 litres/ hour).
- In a diesel system (DIESEL 3200): 0.3" of mercury at 25 US gallons /hour (100 litres/ hour) and 1.5" of mercury at 80 US gallons per hour (300 litres/hour).

It is the owners responsibility to ensure that fitting the fuel flow sensor(s) does not cause fuel starvation which may lead to poor engine performance.

Fuel Computer: Fuel economy can alter drastically depending on the boat loading and sea conditions. The fuel computer should not be the sole source of information concerning available fuel onboard and the electronic information should be supplemented by visual or other checks of the fuel load. This is necessary due to possible operator induced errors such as forgetting to reset the fuel used when filling the tank, running the engine with the fuel computer not switched on or other operator controlled actions that may render the device inaccurate. Always ensure that adequate fuel is carried onboard for the intended trip plus a reserve to allow for unforeseen circumstances.

Specific requirements: Your boat's fuel installation boat might be subject to specific requirements (such as USCG, NMMA and ABYC guidelines or local laws), particularly if the boat is licensed, surveyed, chartered or inspected. It is the owner's sole responsibility to install and use the instrument and its sensor(s) in compliance with these requirements.

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Governing Language: This statement, any instruction manuals, user guides and other information relating to the product (Documentation) may be translated to, or has been translated from, another language (Translation). In the event of any conflict between any Translation of the Documentation, the English language version of the Documentation will be the official version of the Documentation.

This manual represents the FUEL 3100 and DIESEL 3200 as at the time of printing. Navman NZ Limited reserves the right to make changes to specifications without notice.

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1 Introduction

This manual describes two different Navman marine fuel instruments:

- The FUEL 3100, which is installed with the separate petrol/ gasoline flow sensor kit, and measures petrol consumption.
- The DIESEL 3200, which is installed with the separate diesel flow sensor kit, and measures diesel consumption.

This manual describes how to install, set up and operate the instruments. For more information, refer to the separate *Flow Sensor Installation Manual* (for the FUEL 3100 and petrol systems) and *Diesel Flow Sensor Installation and Operation Manual* (for the DIESEL 3200 and diesel systems); this manual has extensive information on understanding and optimising your diesel boat's performance.

The FUEL 3100 or DIESEL 3200 measures and displays the fuel flow in real time for a single or twin engine boat. It can calculate and display the amount of fuel used, the amount of fuel remaining and the fuel flow rate.

If an optional speed sensor or speed instrument is connected, the unit can also

show the fuel economy, boat speed and the trip log and total logs.

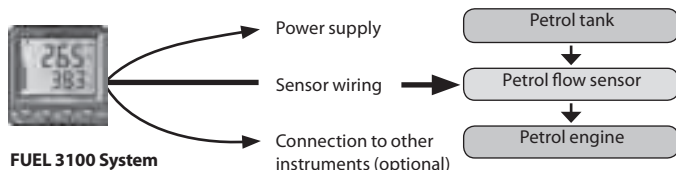
Knowing the fuel economy can help determine the optimum throttle settings and maximize fuel savings. With twin engine boats, comparison between the flow rates of each engine can be used to achieve maximum synchronisation.

It is essential to update the fuel readings in the FUEL 3100 or DIESEL 3200 after a partial or full refill, or after manually removing fuel, to maintain accurate readings (see section 5).

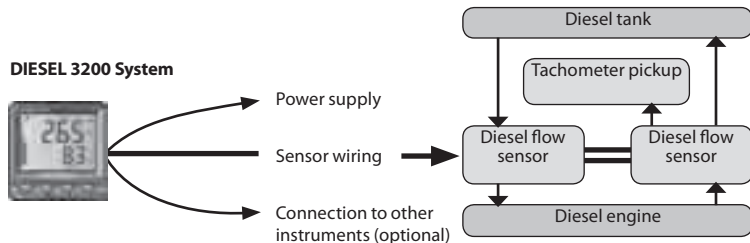
The FUEL 3100 and DIESEL 3200 are part of the Navman family of instruments for boats, which includes instruments for speed, depth, wind and repeaters. These instruments can be connected together, using NavBus or NMEA, to form an integrated data system for a boat.

Information in this manual applies to both the FUEL 3100 and the DIESEL 3200 unless noted. It is vital to read this document and the Navman instrument's installation and operation manual before installing or using this kit.

1-1 Typical Installations



FUEL 3100 System



DIESEL 3200 System

In a twin engine system, each engine has its own sensor(s)

1-2 How the flow sensors work

Petrol flow sensor (FUEL 3100): The petrol flow sensor is fitted in the fuel line between the fuel tank and the engine. A small turbine inside the fuel flow sensor measures the rate of the fuel flow into the engine. This information is relayed through the fuel flow sensor cable and shown electronically on the display unit.

Diesel flow sensor (DIESEL 3200): A diesel sensor is a positive displacement flowmeter, with one moving internal part, made of low

friction, fuel proof plastic. There are no fine pointed shafts and jewelled bearings to get worn or hammered by diesel pulsing.

Each engine is fitted with two fuel flow sensors, to measure fuel supply and return. The system calculates the engine consumption, compensating for pulsing from diaphragm lift pumps, different fuel temperatures in the supply and return lines and the flow characteristics of the sensors.

1-3 Cleaning and maintenance

Clean the display unit and any plastic sensor with a damp cloth or mild detergent. Avoid abrasive cleaners, petrol or other solvents.

Put the protective cover over the display when it is not being used.

1-4 Calibration

FUEL 3100: It is essential to calibrate the fuel flow sensors after installation and again after the first 100 engine hours to allow moving parts to wear in (see section 3-4).

DIESEL 3200: The sensors are factory calibrated and are highly accurate. They can be calibrated but this should not be necessary.

2 Operation

2-1 Turning on and off

The display unit does not have its own power switch, but if possible should be wired so that it turns on when the engine ignition is turned on to allow the engine hours counter to function properly. (See section 4-5).

Turn the unit on and off with the boat's ignition switch. The display unit does not have its own power switch. When the unit is turned off, any settings you have made are retained.

If **SIM** flashes at the bottom left corner of the display, the unit is in simulation mode (see section 2-9).

2-2 The Keys

The unit has four keys, **ESC**, **ENT**, **∨** and **∧**. In this manual:

- **Press** means push the key for less than one second.
- **Hold** means hold the key down until the display changes.

In general:

- Press **∧** to change what is displayed in the upper display.
In a setup menu, press or hold **∧** to increase the setting.
- Press **∨** to change what is displayed in the lower display.



In a setup menu, press or hold **∨** to decrease the setting.


2-3 Setting the backlight

The display and keys are backlit for easy reading in dim light. To change the backlight, change **LAMP** in the **LAMP** menu. (see section 3-3)



2-4 Upper display

Press **^** one or more times to change what is displayed (for example, if the display shows **USED** then press **^** to change the display to **FLOW**):

- **REMAINING**: Fuel remaining. Update this when you add or remove fuel (see section 5).
- **USED**: The fuel used since last reset.
To reset fuel used, press **^** one or more times until used is displayed, then hold **ENT** and **^** together until the reading resets to zero.
- : Displays supply voltage to the head unit.
- **FLOW**: Fuel flow rate.
- **ECONOMY**: Distance travelled per unit of fuel used (requires optional speed input, see section 3-6)
- **RPM**: Engine RPM (DIESEL 3200 only).
PORT RPM: Port engine RPM (displayed on upper display)
STBD RPM: Starboard engine RPM (displayed on lower display)

Note:

- If the boat has twin engines, then when **FLOW** is displayed, press **ENT** one or more times to display **PORT**, **STBD** or **TOTAL** flow.
- If the boat has a twin fuel tanks, then when **REMAINING** or **USED** is displayed, press **ENT** one or more times to display **PORT**, **STBD** or **TOTAL** data.

2-5 Lower display

Press **v** one or more times to change what is displayed:

- **LOG**: Trip distance; the distance travelled since log was reset.
To reset log, press **v** one or more times until log is displayed, then hold **ENT** and **v** together until the reading resets to zero.
- **TOTAL LOG**: Total distance; the distance travelled since total log was reset.
To reset total log, press **v** one or more times until total log is displayed, then hold **ENT** and **v** together until the reading resets to zero.
- **hours**: Hours the engine has run since hours was reset.
To reset hours, press **v** one or more times until hours is displayed, then hold **ENT** and **v** together until the reading resets to zero.
- **RANGE**: Estimated distance that can be travelled on the remaining fuel at the current consumption.
- **SPEED**: Boat speed.


Note:

- **LOG**, **TOTAL LOG**, **RANGE** and **SPEED** require the optional speed input (see section 3-6).


2-6 Fuel and battery alarms

The unit has two alarms:

- **Low fuel:** Alarm sounds when the fuel left in the tank becomes less than the alarm value.
- **Low battery:** Alarm sounds when the battery voltage becomes less than the alarm value.

To turn the alarms on and off and to set the alarm values, see section 3-3. When an alarm sounds, the  symbol flashes, the internal beeper sounds and any external beepers or lights operate. For a low fuel alarm the fuel gauge flashes.

Press **ESC** to mute the alarm.

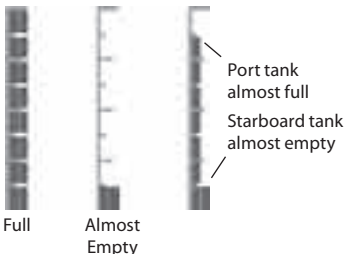
 alarm symbol

2-7 Fuel gauge

Displays fuel remaining in the tank(s). If the boat has twin tanks, the gauge shows both tanks; the left side is the port tank and the right side the starboard tank:

Single tank

Twin tanks



2-8 Changing fuel units

- 1 Press **^** until **REMAINING, USED, FLOW** or **ECONOMY** are displayed.
- 2 Hold **^** one or more times to change fuel units.

Note:

When "gal" is displayed, this could be US gallons or imperial gallons. Check the units menu to confirm and change if required (see **FUEL UnItS** in the **UnItS** menu, section 3-3).

Changing distance and speed units

- 1 Press **v** until **LOG, TOTAL LOG, RANGE** or **SPEED** are displayed.
- 2 Hold **v** one or more times to change distance and speed units.



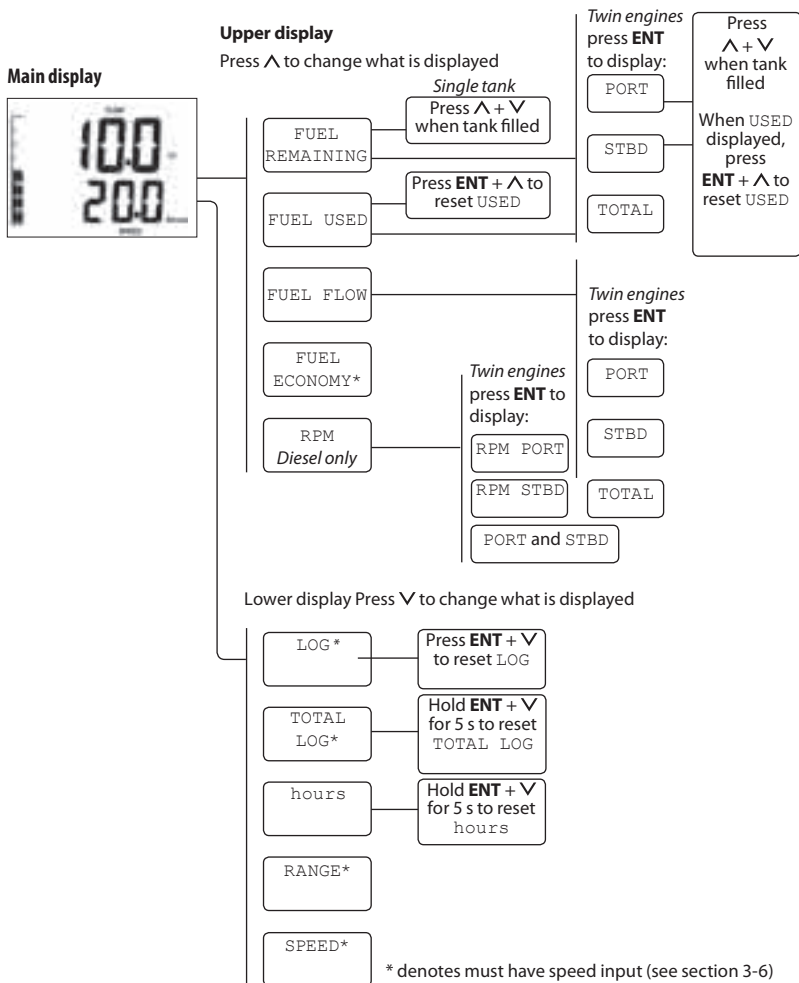
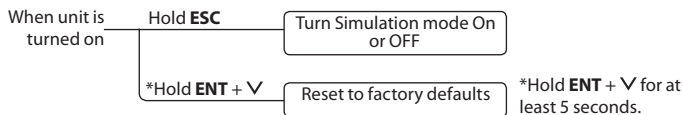
2-9 Simulation mode

Simulation mode allows the user to become familiar with the FUEL 3100 off the water. In Simulation mode, the FUEL 3100 generates data internally and ignores input from the sensor. The word **SIM** flashes at the bottom left corner of the display.

To turn Simulation mode on or off:

- 1 Turn the power off.
- 2 Hold **ESC** while turning the power on.

2-10 Key reference



3 The setup menus

3-1 Setup data

Use the setup menus, shown on the following pages, to customize the unit to suit your boat and your own preferences. To display or change setup data:

- 1 From the main display, press **ESC** and **ENT** together to start setup mode.
- 2 Press **V** or **^** one or more times to display the setup menus.
- 3 Press **ENT** to select a setup menu.
- 4 Press **V** or **^** one or more times to display the setup data for the setup menu.
- 5 If the boat has twin engines or twin tanks, press **ENT**. Press **V** one or more times to display the port or starboard setup data.
- 6 To change the data:
 - i Press **ENT**; the data will blink.
 - ii Press or hold **^** or **V** to change the value.
 - iii Press **ENT** to accept the new value or press **ESC** to ignore your changes.
- 7 To display or change other setup data for this setup menu, repeat steps 4, 5 and 6. Then press **ESC**.
- 8 To display or change setup data for other setup menus, repeat steps 2 to 6. Finally, press **ESC** to return to the main display.

3-2 Initial Setup

- 1 In the **FUEL** menu set up the number of fuel tanks. Select **dUAL** then **Off** (1 tank) or **On** (2 tanks). Then select the number of engines. **Motor** (1 or 2).
- 2 In the **dSL Sen** Menu identify the motors by:
 - i Reset to single engine installation.
 - ii Select one motor (port or starboard), then remove power from the other motor's diesel flow sensor by unplugging the white coloured connector.
 - iii Press and hold **ENT** for 2 seconds to configure the motor, a beep will sound when complete.
Repeat ii and iii for the other motor.
- 3 In the **SPEED** menu identify the speed input. **None**, **GPS** or **Sen**.
- 4 To reset all data to the factory defaults see section 4-8
- 5 For single engine/ single tank diesel installation factory defaults will work.

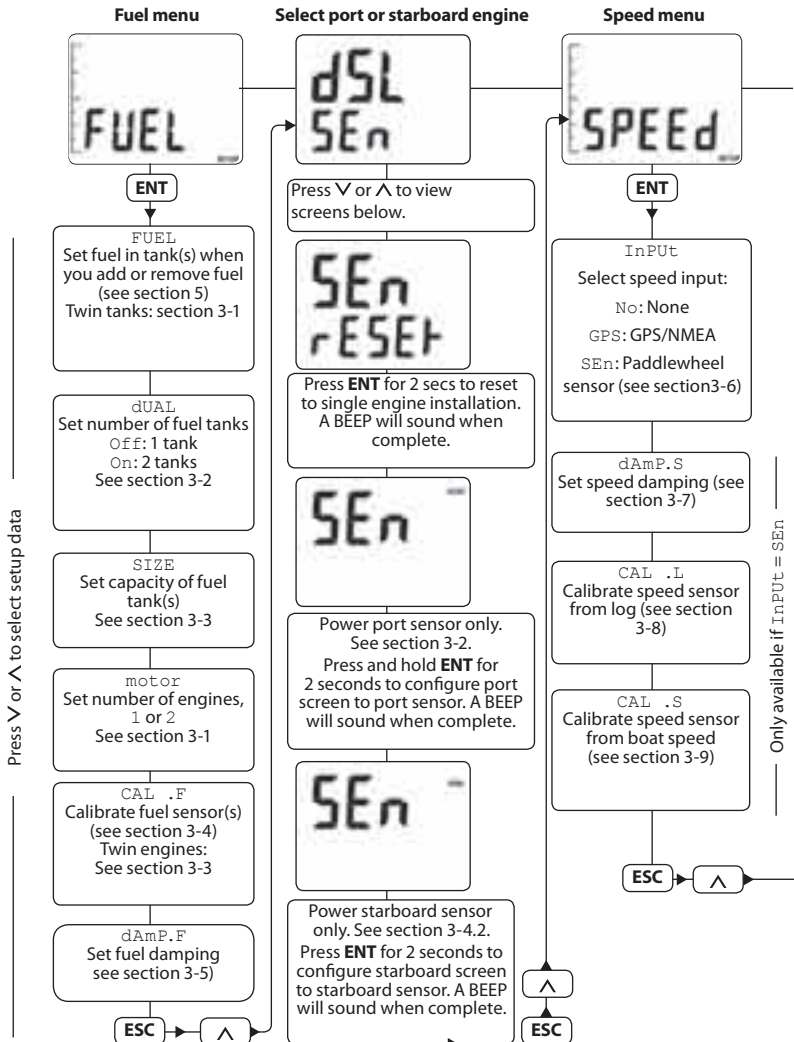
3-3 Setup Menus and data

See also section 4-1

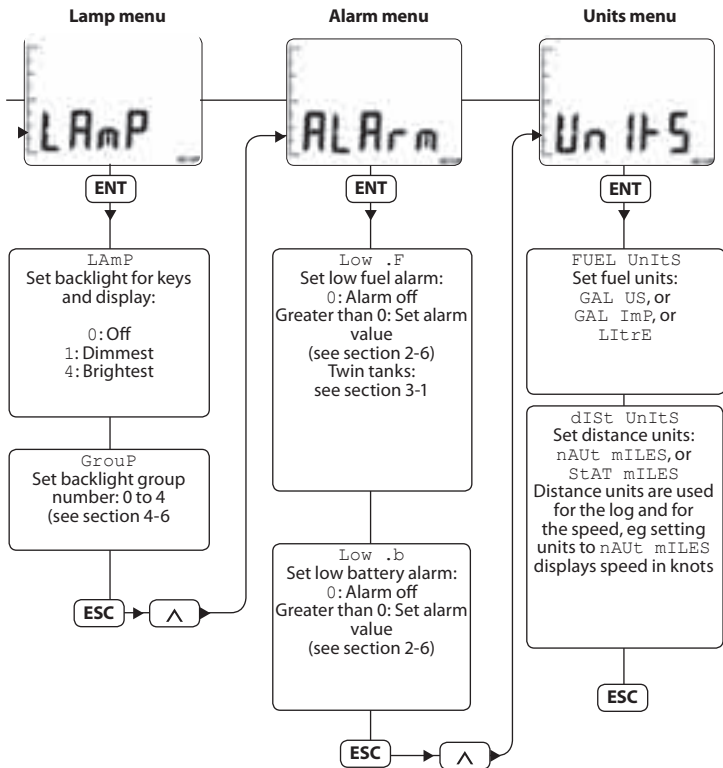
From the main display, press **ENT** + **ESC** together to start setup mode. Press **V** or **^** until desired

menu is displayed then press **ENT** to select it. Press **ESC** again to return to the main menu.

Press **V** or **^** to select a setup menu



Press ∇ or \wedge to select a setup menu



Press ∇ or \wedge to select setup data

Sequence of key strokes

Start setup mode press **ENT** + **ESC** together

Move to the desired menu by using \wedge or ∇

Select the menu by pressing **ENT**

Move to the desired page by using \wedge or ∇

Select the page press **ENT**

Change the data press \wedge or ∇

Accept the change press **ENT**

Leave the page press **ESC**

Return to the main display press **ESC**

3-4 Fuel calibration (CAL.F)

To calibrate a fuel flow sensor, select CAL.F in the FUEL menu. Calibrate the sensors if you are doubtful of their performance.

FUEL 3100: It is essential to calibrate the fuel flow sensors after installation and again after the first 100 engine hours to allow moving parts to wear in.

DIESEL 3200: The sensors are factory calibrated and are highly accurate. They can be calibrated but this should not be necessary.

Calibrating a fuel flow sensor requires accurate measurement of the fuel consumption. This is best done using a small portable tank. At least 4 gallons (15 litres) of fuel should be used to ensure an accurate calibration. The more fuel used, the more accurate the calibration.

Twin engine boats require both engines to be calibrated. Do these together with two portable tanks, or at different times using one portable tank.

To calibrate an engine's fuel flow sensor:

- 1 Connect the portable tank to the engine through the fuel flow sensor.
- 2 Reset USED:
 - i Press **^** one or more times until USED is displayed.
 - ii If your boat has twin tanks, press **ENT** one or more times to display PORT or STBD.
 - iii Hold **ENT** and **^** together until the reading resets to zero.
- 3 Run the engine at normal cruising speed until a **known** amount of fuel, at least 15 litres (4 gallons), has been used per engine.
- 4 Select the FUEL setup menu, then select CAL.F; if your boat has twin engines, select the PORT or STBD engine to be calibrated (see section 3-1).
- 5 If the value of CAL.F does not match the **known** amount of fuel used, press **ENT**, then press **^** or **v** and change CAL.F until it does match. Then press **ENT** to save the correct value (otherwise press **ESC** to ignore the calibration).

3-5 Fuel flow damping (dAmP.F)

Waves and rocking of the boat cause the fuel flow to fluctuate slightly. To give a stable reading, the instrument calculates flow by taking several measurements over a period of time and averaging them. This is called damping.

Set dAmP.F to between 1 to 99 seconds. Small values will give more accurate readings but will show fluctuations. Large values will give more stable readings, but will ignore some true fluctuations.

3-6 Speed input (InPUt)

Select the optional speed input:

NO: No speed input is available.

GPS: Use GPS speed received via NMEA. This is speed over ground.

SEn: The optional paddlewheel sensor connected directly to the unit, or through the Navbus system. This is speed through water.

Note:

A speed input is required to display LOG, TOTAL LOG, RANGE and SPEED (see section 2-5).

Speed over ground and speed through water can give different values for some displayed data (see appendix C).

3-7 Speed damping (dAmP.S)

(Only available if an optional paddlewheel sensor is connected to the unit and InPUt = SEn.) Waves and rocking of the boat cause the speed to fluctuate slightly. To give a stable reading, the instrument calculates speed by taking several measurements over a period of time and averaging them. This is called damping.

Set dAmP.S to 1 (6 sec), 2 (12 sec), 3 (18 sec), 4 (24 sec) or 5 (30 sec). Small values will give more accurate readings but will show fluctuations. Large values will give more stable readings, but will ignore some true fluctuations.

3-8 Speed calibration by log (CAL.L)

(Only available if an optional paddlewheel sensor is connected to the unit and **InPUt = SEEn**.) Select **CAL.L** to calibrate the paddlewheel speed sensor using the trip log.

- 1 Press **▼** until **LOG** is displayed in the lower part of the screen. Press **ENT + ▼** to reset **LOG** to 0.
- 2 Travel a known distance in a straight line at a speed between 5 and 20 knots. Best results are achieved in calm conditions and with minimal current (best at high or low tide). Tidal effects can be reduced by making the trip once in each direction, parallel to the current, to average the distance.
- 3 Select the **SPEED** setup menu, then select **CAL.L**, the distance travelled.
- 4 If the value of **CAL.L** does not match the **known** distance, press **ENT** then **▲** or **▼** and change the value until it does match. Then press **ENT** to save the correct value (otherwise press **ESC** to exit).

3-9 Speed calibration by boat speed (CAL.S)

(Only available if an optional paddlewheel sensor is connected to the unit and **InPUt = SEEn**.) Select **CAL.S** to calibrate the paddlewheel speed sensor using boat speed.

You need an accurate way of knowing boat speed, such as another boat with a calibrated paddlewheel sensor or a GPS receiver.

For accurate calibration:

- The speed from another paddlewheel sensor should be between 5 and 20 knots.
- Conditions should be calm, with little current (best at high or low tide).

To calibrate:

- 1 Travel at a constant, known speed.
- 2 Select the **SPEED** setup menu, then select **CAL.S**, the boat speed.
- 3 If the value of **CAL.S** does not match the **known** boat speed, press **ENT** then **▲** or **▼** and change the value until it does match. Then press **ENT** to save the correct value (otherwise press **ESC** to exit).

Note:

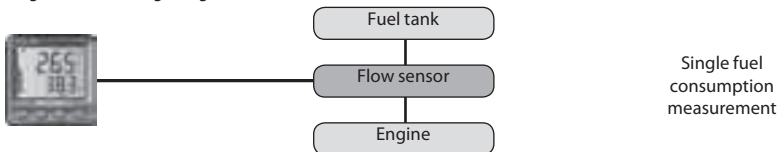
After you press **ENT**, it does not matter if the boat's speed changes.

4 Installation

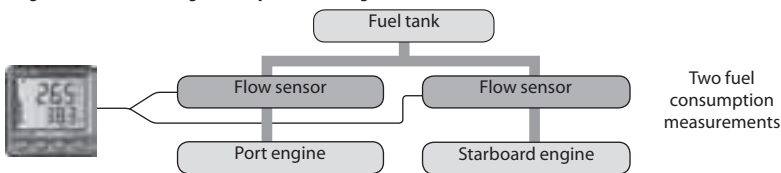
Correct installation is critical to the performance of the unit. It is vital to read the entire installation section of this manual, and the documentation that comes with any optional other parts, before starting the installation.

For more information, refer to the installation instructions supplied with the sensor, or consult your Navman dealer.

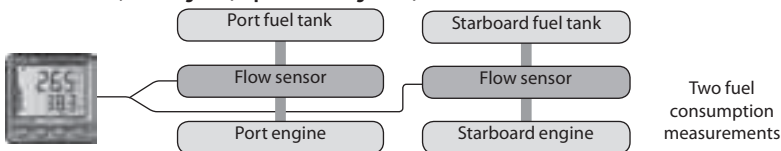
Single fuel tank, single engine



Single fuel tank, twin engines (requires twin engine kit)



Twin fuel tanks, twin engines (requires twin engine kit)



4-1 Tank and engine options

There are three options for the FUEL 3100 and the DIESEL 3200.

A FUEL 3100 uses one sensor to measure fuel consumption. The DIESEL 3200 uses two sensors to measure fuel consumption, a sensor in the supply line and a sensor in the return line (see section 1-1).

To configure the unit for different tank and engine options, set `dUAL` and `motor` in the

FUEL menu and for twin motors identify each engine in the `dSL SEN` menu by alternately removing power from the flow sensors as described in this section.

Note:

Twin fuel tanks connected by an open balance pipe should be configured as a single fuel tank.

4-2 The display unit

- 1 Choose a location for the display unit that:
 - is easily seen and protected from damage
 - is at least 100 mm (4") from a compass and at least 500 mm (19.5") from a radio or radar antenna
 - is away from engines, fluorescent lights, power inverters and radio or radar transmitters
 - is accessible from the back; a minimum clearance of 50 mm (2") is required at the back (see mounting diagram)
 - protects the back of the unit from moisture and water.
- 2 The unit must be mounted on a flat panel less than 20 mm (0.75") thick. Stick the mounting template in place. Drill a 50 mm (2") fixing hole through the centre hole in the template. Note that the template allows space around the display unit for the protective cover.
- 3 Remove the fixing nut from the back of the display unit. Insert the stud at the back of the display unit through the mounting hole. Hand tighten the fixing nut.

Warnings

1. The display unit is waterproof from the front. Protect the rear from water, otherwise water might enter the breathing hole and damage the display unit. The warranty does not cover damage caused by moisture or water entering the back of the display unit.
2. Ensure that any holes cut for the installation will not weaken the boat's structure. If in doubt, consult a qualified boat builder.

4-3 The fuel flow sensor(s)

Install the fuel flow sensor(s) following the instructions in the manual supplied with the petrol fuel or diesel flow sensor(s). Note the warning about fuel types in appendix B.

FUEL 3100: Plug the sensor cable into the FUEL 3100 cable with a white connector and do up the locking collar. For a twin engine or twin tank boat, follow the instructions in the *Fuel Sensor Installation Manual*.

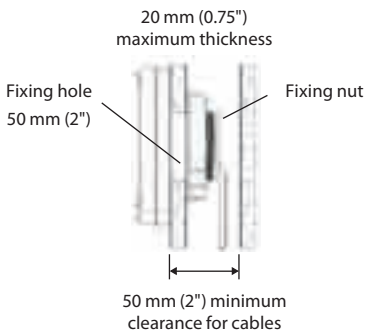
DIESEL 3200: Connect the white sensor cable to the DIESEL 3200. For a twin engine installation install the white T connector and then connect the sensor cables to this.

4-4 The speed sensor (optional)

If required, install the optional paddlewheel speed sensor following the instructions in the manual supplied with the sensor. Plug the sensor cable into the FUEL 3100 cable with a blue connector and do up the locking collar.

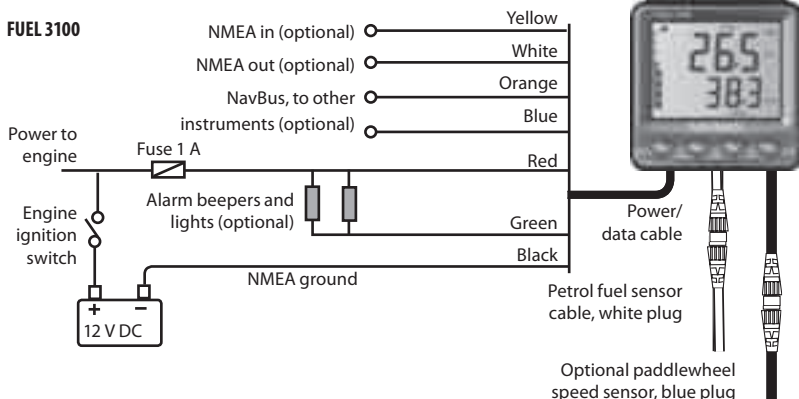
If a NavBus or NMEA speed source is used, connect it to the power/data cable (see next page).

Side view of display unit mounting

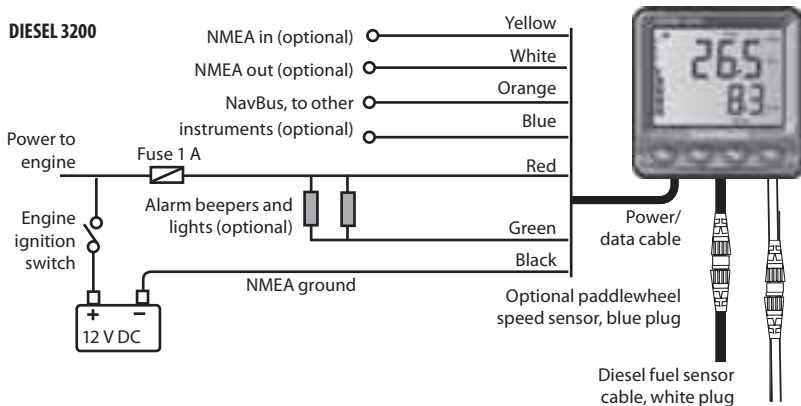


4-5 Power/data cable wiring

FUEL 3100



DIESEL 3200



Notes for both FUEL 3100 and DIESEL 3200:

Use a Navman junction box or any simple wire to wire connector system to wire the power/data cable. Tape or cover any unused wires or connectors to protect them from water and keep them from shorting together. The unit requires between 9 and 30 V DC power. To allow the engine hours counter to function properly the unit should be powered only when the engine's ignition switch is turned on. With twin engines the unit ideally needs to work when either one or both engines are running. If acceptable power

is available wire the unit through each ignition system **separately** using an On/On switch. Alternatively wire it through a separate switch to the vessel's 12 V power supply. **The units must not be powered from both ignition systems simultaneously.**

If a Navman connector box is not used a 1 A fuse must be fitted in the power supply (+) line.

The instrument's alarm output is switched to ground to sound the alarm, 30V DC and 250 mA maximum. If the external alarms require more than 250 mA DC total, fit a relay.

4-6 Systems of several instruments

Several Navman instruments can be connected together to share data, either by using NavBus or NMEA.

NavBus

NavBus is a Navman proprietary system that is high speed and allows a wide range of data to be shared by the instruments.

When instruments are connected by NavBus:

- Data from a sensor connected to one instrument is available to all instruments.
- If the units, alarms or calibration are changed in one instrument, then the values will automatically change in all instruments of the same type.
- Each instrument can be assigned to a group of instruments by setting a group number between 0 and 4. Then, if the backlight is changed in an instrument in groups 1, 2, 3 or 4, it will automatically change in all the other instruments in that group.

However, changing the backlight setting in an instrument in group 0 will not affect any other instrument.

To assign the FUEL 3100 or DIESEL 3200 to a group, set `GROUP` in the `LAMP` menu (see section 3-3).

- If an alarm sounds, mute it by clearing the alarm on any instrument which can display that alarm.
- NavBus junction boxes simplify wiring.

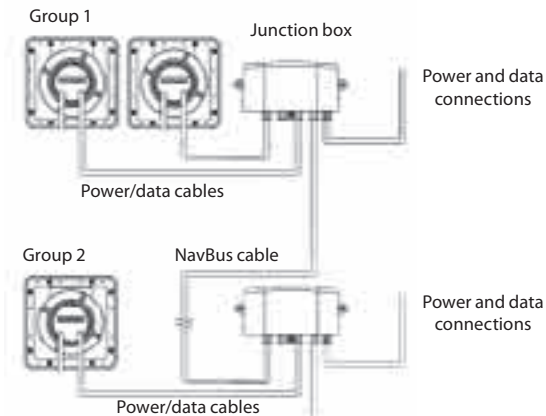
For more information, refer to the *NavBus Installation and Operation Manual*.

NMEA

NMEA is an industry standard for marine instrument connections. The FUEL 3100 and DIESEL 3200:

- Can read speed data (RMC) from a compatible NMEA GPS instrument (see section 3-6)
- Transmit PTTKV, VHw, XDR, VLW .

A typical NavBus system



4-7 Testing the installation

To check out the installation:

- 1 Power on the boat and any other instruments. Check the instruments work properly.
- 2 Enter the setup data (see section 3).
Set **dUAL**, **motor**, and **InPUt** first, then enter the rest of the setup data.
For boats with twin tanks or twin engines, remember to enter port and starboard data separately where required.
- 3 Fill the fuel tank(s) and set the fuel in the tank(s) in the **FUEL 3100** or **DIESEL 3200** (see section 5).
- 4 On boats with twin engines, check the installation of the port and starboard fuel sensors:
 - **DIESEL 3200:** Start the port engine. Check the LED lights under the sensors are blinking. This indicates the sensors are operating correctly. Confirm the fuel flow is being displayed as port engine fuel usage

on the instrument. (If it is being displayed as starboard engine fuel usage, swap over the fuel flow sensor connectors on the 'T' connector.) Repeat the check with starboard engine.

- **FUEL 3100:** Start the port engine. Confirm the fuel flow is being displayed as port engine fuel usage on the instrument. If it is being displayed as starboard engine fuel usage, reconfigure the settings (see section 3-3).
- 5 **FUEL 3100 only:** Calibrate the fuel sensor(s) (see section 3-4).
- 6 If a paddlewheel speed sensor is connected, calibrate it (see sections 3-8 and 3-9).
- 7 Take the boat for a trial run and check the unit is displaying the correct data.

FUEL 3100: Recalibrate the **FUEL 3100's** fuel sensor(s) after the first 100 engine hours (see section 3-4).

4-8 Resetting to factory defaults

To reset to factory defaults:

- 1 Turn the power off.
- 2 Hold **ENT** + **∨** while turning on the power and for at least five seconds after.

5 When you add or remove fuel

When you add or remove fuel from a tank, you must enter into the **FUEL 3100** or **DIESEL 3200** how much fuel you have added or removed. Otherwise **REMAINING**, **RANGE** and the low fuel alarm will be meaningless. Twin tanks connected by an open balance pipe should be treated as a single fuel tank.

When you add or remove fuel from a tank:

a When you fill a tank

- 1 Fill the tank.
- 2 Press **∧** until **REMAINING** is displayed.
- 3 If the boat has twin tanks, press **ENT** until the display shows the name of the tank you have filled, **PORT** or **STBD**.
- 4 Press **∨** and **∧** together.
- 5 If the boat has twin tanks and you are filling the other tank as well, repeat the above steps.

Note:

It is often very difficult to refill underfloor fuel tanks to the same level twice, due to air pockets. Because of this, owners of boats with underfloor fuel tanks should:

- Ensure the boat is trimmed to sit at the same angle in the water each time procedure a above is followed.
- Mostly use procedure b below when filling the tank, but use procedure a above about every tenth fill.

b When you fill or part fill a tank

- 1 Before adding or removing fuel, press **ESC** and **ENT** together, then press **∨** until the **FUEL** setup menu is displayed.
- 2 Press **ENT**, then press **∨** or **∧** until the **FUEL** data is displayed.

- 3 If the boat has twin tanks, press **ENT**. Then press **∨** until the display shows the name of the tank to be filled, **PORT** or **STBD**.
- 4 Write down the number displayed, **FUEL**, which is the amount of fuel now in the tank.
- 5 Add fuel to the tank, writing down how much you add.
- 6 Add together the two figures you have written down, to calculate the amount of fuel now in the tank. Press **ENT**. Then press or hold **∧** to change **FUEL** to the amount of fuel now in the tank.
- 7 Press **ENT**, then press **ESC** to return to the main display.
- 8 If the boat has twin tanks and you are adding fuel to the other tank as well, repeat the above steps.

Note:

If you follow procedure b above every time you add fuel, then a small error will accumulate, because it is hard to measure exactly how much fuel you add. To avoid this, about every ten tankfuls of fuel, fill the tank and follow procedure a.

c When you remove fuel from a tank

Repeat the steps for procedure b above, but:

- i This time subtract the fuel you have removed from the original amount of fuel in the tank to calculate the amount of fuel now in the tank.
- ii Press or hold **∨** to change **FUEL** to the amount of fuel now in the tank.

6 Troubleshooting

This troubleshooting guide assumes that this manual has been read and understood.

It is possible in many cases to solve difficulties without having to send the unit back to the manufacturer for repair. Please follow this troubleshooting section before contacting the nearest Navman dealer.

There are no user serviceable parts. Specialized methods and testing equipment are required to ensure that the unit is reassembled correctly and is waterproof. Repairs to the unit must only be carried out by a service centre approved by Navman NZ Limited. Users who service the unit themselves will void the warranty.

More information can be found on our website: www.navman.com

1 Instrument will not turn on:

- a Power/data cable is damaged or disconnected. Perform a visual check.
- b Fuse is blown or circuit breaker has tripped. Replace the fuse or reset the circuit breaker.
- c Battery voltage is outside the range 9 to 30 V DC. Check the battery voltage using a multimeter.

2 The word SIM flashes at bottom left corner of screen, values displayed are unexpected:

- a The instrument is in simulation mode (see section 2-9).

3 Fuel reading is wrong or erratic:

- a Check for leaks in the fuel line or in the fuel pickup in the tank.
- b Fuel sensor cable is unplugged or damaged. Perform a visual check. DIESEL 3200: check the LED light on the underneath of flow sensor blinks when the engine draws fuel.
- c The fuel **REMAINING** reading is incorrect. The fuel tank capacity (**SIZE**) may be incorrect, or the fuel **REMAINING** setting may not have been updated after a refill. See section 5.
- d Sensors require calibration (see section 3-4; diesel sensors do not normally need to be calibrated).
- e The fuel flow sensor may have been mounted too close to the fuel pump, or may be subject to excessive vibration. Refer to the installation instructions supplied with the fuel sensor.
- f The fuel flow sensor damping (**dAmP.F**) value is not suitable for the engine. Check that the value is not set to zero and then try increasing the value until a steady flow rate is shown (see section 3-5)

4 Speed reading is wrong or erratic:

- a Speed readings require the optional speed sensor to be installed and setup (see section 3-6).

- b Speed sensor cable is unplugged or damaged. Perform a visual check.
- c Speed calibration is incorrect (see sections 3-8 and 3-9).
- d Interference from electrical noise may be affecting the measurements. Review the installation.

5 Low Fuel Alarm sounds when fuel not low:

- a The fuel **REMAINING** reading is incorrect. The fuel tank capacity (**SIZE**) may be incorrect, or the fuel **REMAINING** setting may not have been updated after a refill. See sections 2-6. and 5.

6 The display unit fogs:

- a Moist air has entered the breathing tube at the rear of the unit. Air the boat or run the instrument with backlight fully on.
- b Water has entered the breathing tube. Return the instrument for servicing.

7. Flow indicates no fuel or low fuel

- a **FUEL 3100:** Check that the fuel cable connectors are securely plugged in and the collar is locked in place. The collar must be locked in place to give a watertight connection.
- b A fuel sensor may be clogged. If so, remove the sensor from the fuel line and gently blow through it in the opposite direction to the fuel flow. A fuel filter between the fuel sensor and the fuel tank must be installed as per the fuel installation guide. Failure to do so will void the warranty.
- c Inspect the fuel cable from end to end for damage such as cuts, breaks, squashed or trapped sections.
- d Check that the fuel filter is clean.

8 Fuel used or remaining seem inaccurate:

- a In rough seas, fuel may surge back and forth through the fuel sensor, resulting in incorrect readings. Try installing a one-way valve between the fuel sensor and the fuel tank.
- b The amount of fuel must be reset after every refuelling (see section 5).
- c The fuel tank may not refill to the same capacity each time due to air pockets. This is particularly noticeable with underfloor tanks (see section 5).
- d Petrol fuel sensors wear out over time and should be replaced after every 5000 litres of fuel.

9 A twin engine installation shows only one flow rate:

- a Check that the number of engines is set to 2 (motor in the **FUEL** menu, see section 3).

10 There is no reading for fuel economy:

- a The boat must be travelling through the water to generate an economy reading.
- b If an optional paddlewheel sensor is fitted, check that the paddlewheel spins freely.

Appendix A Specifications

Physical

- Case size 113 mm (4.4") square.
- LCD display 82 mm (3.2") wide, 61 mm (2.4") high; twisted nematic.
- LCD digits 30 mm (1.2") high on top line, 20 mm (0.8") high on bottom line.
- Four operator keys, laser etched.
- Backlighting for display and keys, amber, four levels and off.
- Operating temperature 0 to 55°C (32 to 131°F).
- Power/data cable 1.1 m (3.25 ft).

Electrical

- Power supply 10.5 to 16.5 V DC, 30 mA without backlighting, 80 mA with full backlighting.
- External alarm: Output is switched to ground to sound the alarm, 30 V DC and 250 mA maximum.

Fuel

- Displays fuel used, fuel remaining, rate of fuel flow and the fuel economy.
- Range 0 to 9999 with resolution of 0.1 unit for the first 999 units, thereafter resolution of 1.0 unit.

Log

Displays trip log and total log.

- Range 0 to 9999 miles or nautical miles.

Engine Hours

- Displays 0.0 to 9999.

Engine RPM (DIESEL 3200 only)

- Displays 0 to 9999.

Speed (if optional speed sensor or input is installed)

- Range 0 to 100 knots (0 to 115 mph).
- Speed resolution of 0.1 unit.
- Adjustable damping for speed and log gives stable readings in all sea conditions by averaging the readings. Damping values available are: 1 (6 sec), 2 (12 sec), 3 (18 sec), 4 (24 sec) or 5 (30 sec).

Calibration

- Fuel sensors can be calibrated (diesel flow sensors do not normally need to be calibrated). Speed can also be calibrated if the optional speed sensor is installed.

Interfaces

- NavBus connection to other Navman instruments.
- NMEA 0183: Input: RMC.
Outputs: PTTKV, VHW, XDR, VLW

Standards compliance

• EMC compliance

USA (FCC):

Part 15 Class B.

Europe(CE):

EN50081-1, EN50082-1, EN55024, EN55022, ISO7637-1.

New Zealand and Australia (C Tick) :

AS-NZS 3548.

• Environment:

IP66 from front when correctly mounted on the bulkhead.

Power / data cable

Wire	Signal
Red	Power positive, 12 V DC, 100 mA maximum
Black	Ground/Shield (NMEA common)
Green	External alarm, switched to ground, 30 V DC and 250 mA max.
Orange	NavBus +
Blue	NavBus -
White	NMEA output
Yellow	NMEA input

Appendix B Diesel fuel flow sensor hardware

B-1 FUEL 3100

What comes with your FUEL 3100?



FUEL 3100 display unit



Protective cover



Fuel flow sensor and cable,
8 m (26¼ ft)



Two stainless steel clips

Also: Warranty card, mounting template, this manual and the *Fuel Sensor Installation Manual*.

FUEL 3100 options:

- Additional FUEL 3100 display units to repeat the data. These do not require flow sensors.
- FUEL 3100 twin engine upgrade kit.

B-2 DIESEL 3200

What comes with your DIESEL 3200?



DIESEL 3200 display unit



Protective cover

Also: Warranty card, mounting template and this manual.

DIESEL 3200 options:

- Additional DIESEL 3200 display units to repeat the data. These do not require flow sensors.
- A second diesel flow sensor kit, for twin engines.



Diesel flow sensor kit, with two fuel sensors, tachometer pickup, cables, two straight through pipes, *Diesel Fuel Flow Sensor Installation and Operation Manual*.

B-3 Other options (FUEL 3100 and DIESEL 3200)

- Wiring, 1 A fuse, junction box. Use a Navman NavBus junction box to simplify wiring, particularly when connecting several instruments together (see the separate *NavBus Installation and Operation Manual*).
- External alarm beepers and/or lights (see section 6-4).
- Paddlewheel speed sensors (see section 4-5).

Note:

Speed data can also be received from most other Navman products that output speed data via NavBus or NMEA, or from most other compatible instruments via NMEA (see sections 4-5 and 6-5).

- Paddlewheel speed sensor extension cable, 4 m (13 ft) long.



NavBus junction box

Navman paddlewheel speed sensors



Transom
mount



Through hull
bronze



Through
hull plastic

Note:

For information on options and accessories, see www.navman.com or your Navman dealer.

Warnings for fuel types

Navman petrol flow sensors and FUEL 3100 instruments have been specifically developed for use in marine applications with petrol (gasoline) inboard and outboard engines and are not warranted for any other type of application. These sensors and instruments must NOT be used with petrol EFI engines with a return line to the tank or with diesel engines.

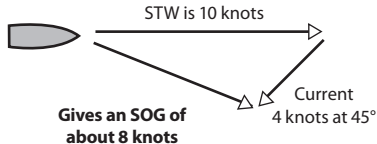
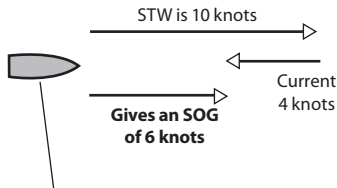
Navman diesel flow sensors and DIESEL 3200 instruments have been specifically developed for use in marine applications with diesel engines and are not warranted for any other type of application. These sensors and instruments must NOT be used with petrol (gasoline) engines. The diesel sensors can be used in 12 or 24 V systems. Some display units such as the DIESEL 3200 require 12 V DC. Before connecting any power greater than 12 V DC to the display unit, check that the unit can tolerate the intended voltage.

Appendix C - Speed through water and over ground

Different instruments measure different boat speeds. A paddlewheel sensor measures boat Speed Through the Water (STW). A GPS measures boat Speed Over the Ground, ie over the bottom of the water (SOG). If there is a current, these speeds will be different, as

explained below. Therefore, the readings for speed, log, trip log, economy and range will depend on whether the speed input is STW or SOG and if the current is constant.

When the current is from ahead, speed over ground is less than speed through water

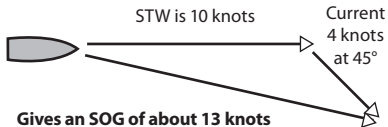
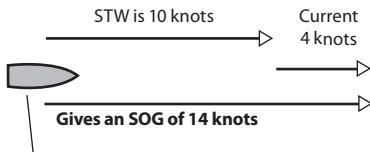


For this example:

If the boat travels for one hour, uses 3 gallons of fuel and has 50 gallons of fuel left:

	Speed	Log	Economy	Range
Using STW:	10 knots	10 nm	3.3 nm / gal	165 nm
Using SOG:	6 knots	6 nm	2.0 nm / gal	100 nm

When the current is from behind, speed over ground is more than speed through water



For this example:

If the boat travels for one hour, uses 3 gallons of fuel and has 50 gallons of fuel left:

	Speed	Log	Economy	Range
Using STW:	10 knots	10 nm	3.3 nm / gal	165 nm
Using SOG:	14 knots	14 nm	4.7 nm / gal	235 nm

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Lat 36° 48.404'S



FUEL 3100 and DIESEL 3200

NAVMAN

FC CE