ST70 Autopilot Controller

SmartPilot X Commissioning Instructions

Contents

Preface

Warnings and cautions

WARNING: Product installation & operation
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.

CAUTION:
Before commissioning the SmartPilot X system, check that individual components are the correct voltage for your boat's supply.

As correct performance of the boat's steering is critical, we **STRONGLY RECOMMEND** that an Authorized Raymarine Service Representative commissions this product. You will only receive full warranty benefits if you can show that an Authorized Raymarine Service Representative has installed or commissioned this product.

WARNING: Electrical safety
The power supply must be switched off before making any adjustments to system hardware: components or cabling.

WARNING: Navigational safety
Although Raymarine designs all its products to be accurate and reliable, many factors can affect product performance. Raymarine products should serve only as an aid to navigation and should never replace commonsense and navigational judgement. Always maintain a permanent watch so you can respond to situations as they develop.

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.

EMC 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 recommend that:

- Raymarine equipment and the cables connected to it are:
    - At least 3 ft (1 m) from any equipment transmitting or cables carrying radio signals e.g. VHF radios, cables and antennas. In the case of SSB radios, the distance should be increased to 7ft (2m).
    - More than 7 ft (2 m) from the path of a radar beam. A radar beam can normally be assumed to spread 20 degrees above and below the radiating element.
- The product is supplied from a separate battery 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.
- Raymarine specified cables are used.
- Cables are not cut or extended 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 EMC performance for the installation.

Suppression ferrites

Raymarine cables may be fitted with suppression ferrites. These are important for correct EMC performance. Any ferrite removed to facilitate installation must be replaced in the original position immediately 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.

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).

Compass

The compass is sensitive to magnetic influences and other potential sources of interference including engines and VHF radio waves. To ensure optimum operation it is essential to locate the compass correctly. For detailed instructions refer to the separate installation information supplied with the compass.

To the best of our knowledge, the information in the product documents was correct when they went to press. However, Raymarine cannot accept liability for any inaccuracies or omissions in product documents.

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

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.

Chapter 1:   Before you begin

To achieve proper and reliable commissioning of your SmartPilot X system, installation and commissioning must be carried out by a competent professional.

WARNING: Commissioning requirement
For proper control of your boat, you MUST commission your SmartPilot X system using the instructions contained in this guide. Failure to do this could cause poor product performance which could result in personal injury and/or damage to your boat, unreliable course keeping and erratic behavior.
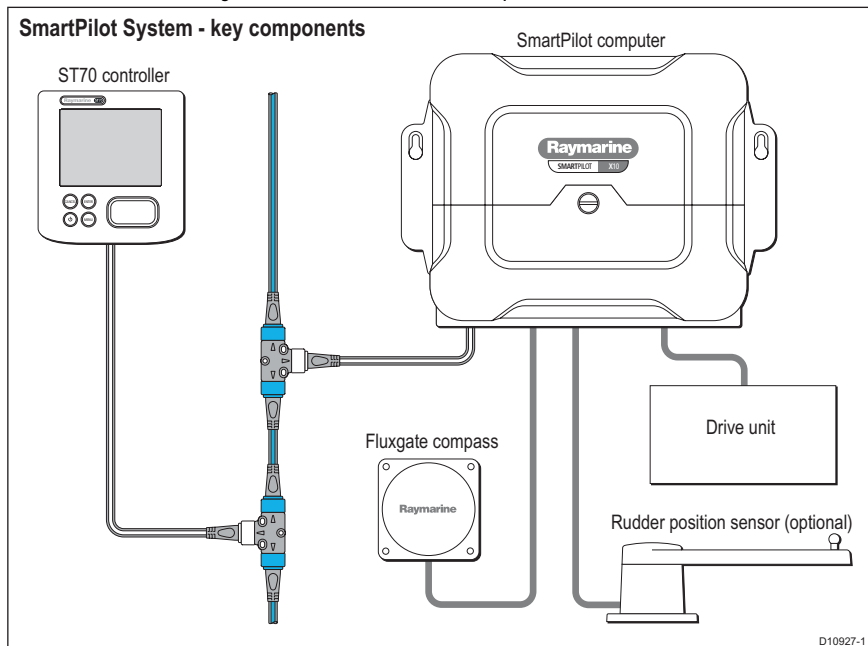
1.1   Commissioning overview

Commissioning is an essential procedure following installation, consisting of a series of dockside safety checks and a seatrial calibration. Use this manual to guide you through the commissioning procedure for a newly installed SmartPilot X system with an ST70 autopilot controller. (For ST70 operating principles, refer to your ST70 Pilot Controller User Reference Guide).

If your autopilot system has previously been commissioned successfully and has an existing ST70 autopilot controller, you do not need to repeat the commissioning process, unless you wish to recalibrate your system.

Note: *To commission an SmartPilot X system using a SmartPilot controller (ST6002, ST7002, ST8002), refer to the SmartPilot Series Commissioning Guide (part no. 81273).*

SPX SmartPilot system with ST70 autopilot controller

SmartPilot System - key components

ST70 controller

SmartPilot computer

Fluxgate compass

Drive unit

Rudder position sensor (optional)

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Commissioning pre-requisites

Before commissioning the SmartPilot X system, check that the following processes have been carried out correctly:

- Autopilot system installation completed in accordance with the SmartPilot X Installation Guide.
- SeaTalk[ng] network installed in accordance with the SeaTalk[ng] Reference Manual.
- GPS installation and connections carried out in accordance with the GPS installation guide.

Check also that the commissioning engineer is familiar with the installation and components of the autopilot system including:

- Vessel type.
- What the autopilot will be used for.
- System layout: components and connections (you should have a schematic of the boat's autopilot system).

Commissioning process

- Check you have adhered to commissioning pre-requisites.
- Initial setup: switch on, system settings.
- Dockside calibration.
- Seatrial calibration.
- SmartPilot X system ready for use.

1.2 Certified installation

Raymarine recommends certified installation by a Raymarine approved installer. A certified installation qualifies for enhanced warranty benefits. (See the separate warranty card packed with your product.) For more information on certified installation contact your Raymarine dealer or refer to the Raymarine web site: www.raymarine.com.

1.3 Further assistance

Comprehensive customer support is available online and by telephone.

www.raymarine.com

In the Customer Service area you will find:

- Frequently Asked Questions (FAQs).
- Servicing information.
- Email access to the Raymarine Technical Support Department.
- Details of Raymarine agents worldwide.

Telephone helpline

In the USA
+1 603 881 5200 extension 2444

In the UK, Europe, the Middle East or the Far East
+44 (0) 23 9271 4713 (voice)

+44 (0) 23 9266 1228 (fax)

Help us to help you

When requesting service, please quote as much of the following product information as possible:

- Product type
- Model number
- Serial number
- Software issue number

1.4 Product documents

The following documents are available from **www.raymarine.com/handbooks** to help you install and operate an autopilot system based around the SPX SmartPilot:

Document	Part number
SmartPilot X Commissioning Instructions (this document). Following installation, this document, which is supplied with your autopilot controller, must be used to correctly commission your autopilot system before it can be used.	**81287-1**
SmartPilot X System Installation Guide. Professional installers should use this guide to ensure effective installation/set up of a **SmartPilot X** system.	**87071-1**
SeaTalk^{ng} Reference Manual. This provides detailed information regarding SeaTalk^{ng} connectivity.	**81300-1**
ST70 Pilot Controller User Reference Guide. Supplied with the ST70 autopilot controller.	**81288-1**
Product installation guides. Separate installation sheets are provided with individual components of the autopilot system including the compass, rudder reference sensor, controller and drive	

To the best of our knowledge, the information in the product documents was correct when they went to press. However, Raymarine cannot accept liability for any inaccuracies or omissions in product documents.

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

Chapter 2: Commissioning procedures

⚠️ **WARNING: Calibration requirement**
All autopilot systems must be calibrated before use.

This chapter will guide you through the commissioning process for an SmartPilot X system. It includes:

- Initial setup.
- Dockside calibration.
- Seatrial calibration.

The ST70 Autopilot Controller has an initial setup and calibration wizard, which will take you through the commissioning process. Your autopilot will select the setup screens relevant to your system. Those that are not relevant will be skipped automatically.

Note: *If you already have an ST70 instrument installed, some settings will be automatically transferred from that and the wizard will skip those settings.*

2.1 Switching on and initial setup

With the boat safely tied up, use these *initial setup* instructions to switch on the autopilot system and controller, and to carry out the following initial setup procedures:

- Select language.
- Set boat type.
- Set date and time format (only if GPS is fitted).
- Set correct local time (only if GPS is not fitted).
- Set required data units.

Note: *In order to carry out calibration procedures you must complete initial setup.*

If the system has previously been set up and calibrated this part of the setup wizard will not be displayed and you can continue immediately with dockside calibration.

Switch on

1. Once you are sure the SmartPilot X system has been installed correctly in accordance with the SmartPilot X installation guide, switch on the main power breaker.

2. Switch on the ST70 autopilot controller by holding down the On/Standby button for 1 second.

On/Standby button

3. If the SmartPilot X and ST70 autopilot controller are active, the ST70 will display the **Select Language** menu.

Troubleshooting

- If the display is blank, check the fuse/circuit breaker and the SeaTalk^{ng} fuse in the SmartPilot X computer.

- If the display shows the SEATALK^{NG} FAIL or NO DATA alarm message, check the SeaTalk^{ng} connections.

Initial setup

Select language

Use < and > to select the required language, then press **ENTER** to display the 'Welcome' screen. When you are ready to proceed, press **ENTER** to display the **Set Vessel Type** screen.

Select Vessel Type

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

- Race Sail
- Catamaran
- RIB
- Inboard Speedboat
- Power Cruiser 2 (up to 30 Kts)
- Sport Fishing

- Sail Cruiser
- Workboat
- Outboard Speedboat
- Power Cruiser 1 (up to 12 Kts)
- Power Cruiser 3 (30 Kts+)
- Pro Fishing

1. Use < and > to select the boat type that is most appropriate to your vessel.
2. When you have chosen the boat type, press **ENTER** to confirm the choice.

If your system is receiving GPS information, a **Time & Date** summary page is displayed next. If your system is not receiving GPS information, the next screen you will see will be Data units (see *Data units* on *page 8*) unless you already have an ST70 instrument installed.
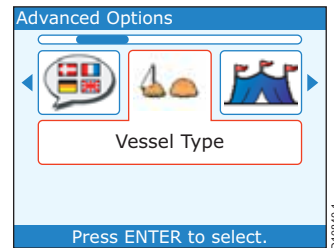
Time & Date

If necessary, you can set the format of the date and time:

- You can select either DD/MM/YY or MM/DD/YY as the date format
- You can select either 12-hour (am/pm) or 24-hour as the time format.

With the **Time & Date** summary page displayed, check the date and time, then press **ENTER** to display the **Time & Date** setup menu.

Set date format

To set the required date format:

1. At the **Time & Date** setup menu, use < and > to select the **Set date format** option, then press **ENTER**, to display the **Set date format** page.
2. Use < and > to select the required Date Format, then press **ENTER**, to save the format and return to the **Time & Date** setup menu.
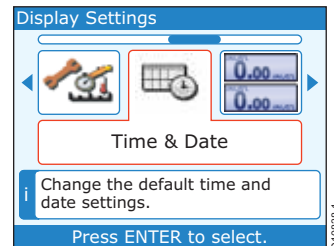
Set time format.

To set the required time format:

1. At the **Time & Date** setup menu, use < and > to select the **Time Format** option, then press **ENTER**, to display the **Set time format** page.
2. Use < and > to select the required Time Format, then press **ENTER**, to save the format and return to the **Time & Date** setup menu.

Set local time

To set the pilot controller time to your local time:

1. At the **Time & Date** setup menu, use < and > to select the **Set time offset** option, then press **ENTER**, to display the **Set time offset** page.
2. Use < and > to set the correct local time. For example, if your local time is 1 hour after GMT, set **+1**, then press **ENTER**, 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. Display the **Time & Date** setup menu.
2. Use < and > to select the **Continue** option.
3. Press **ENTER**, to proceed to the **Units** summary page which shows the units currently in use.

Data units

You can set the units you want to use for displaying data. You can set:

- Speed: miles per hour, kilometers per hour or knots.
- Depth: feet, fathoms or meters.
- Distance: either miles, nautical miles or kilometers.
- Wind speed: knots or meters per second.
- Heading: magnetic or true.
- Temperature: degrees Celsius or degrees Fahrenheit.
- Flow rate: gallons per hour or liters per hour.
- Number of engines from 1 to 5.
- No of batteries from 1 to 5.
- Pressure: pounds per square inch, bar, or kilo pascal.
- Volume: liters, UK gallons or US gallons.
- Number of fuel tanks from 1 to 5.

When you are ready to proceed:

1. Press **ENTER** to display the second **Units** summary page.
2. Press **ENTER** again, to display the **Units** menu.

To set the required units:

1. Use < and > to select the type of data you want to change, i.e. Speed, Depth, Distance etc.
2. Press **ENTER**, to display the setup page for the units you have selected.
3. Use < and > to select the required units.
4. Press **ENTER**, to save the units setting and return to the **Units** setup menu.
5. Repeat steps 1 to 4 for all data types you want to set.

Leaving units setup

When all units are set to your preferences, display the **Units** menu, then:

1. Use < and > to select the **Continue** option.
2. Press **ENTER**, to complete initial setup.
3. Press **ENTER** to leave Initial Setup and proceed to the first calibration page.

Note: *If necessary, the initial setup values can be changed later, via the Main Menu.*

2.2 Dockside calibration

When the initial setup is complete, the ST70 autopilot controller will determine whether the SmartPilot X has been calibrated. If it has, you may begin to use your ST70 immediately. If not, the on screen wizard will then take you through the calibration process, starting with dockside calibration.

Dockside Calibration

Before you can use your autopilot you need to do some dockside checks.

Press CANCEL to exit without saving.

Press ENTER to continue.

If the system has already been calibrated but you wish to repeat the process, you can run the Setup Wizard from the Advanced Options menu, accessible from the main menu.
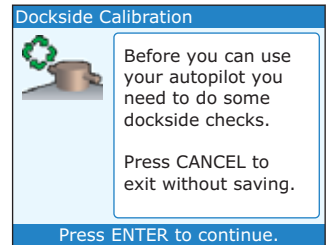
WARNING: Ensure proper control
For proper control of your boat, you MUST complete the dockside checks before starting the initial seatrial.

With the boat still safely tied up, use these *dockside calibration* instructions to:

- Set up the drive.
- Check the rudder.
- Check motor phasing (test the drive).

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

Drive setup

1. Press **ENTER** to begin drive setup
2. Press **ENTER** to select drive type from the following:
   - Type 1 or 2 linear
   - Type 2 or 3 hydraulic linear
   - I/O stern
   - IPS
   - Jet drive (pump or fly-by-wire)
   - Wheel drive
   - Tiller
   - CR solenoid
   - Sport drive
   - Type 1 or 2 rotary
   - Type 1, 2 or 3 hydraulic pump
   - Constant running pump
   - Verado

If you drive type is not listed, contact your Raymarine dealer for advice.

Rudder check

WARNING: If no rudder reference has been fitted you MUST ensure that adequate provision is made to prevent the steering mechanism from impacting the end stops.

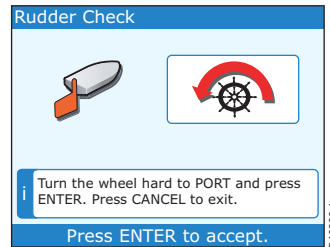**Note:** *Systems without a rudder reference will skip this section and go straight to seatrial calibration.*

This procedure establishes port and starboard rudder limits. Fine-tuning adjustments to the rudder position may be made during seatrial calibration. You can exit this procedure at any time by pressing **CANCEL**.
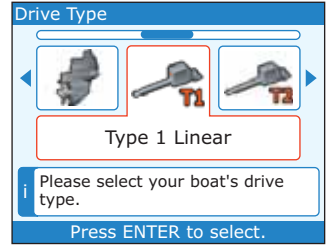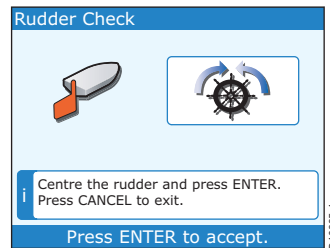
1. Turn the rudder hard to starboard and press **ENTER**.

Rudder Check

i Turn the wheel hard to STARBOARD and press ENTER. Press CANCEL to exit.

Press ENTER to accept.

D10902-1
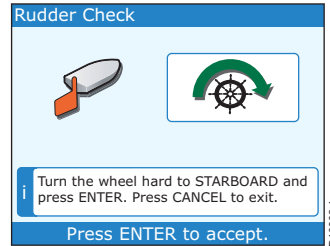
2. When prompted, turn the rudder hard to port and press **ENTER**.

Rudder Check

i Turn the wheel hard to PORT and press ENTER. Press CANCEL to exit.

Press ENTER to accept.

D10900-1

3. When prompted, center the wheel and press **ENTER**.

Rudder Check

i Centre the rudder and press ENTER. Press CANCEL to exit.

Press ENTER to accept.

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Motor phasing check

The system will check the drive connection from the SmartPilot X. Once it has completed the check successfully, a message will appear asking if it is safe for the system to take the helm.

1. Press **ENTER** to continue.
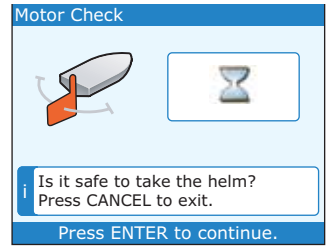
2. If the rudder moves to port, press **ENTER**. If it moves to starboard, press **CANCEL**.
3. When prompted, press **ENTER** to confirm that the motor phase is now correct.

The system now knows which signals to send the rudder control for turns to port and starboard.
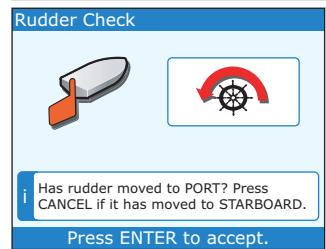
Dockside calibration complete

Once you have completed all the dockside setup, checks and calibration, you may take your boat out to an area of calm water to commence seatrial calibration.

2.3 Seatrial calibration

WARNING: Ensure you have sufficient sea room for calibration. The seatrial calibration manoeuvres require a clear, familiar area of water. Ensure you are not likely to collide with any vessel or other obstruction during calibration.

**WARNING: Maintain sensible speeds. The autopilot may make unexpected turns.**

CAUTION: Sailing vessels should perform the sea trial under engine power.

When the dockside setup and calibration procedures are complete, navigate to a place where you have plenty of sea room, then carry out the seatrial calibration procedures to complete the SmartPilot X system commissioning.

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

Begin Seatrial calibration

1. Press **ENTER** to begin seatrial calibration.
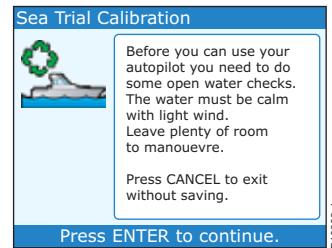
2.) Press **ENTER** for standby warning message.

3.) Press **ENTER** to begin compass calibration.

> **Sea Trial Calibration**
>
> Before you can use your autopilot you need to do some open water checks. The water must be calm with light wind. Leave plenty of room to manoeuvre.
>
> Press CANCEL to exit without saving.
>
> **Press ENTER to continue.**
>
> D10903-1

> **Sea Trial Calibration**
>
> **STANDBY**
>
> IMPORTANT!
>
> You can press STANDBY at any time to take over the helm.
>
> **Press ENTER to continue.**
>
> D10904-1

Compass swing

You will need to turn your boat in slow circles while the system automatically makes adjustments to account for compass deviation. Each 360-degree circle should take no less than two minutes, and you should complete at least two circles.

1. Press **ENTER** and begin to turn your boat in slow, even circles. Keep speed to below 2 knots. Watch the display to ensure you are not turning too fast. If the message 'Slow Down' is displayed you will need to slow down.
2. When the compass has been calibrated, a message will be displayed showing the detected deviation. If this is more than 5 degrees you will need to abort the calibration

process and resite the compass further away from metal items, then repeat the calibration process.

If you still find a deviation of more than 5 degrees, contact your Raymarine dealer for advice.

If the deviation is within acceptable limits, press **ENTER** to continue calibration.
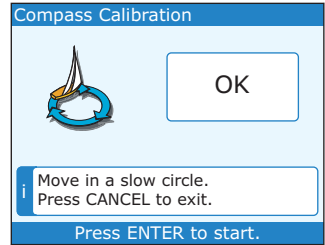
Compass alignment to GPS

Note: *Systems without a GPS will skip this section and go straight to Manual compass alignment on page 14.*

If your system has a GPS connected to your data network (SeaTalk, SeaTalk[ng] or NMEA), the autopilot is tuned to the GPS heading while you steer to a known magnetic heading. This step provides a rough alignment and minimizes the amount of compass fine tuning required.

1. When the vessel has performed sufficient turns to complete compass linearization, the following display should be shown.
2. Steer the boat on steady course and accelerate to more than 3 knots.
3. Follow the on-screen instructions until the screen displays the 'OK' message, then press **ENTER** to continue.
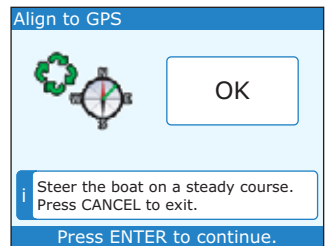
Manual compass alignment

1. Continue to steer on a steady course and use the Use **+1** and **-1** buttons to adjust the heading displayed until it matches the ship's compass reading.
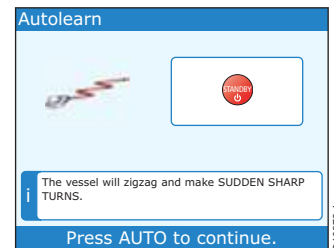2. Press **ENTER** to continue.
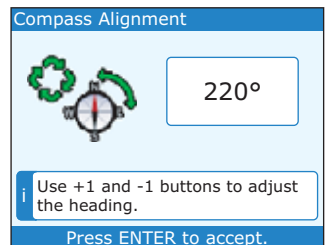
Autolearn

The next stage of calibration requires the autopilot to learn the vessel's steering characteristics. This will require the pilot to execute a number of maneuvers.

CAUTION: You must have significant clear water in front of the boat to accommodate a series of maneuvers, which include sudden, sharp turns. There should be a clear area at least 100m wide and 500m ahead.

1. Ensure there is sufficient free water in front of the vessel.
2. Press **ENTER** to continue.
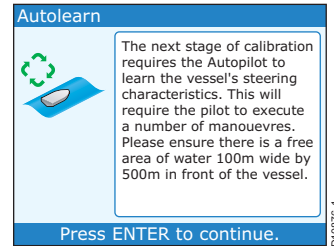
1. Press **AUTO** to continue.
2. Maintain a normal cruising speed (at least 3 knots).
3. During this procedure a number of messages will appear. Simply follow the prompts to complete the procedure. Ensure that 'PASS' is displayed signalling the completion of autolearn.
4. Press **ENTER** to finish calibration and return to manual helm.
5. Pilot enters **STANDBY**

You have successfully completed the commissioning process for your SmartPilot X system.
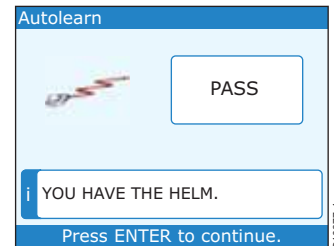
2.4 After commissioning

Before using the autopilot system you should familiarize yourself with its functions and ensure you know how to use it correctly. It is important to:
- Read the user documentation supplied with your ST70 pilot controller
- Trial the system in familiar waters away from other vessels and obstructions

CAUTION: Any additional changes you make to your system settings may require you to repeat the calibration process. Refer to the ST70 Pilot Controller User Reference Guide for more information.

EMC Conformance

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

Chapter 3: Check and adjust settings

3.1 Introduction

Many installations will require fine tuning. If you are a professional installer, ensure you check the autopilot settings before handing the system over to the customer.

3.2 Vessel settings

You can adjust the following vessel settings to more accurately reflect your boat's particular setup and what you will be using your autopilot system for.

Setting Vessel Type

CAUTION: Vessel Type determines other parameters
If you change the Vessel Type, you must then ensure all other parameters are set as you require before using the boat, as some other parameters change when the Vessel Type changes.

The vessel type options will normally give optimum performance for typical vessels of each type. However, you may find you can improve the performance of your vessel by selecting an option for a different vessel type.

1. At the **Advanced Options** menu, use < and > to select **Vessel Type**, then press **ENTER** to display the **Vessel Type** menu.
2. Use < and > to select the required Vessel Type, then press **ENTER** to save and exit the menu.

Refer to *Select Vessel Type* on *page 7* for more details.

Drive type

Refer to *Drive setup* on *page 10* for more details.

Auto release (mechanical stern drive only)

.Auto release allows you to override the pilot by taking hold of the wheel or tiller. When you release the wheel or tiller, the pilot will return to the last locked heading.

1. Use < or > to switch auto release on or off.
2. Press **ENTER** to accept the new value.
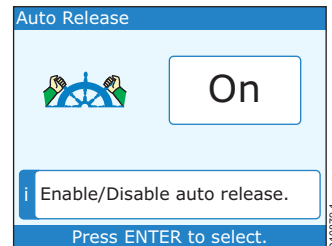
Cruise speed

Set the cruise speed to the boat's typical cruising speed. If no speed data is available, the SmartPilot system will use the cruise speed value you set here as a default when adjusting autopilot settings.

1. Use < or > to increase or decrease the cruising speed.
2. Press **ENTER** to accept the new value.

Cruising Speed

15 KTS

i Set boat cruise speed.

Press ENTER to select.
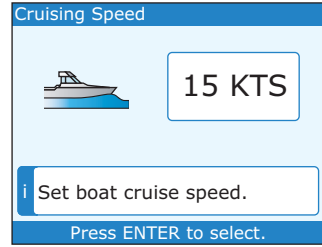
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3.3 Drive / rudder settings

CAUTION: Adjustments to the drive and rudder settings will require you to recommission the system.

You may be able to improve steering and autopilot performance by making adjustments to the following settings:

Rudder gain

Rudder gain is a measure of how much helm the SmartPilot X will apply to correct course errors. The higher the setting the more rudder will be applied. The rudder gain setting is set automatically as part of the Autolearn process (see *Autolearn* on *page 15*).

Screen Text	Range
Rudder Gain	1 to 9

1. Use < or > to increase or decrease the amount of gain.
2. Press **ENTER** to accept the new value.

Rudder Gain

4

i Defines the amount of rudder applied to correct the vessel's course.

Press ENTER to select.
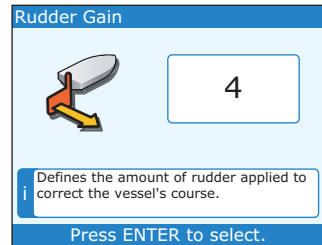
D10897-1

Counter rudder

Counter rudder is the amount of rudder the SmartPilot X system applies to try to prevent the boat from yawing off course. Higher counter rudder settings result in more rudder being applied.

Screen Text	Range
Counter Rudder	1 to 9 (Do NOT set to 0)

The default counter rudder gain is set as part of the initial seatrial Autolearn process.

1. Use < or > to increase or decrease the setting.
2. Press **ENTER** to accept the new value.
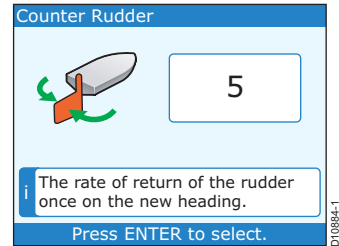
Rudder damping

On SmartPilot X systems with a rudder reference transducer, you can set the rudder damping to prevent autopilot 'hunting'. Increasing the rudder damping value reduces hunting. When adjusting the value, increase the damping one level at a time until the autopilot stops hunting. Always use the lowest acceptable value.

Screen Text	Range
Rudder Damping	1 to 9

1. Use < or > to increase or decrease the setting.
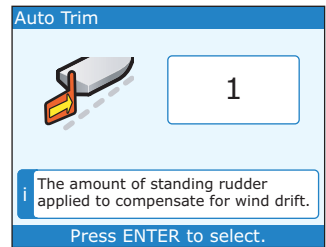2. Press **ENTER** to accept the new value.
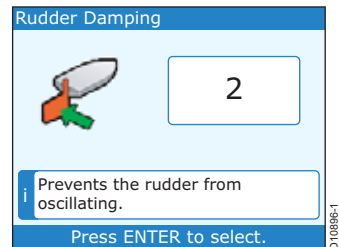
Auto trim

The AutoTrim setting determines the rate at which the SmartPilot X system applies 'standing helm' to correct for trim changes caused by varying wind loads on the sails or superstructure.

The default AutoTrim is set as part of the Autolearn process.

Setting	Effect
OFF	No trim correction
1 to 6	Auto trim applied: 1 = Slowest, 6 = Fastest

If you need to change the setting, increase the AutoTrim one level at a time and use the **lowest** acceptable value:

- If the SmartPilot X system gives unstable course keeping or excessive drive activity with a change in the heel angle, decrease the AutoTrim level.
- If the SmartPilot X system reacts slowly to a heading change due to a change in the heel angle, increase the AutoTrim level.
- If the AutoTrim level is too high, the boat will be less stable and snake around the desired course.

1. Use < or > to increase or decrease the setting.
2. Press **ENTER** to accept the new value.

Auto turn (motor boats only)

This setting defines the amount of course change when performing an auto turn.

1. Use < or > to increase or decrease the setting.
2. Press **ENTER** to accept the new value.
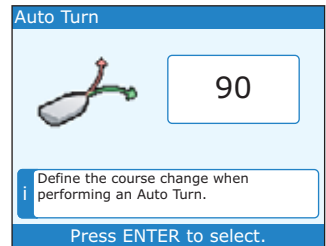
Response level

This sets the default SmartPilot X system response level setting. The response level controls the relationship between course keeping accuracy and the amount of helm/drive activity. You can make temporary changes to response during normal operation (see the *ST70 Pilot Controller User Reference Guide* for details).

Setting	Options
Levels1 to 3	Minimize the amount of pilot activity. This conserves power, but may compromise short-term course-keeping accuracy
Levels 4 to 6	Should give good course keeping with crisp, well controlled turns under normal operating conditions
Levels7 to 9	give the tightest course keeping and greatest rudder activity (and power consumption). This can lead to a rough passage in open waters as the SPX system may 'fight' the sea.

1. Use < or > to increase or decrease the setting.
2. Press **ENTER** to accept the new value.
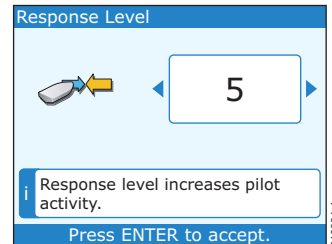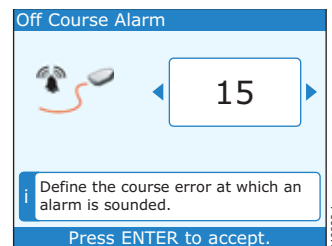

Off course alarm

This screen determines the angle used by the **OFF COURSE** alarm (see your *ST 70 Operating Guide*). The **OFF COURSE** alarm operates if the pilot strays off course by more than the specified angle for more than 20 seconds.

Screen Text	Range
Off Course Alarm	15° to 40° in 1° steps

1. Use < or > to increase or decrease the setting.
2. Press **ENTER** to accept the new value.

Turn rate limit

This limits your boat's rate of turn under SmartPilot X system control. It is only effective if your speed is greater than 12 knots.

Screen Text	Range
Turn Rate	1° to 30° per second in 1° steps

1. Use < or > to increase or decrease the setting.
2. Press **ENTER** to accept the new value.

Turn Rate Limit

5

Sets the maximum rate of turn under pilot control.

Press ENTER to accept.
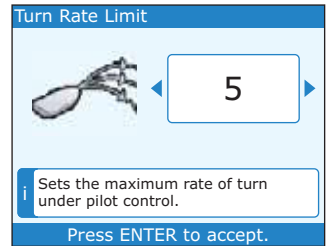
Joystick control

Note: *This is not available on SeaTalk^{ng}*. Joystick operation is available only with an ST8002 control head or Joystick connected via SeaTalk.

| Setting	Effect
Proportional	The steering will behave in proportion to the movement of the joystick or rotary wheel on an ST8002 control head.
Bang Bang	Will move the rudder hard over in the direction the joystick is moved.

1. Use < or > to change the setting.
2. Press **ENTER** to accept the new value.

Joystick Control

Bang Bang

Select Joystick control mode.

Press ENTER to select.

Latitude compass damping

If no valid latitude data is available, the SmartPilot X system will use this setting, which provides the necessary adaptation for higher latitudes.

1. Use < or > to change the setting.
2. Press **ENTER** to accept the new value.

Latitude Compass Damping

On

Set cruising latitude.

Press ENTER to select.
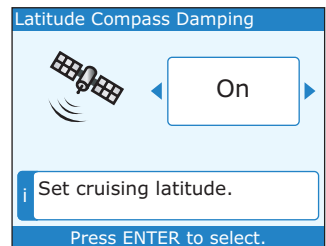
Rudder limit

The rudder limit screen is displayed only if a rudder reference transducer is fitted.

WARNING: If no rudder reference has been fitted you MUST ensure that adequate provision is made to prevent the steering mechanism from impacting the endstops.

If a rudder reference transducer is fitted, this screen is used to set the limits of the rudder control just inside the mechanical end stops, and thus avoid putting the steering system under unnecessary load. This should be set when commissioning the SmartPilot X system. The limit should be set to approximately 5 degrees less than the maximum rudder angle.

1. Use < or > to increase or decrease the setting.
2. Press **ENTER** to accept the new value.

Rudder Limit

20

i Sets the rudder limit.

Press ENTER to select.
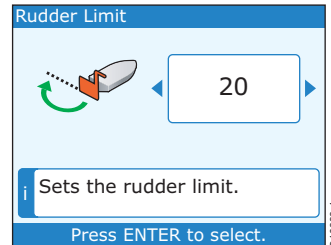
Rudder offset

This specifies the offset from amidships (zero adjustment).

1. Use < or > to increase or decrease the setting.
2. Press **ENTER** to accept the new value.

Rudder Offset

0

i Sets the rudder offset.

Press ENTER to select.
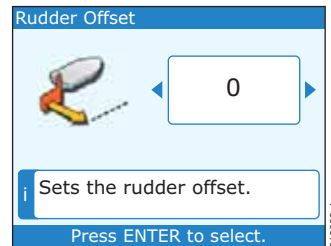
Reverse rudder reference

This reverses the phase of the rudder reference display.

1. Use < or > to change the setting.
2. Press **ENTER** to accept the new value.

Reverse Rudder Reference

Port

i Reverses the rudder.

Press ENTER to select.
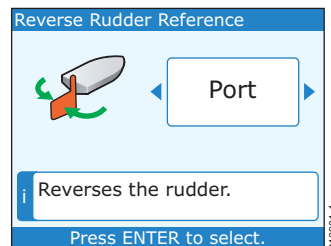
3.4 Sailboat settings

These settings are only applicable to sailboats

AutoTack

The Auto Tack Angle feature allows you to specify the angle through which the vessel will tack when you select Auto Tack. When in Wind Vane mode, this will match Apparent Wind Angle.

1. Press **MENU**, then use < and > to scroll to **Autopilot Calibration** and press **ENTER**.
2. Use < and > to scroll to **Vessel Settings** and press **ENTER**.
3. Use < and > to scroll to **Sailboat Settings** and press **ENTER**.
4. Use < and > to scroll to **Auto Tack Angle** and press **ENTER**.
5. Use < and > to increase or decrease the auto tack angle.
6. Press **ENTER** to accept the change or **CANCEL** to exit without making any changes.
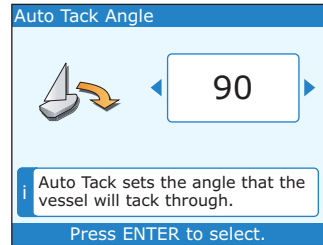
Gybe inhibit

With gybe inhibit on, to prevent accidental gybes, the SmartPilot will prevent the boat from performing an AutoTack away from the wind

With gybe inhibit off, you can perform an AutoTack into or away from the wind. See also *AutoTack* on *page 24*.

1. Press **MENU**, then use < and > to scroll to **Autopilot Calibration** and press **ENTER**.
2. Use < and > to scroll to **Vessel Settings** and press **ENTER**.
3. Use < and > to scroll to **Sailboat Settings** and press **ENTER**.
4. Use < and > to scroll to **Gybe Inhibit** and press **ENTER**.
5. Use < and > to enable or disable gybe inhibit.
6. Press **ENTER** to accept the change or **CANCEL** to exit without making any changes.

Wind selection

Note: *Only available if wind data is available.*

This option determines whether the boat steers to apparent or true wind in Wind Vane mode.

1. Press **MENU**, then use < and > to scroll to **Autopilot Calibration** and press **ENTER**.
2. Use < and > to scroll to **Vessel Settings** and press **ENTER**.
3. Use < and > to scroll to **Sailboat Settings** and press **ENTER**.
4. Use < and > to scroll to **Wind Selection** and press **ENTER**.
5. Use < and > to switch between True and Apparent.
6. Press **ENTER** to accept the change or **CANCEL** to exit without making any changes.
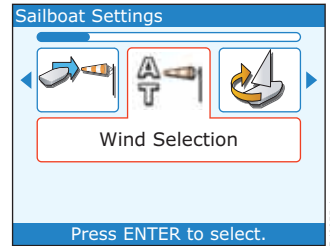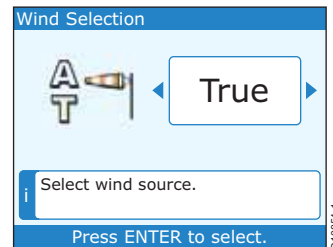
WindTrim

WindTrim controls how quickly the SmartPilot X system responds to changes in the wind direction. Higher wind trim settings will result in a system that is more responsive to wind changes.

1. Press **MENU**, then use < and > to scroll to **Autopilot Calibration** and press **ENTER**.
2. Use < and > to scroll to **Vessel Settings** and press **ENTER**.
3. Use < and > to scroll to **Sailboat Settings** and press **ENTER**.
4. Use < and > to scroll to **Wind Trim** and press **ENTER**.
5. Use < and > to increase or decrease the auto tack delay.
6. Press **ENTER** to accept the change or **CANCEL** to exit without making any changes.
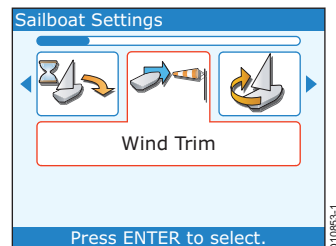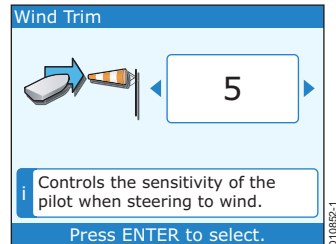
3.5   Dealer Calibration options

Note: *Use the table below to note down your calibration settings so you can easily reference to them (if required).*

Vessel type	Factory Default	Displacement	Semi-Displacement	Planing	Stern Drive (I/O)	Work Boat	Sail Boat	Your Settings
Calibration Lock	OFF, ON							
Vessel Type	DISPLACE, SEMI DISPLACE, PLANING, STERN DRV, WORK BOAT, SAIL BOAT							
Drive Type	3, 4, 5							
Rudder Alignment	: -9 to +9							
Rudder Limit	10 to 40							
Rudder Gain	1 to 9							
Counter Rudder	1 to 9							
Rudder Damping	1 to 9							
AutoTrim	0 to 4							
Response: Gyro / Non-G	1 to 9 / 1 to 3							
Turn Rate Limit	1 to 30							
Off Course Angle	15 to 40							
Power Steer (Joystick)	OFF, 1, 2							
AutoRelease	OFF, ON							
AutoTack Angle	40 to 125							
Gybe Inhibit	OFF, ON							
Wind Type	APPARENT, TRUE							
Wind Trim	1 to 9							
Cruise Speed	4 to 60							
AutoAdapt	OFF, nth, Sth							
Latitude	0 to 80							
Variation	-30 to +30							
Autopilot Reset	OFF, ON							

Chapter 4: Maintenance & Troubleshooting

4.1 Maintenance

Servicing and safety

Unless specific instructions are given to the contrary, Raymarine equipment should be serviced only by authorized Raymarine service technicians. They will ensure that service procedures and replacement parts used will not affect performance.

Some products generate high voltages, so never handle the cables/connectors when power is being supplied to the equipment.

When powered up, all electrical equipment produces electromagnetic fields. These can cause nearby electrical equipment to interact, with a possible adverse effect on operation. To minimize these effects and enable best possible performance from your Raymarine equipment, guidelines are given in the installation instructions.

Always report any EMC-related problem to your nearest Raymarine dealer. We use such information to improve our quality standards.

In some installations, it may not be possible to prevent the equipment from being affected by external influences. In general this will not damage the equipment but it can lead to spurious resetting action, or momentarily may result in faulty operation.

Instrument Cleaning

Periodically clean your ST70 pilot head with a soft damp cloth.

Do NOT use chemical or abrasive materials to clean your pilot head.

Do NOT wipe the pilot head with a dry cloth as this could cause scratches.

Cabling

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

4.2 Troubleshooting

In the unlikely event that you encounter problems using your ST70 pilot head, use this section to resolve the situation.

First considerations

If your ST70 is not performing as you think it should, be sure you are operating correctly as described in the ST70 Pilot Controller User Reference Guide, supplied with the pilot head.

Then:
- Ensure that any data you think may be missing, is available on your boat. For example, if you do not have a wind transducer, then there will be no wind-related data.
- Take into account any changes that may have been made to the electrical system aboard your boat. Such changes could affect the performance of your ST70 pilot head.
- Be aware that radio signals transmitted nearby (for example from another boat or shore station) could affect the performance of your ST70 pilot head.

If you are satisfied that the problem is not due to any of the above, use the procedures in this section to isolate the cause of the problem.

Procedures

If an ST70 pilot head appears not to be operating satisfactorily, check the symptoms below to determine how to resolve the problem:

- Nothing on the pilot head screen - refer to *Figure 4-1* on page 29
- Data missing from the pilot head screen - refer to *Figure 4-2* on page 30
- Data on the pilot head screen is garbled- refer to *Figure 4-3* on page 31
- Specific data types are missing or incorrect:
    - Check the relevant Transducer and Pod, including connections between them and to the system.
    - If speed readings are missing or obviously wrong, the speed transducer paddle wheel could be fouled and need cleaning.
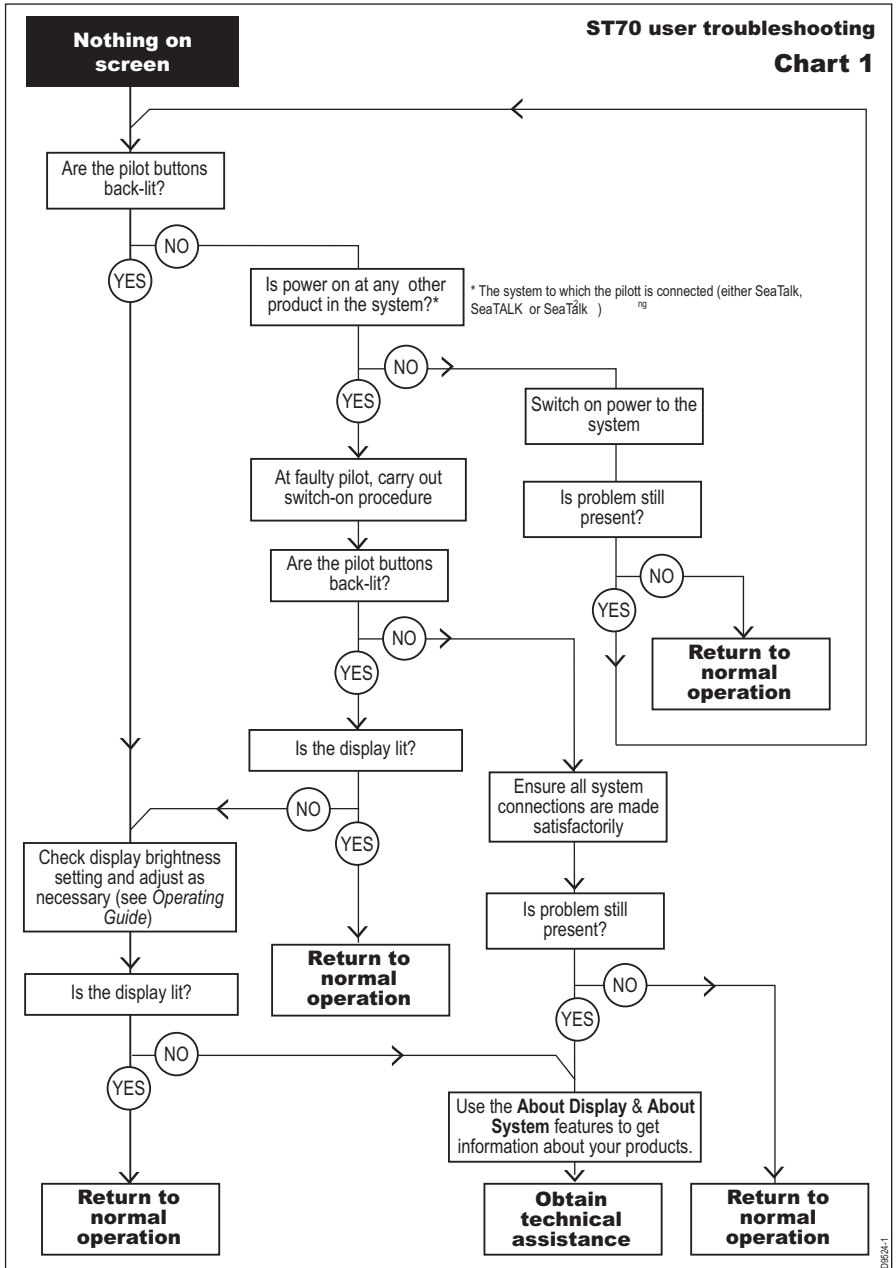
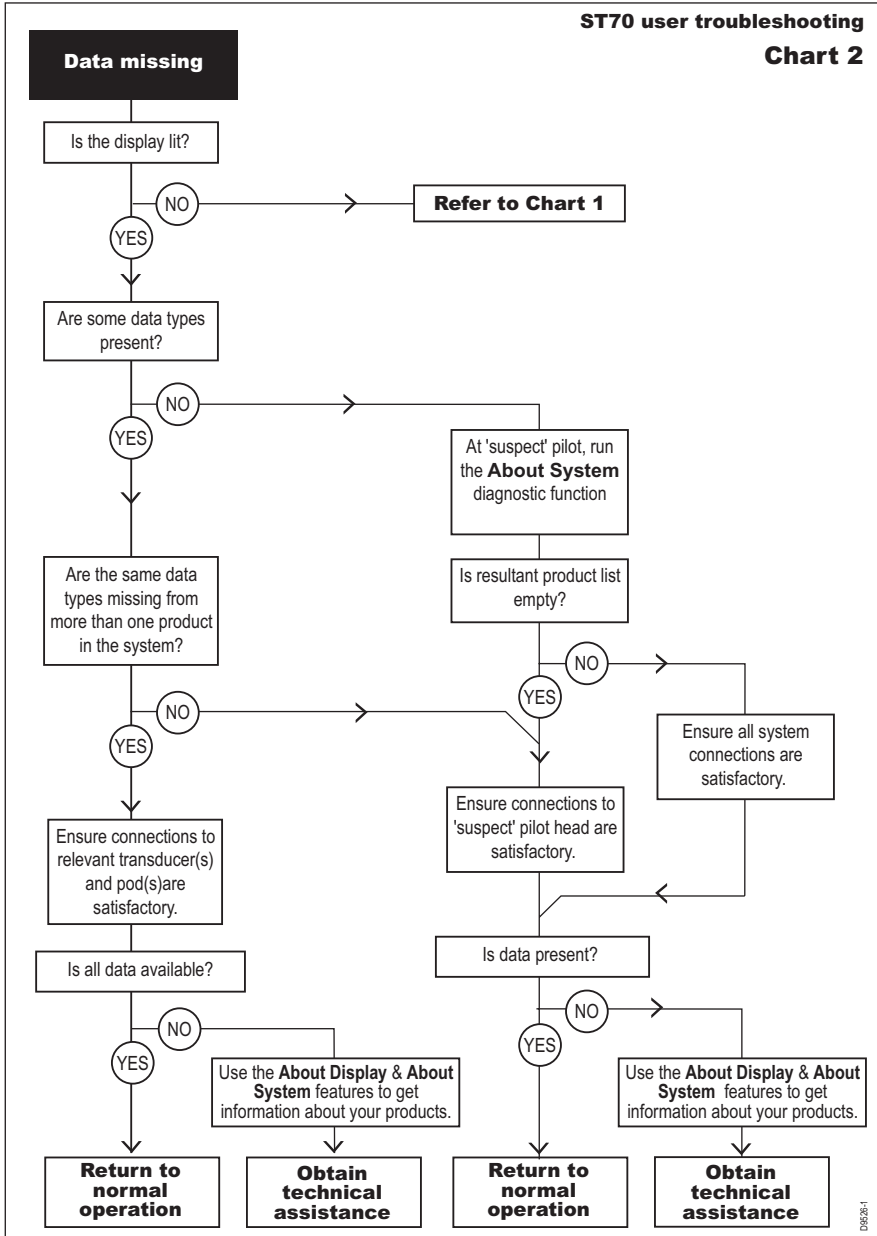Figure 4-1 ST70 troubleshooting – Chart 1
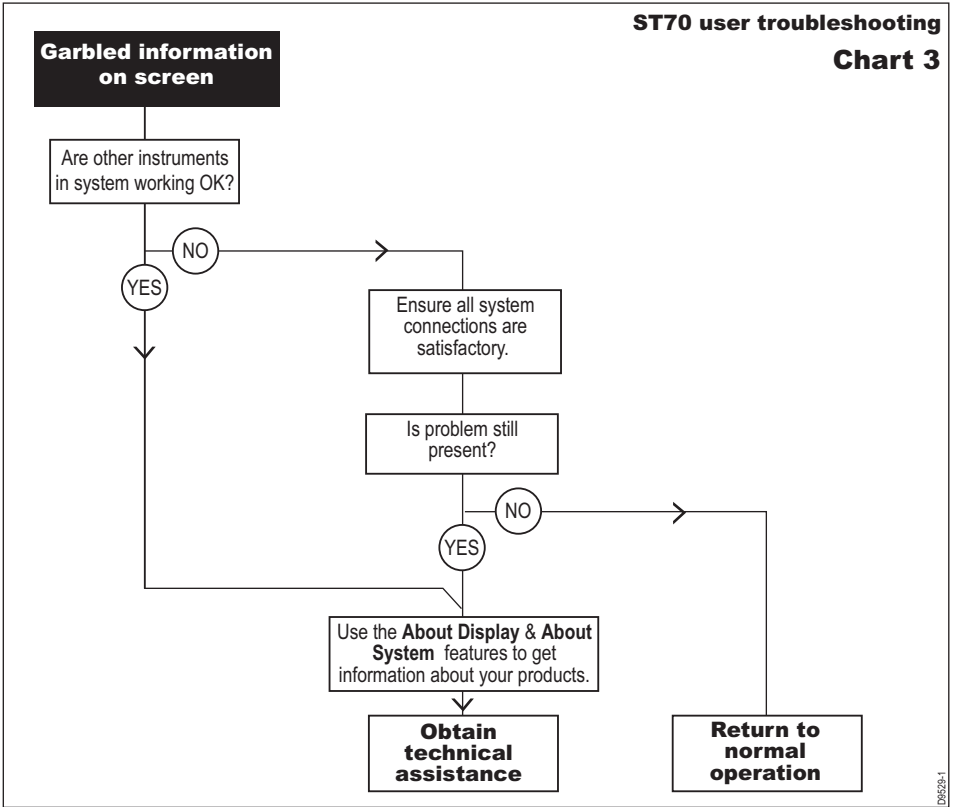
Figure 4-2 ST70 troubleshooting – Chart 2

Figure 4-3 ST70 troubleshooting – Chart 3

Troubleshooting tools

Your ST70 pilot head has the following in-built user diagnostic functions:

• About Display
• About System

Use these as appropriate to help isolate problem areas.

About Display

The About Display function provides information about the pilot head on which it is run. Before seeking technical assistance, please use the About Display function whenever possible to find out the relevant:

• Software Version Number
• Hardware Version Number
• Bootloader Version Number
• Temperature
• Voltage
• Current
• Total hours run

To run the About Display function:

1. With the pilot head switched on, press **MENU** to display the Main Menu, then use < or > to select the **Diagnostics** option.
2. Press **ENTER** to display the **Diagnostics** menu.
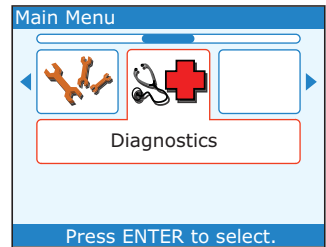
3. Use < or > to select the **About Display** option, then press **ENTER**.
4. The **About Display** information is displayed. Make a note of the data you need then press **ENTER**:

   • If you have seen all the available data the display shows the **Diagnostics** menu.
   • If there is more data to be displayed, the next page of About Display data is displayed. Repeat step 4 until the display shows the **Diagnostics** menu.
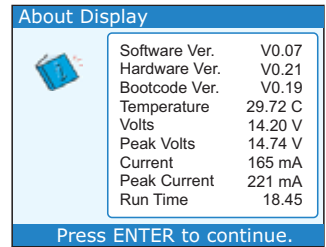
About System

The About System function provides a list of products on the system and a serial number for each product.

To run the About System function:

1. With the **Diagnostics** menu displayed, use < or > to select the **About System** option.
2. Press **ENTER** to display the **Diagnostics** menu.

3. Use < or > to select the **About System** option, then press **ENTER**.
4. The **About System** information is displayed. Make a note of the data you need then press **ENTER**:
   - If you have seen all the available data the display shows the **Diagnostics** menu.
   - If there is more data to be displayed, the next page of About Display data is displayed. Repeat step 4 until the display shows the **Diagnostics** menu.

Technical support

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

If you intend seeking technical assistance, please first use the About Display and About System functions whenever possible, and make a note of the information available there.

Note: *If it is not possible to use the About Display function on a faulty instrument, remember you may still be able to get system information by running About System at another instrument.*

World wide web

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

www.raymarine.com

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

Telephone help line

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

In the USA, call:
- +1 603 881 5200 extension 2444

In the UK, Europe the Middle East or the Far East, call:
- +44 (0) 23 9271 4713 (voice)
- +44 (0) 23 9266 1228 (fax)

Help us to help you

When requesting service, please have the following product information to hand:
- Equipment type.
- Model number.
- Serial number.
- Software version.
- Hardware version.

You can find out this information by running the About Display and About System diagnostic functions.

Glossary

Abbreviation	Description
AWA	Apparent Wind Angle
AWS	Apparent Wind Speed
COG	Course Over Ground
EMC	Electromagnetic Compatibility
NGCC	New Generation Course Computer
SOG	Speed Over Ground
ST	SeaTalk
ST2	SeaTALK^2
STNG	SeaTalk New Generation / SeaTalk^{ng}
STW	Speed Through Water
TWA	True Wind Angle
TWS	True Wind Speed

Specification

Supply voltage:	Nominal12 V dc Maximum16 V dc Minimum 10 V dc Absolute maximum: 18.5 V dc
Current:	Nominal – dependent on screen brightness setting Maximum – not more than 220 mA
Dimensions (excluding studs)	4.33 in W x 4.53 in H x 1.28 in D (110 mm x 115 mm x 32.5 mm)
Connections	Two SeaTalk^{ng}
Operating temperature	-20^{0} to +70^{0}C
Illumination	Sliding scale
Compliances	RoHS EMC EN60945 Revision 4
Buzzer	Monotone buzzer (3.9 kHz)

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