

**SIMRAD**

# AP70/AP80

Operator Manual

ENGLISH





# Preface

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## Disclaimer

As Navico is continuously improving this product, we retain the right to make changes to the product at any time which may not be reflected in this version of the manual. Please contact your nearest distributor if you require any further assistance.

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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This manual represents the product as at the time of printing. Navico Holding AS and its subsidiaries, branches and affiliates reserve the right to make changes to specifications without notice.

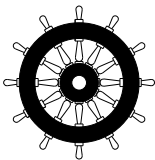
## Compliance

The AP70 and AP80 systems complies with the following regulations:

- Wheelmark directive 2002/84 EC (HCS and HSC)
  - CE (2004-108 EC EMC Directive) - AP70 systems when used with an AC70 computer
  - C - Tick
- **Note:** AP70 systems are not wheelmark approved when used with an AC70 computer.

For more information please refer to our websites:

[www.navico.com/commercial](http://www.navico.com/commercial) and [www.simrad-yachting.com](http://www.simrad-yachting.com).



## The Wheelmark

The AP70 and AP80 system are produced and tested in accordance with the European Marine Equipment Directive 96/98. This means that the systems comply with the highest level of tests for nonmilitary marine electronic navigation equipment existing today.

The Marine Equipment Directive 96/98/EC (MED), as amended by 98/95/EC for ships flying EU or EFTA flags, applies to all new ships, to existing ships not previously carrying such equipment, and to ships having their equipment replaced.

This means that all system components covered by annex A1 must be type-approved accordingly and must carry the Wheelmark, which is a symbol of conformity with the Marine Equipment Directive.

While the autopilot system may be installed on vessels not needing to comply with the Marine Equipment Directive, those requiring compliance must have one Control unit set-up as a "master unit" in order for the installation to be approved.

Navico has no responsibility for the incorrect installation or use of the autopilot, so it is essential for the person in charge of the installation to be familiar with the relevant requirements as well as with the contents of the manuals, which covers correct installation and use.

## Copyright

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## Warranty

The warranty card is supplied as a separate document.

In case of any queries, refer to the our websites:  
[www.navico.com/commercial](http://www.navico.com/commercial) and [www.simrad-yachting.com](http://www.simrad-yachting.com).

## About this manual

This manual is a reference guide for operating the Simrad AP70 and AP80 Autopilot Systems. The manual will be continuously updated to match new software releases. The latest available manual version can be downloaded from our web sites.

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.

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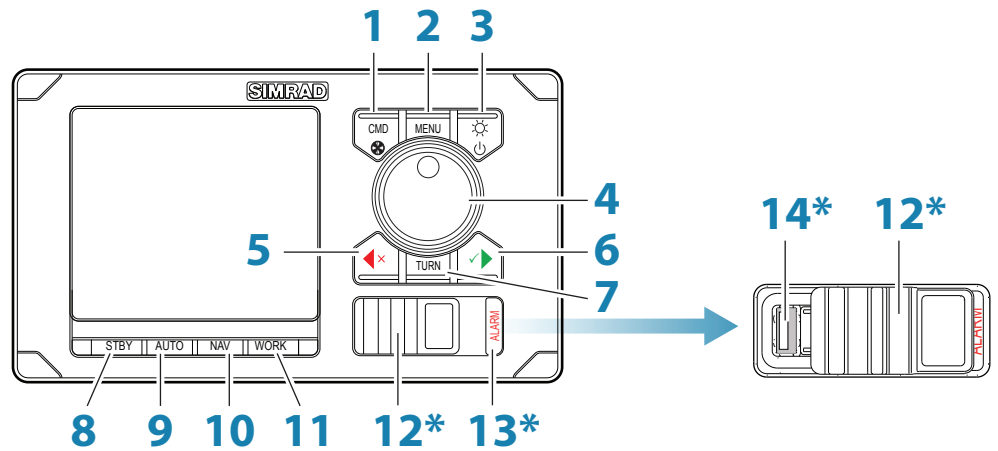
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# 1

## Introduction

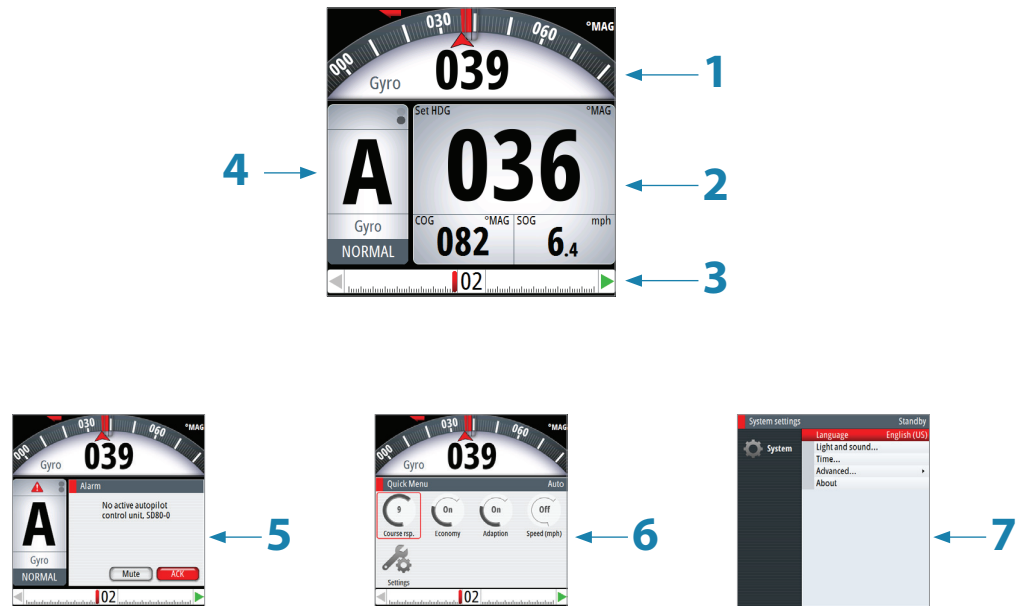
### The front panel and keys



→ \* Available on AP80 control units only.

No.	Key/Description	
1	<b>CMD/THRUSTER.</b> A short press takes/requests command. A long press (3 seconds) activates/deactivates available thrusters	
2	<b>MENU.</b> A short press displays the active steering mode's quick menu. A second click displays the Settings menu	
3	<b>POWER/LIGHT.</b> A short press displays the Light dialog. A long press (3 seconds) turns the unit ON/OFF	
4	<b>ROTARY KNOB (Course wheel).</b> Rotated for selecting menu item and adjusting value, pressed to confirm a selection/entry. For mode specific operation, refer to "The operational modes" on page 20.	
5	<b>PORT (Cancel).</b> Exits menu/returns to previous menu level. Activates <b>NFU</b> steering when in <b>Standby</b> mode. Changes set heading, set course and track offset to port.	
6	<b>STBD (Confirm).</b> Confirms menu selection/enters next menu level. Activates <b>NFU</b> when in <b>Standby</b> mode. Changes set heading, set course and track offset to starboard.	
7	<b>TURN.</b> Displays the Turn dialog	
8	<b>STBY.</b> Turns the autopilot to <b>Standby</b> mode	
9	<b>AUTO.</b> Activates <b>Auto</b> and <b>NoDrift</b> mode	
10	<b>NAV (AP70) / TRACK (AP80).</b> Activates <b>Nav</b> or <b>Track</b> steering mode	
11	<b>WORK.</b> Used for selecting work profile	
12	USB port door	AP80 control units only
13	<b>ALARM.</b> Displays the Alarm listing dialog	
14	USB connector	

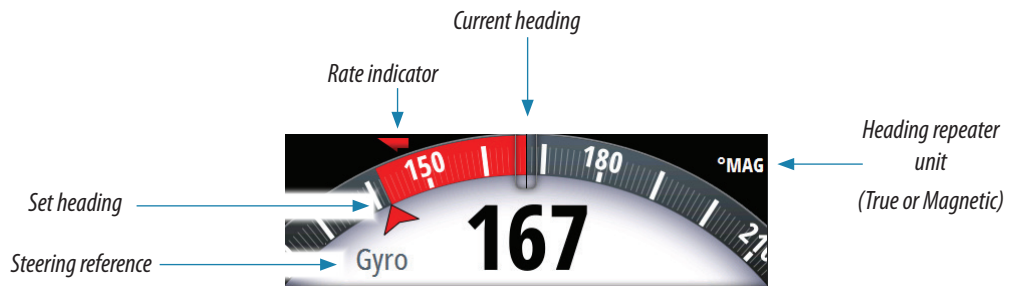
## The screen



### 1 Heading repeater

Analog and digital heading readout. Digital readout is shown with one decimal if true heading.

In automatic modes the difference between current and set heading is red for port, green for starboard deviation.

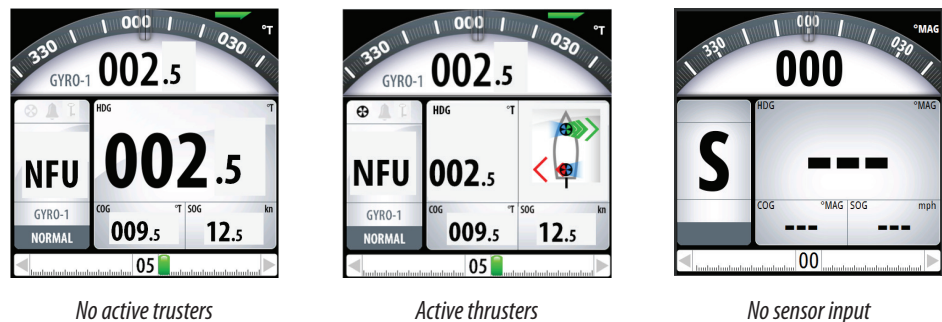


### 2 Mode Info panel

The panel contains mode specific content and varies with the operational mode. See “The operational 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.

If sensor input is missing, the numbers will be replaced with hyphens.



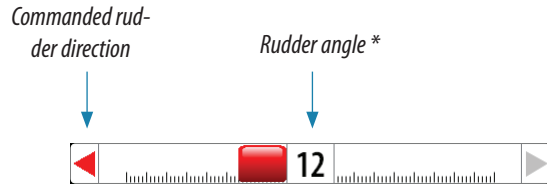


### 3 Rudder bar

Rudder position indicator with digital and analog readout.

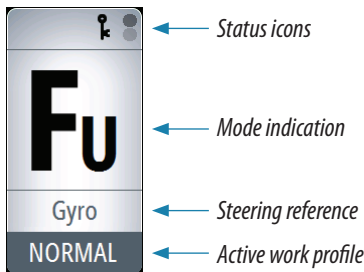
The digital readout shows 1 bar per 1° rudder angle up to 40°. Rudder angle above 40° will have a non-linear indication in the outer left/right part of the bar.

Direction indicators are turning red (port) and green (starboard) when rudder movement is commanded. The direction arrows are only shown when rudder feedback is available.



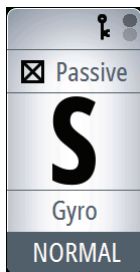
\* Showing commanded rudder angle in systems with analog steering without rudder feedback.

### 4 Status panel



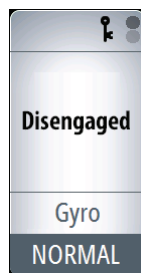
The following mode abbreviations are used:

- S:** Standby
- FU:** Follow Up
- NFU:** Non Follow Up
- A:** Auto heading
- ND:** No Drift
- N:** Nav

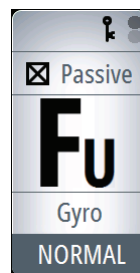


If the autopilot is operated from another unit, this is shown in the mode indication field.

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



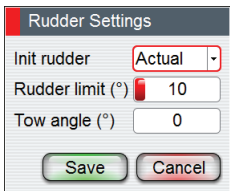
Autopilot disengaged by external system selector



Rudder controlled by external follow-up

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

Icon	Description
	Icon available if one or more thrusters are installed. The icon will be shaded when the thrusters are unavailable for steering
	Active alarm message. Red icon for alarms, yellow for warnings
	Control unit locked
	Screen alive indication - white and black "balls" fade-swap color

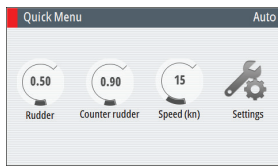


## 5 Dialogs

Used for user input or for presenting information to the user.

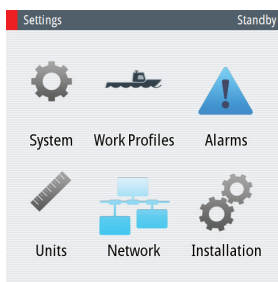
A dialog may be presented in full-screen or as an overlay. Depending on type of information or entry, different keys are used to confirm, cancel and close the dialog.

A dialog can always be closed by selecting the Close/Cancel dialog key, or by pressing the **PORT** key.



## 6 Quick menus

Mode dependant menu, displayed by pressing the **MENU** key. The Quick menu contain the most common used settings for the active mode. The menu varies with the autopilot mode and also with the way the autopilot is operated.



## 7 Settings menus

Used for installation and system setup. The menus are activated from the quick menu, or by pressing the **MENU** key twice.

## Operational mode overview

The autopilot has several steering modes. Number of modes and features within the mode depend on available input as shown below.

The modes are described in "The operational modes" on page 20.

MODE	FEATURE	DESCRIPTION
<b>STBY</b>		Standby mode used when manually steering at the helm. Compass and rudder angle will be shown on the display
<b>NFU</b>		Non-Follow-Up steering where the rudder movement is controlled by using the red (port) or green (starboard) keys, or by another NFU unit
<b>FU</b>		Follow-up steering where the rudder angle is set by the rotary knob or by another FU unit
<b>AUTO</b>		Auto compass mode. Keeps the vessel on set heading
	Heading capture	Aborts the turn and uses the instantaneous compass reading as set heading
	Turn (Pattern)	Moves the vessel automatically in pre-defined turn steering patterns
<b>NoDrift</b>		Automatic steering, keeping the vessel on a straight bearing line by compensating for drift
	Heading capture	Aborts the turn and uses the instantaneous compass reading as set heading
<b>NAV</b>		Navigation steering. The vessel is steered to a specific waypoint location, or through a route set on a chart plotter
<b>TRACK</b>		Track steering. Approved for AP80 only and requires an unlock key/code. The routes are planned on and commanded by an ECDIS (Electronic Chart Display Information System)

# 2

## Basic operation

### Safe operation with the autopilot

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

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 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 magnetic or fluxgate compass used in the autopilot system
- Verify the course and position of the vessel at regular intervals
- Always switch to **Standby** mode, and reduce speed in sufficient time to avoid hazardous situations

### Using an external system selector to control autopilot operation

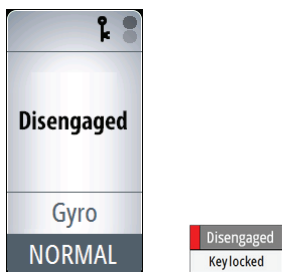
IMO resolution MSC64 and other regulations require that an external switch is used for changing over from manual to automatic steering.

#### 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 menu can however be used, alarms acknowledged and illumination adjusted.

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

When a mode key is pressed, a dialog will show that the autopilot system is disengaged.



#### 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.

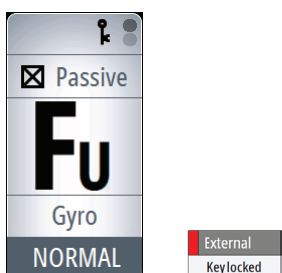
### External follow-up override

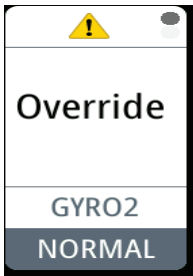
On some autopilot computers you can connect a switch for allowing an external follow-up to override autopilot control of the rudder. Refer the autopilot installation manual for connection details.

When external follow-up override is selected, it is not possible to use any mode keys. The menu can however be used, alarms acknowledged and illumination adjusted.

When the rudder is controlled by an external FU, this will be indicated in the mode display.

If you press a mode key, external control is indicated in the display.





## 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 regained by pressing the **AUTO** or the **WORK** key.

## Pendulum feature

The pendulum feature is intended for pendulum ferries where it is required to turn the heading 180° when the vessel is going «backwards».

The feature can be included in AP70/80 systems equipped with SD80 or AD80 boards. It can only be used for NMEA 0183 heading sensors, RC42 and CDI80.

The function is activated by using an external switch. When the contact is closed the system will add 180° to the heading received on the NMEA 0183 interface on SI80 and AC70. The heading is changed before heading data enters the CAN bus network, and all instruments on the bus will pick up the modified heading.

→ **Note:** The AP70/80 must be configured for the pendulum feature as described in “Configuration” on page 60.

## Turning the autopilot system on/off

You turn ON the autopilot system on by a short press on the **POWER** key when this is red light colored.

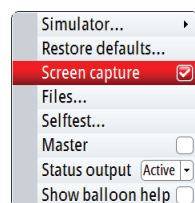
The system is turned OFF (Sleep mode) by pressing and holding the **POWER** key on an active control unit. During the shut-down procedure the system will automatically go to **Standby** mode before it is turned off. If the **POWER** key is released before shut-down is completed, the power off is cancelled.

→ **Note:** The **POWER** key will remain lit on units that are turned OFF. Note: To stop the system from drawing current a separate breaker should be installed.

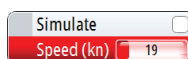
## The menus

You display a menu by pressing the **MENU** key.

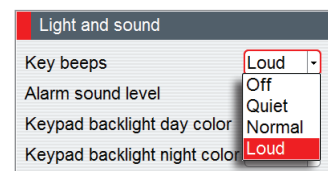
- Use the rotary knob to select a menu item, then press the rotary knob or the **STBD** key to confirm your selection
- Toggle on/off a check box by pressing the rotary knob or the **STBD** key
- Activate a slide bar by pressing the rotary knob or the **STBD** key, then select the value by turning the rotary knob. Confirm your selection by pressing the rotary knob or the **STBD** key
- Expand a Drop-down listing by pressing the rotary knob or the **STBD** key, then select the item by turning the rotary knob. Confirm your selection by pressing the rotary knob or the **STBD** key
- Press the **PORT** key to return to previous menu level. Repeat pressing the **PORT** key to exit the menus.



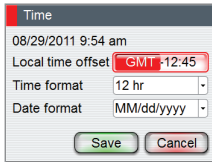
Check box



Slide bar



Drop-down listing



## Dialog boxes

You select entry fields and keys in a dialog box by using the rotary knob. You can only enter information when a field is selected and highlighted.

You exit a dialog and cancel your entries by selecting the Cancel key in the dialog, or by pressing the **PORT** key.

You confirm your entries and close the dialog by selecting the OK key in the dialog, or by pressing the **STBD** key.

An alphanumeric keyboard will automatically be displayed when required for entering user information in dialogs.

1. Select characters by turning the rotary knob
2. Confirm your entry by pressing the rotary knob
3. Complete your entry by pressing the Enter key on the virtual keyboard

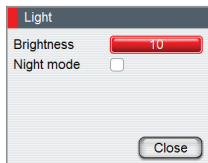


## Display illumination

### Light adjustment

A single press on the **POWER** key will display the light adjustment dialog. The brightness level is adjusted by the rotary knob.

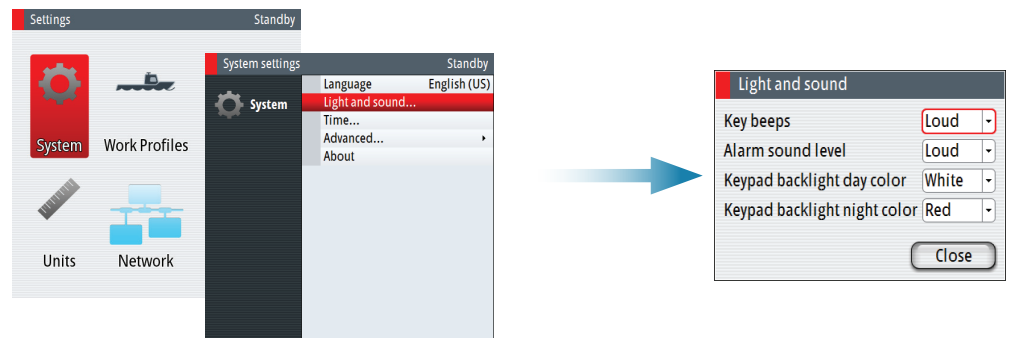
Repeated presses on the **POWER** key will toggle between preset brightness levels (10 - 6 - 3 - 1).



### Day/Night illumination

A night illumination option is included. This optimizes the color palette for low light conditions. You switch between Day and Night illumination mode from the Light dialog.

White is the default background color on display and keys for Day illumination, while red is used for Night. You can select which of these colors you want to use.



→ **Note:** The brightness level are adjusted independently for day and night illumination.

## Taking command

You can take command from any control unit and/or remote by pressing the **CMD** key.

In an open system (no command transfer restrictions) you will get immediate control from the control unit requesting command. A steering handle without a **CMD** key will get control when the lever is operated.

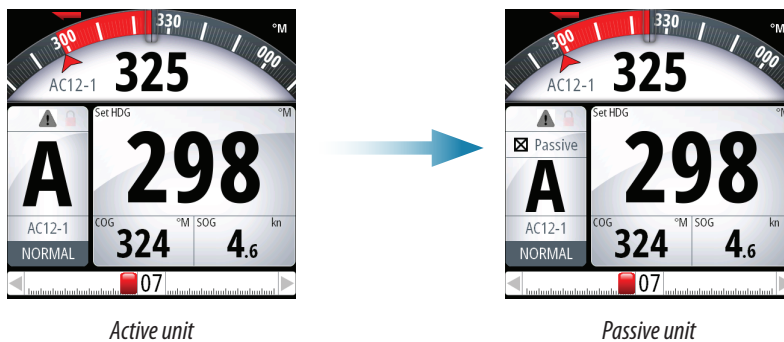
In a multi-station system with active lock function, the command request must be confirmed on the active control unit.

### Active/Passive units

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 in the mode status field with passive icon, and the mode indication letter size is reduced.

See "Delegation of control in multiple station systems" on page 16 for further information



On a passive/locked unit illumination can be adjusted, alarm sound can be locally silenced, and the **CMD** key can be used for requesting command. All other functions are unavailable.

## Selecting autopilot modes

You switch between **Standby** mode, **Auto** modes and **Nav** steering by pressing the corresponding mode key.

When in **Standby** mode you can select **NFU** (Non Follow Up) by pressing the **PORT** or **STBD** keys. Rudder will move and active trusters rotate as long as the key is pressed.

When in **Standby** or **NFU** mode you can select **FU** by pressing the rotary knob. The rudder angle is then set by turning the rotary knob.

## Switching from automatic mode to hand steering

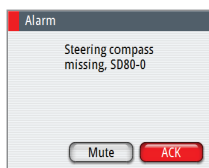
You can switch the autopilot to **Standby** mode from any operational mode by a short press on the **STBY** key.

## Selecting work profiles

The autopilot can be set up with 6 different work profiles associated with different work modes or various crew members preferences.

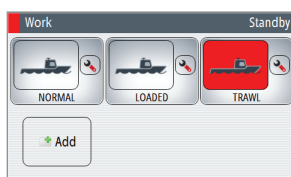
1. Press the **WORK** key to open the Work dialog
2. Repeat pressing the **WORK** key or use the rotary knob to select preferred profile
3. Press the rotary knob or the **STBY** key to confirm your selection

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



## Alarm

When an alarm occurs, active, show



## Alarm message

When an alarm occurs, the alarm icon will be shown and the alarm message will be displayed.



## Alarm message

When an alarm occurs, the alarm icon will be shown and the alarm message dialog will be displayed.

The following options are available in the alarm dialog for acknowledging a message:

Option	Result
ACK	Sets the alarm state to acknowledged, meaning that you are aware of the alarm condition. The siren will stop and the alarm dialog will be removed. The alarm icon will however remain active, and the alarm will be included in the alarm listing until the reason for the alarm has been removed
Mute	Mutes the siren locally for all units in the same SimNet display group. The alarm dialog remains on the display



## Working with thrusters

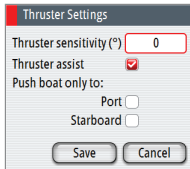
If the vessel is equipped with thrusters, they can be connected to the autopilot system. The

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

### 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. Refer to the separate autopilot Installation manual.
- 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 gets below the inhibited limit
  - OFF: you must manually turn thrusters ON



For more information see “Work profile setup” on page 33.

### Activating and de-activating thrusters

You can manually toggle thrusters on/off by pressing and holding the **CMD** key. A popup with slide bar will be displayed as long as the key is pressed. The slider moves from hiding to showing (or opposite) the thruster symbols.



*Thruster(s) ON*



*Slider moving*



*Thruster(s) OFF*

### Thruster presentation

When thrusters are installed, the thruster status icon and the thruster information in the mode info panel are as shown below.

	<ul style="list-style-type: none"> <li>• Thrusters installed and in use</li> </ul>
	<ul style="list-style-type: none"> <li>• Thruster(s) installed, but not configured for present work profile</li> <li>• Thruster(s) installed, but unavailable (vessel speed is above inhibit limit)</li> </ul>
	<ul style="list-style-type: none"> <li>• Thruster(s) available, but turned OFF</li> </ul>

# 3

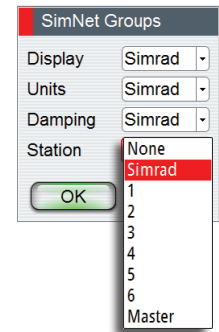
## Delegation of control in multiple station systems

### Steering stations

An autopilot system with multiple stations can be set up with different steering stations (SimNet group settings - Station). This setting is done during installation of the system, and the separate autopilot Installation manual details how to define SimNet groups.

The SimNet group Station settings determines lock/unlock and command transfer principle between active and passive control units. Based on this setting the system is defined as an open system or a master system as described in the following sections.

On a locked unit you can only adjust illumination and silence an alarm locally. All other functions are unavailable.



### Open systems

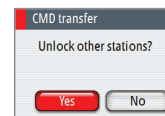
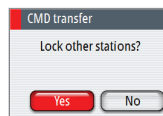
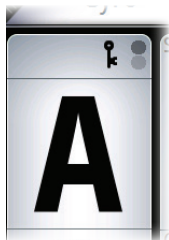
In a default installation the system is open, and control is accessible from every control unit connected to the autopilot system. One control unit is active and provides the user with access to all functions. All remaining control units are inactive and have no effect on course changes. A single press on the **CMD** key on an inactive control unit will allow transfer of command and make the unit active. On steering levers without a command key (e.g. JS10, S35, S9), command is taken by moving the lever.

### Locking and unlocking units in an open system

You can temporarily lock units in an open system if you want to avoid accidental control from another control unit

An active AP70/AP80 control unit can lock and unlock all passive control units.

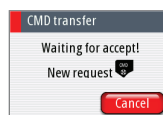
1. Activate the lock function from any active control unit by a single press on the **CMD** key
2. De-activate the function with a second press on the **CMD** key



Active locking function is indicated with a lock symbol on both active and passive units.

### Taking command from a locked unit in an Open system

1. Press the **CMD** key on the locked unit
  - A dialog will be shown on the unit requesting command
  - A command request dialog will be shown on the active unit, accompanied by a 2 second sound



Passive unit requesting command



Active unit accepting command request



2. Accept the command request on the active unit
  - All passive units will be opened for command transfer, indicated as below
  - The lock function will be de-activated, and the lock symbol removed from all units



Passive units

3. Take command on selected remote unit

## Master systems

The international standard for heading control systems (ISO 11674/16329) requires controlled command transfer when remote stations are provided. The delegation of control to the remote station and the return of control shall be incorporated in the autopilot system, and shall avoid unintended operation from a remote station.

To fulfill this requirement the AP70/AP80 system includes a Master function. This is used in Wheelmarked systems where you permanently want to control command transfer to remote stations.

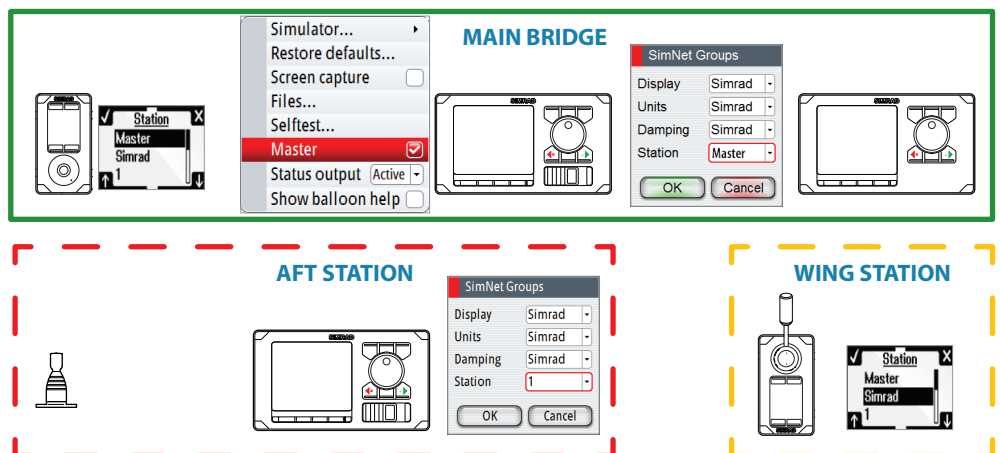
In a Master system, one steering station is defined as the Master station. There can be several control units in a master station, but only one of them can be set as the Master unit.

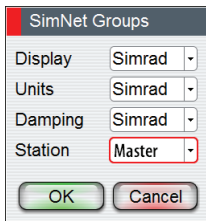
All units included in the master station will be unlocked, and command transfer within the master group will be as in an open system.

Units not included in the master station will be locked. It is not possible to take command from units outside the master station unless the master control unit opens for this. All units outside the master station will have a lock symbol.

In the illustration below the main bridge is defined as master station. One QS80, one AP80 control unit and one AP70 control unit are included in the master station. The AP80 control unit is defined as the Master unit.

The illustration includes SimNet group settings for each unit, showing how the units are defined as part of different SimNet stations.

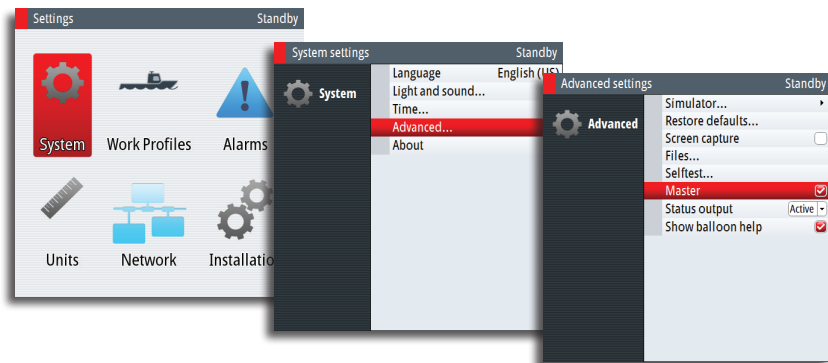




## Defining a Master system

A master station is usually defined and units assigned to the master station during system setup. Refer to the separate autopilot installation manual for details.

- **Note:** When a SimNet group Station is set to Master, one control unit in this steering station has to be defined as the Master unit as shown below.

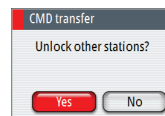


In a Master system command can be transferred to a remote unit either by opening the system for remote operation from the Master unit, or by requesting command from one of the remote units.

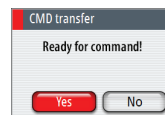
- **Note:** You can at any time return to control from the master station by pressing the **CMD** key on one of the units in the master station.

## Opening a Master system for operation from a remote unit

1. Press the **CMD** key on the Master unit



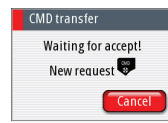
2. Accept the command request on the Master unit
  - The system will now be open and command can be taken from any station



3. Take command on selected remote by pressing the **CMD** key
  - Command will be transferred to this remote, accompanied by a 2 second sound
  - All other remote units will return to locked transfer status

## Taking command from a locked unit in a Master system

1. Press the **CMD** key on a locked station
  - A dialog will be shown on the unit requesting command
  - A command request dialog will be shown on the master unit

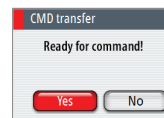


*Passive unit requesting command*



*Active unit accepting command request*

2. Accept the command request on the master unit
  - The requesting remote will now be opened for command transfer. All other units will remain locked



3. Take command on requesting remote by pressing the **CMD** key
  - Command will be transferred to this remote, accompanied by a 2 second sound

# 4

## The operational modes

### Mode overview

The autopilot has several steering modes. Number of modes and features within the mode depend on available input as shown below.

MODE	FEATURE	DESCRIPTION	REQUIRED INPUT
<b>STBY</b>		Standby mode used when manually steering at the helm. Compass and rudder angle will be shown on the display	
<b>NFU</b>		Non-Follow-Up steering where the rudder movement is controlled by using the red (port) or green (starboard) keys, or by another NFU unit	Rudder feedback
<b>FU</b>		Follow-up steering where the rudder angle is set by the rotary knob or by another FU unit	Rudder feedback
<b>AUTO</b>		Auto compass mode. Keeps the vessel on set heading	Heading
	Heading capture	Aborts the turn and uses the instantaneous compass reading as set heading	
	Turn (Pattern)	Moves the vessel automatically in pre-defined turn steering patterns	
<b>NoDrift</b>		Automatic steering, keeping the vessel on a straight bearing line by compensating for drift	Heading, speed, position
	Heading capture	Aborts the turn and uses the instantaneous compass reading as set heading	
<b>NAV</b>		Navigation steering. The vessel is steered to a specific waypoint location, or through a route set on a chart plotter	Heading, speed, Cross Track Distance (XTD) and Bearing waypoint to waypoint (BWW)
<b>TRACK</b>		Track steering. Approved for AP80 only and requires an unlock key/code. The routes are planned on and commanded by an ECDIS (Electronic Chart Display Information System)	Heading (True), Speed and Track control data via proprietary TNT sentence.



See "Using an external system selector to control autopilot operation" on page 11 for further information

### External system selector

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

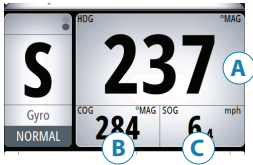
The mode descriptions in the following pages assumes that an external system selector has opened for autopilot operation, or that no external selector is installed.

## Hand steering

### Standby mode

**Standby** mode is used when you steer at the helm. The autopilot will always be in this mode when you turn the system on.

- Switch the autopilot to **Standby** mode from any operation by a short press on the **STBY** key.



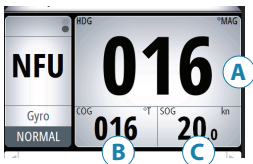
#### The Standby mode info panel

- A.** HDG: Current heading and Header repeater unit (True or Magnetic)
- B.** COG: Course over ground
- C.** SOG: Speed over ground
  - If SOG is missing, the speed info will be taken from log (STW). If also log is missing or erratic, speed can be set manually from the Quick menu (MAN).

### Non-Follow-Up (NFU) steering

In **NFU** mode you use the **PORT/STBD** keys to control the rudder.

- Select **NFU** mode by pressing the **PORT** or **STBD** keys when the autopilot is in **Standby** or **FU** mode
  - The the rudder will move as long as the key is pressed



#### The NFU mode info panel

- A.** HDG: Current heading and Header repeater unit (True or Magnetic)
- B.** COG: Course over ground
- C.** SOG: Speed over ground
  - If SOG is missing, the speed info will be taken from log (STW). If also log is missing or erratic, speed can be set manually from the Quick menu (MAN).

### Follow-up (FU) steering

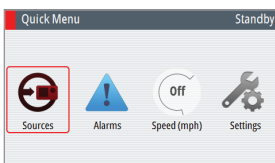
In **FU** mode you use the rotary knob to set rudder angle.

- Select **FU** mode by pressing the rotary knob when the system is in **Standby** or **NFU** mode
- Turn the rotary knob to set the rudder angle
  - The rudder will move to the commanded angle and then stop

#### FU mode info panel



- A.** Set rudder angle
- B.** COG: Course over ground
- C.** SOG: Speed over ground
  - If SOG is missing, the speed info will be taken from log (STW). If also log is missing or erratic, speed can be set manually from the Quick menu (MAN).

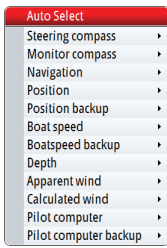


### Quick menu in STBY, FU and NFU mode

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

The Quick menu includes access to the Settings dialogs.

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



### Source selection

Gives access to automatic and manual source selection menus.

Source setup is done on initial start up of the system. It is also required to run the source selection if any part of the network has been changed or replaced.

See the separate AP70/AP80 Installation manual for more details.

#### Automatic source selection

The Auto Select option will look for all sources connected to the network. If more than one source is available for each data type, the system will automatically select from an internal priority list.

Make sure all devices are connected and are turned on before selecting the Auto Select option.

#### Manual source selection

This option allows you to manually select sources. This is generally only required where there is more than one source for the same data, and where the internal priority is not giving the preferred selection.

### Alarm status

Displays a list of current alarms.

For alarm setting and history, refer to "The Alarm dialog" on page 41.

### Speed adjustment

Used to manually set the vessel speed if a speed log or other speed source is not connected.

### Settings

Settings dialogs are described in "The settings dialog and submenus" on page 51, and in the separate AP70/AP80 Installation manual.

## AUTO modes

AP70/AP80 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



- Toggle between auto modes by repeated presses on the **AUTO** key
  - The selection times out and triggers the mode shift. You can also confirm your selection by pressing the STBD key or the rotary knob.

### AUTO

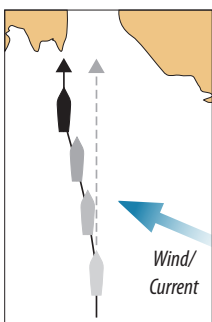
In **AUTO** mode the autopilot issues rudder commands required to steer the vessel automatically on a set heading.

1. Steer the vessel onto the desired heading
2. Press the **AUTO** key to activate **AUTO** mode
  - The autopilot selects the current vessel heading as the set heading. The autopilot will keep the vessel on this heading until a new mode is selected or a new heading is set.

→ **Note:** It is only possible to select **AUTO** mode if valid heading is available.

#### The AUTO mode info panel

- A. Set HDG: Set heading and Header repeater unit (True or Magnetic)
- B. COG: Course over ground
- C. SOG: Speed over ground
  - If SOG is missing, the speed info will be taken from log (STW). If also log is missing or erratic, speed can be set manually from the Quick menu (MAN).



### Immediate heading change

Set heading is adjusted by turning the rotary knob (press and rotate simultaneously if the Turn Preset function is activated), or by pressing the **PORT** or **STBD** keys.

An immediate heading change will take place, also if the heading change is more than 180°. The new heading will be maintained until a new heading is set.

### Temporary course 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. The autopilot will go to **AUTO** mode with current heading as set heading.



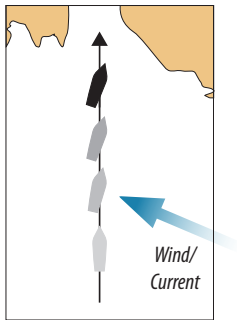
### NoDrift

This mode the vessel is steered along a fictive track line, from present position to infinity in a direction set by the user. If the vessel is drifting away from the original course line due to current and/or wind, the vessel will follow the line with a crab angle.

1. Steer the vessel onto the desired course
2. Press the **AUTO** key to activate **NoDrift** mode
  - The autopilot will draw an invisible track line based on current heading from the vessel's position

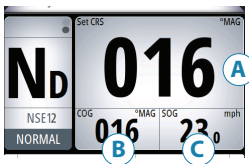
The autopilot will now use the position information to calculate the cross track distance, and automatically keep your track straight.

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



### The NoDrift mode info panel

- A. Set CRS: Set course and Header repeater unit (True or Magnetic)
- B. COG: Course over ground
- C. SOG: Speed over ground
  - If SOG is missing, the speed info will be taken from log (STW). Speed can also be set manually from the Quick menu (MAN)



### Changing set course

Set course is adjusted by using the rotary knob or the **PORT/STBY** keys.

- Turn the rotary knob (press and turn simultaneously if the Turn Preset function is activated)
  - The course is changed with 1° for each step made by the knob
- Press the **PORT** or **STBD** key
  - The course increment is set by the user, and can be 10, 5, 1 or 0.1° (default is 1°). See "Setting the heading and course change increments" on page 24

An immediate course change will take place, also if the course change is more than 180°. The new course will be maintained until a new course is set.

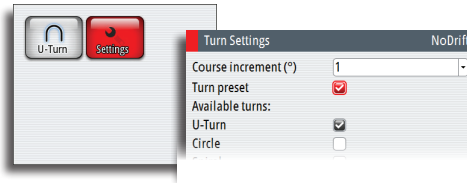
### The Turn preset feature

The system includes a turn preset feature for **AUTO** and **NoDrift** mode. This allows for setting the new heading/course, turn radius and turn type before the turn starts. The function gives a more precise starting point for the turn, and it also avoids unintended heading/course changes when accidentally turning the rotary knob.

→ **Note:** The **PORT** and **STBY** keys will always give immediate action, also when turn preset function is active.

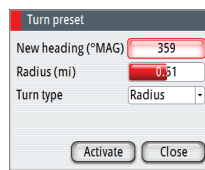
### Activating the turn preset function

1. Press the **TURN** key
2. Tick on the Turn preset option in the Turn Settings dialog

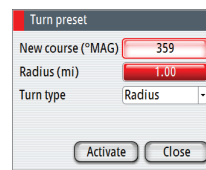


### Using turn preset

1. Select **AUTO** or **NoDrift** mode
2. Turn the rotary knob to display the Turn preset dialog
3. Set new heading/course, radius and turn type as required in the dialog

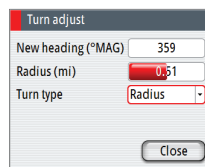


*AUTO mode*

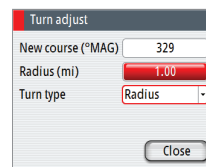


*NoDrift mode*

4. When the vessel reaches the selected turn point, initiate the turn by selecting the Activate key
  - The pre-set heading/course will immediately be shown in the course display
  - The dialog will change to show turn adjust options. If settings are adjusted the changes will take effect immediately



*AUTO mode*



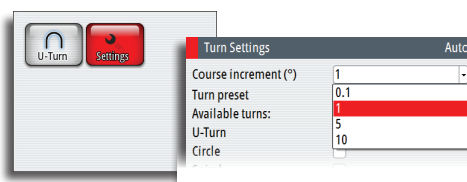
*NoDrift mode*

You can close the Turn adjust dialog at any time without disturbing the pre-setting or execution of a turn. If closed, the Turn adjust dialog is recalled by turning the rotary knob.

### Setting the heading and course change increments

By default the set heading (**AUTO**) and set course (**NoDrift**) will change 1° each time you press the **PORT/STBY** keys. You can change this increment setting if required.

1. Press the **TURN** key
2. Select one of the preset course increment values in the Turn Settings dialog



➔ **Note:** If 0.1 is selected, the set heading/course will be displayed with one decimal in the mode info panel.



## Heading capture

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

## Turn pattern steering

The autopilot includes automatic U-turn steering feature in **AUTO** and **NoDrift** modes, and S-turn steering feature in **AUTO** mode.

## U-turns

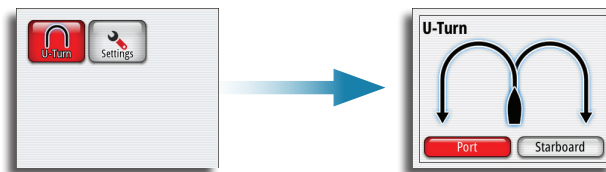
The U-Turn changes the current set course to be 180° in the opposite direction.

The turn rate is identical to default rate of turn (ROT) setting. This cannot be changed during the turn.

After starting a U turn the dialog will be removed from the display.

### Initiating a U-turn

1. Press the **TURN** key to display turn options
2. Select the U-Turn icon
3. Select the port or starboard turn direction in the turn dialog



### Stopping the U-turn

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

## S-turns

When activating the S-Turn pattern the boat will yaw around the main course.

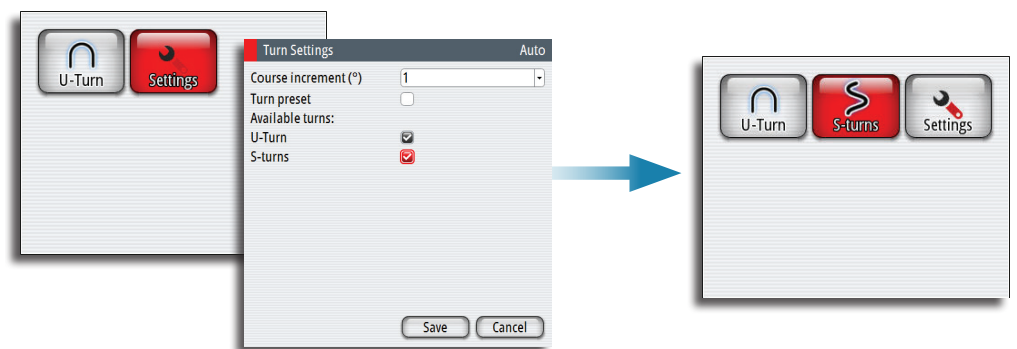
You set the selected course change before the turn is started. During the turn you can alter the course change and the turn radius.

The main course can be changed by turning the rotary knob.

→ **Note:** The S-turns are only available in **AUTO** mode.

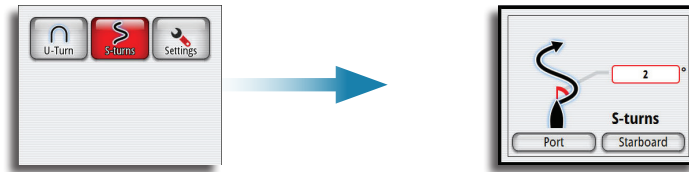
### Activating the S-turn option

Before the S-turns mode can be applied it must be enabled in the turn settings thus making it available in the turn settings dialog.



## Initiating S-turns

1. Press the **TURN** key to display turn options
2. Select the S-turns icon
3. Select the port or starboard turn direction in the turn dialog



## Stopping S-turns

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

## Navigating mode

**Warning:** Navigational steering should only be used in open waters.

The AP70 and AP80 can use steering information from an external navigator to direct the vessel to one specific waypoint location, or through a series of waypoints.

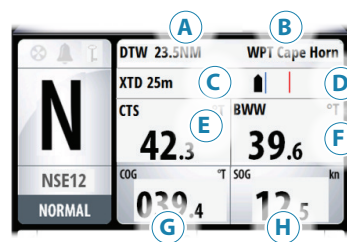
In **NAV** mode the autopilot will steer straight legs along a route set on chart plotter

- **Note:** It is not possible to select **NAV** mode if heading information is missing, or if steering or speed information is not received from the external navigator.

When in a **NAV** mode, the autopilot uses the heading sensor as its heading source for course keeping. The steering and speed 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 chart system. Autosteering must be tested and determined satisfactory prior to entering the navigation mode.

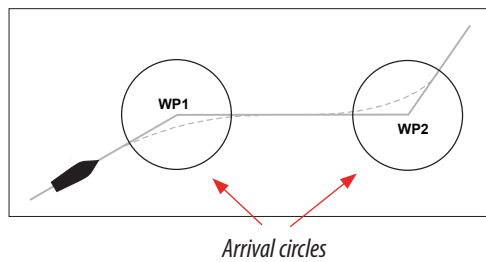
## The NAV mode info panel



- A. DTW: Distance to next waypoint
- B. WPT: Waypoint name
- C. XTD: Cross Track Distance
- D. Vessel position relative to leg line
- E. CTS: Course to steer (set heading calculated by the autopilot)
- F. BWW: Bearing to next waypoint
- G. COG: Course over ground
- H. SOG: Speed over ground
  - If SOG is missing, the speed info will be taken from log (STW). Speed can also be set manually from the Quick menu (MAN)

## The waypoint arrival circle

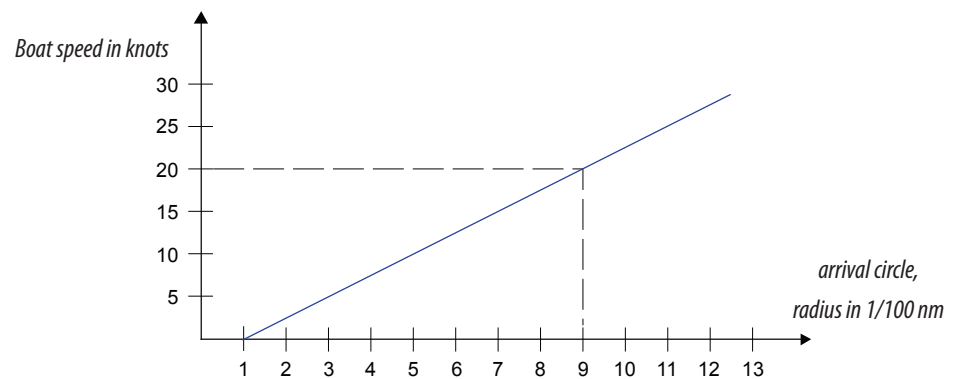
The arrival circle defines the point at which a turn is initiated when you are navigating a route.



The arrival circle 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 arrival circle is set in your chart system.

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

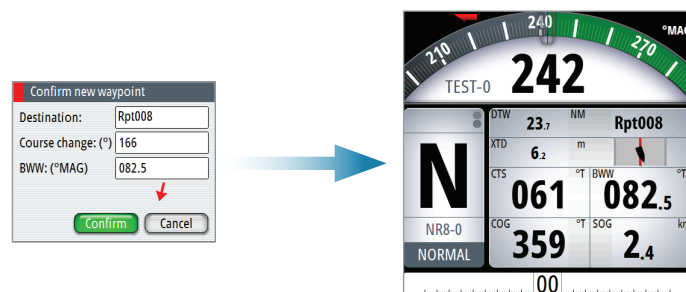


Example: With the speed of 20 knots you should use a waypoint circle with radius 0.09 nm.

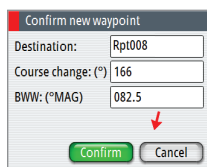
→ **Note:** The distance between any waypoints in a route must not be smaller than the radius of the waypoint arrival circle when using automatic waypoint shift.

## Start navigating

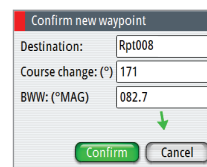
1. Start navigating a route on your chart system
2. Press the **NAV** (AP70) or **TRACK** key (AP80) on the autopilot
3. Accept the waypoint as the location to steer towards to activate the navigational mode
  - If the waypoint is not accepted within 8 seconds, the dialog will be removed and the autopilot will remain in active mode



Red or green arrow symbol in the dialog indicates required course change direction.



Course change to port



Course change to starboard

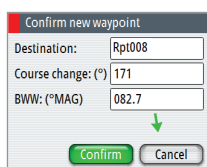
### Turning in NAV mode

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

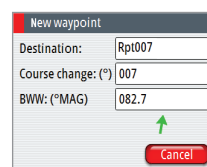
The turn radius used is defined in the turn parameters for the work profile in use. Refer "Turn settings" on page 34.

If the required course change to next waypoint in a route is more than the set limit, you are prompted to verify that the upcoming course change is acceptable. See "Course change limit (Not applicable for ECDIS Track steering)" on page 35.

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 **PORT/CANCEL** key.



New waypoint - accept required



New waypoint - information only

### Track offset

The track offset options allows for steering parallel to the track in **NAV** mode.

You activate the track offset option by pressing and holding the rotary knob on the AP70/80. The display will change to show current distance from track (XTD) and set offset (OFF).

Turn the rotary knob to adjust the offset distance. The red line shows the offset in relation to the track.

The system will remain in track offset mode as long as there is an offset value. It will time out when the offset distance is set to 0 (zero).



→ **Note:** Track offset is not available in **Track** mode.

### Track steering

With AP70/80 software release 1.2 the AP80 system and a Simrad CS68 ECDIS forms a fully type approved Track steering system according to IEC62065 ed.1.

The routes are planned on and commanded by an ECDIS (Electronic Chart Display Information System). When the system is installed and configured as described in this section, you can start a route on the ECDIS and make the AP80 automatically keep the vessel on this route.

The Track feature is only available after unlocking it using a key obtained from Navico. The unlock mechanism resides in the autopilot computer board. Only after enabling this feature, the autopilot system can form part of a certified track control system.

Refer to the Type approval certificate on the product web site for details: [www.navico.com/commercial](http://www.navico.com/commercial).

The following requirements and limitations apply:

- The autopilot system must comprise of at least one AP80, and at least one of the following autopilot computers: AC80A, AC80S or AC85
- The ECDIS system must be connected to the AP80 system via an SI80
- A valid unlock key must be obtained from Navico
- In a system with multiple autopilot computer boards where track feature shall be redundant, each autopilot computer board needs a separate unlock key

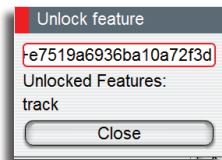
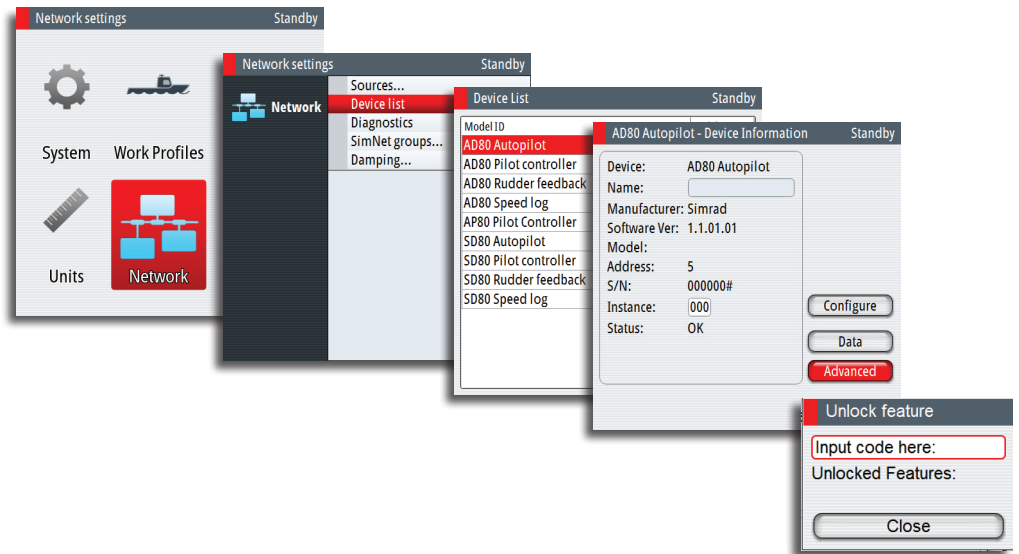
The Track feature will remain unlocked after restarting the system and after later software upgrades.

→ **Note:** A factory reset of the autopilot computer will delete the unlock key and it must be re-entered.

### Unlocking the Track steering feature

A unlock key must be obtained from Navico to unlock the Track steering feature. Contact a Simrad Sales office for further information.

1. Navigate to the **Device list** dialog, and select the autopilot computer where you want to install the feature
2. Press the Rotary knob or the Right arrow key to bring up the computer's information dialog
3. Select **Add feature** to display the **Unlock feature** dialog
4. Select the input field, and press the Rotary knob or the Right arrow key to bring up the on-screen keyboard
5. Enter the entire unlock key as received from Navico. The string is case sensitive, but the dashes (" - ") can be omitted

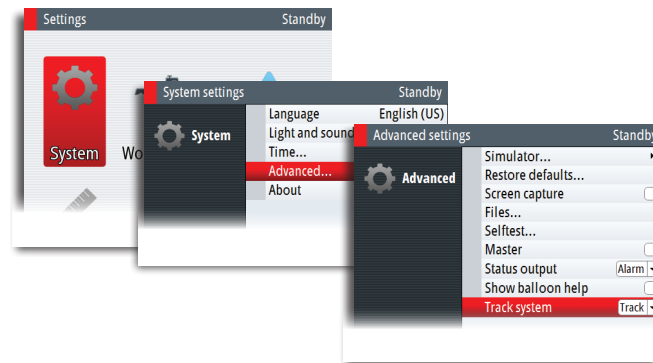


6. Select **Enter** in the onscreen keyboard to confirm your entry and to remove the keyboard
  - The **Unlock feature** dialog will confirm that the feature is unlocked
7. Select **Close** or press the Left arrow key to close the dialog

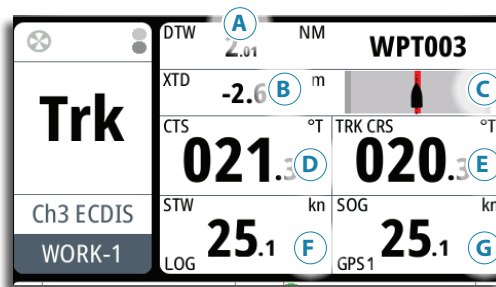
After unlocking the Track steering feature it will continue to be available after restarting the system and after later software upgrades. However, a factory reset of the autopilot computer will delete the unlock key and it must be re-entered.

## Enable the Track steering feature

After the Track feature is unlocked, it must be enabled by setting the **Track system** option to **Track** as shown below:



## Track steering mode info panel



- A. DTW: Distance to next waypoint
- B. XTD: Cross Track Distance
- C. Vessel position relative to leg line
- D. CTS: Course to steer (set heading calculated by the autopilot)
- E. TRK CRS: Track course to next waypoint
- F. STW: Speed through water. Speed of the vessel relative to the surrounding water.
- G. SOG: Speed over ground
  - If SOG is missing, the speed info will be taken from log (STW). Speed can also be set manually from the Quick menu (MAN)

## Start Track steering

Before the AP80 can be used for track steering, the system must be setup and configured according to the separate AP70/80 Installation manual. The wiring to the ECDIS system must be according to previous section, and both the ECDIS system and the AP80 system must be configured as previously described.

1. Steer the vessel to a position that allows the route to be started on the ECDIS system
  - The route will not start if the difference between vessel heading and bearing on leg exceeds 2\*Off course limit, or if the difference between vessel heading and bearing on leg is more than 90°
  - XTD from the imaginary extension of the first leg must not exceed the deviation corridor
2. Activate the selected route on the ECDIS system
3. Once inside the track corridor, press the **TRACK** key on the AP80 to start automatic Track steering.

The AP80 will remain in **TRACK** mode until the vessel reaches end of route, unless certain error conditions occur which renders the system unable to continue in **TRACK** mode and therefore automatically change the mode. At end of route the AP80 will automatically change to **AUTO** mode with same heading as on the last leg.

## Turning in TRACK mode

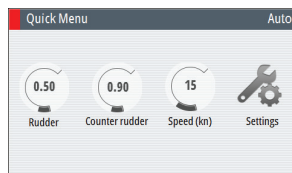
The AP80 receives turn information from the ECDIS system. When the vessel reaches the arrival circle for a waypoint, the ECDIS system will give a wheel-over alarm. The autopilot will turn the vessel according to route information independent on if the alarm is confirmed on the ECDIS system.

## Controlling steering performance in automatic and navigational modes

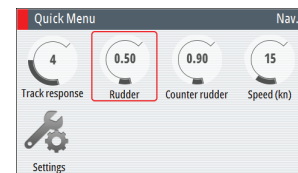
### The Quick menus

Some parameters might be adjusted during operation to suit your personal preferences in auto and navigation modes.

The parameters are available in the quick menus, accessed by pressing the **MENU** key.



Quick menu - AUTO mode



Quick menu - NAV mode

### Track response (NoDrift and NAV mode)

Defines how fast the autopilot shall respond after having registered a cross track distance.

### Rudder

This parameter determines the ratio between commanded rudder and the heading error. The higher rudder value the more rudder is applied.

- The value is set too high. Steering becomes unstable and often the overshoot will increase
- Rudder 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



### Counter rudder

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

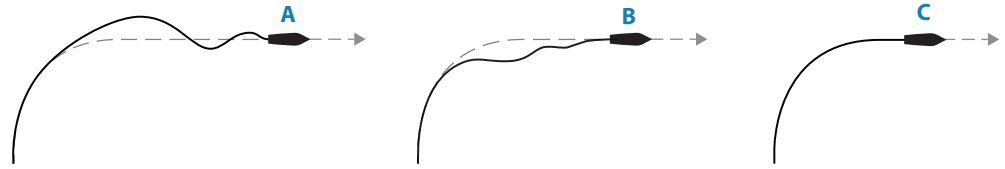
The settings depends on vessel's characteristics, loaded/ballast conditions and rate of turn.

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

Increasing counter rudder settings may result in some higher rudder activity also when steering a straight course.

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 too low; overshoot response
- B. Counter rudder too high; sluggish and creeping response
- C. Correct setting or 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.

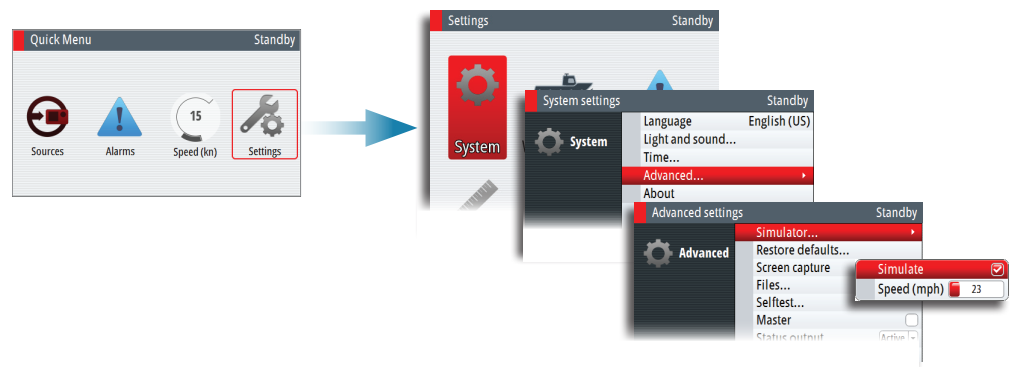
→ **Note:** As many boats turn differently to port versus starboard (due to propeller rotation direction), do the course changes in both directions. You may end up with a compromise setting of Counter rudder that gives a little overshoot to one side and a bit sluggish response to the other.

### Speed

Used to manually set the vessel speed if a speed log or other speed source is not connected.

## Simulator mode

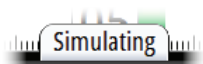
The autopilot includes a simulator mode useful for demonstration and on show. The simulator lets you operate the unit without being connected to sensors.



It is not possible to simulate commissioning and setup, but you can adjust simulated vessel speed.

If the unit is turned off while in simulator mode, this mode will still be active on next power on.

When the simulator is toggled on this is indicated with a flashing message in the lower part of the display.



→ **Note:** Simulator mode is not available if the unit is connected to the CAN bus.



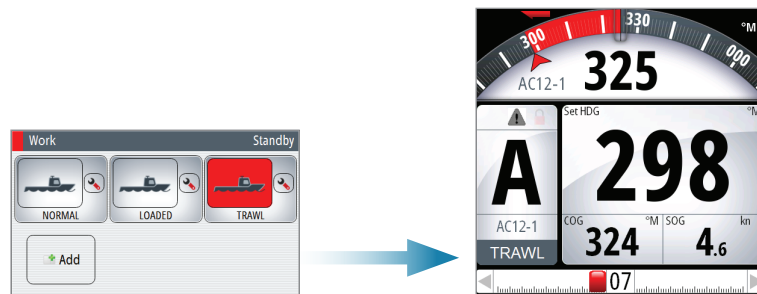
# 5

## Work profile setup

A work profile is a set of steering parameters used by the AP70/AP80 system to improve the autopilot steering under different operational conditions. This gives high steering performance very quickly when the operational conditions change, compared to waiting for the autopilot adaption process.

The AP70/AP80 has a set of predefined work profiles. You can edit all predefined profiles, and you can add new profiles. There can be up to 6 work profiles defined in the system. All profiles except Normal can be deleted.

The work profiles are accessed by pressing the Work key. Active profile is shown in the Mode status panel.



### The Normal profile

This is the default profile, and the initial parameters in the profile are automatically assigned when you select your vessel type.

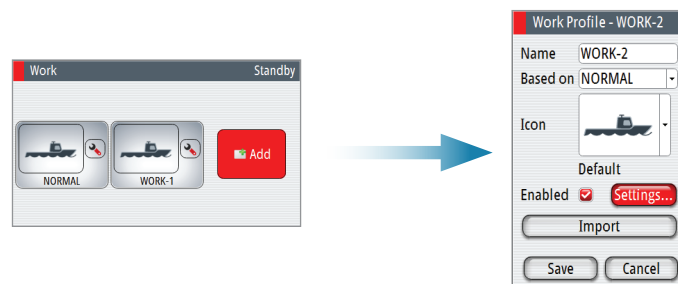
During commissioning and seatrial the parameters for active profile will be tuned for optimized steering performance. The parameters will be saved as part of the profile settings.

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.

### Creating new profiles

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

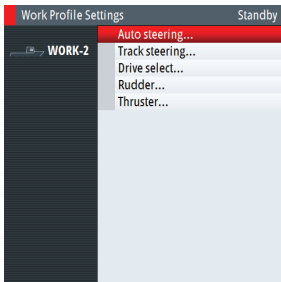
You can also define a profile for easy access to preferred parameters for various crew members.



1. Press the **WORK** key to display the work dialog
2. Select the Add button to display the Work profile dialog
3. Enter profile name
  - The virtual keyboard will be available when the name field is selected
- **Note:** Profile name is limited to max 6 characters
4. 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 if required
5. Select preferred vessel icon

- Use one of the default vessel icons
6. Enable/disable the work profile
    - Only enabled profiles will be shown in the profile listing, activated by pressing the **WORK** key
  7. Edit profile settings if required
    - The default parameters are copied from the profile you select when creating a new profile. These settings can be adjusted to match your preferred steering as described in the next paragraphs

See also "Importing and exporting work profiles (AP80 only)" on page 38.



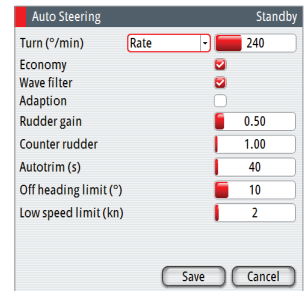
## Profile settings

### Auto steering

#### Turn settings

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
- Default: Rate
- Initial value: Determined during sea trial



#### Economy

This allows for higher course deviation before responding, compared to default precision auto steering.

- Range: ON/OFF
- Default: OFF

#### Wave filter

Automatically reduces the rudder activity and sensitivity of the autopilot in rough weather.

- Range: ON/OFF
- Default: OFF

#### Adaption

This is a software 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.

- Range: ON/OFF
- Default: OFF

#### Rudder gain

This is the ratio between the heading error and the commanded angle.

- Range: 0.05 - 4.00
- Default: Depends on the vessel length
- Initial value: Determined during sea trial

#### Counter rudder

This parameter counteracts the effect of the vessel turn rate and inertia.

- Range: 0.05 - 8.00
- Default: Depends on the vessel length
- Initial value: Determined during sea trial

#### Auto trim

When the vessel has a constant heading error due to external forces such as wind and current, the Auto trim function corrects for this by building up a constant rudder offset.

The Auto trim value is reset every time the **AUTO** mode is entered or when a course change greater than approximately 20° is made.

Auto trim is automatically disabled during a turn.

- Range: 10 - 800 sec
- Default: Depends on the vessel length

**Off heading limit**

Sets the limit for the off heading alarm.

An alarm occurs when the actual heading deviates from the set heading more than the selected limit.

- Range: 5° - 35°
- Default: 10°

**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.

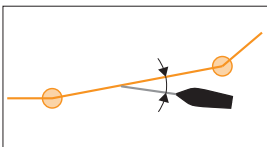
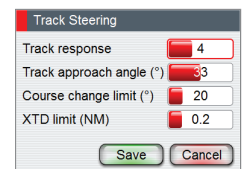
- Range: 1 - 20 (kn)
- Default: 1 (kn)

**Nav/Track steering**

**Track response**

Defines how fast the autopilot shall respond after having registered a cross track distance.

- Range: 1 - 9
- Default: 4



**Track approach angle**

Defines the angle used when the vessel is approaching a leg.

This setting is used both when you start navigating and when you use track offset.

- Range: 5° - 60°
- Default: 30°

**Course change limit (Not applicable for ECDIS Track steering)**

Defines the limits for 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.

- Rang: OFF / 10° - 90°
- Default: 30°

**XTD limit**

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

- Range: 1 (m) - 1 (NM)
- Default: 50 (m)

**Drive select**

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

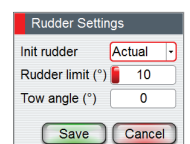


**Rudder**

**Init rudder**

Defines how the system moves the rudder when switching from power steering to an automatic mode:

- Midships moves the rudder to zero position.
- Actual maintains the rudder offset, and use this as trim value (bumpless transfer)



→ **Note:** Actual is only available with rudder feedback signal available.

- Default: Midships

#### **Rudder limit**

Determines the maximum rudder movement in degrees from the “used” midship position that the autopilot can command the rudder in the automatic modes.

“Used” midship position is the rudder angle required to maintain a straight course.

The Rudder limit setting is only active during autosteering on straight courses, NOT during course changes. This Rudder limit does not affect Non-Follow-up or Follow Up steering. In Non-Follow-up or Follow Up steering, only the max. rudder limit applies.

→ **Note:** The max. rudder limit was set automatically to physical stop minus 3° when the rudder feedback calibration was performed.

- Range: 5° - Max rudder limit
- Default: 10°

#### **Toe angle**

This option sets the allowed angle deviation between the rudders. The feature will enhance rudder efficiency at small rudder commands around center position, and it will reduce vibration and/or propeller/water jet noise.

The toe angle is the angle between the rudder’s 0-position and the rudder’s actual position (**t**) as shown in the illustration.

The toe angle will be applied as an offset to each rudder. Toe out (positive value), angles the two rudders apart, while Toe in (negative value) angle them towards center.

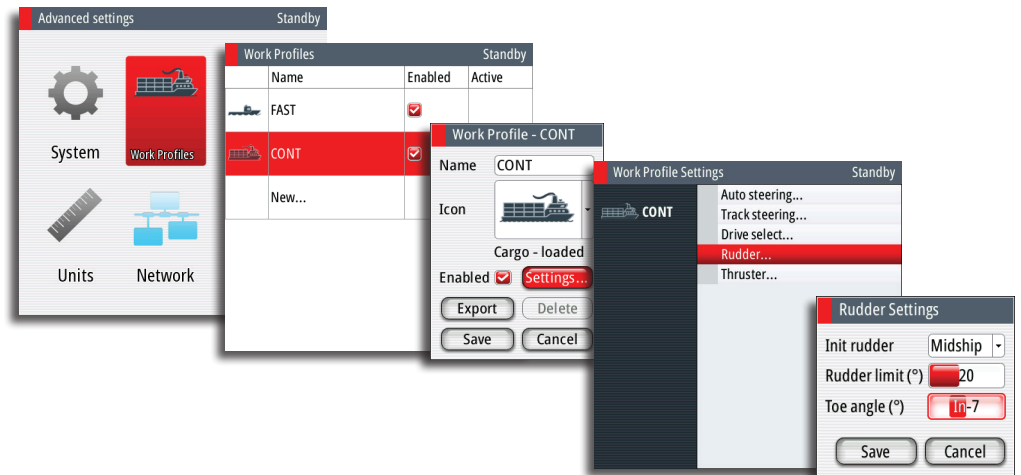


- Range: In 15° - 0 - Out 15°
- Default: 0°

→ **Notes:**

- The toe angle is a work profile setting, and must be enabled for current work profile to be available.
- The Toe angle is only available if the vessel has 2 rudders. It applies only to rudders located on the side of the ship - it will have no effect on a rudder located in the ship center.
- The Toe angle is effecting all operating modes except **Standby** and **NFU**.
- When the feature is enabled, one rudder will stop moving before the other one if max/min rudder angles are demanded.
- When the feature is enabled, the rudder bar on AP70/80 and QS-/NF-/FU80 shows rudder command instead of measured rudder angle.

Enable the Toe angle feature by editing the work profile setting.

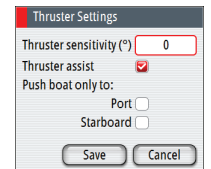


## Thruster

### *Thruster sensitivity*

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.

- Range: 0° - 30°
- Default: 1° for Analog thrusters, 3° for on/off thrusters



### *Thruster 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 gets 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.

- Range: ON/OFF
- Default: OFF

### *Push boat to*

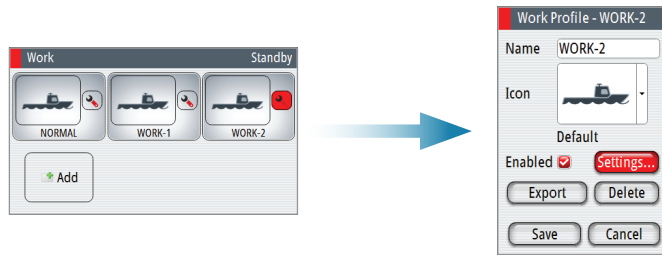
Allows the user to specify if the thrusters should be used to push the vessel to one side only. If no option is selected the thrusters will be used for both port and starboard course deviations.

- Range: ON/OFF for Port and Starboard
- Default: OFF

## Edit a profile

You can edit profile name, icon and settings for all profiles, also for the Normal profile.

- ➔ **Note:** It is not recommended to change any of the auto steering parameters in the Normal profile after the vessel is commissioned.
1. Press the **WORK** key to display all work profiles
  2. Turn the rotary knob to select the edit icon on the work profile you want to change
  3. Make the required changes and save the new settings



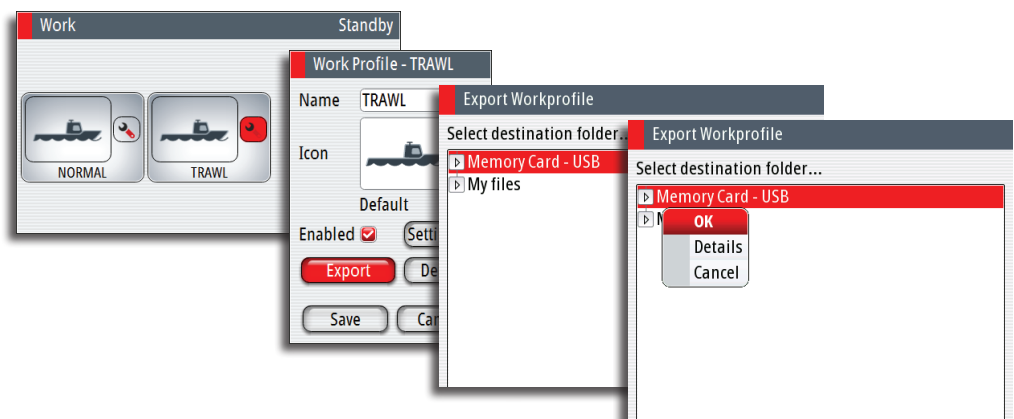
→ **Note:** Refer to “Work profile setup” on page 33 for details about work profile settings.

## Importing and exporting work profiles (AP80 only)

It is possible to export and import a work profile to/from a USB stick.

### Export

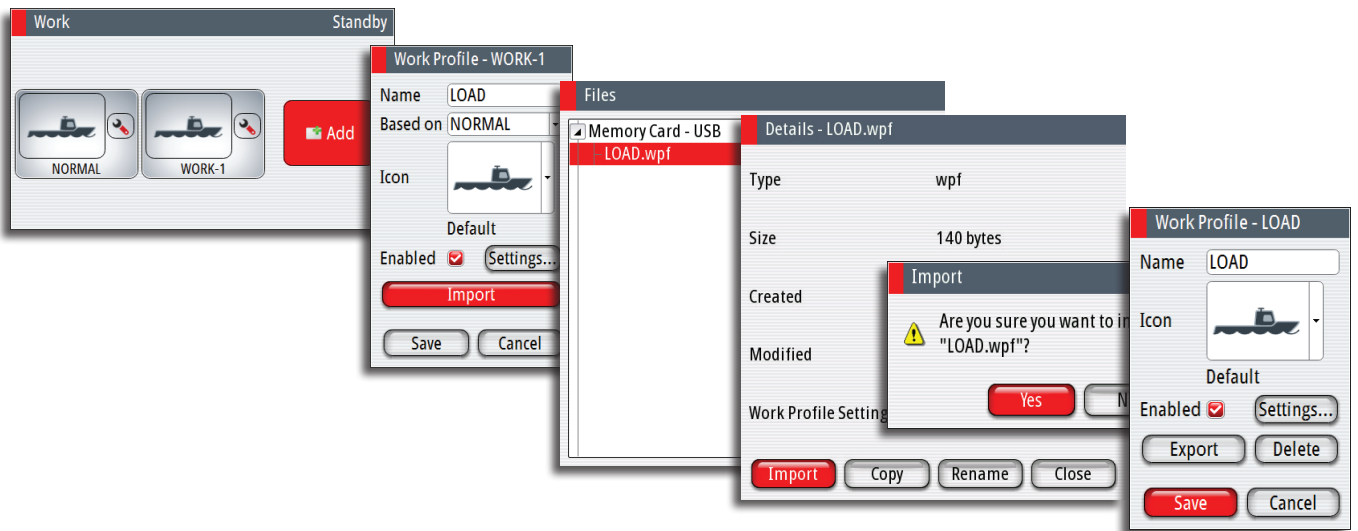
1. Press the **WORK** key to display all work profiles
2. Turn the rotary knob to select the edit icon on the work profile you want to export
3. Select Save to disk
  - The Files dialog will be displayed
4. Select the USB
5. Press the **MENU** key and confirm your selection



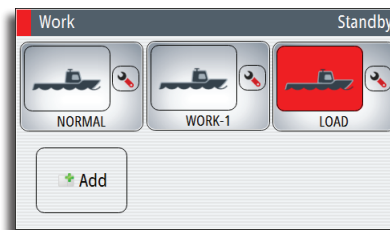
→ **Note:** only 6 characters can be used to identify the work profile.

### Import

1. Select Add in the work profile dialog to create a new profile
  1. Select Load Profile from disk
    - The Files dialog will be displayed
  2. Locate the file on the USB stick
- **Note:** The work profile files have .wpl extension!
3. Press the **LEFT** key or the rotary knob to access the file details
  4. Select Import
  5. Confirm your selection
  6. Save the new work profile



7. Return to the work dialog and confirm that the imported work profile is available



→ **Note:** The first 6 characters in the file name will be used as profile name.

# 6

## The alarm system

The AP70/AP80 system will continuously check for dangerous situations and system faults while the system is running.

### Message types

There are two type of messages:

- Alarms
  - Generated when conditions are detected that critically effect the capability or performance of the system.  
You must critically examine all alarm messages to determine their course and effect.
- Warnings
  - Informing you of conditions that could result in unwanted system response or eventual failure

### Alarm indication

When an alarm situation occurs, siren will sound, the alarm icon will be active. The alarm dialog will show alarm cause, followed by the name of the device that generated the alarm.



Message type	Status	Icon		Alarm dialog	Siren
		Color	Appearance		
Alarm	New	Red	Flashing	Yes	Until acknowledged
	Acknowledged		Steady	Closed	Muted
Warning	New	Yellow	Steady	Yes	2 seconds
	Acknowledges			Closed	No

The alarm and alarm details are recorded in the alarm listing. Refer “The alarm dialogs” on page 41.

### The icon

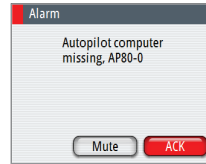
The alarm icon will remain on the display until the reason for the alarm/warning is removed.



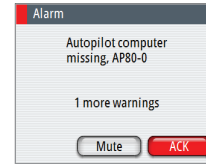
## The Alarm dialog

All new alarms and warnings activates the alarm dialog. The dialog will be closed when the message is acknowledged.

If more than one message is activate, this will be indicated in the alarm dialog. Only the cause for the most recent message will be displayed. The remaining messages are available in the Alarms listing as described on page 41.



Single active alarm

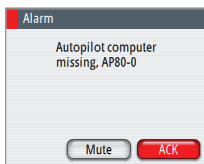


Multiple active alarms

## Acknowledging a message

There is no time-out on the alarm message or siren. These remain active until you acknowledge it or until the reason for the alarm is removed.

The following options are available in the alarm dialog for acknowledging a message:

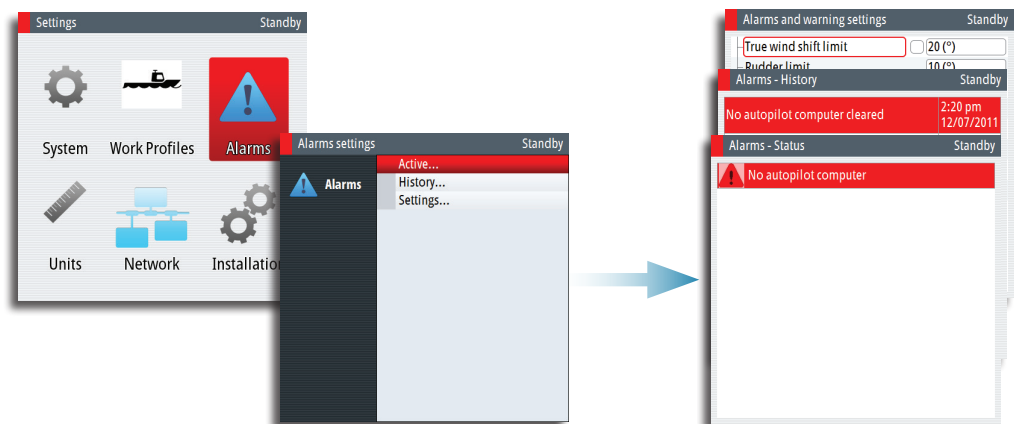


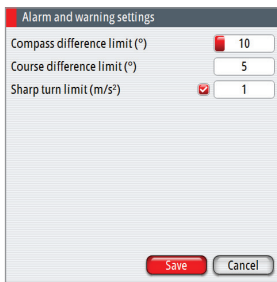
Option	Result
ACK	Sets the alarm state to acknowledged, meaning that you are aware of the alarm condition. The siren will stop and the alarm dialog will be removed. The alarm icon will however remain active, and the alarm will be included in the alarm listing until the reason for the alarm has been removed
Mute	Mutes the siren locally. The alarm dialog remains on the display

## The alarm dialogs

The system includes three different alarm displays:

- Active alarms
  - List of all active messages
- Alarm history
  - Alarm events, including alarm type and time/date
- Alarm settings
  - List of all alarms that can be enabled and configured by the user





## Setting the alarm and warning limits

The alarms and warning limits are adjusted from the settings display.

1. Activate the alarm settings dialog as shown above
2. Select the parameter to be changed
3. Press the rotary knob to edit the value
4. Change the value by using the rotary knob or the arrow keys
5. Repress the rotary knob to confirm your setting

Only a few alarms can be turned off. These are indicated with a check box, and are turned on/off by pressing the rotary knob.

- **Note:** Additional alarm limits that can be defined for each Work profile. Refer to Work Profile description in the Operator Manual.

### Compass difference limit

When two compasses are used (main compass and monitor compass), there is virtually always a difference between the readings of the two. If the difference exceeds the set limit, an alarm is given.

- **Note:** The difference between the two compass readings may vary with the vessel's heading and from one area to another where a vessel is in transit. The difference between the two compass readings is automatically reset when a Compass diff. alarm is acknowledged.
- Range: 5° - 35°
  - Default: 10°

### Course difference limit

Sets the value the actual heading can differ from track course.

- Range: 5° - 35°
- Default: 35°

### Sharp turn limit

Gives a warning if a turn is started in any auto mode with a combination of speed and turn rate/radius that will cause sidewise acceleration bigger than set limit.

- Range: OFF / 1 - 10 m/s
- Default: OFF

## Fallback and failures during automatic steering

### Rudder angle sensor missing

Alarm will be given and steering will after 0.1 sec continue using "virtual" rudder angle data (virtual is estimated value based on known rudder speed)

### Steering compass missing

#### When monitor compass is available

Alarm for main compass failure is given and steering continues using monitor compass. If there is a difference between the compasses, a smooth transition (2 min filter) to the monitor compass heading takes place.

When acknowledging the alarm, the autopilot goes to **STBY** mode.

#### When no monitor compass

Rudder is kept at fixed angle (i.e. heading is approximately maintained if failing when heading keeping, turn is approximately maintained if failing when turning), alarm is given and autopilot goes to **STBY** mode.

### Magnetic variation missing

If heading source is set to be adjusted for magnetic variation, variation is taken from available sensors in following order: Position source – Navigation source – Compass – any other variation available on CAN bus. If variation disappears, last valid variation will be used until automatic steering is cancelled and heading shown will then be corrected according to alternative variation in the order given above.

### Jump in heading data

If there is an abnormal heading jump in steering compass heading, an alarm will be given and a smooth transition to new heading will take place. There may also be a compass difference alarm if a monitor compass is in use.

### Speed sensor lost

If speed in use is lost there will be an alarm and smooth transition (2 min filter) to fallback speed. Speed for steering and speed for navigation will use following use priority and fallback:

Steering:	STW	STW backup	SOG	SOG backup	Manual speed	Cursing speed
Navigation:	SOG	SOG backup	STW	STW backup	Manual speed	Cruising speed

### Position data missing

During NoDrift steering, alarm is given and a smooth transition to position backup source takes place. If no position backup steering source, steering mode will change to auto heading.

### Navigation data missing

If lost during track/nav. steering, give alarm and change to auto heading steering.

### Local supply voltage missing

When control unit(s) and CAN bus have different power source, alarm will be given on active control unit with sound and flashing red power button led (display will go "black"). Main steering computer will go to **STBY** mode and activate alarm on all other control units.

### CAN bus supply voltage missing

Active control unit will give local alarm and rudder/thruster drive units will go to **STBY** mode.

### Rudder/thruster drive computer failure

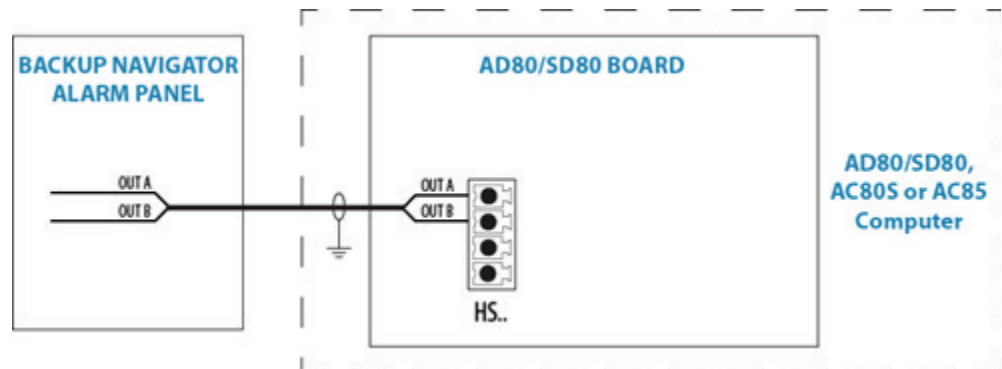
Alarm will be given and the ready signal to the steering /thruster gear will disappears. If sw failure, there will be a watchdog restart of failing drive computer. The autopilot steering computer will try to maintain steering as far as possible with remaining drive computers. If the faulty unit is the autopilot steering computer, autopilot backup computer has to be selected manually (ref. Menu- source selection).

### Backup navigator alarm (AP80 only)

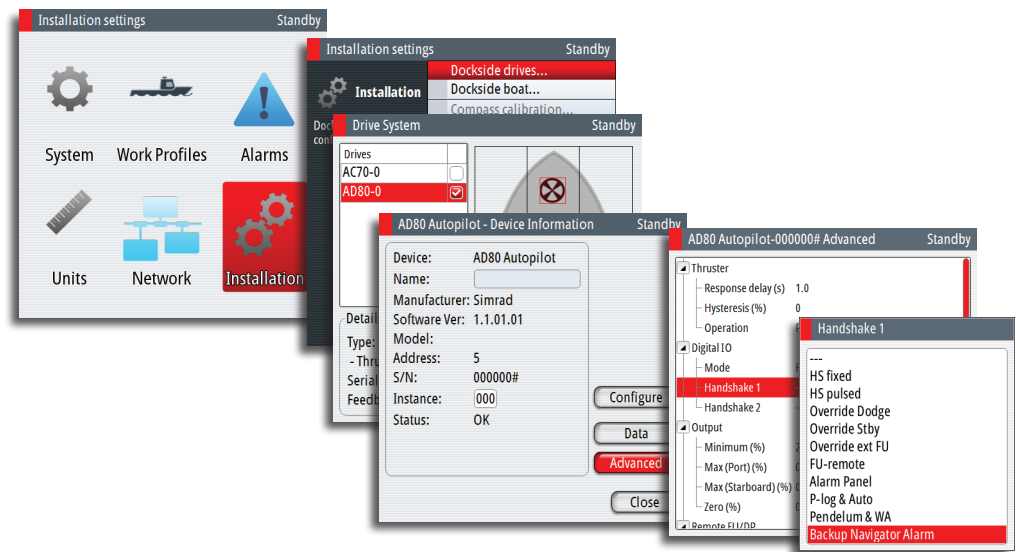
A backup navigator alarm is available when the AP80 is connected to an ECDIS in a Track system.

If an alarm is not acknowledged within the specified timefram e.g. "wheelover", "end of route" or "track control stopped", a backup navigator alarm can be activated to notify bridge officer off duty. The backup navigator alarm can only be acknowledged from AP80.

To enable this feature, the autopilot system provides a configurable handshake port on SD80 or AD80 that can be connected to an external alarm panel or loudspeaker.



Select **Backup Navigator Alarm** for Handshake 1 or 2, depending on physical connection of external switch.



## List of possible alarms and corrective actions

The next pages includes a list of all alarms generated by the autopilot system.

The AP70/AP80 control units might also display alarms received from other units connected to the system. Refer separate documentation for the relevant equipment for further descriptions of these alarms.

Alarm/Warning	Type	Warning/Alarm condition	Possible cause and recommended action
Red flashing AP70/AP80 power button, black display	A	< 5 V	Local supply voltage to AP70/AP80 missing or <5 V. Check local supply, connections and fuses to AP70/AP80 control units
Active control unit missing	A	Autopilot computer has lost contact with active control unit	Active control unit goes silent. <ol style="list-style-type: none"> <li>1. Check/repair CAN bus cable</li> <li>2. Replace the control unit</li> </ol>
Autopilot computer missing	A	Active control unit has lost contact with autopilot computer	Faulty autopilot computer or poor cable connections from the same. <ol style="list-style-type: none"> <li>1. Check connectors and cable</li> <li>2. Check local power to control unit</li> <li>3. Check that control unit is turned on</li> <li>4. Replace autopilot computer</li> </ol> <p>→ <b>Note:</b> This alarm will only show up on passive units if active control unit is defective or has lost bus communication.</p>

Alarm/Warning	Type	Warning/Alarm condition	Possible cause and recommended action
Boat speed missing	W/A	Lost sensor data	The speed signal from the GPS or the log is missing. <ol style="list-style-type: none"> <li>1. Check Device list for valid speed source</li> <li>2. Try a new automatic source update</li> <li>3. Check the GPS, log, and cable connections</li> </ol>
CAN bus failure	A	Not possible to send or receive data although bus voltage is ok	Poor CAN bus backbone, defective cable/connector or defective CAN bus receiver in autopilot control unit. <ol style="list-style-type: none"> <li>1. Check backbone terminations</li> <li>2. Check cable and connectors</li> <li>3. Replace Autopilot control unit</li> </ol>
CAN bus supply overload	W	Current >4.3 A	Check summary unit loads
	A	Current >10 A for 1 ms, hw shutdown	Excessive current draw. Check for short circuit/defective device on network.
Check heading	A	Lasting steering compass heading jump >10° within 1 sec during automatic steering	A sudden jump in heading of more than 10 degrees is detected Check steering compass. Possibly change to other heading source or monitor compass.
Compass difference	A	Difference between steering compass and monitor compass +variance > set limit	The difference in readings between the main compass and the monitor compass exceeds the limit set for "Compass difference". 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	A	Actual heading diff from track course by set limit	Compass heading is deviating too much from the track course (BWW). May be caused by extreme wind and current, combined with low speed.
Cross track distance limit	W/A	XTD > XTD limit	XTD has reached set XTD limit in <b>NAV/TRACK</b> mode. May be caused by extreme wind and current or too low boat speed.
Drive inhibit	A	Motor or solenoid drive electronics critically overloaded	Check for wire shortage, eventually disconnect suspicious wires.
Drive not available	A	No drive available response upon request from autopilot on Handshake port of faulty SD80/AD80 board	Check that steering gear/thruster is set for autopilot control. Check cabling to Handshake port of faulty SD80/AD80 board. Make sure Handshake port of faulty SD80/AD80 board is configuration for HS fixed/HS pulse (refer "Configuring the handshake" on page 60).
Drive reference voltage missing	A	Reference voltage to faulty AD80 is missing	Check that the two <b>U_CTRL</b> dip switches of faulty AD80 board is set correctly (ref. cable connection label inside faulty unit). If drive control signal is 4-20 mA current or voltage using internal ±10 V reference, switches must be set to <b>INT</b> . If external ref. voltage is connected switches must be set to <b>EXT</b> . If ext. ref. voltage, check cabling and measure correct voltage between <b>U_REF+</b> and <b>U_REF-</b> of AD80 board
Drive unit failure	W/A	Autopilot computer has lost communication with faulty device	Check that green CPU led of faulty unit is alternating (ref. label inside unit cover for location of led). If off, check local power supply/fuse (AC70). For other boards, check CAN supply for 9-15 V between <b>NET-S</b> and <b>NET-C</b> of SimNet plug. If led is ok, check cabling, T-connector backbone etc. If led is on, try to restart unit by turning power off/on

Alarm/Warning	Type	Warning/Alarm condition	Possible cause and recommended action
End of route	A	Given if WP name = "End of route"	Warning given on the active control unit when a "END ROUTE" waypoint name has been received from the Plotter/ECS.
ENGAGE output overload	W	Current > 3.5 A	Bypass valve or clutch is drawing excessive current (>3,5 A).
	A	Current > 5 A	Make sure there is no shortage to ground or cabling damage, disconnect cable from AC70 to motor, and make sure there is no alarm when engaging FU or Auto mode.
EVC comm. error	A	Lost communication with EVC system (Volvo IPS and similar).	Check connection with EVC engine interface. For IPS, engine must be running.
External mode illegal	A	Signals to external mode input port of faulty SD80/AD80 board has illegal combination	Check if alarm is given for a certain position of external mode selector. Check cabling to <b>MODE SEL</b> port of faulty board
High internal temp.	W	>75°C	Excessive temperature in unit (>75°C).
High drive temp.	W	Drive electronic temperature >80°C	Excessive temperature in Autopilot Computer drive transistors (>80°C), possible long term overload.
	A	Drive electronic temperature close to critical for more than 1 s.	<ol style="list-style-type: none"> <li>1. Switch off autopilot</li> <li>2. Check for backload in Drive unit/steering system.</li> <li>3. Check that the autopilot computer specifications matches Drive unit</li> </ol>
Low CAN bus voltage	W	< 9 V	Check cable length, bus load and bus supply feeding point. If possible, check if fault disappears by disconnecting some units
Low supply voltage	W	<10 V (12 V -15%)	Mains voltage less than 10 Volts. <ol style="list-style-type: none"> <li>1. Check battery/charger condition</li> <li>2. Verify mains cable has correct gauge</li> </ol>
Low boat speed	W/A	Speed below set limit for steering in Work profile	Speed below set limit for acceptable course keeping (in Work profile). Switch to hand steering or adjust Work profile settings.
Monitor compass missing	W	Lost sensor data	No data from the selected monitor compass. (Warning only.)
Navigation data missing	W/A	Lost sensor data (NAV mode)	Navigation data from Plotter/ECS is missing. <ol style="list-style-type: none"> <li>1. Check Device list for valid navigation source</li> <li>2. Try a new automatic source update</li> <li>3. Check the Plotter/ECS and cable connections</li> </ol>
New WP	A	Ref. "Course change confirm limit" in NAV	Nav mode only; Course change from one leg to the next is exceeding set "Course change limit"
No rudder response	A	No response to rudder command	<ol style="list-style-type: none"> <li>1. Check all connections</li> <li>2. Check Rudder FB transmission link (not applicable for Virtual feedback installations)</li> <li>3. Check drive unit motor/brushes</li> <li>4. For SD80, check that port/stbd led is activated (ref label in cover for location)</li> <li>5. Replace the Autopilot Computer Drive board</li> </ol>
Off heading	A	Boats heading is outside set off heading limit. Automatic reset when inside limit	May be caused by extreme weather conditions, and/or too slow speed. <ol style="list-style-type: none"> <li>1. Check steering parameters (Rudder, Autotrim, Seastate-filter)</li> <li>2. Increase Response/Rudder value</li> <li>3. Increase boat speed, if possible, or steer by hand</li> </ol>

Alarm/Warning	Type	Warning/Alarm condition	Possible cause and recommended action
Override	W	<ol style="list-style-type: none"> <li>1. EVC override via SG05</li> <li>2. Override via SD80/AD80 Handshake (ref. KaMeWa)</li> <li>3. Override via SD80/AD80 RUD UI port</li> </ol>	If unintended warning, make sure override handle is not being activated by loose objects. Check cabling and override switches connected to Handshake port of faulty SD80 or AD80 board
Position data missing	W/A	Lost sensor data (NoDrift mode)	<p>Position data from the GPS is missing.</p> <ol style="list-style-type: none"> <li>1. Check Device list for valid position source</li> <li>2. Try a new automatic source update</li> <li>3. Check the GPS and cable connections</li> </ol>
Rudder data missing	A	Rudder angle signal to faulty board is missing	If several rudder angle sensors, check which one the faulty board is set up for use (refer "Drive test/calibration" on page 62). If the missing sensor is connected to an autopilot computer check cabling to the board. If missing sensor is a CAN device, check backbone bus network connection.
Rudder limit	W	Limit rel. to rudder cmd in auto modes. Not applicable for NFU/FU where rudder shall stop at max -3°	The set rudder limit has been reached or exceeded. This is a warning only and may be caused by disturbance to compass (waves), speed log, sharp turn or improper parameter setting.
Rudder too slow	W	Rudder speed from RF < 2°/sec	<p>Excessive load on steering gear. Air in hydraulic system. Insufficient drive unit capacity.</p> <ol style="list-style-type: none"> <li>1. Look for mechanical obstructions at the rudder/tiller/quadrant. Check the back drive force</li> <li>2. Bleed the hydraulic system</li> <li>3. Replace with bigger pump unit</li> </ol>
Sharp turn	W	Acceleration > set g-limit (Alarms - settings)	If unintended warning, check that the boat speed to the autopilot is correct. Check that set turn rate or radius corresponds to actual
Drive overload	W	AC70: Motor/sol current > 30 A SD80: Sol current >8 A	<p><b>Reversible motor</b></p> <p>Motor stalls or is overloaded</p> <ol style="list-style-type: none"> <li>4. Fix possible mechanical blocking of rudder.</li> <li>5. If heavy sea at high rudder angle, try to reduce boat speed or rudder angle by steering at another heading</li> <li>6. Make sure there is no shortage to ground or cabling damage, disconnect cable from AC70 to motor, and make sure there is no alarm when trying to run NFU-mode</li> </ol> <p><b>Solenoids</b></p> <p>Shortage to ground or cabling damage. Same action as for motor</p>
	A	AC70: Mot/sol current > 55 A SD80: Sol current > 9 A	
Steering compass missing	A	Lost sensor data	No data from the selected steering compass. If no monitor (back up) compass; the autopilot goes to <b>STBY</b> mode. If Monitor compass; the autopilot switches to monitor compass. If there is a difference the autopilot will gradually synchronize with the new heading (2 minutes).
Thruster inhibited	W	Vessel speed > set limit	<p>The vessel speed exceed the set limit for when thrusters can be used.</p> <p>→ <b>Note:</b> The Thruster inhibit limit will only apply when speed source is Log or SOG, not if the speed is set manually.</p>

# 7

## Maintenance

### Preventive maintenance

The AP70/AP80 control units do not contain any field serviceable components, therefore the operator is required to perform only a very limited amount of preventative maintenance.

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

### Simple maintenance procedures

#### Cleaning the display unit

The supplied cleaning cloth should be used to clean the screen where possible. Use plenty of water to resolve and remove salt remains. Crystallized salt may scratch the coating if using a damp cloth. Apply minimal pressure to the screen.

Where marks on the screen can't 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, plastics bezel, or rubber keys.

#### Checking the connectors

The connectors and computer terminals should be checked by visual inspection only.

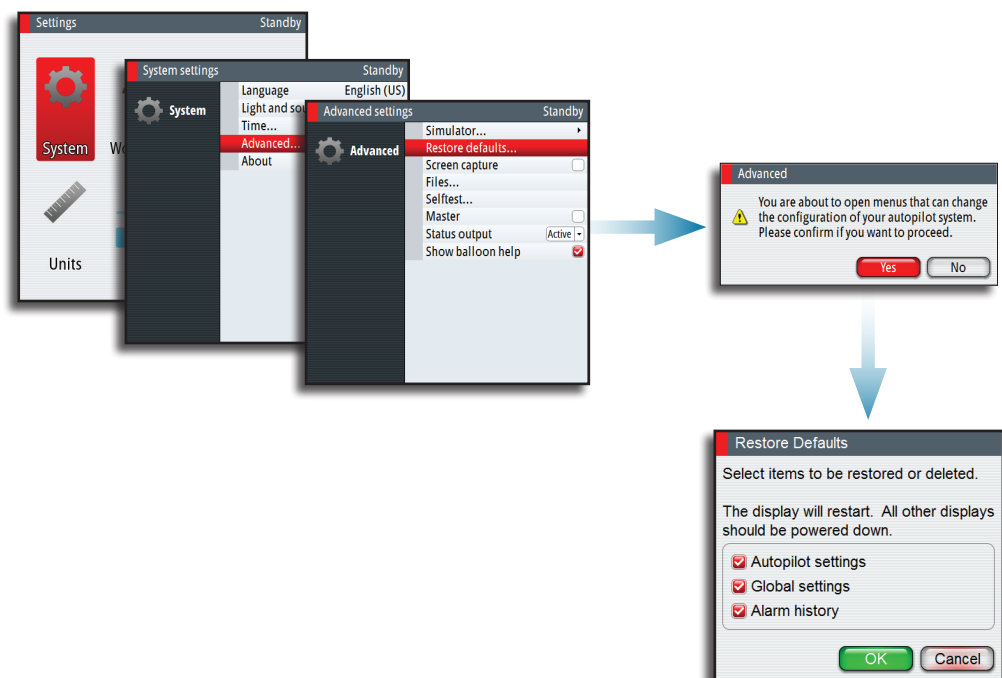
Push the connector plugs into the connector. If the connector plugs are equipped with a lock; ensure that this is in the correct position.

### Restoring factory default settings

A default restore will reset the memories to factory settings.

The first time the autopilot system is started and after restore, it will run through the automatic setup-procedure.

→ **Note:** Unless you need to clear all stored values during the installation set-up procedure, you should not perform a restore of factory settings.





## Software upgrades

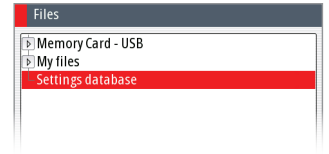
The latest software for the AP70/AP80 will be available for download from our web sites: [www.navico.com/commercial](http://www.navico.com/commercial) and [www.simrad-yachting.com](http://www.simrad-yachting.com).

Detailed instructions for how to install the software will follow the upgrade files.

## Backing up your system data

It is recommended to copy the user settings files after the system has been commissioned. This should also be done as part of your back-up routine.

See the next section describing how to manage files in the autopilot control units.

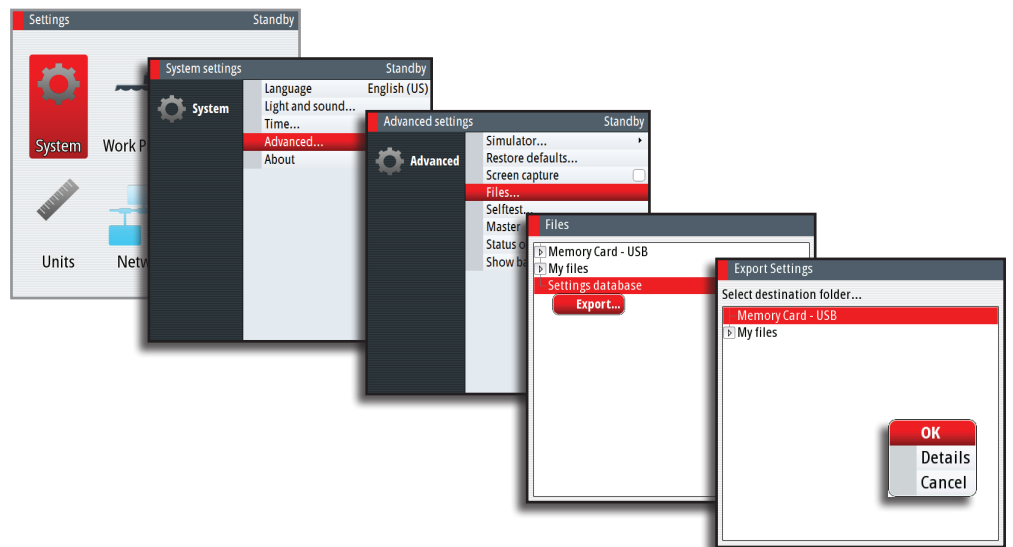
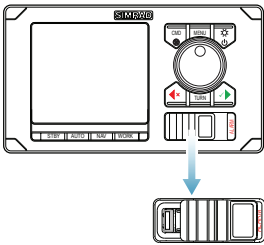


## File management

The autopilot includes a file management system. For AP80 files can be copied to a USB stick inserted in the card slot on the front of the unit.

The following procedure describes how to copy your settings database to a USB stick.

1. Press the **MENU** key twice to access the Settings dialog, and continue as illustrated to access the Files dialog
2. Select the Settings database folder
3. Press the **MENU** key, and select Export
4. Select the USB stick
5. Press the **MENU** key again, and confirm your selection



# 8

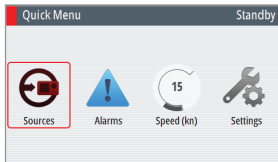
## Menu overview

### The Quick menus

The Quick menus are mode dependant, displayed by pressing the **MENU** key.

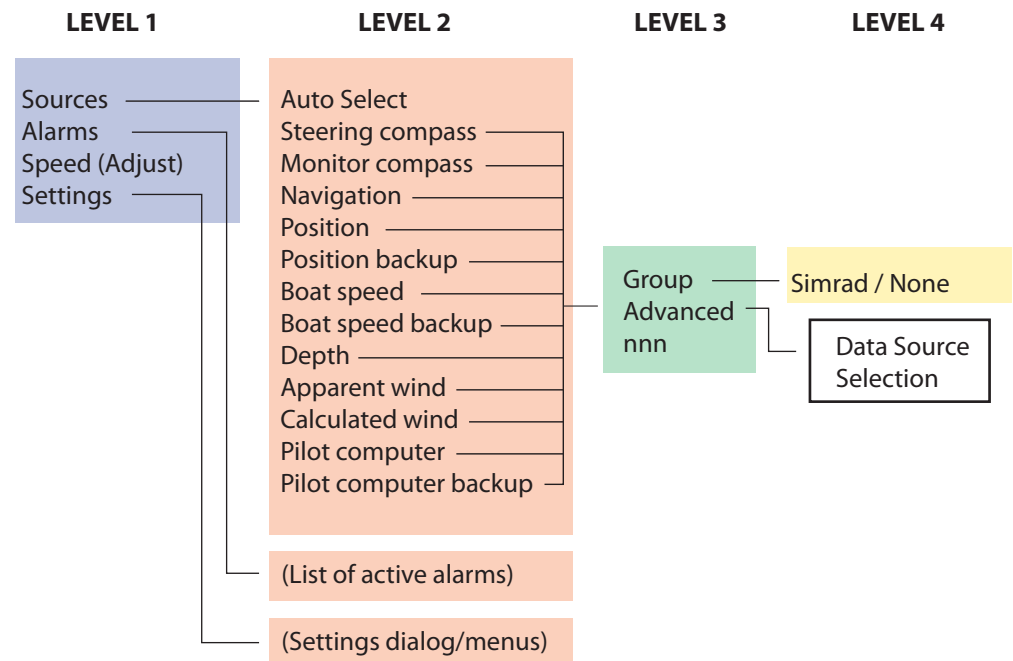
The menus containing the most common used settings for the active mode. Each Quick menu have access to the Settings menus.

The Quick menus are described in the "The operational modes" on page 20.



### Quick menu in Manual modes

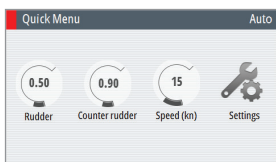
From the Quick menu for **STBY**, **NFU** and **FU** you can change sources used for steering, you can display active alarms and set manual speed.



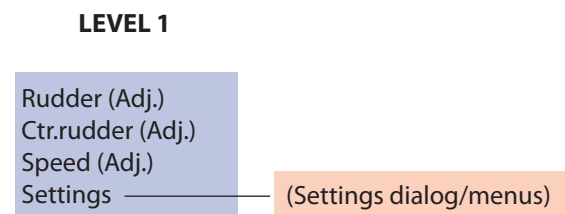
### Quick menu in Automatic and navigational modes

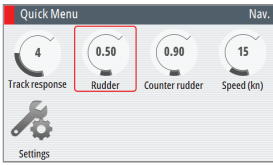
Steering performance in automatic and navigational modes might be adjusted from the mode's Quick menu.

The different settings are described in "Controlling steering performance in automatic and navigational modes" on page 31.



### Auto mode





## NoDrift and NAV mode

### LEVEL 1

- Track resp (Adj.)
- Rudder (Adj.)
- Ctr.rudder (Adj.)
- Speed (Adj.)
- Settings ——— (Settings dialog/menus)

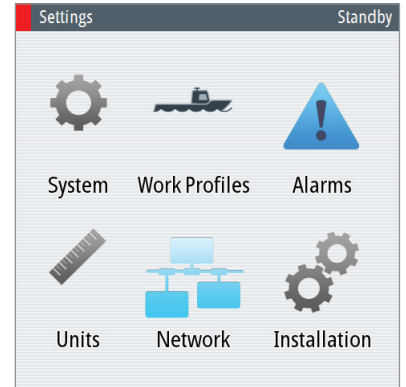
## The settings dialog and submenus

The system is configured and most system settings defined during installation and commissioning of the system.

All system configuration and Installation setup is described in the separate AP70/AP80 Installation manual.



The settings parameters are logically grouped, and each group is presented with an icon in the Settings dialog. This dialog is accessed by pressing the Settings icon available in all mode specific menus, or by double clicking the **MENU** key.



### LEVEL 1

- System
- Work profiles
- Alarms
- Units (select)
- Network
- Installation

### LEVEL 2

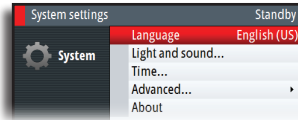
- Language (select)
- Light and sound
- Time
- Advanced
- About
- (Create/Edit/Enable)
- Active
- History
- Settings
- Sources
- Device list
- Diagnostics
- SimNet groups
- Damping
- Dockside drives
- Dockside boat
- Compass calibr.
- Seatrial drives
- Seatrial boat

### LEVEL 3

- Key beeps
- Alarm sound level
- Key. backl. day
- Key. backl. night
- Local time offset
- Time format
- Date format
- Simulator
- Restore defaults
- Screen capture
- Files
- Selftest
- Master
- Status output
- Show balloon help
- Track system

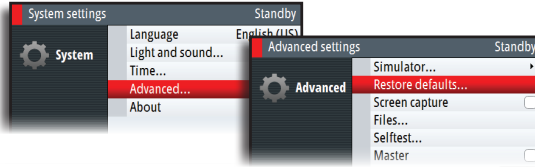


## System



User settings that have not any affect on autopilot performance.

## Advanced system settings



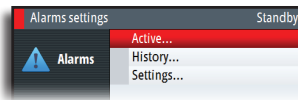
## Work profiles

Name	Enabled	Active
NORMAL	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
LOAD	<input checked="" type="checkbox"/>	<input type="checkbox"/>
New...		

Used for creating and managing the vessel's work profiles. Described in "Work profile setup" on page 33.



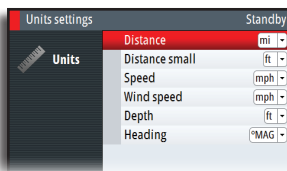
## Alarms



Alarm listings and settings. Described in "The Alarm dialog" on page 41.



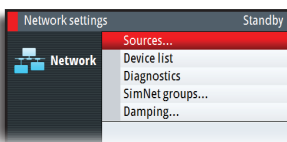
## Units



Units of measure used on display, in dialogs and menus.



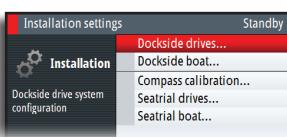
## Network



List of devices connected to the CAN bus network. Used for setup, diagnostics and configuration. See "System configuration" on page 53.



## Installation



Includes dockside and seatrial calibrations. See "System configuration" on page 53.

# 9

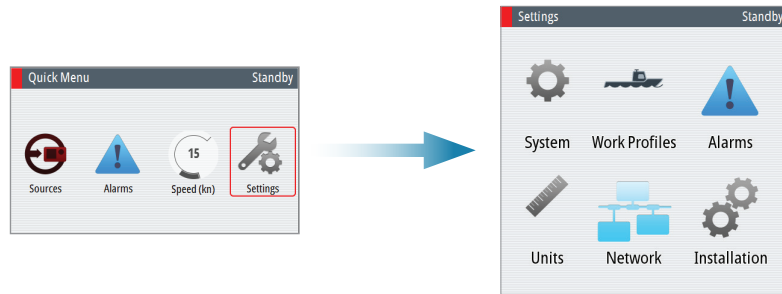
## System configuration







### General

When the autopilot installation is completed, the system must be configured and the commissioning procedures performed. Failure in setting up the autopilot correctly may prohibit the autopilot from functioning properly.

### The settings dialog and submenus

The system configuration settings are logically grouped in the Settings dialog, and each group is presented with an icon. This dialog is accessed by pressing the Settings icon available in all mode specific menus, or by double clicking the **MENU** key.



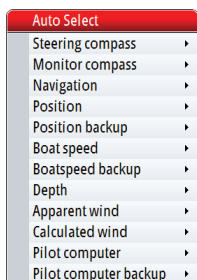
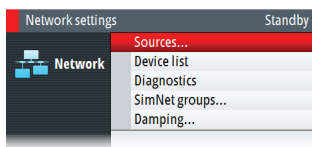
Icon	Description	Refer
	System settings. These settings have no affect on autopilot performance	
	Work profile settings	AP70/AP80 Operator manual
	Active alarms, alarm history and alarm settings	
	Units of measure used on display, in dialogs and menus.	-
	Network sources setup	"Network settings" on page 54
	Installation setup. The pilot must be in <b>Standby</b> mode to access these settings	"Installation settings" on page 58

### Turning on for the first time

Before attempting to turn on the autopilot and perform an Installation Set-up, the hardware installation and electrical installation must be completed and performed in accordance with the installation instructions

The first time the autopilot system is started and after a factory reset, you will be guided through a set of initial settings.

If the settings are not completed, you can configure the autopilot system manually as described in the following sections.



## Network settings

Setup and selection of sources are done from the Network menu.

### Selecting data sources

A data source can be a sensor or a device connected to the network, providing data to other devices. Data can be of different type such as compass data, apparent wind data, calculated wind data, depth data, etc.

Source selection is required on initial start up of the system, if any part of the CAN bus network has been changed or replaced, or if an alternative source is made available for a given data type and this source has not been selected automatically.

At the first time turn on of a group of SimNet interconnected products, data sources are automatically selected from an internal SimNet priority list. If a data source is connected to SimNet after the first time turn on, this will be identified and automatically selected if no other data source already is selected for the given data type.

You can let the system automatically select your sources, or set up each source manually as described below.

#### Auto select

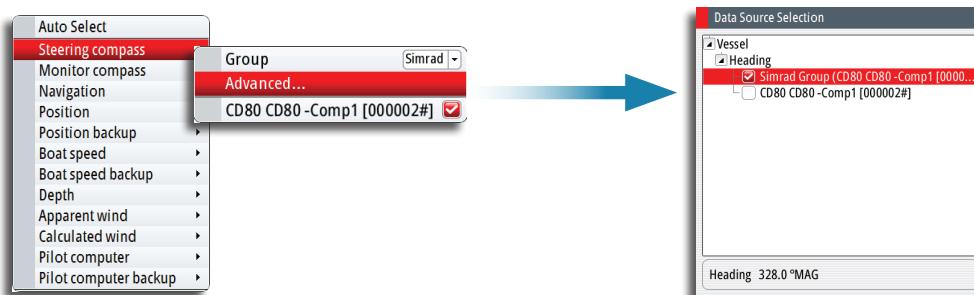
The Auto Select option will look for all SimNet sources connected to the network. If more than one source is available for each data type, the system will automatically select from an internal priority list.

The Auto select function is mainly for situations where the automatic source selection needs to be updated because a selected data source is not supplying data or has been physically replaced with another one. The update secures that the existing source selections are valid and maintained. Missing sources are either automatically exchanged with an alternative source from the list of available sources for the given data type, or the replacing source is selected.

#### Manual source selection

You can manually select the preferred source. This is useful if you have more than one of the same type of device on the network.

Available sources are listed as shown in the example below. You select active source by ticking the preferred unit.



#### Group selection

The autopilot system can use data sources that all other products on the network use, or select individual sources for the autopilot system.

If the group is set to Simrad, any changes to a source will also affect other systems on the network.

If the group is None, the selected source will be used for the autopilot system only.

In the example below the steering compass is common for all systems on the network.

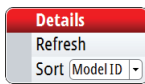
#### Advanced selection

Allows the advanced selection of sources available on the network.

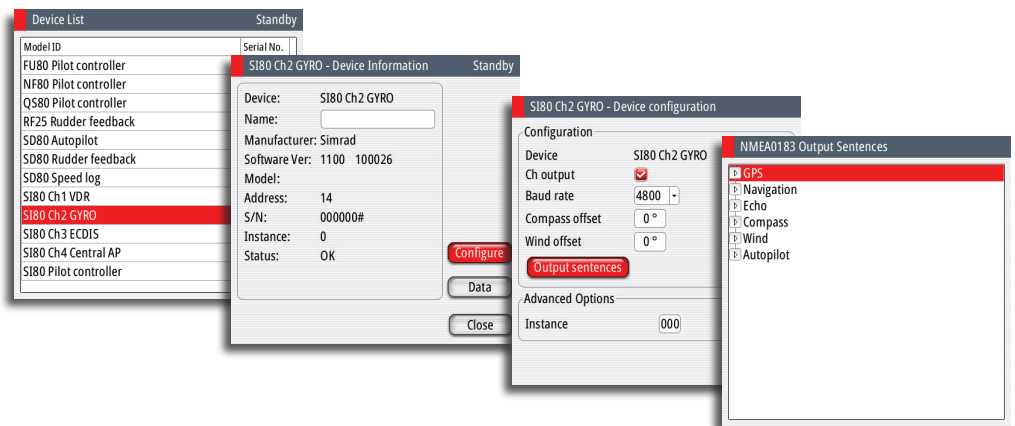
## Device list

From the device list you can:

- list all of the active SimNet and NMEA 2000 devices on the network, showing model description and serial number. Devices can be sorted by model ID or by serial number
- display information relating to a device such as, name, manufacturer, software version, instance, status
- give the device a logical name relevant to the user
- see data coming from the device
- get access to configuration page for the device



- Press the **MENU** key to sort the device list
- Press the **MENU** key, the **STBD** key or the rotary knob to see selected device details.



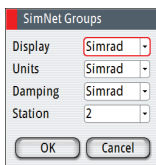
→ **Note:** The graphics show gyro input on an SI80 board. Device details and options depends on data type.

## Diagnostics

The diagnostic page shows details for the NMEA 2000/CAN bus network.

Diagnostics - NMEA 2000		Auto
Bus State:	Bus On	
Rx Overflows:	0	
Rx Overruns:	0	
Rx Errors:	0	
Tx Errors:	0	
Fast packet Errors:	94	
Rx Messages:	791085	
Tx Messages:	19242	
Bus Load:	5.4 %	

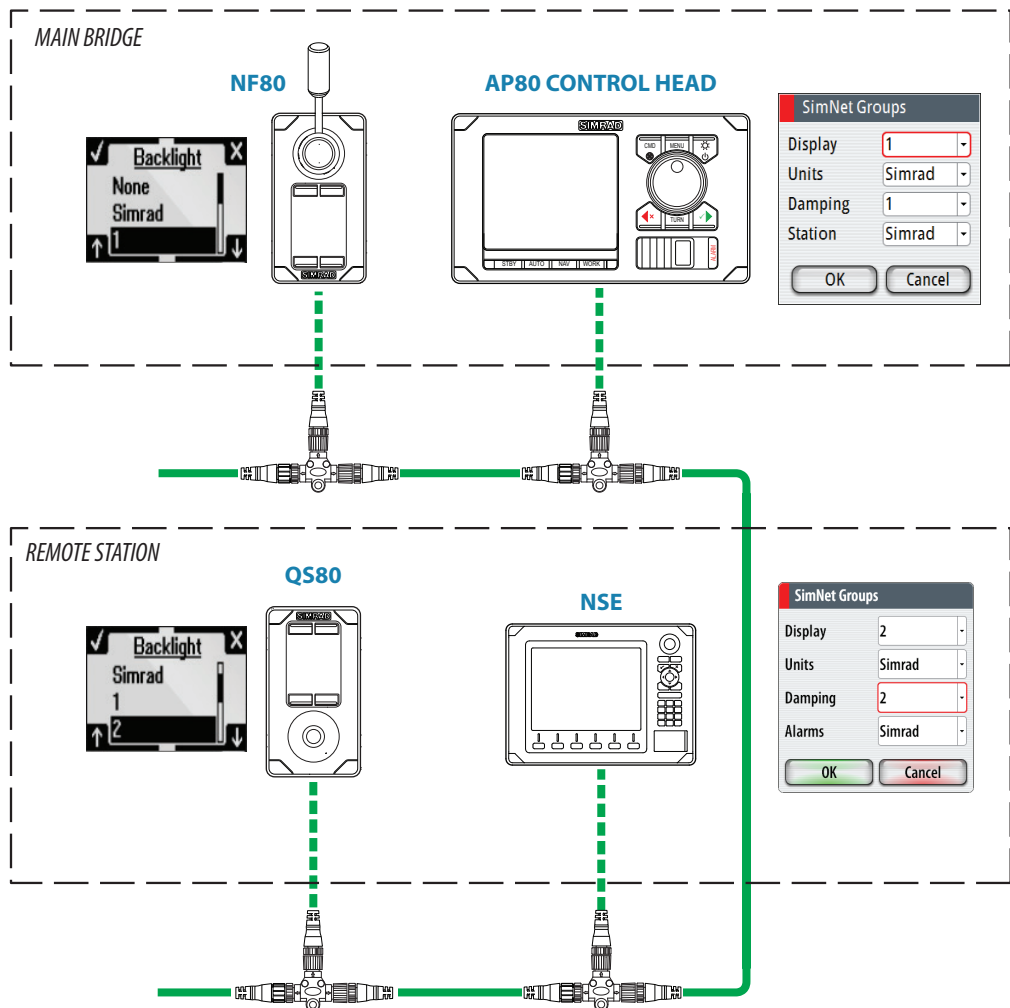
Option	Description
Bus State	Indicates if network backbone is operating. Check power: Check termination
Rx Overflows	Value greater than 0 could indicate the software is very busy and unable to keep up with incoming messages.
Rx Overruns	
Rx Errors	CAN interface error counters. Count up when there are errors on the CAN bus, and down when things are ok. Should normally be 0. Goes bus off when 255 is reached. Check same things as for Bus state if greater than 0 observed
Tx Errors	
Fast packet Errors:	Detected errors since power up. Check the network if this is continually increasing.
Rx Messages	A count since power up of messages received / transmitted.
Tx Messages	
Bus Load	Real time bus load in percentage of max capacity



### SimNet groups

The SimNet Group function is used to control parameter settings, either globally or in groups of units. The function is used on larger vessels where several SimNet units are connected via 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.

The illustration below shows a two station installation. Units on the bridge have their backlight and damping settings in different SimNet Groups from the units in the cockpit. If the back light is adjusted on a display in the cockpit, it will change on all displays in the cockpit. It will not change the light settings on the bridge. If the damping is adjusted on the AP80 control unit, this will also affect damping on the NSE unit in the remote station.





## Master systems

The international standard for heading control systems (ISO 11674/ISO 16329) requires controlled command transfer when remote stations are provided. The delegation of control to the remote station and the return of control shall be incorporated in the autopilot system, and shall avoid unintended operation from a remote station.

To fulfill this requirement the AP70/AP80 system includes a Master function. This is used in larger Wheelmarked systems where you permanently want to control command transfer to remote stations.

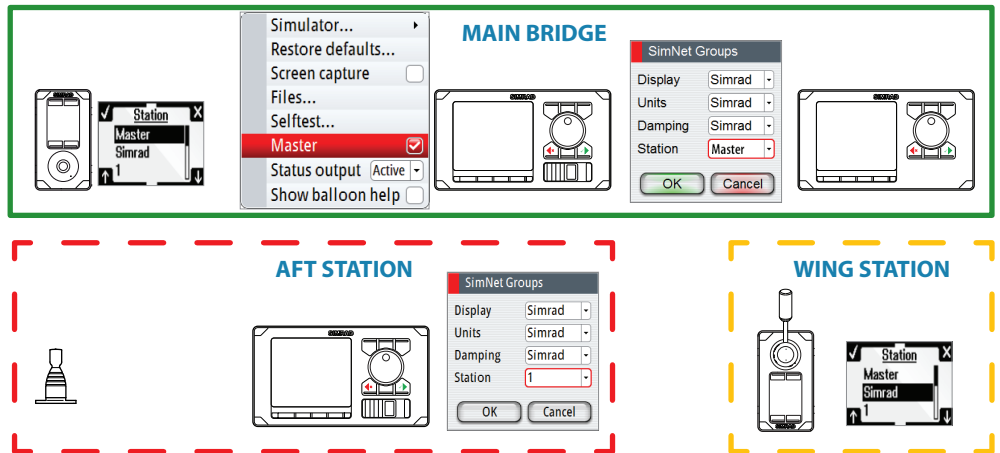
In a Master system, one steering station is defined as the Master station. There can be several control units in a master station, but only one of them can be set as the Master unit.

All units included in the master station will be unlocked, and command transfer within the master group will be as in an open system.

Units not included in the master station will be locked. It is not possible to take command from units outside the master station unless the master control unit opens for this. All units outside the master station will have a lock symbol.

In the illustration below the main bridge is defined as master station. One QS80, one AP80 control unit and one AP70 control unit are included in the master station. The AP80 control unit is defined as the Master unit.

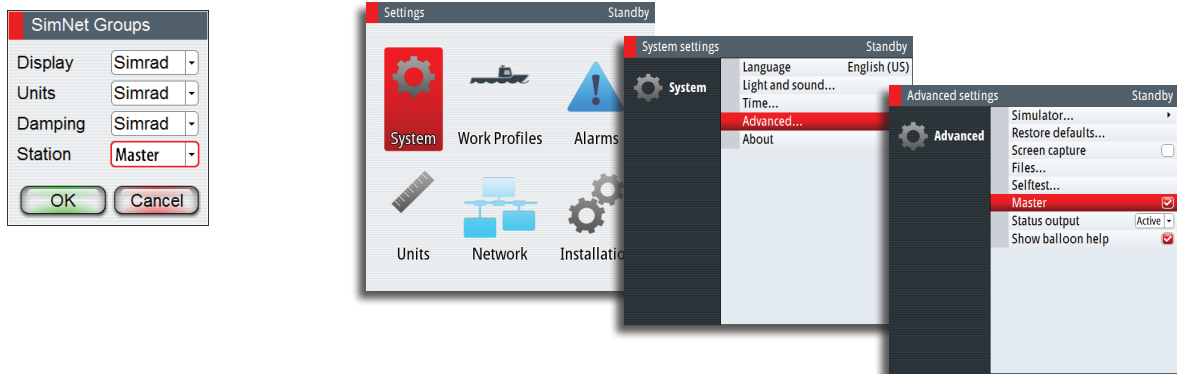
The illustration includes SimNet group settings for each unit, showing how the units are defined as part of different SimNet stations.

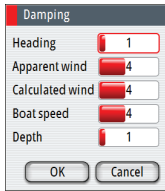


## Defining a Master system

A master station is usually defined and units assigned to the master station during system setup.

➔ **Note:** When a SimNet group Station is set to Master, one control unit in this steering station has to be defined as the Master unit as shown below.





## Damping

Controls how quickly the display updates values from sensors.

Increasing the damping applies more averaging or smoothing of the data update rate on the display.

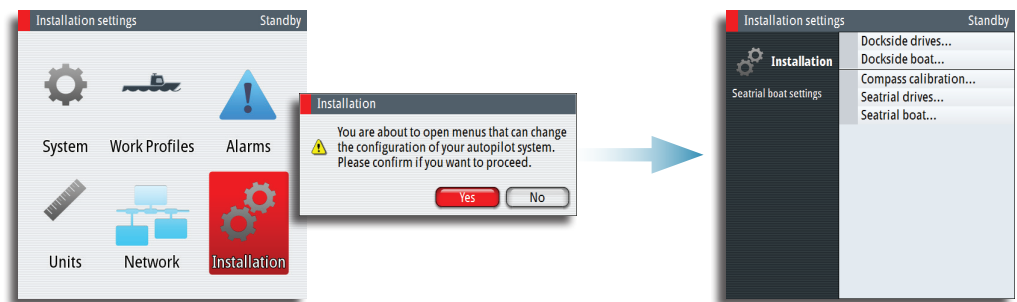
Damping settings are applied to SimNet units belonging to particular damping SimNet Groups.

- **Note:** If the damping factor for heading is high, the captured heading might differ from the heading read on the display when using the heading capture function.

## Installation settings

The installation setup includes dockside and seatrial configuration of drives, together with compass calibration.

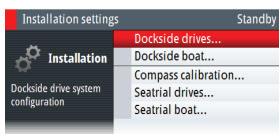
When the autopilot is delivered from factory AND ANY TIME AFTER AN AUTOPILOT RESET HAS BEEN PERFORMED, the installation settings are all reset to factory preset (default) values. A notification will be displayed, and a complete setup has to be made.



- **Note:** The Installation settings can only be accessed in **STBY** mode.

**⚠ Warning:** The installation settings must be performed as part of the commissioning of the autopilot system. Failure to do so correctly may prohibit the autopilot from functioning properly!

- **Note:** The seatrial settings are dependent on successful completion of the dockside settings.








## Dockside - Drive system

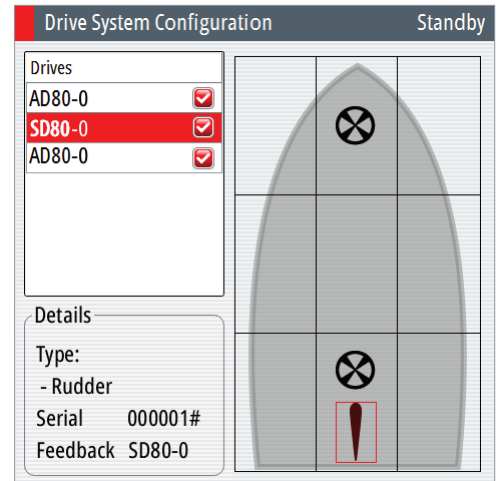
Drive units must be configured and calibrated before they can be used.

The drive system configuration dialog lists all drive units available on the network. The details field includes drive type, serial number and source name.

When the drive configuration is completed this is indicated with a tick after the drive name. The dialog will not illustrate drive type and location before the drive location and type is defined.

The following symbols are used to illustrate drive type:

	Tunnel thruster
	Azimuth
	Voith Schneider
	Rudder
	WaterJet

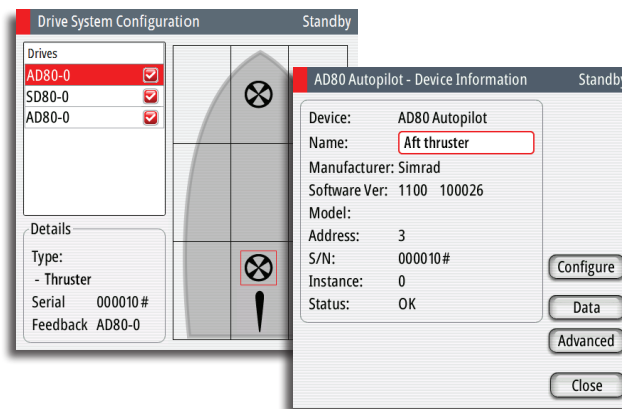


The figure shows a completed commissioning for a vessel with one rudder driven by an SD80 board, one solenoid operated tunnel thruster and one analog tunnel thruster operated by two different AD80 boards.

### Configuring the drive system

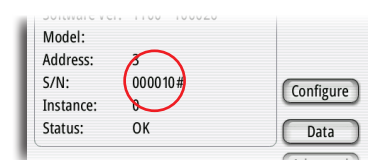
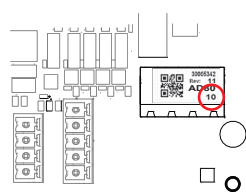
The drive system configuration is accessed from the drive system configuration dialog.

1. Select the drive to be configured, and press the rotary knob or the **MENU** key to proceed to the device information dialog

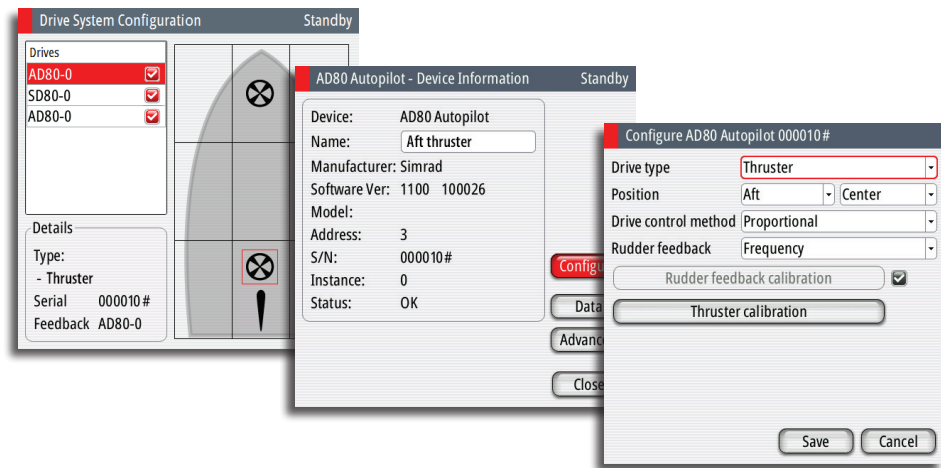


2. Enter a descriptive name for the device (e.g. Aft thruster)
  - If two identical boards are used, they are identified by the serial number. This number is found in the device information dialog on a tag on the SimNet plug on the board

→ **Note:** The label below is an example only and varies with board type.

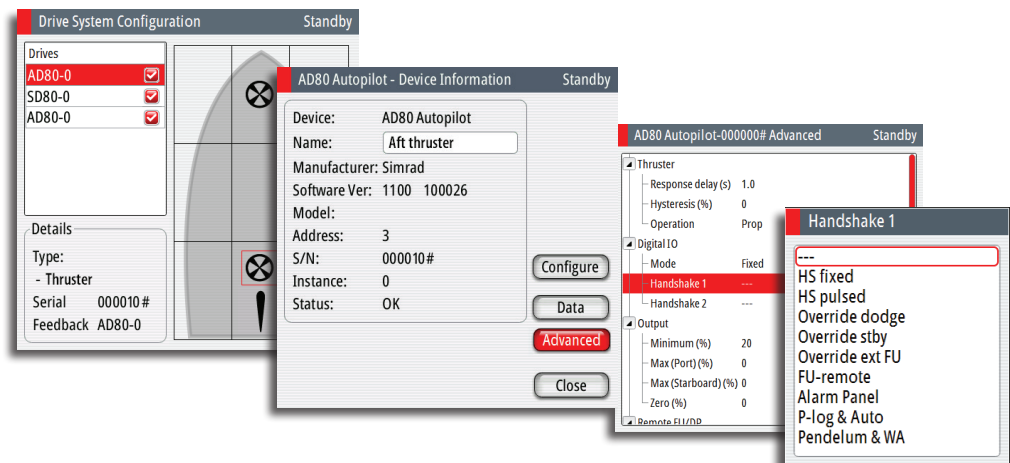


3. Select the Configure option to proceed to device configuration dialog. The dialog differs slightly for the different drive types



4. Select relevant settings for the selected drive, and save your settings

### Configuring the handshake



### Pendulum feature

The pendulum feature is intended for pendulum ferries where it is required to turn the heading 180° when the vessel is going «backwards».

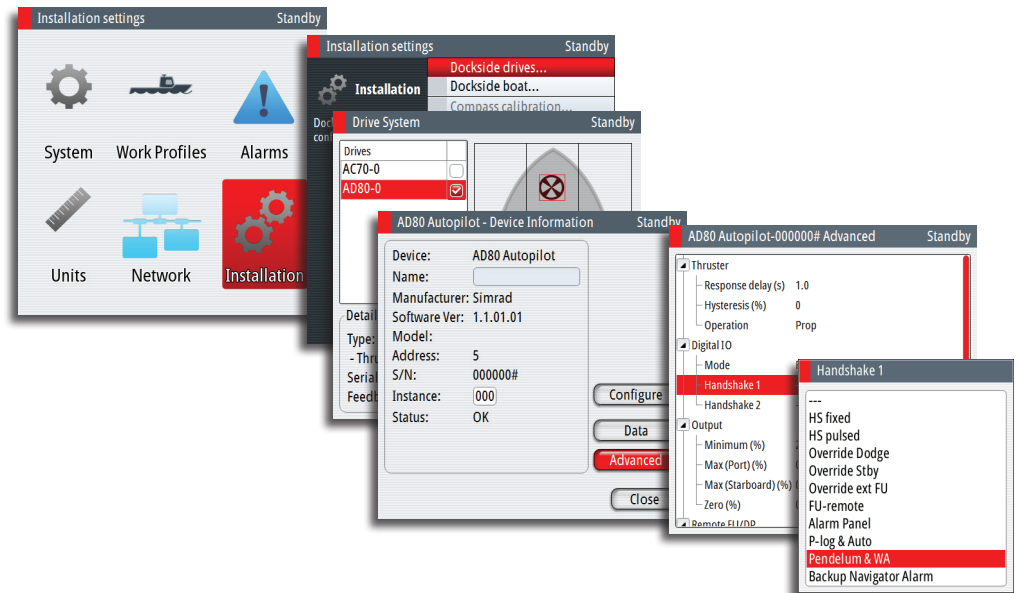
The feature can be included in AP70/80 systems equipped with SD80 or AD80 boards. It can only be used for NMEA 0183 heading sensors, RC42 and CDI80.

The function is activated by using an external switch. When the contact is closed the system will add 180° to the heading received on the NMEA 0183 interface on SI80 and AC70. The heading is changed before heading data enters the CAN bus network, and all instruments on the bus will pick up the modified heading.

### Configuration

The AP70/AP80 must be configured for the pendulum function as shown below.

Select Pendulum & WA for handshake 1 or 2, depending on physical connection of external switch.



### Handshake settings overview

Handshake setting	Function	Description
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
HS pulse	Autopilot/steering gear interface with pulse signals	Output contact is closed for 1 sec 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 <b>AUTO</b>	When input contact is closed, autopilot will give override warning, acknowledge with closed output contact and go to <b>STBY</b> mode. When input opens, output contact will open and autopilot returns to <b>AUTO</b> mode on present heading. Typically used for joystick hand steering with override button on top.  → <b>Note:</b> must be limited to one autopilot computer board
Override <b>STBY</b>	Manual override to <b>STBY</b>	When input contact is closed, autopilot will give override warning, acknowledge with closed output contact and lock to <b>STBY</b> 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.  → <b>Note:</b> Must be limited to one autopilot computer board
Override ext <b>FU</b>	Unconditional external FU/DP control	When input contact is closed, autopilot will respond with closed output, display "External" and use the installed current or voltage input to the <b>RUD UI</b> plug of <b>SD80/AD80</b> board for follow up rudder control.  → <b>Note:</b> Must be limited to one autopilot computer board

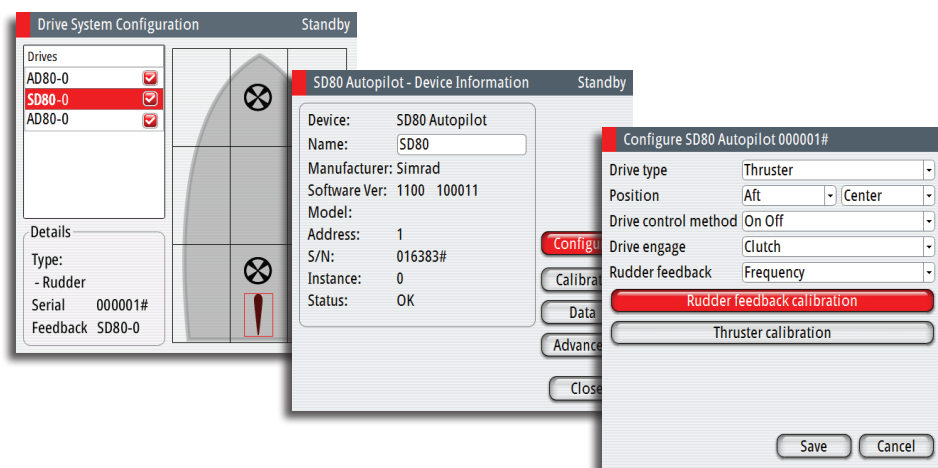
Handshake setting	Function	Description
FU-remote	External FU/DP control by command transfer	When input contact is closed, a command transfer dialogue is started (refer Command transfer description in the AP70/AP80 Operator Manual). When accepted, the output contact will close and use the installed current or voltage input to the <b>RUD UI</b> plug of SD80/AD80 board for follow up rudder control. Output will open if control is taken from another unit again.
Alarm panel	Interface to central alarm panel with direct I/O	Refer "Central alarm panel with direct I/O interface on page 33 ???
P-log & Auto	Pulse log input, auto mode output	If a pulse log of 200 p/NM to the input, it will show up as a speed source on the CAN network. The output will be a closed contact whenever the autopilot is in <b>AUTO, NoDrift</b> or <b>NAV/TRACK</b> mode. The signal can be used for reducing oil flow to rudder, watch alarm activate etc.
Pendulum & WA		If input signal is closed, steering and monitor compass will be offset by 180°. Output contact will close for 0.5 sec when active control unit is operated. Can be used for watch alarm systems that require information about operation of equipment.

### Rudder feedback/tunnel thruster feedback calibration

If a rudder or thruster feedback is available, this must be calibrated. This is required for the autopilot to know signal for mid-position, port/starboard side and rudder movement range.

→ **Note:** The graphics below shows the dialog when the rudder is controlled by an SD80. The configuration dialog varies with drive device and drive type.

1. Select feedback calibration option in the device configuration dialog

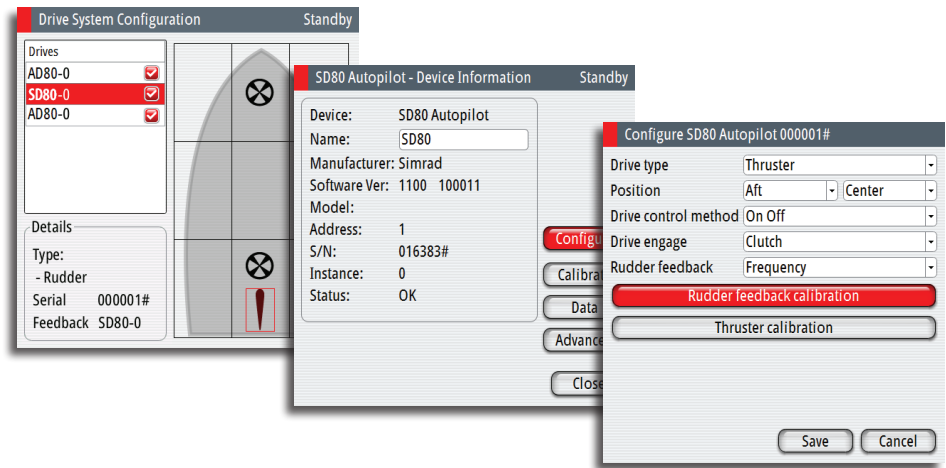


2. Follow the guided steps through the calibration process
3. Save the settings when completed

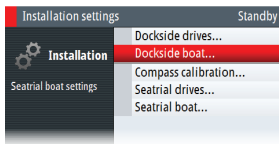
### Drive test/calibration

When the drives are configured and calibrated, the autopilot need to know drive output level for standstill, polarity for port/stbd movement, the speed/signal- level relationship and max signal levels allowed. This is learned during the drive test or drive calibration.

1. Select test option in the device configuration dialog



2. Follow the guided steps through the testing process
  3. Save the settings when completed
- **Note:** When a rudder feedback signal is set in the configure view, the feedback must always be calibrated before drive test or drive calibration is allowed.

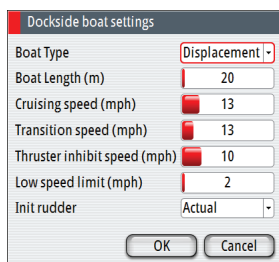


## Vessel configuration

- **Note:** The unit of measurement in the dialog reflects your unit settings.

### Boat type

The boat type setting is used by the system to select appropriate preset steering parameters. It will also affect available autopilot features.



### Boat length

The boat length affects the steering parameters.

- Rang: 5 - 500 (m)

### Cruising speed

The cruising speed is used if no speed info is available, and if manual speed is set to Auto. It is also used by the autopilot system to calculate steering parameters.

- Rang: 2 - 50 (kn)
- Default: 15 (kn)

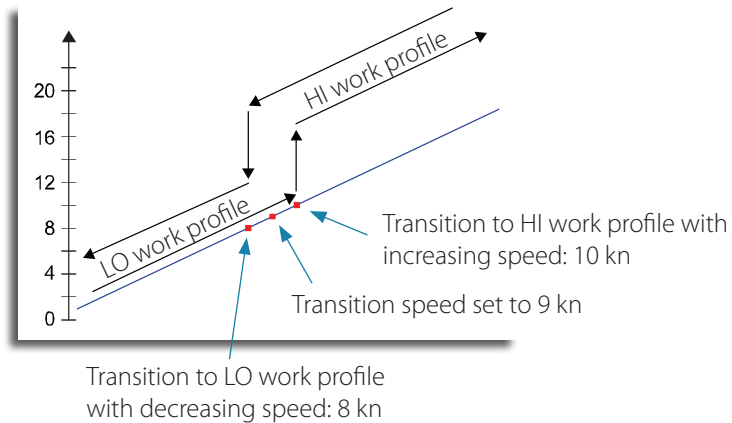
### Transition speed

- **Note:** Only available if the boat type is set to planing.

The transition speed is the speed at which the system automatically changes from LOW to HIGH work profile.

These two work profiles are automatically defined when you set the boat profile to planing. The work profiles are set up with high and low speed parameters to control the different steering characteristics before and after planing.

On power boats it is recommended that you set a value that represents the speed where the hull begins to plane or the speed where you change from slow to cruising speed.



- Rang: OFF - 40 (kn)
- Default: OFF

#### Thruster inhibit speed

This feature 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.

When the speed exceed the set limit the truster indication will change as shown below.

<i>Thruster(s) in use</i>	<i>Thrusters unavailable when speed exceed inhibit limit</i>

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

- Rang: 1 - 40 (kn)
- Default: 6 (kn)

#### 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.

- Range: 1 - 20 (kn)
- Default: 1 (kn)

#### Init rudder

Defines how the system moves the rudder when switching from power steering to an automatic mode:

- Midships moves the rudder to zero position.
- Actual maintains the rudder offset, and use this as trim value (bumpless transfer)

→ **Note:** Actual is only available with rudder feedback signal available.

- Default: Midships



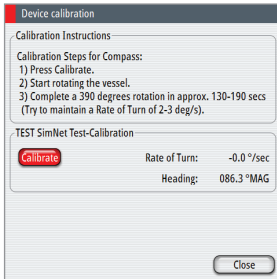
## Seatrials

### Compass calibration

All magnetic compasses must be calibrated as part of the autopilot seatrial procedure.

Before the compass calibration is started, make sure that there is enough open water around the vessel to make a full turn.

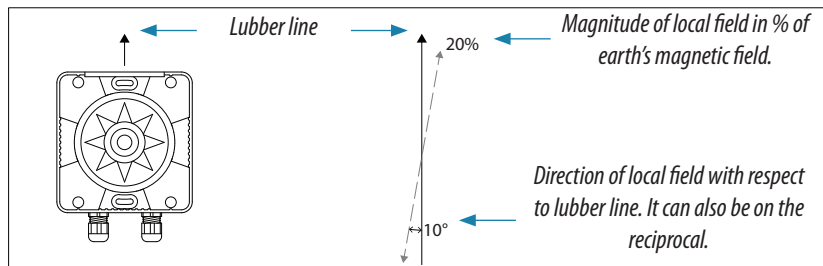
The calibration should be done in calm sea conditions and with minimal wind to obtain good results. Follow the on-screen instruction, and use about 60-90 seconds to make a full circle.



1. Start the calibration by selecting the Calibrate button in the device calibration dialog
2. Follow the online instructions

During the calibration, the compass will measure the magnitude and direction of the local magnetic field.

- If the local magnetic field is stronger than the earth's magnetic field (the local field is reading more than 100%), the compass calibration will fail
- If the local field is reading more than 30%, you should look for any interfering magnetic objects and remove them, or you should move the compass to a different location. The (local) field angle will guide you to the local interfering magnetic object.



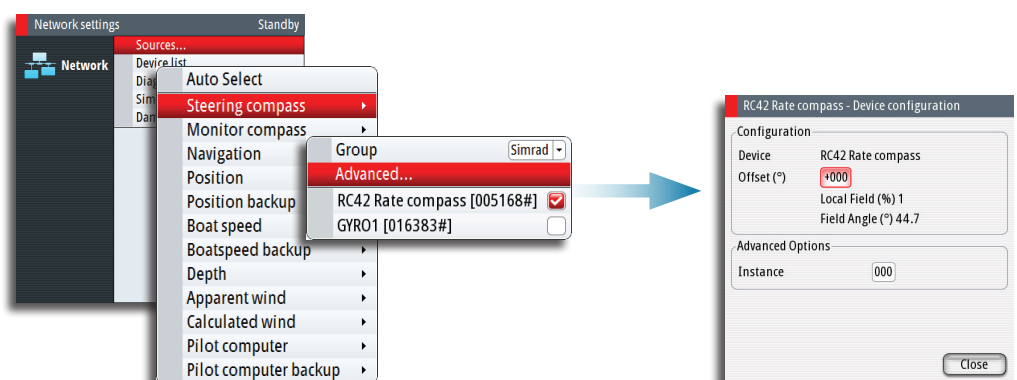
→ **Note:** Calibration must be made on the compass that is active for the autopilot. If another model compass from Simrad or another manufacturer is installed, refer to the calibration instruction for that compass.

→ **Note:** In certain areas and at high latitudes the local magnetic interference becomes more significant and heading errors exceeding  $\pm 3^\circ$  may have to be accepted.

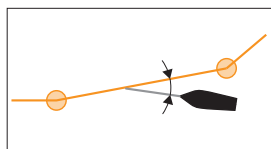
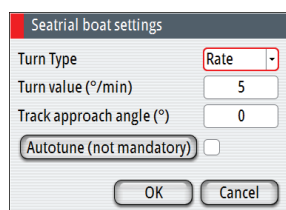
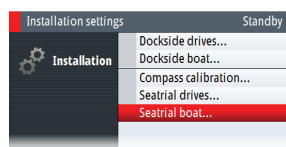
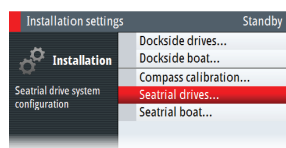
### Compass mounting offset

The difference between the compass lubber line and the boat's center line should be compensated for.

1. Find the bearing from the boat position to a visible object. Use a chart or a chart plotter
2. Steer the boat so that the center line of the boat is aligned with the bearing line pointing towards the object
3. Activate the device configuration dialog as shown below
  - Ensure that the active compass is selected
4. Change the offset parameter so that the bearing to the object and the compass readout becomes equal



- **Note:** Make sure that both the compass heading and the bearing to the object have the same unit (Magnetic or True).



## Drive configuration

The drive setup can usually be done while at dock, and only minor adjustments may be required at seatrial.

Refer "Dockside - Drive system" on page 58.

## Boat settings

These settings are used as initial values for the vessel. Each of them can be changed in the different work profile settings.

### Turn type and Turn value

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
- Default: Rate
- Initial value: Determined during sea trial

### Track approach angle

Defines the angle used when the vessel is approaching a leg.

This setting is used both when you start navigating and when you use track offset.

- Range: 5° - 60°
- Default: 30°

## Tuning the autopilot for optimum steering performance

Providing you have entered correct vessel type, length and cruising speed, you may not have to perform further manual- or automatic tuning. Refer "Vessel configuration" on page 63.

### → Notes:

- If steering compass is magnetic type, perform any autopilot tuning steering East or West, as this will yield the best-balanced parameters
- The speed during tuning should be as close as possible to cruising speed. Ensure that this is set correctly and as described in "Vessel configuration" on page 63
- Active work profile that should be used during seatrial depends on vessel type.
  - For displacement boats **NORMAL** work profile should be used
  - Planing boats will have to tune both **LO SPD** and **HI SPD** work profiles
- All tuning should always be performed in open waters at a safe distance from other traffic

### Initial automatic learning process

Before doing any manual or automatic tuning the autopilot needs to learn the turn characteristic of the boat. This is done in **AUTO** mode by making a major course change (min 90°) to port and starboard. For this test you may use the U-turn function (180°).

The autopilot will now find the appropriate amount of rudder to maintain the set turn rate during the turn. See also "Turn type and Turn value" on page 66.

When the automatic learning process is done, now 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 example “Manual tuning” on page 67)

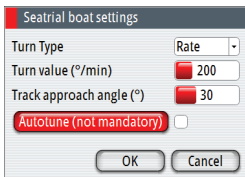
If the autopilot is not keeping the heading satisfactorily or not making the turns satisfactorily, you may now either try the Autotune function or go directly to Manual tuning.

- **Note:** If the vessel is more than approximately 30 m/100 ft it may be unpractical to perform Autotune, and it is suggested to proceed with manual tuning.

Both Autotune and Manual tuning should be performed in calm or moderate sea conditions.

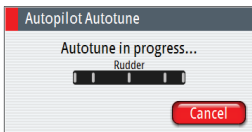
### Autotuning

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 and Counter rudder). The scaling factors for the parameters are set automatically as a function of the set boat type.



1. Stabilize the vessel on a heading
2. Set the speed is as close to cruising speed as possible
3. Start autotuning from the dialog
  - The pilot will take control of the vessel. Autotuning may take up to 3 minutes to complete

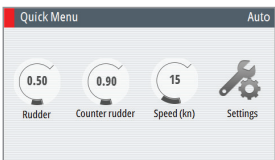
After the autotuning is completed the autopilot will return to **STBY** mode, and the rudder must be controlled manually.



- **Note:** Autotuning can be stopped at any time by selecting **Cancel**.

### Manual tuning

1. Stabilize the vessel on a heading, and then select **AUTO** mode
2. Set the speed as close to cruising speed as possible
3. Activate the Quick menu by pressing the **MENU** key
4. Select **Rudder** and adjust according to the description below
5. If required, adjust slightly **Counter** rudder



#### Rudder

This parameter determines the ratio between commanded rudder and the heading error. The higher rudder value the more rudder is applied.

- A. The the value is set too high. Steering becomes unstable and often the overshoot will increase
- B. Rudder 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



- Range: 0.05 - 4.00
- Default: Defined by system based on boat type and length

#### Counter rudder

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

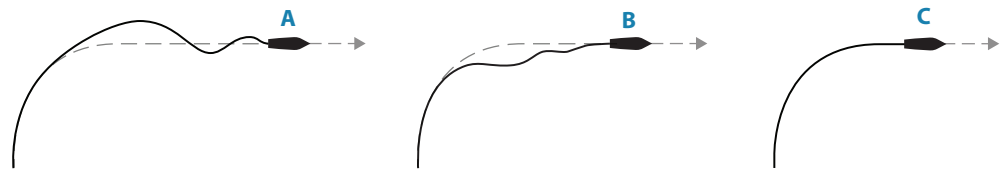
The settings depends on vessel's characteristics, loaded/ballast conditions and rate of turn.

- If the vessel has good dynamic stability, relatively small settings will be sufficient

- An unstable vessel will require high settings
  - The greater the vessel's inertia, the greater value will be required
- Increasing counter rudder settings may result in some higher rudder activity also when steering a straight course.

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 too low; overshoot response
- B.** Counter rudder too high; sluggish and creeping response
- C.** Correct setting or 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 illustration C below.

- **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 sluggish response to the other.

- Range: 0.05 - 32.00
- Default: Defined by system based on boat type and length

# 10

## List of display abbreviations

---

The following tables holds a list of abbreviations used in the autopilot display. For further information see “The operational modes” on page 20.

BWW	Bearing Waypoint to Waypoint
COG	Course Over Ground
CRS	Course
CTS	Course To Steer
DTW	Distance To Waypoint
HDG	Heading
MAN	Manual (speed input)
SOG	Speed Over Ground
STW	Speed Through Water
WPT	Waypoint (followed by waypoint name)
XTD	Cross Track Distance







**SIMRAD**

