ST70+
Installation Guide

Document reference: 87099-1
Date: January 2009

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Contents

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Preface

Warnings and cautions

WARNING: Product installation & operation

This equipment must be installed, commissioned 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: Switch off power supply

Ensure the boat's power supply is switched OFF before starting to install this product. Do NOT connect or disconnect equipment with the power switched on, unless instructed in this document.

WARNING: Ensure safe navigation

This product is intended only as an aid to navigation and must never be used in preference to sound navigational judgment. Only official government charts and notices to mariners contain all the current information needed for safe navigation, and the captain is responsible for their prudent use. It is the user's responsibility to use official government charts, notices to mariners, caution and proper navigational skill when operating this or any other Raymarine product.

WARNING: Potential ignition source

This product is NOT approved for use in hazardous/flammable atmospheres. Do NOT install in a hazardous/flammable atmosphere (such as in an engine room or near fuel tanks).

CAUTION: Replaceable parts

This product does not contain any user serviceable parts. Please refer all repair requirements to an authorized Raymarine dealer. Unauthorized repairs may affect your warranty.

Electromagnetic Compatibility (EMC) conformance

Raymarine equipment and accessories conform to the appropriate Electromagnetic Compatibility (EMC) regulations for use in the recreational marine environment. Correct installation is required to ensure that EMC performance is not compromised.

Always check the installation before going to sea to make sure that it is not affected by radio transmissions, engine starting or other forms of interference.

To do this:

1. Turn on all transmitting equipment (radar, VHF radio, etc).
2. Check that all electronic systems are unaffected by interference from the transmitting equipment.

EMC installation guidelines

Raymarine equipment and accessories conform to the appropriate Electromagnetic Compatibility (EMC) regulations. This minimizes electromagnetic interference between equipment, which could otherwise affect the performance of your system.

Correct installation is required to ensure that EMC performance is not compromised.

For **optimum** EMC performance, we make the following recommendations:

- Place Raymarine equipment and cables at least 3 ft (1 m) from any equipment that transmits, or cables that carry, radio signals from VHF radios, cables and antennas. In the case of SSB radios, the distance should be increased to 7 ft. (2 m).
- Place Raymarine equipment and cables 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.
- Use a power source separate from that used for engine-start. This is important to prevent erratic behavior and data loss which can occur if the engine-start does not have a separate battery.
- Use Raymarine-specified cables.
- Do not cut or extend cables unless doing so is detailed in the installation manual.

Remember

Where constraints on the installation prevent any of the above recommendations:

- Always allow the maximum separation possible between different items of electrical equipment.

This will provide the best conditions for good EMC performance of the installation.

Suppression ferrites

Raymarine cables may be fitted with suppression ferrites. These are necessary for correct EMC performance. Any ferrite removed during installation must be replaced as soon as installation is complete.

Use only ferrites of the correct type, supplied by Raymarine authorized dealers.

Connections to other equipment

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

Pressure washing

Do NOT pressure wash any Raymarine product.

Subjecting any Raymarine product to high pressure washing may cause subsequent water intrusion and failure of the product. Raymarine will not warranty product subjected to high pressure washing.

Certified installation

Raymarine recommends certified installation by a Raymarine approved installer. A certified installation qualifies for enhanced warranty benefits. Contact your Raymarine dealer for further details and refer to the separate warranty document packed with your product.

Product documents

This document is part of a series of books associated with the ST70+. Product documents can be downloaded from www.raymarine.com/handbooks.

- ST70+ Installation Guide (this document).
- ST70+ Operating Guide. Comprises operating cards with instructions for day-to-day operation of ST70+.
- ST70+ User Reference manual.This is supplied as a PDF document on your ST70+ CDROM. It includes commissioning, setup and diagnostic information.
- SeaTalk^{ng} Reference Manual. This provides detailed information regarding SeaTalk^{ng} connectivity.

Technical accuracy

To the best of our knowledge, the information in this document was correct at the time it was produced. 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. As a result, Raymarine cannot accept liability for any differences between the product and this document.

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 wheelie 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.

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Chapter 1: Getting started

1.1 Introduction

It is important that ST70+ products are installed correctly. For a safe and successful installation, we recommend a certified installation.

Certified installation

Raymarine recommends certified installation by a Raymarine approved installer. A certified installation qualifies for enhanced warranty benefits. Contact your Raymarine dealer for further details and refer to the separate warranty card packed with your product.

Overview

The key steps in the installation procedure are:

- Planning
  - Plan your system.
  - Decide where to locate the ST70+ products.
  - Check parts.
- Installing
  - Mount and connect the displays and keypads.
  - Install the transducers.
  - Fix equipment in place.
  - Commission the displays before use.

Getting assistance

If you require assistance with installation, please refer to your dealer and/or visit the Raymarine web site at www.raymarine.com.

1.2 Planning

General information

An ST70+ system comprises one or more color displays, controlled by one or more keypads. These products are connected to the boat's SeaTalk^{ng} system from which they receive autopilot and transducer data. Refer to the *SeaTalk^{ng} System Reference Manual* for information on SeaTalk^{ng} connectivity.

In a SeaTalk^{ng} system, displays and keypads are connected to the SeaTalk^{ng} backbone using spur cables. Transducers are also connected, either via compatible pods or directly, depending on transducer type.

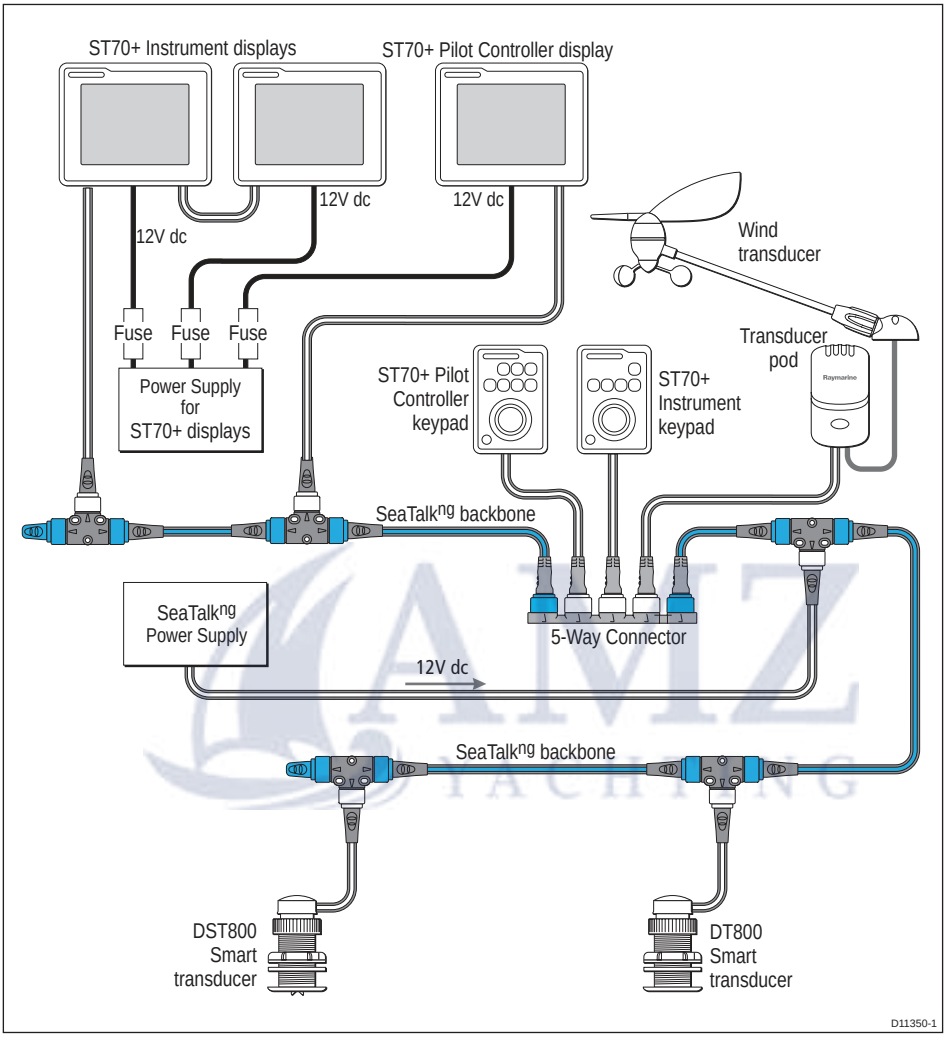


Figure 1-1: Typical system

Note: *See page 8 for information about additional SeaTalk^{ng} cables and accessories, including the SeaTalk^{ng} backbone kit.*

Displays

Functionality

The functionality of each ST70+ display is set up after installation but before use, to determine whether the display functions as either an Instrument or a Pilot Controller.

Dimensions

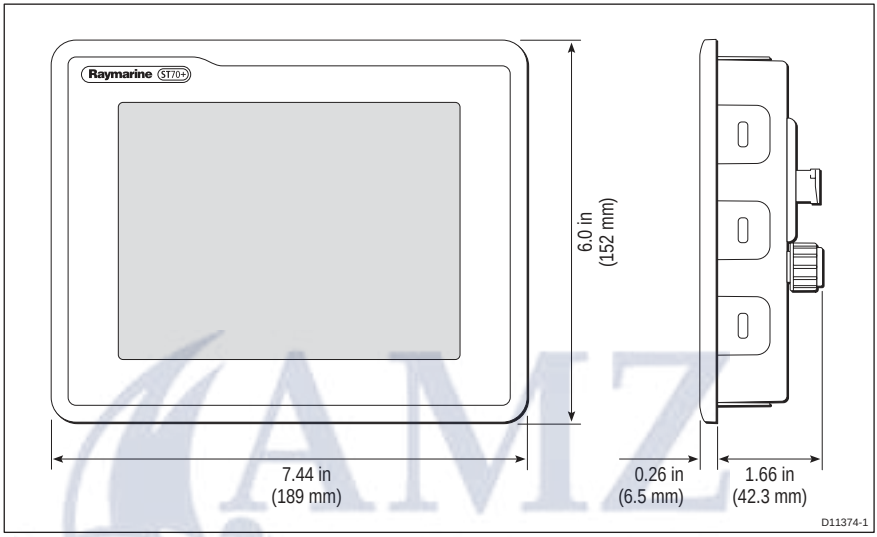


Figure 1-2: Display dimensions

Keypads

Three types of keypad are available, namely:

- Instrument keypad.
- Pilot Controller keypad for power boats.
- Pilot Controller keypad for sail boats.

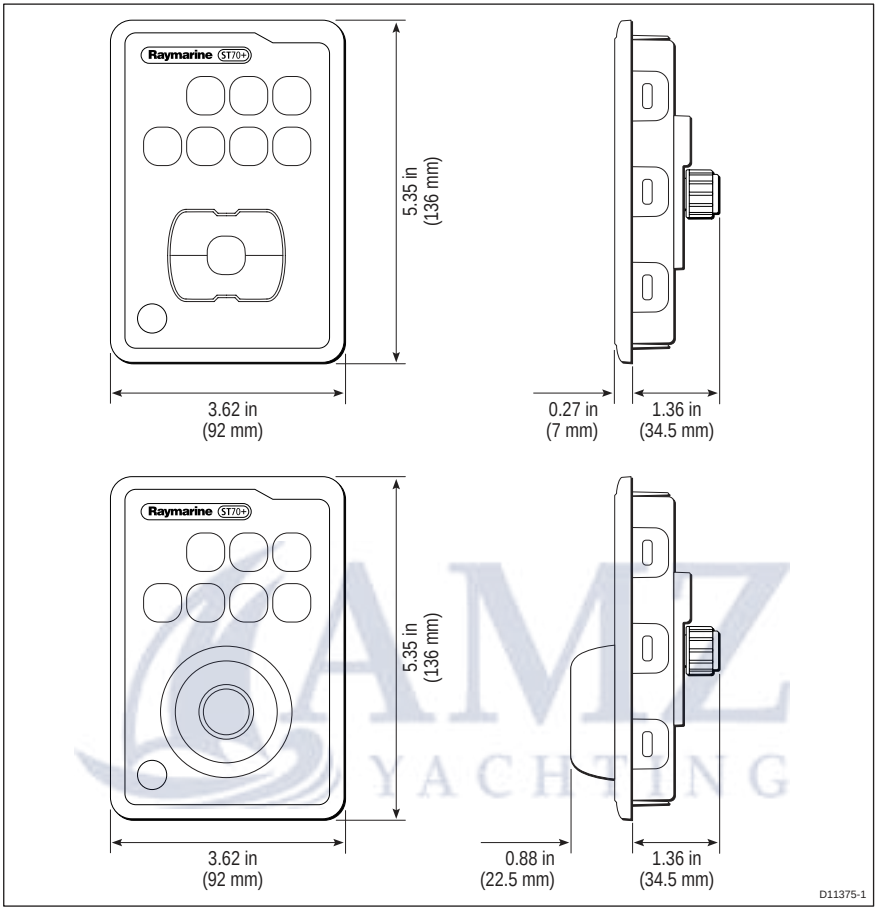


Figure 1-3: Keypad dimensions

Power supplies

In a typical ST70+ system, displays and keypads are powered by 12 V dc from SeaTalk^{ng}. The power loading from SeaTalk^{ng} is described in terms of a Load Equivalency Number (LEN) for each product.

Each display has a LEN value of 1 and each keypad type has a LEN value of 2.

When planning an ST70+ system, take into account the total LEN of all the products you intend installing, to ensure SeaTalk^{ng} is not overloaded. Refer to the *SeaTalk^{ng} Reference manual* to ensure correct installation.

Dedicated display power supply

In addition to using power from SeaTalk^{ng}, the ST70+ displays require an additional dedicated 12 V power source. Each individual display must be separately connected to the power source with the power cable supplied, and each power cable must be connected to the power supply via a 5A fuse or equivalent protective device.

Positioning ST70+ displays & keypads

Siting requirements

WARNING: Potential ignition sources

The equipment in these instructions is NOT approved for use in hazardous/flammable atmospheres such as an engine room.

CAUTION: Maintain structural safety

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

ST70+ displays and keypads can be fitted either above or below deck, provided the rear of each product is protected from contact with water.Each product must also be positioned where:

- It is easily read by the helmsman. Bear in mind that there are limitations in how well the display screens can be read when not viewed straight-on, Note that the maximum viewing angles are:
  - From above: 30°
  - From below: 60°
  - From the each side: 55°
- It is protected against physical damage.
- It is at least 9in (230mm) from a compass.
- It is at least 20in (500mm) from radio receiving equipment.
- There is reasonable rear access for installation and servicing.
- It is within 400 mm of a SeaTalk^{ng} T-piece or connector block, or another ST70+ display or keypad.

Other considerations

When planning an installation, ensure that you position the displays and keypads for most effective control of the boat, bearing in mind that, during the subsequent commissioning procedure:

- Each ST70+ display is set up to operate either as an Instrument or as a Pilot Controller.
- The entire ST70+ system can be configured to operate in groups, with each group comprising up to four displays all of the same type, i.e. all Instruments or all Pilot Controllers.
- At least one keypad is allocated to each group of displays. The allocated keypad must be of the appropriate type for the display group, i.e. either an Instrument keypad or Pilot Controller keypad.

1.3 Equipment & tools

Parts supplied

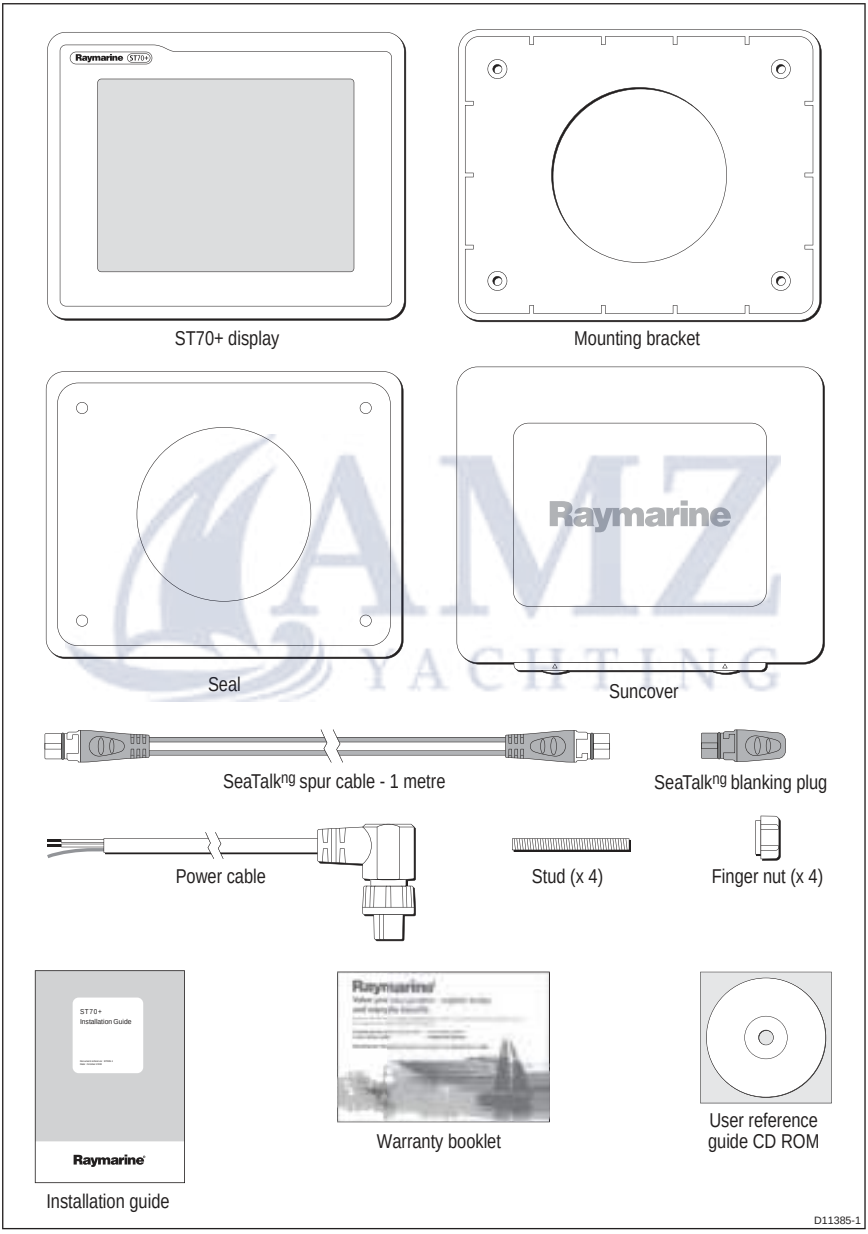


Figure 1-4: Display and associated parts supplied

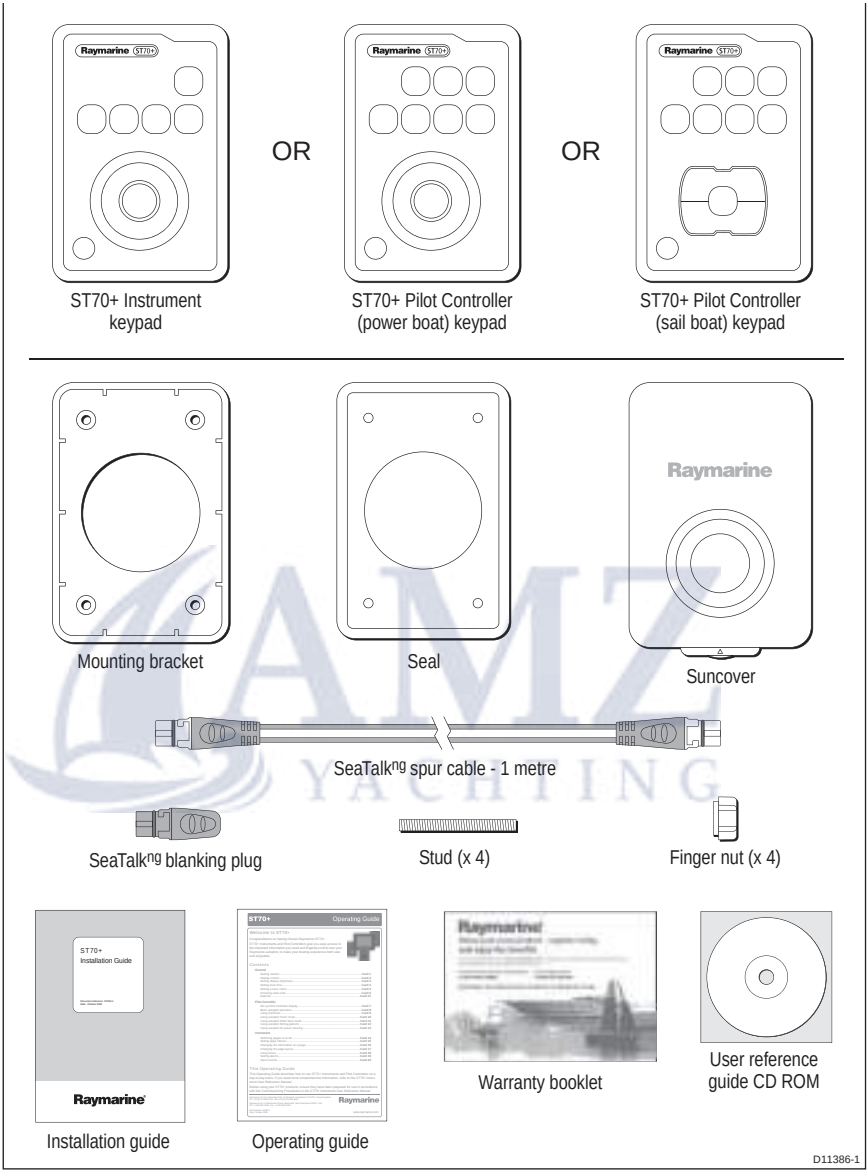
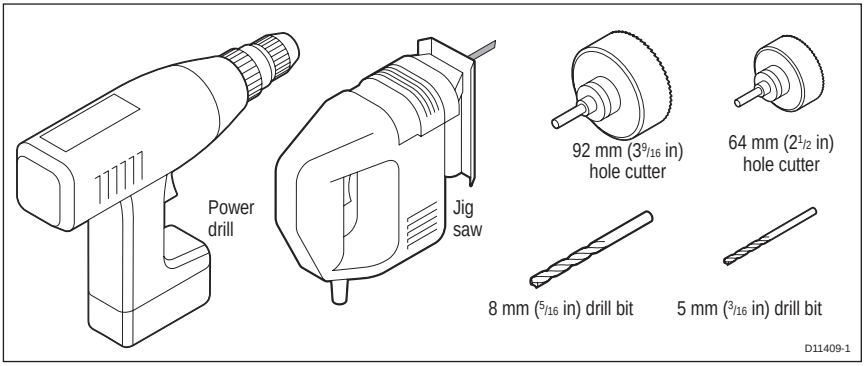


Figure 1-5: Keypad and associated parts supplied

Parts not supplied

You will need the following tools:



Optional cabling and connectors

Each ST70+ product is supplied with one SeaTalk^{ng} spur cable and one backbone blanking plug and should be connected to a SeaTalk^{ng} system as described in the *SeaTalk^{ng} System Installation Guide* (supplied with the SeaTalk^{ng} backbone kit). You may need other SeaTalk^{ng} components to achieve this.

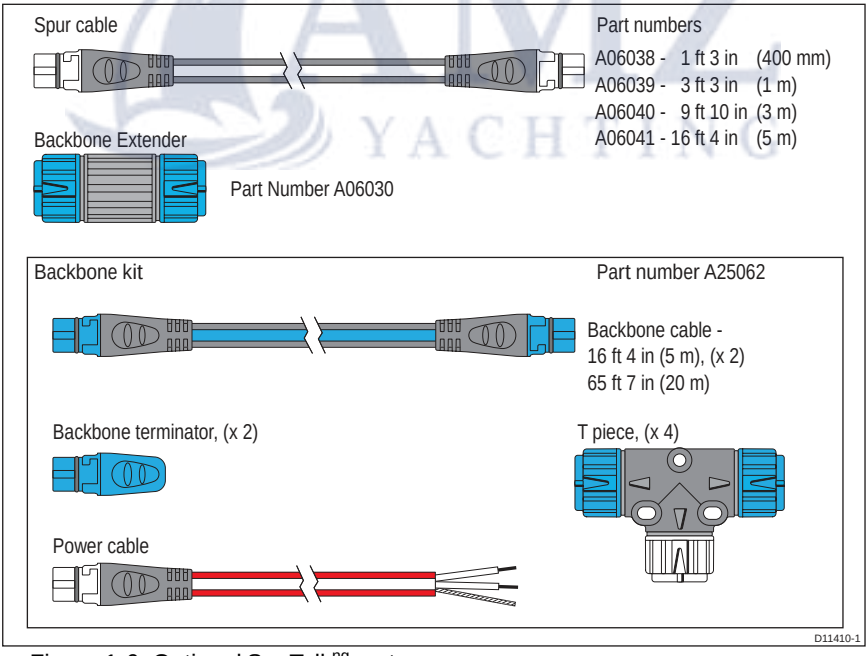


Figure 1-6: Optional SeaTalk^{ng} parts

For further information on SeaTalk^{ng} products, refer to the *SeaTalk^{ng} System Installation Guide*, talk to your dealer, or visit the Raymarine web site at www.raymarine.com.

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Chapter 2: Installation

Before starting to install your ST70+ products, read *Chapter , Getting Started*, so that:

- You have all the necessary equipment to hand.
- You know where you want to install the ST70+ products and where the appropriate network connection points are.

2.1 Procedure

WARNING:

Before starting installation, ensure the boat is securely moored and that electrical supplies are switched off.

With the boat at dockside, install each ST70+ display and keypad by carrying out the procedures for:

- Cabling.
- Mounting & connecting

Cabling

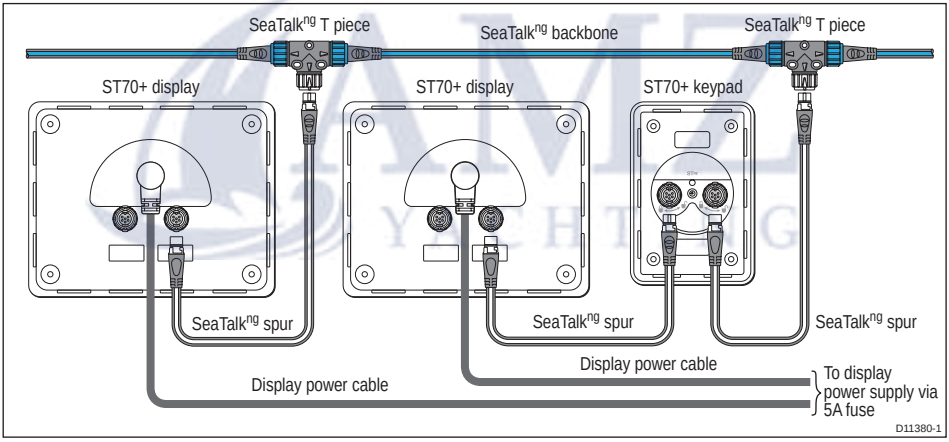

Figure 2-1: Typical cabling at rear of displays and keypads

Display power cables

Ensure you have a suitable power supply for the displays (as described in *Chapter 1)*, then run a power cable (supplied) from the intended location of each display, via a 5 A fuse (or equivalent protective device) to the display power supply.

SeaTalk^{ng} connections

For each ST70+ product:

1. Locate a SeaTalk^{ng} connection point within 400 mm of the intended location of the product. This can be at any of the following:
   - SeaTalk^{ng} T piece.
   - Spare SeaTalk^{ng} connector on a product already installed.
   - SeaTalk^{ng} 5-way connector block.
2. For each SeaTalk^{ng} connection, label both ends of a SeaTalk^{ng} spur cable, then connect it to the connection point, and run the free end to the intended location.

Mounting & connecting products

Mounting options

You can either flush mount or surface mount your ST70+ displays and keypads.

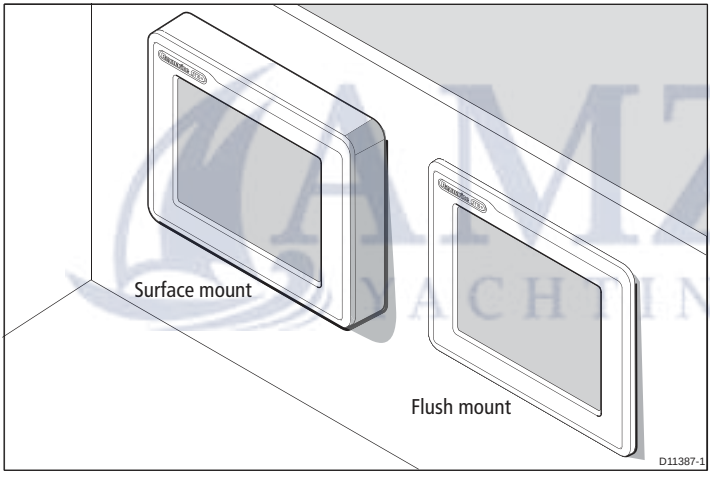

Figure 2-2: Example of flush and surface mounting

Use the appropriate template to facilitate the installation of each product. Templates for flush and surface mounting are provided as follows:

- Keypad templates are included at the end of this Installation Guide.
- Display templates are provided with each display, on a separate document 87107-1.

At each location, ensure that:

- The mounting panel is capable of supporting the product(s) you intend installing.
- The mounting surface is clean, smooth and flat.
- There is sufficient space behind the mounting panel to accommodate the rear of the product and the connections to it.

Mounting procedure

Illustrations showing how to surface mount and flush mount an ST70+ display are given at *Figure 2-3:* and *Figure 2-4:* respectively. Keypads are mounted in a similar manner except they connect only to SeaTalk^{ng} and do not have an additional power cable connection.

To mount an ST70+ display or keypad:

1. Use the appropriate flush- or surface-mount template to cut the mounting slot for the display and to drill holes for the fixing screws.
2. Clean and de-burr the mounting surface.
3. Fit gaskets and brackets.

Note: *Stick the self-adhesive side of the gasket to the display or keypad, NOT to the mounting location.*

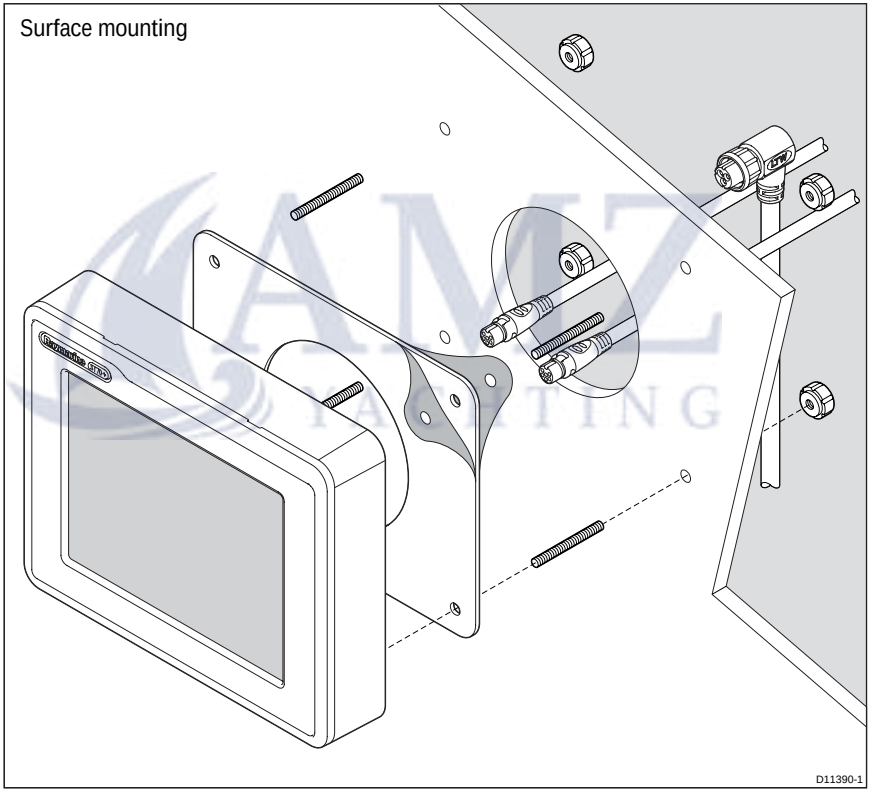

Figure 2-3: Surface mounting a display

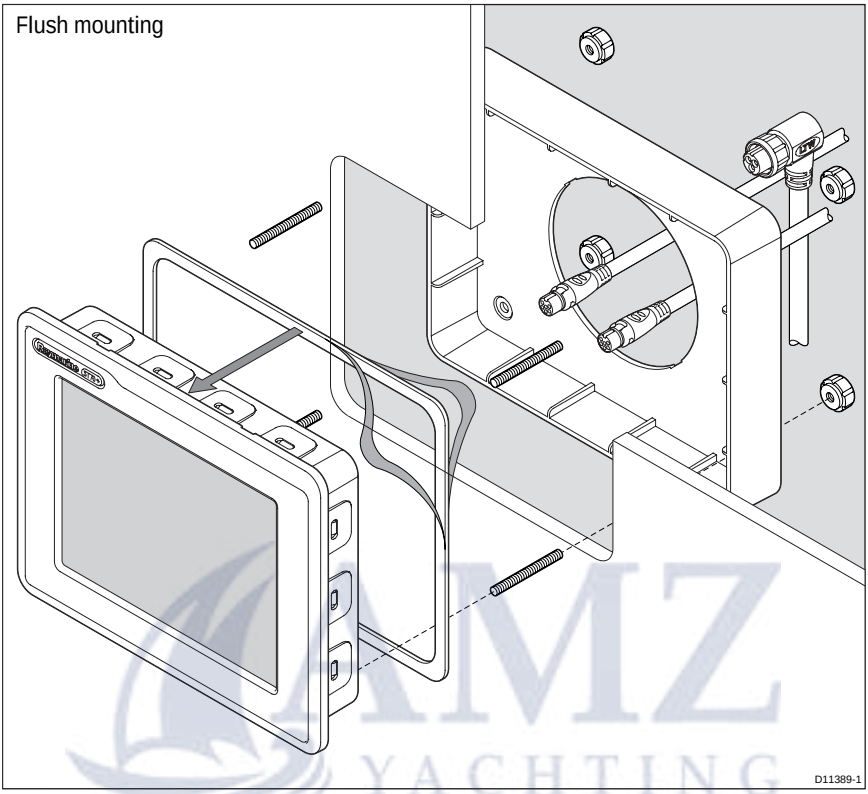

Figure 2-4: Flush mounting a display

Connecting

Make the necessary connections to each product (see *Figure 2-5*):

- At each display and keypad make at least one SeaTalk^{ng} connection.
- At each display also make a power connection.

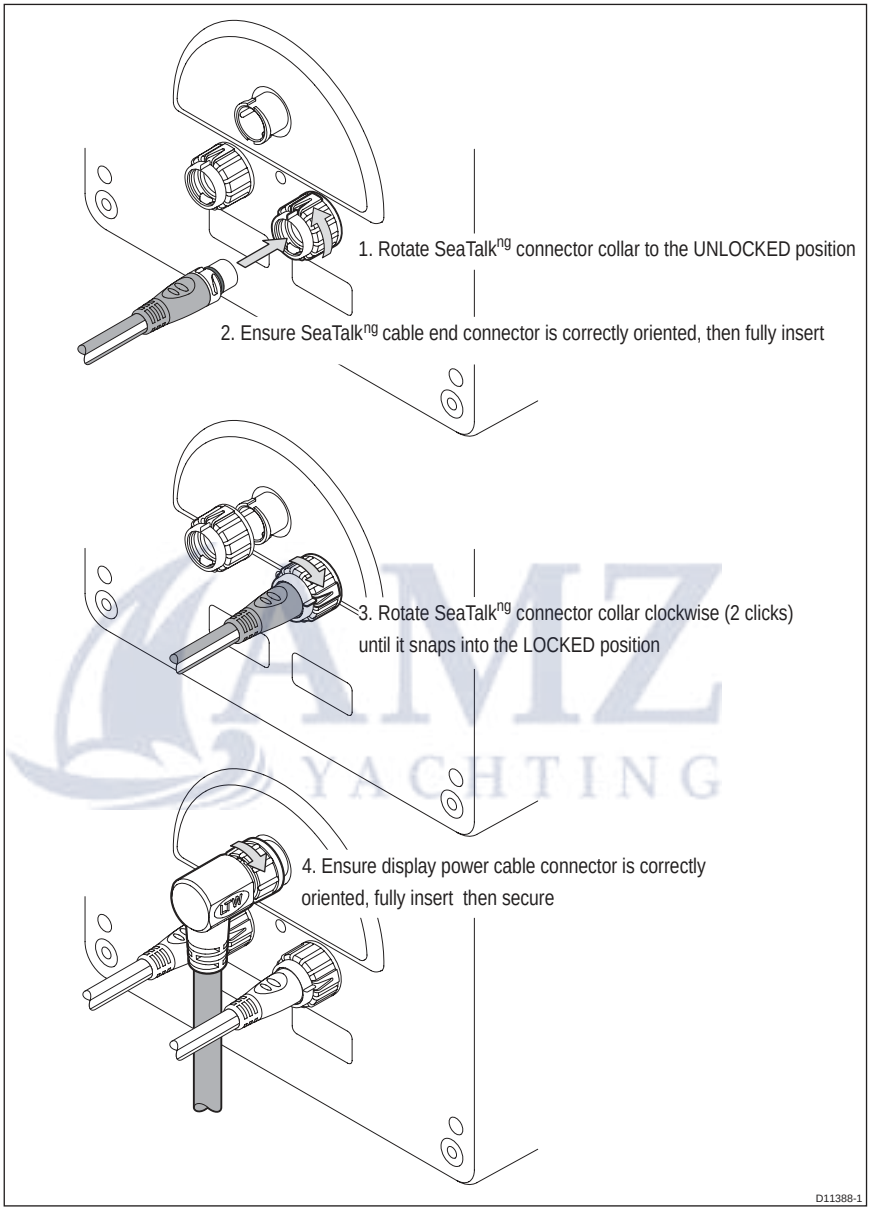

Figure 2-5: Rear connections

2.2 Installing transducers

Transducer types

ST70+ can operate with:

- Conventional transducers (separate Speed, Depth and Wind).
- Smart transducers (combined Depth/Speed/Temperature (DST) and combined Depth/Temperature (DT) transducers).

The main difference in installation requirements for these two groups is that each conventional transducer connects to a dedicated pod which then connects to SeaTalk^{ng} via a fitted SeaTalk^{ng} spur cable, whereas each smart transducer connects directly to the SeaTalk^{ng} backbone via a fitted SeaTalk^{ng} spur cable.

Fitting

Fit each transducer in accordance with the accompanying instructions.

Connecting

Conventional transducers

CAUTION: Do not use the wrong pod

Using the wrong type of pod could cause damage to your equipment. Before connecting, always ensure that the pod you intend to use is compatible with the transducer type.

Conventional transducers and associated pods are available for wind, depth and speed. Each transducer connects via a dedicated pod to SeaTalk^{ng}.

Connect each conventional transducer as follows:

1. Ensure the pod you intend using is compatible with the transducer, i.e. speed pod for a speed transducer, depth pod for a depth transducer or wind pod for a wind transducer.

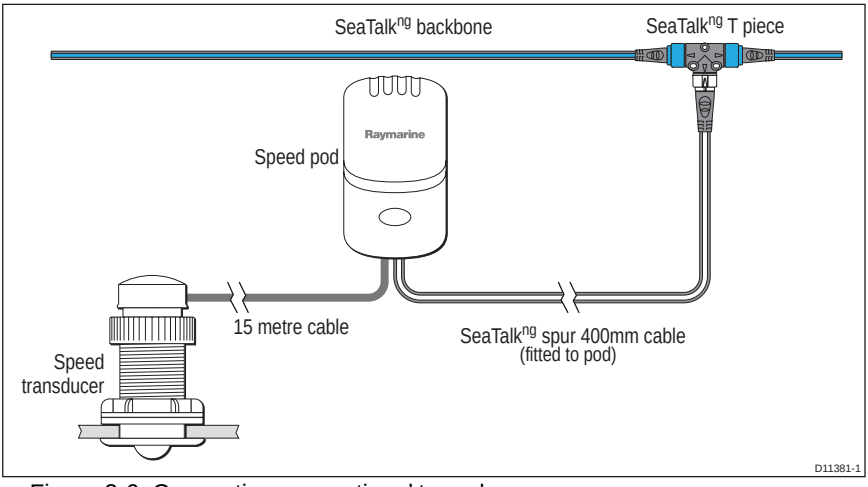

Figure 2-6: Connecting conventional transducer

2. Referring to the instructions supplied with the pod, connect the transducer to the pod. When doing this, ensure that each wire is connected to the correspondingly-colored connector.
3. Connect the pod to the SeaTalk^{ng} backbone using the 400mm SeaTalk^{ng} spur cable supplied with each pod. Pods must be located no further than 400mm from their corresponding connection points on the backbone.

Smart transducers

ST70+ products are compatible with the following smart transducer types:

- Combined depth/speed/temperature transducer, type DST800.
- Combined depth/temperature transducer, typeDT800.

Connect the fitted SeaTalk^{ng} spur cable from each smart transducer to a convenient point on the SeaTalk^{ng} backbone.

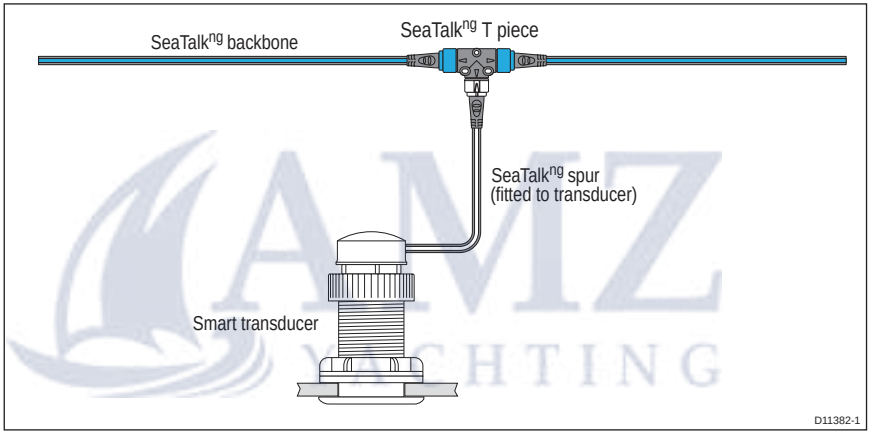

Figure 2-7: Connecting smart transducer

2.3 Commissioning requirement

WARNING: Product installation & operation

An ST70+ system must be prepared for use in accordance with the Commissioning Procedures, before it is used for operational purposes. Failure to comply with this could result in death, personal injury, damage to your boat and/or poor product performance.

After installation, an ST70+ system must be commissioned in accordance with *Chapter 2: Commissioning Procedures*, before it is used for operational purposes.

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Chapter 3: Commissioning Procedures

3.1 Introduction

Requirement

WARNING: Product installation & operation

An ST70+ system must be prepared for use in accordance with the Commissioning Procedures, before it is used for operational purposes. Failure to comply with this could result in death, personal injury, damage to your boat and/or poor product performance.

Before an ST70+ system is used for the first time, it must be commissioned in accordance with the instructions in this chapter. Commissioning comprises:

1. *Initial setup*.
2. *Dockside setup*.
3. *Open water calibration*.
4. *Checking autopilot operation*.

Note: *If your ST70+ product is connected to an existing SeaTalk^{ng} system that has already been successfully commissioned, you do not need to commission the system again.*

Autopilot calibration

The detailed requirement for autopilot calibration is determined by the autopilot. The autopilot calibration procedures in this chapter are those for a 'typical' Raymarine autopilot system. If necessary adapt these procedures to suit your system. If you need assistance, please contact your Raymarine dealer.

Control information

As the ST70+ displays do not have fitted controls, all control actions are made at the appropriate ST70+ keypad. Information on keypad controls, commissioning and menu maps is provided in the *ST70+ User Reference Manual* which is in PDF form on the CDROM supplied with each ST70+ product. If you are unclear about the action of keypad controls, please refer to the *ST70+ User Reference Manual* before you start the commissioning procedure.

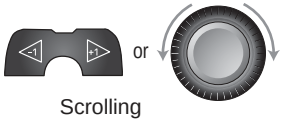
Wherever an instruction calls for a button to be pressed or a control to be operated, this refers to the appropriate keypad.

Commonly used control functions

Many ST70+ setup functions and values, plus many display options are selected by scrolling to the required function or value, then confirming the value.

The manner in which you scroll to a function or value you want and confirm your selection, depends on keypad type

Scrolling.

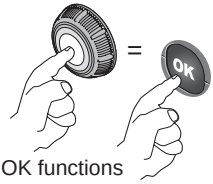


Scrolling

To scroll to an option or set a value, either:

- Press the < and > buttons on the sail boat Pilot Controller keypad, or
- Turn the Rotary Control on the power boat Pilot Controller keypad or the Instrument keypad

OK function



OK functions

The manner in which you confirm, (i.e. 'OK') selections and edited values depends on which keypad type you are using.

- On a sailboat Pilot Controller keypad, press and release the OK button.
- On a power boat Pilot Controller keypad or an Instrument keypad, press and release the center of the Rotary Control.

Select Display

The Select Display button is used in systems with more than one display, to select the display you want to control or set up. One press highlights the currently selected display. If you press Select Display again while the currently selected display is highlighted (i.e. within 6 seconds), this selects the next display in the system. Repeating this action enables you to select each display in turn.

3.2 Initial setup

Carry out the initial setup procedures in the following sequence:

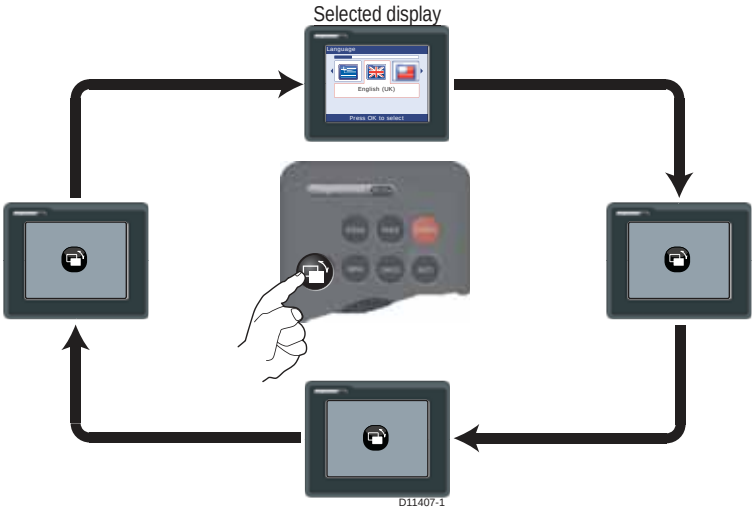
- Switch on.
- Selecting language.
- Setting vessel type.
- Setting display types and groups.
- Allocate keypad.
- Set date and time format (only if GPS is fitted).
- Set correct local time (only if GPS is fitted).
- Set required data units.

Switch on.

At an ST70+ keypad, press the power button switch on the displays. When an ST70+ system is first switched on after installation, one display shows a select **Language** menu. This is the active display.

Other displays show a Select Display icon .

If necessary use the Select Display button on any ST70+ keypad to select another display as the active display, i.e. so it shows the select **Language** menu.



Selecting language

Scroll to select the required language.

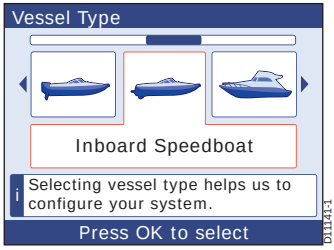
CAUTION:

Be sure to select the correct Language. If you select the wrong language, the ST70+ system will be difficult to use.

If you are sure you have selected the language you want, press OK to confirm the selection, to display the 'Welcome' screen.

When you are ready to proceed, press OK to display the **Vessel Type** menu.

Setting Vessel Type



The **Vessel Type** menu enables you to automatically apply the optimum system settings for your vessel type. The options are:

- Race Sail
- Sail Cruiser
- Catamaran
- Workboat
- RIB
- Outboard Speed Boat
- Inboard Speed Boat
- Power Cruiser 1*
- Power Cruiser 2*
- Power Cruiser 3*
- Sport Fishing
- Pro Fishing

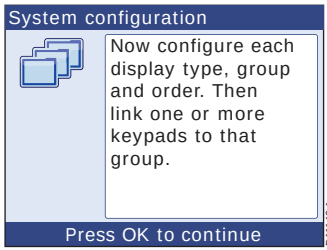
***Power Cruiser settings**. Note that the Power Cruiser settings apply as follows:

- Power Cruiser 1 - vessels capable of speeds up to 12 knots.
- Power Cruiser 2 - vessels capable of speeds up to 30 knots.
- Power Cruiser 3 - vessels capable of speeds greater than 30 knots.

Select type

Scroll to select the vessel type that most closely corresponds to your vessel.

When you have chosen the vessel type, press OK to confirm the choice. The Time and Date values and the data Units considered most appropriate for the Language and Vessel Type you chose, are then automatically applied to your ST70+ system and an automatic check of system parameters is carried out. On completion, a **System configuration** page is present all displays in the system.



Setting display types and groups

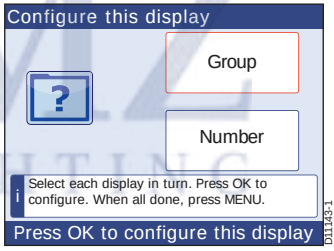
You must now:

- Select the display you want to set up.
- Set the display type for each display (Instrument or Pilot Controller).
- Allocate each display to a group.
- Set the sequence number of each display within the group.
- Link at least one keypad to each group.

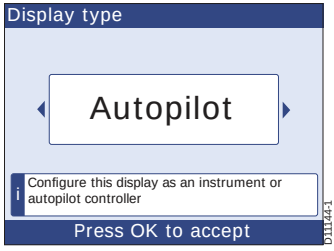
To do this:

1. With the **System configuration** page displayed, press OK to display the **Configure this display** page.

   For unassigned displays (e.g. at first switch on), the legends **Group** and **Number** are displayed. If the selected display has already been set up, this shows the current group and number in the group for the selected display.

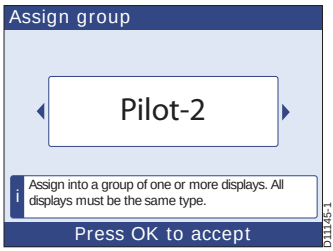


2. Use the Select Display button as necessary, to move the screen highlight to the display you want to set up, i. e. so it is the selected display.
3. Press OK to display the **Display type** setup page.
4. Scroll to select either **Instrument** or **Autopilot**, as required.

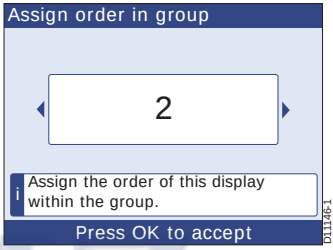


Note: *From this point, you must use a keypad type appropriate to the display type you have selected.*

5. Press OK to confirm the display type and display the **Assign group** page.
6. Scroll to the name of the group to which you want to assign the display.
   - Pilot Controller group name options are: **Pilot-1**, **Pilot-2, Pilot-3**, **Pilot-4** and **Pilot-5**
   - Instrument group name options are: **Inst-Helm1**, **Inst-Helm2**, **Inst-Cockpit**, **Inst-Flyb.**, **Inst-Mast**, **Inst-1**, **Inst-2**, **Inst-3**, **Inst-4**, **Inst-5**, **Inst-6**, **Inst-7**, **Inst-8**, **Inst-9**, **Inst-10**, **Inst-11**, **Inst-12**, **Inst-13**, **Inst-14** and **Inst-15.**



7. Press OK to save the group assignment and display the **Assign order in group** page. Each display in a group has a discrete number, and these numbers determine the order in which displays are selected within the group during normal operation, when the Select Display button is used.
8. Scroll to the required number.
9. Press OK to save the group settings and display the **Link keypad to group** page.



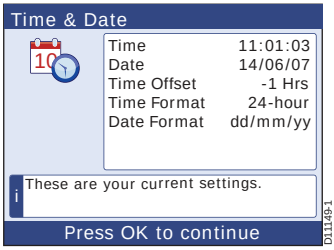
10. If you have not allocated keypads to the group containing the display you are setting up:
    i. Press OK at a keypad you want to link to this group.
    ii. Wait until the confirming popup disappears.
    iii. Repeat i and ii for each keypad you want to link to this group.

Note: *Remember you can only link Instrument keypads to Instrument groups, and Pilot Controller keypads to Pilot Controller groups.*

11. When you have allocated all the required keypads to this group, press MENU to save the group settings and display the **Configure this display** page.
12. Repeat steps 3 to 11 for each display.
13. When all displays are set as you want, and with the **Configure this display** page displayed, press MENU, to leave the *Setting display types and groups* procedure, and display either:
    - A **Time & date** summary page, if your system provides GPS information,
    - or
    - A **Units Summary** page if GPS information is not available.

Date & Time

The **Time & Date** summary page shows the current values applied to your ST70+ system.



Note: *If your display is not receiving GPS information, the Time & Date page is not displayed. In this case, proceed with the Data units setup procedure below.*

Check the information, on the **Time & Date** summary page, then press OK to display the **Time & Date** setup menu.

You can change certain date and time parameters. You can:

- Select either dd/mm/yy or mm/dd/yy as the date format
- Select either 12-hour (am/pm) or 24-hour as the time format.
- Set the value of the time offset to give the required local time.

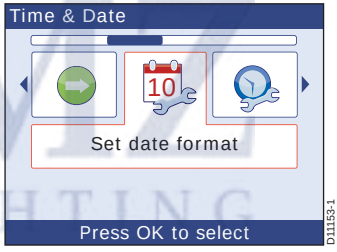
If you want to change any **Time & Date** values, carry out the *Setting date format*, *Setting time format* and/or *Setting local time* procedure below, as appropriate.

If you do not want to change any **Time & Date** values, proceed from *Leaving date & time* setup below.

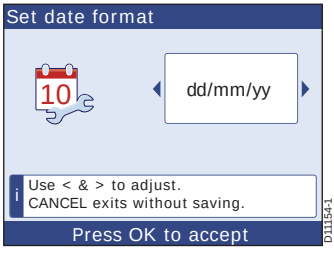
Setting date format

To set the required date format:

1. At the **Time & Date** setup menu, scroll to the **Set date format** option, then press OK to display the **Set date format** page.



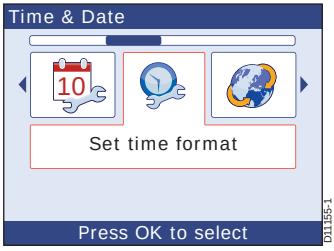
2. Scroll to select the required Date Format, then press OK to save the format and return to the **Time & Date** summary page.
3. Press OK to select the **Time & Date** setup menu.



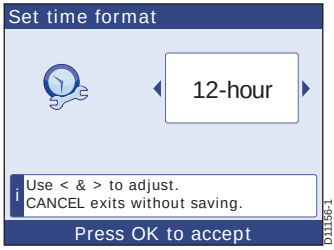
Setting time format

To set the required time format:

1. With the **Time & Date** setup menu displayed, scroll to select the **Time Format** option, then press OK to display the **Set time format** page.



2. Scroll to the required Time Format, then press OK to save the format and return to the **Time & Date** summary page.
3. Press OK to select the **Time & Date** setup menu.

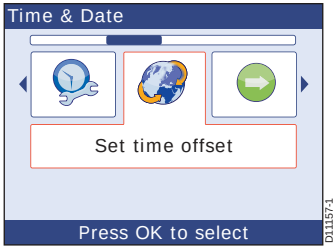


Setting local time

Note: *If your ST70+ display is connected to a Raymarine multi-function display, then the time offset is controlled by the multifunction display and you cannot use this procedure to change it.*

To set the display time to your local time.

1. At the **Time & Date** setup menu, use < and > to select the **Set time offset** option, then press OK, to display the **Set time offset** page.
2. Scroll to set the correct local time. For example, if your local time is 1 hour after GMT, set **-1**.
3. Press OK, to save the setting and return to the **Time & Date** setup menu.



Leaving date & time setup

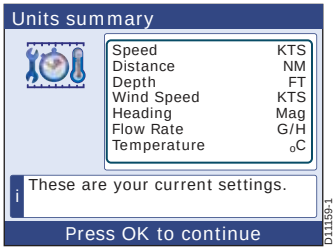
When your date and time formats and values are set as required:

1. At the **Time & Date** setup menu, scroll to the **Continue** option.
2. Press OK to proceed to the **Units summary** page.
3. Proceed from *Data units* (below).

Data units

The **Units summary** comprises two pages and shows units currently in use. You can accept all or change any of the data unit settings. You can set:

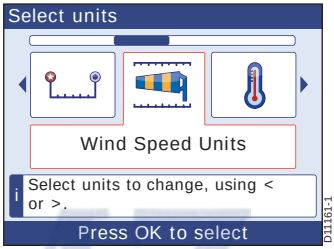
- Speed to either miles per hour, kilometers per hour or knots.
- Distance to either miles, nautical miles or kilometers.
- Depth to either feet, fathoms or meters.



- Wind speed to either knots or meters per second.
- Heading to either magnetic or true.
- Flow rate to either US gallons per hour, UK gallons per hour or liters per hour
- Temperature to degrees Celsius or degrees Fahrenheit.
- Pressure to pound per square inch or kilo Pascals.
- Volume to either US gallons, UK gallons or liters
- Number of engines to either 1, 2, 3, 4 or 5.
- Number of batteries to either 1, 2, 3, 4 or 5.
- Number of fuel tanks to either 1, 2, 3, 4 or 5.

Press OK to see the second **Units summary** page, and if you want to return to the first page from the second, press CANCEL.

Check the information on the **Units summary** pages, then with the second **Units summary** page displayed, press OK to display the **Select units** menu.



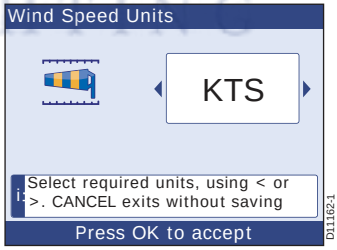
If you want to change any data units, carry out the *Changing units* procedure below.

If you do not want to change any data units, proceed from *Leaving units setup* below.

Changing units

To change any data units:

1. With the **Select units** menu displayed, scroll to select the type of data you want to change, i.e. Speed, Depth, Distance, Wind Speed etc.
2. Press OK to display the setup page for the units you have selected.
3. Scroll to select the required units.
4. Press OK to save the units setting and return to the first **Units summary** page.
5. Press OK twice, to display the **Select units** menu.
6. If you want to change any other units, repeat steps 1 to 5 of this procedure.

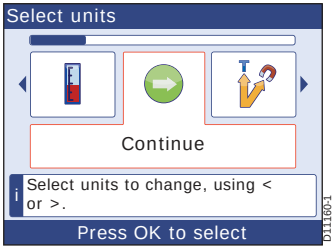


Leaving units setup:

When your data units are set as required:

1. With the **Select units** menu displayed, scroll to the **Continue** option.
2. Press OK.

Initial setup now ends.



Initial setup end routine

If the function of any display has changed since switch on (i.e. Instrument to Pilot Controller or vice versa), the relevant displays reboot when you press OK at the **Select units** menu.

When any necessary reboot has taken place, an operational page for either an Instrument or a Pilot Controller is displayed, depending on which display function you set previously. The display is now in operating mode.

Next actions

Now carry out the remaining dockside setup procedures.

3.3 Dockside setup

Carry out the dockside setup procedures in the following sequence:

- *Autopilot system.*
- *Transducer setup.*
- *Miscellaneous setup.*

Autopilot system

CAUTION:

Before starting any dockside setup procedure, ensure the boat is securely moored alongside.

The autopilot dockside setup procedures comprise:

- Using the Dockside wizard to:
  - Set drive type.
  - Perform motor phasing check.
  - Perform rudder check.
- Setting rudder hard over time.

The exact procedures are dependent on the type of autopilot. Typical procedures are given here, but you may need to adapt these procedures to suit your installation. If you require advice or assistance, please contact your local Raymarine dealer.

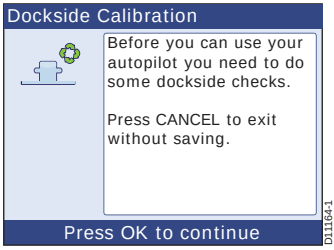
Dockside wizard

Starting the wizard

At a convenient Pilot Controller:

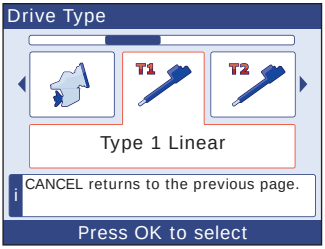
1. Press MENU to display the **Main Menu**.
2. Scroll to **Autopilot calibration** then press OK to display the **Autopilot Autocalibration** menu.

3. Scroll to select **Commissioning,** then press OK to display the **Commissioning** menu.
4. Scroll to **Dockside wizard** then press OK to start the wizard. The **Dockside Calibration** page is displayed.



Set drive type

With the **Dockside calibration** page displayed at the selected Pilot Controller, press OK on the associated keypad to display the **Drive type** page then:



1. Scroll to select the autopilot drive type appropriate to your boat. The options available depend on the type of autopilot, but options supported are:

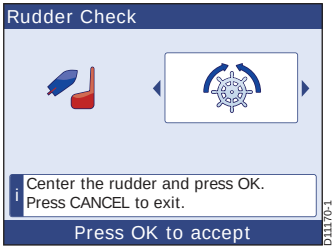
Type 1 Linear	**Jet Drive (fly-by-wire)**	
Type 2 Linear	**Wheel Drive**	
Type 2 Hydraulic Linear	**Tiller**	**Hydraulic Pump Type 1**
Type 3 Hydraulic Linear	**CR Solenoid**	**Hydraulic Pump Type 2**
I/O Stern	**Sport Drive**	**Hydraulic Pump Type 3**
IPS	**Rotary Drive Type1**	**Constant Running Pump**
Jet Drive (pump)	**Rotary Drive Type 2**	**Verado**

Note: *If your drive type is not included, seek advice from your Raymarine dealer.*

2. Press OK to save your setting and display the next setup page. This is either:
   - The **Rudder check** (center) page, if the boat has a rudder reference transducer, or
   - The **Motor phasing non-referenced** page, if a rudder reference transducer is not fitted.
3. Press **OK** to proceed with the Rudder and motor checks. Use the procedure for either *Systems with a Rudder Reference transducer* or *Systems without a Rudder Reference transducer*, as appropriate.

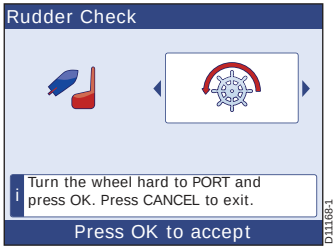
Rudder and motor checks for systems with a Rudder Reference transducer

After setting the drive type, the Rudder check page (center) is displayed, if your system has a Rudder Reference transducer. If this is the case, carry out the rudder and motor checks as follows:

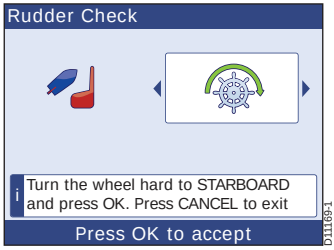


1. Manually center the rudder.

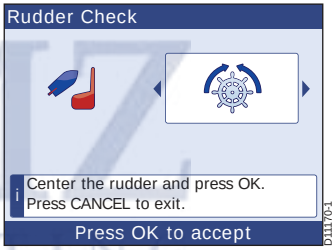
2. Press OK to display the **Rudder Check** (port) page.
3. Turn the wheel fully to port.



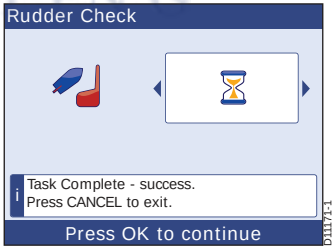
4. Press OK, to display the **Rudder Check** (starboard) page.
5. Turn the wheel fully to starboard.



6. Press OK, to display the **Rudder Check** page (center) again.

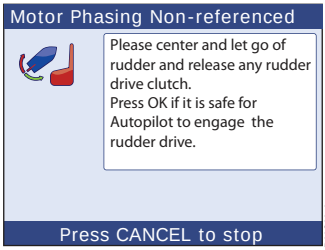


7. Press OK to display the **Rudder Check Task Complete** page.

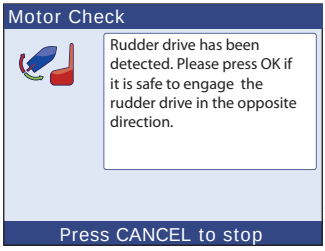


8. Press OK to display the **Motor Check** entry page.

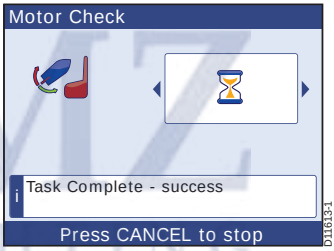
9. Press OK to display a **Motor Check** caution page.



10. Manually center the rudder, then if it is safe to proceed, press OK. The autopilot automatically drives the rudder in one direction. When this is complete a result page is displayed.

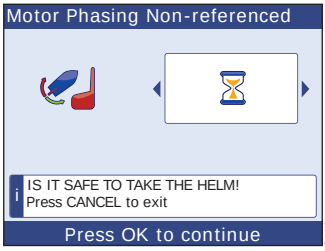


11. If it is safe to proceed, press OK.
    The autopilot then drives the rudder in the opposite direction. When this check is complete, a **Motor Check Task Complete** page is displayed.
12. Press OK to end the autopilot dockside wizard.



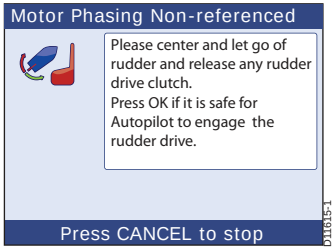
Rudder and motor checks for systems without a rudder reference transducer

After setting the drive type, the **Motor Phasing Non-referenced** entry page is displayed, if your system does not have a Rudder Reference transducer.

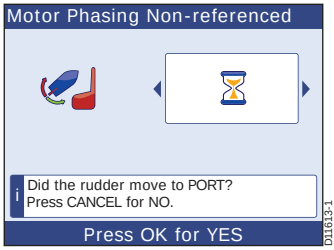


Carry out the rudder and motor checks as follows:

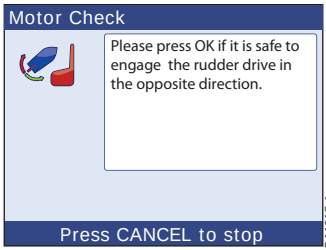
1. Press OK to display a **Motor Check** caution page
2. If it is safe to proceed. press OK, then check which way the autopilot drives the rudder.direction.



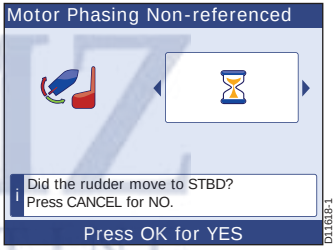
3. When the **PORT** result page is displayed, press either
   - OK if the rudder moved to port, or
   - CANCEL if the rudder did not move to port.



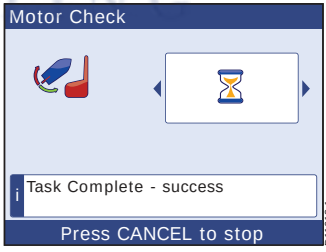
4. If you press OK a second **Motor Check** caution page is displayed.
5. If it is safe to proceed. press OK, then check which way the autopilot drives the rudder.direction.
6. If you press OK a second **Motor Check** caution page is displayed.



7. When the **STBD** result page is displayed, press either
   - OK if the rudder moved to starboard, or
   - CANCEL if the rudder did not move to starboard.



8. If you press OK a task complete page is displayed.
9. Press OK to end the autopilot dockside wizard.



Hard over time

Note: *Not applicable to boats with a rudder reference transducer.*

On boats without a rudder reference transducer, it is of critical importance to set the hard over time, to ensure accurate autopilot operation. To do this:

At a convenient Pilot Controller:

1. Press MENU to display the **Main Menu**.
2. Scroll to **Autopilot calibration** then press OK to display the **Autopilot Autocalibration** menu.
3. Scroll to select the **Drive settings** option then press **OK** to display the **Drive settings** menu.

4. Scroll to select the **Hard Over time** option then press OK to display the **Hard Over time** page.
5. Measure the time it takes for the autopilot to drive the rudder from hard over port, to hard over starboard.
6. On the **Hard over time** page, scroll to set the appropriate time in the edit box.
7. Press OK to save the setting and return to the **Drive settings** menu.

End of autopilot dockside setup

At the end of the autopilot dockside setup, use the CANCEL button to return to a Pilot Controller operational page. Before starting any sea trial or other open water calibration, carry out the *Transducer setup* and *Miscellaneous setup* procedures (below).

Transducer setup

CAUTION:

Before starting any dockside setup procedure, ensure the boat is securely moored alongside.

Use these dockside setup procedures to set:

- Correct depth offset and sea temperature.
- Required method for calculating ground wind.
- Correct magnetic variation.
- Required display response.
- Trim tab calibration.

Introduction to transducer setup

Depth, speed and temperature data are derived from transducers in the boat's hull. Either of the following transducer configurations may be fitted to provide this data:

- Conventional transducers, i.e. separate Depth and Speed, with the water temperature sensor built into the Speed transducer
- Smart transducers (either combined Depth/Speed/Temperature (DST) or combined Depth/Temperature (DT) transducers).

A Wind transducer may also be fitted, to provide wind speed and direction information.

Depth offset and sea temperature must be calibrated as part of the Dockside setup, but the exact method for calibrating these parameters depends on which transducers are fitted:

- With conventional transducers, the Depth offset and water temperature are calibrated separately.
- With a smart transducer, the depth offset and water temperature setup are part of one continuous procedure.

The speed and wind functions are calibrated later as part of the Open water calibration.

Depth offsets

Depths are measured from the Depth transducer to the sea bed, but you can apply an offset value to the depth data, so that the displayed depth reading represents the depth to the sea bed from either the keel or the water line.

If an offset is not applied, the displayed depth readings are from the transducer to the sea bed.

Before attempting to set a **waterline** or **keel** offset, find out the vertical separation between the transducer and either the waterline or the bottom of the keel on your vessel, as appropriate. See *Figure 3-1*.

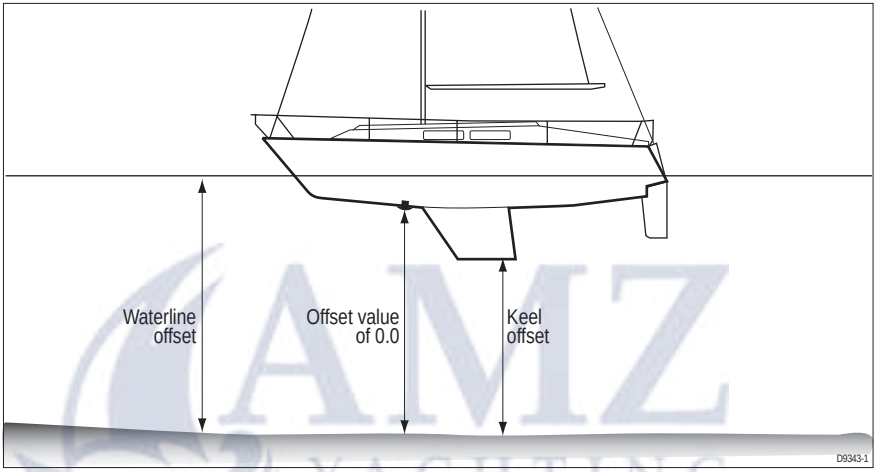


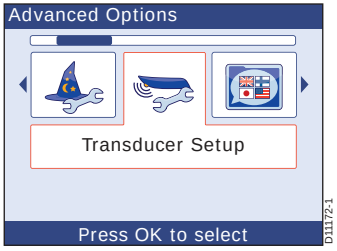
Figure 3-1 Depth offsets

Accessing transducer setup

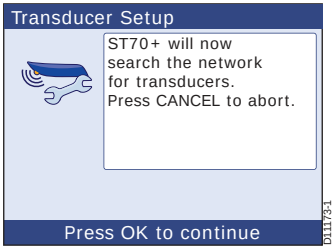
Use the Select Display button on a suitable Instrument keypad, to select a convenient Instrument to carry out the Instrument system dockside setup procedures.

To access the required transducer:

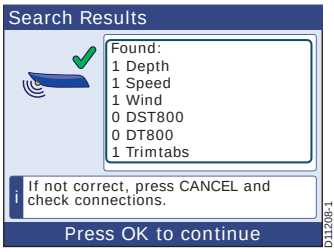
1. With any operational Instrument page displayed, press MENU to display the **Main Menu**.
2. Scroll to **Advanced Options**, then press OK
3. At the **Advanced Options** menu, scroll to **Transducer Setup**.



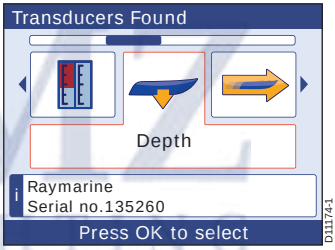
4. Press OK to display the **Transducer setup** start search page.



5. Press OK again to initiate a system search for transducers. At the end of the search, a **Search results** page is displayed.



6. With the search results page displayed, press OK to access the **Transducers found** menu.
7. Set up the following:
   - The correct Depth Offset, using the procedure described under either *Calibrating conventional transducers* or *Calibrating smart transducers* as appropriate
   - The correct Water Temperature using the procedure described under either *Calibrating conventional transducers* or *Calibrating smart transducers* as appropriate.
   - Trim tabs



Calibrating conventional transducers

Use these procedures to calibrate Depth & Temperature values for conventional transducers.

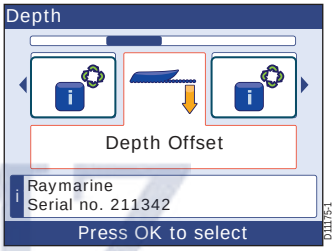
Setting Depth offset

If you want to apply an offset to your depth readings, you MUST ensure the offset value is correct, before relying on subsequent Depth data.

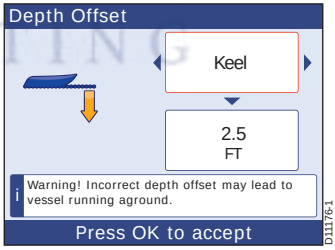
WARNING: Ensure you use the correct depth offset

The use of the correct depth offset is critical to the safety of the vessel. If an incorrect offset value is applied, this could result in misleading depth information being displayed with a consequent risk of running aground. Take great care to ensure you set the correct value.

Set the correct depth offset as follows:



1. With the **Transducers found** menu displayed, select **Depth**. to display the **Depth** transducer menu.
2. With the **Depth** transducer menu displayed, scroll to the **Depth Offset** option, then press OK, to display the **Depth Offset** setup page.
   - Check the type and value of the offset currently applied:
   - If the offset type is what you require and the value is correct for your boat, press CANCEL to return to the **Depth** transducer menu, then proceed from step 6.
   - Otherwise proceed from step *3.*

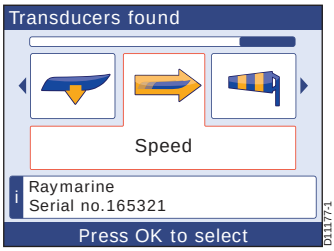


3. If necessary, press PAGE UP to select the upper (offset type) adjust box.
4. Scroll to either **Water line**, **Keel** or **Transducer**, as required. If you select **Transducer**, an offset value of zero is automatically applied.
5. If you have selected:
   - Either **Water line** or **Keel,** press PAGE DN to select the lower (offset value) adjust box then scroll to set the correct value.
   - **Transducer**, ensure the offset value is zero.
6. Press OK to save the offset value and display the **Depth** transducer menu.
7. Press CANCEL to return to the **Transducers found** menu.

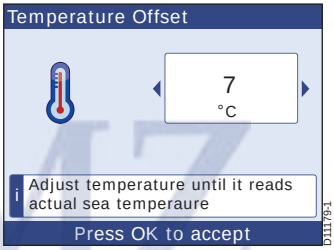
Setting water temperature

Set the correct water temperature as follows:

1. With the **Transducers Found** menu displayed, scroll to the **Speed** option.
2. Press OK to display the **Speed** transducer setup menu.
3. Scroll to the **Temperature Offset** option.
4. Press OK to display the **Temperature Offset** setup page.



5. Using a suitable thermometer, measure the water temperature, then scroll to set the correct system temperature value.
6. Press OK to accept the value and return to the **Speed** transducer menu.
7. Press CANCEL to return to the **Transducers found** menu.
8. Press CANCEL to return to the **Search Results** summary.
9. Press CANCEL to return to the **Transducer Setup** start page.
10. Press CANCEL to return to the **Advanced Options** menu.



Calibrating smart transducers

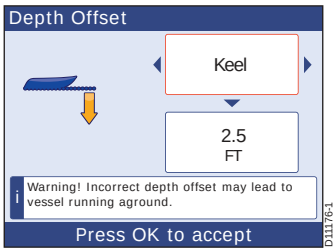
WARNING: Ensure you use the correct depth offset

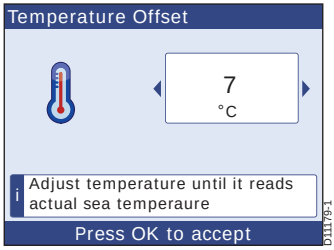
The use of the correct depth offset is critical to the safety of the vessel. If an incorrect offset value is applied, this could result in misleading depth information being displayed with a consequent risk of running aground. Take great care to ensure you set the correct value.

Use this procedure to calibrate Depth & Temperature values for a smart transducer:

1. With the **Transducers found** menu displayed, select **DST** or **DT** to display the **Details** page.
2. Press OK, to display the **Depth Offset** setup page.
3. Check the type and value of the offset currently applied:
   - If the offset type is what you require and the value is correct for your boat, proceed from step 7.
   - Otherwise proceed from step 4.

4. If necessary, press PAGE UP to select the upper (offset type) adjust box.
5. Scroll to either **Water line**, **Keel** or **Transducer**, as required. If you select **Transducer**, an offset value of zero is automatically applied.
6. If you have selected:
   - Either **Water line** or **Keel,** press PAGE DN to select the lower (offset value) adjust box then scroll to set the correct value.
   - **Transducer**, ensure the offset value is zero.
7. Press OK to save the offset value and display the **Temperature offset** page.
8. Using a suitable thermometer, measure the water temperature, then scroll to set the correct system temperature value.
9. Press OK to accept the value.
10. Press CANCEL.

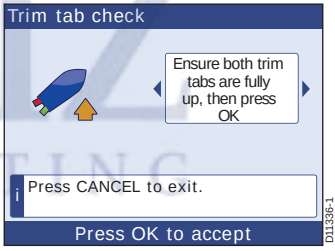




Calibrating trim tabs

If the boat has trim tabs, carry out the following procedure:

1. With the **Transducers found** menu displayed, select **Trimtabs**. to display the **Trim tabs check** (up) page.
2. Raise the trim tabs to the fully up position, then press OK. The **Trim tabs check** (down) page is then displayed.
3. Lower the trim tabs to the fully down position, then when instructed to do so, press OK.



End of transducer setup

When the dockside transducer setup procedures have been completed, carry out the relevant *Miscellaneous setup* procedures.

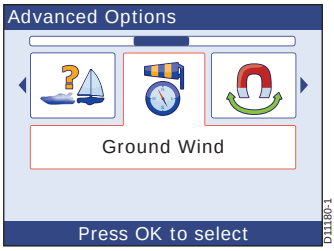
Miscellaneous setup

Setting ground wind

You can choose either Speed Over Ground (SOG) or Speed Through Water (STW) from which to derive the ground wind speed.

To set the required method:

1. At a convenient Instrument keypad press MENU to select the **Main menu**.
2. Scroll to **Advanced Options** then press **OK** to select the **Advanced Options** menu
3. Scroll to select the **Ground Wind** option.



4. Press OK to display the **Ground Wind** setup box.
5. Scroll to select either **STW** or **SOG,** then press OK to return to the **Advanced Options** menu**.**

Now proceed to *Set magnetic variation.*

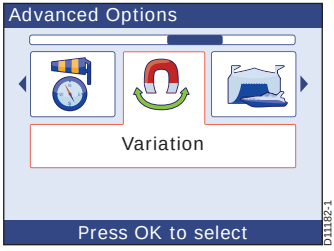
Setting magnetic variation

The magnetic variation is the difference in heading between true north and magnetic north. Before setting this, refer to an up-to-date chart of the area in which you intend using your boat, to ascertain the correct value of magnetic variation.

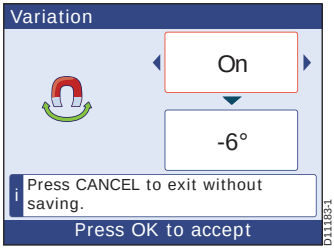
Note: *As the magnetic variation is dependent on your geographical location, you may need to change the magnetic variation value during a long voyage.*

To set the magnetic variation:

1. With the **Advanced Options** menu displayed (as above), scroll to select the **Variation** option.



2. Press OK to display the **Variation** setup box. This has two adjust boxes, an upper box which shows the variation mode, and a lower box that shows the variation value.
3. If necessary, press PAGE UP to select the upper (mode) adjust box.



4. Scroll to select the required mode:
   - Select **ON** if you want to set a value for variation. if you choose this mode, the value you set will be applied to the rest of the system.
   - Select **OFF** if you do not want to apply a variation value to the system.
   - If **SLAVE** is displayed in the mode adjust box, the variation has been set at another product in the system, and the value is shown in the lower adjust box. In this mode. In this case you cannot change the variation value.
5. If you selected the **OFF** or **SLAVE** mode, proceed from step 6. If you selected the **ON** mode:
   i. Press PAGE DN to select the lower (value) box.
   ii. Scroll to set the correct variation value.
6. Press OK to save the value and return to the **Advanced Options** menu.
7. Press CANCEL to return to the **Main Menu**.

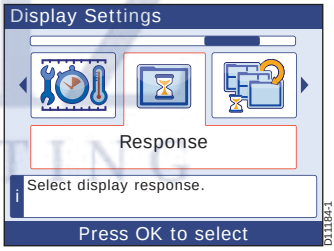
Now proceed to *Changing response rate*.

Changing display response rate

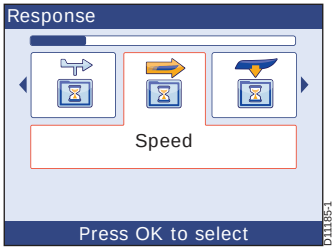
The display response rate determines the rate at which data readings update. You can adjust the response independently for each display and for individual data types, to best suit the conditions under which you are operating.

If you want to change the response at any display:

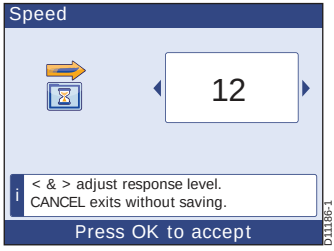
1. With the **Main Menu** displayed, scroll to **Display Settings.**
2. Press OK to display the **Display Settings** menu.
3. At the **Display Settings** menu, scroll to the **Response** option.



4. Press OK to display the **Response** menu, then scroll to the required data type (**Speed** shown here).



5. Press OK to display the response adjust box for the data you have selected.
6. Scroll to set the response rate. A higher value gives a quicker response rate and vice versa.
7. Press OK to save the value and return to the **Response** menu.

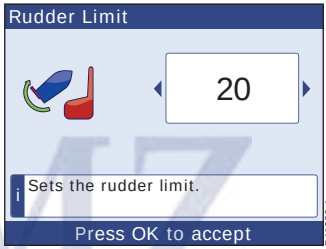


8. If you want to change the response for other data types, scroll to the required data type, then repeat steps 5 to 7.
9. To leave response setup, ensure the **Response** menu is displayed, then:
   i. Press CANCEL to return to the **Display Settings** menu.
   ii. Press CANCEL to return to the **Main Menu**.
   iii. Press CANCEL to return to the operational page.

Rudder limit

The rudder limit adjust function is available only if the rudder reference option is fitted. It enables you to adjust the rudder so it will not put a strain on the end stops. To do this:

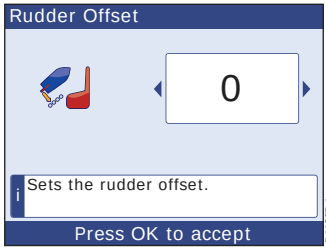
1. At a suitable Pilot Controller keypad, press MENU to display the **Main menu**.
2. Scroll to **Autopilot calibration** then press OK to display the **Autopilot calibration** menu.
3. Scroll to **Drive settings**, then press OK to display the **Drive settings** menu.
4. Scroll to **Rudder limit**, then press OK to display the **Rudder limit** page.
5. Turn the wheel to move the rudder:
   - To the port end stop and note the angle on the rudder bar.
   - To the starboard end stop and note the angle on the rudder bar.
6. Observing the **Rudder limit** page, scroll to set the rudder limit to 5° less than the lowest angle you have noted in each case.
7. Press OK to save the setting and return to the **Drive settings** menu.



Setting rudder offset

The **Rudder offset** page is available only if the rudder reference option is fitted, to enable you to align the rudder reference indicator. To do this:

1. With the **Drive settings** menu displayed, scroll to **Rudder offset**.
2. Press OK to display the **Rudder offset** page.
3. Turn the wheel to center the rudder.
4. Observing the **Rudder offset** page, scroll to set the offset value to 0.
5. Press OK to save the setting and return to the **Drive settings** menu.



Next actions

When the *Initial setup* and *Dockside setup* procedures have been satisfactorily completed, carry out the *Open water calibration*, (below).

3.4 Open water calibration

WARNING: Ensure you have sufficient open space for calibration

The open water calibration manoeuvres require a clear, familiar area of water, with enough depth for your vessel. Ensure you are not likely to collide with any vessel or other obstruction during calibration.

WARNING: Unexpected turns

The autopilot may make unexpected turns during open water calibration. Maintain a speed that will enable safe turns.

Ensure that the *Initial setup* and *Dockside setup* have been satisfactorily completed, then navigate to a familiar area of open water, and carry out the separate *Open water calibration* procedures for the autopilot and instrument systems, as necessary.

Sailing vessels should perform open water calibration under engine power.

Note: *You may exit the calibration process at any time by pressing* CANCEL *on your ST70+ keypad. The next time you power up, you will be prompted to complete calibration.*

Autopilots

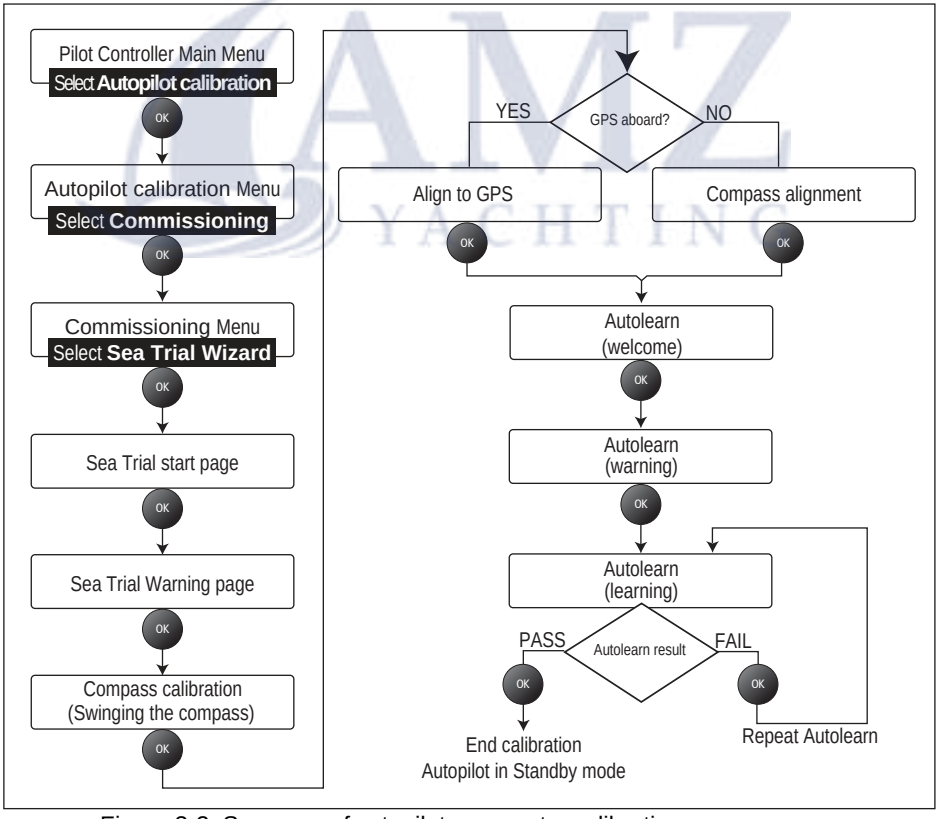


Figure 3-2: Summary of autopilot open water calibration

Starting open water calibration

If the **SeaTrial calibration** page is not displayed, used the following procedure to gain access:

1. Use the Select Display button on an appropriate Pilot Controller keypad, to select the Pilot Controller you want to use to carry out the autopilot open water setup procedures.
2. At the appropriate Pilot Controller keypad, press MENU to display the Main menu page.
3. Scroll to **Autopilot calibration** then press OK to display the Autopilot calibration menu.
4. Scroll to select **Commissioning**, then press OK to display the **Commissioning** menu.
5. Scroll to select **SeaTrial Wizard** , then press OK, to display the **SeaTrial calibration start** page.
6. Press OK. to display a Warning page.
7. Press OK to display the **Swing compass** page, then start the *Compass calibration* procedure.

Compass calibration

The compass calibration procedures are:

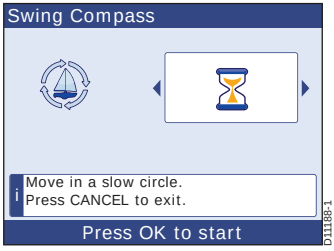
- Swinging the compass.
- Aligning the compass.

Swinging the compass

The magnetic deviation correction procedure (commonly called “swinging the compass”) involves turning your boat in slow circles so the autopilot can automatically determine the deviation and apply any correction required. The correction procedure reduces deviation errors to a few degrees.

As magnetic deviation can cause significant compass errors on your boat, you **MUST** complete the compass swing before any other seatrial procedure.

To swing the compass, ensure the **Swing compass** page is displayed, then when you are ready to turn the boat:



1. Press OK and begin to SLOWLY turn the boat in circles (keeping the boat’s speed below 2 knots).
   - Take at least 2 minutes to complete each 360°.
   - Complete at least two circles.

   If you turn the boat too quickly, the display will show a **Slow down** message. If this occurs, **apply less helm to turn in a larger circle.**

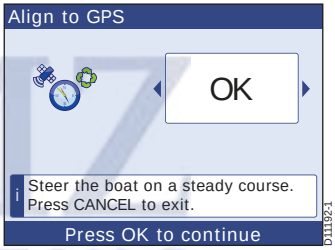
2. When calibration is complete, a message will be displayed showing the detected deviation. If deviation is more than 5 degrees:
   i. Stop the calibration process
   ii. Re-site the compass away from metal items
   iii. Repeat the calibration process.

   If deviation remains at more than 5 degrees, contact your Raymarine dealer for advice.

   If the deviation figure exceeds 15° or the display shows no deviation value, the compass is being affected by ferrous objects on your boat. Move the compass to a better location. Higher deviation figures are acceptable on steel boats.
3. If the deviation is within acceptable limits, press OK to continue calibration:
   - If GPS data is available on the system, the **Align to GPS** screen is displayed. Carry out the *Aligning the compass to GPS* procedure.
   - If your system does not have a GPS, the **Compass Offset** screen is displayed. Carry out the *Aligning the compass manually* procedure.

Aligning the compass to GPS

If a GPS is connected to your data network (SeaTalk, SeaTalk^{ng} or NMEA), the autopilot is set to the GPS heading while you steer to a known magnetic heading. This step provides a rough alignment to reduce the amount of subsequent adjustment required.



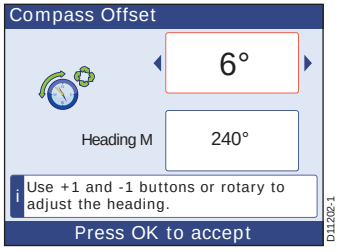
If GPS data is available, align the compass as follows:

1. Steer the boat on steady course and travel above 3 knots.
2. Follow the on-screen instructions until the screen displays the '**OK**' message, then press OK to continue to the **AutoLearn** entry page.

Aligning the compass manually

If GPS data is not available, carry out a manual compass alignment as follows:

1. Steer on a steady course and scroll, to adjust the displayed heading offset in the upper edit box, until the actual heading in the lower box matches the ship's compass reading.



Note: *There may be a slight delay between the adjustment of the heading offset and the change in the value of the actual heading.*

2. When the actual heading value has stabilized, press OK to continue to the **AutoLearn** entry page.

AutoLearn

AutoLearn enables the autopilot to 'learn' the vessel's steering characteristics, by carrying out a number of maneuvers.

WARNING: Clear water

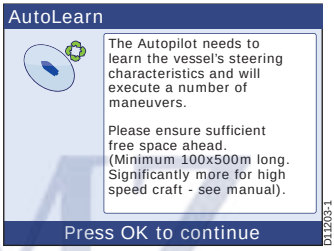
When using Autolearn you must have significant clear water both in front and to the sides of the vessel. This is needed to accommodate a series of maneuvers, which include sudden, sharp turns.

WARNING: Vessel safety

Press the Standby button to return to manual steering at any time during an AutoLearn routine. NEVER compromise vessel safety.

Requirement for a clear area

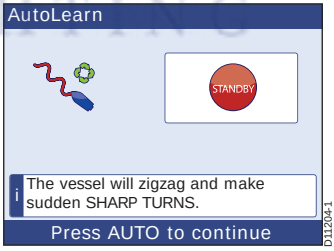
The Autolearn setup feature performs a series of 7 or 8 turns at normal cruising speed. The amount of clear water required depends upon the cruising speed of your vessel, but minimum requirements are.



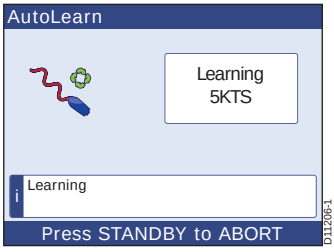
- A typical non-planing vessel at traveling at 6 kts requires a minimum area of clear water 100 m wide and 500 m ahead.
- A typical planing vessel at traveling at 20 kts requires a minimum area of clear water 500 m wide and 2000 m ahead.

Procedure

1. When the AutoLearn entry page is displayed press OK to continue to the **AutoLearn** warning page.
2. Ensure there is sufficient free water in front of the vessel to enable the AutoLearn to be safely completed.

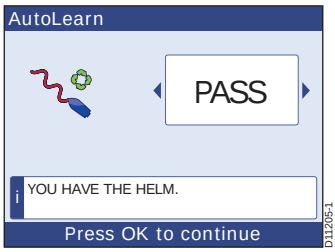


3. Ensure it is safe to proceed, then press AUTO to start the AutoLearn. During AutoLearn:
   - Maintain a normal cruising speed (at least 3 knots).
   - A number of instructions will be displayed. Follow these instructions to complete the procedure.



4. When AutoLearn is complete and a **PASS** message is displayed, then AutoLearn is complete. Press OK to leave calibration and return to normal operation with the autopilot in Standby mode, i.e. with manual helm.

   If **FAIL** is displayed, press OK to repeat the AutoLearn process.



Next actions

Proceed with the open water *Instrument system calibration*.

Instrument system calibration

When the dockside calibration procedures are complete, navigate to a place where you have plenty of sea room then carry out the seatrial calibration procedures for the ST70+ Instruments.

The instrument system open water calibration comprises a preliminary procedure followed by:

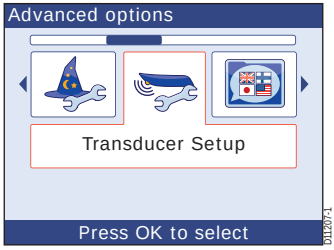
- Wind calibration & alignment.
- Speed calibration.

When you have completed the appropriate procedures, proceed to *Return to normal operation*.

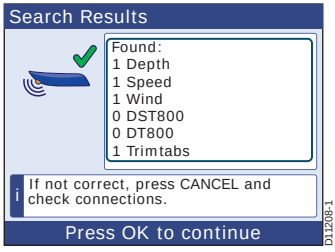
Preliminary procedure

To carry out any Instrument seatrial calibration procedure, switch on the display, then when an operational page is displayed:

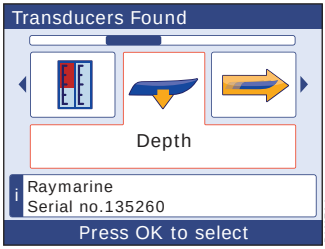
1. With an Instrument operational page displayed, press MENU to select the **Main Menu**.
2. Scroll to **Advanced options.**
3. Press OK to display the **Advanced options** menu..
4. Scroll to the **Transducer Setup** option, then press OK, to display the **Transducer Setup** screen showing a search initiation message.
5. Press OK again, to initiate a search for transducers connected to the system.



6. When the search is complete, a **Search results** page is displayed.



7. Press OK to display the **Transducers found** menu.
8. If you have:
   - A Wind transducer, carry out the *Wind transducer setup* procedure below.
   - A Speed transducer, carry out the *Speed calibration* on *page 47*.



Wind transducer setup

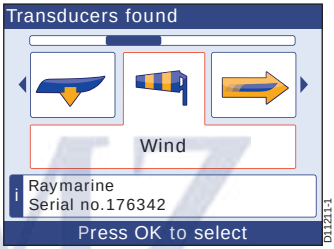
The wind transducer setup procedures are used to:

- Linearize the vane.
- Align the vane.
- Calibrate the wind speed.

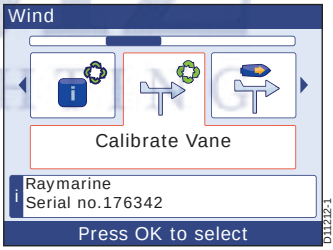
Linearization

To linearize the wind vane:.

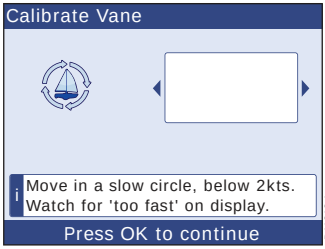
1. With the **Transducers found** menu displayed (see *Preliminary procedure* on *page 45*), scroll to the **Wind** option.
2. Press OK to select the **Wind** transducer setup menu.



3. Scroll to the **Calibrate Vane** option.



4. Press OK to select the **Calibrate Vane** start screen.
5. Keeping the boat speed below 2 knots and observing the screen, turn the boat in circles, then press OK to start the calibration.
6. Observe the **Calibrate Vane** run screen and continue turning the boat:
   - If the boat speed is too high during calibration, a **Slow down** message is displayed. If this happens, reduce your speed.
   - Calibration completes automatically.



7. When calibration is complete, the **Wind** transducer setup menu is displayed.

Alignment

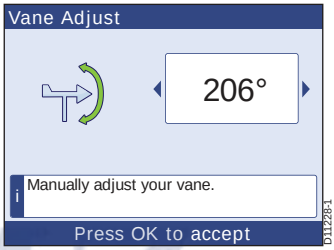
To carry out the wind vane alignment:

1. With the **Wind** transducer setup menu displayed, scroll to **Align Vane**, then press OK to display the **Align Vane** screen
2. Sail the boat directly into the wind, then press OK to accept the alignment and return to the **Wind** transducer setup menu.

Note: *On a calm day, motor fast enough to create 'your own wind'.*

If there is any inaccuracy after you have completed the wind vane alignment, then:

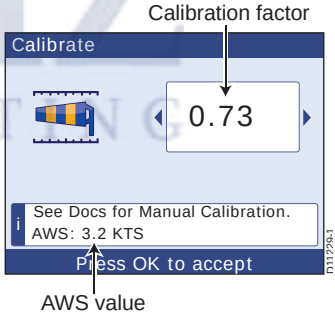
1. At the **Wind** transducer setup menu, select **Vane Adjust**, to display the **Vane Adjust** screen.
2. Sail the boat directly into the wind, then scroll to manually set the wind reading to zero.
3. Press OK to accept the value and return to the **Wind** transducer setup menu.
4. Press CANCEL to return to the **Transducers found** menu.



Calibrate wind speed

To set the correct apparent wind speed reading:

1. With the **Wind** transducer setup menu displayed, scroll to **Calibrate AWS**, then press OK to display the **Calibrate AWS** screen.
2. Scroll to adjust the Calibration Factor so that the AWS value in the information box is set to the correct value.
3. Press OK to accept the value and return to the **Wind** transducer setup menu.
4. Press CANCEL to return to the **Transducers found** menu.



Speed calibration

The object of speed calibration is to ensure that the speed readings at the ST70+ Instruments are true indications of the boat speed, ideally over the speed range of the vessel, i.e. from stationary to top speed.

In order to take into account the changes in water-flow characteristics across the hull, for different speeds, it is advisable carry out speed calibration at as many speeds as possible, over the speed range of the vessel. **This is particularly important for planing vessels**.

Conventional Speed transducers have a maximum of five calibration speeds, and smart transducers (DST800) have up to eight. The correct calibration at each speed is achieved by applying a calibration factor to the indicated speed reading.

In order to achieve accurate results, speed calibration must be carried out in conditions of **zero tide and zero current**.

Carry out the procedure for either *Speed calibration for conventional speed transducer* or the *Speed calibration for smart transducer*, as appropriate for your vessel.

Speed calibration for conventional speed transducer

When calibrating a conventional Speed transducer, you can obtain correct values for the calibration factor by one of two methods:

- If SOG information is available, you can use this as a reference, to enable you to set the correct calibration factor.
- If SOG information is not available, you need to manually calculate and apply the correct calibration factor.

Carry out the *Starting speed calibration* procedure (below) followed by either:

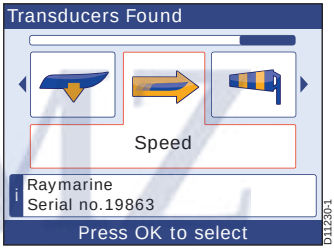
- the *Set to SOG* procedure (*page 49*), or
- the *Manual speed calibration* procedure (*page 49*)

as required.

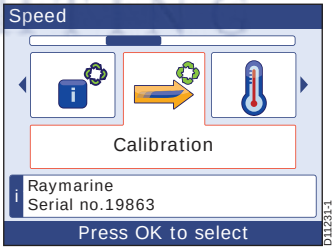
Starting speed calibration

To calibrate the Speed transducer:

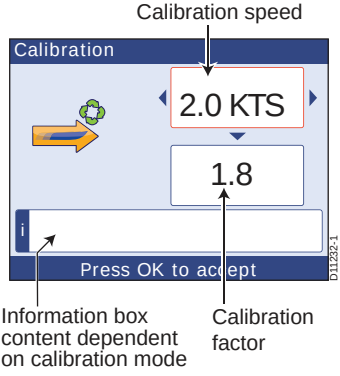
1. With the **Transducers Found** menu displayed (see *Preliminary procedure* on *page 45*), use the appropriate Instrument keypad to scroll to the **Speed** option.



2. Press OK to select the **Speed** transducer setup menu.
3. Scroll to the **Calibration** option.
4. Press **OK** to select the Speed **Calibration** screen



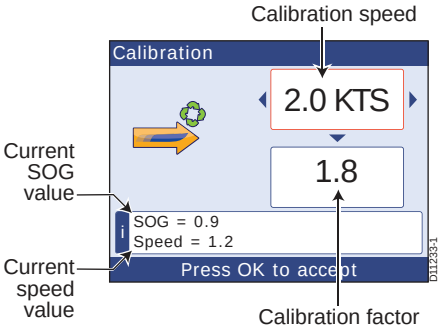
5. Press PAGE UP to highlight the calibration speed field.
6. Scroll to select the lowest calibration speed.
7. Apply the appropriate calibration factor, using one of the following:
   - If SOG information is available, use the *Set to SOG* procedure.
   - If SOG information is not available, carry out the *Manual speed calibration* procedure (on *page 49*)



Set to SOG

To use SOG to set the correct speed:

1. Carry out the *Starting speed calibration* procedure (above).
2. Press PAGE DN to highlight the calibration factor field.
3. In conditions of zero tide and zero current, run your vessel at approximately the selected calibration speed, using the SOG reading as a guide.
4. Scroll to adjust the calibration factor, so the current speed value changes to be the same as SOG
5. Press PAGE UP to highlight the calibration speed field.
6. Scroll to select the next calibration speed.



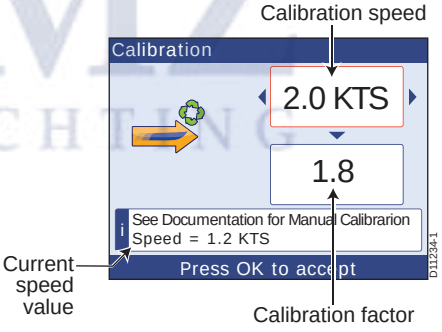
7. Repeat *Set to SOG* steps 2 to 6, until calibration factor values have been set for all calibration speeds.
8. Press OK to save the values and return to the **Speed** transducer setup menu.
9. Press CANCEL to return to the Transducers found menu.

Manual speed calibration

You only need to carry out a manual speed calibration if SOG data is not available. If you have successfully calibrated your system using SOG data, ignore this manual procedure.

To manually calibrate a conventional speed transducer:

1. Using the appropriate start speed calibration procedure (above), display the speed **Calibration** screen and select the calibration speed field.



2. In conditions of zero tide and zero current, run your vessel at a steady speed approximately that of the selected calibration speed, over a measured distance.When you do this, make a note of:
   - The current speed value.
   - The time it takes to cover the measured distance.
3. Calculate the actual speed over the measured distance (distance/time).

4. If the calculated speed is:
   - The same as the current speed value noted during the calibration run, then the calibration is correct at this speed, so proceed from *Manual calibration* step 6.
   - Not the same as the indicated speed:
     i. Calculate a new, corrected calibration factor, as follows

$$\text{new calibration factor} = \frac{\text{actual speed x old calibration factor}}{\text{indicated speed}}$$

     ii. Press PAGE DN to highlight the calibration factor value field.
     iii. Scroll to set the displayed calibration factor to the new calculated value.
5. Repeat *Manual calibration* steps 2 to 4, until the current speed value displayed during the calibration run is the same as the calculated speed.
6. Press PAGE UP to highlight the calibration speed field.
7. Scroll to select the next calibration speed.
8. Repeat *Manual calibration* steps 2 to 7, until the calibration factor values are correct at all calibration speeds.
9. Press OK to save the values and return to the **Speed** transducer setup menu.
10. Press CANCEL to return to the Transducers found menu.

Speed calibration for smart transducer

When fitted, a smart (DST800) transducer is calibrated to a set of six default speeds:

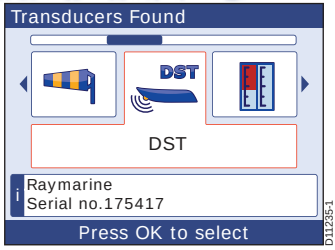
- 0.5 kt, 1.5 kt, 2.8 kt, 4.8 kt, 10.6 kt and 80 kt

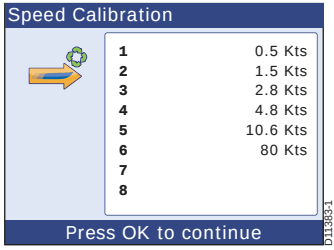
These values provide acceptable transducer performance in most circumstances.

However you can insert and/delete different calibration speeds, up to a maximum of eight, to provide a range of speed values to best suit the way the boat will be used.

To do this:

1. With the **Transducers Found** menu displayed (see *Preliminary procedure* on *page 45*), scroll to the **DST** option.
2. Press OK to select the DST **Details** page, then press OK, to display the **Depth Offset** setup page.
3. Ensure the correct depth offset is correct, then press OK to display the DST **Temperature** page.
4. Press OK again to display the **Speed Calibration** page. This shows the list of speeds to which the DST800 transducer is calibrated.
5. To change these speeds, press OK to display the **Airmar Speed Calibration** menu. This gives the following options:
   - **Add point**. Use this to add a speed value to the list of calibration speeds (see below).
   - **Delete point**. Use this to remove a speed value from the list of calibration speeds (see below).
   - **Factory Reset**. Use this to reapply the default list of calibration speeds.

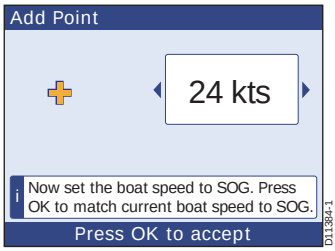




Add point

To add a new speed calibration value:

1. At the **Airmar Speed Calibration** menu, scroll to Add point then press OK to display the **Add Point** page.
2. Set your boat speed through the water so that the displayed SOG value is the speed you want as a calibration speed.
3. Press OK to add this to confirm this as a calibration speed and return to the **Speed Calibration** page.
4. Repeat steps 1 to 3 for all speeds appropriate to your vessel.



Delete point

To delete a speed calibration value:

1. At the **Airmar Speed Calibration** menu, scroll to **Delete point** then press OK to display the **Delete Point** page.
2. Scroll to display the speed value you want to delete.
3. Press OK to delete this value and return to the **Speed Calibration** page.
4. Repeat steps 1 to 3 for all speeds you want to delete.

Return to normal operation

When you have completed all the appropriate dockside setup and seatrial calibration procedures, return to normal operation as follows:

1. With the Transducers found menu displayed, press CANCEL to select the **Search Results** screen.
2. Press CANCEL to select the **Transducer Setup** screen showing the search initiation message.
3. Press CANCEL to select the **Advanced options** menu.
4. Press CANCEL to select the **Main Menu**.
5. Press CANCEL to return to normal operation.

3.5 Checking autopilot operation

General

After completing calibration, check the basic autopilot operation, as follows:

1. Steer onto a compass heading and hold a steady course at normal cruising speed. If necessary, steer the boat manually for a short time to check how the boat steers.
2. Ensure it is safe to engage the autopilot, then at a convenient Pilot Controller keypad press AUTO to lock onto the current heading. The autopilot should hold a constant heading in calm sea conditions.
3. Use -1, +1, -10 and +10 or the Rotary Control, to see how the SmartPilot alters the course to port and starboard.
4. Press STANDBY to return to manual steering.

Checking rudder gain

To determine whether the rudder gain is set correctly, carry out the following test:

1. Ensure you have set the autopilot response to level **5**, as described above.
2. Motor your boat at a typical cruising speed in clear water.
   It is easier to recognize the steering response in calm sea conditions where wave action does not mask steering performance.
3. Press AUTO to enter Auto mode, then alter course by 40°:
   - This course change should result in a crisp turn followed by an overshoot of no more than 5°, If the rudder gain is adjusted correctly.
   - If the course change causes a distinct overshoot (more than 5°) and/or there is a distinct 'S' in the course (as at **A** in *Figure 3-3*), the rudder gain is too high.
   - If the boat's performance is sluggish and it takes a long time to make the 40° turn, with no overshoot (as at **B** in *Figure 3-3*), the rudder gain is too low.

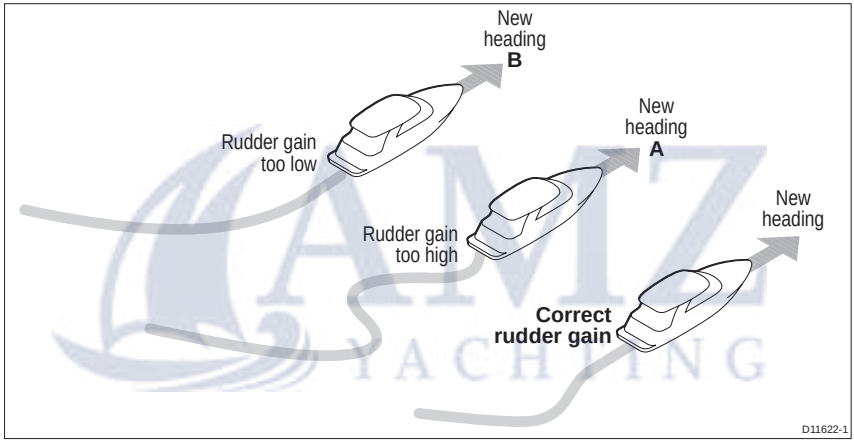


Figure 3-3: The affect of different rudder gain values

If necessary, use the *Setting rudder gain* procedure in the *ST70+ User Reference Manual*, to improve autopilot performance.

Checking counter rudder

To check the counter rudder setting:

1. Ensure you have set the response to level **5**, as described above.
2. Motor your boat at cruising speed in clear water.
3. Press AUTO to switch the autopilot to Auto mode, then make a 90° course change:
   - When rudder gain and counter rudder are both set correctly, the boat performs a smooth continuous turn with minimal overshoot.
   - If the counter rudder is too low, the boat will still overshoot.
   - If counter rudder is too high, the boat will 'fight' the turn and make a series of short, sharp turns: this results in a very 'mechanical' feel as the boat changes course.

If necessary, use the *Setting counter rudder* procedure in the *ST70+ User Reference Manual*, to improve autopilot performance.

Rudder damping

If the autopilot is 'hunting', i.e. continuously moving the steering backwards and forwards by small amounts, use the *Setting rudder damping* procedure in the *ST70+ User Reference Manual*, to improve autopilot performance.

Setting AutoTrim

AutoTrim determines how quickly the autopilot applies 'standing helm' to correct for trim changes, caused, for example, by changes in the wind load on the superstructure, or an imbalance of engines.

Increasing the AutoTrim level reduces the time the autopilot takes to return to the correct course, but makes the boat less stable. If the autopilot:

- Gives unstable course keeping and the boat 'snakes' around the desired course, **decrease** the AutoTrim level.
- Hangs off course for excessive periods of time, **increase** the AutoTrim level.

If necessary, use the *Setting AutoTrim* procedure in the *ST70+ User Reference Manual*, to improve autopilot performance.

3.6 After commissioning

When the dockside setup and open water calibration have been completed, and you have returned to normal operation, your ST70+ system is ready for use. Refer to the *ST70+ Operating Guide* for instructions on how to use ST70+ on a day-to-day basis.

EMC conformance

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

To do this:

1. Turn on all transmitting equipment (radar, VHF radio etc.).
2. Check that all electronic systems are unaffected by the transmitting equipment (e.g. without undue interference).

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Appendix 1: Specifications

Display

Screen	6.5” Color VGA TFT-LCD
Aspect ratio	4:3
Resolution	640 x 480 pixels
Viewing angles (max)	55° from each side, 30° from above, 60° from below
Backlight	White LED,
Dimensions	
Overall	7.44 in (189 mm) x 6 in (152 mm) x 1.92 in (48.8 mm)
Weight	2 lb (1 kg)
Main power supply	
Voltage (working):	10 V to 16 V dc
Voltage (nominal):	12 V dc
Power consumption:	Maximum 11 W, standby 3 W
Inrush current (max peak):	1 A
SeaTalk^{ng} power supply	
Voltage (working):	9 V to 16 V dc
Voltage (nominal):	12 V dc
LEN:	1
Inrush Current (max peak):	1A
Approvals	EMC Directive 2004/108/EC Australian/NZ C-Tick

Keypads

All types

Power supply (SeaTalk^{ng})	
Voltage (working):	9 V to 16 V dc
Voltage (nominal):	12 V dc
Power consumption:	Maximum 11 W, standby 3 W
LEN:	2
Inrush current (max peak):	1A
Weight	10.5 oz (300 g)
Approvals	EMC Directive 2004/108/EC Australian/NZ C-Tick

Instrument keypad

Dimensions (overall)	3.62 in (92 mm) x 5.35 in (136 mm) x 2.24 in (57 mm)	
Buttons	Power ( )	Select Display ( )
	CANCEL	PAGE UP
	MENU	PAGE DN
Rotary Control	Rotate to select/adjust Press in to perform OK function	

Pilot Controller (power boat) keypad

Dimensions (overall)	3.62 in (92 mm) x 5.35 in (136 mm) x 2.24 in (57 mm)	
Buttons	Power ( )	Select Display ( )
	STANDBY	AUTO
	MENU	DODGE
	CANCEL	TRACK
Rotary Control	Rotate to select/adjust Press in to perform OK function	

Pilot Controller (sail boat) keypad

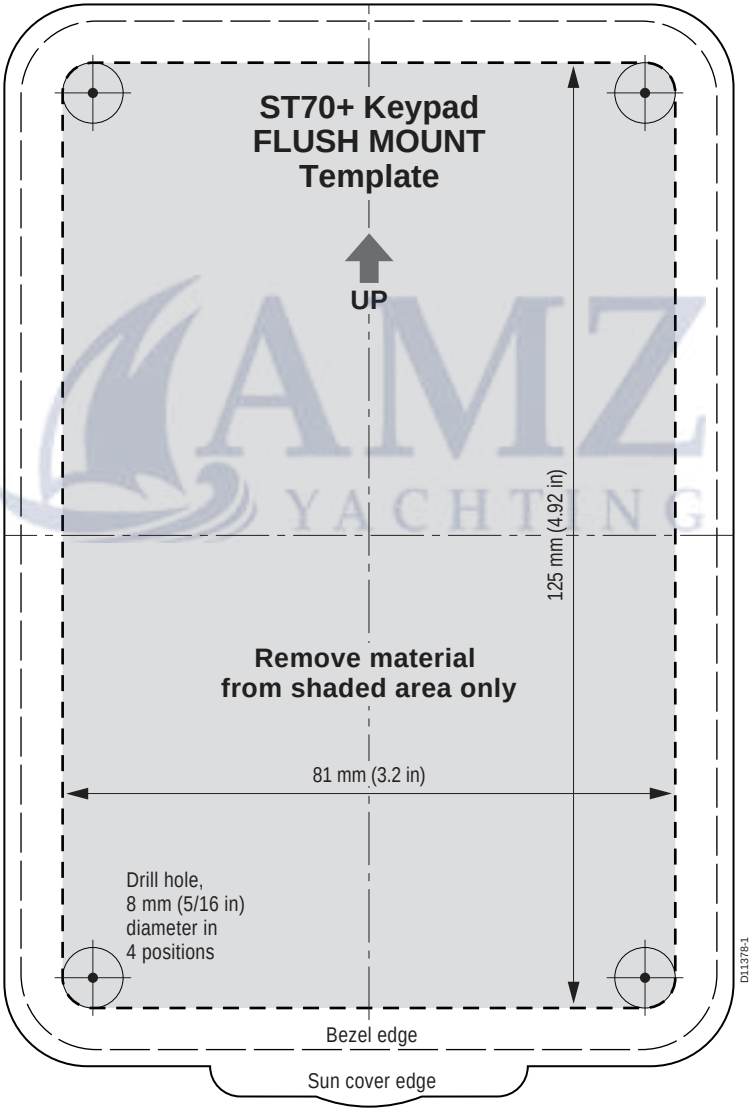
Dimensions (overall)	3.62 in (92 mm) x 5.35 in (136 mm) x 1.63 in (41.5 mm)	
Buttons	Power ( )	Select Display ( )
	STANDBY	AUTO
	MENU	DODGE
	CANCEL	TRACK
	-1	+1
	-10	+10
	OK	

Index

Templates

This section provides templates for flush mounting and surface mounting ST70+ keypads. Flush and surface mount templates for the ST70+ displays are provided in a separate document 87107, provided with the product.

ST70+ keypad flush mount template



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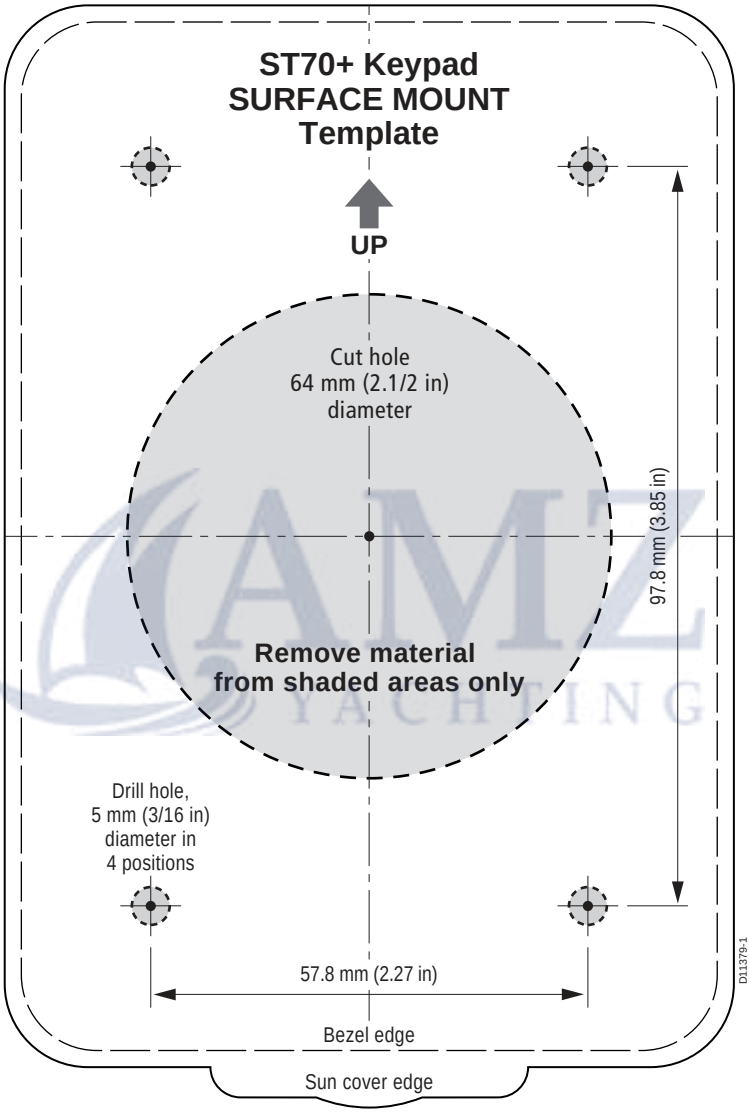
ST70+ keypad surface mount template



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