SIMRAD

AP™ 44

Operator Manual

ENGLISH

www.simrad-yachting.com

Contents

1 Introduction

The AP44 is a networked autopilot display and control unit.

The unit is compatible with a range of Navico autopilot computers.

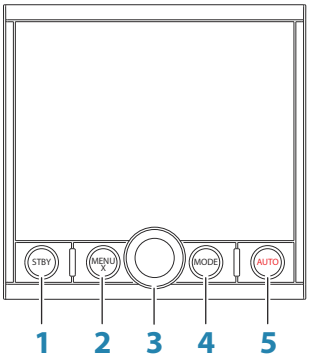
The AP44 systems include several modules that need to be mounted in different locations on the vessel and that need to interface with at least three different systems on the boat:

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

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

- Mechanical installation and wiring of all units. Refer to separate documentation for the units
- Software setup of the system. Refer to *"Software setup"* on page 30
- Commissioning and setup of the autopilot computer. Refer to the installation and commissioning documentation for your autopilot computer

Front panel and keys



1 STBY key
Press to turn the autopilot to Standby mode.

2 MENU/X key
With no menu active:
- Press to display the Settings menu
- Press and hold to display the Display setup dialog

Menu and dialog operation:
- Press to return to previous menu level or to exit a dialog

3 Rotary knob
Menu and dialog operation:
- Turn to move up and down in menus and dialogs
- Turn to adjust a value
- Press to select a menu option and to enter the next menu level

In STBY mode:
- Press to select FU mode

In FU mode:
- Turn to set rudder angle

In AUTO, NoDrift and Wind mode:
- Turn to change set heading/set course/set wind angle

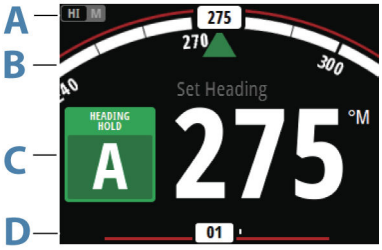
4 MODE key
Press to display the Mode list

5 AUTO key
Press to turn the autopilot to AUTO mode

The autopilot page

The content of the autopilot page varies with active mode. All modes include:

- Response/ Profile mode (depending on connected autopilot computer) (**A**)
- Heading indicator, analog and digital (**B**)
- Autopilot mode indication (**C**)
- Rudder indicator, analog and digital (**D**)



For more information, refer to the separate mode descriptions and to the *"Terms and abbreviations"* on page 48.

2 Basic operation

Safe operation with the autopilot

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

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

Do not use automatic steering when:

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

When using an autopilot:

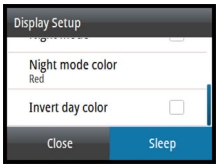
- Do not leave the helm unattended
- Do not place any magnetic material or equipment near the heading sensor used by the autopilot system
- Verify at regular intervals the course and position of the vessel
- Always switch to Standby mode and reduce speed in due time to avoid hazardous situations

Turning the unit on and off

The unit has no power key, and it will be running as long as power is connected to the NMEA 2000 network backbone.

First time startup

When the unit is started for the first time and after a factory reset, the unit displays a setup wizard. Respond to the setup wizard prompts to select some fundamental setup options. These settings can later be changed and further configuration made as described in *"Software setup"* on page 30.

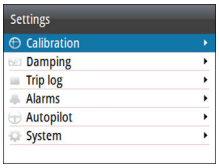


Sleep mode

In Sleep mode, the backlight for screen and keys are turned off to save power. The system continues to run in the background.

You select Sleep mode from the Display setup dialog, activated by pressing and holding the **MENU** key. Switch from Sleep mode to normal operation by a short press on the **MENU** key.

Operating the menu system

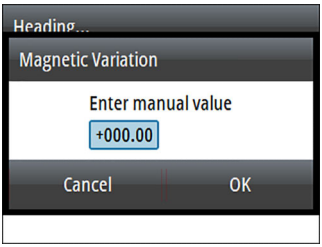


All settings and configuration in the unit are available from the Settings menu, activated by pressing the **MENU** key.

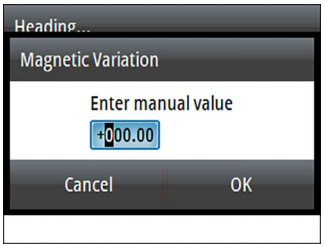
- Turn the Rotary knob to move up and down in the menus and in the dialogs
- Confirm a selection by pressing the Rotary knob
- Return to previous menu level by pressing the **MENU** key

Edit a numeric value

1. Turn the Rotary knob to select the entry field
2. Press Rotary knob to turn the field into edit mode
   - The left digit starts flashing
3. Turn the Rotary knob to set the value for the flashing digit
4. Press the Rotary knob to move focus to the next digit
5. Repeat step 3 and 4 until all digits are set
6. Press the Rotary knob to leave edit mode for the selected field
7. Turn the Rotary knob to select the Cancel or Save buttons, then press the Rotary knob to confirm your selection and to close the dialog



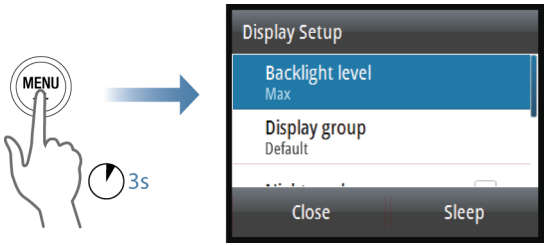
Selected field



Field in edit mode

→ ***Note:*** You can at any time press the **MENU** key to leave a dialog without saving the entries.

Display setup



The display setup can be adjusted at any time from the Display setup dialog, activated by pressing and holding the **MENU** key.

The following options are available:

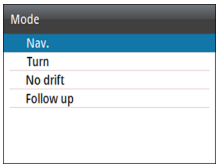
- Backlight level: Adjusts the backlight level from Min (10%) to Max (100%) in 10% increments
  - When the Backlight level field is active, subsequent presses on the **MENU** key adjusts backlight level in decrements of 30%
- Display group: Defines which network group the unit belongs to
- Night mode: Activates/deactivates the night mode color palette
- Night mode color: Sets the night mode color palette
- Invert day color: Changes the background color for the pages from default black to white
- Sleep: Turns the backlight for screen and keys off to save power

➔ ***Note:*** All changes made to the display setup will apply to all units belonging to the same display group. For more information about network groups, refer to *"Network groups"* on page 39.

3 Autopilot modes

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

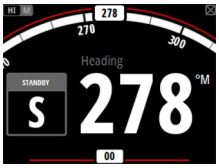
Selecting an autopilot mode



You select Standby mode and AUTO mode by pressing the dedicated **STBY** and **AUTO** keys.

You select other modes and automatic features by selecting the relevant option from the Mode list, activated by pressing the **MODE** key.

Standby mode



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

- Switch to Standby mode by pressing the **STBY** key.

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

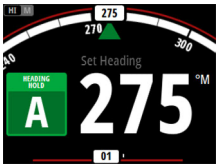
Follow-up (FU) mode

In FU mode you turn the rotary knob to adjust the set rudder angle.

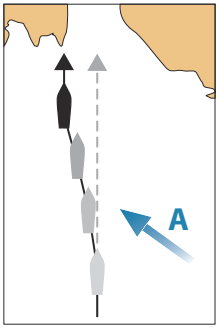
The rudder will move to the commanded angle and then stop.

- Switch to FU mode from any mode by selecting the Follow-up option in the Mode list, or switch directly from Standby mode to FU mode by pressing the rotary knob.

AUTO mode (Heading hold)



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



- Switch to AUTO mode by pressing the **AUTO** key. When the mode is activated, the autopilot selects the current boat heading as the set heading.

Changing set heading in AUTO mode

You adjust the set heading by turning the rotary knob.

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

Tacking and Gybing in AUTO mode

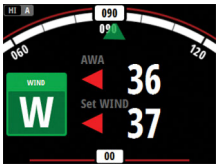
→ ***Note:*** Only available when the boat type is set to SAIL.

Tacking and Gybing in AUTO mode uses the heading as reference. The tacking/gybing operation changes the set heading to port or starboard with a fixed angle.

The tacking parameters are set in the Setup/Sailing parameters: The **Tack angle** defines the tacking angle, while the **Tack time** defines the rate of turn during the tack/gybe. Refer to *"Autopilot settings"* on page 36.

- Initiate the Tack or Gybe function by selecting the **Tack/Gybe** option in the Mode list.
  - The turn is started when the direction is selected in the dialog.

Wind mode



→ ***Note:*** Wind mode is only available when the boat type is set to SAIL. It is not possible to activate wind mode if wind information is missing.

When wind mode is engaged, the autopilot captures the current wind angle as steering reference, and adjusts the heading of the boat to maintain this wind angle.

Prior to entering wind mode the autopilot system must be operating in AUTO mode and with valid input from the wind transducer.

- Switch to Wind mode by selecting the Wind option in the Mode list

> ⚠ Warning: In wind mode the autopilot steers to the apparent or true wind angle and not to a compass heading. Any wind shift could result in the vessel steering on an undesired course.

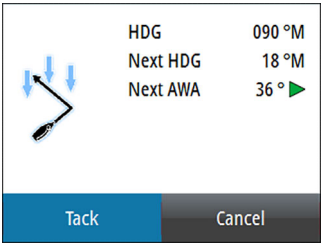
Tacking and Gybing in Wind mode

Tacking and Gybing in Wind mode can be performed when sailing with apparent or true wind as the reference. In either case the true wind angle must be less than 90 degrees (tacking) and more than 120° (gybing).

The tacking/gybing operation will mirror the set wind angle on the opposite tack.

The rate of turn during the tack/gybe is set by the **Tack time** in the Setup/Sailing menu. Refer to *"Autopilot settings"* on page 36.

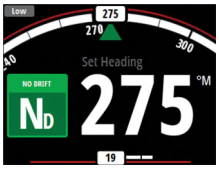
- Initiate the Tack or Gybe function by selecting the **Tack/Gybe** option in the Mode list.
- Confirm the tack/gybe in the dialog.



→ ***Note:*** The autopilot will temporarily add a 5 degree bear-away on the new tack to allow the boat to pick up speed. After a short period the wind angle will return to the set angle.

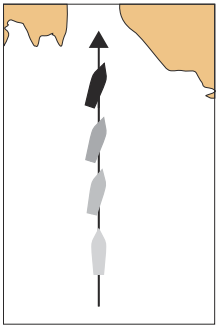
→ ***Note:*** If the Tack/Gybe is not confirmed the dialog will close after 10 seconds, and the requested tack/gybe will not be initiated.

NoDrift mode



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

In NoDrift mode the vessel is steered along a calculated track line, from present position and in a direction set by the user. If the vessel is drifting away from the track line due to current and/or wind (**A**), the vessel will follow the line with a crab angle.



Prior to entering NoDrift mode the autopilot system must be operating in AUTO mode and with valid input from GPS and heading sensor.

- Switch to NoDrift mode by selecting the **NoDrift** option in the Mode list
  - The autopilot will draw an invisible track line based on current heading from the vessel's position

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

Changing set course in NoDrift mode

You adjust the set course by turning the rotary knob.

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

Dodging

→ ***Note:*** Only available for AC12N/AC42N autopilot computers.

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

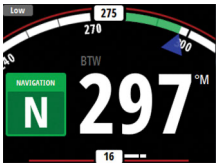
If you return to NoDrift mode within 60 seconds you can select to continue on previous set bearing line.

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

Heading capture

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

NAV mode



→ ***Note:*** NAV mode requires a compatible chartplotter connected to the network.
It is not possible to select NAV mode if heading information is missing, or if steering information is not received from the external chartplotter.

⚠ Warning: NAV mode should only be used in open waters. Navigation mode must not be used while sailing, as course changes may result in unexpected tacks or gybes!

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

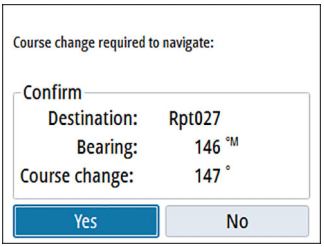
In NAV mode, the autopilot's heading sensor is used as heading source for course keeping. Speed information is taken from SOG or from selected speed sensor. The steering information received from the external chartplotter alters the set course to direct the vessel to the destination waypoint.

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

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

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

- Initiate NAV mode by selecting the **NAV** option in the Mode list
- Confirm to switch to NAV mode in the dialog.

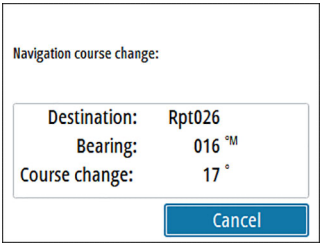


Turning in NAV mode

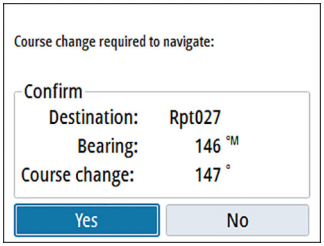
When your vessel reaches a waypoint, the autopilot will give an audible warning and display a dialog with the new course information.

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

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



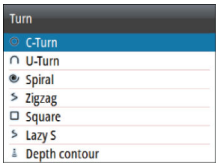
Course change less than set limit



Course change larger than set limit

The limit for automatic course change is set during commisioning of the autopilot computer. For more information refer to *"Autopilot settings"* on page 36.

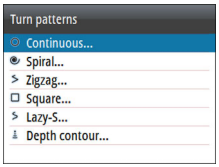
Turn pattern steering



The system includes a number of automatic turn steering features when the autopilot is in AUTO mode.

→ ***Note:*** Turn pattern steering is not available if the boat type is set to Sail. Instead the tack/gybe feature is implemented.

Turn variables



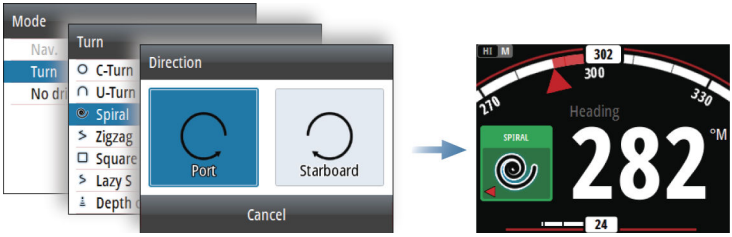
All turn patters, except the U-turn, have settings that you adjust before you start a turn or at any time when the boat is in a turn.

The turn settings are available from the Autopilot settings dialog. The variables are described for each turn pattern option in the following pages.

Starting and stopping a turn

→ ***Note:*** For starting a DCT turn, see *"Depth contour tracking (DCT)"* on page 23.

You start the turn by selecting the turn option in the Mode list, followed by selecting the port or starboard options in the turn dialog to select the turn direction.



You can at any time stop the turn by pressing the **STBY** key to return to Standby mode and manual steering.

C-turn (Continuous turn)

Steers the vessel in a circle.

- Turn variable:
  - Rate of turn. Increasing the value makes the vessel turn a smaller circle.

U-turn

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

The turn rate is set during commisioning of the autopilot computer. For more information refer to *"Autopilot settings"* on page 36.

Spiral turn

Makes the vessel turn in a spiral with a decreasing or increasing radius.

- Turn variables:
  - Initial radius
  - Change/turn. If this value is set to zero, the boat will turn in a circle. Negative values indicate decreasing radius while positive values indicate increasing radius.

Zigzag turn

Steers the vessel in a zigzag pattern.

- Turn variables:
  - Course change (**A**)
  - Leg distance (**B**)

Square turn

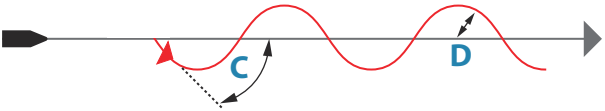
Makes the vessel automatically turn 90° after having travelled a defined leg distance.

- Turn variable:
  - Leg distance

S-turn

Makes the vessel yaw around the main heading.

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

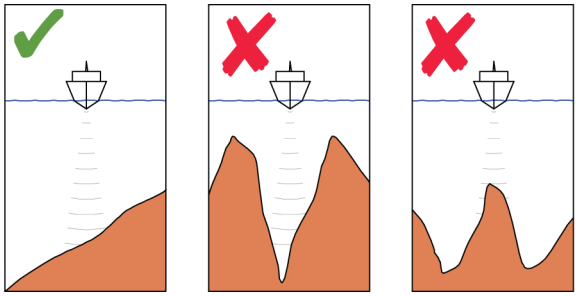


Depth contour tracking (DCT)

Makes the autopilot follow a depth contour.

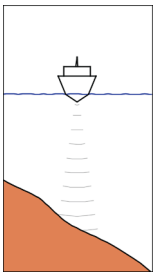
→ ***Note:*** DCT turn pattern is only available if the system has a valid depth input.

⚠ Warning: Do not use the DCT turn pattern unless the seabed is suitable. Do not use it in rocky waters where the depth is varying significantly over a small area.

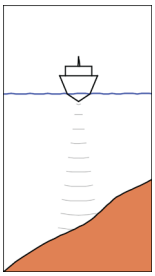


To initiate a DCT turn:

- Ensure that you have depth reading on the panel or on a separate depth instrument
- Steer the boat to the depth you want to track, and in the direction of the depth contour
- Activate AUTO mode, then select depth contour tracking while monitoring the depth reading
- Select the port or starboard option in the turn dialog to initiate the depth contour steering to follow the bottom sloping to starboard or to port



Port option
(depth decreases to port)

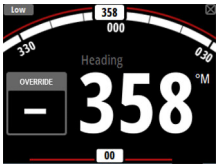


Starboard option
(depth decreases to starboard)

- Turn variables:
  - Depth gain. This parameter determines the ratio between commanded rudder and the deviation from the selected depth contour. The higher depth gain value the more rudder is applied. If the value is too small it will take a long time to compensate for drifting off the set depth contour, and the autopilot will fail to keep the boat on the selected depth. If the value is set too high the overshoot will increase and the steering will be unstable.
  - CCA. The CCA is an angle that is added to or subtracted from the set course. With this parameter you can make the boat yaw around the reference depth with s movements. The larger the CCA the bigger yawing will be allowed. If the CCA is set to zero there is no S-ing.
  - Ref. depth. This is the reference depth for the DCT function. When DCT is initiated the autopilot reads the current depth and set this as the reference depth. The reference depth can be changed when the function is running.

→ ***Note:*** If depth data is lost during DCT the autopilot will automatically switch to AUTO mode.
It is recommended to turn ON the AP Depth Data Missing alarm when using DCT. When this alarm is activated an alarm will be raised if the depth data is lost during DCT.

Using the autopilot in an EVC system



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

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

The autopilot goes into standby mode if no rudder command is given from the EVC system within a predefined period.

SteadySteer

The SteadySteer feature allows you to control how the autopilot system reacts to manual steering.

When enabled:

- Manual steering overrides theactive mode.
- If Auto mode or NoDrift mode was active before going into manual steering, they will automatically re-engage when the vessel has stabilized on a new course.
- If NAV mode was active before going into manual steering a dialog will be shown.
  - Confirm course change to reactivate NAV mode.
  - Cancel the course change to activate Auto mode on the new heading.
  - If no action is taken the autopilot will go into Standby mode.

For any other modes, the autopilot goes into Standby mode.

When disabled:

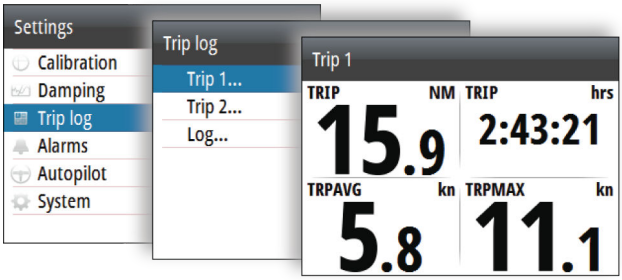
- Manual steering overrides the active mode.
- Independent of modes, the autopilot goes into Standby mode.

Refer to the documentation for your autopilot computer for more information.

4

Trip log

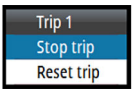
The Trip log is available from the Settings menu.



There are three log options available:

- Trip 1: records distance traveled through the water (Log input)
- Trip 2: records distance traveled via GPS input
- Log: shows total distance run from system installation or from a system restore

→ ***Note:*** Trip 1 requires correctly calibrated boat speed for accurate trip records.
Trip 2 requires a compatible GPS connected to the network.



You start, stop and reset the active Trip log from the menu, activated by pressing the rotary knob.

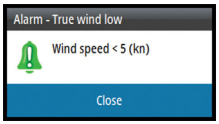
5 Alarms

The system continuously checks for dangerous situations and system faults while the system is running. The alarm system can be activated if any alarm settings are exceeded.

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

Alarm indication

An alarm situation is indicated with an alarm pop-up. If you have enabled the siren, the alarm message is followed by an audible alarm.



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

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

Type of messages

The messages are classified according to how the reported situation affects your vessel. The following color codes are used:

Color	Importance
Red	Critical alarm
Orange	Important alarm
Yellow	Standard alarm
Blue	Warning
Green	Lite warning

Acknowledging the alarms

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

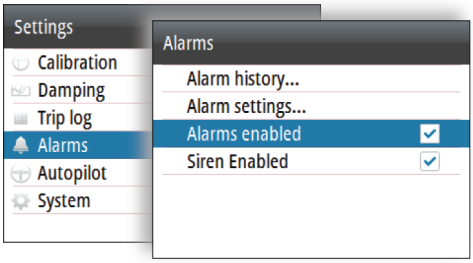
This removes the alarm notification, and silences the alarm from all units that belong to the same alarm group. A reminder reappears at given intervals for as long as the alarm condition exists.

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

Enabling the alarm system and the alarm siren

You enable the alarm system and the alarm siren from the Alarms menu.

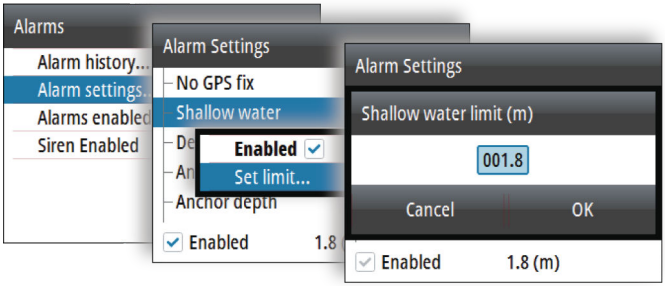
It is recommended that you enable all autopilot alarms when using an autopilot.



Individual alarm settings

You enable/disable the single alarm and set the alarm limits from the Alarms settings dialog.

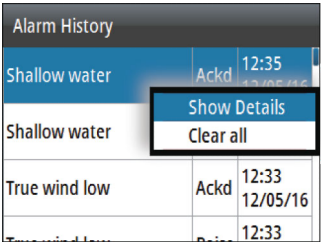
- Press the rotary knob to display the menu from where you can enable/disable the alarm and set the alarm limit



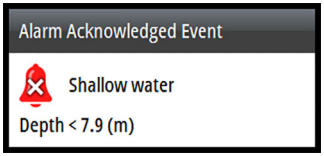
Alarm history

The Alarm history dialog stores alarm messages until they are manually cleared.

You show alarm details for a selected alarm and clear all alarms in the alarm history by pressing the rotary knob when the Alarm history dialog is active.



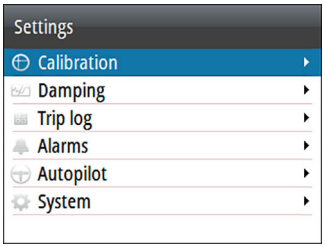
Menu options



Alarm details

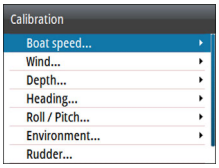
6 Software setup

Prior to use, the AP44 requires a number of settings be configured in order for the system to perform as expected. Access to the required options are found in the Settings menu, accessed by pressing the **MENU** key.



→ ***Note:*** The following settings are described in other sections of this manual:
"Trip log" on page 26
"Alarms" on page 27

Calibration



→ ***Note:*** Once the unit is setup and before you proceed with calibration ensure all network sources are selected and configured. Refer to *"System settings"* on page 36.

Boat speed

Speed calibration is necessary to compensate for hull shape and paddlewheel location on your boat. For accurate speed and log readings, it is essential that the paddlewheel is calibrated.

SOG reference

This is an auto calibration option that uses speed over ground (SOG) from your GPS, and compares the average of SOG against the average boat speed from the speed sensor for the duration of the calibration run.

→ ***Note:*** This calibration should be made in calm sea with no effect from wind or tidal current.

- Bring the boat up to cruising speed (above 5 knots), then
- Select the **SOG reference** option

When the calibration is completed the Boat speed calibration scale will show the adjusted percentage value of the boat speed.

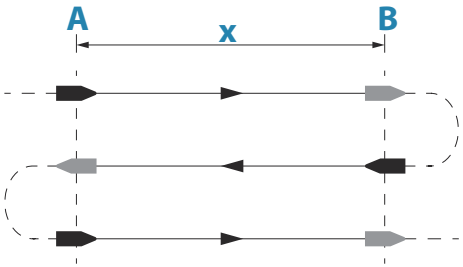
Distance reference

Allows you to calibrate the log via a distance reference. You will need to complete consecutive runs, under power at a constant speed made along a given course and distance.

→ ***Note:*** The distance should be greater than 0.5 NM, ideally 1 NM. To eliminate the effect of tidal conditions it is advisable to perform at least two runs, preferably three, along the measured course.

Referring to the diagram, **A** and **B** are the markers for each run. **X** is the actual distance for each run.

- Enter the desired distance in nautical miles that you would like to calculate the distance reference over
- When the boat gets to the predetermined starting position of the distance reference calculation, start the calibration timer
- As the boat passes marks **A** and **B** on each run, instruct the system to start and stop and finally OK to end calibration.



Use SOG as boat speed

If boat speed is not available from a paddle wheel sensor, it is possible to use speed over ground from a GPS. SOG will be displayed as boat speed and used in the true wind calculations and the speed log.

Wind

MHU (Masthead unit) alignment

This provides an off set calibration in degrees to compensate for any mechanical misalignment between the masthead unit and the center line of the vessel.

To check the masthead unit alignment error we recommend you use the following method which involves a sailing trial:

- Sail on a starboard tack on a close hauled course and record the wind angle, then repeat the process on a port tack
- Divide the difference between the two recorded numbers and enter this as the wind angle off set

If the starboard apparent wind angle is greater than the port angle, then divide the difference by 2 and enter this as a negative offset.

If the port angle is greater than the starboard then divide the difference by 2 and enter this as a positive offset.

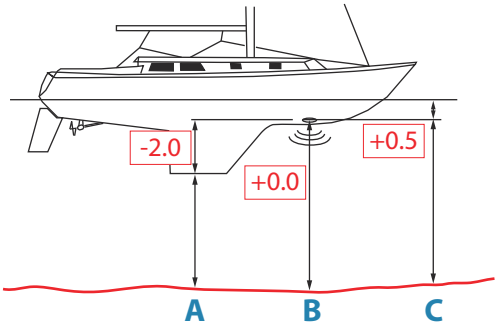
Enter the offset it into the MHU Align calibration field.

Depth

Depth offset

All transducers measure water depth from the transducer to the bottom. As a result, water depth readings do not account for the distance from the transducer to the lowest point of the boat (for example; bottom of the keel, rudder, or propeller) in the water or from the transducer to the water surface.

- For depth below keel (**A**): Set the distance from transducer to the bottom of the keel as a negative value. For example, -2.0.
- For depth below transducer (**B**): no offset required.
- For depth below surface (waterline) (**C**): Set the distance from transducer to the surface as a positive value. For example,+0.5.



Aft depth offset

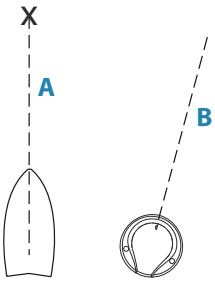
This option allows the system to display two depth readings.

The Aft depth is calibrated in the same manner as the Depth offset.

→ ***Note:*** Aft Depth is only available when a valid signal is received from a second and compatible NMEA 2000 or NMEA 0183 device.

Heading

→ ***Note:*** All magnetic compasses must be calibrated to ensure correct heading reference.
The calibration must be made on the active compass.
The calibration should be done in calm sea conditions and with minimal wind and current to obtain good results.

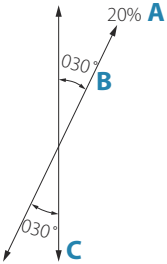


Offset

The **Offset** option is used for compensating for any difference between the boat's center line (**A**) and the compass lubber line (**B**).

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. 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 (°M or °T).



User triggered calibration

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

The **Calibrate** option is used for manually starting the heading calibration procedure.

During this calibration, the compass measures the magnitude and direction of the local magnetic field.

The illustration shows magnitude of local field in percentage of earth's magnetic field (**A**), direction of local field (**B**) with respect to the boat's centerline (**C**).

Follow the on-screen instruction, and use about 60-90 seconds to make a full circle. Keep turning until the system reports a pass.

- 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 guides you to the local interfering magnetic object.

→ ***Note:*** In certain areas and at high latitudes the local magnetic interference becomes more significant, and heading errors exceeding ±3° may have to be accepted.

Automatic calibration

An auto calibration option is available for compasses that offers a fully automatic calibration procedure.

See more instructions in the documentation delivered with your compass.

Magnetic variation

Defines how magnetic variation is handled by the system.

- Auto: Receives variation data from a network source
- Manual: Used for manually entering a value for the magnetic variation

Use COG as heading

If heading data is not available from a compass sensor, it is possible to use COG from a GPS. COG will be used in the true wind calculations.

→ ***Note:*** The autopilot cannot be operated using COG as the heading source. COG cannot be calculated when stationary.

Pitch and roll

If a suitable sensor is fitted, the system will monitor the inclination of the vessel. The offset value should be entered to adjust the readings so that while the vessel is stationary at the dock, the pitch and roll value reads 0.

Environment

If a suitable sensor is fitted, the system will monitor the current sea/air temperature and barometric pressure.

The offset value to be entered should adjust the reading from the sensor to match a calibrated source.

Rudder

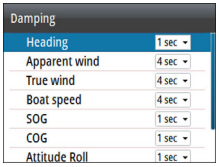
Starts the automatic calibration of the rudder feedback. This procedure sets the correct relationship between the physical rudder movement and the rudder angle readout.

Follow the instructions on the display to perform the rudder feedback calibration procedure.

Advanced

This option is used for manually applying an offset to the displayed data for third party sensors which cannot be calibrated through the AP44.

Damping



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

Autopilot settings

The autopilot settings can be split between settings done by the user, and settings done during installation and commissioning of the autopilot system.

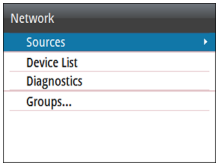
- User settings can be changed for various operational conditions or user preferences
- Installation settings are defined during commissioning of the autopilot system. No changes should later be done to these settings

For setup and commissioning, refer to the documentation for your autopilot computer.

→ ***Note:*** For Turn pattern settings, refer to *"Turn pattern steering"* on page 21.

System settings

Network



Sources

Data sources provide live data to the system.

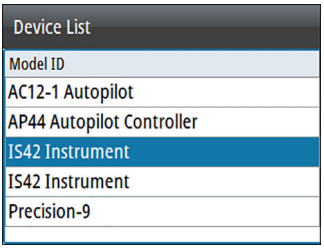
The data may originate from modules internal to the unit (for example internal GPS or sonar), or external modules connected to the NMEA 2000 or via NMEA 0183 if available on the unit.

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

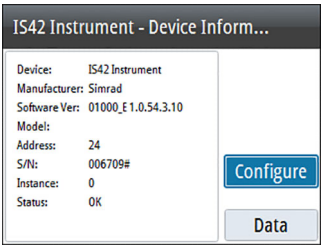
- Auto select: Looks for all sources connected to the device. If more than one source is available for each data type, selection is made from an internal priority list. This option is suitable for the majority of installations.
- Manual source selection: Manual selection is generally only required where there is more than one source for the same data, and the automatically selected source is not the one desired.

Device list

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



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



All devices allow allocation of an instance number in the configure option. Set unique instance numbers on any identical devices on the network to allow for the unit to distinguish between them. The data option shows all data being output by the device. Some devices will show additional options specific to the device.

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

Diagnostics

The NMEA 2000 tab on the diagnostics page can provide information useful for identifying an issue with the network.

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

correcting termination, reducing backbone or drop lengths, or reducing the number of network nodes (devices).

Bus state

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

Rx Overflows

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

Rx Overruns

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

Rx/Tx Errors

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

Rx/Tx Messages

Shows actual traffic in and out of device.

Bus Load

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

Fast Packet Errors

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

→ ***Note:*** Rx and Tx Errors often indicate an issue with the physical network, which may be resolved by correcting termination,

reducing backbone or drop lengths, or reducing the number of network nodes (devices).

Network groups

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

Units

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

Decimal places

Defines number of decimals used for speed and sea temperature.

Key beeps

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

Language

Controls the language used on this unit.

Time

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

Display setup

Displays the Display setup dialog.

The following options are available:

- Backlight level: Adjusts the backlight level from Min (10%) to Max (100%) in 10% increments
  - When the Backlight level field is active, subsequent presses on the backlight key adjusts backlight level in decrements of 30%
- Display group: Defines which network group the unit belongs to
- Night mode: Activates/deactivates the night mode color palette
- Night mode color: Sets the night mode color palette

- Invert day color: Changes the background color for the pages from default black to white
- Sleep: Turns the backlight for screen and keys off to save power

Files

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

Simulate

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

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

Restore defaults

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

Global reset

Resets the source selection on all displays connected to the network.

About

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

7 Maintenance

Preventive maintenance

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

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

Cleaning the display unit

To clean the screen:

- A micro-fiber or a soft cotton cloth should be used to clean the screen. Use plenty of water to dissolve and take away salt remains. Crystallized salt, sand, dirt, etc. can scratch the protective coating if using a damp cloth. Use a light fresh water spray then wipe the unit dry with a micro-fiber or a soft cotton cloth. Do not apply pressure with the cloth.

To clean the housing:

- Use warm water with a dash of liquid dish soap or detergent.

Avoid using abrasive cleaning products or products containing solvents (acetone, mineral turpentine, etc.), acid, ammonia, or alcohol as they can damage the display and plastic housing.

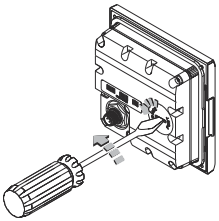
Do not use a jet or high pressure wash. Do not run your unit through a car wash.

Checking the connectors

The connectors should be checked by visual inspection only.

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

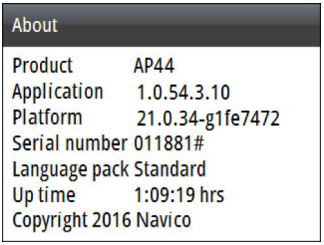
Software update



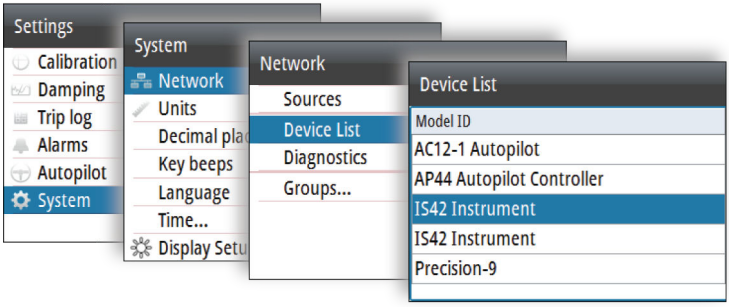
The AP44 includes a USB port of the back of the units. You use this port for software updates.

You can update the software for the AP44 unit itself and for NMEA 2000 sensors connected to the network from the AP44.

You can check the units software version from the About dialog.



The software version for connected NMEA 2000 sensors is available in the Device list.



The latest software is available for download from our website: www.simrad-yachting.com.

Software update for the unit

1. Download the latest software from our website: www.simrad-yachting.com, and save it to a USB device
2. Insert the USB device to the AP44 unit, and restart the AP44 unit
   - The upgrade will now start automatically the upgrade procedure for all units

3. Remove the USB device when the update is completed.

> ⚠ Warning: Do not remove the USB device until the update is completed. Removing the USB device before the update is completed may damage the unit.

Software update for remote devices

1. Download the latest software from our website: www.simrad-yachting.com, and save it to a USB device
2. Insert the USB device to the AP44 unit
3. Start the File explorer, and select the update file on the USB device
4. Start the update from the file details dialog
5. Remove the USB device when the update is completed.

8

Menu tree

The system includes a Settings menu, accessed by pressing the **MENU** key. The Settings menu gives access to settings for the sensors, the vessel, the autopilot computer and for the system.

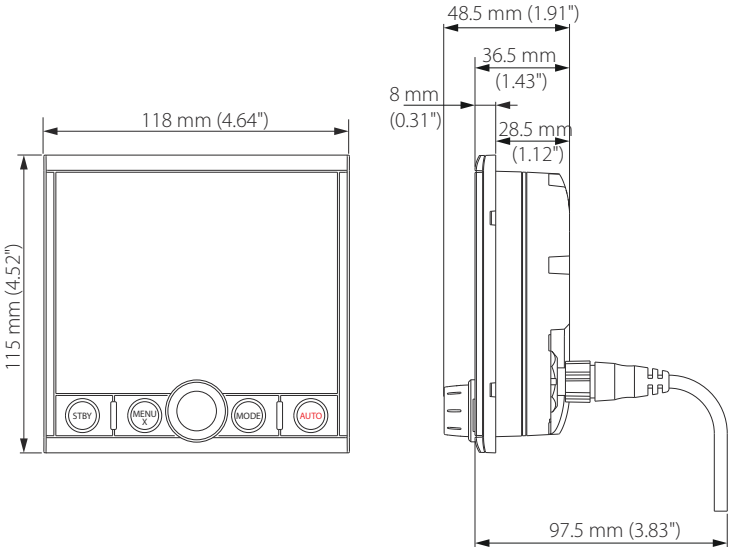
Level 1	Level 2
Calibration	Boat speed...
	Wind...
	Depth...
	Heading...
	Roll/Pitch...
	Environment...
	Rudder...
	Advanced...
Damping	Heading
	Apparent wind
	True wind
	Boat speed
	SOG
	COG
	Attitude Roll
	Attitude Pitch
	Tide
Trip log	Trip 1...
	Trip 2...
	Log...
Alarms	Alarm history...
	Alarm settings...
	Alarms enabled
	Siren Enabled

Level 1	Level 2
Autopilot Available options depend on connected autopilot computer.	Steering
	Sailing
	Turn patterns
	Installation
System	Network
	Units
	Decimal places
	Key beeps
	Language
	Time
	Display Setup...
	Digital gauges
	Files
	Simulate
	Restore defaults...
	Global reset...
	About

9 Technical specifications

Dimensions	Refer to *"Dimensional drawing"* on page 47
Weight	0.32 kg (0.7 lbs)
Power consumption(@ 13.5 V)	
Backlight OFF	1.35 W (100 mA)
Backlight MAX	2.16 W (160 mA)
Network load	4 LEN
Color	Black
Display	
Size	4.1" (diagonal). 4:3 Aspect ratio
Type	Transmissive TFT-LCD. White LED backlight
Resolution	320 x 240 pixels
Illumination	White for day mode. Red, green, blue or white for night mode
Environmental protection	
Waterproof rating	IPx7
Humidity	100% RH
Temperature	
Operating	-25° to +65ºC (-13°F to +149 ºF)
Storage	-40° to +85ºC (-40°F to +185 ºF)

10 Dimensional drawing



11 Terms and abbreviations

This list shows terms and abbreviations used in the pages and in dialogs in the AP44 system.

AIR TEMP	Air temperature
AIS	Automatic Identification System
AVG SPD	Average speed
AWA	Apparent wind angle
AWS	Apparent wind speed
BSPD	Boat speed
BTW	Bearing to waypoint
BWW	Bearing Waypoint To Waypoint
COG	Course Over Ground
CTS	Course To Steer
DGPS	Differential Gps
DTW	Distance to next waypoint
DSC	Digital Selective Calling
EPFS	Electronic Position Fixing System
EPIRB	Emergency Position Indicating Radio Beacon
ETA	Estimated Time Of Arrival
ETW	Estimated time of arrival to next waypoint
GLONASS	Global Orbiting Navigation Satellite System
GMDSS	Global Maritime Distress And Safety System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HDG	Heading
Km	Kilometer
KN	Knots
LL DIST	Layline distance
LL TIME	Layline time
m	Meters

MAX SPD	Maximum speed
MIN	Minimum
MOB	Man Over Board
NM	Nautical Mile
OPP HDG	Heading on opposite tack
POS	Position
RM	Relative Motion
RNG	Range
ROT	Rate Of Turn
RTE	Route
SAR	Search And Rescue
SOG	Speed Over Ground
SPD	Speed
STBD	Starboard
STW	Speed Through Water
TCPA	Time To Closest Point Of Approach
TGT	Target
TIME LOC	Local time
TM	True Motion
TRK	Track
TRK CRS	Track course to next waypoint
TWA	True wind angle
TWD	True wind direction
TWS	True wind speed
WOL	Wheel Over Line
WOP	Wheel Over Point
WPT	Waypoint name
WPT BRG	Bearing to waypoint
WPT DIST	Distance to waypoint
XTE	Cross track error

12 Supported data

→ ***Note:*** NMEA 0183 and NMEA 2000 data output requires the connection of relevant sensors.

NMEA 2000 PGN (transmit)

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

NMEA 2000 PGN (receive)

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

129026	COG & SOG, Rapid Update
129029	GNSS Position Data
129033	Time & Date
129283	Cross Track Error
129284	Navigation Data
129539	GNSS DOPs
129283	Cross Track Error
129284	Navigation Data
130074	Route and WP Service - WP List - WP Name & Position
130306	Wind Data
130576	Small Craft Status
130577	Direction Data

LOWRANCE

SIMRAD

B&G

NAC™ -2/NAC™ -3

Commissioning Manual

ENGLISH

Contents

1 Introduction

NAC-2 and NAC-3 autopilot computers

The NAC-2 and NAC-3 autopilot computers contain the electronics needed to operate a hydraulic steering pump or mechanical drive unit, while also interfacing with rudder feedback units and NMEA 2000 devices.

The NAC-2 is designed for boats up to 10 metres (33 feet) in length and is suitable for low-current pumps, mechanical drive units, or solenoid valves (8 A continuous/16 A peak).

The NAC-3 is designed for boats 10 metres (33 feet) or greater in length and is rated to operate high-current pumps, mechanical drive units, and solenoid valves (30 A continuous/50 A peak).

The user interface

Autopilot functions are presented a bit differently depending on the device being used, for example multi-function displays (MFD) and autopilot controllers (AP44 or AP48).

This manual shows screen examples from both an MFD running NOS software and the AP48.

MFDs running NOS software and autopilot controller displays

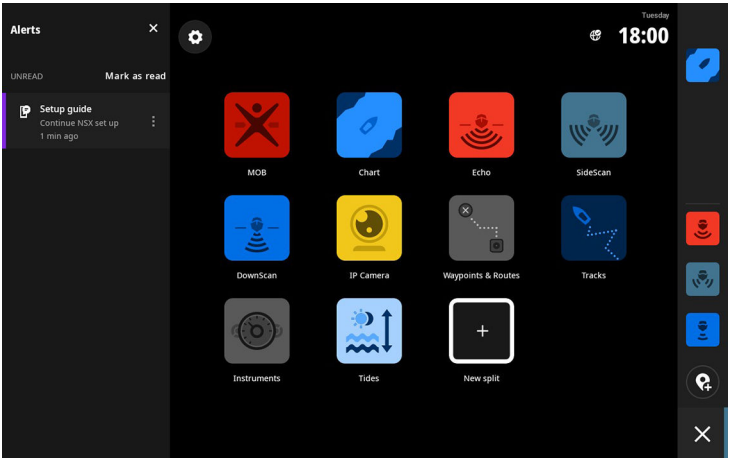
The instructions in this manual are for MFDs running NOS software and autopilot controller displays like the AP48.

The screenshots in this manual are from an MFD running NOS software and the AP48.

MFDs running NEON software

If the home page on your MFD looks similar to the following illustration, then you have a NEON software based MFD.

To commission the autopilot connected to your NEON software based system, select the **Set up guide** button on the home screen and follow the prompts in the setup app. Alternatively, select the settings button on the home page and navigate to the device set up screen. Setting up connected devices is described in the documentation available for the MFD running NEON software.



Autopilot controllers

The NAC can be controlled by various Navico control units. This can be dedicated autopilot controllers, Multifunction displays (MFDs) and autopilot remote controllers used in combination with instrument systems, or any combination of the above.

Autopilot functions

NAC-2 and NAC-3 include a large range of functions, but not all autopilot controllers have access to all options. E.g. autopilot systems including only an autopilot remote controller (without display unit) do not have access to turn patterns.

Autopilot computer setup

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

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

- Installation settings
  - Including dockside and seatrial commissioning. See *"Dockside setup"* on page 13 and *"Sea trial"* on page 21
- User adjustment of autopilot settings

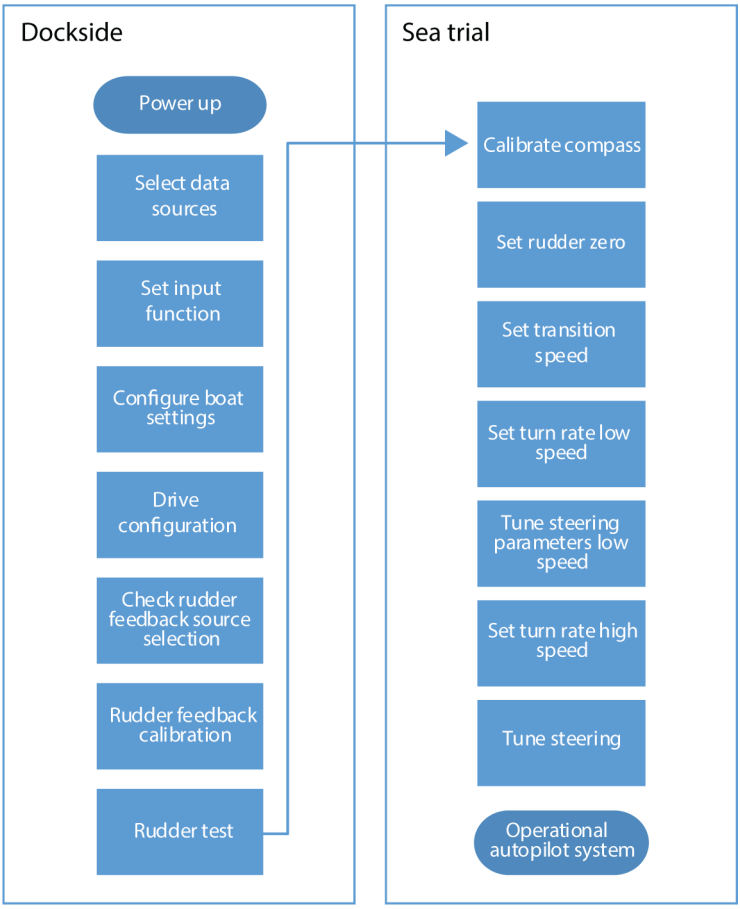
- Manual fine-tuning for various operational conditions and user preferences. See *"User settings"* on page 28

➔ ***Note:*** Dockside settings can only be accessed when the autopilot is in Standby mode.

➔ ***Note:*** Some systems require a dedicated physical standby key to perform installation procedures. This key can be a key on the autopilot controller, on an autopilot remote controller, or it can be a separate standby key.

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

Installation setup workflow



2 Dockside setup

Data source selection

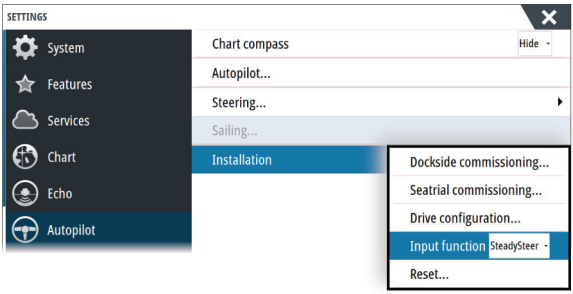
Before commencing with autopilot computer setup the data sources must be available and configured.

Data sources selection is required on initial start-up of the system, if any part of the 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.

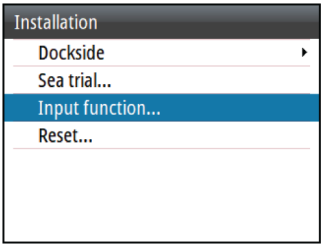
You can let the system automatically select your sources, or set up each source manually. Refer to documentation for the autopilot controller or for the display unit for details about how to perform the data source selection.

Input function

Determines how the autopilot computer/system reacts to an external input. External input can be connected to blue/yellow wire on NAC-2 and mode/function selector on NAC-3. For wiring details and options, refer to the installation documentation.



Autopilot installation dialog, MFDs



Autopilot installation dialog, AP48

Auto/Standby

Select this mode if you have a toggle button connected to your NAC-2 autopilot computer. Press the button to toggle between Auto and Standby mode.

Disengage

Select this mode if you have a disengage switch connected to your NAC-3 autopilot computer.

- OPEN – Normal operation, can be controlled by controller.
- CLOSED to OPEN – Activates Auto mode regardless of previous state.
- CLOSED – Disengaged. Cannot be controlled by controller.

SteadySteer

Select this mode if you have a SteadySteer connected to your NAC-2/NAC-3.

- Manual steering overrides the active mode.
- If Auto mode or NoDrift mode was active before going into manual steering, they will automatically re-engage when the vessel has stabilized on a new course.
- For any other modes, the autopilot goes into Standby mode.
- If NAV mode was active before going into manual steering a dialog will be shown.
  - Confirm course change to reactivate NAV mode.
  - Cancel the course change to activate Auto mode on the new heading.
- If no action is taken the autopilot will go into Standby mode.

Disable input

Select if no external input is connected, or to disable connected input (default).

Boat characteristics

Boat type

Affects steering parameters as well as available autopilot features.

The following options are available:

- Sail
- Displacement
- Planing

→ ***Note:*** If the boat type is set to Sail, Virtual Rudder Feedback is not available.

Boat length

Used by the autopilot system to calculate steering parameters.

Cruising speed

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

Drive configuration

The drive configuration controls how the autopilot computer operates the steering system.

Refer to your drive unit documentation for relevant specifications.

Control method

Used for setting the appropriate control ouput for your drive.

The following options are available:

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

Drive voltage

Nominal drive voltage specified for your drive unit.

- Options: 12 V and 24 V.

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

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

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

Drive engage

Defines how the Engage output is used.

The following options are available:

- Clutch
  If your drive unit/motor/pump needs clutch to engage the actuator, it shall be connected to the "engage" output. Configure the "Drive engage" as clutch. The clutch will be activated when autopilot computer is controlling the rudder. In standby, the clutch is released to allow manual steering. Check specification of your drive unit to determine whether clutch is required.

- Auto
  Output activated when autopilot computer is in Auto, NoDrift or Navigation modes. For manual rudder control (Standby, NFU and FU) the output is not activated. Typically used to switch between two rudder speeds on a continuous running pump, used when different rudder speeds are required for automatic and Follow-up/Non-Follow-up steering.

Minimum rudder

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

performance on some boats. However, this will increase the rudder activity.

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

Rudder deadband

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

The following options are available

- Auto
  (Recommended).
  The rudder deadband is adaptive and is continuously operative. It will also optimize the deadband to the pressure on the rudder
- Manual
  If the Auto setting doesn't perform properly due to extreme rudder speed and/or overshoot, it can be adjusted manually. Can also be used to reduce the rudder activity. Rudder commands smaller than the size of the dead band will be ignored

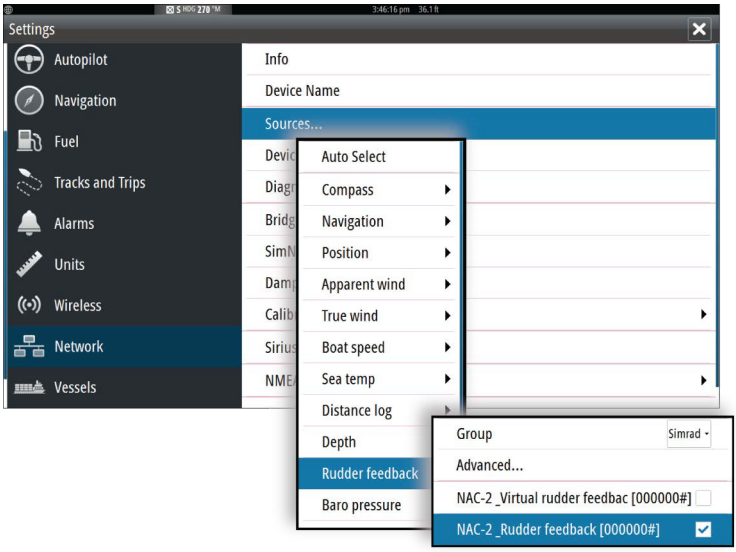
Find the lowest possible value that will prevent the rudder from continuous hunting. A wide deadband will cause inaccurate steering. It is recommended to check rudder stability in AUTO mode at cruising speed to get pressure on the rudder. (Slight hunting observed dockside may disappear at cruising speed.)

Rudder setup

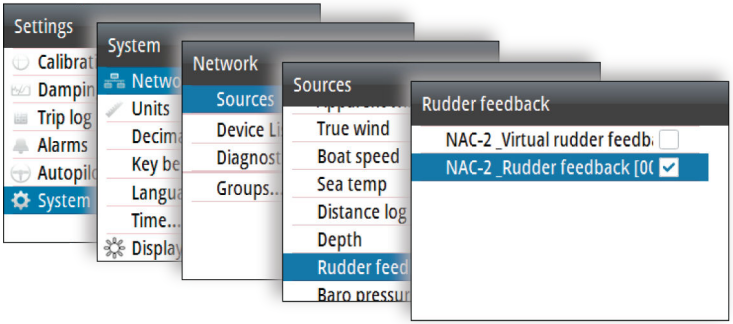
⚠ Warning: During the rudder calibration and test the autopilot computer issues a series of rudder commands. Stand clear of the helm and do not attempt to take manual control of the rudder during this test!

Rudder source

The correct rudder source has to be selected before the rudder feedback calibration can be performed.



Rudder source selection, MFDs



Rudder source selection, AP48

Rudder feedback calibration

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

The rudder feedback calibration determines the rudder feedback's direction.

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

Rudder test

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

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

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

Failure to complete test will result in an alarm.

VRF calibration

→ ***Note:*** Only available if the rudder source is set to a virtual rudder feedback.

VRF calibration determines the direction of rudder movement, the minimum output required to move the rudder and the voltage to rudder speed ratio.

To perform the VRF calibration you must be able to view the movement of the rudder.

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

➔ ***Note:*** When you get asked if the rudder moved you may have to select no several times to ensure the pump provides enough power to turn the motor at high vessel speed.

3 Sea trial

> ⚠ Warning: An autopilot is intended only as a supplemental aid to navigation. It IS NOT a replacement for a human navigator or prudent seamanship. Never leave the helm unattended.

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

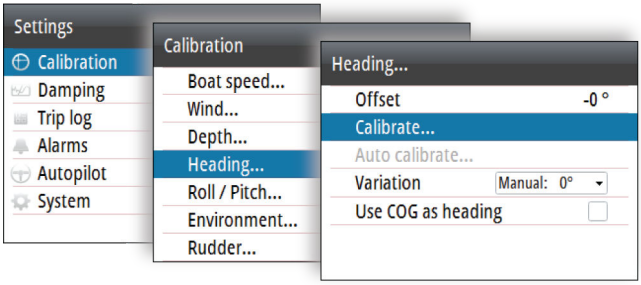
→ ***Note:*** The seatrial must always be performed in calm conditions, in open waters and at a safe distance from other traffic.

Compass setup

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

The setup needs to be done from an appropriate display unit. Depending on the unit, access to the compass setup is available from the compass's device dialog, or from a dedicated Calibration option in the unit's Settings menu.

Device dialog, MFDs



Calibration option, AP48

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

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

Transition speed

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

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

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

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

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

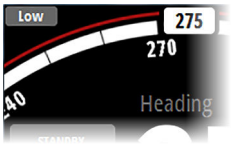
Example

The transition speed is set to 9 knots.

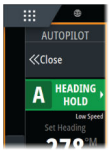
- The system changes from Low profile to High profile when the speed increases to 10 knots (= Transition speed plus 1 knot)

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

The active profile ('**Low**' or '**High**') is shown in the autopilot page (e.g. AP44) and in the autopilot pop-up (MFDs):



AP48 page



MFD Autopilot control bar

Set rudder zero position

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

→ ***Note:*** Setting rudder zero position should always be done in calm conditions, where steering is not affected by wind and/or current.

Bring the rudder to the position where the boat steers straight, then activate the **Set rudder zero** option to save the rudder zero parameter.

→ ***Note:*** On dual engine boats, verify that the engine RPM is equal on both engines so that the thrust from both propellers is equal. Otherwise, the zero rudder position might be set wrong.

Set turn rate

Used for setting the preferred turn rate of the boat.

Bring the boat into a turn with the preferred safe and comfortable turn rate, then activate the **Set turn rate** option to save the turn rate parameters.

→ ***Note:*** The captured turn rate will be stored in the active steering profile. This setting must therefore be repeated for each steering profile.

Tuning the autopilot

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

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

Proceed as follows to verify satisfactorily steering:

1. Stabilize the vessel on a heading, and then select **AUTO** mode
2. Observe course keeping and rudder commands
   - The autopilot should keep the vessel on the set heading within an average of +/-1 degree, providing calm sea and wind
3. Make some small and bigger heading changes to port and starboard and observe how the vessel settles on the new heading
   - The vessel should have a minimum of overshoot. See *"Rudder gain"* on page 26 and *"Counter rudder"* on page 26.

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

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

Autotuning

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

- Stabilize the vessel on a heading and set the speed between 5-10 kn, then select **Autotune**.
  - The autopilot will now switch to AUTO mode and take control of the vessel.

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

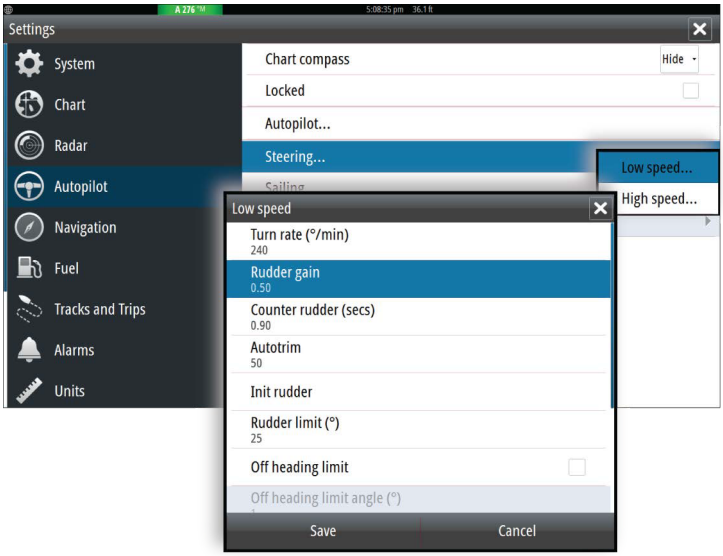
The autotuning takes approximately 3 minutes to complete. When completed the autopilot automatically switches to Standby mode, and the rudder must be controlled manually.

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

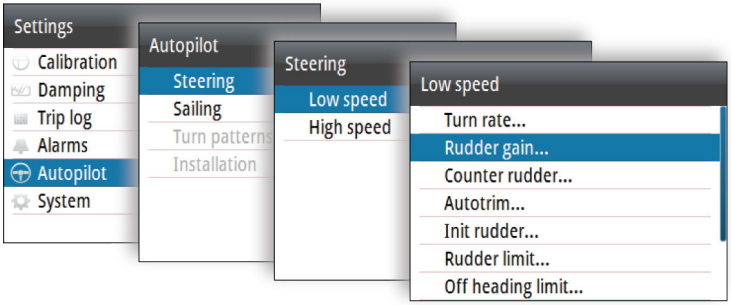
Manual tuning

Rudder gain and Counter rudder can be manually adjusted.

- Stabilize the vessel on a heading and set the speed in the middle of the profile range (well clear of the transition speed) to avoid profile switching during tuning. Then activate the **Rudder gain** option. Adjust the value according to the descriptions below.
- If required, adjust slightly the **Counter rudder** option.



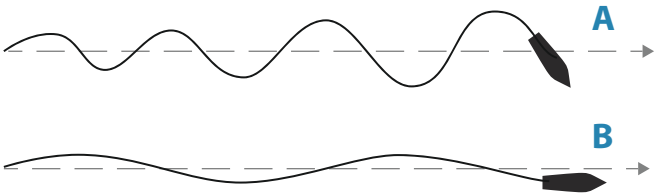
Tuning parameters, MFDs



Tuning parameters, AP48

Rudder gain

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



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

B The value is set too low. It will take a long time to compensate for a heading error, and the autopilot will fail to keep a steady course

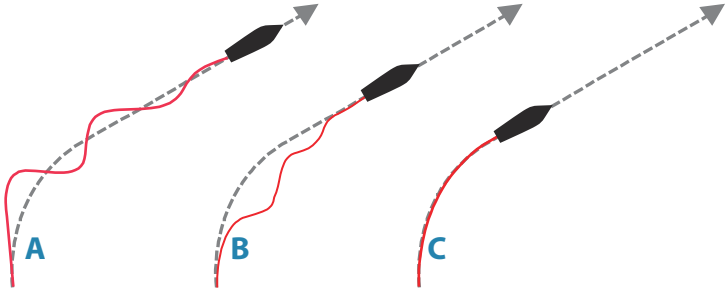
Counter rudder

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

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

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

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



A Counter rudder value too low; overshoot response

B Counter rudder value is too high; sluggish and creeping response

C Correct setting of Counter rudder; ideal response

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

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

4 User settings

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

Steering profile settings

The NAC include two steering profiles (High and Low), used for high and low boat speed.

The initial parameters are automatically assigned when you select your vessel type. During the seatrial the parameters will be tuned for optimized steering performance. See *"Tuning the autopilot"* on page 24.

The options listed in the next pages are available for both High and Low speed profiles.

For Rudder gain and Counter rudder, see *"Rudder gain"* on page 26 and *"Counter rudder"* on page 26.

Turn rate

Used for manually setting the turn rate used when the heading change is larger than 5°.

Autotrim

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

Init rudder

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

The following options are available:

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

Rudder limit

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

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

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

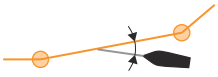
Off heading limit angle

Sets the limit for the off heading alarm.

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

Track response

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



Track approach angle

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

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

Course change confirm angle

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

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

Sailing parameters

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

Wind mode

Select what wind angle the autopilot will steer towards.

The following options are available:

- Auto
  If True Wind Angle (TWA) is <70º: Wind mode will steer towards Apparant Wind Angle (AWA)
  If TWA is ≥70º: Wind mode will steer towards TWA
- Apparent
  Steers towards AWA
- True
  Steers towards TWA

Tack time

Controls how fast the autopilot tacks in wind mode.

Tack angle

Controls the angle that the boat will tack to in AUTO mode.

Manual speed

If neither boat speed nor SOG data are available and/or deemed unreliable, a manual value for speed can be entered and used by the autopilot to aid steering calculations.

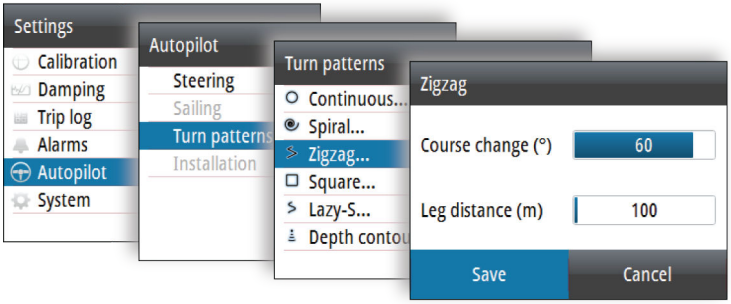
Turn pattern settings

The autopilot computer supports a number of automatic turn steering features when the autopilot is in AUTO mode.

→ ***Note:*** Turn pattern steering is not available if the boat type is set to Sail.

All turn patters, except the U-turn, have associated turn pattern settings. Depending on the autopilot controller these turn pattern settings can be adjusted before you start the turn or during the turn.

Turn pattern settings, MFD



Turn pattern settings, AP48

→ ***Note:*** Not all autopilot controllers include turn pattern steering. Refer to your autopilot controller for more information.

C-turn (Continuous turn)

Steers the vessel in a circle.

- Turn variable:
  - Rate of turn. Increasing the value makes the vessel turn a smaller circle.

U-turn

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

Spiral turn

Makes the vessel turn in a spiral with a decreasing or increasing radius.

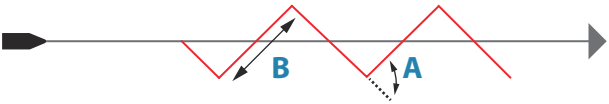
- Turn variables:
  - Initial radius
  - Change/turn. If this value is set to zero, the boat will turn in a circle. Negative values indicate decreasing radius while positive values indicate increasing radius.

→ ***Note:*** This turn pattern is not available for HDS Live multi-function displays.

Zigzag turn

Steers the vessel in a zigzag pattern.

- Turn variables:
  - Course change (**A**)
  - Leg distance (**B**)



Square turn

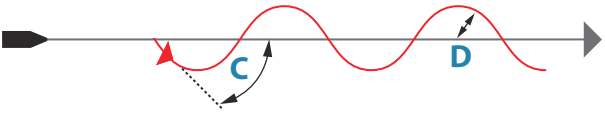
Makes the vessel automatically turn 90° after having travelled a defined leg distance.

- Turn variable:
  - Leg distance

S-turn

Makes the vessel yaw around the main heading.

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



Depth contour tracking (DCT)

Makes the autopilot follow a depth contour.

→ ***Note:*** DCT turn pattern is only available if the system has a valid depth input.

> ⚠ Warning: Do not use the DCT turn pattern unless the seabed is suitable. Do not use it in rocky waters where the depth is varying significantly over a small area.

- Turn variables:
  - Depth gain. This parameter determines the ratio between commanded rudder and the deviation from the selected depth contour. The higher depth gain value the more rudder is applied. If the value is too small it will take a long time to compensate for drifting off the set depth contour, and the autopilot will fail to keep the boat on the selected depth. If the value is set too high the overshoot will increase and the steering will be unstable.
  - CCA. The CCA is an angle that is added to or subtracted from the set course. With this parameter you can make the boat yaw around the reference depth with s movements. The larger the CCA the bigger yawing will be allowed. If the CCA is set to zero there is no S-ing.
  - Ref. depth. This is the reference depth for the DCT function. When DCT is initiated the autopilot reads the current depth and set this as the reference depth. The reference depth can be changed when the function is running.

→ ***Note:*** If depth data is lost during DCT the autopilot will automatically switch to AUTO mode.
It is recommended to turn ON the AP Depth Data Missing alarm when using DCT. When this alarm is activated an alarm will be raised if the depth data is lost during DCT.

5 Installation verification

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

Checklist

Description	Reference
Units mounted and secured according to instructions	Installation instructions for the units
Network powered and terminated according to instructions	Wiring instructions for the units
Sources selected	Autopilot control unit documentation
Vessel configured	*"Boat characteristics"* on page 15
Drive units configured and calibrated	*"Drive configuration"* on page 15
Compass calibrated	*"Compass setup"* on page 21
Seatrial completed (manual or autotune)	*"Sea trial"* on page 21

Boat specific settings

Boat

Settings	
Boat type	
Boat length	
Cruising speed	
Transition sped	

Drives

Settings	
Drive type	
Drive control method	
Nominal drive voltage	
Drive engage	
Minimum rudder	
Rudder deadband	
Manual deadband	
Minimum output	
Maximum output	

Sailing parameters

Settings	
Wind mode	
Tack time	
Tack angle	
Manual speed	

Steering profiles

Settings	Low Speed	High Speed
Turn Rate		
Rudder gain		
Counter rudder		
Autotrim		
Init rudder		
Rudder limit		

Settings	Low Speed	High Speed
Off heading limit		
Track response		
Track approach angle		
Course change confirm angle		

Turn Pattern settings

Settings	
Continuous	
Rate of turn	
Spiral	
Initial radius	
Change/turn	
Zigzag	
Course change	
Leg distance	
Square	
Leg distance	
Lazy-S	
Course change	
Turn radius	
Depth contour	
Depth gain	
CCA	

6 Maintenance

Preventive maintenance

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

Checking the connectors

The connectors should be checked by visual inspection only.

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

Software update

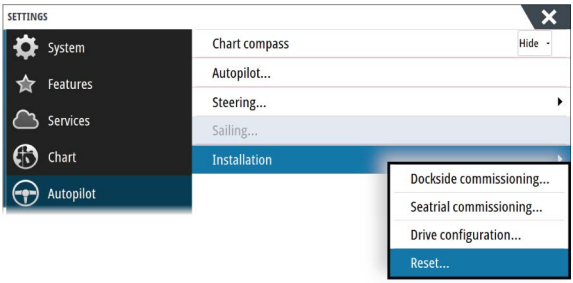
You can update the software for the autopilot computer from a display unit connected to the network.

You can check the autopilot computer's software version from the display unit's Device list.

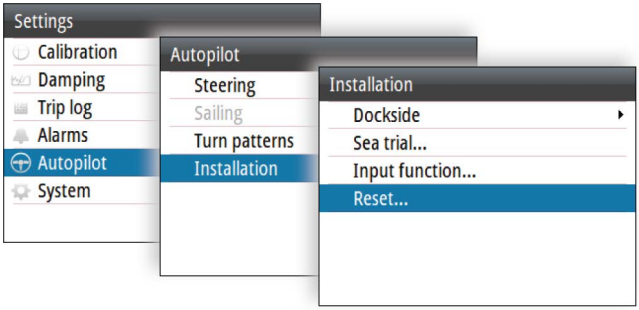
The latest software is available for download from the product webpage at: www.lowrance.com, www.simrad-yachting.com and www.bandg.com.

Resetting the autopilot computer

You can reset the autopilot to factory default settings.



Reset autopilot computer, MFDs



Reset autopilot computer, AP48

The first time the autopilot computer is started after reset, it will run through the automatic setup-procedure.

→ ***Note:*** Unless you need to clear all values set during the installation set-up procedure, you should not perform a reset of the autopilot computer.

7 Technical specifications

→ ***Note:*** The most up-to-date specifications list is available at: www.lowrance.com, www.simrad-yachting.com and www.bandg.com.

NAC-2

Approvals	
Compliance	EMC directive 2014/30/EU
Electrical	
Supply voltage	9-31.2 V DC
Power consumption - Max	500 W
Power consumption - Typical	As required to drive rudder actuator. See pump/motor power ratings
Recommended fuse rating	20 A
Environmental	
Operating temperature	-25°C to +55°C (-13°F to 131°F)
Storage temperature	-30°C to +70°C (-22°F to 158°F)
Waterproof rating	IPx5
Humidity	100%
Shock and vibration	Acc to EN60945
Connectivity	
NMEA 2000	1 Micro-C port, 1 LEN
Drive	12/24 V DC, min 10 mA, max 3 A
Rudder Feedback	Variable voltage/resistive 0-5 V
Physical	
Weight	0.6 kg (1.3 lbs)
Compass Safe Distance	500 mm (20 inches)
Warranty	2 years

NAC-3

Approvals	
Compliance	EMC directive 2014/30/EU
Electrical	
Supply voltage	12/24 V DC +/- 10-30%
Power consumption - Max	750 W
Power consumption - Typical	As required to drive rudder actuator. See pump/motor power ratings
Recommended fuse rating	30 A
Environmental	
Operating temperature	-25°C - +55°C (-13°F - 131°F)
Storage temperature	-30° - +70°C (-22°F - 158°F)
Waterproof rating	IPx5
Humidity	100%
Shock and vibration	Acc to EN60945
Connectivity	
NMEA 2000	1 Micro-C port, 1 LEN
NMEA 0183	1 port IN/OUT. 4.8, 9.6, 19.2 & 38.4 kbaud
Drive	• Reversible motor control of rudder. Max continuous load 30 A, peak 50 A for 1s or • On/off solenoid control of rudder. 12/24 V DC, common, load range 10 mA to 10 A, off current <1 mA
Engage	Output for bypass/clutch. 12/24 V DC, min 10 mA, max 3 A

Rudder	Rudder angle, frequency input. 15 V, 1.4 to 5 kHz, resol. 20 Hz/°
Remote	• Input: External open/ close contact for remote controller • Output: High/Low mode indicator signal
Mode	External open/close or pulse contact for autopilot disengage
Alarm	External alarm output for buzzer/relay. Max 100 mA, voltage level as local supply
Physical	
Weight	0.7 kg (1.6 lbs)
Compass Safe Distance	500 mm (20 inches)
Warranty	2 years

988-11233-004

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