

# **ST60+ Speed Instrument**

## Owner's Handbook

Document reference: 81261-1  
Date: December 2005



---

# Preface

## Important information

### Safety notices



**WARNING: Product installation & operation**

**This equipment must be installed and operated in accordance with the Raymarine instructions provided. Failure to do so could result in personal injury, damage to your boat and/or poor product performance.**



**WARNING: Electrical safety**

**Make sure you have switched off the power supply before you start installing this product.**



**WARNING: Navigational safety**

**Although we have designed this product to be accurate and reliable, many factors can affect its performance. Therefore, it should serve only as an aid to navigation and should never replace commonsense and navigational judgement. Always maintain a permanent watch so you can respond to situations as they develop.**

### EMC conformance

All Raymarine equipment and accessories are designed to the best industry standards for use in the recreational marine environment.

The design and manufacture of Raymarine equipment and accessories conform to the appropriate Electromagnetic Compatibility (EMC) standards, but correct installation is required to ensure that performance is not compromised.

### Handbook information

To the best of our knowledge, the information in this handbook was correct when it went to press. However, Raymarine cannot accept liability for any inaccuracies or omissions it may contain.

In addition, our policy of continuous product improvement may change specifications without notice. Therefore, Raymarine cannot accept liability for any differences between the product and the handbook.

## Product disposal



### **Waste Electrical and Electronic (WEEE) Directive**

The WEEE Directive requires the recycling of waste electrical and electronic equipment.

Whilst the WEEE Directive does not apply to some of Raymarine's products, we support its policy and ask you to be aware of how to dispose of this product.

The crossed out wheellie bin symbol, illustrated above, and found on our products signifies that this product should not be disposed of in general waste or landfill.

Please contact your local dealer, national distributor or Raymarine Technical Services for information on product disposal.

# Contents

<b>Preface</b> .....	i
Important information .....	i
Safety notices .....	i
<b>WARNING: Product installation &amp; operation</b> .....	i
<b>WARNING: Electrical safety</b> .....	i
<b>WARNING: Navigational safety</b> .....	i
EMC conformance .....	i
Handbook information .....	i
Product disposal .....	ii
Contents .....	iii
Introduction .....	vii
Data inputs .....	vii
SeaTalk .....	vii
Stand alone operation .....	viii
Remote control .....	viii
Mounting options .....	viii
Parts supplied .....	ix
<b>Chapter 1: Operation</b> .....	1
1.1 Getting started .....	1
Displayed information .....	1
<b>WARNING: Calibration requirement</b> .....	1
Switching on and off .....	1
1.2 Normal operation .....	1
Speed information .....	2
Boat speed .....	2
Maximum speed .....	2
Average speed .....	3
Velocity made good (to windward).....	3
Speed over ground.....	3
Log, trip & water temperature .....	3
Boat log .....	3
Trip.....	4
Water temperature.....	4
Timers.....	4
Race-start timers.....	5
1.3 Display settings .....	6
Illumination .....	6
Contrast.....	6

1.4 Pop-up Pilot .....	6
1.5 Remote control .....	6
<b>Chapter 2: Maintenance &amp; Troubleshooting</b> .....	<b>7</b>
2.1 Maintenance .....	7
Servicing and safety .....	7
Instrument .....	7
Transducer.....	7
Cabling.....	8
2.2 Troubleshooting .....	8
Preliminary procedures .....	8
Fixing faults.....	8
<b>CAUTION: Prevention of flooding</b> .....	<b>8</b>
Technical support .....	9
World wide web .....	9
Telephone help line.....	9
Help us to help you .....	9
<b>Chapter 3: Installation</b> .....	<b>11</b>
3.1 Planning your installation .....	11
Site requirements.....	11
Transducer .....	11
Instrument.....	13
<b>CAUTION: Keep the rear of the instrument dry</b> .....	<b>13</b>
EMC installation guidelines.....	14
Suppression ferrites.....	14
Connections to other equipment.....	15
3.2 Procedures .....	15
<b>CAUTION: Maintain structural safety</b> .....	<b>15</b>
Unpacking.....	15
Fitting the instrument.....	15
Surface mounting.....	16
Flush mounting .....	17
<b>CAUTION: Use the correct screws</b> .....	<b>17</b>
Bracket mounting.....	19
Fitting transducer .....	20
Running transducer cable.....	20
Connecting the instrument .....	21
Types of connection .....	21
Signal connections .....	21
Power supply connections.....	22

---

<b>CAUTION: Protect the power supply</b> .....	22
3.3 Switching on .....	23
<b>WARNING: Calibration requirement</b> .....	23
EMC conformance .....	23
<b>Chapter 4: Calibration</b> .....	25
4.1 Introduction .....	25
4.2 User calibration .....	25
Set speed units.....	25
Set resolution.....	26
Set log units .....	26
Setting the correct speed .....	26
Set temperature units.....	28
Temperature calibration.....	28
Timer buzzer .....	28
Pop-up pilot .....	28
Leaving User calibration.....	28
4.3 Intermediate calibration .....	28
Speed calibration.....	29
Leaving Intermediate calibration .....	32
4.4 Dealer calibration .....	32
User calibration on/off .....	32
Response settings.....	33
Boat show mode.....	34
<b>CAUTION: Do NOT enable Boat Show Mode</b> .....	34
Factory defaults .....	34
Leaving Dealer calibration .....	34
<b>Glossary</b> .....	35
<b>Index</b> .....	37

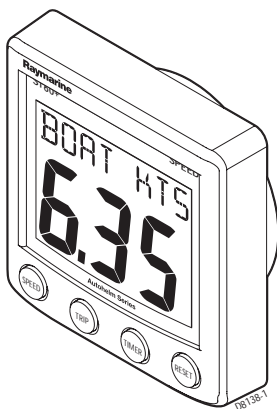




## Introduction

Thank you for purchasing a Raymarine product. We are sure your ST60+ instrument will give you many years of trouble-free operation.

This handbook describes how to install and use the Raymarine ST60+ Speed instrument. This instrument provides accurate speed, log, trip and timer information, on a high quality Liquid Crystal Display (LCD). The instrument is constructed in a rugged weather-proofed case to provide reliable performance, even under the most demanding conditions.



## Data inputs

The ST60+ Speed instrument receives data either from an appropriate speed transducer and/or from a SeaTalk instrumentation system.

## SeaTalk

SeaTalk enables a number of compatible instruments to operate as a single, integrated navigational system. Instruments in a SeaTalk system are linked by means of a single cable, which feeds both power and data. Instruments can therefore be added to the system by plugging them into the network. SeaTalk is flexible enough to adapt to any number of compatible instruments without requiring a central processor. SeaTalk can also communicate via an interface, with non-SeaTalk equipment using the internationally-accepted National Marine Electronics Association (NMEA) protocol.

In a SeaTalk system, each instrument can be either a master or dedicated repeater unit. A master instrument is directly connected to a transducer (the device that provides the raw data), and provides data and control appropriate to its function,

to all other equipment on the SeaTalk network. A repeater instrument is not directly connected to a transducer but displays information provided by other equipment in the SeaTalk network.

The ST60+ Speed instrument can fulfil both master and repeater roles.

## **Stand alone operation**

In Stand alone operation, the ST60+ Speed instrument is connected only to the relevant transducer and does not display information from, or provide information to, any other instruments.

## **Remote control**

When connected to SeaTalk, the ST60+ Speed instrument can be controlled remotely by a SeaTalk Remote Keypad Unit, to provide instant remote access to the various display readouts.

## **Mounting options**

A standard ST60+ instrument is surface-mounted at the required location. If you do not want to surface mount your ST60+ instrument, options are available for:

- Flush mounting. If you have ordered the flush mounting option a flush mount bezel and four fixing screws are provided.
- Bracket mounting.

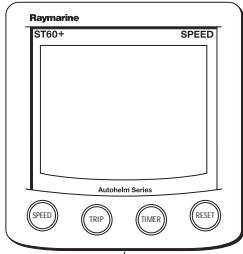
## Parts supplied

Unpack your ST60+ instrument and check that the following items are present:

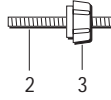
- Item 1, ST60+ Speed instrument fitted with standard bezel for surface mounting.
- Item 2, Fixing studs (2).
- Item 3, Thumb nuts (2).
- Item 4, Gasket.
- Item 5, Speed transducer, plus bung (not illustrated).
- Item 6, SeaTalk interconnection cable.
- Item 7, Power cable.
- Item 8, Instrument Cover.
- Item 9, Owner's Handbook. A Warranty document and fitting templates are included in this Handbook.
- Item 10, Quick Start Guide.

Spare spade terminals are also provided, to re-terminate the transducer cable if it has to be cut to facilitate installation.

**Note:** *The above packing list is for an ST60+ Speed system. Where an instrument is purchased separately, a transducer is not included.*

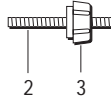


1



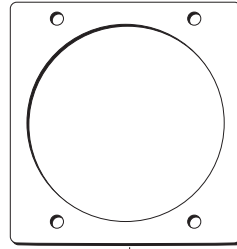
2

3



2

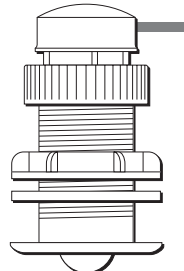
3



4



8



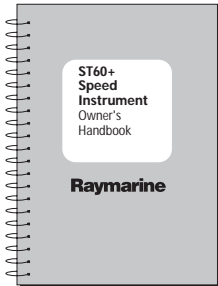
5



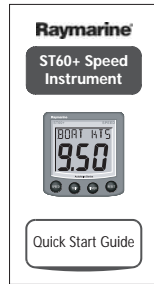
6



7



9



10

---

# Chapter 1: Operation

## 1.1 Getting started

### Displayed information

Your ST60+ Speed instrument provides the following:

- Speed information.
- Log, trip and water temperature information.
- Count-up and race-start timers.



#### **WARNING: Calibration requirement**

**To ensure this product performs at its best on your boat, you MUST calibrate it before use, in accordance with the instructions in Chapter 4, Calibration. Do NOT use the product until you have successfully calibrated it.**

### Switching on and off

All the time that power is applied to the instrument, you can use the **speed** button to switch the instrument off and on as follows:

- To switch the instrument off, hold down the **speed** button for approximately 5 seconds. After this time, a switch off count down of 4 seconds occurs. Keep the **speed** button pressed during this period, to switch off the instrument.
- To switch the instrument back on, hold down the **speed** button for approximately 1 second.

When the power supply is switched off, none of the instrument buttons (including **speed**) has any effect.

**Notes:** (1) *Each time power to the instrument is switched on, the instrument is initially in the on condition. You do not need to use the **speed** button to switch the instrument on.*

(2) *When the instrument is on, the operation of the **speed** button will perform other operating functions, as described below.*

## 1.2 Normal operation

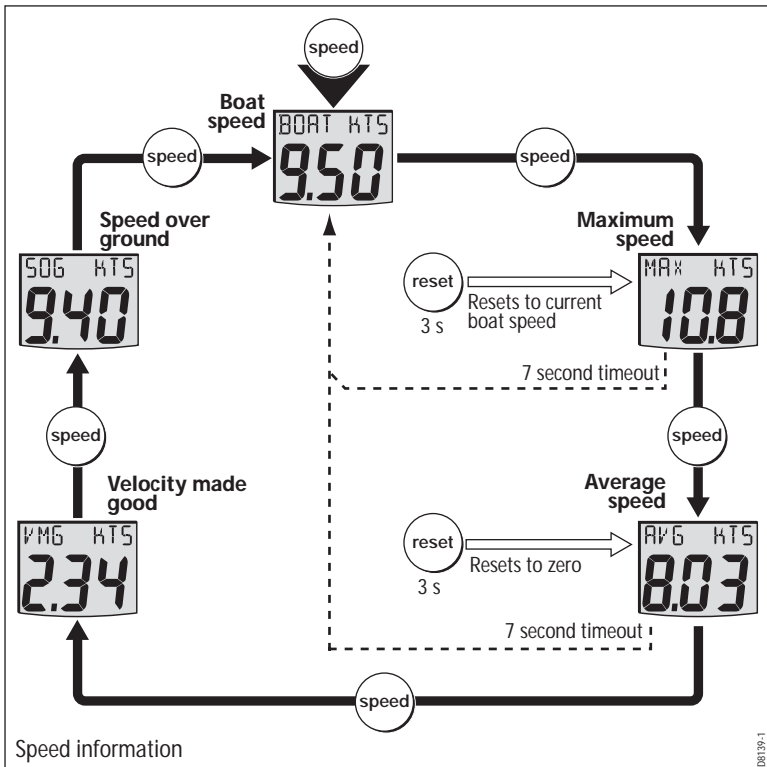
Use the flow charts in this Chapter to operate your ST60+ Speed instrument. The flow charts show the sequence of button presses and displays for the various operating tasks. All button presses are momentary unless otherwise stated.

## Speed information

When power is switched on, the **speed** button gives you access to current speed, maximum speed, average speed, velocity made good (VMG) and speed over ground (SOG) information. Refer to the *Speed information* flow diagram to access the information you want.

### Boat speed

The boat speed reading shows the current speed of the boat through the water. Speed measurement units are either knots (KTS), miles per hour (MPH) or kilometers per hour (KMH). You can select the units you want during user calibration (see *Chapter 4, Calibration*).



### Maximum speed

The maximum speed reading is reset at power up. You can also reset it manually, by pressing the **reset** button for 3 seconds. The display shows the maximum

recorded speed since the last reset. This screen times-out to current speed if no user action occurs for 7 seconds.

## Average speed

The average speed reading is reset at power up. You can also reset it manually by pressing the **reset** button for 3 seconds. The display shows the average speed calculated since the last reset. This screen times-out to current speed if no user action occurs for 7 seconds.

## Velocity made good (to windward)

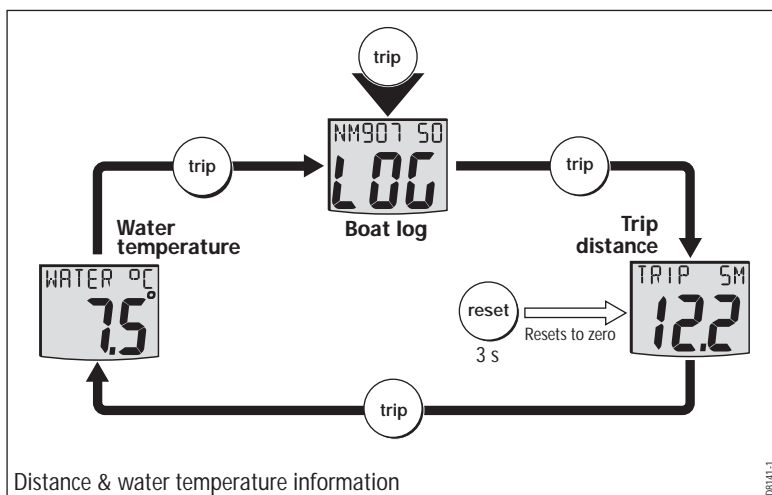
Velocity made good (VMG) information is available if your ST60+ Speed instrument is part of a SeaTalk system to which a SeaTalk-compatible wind instrument is also connected.

## Speed over ground

Speed over ground (SOG) information is available if your ST60+ Speed instrument is part of a SeaTalk system to which a suitable GPS is also connected.

## Log, trip & water temperature

The **trip** button gives you access to log, trip and water temperature information, as shown in the *Distance & water temperature* flow diagram.



## Boat log

The boat log screen shows the total distance covered by the vessel since the ST60+ Speed instrument was fitted.

## Trip

The trip distance is the distance covered since the last reset. It is reset to zero at power up, and if you press the **reset** button for 3 seconds.

**Note:** *The trip distance can be reset only if the instrument is a master, i.e. connected to a speed transducer.*

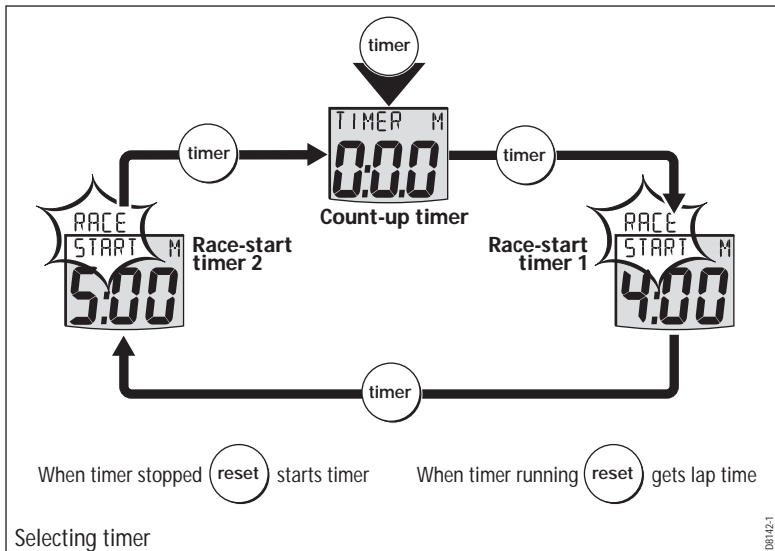
## Water temperature

The water temperature is shown in either degrees Celsius or Fahrenheit. You can set the units you want during User calibration (see *Chapter 4, Calibration*).

## Timers

The **timer** button gives access to a count-up timer and to two race-start timers. Times are either in seconds (S) or minutes (M), depending on the counter values.

Refer to the *Selecting timer* flow diagram to display the required timer.



Once you have selected the required timer display, press the **reset** button to start the timer running. When a timer is running, the delimiter ( . or : ) flashes. For lap timing, press the **reset** button. To stop and reset a timer to the start value, hold down the **reset** button for 1 second.

Once a timer is running, you can leave the timer screen and select any other display. The timer will continue to run in the background.



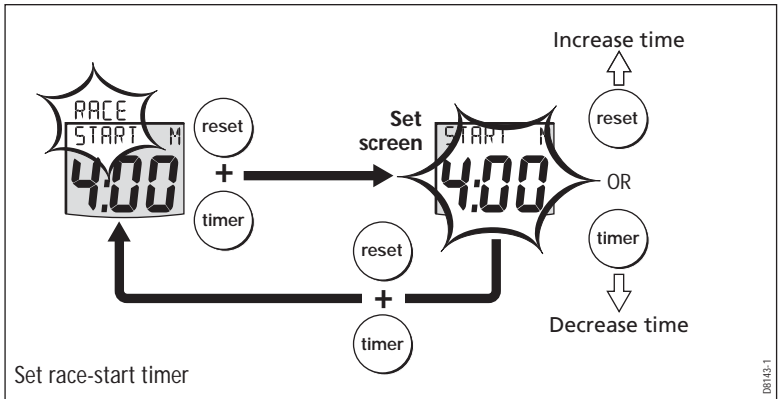
### Race-start timers

You can set each race-start timer to any whole-minute value from 1 to 15 minutes.

**Note:** *When the instrument is first installed, the race-start timers are set to 4 and 5 minutes respectively.*

To set a race-start timer:

1. Use the **timer** button as shown in the *Selecting timer* flow diagram, to select the required race-start timer.
2. Simultaneously press the **timer** and **reset** buttons to enter the race-start timer set mode.
3. Use either the **timer** or **reset** button to set the required value.
4. Simultaneously press the **timer** and **reset** buttons to save the value and leave the race-start timer adjust mode.



### Timer buzzer

The timer buzzer is enabled or disabled during User calibration procedure (see *Chapter 4, Calibration*). If the timer buzzer is enabled and you are using one of the race-start timers, the buzzer will:

- Double-beep every minute.
- Beep three times at the start of the last 30 seconds.
- Beep once for each of the last 10 seconds.
- Beep for 2 seconds at zero.

**Note:** *After a race-start timer has counted-down to zero, it will then start counting up.*

## 1.3 Display settings

### Illumination

When the instrument is first powered up, the display illumination is set to its lowest level, to facilitate initial access to the buttons. To adjust the illumination level:

1. Hold down the **speed** button for approximately one second, to enter the illumination-adjust mode.
2. There are four preset illumination levels. Press the **speed** button to cycle through these levels until you reach the level you want.
3. Press any other button to leave the illumination-adjust mode.

**Note:** *The display will time out to normal operation 7 seconds after the last button press.*

### Contrast

To adjust the display contrast:

1. Hold down the **speed** button for approximately two seconds, to enter the contrast-adjust mode.
  - i. There are four preset contrast settings. Press the **speed** button to cycle through these settings until you achieve optimum display quality.
  - i. Press any other button to leave the contrast-adjust mode.

**Note:** *The display will time out to normal operation 7 seconds after the last button press.*

## 1.4 Pop-up Pilot

A Pop-up Pilot facility enables instruments connected to SeaTalk to constantly monitor any changes to the autopilot mode and to the course settings. If one of these parameters changes, the new value is immediately displayed on the ST60+ instrument for 5 seconds, after which time the display reverts to the previous display.

This facility can be enabled or disabled during User calibration (see *Chapter 4, Calibration*).

## 1.5 Remote control

When connected to SeaTalk, the ST60+ Speed instrument can be controlled remotely with a SeaTalk Remote Keypad Unit. Remote control of an instrument is indicated by a **REMOTE** legend on the display, to indicate that the keypad has control.

Details on how to use the remote control facility are given in the *SeaTalk Remote Keypad Owner's Handbook*.

---

# Chapter 2: Maintenance & Troubleshooting

## 2.1 Maintenance

### Servicing and safety

- Raymarine equipment should be serviced only by authorised Raymarine service technicians. They will ensure that servicing procedures and replacement parts used will not affect performance. There are no user-serviceable parts in any Raymarine product.
- Some products generate high voltages, and so never handle the cables/connectors when power is being applied to the equipment.
- When powered up, all electrical equipment produces electromagnetic fields. These can cause adjacent pieces of electrical equipment to interact with one another, with a consequent adverse effect on operation. In order to minimise these effects and enable you to get the best possible performance from your Raymarine equipment, guidelines are given in the installation instructions, to enable you to ensure minimum interaction between different items of equipment, i.e. ensure optimum Electromagnetic Compatibility (EMC).
- Always report any EMC-related problem to your nearest Raymarine dealer. We use such information to improve our quality standards.
- In some installations, it may not be possible to prevent the equipment from being affected by external influences. In general this will not damage the equipment but it can lead to spurious resetting action, or momentarily may result in faulty operation.

### Instrument

Certain atmospheric conditions may cause condensation to form on the instrument window. This will not harm the instrument and can be cleared by increasing the illumination setting to Level 3.

Periodically clean your ST60+ instrument with a soft damp cloth. Do NOT use chemical and abrasive materials to clean the instrument.

### Transducer

Refer to the Installation & Maintenance instructions supplied with the transducer.

## Cabling

Examine all cables for chafing or other damage to the outer shield, and where necessary, replace and re-secure.

## 2.2 Troubleshooting

### Preliminary procedures

Changes in the electronic environment may adversely affect the operation of your ST60+ equipment. Typical examples of such changes are:

- Electrical equipment has recently been installed or moved aboard your vessel.
- You are in the vicinity of another vessel or shore station emitting radio signals.

If you appear to have a problem, first ensure that the EMC requirements are still being met before further investigating the problem.

### Fixing faults

#### **CAUTION: Prevention of flooding**

**If you need to remove the transducer insert, have the transducer bung to hand and secure it in the transducer body immediately after the insert has been removed, to prevent excessive ingress of water.**

All Raymarine products are subjected to comprehensive test and quality assurance programmes prior to packing and shipping. However, if a fault occurs, the following table may help to identify and rectify the problem.

<b>Fault</b>	<b>Cause</b>	<b>Remedy</b>
Display blank.	No power supply.	Check power supply & ensure the instrument is switched on (see <i>Chapter 1, Operation</i> ). Check SeaTalk cabling and connector security. Check fuse/circuit breaker.
No transfer of information between SeaTalk instruments (e.g. illumination levels).	SeaTalk cable or connector fault.	Check security of SeaTalk connectors. Check condition of SeaTalk cables. Isolate faulty instrument by disconnecting instruments one by one.
Failure of a group of SeaTalk instruments.	SeaTalk cable or connector fault.	Check the security of SeaTalk connectors between functioning and non-functioning instruments.

---

<b>Fault</b>	<b>Cause</b>	<b>Remedy</b>
No speed or temperature information.	Transducer cable or connector fault.	Check the condition of the transducer cable and the security of the connections.
No speed information, but temperature available.	Transducer paddle wheel fouled.	Clean paddle wheel. See CAUTION above.

---

## Technical support

Raymarine provides a comprehensive customer support service, on the world wide web and by telephone help line. Please use either of these facilities if you are unable to rectify a problem.

### World wide web

Please visit the Customer Support area of our web site at:

[www.raymarine.com](http://www.raymarine.com)

As well as providing a comprehensive Frequently Asked Questions section and servicing information, the web site gives e-mail access to the Raymarine Technical Support Department and a details of the locations of Raymarine agents, worldwide.

### Telephone help line

If you do not have access to the world wide web, please call our help line.

**In the USA**, call:

- +1 800 539 5539, extension 2444 or
- +1 603 881 5200 extension 2444

**In the UK, Europe the Middle East or the Far East**, call:

- +44 (0) 23 9271 4713 (voice)
- +44 (0) 23 9266 1228 (fax)

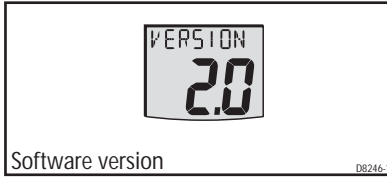
### Help us to help you

When requesting service, please quote the following product information:

- Equipment type.
- Model number.
- Serial number.
- Software issue number.

To find out the software version number of your ST60+ Speed instrument:

1. During normal operation, hold down the **speed** and **trip** buttons for approximately 4 seconds, to display the **VERSION** screen.



2. Note the software version number, then hold down the **speed** and **trip** buttons for approximately 2 seconds, to return to normal operation.

## Chapter 3: Installation

This chapter describes how to install the ST60+ Speed instrument, and associated speed transducer. The transducer is fitted in the hull of the vessel and signals from it are connected by cable, to the rear of the instrument. The actual type of transducer depends on the type of hull in which it is to be installed.

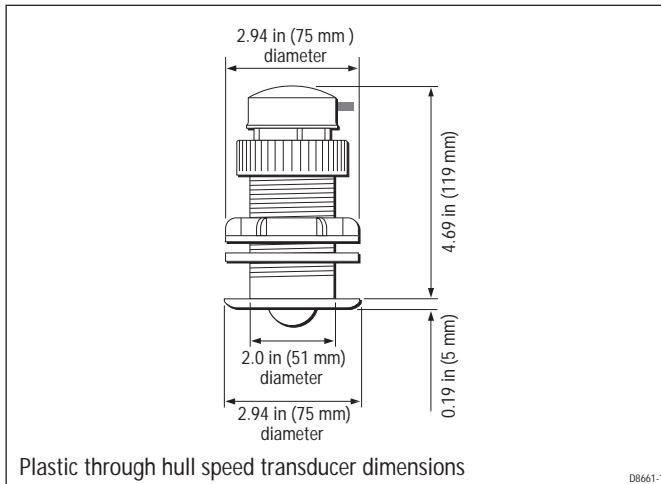
For advice, or further information regarding the installation of this equipment, please contact the Raymarine Product Support Department or your own National Distributor.

### 3.1 Planning your installation

Before starting the installation, spend some time considering the best positions for both transducer and instrument, such that the *Site requirements* and the *EMC installation guidelines* (below) are satisfied.

#### Site requirements

##### Transducer

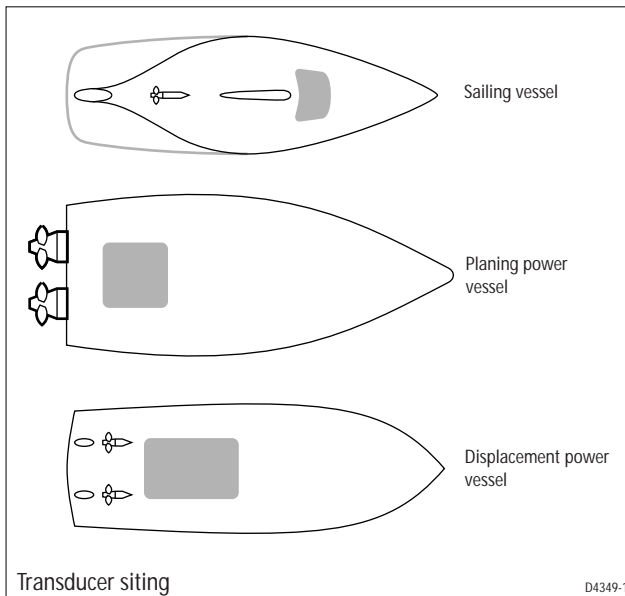


The transducer types required for the various hull types are as follows:

Hull material	Transducer type
Glass reinforced plastic (GRP)	E26031 Through hull plastic
Steel	E26031 Through hull plastic
Aluminium	E26031 Through hull plastic
Wood	M78716 Through hull bronze

Other transducer types are also available for specific requirements. For further details, contact your local Raymarine dealer.

For accurate speed readings the transducer should be sited within the clear water flow areas indicated by the shaded areas in the following diagram.



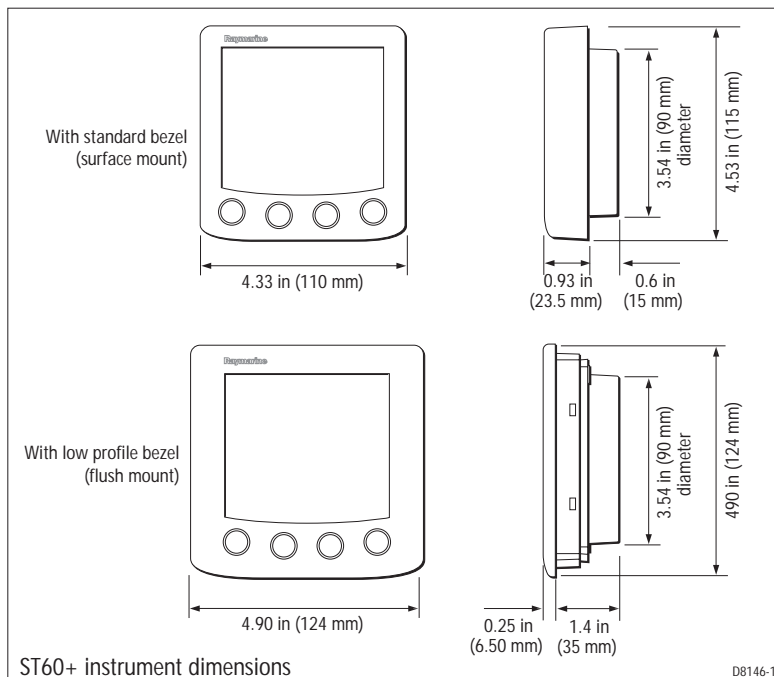
The transducer should also:

- Be ahead of the propellers (by a minimum of 10% of the water line length).
- Be at least 6 in (150 mm) away from the keel (ideally ahead of the keel if a sailing yacht).
- Be as near as possible to the center line of the vessel.
- Be clear of other through-hull fittings or projections.
- Have sufficient clearance inside the hull to fit the nut.
- Have 4 in (100 mm) of headroom to allow for withdrawal.



There must also be a viable route for the transducer cable to be routed to the instrument.

## Instrument



### **CAUTION: Keep the rear of the instrument dry**

**Keep the rear of instrument dry. Failure to observe this caution could result in damage if water enters the instrument through the breathing hole or comes into contact with the electrical connectors.**

ST60+ instruments can be fitted either above or below deck, provided the rear of the instrument is sited where it is protected from contact with water.

Each instrument must also be positioned where:

- It is easily read by the helmsman.
- It is protected against physical damage.
- It is at least 9 in (230 mm) from a compass.
- It is at least 20 in (500 mm) from radio receiving equipment.
- There is reasonable rear access for installation and servicing.

## EMC installation guidelines

All Raymarine equipment and accessories are designed to the best industry standards for use in the recreational marine environment.

Their design and manufacture conforms to the appropriate Electromagnetic Compatibility (EMC) standards, but correct installation is required to ensure that performance is not compromised. Although every effort has been taken to ensure that they will perform under all conditions, it is important to understand what factors could affect the operation of the product.

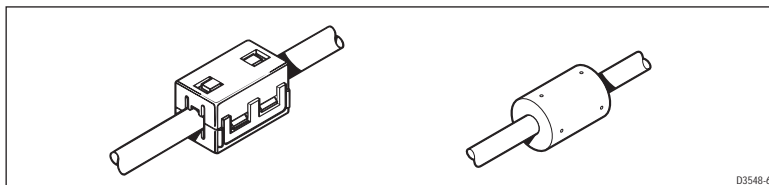
The guidelines given here describe the conditions for optimum EMC performance, but it is recognized that it may not be possible to meet all of these conditions in all situations. To ensure the best possible conditions for EMC performance within the constraints imposed by any location, always ensure the maximum separation possible between different items of electrical equipment.

For **optimum** EMC performance, it is recommended that **wherever possible**:

- Raymarine equipment and cables connected to it are:
  - At least 3 ft (1 m) from any equipment transmitting or cables carrying radio signals e.g. VHF radios, cables and antennas. In the case of SSB radios, the distance should be increased to 7 ft (2 m).
  - More than 7 ft (2 m) from the path of a radar beam. A radar beam can normally be assumed to spread 20 degrees above and below the radiating element.
- The equipment is supplied from a separate battery from that used for engine start. Voltage drops below 10 V in the power supply to our products, and starter motor transients, can cause the equipment to reset. This will not damage the equipment, but may cause the loss of some information and may change the operating mode.
- Raymarine specified cables are used. Cutting and rejoining these cables can compromise EMC performance and must be avoided unless doing so is detailed in the installation manual.
- If a suppression ferrite is attached to a cable, this ferrite should not be removed. If the ferrite needs to be removed during installation it must be reassembled in the same position.

## Suppression ferrites

The following illustration shows typical cable suppression ferrites used with Raymarine equipment. Always use the ferrites supplied by Raymarine.



## Connections to other equipment

If your Raymarine equipment is to be connected to other equipment using a cable not supplied by Raymarine, a suppression ferrite **MUST** always be attached to the cable near the Raymarine unit.

## 3.2 Procedures

As it is not practical to describe procedures for all possible installation scenarios, the procedures given here describe the broad requirements for installing Speed transducers and the ST60+ Speed instrument. Adapt these procedures as appropriate, to suit your individual requirement.

### **CAUTION: Maintain structural safety**

**Where it is necessary to cut holes (e.g. for cable routing and instrument mounting), ensure that these will not cause a hazard by weakening critical parts of the vessel's structure.**

## Unpacking

Unpack your ST60+ equipment and check that the items described in the *Preface* are present.

Each ST60+ instrument is supplied with a standard bezel for surface mounting. Optional mounting kits are available for flush mounting and bracket mounting the instrument. If you have ordered the flush mounting option a flush mount bezel and four fixing screws are also provided.

## Fitting the instrument

The ST60+ Speed instrument can be installed using one of a number of different mounting options:

- Surface mounting. Gives a profile of approximately 0.95 in (24 mm).
- Flush mounting. Gives a profile of approximately 0.25 in (6 mm).
- Bracket mounting.

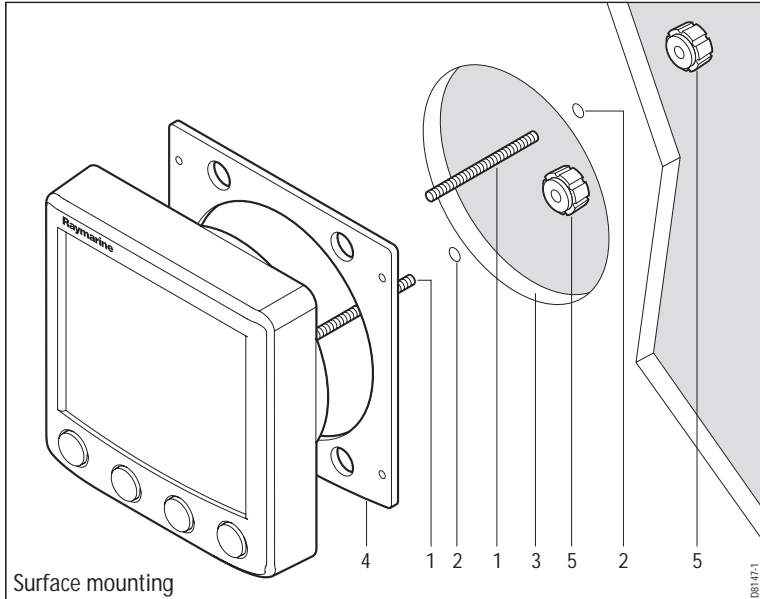
The ST60+ instruments can also be mounted behind a panel with just the instrument dial and buttons visible.

## Surface mounting

To surface mount your ST60+ instrument (see the *Surface mounting* illustration):

1. Ensure that:

- The selected location is clean, smooth and flat.
- There is sufficient space behind the selected location to accommodate the rear of the instrument and connectors.



2. Apply the surface mount template (supplied at the rear of this handbook) to the selected location and mark the centers for the fixing studs (1) and the aperture (3) that will take the rear casing of the instrument.
3. Drill out the two 0.2 in (5 mm) fixing stud clearance holes (2).
4. Cut out the clearance hole (3) then remove the template.
5. Peel off the protective sheet from the self-adhesive gasket (4) then stick the gasket into position on the rear of the instrument.
6. Screw the two fixing studs into the threaded sockets on the rear of the instrument.
7. Mount the assembled instrument, studs, bezel and gasket into the panel. Secure from behind with the thumb nuts (5).

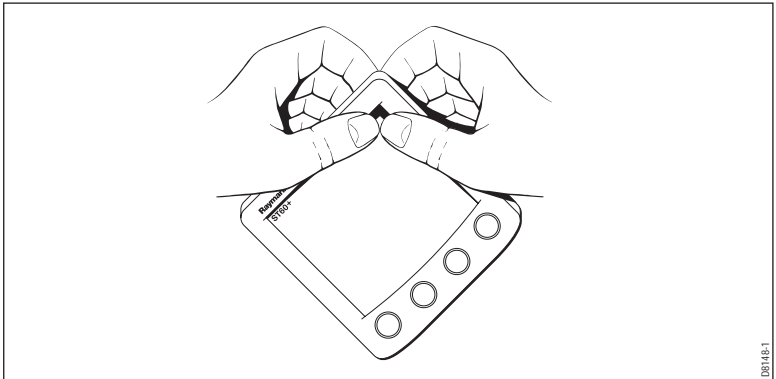
## Flush mounting

The Flush Mounting Kit uses a flush mount bezel to reduce the fitted profile of the instrument, to approximately 0.25 in (6 mm) above the panel fascia.

### Fitting the flush mount bezel

In order to flush-mount your ST60+ instrument, you must first replace the standard bezel with the flush mount bezel as follows:

1. Hold the instrument in both hands with the display towards you.



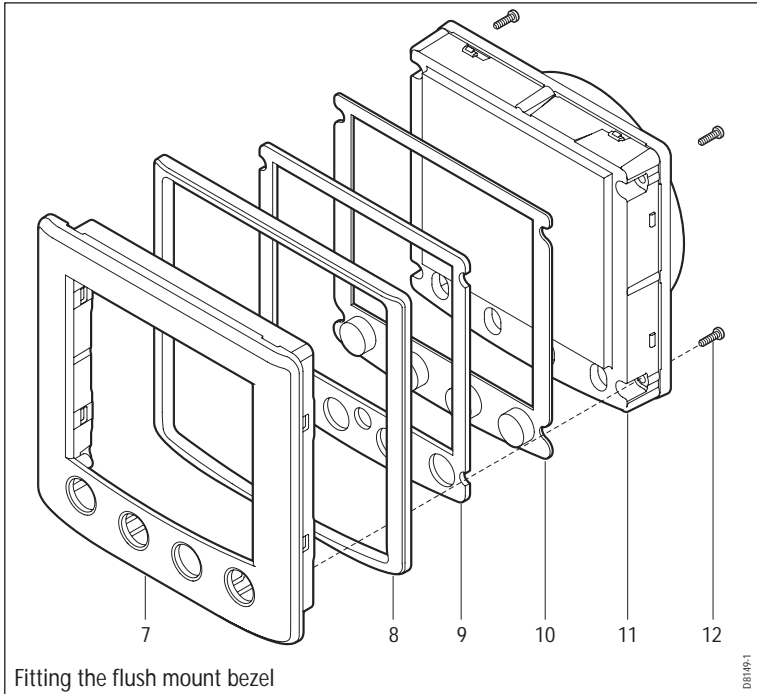
2. Using both thumbs, gently press an upper corner of the instrument from the bezel, then remove the bezel from the instrument. Retain the rubber keypad which is released when the bezel is removed.
3. Referring to the *Fitting the flush mount bezel* illustration, insert the panel seal (8) in the corresponding recess on the back of the flush mount bezel (7).
4. Place the instrument (11) face upwards on a flat surface, then place the rubber keypad (10) in position around the display window (i.e. so that each button outline is located over its associated button on the instrument).
5. Place the keypad seal (9) in position on the keypad (i.e. so that the holes in the seal accept the appropriate keypad buttons).
6. Place the assembled flush mount bezel and panel seal, in position on the instrument, so that the rubber keys are correctly located in the holes on the bezel, then clip the bezel and instrument together.

### CAUTION: Use the correct screws

**It is essential that only screws of the correct size are used to secure the instrument to the bezel. Failure to observe this caution could result in damage to both the instrument and the bezel.**

7. Using the four, self-tapping screws (12) provided, secure the instrument and

bezel together. Fit the screws from the rear of the instrument and tighten them sufficiently to secure the instrument and bezel together. **DO NOT OVERTIGHTEN.**

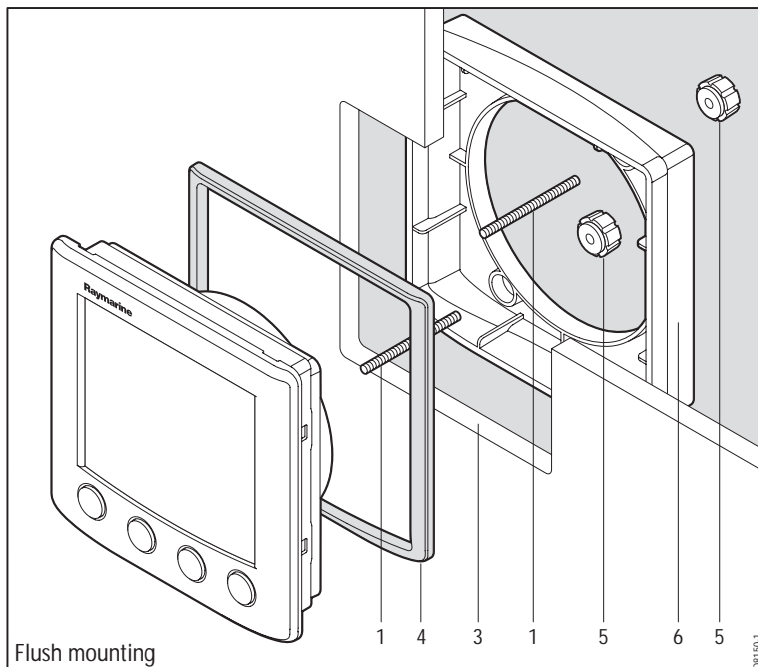


### Flush mounting procedure

Flush mount your instrument (see the *Flush mounting* illustration) as follows:

1. Assemble the ST60+ instrument and flush mount bezel as described under *Fitting the flush mount bezel*.
2. Ensure that:
  - The panel on which you intend to mount the instrument is between 0.12 in (3 mm) and 0.78 in (20 mm) thickness.
  - The selected location is clean, smooth and flat.
  - There is sufficient space behind the selected location to accommodate the rear of the instrument and connectors.
3. Apply the flush mount template (supplied at the rear of this handbook) to the selected location and mark out the aperture into which the assembled instrument and bezel will sit.

4. Cut out the aperture (3) for the assembled instrument and bezel and remove the template.
5. Peel off the protective sheet from the self-adhesive gasket (4) then stick the gasket into position on the rear of the bezel.
6. Screw the two fixing studs (1) into the threaded sockets on the rear of the instrument.
7. Mount the assembled instrument, studs, bezel and gasket into the panel.



8. Locate the flush mount bracket (6) onto the fixing studs and secure the assembly to the panel with the thumb-nuts (5).

## Bracket mounting

A Control Unit Mounting Bracket (Part No. E25009) enables you to mount your ST60+ instrument in locations where other forms of mounting are impractical. Although this provides a useful alternative method for securing your instrument, it is only suitable for use in positions where the instrument will not be exposed to water.

To bracket mount your ST60+ instrument, do so in accordance with the Control Unit Mounting Bracket Instruction Sheet.

## Fitting transducer

The ST60+ Speed instrument is supplied, with a through-hull Speed transducer.

The Speed transducer is supplied with detailed instructions for installation and maintenance. Before attempting to install the Speed transducer, read these instructions and the *Site requirements* for transducers described in this Chapter.

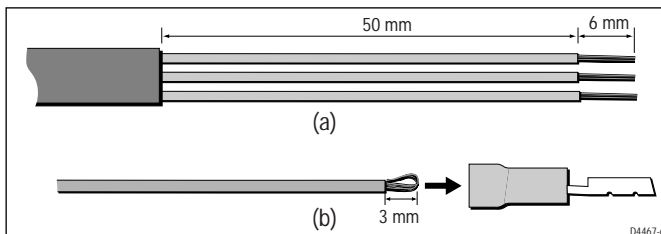
Once you are satisfied you can meet all the installation requirements, install the transducer in accordance with the accompanying installation instructions.

## Running transducer cable

Each transducer type has a 14 m (45 ft) cable fitted with spade terminals for connection to the ST60+ Speed instrument. The manner in which you run the cable will depend on the locations of the transducer and instrument.

Observing the following guidelines, run the transducer cable to the ST60+ Speed instrument:

- If the cable has to be fed through the deck, always use a proprietary deck gland.
- Where cables are fed through holes, always use grommets to prevent chafing.
- Secure long cable runs so they do not present a hazard.
- Do not route the cable through bilges.
- Wherever possible, route the cable away from fluorescent lights, engines, radio transmitting equipment, as these may cause interference.
- Although the transducer cable is fitted with spade connectors for direct connection to the rear of the instrument, it may be necessary to remove these to facilitate installation, e.g. if the cable has to be routed through narrow apertures. Extra spade connectors are provided, to replace any that are removed when running the cable. When fitting spade connectors, prepare the cable as at (a) in the following illustration, then fold back the wire strands and insert into the spade connector as at (b). Ensure the wire strands do not extend beyond the rear of the spade connector insulation, then crimp the connector to the wire.





## Connecting the instrument

### Types of connection

The ST60+ Speed instrument, can be connected:

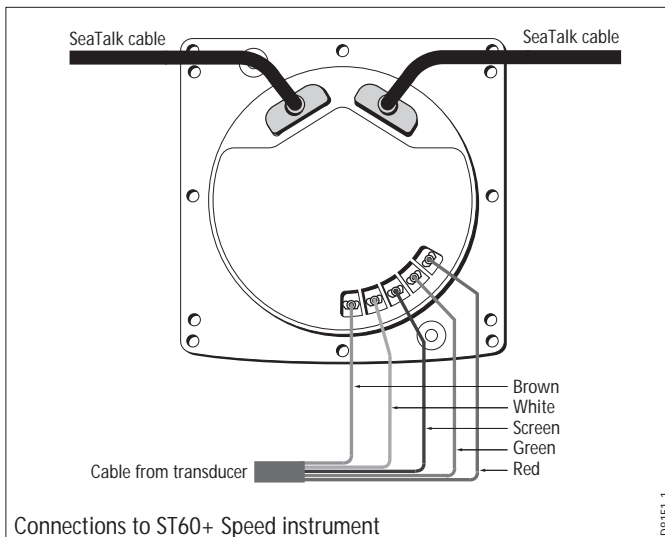
- As a stand-alone, master instrument connected directly to the Speed transducer.
- As a SeaTalk repeater.
- To fulfil both repeater and master roles by being connected both to the transducer and to SeaTalk.

If instruments are connected to SeaTalk, no separate power connection is necessary. Where a SeaTalk system includes an autopilot, the power for the system is provided by the autopilot.

A range of Raymarine SeaTalk extension cables is available to connect separated instruments. These cables are supplied with a SeaTalk connector fitted to each end. A junction box can be used to join cables.

### Signal connections

Make the necessary connections to your ST60+ instrument (see the *Connection to ST60+ Speed instrument* illustration).



## Power supply connections

### CAUTION: Protect the power supply

**Ensure that the 12 V power supply for the instrument is protected by a suitably rated fuse or protective circuit breaker.**

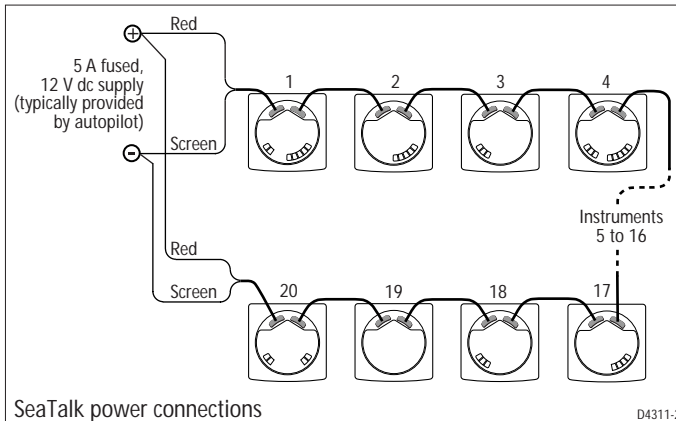
### SeaTalk systems

Ensure that the power supply for the SeaTalk bus is protected by a 5 A fuse or circuit breaker.

Systems with a large number of instruments on the SeaTalk bus may require connections to the power supply from each end of the system ('ring-main' style), to maintain sufficient voltage throughout the system.

This requirement depends on the total length of the cable run and the total number of instruments in the system, as follows:

Cable run	No. of instruments	Power connections
Up to 10 m	13 maximum	1
	26 maximum	2
Up to 20 m	7 maximum	1
	13 maximum	2

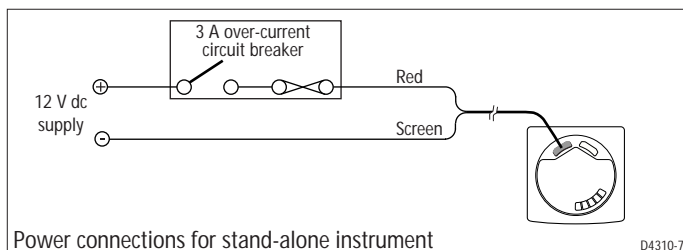


### Stand alone instruments

Stand-alone instruments are not connected to SeaTalk and therefore need to be connected to an alternative 12 V power source. Power cables are available in 2 m and 9 m lengths.

To fit a power cable:

1. Ensure the intended power source is switched off.
2. Run the power cable from the instrument to a suitable 12 V dc power source.



3. If the cable has not already been trimmed at the power supply end:
  - i. Cut the cable to length and trim back an appropriate amount of the outer sheath.
  - ii. Cut back and insulate the yellow wire.
4. Connect the screen to the power supply 0 V terminal.
5. Connect the red wire, via a 3 A fuse or protective circuit breaker, to the power supply +12 V terminal.
6. Insert the power cable connector into one of the SeaTalk connectors at the rear of the instrument.

### 3.3 Switching on

Switch on the power to your ST60+ instrument. When the power is on, you can use the **speed** button to switch the instrument on and off as described in *Chapter 1, Operation*.

Use the procedures in *Chapter 1, Operation* to set the backlighting and contrast how you want them.



#### **WARNING: Calibration requirement**

**To ensure this product performs at its best on your boat, you MUST calibrate it before use, in accordance with the instructions in *Chapter 4, Calibration*. Do NOT use the product until you have successfully calibrated it.**

### EMC conformance

Always check the installation before going to sea to make sure that it is not affected by radio transmissions, engine starting etc.



---

# Chapter 4: Calibration

## 4.1 Introduction

The ST60+ Speed instrument is set up with factory-programmed default settings, so in order to optimise the performance of the instrument on board a particular vessel, the procedures in this Chapter must be carried out immediately after the completion of installation, and before the equipment is used for navigational purposes.

Where practicable, the calibration procedures are presented diagrammatically, to show the sequence of button presses and the resulting displays. Adjustment instructions are given where applicable.

## 4.2 User calibration

The User calibration procedures enable you to:

- Set the required units for speed readings.
- Set the required Log units.
- Set the speed resolution.
- Set the speed readings on the instrument to be a true indication of the actual speed of the vessel.
- Select temperature units.
- Calibrate for correct temperature readings.
- Set timer buzzer on or off.
- Set pop-up pilot display on or off.

To carry out a User calibration:

1. Power up the ST60+ Speed instrument.
2. Hold down the **speed** and **trip** buttons for approximately 2 seconds so that the User calibration entry screen is displayed.
3. Referring to the *User calibration* diagram, carry out the calibration procedure. Use the **speed** button to move from screen to screen and the **timer** and **reset** buttons to set the required values (except Adjust to SOG display).

### Set speed units

Select either **KTS** (knots), **MPH** (miles per hour) or **KMH** (kilometers per hour), as required.

## Set resolution

Select resolution of either **0.01** or **0.1** as required.

## Set log units

Select either **NM** (nautical miles), **SM** (statute miles) or **KM** (kilometers), as required.

## Setting the correct speed

Set the displayed (current) speed using one of the following methods:

- If SOG is available from SeaTalk, use the Adjust to SOG screen to automatically set the current speed to. You must be running in slack tide conditions to successfully use this method.
- Manually apply a calibration factor by means of the Cal factor adjust screen, to set the displayed speed value to your best estimate of the vessel's speed.

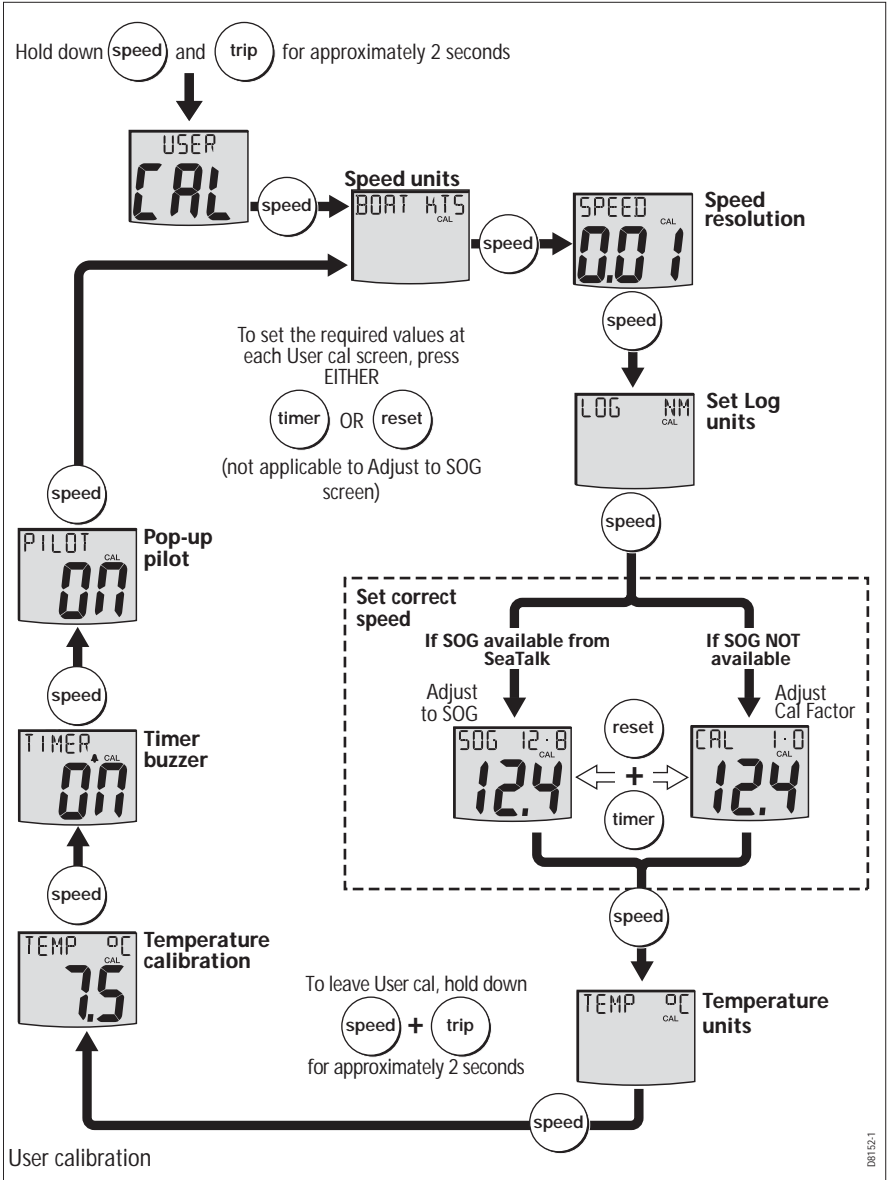
If neither of the above methods is suitable, use the *Speed calibration* procedure described under *Intermediate calibration* to carry out a speed calibration run over a measured distance. This enables the instrument to calculate the correct calibration factor.

## Adjust to SOG

The Adjust to SOG screen is displayed only if SOG data is available from SeaTalk. The current SOG is displayed in the top right of the display (12.8 in the illustration), and the current speed registered by the instrument is shown as large figures (12.4 in the illustration).

It is recommended that, if you are running in slack tide conditions, you press the **reset** button for 3 seconds, to accept the SOG as the current speed. The calibration factor is automatically re-calculated.

If you do not wish to accept SOG as the current speed, simultaneously press the **timer** and **reset** buttons to select the Cal factor adjust screen.



### Adjust cal factor

The adjust cal factor screen enables you to manually adjust the calibration factor. It shows the current calibration factor in the top right of the display, and the current speed as large figures (12.4 in the illustration).

Use the **timer** or **reset** button to adjust the calibration factor so that the current speed equals the speed through the water.

If SOG data is available from SeaTalk, you can turn to the Adjust to SOG screen by pressing the **timer** and **reset** buttons.

**Note:** *If neither of the above methods gives satisfactory results, carry out the Speed calibration procedure (part of Intermediate calibration).*

### Set temperature units

Select either °C or °F, as required.

### Temperature calibration

Set the display to show the current water temperature.

### Timer buzzer

Switches the count-up and race-start timer buzzers on and off.

### Pop-up pilot

Switches the pop-up pilot function on and off.

### Leaving User calibration

Hold down the **speed** and **trip** buttons for 2 seconds to save your settings, exit User calibration and resume normal operation.

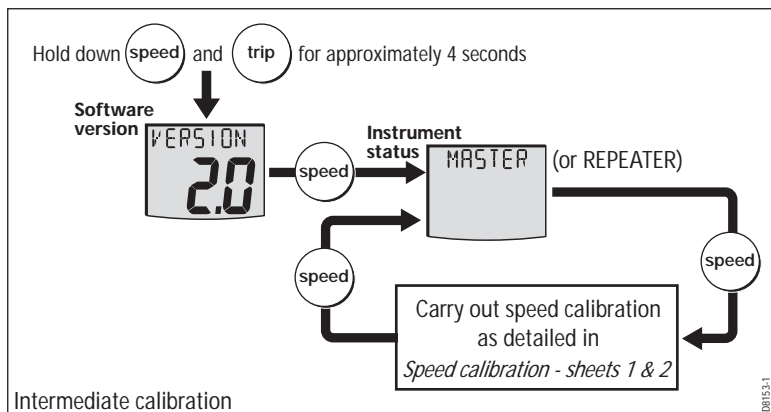
## 4.3 Intermediate calibration

Intermediate calibration enables you to:

- Check the instrument software version.
- Check the instrument status - either **MASTER** (transducer connected) or **REPEATER** (no transducer).
- Carry out a calibration run over a measured distance to ensure accurate speed readings.

To start Intermediate calibration, hold down the **speed** and **trip** buttons for approximately 4 seconds (see *Intermediate calibration* flow chart).



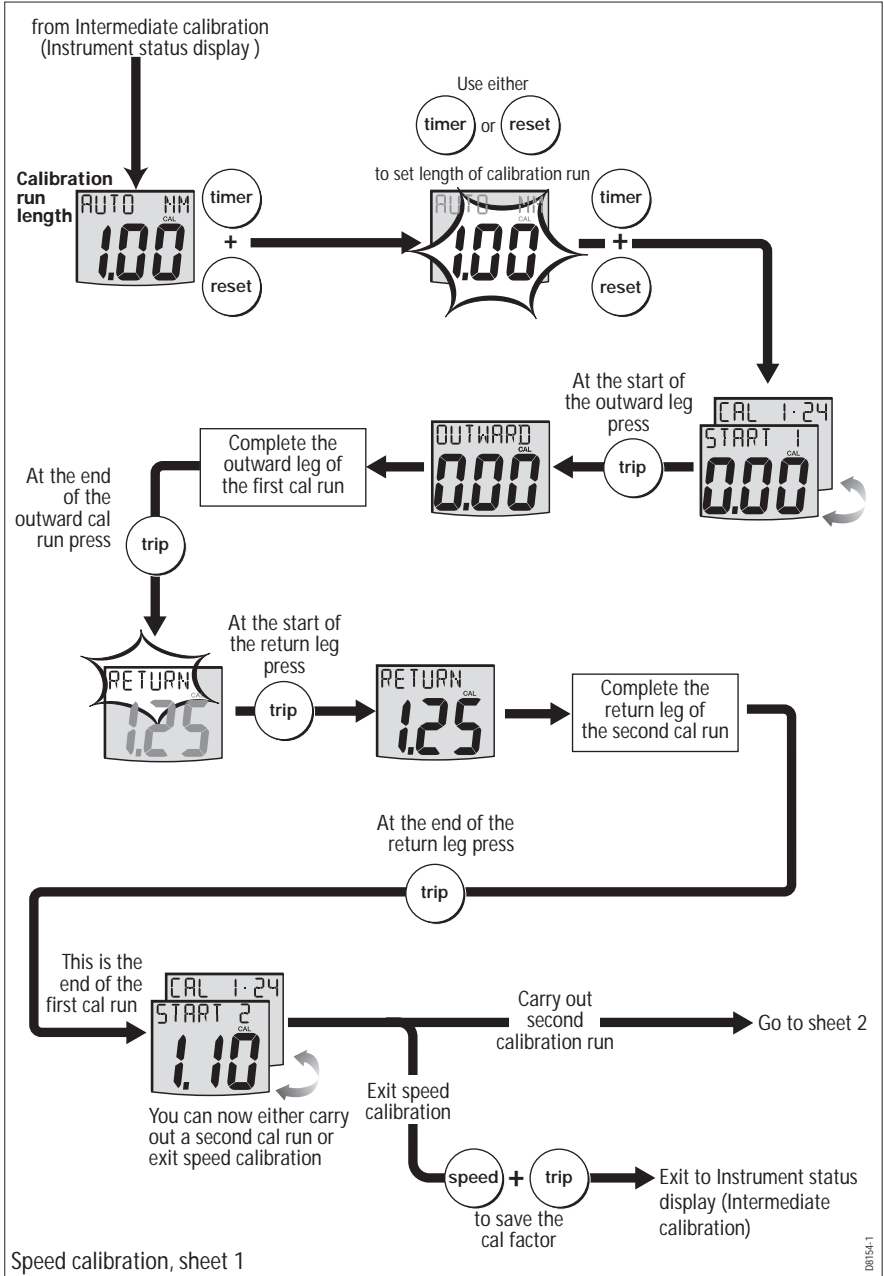


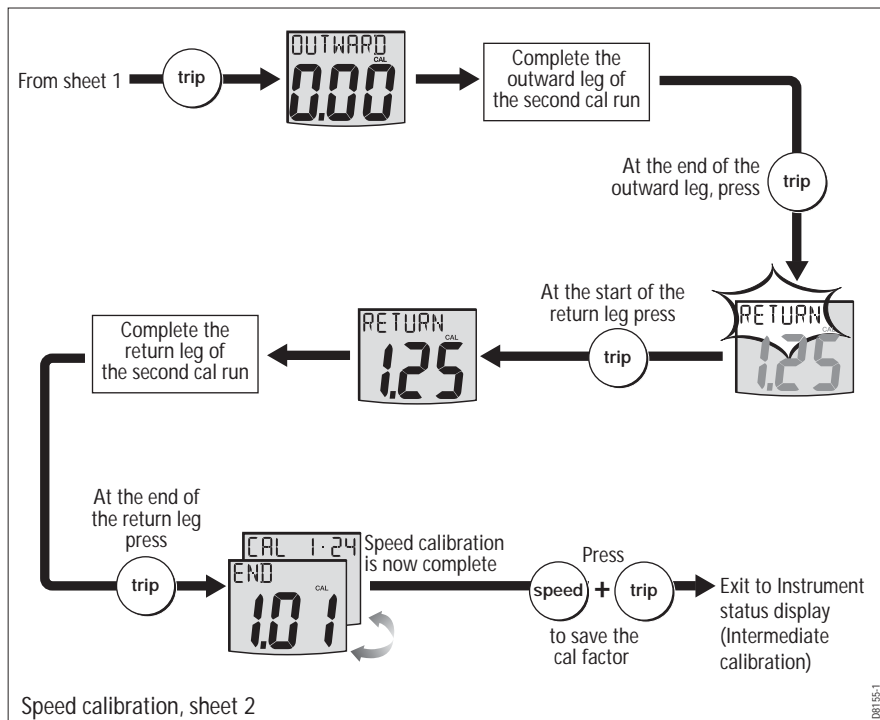
## Speed calibration

This speed calibration procedure involves carrying out two runs over a measured distance, to enable a calibration factor to be determined and applied to your ST60+ Speed instrument, to ensure optimum accuracy. Each calibration run comprises outward and return legs, to minimise the affect of tidal drift when the calibration factor is determined.

To carry out a speed calibration, start the Intermediate calibration procedure and use the **speed** button to proceed to the Calibration run length screen (see *sheet 1* of the *Speed calibration* flow chart). Proceed with the speed calibration as follows:

1. With the Calibration Run Length screen displayed, press the **timer** and **reset** buttons together to enter adjust mode. In this mode, the displayed run length flashes on and off.
2. Set the length of the intended calibration run, using either the **timer** button to decrement or the **reset** button to increment the run length value. You can set any value between 0.25 and 2.50.
3. Press **timer** and **reset** buttons together to commence the speed calibration. The Cal status screen is displayed. The text at the top of the screen alternates between **START 1** and the calibration factor currently applied.
4. Start the outward leg of the calibration run and as you pass the start point, press the **trip** button, so the screen shows **OUTWARD** at the top. As the calibration run proceeds, the displayed value will increment.





5. At the end of the outward leg, press the **trip** button again so that:
  - The text **RETURN** is flashing at the top of the screen.
  - The displayed distance freezes. Note that this value may not be the same as the measured distance, due to errors introduced by tidal flow.
6. Turn the vessel round, start the return leg and as you do so, press the **trip** button so **RETURN** stops flashing and the displayed value increments.
7. At the end of the return leg, press the **trip** button. At this point:
  - The text **START 2** alternating with the new calibration factor is displayed at the top of the screen.
  - The displayed distance freezes. This value should be very close to the actual (measured) distance of the calibration run.
8. Carry out one of the following actions:
  - If you are satisfied with the results of the first calibration run, press the **speed** and **trip** buttons together, to store the new calibration factor, exit speed calibration and return to the Instrument status screen.

- If you want to carry out a second calibration run:
  - i. Press **trip** to start the second calibration run (see *sheet 2* of the *Speed calibration* flow chart).
  - ii. Use the procedure described above in steps 4 to 7, to complete the second run. At the end of the second run, the text **END** alternating with the new calibration factor is displayed at the top of the screen.
  - iii. Press the **speed** and **trip** buttons together, to store the new calibration factor, exit speed calibration and return to the Instrument status screen.

## Leaving Intermediate calibration

Hold down the **speed** and **trip** buttons for 2 seconds to save your settings, exit Intermediate calibration and resume normal operation.

## 4.4 Dealer calibration

The Dealer calibration procedure (see *Dealer calibration* diagram) enables the following parameters to be set:

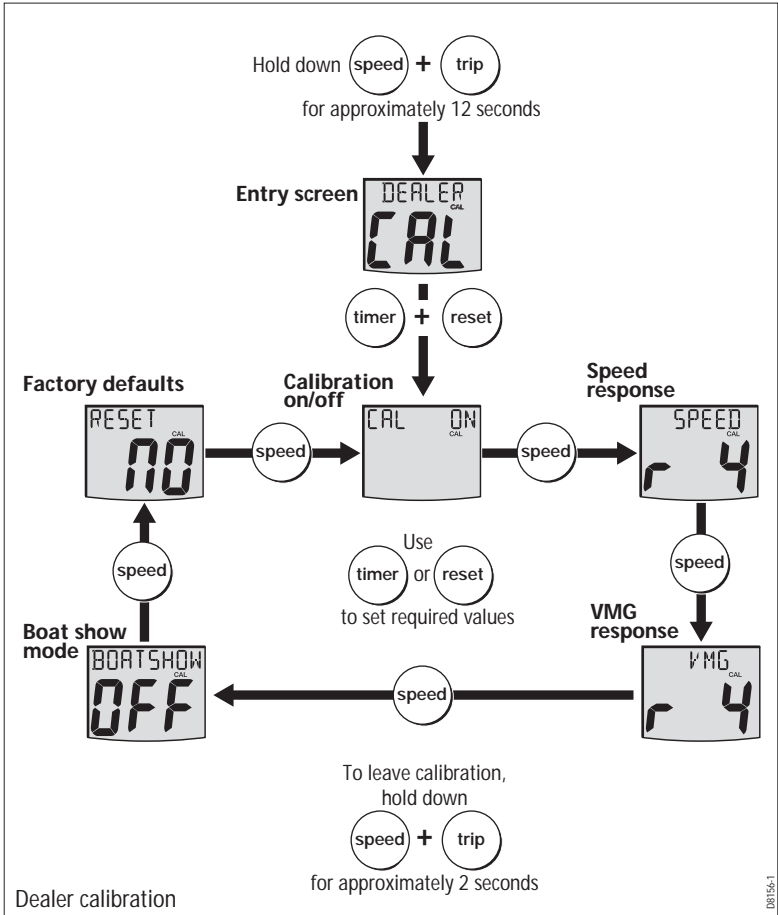
- User calibration on/off.
- Speed response.
- VMG response.
- Boat show mode on/off.

Dealer calibration also gives access to the Factory defaults screen. This enables you to re-apply the factory settings if you want to reset the instrument to a known operating condition.

To commence Dealer calibration, hold down the **speed** and **trip** buttons together for approximately 12 seconds, to select the Dealer calibration entry screen. Press the **timer** and **reset** buttons together, to proceed with the calibration, then use the **speed** button to proceed from screen to screen as calibration progresses.

### User calibration on/off

Press the **timer** or **reset** buttons to toggle the User calibration either **ON** or **OFF** as required. With **OFF** selected, User calibration and Intermediate calibration are both disabled.



## Response settings

The response values for both **SPEED** and **VMG** determine the frequency at which information is updated. A low number provides a smooth response and a high number a much livelier update.

Use the **timer** (decrement) and **reset** (increment) buttons to set the required value. Response values are from 1 to 15 .

## Boat show mode

**CAUTION: Do NOT enable Boat Show Mode**

**Do NOT enable Boat Show Mode. This must be used only for demonstration purposes.**

Ensure that the Boat Show Mode is set to **OFF** . If necessary, use the **timer** or **reset** button to achieve this.

## Factory defaults

You can use this screen to reset the operating parameters to the factory default values. Use the **timer** and **reset** buttons to make the required selection.

Note that the selection you make at this screen will be applied when you exit the screen, so be sure you make the correct selection.

**To retain the current values, ensure that the display shows NO.**

If you want to apply the factory defaults, change the display to **YES**. If you do this, the values you have set up will be overwritten by the factory defaults when you leave this screen.

## Leaving Dealer calibration

Hold down the **speed** and **trip** buttons for 2 seconds to save your settings, exit Dealer calibration and resume normal operation.

---

# Glossary

APP	Apparent
AVE	Average
AWA	Apparent Wind Angle (relative to the vessel)
AWS	Apparent Wind Speed
BTW	Bearing To Waypoint
CMG	Course Made Good
COG	Course Over Ground
DMG	Distance Made Good
DTW	Distance To Waypoint
EMC	Electro Magnetic Compatibility
ETA	Estimated Time of Arrival
GPS	Global Positioning System
HDG	Heading
KM	Kilometer(s)
KMH	Kilometers per hour
KTS	Knot(s)
LAT	Latitude
LCD	Liquid Crystal Display
LON	Longitude
LTR	Liter(s)

M	Magnetic or meters
MAG	Magnetic
MOB	Man Overboard
MPH	Miles per hour
NM	Nautical mile(s)
Response	The sensitivity of an instrument, to data changes
RF	Radio Frequency
SeaTalk	Raymarine proprietary communication system which links products, to provide a single, integrated system sharing power and data
SM	Statute mile(s)
SOG	Speed Over Ground
SPD	Speed
T	True
TTG	Time To Go
TWA	True Wind Angle relative to the vessel, taking into account the speed of the vessel
TWD	True Wind Direction
TWS	True Wind Speed
VMG	Velocity Made Good
WP	Waypoint
XTE	Cross Track Error

---



# Index

## A

Average speed, 3

## B

Backlighting adjustment, 6

Boat log, 3

Boat show mode, 34

Boat speed, 2

Buzzer, 5

## C

Calibration requirement, 1, 23

Cleaning, 7

Condensation, 7

Contrast adjustment, 6

## D

Dealer calibration, 32

Display setup, 6

Disposing of the product, ii

## E

EMC information, i, 7, 14, 23

## F

Factory defaults, 34

## H

Help lines, 9

## I

Installing

instrument, 15

bracket mounting, 19

flush mounting, 17

power supply connections, 22

requirements, 13

signal connections, 21

surface mounting, 16

planning, 11

transducer, 20

requirements, 11

running cable, 20

Instrument mounting options, viii, 15

Intermediate calibration, 28

## L

Log screen, 3

## M

Maximum speed, 2

Mounting options (instrument), viii, 15

## P

Parts supplied, ix

Pop-up pilot, 6

switch on/off, 28

Power supply

SeaTalk systems, 22

stand alone instrument, 22

Product disposal, ii

## R

Race start timers, 5

buzzer, 5

settings, 5

Remote control, viii, 6

Reset

average speed reading, 3

maximum speed reading, 2

trip distance reading, 4

## S

Safety

calibration requirement, 1, 23

electrical, i

general, i

navigation, i

SeaTalk overview, vii

Servicing & safety, 7

Setting

contrast, 6

Setting up

applying factory defaults, 34

backlighting, 6

correct speed, 26, 29

distance units, 26

instrument response, 33

race start timer, 5

- resolution, 26
- speed units, 25
- temperature reading, 28
- temperature units, 28
- User calibration access, 32
- Site requirements
  - instrument, 13
  - transducer, 11
- Software version, 10, 28
- Speed calibration
  - methods, 26
  - procedure, 29
- Speed information, 2
  - average speed, 3
  - boat speed, 2
  - maximum speed, 2
  - Speed Over Ground, 3
  - Velocity Made Good, 3
- Switching on/off, 1, 23

**T**

- Technical support, 9
- Temperature (water), 4
- Timers, 4
  - buzzer, 5
    - switch buzzer on/off, 28
  - race start timers, 5
    - setting, 5
- Trip distance, 4
- Troubleshooting, 8

**U**

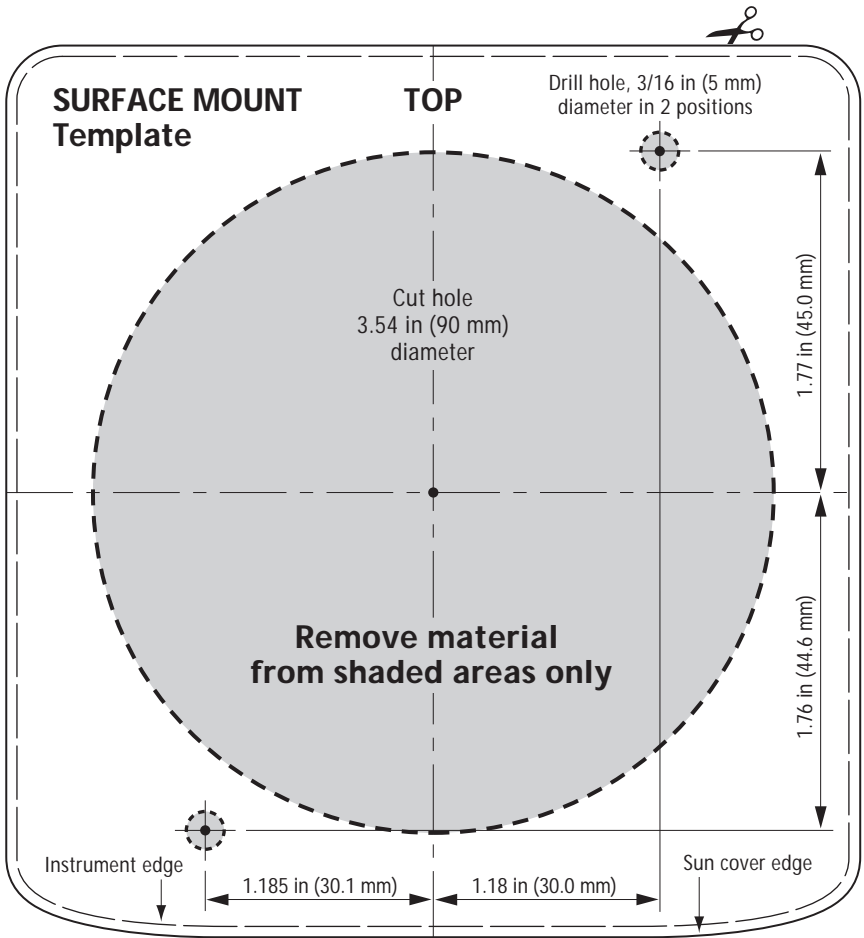
- User calibration, 25

**V**

- Velocity Made Good, 3

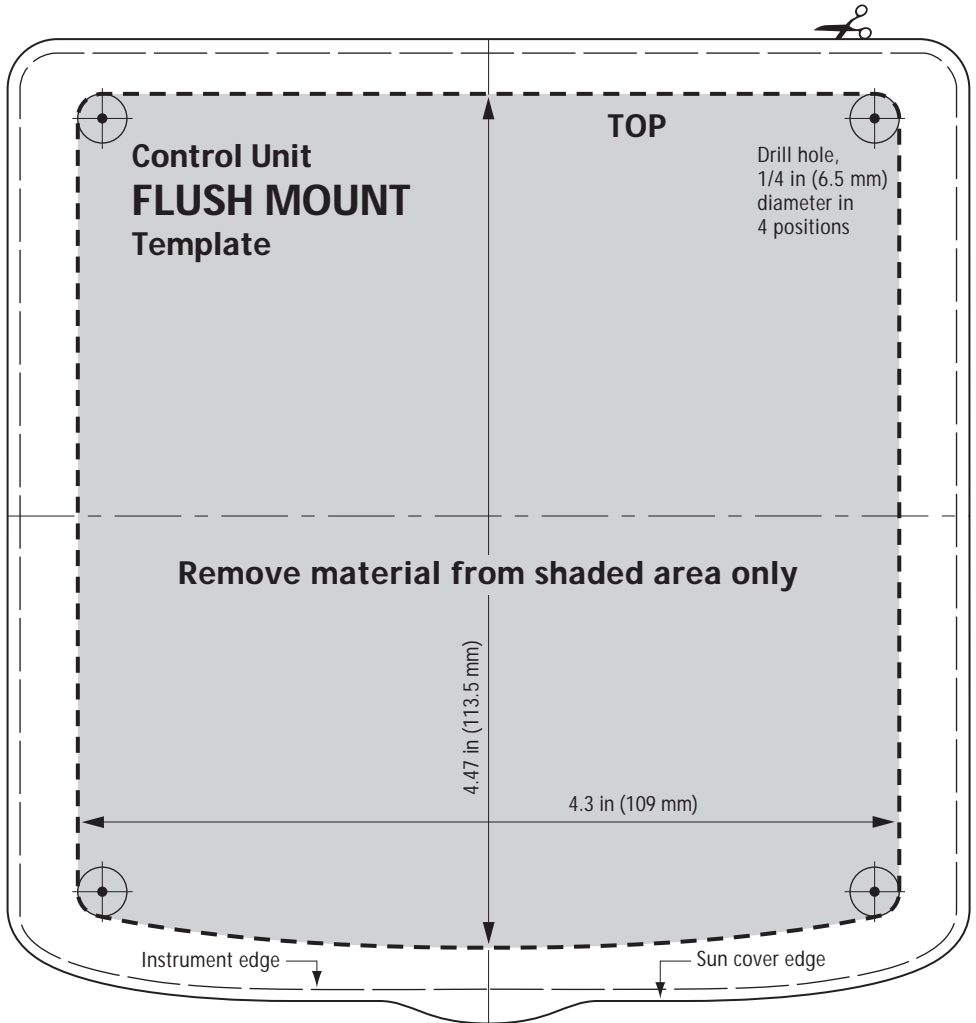
**W**

- Water temperature, 4



**SURFACE MOUNT template for  
ST60+ Instruments**





**FLUSH MOUNT template for  
ST60+ Instruments**

