

SIMRAD

R5000 Radar system Operator Manual

ENGLISH



Preface

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 maritime safety 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.

Governing language

This statement, any instruction manuals, user guides and other information relating to the product (Documentation) may be translated to, or has been translated from, another language (Translation). In the event of any conflict between any Translation of the Documentation, the English language version of the Documentation will be the official version of the Documentation.

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Warranty

The warranty card is supplied as a separate document. In case of any queries, refer to the brand website of your unit or system:

www.navico-commercial.com

Compliance statement

Navico declare under our sole responsibility that the product conforms with the requirements of:

- European Council Directive 2014/90/EU on Marine Equipment modified by Commission Implementing Regulation (EU) 2018/773 (May 2018) - Wheelmark

The relevant declaration of conformity is available in the product's section at the following website:

- www.navico-commercial.com

About this manual

Intended audience

This manual is written for system operators.

The manual assumes that the reader has basic knowledge about this type of equipment with regards to:

- operation
- nautical terminology and practices

Important text conventions

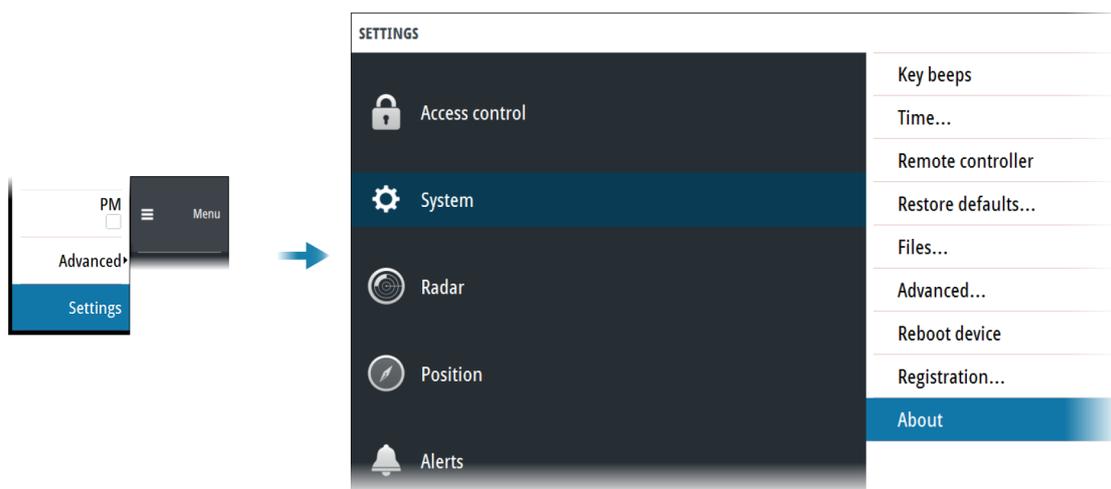
Important text that requires special attention from the reader is emphasized as follows:

→ **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.

Software version

You can view the software version installed on the unit in the about dialog:



The manual will continuously be updated to match new software releases. The latest available manual version can be downloaded from the product website on: www.navico-commercial.com

Change log

Part no	Date and description
988-12294-001	2018-Sept-19
	First version.
988-12294-002	2018-Nov-01
	Updated to match software release.

Safety precautions

Safety precautions described in this section are applicable to the radar system. They are general safety precautions that are not related to any specific procedure, and they might therefore not appear elsewhere in this manual. They are recommended precautions that personnel must understand and apply during operation and maintenance of the system.

You are obliged to read these operating instructions prior to operation, and to adhere to the operating instructions in order to prevent possible danger. Prevention of danger includes that operator personnel are trained and authorized for safe operation of the equipment. We assume no liability for damage due to improper operation which could have been prevented.

The system must only be operated by persons who have passed the relevant mandatory training on the respective systems and applications. Only reading these operating instructions cannot replace such training. Persons authorized to operate, maintain and troubleshoot the system are instructed and trained by Simrad. Persons operating or servicing this radar system must be familiar with the general safety regulations and specific safety systems, and they must have passed all required training. They must have read the relevant operating instructions and manuals before starting to work.

Have these operating instructions always at hand on all relevant locations, and ensure that copies are available to all operators. Operating personnel must at all times follow all safety regulations.

During normal operation, the unit can be quickly disconnected from the main power line by turning OFF the relevant circuit breaker located on the electric switchboard.

Do not replace components or make adjustments inside the unit when the voltage supply is turned ON. Always remove power and discharge to ground a circuit before touching it.

Under no circumstances should any person initiate servicing or repairing the unit except in the presence of a qualified person.

Ensure unobstructed access to all operator panels, controls, and relevant switchgear cabinets in order to enable instant response to alarms.

Whenever it is necessary to disconnect the waveguide from a radar transmitter for maintenance purpose, the transmitter output should be terminated with a matched load. If this is not possible, care should be taken. Do not stand in front of an open-ended waveguide from which power is being radiated.

→ **Note:** Main power is always present on the terminal board unless the main break from the power distribution panel of the vessel is turned off.

⚠ Warning: Never look down a waveguide from which power is being radiated!

Warnings

High voltage

Radar equipment includes high voltage that can cause injury or loss of life. Danger exists only when the units are opened, exposing internal circuits, as when servicing the equipment.

This radar has been carefully designed to protect personnel from possible injury from high voltages. Although every effort has been made to eliminate danger to personnel, no responsibility is accepted for any injury or loss of life suffered in connection with this equipment.

Radio frequency radiation

Harmful effects (particularly to the eyes) may be caused by exposure of any part of the human body to high power radio frequency radiation.

However, the system is designed to always disable the microwave radiation when the antenna is not rotating.

Hazard distances

Configuration	Distance 100 W/m² point (m)	Distance 50 W/m² point (m)	Distance 10 W/m² point (m)
12 KW Transceiver 6' X-band Antenna	-	0.15	0.6
12 KW Transceiver 9' X-band Antenna	-	-	0.5
12 KW Transceiver 12' X-band Antenna	-	-	0.35
25 KW Transceiver 6' X-band Antenna	0.1	0.2	1.3
25 KW Transceiver 9' X-band Antenna	-	0.1	1.0
25 KW Transceiver 12' X-band Antenna	-	0.05	0.9
30 KW Transceiver 12' S-band Antenna	-	-	0.4

X-Ray radiation

This radar system does not generate X-ray radiation.

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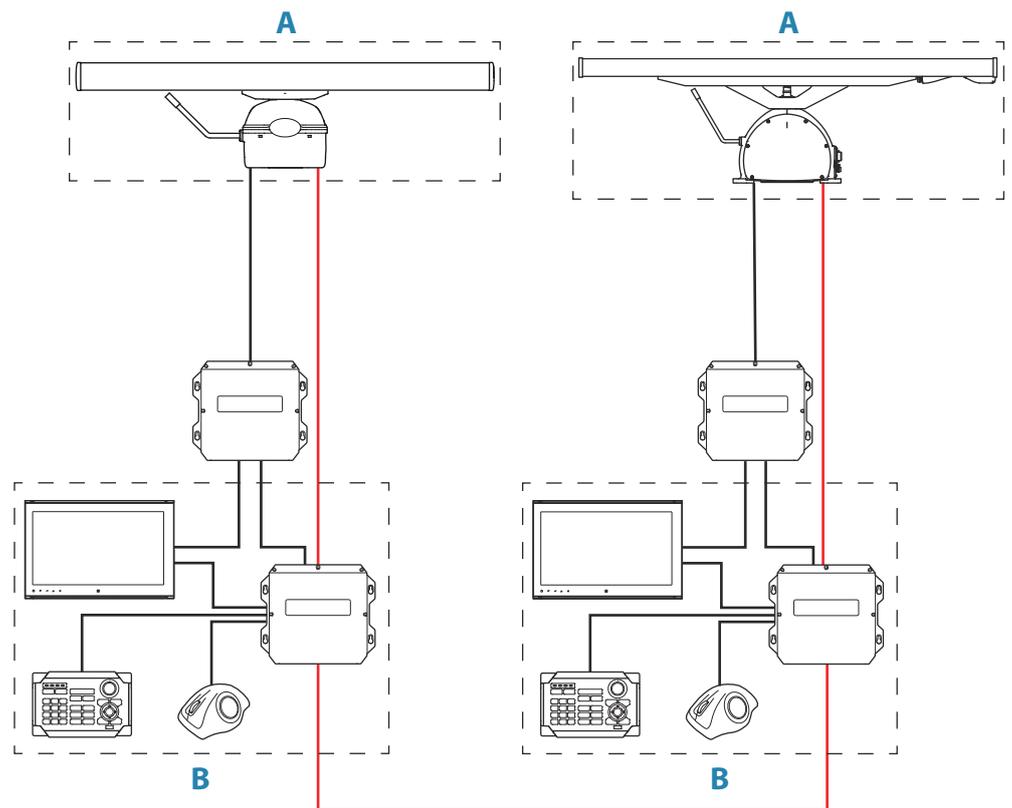
1

Introduction

R5000 system overview

A basic R5000 radar system has the following main parts:

- SRT LAN radar sensor (**A**), including:
 - Antenna
 - Up-mast or down-mast SRT LAN transceiver
 - R5000 power supply unit
- R5000 radar control station (**B**), including:
 - M5000 monitor
 - O2000 control unit
 - O5000 trackball unit
 - R5000 radar processor



An R5000 system can be installed as a stand-alone radar system, or as an advanced installation with several sensors and control stations.

In an advanced installation, each radar sensor has a control station directly wired to it. This control station will be the radar sensor's default master controller. The R5000 radar processors can be connected with an interswitch LAN cable. This allows for sharing the control of the radar sensors between multiple radar control stations. During commissioning of the system, the interswitch function is configured to manage the control of the radar sensors. For more information, refer to "*The Interswitch function*" on page 24.

R5000 manuals

The following documentation is available for the R5000 radar systems:

R5000 Operator manual

User descriptions of the radar control unit and of the features included in the system.

Intended audience: System operator.

R5000 Quick Guide

Graphical document describing the keys and the main functions.

Intended audience: System operator.

R5000 System installation manual

Mechanical installation and wiring, technical specifications and mechanical drawings for all system components.

Intended audience: Shipyard installation personnel.

R5000 Configuration manual

System setup/configuration and commissioning of the system.

Intended audience: Installation and service engineers.

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Operating the system

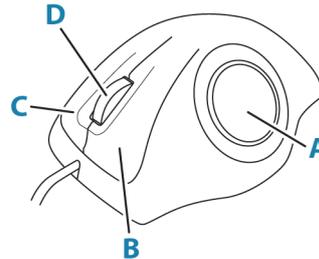
The system is operated by the remote control unit (O2000) and by the mouse (O5000 Trackball unit).

The remote controller is used for menu operation, and for easy operation of the quick access buttons.

The mouse is mainly used for managing targets, and in situations where it is required to position the cursor accurately on the PPI.

For a full overview of remote controller and mouse keys, refer to "O2000/O5000 Trackball, key function comparison" on page 69.

O5000 trackball mouse keys



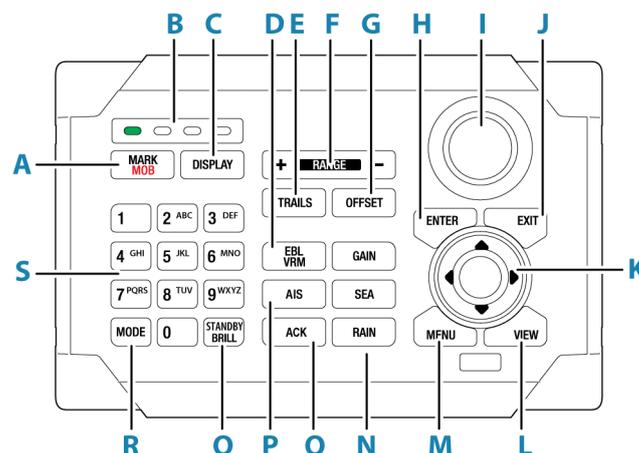
The optical trackball (A) is used for positioning the cursor. The other mouse keys have different functionality depending on the position of the cursor on the radar panel.

The following table lists the key functions relative to the part of the radar panel that is under the cursor.

→ **Note:** The cursor must be located over an open menu or over the quick access pop-up to be able to use the scroll function.

Cursor over ...	Left key (B)	Right key (C)	Scroll wheel (D)
Menu	Select	Return to previous menu level	<ul style="list-style-type: none"> Rotate to scroll menu options Press to select
Quick access button	Select	Display selected button's pop-up	<ul style="list-style-type: none"> Rotate to scroll pop-up options
AIS target	Activate/deactivate	Display target menu	No action
Radar target	Acquire target		

O2000 front controls



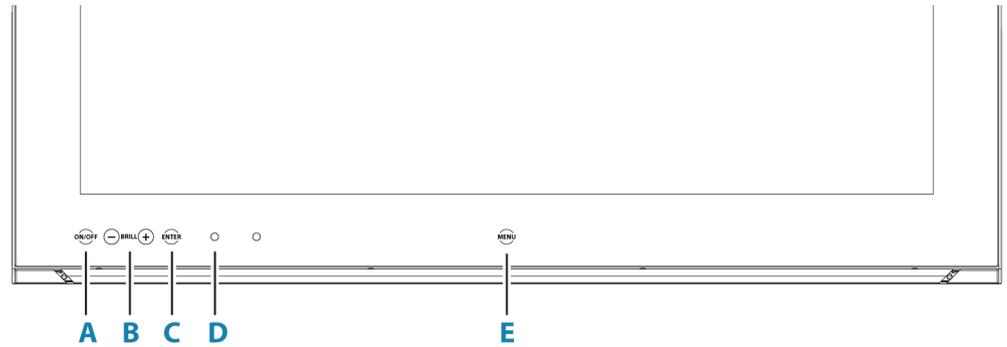
→ **Note:** The O2000 can be used with different equipment. As noted below, some of the keys are not applicable for the R5000.

- A** Mark/MOB key. Not used for R5000
- B** Unit under command LEDs. Not used for R5000
- C** Display key. Used for configuration of the O2000. Not used for operating the R5000
- D** EBL/VRM key. Press once to toggle EBL/VRM markers On/Off. Re-press to display the EBL/VRM pop-up. Press and hold to toggle between EBL/VRM 1 and EBL/VRM 2.
- E** Trails key. Press to toggle trails ON/OFF.
- F** Range key. Press the + or the - indication to increase or decrease the radar range
- G** Offset key. Press once to display the Offset menu
- H** Enter key. No cursor on PPI: no action. Cursor on PPI: press to activate/deactivate AIS, press and hold to display the targets menu.
Menu operation: press to select an option
- I** Rotary knob. With no menu active: behavior depending on operational mode.
Menu operation: rotate to scroll through menu items and to adjust values, press to select or to save settings
- J** Exit key. With no menu active: clear the cursor from the PPI. Menu operation: press to return to previous menu level or to exit a dialog
- K** Arrow keys. With no menu active: press to move the cursor on the radar PPI.
Menu operation: press to move through menu items and to adjust a value
- L** View key. Press once to display the View menu
- M** Menu key. Press once to display the Main menu
- N** Gain, Sea, and Rain keys. Press to set radar sensitivity
- O** Acknowledge key. Press once to acknowledge the most recent alarm or warning in the Alerts panel. Press the key again to acknowledge the next alarm or warning.
Press and hold to bring the focus on the Alerts panel without acknowledging the most recent alarm
- P** AIS key. Press to activate/deactivate AIS information on screen. Press and hold to display the Vessels dialog
- Q** Standby/Brilliance key. Press once to display the Standby/Brightness pop-up. Press twice to toggle between Standby and Transmit. Press and hold to switch the radar system ON/OFF.
- R** Mode key. Not used for R5000
- S** Alpha numeric keypad. Used for entering numbers or text in dialog boxes. With no menu active: press a key to modify the range as shown below:

	1	2	3	4	5	6	7	8	9	0
NM	1/8	1/4	1/2	3/4	1.5	3	6	12	24	48

M5000 monitor keys

The monitor is configured and controlled using the row of touch sensitive buttons along the lower edge of the monitor frame. All buttons are backlit - only the power button is illuminated when the monitor is turned off.



A Power key

- With OSD (On Screen Display) menu active: press to return to previous menu level
- With no OSD menu action: no action

B Brilliance adjustment key

- Press plus/minus key to decrease/increase brightness (no on-screen display of brightness level)
- Simultaneously press and hold both keys to reset the brightness level to default value. The default value is set in the OSD menu
- With OSD menu active: press plus/minus key to move focus up/down in the menu

C Enter key

- With OSD menu active: press to confirm a selection
- With no OSD menu active: no action

D Red LED

- Solid on: standby mode, or no video source
- Flashing: monitor booting or upgrading

E Menu key

- Press and hold to activate the OSD menu

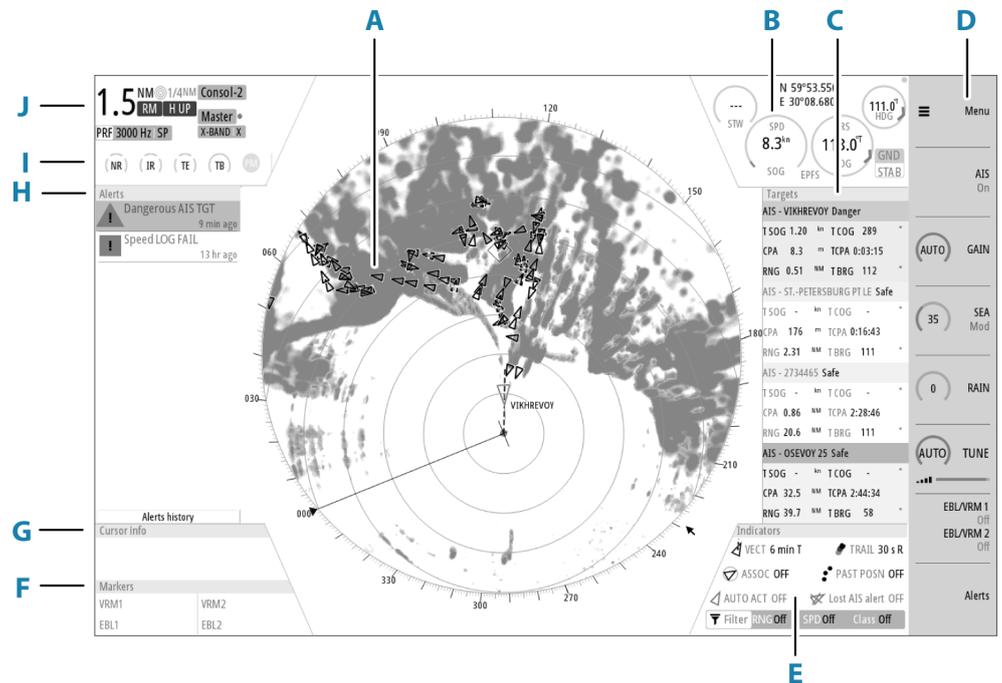
For more information, refer to the separate documentation for the monitor.

3

The user interface

Main panel

The main panel is divided into predefined areas as shown in the figure below.



A Plan Position Indicator (PPI)

Radar video area where all tracking and navigation options are performed.

B Own ship information

Stabilization mode indicator, picture freeze indicator and gauges showing primary and secondary sensors.

C Target panel

Detailed information about selected targets and AIS targets.

D Quick access buttons

Dedicated buttons for main function.

E Target indicators

Overview of target indicator settings.

F Markers

Details for active VRM and EBL markers.

G Cursor information

Range and bearing from the vessel to the cursor position. Also including position information if a position source is available.

H Alerts panel

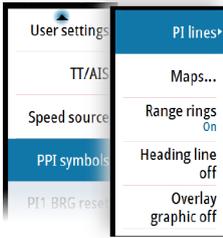
List of all active alerts.

I Signal indicators

Gauges for signal processing and indicators for radar functions.

J System information

Range, mode and pulse details.



PPI symbols

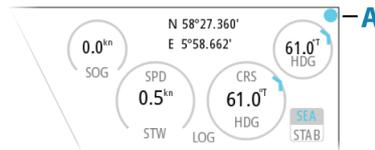
Range rings and heading line symbols can be turned on and off individually.

For parallel index lines and maps, see *"Parallel index lines"* on page 45 and *"Maps"* on page 50.

The overlay graphic off menu option turns off all graphics overlaid on the radar PPI, showing only the video signal.

→ **Note:** The heading line off and overlay graphic off menu options are mono stable. That means you have to press and hold the enter key or the right arrow key to temporarily remove the relevant symbols from the panel. The graphics are invisible as long as the key is pressed, and will turn on again when the key is released.

Picture freeze indicator



The image includes a picture freeze indicator (**A**). The small dot blinks at an interval of 1 second to show that the screen is alive and that information from sensors is updated.

If the picture freezes the unit needs to be restarted.

Quick access buttons

The quick access buttons are activated from the dedicated keys on the controller, or by using the mouse to select the button.

More details about the quick access buttons are available in the separate sections describing the functions later in this manual.

Quick access pop-ups

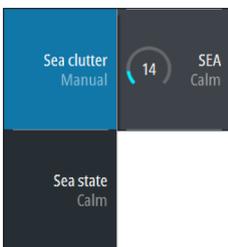
Some of the quick access buttons have additional functions, presented as a pop-up.

To display the pop-up:

- Double-press the dedicated key on the controller
- Press the right mouse key when the cursor is over a selected quick access button

To remove the pop-up and revert to the button's main function:

- Press the exit key on O2000
- Press the left mouse key when the cursor is outside the pop-up
- Press the right mouse key when the cursor is over the pop-up



Main menu and submenus

You access the main menu by pressing the menu key, or by selecting the quick access menu button.

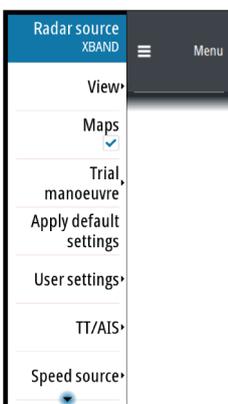
To operate the menu with the O2000:

- Press the up and down arrow keys or turn the rotary knob to move up and down in a menu
- Press the enter key, the right arrow key or the rotary knob to access a submenu, to toggle options or to confirm a selection
- Press the exit key or the left arrow key to return to previous menu level and then exit the menu system

Some options display a slider. Turn the rotary knob or press the up/down arrow keys to adjust the value.

To use the trackball mouse to operate the menu:

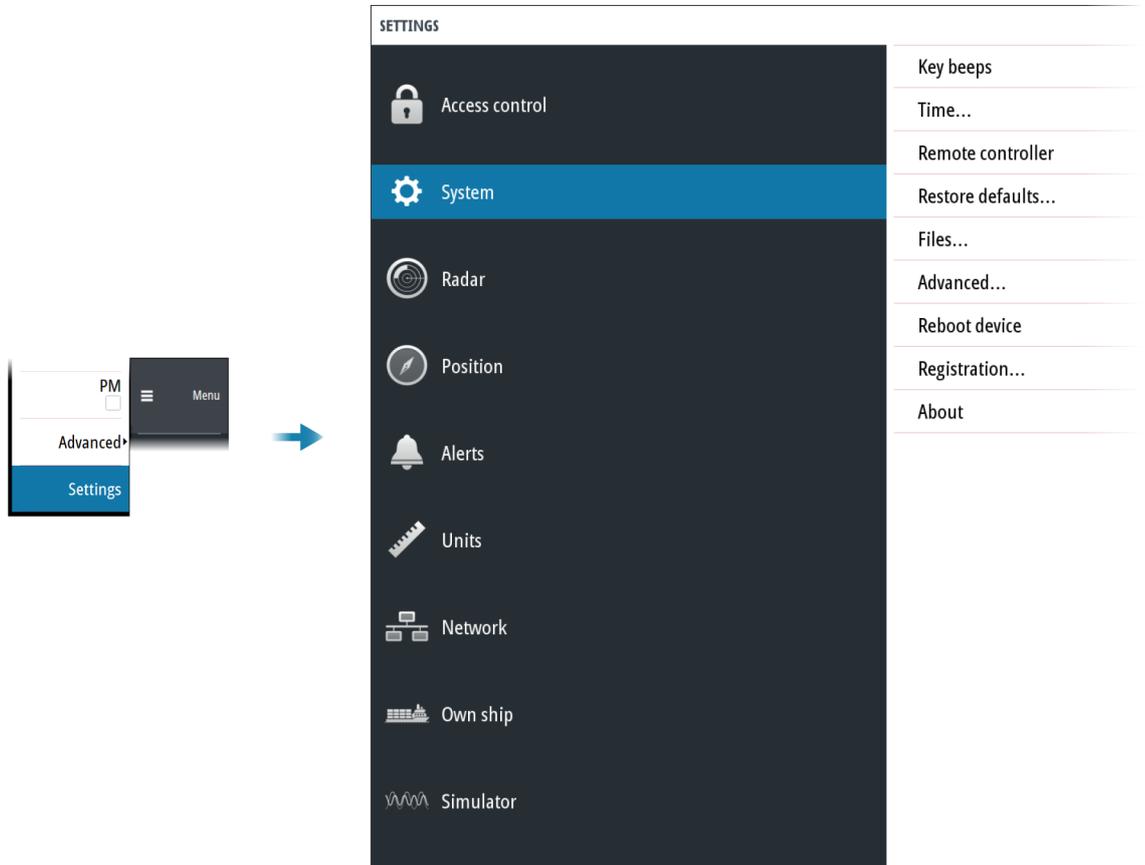
- Use the scroll wheel to move up and down in a menu
- Use the left key to access a submenu, to toggle options or to confirm a selection



- Use the right key to return to previous menu level and then exit the menu system
- **Note:** The cursor must be located over the menu to operate the menu system.

The settings dialog

The software setup is done from the settings dialog.



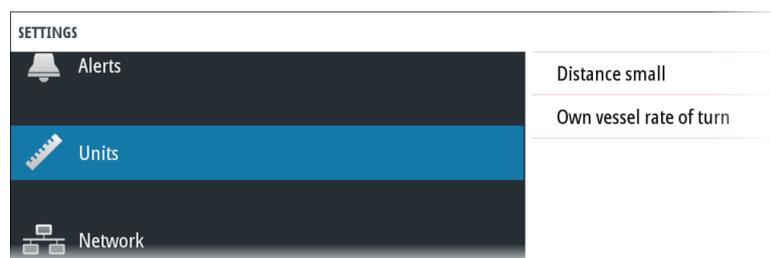
Own vessel symbol

At large range scales, the indication of antenna position, the CCRP and own vessel are the same, and indicated as an own ship minimized symbol.

At small range scales, the vessel's actual size (defined in the commissioning of the radar system) is indicated. If the antenna position deviates from the CCRP this will be shown on the image.



Units of measure settings



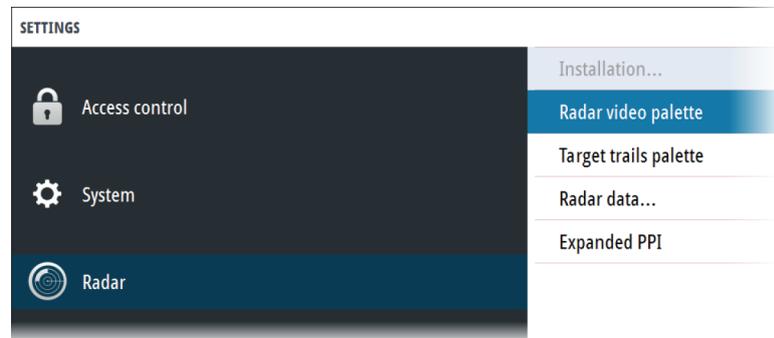
By default, speed measurements are in knots (kn), and large range measurements are in nautical miles (NM). These settings cannot be changed.

For distances below 0.125 NM you can select to show the distance in meters.

→ **Note:** Units of measurements can only be changed when the connected antenna is in standby mode.

Radar video palettes

Different palettes are available for the radar video and for the target trails.



Expanded PPI

With this option selected, the radar video outside the bearing scale is visible as a shaded image. Targets, VRM and Range rings are not visible in the expanded PPI area.

On-screen keyboard

A numeric or alphanumeric virtual keyboard is displayed when required to enter user information in dialogs.

To enter text:

- Use the arrow keys to locate the cursor over a virtual key, then confirm the selection with enter key
- Select a virtual key with the left mouse key

If the virtual keyboard is inactive for 10 seconds it will automatically close.

Complete the entry and close the dialog by selecting the virtual enter key.

Remove the virtual keyboard without saving by pressing the exit key.

4

Basic operation

Turning the system ON and OFF

Turning ON

Press the standby/brilliance key to turn the system ON.

The system will be ON as long as power is connected.

Switching the system to standby mode

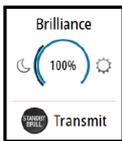
Press and hold the standby/brilliance key to turn the R5000 radar processor and the monitor to standby mode. The radar sensor is turned into standby mode only if R5000 is controlling it (connected as master). If it is in slave/clone mode, the sensor will continue transmitting.

→ **Note:** For controlling the radar sensor in a multi-radar installation, refer to "*The Interswitch function*" on page 24.

Adjusting display brightness

The brilliance is adjusted from the brilliance pop-up.

- Display the pop-up by pressing the standby/brilliance key, then adjust the display brilliance by turning the rotary knob.



At first start-up, the display brilliance is set to 100%. When the unit is restarted, the brilliance is automatically set to the level it was prior to switching the unit off.

The system includes a day and a night color palette. When the brilliance is set to 40% or lower, the system switches to use the night palette.

- With the pop-up open, switch between the day and night palette by pressing the left (40%) or right (100%) arrow keys.

Close the pop-up by pressing the exit key.

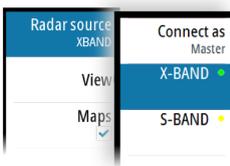
This brightness adjustment affects all screen items on the radar panel. You can also adjust the display brightness for individual panel items. Refer to "*Setting the brilliance for panel items*" on page 32.

Selecting radar source

More than one radar sensor can be connected to the radar control unit.

Select the active radar sensor from the main menu.

For information about controlling radar sensors in a multiple radar installation, see "*The Interswitch function*" on page 24.



Switching the sensor between transmit and standby mode

You switch between transmit and standby mode when the brilliance pop-up is displayed.

- Display the pop-up by pressing the standby/brilliance key, then repeat short presses on the key to switch between standby and transmit mode

Adjusting the radar range

The radar range is shown in the system information area on the radar image.



To increase or decrease the range:

- Press the + or - icons on the range key
- Select a predefined radar range by using the numeric keys on the remote controller. Refer to "*O2000 front controls*" on page 12.

There is a direct link between the range scale and the operational mode of the selected radar sensor.

Range scale	Standard radar operation		Target boost radar operation	
	A	B	A	B
1/8 NM (200m)	0.08/3000	24	0.08/3000	24
1/4 NM	0.08/3000	24	0.08/3000	24
1/2 NM	0.08/3000	24	0.08/3000	24
3/4 NM	0.08/3000	24	0.08/3000	24
1.5 NM	0.08/3000	24	0.08/3000	24
3 NM	0.08/3000	24	0.25/1500	48
6 NM	0.25/1500	48	0.25/1500	48
12 NM	0.25/1500	48	0.8/750	72
24 NM	0.8/750	72	0.8/750	72
36 NM	0.8/750	72	0.8/750	72
48 NM	0.8/750	72	0.8/750	72
64 NM	0.8/750	72	0.8/750	72
72 NM	0.8/750	72	0.8/750	72

A: Pulse length (μ S/PRF (Hz))

B: Maximum radar range visibility (NM)

For more information refer to the radar sensor documentation.

Using the cursor

The cursor can be used to measure a distance, to define various radar map elements, and to acquire and select targets within the PPI area.

By default, the cursor is not active after power on.

To activate the cursor:

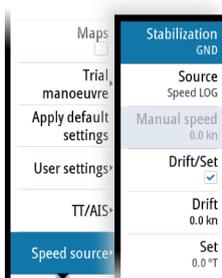
- Press one of the arrow keys
- Use the mouse to position the pointer inside the PPI area

When the cursor is active on the radar PPI, the cursor information area will show range and bearing from the vessel to the cursor position. If the system is connected to a position source (i.e. EPFS), the cursor information area includes the geographic position of the cursor.

To deactivate the cursor:

- Press the exit key
- Use the mouse to position the pointer outside the PPI area

Cursor info	
N 55°15.526'	7.22 NM
E 12°09.881'	69.6 °T



Selecting speed source

Speed information can be obtained from different speed sources connected to the system.

At any time you can switch the preferred primary speed source to any of the available speed sensors from the menu.

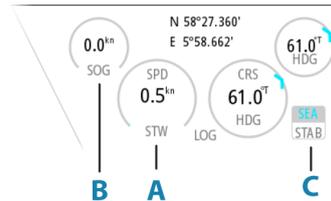
The stabilization mode depends on the selected speed source. The system will automatically switch to the available stabilization mode when the speed source is changed.

The table shows stabilization modes available for each speed source type. Any restrictions for a source are detailed under each speed source description in the following sections.

Speed source	Stabilization mode available	Restrictions
Speed LOG (Single axis)	Sea	None

Speed source	Stabilization mode available	Restrictions
Speed LOG (Dual axis)	Sea and Ground (depending on the transducer)	None
EPFS	Ground	None
Manual	Sea	Yes
Auto drift	Ground	Yes

Primary speed source (**A**), secondary speed source (**B**) and stabilization mode (**C**) are shown in the own ship information panel.



→ **Note:** In case of unsafe data integrity the vessel coordinates are highlighted with yellow color.

Speed log

The speed log can be single or dual axis input, and either water track or bottom track. Therefore the stabilization mode available can be either sea or ground depending on the sensor in use.

→ **Note:** The speed through water measured close to the hull is affected by the tide and by the current, so from time-to-time it will differ significantly from the speed over the ground. A speed log measuring speed through water may, in specific cases, be affected by poor conditions due to e.g. air or ice below the sensor. If the sensor measures only the longitudinal component of the speed, the transversal ship component is unknown to the radar.

EPFS

The EPFS provides true speed and true course over ground.

Manual speed

When this option is selected you can manually enter speed, drift and set (heading).

→ **Note:** Manual speed is not available if AIS is turned ON.

Auto drift

When this option is selected the system uses a stationary tracked target as speed reference for calculating own ship speed. The function is used when no speed sensors are available.

→ **Note:** The auto drift option is only available if the AIS function is OFF and if a target is set as reference.

⚠ Warning: The echo used as reference must be a stationary target. Otherwise all speed calculated will not be true, but only relative to the reference target. It is wrong to select a ship that is anchored as a reference; no alarm will be signaled when the ship starts to move and all the calculated true speed will change to erroneous values. The reference echoes should never be used to calculate relative speed. This data is not following a speed change with adequate accuracy for an anti-collision system.

⚠ Warning: When the reference target is lost, a warning is raised and the speed source will automatically be switched to LOG. If the LOG is working on water track, the speed mode will become sea stabilized and the user will be notified in case of a change of stabilization. The loss of a reference target may have a major impact on the accuracy of the results for true speed and true course of the target, and own speed precision will be degraded.



Selecting a reference target

A reference target must be selected before the speed source can be set to auto drift. The reference target is selected from the target menu.

To display the target menu, position the cursor over the preferred target and then:

- Press the enter key
- Press the right mouse key

The reference target is labelled with an **R** to identify it as a reference.

Target tracking

The enter key on O2000 and the mouse keys are used for managing targets.

To immediately acquire a radar target or to activate/de-activate an AIS target at the cursor position:

- Press the enter key
- Press the left mouse key

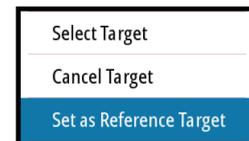
More options are available from the target menu, displayed by:

- Pressing and holding the enter key
- Pressing the right mouse key

The options in the target menu depends on if a target is located at the cursor position, the type of target, and the status of the target.



No target at cursor position



Target at cursor position

See more details about radar and AIS targets in *"Targets"* on page 33.

Acknowledging alerts

To acknowledge the most recent alert:

- Press the acknowledge key

The focus is moved to the alerts panel.

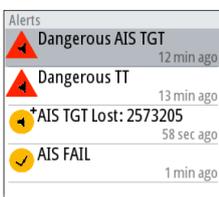
Repeat pressing the key to continue acknowledging alerts from the top of the alerts panel.

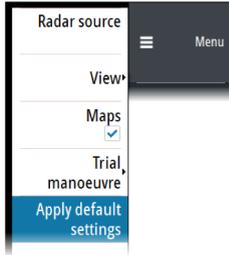
Press the exit key to exit the alerts panel.

When an alert is acknowledged, the alert icon stops flashing and changes to the acknowledged icon. The siren continues to sound if there are remaining unacknowledged alerts, otherwise it is muted.

The acknowledged alert is not moved to its new position in the sort order until there has been 2 seconds without any alerts being acknowledged.

For more details, refer to *"The alert system"* on page 60.





Applying default control settings

The apply default settings option allows for quickly setting the system back to a predefined state. The predefined values are defined in the radar requirements standard.

Refer "*Customizing radar control settings*" on page 54.

Screen capture

To take a screen capture:

- Simultaneously press the enter key and the standby/brilliance key

Screen captures are saved to internal memory.

5

The Interswitch function

Description

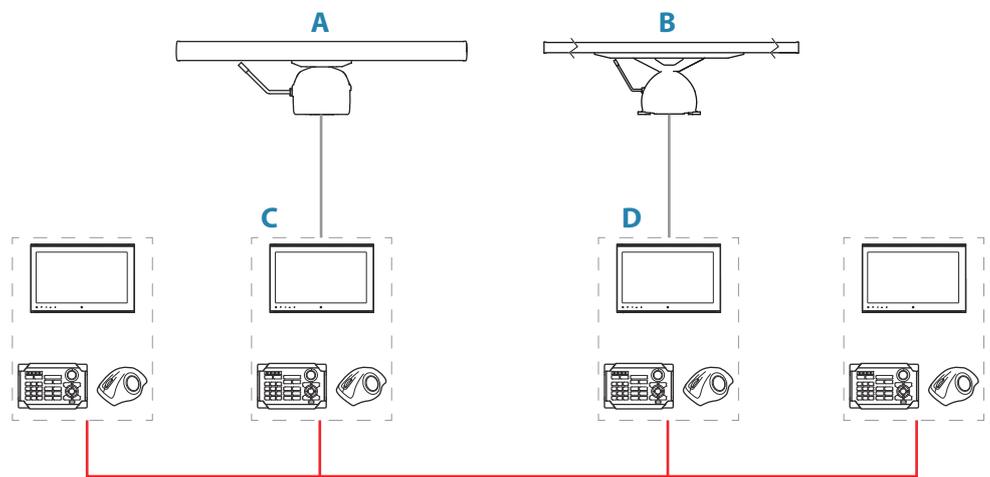
The interswitch function allows for sharing a radar sensor between multiple radar control stations.

Default master control station

The control station directly connected to a sensor shall always be that sensor's default master. A default master has top priority over all other control stations in the interswitch network, and can assume master control for this sensor at any time.

In the event of an interswitch network failure, the control station and the directly wired sensor will operate as a standalone radar.

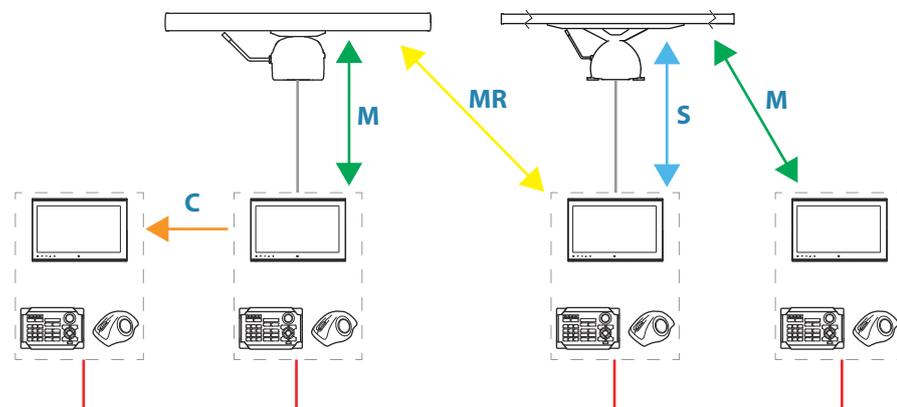
The illustration shows an installation with 2 sensors and 4 control stations. The control stations are connected via the interswitch network. In this example, sensor **A** is directly wired to control station **C**. Control station **C** is then by default sensor **A**'s default master. The same applies to sensor **B** and control station **D**.



Control station modes

The control station can have different control modes for the sensors connected via the interswitch network.

The illustration shows an example of control modes for an installation with 2 sensors and 4 control stations.



- M** Master mode
- MR** Master mode requested
- S** Slave mode
- C** Clone mode

Master

A master control station has full control of a radar sensor.

There can be only one master for each sensor at a given time. A control station has to release its master status before another control station can be set to master mode.

To release master control:

- Change the status from the menu. Refer to *"Changing control mode"* on page 25
- Turn the radar sensor to standby mode from the brilliance pop-up
- Turn the control station to standby mode by pressing and holding the standby/brilliance key

When a control station request master control of a radar sensor, the transfer will be pending until the current master has released its master status. When master mode for the sensor is available, the control will switch automatically.

If more than one control station request master control of a radar sensor, the control transfer is decided according to the priority table defined during setup of the system.

Slave

A slave control station has restricted control of the radar sensor.

There can be max 3 slaves for each radar sensor simultaneously.

Slave mode limitations

A slave cannot access:

- Radar transmission controls
- Performance monitor
- Radar tuning

If a master is available for the same sensor, a slave has limitations for the following functions:

- Transmit ON and OFF: only possible if the sensor is set to transmit on the master control station
- Radar range: the maximum radar range on a slave cannot exceed the range set on the master control station

→ **Note:** The slave control station can disable its radar presentation by pressing the standby/brilliance key on the O2000.

Clone

A clone control station mirrors a selected control station's display. A clone cannot control a radar sensor.

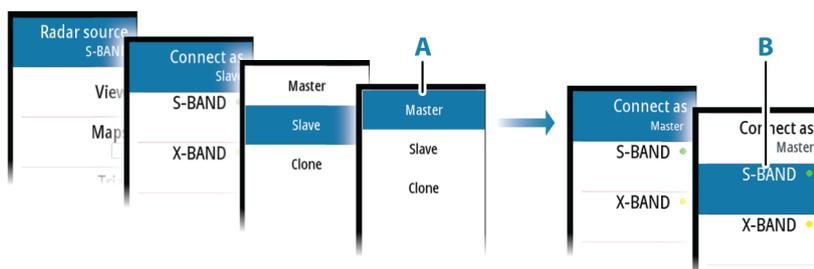
If the console that is controlling the radar sensor is disconnected, the clone will lose the connection to the radar sensor. The clone will have to manually select a new sensor.

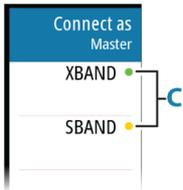
There can be multiple clone stations for each control station simultaneously.

Changing control mode

To request a control mode for a sensor from a control station:

- 1 Select the status you want to request (**A**)
- 2 Assign the status to a sensor (**B**)





The color indication (**C**) for the sensors shows if a control station can be connected as the master for a sensor:

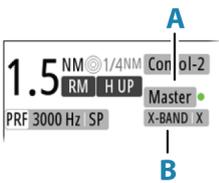
- Green: the sensor is available for master control
- Yellow: another control station has master control of the sensor

You can also request master or slave control mode from the sensor network status dialog.

TRANSMITTER NETWORK STATUS				
Transceiver	State	Master	Slaves	Default master
X-BAND	Standby		Consol-2	Consol-2
30U/1283-GSD	Warming			
S-BAND	Standby		Consol-1	Consol-1

Indication of control status

The control station's operational mode (**A**) for the active radar sensor (**B**) is indicated in the system information panel.



6

Adjusting the radar image

The radar image can be improved by adjusting the gain, by filtering out unwanted echoes due to sea clutter, rain or other weather conditions, and by tuning the sensitivity of the radar receiver.

Some functions include both a manual and an automatic mode. It is recommended to use the manual mode only if the automatic mode does not provide satisfactory results.

→ **Note:** The radar image settings do not affect the AIS targets.

Sea and rain clutter could be present at the same time, and further degradation in detection performance will be experienced. As sea clutter is related to short range and rain clutter is usually present in a longer range, rain clutter settings can be adjusted without affecting the echoes in the sea clutter area.

Long pulses should not be used in heavy rain, as the range will decrease significantly. See "*Performance limitations*" on page 28.

The radar image is controlled as described in the next sections.

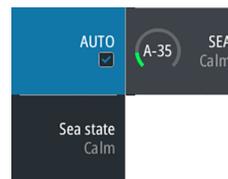
→ **Note:** It is recommended to turn trails off when you adjust the radar image as trails might hinder the proper video adjustment feedback.



Fine tuning automatic settings

Some radar settings include an automatic mode.

To achieve the best possible result in auto mode, the value can be manually adjusted to fine tune the settings. The text within the control icon will then change from **AUTO** to **A ± NN**, indicating that the automatic setting is manually adjusted.



To fine tune the automatic setting:

- Turn on the automatic option
- Use the rotary knob or the arrow keys to manually adjust the setting

Gain

The gain option controls the sensitivity of the radar receiver. A higher gain makes the radar more sensitive to radar echoes, allowing it to display weaker targets. If the gain is set too high, the image might be cluttered with background noise.

→ **Note:** The gain control shall not be used to clean the picture from sea or rain clutter.

The value of the gain should be set so that the background noise is just visible on the radar panel.

At start-up of the system, the gain is 80% in order to receive the optimum noise level.

Gain has a manual and an automatic mode.



Adjusting the gain

To adjust the gain:

- Press the gain key to activate the function, then turn the rotary knob to manually adjust the setting
- Press and hold the gain key to turn on/off the automatic option

Sea anti-clutter

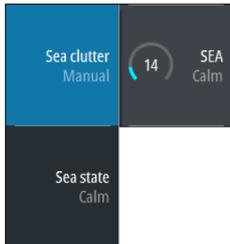
The sea anti-clutter option is used to filter the effect of random echo returns from waves or rough water near the vessel. When you increase the value, the sensitivity of the near field clutter caused by waves is reduced. If the value is increased too much, both sea clutter and

targets will disappear from the display. Targets around own ship may then not be shown as potentially dangerous targets.

⚠ Warning: At increasing levels of sea clutter, some targets cannot be detected even by means of the sea anti-clutter filtering, since buoys or other small objects are producing echoes of a level lower than the ones coming from waves.

The value of the sea anti-clutter should be set so that the clutter is seen as small dots, and small targets will become distinguishable around the ship.

Sea anti-clutter has a manual mode and an automatic mode. The system includes predefined settings for calm, moderate and rough sea state conditions.



Adjusting the sea anti-clutter

To adjust the sea anti-clutter:

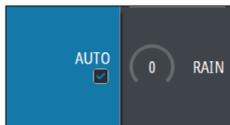
- Press the sea key to activate the function, then turn the rotary knob to adjust the setting
- Press and hold the key to turn ON/OFF the automatic option

Rain anti-clutter

Rain anti-clutter is used to reduce the effect of rain, snow or other weather conditions on the radar image. When you increase the value, the sensitivity of the long distance field clutter caused by rain is reduced. The value should not be increased too much as this may filter out real targets.

If the precipitation is located over the ship's position, the adjustment of rain clutter will affect the presentation of near echoes.

Rain anti-clutter has a manual and an automatic mode.



Adjusting the rain anti clutter

To adjust the rain anti-clutter:

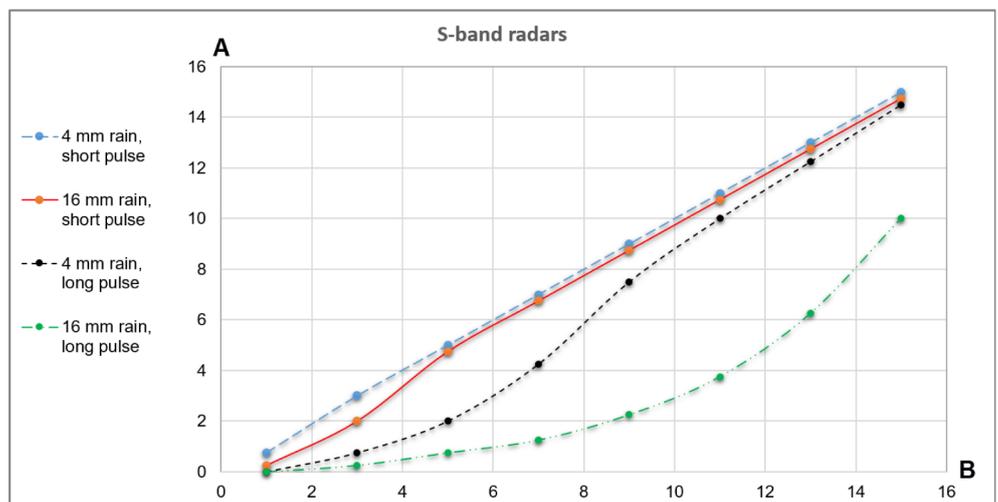
- Press the rain key to activate the function, then turn the rotary knob to adjust the setting
- Press and hold the key to turn ON/OFF the automatic option

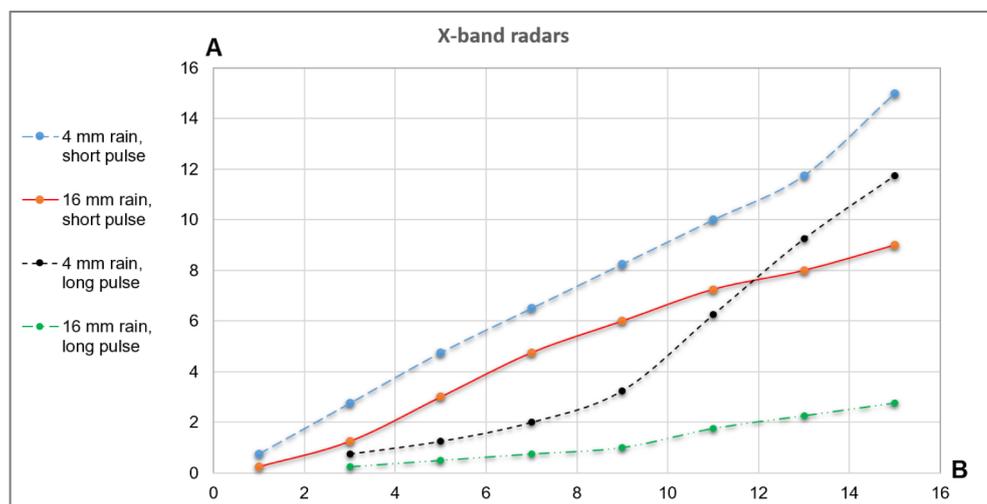
Performance limitations

The figures below show how the amount of rain and pulse length affect the detection range (in NM) for X-band and S-band radars.

The vertical axis (**A**) is reduction of range for first detection of a target. The horizontal axis (**B**) is the original range for first detection of a target.

As an example for long pulse length: a target that can be detected at 10 NM can only be detected on 3 NM with 16 mm rain.





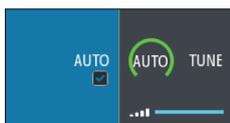
Tuning the radar sensor

You can tune the radar sensor to show maximum target returns on the screen.

Tuning has a manual and an automatic mode.

In automatic tuning mode, system performs a tuning of the radar sensor when the range scale changes.

Manual tuning should only be used if the automatic tuning fails. The tuning should not be performed earlier than 10 minutes after the radar has been switched on. Manual tuning is best done by a long pulse setting (range set to 24 NM), and by using a high level of gain. In this condition, adjust the tuning control to obtain the maximum signal strength.



Adjusting the tuning

The O2000 remote controller has no dedicated tune key. Adjust the tuning by using the mouse, or by using a combination of the mouse and the remote controller:

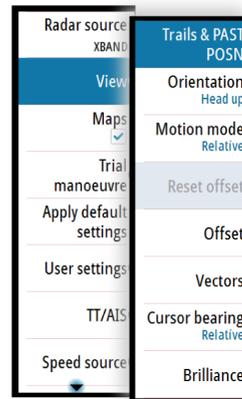
- Select the tune quick access key to activate the function, then use the scroll wheel or the rotary knob to adjust the setting
- Press the left mouse key twice to turn ON/OFF the automatic option

7

Radar view options

Several radar view options are available from the menu.

→ **Note:** The motion mode and offset options are disabled at max zoom range (72 NM). The functions are enabled again when zooming down one level.

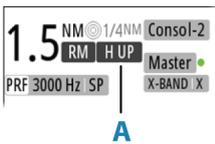


Target trails and past position

You select how the radar targets are displayed on the radar image in the trails and past position submenu. See "Display settings for radar targets" on page 35.

Radar orientation

Selected radar orientation is shown in the system information panel (A).



Head-up

In head-up mode, the heading line on the PPI is oriented on the 0° on the bearing scale and towards the top of the screen. The radar image is displayed relative to own ship, and when the ship turns the radar image rotates.

→ **Note:** Head-up is only available in relative motion mode, and it is the only orientation mode available if the radar is not connected to a heading source.

North up

In north up mode, the 0° indication on the PPI represents north. The heading line on the PPI is oriented according to own ship heading obtained from the gyro compass. When the ship turns the heading line changes its direction according to the ship's heading, while the radar image remains stabilized.

The north up orientation is not available if no heading source is connected to the radar. If heading data is lost, the system will automatically switch to head-up orientation.

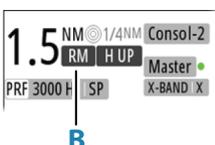
Course up

In course up mode, the top of the bearing scale indicates the ship's true course measured from north at the time course up was activated. When the ship turns the bearing scale remains fixed, while the heading line rotates with the ship's yawing and course change.

The course up orientation is reset by re-selecting the course up mode.

Radar motion mode

Selected radar motion mode is shown in the system information panel (B).



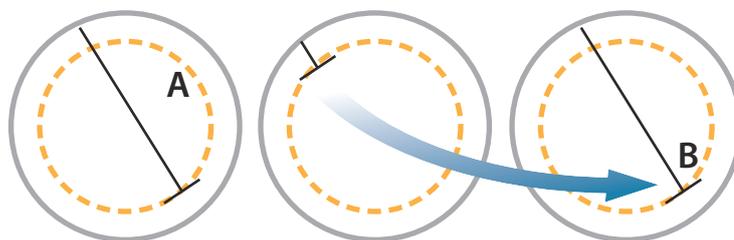
Relative motion

In relative motion your vessel remains in a fixed location on the Radar PPI, and all other objects move relative to your position.

You select the position of the fixed location as described in "Offsetting the PPI center" on page 31.

True motion

In true motion your vessel and all moving targets move across the Radar PPI as you travel. All stationary objects remain in a fixed position. When the vessel's symbol reaches 75% of the PPI radius (**A**), the radar image is redrawn with the vessel symbol re-positioned (**B**) 180° opposite the current heading bearing.

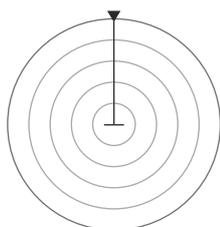


When true motion is selected, the true motion reset option is available from the menu. This allows for manually resetting the radar image and vessel symbol to its starting position.

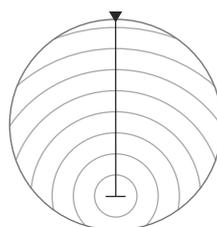
→ **Note:** True motion is only available when the PPI is in either north up or course up orientation mode.

Offsetting the PPI center

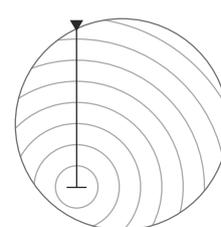
You can set the antenna position origin to a different location on the radar PPI. The options described in the next sections are available.



PPI center: Center



PPI center: Look Ahead



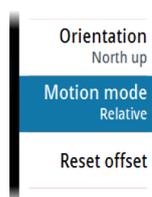
PPI Center: Offset

→ **Note:** The bearing scale is according to the Consistent Common Reference Point (CCRP), while the offset sets the radar antenna position on the PPI. The maximum off-centering allowed is 75% of the radius at the current range. This may result in the CCRP being outside of the bearing scale. In such cases the measurements are still taken by the CCRP and the bearing scale is compressed accordingly.

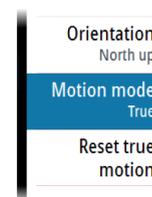
Re-setting the PPI center

In relative motion, you can reset the offset by using the reset offset option in the menu.

In true motion, the offset will be removed when the radar image is automatically redrawn. You can manually remove the offset by using the reset true motion option in the menu.



Menu option - Relative motion



Menu option - True motion

Look ahead

The Look ahead option is used to maximize the view ahead of the vessel. When selected the PPI center is placed at 70% of the radius of the PPI, 180° opposite the top of the display.

→ **Note:** The look ahead option is only available for heading up radar orientation.

Offset to cursor position

This option allows you to use the cursor for selecting the antenna center.

When the option is selected, the cursor is displayed on the PPI.

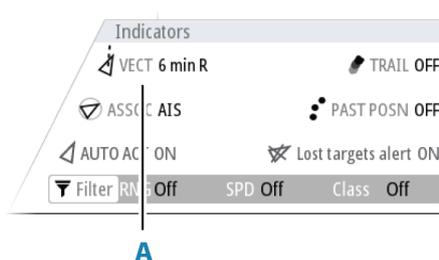
- Move the cursor to the preferred offset position, then press the enter key or the left mouse key to move the PPI center to the cursor position.

Vectors

A target vector indicates the expected target movement within a defined time. The vectors are computed by multiplying the target speed with the set time value.

You can select to show target vectors with true or relative speed, and you can set the length of the vector. The length represents the vessel movement within the given time period.

Vector settings are shown in the target indicators panel (A).



- **Note:** True speed indication is not possible if there is a gyro or speed source failure. If the vectors are in true presentation and one of the sensors (gyro or speed log) fails, the presentation is automatically switched to relative.

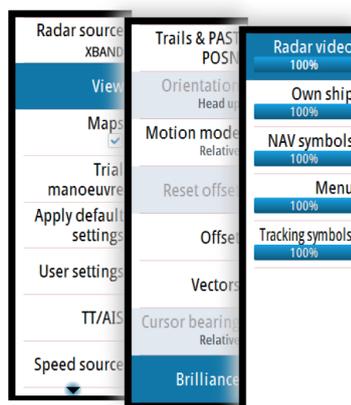
Cursor bearings

You can select to show the cursor bearings as true or relative to own vessel.

- **Note:** True can only be selected when a gyro is available.

Setting the brilliance for panel items

The brilliance can be set individually for the various panel items.



8

Targets

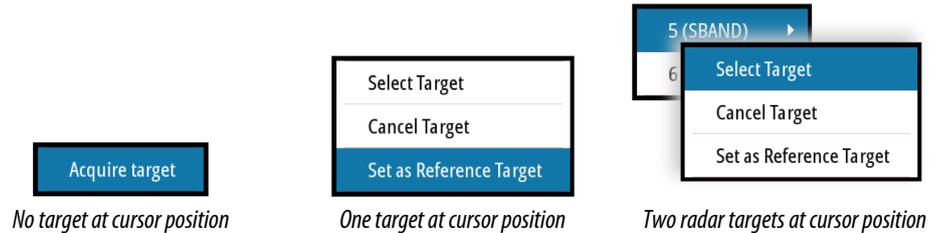
The target menu

When the cursor is active, the target menu can be displayed by:

- Pressing and holding the enter key
- Pressing the right mouse button

The items in the target menu depends on if a target is positioned at the cursor position, the type of target, and the status of the target.

If more than one target is located at cursor position, the menu will show the reference number for radar targets, and ship names for AIS targets.



Close the target menu by:

- Pressing the exit key
- Re-pressing the right mouse button

The target panel

The target panel can display basic information for up to four targets (**A**), or detailed information about a selected target (**B**).

A				B							
Targets				TT - 44 Danger							
RSTW	0.00	kn	RCTW	0	°						
CPA	0.54	NM	TCPA	0:01:02							
RNG	0.54	NM	RBRG	89	°						
TT - 26 Danger				TT - 44 Danger							
RSTW	0.00	kn	RCTW	0	°	RSTW	0.00	kn			
CPA	0.60	NM	TCPA	0:01:02			RCTW	0	°		
RNG	0.60	NM	RBRG	89	°	CPA	0.54	NM			
				TCPA				0:01:02			
				RNG				0.54	NM		
				RBRG				89	°		
				ROT				-			

The following targets are included in the target panel:

- Tracked radar targets
- Activated AIS targets
- Dangerous targets

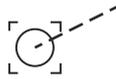
The targets listed are prioritized by the time they appear (the first appears on the top).

Selecting and de-selecting targets

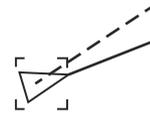
AIS targets and tracked radar targets can be selected from the target menu. Only one target can be selected at a time.

When you select a radar or an AIS target, the target symbol changes to the selected target icon, and the target panel changes to show detailed information for the selected target





Selected radar target



Selected AIS target

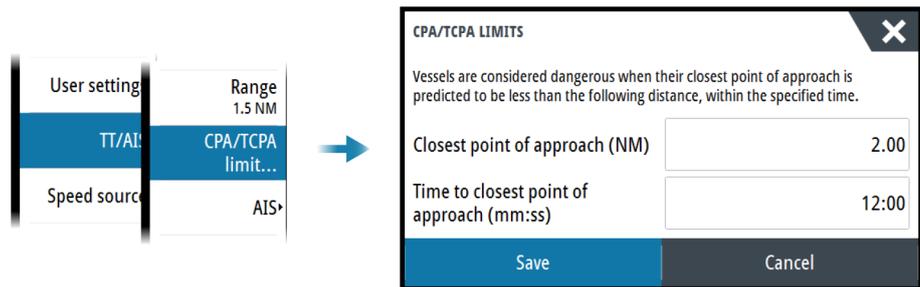
To de-select a target and remove the detailed target information in the target panel:

- Select the deselect target option in the target menu

→ **Note:** Deselected target is placed first in the Target panel list.

Defining dangerous vessels

You can use the CPA (Closest point of approach) and TCPA (Time to closest point of approach) values to define when a target should be considered as dangerous. When a target comes within the distance for CPA or within the time limit for TCPA, the symbol changes to the dangerous target symbol.



Radar targets

Any radar echo within a preset range can be acquired and tracked. The system can track up to a preset number of radar targets. For target range and number of targets, refer to *"Technical specifications"* on page 78.

An alert is triggered if the number of tracked targets exceeds 95% of the maximum system limitation and when maximum capacity is reached. Only the target closest to the own vessel will be visualized.

You can manually acquire a radar target as described in the next section.

The guard zone option enables the system to automatically acquire targets. Refer to *"Tracking zones"* on page 44.

Manually acquiring radar targets

When the cursor is active, you can immediately acquire a radar target at the cursor position by:

- Pressing the enter key
- Pressing the left mouse button

You can also acquire a target from the target menu. Display the menu by:

- Pressing and holding the enter key
- Pressing the right cursor button

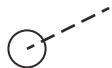
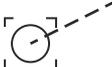
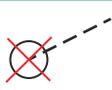
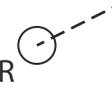
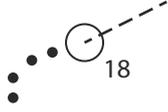
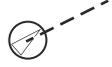
There might be a delay after having acquired a radar target before the system receives stable target data:

- After 1 minute the symbol will show a trend vector, and speed and course of the trend will be shown in the target panel
- After 3 minutes the symbol will become steady, and all the data fields of selected targets will be available. The target symbol will change to the tracked radar target symbol.

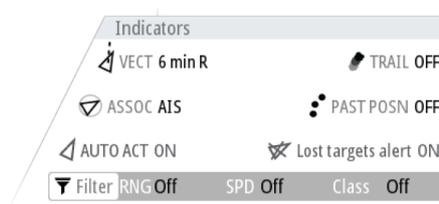
The above time references represent worst case situations. In a stable situation the radar target information is available immediately.

Radar target symbols

The following symbols are used for radar targets in the system:

Symbol	Description
	Tracked radar target with velocity vector
	Selected radar target , indicated with a square (dotted line) around the target symbol
	Dangerous radar target , indicated with bold line and with red color. The symbol flashes until the target alarm is acknowledged by the operator. It remains red until the system no longer defines it as a dangerous target
	Lost radar target , indicated with crossed lines centered on the target symbol. The symbol is located at the last received position from the target
	Reference target
	Radar target with past position and velocity vector
	Radar target in acquisition state , indicated as a broken circle centered at the position of target acquisition
	Associated target - using radar data

Display settings for radar targets



You select how the radar targets are displayed on the radar image in the trails and past position menu.

The settings are indicated in the indicators panel.

Trails and past position presentation mode

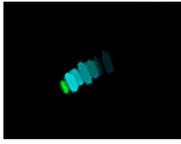
Trails and past position indicators can be displayed as either true or relative to own ship.

Trails and past position indicators are available in both sea and ground stabilization modes. See *"Selecting speed source"* on page 20.

Target trails

A target trail indicates the target movement by leaving an afterglow, gradually reducing the intensity over time.

Target trails show where a target used to be, and the function is useful for quickly assessing the movement of targets relative to your own vessel.



You can set the length of the trails. The length represents the time it takes for the trails to fade out.

The clear trails option clears target trails from your radar panel temporarily. The trails start to build up again unless you switch the function off.

Showing a target's past position

- Past positions: used to visualize the previous positions of a tracked target or an activated AIS target
- Time: defines the length of time for which each target's past positions should be displayed on the PPI
- Interval: defines the distance between each past position indicator

⚠ Warning: Trails build-up starts when exiting from the standby condition. Trails or past position length will be reached only after the selected time duration.

Possible target tracking errors

Some factors can generate tracking errors or make the radar image difficult to read, and therefore reduce target detection capability:

- Sea, rain, snow and low clouds returns
- Radar Interference
- Sidelobe echoes
- Blind sectors
- Low signal to noise ratio and signal to clutter ratio

⚠ Warning: The speed and course of a radar target are obtained by consecutive measurements of the echo position. The data is then filtered to reach the required precision. This means, that every abrupt change of speed and direction will be recognized with a certain delay to reach absolute certainty that the target is moving in a different way. The confirmation delay is about five scans and after that some additional time is needed to reach the same data precision as from before the maneuver.

Sea, rain, snow and low clouds returns

Radar echoes in sea, rain or weather clutter areas may be masked by the clutter. The effects of such errors appear as continuous big changes of the target course and speed vectors. Sometimes the symbol of a target that has been acquired at high speed can slip away from the real target position after a certain time, and this might generate the lost target alarm.

These errors can be avoided or at least minimized by proper manual adjustments of sea and rain controls, or by selecting the automatic control option. For more details, see "*Adjusting the radar image*" on page 27.

Radar interference

Other radars operating in the same frequency band can generate interference. Normally this is seen on the radar screen as a series of spirals. When the interference falls on the tracked target, it can cause a deformation of the size of the echo, and consequently a small error in the target's course and speed values.

Adjustment option is available in the advanced menu. See "*Rejecting radar interference*" on page 55.

Second trace echo

A second trace echo is an echo received from a distant target, received after the following pulse has been transmitted.

Second trace echoes are present only under abnormal atmospheric conditions, or in condition of super-refraction.

These echoes will be displayed at their correct bearing, but at a wrong range.

Second trace echoes can be recognized by their irregular shape. Since the period between two subsequent transmitted pulses is subject to small variations, the second trace echo appears undefined and hazy.

Second trace echoes are automatically suppressed by the radar when the interference rejection is turned on. Refer "*Rejecting radar interference*" on page 55.

Sidelobe echoes

Radar antennas have a radiation pattern consisting of a main lobe and several very small sidelobes. Most of the energy transmitted by the radar is radiated and received back on the main lobe, and a very small part on the sidelobes. This has no effect in case of distant or small targets, but the returns from a large target at short range (less than 3 NM) can generate, on both sides of the main echo and at the same range, arcs or series of small echoes. These effects, when they are an extension of the main echo, can cause momentary errors for the tracking, and course and speed values given by the tracking can become unstable.

The problem can usually be eliminated or strongly reduced by an accurate adjustment of the Sea control. Refer "*Sea anti-clutter*" on page 27.

Blind sectors

Funnels, masts or other obstructions (when located near the radar antenna) may cause blind or shadow sectors, where the target visibility may be completely lost or strongly reduced. Targets remaining in these sectors for a long time (more than 10 antenna revolutions) will be considered lost, and the lost target alert will be triggered.

Low signal to noise ratio and signal to clutter ratio

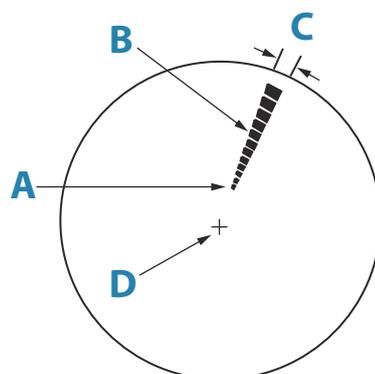
In situations where the signal to noise or the signal to clutter ratio of the radar echoes is low (small vessels in heavy sea or rain clutter, or big vessels close to the radar horizon), target detection is poor and the tracking will not detect the target at each antenna revolution. This will cause errors in the tracking, and it can range from missed information and up to complete loss of the target when it is missed for 10 consecutive antenna revolutions.

Radar SART

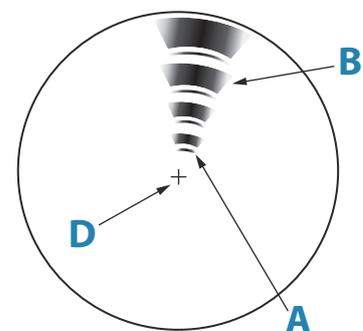
A SART (Search And Rescue Transponder) is used for emergencies. These devices may be either a radar-SART, or a GPS-based AIS-SART.

The radar-SART is used to locate a survival craft or distressed vessel by creating a series of dots on the radar PPI. The range for detection of a radar-SART is normally about 8 NM, and its signal may be triggered by any HD or X-Band radar.

Since the radar-SART is very near, side lobes from the radar antenna may show the responses as a series of concentric arcs or rings. This effect can be removed by using the Sea anti-clutter control. It is useful to observe the side lobes as they might be easier to detect in clutter conditions, and they will confirm that the radar-SART is very close to own ship.



Radar-SART far from own vessel (range: 24 NM)



Radar-SART close to own vessel (range: 3 NM)

- A** Position of SART
- B** Echo from SART

- C Radar antenna beamwidth
- D Own ship position

Recommended settings for radar-SART detection

To best detect a radar-SART signal, adjust the settings as follows:

- Set the range scale between 6 and 24 NM
 - The spacing between responses is too small to be distinguished at higher scales (0.64 NM)
 - The length of the radar-SART response (12 dots) may be extended to 9.5 NM beyond the position of the radar-SART, and it is necessary to see more than one response dot to distinguish the radar-SART from other responses
- Set the sea clutter control to manual mode and adjust it to minimum
 - A high value could remove the SART response
- **Note:** With a minimum value for SEA anti-clutter, ships inside the clutter range may not be visible to the radar.

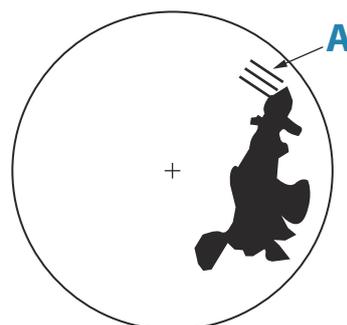
If the sea clutter is strong when the SEA anti-clutter control is set to minimum, the first few dots of the radar-SART response might not be detectable. In such conditions, the position of the radar-SART may be estimated by using the EBL/VRM off center function and measure 9.5 nautical miles from the farthest dot back towards own ship.
- Set the rain anti-clutter control to manual mode, and adjust as required to avoid rain clutter
 - The setting does not affect the radar-SART detection
- Set the gain control to manual mode, and adjust it to see some noise dots in the background
 - Normal gain setting for long range detection can usually be used (around 80% of max range)
- Turn OFF target boost. See "*Target boost*" on page 55
 - The shape and dimension of the radar-SART dots could be affected by this setting.

⚠ Warning: The operator should take care when using the radar with these settings. The detuned radar will not be able to see and track targets as well as it will when it is tuned, and the anti-collision functions may no longer be working. The tuning should be returned to normal as soon as possible.

Racon

A racon (radar beacon) is a radar transponder commonly used to mark maritime navigational hazards.

A racon responds to a received radar pulse by transmitting an identifiable mark back to the radar. The displayed response has a length on the radar display corresponding to a few nautical miles, encoded as a Morse character beginning with a dash for identification. The inherent delay in the racon causes the displayed response to appear behind the echo from the structure on which the racon is mounted (**A**).



Racones and their identifying marks are normally indicated on marine charts. Their purpose can change with the country they are used in. Generally they are used to:

- Identify aids to navigation, both seaborne (buoys) and land-based (lighthouses)
- Identify landfall or positions on inconspicuous coastlines
- Indicate navigable spans under bridges
- Identify offshore oil platforms and similar structures
- Identify and warn of environmentally-sensitive areas (such as coral reefs)

In some countries they are also used to:

- Mark new and uncharted hazards (these should use the Morse identifier "D")
- Identify center and turning points
- Leading line racons

Racones installed on buoys are usually active for 20 seconds, and then off for the next 20 seconds.

Recommended settings for racon detection

The racon response could be degraded by rain and sea anti-clutter control, and by interference suppression. Turning off of the above mentioned settings should improve the racon visibility on the PPI. The detection range of a racon may also be reduced if the radar receiver is not tuned.

AIS targets

If a compatible AIS receiver is connected to the radar system, AIS targets can be displayed and tracked.

The system can display and activate a preset number of AIS targets. Refer details in "*Technical specifications*" on page 78. An alert is triggered if the number of AIS targets exceeds 95% of the maximum system limitation and when the maximum capacity is reached. When the total AIS capacity is reached, additional AIS targets will be visualized following a range based priority logic. Only the target closest to the own vessel will be visualized.

The AIS function is available when:

- AIS data is available through the serial line
- Gyro compass heading is available. If gyro heading is lost the AIS function is automatically switched OFF
- EPFS valid position is available

By default, all AIS targets are shown as sleeping targets if the AIS function is turned ON. You can manually activate a sleeping target, or you can set up the system to automatically activate sleeping targets as described in the next sections.

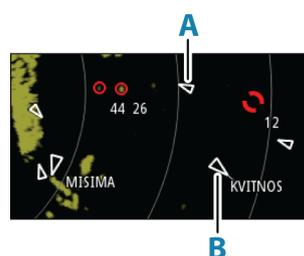
AIS targets can be filtered as described in "*AIS target filters*" on page 41.

Activating AIS targets

AIS targets are initially presented in sleeping status (**A**). A sleeping target does not show vectors and heading lines, but only a small icon pointing in the direction of the target's heading.

You can switch a sleeping target to an activated target (**B**). An activated AIS target shows a larger icon, and it has an associated vector, heading line and a turning indicator if available. Only activated AIS targets are listed in the target panel.

Activated AIS targets are always processed against CPA/TCPA limits, and are defined as dangerous targets if the CPA/TCPA limits are exceeded.



Manually activating an AIS target

When the cursor is active, you can immediately activate an AIS target at cursor position by:

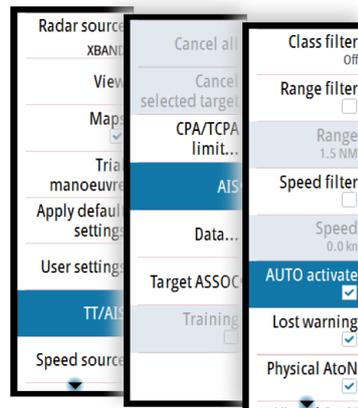
- Pressing the enter key
- Pressing the left mouse button

You can also activate an AIS target from the target menu, displayed by:

- Pressing and holding the enter key
- Pressing the right cursor button

Automatically activating AIS targets

You can enable the system to automatically switch a sleeping target to an activated target when the CPA or TCPA is lower than the set minimum safe value. In this situation the AIS target is automatically defined as a dangerous target.



AIS vessel ID

Activated AIS targets are shown with the vessel ID.



AIS target symbols

The following icons are used for AIS targets in the system:

Symbol	Description
	Sleeping AIS target , aligned with received heading information or with COG information if heading is not available
	AIS target with heading line and SOG/COG (dashed line), and with indicated turn direction
	AIS target with true scaled outlines
	AIS target with past track
	Selected AIS target , indicated with a square (dashed line) around the target symbol