ST7001+
Autopilot
Control Unit
Owner's
Handbook

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Raymarine
ON BOARD

Contents

About this handbook

Welcome to the handbook for the ST7001+ autopilot control unit. This handbook contains two main parts:

Part 1: Using the ST7001+

<table>
<tr><td>1</td><td>**Chapter 1: Introduction**
Introduces the autopilot, its features and its use.</td><td>page 1</td></tr>
</table>

<table>
<tr><td>2</td><td>**Chapter 2: Basic Operation**
Covers basic autopilot operation: using Auto mode, adjusting autopilot performance, and changing the control unit lighting.</td><td>page 3</td></tr>
</table>

<table>
<tr><td>3</td><td>**Chapter 3: Advanced Operation**
Explains how to use Track and Wind Vane modes, adjust rudder gain and display data pages.</td><td>page 17</td></tr>
</table>

<table>
<tr><td>4</td><td>**Chapter 4: Fault Finding & Maintenance**
Provides general maintenance procedures and trouble-shooting information (including alarm messages).</td><td>page 35</td></tr>
</table>

Part 2: Installing the ST7001+

<table>
<tr><td>5</td><td>**Chapter 5: Installing the ST7001+**
Explains how to install your ST7001+ control unit and connect it to your autopilot system.</td><td>page 45</td></tr>
</table>

<table>
<tr><td>6</td><td>**Chapter 6: Commissioning the Autopilot**
Covers dockside checks after installation, and the initial seatrial calibration.</td><td>page 55</td></tr>
</table>

<table>
<tr><td>7</td><td>**Chapter 7: Adjusting Autopilot Settings**
Provides details on adjusting the control unit and autopilot settings in Calibration mode.</td><td>page 75</td></tr>
</table>

At the end of this handbook we have included an appendix, product specifications, a glossary, an index, installation template, and warranty information.

Note: *This handbook contains important information about installing, using and maintaining your new Raymarine product. To get the best from the product, please read this handbook thoroughly.*

Important Information

Warranty

To register your new Raymarine product, please take a few minutes to fill out the warranty card. It is important that you complete the owner information and return the card to us to receive full warranty benefits.

Safety notices

WARNING: Product installation

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

WARNING: Electrical safety

Make sure the power supply is switched off before you make any electrical connections.

WARNING: Calibration

We supply this product calibrated to default settings that should provide initial stable performance for most boats. To ensure optimum performance on your boat, you must complete *Chapter 6: Commissioning the Autopilot* before use.

WARNING: Navigation aid

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

Your Raymarine autopilot will add a new dimension to your boating enjoyment. However, it is the skipper's responsibility to ensure the safety of the boat at all times by following these basic rules:

• Ensure that someone is present at the helm AT ALL TIMES, to take manual control in an emergency.

- Make sure that all members of crew know how to disengage the autopilot.
- Regularly check for other boats and any obstacles to navigation – no matter how clear the sea may appear, a dangerous situation can develop rapidly.
- Maintain an accurate record of the boat's position by using either a navigation aid or visual bearings.
- Maintain a continuous plot of your boat's position on a current chart. Ensure that the locked autopilot heading will steer the boat clear of all obstacles. Make proper allowance for tidal set – the autopilot cannot.
- Even when your autopilot is locked onto the desired track using a navigation aid, always maintain a log and make regular positional plots. Navigation signals can produce significant errors under some circumstances and the autopilot will not be able to detect these errors.

EMC conformance

All Raymarine equipment and accessories are designed to the best industry standards for use in the recreational marine environment. The design and manufacture of Raymarine equipment and accessories conform to the appropriate Electromagnetic Compatibility (EMC) standards, but correct installation is required to ensure that performance is not compromised.

Handbook information

To the best of our knowledge, the information in this handbook was correct when it went to press. However, Raymarine cannot accept liability for any inaccuracies or omissions it may contain. In addition, our policy of continuous product improvement may change specifications without notice. As a result, Raymarine cannot accept liability for any differences between the product and the handbook.

Part 1:
Using the
ST7001+

Part 1: Using the ST7001+

Chapter 1: Introduction
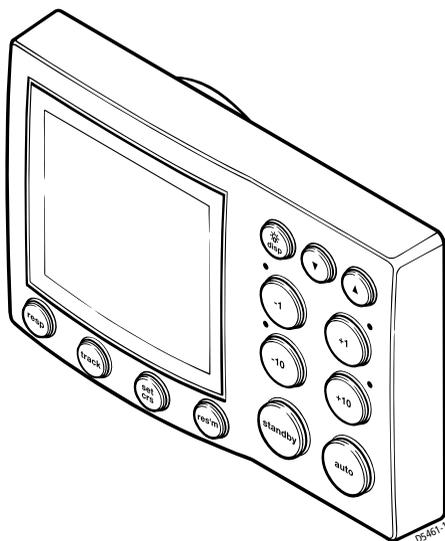
The Raymarine ST7001 Plus (ST7001+) is a SeaTalk® compatible autopilot control unit. It is designed as the main control unit for Raymarine Type 150, 150G, 400 and 400G course computers.

The ST7001+control unit has the following modes:

1. **Standby**: autopilot off (see *page 6*)
2. **Auto**: autopilot steers the boat to maintain a locked heading (see *page 6*)
3. **Track**: autopilot steers the boat to maintain a track between two waypoints created on a navigation aid (see *page 18*)
4. **Wind Vane**: autopilot steers the boat to maintain a course relative to a true or apparent wind angle (see *page 25*)
5. **Calibration**: so you can adjust the autopilot to give optimum performance for your boat (see *page 76*). This includes automatic compass deviation correction (all autopilots) and AutoLearn automatic steering calibration (Type 150G/400G systems only)

The ST7001+ also provides:

- automatic tack (AutoTack) in Auto and Wind Vane modes
- Northerly/Southerly heading compensation
- waypoint advance feature in Track mode

Functions with Type 150/150G and 400/400G autopilots

The functions provided with Type 150/150G and Type 400/4000G autopilots depend on whether the course computer contains an internal GyroPlus yaw sensor:

Type 150G/400G (with GyroPlus)	Type 150/400 (without GyroPlus)
Internal GyroPlus yaw sensor provides enhanced course keeping using AST (Advanced Steering Technology)	Full basic functionality: uses Raymarine steering algorithm without AST
Improved track-keeping	Improved track-keeping
Steering to true and apparent wind in Wind Vane mode	Steering to true and apparent wind in Wind Vane mode
Improved calibration access, including AutoLearn (self-learning calibration)	Improved calibration access, but without AutoLearn

Extended systems

You can connect the ST7001+ to other Raymarine SeaTalk equipment so it can send and receive SeaTalk data:

- it can use wind information from a SeaTalk wind instrument for Wind Vane steering
- 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

You can also use the ST7001+ autopilot with any navigator (GPS, Decca, Loran) or wind instrument that transmits National Marine Electronics Association (NMEA) 0183 data.

The ST7001+ can display SeaTalk and NMEA instrument data in a user-defined selection of data pages. When you are using the ST7001+ to repeat instrument data, it shows a 'pop-up' pilot page for 5 seconds whenever you make a change in autopilot control.

Compatibility with other autopilots

The ST7001+ is also compatible with Raymarine Type 100 and Type 300 course computers (see the Appendix for more details). You can also use it as an additional repeater control unit for any SeaTalk autopilot system, allowing autopilot control from a secondary location.

Chapter 2: Basic Operation

The sections in this chapter explain how to use the basic functions on your ST7001+ autopilot control unit:

2.1	**Using the control unit** Summarizes the key functions and screen layout on the ST7001+ control unit.	page 4

2.2	**Using Auto mode** Provides instructions for engaging/disengaging the autopilot, using Auto mode and adjusting the autopilot's performance.	page 6

2.3	**Adjusting display/keypad lighting and contrast** Explains how to change the lighting and contrast on the control unit display and keypad.	page 15

Note: *If you are using the control unit with a non-150/400 autopilot system, refer to the notes in the Appendix.*

2 Basic Operation

2.1 Using the control unit

Start-up mode

The autopilot always powers up in Standby mode with the display showing the boat's current compass heading.

Note: *You can press* **standby** *at any time to return to manual steering.*

Keypad functions

The autopilot is controlled using simple push-button operations, all of which are confirmed with a short beep. In addition to the main single-key functions, there are several dual key operations.

2 Basic Operation

▼ & ▲
Press to adjust calibration parameters, response and gain

disp
Press to display data pages

Press for 1 second for lamp control

resp
Press to display response level

Press for 1 second for rudder gain

track
Press for Track mode from Auto mode (if a navigator is connected)

Press to accept waypoint advance

Press for 1 second to skip waypoint

set crs
Press to set course bearing

res'm
Press to resume previous course

course change keys
-1 = Port 1˚
-10 = Port 10˚
+1 = Starboard 1˚
+10 = Starboard 10˚

-1 plus **-10**
Press together for AutoTack to port

+1 plus **+10**
Press together for AutoTack to starboard

-1 plus **+1**
Press together for response level

-1 plus **+1**
Press for 1 second for rudder gain

standby
Press for Standby mode

Press for 2 seconds to enter Calibration mode

auto
Press for Auto mode

Press for 1 second for Last Heading

Press again to accept Last Heading

standby plus **auto**
Press for Wind Vane mode (if a wind vane is connected)
Press for 1 second to display Last Wind
Press again to accept Last Wind

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Display layout

The ST7001+ display screen provides the following information:

Autopilot mode indicators

GyroPlus indicator (appears if a yaw sensor is connected to the autopilot)

Variable text area (up to 9 characters)

Distance units:
- no units = kilometres
- nm = nautical miles
- SM = statute miles

Heading indicators

Port and Starboard direction-to-steer indicators

Calibration mode indicator (displayed on calibration pages)

Rudder position indicator or error bar

D5458-1

2 Basic Operation

The bar graph at the bottom of the screen is normally a rudder position indicator. This indicates the current position of the rudder, as measured by the rudder position sensor.

Note: *You can change this to a heading/cross track/wind error bar in Display Calibration, see page 79.*

2.2   Using Auto mode

CAUTION:

Before using Auto mode, make sure that the pilot has been correctly commissioned.

Engaging the autopilot (Auto mode)

To engage the autopilot:

1. Steady the boat on the required heading.
2. Press **auto**:
    *   in Auto mode, the display shows the locked autopilot heading
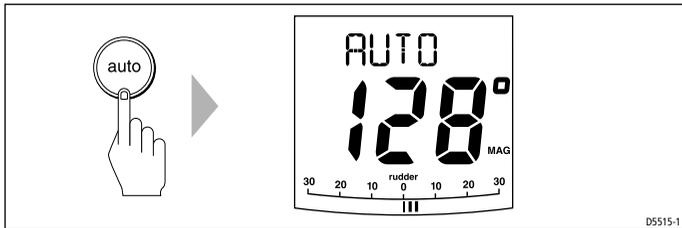
CAUTION:
Autopilot course control makes it easier to sail a boat, but it is NOT a substitute for good seamanship. ALWAYS maintain a permanent watch by the helm.

Disengaging the autopilot (Standby mode)

Press **standby** to disengage the autopilot:

*   in Standby mode, the display shows the boat's current compass heading.
*   the last heading is memorized and can be recalled (see *page 11*).
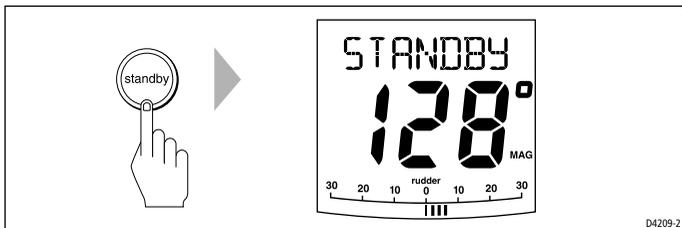
Changing course in Auto mode

In Auto mode, use the **-1** and **-10** (port) and **+1** and **+10** (starboard) keys to change the locked heading in steps of 1° or 10°. For example: press **-10** three times for a 30° course change to port.
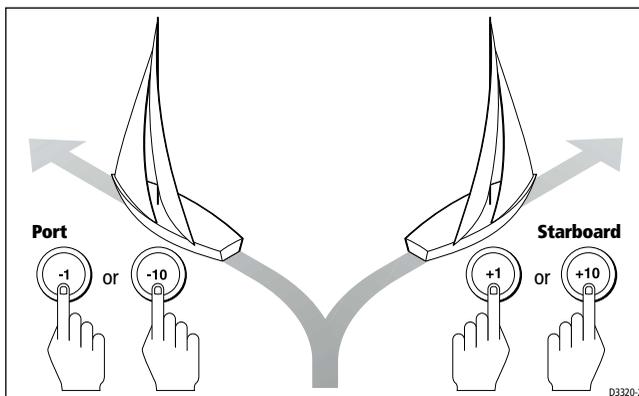
Adjusting performance – Type 150G/400G

The main way you can adjust the performance of Type 150G/400G (GyroPlus) autopilot systems is by changing the response level. This is the only user adjustment you should need to make to the autopilot on a regular basis.

The response level controls the relationship between the autopilot's course keeping accuracy and the amount of helm/drive activity.

Type 150G and 400G autopilot systems have 9 levels of response:

- level 1 gives the least pilot activity to conserve power, but may compromise short-term course-keeping accuracy
- levels 4 to 6 should give good course keeping under normal operating conditions – with crisp, well controlled turns but without being over-aggressive
- level 9 gives the tightest course keeping and greatest rudder activity, but may lead to a rough passage in open waters as the autopilot may 'fight' the sea

When you require extra tight course keeping (e.g. for pilotage in confined and sheltered waters), increase the setting. If you want to minimize drive activity and conserve battery power, decrease the setting.

You can adjust the **default** response level in either User or Dealer Calibration (see *page 89*). This determines the default power-up response level.

However, when using your autopilot on a day-to-day basis, you can make **temporary** adjustments to the response level. By doing this you can match autopilot performance to different conditions.

Temporary changes to response – Type 150G/400G

With these points in mind, you should use the following procedure to make temporary adjustments to the response level when required:

1. Display the RESPONSE screen by pressing either the **resp** key or the **-1** and **+1** keys together momentarily.
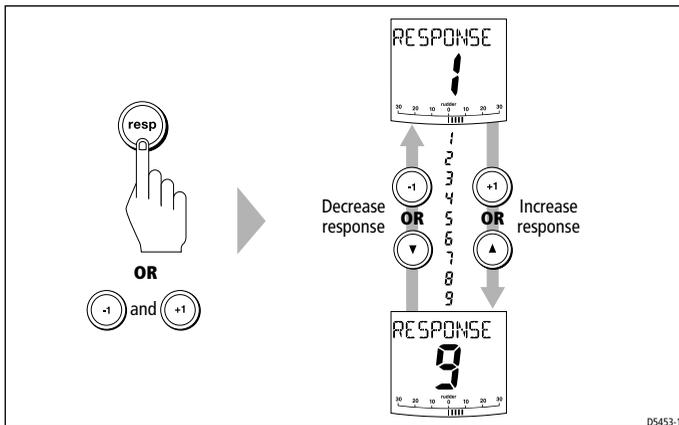
Note: *The* RESPONSE *screen is set as a default data page (see page 81) so you can also access it by pressing* **disp** *and then scrolling through the data pages.*

2. Press **-1** or **+1** or the **up** arrow or **down** arrow keys to change the response level.
3. Press **disp** or wait for 5 seconds to return to the previous display.

Note: *You will lose these temporary changes to response level whenever the system is powered off. You can make **permanent** adjustments in User or Dealer Calibration (see page 89).*

Adjusting performance – Types 150/400 and 100/300

To adjust the performance of Type 150/400 (non-GyroPlus) and Type 100/300 autopilot systems you can change the response level.

Response level – Types 150/400 and 100/300

The response level controls the relationship between the autopilot's course keeping accuracy and the amount of helm/drive activity.

You can adjust the **default** response level in either User or Dealer Calibration (see *page 89*). This determines the default power-up response level.

However, when using your autopilot on a day-to-day basis, you will need to make **temporary** adjustments to the response level. By doing this you can match autopilot performance to different conditions.

Type 150/400 (without GyroPlus) and Type 100/300 autopilot systems have three different response levels:

- **Response Level 1: AutoSeastate on (Automatic deadband)**
  This setting causes the autopilot to gradually ignore repetitive boat movements and only react to true variations in course. This provides the best compromise between power consumption and course keeping accuracy, and is the default calibration setting.
- **Response Level 2: AutoSeastate off (Minimum deadband)**
  This setting provides tighter course keeping. However, this results in increased power consumption and drive unit activity.
- **Response Level 3: AutoSeastate off + yaw damping**
  This setting provides the tightest possible course keeping by introducing counter rudder yaw damping. You can adjust the counter rudder setting in Dealer Calibration (see *page 95*)

To make a **temporary** change to the response setting:

1. Display the RESPONSE screen by pressing either the **resp** key or the **-1** and **+1** keys together momentarily.
2. Press **-1** or **+1** or the up arrow or down arrow keys to change the response between levels 1 to 3.
3. Press **disp** or wait for 5 seconds to return to the previous display.

Note: *You will lose these temporary changes to response level whenever the system is powered off. You can make **permanent** adjustments in User or Dealer Calibration (see page 89).*

2 Basic Operation

Off Course warning

Pt = deviation to port
Stb = deviation to starboard
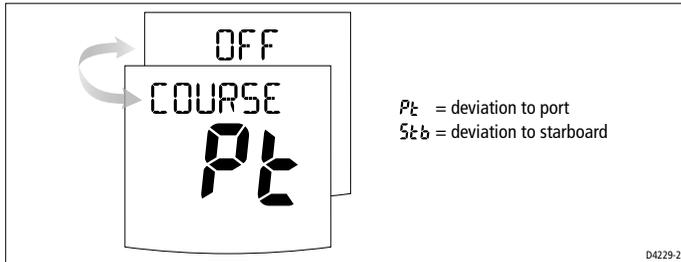
The ST7001+ activates the OFF COURSE warning when the boat has been off course from the locked heading by more than the specified angle* for longer than 20 seconds. It shows whether the deviation is to port or starboard.

Note: * *You can adjust this specified off course angle in Dealer Calibration (see page 97).*

1. To cancel the off course warning, press **standby** to return to hand steering.
2. Check whether your boat is carrying too much sail, or whether the sails are badly balanced. You can usually significantly improve course keeping by improving the sail balance.

Note: *The ST7001+ also clears the warning if the heading recovers, if you change the course, or if you change the operating mode.*

Dodging obstacles 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.

Dodging an obstacle

Obstacle

Original course

-10
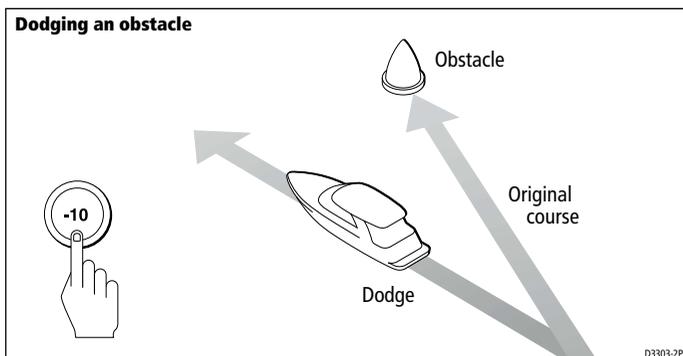
Dodge

Dodging an obstacle

1. Select a course change in the appropriate direction. For example, press **-10** three times for a 30° dodge to port.
2. When safely clear of the obstacle, you can either:
   - reverse the previous course change (for example, press **+10** three times), or
   - return to the previous locked heading (LAST HEADING) as described below

Returning to the previous heading (LAST HEADING)

When the boat is in Auto mode and you have steered the boat away from the selected locked heading for any reason (for example, to execute a dodge maneuver), you can return to the **previous locked heading** (the most recent heading held for 20 seconds). To do this:

1. Press **res'm**. The display flashes and shows the previous locked heading (LAST HEADING) for 10 seconds. The direction-to-steer indicator shows the direction the boat will turn.
2. To accept this heading, and resume this course, press **auto** when the display is flashing.

Note: *If you do not press* **auto** *while the display is flashing, the autopilot will maintain the current heading.*

2 Basic Operation

Returning to last heading
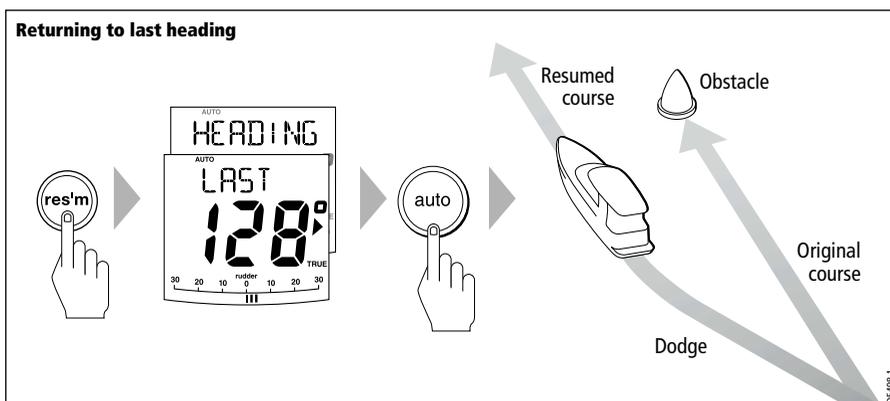
Using the set course feature

The ST7001+ has a set course feature that allows you to set up a course and then apply it at a specific time (e.g. to make a course change at a pre-determined time or location).

To set up a course:

1. Press the **set crs** key. You will then see the SETCOURSE screen with a flashing heading.
2. Use the **-1**, **+1**, **-10** and **+10** keys to set the heading you want. The autopilot will **not** accept the new heading at this stage.
3. If you do not want to accept the new course at this time, return to the previous autopilot mode by either pressing the **disp** key or waiting 10 seconds for the screen to time-out.

To accept the heading you have set on the SETCOURSE screen:

1. Press **set crs** to show the SETCOURSE screen.
2. Press **auto**: the control unit will sound an alarm and show the direction the autopilot will steer (PORT or STARBOARD).
3. Press **auto** again to accept the new heading. The autopilot will then turn the boat onto the set course.

Using sail boat features

Automatic tack (AutoTack)

The ST7001+ has a built in automatic tack facility (AutoTack) that turns the boat through 100° in the required direction. If you have set the vessel type to SAIL BOAT, you can adjust the default AutoTack angle in User or Dealer calibration (see *page 87*).

- to AutoTack to **port**: press the **-1** and **-10** keys together
- to AutoTack to **starboard**: press the **+1** and **+10** keys together

CAUTION:

When making major course changes, the trim on the boat may change substantially. Because of this, the autopilot may take some time to settle accurately onto the new course.

2 Basic Operation

AutoTack - Port

AutoTack - Starboard

D5399-1
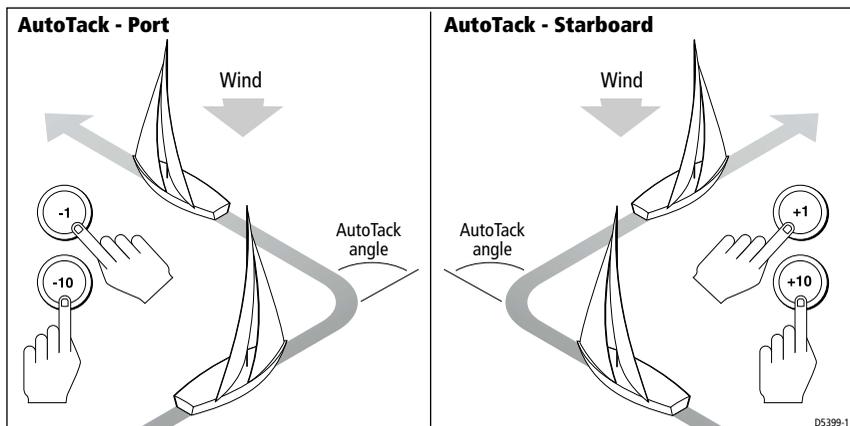
Preventing accidental gybes

Note: *For the gybe inhibit feature to work, the autopilot needs suitable wind information (see page 25).*

The gybe inhibit feature stops the boat from performing an AutoTack away from the wind – this will prevent accidental gybes. On Type 150/150G and 400/400G autopilots, you can turn off this feature if required:

- with gybe inhibit **on**:
  - you will be able to perform an AutoTack into the wind
  - to prevent accidental gybes, the autopilot 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.

Note: *Gybe inhibit is switched on as a default. On Type 150/150G and Type 400/400G autopilots you can switch it off in User or Dealer Calibration (see page 87).*

Gusty conditions

In gusty conditions, the course may tend to wander slightly, particularly if the sails are badly balanced. If you take the following precautions, the autopilot will be able to maintain competent control even in gale force conditions:

- You can significantly improve course keeping by improving the sail balance:
  - do not allow the boat to heel over excessively
  - ease the mainsheet traveller to leeward to reduce heeling and weather helm
  - if necessary, reef the mainsail a little early
- In very strong winds and large seas, you should avoid sailing with the wind dead astern:
  - ideally, bring the wind at least 30° away from a dead run
  - in severe conditions, you may also need to remove the mainsail and sail under headsail only

2.3 Adjusting display/keypad lighting and contrast

Lighting

Note: *When the display lighting is off, the control unit illuminates the keys at a courtesy level.*

To adjust the display and keypad lighting:

1. Press **disp** for 1 second from any mode to access the LAMP screen and turn on the lights.

2. Press the **disp** key to cycle through the possible illumination settings: LAMP 3 (the brightest setting), LAMP 2, LAMP 1, OFF, LAMP 1, LAMP 2, LAMP 3 and so on:
   • as you change the setting, the illumination on any other SeaTalk instruments or control units will also change
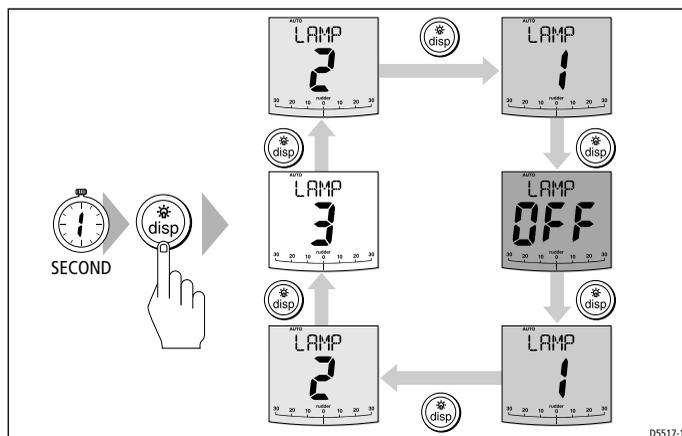
3. The display automatically returns to the previous mode if you do not press a key for 10 seconds:
   • if you press another mode key within 10 seconds you will select the mode assigned to that key (for example: **auto** selects Auto mode, **standby** selects Standby mode)

Note: *You can also adjust the lighting level from any other SeaTalk instrument or control unit.*

Note: *When you switch off the unit you lose any changes you have made to the lighting level.*

2 Basic Operation

Contrast

To set the contrast level for the ST7001+ display:

1. With the autopilot in Standby mode, press the **disp** key for one second to access the LAMP screen.

2. Press the **disp** key for one second again, to display the CONTRAST screen.

3. Use the **up** and **down** arrow keys to set the required contrast level (from 1 to 15).

4. The display automatically returns to the previous mode if you do not press a key for 10 seconds:

   • if you press another mode key within 10 seconds you will select the mode assigned to that key (for example: **auto** selects Auto mode, **standby** selects Standby mode)

Chapter 3: Advanced Operation

The sections in this chapter explain how to use the more advanced functions on your autopilot:

3.1	**Using Track mode** Tracking between waypoints created on navigation equipment connected to the autopilot system.	page 18

3.2	**Using Wind Vane mode – sail boats** Using the autopilot to maintain a course relative to a true or apparent wind angle.	page 25

3.3	**Adjusting the rudder gain** Explains how to adjust the rudder gain setting (mainly applies to non-GyroPlus Type 150/400 systems).	page 29

3.4	**Displaying data pages** Describes how to use data pages to display SeaTalk and NMEA information on the control unit. This section also explains the Watch timer feature.	page 31

3.5	**Remotely controlling ST60 and ST80 instruments** Describes how to use the ST7001+ as a remote control keypad for ST60 and ST80 instruments.	page 34

Note: *If you are using the control unit with a non-150/400 autopilot system, refer to the notes in the Appendix.*

3.1   Using Track mode

Note: *You can only use Track mode if you have connected the autopilot to a suitable navigation system providing SeaTalk or NMEA navigation information.*

The autopilot system can receive track information from either:

- a SeaTalk navigation instrument or chartplotter (see *page 50* for information on connecting to SeaTalk), or
- a non-SeaTalk navigation system transmitting data in the NMEA 0183 format (see *page 51* for information on connecting NMEA equipment)

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

Selecting Track mode

CAUTION:

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

To select Track mode:

1. Start with the autopilot in Auto mode.
2. Press **track** to enter Track mode.
3. Wait for the Waypoint Advance warning to sound. The display will show the bearing to the next planned waypoint and the direction the boat will turn to reach this waypoint.
4. Check that it is safe for the boat to turn onto the new course.
5. Press the **track** key:
   - the autopilot will turn the boat onto the new course in a controlled way
   - the display shows the heading required to achieve the required track

Note: *The closer the boat is to the correct heading and track when you press* **track***, the quicker the autopilot will bring the boat onto the new course. If the boat is more than 0.3 nm from the track, the Large Cross Track Error warning will sound (see page 19).*
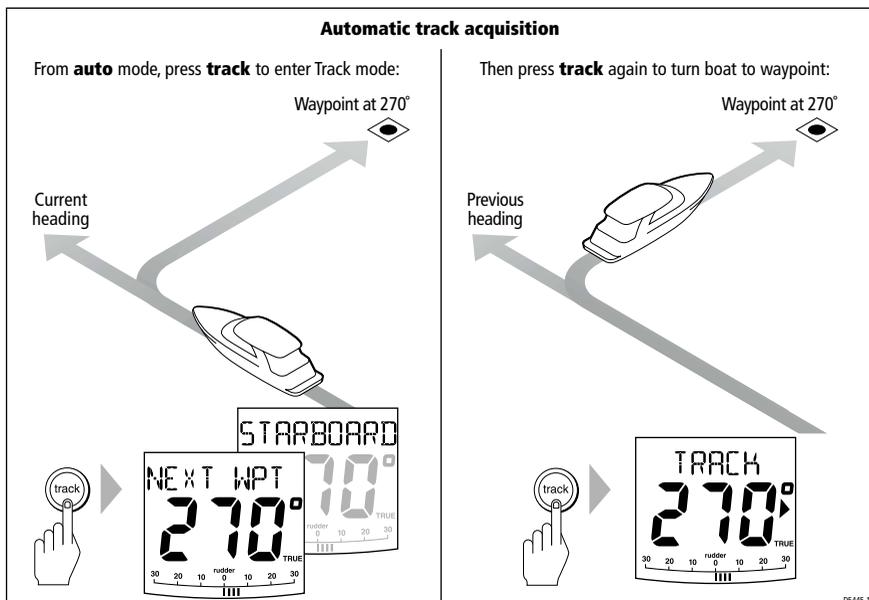
Exiting Track mode

You can exit Track mode and return to Auto or Standby mode by:

- pressing **auto** to return to Auto mode
- 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 route. The autopilot receives the cross track error information from the navigation equipment, and displays the XTE in nautical miles (nm), statute miles (SM) or kilometres.

If the cross track error is greater than 0.3 nm, the ST7001+ will sound the Large Cross Track Error warning and show whether you are to the port (Pt) or starboard (Stb) of the planned track.

Cross track error (XTE) more than 0.3 nm

Waypoint 2

Actual route

Planned route

Waypoint 1

LARGE XTE
Pt
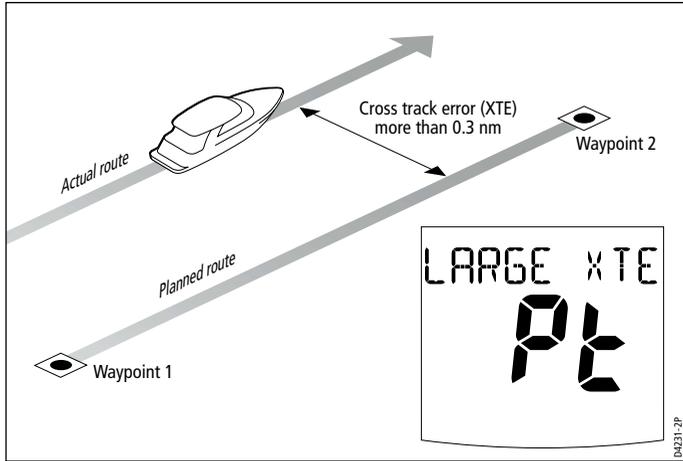
Tidal stream compensation

Under most conditions, the autopilot will hold the selected track to within ±0.05 nm (300 ft) or better. The autopilot takes account of the boat's speed when computing course changes to ensure optimum performance over a wide range of boat speeds.

Waypoint 2

Tidal component

Boat's speed over ground

Boat's speed through water
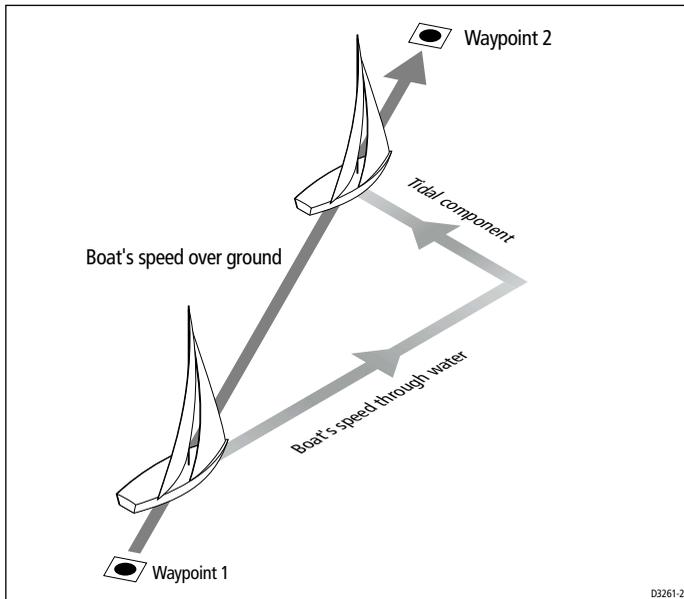
Waypoint 1

In order of preference, the autopilot uses:

- measured boat speed (speed through water)
- if this is not available, it uses the speed over ground (SOG)
- if this is not available, it uses the cruise speed specified in Dealer Calibration (see *page 99*)

Waypoint arrival and advance

Note: *Waypoint advance only operates if the ST7001+ is receiving valid bearing to waypoint and waypoint name information.*

Arrival

As the boat arrives at the target waypoint the navigation aid will select the next target waypoint and transmit this to the autopilot. The autopilot will then detect the new target waypoint name, sound the Waypoint Advance warning and display the Waypoint Advance (NEXT WPT) screen. This shows the new bearing to the next waypoint and the direction the boat will turn to acquire the new track.

Waypoint arrival and advance
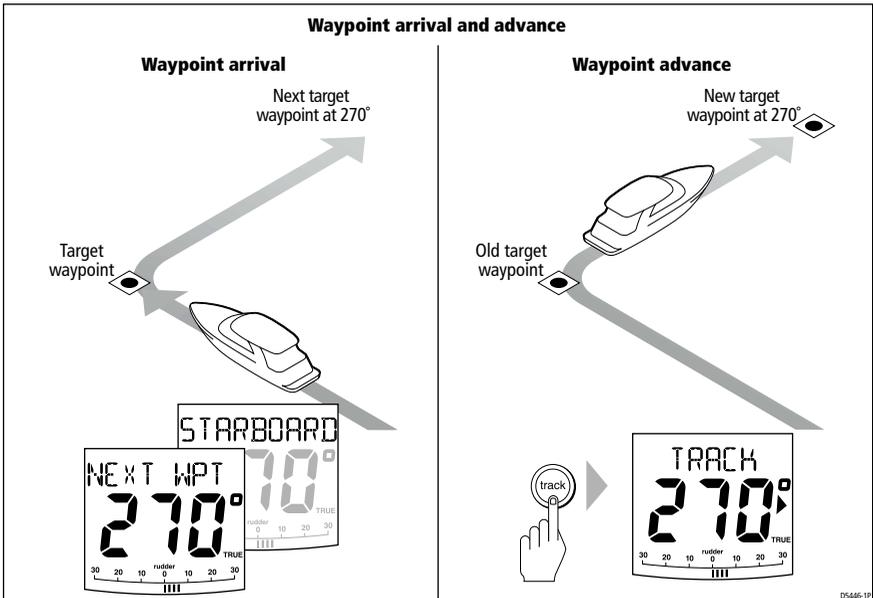
Advance

When the ST7001+ sounds the Waypoint Advance warning, it 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** key. 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 autopilot will maintain the current heading and continue sounding the warning.*

Skipping a waypoint – SeaTalk navigators 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:

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

Route Completed warning

The ST7001+ displays the ROUTE COMPLETED warning when you have reached the last waypoint on a route in Track mode.

To respond to this message:

• press **auto** to continue on the same heading
• or press **standby** to return to hand steering

Waypoint Advance warning – summary

The ST7001+ activates the Waypoint Advance warning (NEXT WPT?) 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 waypoint and the navigator accepts the next waypoint
- you activate the Man Overboard (MOB) function in Track mode

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

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

Responding to a Waypoint Advance warning

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:
    - **standby** to return to hand steering
    - or **auto** to return to Auto mode

Dodges in Track mode

When the autopilot is in Track mode you still have full control from the keypad.

Initiating a dodge maneuver

In Track mode, you can make a dodge maneuver by using the course change keys (**-1**, **+1**, **-10** or **+10**) to select the desired course change.

Cancelling a dodge maneuver

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

3 Advanced Operation

Safety in Track mode

CAUTION:

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.

Sailing in 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.

Confirming position at the start of a journey

At the start of a journey you must always use an easily identifiable fixed object to confirm the fix given by the navigation system. Check for fixed positional errors and compensate for them.

Verifying computed positions

Always verify the computed position with a dead reckoned position, calculated from the average course steered and the distance logged.

Plot frequency

- In open water, you should make plots at least every hour.
- In confined waters or when near to potential hazards, you should make plots more frequently.

3.2   Using Wind Vane mode – sail boats

Note: *You can only select Wind Vane mode if the autopilot is receiving suitable SeaTalk or NMEA wind direction information.*

About Wind Vane mode

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

Wind information

To use Wind Vane mode, the autopilot must receive wind information from one of the following sources:

• SeaTalk wind instrument connected to the autopilot via SeaTalk
• NMEA wind instrument
• Raymarine pushpit wind vane connected via a SeaTalk interface

True and apparent wind

Type 150/150G and 400/400G autopilots can maintain a course relative to either an apparent or true wind angle in Wind Vane mode:

• steering to **apparent wind**, the autopilot maintains the apparent wind angle
• steering to **true wind**, the autopilot maintains the true wind angle

Note: *The default setting is apparent wind. On Type 150/150G and 400/400G autopilots you can change this to true wind in User or Dealer Calibration (see page 89). Type 100/300 autopilots can only maintain a course relative to apparent wind.*

WindTrim

In Wind Vane mode the autopilot 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 or Dealer Calibration (see *page 89*) to control how quickly the autopilot responds to changes in the wind direction. Higher wind trim settings will result in a pilot that is more responsive to wind changes.

3 Advanced Operation

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 **standby** and **auto** together 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)
   - if the autopilot does not enter Wind Vane mode, it is not receiving wind data - check the instrument and connections
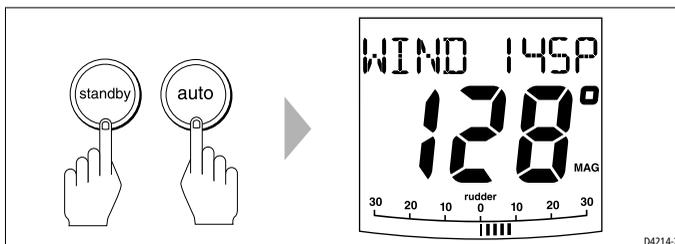
The autopilot will then adjust the boat's heading to maintain the locked wind angle.

Exiting Wind Vane mode

You can exit Wind Vane mode by:
- pressing **auto** to return to Auto mode
- pressing **standby** to steer manually in Standby mode

Adjusting the locked wind angle

You can adjust the locked wind angle by using the **-1**, **+1**, **-10** and **+10** keys 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.*

3 Advanced Operation

Returning to the previous wind angle (LAST WND)

If you have steered the boat away from the selected wind angle for any reason (such as a dodge maneuver or selecting Standby mode), you can return to the previous locked wind angle:

1. Press **res'm** to display the previous wind angle (LAST WIND):
   - the LAST WIND text alternates with the previous wind angle and direction. The display shows the previous locked heading and an indication of which direction the boat will turn
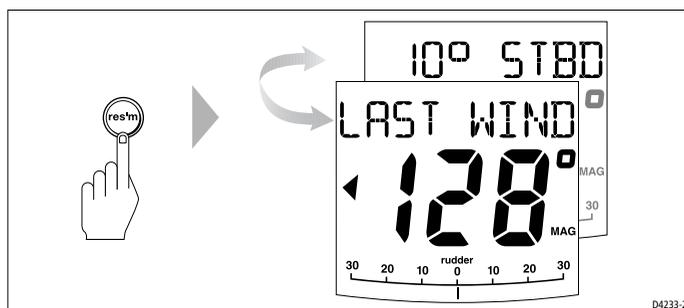
2. Check that it is safe to turn onto this course.
3. To accept this wind angle, press **standby** and **auto** together within 10 seconds.

Note: *If you do not accept the previous wind angle within 10 seconds, the autopilot will lock onto the current wind angle.*

Dodges in Wind Vane mode

When the autopilot is in Wind Vane mode you still have full control from the keypad.

Initiating a dodge maneuver

In Wind Vane mode, you can make a dodge maneuver by using the course change keys (**-1**, **+1**, **-10** or **+10**) to select the desired course change. The autopilot will adjust both the locked heading and locked wind angle.

Cancelling a dodge maneuver

After you have avoided the hazard, you can reverse the previous course change, or return to the previous wind angle (LAST WIND).

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 **standby** and **auto** together.
- Alternatively, to cancel the warning and return to the previous heading, either:
    - adjust the locked wind angle using the **-1**, **+1**, **-10** and **+10** keys,

    or

    - press **standby** to return to hand steering, steer onto the required heading, and press **standby** and **auto** together 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 ST7001+ has a built in automatic tack facility (AutoTack) that turns the boat through 100° in the required direction:

- to AutoTack to **port**: press the **-1** and **-10** keys together
- to AutoTack to **starboard**: press the **+1** and **+10** keys together
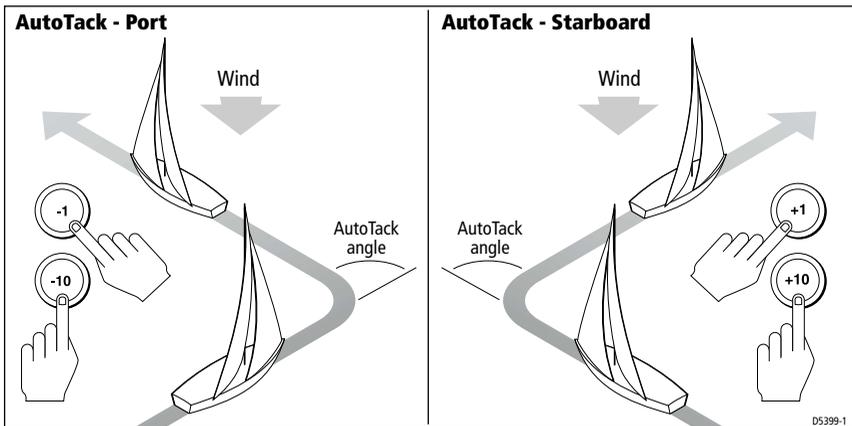
Note: *If you have set the vessel type to* SAIL BOAT, *you can adjust the default AutoTack angle in User or Dealer calibration (see page 87).*

When you AutoTack in Wind Vane mode, the boat turns through the AutoTack angle. The autopilot 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 pilot 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.

3.3   Adjusting the rudder gain

Note: *Although this feature is available on all systems, you should not need to adjust the rudder gain setting on Type 150G/400G autopilot systems after completing the AutoLearn (see page 68).*
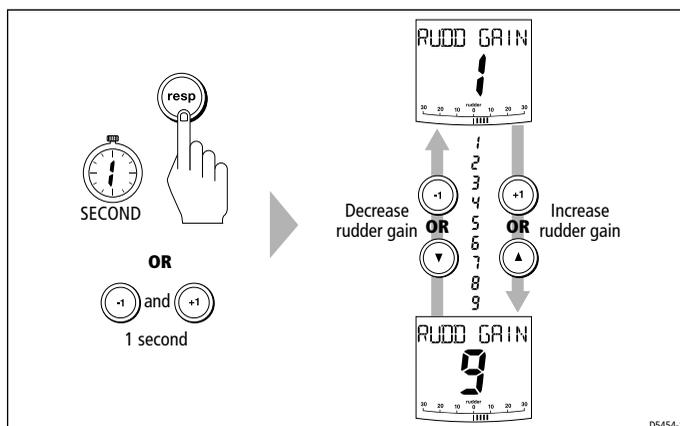
On Type 150/400 (non-GyroPlus) and Type 100/300 systems, you can make temporary adjustments to rudder gain to change the autopilot's steering characteristics. Rudder gain is a measure of how much helm the autopilot will apply to correct course errors:

- if rudder gain is adjusted **correctly**, the course changes should result in a crisp turn followed by an overshoot of no more than 5°

• if rudder gain is **too high**, courses change will result in a distinct overshoot (**A**)

• if rudder gain is **too low**, the boat will feel sluggish – it will take a long time to make the turn and there will be no overshoot (**B**)
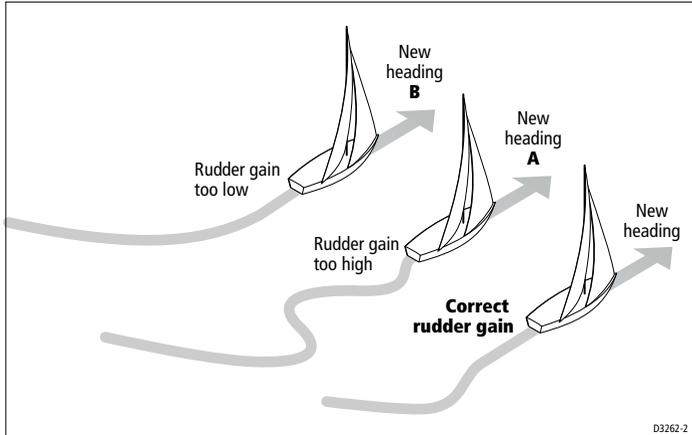
Note: *See page 71 for a full explanation of rudder gain and how to adjust it correctly.*

If necessary, you can make a **temporary** change to rudder gain as follows:

1. Press the **resp** key or the **-1** and **+1** keys together for **1 second** to display the rudder gain (RUDD GAIN) screen:
   • if you have set up the RUDD GAIN screen as a default data page (see *page 81*) you can also access it by pressing **disp** and then scrolling through the data pages.
2. Press **-1** or **+1** or **up**/ **down** arrow keys to change the rudder gain.
3. Press **disp** or wait for 5 seconds to return to the previous display.

Note: *You will lose these temporary changes to rudder gain whenever the system is powered off. You can make **permanent** adjustments in User or Dealer Calibration (see page 95).*

WARNINGS:

1. You must set rudder gain correctly on planing craft. Incorrect rudder gain will lead to poor steering performance and can be dangerous at high speeds.

2. If you increase the rudder gain setting on a Type 150G/400G autopilot, you must also increase the counter rudder setting.

3 Advanced Operation

3.4   Displaying data pages

Use the **disp** key to show 'data pages' of SeaTalk or NMEA data:

1.   Press **disp** to access the first data page, and press it again to cycle through each data page in turn:
     *   to return to a previous data page, press **disp** for 1 second within 2 seconds of displaying a page
     *   when you cycle past the last data page, the display returns to the current autopilot mode screen (for example, Auto)
     *   4 data pages are set in the factory as a default (see diagram): within User setup you can select up to 15 pages and control the information they display (see *page 81*)
2.   Select the data page you want to use as the main display:
     *   the current autopilot mode is shown at the left of the display and the autopilot bar graph remains in use
     *   if you then select a new mode or make a course change, the autopilot mode screen appears as a 'pop-up' for 5 seconds (you can adjust the 'pop-up' time as described on *page 81*)

Notes: *1. If the autopilot system cannot obtain the required information, the data page will show dashes instead of a value.*
2. The direction-to-steer arrows relate to the data page information.
3. Most data pages show repeated data so you cannot adjust them: the exceptions are the RESPONSE *and* RUDDER GAIN *data pages, which you can adjust using the* **-1** *and* **+1** *or* **up/down** *arrow keys*
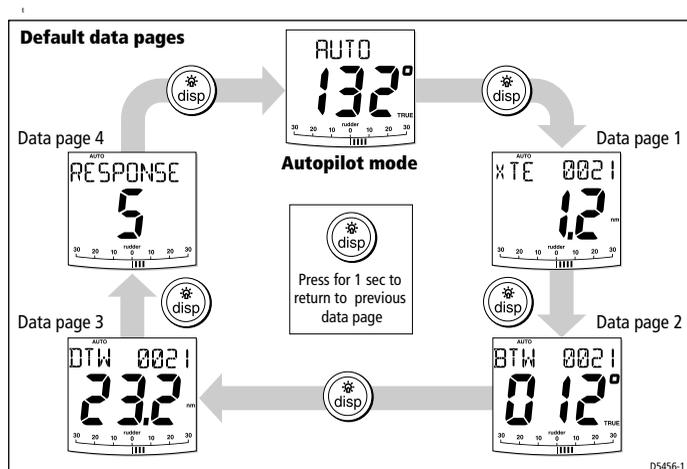
Waypoint names

If waypoint names have been allocated, the ST7001+ will display them on the Cross Track Error (XTE), Bearing To Waypoint (BTW) and Distance To Waypoint (DTW) data pages:

- waypoint names of five characters or less are displayed together with the page name (as shown by screen A below)
- waypoint names of more than five characters alternate with the page name (as shown by screen B below)
- if the waypoint name has more than nine characters, the display only shows the first nine characters
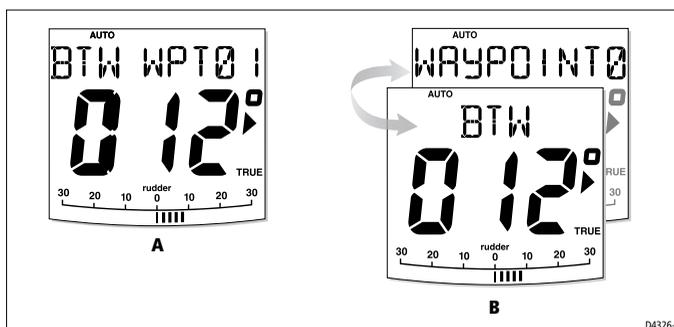
Watch timer

The ST7001+ has a Watch timer controlled by the WATCH data page. This timer sounds a warning every 4 minutes, requiring a keypad press on the autopilot.

Setting the Watch timer

To set the Watch timer:

1. First, you must configure the WATCH screen as one of the data pages for display (see *page 81*).
2. When you have done this select Auto, Track or Wind Vane mode.
3. Press the **disp** key until you see the WATCH data page:
    - the watch timer will start counting
    - when the timer reaches 3 minutes, the WATCH text starts flashing to indicate that the timer is in the last minute
    - when the timer reaches 4 minutes, the ST7001+ activates the audible Watch warning

Responding to a Watch warning

To respond to a Watch warning:

- press **auto** to silence the warning and reset the timer to 4 minutes
  or
- press any other key to silence the warning, reset the timer and perform that key's normal function

Note: *You cannot engage Auto mode directly when the* WATCH *screen is displayed – pressing* **auto** *will only reset the Watch timer. If you want to enter Auto mode, you must first exit the* WATCH *screen (see below).*

Exiting the Watch screen

To exit the Watch screen:

- press **disp** to display a different data page
  or
- press **standby**

Warning messages

Shallow warning (SHALLOW)

The ST7001+ shows the Shallow warning if it receives a shallow depth message from an instrument on the SeaTalk system. Press **standby** or **disp** to cancel the warning.

Man Overboard warning (MOB)

The ST7001+ activates the Man Overboard warning if it receives a man overboard (MOB) message from another instrument on the SeaTalk system. It displays the text MOB instead of the waypoint number for the XTE, DTW and BTW data pages.

3 Advanced Operation

3.5 Remotely controlling ST60 and ST80 instruments

You can use the ST7000+ to remotely control ST60 or ST80 instruments (both standard 110 mm and Maxiview instruments).

Note: *Before attempting to remotely control ST60 or ST80 instruments, you first need to define the instrument grouping and allocate the ST7001+ to the required group (see page 83).*

To operate ST60 or ST80 instruments from the ST7001+ control unit:

1. Select either:
   - the INST REM data page (to control standard instruments), or
   - the MAXI REM data page (to control ST80 Maxiviews).
2. Carry out the required instrument control functions from your ST7001+ (using the keys shown in the following illustration).

Note: *The currently-selected instrument is indicated as follows:*
- *on ST80 instruments, the characters are displayed as white characters on a black background (instead of black on white)*
- *on ST60 digital instruments, you will see a* REMOTE *message*
- *on ST60 analogue instruments, you will see a flashing* TRUE/MAG *and/or* TRUE/APP *message*

Select instrument

All instrument types

Controlling a standard instrument

STANDBY
INST REM

Replicates the key-layout of the selected instrument.
For example: if you press **resp**, the selected instrument responds as though its far left key has been pressed.

Controlling a Maxiview instrument

STANDBY
MAXI REM

Chapter select

Page select

D4325-2
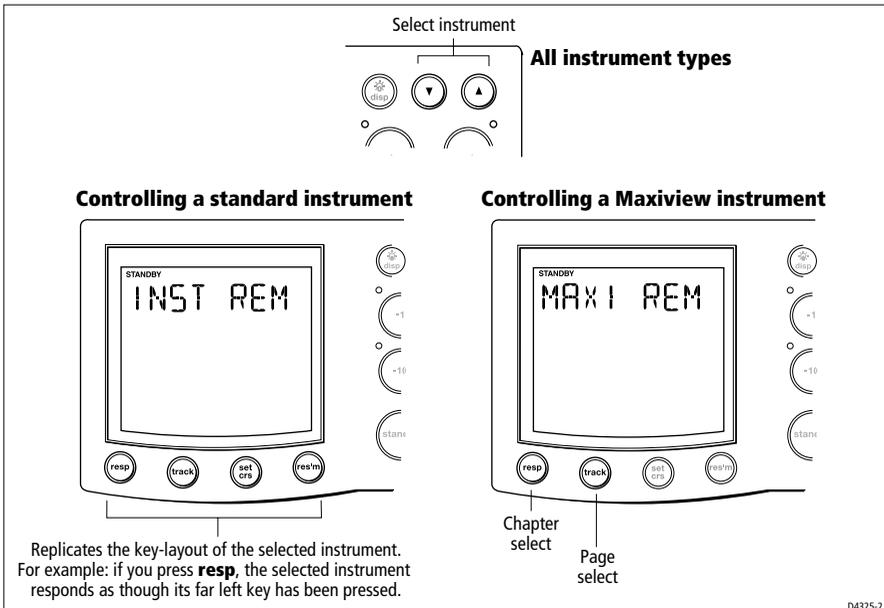
Chapter 4:   Fault Finding & Maintenance

All Raymarine products are designed to provide many years of trouble-free operation. We also put them through comprehensive testing and quality assurance procedures before shipping.

This chapter provides information about identifying common problems, interpreting alarm messages, maintaining your autopilot system and obtaining product support.

If a fault occurs with your autopilot, use the fault finding tables in this section to help identify the problem and provide a solution.If you cannot resolve the problem yourself, refer to the product support information.

4.1	**Fault finding** This section provides information to help you identify and resolve common autopilot problems and error messages.	page 36

4.2	**General maintenance** This section explains how to maintain your autopilot system.	page 39

4.3	**Product support** This section outlines the product support available from Raymarine worldwide.	page 40

4.1   Fault finding

Common autopilot problems

SYMPTOM	CAUSE and SOLUTION
Display is blank	No power – check the power and SeaTalk fuses on course computer, then check main fuse/circuit breaker.
Display shows stationary dashes	The control unit is not receiving data – check cabling.
Display shows rotating dashes	Compass correction in progress (see page 64).
Displayed compass heading does not agree with the boat's compass	You have not calibrated the compass. Carry out the deviation and alignment procedures (see page 64).
No display bar on the display	Rudder bar switched off in Display Calibration – select RUDD BAR or STEER BAR
Rudder bar display moves in opposite direction to rudder	Reverse the red and green rudder position sensor connections at the course computer
Boat turns slowly and takes a long time to come onto course	Rudder gain too low (see page 71). Complete AutoLearn or increase setting.
Boat overshoots when turning onto a new course	Rudder gain too high (see page 71). Complete AutoLearn or decrease setting,
The autopilot appears to be unstable in Track mode, or track-holding is slow	If tide speed exceeds 35% of boat speed, and boat speed is not available via SeaTalk, change the Cruise Speed setting in Dealer Calibration to the boat's cruising speed (see page 99).
The autopilot appears to be unstable on Northerly headings in the Northern hemisphere (or Southerly headings in the Southern hemisphere)	Northerly/Southerly heading correction (AutoAdapt) is not set up (see page 99). [Does not apply to 150G/400G systems.]
You cannot enter Seatrial Calibration	Seatrial calibration lock is on – turn off the calibration protection feature in Dealer Calibration (see page 92).
The autopilot will not 'talk' to other SeaTalk instruments	Cabling problem – make sure all the cables are connected properly.
Position information not received	Navigator not transmitting the correct position data.
The autopilot will not auto advance to the next waypoint	No bearing to waypoint information received from the navigator.

Autopilot alarm messages

When the autopilot detects a fault or failure on the system, it will activate one of the alarm messages listed in the following table.

- Unless otherwise stated, you should respond to the alarm by pressing **standby** to clear the alarm and return to hand steering, before you attempt to resolve the problem.
- In some situations, the autopilot will raise more than one alarm. When you have dealt with the first alarm, the autopilot will display the next alarm.

ALARM MESSAGE	CAUSE and SOLUTION
AUTO RELEASE	Possible fault with rudder position sensor – check connections. OR Stern (I/O) drives only – you have taken manual control of steering with AutoRelease on. The alarm cancels automatically after 10 seconds.
CURRENT and LIMIT	Serious drive failure – the drive is taking too much current due to short-circuit or jamming. Check the drive unit.
DRIVE and STOPPED	The autopilot is unable to turn the rudder (this occurs if the weather load on helm is too high, or if the rudder position sensor has passed beyond the preset rudder limits or rudder end-stops). Check drive and rudder position sensor.
LOW and BATTERY	Supply voltage has dropped below acceptable limits. To respond to a Low Battery alarm: • press standby to clear the alarm and return to hand steering • start the engine to recharge the battery
LRN FAIL 1, 2 or 4	AutoLearn not completed successfully. Failure codes: 1 = AutoLearn has not been carried out (default setting) 2 = AutoLearn failed, usually due to manual interruption 4 = AutoLearn failed, probably due to drive or compass failure Repeat the AutoLearn procedure.
MOT POW and SWAPPED	Motor cables are connected to power terminals (and power cables are connected to motor terminals) at course computer. Turn off power and swap over connections.
[Table continues over page]	

ALARM MESSAGE	CAUSE and SOLUTION

NO DATA	Caused by any of the following situations:
	• the compass is not connected
	• the autopilot is in Wind Vane mode and it has not received wind angle data for 30 seconds
	• the autopilot is in Track mode and:
	  • the autopilot is not receiving SeaTalk navigation data, or
	  • the position sensor (GPS, Loran, Decca) is receiving a low strength signal – this will clear when the signal improves
	Check the connections to the compass and/or wind instrument and/or navigator.
	Note: The autopilot stops adjusting the heading as soon as it loses data.

NO PILOT	The control unit is not receiving data from the course computer. Check connections and check course computer is switched on.
RG FAIL	GyroPlus yaw sensor has failed: • If you have a Type 150G/400G course computer with internal GyroPlus sensor – call a Raymarine service agent. • If you have a Type 150/400 course computer with external GyroPlus yaw sensor – check the sensor and connections, then call a Raymarine service agent.
SEATALK and FAIL 1 or 2	SeaTalk data problem on one of the SeaTalk lines – check connections.
SEATALK and FAIL	The control unit cannot transmit data to the SeaTalk system. Make sure all SeaTalk cables are connected properly.

4.2   General maintenance

Routine checks

CAUTION:

The control unit does not contain any user serviceable parts. It should be serviced only by authorized Raymarine service technicians.

The control unit is a sealed unit. As a result, user maintenance is limited to the following checks:

*   make sure all cable connectors are firmly attached
*   examine the cables for signs of wear or damage – replace any damaged cables

Cleaning the display

CAUTION:

Take care when cleaning the display. Avoid wiping the display screen with a dry cloth as this could scratch the screen coating. If necessary, only use a mild detergent.

*   **Never** use chemical or abrasive materials to clean the control unit. If it is dirty, wipe it with a clean, damp cloth.
*   In certain conditions, condensation may appear inside the display screen. This will not harm the unit, and you can clear it by switching on the illumination for a short time.

EMC advice

*   When powered up, all electrical equipment produces electromagnetic fields. These can cause adjacent pieces of electrical equipment to interact with one another, with a consequent adverse effect on operation.
*   To minimize these effects and enable you to get the best possible performance from your Raymarine equipment, guidelines are given in the installation instructions, to enable you to ensure minimum interaction between different items of equipment, i.e. ensure optimum Electromagnetic Compatibility (EMC).

4 Fault Finding & Maintenance

- Always report any EMC-related problems 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.

4.3 Product support

Raymarine products are supported by a worldwide network of distributors and Authorized Service Representatives. If you encounter any difficulties with this product, please contact either your national distributor, service representative, or the **Raymarine Technical Services Call Center**. Refer to the back cover or the Worldwide Distributor List for contact details.

Before you consider returning the autopilot, make sure that the power supply cable is sound and that all connections are tight and free from corrosion. If the connections are secure, refer to the Fault Finding section in this chapter (see *page 36*).

If you cannot trace or rectify the fault, contact your nearest Raymarine dealer or Service Center, specifying:

- the control unit and course computer serial numbers:
    - the control unit serial number is printed on its rear cover
    - the course computer serial number is printed under its connector cover
- the control unit and course computer software version numbers

The following illustration shows how to display the software information:

- press and hold **standby** for 4 seconds:
    - after 2 seconds you will see the DISPLAY CAL screen
    - then after another 2 seconds you see control unit software version
- press **disp** to display the course computer software version
- press **disp** again to display the total number of hours the autopilot has been used in Auto mode (*Note: Type 100/300 systems do not display hours used.*)

4 Fault Finding & Maintenance

Software Information

STANDBY

128°

30 20 10 rudder 0 10 20 30

standby   standby   4 seconds

VERSION
02

disp

disp   1 second   Control unit   1 second   disp
                        software version

disp

00361 HRS   VER 200

Time autopilot   Course computer
used in Auto   software version

1 second

disp

disp

D5494-1
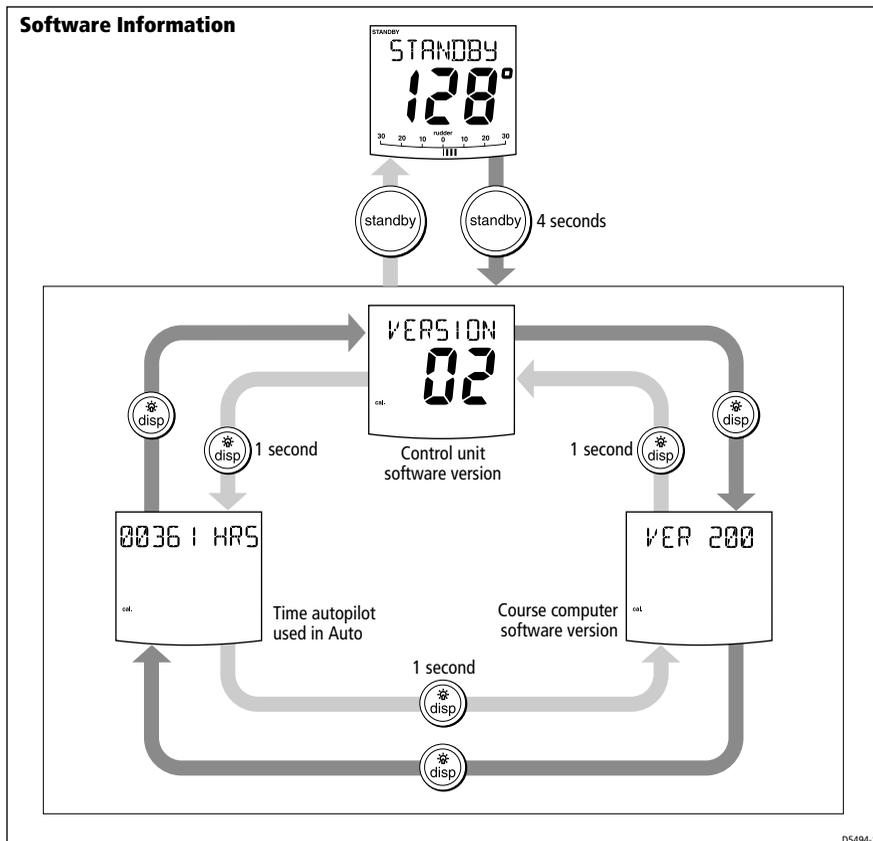
Product details table

For future reference, you may want to use this table to record serial
and software information for your autopilot system:

	Serial number	Software version
Control unit		
Course computer		
Hours used		hours

4 Fault Finding & Maintenance

Part 2:
Installing the
ST7001+

Part 2: Installing the ST7001+

Chapter 5: Installing the ST7001+

The sections in this chapter explain how to install the ST7001+ control unit and connect it to an autopilot system:

5.1	**Select the location** How to select a suitable location for the ST7001+ control unit.	page 46

5.2	**Control unit installation** How to install the ST7001+ control unit.	page 49

5.3	**SeaTalk connections** How to connect the control unit to SeaTalk (for power supply and SeaTalk data exchange).	page 50

5.4	**NMEA connections** How to connect NMEA equipment to the control unit.	page 51

5.5	**Functional test – repeater units only** How to check an ST7001+ connected as a repeater unit on an existing autopilot system.	page 54

Tools required

To install the ST7001+ control unit you will need the following items:

- tape measure (metric/imperial)
- pencil and center punch
- pliers
- sandpaper/file to smooth cut edges
- additional SeaTalk cables (if required – see *page 51*)
- 90 mm hole cutter (for the control unit aperture)
- drill and 5 mm ($^5/_{32}$ in) drill bit

Parts supplied

- control unit and sun cover
- fixing studs (x4) and thumb nuts (x4)
- self-adhesive gasket
- 9 m (29 ft 6 in) SeaTalk cable

5.1   Select the location
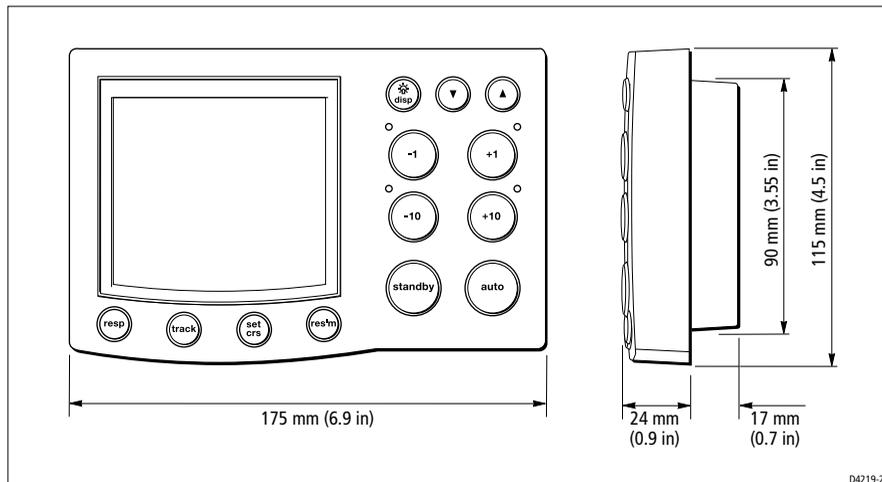
Site requirements

Locate the ST7001+ control unit so it is:

- within easy reach from the steering position
- viewable straight on, or with a maximum viewing angle of 30°
- protected from physical damage
- at least 230 mm (9 in) from any compass
- at least 1 m (3 ft) from any radio or radar receivers or transmitters

The selected location should also:

- be clean, smooth and flat
- be accessible from behind (so you can secure and run cables)
- have sufficient space to accommodate the rear of the control unit and connectors
- allow at least 6 mm ($^1/_4$ in) between adjacent control units/instruments so you can fit their sun covers
- meet the cabling and EMC installation guidelines detailed below

CAUTION:

The ST7001+ front cover is waterproof when installed according to the following instructions. However, you must protect the rear of the control unit from water in a ventilated and drained area.

Any moisture or water vapor in this area could cause damage by coming into contact with electrical connections, or condensation by entering the control unit through its breathing hole.

Cabling guidelines

- consider how you will run cables to and from the control unit
- avoid running cables through bilges where possible
- avoid running cables close to fluorescent lights, engines, radio transmitting equipment etc.

EMC installation guidelines

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

Their design and manufacture conforms to the appropriate Electromagnetic Compatibility (EMC) standards, but correct installation is required to ensure that performance is not compromised.

Although every effort has been taken to ensure that they will perform under all conditions, it is important to understand what factors could affect the operation of the product.

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

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

- Raymarine equipment and cables connected to it are:
  - At least 3 ft (1 m) from any equipment transmitting or cables carrying radio signals e.g. VHF radios, cables and antennas. In the case of SSB radios, the distance should be increased to 7 ft (2 m).
  - More than 7 ft (2 m) from the path of a radar beam. A radar beam can normally be assumed to spread 20 degrees above and below the radiating element.
- The equipment is supplied from a separate battery from that used for engine start. Voltage drops below 10 V, and starter motor

transients, can cause the equipment to reset. This will not damage the equipment, but may cause the loss of some information and may change the operating mode.

• Raymarine specified cables are used. Cutting and rejoining these cables can compromise EMC performance and must be avoided unless doing so is detailed in the installation manual.

• If a suppression ferrite is attached to a cable, this ferrite should not be removed. If the ferrite needs to be removed during installation it must be reassembled in the same position.

EMC suppression ferrites

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

D3548-2
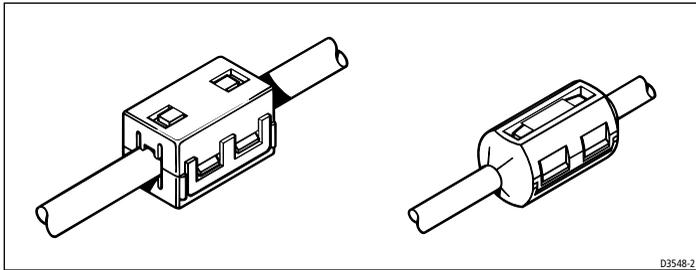
Connections to other equipment

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

5.2 Control unit installation

To fit the control unit:

1. Apply the template (supplied at the back of this handbook) to the selected bulkhead.
2. Mark the centers of the four fixing holes and the cable boss.
3. Drill four 5 mm ($^3/_{16}$ in) diameter holes for the fixing studs.
4. Use a 90 mm (3.55 in) diameter cutter to drill the hole for the cable boss.
5. Peel the protective sheets from the self-adhesive gasket, then stick the gasket into position on the rear of the control unit.
6. Screw the four fixing studs into the threaded sockets on the rear of the control unit.
7. Pass the SeaTalk/NMEA cables through the bulkhead and connect them to the appropriate terminals (as described later in this chapter).
8. Assemble the control unit to the bulkhead.
9. Secure the control unit with the thumb nuts provided.
   Hand-tighten the thumb nuts – do NOT use a wrench.
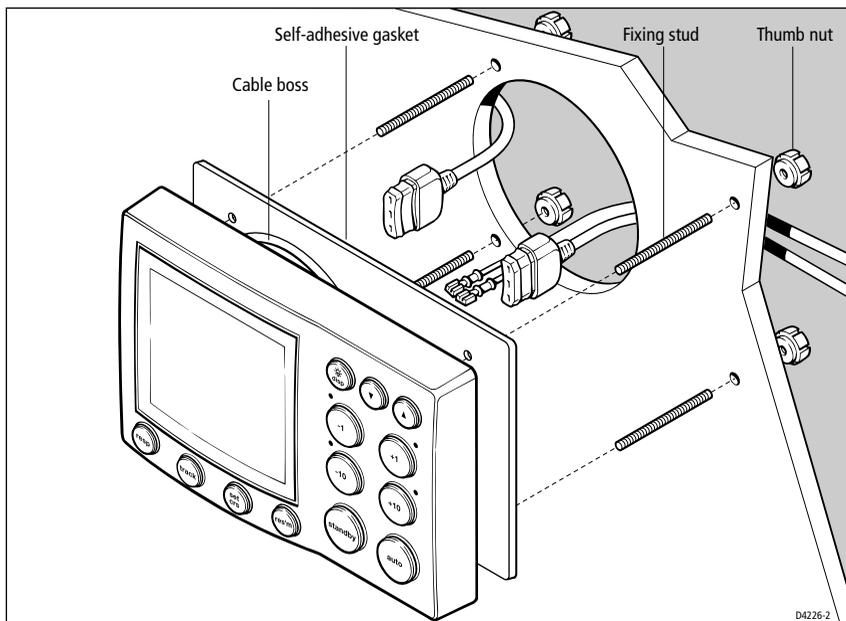
5.3 SeaTalk connections

The SeaTalk connections on the ST7001+ provide it with its 12 V DC power supply and allow it to share data with SeaTalk equipment.

Connecting to a course computer

If you are using the ST7001+ as the main control unit for a course computer autopilot system, connect it directly to the course computer SeaTalk terminals. To do this:

• cut off the moulded plug at one end of the SeaTalk cable
• strip 5 mm ($^1/_2$ in) of insulation from each wire
• then connect to the course computer terminals as shown

Connecting to course computer as main control unit
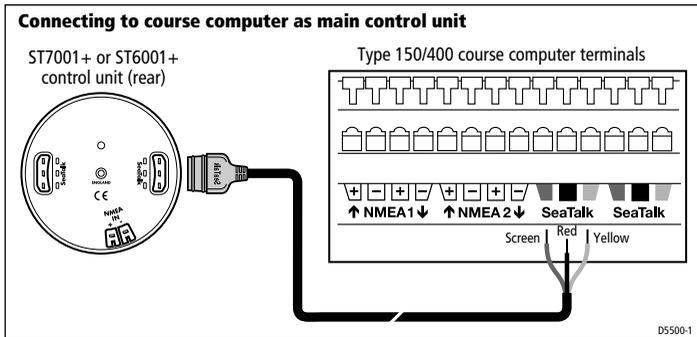
Note: *If you are connecting the ST7001+ to a course computer autopilot system that includes other control units, refer to the information contained in the Autopilot System Installation Guide.*

Connecting to SeaTalk

If you are using the ST7001+ as an additional control unit, use a SeaTalk cable to connect it to another SeaTalk unit as shown.

Connecting to SeaTalk as additional control unit
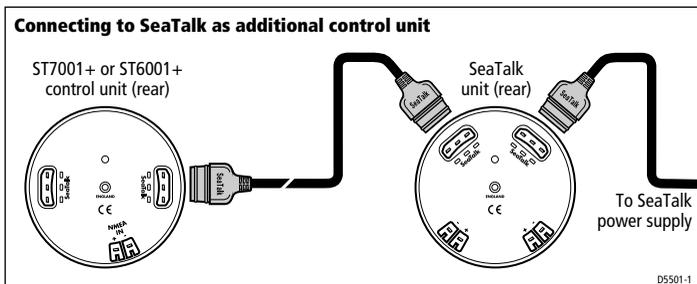
We supply the ST7001+ with a 9 m (29 ft 6 in) SeaTalk cable as standard. Depending on your installation, you may need to obtain alternative or additional SeaTalk cables (as shown in the following illustration).

Flat moulded plugs at each end

Part no.	Type	Length
D284	Flat moulded plugs at each end	1 m (3 ft 3 in)
D285	Flat moulded plugs at each end	3 m (9 ft 10 in)
D286	Flat moulded plugs at each end	5 m (16 ft 5 in)
D287	Flat moulded plugs at each end	9 m (29 ft 6 in)
D288	Flat moulded plugs at each end	20 m (65 ft 6 in)

Flat moulded plug to round plug

Part no.	Type	Length
D187	Flat moulded plug to male round plug	0.15 m (6 in)
D188	Flat moulded plug to female round plug	0.3 m (12 in)

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5.4 NMEA connections

The ST7001+ has a set of NMEA inputs so it can receive data in NMEA 0183 format from navigation or wind instruments. It can use this data to operate in Track or Wind Vane modes.

Note: *If your ST7001+ control unit is part of a course computer system, you can connect additional NMEA equipment to other parts of the system. To decode the maximum amount of NMEA data (so it can be transmitted onto SeaTalk), connect the navigator to the course computer NMEA terminals. Refer to the Autopilot System Installation Guide for more information.*

Receiving NMEA data

NMEA data formats

The ST7001+ can decode the following NMEA 0183 navigation and wind data received:

5 Installing the ST7001+

Information	NMEA 0183 data
Latitude and Longitude	GLL, RMC, RMA, GLP, GOP, GXP, GGA, GDP
Course Over Ground	VTG, RMC, RMA
Speed Over Ground	VTG, RMC, RMA
Cross Track Error	APB, APA, RMB, XTE
Bearing to Waypoint	APB, BWR, BWC, RMB
Distance to Waypoint	BWR, BWC, RMB
Waypoint Number	APB, APA, BWR, BWC, RMB
Apparent Wind Speed	VWR, MWV
Apparent Wind Angle	VWR, MWV
Speed Through Water	VHW
Depth	DBT
Water Temperature	MTW

Note: The ST7001+ only decodes the last four characters of waypoint names. This means that the last four characters of long waypoint names must be unique for the waypoint advance function to work.

NMEA cabling

Connect the NMEA navigator or wind instrument to the **NMEA IN** terminals on the rear of the ST7001+ control unit. You can only connect a single piece of NMEA equipment to these terminals.
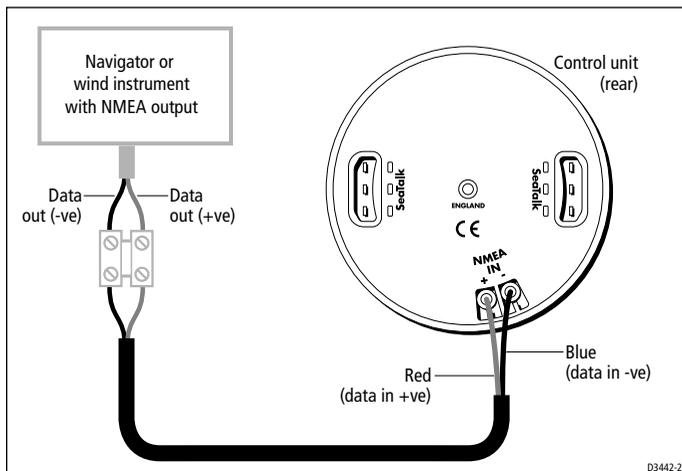
NMEA cable connectors

NMEA connections are made using spade connectors. When fitting the spade connectors, make sure the connector fits securely over the blade and not between the connector and its plastic insulating cover. Incorrect fitting will give intermittent contact which will lead to faulty autopilot operation.

D3286-2
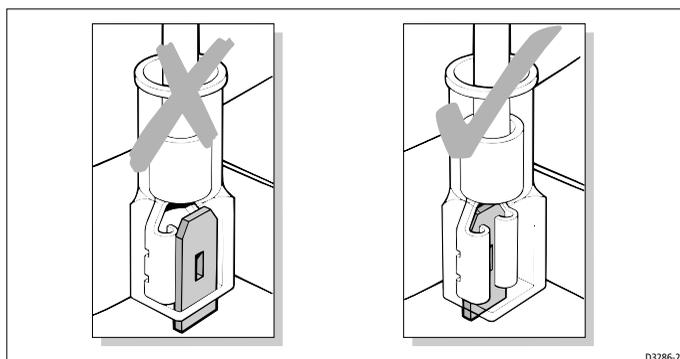
Transmitting NMEA data

Transmitting NMEA data on SeaTalk

If the ST7001+ receives any of the NMEA data shown above, and the equivalent data is not present on SeaTalk, it will transmit the data onto SeaTalk to make it available to other SeaTalk instruments:

- the ST7001+ transmits depth information in the units defined by the first page in the data page rollover
- the ST7001+ always transmits water temperature in °C

Transmitting NMEA data to other NMEA equipment

If you want to transmit NMEA information to non-SeaTalk equipment you can either:

- connect the NMEA equipment to the NMEA outputs on the course computer (if your system includes a course computer) or
- use a SeaTalk/NMEA Interface (part number: E85001) to convert SeaTalk data to NMEA data (if your system does not include a course computer)

5.5 Functional test – repeater units only

If you have installed the ST7001+ as an additional control unit for an existing autopilot system, complete the following checks to make sure you have installed the control unit correctly.

Note: *If you have connected the ST7001+ as part of a new autopilot installation, you **MUST** calibrate the autopilot as described in Chapter 6: Commissioning the Autopilot.*

Switch on

1. When you have installed the ST7001+ control unit, switch on the main power breaker.
2. If the control unit is active and the system operating, the control unit will beep and display the control unit type (ST7001) for 2 seconds.
3. After 2 seconds, the control unit will display the STANDBY screen.

SeaTalk and NMEA connections

If you have connected the ST7001+ to other SeaTalk instruments or control units, check the links as follows:

1. Select display lighting level 3 (LAMP 3) on one of the other SeaTalk instruments or control units.
2. The ST7001+ should immediately switch on its display lighting:
   • if the lighting does not switch on, there is a fault in the SeaTalk cabling between the ST7001+ and the other units
3. If you have connected an NMEA navigator to the control unit NMEA inputs, check the connections as described on *page 57*.

Troubleshooting

• If the head does not beep, check the fuse/circuit breaker.
• If the display shows the SEATALK FAILURE or NO DATA alarm message, check the SeaTalk connections.

Chapter 6: Commissioning the Autopilot

WARNING:

All new autopilot system installations MUST be calibrated.

If you have connected the ST7001+ to a newly installed Type 150/150G or Type 400/400G course computer autopilot system, you must commission the system This involves a series of dockside checks and then the seatrial calibration:

6.1	**Dockside Checks** With the boat safely tied up, you need check the autopilot system and adjust some key autopilot settings.	page 56

6.2	**Seatrial Calibration** The purpose of this seatrial is to calibrate the compass and optimize the autopilot set-up for your boat.	page 63

Note: *If you have connected the ST7001+ to a non-150/400 autopilot system refer to the notes in the Appendix.*

6.1 Dockside Checks

With the boat safely tied up, complete the following dockside checks:

1. Switch on.
2. Check the SeaTalk and NMEA connections.
3. Check the autopilot operating sense.
4. Set the basic autopilot parameters.

WARNING:

For safe control of your boat, you MUST complete the dockside checks before starting the initial seatrial.

Step 1 - Switch on

1. When you have installed the ST7001+ control unit and the rest of the autopilot system, switch on the main power breaker.
2. If the control unit and system are active, the control unit will beep and display the control unit type (ST7001) for 2 seconds.
3. You will then see a CALIBRATE REQUIRED message for 4 seconds if either: the vessel type is not selected (see *page 59*), or the compass is not calibrated (see *page 64*).
4. The control unit will then display the STANDBY screen.
5. Check that the STANDBY screen displays a live compass heading and a rudder angle.
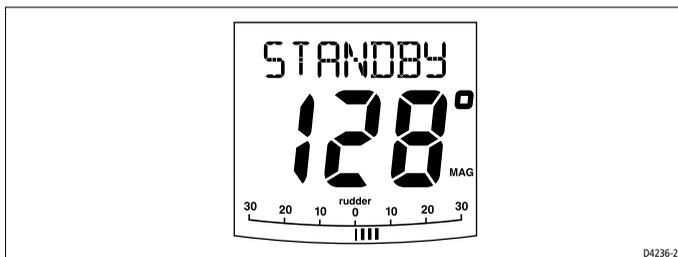
Troubleshooting

- If the head does not beep or the display is blank, check the fuse/circuit breaker and the SeaTalk fuse in the course computer.
- If the display shows the SEATALK FAILURE or NO DATA alarm message, check the SeaTalk connections.
- If the STANDBY screen does not display a live compass heading or a rudder angle, check the sensor connections.

Step 2 - Check the SeaTalk and NMEA connections

SeaTalk connections

If you have connected the ST7001+ to other SeaTalk instruments or control units, check the links as follows:

1. Select display lighting level 3 (LAMP 3) on one of the SeaTalk instruments or control units.
2. The ST7001+ should immediately switch on its display lighting:
   - if the lighting does not switch on, there is a fault in the SeaTalk cabling between the ST7001+ and the other units

NMEA navigator connections

If you have connected the ST7001+ to an NMEA navigator, check the links by displaying the default navigation data pages (XTE/BTW/DTW):

- press **disp** to display the first data page, and check that this page shows the expected data
- press **disp** again to check each successive data page

If the display shows dashes instead of data values, the cause could be one or more of the following:

- navigator not switched on or not transmitting an active waypoint
- cabling error: check for open circuit, short circuit, reversed wires
- navigator is not configured to transmit the required data format

Wind instrument connections

If you have connected the autopilot to an NMEA or SeaTalk wind instrument, check the links by pressing **standby** and **auto** together:

- the ST7001+ should display the Wind Vane mode screen, with the locked wind angle and locked heading:
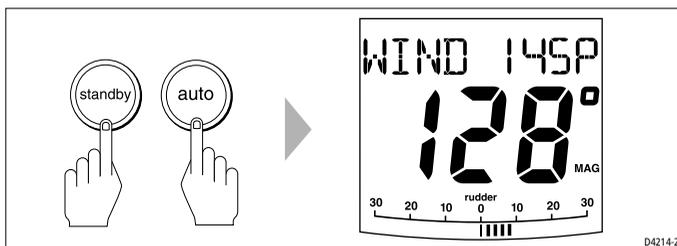
- if nothing happens when you press **standby** and **auto** together, the ST7001+ is not receiving wind data: check the wind instrument and connections

Step 3 - Check the autopilot operating sense

Check the rudder position sensor

1. Turn the wheel manually to starboard.
2. Check that the rudder bar on the display moves to starboard.
   If the rudder bar display moves the wrong way:
   - turn off the power
   - reverse the red and green wires connected to the **RUDDER** inputs on the course computer
   - switch on the power and re-check

Check the autopilot steering sense

1. Manually center the wheel, then press the **auto** key so the autopilot is in Auto mode. Check that the display shows AUTO.
   Be ready to press standby if the rudder moves hardover.
2. Press the **+10** key once. Check that the rudder moves to starboard a few degrees and then stops.
   - if the rudder drives hardover, **immediately** press **standby** to prevent further rudder movement
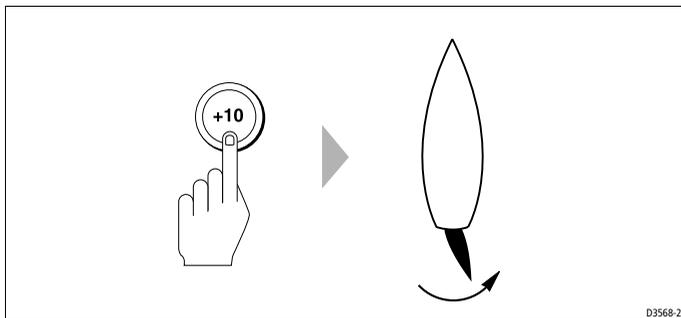
If the rudder moves to port or the rudder drives hardover:

- press **standby**
- turn off the power
- reverse the motor wires connected to the course computer
- switch on the power and re-check

Note: *If the rudder overshoots and has to drive back or starts to hunt back and forth, you will need to increase the rudder damping level as described in Step 3 (see page 62).*

Step 4 - Adjust basic autopilot settings

Note: *For more information about these calibration settings refer to the following pages: vessel type (page 94), drive type (page 94), rudder sensor alignment (page 94), rudder limits (page 95).*

The autopilot system has four main calibration groupings, as illustrated on the following page (for more information about these groupings see *Chapter 7: Adjusting Autopilot Settings*).

The next step in the dockside set-up is to enter Dealer Calibration mode so you can adjust some basic autopilot settings.

Enter Dealer Calibration mode

1. Start with the autopilot in Standby mode.
2. Enter DEALER CAL as follows:
    • press and hold the **standby** key for two seconds to enter the Calibration mode
    • when the screen shows DISPLAY CAL, press the **disp** key or **up**/**down** arrow keys until you see the DEALER CAL screen
    • press the **auto** key: the display will change to CAL
    • press the **-1** and **+1** keys together to enter Dealer Calibration (DEALER CAL)

Set the vessel type

1. Use the **disp** key to page through the Dealer Calibration screens until you reach the VESSEL TYPE screen.
2. Use the **-1** or **+1** keys to select a vessel type suitable for your boat:
    • Displacement: DISPLACE
    • Semi Displacement: SEMI DISPLACE
    • Planing: PLANING
    • Stern (I/O) Drive: STERN DRV
    • Work Boat: WORK BOAT
    • Sail Boat: SAIL BOAT

Note: *When you select the vessel type, the autopilot will select appropriate defaults for various other calibration settings.*

6 Commissioning the Autopilot

6 Commissioning the Autopilot

Calibration Mode Overview

STANDBY mode

2 seconds
(saves changes) (standby)

(standby) 2 seconds

Calibration Mode

or (▼) (disp)

DISPLAY CAL

or (▼) (disp)

or (▲) (disp)
1 second

auto
standby ▼
Display bar selection
Heading type
Pop-up pilot time-out
Data pages 1 to 15

or (▲) (disp)
1 second

DEALER CAL

auto
standby **-1** and **+1**
▼
Calibration lock
Vessel type
Drive type
Align rudder
Rudder limit
Rudder gain
Counter rudder
Rudder damping
AutoTrim
Response level
Turn rate limit
Off course alarm angle
AutoRelease (stern drive)
AutoTack angle*****
Gybe inhibit*****
Wind type*****
Wind response (WindTrim)*****
Cruise speed
AutoAdapt
Latitude
Magnetic variation
Autopilot reset

USER CAL

auto
standby ▼
AutoTack angle*****
Gybe inhibit*****
Wind type*****
Wind response (WindTrim)*****
Response level
Magnetic variation

SEATRIAL CAL

auto
standby ▼
Swing compass
Compass deviation
Align heading
Align rudder
AutoLearn start
AutoLearn pass/fail

or (▲) (disp)
1 second

or (▼) (disp)

or (▲) (disp)
1 second

or (▼) (disp)

Within DISPLAY CAL, USER CAL, SEATRIAL CAL and DEALER CAL:
– press **disp** or ▼ to move forwards through items (*****sail boats only)
– press **disp** for 1 second or ▲ to move backwards
– use **-1, +1, -10, +10** to adjust settings
– press **standby** for 2 seconds to save changes

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Set the drive type

1. With the autopilot still in Dealer Calibration, use the **disp** key to page through the calibration screens until you reach the Drive Type screen (DRIVE TYP).
2. Use the **-1** or **+1** keys to select the appropriate drive type:
   - 3 = Linear drive, rotary drive or I/O (stern) drive
   - 4 = Hydraulic pump or hydraulic linear drive
   - 5 = Constant running hydraulic pump solenoids

Align the rudder position sensor

1. With the autopilot still in Dealer Calibration, press the **disp** key to page through the calibration screens until you reach the ALIGN RUDDER screen.
2. Use the wheel to manually center the rudder.
3. Use the **-1** and **+1** keys to adjust the displayed rudder bar so its offset is zero:
   - you can only use this screen to adjust offsets within ±7°: if the offset is beyond these limits, you will need to physically adjust the sensor's alignment (as described in the Autopilot System Installation Guide)

Note: *Alternatively, you can zero the rudder bar with the boat underway during the initial seatrial, by manually steering a straight course then accessing the* ALIGN RUDDER *screen in Seatrial Calibration to adjust the offset.*

Set the rudder limits

1. With the autopilot still in Dealer Calibration press the **disp** key to page through the Dealer Calibration screens until you reach the RUDDER LIMIT screen
2. Turn the wheel to move the rudder:
   - to the port end stop and note the angle
   - to the starboard end stop and note the angle
3. Use the **-1**, **+1**, **-10** and **+10** keys to set the rudder limit to 5° less than the lowest angle you have noted.

6 Commissioning the Autopilot

6 Commissioning the Autopilot

Adjust the rudder damping

Note: *You only need to adjust the rudder damping value if the autopilot 'hunts' when trying to position the rudder. Increasing the rudder damping value reduces hunting.*

To adjust the rudder damping:

1. Use the **disp** key to page through the Dealer Calibration screens until you reach the RUDD DAMP screen.
2. Use the **-1** or **+1** keys to adjust the rudder damping:
    *   increase the damping one level at a time until the autopilot stops hunting, and always use the lowest acceptable value

Save the new settings

When you have adjusted these basic settings in Dealer Calibration:

*   press and hold **standby** for two seconds to store the changes
*   the screen will show DEALER CAL then the STANDBY screen

6.2   Seatrial Calibration

When you have completed the dockside calibration, you must complete the setup by taking the boat on a short seatrial to:

1. Calibrate the compass:
   - complete the automatic deviation correction
   - align the compass heading
2. Adjust the autopilot settings to suit your boat:
   - automatically on Type 150G/400G autopilot systems
   - manually on Type 150/400 (non-GyroPlus) and Type 100/300 autopilot systems

Seatrial safety

Note: *You can return to hand steering at any time during the seatrial by pressing* **standby***.*

You should **only** perform the initial seatrial:

- when you have successfully completed the dockside calibration
- in conditions of light wind and calm water, so you can assess autopilot performance without the influence of strong winds or large waves
- in waters that are clear of any obstructions, so the boat has plenty of clear space to maneuver

Note: *Before you start your seatrial, make sure you have switched on any ancillary equipment – such as a GPS (providing course over ground (COG), speed over ground (SOG) and latitude (LAT) data) or a speed log (providing speed through the water). This information will help the autopilot achieve its best performance.*

CAUTION: EMC conformance

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

Calibrating the compass

Note: *This section does not apply if you have connected an NMEA compass to your autopilot system. Refer to the handbook supplied with the NMEA compass for information about calibration.*

Depending on your boat type, deviating magnetic fields can cause significant compass errors. The correction procedure reduces these errors to a few degrees, so you MUST perform this procedure as the first item in your initial seatrial. The autopilot will then automatically correct the fluxgate compass.

CAUTION:

If you fail to complete the deviation correction, your autopilot's performance will be impaired on some compass headings.

The deviation correction procedure (swinging the compass) involves turning your boat in slow circles so the autopilot can determine the deviation and calculate any correction required. You must carry out this procedure in calm conditions and preferably on flat water.

Automatic compass deviation correction

1. With the pilot in Standby mode, enter Seatrial Calibration as follows (see the following illustration):
    *   press and hold the **standby** key for two seconds to enter Calibration mode
    *   when you see the DISPLAY CAL screen, press the **disp** key or **up**/**down** arrow keys until you see the SEATRIAL CAL screen
    *   press the **auto** key to enter Seatrial Calibration

Note: *If you cannot access SeaTrial Calibration, you need to turn off the calibration lock in Dealer Setup (see page 92).*

2. You should see the SWING COMPASS screen when you first enter Seatrial Calibration. (If not, use the **disp** key to page through the Seatrial Calibration items until you see SWING COMPASS)
3. When you are ready to start, press the **+1** key to select SWING COMPASS On. You will then see the TURN BOAT screen.

Compass calibration

❶ Enter Seatrial Calibration

STANDBY **128°** → (standby) 2 sec → DISPLAY **CAL** → (disp) x2 → SEATRIAL **CAL** → (auto) → COMPASS SWING **OFF**

❷ Compass deviation correction

COMPASS SWING **OFF** → (+1) → COMPASS SWING **On** → TURN BOAT → **Start turning boat** (see below)

Turn boat in slow circles so:
• boat's speed stays below 2 knots
• each circle takes at least 2 minutes

Minimum of 2 circles

Keep turning the boat until you see the DEVIATION screen
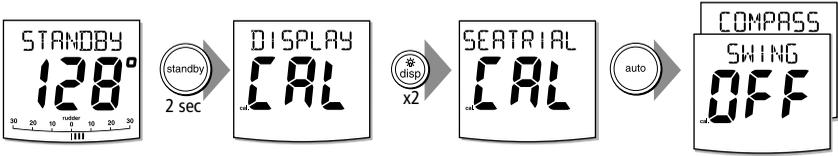
DEVIATION **3°** → (disp) → **Autopilot heading** ALIGN HDG **023°**
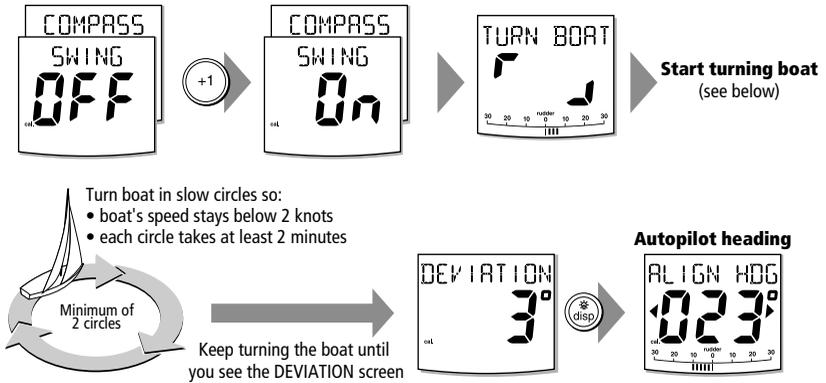
❸ Compass heading alignment

(a) **Coarse adjustment:** If COG is available from GPS, press (auto) to set autopilot heading to COG value, then fine tune manually (see below).

(b) **Fine adjustment:** If COG is not available (or after setting heading to COG), align autopilot heading manually:

ALIGN HDG **023°** → (-1) or (+1) / (-10) or (+10) → **Autopilot heading** ALIGN HDG **155°** = **Steering compass**

Adjust the autopilot heading so it shows the same value as the boat's steering compass

Known heading

❹ Save changes

(standby) 2 sec → STANDBY **128°**
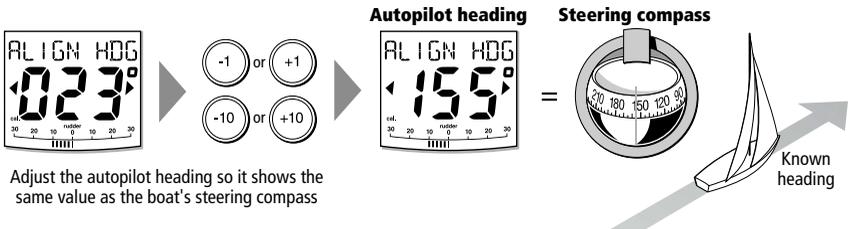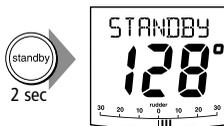
To:
• save deviation correction
• save heading alignment
• return to STANDBY mode

D5477-1

6 Commissioning the Autopilot

4. Start turning the boat in slow circles (with the boat's speed below 2 knots). You will need to complete at least two circles, taking at least 2 minutes to complete each 360°:

   • the display will show a TOO FAST message if you turn the boat too quickly for the course computer to correct the compass – if you see this message apply less helm to turn in a larger circle

Note: *If necessary, you can quit the correction process by pressing the* **standby** *or* **disp**. *If you then want to repeat the deviation correction, return to the* SWING COMPASS *screen.*

5. Continue slowly turning the boat until the control unit beeps and displays the DEVIATION screen to indicate that the autopilot has completed the deviation correction.
   This screen shows the maximum deviation encountered over 360° (not as an east/west value).

Note: *If the deviation figure exceeds 15° or the display shows no deviation value, the compass is being affected by ferrous objects on your boat. You should move the compass to a better location. Higher deviation figures are acceptable on steel boats.*

Aligning the compass heading

1. Once the deviation is displayed, press the **disp** key to move onto the Heading Alignment screen (ALIGN HDG).
2. Manually steer the boat on a steady course at a speed which enables you to hold that course.
3. If you have a GPS connected to your autopilot:
   • increase the boat speed to more than 3 knots
   • press the **auto** key: the autopilot will then set the heading to agree with the COG (course over ground) heading received from the GPS
   • because many factors can cause a difference between heading and COG (such as tides and leeway affecting the boat) you must then fine-tune the heading alignment so it matches the boat's steering compass or a known transit bearing
4. Use **-1**, **+1**, **-10** and **+10** to adjust the displayed heading until it matches boat's steering compass or a known transit bearing.
5. Press and hold **standby** for 2 seconds to exit Seatrial Calibration and save the new compass settings.

Adjusting the heading alignment

If you experience difficulties with compass alignment, you can check the compass alignment after completing the deviation correction procedure (swinging the compass). After completing the initial compass calibration, you can make further adjustments to the alignment without swinging the compass again.

Although the compass calibration removes most of the alignment error, small errors (of the order of a few degrees) will probably remain. These will vary depending on the heading.

Ideally, you should check the heading reading against a number of known headings, plot a deviation curve, and determine the heading alignment value that will give the lowest **average** alignment error. You can then enter this value on the Heading Alignment screen, as described above.

If the average heading error is more than 5°, you should perform the compass deviation correction procedure again, circling more slowly and in more favorable conditions.

Adjusting autopilot settings

The next stage of the seatrial is to set key autopilot parameters that affect the autopilot's steering characteristics. You can do this in one of two ways:

- **using AutoLearn:** Type 150G and Type 400G autopilot systems use AutoLearn – a self-learning calibration feature that automatically adjusts rudder gain, counter rudder and AutoTrim to suit your boat

- **manual set-up:** if you have a Type 150/400 (non-GyroPlus) or Type 100/300 autopilot you will need to adjust these settings **manually** – as described on *page 71*

Note: *For a full explanation of the parameters set during the AutoLearn, and how to adjust them manually, refer to the manual set-up section.*

AutoLearn: Type 150G/400G systems

WARNING:

The AutoLearn process requires a significant amount of CLEAR SEA SPACE in front of the boat. The autopilot will take the boat through a number of zig-zag maneuvers until it has acquired enough data. If you need to cancel the AutoLearn at any time, press the standby key to gain manual control of the boat.

AutoLearn maneuvers

Wind

At least 0.04 nm (100 m) of clear sea space

At least 0.25 nm (500 m) of clear sea space

MINUTE (approximately)

D5495-1
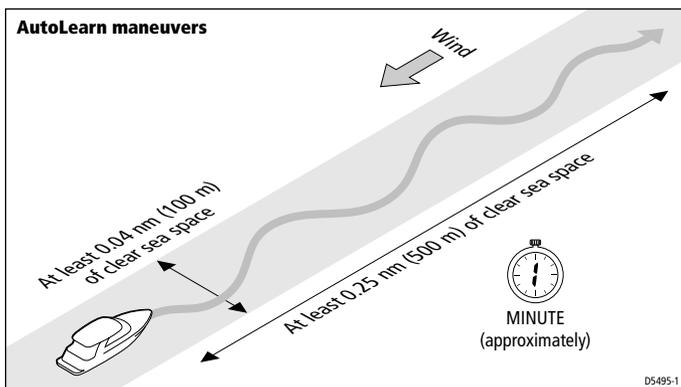
AutoLearn calibration

1 Enter Seatrial Calibration

STANDBY **128°** → standby 2 sec → DISPLAY **CAL** → disp x2 → SEATRIAL **CAL** → auto → COMPASS SWING **OFF**

---
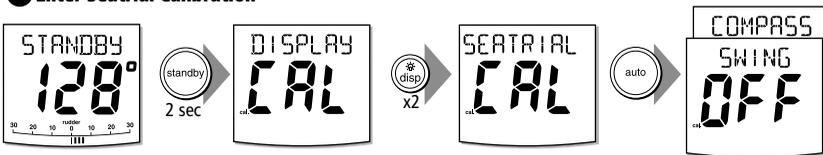
2 Start the AutoLearn

To prepare for the AutoLearn:
• steer straight ahead at cruising speed (planing boats – off the plane)
• head into wind and waves

Check you have sufficient clear sea space before proceeding

COMPASS SWING **OFF** → disp x4 → AUTOLEARN **OFF** → +1 → MANOEUVRE CLEAR TO → auto → LEARNING **1**

AutoLearn in progress

---
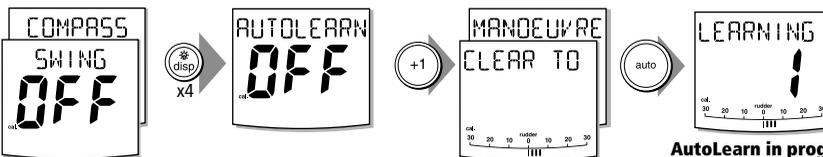
3 Boat completes AutoLearn
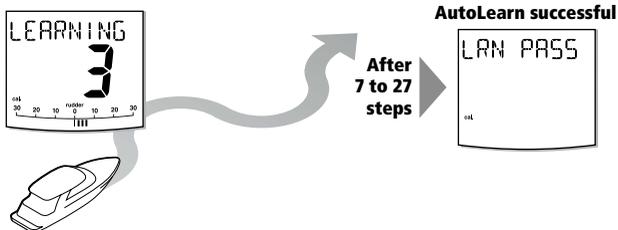
LEARNING **3** → After 7 to 27 steps → **AutoLearn successful** LRN PASS

Note: If you see a LRN FAIL message, press **disp** to return to the AUTOLEARN screen then repeat from Step 2

⚠ If you need to cancel the AutoLearn, press (standby) or (disp)

---

4 Save new settings

standby 2 sec → STANDBY **128°**
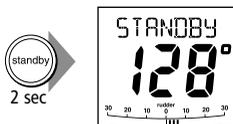
To:
• save AutoLearn calibration settings
• return to STANDBY mode

D5480-1

1. Access the AUTOLEARN screen in Seatrial Calibration:
   - from Standby mode, press **standby** for 2 seconds, then **disp** twice to see the SEATRIAL CAL screen
   - then press **auto** to enter Seatrial Calibration, and **disp** 4 times until you see the AUTOLEARN screen
2. Prepare to start the AutoLearn:
   - **power boats:** steer straight ahead (with the rudder centered), and set the boat's speed at 8 to 15 knots – planing boats should be off the plane
   - **sail boats:** with the sails down, steer straight ahead (with the rudder centered) and motor the boat at typical cruising speed
   - if conditions are not calm, head **into** the wind and waves
3. When you are ready to start the AutoLearn, press the **+1** key to select AUTOLEARN On.
4. The screen will then show the CLEAR TO MANEUVER message. Press the **auto** key to start the AutoLearn process:
   - the boat will start its AutoLearn maneuvers and the display will show a LEARNING message, with a number that increases to show that the AutoLearn is in progress
   - the number will increase as the autopilot steps through the various maneuvers
   - typically, the AutoLearn will be complete within 7 to 27 steps (depending on boat characteristics and sea conditions)

Note: *If you need to cancel the AutoLearn for any reason, press the* **standby** *or* **disp** *key.*

5. When the autopilot has finished learning, the control unit will beep and the display will change to LRN PASS or LRN FAIL:
   - LRN PASS = AutoLearn completed successfully
   - LRN FAIL = AutoLearn was not successful and should be repeated again. Failure codes:
     - LRN FAIL 1 = AutoLearn has not been carried out
     - LRN FAIL 2 = AutoLearn failed, due to manual interruption
     - LRN FAIL 4 = AutoLearn failed, probably due to drive or compass failure
6. Press and hold the **standby** key for two seconds to store the new calibration settings.

The pilot is now fully calibrated and ready for use. The only setting you should now need to adjust is the response level (see *page 7*　**).**

Manual set-up: Type 150/400 & Type 100/300

If you have a Type 150/400 (non-GyroPlus) or Type 100/300 autopilot system you need to manually adjust the rudder gain, counter rudder and AutoTrim settings, based on your observations of the boat's performance under autopilot control.

Adjust these settings when motoring your boat at cruising speed. On sail boats, repeat if necessary under sail to optimize the pilot.

Checking autopilot operation

Before manually adjusting any of these settings, familiarize yourself with basic autopilot operation:

1. Steer onto a compass heading and hold the course steady.
   If necessary, control the boat manually for a while to check how the boat steers.
2. Press **auto** to lock onto the current heading. The autopilot should hold a constant heading in calm sea conditions.
3. Use the **-1**, **+1**, **-10** and **+10** keys to check how the autopilot alters the course to port and starboard in multiples of 1° and 10°.
4. Press **standby** to return to hand steering.

Adjusting the rudder gain

Boats can vary widely in their response to helm, and by adjusting the rudder gain you can change the autopilot's steering characteristics. Rudder gain is a measure of how much helm the autopilot applies to correct course errors – higher settings mean more rudder is applied.

Complete the following test to determine whether the rudder gain is set correctly:

1. Set RESPONSE to level 2:
   • press the **resp** key, use the **-1** or **+1** key to adjust the setting, then press **disp**
2. Sail your boat at cruising speed in clear water:
   • you will find it easiest to recognize the steering response in calm sea conditions where wave action does not mask basic steering performance
3. Press **auto** to enter Auto mode, then alter course by 40°:
   • if the rudder gain is adjusted **correctly**, the 40° course change should result in a crisp turn followed by an overshoot of no more than 5°

- if the rudder gain setting is **too high**, the 40° course change will result in a distinct overshoot of more than 5° and there may be a distinct 'S' in the course (**A**)
  *Correct this oversteer by **reducing** the rudder gain setting.*
- if the rudder gain is **too low**, the boat's performance will be sluggish – it will take a long time to make the 40° turn and there will be no overshoot (**B**)
  *Correct this understeer by **increasing** the rudder gain setting.*
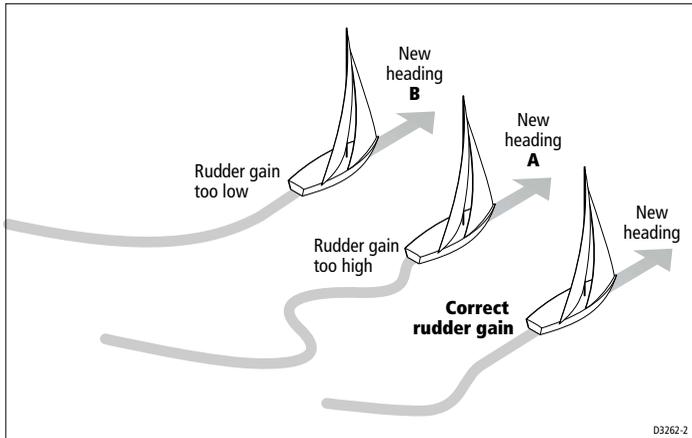
To adjust the rudder gain:

1. Access the RUDD GAIN screen in Dealer Calibration.
2. Use the **-1** or **+1** keys to adjust the rudder gain.
3. Press and hold **standby** for 2 seconds to save the changes.
4. Press **auto** to check the autopilot performance in Auto mode.

Adjusting the counter rudder

If you intend to use RESPONSE level 3 on a Type 150/400 (non-GyroPlus) or Type 100/300 autopilot system, you will need to adjust the counter rudder. Counter rudder is the amount of rudder the autopilot applies to try to prevent the boat from yawing off course. Higher counter rudder settings result in more rudder being applied.

To check the counter rudder setting

1. Set RESPONSE to level 3.
2. Sail your boat at cruising speed in clear water
3. Press **auto** to switch the autopilot to Auto mode, then make a 90° course change:

- when gain and counter rudder are both set correctly, the boat performs a smooth continuous turn with minimal overshoot
- if the counter rudder is too low, the boat will still overshoot
- if counter rudder is too high, the boat will 'fight' the turn and make a series of short, sharp turns: this results in a very 'mechanical' feel as the boat changes course

To adjust the counter rudder:

1. Access the COUNT RUD screen in Dealer Calibration.
2. Use the **-1** or **+1** keys to adjust the counter rudder.
3. Press and hold **standby** for 2 seconds to save the changes.
4. Press **auto** to check the autopilot performance in Auto mode.

The pilot is now calibrated and ready for use.

Further adjustments (Type 150/400 and Type 100/300)

Over time you may need to repeat these adjustments over a range of sea conditions and headings to achieve good overall performance.

You may also need to adjust the **AutoTrim** setting. AutoTrim determines how quickly the autopilot applies 'standing helm' to correct for trim changes (caused, for example, by changes in the wind load on the sails or superstructure, or an imbalance of engines).

Gain experience with your autopilot before attempting to adjust the AutoTrim setting. On sail boats you can only evaluate the effect of AutoTrim while under sail.

Increasing the AutoTrim level reduces the time the autopilot takes to get back onto the correct course, but makes the boat less stable:

- if the autopilot gives unstable course keeping and the boat 'snakes' around the desired course, **decrease** the AutoTrim level
- if the autopilot hangs off course for excessive periods of time, **increase** the AutoTrim level

If you need to adjust AutoTrim, go up one level at a time and use the **lowest** acceptable value. The possible settings range from OFF (no trim correction) to 4 (fastest trim correction). To adjust the AutoTrim:

1. Access the AUTOTRIM screen in Dealer Calibration.
2. Use the **-1** or **+1** keys to adjust the AutoTrim level.
3. Press and hold **standby** for 2 seconds to save the changes.
4. Press **auto** to check the autopilot performance in Auto mode.

6 Commissioning the Autopilot

Chapter 7:   Adjusting Autopilot Settings

This chapter explains all of the calibration settings you can adjust on the autopilot system. You will have adjusted many of these settings when commissioning the system (see Chapter 6), and they should not require further adjustment.

Note: *Complete the procedures described in Chapter 6 before adjusting any calibration settings.*

The sections in this chapter provide explain the Calibration mode and the settings in the 4 calibration groupings:

7.1	**Calibration basics** This explains the structure of the Calibration mode, and how to access the four calibration groupings.	page 76

7.2	**Display Calibration** The Display Calibration grouping allows you to control the ST7001+ display features (bar graph type and data page information). This section also explains how to use data pages to set up the control unit as a remote control for ST60/ST80 instruments.	page 79

7.3	**User Calibration** The User Calibration grouping includes autopilot settings that you may need to adjust in response to changing sea conditions.	page 87

7.4	**Seatrial Calibration** The Seatrial Calibration grouping is used specifically for the initial autopilot seatrial (see Chapter 6 for full details).	page 91

7.5	**Dealer Calibration** The Dealer Calibration grouping controls the main autopilot settings and also the calibration lock.	page 92

Note: *If you are connecting the ST7001+ to a non-150/400 autopilot system, the calibration groups are different. Refer to the Appendix for more information.*

7 Adjusting Autopilot Settings

7.1 Calibration basics

Calibration groups

Note: *If you are connecting the ST7001+ to a non-150/400 autopilot system, the calibration groups are different. Refer to the Appendix for full details.*

The Calibration mode has 4 main calibration groups:

Display Calibration (DISPLAY CAL)

The items in Display Calibration only affect the individual control unit. They are stored in the control unit and do not affect any other control units connected through SeaTalk.

You can adjust the Display Calibration settings as often as necessary – for example, to add or change information displayed on data pages

User Calibration (USER CAL)

The items in User Calibration vary according to the Vessel Type you have selected in Dealer Calibration.

You will probably need to access User Calibration on a fairly regular basis to adjust the autopilot settings in response to changing conditions.

Seatrial Calibration (SEATRIAL CAL)

The Seatrial Calibration group is specifically designed for use during the initial autopilot seatrial (see *page 63* of Chapter 6 for full details).

You should not need to access Seatrial Calibration during normal autopilot operation.

Dealer Calibration (DEALER CAL)

The Dealer Calibration group includes items that have a significant impact on autopilot operation and can affect your boat's safety.

After you have completed the initial installation and seatrial, you should not normally need to alter the Dealer Calibration values. The items in Dealer Calibration vary according to the Vessel Type you have selected.

Calibration Mode Overview

STANDBY mode

2 seconds (saves changes) standby

standby 2 seconds

Calibration Mode

or ▼ / disp

DISPLAY **CAL**

or ▲ / disp
1 second

or ▼ / disp

or ▲ / disp
1 second

auto
standby ▼
Display bar selection
Heading type
Pop-up pilot time-out
Data pages 1 to 15

DEALER **CAL**

auto
standby -1 and +1
Calibration lock
Vessel type
Drive type
Align rudder
Rudder limit
Rudder gain
Counter rudder
Rudder damping
AutoTrim
Response level
Turn rate limit
Off course alarm angle
AutoRelease (stern drive)
AutoTack angle*
Gybe inhibit*
Wind type*
Wind response (WindTrim)*
Cruise speed
AutoAdapt
Latitude
Magnetic variation
Autopilot reset

USER **CAL**

auto
standby ▼
AutoTack angle*
Gybe inhibit*
Wind type*
Wind response (WindTrim)*
Response level
Magnetic variation

SEATRIAL **CAL**

auto
standby ▼
Swing compass
Compass deviation
Align heading
Align rudder
AutoLearn start
AutoLearn pass/fail

or ▲ / disp
1 second

or ▲ / disp
1 second

or ▼ / disp

or ▲ / disp
1 second

or ▼ / disp

Within DISPLAY CAL, USER CAL, SEATRIAL CAL and DEALER CAL:
– press **disp** or ▼ to move forwards through items (*sail boats only)
– press **disp** for 1 second or ▲ to move backwards
– use **-1, +1, -10, +10** to adjust settings
– press **standby** for 2 seconds to save changes

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Accessing the Calibration mode

You can only access Calibration mode from Standby mode:

1. With the autopilot in Standby mode, press and hold the **standby** key for 2 seconds. The display will change to show DISPLAY CAL.

2. Press the **disp** key or **down** arrow key to scroll down through the 4 calibration groupings:
   • Display Calibration (DISPLAY CAL)
   • User Calibration (USER CAL)
   • Seatrial Calibration (SEATRIAL CAL)
   • Dealer Calibration (DEALER CAL)

   Note: *You can go backwards through the groups by pressing and holding the* **disp** *key for one second or by using the* **up** *arrow key.*

3. When you reach the Calibration group you want to access, press the **auto** key to enter that group:

   To prevent accidental access, we have made entry to Dealer Calibration more difficult than the other groups. After pressing the **auto** key, the display will show CAL. When you see this, press the **-1** and **+1** keys together to enter Dealer Calibration.

4. When you have entered one of the Calibration groupings, press **disp** key or **down** arrow key to scroll down through the items within that grouping:

   Note: *You can go backwards through the list by pressing and holding the* **disp** *key for one second or by using the* **up** *arrow key.*

5. When you reach an item you wish to adjust, use the **-1**, **+1**, **-10** and **+10** keys (as appropriate) to change the value.

6. If you then want to adjust settings in another Calibration group, press the **standby** key and then repeat steps 2 to 5 as necessary.

7. When you have made all the changes you want to make, press and hold the **standby** key for two seconds to exit Calibration mode and save changes.

7 Adjusting Autopilot Settings

7.2 Display Calibration

Display Calibration allows you to select the type of bar graph and heading shown on the ST7001+ display, and control the information shown on the data pages.

Display Calibration screens

Display bar selection

This screen allows you to select the type of bar graph shown at the bottom of the ST7001+ display.

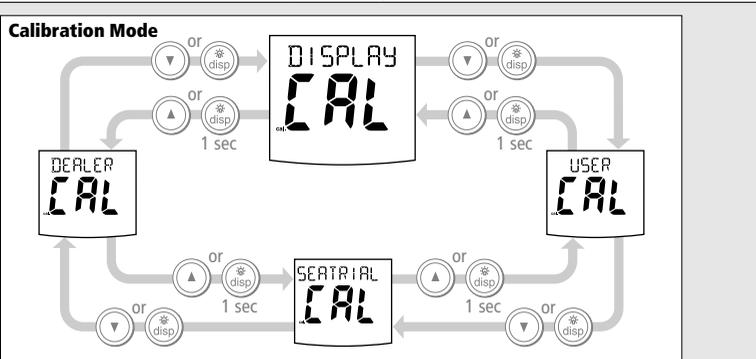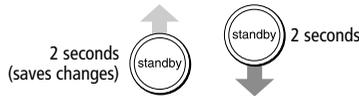| Options	
RUDD BAR	**Rudder position bar** This is the default setting. It uses the bar graph to show the true rudder angle. Requires rudder position sensor for accurate rudder information.
STEER BAR	**Steer/error bar** This setting uses the bar graph to indicate different information in different operating modes: • Standby: rudder position bar • Auto: heading error bar (in 2° increments) • Track: cross track error (XTE) bar (in 0.02 nm increments) • Wind Vane: wind angle error bar (in 2° increments)
BAR OFF	No bar displayed.

Heading selection

This screen allows you to display any heading as either a magnetic or true value. During normal autopilot operation the screen will indicate MAG for magnetic headings and TRUE for true headings.
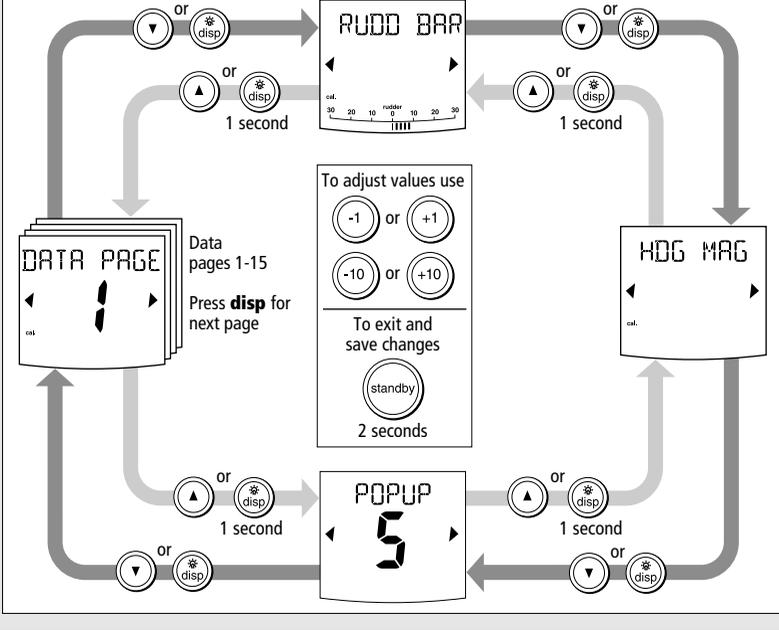
Options	
HDG MAG	Magnetic heading.
HDG TRUE	True heading.

7 Adjusting Autopilot Settings

Accessing Display Calibration

STANDBY mode

2 seconds
(saves changes) standby

standby 2 seconds

Calibration Mode

DISPLAY
CAL

or ▼ / disp

or ▲ / disp
1 sec

or ▼ / disp

or ▲ / disp
1 sec

DEALER
CAL

USER
CAL

or ▲ / disp
1 sec

SEATRIAL
CAL

or ▲ / disp
1 sec

or ▼ / disp

or ▼ / disp

standby

auto

Display Calibration

or ▼ / disp

RUDD BAR
◄   ►
cal.
rudder
30 20 10   0   10 20 30

or ▼ / disp

or ▲ / disp
1 second

or ▲ / disp
1 second

To adjust values use

-1 or +1

-10 or +10

To exit and
save changes

standby
2 seconds

DATA PAGE
◄   1   ►
cal.

Data
pages 1-15

Press **disp** for
next page

HDG MAG
◄   ►
cal.

or ▲ / disp
1 second

POPUP
◄   5   ►

or ▲ / disp
1 second

or ▼ / disp

or ▼ / disp

Pop-up pilot time-out

During normal autopilot operation, you can set the control unit so it has a data page as the main display (see *page 31*). Whenever you select a new autopilot mode or make a course change, the autopilot mode screen will 'pop-up'. After a short period, the display will revert to the selected data page. The default pop-up time is 5 seconds. You can use this Display Calibration screen to adjust the pop-up pilot display time-out.

Screen text	Options
POPUP TIMEOUT	1 seconds to 10 seconds; Default = 5 seconds

Data pages 1-15

The next 15 screens allow you to modify the settings for the data pages. These define the SeaTalk/NMEA data pages that will be available during normal operation (see *page 31*). Each data page setup screen initially shows the title DATA PAGE and the page number. After 1 second, the text changes to the title of the data currently set for that page.

The default settings are:

Data page	Default setting
1	XTE (Cross Track Error)
2	BTW* (Bearing to Waypoint)
3	DTW* (Distance to Waypoint)
4	RESPONSE
5 -15	NOT USED (These pages are not displayed when you scroll through the data pages during normal operation)

*Note: It is good practice to keep the BTW and DTW pages for display. If the autopilot receives a man overboard (MOB) message, these data pages will show the bearing and distance to the MOB location.

To change the data displayed on a data page:

- Press **disp** to move to the appropriate data page setup screen.
- Use the **-1** and **+1** keys to scroll forwards or backwards through the available data pages (see following table).
- Then press **disp** to move to the next data page you want to change, or press and hold **standby** for 2 seconds to save changes.

7 Adjusting Autopilot Settings

Available data pages	Displayed as
Speed Knots	SPEED KTS
Log	LOG XXXX.X
Trip	TRIP XXX.X
Average Speed, Knots	AV. SPD KTS
Wind Direction	e.g. WIND PORT
Wind Speed	WIND KTS
Depth Metres*	DEPTH M
Depth Feet*	DEPTH FT
Depth Fathoms*	DEPTH FA
Heading	HEADING
Water Temperature, Degrees C*	WATER °C
Water Temperature, Degrees F*	WATER °F
Course Over Ground	COG
Speed Over Ground, Knots	SOG KTS
Cross Track Error	XTE
Distance to Waypoint	DTW
Bearing to Waypoint	BTW
Rudder Gain	RUDD GAIN
Response	RESPONSE
Watch	WATCH - used to control the Watch timer (see page 32)
Universal Time Coordinated	UTC
Remote Control for Standard ST60/80 Instruments	INST REM
Remote Control for Maxiview Instruments	MAXI REM
NOT USED	Page not displayed (Any data page set to NOT USED is not displayed when you scroll through the data pages during normal operation)

*NOTE: There are 3 depth pages (meters, feet and fathoms) and 2 water temperature pages (°C and °F). The ST7001+ will display the water temperature or depth data in the units defined by data page you select.

Using data pages to set up ST60 and ST80 remote control

Where the ST7001+ is used in conjunction with ST60 or ST80 instrumentation, you can use the ST7001+ to control the ST60 or ST80 instruments by duplicating the functions of the Remote Keypads used by these instruments. This means you can operate your autopilot and ST60/ST80 instruments from the same location.

By using the INST REM and MAXI REM data pages, you can use ST7001+ as a remote keypad to control any ST60 or ST80 instruments connected to it:

- the INST REM data page can control a standard (110 mm) ST60/ST80 instrument group
- the MAXI REM data page can control an ST80 Maxiview instrument group

Each ST7001+ can control one group of up to eight standard instruments and another group of up to eight Maxiview instruments.

Before you can use an ST7001+ to remotely control other instruments, you must define the instrument grouping and then allocate the ST7001+ to the required group.

Instrument grouping

Grouping allows you to create up to eight standard instrument and eight Maxiview instrument groups:

- each group can have up to eight instruments
- each group must have one or more remote keypads or an ST7001+ grouped to it
- each ST7001+ can be grouped with one ST80 Maxiview group and one ST80/ST60 standard instrument group
- each instrument in a group has a unique alphanumeric identity (e.g. A1, where A defines the group and 1 the instrument sequence number within the group):
  - standard ST60 or ST80 instruments are assigned group letters from A to H
  - maxiview instruments are assigned group letters from J to Q
  - ungrouped instruments have a dash (-) in place of a group letter
- The instrument sequence number range is from 1 to 8.

When you set up ST60 and ST80 instrument groups you will need to use the following ST7001+ keys.

Standard instruments   Press to select the required standard instrument.
                                            Press for 4 sec to enter Group Setup mode.

STANDBY   RESP 2

DSP SETUP

Toggle to select either: Press to set the identification you want:
• group letter   • A to H for group identity
  or   • 1 to 8 for instrument sequence, within group
• sequence number

Maxiview instruments   Press to select the required Maxiview instrument.
                                            Press for 4 sec to enter Group Setup mode.

STANDBY   RESP 2

DSP SETUP

Toggle to select either: Press to set the identification you want:
• group letter   • A to H for group identity
  or   • 1 to 8 for instrument sequence, within group
• sequence number

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### Setting up an instrument group

1. At the ST7001+:
    - select the INST REM data page to group standard instruments
    - select the MAXI REM data page to group Maxiview instruments
2. At the ST7001+, use the arrow keys to select an instrument.

Note: *The currently-selected instrument is indicated as follows:*

- *on ST80 instruments (including Maxiview), the characters are displayed as white characters on a black background (instead of the standard black on white)*
- *on ST60 digital instruments, you will see a* REMOTE *message*
- *on ST60 analogue instruments, you will see the* TRUE/MAG *and/or* TRUE/APP *message flashing*

3. Press both the up and down arrow keys on the ST7001+ for 4 seconds, to put the instruments and the ST7001+ into Group Setup mode.
    When you enter Group Setup mode:
    - one instrument will be selected with a flashing cursor (and inverse characters on ST80 instruments, including Maxiview)
    - the ST7001+ screen text will alternate between:
        - INST REM and DSP SETUP for standard instruments
        - MAXI REM and DSP SETUP for Maxiview instruments
4. At the ST7001+, use the up or down arrow key to select an instrument to be the first in the group, i.e. so the required instrument shows it has been selected (as described above).

Standard instruments: group setup mode

Selected instrument

D5520-1
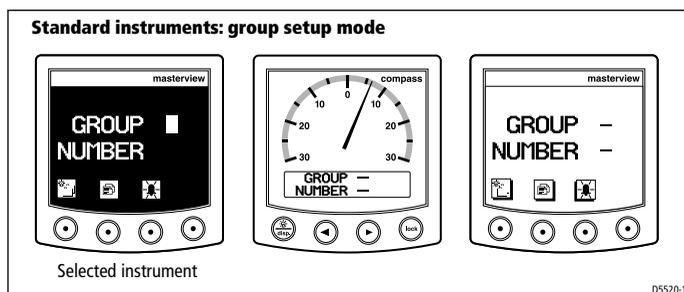
5. Use the ST7001+ to allocate a group letter and sequence number to the selected instrument. To do this:
    - Standard instruments: use the **track** key to toggle between group letter and sequence number, and the **set crs** key to set the identifying character.

- Maxiview instruments: use the **resp** key to toggle between group letter and sequence number, and the **track** key to set the identifying character.

  When you have identified the instrument, it should display its group letter and sequence number, e.g. A2.

Note: *You can select all instruments in Group Setup mode.*

6. Press either the up arrow or down arrow key to select another instrument and repeat the procedure in step 5.
7. Repeat steps 5 and 6 until all you have identified all instruments in the group.

Note: *If you have more than eight ST60 or ST80 instruments, you must create a second group with a separate identification code (for example* B1, B2 *etc.), operated by another remote keypad.*

8. Use the arrow keys to select an instrument in the group to which you want to allocate the ST7001+ as a keypad.
9. Press the up and down arrow keys together for 1 second. The ST7001+ screen text will alternate between:
   - INST REM and KPD SETUP for standard instruments
   - MAXI REM and KPD SETUP for Maxiview instruments

   Each instruments in the selected group will display PRESS KEY.
10. To allocate the ST7001+ to the selected group of instruments:
    - press the **track** or **set crs** key for standard instruments
    - press the **resp** or **track** key for Maxiview instruments
11. If you are creating more than one group, repeat steps 3 to 10 for each group.
12. When you have set up all instrument groups, return to normal operation as follows:
    - standard instruments:
      - press the **track** and **set crs** keys for 1 second to return to Group Setup mode
      - then press the **track** and **set crs** keys again for 2 seconds to return to normal operation
    - Maxiview instruments:
      - press the **resp** and **track** keys for 1 second, to return to Group Setup mode
      - press the **resp** and **track** keys again for 2 seconds to return to normal operation.

7 Adjusting Autopilot Settings

7.3 User Calibration

Note: *If you are connecting the ST7001+ to a non-150/400 autopilot system, the User Calibration group is not available. Refer to the Appendix for full details.*

The User Calibration group includes settings that you may need to adjust on a regular basis due to changing conditions.

User Calibration screens

AutoTack angle

Note: *Only available if vessel type =* SAIL BOAT.

The AutoTack angle is the angle through which the boat will turn when you select an automatic tack (see *page 12*).

Screen text	Options
AUTO TACK	40° to 125° in 1° steps

Gybe inhibit

Note: *Only available if vessel type =* SAIL BOAT.

With gybe inhibit on:

- you will be able to perform an AutoTack into the wind
- to prevent accidental gybes, the autopilot 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.

Screen text	Options
GYBE STOP	On = Gybe inhibit on (gybes prevented)
	OFF = Gybe inhibit off (gybes permitted)
	Default = On

7 Adjusting Autopilot Settings

Accessing User Calibration

STANDBY mode

2 seconds
(saves changes) standby

standby 2 seconds

Calibration Mode

DISPLAY CAL

or ▼ disp

or ▲ disp
1 second

DEALER CAL

USER CAL

or ▲ disp
1 second

SEATRIAL CAL

or ▲ disp
1 second

standby   auto

User Calibration

or ▼ disp

AUTO TACK
◄ 100°
cal.
Sail boats only

or ▼ disp

or ▲ disp
1 second

or ▲ disp
1 second

VARIATION
◄ 0 ►
cal

GYBE STOP
◄ On ►
cal.
Sail boats only

▼

or ▼ disp

or ▲ disp
1 second

To adjust values use

-1 or +1

-10 or +10

To exit & save changes

standby
2 seconds

or ▲ disp
1 second

or ▼ disp

RESPONSE
◄ 5 ►
cal

WIND APP
◄ ►
cal
Sail boats only

or ▲ disp
1 second

WIND TRIM
◄ 5 ►
cal
Sail boats only

or ▲ disp
1 second

or ▼ disp

or ▼ disp

D5489-1

Wind selection

Note: *Only available if vessel type =* SAIL BOAT *and appropriate wind data is available.*

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

Options	
WIND APP	Autopilot steers to **apparent** wind angle (default): • the autopilot will maintain the apparent wind angle
WIND TRUE	Autopilot steers to **true** wind angle: • the autopilot will maintain the true wind angle

WindTrim (wind response)

Note: *Only available if vessel type =* SAIL BOAT.

WindTrim (wind response) controls how quickly the autopilot responds to changes in the wind direction. Higher wind trim settings will result in a pilot that is more responsive to wind changes.

Screen text	**Options**
WIND TRIM	Range = 1 to 9 Lower values (1 to 3) = autopilot responds to longer term wind changes (less pilot activity) Typical values = 4 to 6 Higher values (7 to 9) = autopilot responds to shorter term wind changes (more pilot activity)

Response level

This is the default autopilot response level. 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 *page 7*).

7 Adjusting Autopilot Settings

Type 150G/400G autopilot systems

Type 150G/400G autopilot systems have 9 possible response levels.

Screen text	Options
RESPONSE	1 to 9 • level 1 gives the least pilot activity to conserve 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 • level 9 gives the tightest course keeping and greatest rudder activity, but may lead to a rough passage in open waters as the autopilot may 'fight' the sea

Type 150/400 autopilot systems

Type 150/400 (non-GyroPlus) autopilot systems have 3 possible response levels:

Screen text	Options
RESPONSE 1	AutoSeastate on (Automatic deadband) • autopilot to gradually ignores repetitive boat movements and only react to true variations in course • provides the best compromise between power consumption and course keeping accuracy
RESPONSE 2	AutoSeastate off (minimum deadband) • provides tighter course keeping • increased power consumption and drive unit activity
RESPONSE 3	AutoSeastate off + counter rudder yaw damping • provides tightest possible course keeping by introducing counter rudder yaw damping

Magnetic variation

If required, set this value to the level of magnetic variation present at your boat's current position – indicated as east (VAR EAST) or west (VAR WEST). The autopilot sends this variation setting to other instruments on the SeaTalk system, and it can be updated by other SeaTalk instruments.

Screen text	Options
VARIATION	Default setting = 0°
VAR EAST/ VAR WEST	30°EAST(-30°) to 30° WEST (+30°) in 1° steps

7 Adjusting Autopilot Settings

7.4   Seatrial Calibration

The Seatrial Calibration group has been designed specifically for use during the initial seatrial when commissioning your autopilot. Refer to *Chapter 6: Commissioning the Autopilot* for full details.

CAUTION:

You should not need to access Seatrial Calibration to adjust settings during normal autopilot operation.

Note: *If you are connecting the ST7001+ to a non-150/400 autopilot system, the Seatrial Calibration group is not available. You will need to use the Compass Calibration group instead. Refer to the Appendix for full details.*

7.5   Dealer Calibration

The Dealer Calibration group includes items that have a significant impact on autopilot operation and can affect your boat's safety.

CAUTION:

After you have commissioned the autopilot, you should not normally need to alter the Dealer Calibration values.

Note: *If you are connecting the ST7001+ to a non-150/400 autopilot system, the items in the Dealer Calibration group appear in a different order and several items will not be available. Refer to the Appendix for full details.*

Accessing Dealer Calibration

To prevent accidental access, we have made entry to Dealer Calibration more difficult than the other groups:

- when you see the DEALER CAL screen, press the **auto** key
- the display will show CAL
- press the **-1** and **+1** keys together to enter Dealer Calibration

Dealer Calibration screens and settings

The items in Dealer Calibration vary according to the vessel type you have selected. See the table on *page 92* for default values.

SeaTrial Calibration lock

This screen controls whether it is possible to access Seatrial Calibration.

Note: *On non-150/400 systems, the calibration lock controls whether it is possible to enter Compass Calibration. See the Appendix for full details.*

Options	
CAL LOCK OFF	Calibration lock off – Seatrial calibration can be accessed (default)
CAL LOCK ON	Calibration lock on – Seatrial calibration cannot be accessed

Accessing Dealer Calibration

STANDBY mode

2 seconds (saves changes) (standby)

(standby) 2 seconds

Calibration Mode

▲ or (disp) 1 second

DISPLAY CAL

▼ or (disp)

DEALER CAL

USER CAL

▼ or (disp)

SEATRIAL CAL

▼ or (disp)

(auto)

CAL

(standby)   (-1)   (+1)

Dealer Calibration

CAL LOCK OFF

▲ or (disp) 1 second

▼ or (disp)

RESET

VARIATION

LATITUDE

AUTOADAPT

CRUISE SP

WIND TRIM

WIND APP

GYBE STOP

AUTO TACK

} Sail boats only

RELEASE — Stern drives only

VESSEL

DRIVE TYP

ALIGN

LIMIT

RUD GAIN

COUNT RUD

RUD DAMP

AUTO TRIM

RESPONSE

TURN RATE

To adjust values use

(-1) or (+1)

(-10) or (+10)

To save changes

(standby)

2 seconds

OFFCOURSE 20°

Not sail boats — TURN RATE

▲ or (disp) 1 second

▼ or (disp)

D5491-1

Vessel type

Vessel type should be set when commissioning the autopilot
(see *page 59*).

Options	
DISPLACE	Displacement powerboat
SEMI DISPLACE	Semi-displacement powerboat
PLANING	Planing powerboat
STERN DRV	Planing powerboat with I/O drive (stern drive)
WORK BOAT	Work boat (150/150G and 400/400G only)
SAIL BOAT	Sail boat (150/150G and 400/400G only)

Note: *When you select the vessel type, the autopilot will set
appropriate defaults for several other calibration settings. Refer to
the table on page 101 for default values.*

Drive type

The drive type setting controls how the autopilot drives the steering
system. The drive type should be set when commissioning the
autopilot (see *page 61*).

Options	
DRIVE TYP 3	Linear drive, rotary drive or I/O (stern) drive
DRIVE TYP 4	Hydraulic pump or hydraulic linear drive
DRIVE TYP 5	Constant running hydraulic pump solenoids

Align rudder

Use the screen to center the rudder bar display after installing the
autopilot system (see *page 61*). This screen also appears in the
Seatrial Calibration grouping.

Screen text	Range
ALIGN RUDDER	-7° to +7° in 1° steps

Rudder limit

Use the rudder limit screen to set the limits of autopilot rudder control just inside the mechanical end stops. This will avoid putting the steering system under unnecessary load. You should adjust this setting when commissioning the autopilot (see *page 61*).

Screen text	Range
RUDDER LIMIT	10° to 40° in 1° steps

Rudder gain

This screen determines the default rudder gain setting. Rudder gain is a measure of how much helm the autopilot will apply to correct course errors. The higher the setting the more rudder will be applied.

The default rudder gain is set during the initial seatrial:

- Type 150G/400G autopilots will adjust the rudder gain automatically during the AutoLearn (see *page 68*)
- Type 150/400 and Type 100/300 autopilots will require manual adjustment of rudder gain (see *page 71*)

You can make temporary changes to this rudder gain value during normal operation (see *page 29*).

Screen text	Range
RUDD GAIN	1 to 9

Counter rudder

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

The default rudder gain is set during the initial seatrial:

- Type 150G/400G autopilots will adjust the counter rudder setting automatically during the AutoLearn (see *page 68*)
- Type 150/400 and Type 100/300 autopilots will require manual adjustment of counter rudder (see *page 71*)

Screen text	Range
COUNT RUD	1 to 9

7 Adjusting Autopilot Settings

Rudder damping

Adjust the rudder damping value if the autopilot 'hunts' when trying to position the rudder (see *page 62*). Increasing the rudder damping value reduces hunting.

Screen text	Range
RUDD DAMP	1 to 9

AutoTrim

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

The default AutoTrim is set when commissioning the autopilot:

* Type 150G/400G autopilots will adjust the AutoTrim setting automatically during the AutoLearn (see *page 68*)
* Type 150/400 and Type 100/300 autopilots will require manual adjustment of AutoTrim (see *page 71*) after the initial seatrial

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

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

Note: *Type 150G/400G autopilots have a 'FastTrim' feature within AutoTrim. Select* AUTO TRIM OFF *to turn off FastTrim as well as AutoTrim.*

Setting	Effect
AUTO TRIM OFF	No trim correction
AUTO TRIM 1	Slow trim correction
AUTO TRIM 2	Medium trim correction
AUTO TRIM 3	Rapid trim correction
AUTO TRIM 4	Very rapid trim correction

7 Adjusting Autopilot Settings

Response level

This screen determines the default response setting. This screen also appears in User Calibration – see *page 89* for full details (or refer to the Appendix for Type 100/300 autopilots).
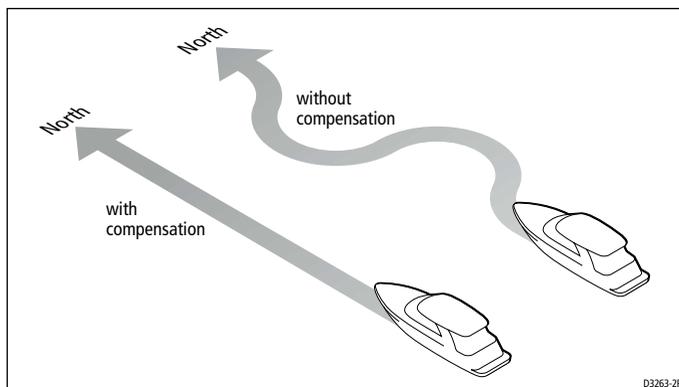
Turn rate limit

Note: *Not available if vessel type* = SAIL BOAT.

This limits your boat's rate of turn under autopilot control.

Screen text	Range
TURN RATE	1° to 30° per second in 1° steps

Off course warning angle

This screen determines the angle used by the OFF COURSE warning (see *page 10*). The OFF COURSE warning operates if the pilot strays off course by more than the specified angle for more than 20 seconds.

Screen text	Range
OFF COURSE	15° to 40° in 1° steps

AutoRelease (I/O drives only)

Note: *Only available if vessel type* = STERNDRV.

If the vessel type is set to STERN DRV (I/O or stern drive), you will see the AutoRelease screen (AUTO RELEASE) set to ON as a default.

AutoRelease provides emergency manual over-ride in situations when you need to avoid an obstacle at the last moment.

Screen text	Range
AUTO RELEASE	ON = AutoRelease on
	OFF = AutoRelease off

AutoTack angle

Note: *Only available if vessel type =* SAIL BOAT *(Type 150/150G or Type 400/400G) or* DISPLACEMENT *(Type 100/300).*

This screen also appears in User Calibration – see *page 87* for full details (or refer to the Appendix for Type 100/300 autopilots).

Gybe inhibit

Notes:
1. Only available if vessel type = SAIL BOAT.
2. Not available on Type 100/300 autopilot systems.

With gybe inhibit on you can only AutoTack into the wind. This screen also appears in User Calibration – see *page 87* for full details.

Wind type

Notes:
1. Only available if vessel type = SAIL BOAT.
2. Not available on Type 100/300 autopilot systems.

This screen determines whether the boat steers to apparent or true wind in Wind Vane mode. This screen also appears in User Calibration – see *page 89* for full details.

WindTrim (wind response)

Note: *Only available if vessel type =* SAIL BOAT *(Type 150/150G or Type 400/400G) or* DISPLACEMENT *(Type 100/300).*

WindTrim (wind response) controls how quickly the autopilot responds to changes in the wind direction. This screen also appears in User Calibration – see *page 89* for full details (or refer to the Appendix for Type 100/300 autopilots).

Cruise speed

Set the cruise speed to the boat's typical cruising speed. If both the boat's speed through the water and speed over ground are unavailable via SeaTalk or NMEA, the autopilot will use this default cruise speed when computing course changes.

Screen text	Range
CRUISE SP	4 to 60 knots

AutoAdapt

The AutoAdapt feature allows the autopilot to compensate for heading errors at higher latitudes, which are caused by the increasing dip of the earth's magnetic field. The increased dip has the effect of amplifying rudder response on northerly headings in the northern hemisphere, and on southerly headings in the southern hemisphere.

Options	
AUTOADAPT OFF	AutoAdapt off
AUTOADAPT nth	AudoAdapt compensation on – Northern hemisphere
AUTOADAPT Sth	AutoAdapt compensation on – Southern hemisphere

Note: *If you set* AUTOADAPT *to* nth *or* Sth*, you then need to enter your current latitude in the next screen (*LATITUDE*), so that the autopilot can provide accurate course keeping by automatically adjusting the rudder gain depending on the heading. If you have a GPS connected, the autopilot will take latitude information from the GPS.*

Latitude

The ST7001+ only displays this screen if you have set AutoAdapt to nth or Sth. Use the **-1**,**+1, -10 and +10** keys to set the value to your boat's current latitude, to the nearest degree.

Note: *If valid latitude data is available via SeaTalk or NMEA, the ST7001+ will use this data instead of the calibration value.*

Screen text	Range
LATITUDE	0° to 80° in 1° steps

Magnetic variation

This is the degree of magnetic variation. This screen also appears in User Calibration – see *page 90* for full details.

Autopilot reset

Note: *Not available on Type 100/300 autopilot systems.*

WARNING:

Do NOT use this feature unless advised to do so by a Raymarine dealer. If you complete a reset you will lose ALL autopilot calibration settings. You will then need to repeat the autopilot commissioning process.

Selecting an autopilot reset will reset all of the autopilot calibration values in the course computer:

- all of the settings in User Calibration, Seatrial Calibration and Dealer Calibration will return to the factory default values
- the settings in Display Calibration will not change, as these are stored in each individual control head

To reset the autopilot:

1. Select the Autopilot reset (RESET) screen in Dealer Calibration.
2. Press the **+1** key.
3. The screen will then show an ARE YOU SURE message:
   - press the **+1** key again to select 'YES' and reset the autopilot
   - alternatively, press the **disp** key to cancel
4. You will then see the CAL LOCK screen:
   - press **standby** for 2 seconds to save the new default settings, then turn the course computer power off and back on

Dealer Calibration defaults: Types 150/150G & 400/400G

Calibration setting	Vessel type						
	Factory default	Displacement	Semi Displacement	Planing	Stern drive (I/O)	Work boat	Sail boat
Calibration lock	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Vessel type	0	DISPLACE	SEMI DISPLACE	PLANING	STERN DRV	WORK BOAT	SAIL BOAT
Drive type	3	4	4	4	3	5	3
Rudder alignment	0	0	0	0	0	0	0
Rudder limit	30	30	30	20	20	30	30
Rudder gain	4	5	4	4	4	5	2
Counter rudder	4	3	5	5	5	2	2
Rudder damping	2	2	2	2	2	3	2
AutoTrim	2	2	3	3	3	2	1
Response: with G	5	5	5	5	5	5	5
non-G	2	2	2	2	2	2	2
Turn rate limit	5	5	5	5	5	5	---
Off course angle	20	20	20	20	20	20	20
AutoRelease	OFF	---	---	---	ON	---	---
AutoTack angle	100	---	---	---	---	---	100
Gybe inhibit	ON	---	---	---	---	---	ON
Wind type	APP	---	---	---	---	---	APP
Wind Trim	5	---	---	---	---	---	5
Cruise speed	8	8	8	8	20	8	8
AutoAdapt	nth	nth	nth	nth	nth	nth	nth
Latitude	0	0	0	0	0	0	0
Variation	0	0	0	0	0	0	0
Autopilot reset	OFF	OFF	OFF	OFF	OFF	OFF	OFF

Dealer Calibration options: Types 150/150G & 400/400G

Calibration setting	Vessel type							Your settings
	Factory default	Displacement	Semi Displacement	Planing	Stern drive (I/O)	Work boat	Sail boat	
Calibration lock				OFF, ON				
Vessel type			DISPLACE, SEMI DISPLACE, PLANING, STERN DRV, WORK BOAT, SAIL BOAT					
Drive type				3, 4, 5				
Rudder alignment				-7 to +7				
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				1 to 9 (Type 150G/400G) 1 to 3 (Type 150/400)				
Turn rate limit				1 to 30				
Off course angle				15 to 40				
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				

Appendix: Using the ST7001+ With Non-150/400 Autopilots

Introduction

The information in this Appendix explains the key differences when using, commissioning and calibrating the autopilot if you have connected the ST7001+ to a Raymarine autopilot other than a Type 150/150G or Type 400/400G.

Using the autopilot (non-150/400 systems) This section explains the key differences when using the ST7001+ to control a non-150/400 autopilot.	page 104

Commissioning the autopilot (non-150/400 systems) This section explains how t o commission your autopilot after installation. Commissioning consists of a series of dockside checks followed by a seatrial.	page 105

Calibration mode (non-150/400 systems) This section explains the Calibration mode when the ST7001+ is used with a non-150/400 autopilot.	page 106

Type 100/300 autopilots

The ST7001+ is compatible with Raymarine Type 100/300 course computers. When used with a Type 100/300 course computer, the control unit provides:

- standard functionality using the Raymarine steering algorithm without AST (Advanced Steering Technology)
- improved calibration access, but without the AutoLearn calibration feature

Other autopilot systems

You can also use the ST7001+ as an additional control unit for any SeaTalk autopilot system (e.g. ST4000+, ST5000+ or SportPilot) allowing autopilot control from a secondary location.

Appendix

Using the autopilot (non-150/400 systems)

The operating procedures when using the ST7001+ control unit with a non-150/400 autopilot are basically the same as the procedures for using a 150/400 system without a GyroPlus.

Follow the instructions in *Chapter 2: Basic Operation* and *Chapter 3: Advanced Operation*, bearing in mind these main differences:

Adjusting autopilot performance

You can select three response levels to adjust autopilot performance:

- **Response Level 1: AutoSeastate on (Automatic deadband)**
  This setting causes the autopilot to gradually ignore repetitive boat movements and only react to true variations in course. This provides the best balance between power consumption and course keeping accuracy, and is the default calibration setting.
- **Response Level 2: AutoSeastate off (Minimum deadband)**
  This setting provides tighter course keeping. However, this results in increased power consumption and drive unit activity.
- **Response Level 3: AutoSeastate off + yaw damping**
  This setting provides the tightest possible course keeping by introducing counter rudder yaw damping. Yaw damping will use the information provided by a GyroPlus, if connected.

Wind Vane mode

When using Wind Vane mode:

- you can only use the autopilot to maintain an **apparent** wind angle (not a true wind angle)
- gybe inhibit is permanently switched on
- WindTrim provides **two** settings: 1 = normal; 2 = faster response

Manual (Joystick) mode

If you connect the ST7001+ to a Type 100/300 course computer system fitted with a joystick, you will enter Manual (joystick) mode when you press the joystick button.

In Manual (joystick) mode you can use the joystick to power steer the rudder. The ST7001+ will return to Standby mode if you release the joystick button or if you press the **standby** key on the control unit. You can set the autopilot to power steer in either proportional or bang-bang mode (see *page 110*).

Commissioning the autopilot (non-150/400 systems)

Using the ST7001+ to commission a non-150/400 autopilot is basically the same as the commissioning a 150/400 system without a GyroPlus. It involves a series of dockside checks, then a seatrial to calibrate the compass and manually adjust the autopilot's settings.

Follow the instructions in *Chapter 6: Commissioning the Autopilot* bearing in mind these main points:

Dockside Checks

With the boat safely tied up, complete the dockside checks described on *page 56* to *page 57* of *Chapter 6: Commissioning the Autopilot*:

1. Switch on.
2. Check the autopilot operating sense.
3. Adjust the basic autopilot settings.
4. Check the SeaTalk and NMEA connections.

When adjusting the basic autopilot settings you will need to enter Display Calibration, as shown on the illustration on *page 107*. When setting the vessel type you will have the following options:

- Displacement: DISPLACE (including sail boats)
- Semi Displacement: SEMI DISPLACE
- Planing: PLANING
- Stern (I/O) Drive: STERN DRV

Seatrial Calibration

When you have completed the dockside checks, you must complete the setup by taking the boat on a short seatrial to:

1. Calibrate the compass: complete the automatic deviation correction and heading alignment as described in *Chapter 6: Commissioning the Autopilot*.
   NOTE: You will need to enter COMPASS CALIBRATION (not Seatrial Calibration) to swing the compass on a Type 100/300 course computer systems. For more details about accessing and using the Compass Calibration grouping, see the next page.
2. Manually adjust the autopilot settings to suit your boat, as described in *Chapter 6: Commissioning the Autopilot*.

Appendix

Calibration mode (non-150/400 systems)

Calibration groups

When connected to an autopilot other than a Type 150/150G or 400/400G, the Calibration mode provides 3 main calibration groups:

Display Calibration (DISPLAY CAL)

The items in Display Calibration only affect the individual control unit. They are stored in the control unit and do not affect any other control units connected through SeaTalk.

You can adjust the Display Calibration settings as often as necessary – for example, to add or change information displayed on data pages

Compass Calibration (COMPASS CAL)

The Compass Calibration group is specifically designed for use during the initial autopilot seatrial, so you can correct the compass deviation and then align the compass.

Dealer Calibration (DEALER CAL)

The Dealer Calibration group includes items that have a significant impact on autopilot operation and can affect your boat's safety.

After you have completed the initial installation and seatrial, you should not normally need to alter the Dealer Calibration values. The items in Dealer Calibration vary according to the Vessel Type you have selected.

**Calibration Mode Overview
100/300 Autopilot Systems**

STANDBY mode

2 seconds
(saves changes) (standby)

(standby) 2 seconds

Calibration Mode

(disp)
or
(▼)

or (▲) (disp)
1 sec

DISPLAY
CAL

auto
standby ▼
Display bar selection
Heading type
Pop-up pilot time-out
Data pages 1 to 15

1 sec (disp)
or
(▼)

(disp)
or
(▲)

DEALER
CAL

auto
standby -1 and +1
▼

Vessel type
Calibration lock
Rudder gain
Counter rudder
Align rudder
Rudder limit
Turn rate limit
Cruise speed
Off course alarm angle
AutoTrim
Power steer on/off
Drive type
Rudder damping
Magnetic variation
AutoAdapt
Latitude
WindTrim (Displacement only)
AutoTack (Displacement only)
AutoRelease (Sterndrive only)
Response level

COMPASS
CAL

auto
standby ▼
Swing compass
Compass deviation
Align heading

1 sec (disp)
or
(▼)

(disp)
or
(▲)

Within DISPLAY CAL, COMPASS CAL and DEALER CAL:
– press **disp** or ▼ to move forwards through items
– use **-1, +1, -10, +10** to adjust settings
– press **standby** for 2 seconds to save changes

D5492-1

Dealer Calibration screens

The illustration shows the screens that appear in the calibration groups when the ST7001+ is connected to a Type 100/300 course computer.

Vessel type

Vessel type should be set when commissioning the autopilot (see *page 59*).

Options	
DISPLACE	Displacement
SEMI DISPLACE	Semi-displacement
PLANING	Planing
STERN DRV	Boat with I/O drive (stern drive)

Note: *When you select the vessel type, the autopilot will set appropriate defaults for several other calibration settings.*

Compass Calibration lock

This screen controls whether it is possible to access Compass Calibration.

Options	
CAL LOCK OFF	Lock off: Compass Calibration can be accessed
CAL LOCK ON	Lock on: Compass Calibration cannot be accessed

Rudder gain

This screen determines the default rudder gain setting. Rudder gain is a measure of how much helm the autopilot will apply to correct course errors. The higher the setting, the more rudder will be applied. You should adjust this setting when commissioning the autopilot. (see *page 71*). You can make temporary changes to this rudder gain value during normal operation (see *page 29*).

Screen text	Range
RUDD GAIN	1 to 9

Counter rudder

Counter rudder is the amount of rudder the autopilot applies to try to prevent the boat from yawing off course. Higher counter rudder settings result in more rudder being applied. You should set the default counter rudder when commissioning the autopilot (see *page 72*).

Screen text	Range
COUNT RUD	1 to 9

Align rudder

Use this screen to center the rudder bar display after installing the autopilot system.

Screen text	Range
ALIGN RUDDER	-7° to +7° in 1° steps

Rudder limit

Use the rudder limit screen to set the limits of autopilot rudder control just inside the mechanical end stops. This will avoid putting the steering system under unnecessary load. You should adjust this when commissioning the autopilot (see *page 61*).

Screen text	Range
RUDDER LIMIT	15° to 30° in 1° steps

Turn rate limit

This limits your boat's rate of turn under autopilot control.

Screen text	Range
TURN RATE	5° to 20° per second in 1° steps

Cruise speed

Set the cruise speed to the boat's typical cruising speed. If both the boat's speed through the water and speed over ground are unavailable via SeaTalk or NMEA, the autopilot will use this default cruise speed when computing course changes.

Screen text	Range
CRUISE SP	4 to 60 knots

Appendix

Off course warning angle

This screen determines the angle used by the OFF COURSE warning (see *page 10*). The OFF COURSE warning operates if the pilot strays off course by more than the specified angle for more than 20 seconds.

Screen text	Range
OFF COURSE	15° to 40° in 1° steps

AutoTrim

The AutoTrim setting determines the rate at which the autopilot applies 'standing helm' to correct for trim changes caused by varying wind loads on the sails or superstructure. You should set the default AutoTrim after commissioning the autopilot (see *page 73*).

Setting	Effect
AUTO TRIM OFF	No trim correction
AUTO TRIM 1	Slow trim correction
AUTO TRIM 2	Medium trim correction
AUTO TRIM 3	Rapid trim correction (default)
AUTO TRIM 4	Very rapid trim correction

Power steer

If you have a joystick connected to your Type 100/300 autopilot system, use power steer to select the required joystick mode of operation (see table).

Options	
POWER STR OFF	Power steer off
POWER STR 1	1 = Proportional power steer Proportional power steer applies rudder in proportion to joystick movement – the further the joystick is held over, the greater the applied rudder.
POWER STR 2	2 = Bang-bang power steer Bang-bang power steer applies continuous rudder in the direction of the lever movement – to improve control, the speed of rudder movement changes with the angle of the lever. For maximum speed, push the lever hardover. If you return the lever to the center position, the rudder will remain in its current position.

Appendix

Drive type

The drive type setting controls how the autopilot drives the steering system. You should set the drive type when commissioning the autopilot (see *page 61*).

Options	
DRIVE TYP 1 or 2	Not used
DRIVE TYP 3	Linear drive, rotary drive or I/O (stern) drive
DRIVE TYP 4	Hydraulic pump or hydraulic linear drive
DRIVE TYP 5	Constant running hydraulic pump solenoids

Rudder damping

Set this option during the initial dockside checks if the autopilot 'hunts' when trying to position the rudder (see *page 62*).

Screen text	Range
RUDD DAMP	1 to 9

Magnetic variation

If required, set this value to the level of magnetic variation present at your boat's current position – indicated as east (VAR EAST) or west (VAR WEST). The autopilot sends this variation setting to other instruments on the SeaTalk system, and it can be updated by other SeaTalk instruments.

Screen text	Options
VARIATION	Default setting = 0°
VAR EAST/ VAR WEST	30°EAST(-30°) to 30° WEST (+30°) in 1° steps

AutoAdapt

The AutoAdapt feature allows the autopilot to compensate for heading errors at higher latitudes, which are caused by the increasing dip of the earth's magnetic field.

The increased dip has the effect of amplifying rudder response on northerly headings in the northern hemisphere, and on southerly headings in the southern hemisphere.

Note: *If you set* AUTOADAPT *to* nth *or* Sth, *you then need to enter your current latitude in the next screen (*LATITUDE*), so that the autopilot can provide accurate course keeping by automatically adjusting the rudder gain depending on the heading.*

Options	
AUTOADAPT OFF	AutoAdapt off
AUTOADAPT nth	AudoAdapt compensation on – Northern hemisphere
AUTOADAPT Sth	AutoAdapt compensation on – Southern hemisphere

Latitude

The ST7001+ only displays this screen if you have set AutoAdapt to nth or Sth. Use the **-1**,**+1, -10 and +10** keys to set the value to your boat's current latitude, to the nearest degree.

Note: *If valid latitude data is available via SeaTalk or NMEA, the autopilot will use this data instead of the calibration value.*

Screen text	Range
LATITUDE	0° to 80° in 1° steps

WindTrim (wind response)

Note: *Only available if vessel type =* DISPLACEMENT.

WindTrim (wind response) controls how quickly the autopilot responds to changes in the wind direction.

Screen text	Options
WIND TRIM	1 = Normal setting 2 = Faster response for wind shifts

AutoTack angle

Note: *Only available if vessel type =* DISPLACEMENT.

The AutoTack angle is the angle through which the boat will turn when you select an automatic tack (see *page 12*).

Screen text	Options
AUTO TACK	40° to 125° in 1° steps

AutoRelease (I/O drives only)

Note: *Only available if vessel type = STERNDRV.*

If the vessel type is set to STERN DRV (I/O or stern drive), you will see the AutoRelease screen (AUTO RELEASE) set to ON as a default. AutoRelease provides emergency manual over-ride in situations when you need to avoid an obstacle at the last moment.

Screen text	Range
AUTO RELEASE	ON = AutoRelease on OFF = AutoRelease off

Response level

This is the default response setting. The response level controls the relationship between the autopilot's course keeping accuracy and the amount of helm/drive activity. You can make temporary changes to response during normal operation (see *page 7*).

Screen text	Options
RESPONSE 1	AutoSeastate on (Automatic deadband) = default • autopilot to gradually ignores repetitive boat movements and only react to true variations in course • provides the best compromise between power consumption and course keeping accuracy
RESPONSE 2	AutoSeastate off (minimum deadband) • provides tighter course keeping • increased power consumption and drive unit activity
RESPONSE 3	AutoSeastate off + counter rudder yaw damping • provides tightest possible course keeping by introducing counter rudder yaw damping

Dealer Calibration: possible settings with Type 100/300

Calibration setting	Vessel type				Your settings
	Displacement	Semi Displacement	Planing	Stern drive (I/O)	
Vessel type	DISPLACE	SEMIDISP	PLANING	STERNDRV	
Calibration lock	OFF	OFF	OFF	OFF	
Rudder gain	5	5	4	3	
Counter rudder	7	7	7	5	
Rudder alignment	0	0	0	0	
Rudder limit	30	30	30	20	
Turn rate limit	20	15	15	8	
Cruise speed	6	8	15	15	
Off course angle	20	20	20	20	
AutoTrim	2	3	3	3	
Power steer	OFF	OFF	OFF	OFF	
Drive type	3	4	4	3	
Rudder damping	2	2	2	2	
Variation	OFF	OFF	OFF	OFF	
AutoAdapt	NORTH	NORTH	NORTH	NORTH	
Latitude	0	0	0	0	
Wind Trim (displacement only)	1	---	---	---	
AutoTack angle (displacement only)	100	---	---	---	
AutoRelease (stern drives only)	---	---	---	ON	
Response	1	1	1	1	

Note: Information applies to Type 100/300 Course Computers with Version 15 software.

Specifications

ST7001+ control unit

Nominal supply voltage:	12 V DC via SeaTalk
Operating voltage range:	10 V to 15 V DC
Current consumption (in Standby mode)	50 mA (less than 120 mA with full lighting)
Operating temperature:	0 °C to +70 °C (32 °F to 158 °F)
Water protection:	waterproof to CFR46
Overall dimensions: 　　　　　width 　　　　　height 　　　　　depth	 175 mm (6.9 in) 115 mm (4.53 in) 41 mm (1.62 in)
Keypad:	13 button illuminated keypad
Liquid Crystal Display (LCD):	shows heading, locked course and navigational data, and up to 15 data pages
LCD illumination:	3 brightness levels + off; 15 contrast levels
Input connections:	SeaTalk (x2) and NMEA 0183
Output connections:	SeaTalk (x2)
CE approvals:	conforms to: 89/336/EC (EMC), EN60945:1997

Course computer functions

Control unit	Course computer		
	Type 150G/400G	**Type 150/400**	**Type 100/300**
ST7001+	• Internal GyroPlus yaw sensor • Enhanced course keeping using AST • FastTrim • Full access to AutoLearn, providing automatic steering calibration • Improved track-keeping • Steers to true and apparent wind in Wind Vane mode • Improved calibration access	• Full basic functionality • Improved track-keeping • Steers to true and apparent wind in Wind Vane mode • Improved calibration access, but without AutoLearn • Uses Raymarine steering algorithm without AST • No FastTrim	• Standard functionality using Raymarine steering algorithm without AST • Improved calibration access, but without AutoLearn • Steers to apparent wind only in Wind Vane mode

Glossary

Term	Meaning
°	Degrees
A	Amp
AST (Advanced Steering Technology)	AST (Advanced Steering Technology) is Raymarine's unique advanced steering algorithm. It uses inputs from a wide variety of sensors to tune the autopilot's operation to provide superior control of the boat in any condition.
AutoLearn	Self-learning calibration feature available on Type 150G and 400G autopilot systems.
AutoTrim	The AutoTrim setting determines the rate at which the autopilot applies 'standing helm' to correct for trim changes caused by varying wind loads on the sails or superstructure.
AWG	American Wire Gauge
CE	Marked on Raymarine products that comply with defined European Community standards
counter rudder	Counter rudder is the amount of rudder the autopilot applies to try to prevent the boat from yawing off course. Higher counter rudder settings result in more rudder being applied.
CR pump	Constant Running hydraulic pump
DC	Direct current
EMC (Electromagnetic Compatibility)	When powered up, all electrical equipment produces electromagnetic fields. These can cause adjacent pieces of electrical equipment to interact with one another, and this can degrade their performance. By following the EMC guidelines in this handbook, you can minimize these effects by ensuring optimum Electromagnetic Compatibility (EMC) between equipment.
Fluxgate	Standard Raymarine compass supplied with course computer core pack
ft	Foot (1 ft = 305 mm)
GPS	Global Positioning System
GyroPlus	Raymarine's GyroPlus yaw sensor that measures the boat's rate of turn. It is built into the Type 150G and Type 400G course computers.
Hz	Hertz (cycles per second)
in	Inch (1 in = 25.4 mm)
I/O drive	Inboard/Outboard or stern drive
km	Kilometre
m	Metre (1 m = 39.4 inches)
mm	Millimeter (1 mm = 0.04 inches)

Term	Meaning
MOB	Man overboard
nm	Nautical mile
NMEA	The NMEA (National Maritime Electronics Association) protocol is an internationally accepted serial communication interface standard for sharing data between electronic equipment. Raymarine products can share information with non-SeaTalk equipment using the NMEA 0183 protocol.
response	The autopilot response level controls the relationship between course keeping accuracy and the amount of helm/drive activity.
rudder gain	Rudder gain is a measure of how much helm the autopilot will apply to correct course errors. The higher the setting the more rudder will be applied.
SeaTalk	SeaTalk is Raymarine's proprietary communication system. It links the products to provide a single, integrated system sharing power and data.
SeaTalk bus	This refers to the continuous SeaTalk system connecting together a series of Raymarine units.
SM	Statute (land) mile
SSB	Single Side Band (radio)
Type 150	Raymarine 12 V course computer without internal GyroPlus
Type 150G	Raymarine 12 V course computer with internal GyroPlus
Type 400	Raymarine 12/24 V course computer without internal GyroPlus
Type 400G	Raymarine 12/24 V course computer with internal GyroPlus
V	Volt
VHF	Very High Frequency (radio)
W	Watt
WindTrim	WindTrim (wind response) controls how quickly the autopilot responds to changes in the wind direction. Higher wind trim settings will result in a pilot that is more responsive to wind changes.
XTE	Cross track error
Yaw	The boat's rate of turn (°/sec)

Index

✂

Control unit - surface mount template

Drill 5mm

Drill 5mm

Drill 5mm

Drill 5mm

Machine hole
90 mm (3.55 in)
diameter

D4235-4
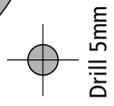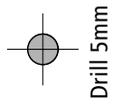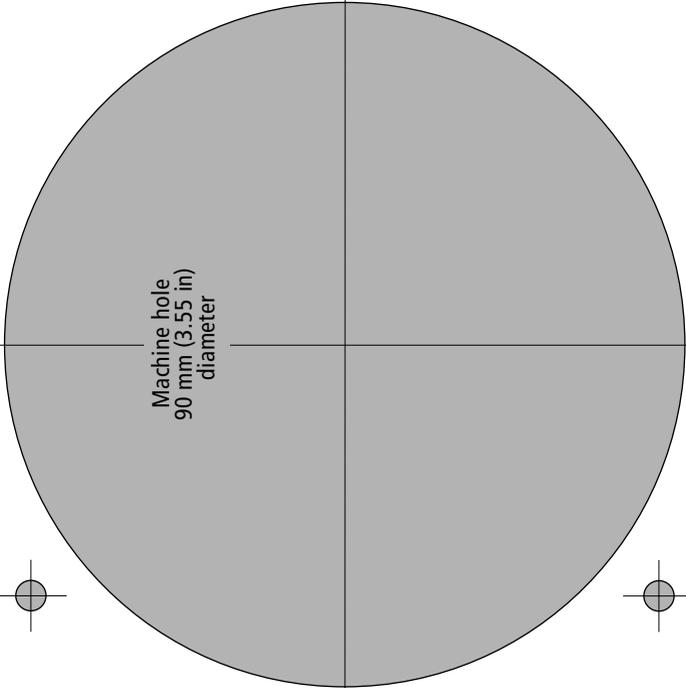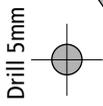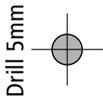
Limited Warranty Certificate

Raymarine warrants each new Light Marine/Dealer Distributor Product to be of good materials and workmanship, and will repair or exchange any parts proven to be defective in material and workmanship under normal use for a period of 2 years/24 months from date of sale to end user, except as provided below.

Defects will be corrected by Raymarine or an authorized Raymarine dealer. Raymarine will, except as provided below, accept labor cost for a period of 2 years/24 months from the date of sale to end user. During this period, except for certain products, travel costs (auto mileage and tolls) up to 100 round trip highway miles (160 kilometres) and travel time of 2 hours, will be assumed by Raymarine only on products where proof of installation or commission by authorized service agents, can be shown.

Warranty Limitations

Raymarine Warranty policy does not apply to equipment which has been subjected to accident, abuse or misuse, shipping damage, alterations, corrosion, incorrect and/or non-authorized service, or equipment on which the serial number has been altered, mutilated or removed.

Except where Raymarine or its authorized dealer has performed the installation, it assumes no responsibility for damage incurred during installation.

This Warranty does not cover routine system checkouts or alignment/calibration, unless required by replacement of part(s) in the area being aligned.

A suitable proof of purchase, showing date, place, and serial number must be made available to Raymarine or authorized service agent at the time of request for Warranty service.

Consumable items, (such as: Chart paper, lamps, fuses, batteries, styli, stylus/drive belts, radar mixer crystals/diodes, snap-in impeller carriers, impellers, impeller bearings, and impeller shaft) are specifically excluded from this Warranty.

Magnetrons, Cathode Ray Tubes (CRT), TFT Liquid Crystal Displays (LCD) and cold cathode fluorescent lamps (CCFL), hailer horns and transducers are warranted for 1 year/12 months from date of sale. These items must be returned to a Raymarine facility.

All costs associated with transducer replacement, other than the cost of the transducer itself, are specifically excluded from this Warranty.

Overtime premium labor portion of services outside of normal working hours is not covered by this Warranty.

Travel cost allowance on certain products with a suggested retail price below $2500.00 is not authorized. When/or if repairs are necessary, these products must be forwarded to a Raymarine facility or an authorized dealer at owner's expense will be returned via surface carrier at no cost to the owner.

Travel costs other than auto mileage, tolls and two (2) hours travel time, are specifically excluded on all products. Travel costs which are excluded from the coverage of this Warranty include but are not limited to: taxi, launch fees, aircraft rental, subsistence, customs, shipping and communication charges etc. Travel costs, mileage and time, in excess to that allowed must have prior approval in writing.

TO THE EXTENT CONSISTENT WITH STATE AND FEDERAL LAW:

(1) THIS WARRANTY IS STRICTLY LIMITED TO THE TERMS INDICATED HEREIN, AND NO OTHER WARRANTIES OR REMEDIES SHALL BE BINDING ON RAYMARINE INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABLE OR FITNESS FOR A PARTICULAR PURPOSE.

(2) Raymarine shall not be liable for any incidental, consequential or special (including punitive or multiple) damages.

All Raymarine products sold or provided hereunder are merely aids to navigation. It is the responsibility of the user to exercise discretion and proper navigational skill independent of any Raymarine equipment.

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Stick barcode label here

Purchased from _____ Purchase date _____

Dealer address _____

_____

Installed by _____ Installation date _____

Commissioned by _____

Commissioning date _____

Owner's name _____

Mailing address _____

_____

This portion should be completed and retained by the owner.