

SIMRAD

A2004

Operator Manual

ENGLISH



Preface

Disclaimer

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It is the owner's sole responsibility to install and use the equipment in a manner that will not cause accidents, personal injury or property damage. The user of this product is solely responsible for observing safe boating practices.

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Warranty

The warranty card is supplied as a separate document.

In case of any queries, refer to the brand website of your display or system: www.navico.com/commercial.

Compliance statements

This equipment complies with:

- CE under EMC directive 2014/30/EU
- The requirements of level 2 devices of the Radio communications (Electromagnetic Compatibility) standard 2008

The relevant Declaration of conformity is available in the product's section at the following website: www.navico.com/commercial.

About this manual

This manual is a reference guide for operating, configuring and commissioning an autopilot system with the A2004 control unit.

The manual assumes that the user has basic knowledge of navigation, nautical terminology and practices.

Important text that requires special attention from the reader is emphasized as follows:

→ **Note:** Used to draw the reader's attention to a comment or some important information.

⚠ Warning: Used when it is necessary to warn personnel that they should proceed carefully to prevent risk of injury and/or damage to equipment/personnel.

Manual version

This manual is written for software version 1.0. The manual is continually updated to match new software releases. The latest available manual version can be downloaded from www.navico.com/commercial.

Contents

- 7 Introduction**
 - 7 Manuals
 - 8 A2004 Front panel and keys
 - 10 The autopilot page

- 13 Basic operation**
 - 13 Safe operation with the autopilot
 - 13 Turning the unit on and off
 - 14 Taking command
 - 14 Operating the menu system
 - 15 Display setup
 - 16 Selecting autopilot mode
 - 16 Selecting work profile
 - 17 Working with thrusters
 - 18 External system selector
 - 19 External EVC override (SG05 PRO)
 - 19 Using the autopilot in an EVC system

- 20 Autopilot modes**
 - 20 External system selector
 - 20 Hand steering
 - 21 Automatic modes
 - 25 NAV mode
 - 28 Controlling steering performance in automatic modes

- 30 Work profiles**
 - 30 Predefined profiles
 - 30 Creating a new profile
 - 31 Edit profile settings

- 32 Software setup**
 - 32 System settings
 - 33 Units
 - 33 Network

- 37 Autopilot computer setup**
 - 38 Installation setup workflow

38	Dockside setup
46	Sea trial
48	User configurable settings
55	Installation verification
55	Checklist
55	Boat specific settings
59	Alerts
59	Alert settings
59	Alert message types
60	Alert indication
61	Acknowledging the alerts
61	Alert dialogs
62	List of possible alerts and corrective actions
63	Maintenance
63	Preventive maintenance
63	Cleaning the display unit
63	Checking the connectors
63	Backup and restore of system data
64	Software update
65	Menu overview
65	Settings menus
67	Technical specifications
69	Dimensional drawings
69	A2004 without bracket
69	A2004 with bracket
70	Supported data
70	NMEA 2000 PGN (transmit)
70	NMEA 2000 PGN (receive)
72	Appendixes
72	List of possible alarms and corrective actions

1

Introduction

The A2004 is a networked autopilot display and control unit.

The unit is used as controller in autopilot systems including a Simrad AC70 or an SG05 autopilot computer. One thruster can be included in the A2004 system when connected via an AD80 or an SD80 unit.

The A2004 systems include several modules that need to be mounted in different locations on the vessel and that need to interface with at least three different systems on the boat:

- The boat's steering system
- The boat's electrical system (input power)
- Other equipment onboard

All parts of the autopilot system must be installed and configured according to supplied documentation prior to using the autopilot. The following steps are required:

- Mechanical installation and wiring of all units. Refer to separate documentation for the units
- Software setup of the system. Refer to "*Software setup*" on page 32
- Commissioning and setup of the autopilot computer. Refer to "*Autopilot computer setup*" on page 37

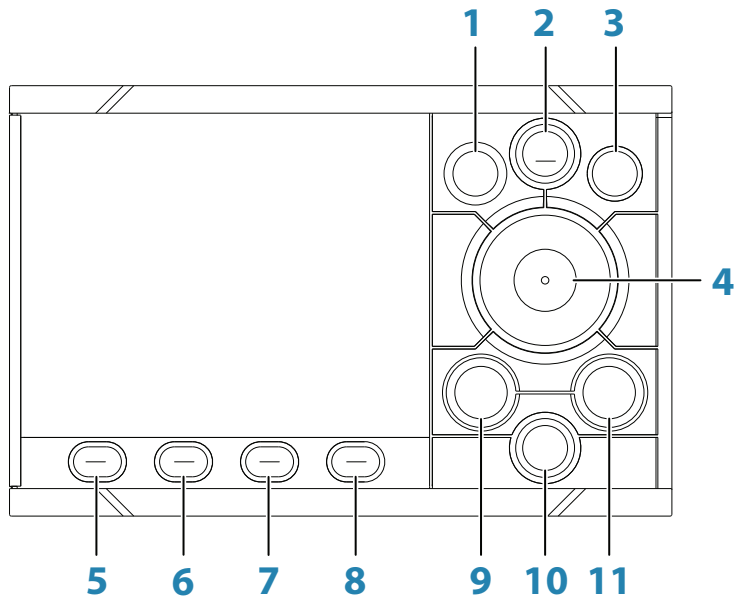
Manuals

The following documentation is available for the A2004 system:

- A2004 Operator manual - this manual
- A2004 Quick guide
- A2004 Installation guide
- AP48/A2004 Mounting template
- AC70 Installation guide
- SG05 Installation guide
- AD80 Installation guide
- SD80 Installation guide

→ **Note:** The latest version of all documents can be downloaded from the product website on www.navico.com/commercial.

A2004 Front panel and keys



- 1 Power key**
In any mode: Press to show the Display setup dialog.
Repeat short presses to toggle preset light levels.
In Standby mode: Press and hold to turn the autopilot system to Sleep mode. Re-press the key to re-activate the system.
- 2 MENU key**
Press once to display the Quick menu.
Press twice to show the Settings menu.
- 3 X key**
Press to return to previous menu level or to exit a dialog.
Press and hold to exit the menu system and return to last active mode page.

4 Rotary knob

Menu and dialog operation:

- Turn to move up and down in menus and dialogs
- Turn to adjust a value
- Press to select a menu option and to enter the next menu level

In Standby and NFU mode: Press to activate Follow up (FU) mode.

In FU mode: Turn to set the rudder angle .

In automatic modes: Turn to change the set heading/set course, press to re-activate automatic mode with current heading/course as reference.

5 STBY key

Press to activate Standby mode.

6 AUTO key

Press to activate last active mode (AUTO or NoDrift), and to display the mode pop-up menu. Repeat short presses to toggle the pop-up menu options.

7 NAV key

Press to activate NAV (Navigation) mode.

8 WORK/Thruster key

Press to display work profile options. Repeat short presses to toggle the work profile options.

Press and hold to activate or de-activate the thruster.

9, 11 < and > (port and starboard) keys

In Standby and FU mode: Press to activate Non-Follow Up (NFU) steering.

In automatic modes: Press to change the set heading/set course to port or to starboard.

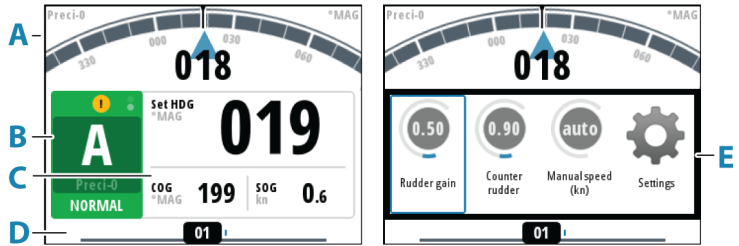
10 Turn key

Press to display the Turn dialog.

The autopilot page

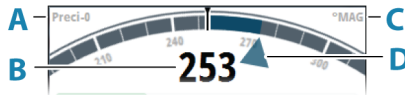
The autopilot page includes:

- **A:** Heading repeater
- **B:** Status panel
- **C:** Mode info panel
- **D:** Rudder bar
- **E:** Quick menu
 - displayed by pressing the **MENU, WORK/Thruster** or the **TURN** key



Heading repeater

Panel including heading source (**A**), heading unit (True or Magnetic) (**C**), current heading (**B**) and set heading (**D**).

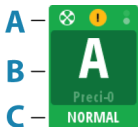


Status panel

The panel includes status icons (**A**), active mode with steering reference (**B**), and active profile (**C**).

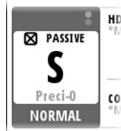
The following mode abbreviations are used:

- **S:** Standby
- **A:** AUTO
- **FU:** Follow-up
- **ND:** No Drift
- **NFU:** Non-Follow Up
- **N:** NAV
- S-turn icon

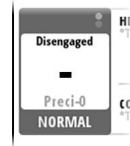


If the autopilot is operated from another control unit, the passive icon is shown in the mode indication field.

If the autopilot is controlled by an external system selector, the mode indication will be replaced as below.



Passive control unit



Autopilot disengaged by external system selector

Available status icons are shown below. Only active icons are visible.



Icon available if a thruster is installed. The icon will be shaded when the thruster is deactivated for steering



Active alert. Red icon for alarms, yellow for warning. See more details in *"Alerts"* on page 59

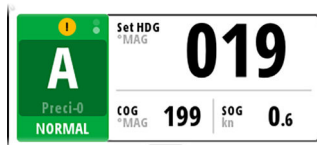


Picture freeze indicator. Two dots alternate slowly to show that the screen is alive and that information from sensors is updated

Mode info panel

The panel contains mode specific content and varies with the operational mode. See *"Autopilot modes"* on page 20 onwards for more details.

If a thruster is available and active, the mode info panel will be split to show thruster information.



No thruster available



Thruster in use

→ **Note:** If sensor input is missing, the numbers will be replaced with hyphens.

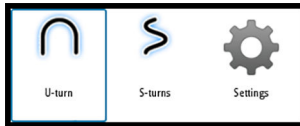
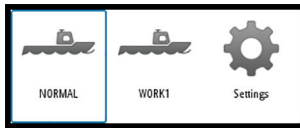
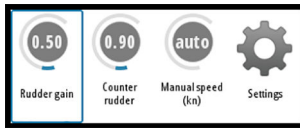
Rudder bar

Rudder position indicator with digital and analog readout. Direction indicator (**A**) is shown when rudder movement is commanded and rudder feedback is available.



Quick menus

The system includes 3 different quick menus:



- Mode Quick menu, activated by pressing the **MENU** key. See "*Autopilot modes*" on page 20
- Work profile Quick menu, activated by pressing the **WORK/Thruster** key. See "*Selecting work profile*" on page 16 and "*Work profiles*" on page 30
- Turn Quick menu, activated by pressing the **TURN** key. See "*Turn pattern steering*" on page 24

2

Basic operation

Safe operation with the autopilot

⚠ **Warning:** An autopilot is a useful navigational aid, but DOES NOT replace a human navigator.

⚠ **Warning:** Ensure the autopilot has been installed correctly, commissioned and calibrated before use.

Do not use automatic steering when:

- In heavy traffic areas or in narrow waters
- In poor visibility or extreme sea conditions
- When in areas where use of an autopilot is prohibited by law

When using an autopilot:

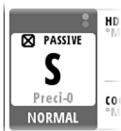
- Do not leave the helm unattended
- Do not place any magnetic material or equipment near the heading sensor used by the autopilot system
- Verify at regular intervals the course and position of the vessel
- Always switch to Standby mode and reduce speed in due time to avoid hazardous situations

Turning the unit on and off

The unit will be running as long as power is connected to the NMEA 2000 backbone. It is possible to put the unit to Sleep mode, refer to "*Display setup*" on page 15.

First time startup

When the unit is started for the first time and after a factory reset, the unit displays a setup wizard. Respond to the setup wizard prompts to select some fundamental setup options. These settings can later be changed and further configuration made as described in "*Software setup*" on page 32.



Taking command

In a system including more than one control unit and/or remote units, only one unit can be in control at a time. All other units will be passive. A passive unit is indicated with a passive icon in the mode status field.

If the A2004 is passive, control can be obtained by pressing one of the mode keys.

You can access the menu system, adjust illumination and locally silence an alert sound on a passive unit. All other functions are unavailable.

Operating the menu system

All settings and configuration in the unit are available from the Settings menu, activated by pressing the **MENU** key twice.

- Turn the rotary knob to move up and down in the menus and in the dialogs
- Confirm a selection by pressing the rotary knob
- Return to previous menu level by pressing the **X** key
- Leave the menu system by pressing and holding the **X** key

Edit a value

1. Press the rotary knob to turn the field into edit mode
 - The entry field turns blue
2. Turn the rotary knob to select a preset value or increment/ reduce a numeric value
3. Press the rotary knob to leave edit mode for the selected field

Nav steering	
Nav response	<input type="text" value="3"/>
Approach angle	<input type="text" value="5°"/>
Course change limit	<input type="text" value="Off"/>
XTD limit	<input type="text" value="1m"/>

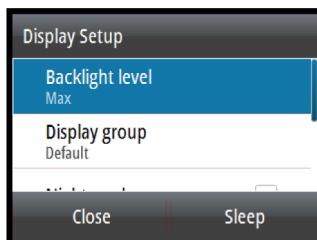
Selected field

Nav steering	
Nav response	<input style="background-color: #0070C0; color: white;" type="text" value="3"/>
Approach angle	<input type="text" value="5°"/>
Course change limit	<input type="text" value="Off"/>
XTD limit	<input type="text" value="1m"/>

Field in edit mode

→ **Note:** You can at any time press the **X** key to leave a dialog.

Display setup

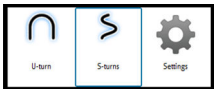
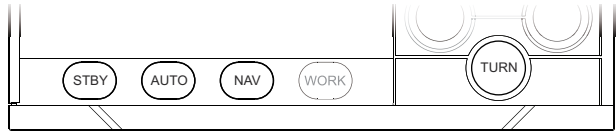


The display setup can be adjusted at any time from the Display setup dialog, activated by pressing the power key.

The following options are available:

- Backlight level: Adjusts the backlight level from Min (10%) to Max (100%) in 10% increments
 - When the Backlight level field is active, subsequent presses on the power key adjusts backlight level in decrements of 30%
 - Display group: Defines which network group the unit belongs to
 - Night mode: Activates/deactivates the night mode color palette
 - Night mode color: Sets the night mode color palette
 - Invert day color: Changes the background color for the pages from default white to black
 - Sleep: Turns the backlight for screen and keys off to save power
- **Note:** All changes made to the display setup will apply to all units belonging to the same display group. For more information about network groups, refer to "*Network groups*" on page 36.
- **Note:** The system will switch to Standby mode when Sleep mode is activated.

Selecting autopilot mode



- Standby mode and NAV mode: press the dedicated mode key
- AUTO mode or NoDrift mode: press the **AUTO** key
 - last active mode (AUTO or NoDrift) is activated immediately, and the mode pop-up menu is displayed
 - repeat pressing the **AUTO** key to toggle the pop-up menu options. The selection times out and triggers the mode shift
- S-Turn mode: press **TURN** key when the system is in AUTO mode, then select the S-turn option from the Turn Quick menu
- NFU (Non Follow Up) mode: press the port or starboard key when the system is in Standby mode
- FU (Follow Up) mode: press the rotary knob when the system is in Standby or NFU mode

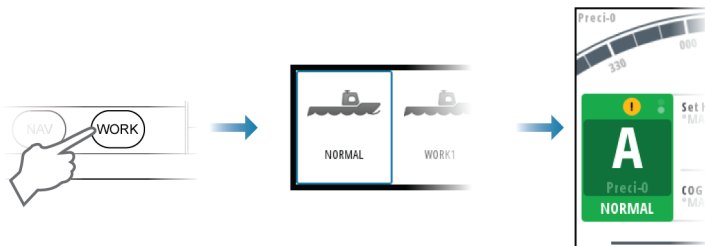
See more details in the "*Autopilot modes*" on page 20.

Selecting work profile

The autopilot can be set up with 3 different profiles associated with different work modes. See more details in "*Work profiles*" on page 30.

1. Press the **WORK** key to display the work profile options
2. Repeat pressing the **WORK** key or use the rotary knob to select preferred profile
 - The selection times out and triggers the work profile shift. You can also confirm your selection by pressing the rotary knob.

The name of the work profile in use is displayed in the mode status panel.



Working with thrusters

One thruster can be connected to the autopilot system. The thruster can be configured to different work profiles, and the work profile in use will then decide if the vessel can be controlled by rudder, thrusters, or both rudder and thruster.

Thruster settings

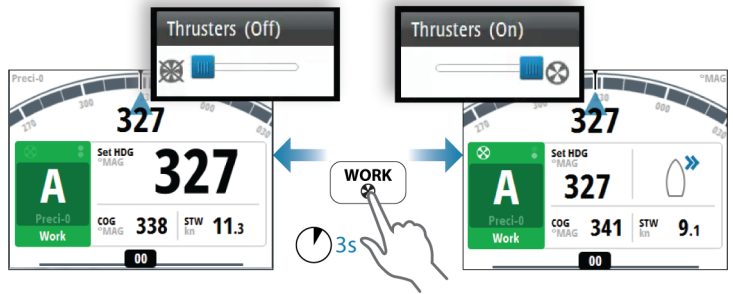
Two settings affect how the thrusters are used by the autopilot:

- **Thruster inhibit** speed - set during dockside setup
 - This setting will turn the thrusters OFF when the vessel is running above a set speed limit
- The **Thruster assist** function - set when configuring the thrusters for the work profiles
 - ON: the thrusters will automatically be used by the autopilot system. If the thrusters are turned off when the vessel increases inhibited speed, the thrusters will automatically be turned on again when the speed goes below the inhibited limit
 - OFF: you must manually turn thrusters ON

For more information see "*User configurable settings*" on page 48.

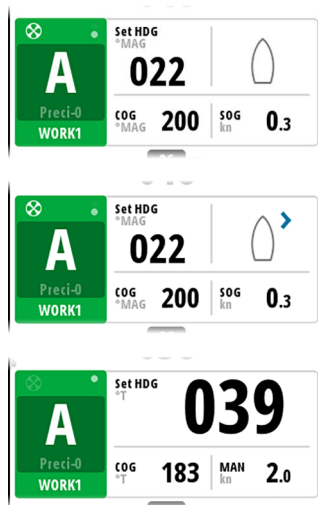
Activating and de-activating the thruster

You can manually toggle the thruster on and off by pressing and holding the **WORK/Thruster** key for 3 seconds. A popup with slide bar is displayed to indicate change in thruster status.



Thruster presentation

When a thruster is installed and activated in the work profile, the thruster status icon and the thruster information in the mode info panel are as shown below.



- Thruster available for present work profile, no thrust applied
- Thruster in use. Image including thrust direction
- Thruster manually deselected
- Thruster unavailable (vessel speed is above inhibit limit)

External system selector

An external system selector can be used to control autopilot operation.



Manual steering

When an external system selector is set to manual steering, the autopilot will be disengaged. The control unit will display information as in Standby mode. It is not possible to change to FU, NFU or to any automatic mode. The menus can however be used, alerts acknowledged and illumination adjusted.

When the autopilot is disengaged by an external switch, this will be indicated in the mode display.

Autopilot operation

When the external selector is set to automatic steering, the autopilot will go directly to AUTO heading mode with present heading as set reference. The autopilot can then be used in all operational modes.

External EVC override (SG05 PRO)

You may at any time, irrespective of the autopilot mode, take manual control of the steering by means of the helm. The autopilot will then go to Standby mode and display Override to indicate the steering is from the helm. Autosteering can be resumed by pressing the **AUTO** or the **WORK** key.

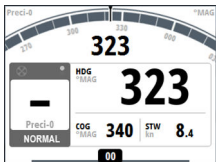


Using the autopilot in an EVC system

When the A2004 is connected to an EVC system via the SG05, you can take manual control of the steering regardless of the autopilot mode.

The mode indicator is replaced by a dash to indicate EVC override.

The system returns to A2004 control in Standby mode if no rudder command is given from the EVC system within a predefined period.



3

Autopilot modes

The autopilot has several steering modes. The number of modes and features within the mode depend on the autopilot computer, the boat type and available inputs, as explained in the description of the following steering modes.

External system selector

An external switch can be used for controlling change over from manual to automatic steering.

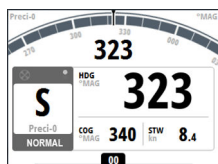
The mode descriptions in the following pages assumes that an external system selector has opened for autopilot operation, or that no external selector is installed.

Hand steering

Standby mode

Standby mode is used when you steer the boat at the helm.

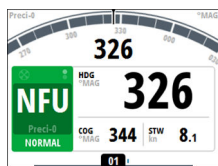
- Switch to Standby mode by pressing the **STBY** key.
- **Note:** If sensor data vital for autopilot operation (e.g. rudder response) is lost when the autopilot is running in an automatic mode, the system will automatically switch to Standby mode.



Non-Follow Up (NFU) mode

In NFU mode you can use the port and starboard keys on the controller to operate the rudder. The rudder will move as long as the key is pressed.

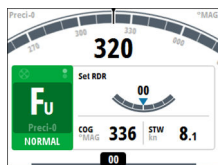
- Switch to NFU mode by pressing one of the port or starboard keys when the autopilot is in Standby mode or FU mode.



Follow-up (FU) mode

In FU mode you turn the rotary knob to adjust the set rudder angle. The rudder will move to the commanded angle and then stop.

- Switch to FU mode from Standby mode or NFU mode by pressing the rotary knob.





Quick menus in Standby, FU and NFU modes

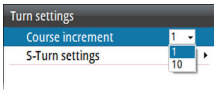
From the Quick menu in Standby, NFU and FU you can change sources used for steering, display active alerts and set manual speed.

- Activate the Quick menu by a short press on the **MENU** key.

Automatic modes

The A2004 includes two automatic modes:

- AUTO compass mode keeps the vessel on set heading
- NoDrift mode combines heading and position information, and keeps the vessel on a straight track



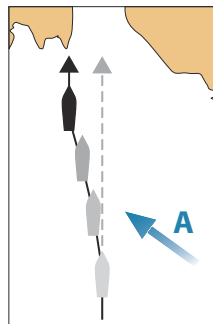
Defining the heading/course change for the arrow keys

By default the set heading (AUTO) and set course (NoDrift) will change 1° each time you press the port or starboard key. You can change this increment setting from the Turn settings dialog. The dialog is activated from the Turn Quick menu and from the Autopilot settings dialog.



AUTO mode (Heading hold)

In AUTO mode the autopilot issues rudder commands required to steer the vessel automatically on a set heading. In this mode the autopilot does not compensate for any drifting caused by current and/or wind (**A**).





- Switch to **AUTO** mode by pressing the **AUTO** key. Repress the key to highlight the **Auto** option in the pop-up menu

When the mode is activated, the autopilot selects the current boat heading as the set heading.

Changing set heading in AUTO mode

You adjust the set heading by turning the rotary knob or by pressing the port or starboard keys.

An immediate heading change takes place. The new heading is maintained until a new heading is set.

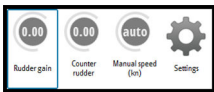
Heading capture

When the vessel is turning in **AUTO** mode, an instant re-press on the **AUTO** key or the rotary knob activates the heading capture function. This will automatically cancel the turn, and the vessel will continue on the heading read from the compass the very moment you pressed the **AUTO** key or the rotary knob.

Temporary heading changes

If you need to avoid an obstacle when in **AUTO** mode, you can press the **STBY** key and power steer or use the helm until the obstacle is passed.

If you re-press the **AUTO** key within 3 minutes you can select to continue on previous set heading. If you don't respond within 3 seconds the menu will disappear, and the autopilot will go to **AUTO** mode with current heading as set heading.



Quick menu in AUTO mode

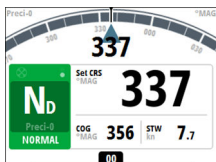
From the Quick menu in **AUTO** mode you can change rudder parameters and set manual speed.

- Activate the Quick menu by a short press on the **MENU** key.

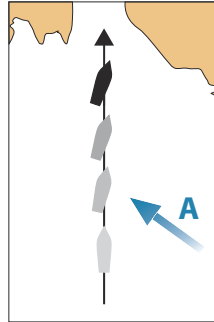
NoDrift mode

→ **Note:** It is not possible to select NoDrift mode if GPS position and heading information is missing.

In NoDrift mode the vessel is steered along a calculated track line, from present position and in a direction set by the user. If the vessel



is drifting away from the track line due to current and/or wind (**A**), the vessel will follow the line with a crab angle.



- Switch to NoDrift mode by pressing the **AUTO** key. Repress the key to highlight the NoDrift option in the pop-up menu

When the mode is activated, the autopilot will draw an invisible track line based on current heading from the vessel's position.

The autopilot will now use the position information to calculate the cross track distance, and automatically steer along the calculated track.

Changing set course in NoDrift mode

You adjust the set course by turning the rotary knob or by pressing the port or starboard keys.

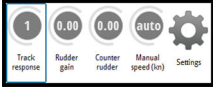
An immediate course change takes place. The new course is maintained until a new course is set.

Dodging

If you need to avoid an obstacle when using NoDrift mode, you can set the autopilot to Standby mode and power steer or use the helm until the obstacle is passed.

If you return to NoDrift mode within 60 seconds you can select to continue on previous set bearing line.

If you do not respond, the dialog disappears and the autopilot goes to NoDrift mode with current heading as set bearing line.



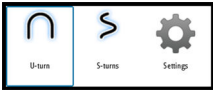
Quick menu in NoDrift mode

From the Quick menu in NoDrift mode you can change the track response, rudder parameters and set manual speed.

- Activate the Quick menu by a short press on the **MENU** key.

Turn pattern steering

U-turn and S-turns pattern steering are available for use in AUTO and NoDrift modes.



Starting and stopping a turn

You start the turn by selecting the turn option in turn Quick menu, activated by pressing the **TURN** key. The turn is initiated when the port or starboard turn direction options is selected in the turn dialog.

You can at any time during a turn press the **STBD** key to return to standby mode and manual steering.

U-turn

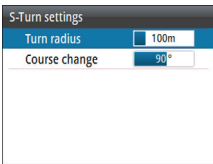
Changes the current set heading to be 180° in the opposite direction.

The vessel will turn with the defined turn rate or turn radius for active profile. Refer to *"Turn"* on page 49.

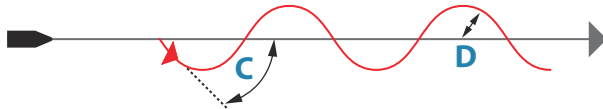
S-turn

Makes the vessel yaw around the main heading.

You set the default heading change and turn radius in the **Turn settings** dialog, activated from the Turn Quick menu.

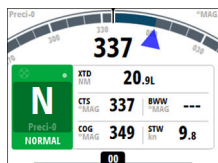


- Turn variables:
 - Course change (**C**)
 - Turn radius (**D**)



During the turn you can alter the main heading by turning the rotary knob or by pressing the port or starboard keys.

NAV mode



→ **Note:** NAV mode requires a compatible navigator connected to the network.

It is not possible to select NAV mode if heading information is missing, or if steering information is not received from the external chartplotter.

In NAV mode the autopilot uses steering information from an external navigator to direct the vessel to one specific waypoint location, or through a series of waypoints.

In NAV mode, the autopilot's heading sensor is used as heading source for course keeping. Speed information is taken from SOG or from selected speed sensor. The steering information received from the external navigator alters the set course to direct the vessel to the destination waypoint.

To obtain satisfactory navigation steering, the autopilot system must have valid input from the navigator. Autosteering must be tested and determined satisfactory prior to entering NAV mode.

→ **Note:** If the navigator does not transmit a message with bearing to next waypoint, the autopilot will steer using Cross Track Error (XTE) only. In that case you must revert to AUTO mode at each waypoint and manually change set course to equal bearing to next waypoint and then select NAV mode again.

Prior to entering NAV mode the navigator must be navigating a route or towards a waypoint.

- Initiate NAV mode by pressing the **NAV** key
- Confirm to switch to NAV mode in the dialog

Course change required to navigate:

Confirm

Destination: Rpt027

Bearing: 146 °M

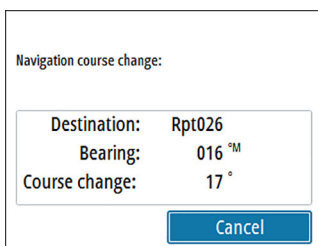
Course change: 147 °

Turning in NAV mode

When your vessel reaches a waypoint, the autopilot will give an audible warning and display a dialog with the new course information.

There is a user defined limit for the allowed automatic course change to next waypoint in a route. If the course change is more than this set limit, you are prompted to verify that the upcoming course change is acceptable.

- If the required course change to the next waypoint is less than the course change limit, the autopilot will automatically change the course. The dialog will disappear after 8 seconds unless cleared by the **X** key.
- If the required course change to next waypoint is more than the set limit, you are prompted to verify that the upcoming course change is acceptable. If the turn is not accepted, the vessel will continue with the current set heading.

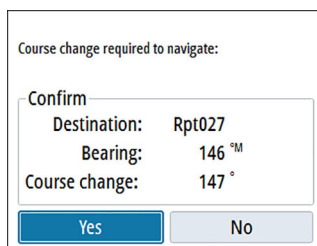


Navigation course change:

Destination:	Rpt026
Bearing:	016 °M
Course change:	17 °

Cancel

Course change less than set limit



Course change required to navigate:

Confirm

Destination:	Rpt027
Bearing:	146 °M
Course change:	147 °

Yes No

Course change larger than set limit

The course change limit setting depends on the autopilot computer:

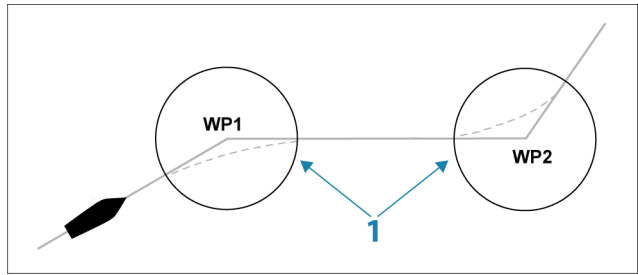
- AC70: **Course change limit**
- SG05 PRO: **Navigation change limit**

Refer to "*Course change limit*" on page 52.

Waypoint arrival circle

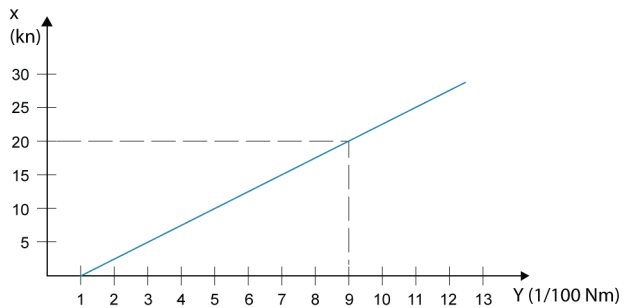
The arrival circle (radius) defines the point at which a turn is initiated when you are navigating a route.

The arrival circle is set in your chart plotter.



The arrival circle (**1**) should be adjusted according to boat speed. The higher the speed, the wider the circle. The intention is to make the autopilot start the heading change in due time to make a smooth turn onto the next leg.

The figure below may be used to select the appropriate arrival circle when creating the route.



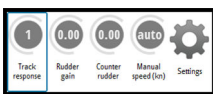
X axis = Boat speed in knots

Y axis = Arrival circle, radius in 1/100 Nm

Example: With the speed of 20 knots you should use a waypoint circle with radius 0.09 Nm.

→ **Note:** The distance between any waypoints in a route must not be smaller than the radius of the arrival circle.

Quick menu in NAV mode



From the Quick menu in NAV mode you can change navigation response and set manual speed.

- Activate the Quick menu by a short press on the **MENU** key.

Controlling steering performance in automatic modes

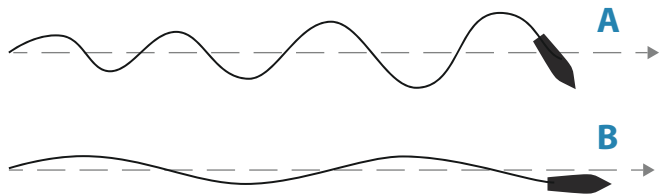
The autopilot should be configured during installation and setup. Some parameters may be adjusted during operation to increase the steering performance. The parameters are available from the Quick menus, activated by pressing the **MENU** key.

Track response

Defines how aggressively the autopilot should steer towards the active route's leg.

Rudder gain

This parameter determines the ratio between commanded rudder and the heading error. The higher rudder gain value the more rudder is applied. If the value is too small it will take a long time to compensate for a heading error, and the autopilot will fail to keep a steady course. If the value is set too high the overshoot will increase and the steering will be unstable.



- A** The value is set too high. Steering becomes unstable and often the overshoot will increase
- B** The value is set too low. It will take a long time to compensate for a heading error, and the autopilot will fail to keep a steady course

Counter rudder

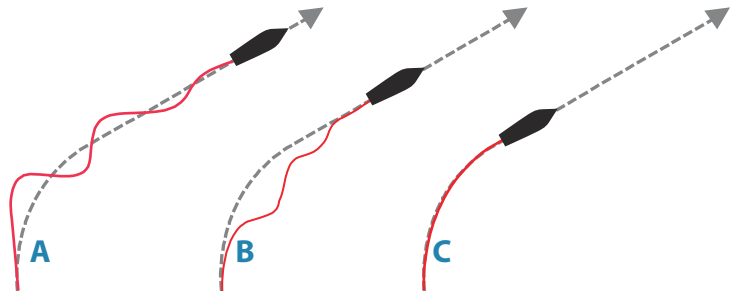
Counter rudder is the amount of counteracting (opposite) rudder applied to stop the turn at the end of a major course change. The

settings depend on vessel's characteristics, inertia, hull shape and rudder efficiency.

- If the vessel has good dynamic stability, a relatively small value will be sufficient
- An unstable vessel will require high value
- The greater the vessel's inertia, the greater value will be required

Increasing counter rudder value may result in some higher rudder activity also when steering a straight course, particularly in high waves.

The best way of checking the value of the Counter rudder setting is when making turns. The figures illustrate the effects of various Counter Rudder settings.



- A** Counter rudder value too low; overshoot response
- B** Counter rudder value is too high; sluggish and creeping response
- C** Correct setting of Counter rudder; ideal response

Perform various course changes and observe how the boat settles on the new heading. Start with small changes, 10-20 degrees, and proceed with bigger changes, 60-90 degrees. Adjust Counter rudder value to obtain best possible response as in illustration **C**.

→ **Note:** As many boats turn differently to port versus starboard (due to propeller rotation direction), do the course changes in both directions. You may end up with a compromise setting of Counter rudder that gives a little overshoot to one side and a bit creeping response to the other.

4

Work profiles

A work profile is a set of steering parameters. You can change the active work profile to adapt the autopilot steering characteristics to different operational conditions.

The A2004 has a set of predefined work profiles, depending on selected boat type. There can be up to 3 work profiles defined in the system.

During commissioning and sea trial the parameters for active profile will be tuned for optimized steering performance.

Predefined profiles

Normal profile

This is the default profile and automatically assigned when you set your vessel type to **Displacement**.

It is recommended to use the Normal profile as a general profile for your vessel. This should be active during the commissioning of your vessel, and all parameter settings will then be saved to this profile.

High and Low profiles

High and **Low** profiles are automatically assigned when you set your vessel to **Planing**.

The system switches automatically between High and Low profiles based on the vessel's speed and the Transition speed setting. Refer "*Transition speed*" on page 45.

Creating a new profile

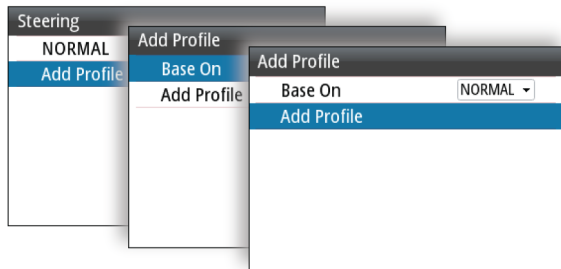
New profiles can be defined for operational modes where the vessel's steering parameters deviate from the default profiles.

You can have up to 3 work profiles in the A2004 autopilot system.

1. Press the **WORK/Thruster** key to display the Work Quick menu, then select the **Settings** option
2. Select the **Add profile** option
3. Select a predefined work profile that matches the working conditions
 - A new profile must be based on an existing or a predefined work profile. The parameters from the work profile you select

as base will be copied to the new profile, and can later be edited

4. Complete the task by selecting the **Add Profile** option



Edit profile settings

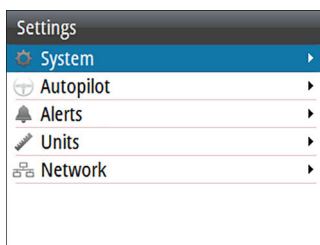
You can edit all profiles, and all user created profiles can be deleted. The parameters for each profile should be optimized for steering performance during commissioning and seatrial of the system. See details in "*User configurable settings*" on page 48.

5

Software setup

Prior to use, the A2004 requires a number of settings be configured in order for the system to perform as expected.

Access to the required options are found in the Settings menu, accessed from the Quick menu or by pressing the **MENU** key twice.

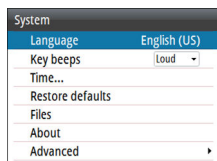


→ **Note:** The following settings are described in other sections of this manual:

"Autopilot computer setup" on page 37

"Alerts" on page 59

System settings



Language

Controls the language used on this unit for panels, menus, and dialogs. Changing the language causes the unit to restart.

Key beeps

Controls the loudness of the beep sound when a key is pressed.

Default setting: Loud

Time

Controls the local time zone offset, and the format of the time and date.

Restore defaults

Allows you to select which settings are to be restored to their original factory settings.

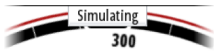
Files

File management system. Used to browse the contents of the unit's internal memory and the content of a device plugged into the unit's USB port.

About

Displays copyright information, software version, and technical information for this unit.

Advanced settings



Simulate

Runs the display with simulated data. Use the simulator to become familiar with your unit before using it on the water.

When activated, the simulator mode is indicated on the display.

Voltage

Displays supply voltage to the unit.

Autopilot logging

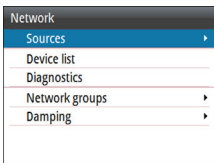
Available if a USB device is connected to the unit.

When activated, autopilot computer data are logged to the USB stick.

Units

Provides setup of units of measure used on various data types.

Network



Sources

Data sources provide live data to the system.

When a device is connected to more than one source providing the same data, the user can choose the preferred source. Before commencing with source selection make sure all external devices and the NMEA 2000 backbone are connected and are turned on.

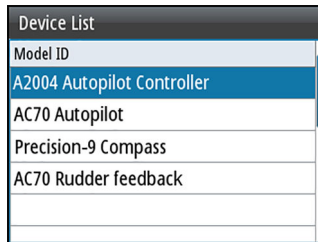
- Auto select: Looks for all sources connected to the device. If more than one source is available for each data type, selection is made

from an internal priority list. This option is suitable for the majority of installations.

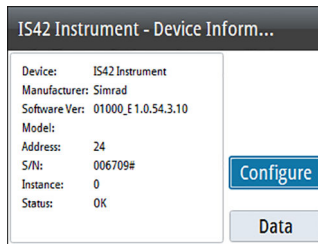
- Manual source selection: Manual selection is generally only required where there is more than one source for the same data, and the automatically selected source is not the one desired.

Device list

The Device list shows the devices that provide data. This may include a module inside the unit, or any external NMEA 2000 device.



Selecting a device in this list will bring up additional details and actions:



All devices allow allocation of an instance number in the **Configure** option. Set unique instance numbers on any identical devices on the network to allow for the unit to distinguish between them. The **Data** option shows all data being output by the device.

Some devices will show additional options specific to the device.

- **Note:** Setting the instance number on a 3rd party product is typically not possible.

Diagnosics

Provides information useful for identifying an issue with the network.

→ **Note:** The following information may not always indicate an issue that can be simply resolved with minor adjustment to network layout or connected devices and their activity on the network. However, Rx and Tx errors are most likely indicating issues with the physical network, which may be resolved by correcting termination, reducing backbone or drop lengths, or reducing the number of network nodes (devices).

Bus state

Simply indicates whether the bus is powered, but not necessarily connected to any data sources. However, if bus shows as **off**, but power is present along with an increasing error count, it is possible that termination or cable topology is incorrect.

Rx Overflows

The unit received too many messages for its buffer before the application could read them.

Rx Overruns

The unit contained too many messages for its buffer before the driver could read them.

Rx/Tx Errors

These two numbers increase when there are error messages, and decrease when messages are received successfully. These (unlike the other values) are not a cumulative count. Under normal operation these should be at 0. Values around 96 upwards indicate a heavily error prone network. If these numbers go too high for a given device, it will automatically drop off the bus.

Rx/Tx Messages

Shows actual traffic in and out of device.

Bus Load

A high value here indicates network is near full capacity. Some devices automatically adjust rate of transmission, if network traffic is heavy.

Fast Packet Errors

Cumulative counter of any fast packet error. This could be a missed frame, or a frame out of sequence etc. NMEA 2000 PGNs are made of up to 32 frames. The entire message will be discarded when a frame is missed.

→ **Note:** Rx and Tx Errors often indicate an issue with the physical network, which may be resolved by correcting termination, reducing backbone or drop lengths, or reducing the number of network nodes (devices).

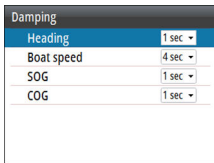
Network groups

The Network Group function is used to control parameter settings, either globally or in groups of units. The function is used on larger vessels where several units are connected to the network. By assigning several units to the same group, a parameter update on one unit will have the same effect on the rest of the group members.

Damping

If data appears erratic or too sensitive, damping may be applied to make the information appear more stable. With damping set to off, the data is presented in raw form with no damping applied.

→ **Note:** Damping settings are applied to units belonging to the same damping group. Refer to "*Network groups*" on page 36.



Damping	
Heading	1 sec ▾
Boat speed	4 sec ▾
SOG	1 sec ▾
COG	1 sec ▾

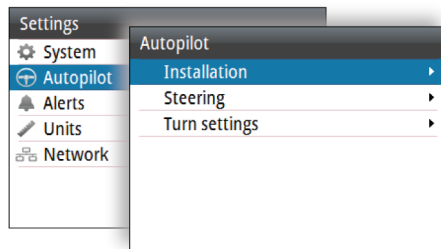
6

Autopilot computer setup

When the autopilot installation is completed, the setup of the autopilot computer must be performed. Failure in setting up the autopilot correctly may prohibit the autopilot from functioning properly.

The setup of the autopilot computer is divided in two main steps:

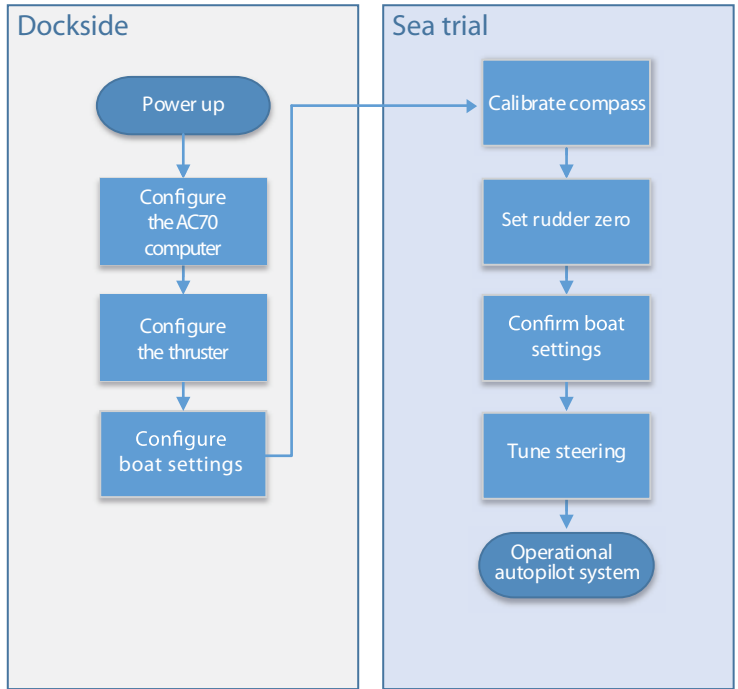
- Installation settings
 - Including dockside and seatrial commissioning. See "*Dockside setup*" on page 38 and "*Sea trial*" on page 46
- User adjustment of autopilot profile settings
 - Manual fine-tuning for various operational conditions and user preferences. See "*User configurable settings*" on page 48



→ **Note:** The Installation settings can only be accessed when the autopilot is in Standby mode.

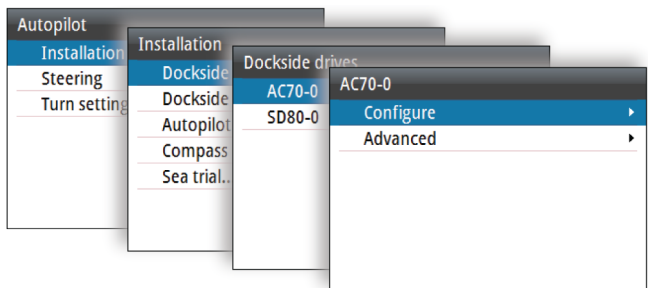
⚠ Warning: When the autopilot is delivered from factory and any time after an autopilot reset has been performed, the installation settings are all reset to factory preset (default) values. A notification will be displayed, and a complete setup has to be made. Failure to do so correctly may prohibit the autopilot from functioning properly!

Installation setup workflow



Dockside setup

AC70 configuration



Control method

Used for setting the appropriate control output for your drive.

The following options are available:

- Solenoid
For on/off steering of hydraulic valves. Gives fixed rudder speed.
- Reversible motor
For variable speed pumps/drives.

Drive voltage

Nominal drive voltage specified for your drive unit.

- Options: 12 V and 24 V.

→ **Note:** 24 V output is only available with 24 V supply.

The setting must match the spec of the solenoids/pump/motor.

⚠ Warning: Selection of improper voltage level for your drive unit may damage both the drive unit and the autopilot computer even if the protection circuits are activated.

Drive engage

Defines how the Engage output is used.

The following options are available:

- Clutch
If your drive unit/motor/pump needs clutch to engage the actuator, it shall be connected to the "engage" output. Configure the "Drive engage" as clutch. The clutch will be activated when autopilot computer is controlling the rudder. In standby, the clutch is released to allow manual steering. Check specification of your drive unit to determine whether clutch is required.
- Auto
Output activated when autopilot computer is in Auto, NoDrift or Navigation modes. For manual rudder control (Standby, NFU and FU) the output is not activated. Typically used to switch between two rudder speeds on a continuous running pump, used when

different rudder speeds are required for automatic and Follow-up/Non-Follow-up steering.

Rudder feedback

Used for selecting rudder feedback type.

The dropdown list includes all compatible rudder feedback units connected to the network.

Rudder feedback calibration

→ **Note:** Only available if you have a rudder feedback unit installed and selected as rudder source.

The rudder feedback calibration determines the rudder feedback's direction, center position and end stops.

- Follow the on-screen guided steps until the rudder calibration is completed.

Rudder test

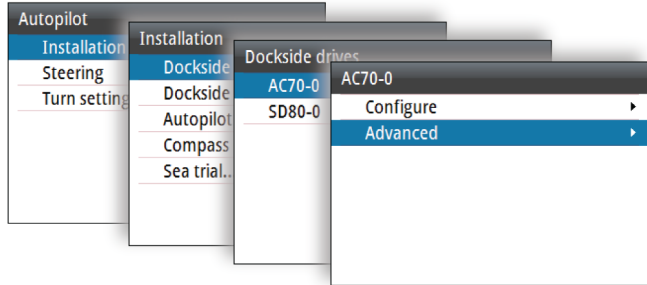
This rudder test verifies the drive direction. It detects minimum power to drive the rudder and reduces the rudder speed if it exceeds the maximum preferred speed for autopilot operation.

→ **Note:** If the boat uses power assisted steering, it is important that the engine or electric motor used to enable the power assist steering is turned on prior to this test.

- Run the rudder test as described in the on-screen instructions
 - Rudder should make a small movement within 10 seconds, then follow up with travelling both directions

Failure to complete test will result in an alarm.

AC70 Advanced settings



Minimum rudder

Some boats may have a tendency to not respond to small rudder commands around the “course keeping” position because of a small rudder, whirls/disturbance of the water-stream passing the rudder, or it is a single nozzle water jet boat. By increasing the Minimum rudder parameter you may improve the course keeping performance on some boats. However, this will increase the rudder activity.

→ **Note:** Only set a value for minimum rudder if it proves to give a better course keeping performance in calm sea. It should be set after the autopilot steering parameters have been optimised/ tuned.

Rudder deadband

Prevents the rudder from hunting induced by mechanical play in the steering gear or rudder.

The following options are available

- Auto
(Recommended).
The rudder deadband is adaptive and is continuously operative. It will also optimize the deadband to the pressure on the rudder
- Manual
If the Auto setting doesn't perform properly due to extreme rudder speed and/or overshoot, it can be adjusted manually. Can

also be used to reduce the rudder activity. Rudder commands smaller than the size of the dead band will be ignored

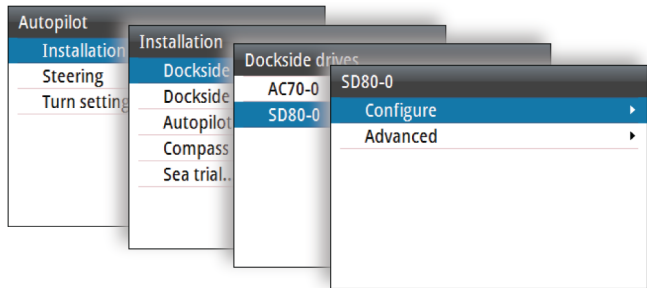
Find the lowest possible value that will prevent the rudder from continuous hunting. A wide deadband will cause inaccurate steering. It is recommended to check rudder stability in AUTO mode at cruising speed to get pressure on the rudder. (Slight hunting observed dockside may disappear at cruising speed.)

Motor output

Shows the amount of power needed to achieve the correct rudder speed. The reading is obtained from the Rudder test.

The automatically set value may be increased or decreased.

AD80/SD80 configuration



→ **Note:** In A2004 systems, the AD80 and SD80 can only be used for thruster control.

Control method

Used for setting the appropriate control output for your drive.

The following options are available:

- Solenoid
For on/off steering of hydraulic valves. Gives fixed thruster speed.
- Reversible motor
For variable speed pumps/drives.

Drive voltage

Nominal drive voltage specified for your drive unit.

- Options: 12 V and 24 V.

→ **Note:** 24 V output is only available with 24 V supply.

The setting must match the spec of the solenoids/pump/motor.

⚠ Warning: Selection of improper voltage level for your drive unit may damage both the drive unit and the autopilot computer even if the protection circuits are activated.

Drive engage

Defines how the Engage output is used.

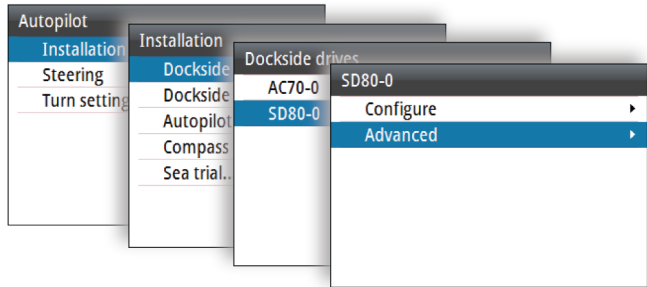
The following options are available:

- Clutch
If your drive unit/motor/pump needs clutch to engage the actuator, it shall be connected to the Engage output. Configure the Drive engage as clutch. The clutch will be activated when autopilot computer is controlling the thruster. In standby, the clutch is released to allow manual steering. Check specification of your drive unit to determine whether clutch is required.
- Auto
Output activated when autopilot computer is in AUTO, NoDrift or Navigation modes. For manual thruster control (Standby, NFU and FU) the output is not activated. Typically used to switch between two thruster speeds on a continuous running pump, used when different thruster speeds are required for automatic and Follow-up/Non-Follow-up steering.

Thruster calibration

If a thruster feedback is available, this must be calibrated. This is required to define the signal for port and starboard side.

Advanced AD80/SD80 settings



Thrust signal output

→ **Note:** Not available for solenoid controlled thrusters.

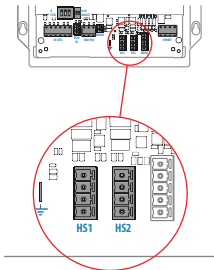
The thrust signal output is the percentage of total signal range needed to achieve correct thrust.

Handshake settings

The handshake settings refer to the **HS1** and the **HS2** terminals on the AD/SD board.

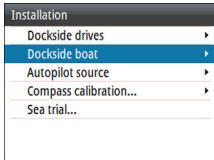
The following options are available:

- HS fixed
 - Autopilot/steering gear interface with fixed level signals
 - Output contact is closed when autopilot requests steering gear control
 - Input to be closed as long as steering gear is available for autopilot control
- Override **Dodge**
 - Manual override with fallback to AUTO mode
 - When input contact is closed, autopilot will give override warning, acknowledge with closed output contact and go to Standby mode
 - When input opens, output contact will open and autopilot returns to AUTO mode on present heading. Typically used for joystick hand steering with override button on top.
- Override **Standby**



- Manual override to Standby mode
 - When input contact is closed, autopilot will give override warning, acknowledge with closed output contact and lock to Standby mode
 - When input opens, output contact will open and autopilot will unlock. This function is normally related to regulations for automatic override when main hand steering is operated.

Boat characteristics



Boat type

Affects steering parameters as well as available autopilot features.

Boat length

Used by the autopilot system to calculate steering parameters.

Cruising speed

Used if no speed info is available. It is used by the autopilot system to calculate steering parameters.

Transition speed

→ **Note:** Only available if the boat type is set to Planing.

The transition speed is the speed at which the system automatically changes between **Low** speed and **High** speed profiles.

The profiles are used to accommodate the boats' tendency to exhibit different steering characteristics at different speeds. You may also have different preferences about the steering performance of your boat required at low and high speeds.

It is recommended that you set a value that represents the speed where the boat's steering characteristics change. For instance the planing threshold (recommended), or at the speed you want the autopilot to change behavior.

There is a 2 knots hysteresis to prevent oscillation of high/low settings when the vessel is travelling at or near the transition speed.

Example

The transition speed is set to 9 knots.

- The system changes from Low profile to High profile when the speed increases to 10 knots (= Transition speed plus 1 knot)

- The system changes from High profile to Low profile when the speed decreases to 8 knots (= Transition speed minus 1 knot)

Thruster inhibit speed

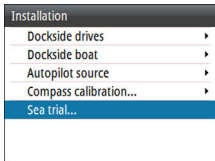
This setting will block the thruster from running above a set vessel speed. It is a safety feature to prevent, especially electrical on/off thrusters, from overheating if out of water or for instance a planing boat or in rough weather.

- **Note:** The Thruster inhibit limit will only apply when speed source is Log or SOG, not if the speed is set manually.

Sea trial

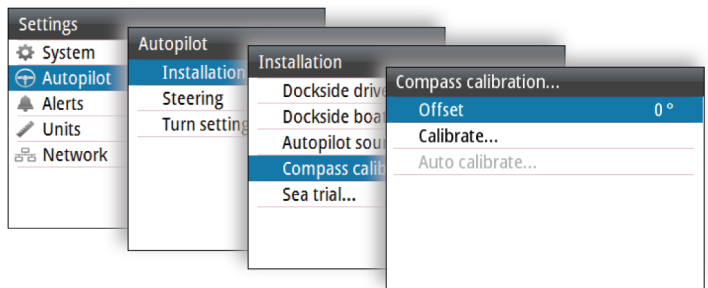
A seatrial can only be performed after the dockside settings are completed.

- **Note:** The seatrial must always be performed in calm conditions, in open waters and at a safe distance from other traffic!



Compass setup

To achieve the best possible performance, the compass should be calibrated, and any offsets should be compensated for.



- **Note:** The setup of the compass should be done in calm sea conditions and with minimal wind and current to obtain good results. Ensure that there is enough open water around the vessel to make a full turn.

Refer to your heading sensor's documentation for further details for your unit.

Set rudder zero position

Used to correct the rudder zero position found during dockside commissioning if the boat needs a small rudder offset in order to steer straight.

- **Note:** Setting rudder zero position should always be done in calm conditions, where steering is not affected by wind and/or current.
- Bring the rudder to the position where the boat steers straight, then activate the **Set rudder zero** option to save the rudder zero parameter.
- **Note:** On dual engine boats, verify that the engine RPM is equal on both engines so that the thrust from both propellers is equal. Otherwise, the zero rudder position might be set wrong.

Tuning the autopilot

- **Note:** Tuning of the autopilot must be done separately for low and high speed profiles.
Both Autotune and manual tuning should be performed in calm or moderate sea conditions.

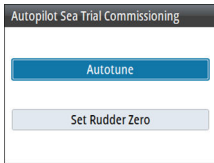
Providing you have entered correct vessel type, length and cruising speed, you may not have to perform further manual or automatic tuning.

Proceed as follows to verify satisfactorily steering:

1. Stabilize the vessel on a heading, and then select **AUTO** mode
2. Observe course keeping and rudder commands
 - The autopilot should keep the vessel on the set heading within an average of +/-1 degree, providing calm sea and wind
3. Make some small and bigger heading changes to port and starboard and observe how the vessel settles on the new heading
 - The vessel should have a minimum of overshoot. See "*Rudder gain*" on page 28 and "*Counter rudder*" on page 28.

If the autopilot is not keeping the heading satisfactorily or not making the turns satisfactorily, you may now either try the Autotune function or go directly to manual tuning.

- **Note:** If the vessel is more than approximately 30 m/100 ft or has a very high cruising speed it may be unpractical to perform Autotune. It is then suggested to proceed with manual tuning.



Autotuning

When performing an autotune, the vessel will automatically be taken through a number of S-turns. Based on the vessel behavior, the autopilot will automatically set the most important steering parameters (Rudder gain and Counter rudder).

- Stabilize the vessel on a heading and set the speed as close to cruising speed as possible, then activate the **Autotune** function.
 - The autopilot will now switch to AUTO mode and take control of the vessel.

- **Note:** Autotuning can be stopped at any time by pressing the **STBY** key on the autopilot controller.

The autotuning takes approximately 3 minutes to complete. When completed the autopilot automatically switches to Standby mode, and the rudder must be controlled manually.

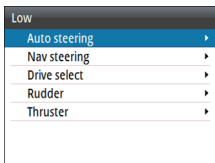
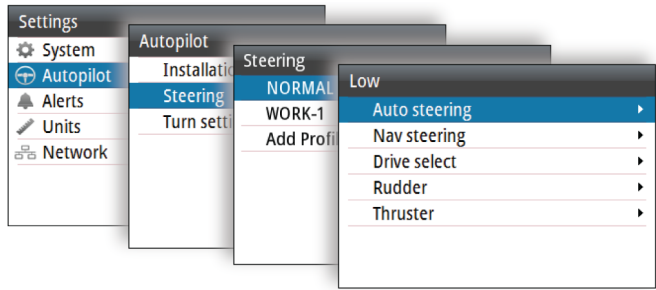
- **Note:** All parameters that are set during autotuning can be manually adjusted. For optimal steering performance it is recommended to manually adjust the steering parameters after running the autotune.

User configurable settings

The steering parameters can be configured differently between the different profiles, depending on boat steering characteristics and user preferences.

The initial parameters are automatically assigned when you select your vessel type. During the seatrial the parameters will be tuned for optimized steering performance.

The options listed in the next pages are available and can be manually adjusted for all profiles.



Auto steering

Turn

Used for selecting how you want to control the vessel's turn: either by defining the Rate of Turn (Rate) or the radius.

- Rate range: 5°/minute - 720°/minute
- Radius range: 10 m - 10 NM
 - The minimum radius can however never be less than the value corresponding to a Rate of Turn = 720°/minute at the set Cruising speed

Turn rate

Used for manually setting the turn rate defined during seatrials (Set turn rate option).

Adaption

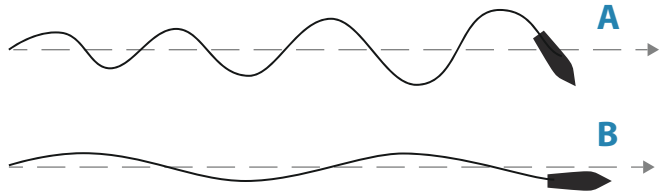
This is a feature that continues to adjust parameters that are essential for the steering performance, e.g. speed, trim, draught and tide effects.

When activated these parameters are optimized during the voyage in response to the ship's behavior. The settings are stored in the active work profile.

Rudder gain

This parameter determines the ratio between commanded rudder and the heading error. The higher rudder gain value the more rudder is applied. If the value is too small it will take a long time to compensate for a heading error, and the autopilot will fail to keep a

steady course. If the value is set too high the overshoot will increase and the steering will be unstable.



- A** The value is set too high. Steering becomes unstable and often the overshoot will increase
- B** The value is set too low. It will take a long time to compensate for a heading error, and the autopilot will fail to keep a steady course

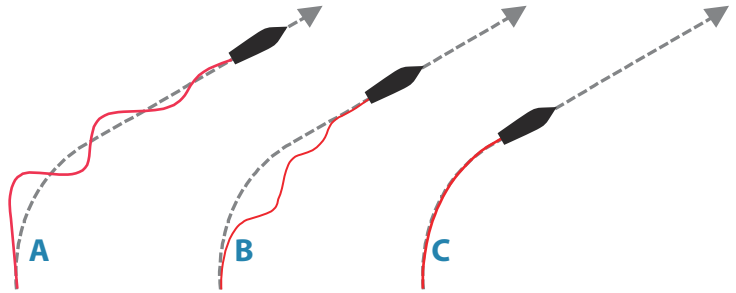
Counter rudder

Counter rudder is the amount of counteracting (opposite) rudder applied to stop the turn at the end of a major course change. The settings depend on vessel's characteristics, inertia, hull shape and rudder efficiency.

- If the vessel has good dynamic stability, a relatively small value will be sufficient
- An unstable vessel will require high value
- The greater the vessel's inertia, the greater value will be required

Increasing counter rudder value may result in some higher rudder activity also when steering a straight course, particularly in high waves.

The best way of checking the value of the Counter rudder setting is when making turns. The figures illustrate the effects of various Counter Rudder settings.



- A** Counter rudder value too low; overshoot response
- B** Counter rudder value is too high; sluggish and creeping response
- C** Correct setting of Counter rudder; ideal response

Perform various course changes and observe how the boat settles on the new heading. Start with small changes, 10-20 degrees, and proceed with bigger changes, 60-90 degrees. Adjust Counter rudder value to obtain best possible response as in illustration **C**.

→ **Note:** As many boats turn differently to port versus starboard (due to propeller rotation direction), do the course changes in both directions. You may end up with a compromise setting of Counter rudder that gives a little overshoot to one side and a bit creeping response to the other.

Autotrim

Controls how fast the autopilot will apply rudder to compensate for a constant heading offset, e.g. when external forces such as wind or current affects the heading. Lower autotrim will give faster elimination of a constant heading offset

→ **Note:** In VRF mode this parameter controls the time constant of the rudder estimate. A lower value makes the rudder estimate faster, i.e. that it will more quickly catch up with the boat's movements.

Off heading limit

Sets the limit for the off heading alarm.

When the alarm option is activated an alarm occurs when the actual heading deviates from the set heading more than the selected limit.

Low speed limit

Sets the limit for the low vessel speed alarm.

An alarm occurs when the vessel's speed goes below the selected limit.

Nav steering

Nav response

Defines how aggressively the autopilot should steer towards the active route's leg.

Approach angle

This setting is a limit to prevent approaching the track too steeply. Approaching the track at shallower angles is permitted depending on the cross track distance (XTD) and nav response setting.

This setting is used both when you start navigating and whenever the autopilot is working the boat towards the route.

Course change limit

Defines the limit for automatic course change to next waypoint in a route when the autopilot is following a route (NAV mode).

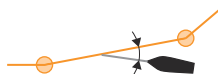
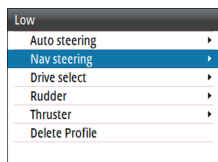
If the course change is greater than this set limit, you are prompted to verify that the upcoming course change is acceptable.

XTD limit

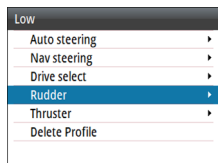
Defines the vessel's accepted offset distance from the track. If the vessel goes beyond this limit an alarm will be activated.

Drive select

Defines which drives that shall be used for the selected work profile.



Rudder



Init rudder

Defines how the system moves the rudder when switching from hand steering (Standby, FU and NFU) to an automatic mode.

The following options are available:

- Center
Moves the rudder to zero position
- Actual
Maintains the rudder angle, and assumes that the current rudder angle is the trim required to maintain a steady heading.

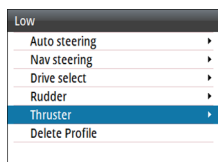
Rudder limit

Determines the dynamic range of the rudder before its movement is restricted and alarm is triggered. Typical usage is to limit the amount of rudder action caused by yawing in following sea.

→ **Note:** Rudder limit is not a hard limitation of the rudder range, only around the current setpoint.

This Rudder limit does not affect Non-Follow-up or Follow Up steering.

Thruster



Deadband

Determines how many degrees the vessel must deviate from the set course before a thruster command is given. As the vessel deviates from its heading, the thruster will push the vessel back.

A higher value will reduce the thruster activity and extend the lifetime, especially for on/off thrusters.

Assist

Determines how the thrusters are used by the autopilot.

When set to ON, the thrusters will automatically be used by the autopilot system if the vessel speed is below inhibited limit. If the vessel speed is above inhibited thruster speed the thrusters will be turned off, but will automatically be turned on again when the speed goes below the inhibited limit.

→ **Note:** Thruster inhibit speed is set during installation and is the max. vessel speed for which the thruster is allowed to run.

When set to OFF, thruster has to be manually enabled.

7

Installation verification

When all units in the autopilot system are installed, external equipment connected and the software configured according to the previous chapters, the installation should be verified according to the checklist. The boat specific settings should be noted down in the relevant tables included this chapter.

Checklist

Description	Reference
Units mounted and secured according to instructions	Installation instructions for the units
Network powered and terminated according to instructions	Wiring instructions for the units
Sources selected	" <i>Software setup</i> " on page 32
Vessel configured	" <i>Boat characteristics</i> " on page 45
Drive unit (AC70) configured and calibrated	" <i>AC70 configuration</i> " on page 38
Thruster (AD80/SD80) configured and calibrated	" <i>AD80/SD80 configuration</i> " on page 42
Compass calibrated	" <i>Compass setup</i> " on page 46
Seatrial completed (manual or autotune)	" <i>Sea trial</i> " on page 46
Profiles defined and configured	" <i>User configurable settings</i> " on page 48

Boat specific settings

Boat

Settings	
Boat type	
Boat length	

Settings	
Cruising speed	
Transition speed	
Thruster inhibit	

AC70 configuration

Settings	
Control method	
Drive voltage	
Drive engage	
Rudder feedback	
Rudder	
Minimum	
Deadband mode	
Deadband (manual)	
Motor output	
Minimum output	
Maximum output	

AD80/SD80 configuration

Settings	
Control method	
Drive voltage	
Drive engage	
Output	
Minimum	
Maximum port	
Maximum starboard	

Settings	
	Zero
Handshake 1	
Handshake 2	

Profile settings

The profile settings can be defined individually for each profile (labelled 1, 2 and 3 in the table below).

Settings	1	2	3
Autosteering			
Turn type			
Turn rate			
Turn radius			
Adaption			
Rudder gain			
Counter rudder			
Auto trim			
Off heading limit			
Low speed limit			
Nav steering			
Nav response			
Approach angle			
Course change limit			
XTD limit			
Drive select			
Rudder			
Thruster			
Rudder			
Init rudder			
Rudder limit			

Settings	1	2	3
Thruster			
Deadband			
Assist			

8

Alerts

The system continuously checks for dangerous situations and system faults while the system is running. The alert system is activated if any alert setting is exceeded.

→ **Note:** If sensor data vital for autopilot operation (e.g. rudder response) is lost when the autopilot is running in an automatic mode, the system will automatically switch to Standby mode.

Alert settings

Most autopilot alerts are activated based on pre-set alert limits, and these limits be changed by the user.

The following settings are user defined, and can be set individually for each profile. Refer details in "*User configurable settings*" on page 48.

Off heading limit angle

Sets the limit for the off heading alarm.

When the alarm option is activated an alarm occurs when the actual heading deviates from the set heading more than the selected limit.

Low speed limit

Sets the limit for the low vessel speed alarm.

An alarm occurs when the vessel's speed goes below the selected limit.

XTD limit

Defines the vessel's accepted offset distance from the track. If the vessel goes beyond this limit an alarm will be activated.

Alert message types

There are two types of messages:

- Alarms
 - Generated when conditions are detected that may critically effect the capability or performance of the system. You must critically examine all alarm messages to determine their cause and effect
- Warnings

- Informing you of conditions that could result in unwanted system response or possible failure

Alert indication

When an alert situation occurs, a siren will sound and the alert icon will become active. The alert dialog will show alert cause, followed by the name of the device that generated the alert.

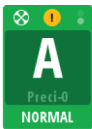


A single alert is displayed with the name of the alert as the title, and with details for the alarm.





If more than one alert is activated simultaneously, the alert pop-up can display 2 alerts. The alerts are listed in the order they occur with the alert activated first at the top. The remaining alerts are available in the Alerts dialog.





Alert icons

The alert icon will remain in the status panel until the alert is acknowledged and rectified.



The table below shows alert icon and behavior depending on if the alert is active, acknowledged, transferred or rectified.

Type	Icon	State	Indication
Alarm		Active - not acknowledged, not silenced	<ul style="list-style-type: none"> • Descriptive text • Audible signal
		Active - not acknowledged, silenced	<ul style="list-style-type: none"> • Descriptive text • No audible signal
		Active - acknowledged	<ul style="list-style-type: none"> • Descriptive text • No audible signal
		Rectified - not acknowledged	<ul style="list-style-type: none"> • Descriptive text • No audible signal

Type	Icon	State	Indication
Warning		Active - not acknowledged, not silenced	<ul style="list-style-type: none"> • Descriptive text • Audible signal
		Active - not acknowledged, silenced	<ul style="list-style-type: none"> • Descriptive text • No audible signal
		Active - acknowledged	<ul style="list-style-type: none"> • Descriptive text • No audible signal
		Rectified - not acknowledged	<ul style="list-style-type: none"> • Descriptive text • No audible signal

The alert and alert details are recorded in the alert listing. Refer "*Alert dialogs*" on page 61.

Acknowledging the alerts

There is no time-out on the alert message or siren. An alert remains active until you acknowledge it or until the reason for the alert is removed.

The most recent alert is acknowledged by pressing the rotary knob.

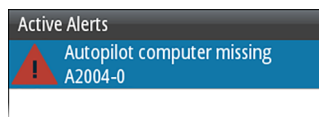
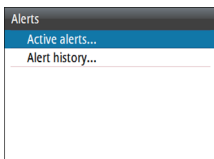
This removes the alert notification, and silences the alert from all units that belong to the same alert group. A reminder reappears at given intervals for as long as the alert condition exists.

→ **Note:** An alert received from non Navico units on the network must be acknowledged on the unit generating the alert.

Alert dialogs

The system includes two different alert panels:

- Active alerts
 - List of all active messages



- Alert history
 - Alert events, including alert type, status and time/date.

Alert History		
Rudder limit AC70-0	Silcd	05:35 27/03/17
Rudder limit AC70-0	Raise	05:35 27/03/17
Steering compass missing AC70-0	Clrd	04:44 27/03/17
Active control unit	Ackd	04:43

The Alerts history dialog stores alert messages until they are manually cleared.

You show details for a selected alert by pressing the rotary knob.


You clear all alerts from the Alerts history dialog by pressing the

MENU key.

Alert History		
Rudder limit AC70-0	Silcd	05:35 27/03/17
	Raise	05:35 27/03/17
Steering compass missing AC70-0	Clrd	04:44 27/03/17
Active control unit	Ackd	04:43

Show Details

Clear all

Alert History		
Alarm Silenced Event		
 Rudder limit AC70-0 Angle > 10 (°)		
Steering compass missing AC70-0		27/03/17
Active control unit	Ackd	04:43

List of possible alerts and corrective actions

For a list of possible alerts and corrective actions refer to "*Appendixes*" on page 72.

The unit might also display alerts received from other units connected to the system. Refer to separate documentation for the relevant equipment for further description of these alerts.

9

Maintenance

Preventive maintenance

The unit does not contain any field serviceable components. Therefore, the operator is required to perform only a very limited amount of preventative maintenance.

It is recommended that you always fit the supplied protective sun cover when the unit is not in use.

Cleaning the display unit

A proper cleaning cloth should be used to clean the screen, where possible. Use plenty of water to dissolve and take away salt remains. Crystallized salt may scratch the coating if using a damp cloth. Apply minimal pressure to the screen.

Where marks on the screen cannot be removed by the cloth alone, use a 50/50 mixture of warm water and isopropyl alcohol to clean the screen. Avoid any contact with solvents (acetone, mineral turpentine, etc.), or ammonia based cleaning products, as they may damage the anti-glare layer or plastic bezel.

To prevent UV damage to the plastic bezel, it is recommended that the sun cover be fitted when the unit is not in use for an extended period.

Checking the connectors

The connectors should be checked by visual inspection only.

Push the connector plugs into the connector. If the connector plugs are equipped with a lock, ensure that it is in the correct position.

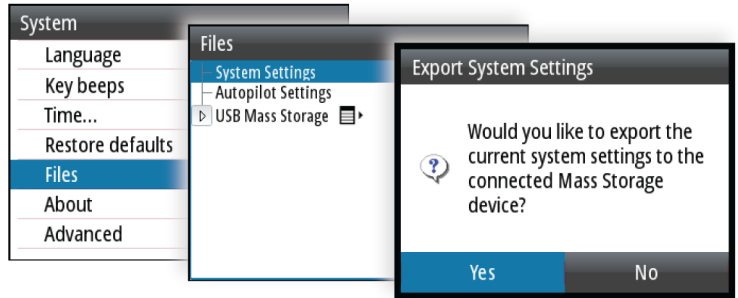
Backup and restore of system data

The system includes a backup and restore function, making it possible to back-up and restore system settings and autopilot configuration files.

→ **Note:** It is strongly recommended to make a backup when the system is installed and configured.

Backup and restore is initiated from the **Files** option when a memory stick is inserted in the USB port on the back of the unit.

The unit will automatically select import or export option depending on the file type selected.



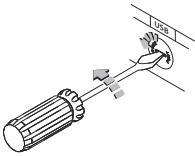
Software update

The A2004 includes a USB port of the back of the units. You use this port for software updates.

You can update the software for the unit itself and for NMEA 2000 sensors connected to the network from the A2004.

You can check the units software version from the About dialog. The software version for connected NMEA 2000 sensors is available in the Device list.

1. Download the latest software from our website: www.navico.com/commercial, and save it to a USB device
2. Insert the USB device to the A2004 unit
3. Start the File explorer, and select the update file on the USB device
4. Start the update from the file details dialog
5. Remove the USB device when the update is completed



10

Menu overview

Settings menus

The system includes a Settings menu, accessed by pressing the **MENU** key twice.

Level 1	Level 2	Level 3
System >	Language	
	Key beeps	
	Time...	
	Restore defaults	
	Files	
	About	
	Advanced >	Simulate
		Voltage
		Autopilot logging
Autopilot >	Installation >	Dockside drives >
		Dockside boat >
		Autopilot source >
		Compass calibration ... >
		Sea trial ...
	Steering >	"Profile 1" >
		"Profile 2" >
		"Profile 3" >
	Turn settings >	Course increment
		S-Turn settings >
Alerts >	Active alerts...	
	Alert history...	
Units >	Distance	
	Distance small	

Level 1	Level 2	Level 3
	Speed	
	Heading	
Network >	Sources >	Auto select
		Steering compass >
		Navigation >
		Position >
		Boat speed >
		Depth >
		Autopilot computer >
	Device list	
	Diagnostics	
	Network groups >	Display
		Units
		Damping
	Damping >	Heading
		Boat speed
		SOG
		COG

11

Technical specifications

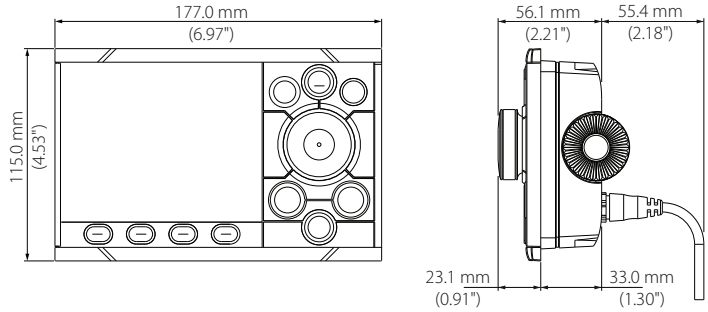
Approvals	Refer to " <i>Compliance statements</i> " on page 4
Dimensions	Refer to " <i>Dimensional drawings</i> " on page 69
Weight (without accessories)	0.51 kg (1.13 lbs)
Power	
Supply voltage	12 V (10.8V < supply voltage < 15.6V)
Supply connection	Micro-C (CAN)
Backlight OFF	1.62 W (0.12 A @ 13.5 V)
Backlight MAX	2.97 W (0.22 A @ 13.5 V)
Network load	5 LEN (244mA max)
Color	Black
Display	
Size	4.1" (diagonal). 4:3 Aspect ratio
Type	Transmissive TFT-LCD
Resolution	320 x 240 pixels
Viewing angles	80° top/bottom, 80° left/right
Brightness	> 600 nits
Color scheme	White for day mode. Red, green, blue, white or yellow for night mode
Multiple controller support	Yes
Compatible autopilot computers	AC70, SG05 Pro
Thruster interface	SD80, AD80
Mounting options	Dashboard, bracket
Software upgrade method	USB
Alarm sound pressure level	75 dB
Environmental protection	

Waterproof rating	IPx7
Humidity	100% RH
Temperature	
Operating	-25°C to +65°C (-13°F to +149 °F)
Storage	-40°C to +85°C (-40°F to +185 °F)

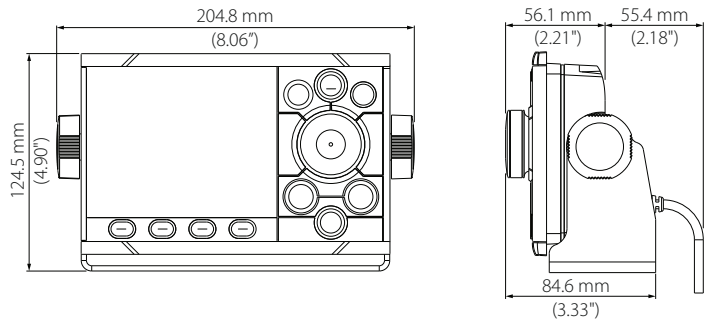
12

Dimensional drawings

A2004 without bracket



A2004 with bracket



13

Supported data

NMEA 2000 PGN (transmit)

59904	ISO Request
60928	ISO Address Claim
126208	ISO Command Group Function
126996	Product Info
127258	Magnetic Variation

NMEA 2000 PGN (receive)

59392	ISO Acknowledgement
59904	ISO Request
60928	ISO Address Claim
126208	ISO Command Group Function
126992	System Time
126996	Product Info
127237	Heading/Track Control
127245	Rudder
127250	Vessel Heading
127251	Rate of Turn
127257	Attitude
127258	Magnetic Variation
128259	Speed, Water referenced
128267	Water Depth
128275	Distance Log
129025	Position, Rapid Update
129026	COG & SOG, Rapid Update
129029	GNSS Position Data
129033	Time & Date

129283	Cross Track Error
129284	Navigation Data
129539	GNSS DOPs
129283	Cross Track Error
129284	Navigation Data
130074	Route and WP Service - WP List - WP Name & Position
130306	Wind Data
130576	Small Craft Status
130577	Direction Data

14

Appendixes

List of possible alarms and corrective actions

List of possible alarms and corrective actions

Autopilot alarms

Alarm/Warning	Possible cause	Recommended action
Active control unit missing	Autopilot computer has lost contact with active control unit.	<ul style="list-style-type: none">• Was active controller switched off/put to sleep?• Take command with a different controller/remote• Check/repair CAN bus cable• Replace the control unit
Autopilot computer missing	Active control unit has lost contact with autopilot computer.	<ul style="list-style-type: none">• Check the network diagnostics page on the display unit. Should show few or no errors• Check that the NMEA 2000 network is powered and terminated according to guidelines• Check that source selection is made and that the correct autopilot computer is selected• Check connectors and cables• Check status LED on autopilot computer. Should blink steadily, 1 sec intervals• Replace autopilot computer

Alarm/Warning	Possible cause	Recommended action
Boat speed missing	The speed signal from the GPS or the log is missing.	<ul style="list-style-type: none"> • Check device list for valid speed source • Try a new automatic source update • Check the GPS, log, and cable connections • If no speed source is available, manual speed can be entered in the "Auto" quick menu
CAN bus supply overload	Excessive current draw.	<ul style="list-style-type: none"> • Check summary unit loads • Check for short circuit/defective device on network
Check heading	Jump in heading of more than 10°/second.	<ul style="list-style-type: none"> • Check steering compass • Change to other heading source or monitor compass
Compass difference	The difference in readings between the main compass and the monitor compass exceeds the limit set for compass difference.	<ul style="list-style-type: none"> • Check the operation of both compasses • If one compass is magnetic, the error may be caused by deviation change or heavy sea disturbances
Course difference	Compass heading is deviating too much from the track course (BWW). May be caused by extreme wind and current, combined with low speed.	<ul style="list-style-type: none"> • Increase speed • Hand steer boat to align better with track and restart navigation mode
Cross track distance limit	XTD exceeds the set XTD limit in NAV mode. May be caused by extreme wind and current or too low boat speed.	<ul style="list-style-type: none"> • Manually control the vessel

Alarm/Warning	Possible cause	Recommended action
Drive inhibit	Motor or solenoid drive electronics critically overloaded.	<ul style="list-style-type: none"> • Check connectors and cables • Check that the rudder angle measurement and the actual physical rudder position corresponds • Try to hand steer the rudder and verify that the rudder can be moved freely
Drive not available	No drive response when requested from autopilot on Handshake port on SD80/AD80 board.	<ul style="list-style-type: none"> • Check that steering gear/thruster is set for autopilot control • Check cabling to Handshake port on SD80/AD80 • Make sure Handshake port on SD80/AD80 is configured for HS fixed/HS pulse
Drive overload	<p>Reversible motor: motor stalls or is overloaded.</p> <p>Solenoids: shortage to ground or cabling damage</p>	<ul style="list-style-type: none"> • Check for possible mechanical blocking of rudder • If heavy sea at high rudder angle, try to reduce boat speed or rudder angle by steering at another heading • Make sure there is no shortage to ground or cabling damage • Disconnect cable from autopilot computer to motor, and make sure there is no alarm when trying to run in NFU mode • Check that the drive unit is appropriately dimensioned for the boat and rudder size

Alarm/Warning	Possible cause	Recommended action
Drive reference voltage missing	Reference voltage to AD80 is missing.	<ul style="list-style-type: none"> • Check that the two U_CTRL dip switches on the AD80 board is set correctly (ref. cable connection label inside faulty unit) <ul style="list-style-type: none"> ◦ If drive control signal is 4-20 mA current or voltage using internal ± 10 V reference, switches must be set to INT. ◦ If external ref. voltage is connected switches must be set to EXT • If external reference voltage, check cabling and measure correct voltage between U_REF+ and U_REF- on AD80 board
Drive unit failure	The autopilot computer has lost communication with device.	<ul style="list-style-type: none"> • Check that green CPU led on the AC70 is alternating (ref. label inside unit cover for location of led) <ul style="list-style-type: none"> ◦ If off, check local power supply/fuse • For AD80/SD80, check CAN supply for 9-15 V between NET-S and NET-C of SimNet plug <ul style="list-style-type: none"> ◦ If LED is ok, check cabling, T-connector backbone etc ◦ If LED is on, try to restart unit by turning power off/on
End of route	Activated on the active control unit when an end route waypoint name has been received from the Plotter/ECS.	<ul style="list-style-type: none"> • Manually control the vessel • Select a new rout

Alarm/Warning	Possible cause	Recommended action
Engage output overload	Bypass valve or clutch is drawing excessive current.	<ul style="list-style-type: none"> • Ensure there is no shortage to ground or cabling damage • Disconnect cable from autopilot computer to motor, and make sure there is no alarm when engaging FU or AUTO mode
EVC Com error	Lost communication with EVC system (Volvo IPS and similar).	<ul style="list-style-type: none"> • Check connection with EVC engine interface. For IPS, engine must be running
Heading missing	No data from selected compass.	<ul style="list-style-type: none"> • Select a different compass source • Make a source update • Check cables and connections
High drive temperature	Drive electronic temperature exceeds the set limit.	<ul style="list-style-type: none"> • Switch off autopilot • Check for overload in drive unit/steering system • Check that the autopilot computer specifications matches drive unit
High internal temp	Internal temperature exceeds the set limit	<ul style="list-style-type: none"> • Switch off autopilot • Check for overload in drive unit/steering system • Check that the autopilot computer specifications matches drive unit
Low boat speed	Speed below set limit for acceptable course keeping (in Work profile).	<ul style="list-style-type: none"> • Switch to hand steering • Adjust Work profile settings • Increase speed to acceptable maneuvering speed

Alarm/Warning	Possible cause	Recommended action
Low CAN bus voltage	CAN bus voltage < 9 V.	<ul style="list-style-type: none"> • Check cable length, bus load and bus supply feeding point • If possible, check if fault disappears by disconnecting some units.
Low supply voltage	Supply voltage <10 V (12 V -15%).	<ul style="list-style-type: none"> • Check battery/charger condition • Verify mains cable has correct gauge
Nav data missing	Navigation data from Plotter/ECS missing.	<ul style="list-style-type: none"> • Check that route is activated on Plotter/MFD • Check device list for valid navigation source • Try a new automatic source update • Check cables and connections

Alarm/Warning	Possible cause	Recommended action
No rudder response	No response to rudder command.	<ul style="list-style-type: none"> • For SD80, check that port/stbd led is activated (ref label in cover for location) • Replace the autopilot computer drive board • Check connectors and cables • Check rudder feedback transmission link (not applicable for Virtual feedback installations) • Check the drive unit motor/brushes • Check for mechanical play in rudder • Check if the rudder is actually not moving • Check that the rudder drive unit is powered and running • Check for other mechanical issues between autopilot computer and rudder
Off heading	The vessel heading is outside set off heading limit. May be caused by extreme weather conditions, and/or too slow speed.	<ul style="list-style-type: none"> • Check steering parameters (Rudder, Autotrim, Seastate filter) • Increase response/rudder value • Increase boat speed, if possible, or steer by hand • Wait and see if autopilot is able to bring vessel back on course.
Override	EVC override via SG05 Pro, override via SD80/AD80 Handshake or override via SD80/AD80 RUD UI port.	<ul style="list-style-type: none"> • If unintended warning, make sure override handle is not being activated by loose objects • Check cabling and override switches connected to Handshake port of SD80 or AD80 board

Alarm/Warning	Possible cause	Recommended action
Position data missing	Position data from the GPS is missing.	<ul style="list-style-type: none"> • Check that the GPS antenna has a clear view of the sky • Check device list for valid position source • Try a new automatic source update • Check cables and connections • Check that the GPS antenna is not covered by ice, snow or any other objects weakening the signals from the satellites
Rudder data missing	Rudder angle signal to autopilot computer is missing.	<ul style="list-style-type: none"> • If several rudder angle sensors, check which port on the board that is set up for use • If the missing sensor is connected to an autopilot computer, check cabling • If missing sensor is a CAN device, check network connection • Check mounting is correct and that the center position of the feedback lines up with the center position of the rudder and that the rudder movement is within the operational range of the feedback • In the case of Frequency feedbacks, and long cable runs, external electromagnetic disturbance may affect the signal in rare and extreme cases
Rudder limit	The set rudder limit is reached or exceeded. Might be caused by disturbance to compass (waves), speed log, sharp turn or improper parameter setting.	<ul style="list-style-type: none"> • Notification only

Alarm/Warning	Possible cause	Recommended action
Thruster inhibited	<p>The vessel speed exceed the set limit for when the thruster can be used.</p> <p>The Thruster inhibit limit will only apply when speed source is Log or SOG, not if the speed is set.</p>	<ul style="list-style-type: none">• Notification only, reduce speed to reactivate thruster• Adjust Thruster inhibit limit settings



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