

ST70 Autopilot Controller User Reference Guide

Document reference: 81288-2
Date: May 2010

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.

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 for safety, we **STRONGLY RECOMMEND** that an Authorized Raymarine Service Representative fits this product. You will only receive full warranty benefits if you can show that an Authorized Raymarine Service Representative has installed and commissioned this product.



WARNING: Electrical safety

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



WARNING: Navigational safety

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

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.

General cabling guidelines

- Do not mix AC and DC cables.
- Adhere to EMC guidelines (above).
- Use Kopex conduit where appropriate to protect cables.
- Label all cables for easy identification.
- Keep fluxgate compass cable separate from other cables.

EMC Servicing and maintenance

- Undue noise and interference may be a symptom of an EMC-related problem. Please report any EMC-related problem to your nearest Raymarine dealer. We use such information to improve our quality standards.
- To minimize any EMC related problems and ensure the best possible performance from your Raymarine equipment, follow the guidelines given in the installation instructions.

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 wheeled 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.

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

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
ST70 Autopilot Controller User Reference Guide (this document). Supplied with the ST70 Autopilot Controller.	81288
ST70 Pilot Operating Guide. Supplied with the ST70 autopilot controller.	81289
SPX System Installation Guide. Professional installers should use this guide to ensure safe and effective set up of an SPX SmartPilot system.	87072
ST70 Autopilot Controller/SmartPilot X Commissioning Instructions. Following installation, this document, which is supplied with your autopilot controller, must be used to commission your autopilot system before it can be used safely.	81287
SeaTalk^{ng} Reference Manual. This provides detailed information regarding SeaTalk ^{ng} connectivity.	81300
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.

Contents

Chapter 1:ST70 Overview	1
1.1 Functions	1
1.2 Display and controls	2
Controls	2
Display	2
1.3 Operating principles	3
1.4 System functionality	4
1.5 Commissioning requirement	4
Chapter 2:Setup Procedures	5
2.1 Using the menu navigation keys	5
2.2 Dockside and open water procedures	6
2.3 General setup procedures	6
Display settings	7
Autopilot calibration	12
Diagnostics	12
2.4 Response Levels	14
2.5 Sailboat setup procedures	15
Auto Tack Angle	15
Gybe Inhibit	15
Wind Trim	16
Wind Selection	16
2.6 Power boat and fishing boat setup procedures	17
Patterns	17
Chapter 3:Operating instructions	19
3.1 SmartPilot Functions	19
Extended systems	20
3.2 Menu structure	20
Sailboat menus	20
Power and fishing boat menus	21
3.3 Pilot view	22
Setting the default Pilot View	22
Changing the Pilot View	22
3.4 Using the SmartPilot to steer your boat	23
Engaging a tiller drive	23
Steering automatically to a heading?	23
Returning to hand steering	23
Changing course in Auto mode	23
Dodging an obstacle and then resuming course	23
3.5 Using preset patterns	24
3.6 Following a route set on a Chartplotter (Track mode)	24
Activating Track mode	25
Leaving Track mode	26
Cross track error	27
Tidal stream compensation	28
Using Dodge in Track mode	28
Waypoint arrival	28
Steering to the next waypoint in a route	29
Skipping a waypoint (SeaTalk chartplotters only)	29

Waypoint Advance warning	30
Route completion.....	30
3.7 Using the SmartPilot with sail boats	31
Using Wind Vane mode.....	31
What is Wind Vane mode?	31
Selecting Wind Vane mode	31
Adjusting the locked wind angle	31
Leaving Wind Vane mode	31
True and apparent wind	31
WindTrim	32
Dodging an obstacle in Wind Vane mode	32
Wind Shift warning.....	32
Using AutoTack in Wind Vane mode	32
Operating hints for Wind Vane mode.....	33
Preventing accidental gybes.....	33
Chapter 4:Maintenance and troubleshooting	35
4.1 Maintenance	35
Servicing and safety	35
Instrument cleaning	35
Cabling.....	35
4.2 Troubleshooting	36
First considerations	36
Procedures	36
Using the About Display feature.....	39
Technical support.....	40
Chapter 5:Alarms	43
Chapter 6:Data List	45
Chapter 7:Vessel Settings	47
Chapter 8:Technical specifications	49

Chapter 1: ST70 Overview

1.1 Functions

The ST70 Autopilot controller is used to control your autopilot system. It can be used with Raymarine SPX, S1, S2 and S3 SmartPilot systems (although it cannot be used to calibrate an S1, S2 or S3 system).

The functions of the ST70 controller are tailored to different situations:

General

- Steering to a heading
- Steering to a waypoint (using GPS or a chartplotter)
- Power / emergency steering

Motor boats and fishermen

- Trolling for fish

Sailboats

- Maintain a fixed point of sail
- Auto tacking



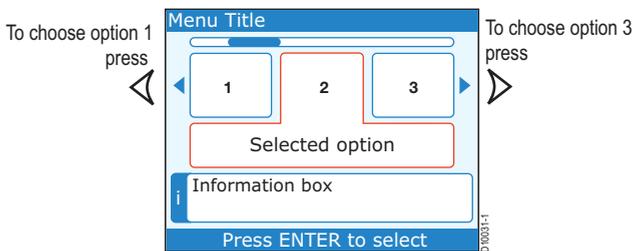
1.2 Display and controls

Controls

STANDBY	When in Standby mode: - Press momentarily to display the Brightness popup. - Hold down to power off. When in Auto mode: Press momentarily to put unit in standby
DODGE	Activate Dodge mode.
TRACK	Activate Track mode.
AUTO	Activate Auto mode.
MENU	Open the control menus.
< / -1	When in Pilot mode: -1° (port) When in Menu mode: Cursor LEFT /decrease value (hold to decrease automatically)
> / +1	When in Pilot mode: +1° (starboard) When in Menu mode: Cursor RIGHT/increase value (hold to increase automatically)
CANCEL / -10	When in Pilot mode: -10° (port) When in Menu mode: Cancel and go back a step without making any changes
ENTER / +10	When in Pilot mode: +10° (starboard) When in Menu mode: Accept value and go back a step

Display

Menu mode



Each setup menu provides a number of options. Use the < and > buttons to set a value or change the option.

When a menu selection results in a setup page, use the < and > buttons to set the value or make the selection that you want. Press ENTER to confirm your choice.

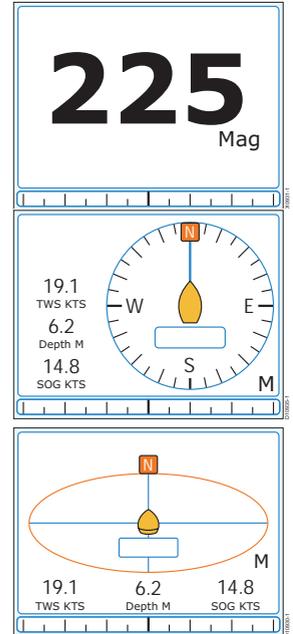
If at any time during setup you want to leave a setup function without making any changes, press CANCEL.

Auto mode

The ST70 Pilot can display current pilot data in one of three ways:

- Heading
- 2D - Compass rose
- 3D - Isometric

Refer to *Section 3.3, Pilot view.*



1.3 Operating principles

The ST70 Pilot has two main modes of operation: Standby and Auto.

With the ST70 in Standby, the helm is free for manual steering and all setup functions and calibrations can be performed. These settings are stored in the Course Computer.

When in Auto mode, manual steering is not possible and the autopilot drives the helm.

First use after installation

When the ST70 Pilot controller is first switched on after installation it will require commissioning.

Details of how to set these values and commission the Pilot are given in the *ST70 Autopilot Controller/SmartPilot X Commissioning Instructions*.

Note: *The values set during initial setup can be changed subsequently via the Main Menu.*

Normal operation

Detailed operating instructions are given in the *ST70 Pilot Operating Guide*.

Setup procedures

Setup procedures are carried out during Commissioning to set:

- Language
- Vessel Type
- Time format
- Date format
- Method used for ground wind calculation
- Magnetic variation
- Response rate

If you need to change any of these after the pilot has been commissioned, refer to the appropriate procedure in the *ST70 Autopilot Controller/SmartPilot X Commissioning Instructions*.

1.4 System functionality

Your ST70 Pilot is fitted with Raymarine SeaTalk^{ng} connectors, but it can be connected to any of the following Raymarine systems, using suitable adaptor cables as necessary:

- SeaTalk
- SeaTalk²
- SeaTalk^{ng}

SeaTalk^{ng}

When connected to a SeaTalk^{ng} system, the ST70 Pilot repeats the data on the bus.

Power protocol

Power to the ST70 Pilot can be switched on and off using the power button. However, where a Pilot is part of a system, it may be more convenient to switch power for the entire system from a central circuit breaker.

In this case, when system power is switched ON again:

- An ST70 Pilot that was switched on when power was last switched off will return to the switched ON state.
- An ST70 Pilot that was OFF when system power was last switched OFF will remain OFF and will need to be switched ON using the power button.

1.5 Commissioning requirement



WARNING: The ST70 Pilot 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.

Chapter 2: Setup Procedures

Many operating parameters are set during commissioning and may not need to be changed again. However, if any of these parameters are not as you want them, you can change:

- The response levels of the pilot.
- The language.
- The time/date format.

Refer to the *ST70 Autopilot Controller/SmartPilot X Commissioning Instructions* for the appropriate procedures.

Other setup procedures may be useful on a day-to-day basis. These include:

- Changing the screen brightness level. See *Brightness* on page 7.
- Changing the screen colors. See *Colors* on page 7.
- Changing data units. See *Units* on page 8.
- Setting local time. See *Time and date* on page 9.
- Auto Tack Angle (sailboats only). See *Auto Tack Angle* on page 15.
- Enable or disable Gybe Inhibit (sailboats only). See *Gybe Inhibit* on page 15.

2.1 Using the menu navigation keys

Use the MENU key to enter the menu system.

Use the < and > keys to:

- scroll to the required option or setting.
- increase or decrease a setting.

Use the ENTER key to:

- select a menu option.
- accept a setting and exit to the previous screen.

Use the CANCEL key to exit to the previous screen without changing anything.

When you have made the changes you require, press CANCEL as many times as required to exit to the Pilot View screen.

2.2 Dockside and open water procedures



WARNING: Dockside and open water procedures.

The ST70 Pilot 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.

The following procedures are described in the *ST70 Autopilot Controller/SmartPilot X Commissioning Instructions* and should be performed in the prescribed order when there is any change in vessel configuration:

- Vessel type
- Drive type
- Rudder check
- Motor check
- Compass calibration
- Auto learn.

2.3 General setup procedures

The setup procedures available depend on the vessel profile as set up during commissioning (Fishing, Sail or Power), and whether the ST70 Pilot is in Standby or Auto mode.

Procedure	Sail	Fishing	Power
Pilot view (see <i>Pilot view</i> on page 22)	x	x	x
Display settings (see <i>Display settings</i> on page 7)	x	x	x
Autopilot calibration (refer to the <i>ST70 Autopilot Controller/SmartPilot X Commissioning Instructions</i>)	x	x	x
Diagnostics (see <i>Diagnostics</i> on page 12)	x	x	x
Response level (see <i>Response Levels</i> on page 14)	x	x	x
Sailboat settings (see <i>Sailboat setup procedures</i> on page 15): Auto Tack Gybe Inhibit Wind Trim	x		
Patterns (see <i>Power boat and fishing boat setup procedures</i> on page 17)		x	x

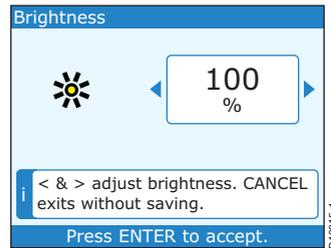
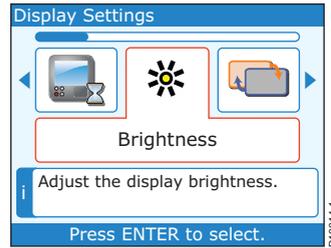
Display settings

1. Press MENU.
2. Use < and > to scroll to the **Display Settings** screen and press ENTER.
3. Use < and > to scroll to the setting you want to change.



Brightness

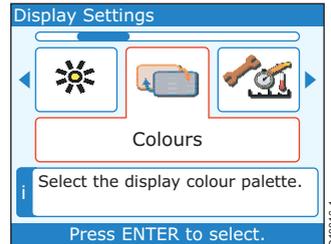
1. Use < and > to scroll to the **Brightness** box and press ENTER.
2. Use < and > to adjust the screen to the required brightness.
 - A momentary press will increment the brightness by 10%.
 - Press and hold for fine adjustment.
3. Press ENTER to accept the new value and exit, or CANCEL to exit without making any change.



Colors

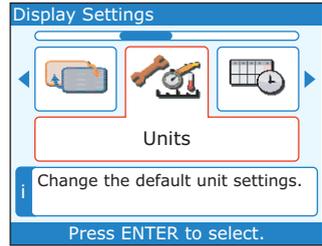
There are a number of options available for day and night use.

1. Use < and > to scroll to the **Colors** box and press ENTER.
2. Use < and > to select the required color scheme.
3. Press ENTER to accept the new value and exit, or CANCEL to exit without making any change.

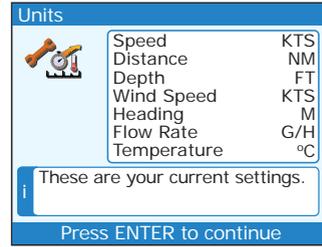


Units

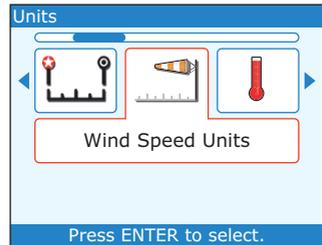
- Use < and > to scroll to the **Units** box and press ENTER.
- The summary box shows the current settings. Press ENTER to display the second page of settings.
- Press ENTER to display the **Units** menu.
- Use < and > and press ENTER to select a unit to change. These are:
 - Speed (knots, mph, km/h)
 - Distance (nm, statute miles, km)
 - Depth (metres, feet, fathoms)
 - Wind speed (knots, metres/sec)
 - Heading (true, magnetic)
 - Flow rate (galls/hr, liters/hr)
 - Temperature (°C, °F)
- Use < and > to scroll to the required setting.
- Press ENTER to accept the new value and exit, or CANCEL to exit without making any change.
- When you have finished setting the units, use < and > to scroll to the **Continue** box, then press ENTER to return to the pilot screen.



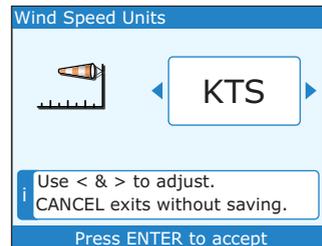
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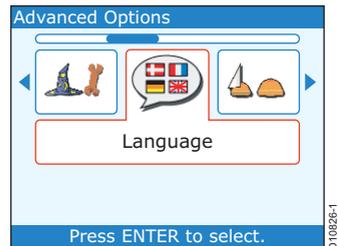
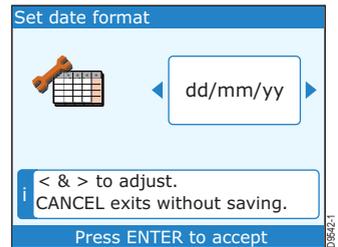
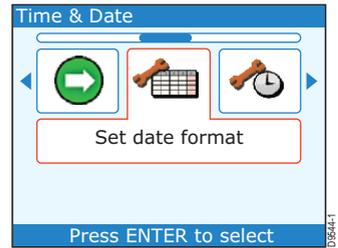
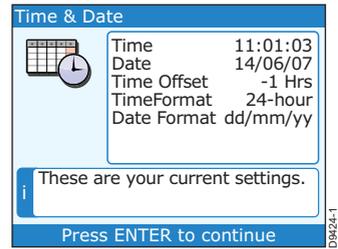
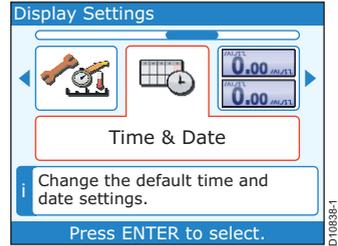
Time and date

Note that only if a GPS is connected to the system, the time, date and time offset will be retrieved from the GPS and cannot be changed here.

- Use < and > to scroll to the **Time & Date** box and press ENTER.
- The summary box shows the current settings. These are:
 - Time
 - Date
 - Time offset
 - Time format (12- or 24-hour)
 - Date format (dd/mm/yy or dd/mm/yy)
- Press ENTER to display the **Time & Date** menu.
- Use < and > and press ENTER to select a setting to change.
- Use < and > to increase or decrease the value or choose a setting.
- Press ENTER to accept the new value and exit, or CANCEL to exit without making any change.
- When you have finished making changes, use < and > to scroll to the **Continue** box, then press ENTER to return to the pilot screen.

Languages

- Use < and > to scroll to the **Languages** box and press ENTER.
- Use < and > to scroll to the language you require.
- Press ENTER to accept the new value and exit, or CANCEL to exit without making any change.



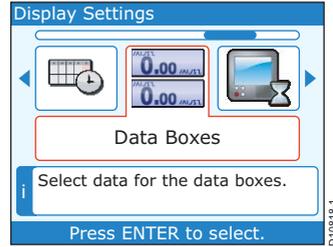
Data Boxes

You can define which data are displayed in each of the three data boxes in the 2D and 3D pilot views.

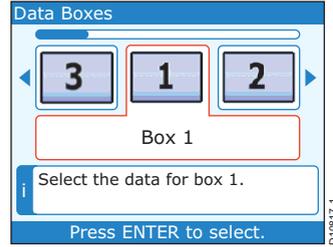
The data that can be displayed (providing it is available) is:

Data	Display
Depth + offset	Depth
Cross Track Error	XTE
Distance to waypoint	DTW
Bearing to waypoint	BTW
Apparent wind angle	AWA
Apparent wind speed	AWS
True wind speed	TWS
True wind angle	TWA
Course over ground	COG
Speed over ground	SOG
Speed	Speed
Average Speed	Average Speed
Log	Log
Trip log	Trip
Sea Temperature	Sea Temp.
Time of day	Time
Date	Date
Heading	Heading

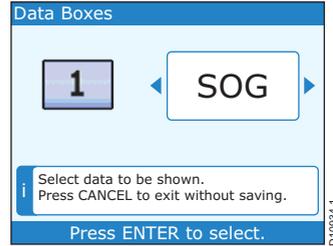
1. Use < and > to scroll to the **Data Boxes** box and press ENTER.



2. Use < and > to scroll to the box whose contents you want to change.



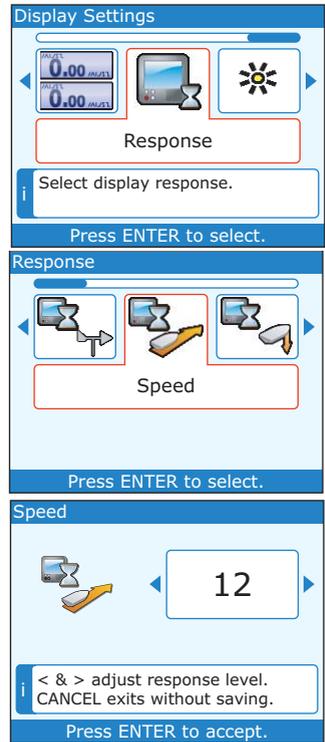
3. Use < and > to select the data you want to be displayed.
4. Press ENTER to accept the new value and exit, or CANCEL to exit without making any change.



Display Response

The response setting determines the rate at which data readings update. You can adjust the response at each pilot head to best suit the conditions under which you are operating. You can independently adjust the response at each pilot head for individual data types:

- Speed
 - Depth
 - Heading
 - Wind Speed
 - Wind Angle
 -
1. Use < and > to scroll to the **Response** box and press ENTER.
 2. Use < and > to scroll to the response parameter you want to change.
 3. Use < and > to increase or decrease the setting as required, from 1 to 15, where 1 is slow and 15 is fast. You may have to experiment to find out the appropriate response level for your vessel.
 4. Press ENTER to accept the new value and exit, or CANCEL to exit without making any change.



Autopilot calibration

Refer to the *ST70 Autopilot Controller/SmartPilot X Commissioning Instructions*.

Diagnostics

Use < and > to scroll to the **Diagnostics** box and press ENTER.

About Display

There are a number of parameters of which you may need to make a note if you experience problems with the pilot controller.

1. Use < and > to scroll to the **About Display** box and press ENTER.
2. A list of current display parameters is displayed. These are:
 - Software, hardware and bootcode versions
 - Temperature
 - Volts
 - Peak volts
 - Current
 - Peak current consumption
 - Run time
3. Press ENTER or CANCEL to exit.

Display Self Test

For factory use only.

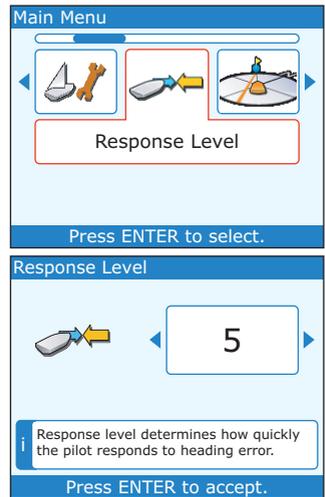
2.4 Response Levels

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, as described in *Chapter 3: Operating instructions*.

Setting the Response level determines how quickly the pilot responds to a change in conditions.

Setting	Options
Levels 1 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
Levels 7 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. Press MENU, then use < and > to scroll to the **Response Level** screen and press ENTER.



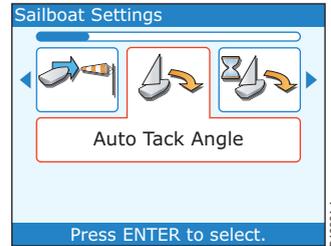
2. Use < and > to increase or decrease the setting as required, from 1 to 9, where 1 is slow and 9 is fast. You may have to experiment to find out the appropriate response level for your vessel.
3. Press ENTER to accept the new value and exit, or CANCEL to exit without making any change.

2.5 Sailboat setup procedures

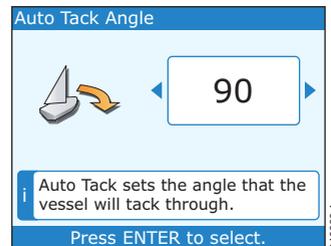
Auto Tack Angle

The Auto Tack Angle feature allows you to specify the angle through which the vessel will tack when you select Auto Tack.

1. Press MENU, then use < and > to scroll to **Auto-pilot 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.



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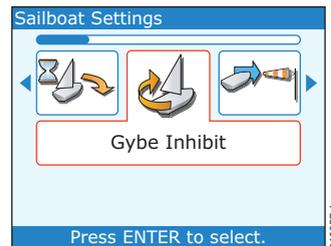


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Gybe Inhibit

Gybe inhibit prevents an accidental gybe. The default setting is enabled, but you can disable the feature if required.

1. Press MENU, then use < and > to scroll to **Auto-pilot 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.



D10861-1

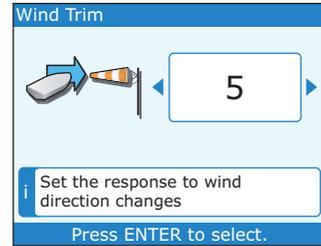
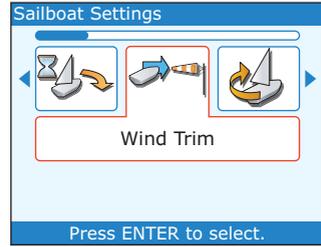


D10861-1

Wind Trim

Wind Trim controls the sensitivity of the pilot when steering in wind vane mode.

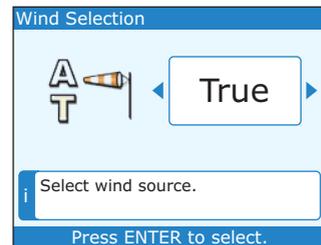
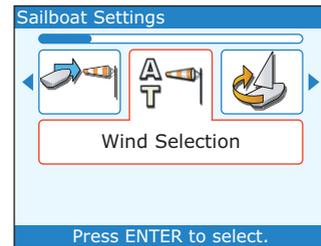
1. Press MENU, then use < and > to scroll to **Autopilot Calibration** and press ENTER.
2. Use < and > to scroll to **Vessel Settings** and press ENTER.
3. Use < and > to scroll to **Sailboat Settings** and press ENTER.
4. Use < and > to scroll to **Wind Trim** and press ENTER.
5. Use < and > to increase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



Wind Selection

You can specify whether the wind source is to be true or apparent when steering 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.

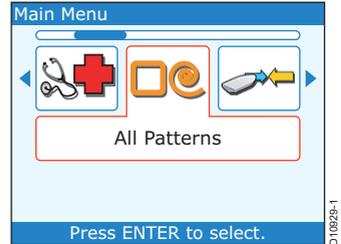


2.6 Power boat and fishing boat setup procedures

Patterns

A number of sailing patterns are provided, each with one or more parameters which can be set to the desired value.

1. Press MENU, then use < and > to scroll to **All Patterns** and press ENTER.
2. Use < and > to scroll to the required pattern, then press ENTER to accept or CANCEL to exit.
3. When you select a pattern, the settings for that pattern will be displayed. The available preset patterns and their settings are:



The preset patterns and the settings you can specify are:

Pattern	Settings
Circle	Direction (port or starboard) and radius
Zigzag	Direction (port or starboard), Angle and Length
Cloverleaf	Direction (port or starboard) Radius
Spiral	Direction (port or starboard) Radius Radius Increment On Heading Radius On Heading Increment
Circle against heading	Direction (port or starboard) and Distance
Figure of eight	Direction (port or starboard) and Radius
Pattern Search	Direction (port or starboard) Width Height Increase Width Increase Height
Box Search	Direction (port or starboard), Width, Height
180° Turn	Direction (port or starboard) and Radius

Chapter 3: Operating instructions

The SmartPilot controller is a SeaTalk^{ng}-compatible autopilot control unit. It is designed as the main controller for the SmartPilot system.

The SmartPilot controller operates in the following modes:

- Standby: SmartPilot off. You have manual control of the boat.
- Auto: The SmartPilot steers the boat to maintain a locked heading.
- Track: The SmartPilot steers the boat to maintain a track between two waypoints created on a navigation aid.
- Wind Vane: The SmartPilot steers the boat to maintain a course relative to a true or apparent wind angle.

The SmartPilot controller also provides:

- automatic tack (Auto Tack) in Auto and Wind Vane modes.
- waypoint advance feature in Track mode.

3.1 SmartPilot Functions

The functions provided with your system depend upon the model of course computer installed.

Non-G systems (without GyroPlus)	S1G, S2G and S3G systems (with GyroPlus)	SPX systems
Full basic functionality	Internal GyroPlus yaw sensor provides enhanced course keeping using AST (Advanced Steering Technology)	Internal GyroPlus yaw sensor provides enhanced course keeping using AST (Advanced Steering Technology)
Steering to true and apparent wind in Wind Vane mode	Steering to true and apparent wind in Wind Vane mode	Steering to true and apparent wind in Wind Vane mode
	Equipped with AutoLearn, Raymarine's self-learning calibration system	Equipped with AutoLearn, Raymarine's self-learning calibration system
		Fishing patterns
		Intelligent dodge
		Smart Rudder Sense (SRS)

Extended systems

You can connect the SmartPilot controller to other Raymarine SeaTalk equipment so it can send and receive SeaTalk data:

- it can use waypoint information from a SeaTalk navigation instrument to provide track control.
- it can use boat speed from a SeaTalk speed instrument to optimize track-keeping performance.
- it can use wind information from a SeaTalk wind instrument for Wind Vane steering.

The SmartPilot control unit can also display data from any compatible multifunctional display or instruments transmitting SeaTalk, NMEA0183, NMEA2000 or SeaTalk^{ng} instrument data in a selection of data pages.

For further information on other connections to your system see *ST70 Autopilot Controller/SmartPilot X Commissioning Instructions*.

3.2 Menu structure

The ST70 pilot controller menu structure varies depending on which Vessel Type has been specified during commissioning and what data is available. For instance, if there is no depth transponder, then no depth data will be available.

Sailboat menus

The menu options available for vessel type sailboat are:

- Wind Vane Mode
- Tack Starboard
- Sailboat Settings (only when connected to a compatible course computer):
 - Auto Tack settings
 - Gybe Inhibit
 - Wind Trim
 - Wind Selection
 - Autopilot calibration
- Pilot View
- Display settings:
 - Brightness
 - Colors
 - System brightness / Color
 - Units
 - Time and Date
 - Data Boxes
 - Response
- Advanced Options:
 - Setup Wizard
 - Language

- Vessel Type
- Boatshow Mode (simulated data - boat show use only)
- Factory Reset
- Autopilot Calibration (only when connected to a compatible course computer):
 - Vessel settings
 - Drive settings
 - Sailboat settings
 - Commissioning
- Diagnostics
- Tack Port

Power and fishing boat menus

The menu options available for vessel types power and fishing boat are:

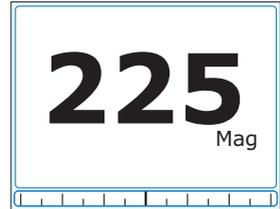
- Pattern 1 (fishing boat only; only when connected to a compatible course computer)
- Pattern 2(fishing boat only; only when connected to a compatible course computer)
- Patterns (only when connected to a compatible course computer)
- Response level
- Pilot View
- Display settings:
 - Brightness
 - Colors
 - System brightness / Color
 - Units
 - Time and Date
 - Data Boxes
 - Response
- Advanced Options:
 - Setup Wizard
 - Language
 - Vessel Type
 - Boatshow Mode (simulated data - boat show use only)
 - Factory Reset
- Autopilot Calibration (only when connected to a compatible course computer):
 - Vessel settings
 - Drive settings
 - Commissioning
- Diagnostics

3.3 Pilot view

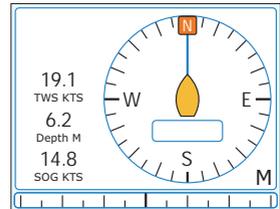
The pilot display can be formatted as **Plain**, **2D** or **3D**.

Setting the default Pilot View

1. Press **MENU**.
2. Use < and > to scroll to the **Pilot View** screen and press ENTER.
3. Use < and > to scroll to the required view option. The options are:
 - Heading

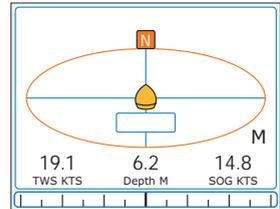


- 2D - Compass rose



- 3D - Isometric

4. Press ENTER to accept the view option and exit, or CANCEL to exit without making any change.



Changing the Pilot View

1. With any operational page displayed, press and hold MENU to display Heading View.
2. Press and hold MENU again to display the 2D Compass Rose View.
3. Press and hold MENU again to display the 3D Isometric View.
4. Press and hold MENU to cycle through the different views.
5. Release the MENU button when the view you want is displayed.

3.4 Using the SmartPilot to steer your boat

CAUTION: Maintain a permanent watch

Automatic course control makes it easier to sail a boat, but it is NOT a substitute for good seamanship. ALWAYS maintain a permanent watch by the helm.

Engaging a tiller drive

- Place the pushrod over the tiller pin. If necessary, extend or retract the pushrod using the -1, +1, -10 and +10 keys.

Steering automatically to a heading?

- Steady the boat on the required heading.
- Press AUTO.

The SmartPilot is now in **AUTO** mode and will steer to the chosen heading, shown on the display. This mode is often known as 'point-and-shoot'.

Returning to hand steering

Press **STANDBY** to disengage the SmartPilot. In **STANDBY** mode, you have manual control of the boat and the display shows the boat's current compass heading.

Changing course in Auto mode

In Auto mode, use the -1 and -10 (port) and +1 and +10 (starboard) buttons to change the locked heading in steps of 1° or 10°. For example: press -10 three times for a 30° course change to port.

Dodging an obstacle and then resuming course

To avoid an obstacle when your boat is under autopilot control, you can dodge the obstacle and then resume your previous course.

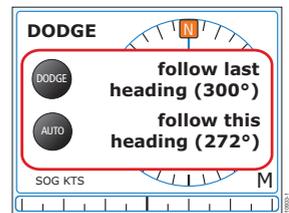
Using Dodge in Auto mode

When in Auto mode, press **DODGE**.

The **DODGE** popup will appear over whichever pilot view you have currently selected.

Once you have finished steering manually you can:

- Press **DODGE** to return to the previous heading, or
- Press **AUTO** to continue on your new heading.



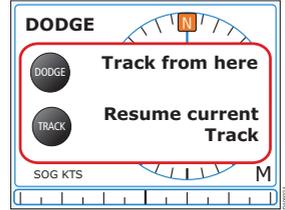
Using Dodge in Track mode

When in Track mode, press DODGE.

The DODGE popup will appear over whichever pilot view you have currently selected.

Once you have finished steering manually you can:

- Press DODGE to track from here to the next waypoint, or
- Press AUTO to return to the previous track.

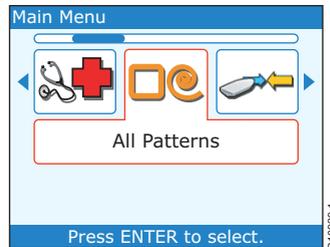


Note: *The dodge to track feature requires a compatible multifunctional display.*

3.5 Using preset patterns

Preset patterns are only available for power boats and fishing boats. If the vessel type is fishing boat, the two most recently used patterns are available as a menu option.

1. Press MENU.
2. Use < and > to select **All Patterns**.
3. Use < and > to select the pattern you want to follow.



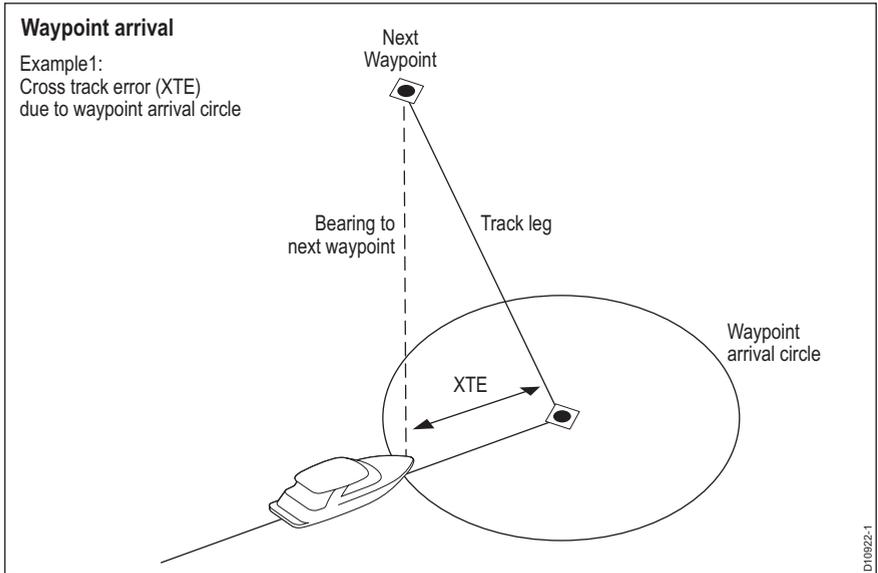
You can change the initial direction and various other parameters for each pattern as required (see *Patterns* on page 17).

3.6 Following a route set on a Chartplotter (Track mode)

CAUTION: Safety in Track mode

Track mode provides accurate track keeping even in complex navigational situations. However, it is still the skipper's responsibility to ensure the safety of their boat at all times through careful navigation and frequent position checks. Track mode assists precise navigation and removes the tasks of compensating for wind and tidal drift. However, you **MUST** still maintain an accurate log with regular plots.

In Track mode, the SmartPilot maintains a route between waypoints created on a navigation system. It makes any course changes necessary to keep your boat on course, automatically compensating for tidal streams and leeway.



Track mode is available only if you have connected the SmartPilot to a suitable navigation system providing SeaTalk or NMEA information. (See *ST70 Pilot Controller/SmartPilot X Commissioning Instructions* for connection details)

Your SmartPilot system can receive route information from:

- a SeaTalk (ST1 & SeaTalk^{ng}) navigation instrument or chartplotter.
- a navigation system transmitting data in NMEA 0183 or NMEA 2000 format.

Activating Track mode

CAUTION: Make suitable preparations for entering track mode

When you enter Track mode, the SmartPilot will bring the boat onto the track in a controlled way. The closer the boat is to the correct heading and track, the quicker it will settle the boat onto the new course. To avoid an unexpected turn, align the boat approximately with the required track before entering Track mode.

Start with the SmartPilot in AUTO mode and your chartplotter following a route.

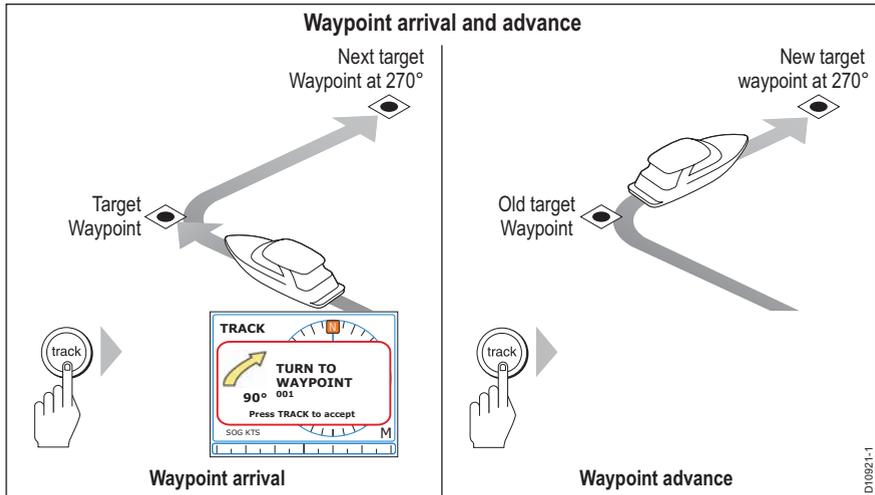
1. Press TRACK to enter Track mode.

2. Wait for the warning to sound.

The display will show the bearing to the next planned waypoint and the direction in which the boat will turn to reach this waypoint.

3. If it is safe for the boat to turn onto the new course, press the TRACK button:

- the SmartPilot will turn the boat onto the new course.
- the display will show the heading required to achieve the required track.



- Notes:
- (1) *The rate of turn when in Track mode is set using the TURN RATE calibration setting. Adjust this as appropriate for optimum comfort.*
 - (2) *If the boat is more than 0.3 nm from the track, the Large Cross Track Error warning will sound (see page 27).*

Leaving Track mode

You can leave Track mode at any time by:

- pressing AUTO to return to Auto mode.
- pressing DODGE to perform a dodge maneuver (see *Using Dodge in Track mode on page 28*).
- pressing STANDBY to steer manually in Standby mode.

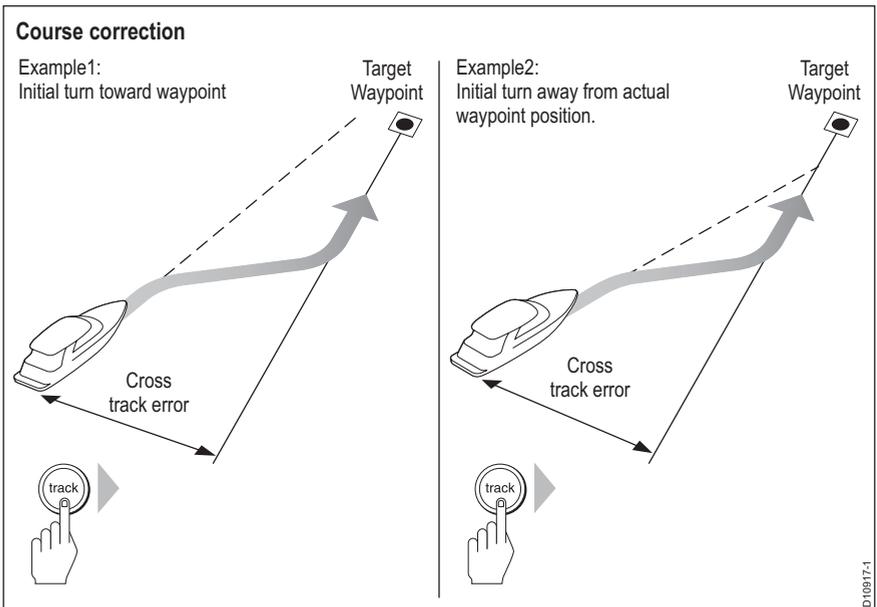
Cross track error

Cross track error (XTE) is the distance between the current position and a planned track leg.

There are a number of reasons why you may have a cross track error (XTE), for example:

- Pressing the track button at a position some distance from the route.
- Course change to avoid an obstacle.
- Waypoint arrival under certain conditions (See *Waypoint arrival* on page 28)

CAUTION: When returning to TRACK mode the autopilot will correct the XTE in order to keep to the defined track leg. The direction of turn may not coincide with the bearing to waypoint and may be different from that expected.

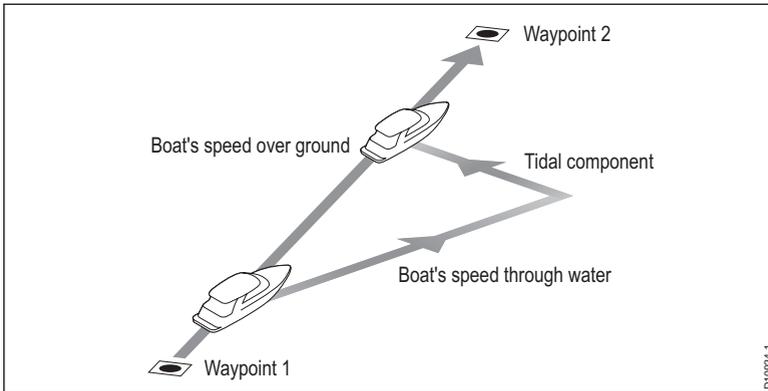


If the cross track error is greater than 0.3 nm, the SmartPilot will sound the Large Cross Track Error warning and show whether you are to the port (Pt) or starboard (Stb) of the planned track.

Note: The cross track error alarm will continue to display and sound until it is reduced to less than 0.3Nm.

Tidal stream compensation

Under most conditions, the SmartPilot will hold the selected track to within ± 0.05 nm (300 ft) or better. It takes account of the boat's speed when computing course changes to ensure optimum performance.



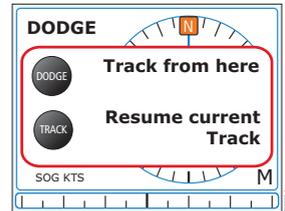
Using Dodge in Track mode

When in Track mode, press DODGE. (See *Dodging an obstacle and then resuming course on page 23*)

The DODGE popup will appear over whichever pilot view you have currently selected.

Once you have finished steering manually you can:

- Press DODGE to track from here to the next waypoint, or
- Press AUTO to return to the previous track.



Waypoint arrival

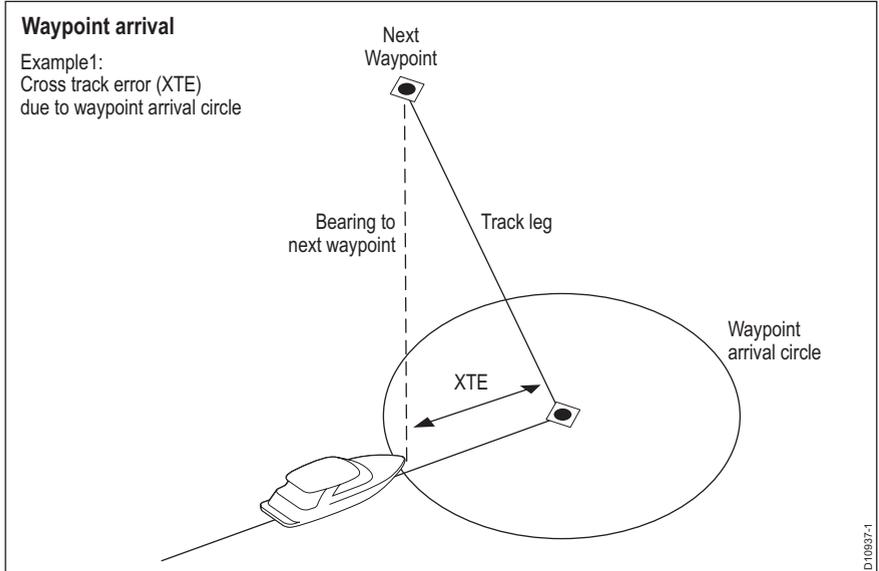
As the boat arrives at the target waypoint the chartplotter will select the next target waypoint and transmit this to the SmartPilot. It will then detect the new target waypoint name, sound a Waypoint Advance warning and display the Waypoint Advance popup.

This shows the new bearing to the next waypoint and the direction the boat will turn to acquire the new track.



Waypoint arrival circle

The NEXT WPT screen and acknowledgement occur within a circle around the actual waypoint (and hence a distance from the next track leg). If you have manually changed the default waypoint arrival circle value to 0.3Nm or greater this can result in a cross track error alarm and associated course correction.



Refer to *Cross track error* on [page 27](#) for more details.

Steering to the next waypoint in a route

When the Waypoint Advance warning sounds, the SmartPilot suspends Track mode and maintains the current boat heading. To advance to the next waypoint:

1. Check that it is safe to turn onto the new track.
2. Press the TRACK button. This will cancel the Waypoint Advance warning and turn the boat towards the next waypoint.

Note: *If you do not press TRACK to accept the Waypoint Advance, the SmartPilot will maintain the current heading and continue sounding the warning.*

Skipping a waypoint (SeaTalk chartplotters only)

If you want to advance to the next waypoint **before** you have arrived at the target waypoint, you can skip a waypoint by pressing TRACK for 1 second. The display will then show the Waypoint Advance screen for the next waypoint. Check it is safe to turn, then press TRACK to turn the boat towards the next waypoint.



WARNING: Ensure navigation safety

Skipping a waypoint will take you straight to the next waypoint. Check your navigation before making the turn.

Waypoint Advance warning

The SmartPilot activates the Waypoint Advance warning in Track mode whenever the target waypoint name changes. This occurs when:

- you select automatic acquisition by pressing TRACK from Auto
- you request waypoint advance by pressing TRACK for 1 second in Track mode (with SeaTalk navigators only)
- the boat arrives at the target and the navigator accepts the next waypoint
- you activate the Man Overboard (MOB) function.

When the warning sounds, the SmartPilot continues on its current heading but displays:

- the bearing to the next waypoint
- the direction the boat will turn to take up that bearing.

To respond to a Waypoint Advance warning:

- check that it is safe to turn onto the new track, then press TRACK to accept the waypoint advance
- alternatively, you can cancel the warning without accepting the waypoint advance by pressing:
 - AUTO to continue on the same heading, or
 - STANDBY to return to manual control

Route completion

The SmartPilot displays the ROUTE COMPLETED warning when you have reached the last waypoint on a route in Track mode.

Note: *The 'Route Complete' alarm only sounds and displays in conjunction with a SeaTalk chartplotter. NMEA chartplotters do not support the 'Route Complete' function, they will display 'NO DATA'.*

- press AUTO to continue on the same heading.
- or press STANDBY to return to manual control.

3.7 Using the SmartPilot with sail boats

Using Wind Vane mode

You can only select Wind Vane mode if the SmartPilot is receiving suitable SeaTalk or NMEA wind direction information.

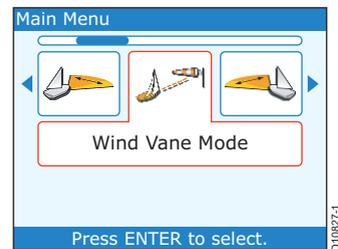
What is Wind Vane mode?

When the SmartPilot is in Wind Vane mode it uses the wind angle as the primary heading reference. As changes in the true or apparent wind angle occur, it adjusts the locked heading to maintain the original wind angle.

Selecting Wind Vane mode

You can select Wind Vane mode from either Standby or Auto mode:

1. Steady the boat onto the required wind angle.
2. Press MENU, then use < and > to select Wind Vane mode and lock the current wind angle. The display shows the locked heading (e.g. 128°) and the wind angle (e.g. WIND 145P indicates an wind angle of 145° to port).
3. The SmartPilot will then adjust the boat's heading to maintain the locked wind angle.



Adjusting the locked wind angle

You can adjust the locked wind angle by using the **-1**, **+1**, **-10** and **+10** buttons to change course. For example, to bear away by 10° when the boat is on a starboard tack:

- press **-10** to turn the boat 10° to port – the locked wind angle and locked heading will both change by 10°.
- the autopilot will then adjust the locked heading as required to maintain the new wind angle.

Note: Because turning the boat affects the relationship between the true and apparent wind angles, you should only use this method to make minor adjustments to the wind angle. For major changes, return to Standby mode, steer onto the new heading, then reselect Wind Vane mode. Refer to the ST70 Autopilot Controller User Reference Guide for the procedure for changing the wind reference between True and Apparent.

Leaving Wind Vane mode

You can leave Wind Vane mode by:

- pressing **AUTO** to return to Auto mode.
- pressing **STANDBY** to return to manual control.

True and apparent wind

SmartPilots can maintain a course relative to either an apparent or true wind angle in Wind Vane mode

The default setting is apparent wind. If required, you can change this to true wind in User Calibration. See *Wind Selection* on page 16.

WindTrim

In Wind Vane mode the SmartPilot uses WindTrim to eliminate the effects of turbulence and short term wind variations. This provides smooth and precise performance with minimal power consumption. You can adjust the wind response (WindTrim) level in User Calibration to control how quickly the SmartPilot responds to changes in the wind direction. Higher wind trim settings will result in a pilot that is more responsive to wind changes. See *Wind Trim* on page 16.

Dodging an obstacle in Wind Vane mode

In Wind Vane mode you still have full control from the keypad. You can make a dodge maneuver by using the course change buttons (**-1**, **+1**, **-10** or **+10**) to select the desired course change.

After you have avoided the hazard, you can cancel the dodge course change by making an equal course change in the opposite direction.

Wind Shift warning

If the autopilot detects a wind shift of more than 15° it will sound the wind shift warning and display the WIND SHIFT message:

- To cancel the warning, and retain the existing wind angle and new heading, press CANCEL.
- Alternatively, to cancel the warning and return to the previous heading:
 - adjust the locked wind angle using the **-1**, **+1**, **-10** and **+10** buttons.
 - press STANDBY to return to hand steering, steer onto the required heading, and press CANCEL to return to Wind Vane mode with the new wind angle.

Using AutoTack in Wind Vane mode

Note: If you use the AutoTack function in Wind Vane mode, make sure the wind vane has been centered accurately.

The SmartPilot has a built in automatic tack facility (AutoTack) that turns the boat through a specified angle (default is 100°) in the required direction.

- To AutoTack to port: press the **-1** and **-10** buttons together.
- To AutoTack to starboard: press the **+1** and **+10** buttons together.

You can adjust the default AutoTack angle in User Calibration. See *Auto Tack Angle* on page 15.

You can also use the menu button to select and execute the autotack option.

When you Auto Tack in Wind Vane mode, the boat turns through the Auto Tack angle. The SmartPilot will then trim the heading to mirror the locked wind angle from the previous tack.

Operating hints for Wind Vane mode

- Always trim your sails carefully to minimize the amount of standing helm.
- Reef the headsail and mainsail a little early rather than too late.
- In Wind Vane mode the SmartPilot will react to long-term wind shifts, but will not correct for short-term changes such as gusts.
- In gusty and unsteady inshore conditions, it is best to sail a few degrees further off the wind so that changes in wind direction can be tolerated.
- Avoid using Auto Tack in conditions where the wind may shift suddenly.

CAUTION: Allow time for course changes

CAUTION: When making major course changes, the trim on the boat may change substantially. Due to this, the SmartPilot may take some time to settle accurately onto the new course.

Preventing accidental gybes

The gybe inhibit feature stops the boat from performing an AutoTack away from the wind – this will prevent accidental gybes. This feature can be disabled if required.

Note: *For the gybe inhibit feature to work, the SmartPilot needs suitable wind information.*

With gybe inhibit on:

- you will be able to perform an AutoTack through the wind.
- the autopilot will prevent the boat from performing an AutoTack away from the wind, to prevent accidental gybes.

With gybe inhibit off:

- you can perform an AutoTack through or away from the wind.

Note: *Gybe inhibit is switched on as a default but can be disabled in User Calibration. See Gybe Inhibit on page 15.*

Chapter 4: Maintenance and 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 autopilot controller with a soft damp cloth.

Do NOT use chemical or abrasive materials to clean your controller.

Do NOT wipe the controller 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 autopilot controller, 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 it correctly as described in the *ST70 Pilot Operating Guide*.

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 controller.
- Be aware that radio signals transmitted nearby (for example from another boat or shore station) could affect the performance of your ST70 controller.

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 it appears that an ST70 controller is not operating satisfactorily, check the symptoms below to determine how to resolve the problem:

- Nothing on the controller screen – refer to *Figure 4-1, ST70 troubleshooting – Chart 1*.
- Data missing from the controller screen – refer to *Figure 4-2, ST70 troubleshooting – Chart 2*.
- Data on the controller screen is garbled – refer to *Figure 4-3, ST70 troubleshooting – Chart 3*.
- Specific data types are missing or incorrect:
 - Check the relevant Transducer and Pod, including the 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.

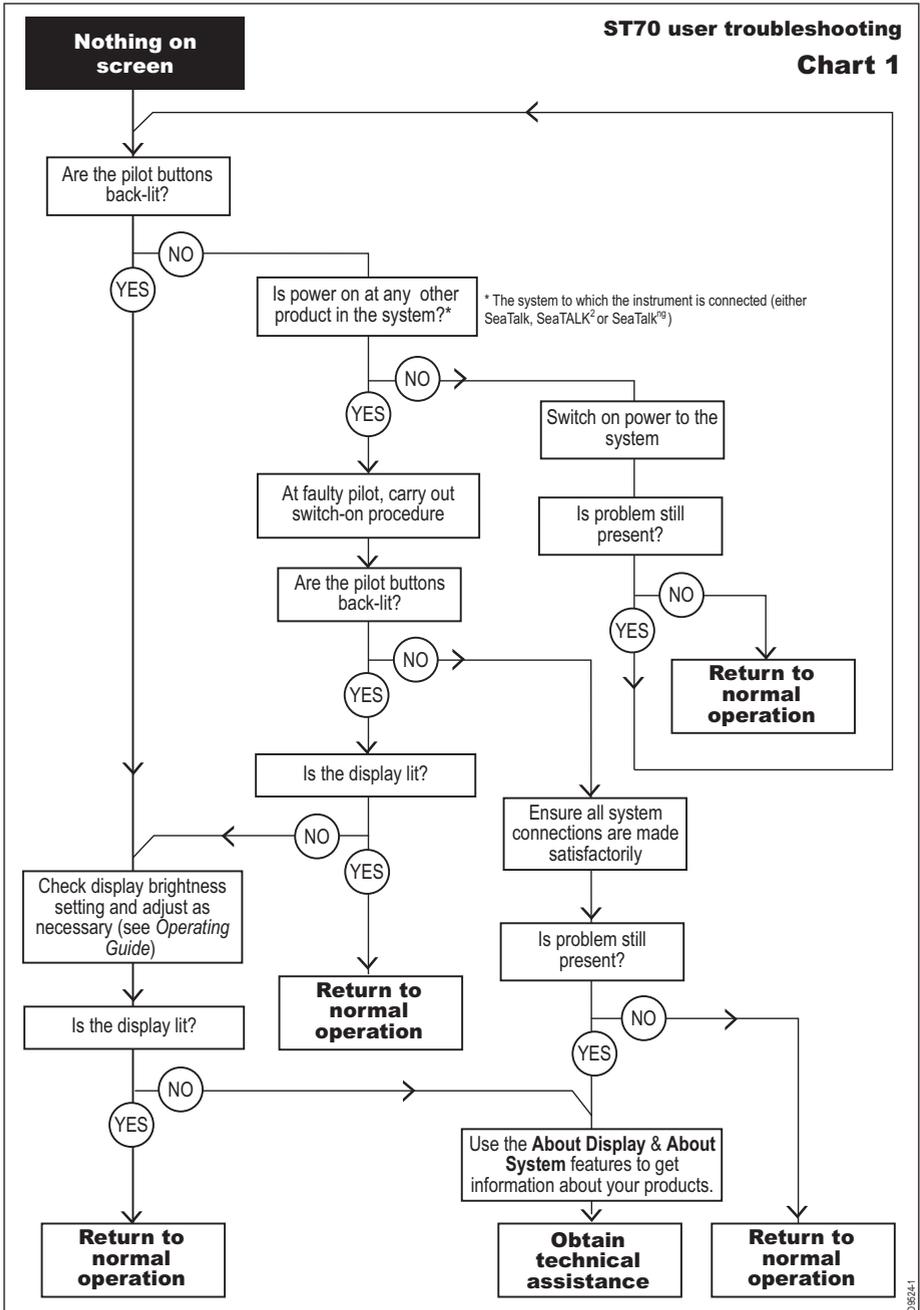


Figure 4-1 ST70 troubleshooting – Chart 1

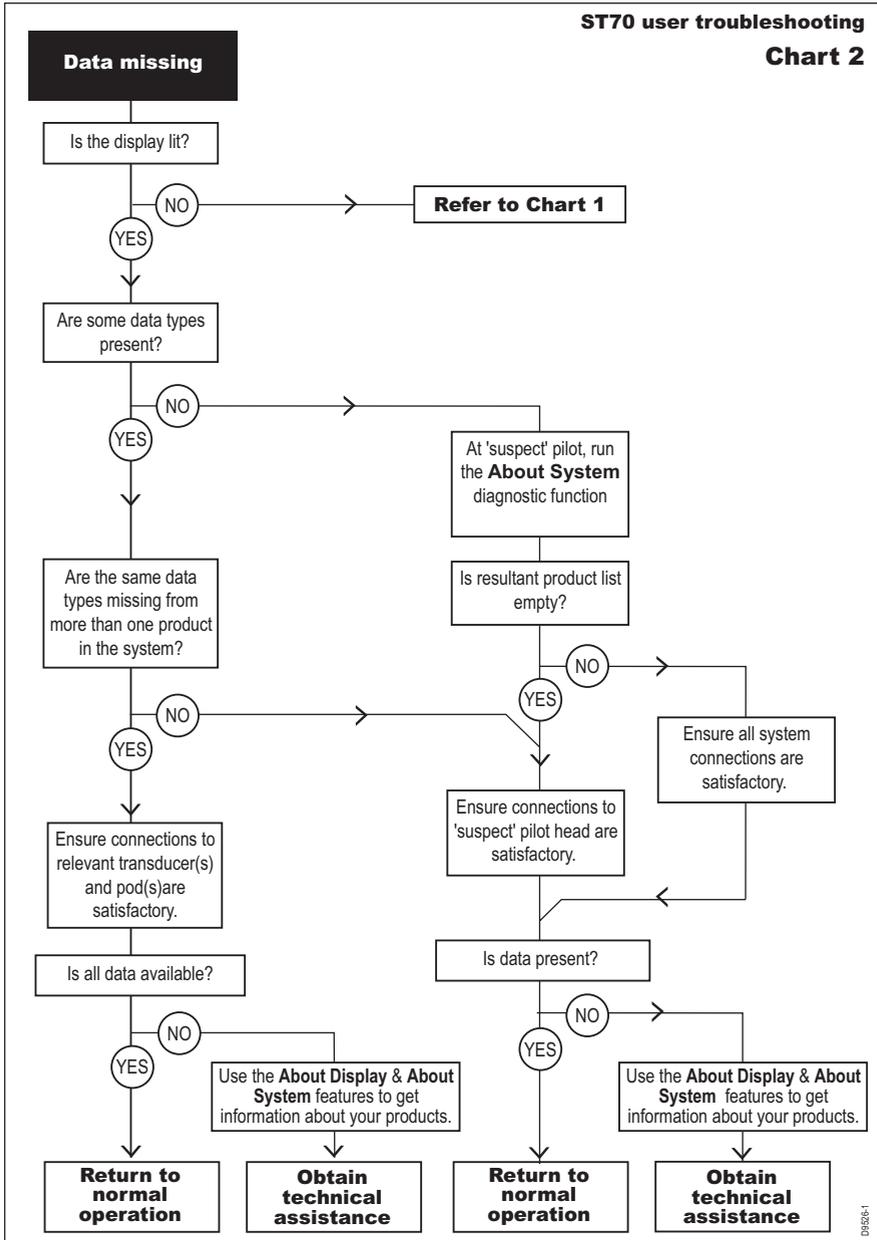


Figure 4-2 ST70 troubleshooting – Chart 2

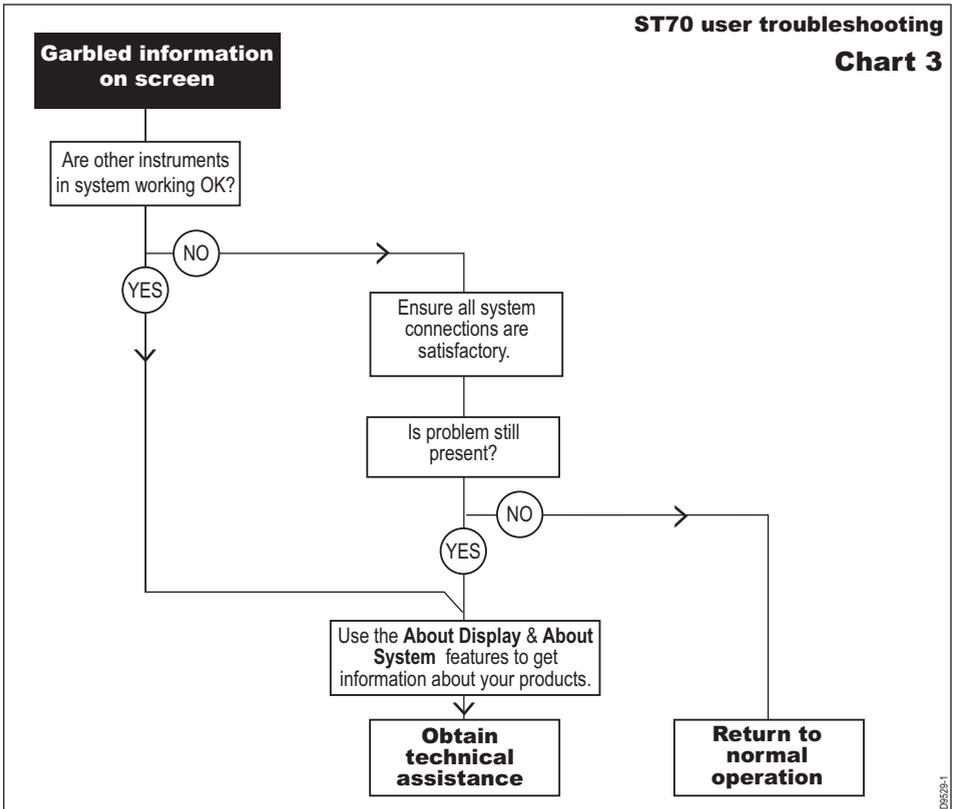


Figure 4-3 ST70 troubleshooting – Chart 3

Using the About Display feature

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

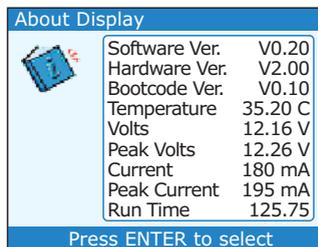
- Software Version Number
- Hardware Version Number
- Bootloader Version Number
- Temperature
- Voltage
- Peak voltage
- Current
- Peak current
- Total hours run

To run the About Display function:

1. With the instrument switched on, press MENU to display the Main Menu, then use < and > to select the **Diagnostics** option.
2. Press ENTER to display the **Diagnostics** menu.



3. With the **Diagnostics** menu displayed, use < and > to select the **About Display** option, then press ENTER. Note that:
 - **Temperature** should be in the range -30°C to +70°C
 - **Volts** should be in the range 9 V to 16 V
 - **Peak Volts** should be in the range 9 V to 16 V
 - **Current** and **Peak Current** should be not greater than 220 mA



4. Make a note of any 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 diagnostic feature.

Chapter 5: Alarms

A range of alarm functions are available, to alert you to particular events. When an alarm occurs, a popup box is displayed and an audible alarm indication may sound. The popup identifies the reason for the alarm. If an alarm occurs you can silence it by pressing CANCEL, or switching to STANDBY (if in **AUTO** mode).

The following alarm functions are supported by the ST70, although they may not all be applicable to your system.



Alarm	Description	Action
Calibration required	The pilot has not been fully calibrated. This will appear for a few seconds after initial power-up.	Self-cancelling. Change mode.
Off course	Vessel is off course by more than the predetermined limit. May appear in Auto, Track and Wind Trim modes.	Change mode. Change course. Reduce heading error.
Route complete	Indicates completion of a route, when in Track mode.	Change mode.
Large Cross Track Error	The cross track error (XTE) is greater than 0.3nm. May appear when in Track mode or when entering Track mode from any other mode.	Change mode. Data flagged as valid.
Loss of waypoint data	Loss of waypoint data	Change mode
Wind shift	Apparent wind angle has changed by more than 15 degrees.	Change mode. Change course. Reduction in change of wind angle.
Auto release	Safety alarm.	
Auto release (SD)	Safety alarm.	
Drive stopped	Safety alarm. A rudder stall condition has persisted for more than a predetermined time, and power has been removed from the drive unit. May appear in Auto, Track and Wind Trim modes.	Change mode. Reversal of drive demand.
No control head	Safety alarm.	
Seatalk 1 fail	Safety alarm.	
Seatalk 2 fail	Safety alarm.	
EEPROM corruption	Safety alarm.	
No pilot	Safety alarm.	
Variable text general alarm	Safety alarm.	Safety alarm.
No compass	Safety alarm.	

Alarm	Description	Action
Rate gyro fault	Safety alarm.	
Current limit	Safety alarm.	
Rudder feedback unit fault	Safety alarm.	
Autolearn fail 1 (not carried out)	Safety alarm.	
Autolearn fail 2 (manual intervention)	Safety alarm.	
Autolearn fail 3 (compass or drive error)	Safety alarm.	
Autolearn fail 4	Safety alarm.	
Autolearn fail 5	Safety alarm.	
Autolearn fail 6	Safety alarm.	
Turn rate too high	Safety alarm. Indicates an excessive turn rate when calibrating the fluxgate compass. May appear in Calibration mode.	Change calibration stage. Reduce turn rate.
Low battery		
No navigation data	Absence of one of the following: Compass (Auto, Track and Wind Trim modes). XTE (Track mode). Wind angle (Wind Trim mode)	
MOB		
Pilot start up		
Waypoint advance	Indicates change of waypoint when in Track mode.	Change mode. Accept new waypoint/leg.
Waypoint advance Turn to port		
Waypoint advance Turn to starboard		
No wind data		
No speed data		
Drive short		
Clutch short		
Solenoid short		

Chapter 6: Data List

This section lists the data supported by the ST70 Autopilot Controller. Please note that these data are dependent on the configuration of individual systems, so will be not all be available on all systems.

Data	Group
Alarm deep anchor	DEPTH
Alarm High Apparent Wind Angle	WIND
Alarm High Apparent Wind Speed	WIND
Alarm High sea temperature	ENVIRONMENTAL
Alarm High speed	SPEED
Alarm High True Wind Angle	WIND
Alarm High True Wind Speed	WIND
Alarm Low Apparent Wind Angle	WIND
Alarm Low Apparent Wind Speed	WIND
Alarm Low sea temperature	ENVIRONMENTAL
Alarm Low speed	SPEED
Alarm Low True Wind Angle	WIND
Alarm Low True Wind Speed	WIND
Alarm maximum depth	DEPTH
Alarm minimum depth (shallow alarm)	DEPTH
Alarm off-course	HEADING
Alarm shallow anchor	DEPTH
Alarm silence	ALARM
Alarm waypoint arrival	NAVIGATION
Apparent wind angle	WIND
Apparent wind speed	WIND
Bearing to waypoint	NAVIGATION
Course over ground	GPS
Course over ground + Speed over ground	GPS
Course to steer	PILOT
Cross track error	NAVIGATION
Depth	DEPTH
Heading	HEADING
Heading response	HEADING
Illumination	SYSTEM
Local date	TIME

Data	Group
Local time	TIME
Local time + date	TIME
Locked heading	HEADING
Magnetic or true	HEADING
MOB	MOB
Sea temperature	ENVIRONMENTAL
Serial number	DIAGNOSTIC
Software version	DIAGNOSTIC
Speed over ground	GPS
Speed	SPEED
Speed through water + Speed over ground	GPS
Tack heading	HEADING
True wind angle	WIND
True wind speed	WIND
Wind angle response	WIND
Wind speed response	WIND

Chapter 7: Vessel Settings

The following table gives possible values for the various vessel settings and their effect on performance. For full details refer to the *ST70 Autopilot Controller/SmartPilot X Commissioning Instructions*.

Setting	Effect	Values	Default
Auto Release	Allows manual override on Auto mode	On or Off	On
Rudder Gain	Amount of helm applied to correct course errors	1 to 9	4
Counter Rudder	Amount of rudder applied to prevent yaw	1 to 9	5
Rudder damping	Prevents hunting	1 to 9	2
Auto Trim	Rate at which helm applied to correct trim changes	OFF, 1 to 6	1
Auto Turn	Amount of course change in Auto Turn	Number of degrees	90
Response Levels	Controls relationship between course accuracy and helm activity	1 to 3 – minimizes 4 to 6 – normal conditions 7 to 9 – tightest	5
Off course alarm	Alarm sounds when off course by this amount for more than 20 seconds	15 to 40 degrees in 1-degree steps	15
Turn Rate Limit	Limits turn rate when over 12 knots	1 to 30 degrees in 1-degree steps	5
Power steer	Controls helm when using a joystick	Proportional Bang-Bang	Proportional
Latitude Compass Damping	Adapts for higher latitudes if no latitude data available	On or Off	On
Rudder Limit	Prevents rudder from hitting endstops	Degrees	20
Rudder Offset	Offset from amidships		0
Reverse Rudder Reference	Reverses the phase of the reference	Port or Starboard	
Auto Tack	Angle through which to tack	Degrees	90
Gybe Inhibit	Prevents gybes	Enable or Disable	Enable
Wind Selection	Use true or apparent wind in Wind Vane mode	True or Apparent	
Wind Trim	Controls response to wind direction changes	1 to 9	5

Chapter 8: Technical specifications

Supply voltage	12 V dc (nominal) 16 V dc (maximum) 9 V dc (minimum)
Current	Nominal: dependent upon screen brightness Maximum: not more than 220 mA
Physical dimensions (excluding studs)	4.33(W) x 4.53 (H) x 1.28 (D) 110 mm x 115 mm x 32.5 mm
Weight	250 g (approx.)
Connections	Two SeaTalk ^{ng}
Operating temperature	-20°C to +70°C
Illumination	Sliding scale. Individual unit and system illumination.
Compliances	Europe: 2004/108/EC (EMC) Australia and New Zealand: C-Tick, Compliance Level 2
Buzzer	Monotone buzzer
Load Equivalency Number (LEN)	5

Note: *System components have a Load Equivalency Number (LEN), which contributes to the overall system load. Your system has a maximum load capacity, which must not be exceeded. For more detailed information on SeaTalk^{ng} system capacity refer to the SeaTalk^{ng} Reference Manual.*

Index

- A
- About Display function, 39
- Alarms, 43
- Apparent wind, 16
- Auto mode, 3
 - changing course, 23
- Auto Tack, 32
 - change angle, 15
- Auto Tack Angle, 15
- C
- Cable checking, 35
- Chartplotter
 - following a track, 24
- Cleaning, 35
- Controls, 2
- Course changes, 23
- Cross track errors, 27
- D
- Data boxes, 10
- Date
 - format, 9
- Depth
 - display response level, 12
 - response level, 14
 - units, 8
- Diagnostics, 12
- Display
 - brightness, 7
 - colors, 7
 - response level, 12
 - settings, 7
- Disposing of the product, v
- Distance
 - units, 8
- Documentation, vi
- Dodge
 - using, 23
- F
- Flow rate
 - units, 8
- Functions, 1, 4
- G
- Gybe Inhibit, 33
 - enable/disable, 15
- H
- Heading
 - display response level, 12
 - response level, 14
 - steer to, 23
 - units, 8
- Help lines, 41
- L
- Language
 - setting, 9
- M
- Menu
 - mode, 2
 - navigation keys, 5
 - structures, 20
- N
- Navigation keys, 5
- O
- Obstacles
 - dodging, 23
- P
- Pilot View
 - changing displayed data, 10
 - setting, 22
- Product disposal, v
- R
- Response level
 - depth, 14
 - heading, 14
 - setting, 14
 - speed, 14
- Route completion, 30
- S
- Safety, 35
 - electrical, iii
 - general, iii
 - navigation, iii
- Servicing, 35
- Setup
 - display, 7
 - general procedures, 6
 - language, 9
 - pilot view, 22
 - procedures, 4, 5
 - time and date, 9
- SmartPilot
 - functions, 19

Specifications, 49

Speed

- display response level, 12

- response level, 14

- units, 8

Speed, wind

- units, 8

T

Technical support, 40

Temperature

- units, 8

Tidal stream compensation, 28

Time

- format, 9

- offset, 9

Time and date

- setting, 9

Track mode, 24

- activating, 26

- leaving, 26

- tidal compensation, 28

Troubleshooting, 36

- charts, 36

- symptoms, 36

 - data missing from screen, 37

 - garbled information, 38

 - nothing on screen, 36

- technical support, 40

- using About Display, 39

True wind, 16

U

Units

- depth, 8

- distance, 8

- flow rate, 8

- heading, 8

- setting, 8

- speed, 8

- temperature, 8

- wind speed, 8

W

Waypoints

- advance warning, 30

- arrival, 28

- skipping, 29

- steering to, 29

- using, 28

Wind

- speed units, 8

- true/apparent, 16

Wind Angle

- display response level, 12

Wind Speed

- display response level, 12

Wind Trim, 32

- change sensitivity, 16

Wind vane mode, 31