SIMRAD®

R5000 Radar System

Operator manual

English



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Preface

Disclaimer

⚠ Warning: Refer to important safety information in the product documentation and review all warnings, limitations, and disclaimers before using this product.

This product is not a substitute for proper training and prudent seamanship. 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.

Navigational features that appear in this document are not a substitute for proper training and prudent seamanship. They do not replace a human navigator and SHOULD NOT be relied on as a sole or primary source of navigation. It is the operator's sole responsibility to use more than one navigational methods to ensure the route suggested by the system is safe.

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

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Compliance statements

Navico declares 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) 2023/1667 (8 August 2023) - Wheelmark

➔ ***Note:*** The R5000 system is Wheelmark approved only when installed according to the relevant R5000 MED-B certificate.

United States of America

This product has been assigned **U.S. Coast Guard Module B number** in accordance with the European Council Decision 2004/425/EC dated 21 April 2004 on the conclusion of an Agreement between the European community and the United Stated of America on Mutual Recognition of Certificates of Conformity for Marine Equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

⚠ Warning: The user is cautioned that any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

➔ ***Note:*** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that the interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that of the receiver is connected
- Consult the dealer or an experienced technician for help

Canada

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Declarations

The relevant declarations of conformity and certificates are available at:

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

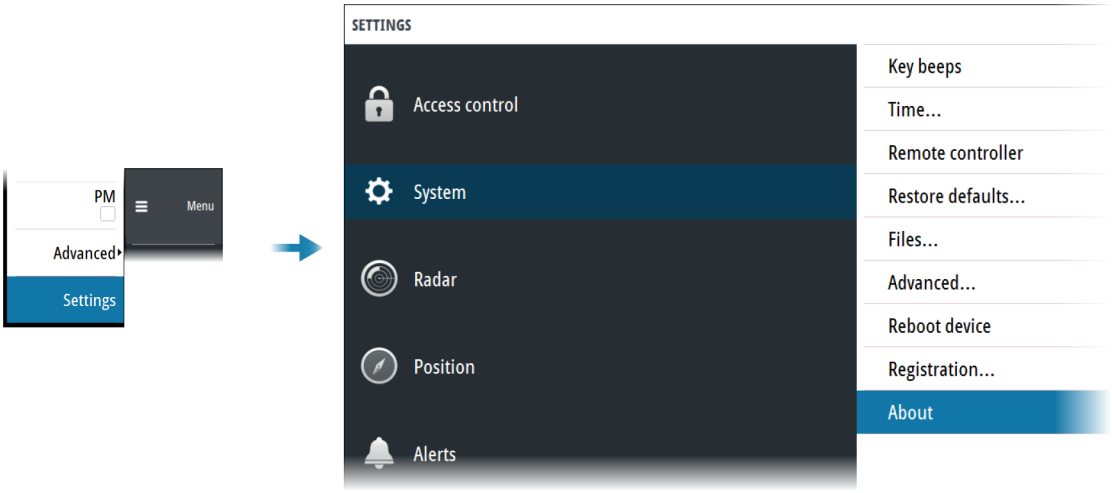
Important text that requires special attention from the reader is emphasized as follows:

→ ***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.
988-12294-003	2021-July-25
	Update to compliance, adding LWE description.
988-12294-004	2023-September-25
	Update cover, compliance, and copyright. Adding HALO 5000 information.
988-12294-005	2023-December-15
	Update to comply with IEC62288 Ed.3.

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/m^2 point (m)	Distance 50 W/m^2 point (m)	Distance 10 W/m^2 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	-	-	0.9
HALO 5000 Series	0.8	0.11	2.5

X-Ray radiation

This radar system does not generate X-ray radiation.

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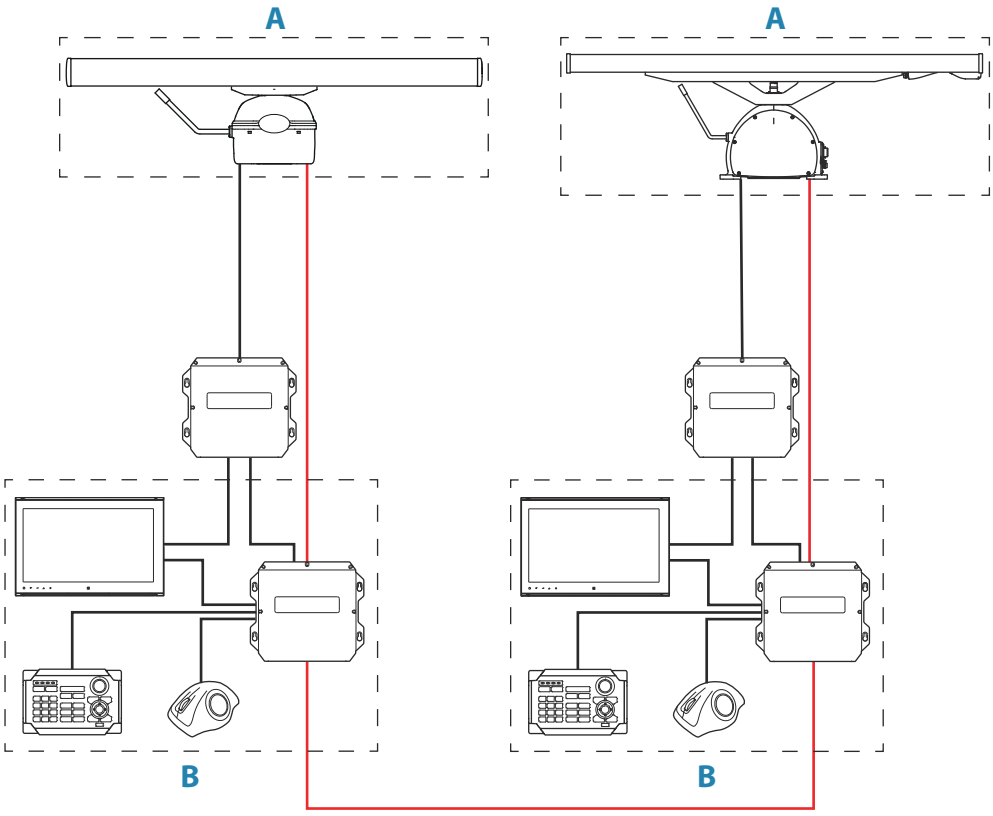
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1 Introduction

R5000 system overview

A basic R5000 radar system has the following main parts:

- Radar sensor (**A**), including:
  - Antenna
  - Up-mast or down-mast SRT LAN or HALO 5000 transceiver
  - Power supply unit
- R5000 radar control station (**B**):



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 28.

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.

2 Operating the system

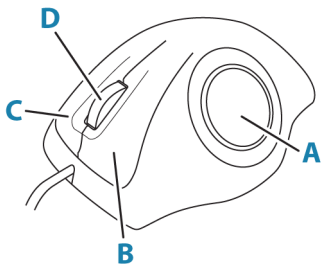
A remote control and mouse are used together to operate the system. The O2000 remote controller and R5000 trackball mouse are used together. Alternatively, the R5000 expanded keyboard with integrated trackball can be used to operate the system.

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 the remote controller and mouse keys, refer to *"02000/05000 trackball, key function comparison"* on page 79.

O5000 trackball mouse keys



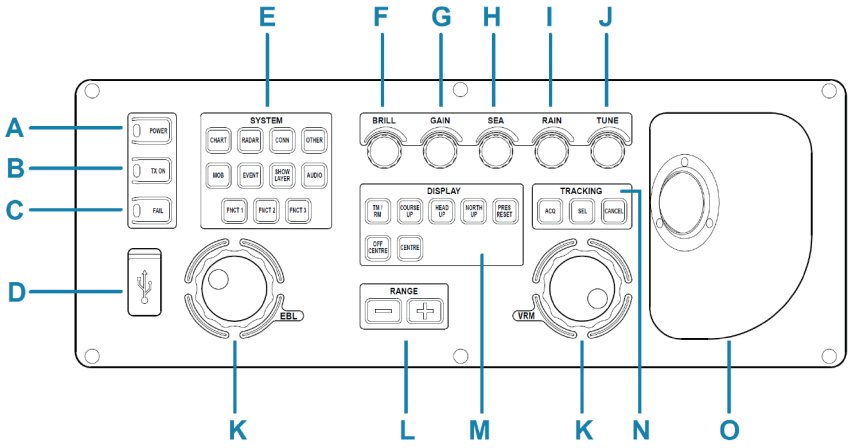
The optical trackball (**A**) is used for positioning the cursor. The other mouse keys have different functionality depending on the position of the cursor on the radar panel.

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	• Rotate to scroll menu options • Press to select
Quick access button	Select	Display selected button's pop-up	• Rotate to scroll pop-up options
AIS target	Activate/deactivate	Display target menu	No action
Radar target	Acquire target		

Expanded keyboard controls and indicators

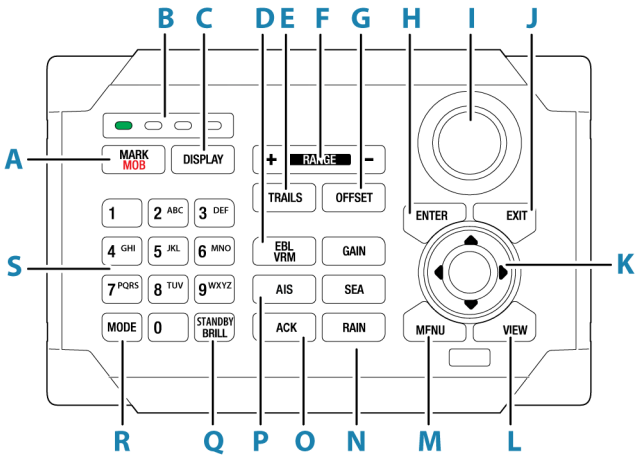


→ ***Note:*** The expanded keyboard can be used with different equipment. As noted below, some of the keys are not applicable for the R5000.

Ref.	Control or indicator	Description and function
A	**POWER**	This pushbutton with green LED indicator is used to switch between Sleep and On conditions. When the system is in Sleep condition it appears to be Off, but the electronic is still on, waiting for the real On condition request. In order to switch on the monitor, and the control panel, the operator has to press the POWER button, and holding it pressed for more than 5 seconds. An audible beep will sound and the green LED next to the pushbutton will change to high brilliance. In "On" condition, by pressing the POWER button again, the monitor, and the control panel will be switched off again and another beep will sound and the green LED will return to low brilliance, bringing the system into a Sleep mode (to shut down the system completely, the main power switch must be set to the off position).
B	**TX ON**	This pushbutton is used to switch the system between Standby and TX ON. In Standby the display does not request the TXRX to transmit, but it is possible to get some information from the system, depending on the type of TXRX connected. In TX ON the radar (if Master) radiates and the antenna turns. This is the normal working condition (the switching "Standby to TX ON" and "TX ON to Standby" are executed at the release of the pushbutton).
C	**FAIL**	This indicator is normally Off. A red-colored LED will be switched on when a system failure occurs (this is an indicator, not a button).
D	USB port	USB type 2.0 for file sharing and software upgrades.
E	**SYSTEM:**	
	System keys	EVENT. Press and hold 5 seconds to create a screenshot. SHOW LAYER = AIS ON/OFF. AUDIO = Temporary AUDIO alarm OFF.
		CHART = Unsupported key RADAR = Unsupported key CONN = Unsupported key OTHER = Unsupported key MOB = Unsupported key
	FNCT 1,2,3	Momentary pushbuttons used to apply one of the first three programmable User Settings (FNCT 1, 2, 3) as described in *"Customizing radar control settings"* on page 61.
F	**BRILL**	Monitor and keyboard dimmer. Push to toggle Day/Night.

Ref.	Control or indicator	Description and function
G	**GAIN**	GAIN control. Push to toggle Manual/Auto modes. The optimum setting is when the receiver background noise is hardly visible. For further details, refer to *"Gain"* on page 31.
H	**SEA**	Sea anti-clutter control. Push to toggle Manual/Auto modes. The optimum setting is when the sea clutter is seen as small dots and small targets become distinguishable around the ship. For further details, refer to *"Sea anti-clutter"* on page 31.
I	**RAIN**	Rain anti-clutter. Push to toggle Manual/Auto modes. Rain or snow clutter can be reduced by the use of the potentiometer, and covered target revealed. For more details, refer to *"Rain anti-clutter"* on page 32.
J	**TUNE**	SRT LAN: Push for 2 seconds to toggle between Manual/Auto modes. If manual, keep it pressed to change the tuning. The tuning may be checked by means of the numeric indicator on the screen, or directly by observing a target echo. In the last case, the echo level should be slightly above the noise level (not saturated). The tuning meter indication is displayed on long pulse only. For more details, refer to *"Tuning the radar sensor"* on page 33.
		HALO 5000: Tuning is not used with HALO 5000 radars.
K	**EBL/VRM**	Use the rotary knob to set the EBL/VRM 1 or 2 alternatively. The EBL/VRM data are displayed in the related windows.
L	**RANGE**	Two momentary pushbuttons used to select one of the 13 different range scales, expressed in NM, and the relevant range rings for PPI presentation.
M	**DISPLAY:**	
	TM/RM	Toggles True Motion and Relative Motion modes.
	COURSE UP	Momentary pushbutton used to select a stabilized Course Up presentation. Press again in Course Up mode to enter a new course reference.
	HEAD UP	Momentary pushbutton used to select Head Up presentation (referred to Heading Line).
	NORTH UP	Momentary pushbutton used to select North Up presentation (referred to Gyro North).
	PRESS RESET	Momentary pushbutton used to reset the position of own ship 180° against the course.
	OFF CENTRE	Momentary pushbutton used to set the off-centered presentation on the point under the cursor of the trackball (if the cursor is placed inside the PPI).
	CENTRE	Momentary pushbutton used to set the PPI centered presentation. Not active in True Motion presentation.
N	**Tracking:**	
	ACQ(UIRE)	Momentary pushbutton used to acquire a radar target or to activate an AIS target.
	SEL(ECT)	Momentary pushbutton used to display alphanumeric information related to the selected radar target or AIS.
	CANCEL	Momentary pushbutton used to delete a tracked radar target or to deactivate an AIS target.
O	**TRACKBALL**	Positioning input device. Use the trackball to move the cursor on the PPI (displayed as a cross) and on the system data area (menus area, displayed as a black arrow, except for the progress bars in which it is possible to change the value, where it's displayed as a double horizontal thin arrow.

O2000 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.

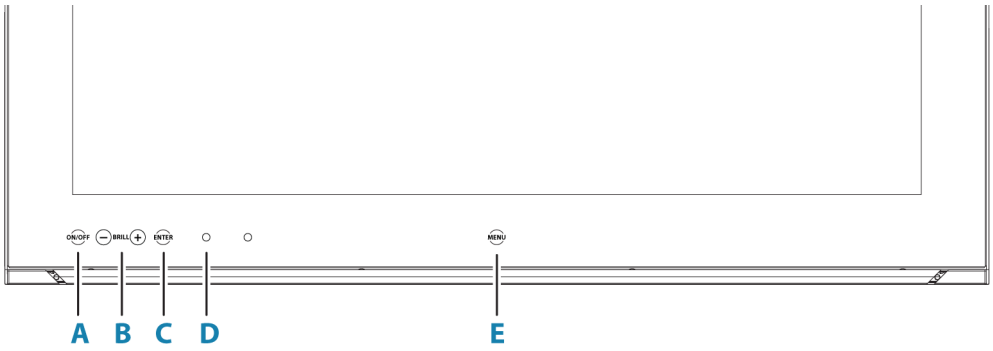
R Mode key. Not used for R5000

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**

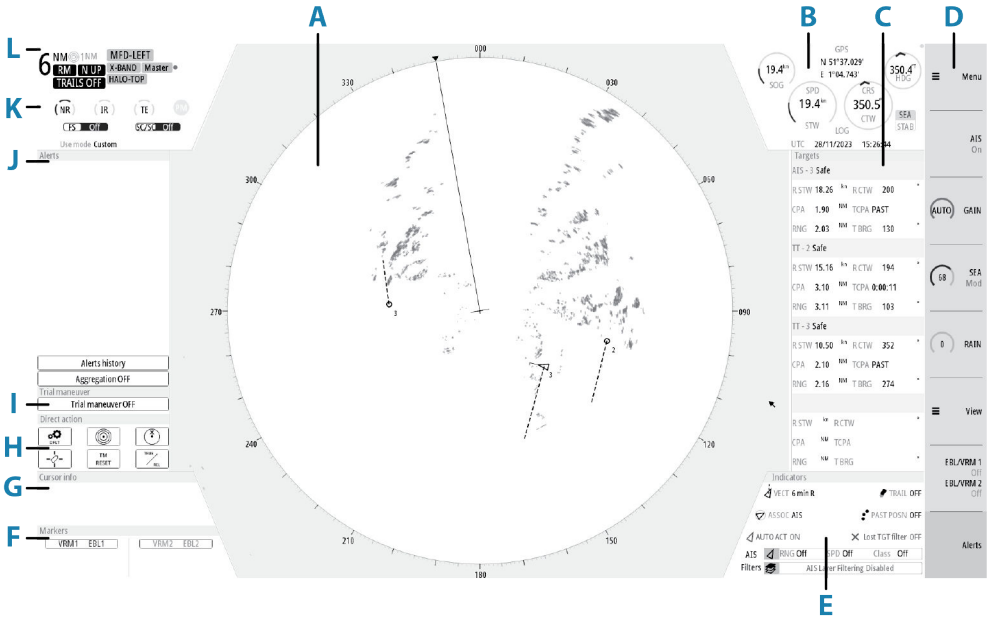
- Press and hold to activate the OSD menu

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 **Direct actions**
Dedicated buttons for direct actions.

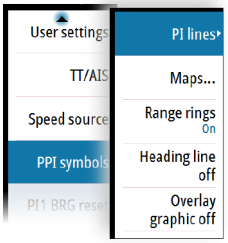
I **Trial maneuver button**
Trial maneuver immediate action.

J **Alerts panel**
List of all active alerts.

K **Signal indicators**
Gauges for signal processing and indicators for radar functions.

L **System information**
Range, mode, band indication, and pulse details.

PPI symbols



Range rings and heading line symbols can be turned on and off individually via the main menu or the **Direct action** buttons on the radar panel.

For parallel index lines and maps, see *"Parallel index lines"* on page 52 and *"Maps"* on page 57.

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.

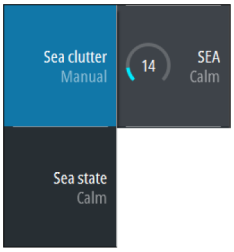
If the picture freezes the unit must be restarted.

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.

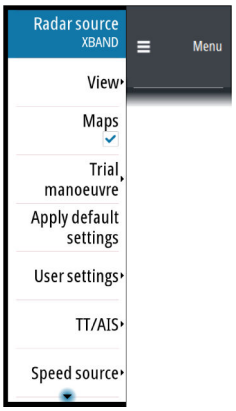
To display the pop-up:

- 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:

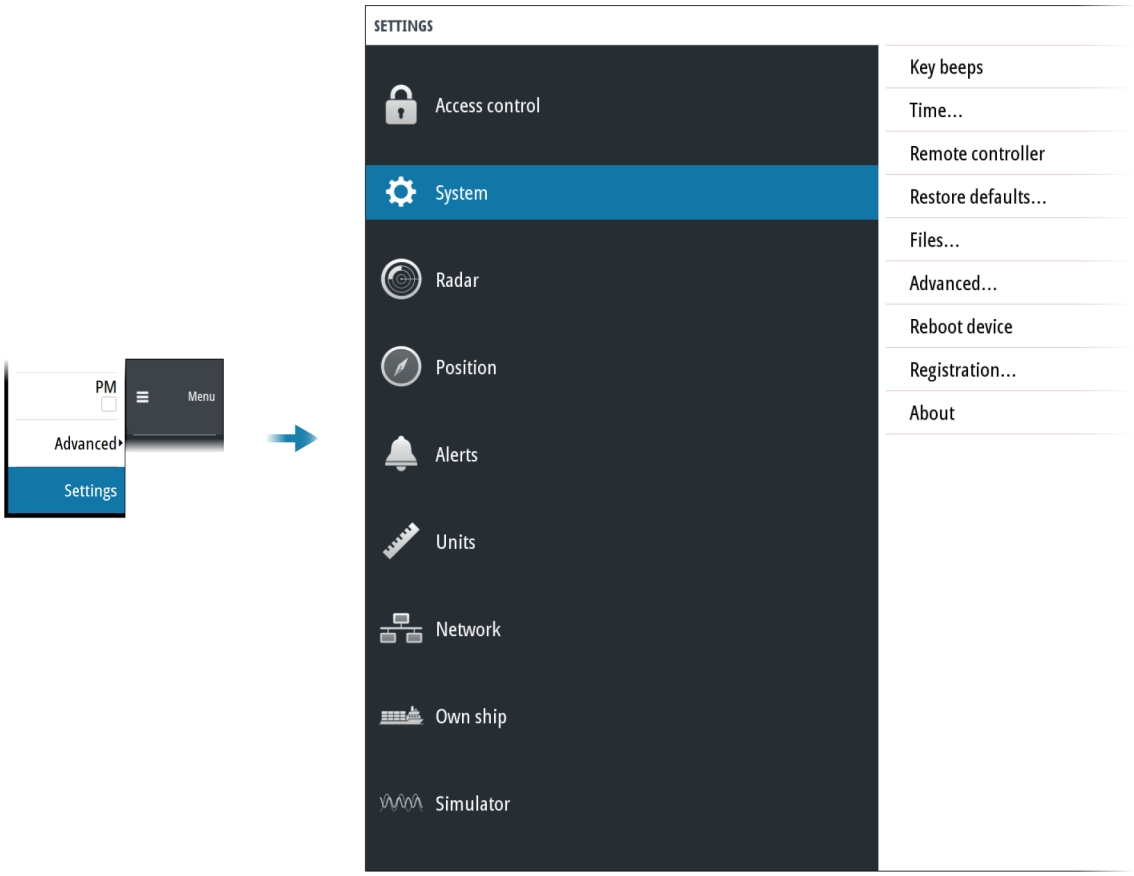
- Use the scroll wheel to move up and down in a menu
- Use the left key to access a submenu, to toggle options or to confirm a selection

- 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

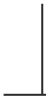
The system setup is done from the settings dialog.



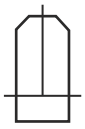
Own vessel symbol

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.



Vessel symbol at large range scale



Vessel symbol at small range scale

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.

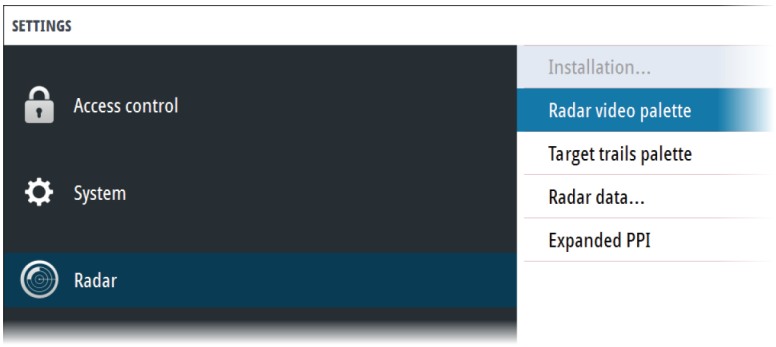
For distances below 0.125 NM you can select to show the distance in meters.

By default, Own vessel rate of turn units in the trial maneuver settings are degrees per minute (°/min), optionally you can select to use degrees per second (°/s).

→ ***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

Turn the system ON by pressing the STANDBY/BRILL key using the O2000, or pressing the POWER button using the expanded keyboard.

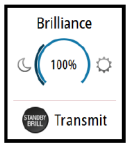
The system will be ON as long as power is connected.

Switching the system to standby mode

Press and hold the STANDBY/BRILL key using the O2000, or press the POWER button using the Expanded keyboard 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 28.

Adjusting display brightness



The brilliance is adjusted with the from the brilliance pop-up.

- Use the O2000 to display the pop-up by pressing the standby/brilliance key, then adjust the display brilliance by turning the rotary knob.
- Turn the BRILL knob on the expanded keyboard to adjust the brilliance.

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.

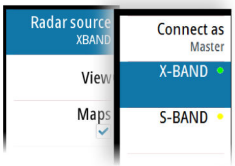
The system includes a day and a night color palette. When the brilliance is set to 40% or lower, the system switches to use the night palette.

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

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 38.

Selecting radar source



More than one radar sensor can be connected to the radar system.

Select the active radar sensor from the menu.

For information about controlling radar sensors in a multiple radar installation, see *"The Interswitch function"* on page 28.

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 on the O2000, then repeat short presses on the key to switch between standby and transmit mode
- Press the TX ON button on the Expanded keyboard 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 *"02000 controls"* on page 17.

There is a direct link between the range scale and the operational mode of the SRT LAN X-band and S-band radars only.

Range scale	Standard radar operation			Target boost radar operation		
	A	B	C	A	B	C
1/8 NM (200m)	0.08/3000	40 ns	24	0.08/3000	-	24
1/4 NM	0.08/3000	40 ns	24	0.08/3000	-	24
1/2 NM	0.08/3000	40 ns	24	0.08/3000	-	24
3/4 NM	0.08/3000	40 ns	24	0.08/3000	-	24
1.5 NM	0.08/3000	40 ns	24	0.08/3000	-	24
3 NM	0.08/3000	40 ns	24	0.25/1500	-	48
6 NM	0.25/1500	4 µs	48	0.25/1500	-	48
12 NM	0.25/1500	4 µs	48	0.8/750	-	72
24 NM	0.8/750	32 µs	72	0.8/750	-	72
36 NM	0.8/750	32 µs	72	0.8/750	-	72
48 NM	0.8/750	32 µs	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 (µS/PRF (Hz))

B: Burst repetition frequency (BRF)

C: 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:

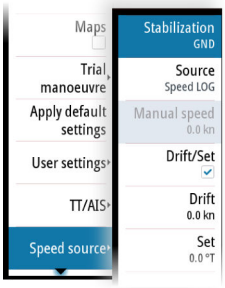
- Press one of the arrow keys
- Use the mouse to position the pointer inside the PPI area



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



Selecting speed source

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

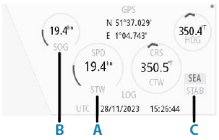
At any time you can switch the preferred primary speed source to any of the available speed sensors from the menu.

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 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.

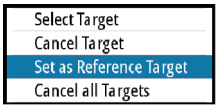
Auto drift

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

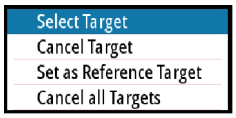
More options are available from the target menu, displayed by:

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

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



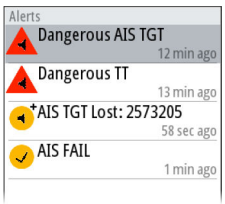
No target at cursor position



Target at cursor position

See more details about radar and AIS targets in *"Targets"* on page 39.

Acknowledging alerts



To acknowledge the most recent alert:

- Press the acknowledge key on the O2000
- Using the left trackball button, click the Alerts box in the bottom right of the screen.

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.

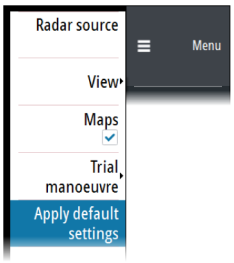
When an alert is acknowledged, the alert icon stops flashing and changes to the acknowledged icon. The siren continues to sound if there are remaining unacknowledged alerts, otherwise it is muted.

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 70.

➔ ***Note:*** In the case of a BAM connection (no Legacy Alerts setup), category B alerts can be acknowledged by the BAM/CAM.

Applying default control settings



The **Apply default settings** menu option allows you to quickly set the system back to a predefined state. The predefined values are defined in the radar requirements standard.

Refer *"Customizing radar control settings"* on page 61.

➔ ***Note:*** You can also apply default settings using the **Direct action** button on the radar panel.



Screen capture

To take a screen capture:

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

Screen captures are saved to internal memory.

➔ ***Note:*** This action is valid for the O2000 controller only. If using the expanded keyboard, long press the EVENT pushbutton.

5 The Interswitch function

Description

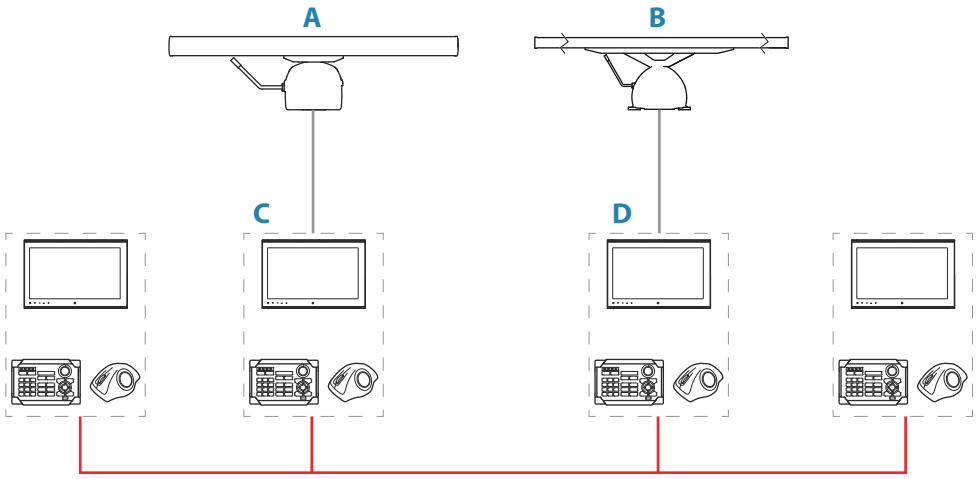
The interswitch function allows for sharing a radar sensor between multiple radar control stations.

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.

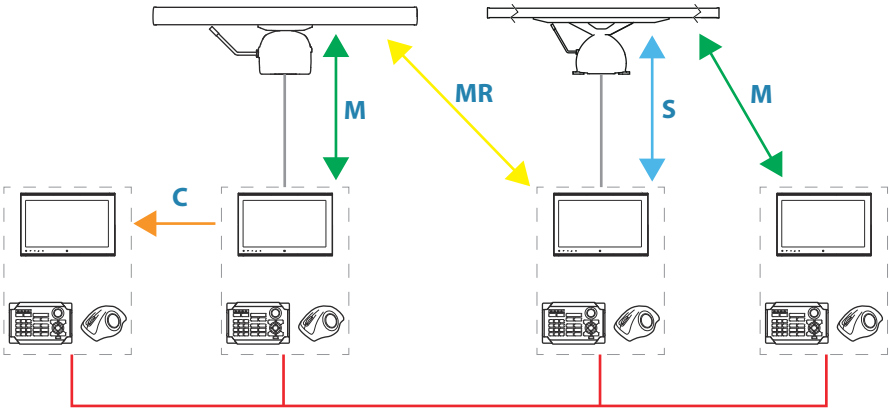
The illustration shows an installation with 2 sensors and 4 control stations. The control stations are connected via the interswitch network. In this example, sensor **A** is directly wired to control station **C**. Control station **C** is then by default sensor **A**'s default master. The same applies 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 29
- 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.

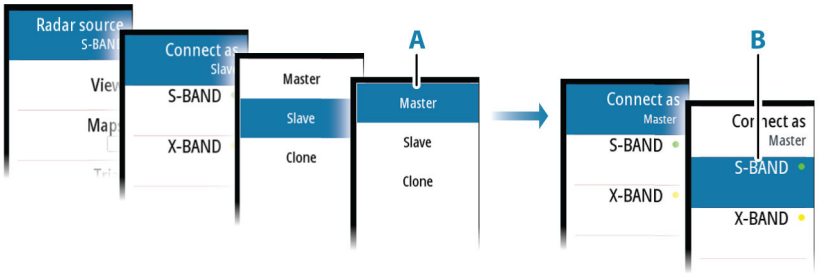
If the console that is controlling the radar sensor is disconnected, the clone will lose the connection to the radar sensor. The clone will have to manually select a new sensor.

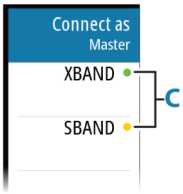
There can be multiple clone stations for each control station simultaneously.

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**)

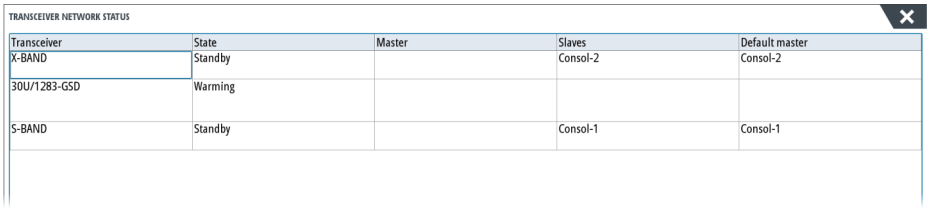




The color indication (**C**) for the sensors shows if a control station can be connected as the master for a sensor:

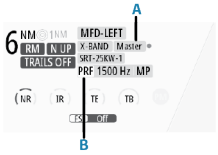
- Green: the sensor is available for master control
- Yellow: another control station has master control of the sensor

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



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 32.



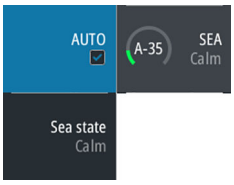
The radar image is controlled as described in the next sections.

→ ***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

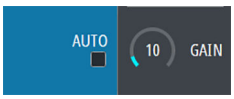
The gain option controls the sensitivity of the radar receiver. A higher gain makes the radar more sensitive to radar echoes, allowing it to display weaker targets. If the gain is set too high, the image might be cluttered with background noise.

→ ***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

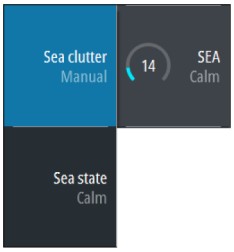
The sea anti-clutter option is used to filter the effect of random echo returns from waves or rough water near the vessel. When you increase the value, the sensitivity of the near field clutter caused by waves is reduced. If the value is increased too much, both sea clutter and

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

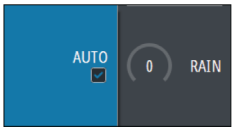
To adjust the sea anti-clutter:

- 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 an automatic mode and a manual mode. It is possible to adjust and clean the rain return residual echoes using the manual gain.

Adjusting the rain anti clutter

To adjust the rain anti-clutter:

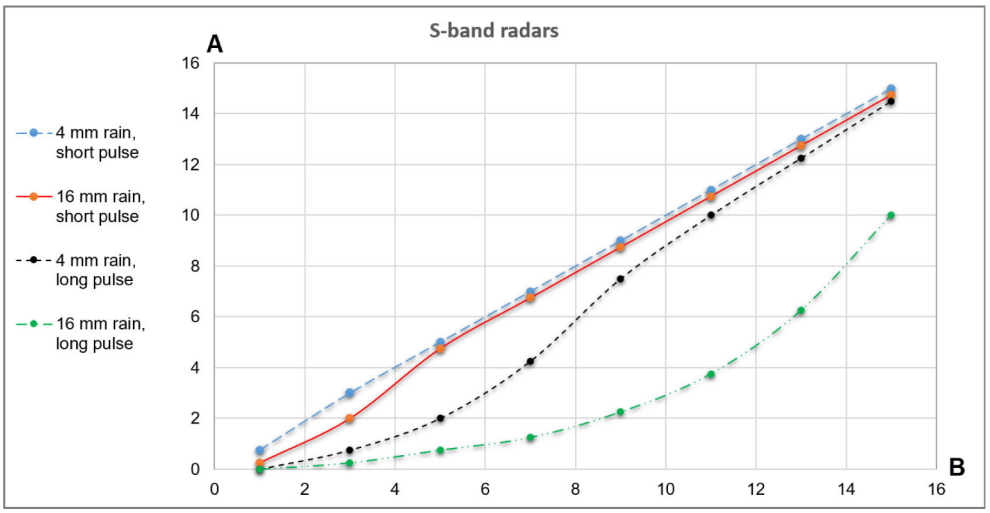
- Press the rain key to activate the function, then turn the rotary knob to adjust the setting
- Press and hold the key to turn ON/OFF the automatic option

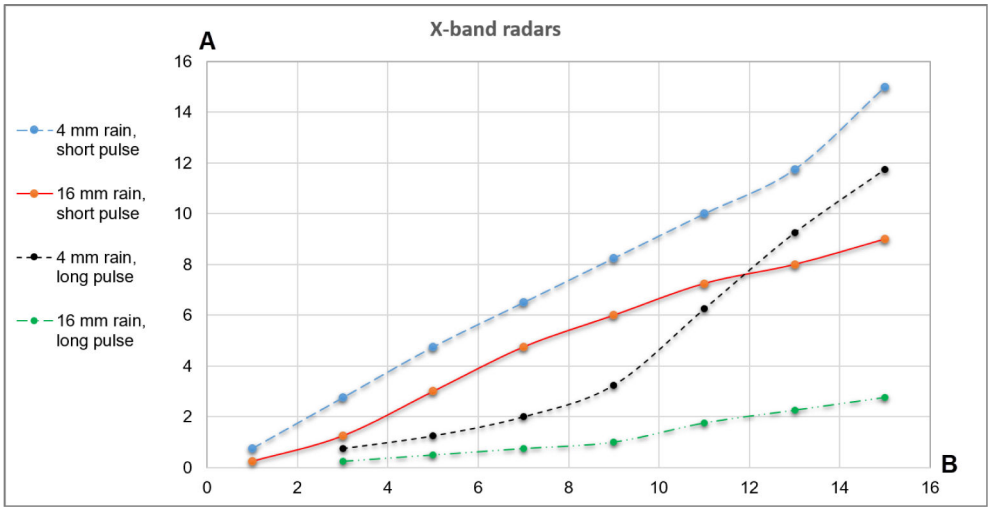
Performance limitations

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

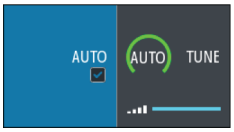
→ ***Note:*** Tuning the radar sensor is not available for HALO 5000 radars. In case of a HALO 5000 connection, the TUNE indicator (and setting) is replaced by the View option.

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:

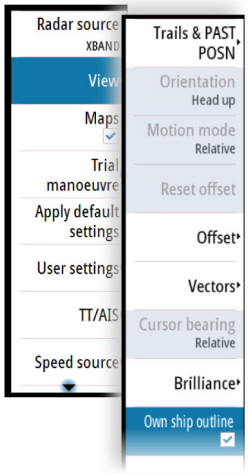
- Select the tune quick access key to activate the function, then use the scroll wheel or the rotary knob to adjust the setting
- Press the left mouse key twice to turn ON/OFF the automatic option

7

Radar view options

Several radar view options are available from the menu.

→ ***Note:*** The motion mode and reset offset options are disabled at max zoom range (72 NM for SRT LAN X- and S-band radars, 48 NM for HALO 5000 radars). The functions are enabled again when zooming down one level.



Target trails and past position

You select how radar targets present on the radar image (**Relative** or **True**, and with or without trails) via the **Trails & PAST POSN** submenu.

Radar target presentation can also be changed via the targets mode button on the system infomration panel.

For more information, see *"Display settings for radar targets"* on page 41.

Radar orientation



The selected radar orientation (**H UP**, **N UP** or **C UP**) displays on the orientation mode button in the system information panel (**A**).

The orientation can be changed via the orientation mode button or the **Orientation** option in the **View** menu.

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 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

The selected radar motion (**RM** or **TM**) displays on the motion mode button in the system information panel (**B**).

The motion can be changed via the motion mode button or the **Motion mode** option in the **View** menu.

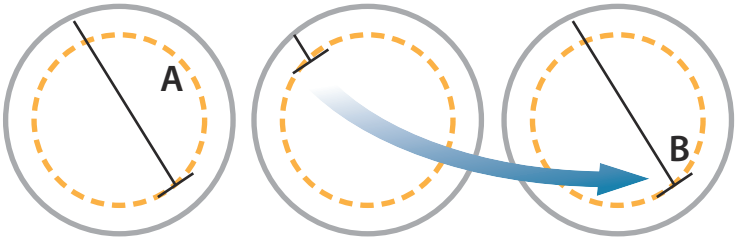
Relative motion

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 35.

True motion

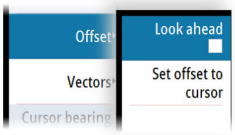
In true motion your vessel and all moving targets move across the Radar PPI as you travel. All stationary objects remain in a fixed position. When the vessel's symbol reaches 75% of the PPI radius (**A**), the radar image is redrawn with the vessel symbol re-positioned (**B**) 180° opposite the current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



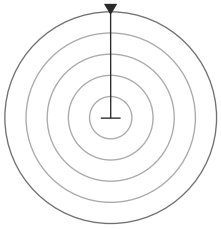
When true motion is selected, the true motion reset option is available from the menu. This allows for manually resetting the radar image and vessel symbol to its starting position.

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

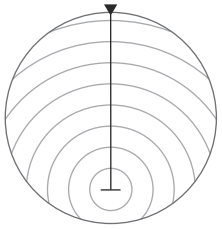
Offsetting the PPI center



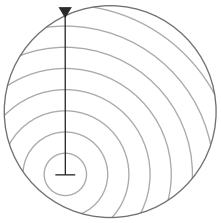
You can set the antenna position origin to a different location on the radar PPI. The options described in the next sections are available.



PPI center: Center



PPI center: Look Ahead

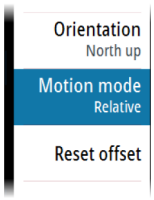


PPI Center: Offset

→ ***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 using the **Reset offset** option in the menu or the **Direct action** button on the radar panel.

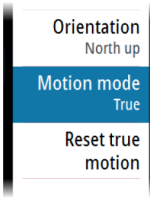


Menu option



Direct action button

In true motion, the offset will be removed when the radar image is automatically redrawn. You can manually remove the offset using the **Reset true motion** option in the menu or the **Direct action** button (**TM Reset**) on the radar panel.



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

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

Move the cursor to the preferred offset position, and confirm your selection.

Vectors

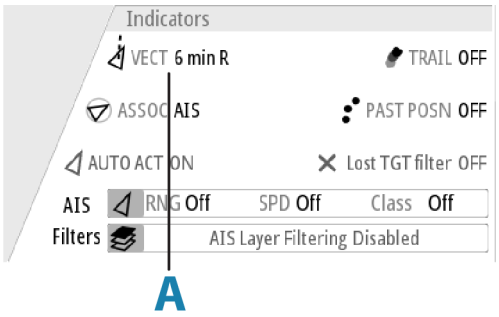
A target vector indicates the expected target movement within a defined time. The vectors are computed by multiplying the target speed with the set time value.

Using the **Vectors** menu option, 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.

→ ***Note:*** You can also change from true to relative speed (or vice versa) using the **Direct action** button on the radar panel.



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.

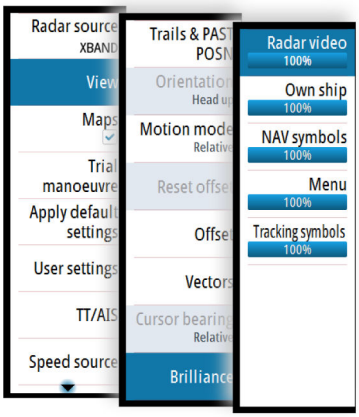
Cursor bearings

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.



Own ship outline

At small range scale the own ship outline can be toggled On/Off.

8 Targets

The target menu

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

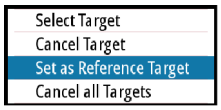
- Pressing and holding the enter key
- Pressing the right mouse button

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.

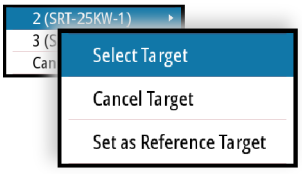
If more than one target is located at cursor position, the menu will show the reference number for radar targets, and ship names for AIS targets.



No target at cursor position



One target at cursor position



Two radar targets at cursor position

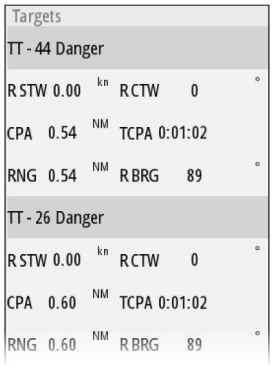
Close the target menu by:

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

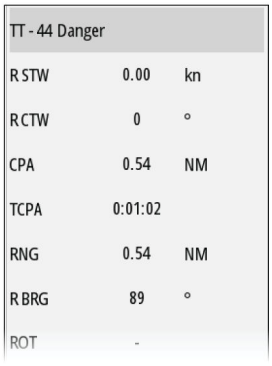
The target panel

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

A



B

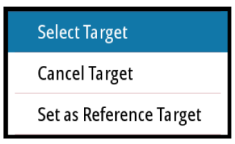


The following targets are included in the target panel:

- 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

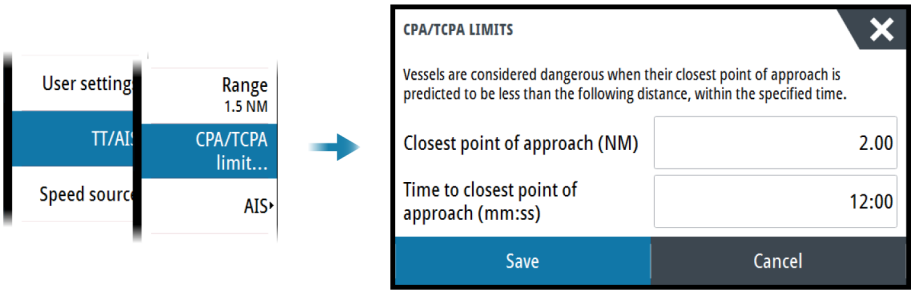
To de-select a target and remove the detailed target information in the target panel:

- 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 89.

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 51.

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 ACQ key on the expanded keyboard (if present)
- 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

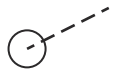
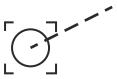
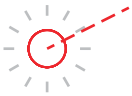
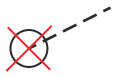
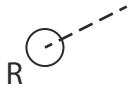
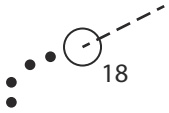
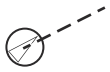
There might be a delay after having acquired a radar target before the system receives stable target data:

- 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.

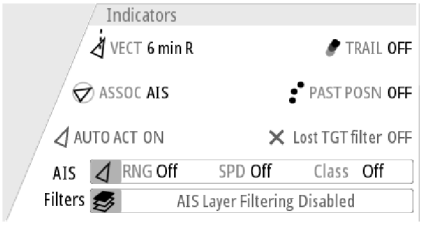
The above time references represent worst case situations. In a stable situation the radar target information is available immediately.

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

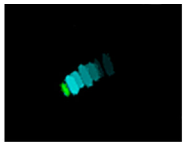
Trails and past position indicators can be displayed as either true or relative to own ship.

Trails and past position indicators are available in both sea and ground stabilization modes. See *"Selecting speed source"* on page 25.

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 31.

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 "" on page 0 .

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 "" on page 0 .

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 anti-clutter control. Refer to *"Sea anti-clutter"* on page 31.

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

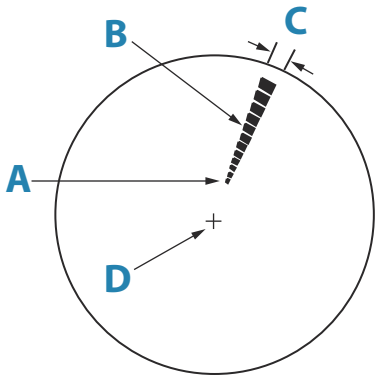
In situations where the signal to noise or the signal to clutter ratio of the radar echoes is low (small vessels in heavy sea or rain clutter, or big vessels close to the radar horizon), target detection is poor and the tracking will not detect the target at each antenna revolution. This will cause errors 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

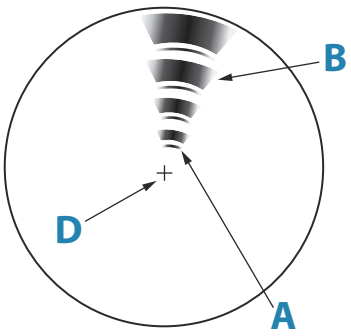
A SART (Search And Rescue Transponder) is used for emergencies. These devices may be either a radar-SART, or a GPS-based AIS-SART. The X-Band radar system is capable of detecting SARTS and radar target enhancers.

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 3.5 NM with the HALO 5000 and 8 NM with the SRT LAN, and its signal may be triggered by any 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 (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.

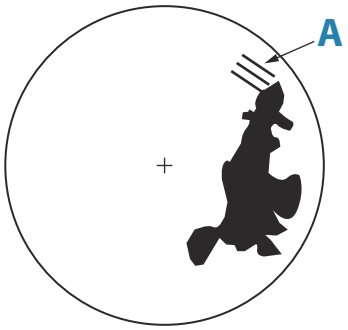
- Set the rain anti-clutter control to manual mode, and adjust as required to avoid rain clutter
  - The setting does not affect the radar-SART detection
- Set the gain control to manual mode, and adjust it to see some noise dots in the background
  - Normal gain setting for long range detection can usually be used (around 80% of max range)
- Turn OFF target boost. See *"Target boost"* on page 63
  - The shape and dimension of the radar-SART dots could be affected by this setting.
- Turn off scan to scan correlation.
  - This setting could remove radar-SART targets.

⚠ 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.

Racons

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**).



Racons 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

Racons 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.

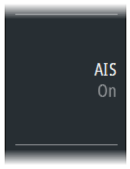
AIS targets

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 89. 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.

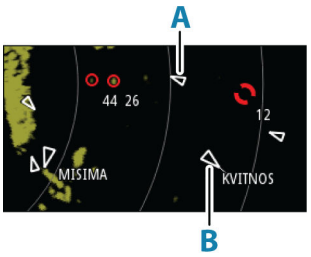
AIS targets can be filtered as described in *"AIS target filters"* on page 47.

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:

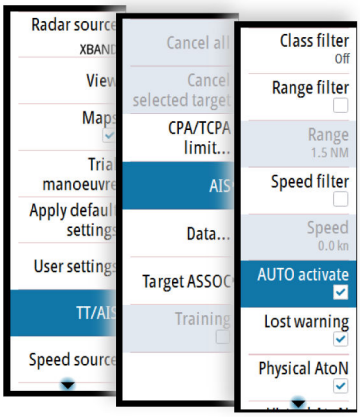
- Pressing the enter key
- Pressing the left mouse button

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.



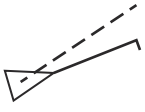
AIS vessel ID

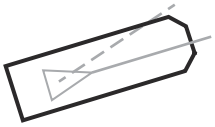
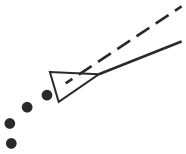
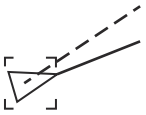
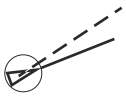


Activated AIS targets are shown with the vessel ID.

AIS target symbols

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

Symbol	Description
	**AIS target - sleeping**, 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

Symbol	Description
	**AIS target - activated** with true scaled outlines
	**AIS target** with heading line, SOG/COG (dashed line) and past track
	**AIS target - selected**, indicated with a square (dashed line) around the target symbol
	**AIS target - dangerous** indicated with bold line and with red color. The symbol flashes until the target alarm is acknowledged by the operator
	**AIS target - lost**, indicated with crossed lines centered on the target symbol. The symbol is located at the last received position from the target
	**Associated target** - using AIS data
	**AIS SART** (AIS Search And Rescue Transmitter)
	**AIS base station**
	**Physical AtoN** (Aids To Navigation)
	**Virtual AtoN**

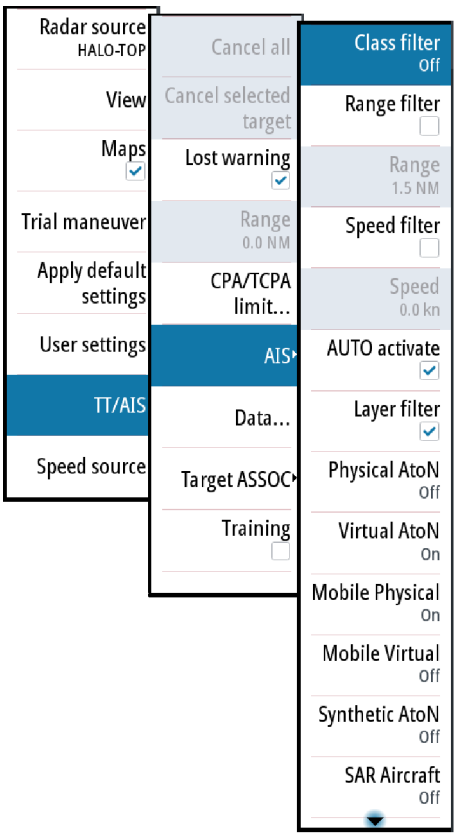
For a complete list of AIS and AtoN symbols, refer to *"Target symbols"* on page 80.

→ ***Note:*** A symbol is drawn with a dashed line if the collision avoidance cannot be calculated.

AIS target filters

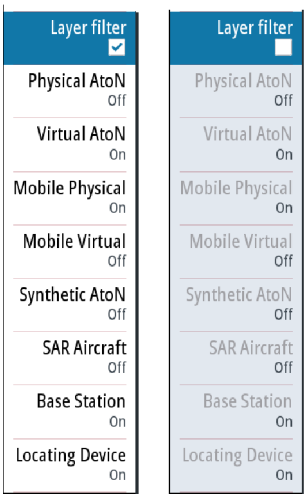
You can select to filter the icons based on AIS class, range and target speed.

In addition, you can enable filters for specific AIS types by selecting (enabling) **Layer filter** and turning on the required filters.



When at least one AIS type filter is enabled (i.e. the presentation of the AIS type is disabled), the message **AIS Layer Filtering Enabled** appears in the **Indicators** area of the screen.

If **Layer filter** is disabled, the AIS type filters are automatically greyed out.



AIS and radar target association

When an echo with its AIS symbol on top is being acquired for tracking, the system can detect that the two symbols represent the same target with the target association function. When the function is activated, the radar target and the AIS target are associated. You select whether to use source data from the AIS target or from the tracked radar target.



Associated targets - using AIS data



Associated targets - using radar data

This function is useful for reducing the number of AIS symbols and radar targets on the PPI. Too many targets could clutter the screen and result in dangerous situations. The function also compensates for a possible failure in one of the two targets, e.g. if the radar tracked

target is positioned behind an island, the system keeps tracking and visualizing the AIS target.

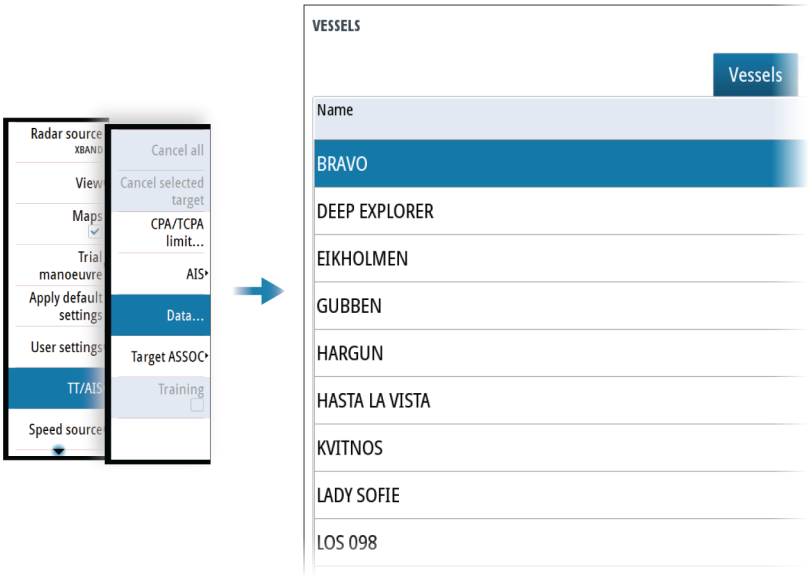
➔ ***Note:*** The tracked radar target continues to be analyzed by the system when the target association is active.

Displaying target information

The vessels dialog

The vessels dialog displays a list of all AIS and TT targets.

By default, the dialog lists targets, arranged by distance to own vessel. You can select to change the sort order, and to display only a selected target type.

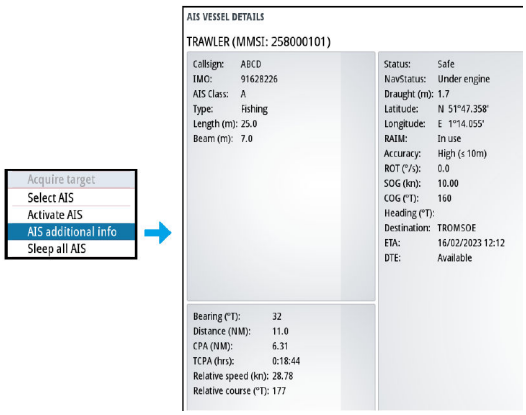


AIS vessel details

Detailed information about an AIS target is available from the AIS vessels details dialog.

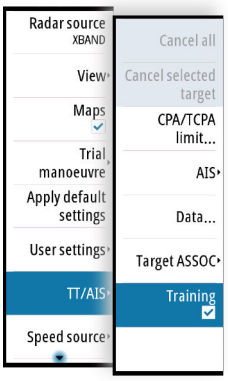
To display the dialog:

- select the AIS additional information option in the target menu
- select an AIS target in the vessels dialog



Training simulator

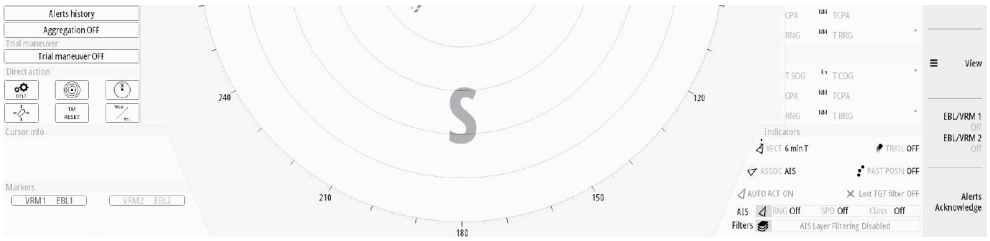
The training function is used to train the operator on manual radar target acquisition, on target selection and on the tracking procedures.



The function is activated from the menu.

When started the system replays a pre-loaded file, simulating a target with constant speed and course approaching own vessel. The training target's speed is as per the pre-loaded file, and it cannot be altered by the user. The CPA and TCPA depends on the simulated target's speed and own vessel's speed.

A flashing **S** is shown on the lower part of the screen as long as the function is active to warn that training simulation is running.



You can perform all tracking operations on the simulated target.

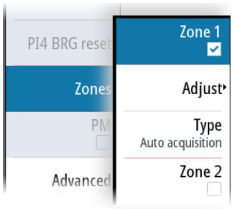
The CPA and TCPA of the training target is automatically tested by the system. Alerts are raised in case of a malfunctioning of the tracking software:

- Training Tgt CPA Out of Range: if the difference between theoretical and target displayed CPA is greater than 0.5NM
- Training Tgt TCPA Out of Range: if the difference between theoretical and target displayed CPA is greater than 30sec

The radar will return to default operation as soon as the training option is turned off from the menu.

9

Navigation tools



Tracking zones

The tracking zone function allows for automatic acquisition of radar and AIS targets when they enter a user defined zone ahead or around your vessel.

Two tracking zones can be defined, each with individual settings.

When a target enters a zone, it will automatically be considered as safe or dangerous based on the CPA/TCPA settings.

Two types of tracking zones are available.

Guard zone

When a target enters a guard zone the following happens:

- radar targets are acquired and AIS targets activated
- warning about new target and warning about target being in zone are activated
- the target icon turns red and flashing

When the warning about new target is acknowledged, the icon stops flashing. The icon remains red until the target leaves the guard zone.

The color of the border line of a guard zone is defined by the user.

Auto acquisition zone

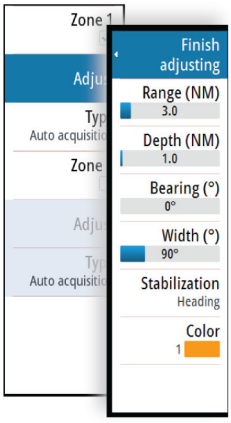
When a target enters an auto acquisition zone the following happens:

- radar targets are acquired and AIS targets are activated
- warning about new target is activated
- the target icon turns red and flashing

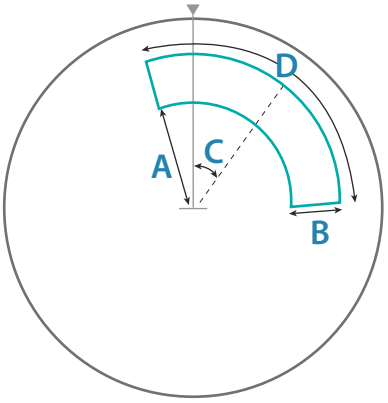
When the warning is acknowledged, the target changes to basic target icon and color depending on its status (safe or dangerous).

The border line of an auto acquisition zone is white.

Defining a tracking zone



1. Turn ON the tracking zone you want to define
   - The tracking zone lines are displayed on the radar PPI
2. Select the adjust option
   - The tracking zone lines turns to dashed lines to indicate that you are in edit mode
3. Define the guard zone options:
   A: Range, relative to vessel center
   B: Depth
   C: Bearing, relative to vessel heading or to North
   D: Width



4 Select the type for the zone

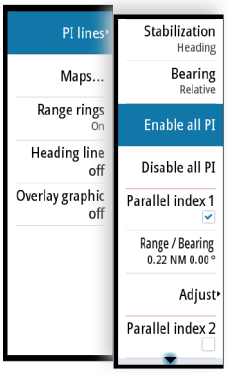
→ ***Note:*** The line color is only applicable when the type is set to guard zone. The line color is always white if the type is set to auto acquisition.

5 Save the changes by selecting the finish adjusting option in the menu

→ ***Note:*** If you exit the menu by pressing the exit key, the zone remains in edit mode. The lines remain with dashed lines, and the zone is not active.

Parallel index lines

Parallel Index (PI) lines are used to visualize the distance to own vessel, other vessels or to land objects. Two index lines can be used to indicate a corridor - typically used to visualize an area you want to maneuver within.

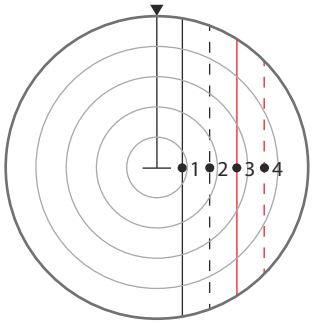


The PI lines can be defined with north or heading stabilization, and with true or relative bearing.

- North stabilization: the line direction is maintained with respect to north
- Heading stabilization: the line rotates with the vessel heading
- True bearings: the parallel index bearing is measured from the geographical north
- Relative bearings: the parallel index bearing is measured from the heading line

You can define four PI lines in the system, and they are identified with different color and style:

- PI1: Grey solid line
- PI2: Grey dashed line
- PI3: Orange solid line
- PI4: Orange dashed line



You can turn each PI line on and off individually, and the position, bearing and truncating can be set for each line.



Each PI line can be reset to be parallel to own ship's heading from the main menu.

Adjusting a PI line

Each PI line's range and bearing are shown in PI lines submenu.

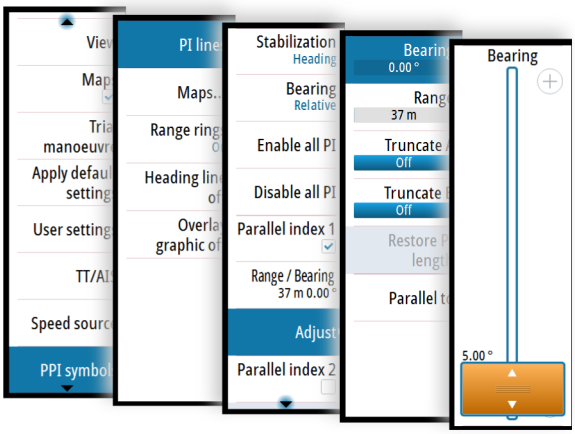


You can adjust the line's settings from the selected line's **Adjust** menu option. The options described in the next sections are available.

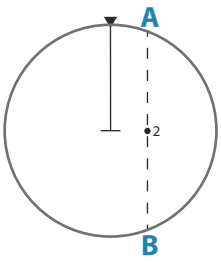
Adjusting range and bearing

1. Select the range or bearing menu options
   - The slider bar is displayed
2. Turn the rotary knob or use the up/down arrow keys to increase or decrease the slider bar value
   - The change is immediately committed and shown on the image
3. Press the exit key or the right arrow key to leave the edit mode

→ ***Note:*** Max range for a bearing line is 12 NM.

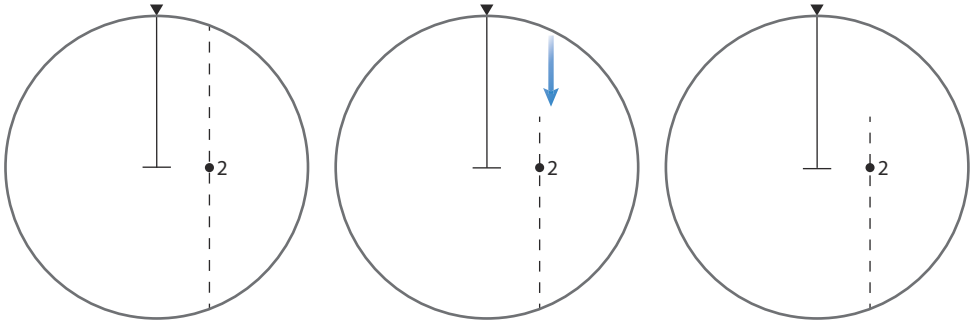


Truncating a PI line

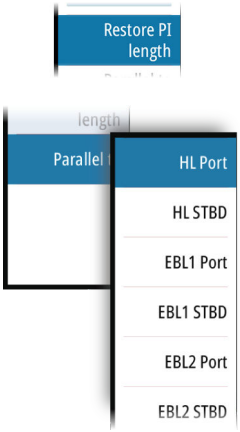


You can use the truncate menu option to extend or reduce an existing PI line. The end points of the line (**A** and **B**) are adjusted individually.

1. Select the truncate A or B option in the menu.
   - The slider bar is displayed
2. Turn the rotary knob to extend or reduce the line
3. Press the exit key to confirm the selection



Function activated *End point adjusted* *Line truncated*



A line remains truncated until the restore length option is selected from the menu.

PI line alignment

A PI line can be parallel to port or starboard of the heading line, or to the port or starboard side of an EBL.

- If the stabilization is set to heading, the PI line rotates as the vessel heading change
- Parallel to EBL is a way to quickly set the bearing of a PI line parallel to the EBL in use. The line does not rotate if the EBL is changed later.

EBL/VRM markers

The EBL/VRM markers are a basic tool for collision avoidance. They are used to mark any fixed or moving radar target, and to measure distances between two objects.

The reference point of an EBL/VRM marker is by default positioned at the center of the vessel. It is possible to offset the reference point to any selected position on the radar image to measure the distance between two objects on the PPI, or to fix the marker to a target.

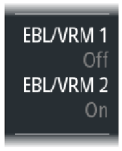
Two different EBL/VRMs can be placed on the radar image. They are identified as dashed rings/lines with different colors to discriminate them from each other and from the fixed range rings:

- EBL/VRM1 is cyan
- EBL/VRM2 is blue

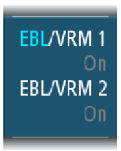
The EBL presentation can be defined with true or relative presentation:

- True motion: the reference is geographic (e.g. a coastal line or current own vessel position)
- Relative motion: the EBL follows a moving reference (own vessel or a moving target)

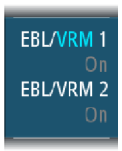
The marker's line width indicates whether the marker is in edit mode (bold lines) or at a fixed position (thin lines).



EBL/VRM1 OFF, function not active



EBL/VRM1 ON, EBL in edit mode



EBL/VRM1 ON, VRM in edit mode

The EBL/VRM pop-up



The content of the pop-up depends on status of the active EBL/VRM. The example shows the pop-up when the active EBL/VRM is offset.

The adjustable parameter is indicated with blue text in the softkey.

From the pop-up you can:

- switch between active EBL/VRM 1 and EBL/VRM 2 marker
- turn ON/OFF displaying of the active marker
- switch between adjusting EBL and VRM for the active marker. You can also switch between adjustable parameter by pressing the rotary knob
- set EBL presentation (True or Relative)
- set offset for active marker
- reset an offset marker to vessel position
- select whether the EBL/VRM should be locked to own vessel or to a geographical position

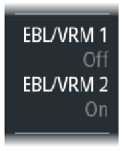
Turning the EBL/VRM marker on and off

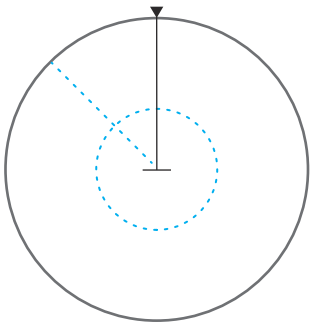
At system start-up, both EBL/VRM markers are turned off.

- Turn ON EBL/VRM 1 by pressing the EBL/VRM key once
- Switch between EBL/VRM 1 and EBL/VRM 2 from the function's pop-up
- Turn OFF an EBL/VRM from the function's pop-up

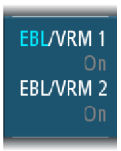
Adjusting the EBL/VRM marker

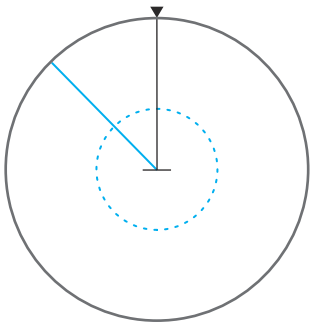
The text in the EBL/VRM short-cut button and the EBL/VRM marker's line width indicate which item that is in edit mode.



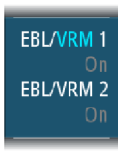


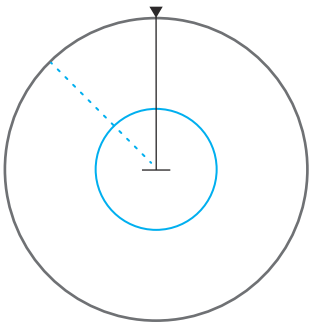
EBL/VRM2 ON, function not in edit mode





EBL/VRM1 and 2 ON, EBL1 in edit mode



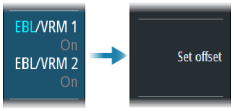


EBL/VRM1 and 2 ON, VRM1 in edit mode

When an EBL/VRM marker is in edit mode, the following options are available for adjusting the marker:

- Use the arrow keys or mouse to move the EBL/VRM intersection
- Turn the rotary knob or left mouse key/scroll wheel to adjust the adjustable parameter (bold line and blue text in softkey)
- Press the rotary knob or mouse scroll wheel to switch between adjusting EBL and VRM

Offsetting EBL/VRM markers

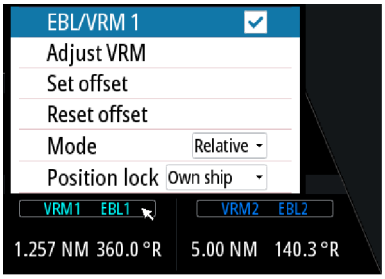


1. Press the EBL/VRM key twice to display the pop-up
2. Select the set offset option
   - The pop-up closes, and the cursor is positioned in the EBL/VRM center
3. Use the arrow keys to move the EBL/VRM center, then select one of the following options:
   - Press the enter key to fix the marker to the selected position, then use the arrow keys to move the EBL/VRM intersection
   - Turn the rotary knob to adjust the EBL
   - Press the rotary knob to toggle between EBL and VRM, then turn the rotary knob or use the arrow keys to adjust the item that is editable

You remove the EBL/VRM marker from the radar image by pressing the exit key.

Using panel buttons to adjust EBL/VRM

You can also use the buttons on the **Markers** area of the radar panel to do any of the EBL/VRM adjustments explained above.



Measuring range and bearing

Different options are available for measuring the position, speed, course, distance and bearing of radar echoes.

- Cursor position
- Range rings and bearing scale
- EBL (Electronic Bearing Lines) and VRM (Variable Range Markers)

It is important to minimize the range to obtain the best precision for the measurement. In most cases you can use a higher range if you position the PPI in one of the off-center modes. Refer to *"Offsetting the PPI center"* on page 35.

→ ***Note:*** Every measurement made with cursor or EBL/VRM is always referred to the Consistent Common Reference Point (CCRP).

Using the cursor



When you position the cursor over a target, the cursor information area will show range and bearing from the vessel to the cursor position.

This measuring option gives a fast and precise measurement of distance to a target.

Range rings and bearing scale

Range rings and bearing scale are used to measure distance when a fast measurement is required. This measuring option only gives an approximate distance and speed of a target.



The range scale (**A**) and the distance between two adjacent range rings (**B**) are shown in the System Information area on the radar image.

The range scales, the related distance between the range rings and number of rings are:

Range (NM)	Range rings interval (NM)	Number of range rings
1/8 (200m)	1/40 (100m)	4
1/4	1/20	4
1/2	1/10	4
3/4	1/4	2
1.5	1/4	5
3	1/2	5
6	1	5
12	2	5
24	4	5
36	6	5
48	8	5
64 (N/A for HALO 5000 radars)	16	3
72 (N/A for HALO 5000 radars)	12	5



Measuring by using EBL/VRM markers

The Electronic Bearing Line (EBL) and Variable Range Marker (VRM) allows quick measurements of range and bearing from own vessel to a target, or between two targets on the PPI. Bearing and range are shown in the Markers panel (**A**).

Measuring distance from own vessel

1. Press the EBL/VRM key to turn the selected EBL/VRM marker on
2. Repress the EBL/VRM key to display the pop-up if you need to:
   - Select the EBL presentation (True or Relative)
   - Reposition the marker to vessel position (if the center of the selected EBL/VRM is offset)
3. Use the arrow keys or turn the rotary knob to position the EBL/VRM on the second measuring point

Measuring distance between two objects

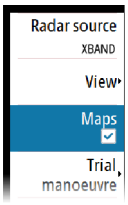
1. Press the EBL/VRM key twice
   - The selected EBL/VRM marker is turned on and the pop-up displayed
2. Select the EBL presentation (true or relative)
3. Select the set offset option
4. Use the arrow keys to reposition the EBL/VRM marker's center on the object from where you want to measure the distance
5. Press the enter key to confirm the position
   - The cursor moves from the marker's center to the EBL/VRM intersection
6. Use the arrow keys or turn the rotary knob to move the EBL/VRM to the second measuring point
   - Range and bearing from the EBL/VRM marker's center to cursor position is now displayed in the Markers panel

You can reset the EBL/VRM marker's center to vessel position by selecting the reset offset option in the EBL/VRM pop-up.

10 Maps

Maps are graphical navigation tools, composed of lines and symbols that can be added to the radar image. Maps are used to help the operator to increase the definition of the coast, restricted or dangerous areas.

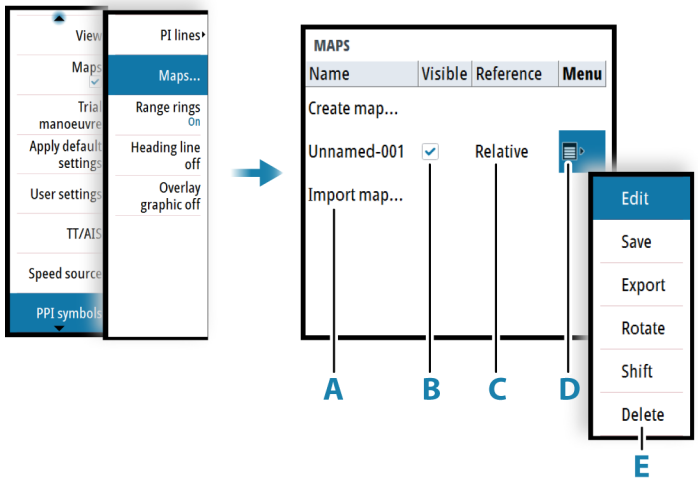
For maximum number of maps, symbols and segments, refer to *"Technical specifications"* on page 89.



→ ***Note:*** The maps option must be enabled to be able to work with maps.

The maps dialog

The maps dialog lists all maps available in the unit's temporary memory and in the non-volatile memory.



From the maps dialog you can:

- Import stored map files from the unit's internal file system or from an SD® card (**A**)
- Select which maps that are displayed (**B**)
- Set a map's reference (**C**)
- Display the maps pop-up from where you can create new maps, edit, save, export and delete a map (**D / E**)

Map references

The system includes the follow map types:

- Relative maps, which follows the position and equals the heading of own ship. All relative map coordinates are stored as distances from own ship
- Geographic maps. The coordinates for this type of maps are stored as geographic positions, and its elements are always drawn in the same absolute position.

When a map is saved the system automatically calculates both relative and the geographic details for all map items. When you switch reference the change is immediately committed without having to save the map.

→ ***Note:*** Relative maps cannot be created or imported if log or gyro is unavailable or failing.

→ ***Note:*** Geographic maps cannot be created or imported if EPFS (Electronic Position Fixing System) or Gyro is unavailable or failing. A geographic map cannot be displayed if the ship is too far from the area of the map.

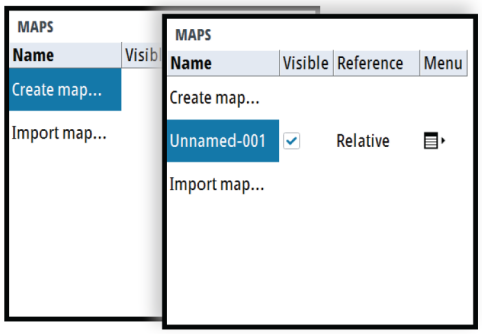
Map colors and symbols

Lines and map symbols can be presented in various colors.

The following map symbols are available:

Symbol	Description	Symbol	Description	Symbol	Description
	Buoy North		Area Caution		Arrow W
	Buoy South		Area Depth		Arrow NW
	Buoy East		Area Empty		Sign Call
	Buoy West		Area Ufo		Sign Reminder
	Buoy Lateral Port		Arrow N		Nato 1
	Buoy Lateral Stbd		Arrow NE		Nato 2
	Buoy Special		Arrow E		Nato 3
	Buoy Danger		Arrow SE		Nato 4
	Buoy Safe		Arrow S		Nato 5
	Buoy Unknown		Arrow SW		Nato 6

Creating a new map



When the create map option is selected, a new map is immediately saved to the unit's temporary memory.

The map name is defined by the system, and the visibility is set to ON.

→ ***Note:*** The new map has at this stage no content.

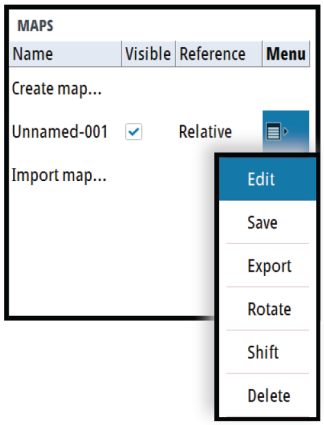
- Select the map name to display the keyboard if you want to give the map a unique name
- Set the map reference
- Select the menu option to enter map details. See *"Modifying a map"* on page 59.

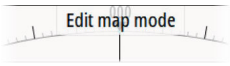
Saving a map

New maps and edited maps are by default saved to the unit's temporary memory. The maps must be saved to be available in the unit after a restart.

Modifying a map

Any details for a map are added or edited from the maps pop-up menu.





When an edit option is selected in the pop-up menu, the system turns into edit map mode. This is indicated on the PPI.

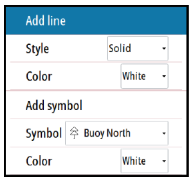
To exit edit map mode:

- Press the exit key

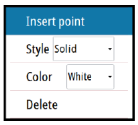
→ ***Note:*** When you exit edit mode the changes are automatically saved to the temporary memory only. The maps must be saved to be available in the unit after a restart.

Edit map details

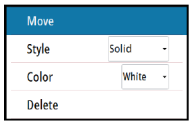
Map details are added or edited from the edit map menu. The content of the edit map menu depends on where the cursor is positioned:



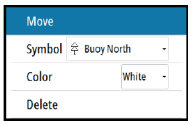
No map details at cursor position



Map line at cursor position



Vertex at cursor position



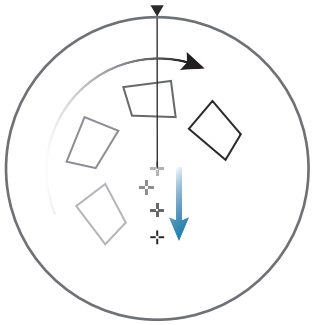
Symbol at cursor position

1. Position the cursor where you want to add or edit a map detail
2. Press the enter key or the right mouse key to display the map edit menu, then select the edit option
3. Continue positioning the cursor and selecting the edit option until all changes are done
4. Press the exit key to leave the edit mode

Rotating a map

When the rotate option is selected, the cursor is positioned in the center of the PPI.

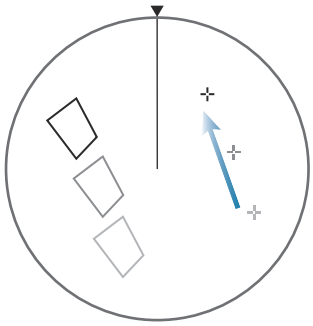
- Use the arrow keys to move the cursor and to rotate the map around the vessel's position
- Press the exit key to leave edit mode



Shifting a map position

When the shift option is selected, the cursor is positioned in the center of the PPI, and the map is anchored to the cursor.

- Use the arrow keys to move the cursor and to shift the map position
- Press the exit key to leave edit mode



Exporting maps

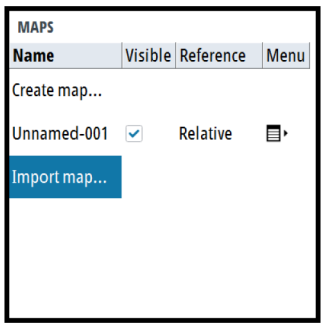
Maps listed in the maps dialog can be exported individually and used on other compatible radar units.

Saved maps can also be copied from internal memory to a memory card from the files management system.

Importing maps

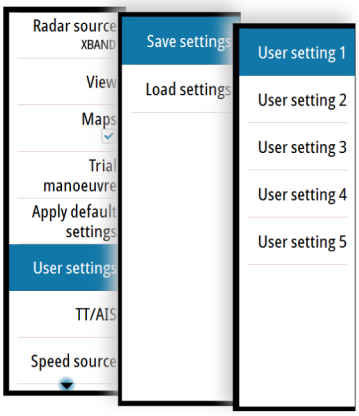
Compatible maps created on other units can be imported to the system. Imported maps are added to the units' non-volatile memory, and the maps are added to the list of loaded maps.

→ ***Note:*** Maps listed in the maps dialog of the radar can be exported individually on a USB memory stick and used on other compatible radar units or edited by the user map PC tool. The Map PC tool editor is an application available in the Navico system builder. If needed, contact your dealer to request a copy of the installation file.



11 Customizing radar control settings

You can save several control settings in the system. The function is used for defining various conditions and user preferences.



For recalling default control settings, refer to *"Applying default control settings"* on page 27.

Customizing radar control settings table

The following functions are included when you save a user setting:

Function	Default setting
Band	X-band
Gain, rain and sea	Automatic
Tuning	Automatic (N/A for HALO 5000 radars)
Range	6 NM
Fixed range rings	Off
VRMs	One VRM on at 0.25 NM
EBLs	Off or last settings
Parallel index lines	Off or last settings
Display mode of PPI	True motion, north up
Stabilization sea/ground	Ground (SOG, COG)
Off-centering	Look ahead
Target trails	On, 6 minutes (same as vector)
Past position	Off
Radar target tracking	Continued
Vector mode	Relative
Vector time	6 minutes
Graphical AIS reported target display	On
Radar and AIS target function	Association On
Operational alarms (except collision warnings)	Off
Collision warning	On (limits CPS 2 NM, TCPA 12 minutes)
Display of maps, navigation lines and routes	Last settings

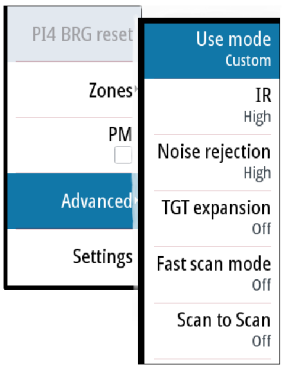
12 Advanced options

The available advanced settings depend on the type of radar.

Use modes

Radar use modes are available with preset control settings for different environments.

→ ***Note:*** Use modes are only available with HALO 5000 radars.



Custom mode

All radar controls can be adjusted and settings will be retained after a mode change or radar power cycle. Radar defaults are set for general purpose use.
Custom mode settings

Interference rejection	Noise rejection	Target expansion	Fast scan mode	Scan to Scan
All settings available to operator	All settings available to operator	All settings available to operator	All settings available to operator	All settings available to operator

Harbor mode

The radar settings are optimized for areas such as busy waterways and large man-made structures where good target discrimination and rapid image updates are needed.
Harbor mode settings

Interference rejection	Noise rejection	Target expansion	Fast scan mode	Scan to Scan
All settings available to operator	Always High	Always Low	Always Off	Always SC/SC-3

Offshore mode

The radar settings are optimized for offshore sea conditions and making isolated targets larger and easy to see.
Offshore mode settings

Interference rejection	Noise rejection	Target expansion	Fast scan mode	Scan to Scan
All settings available to operator	Always High	Always Medium	Always Off	Always SC/SC-2

IR (interference rejection)

The interference rejection (IR) option is used to eliminate second trace echoes from far distance targets, and the interference from radar units operating in the same frequency band.

When the IR is ON, transceiver pulse staggering is enabled. When enabled, the transceiver PRF is changed slightly for each sweep. By doing this, spiral interferences and second trace echoes are split in range from sweep to sweep. The IR processing clears all the echoes found at the same range if they are not present in each sweep.

The IR must be chosen according to the environment around own ship:

- IR off when the maximum signal from the receiver is needed

- IR on when the interference or second trace echoes disturb the radar image

To avoid missing weak targets, the interference rejection should be set to OFF when no interference exists.

Noise rejection

The Noise Rejection control sets the amount of noise filtering applied by the radar. Target sensitivity is increased at longer ranges when this control is set to Low or High, but it also causes some decrease of target discrimination.

→ ***Note:*** Interference rejection is only available on the HALO 5000 radar if Noise Rejection is enabled.

Target boost

The target boost control increases pulse length, reduces radar bandwidth to make targets appear larger in range, and increase radar sensitivity.

→ ***Note:*** Target boos is only available on SRT LAN radars.

TGT expansion

Target expansion increases the length of targets in range, making them easier to see.

Fast scan

Change the speed of the radar antenna rotation from 20 RPM in standard mode to 40 RPM in fast scan mode. This option gives faster target updates.

→ ***Note:*** The fast scan menu option is only available for the 6 and 9 ft X-band standard antennas. The menu option is unavailable for HSC antennas as the antenna rotation is always fast scan mode at 40 RPM.

Scan to scan

Note: This option is only available with HALO 5000 radars.

The function of the Scan to Scan Correlation control is to distinguish real target echoes from sea clutter. Some spiky reflections can be higher as amplitude than smaller echoes such as sailing boats or RIBs. Correlation is performed by storing and comparing echo signals over successive picture frames. If an echo is solid and stable, it is presented in its normal intensity. If an echo is solid and stable, it is presented in its normal intensity. Sea clutter spikes are strong but disappear after some 100th of milliseconds.

The scan to scan signal correlation technique based works internally in true motion compensating the own ship speed. This the reason why the scan to scan processing is automatically disabled in case of heading sensor failure.

Small targets running at high speed over ground (SOG) or small targets at low scale, when the radar echo covers great areas in very short time can be removed as well. For this reason the operator has to pay extra attention to fast moving targets.

Pressing the Scan to Scan button, a list with the selectable number of scans will be opened. The system will perform the above mentioned correlations within the set number of scans, to distinguish the real echoes from the false.

The image processing can take 2 or 3 scans to form for this reason whenever a range scale, gain/anti-sea/anti-rain control is changed the processing is temporarily stopped to see the immediate effect on the PPI presentation. The scan to scan processing is reapplied automatically when a sufficient number of scan is passed scan to scan correlation is a process that filters the radar echoes that are not present in the same position for N consecutive scans. N is a number comprised between 2 and 3. This means that an echo that changes its position during the correlation time (depending also of antenna rotation rate) more than its dimension can be cancelled from the PPI. The table below is useful to estimate which echoes will be stable on the PPI according to their maximum speed. For example, if the antenna rotates at 24 rpm and the operator selects Scan to Scan 3, a radar echo smaller than 30 m with a speed of 10 knots, will move too fast and therefore will not be visible. The same echo

having, for example, maximum dimension of 25 m will be correctly displayed if the antenna rotates at 48 rpm (HSC), as the minimum dimension indicated in the table is 16 m. The highlighted sections in the table indicates cases where the Scan to Scan correlation should not be used, as it will require unrealistic ship sizes in order to be visible.

	24 rpm 2 scans	48 rpm 3 scans	48 rpm 2 scans	24 rpm 3 scans
Small vessel with RADAR reflector	< 15KN	< 7 KN	< 15 KN	< 3 KN
Vessel ≤20 m	< 30 KN	< 15 KN	< 30 KN	< 7 KN
Vessels > 20 m are always visible in any scan to scan configuration.				

13 Trial maneuver

The trial maneuver option is used to avoid dangerous situations when planning a maneuver in heavy traffic areas.

The trial maneuver presents a graphical view of a simulated maneuver, including the predicted position of own vessel relative to tracked targets and AIS targets.

→ ***Note:*** The best trial maneuver information is available when running the radar in Relative motion and with speed source stabilization set to Sea mode. Refer to *"Relative motion"* on page 35, and to *"Selecting speed source"* on page 25.

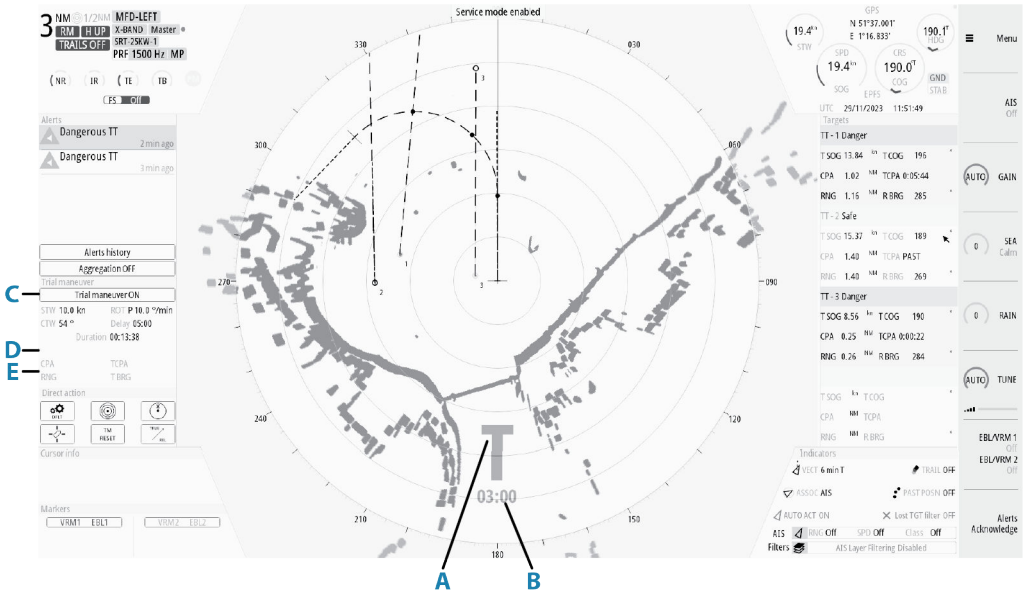
Trial maneuver symbology

When the trial maneuver is started, the trial symbol (**A**) and the countdown time (**B**) is added to the radar image. A Trial maneuver panel (**C**) is added to the radar panel.

The target indication is according to the radar view settings and speed stabilization mode.

The targets are indicated with actual position. Select a target to see its predicted position (**E**). The estimated motion line (EML) is then added between the two target positions.

If you select a target's predicted position, the target name and the predicted position are added to the panel (**D**).



Indication of a dangerous maneuver

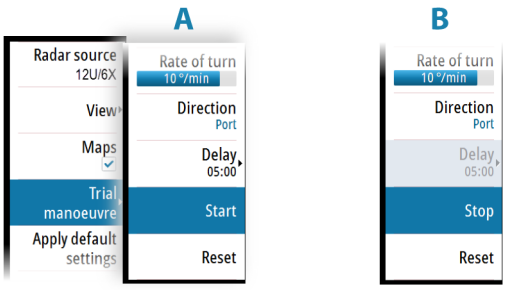
The following indications are used to indicate that a target's position is a dangerous at the end of the trial maneuver:

- flashing red target symbol
- yellow color in the trial maneuver panel
- a relevant alarm

Starting and stopping the trial maneuver

You can start the trial maneuver via the main menu when the final speed or final course is defined.

You can at any time stop the trial maneuver. The function will automatically stop when the delay time has expired.

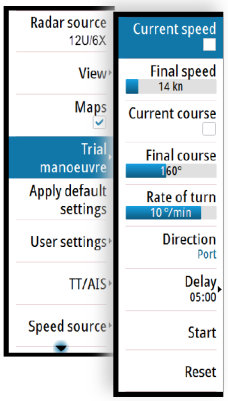


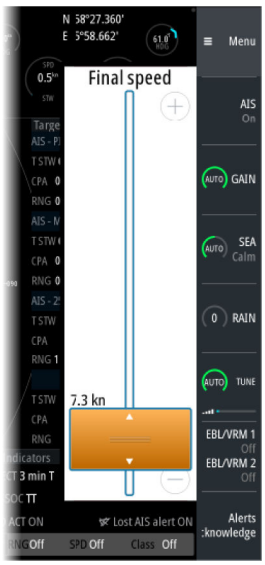
→ ***Note:*** You can also start/stop the trial maneuver using the **Trial maneuver ON/OFF** button on the radar panel.

Manually changing the trial maneuver settings

The default trial maneuver settings are defined during commissioning of the vessel.

The trial maneuver settings menu remains open after the function is started. If a maneuver is considered dangerous, you can adjust the speed and/or course to see how to avoid a dangerous situation.





14 Maintenance

General

The system requires very little maintenance. The operator should inspect the equipment carefully and notice every possible anomaly, such as the integrity of the equipment, the presence of rust, missing paint, and loose screws. Monthly the operator should clean the equipment and remove dust, ash and grease with a soft cotton cloth and alcohol. Caution must be taken not to use solvent to clean plastic parts.

For details about replaceable parts, refer to the separate service manual(s).

→ ***Note:*** The performance monitor functions differently depending on the type of radar.

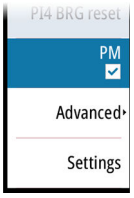
Performance monitor (SRT LAN radar)

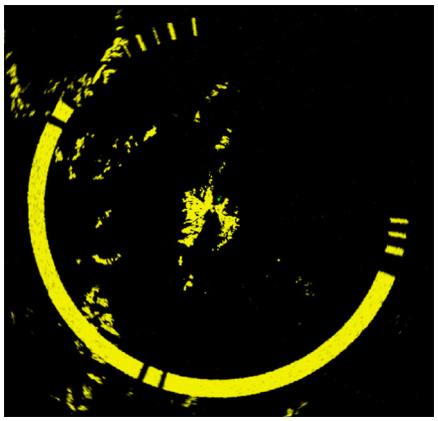
The performance monitor (PM) function is used for checking the performance of the transceiver, the waveguide and the antenna.

Before the function is started you should set the range scale to 24 NM, tune the radar and adjust the gain control to about 90%.

In this condition an intensified noise ring, positioned approximately at 24 NM should appear. The distance of the ring from the center is directly proportional to the TXRX transmitted output power. When the Magnetron has decreased 10 dB in peak power, the ring's distance will decrease to about 12 NM range.

The performance monitor is started from the main menu.



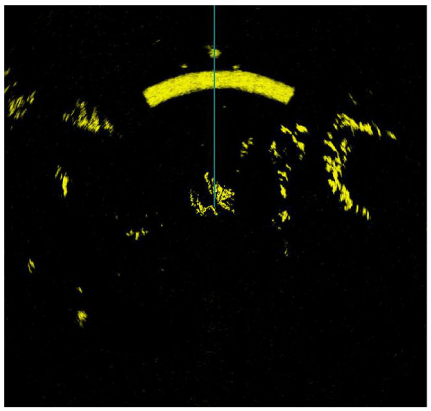


The performance monitor ring should have a missing angular sector of some 60° to 80°. This missing sector is due to the RF beam really transmitted by the antenna. Any RF power degradation between the magnetron and the antenna output results in a smaller angular ring interruption. When the angular sector is reduced below 30°, the antenna section requires service. The ring's width (thickness) is proportional to the tuning condition. The width of the ring for a good and correctly tuned radar will be approximately 2 NM. The ring's strength (difference between background noise and ring's noise) indicates the receiver noise figure. If the receiver noise figure degradation is more than 10 dB, it is not possible to distinguish the performance monitor ring from the background noise.

→ ***Note:*** If sector blanking is enabled, the performance monitor ring will have missing sectors in the sector blanking areas.

Performance monitor (HALO 5000 radar)

The performance monitor on the HALO 5000 series has no user adjustments other than choosing the antenna size. The radar calculates any eventual loss of performance, and the relative warning is displayed when the performance monitor is enabled.



The performance monitor is started from the main menu.

The operator can check the performance monitor ring displayed at 24 NM +- 30° to each side of the zero bearing reference. The ring will disappear if the receive path has a loss greater than 10 dB.

Radar performance is calculated in every condition regardless of the video processing selected. To get a clear picture of the noise ring, the gain should be set to standard or auto value, and the remaining sea/rain processing controls should be disabled.

The ring visibility is not affected by sea clutter and only partially when strong land and rain clutter are present at 24 NM.

Sector blanking within the +- 30° can affect the transmitted power. Sector blanking should not be inserted within the +- 30° or disabled when the performance monitor is enabled.

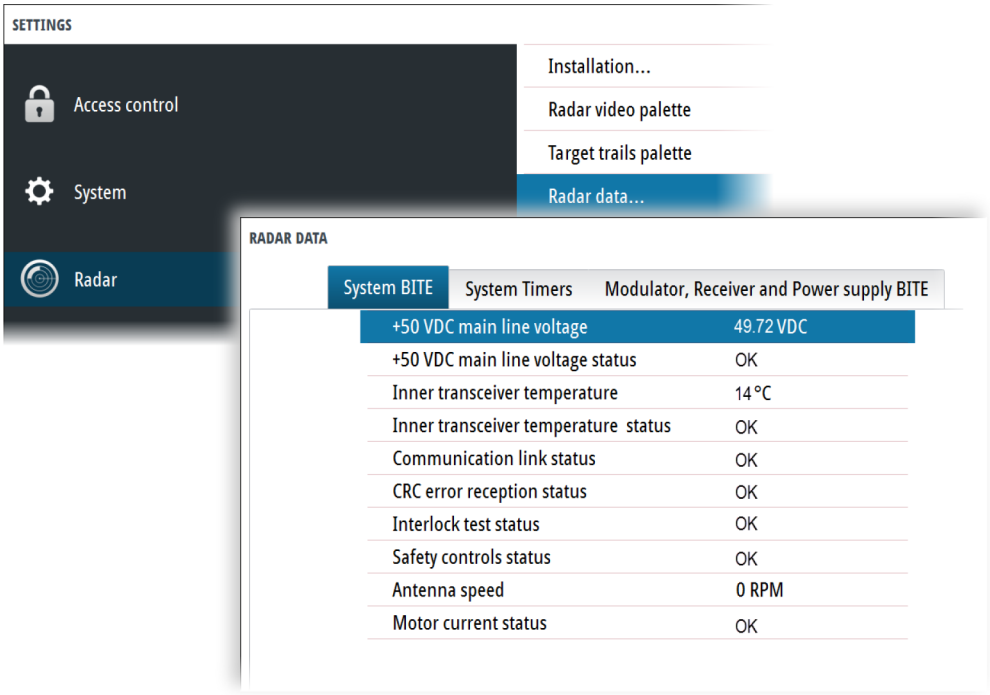
→ ***Note:*** The performance monitor antenna should always be pointed toward a transmission area without metal obstructions requiring sector blanking.

⚠ Warning: Weather conditions with rain precipitation rates more than 166 mm/h can temporarily affect the performance monitor. Rain drop accumulation on both antennas can show a loss greater than 10 dB.

Radar data (SRT LAN radar)

The Radar Data dialog displays the status of vital radar components.

→ ***Note:*** How the radar data option functions depends on the type of radar.

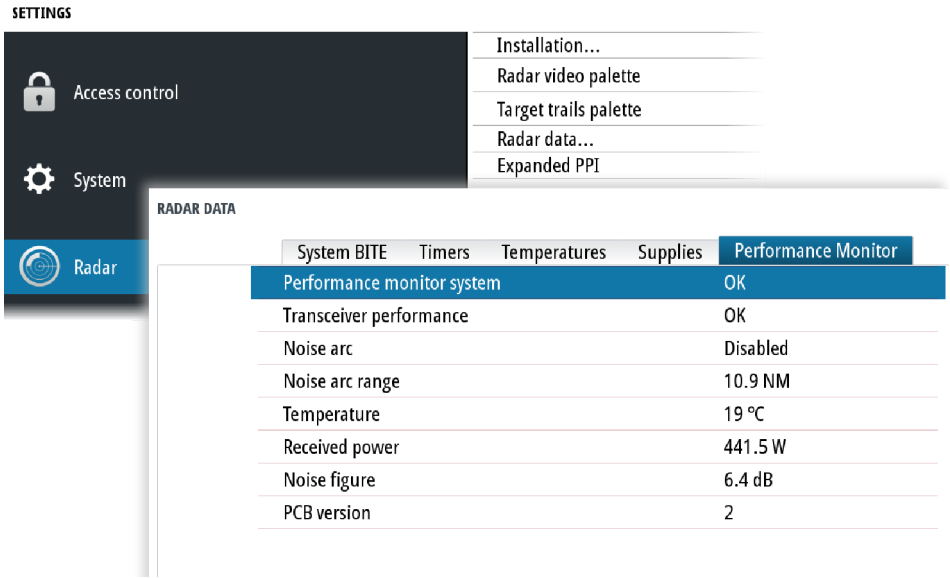


The system displays an alert when the magnetron has to be replaced on X- and S-Band systems.

For replacement procedures, refer to the separate service manual.

Radar data (HALO 5000 radar)

In addition to the status of vital radar components, the HALO 5000 Radar Data dialog displays advanced performance monitor parameters. If there is a radar malfunction, these performance monitor parameters help determine the source of the problem.



15 The alert system

The system continuously checks for dangerous situations and system faults while running.

Type of alerts

There are 3 alert types in the system:

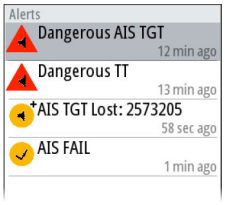
- **Alarms**: This is the system's highest priority alert, activated when a situation occurs that might result in a collision, or for conditions that critically effect the capability or performance of the system. An alarm is accompanied by an audible signal, and the alarm icon flashes until the alarm is acknowledged.
- **Warnings**: These are lower priority alerts, announcing conditions that could result in unwanted system response or eventual failure if no action is taken. A warning is accompanied by an audible signal (2 short signals, repeated as a Warning if not acknowledged). The warning icon flashes until the warning is acknowledged.
- **Cautions**: This is information about danger and caution objects that require attention. Cautions have no audible signal.

Alert categories

Each alert is - in addition to alert type - identified with an alert category. An alert's category decides the action required to rectify the alert.

Category	Action
A	Category A alerts can only be acknowledged on the radar control station. In general, all local alarms generated by a workstation are category A. Example: Danger AIS target alarm. For this category revaluation is not allowed and responsibility transfer is rejected.
B	Category B alerts can be acknowledged on the BNWAS or BAM if these systems are connected. All global alarms generated by navigation systems are category B. Example: Gyro failure warning. For this category the system grants requests for responsibility transfer.

Alert notifications



When an alert is triggered, the alert appears in the Alerts panel.

The alerts are displayed in a sorted order. The sort order is first by state (i.e. not acknowledged before rectified before acknowledged), then severity (i.e. alarm before caution), then age.

Alarms and Warnings have different states:

- Active - not acknowledged, not silenced
- Active - not acknowledged, silenced
- Active - acknowledged
- Active - responsibility transferred to another work station
- Rectified - not acknowledged

When an alert has been both rectified and acknowledged, it will disappear from the Alerts panel.

Cautions cannot be acknowledged, and they disappear from the alert list when the condition is rectified.



A number of related alerts can be aggregated and shown in the Alerts panel as one single item with the aggregation symbol (+) next to the alert symbol. The aggregated symbol shows the state as unacknowledged if at least one alert in the aggregated list is unacknowledged. Each alert in the list has to be acknowledged individually.



AIS and TT target alerts are aggregated only if Aggregation ON is selected.
The table below shows alert icons and behavior depending on alert state.

Alert type	Icon	State	Indication
Alarm		Active - not acknowledged, not silenced	• Flashing symbol and descriptive text • Audible signal
		Active - not acknowledged, silenced	• Flashing symbol and descriptive text • No audible signal
		Active - acknowledged	• Steady symbol and descriptive text • No audible signal
		Active - responsibility transferred	• Steady symbol and descriptive text • No audible signal
		Rectified - not acknowledged	• Flashing symbol and descriptive text • No audible signal
Warning		Active - not acknowledged, not silenced	• Flashing symbol and descriptive text • Audible signal
		Active - not acknowledged, silenced	• Flashing symbol and descriptive text • No audible signal
		Active - acknowledged	• Steady symbol and descriptive text • No audible signal
		Active - responsibility transferred	• Steady symbol and descriptive text • No audible signal
		Rectified - not acknowledged	• Flashing symbol and descriptive text • No audible signal
Caution		Active	• Steady symbol and descriptive text • No audible signal

Siren enabled

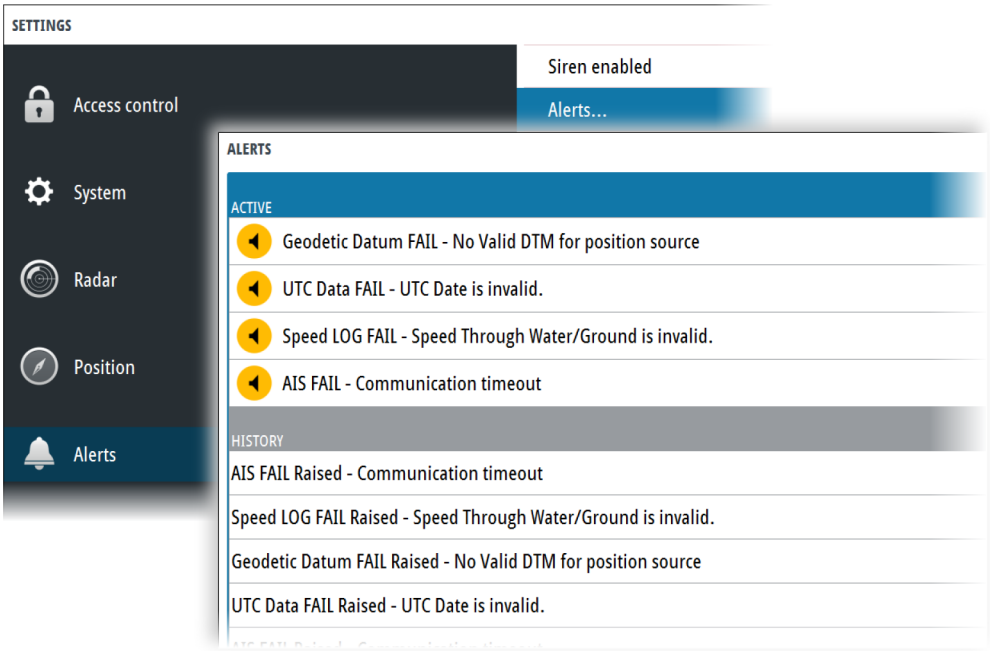
By default, the audible alert signal is turned ON.

You can select to disable the audible signal when service mode is active, but the audible signal will be enabled when service mode is deactivated.

The Alerts dialog

The Alerts dialog includes a list of active alerts together with a historic listing of the last alert state changes. Entries are added to the history whenever an alert is raised, acknowledged, rectified or cleared.

All alerts in the Alerts dialog include a time stamp.



External bridge alert systems

The system supports Bridge Alert Management (BAM) and Bridge Navigational Watch Alarm Systems (BNWAS).

Bridge Alert Management (BAM)

All system alerts are transferred to the bridge alert system if this is connected to the system.

An alert generated by the system can only be acknowledged from the system itself. Global alerts can be acknowledged on both the system control unit and on the bridge alert system.

Bridge Navigational Watch Alarm Systems (BNWAS)

If a BNWAS is connected to the system, the system outputs an EVE sentence to the BNWAS when a user interaction with the system occurs. The EVE sentence remotely resets the BNWAS timer to confirm wheelhouse crew activity.

Alphabetic alert list

Alert type abbreviations:

- C: Caution
- W: Warning
- A: Alarm

Alert text	Description	Type	Cate-gory	Alert ID
AIS Reported Target Display Capacity 95%	AIS target displaying capacity is about to be exceeded.	C	B	3043
AIS Reported Target Capacity Full	AIS target capacity exceeded.	W	A	3042
AIS Data Report Display Capacity 95%	AIS data report display capacity is about to be exceeded.	C	B	10310
AIS Data Report Display Capacity Full	AIS data report display capacity exceeded.	W	A	10311
AIS Locating Device Display Capacity 95%	AIS locating device display capacity is about to be exceeded.	C	B	10312
AIS Locating Device Display Capacity Full	AIS locating device display capacity exceeded.	W	A	10313
AIS FAIL	AIS failure.	W	B	3015
	Not used. AIS failure.	C	B	10194
AIS TGT in GZ	AIS target in guard zone.	W	A	3048
AIS TGT Lost: #	AIS target # is lost.	W	A	3052
BAM HBT Lost	BAM heartbeat lost.	C	B	10000
Bearing Pulse FAIL	Bearing pulse fault.	W	B	16016
Dangerous AIS TGT	CPA or TCPA values of an activated AIS target less than set limits.	A	A	3044
Dangerous TT	CPA or TCPA values of a tracked target less than set limits.	A	A	3044
Door Switch Open	The radar enclosure is open due to maintenance. The radar is not operational.	A	A	3015
EPFS FAIL	Position source failure.	W	B	3015
	Not used. Position source failure.	C	B	10194
Gateware FAIL	Gateway datapath error.	W	B	16026
Geodetic Datum FAIL	Geodetic datum failure.	W	B	3015
GYRO FAIL	Gyro failure.	W	B	3015
	Not used. Gyro failure.	C	B	10194
Heading Line FAIL	Heading line failure.	W	B	3015
Magnetron EOL	Magnetron end of life reached.	C	B	10195
Mechanical FAIL	Mechanical fault.	W	B	16032

Alert text	Description	Type	Cate-gory	Alert ID
Motor driver FAIL	Motor driver failure.	W	B	16045
Motor FAIL	Motor not running.	W	B	16017
Motor or Antenna FAIL	Motor stall.	W	B	16036
PM System FAIL	Performance monitor failure.	W	B	16047
POSN Invalid	Position invalid.	W	B	3015
POSN Unavailable	Position unavailable.	W	B	3015
PSU Hardware FAIL	PSU hardware fault.	W	B	16030
PSU Overheat FAIL	PSU overheat.	W	B	16027
PSU Power FAIL	PSU power.	W	B	16029
PSU Voltage FAIL	PSU voltage.	W	B	16028
Radar Antenna FAIL	Radar antenna failure.	W	B	3015
RADAR FAIL	Radar TXRX failure.	W	B	3015
Radar Persistence FAIL	Persistence corrupt.	W	B	16015
REF TGT Lost	Reference target lost.	W	A	3052
Safety Switch Open	The safety switch is open due to maintenance. The radar is not operational.	A	A	3015
Scanner Config FAIL	Scanner config fault.	W	B	16022
SOG FAIL	Speed Over Ground failure.	W	B	3015
	Not used. Speed Over Ground failure.	C	B	10194
Speed LOG FAIL	Speed log failure.	W	B	3015
	Not used. Speed log failure.	C	B	10194
SPD Long. Axis FAIL	Speed longitudinal axis data failure.	W	B	3015
SPD Tran. Axis FAIL	Speed transversal axis data failure.	W	B	3015
STW FAIL	Speed Through Water failure.	W	B	3015
TGT in GZ	Tracked target # within the vessel's guard zone.	W	A	3048
Train TGT CPA FAIL	Training target CPA out of range.	W	A	3044
Train TGT TCPA FAIL	Training target TCPA out of range.	W	A	3044
Transmitter (Hard) FAIL	PA hard overheat.	W	B	16025
Transmitter (Hard) FAIL	PA hard overcurrent.	W	B	16046
Transmitter (Soft) FAIL	PA soft overheat.	W	B	16024
Trigger FAIL	Trigger failure.	W	B	3015

Alert text	Description	Type	Cate-gory	Alert ID
TT Capacity 95%	Tracked target processing/displaying is about to be exceeded.	C	B	3043
TT Capacity Full	Tracked target capacity exceeded.	W	A	3042
TT Extractor Overload	Target tracking extractor overload.	W	A	3015
TT Lost: #	Tracked target # is lost.	W	A	3052
TT Unavailable	Tracking unavailable.	C	A	16043
TXRX PM Loss	Transmit performance loss.	C	B	16048
UTC Data FAIL	UTC data failure.	W	B	3015
Radar Video FAIL	Radar video failure.	W	B	3015

Operating modes fallback

The following table shows possible failure categories, and which operations that are allowed or not allowed when the failure occurs.

Failure	Possible alert	Fallback arrangement	Function Inhibited
Heading failure	GYRO FAIL	Automatic switch to relative motion head-up mode	• AIS • Acquiring/Tracking radar targets • Geographically referenced maps • North Up/Course Up orientation • True motion presentation • True trails
Speed through water failure	Speed LOG FAIL STW FAIL	Possible to set Manual speed	• AIS
Course and speed over ground failure	Speed LOG FAIL SOG FAIL EPFS speed FAIL	Automatic switch to relative motion, relative vectors and sea stabilization	• True vectors • Geographically referenced maps • True motion presentation • True trails
Position input failure	POSN Invalid POSN Unavailable		• AIS • Geographically referenced maps
Radar video input failure	RADAR FAIL	Possible to display target information based on AIS data	• Acquiring/tracking radar targets • True motion/ True trails • Radar video presentation
AIS input failure	AIS FAIL		• AIS

16 Menu overview

Main menu

> Access submenu

... Open dialog

Level 1	Level 2
Radar source	
View >	Trials & PAST POSN >
	Orientation
	Motion mode
	Reset offset
	Offset >
	Vectors >
	Cursor bearing
	Brilliance >
	Own ship outline
	Route data page
Maps	
Trial maneuver >	Current speed
	Final speed
	Current course
	Final course
	Rate of turn
	Direction
	Delay >
	Start
	Reset
Apply default settings	
User settings >	Save settings >
	Load settings >
TT/AIS >	
	Cancel all
	Cancel selected target
	Lost warning
	Range
	CPA/TCPA limit ...
	AIS >
	Data ...
	Target ASSOC >
	Training
Speed source >	Stabilization
	Source
	Manual speed

Level 1	Level 2
	Drift/Set
	Drift
	Set
PPI symbols >	PI lines >
	Maps ...
	Range rings
	Heading line
	Overlay graphic off
PI1 BRG Reset	
PI2 BRG Reset	
PI3 BRG Reset	
PI4 BRG Reset	
Zones	Zone 1
	Adjust
	Type
	Zone 2
	Adjust
	Type
PM	
Advanced >	Use mode (N/A for SRT LAN radars)
	IR
	Noise rejection
	Target boost (N/A for HALO 5000 radars)
	TGT expansion
	Fast scan mode
	Scan to scan
Settings	

Settings menu

> Access submenu

... Open dialog

Level 1	Level 2
Access control	Service mode
	Enter password ...
System	Key beeps
	Time ...
	Remote controller
	Restore defaults ...
	Files ...
	Advanced ...
	Reboot device
	Registration ...

Level 1	Level 2
	About
Radar	Installation
	Radar video palette
	Target trails palette
	Radar data
	Expanded PPI
Position	Satellites
	Ignore position quality
Alerts	Siren enabled
	Position quality data missing
	Datum type data missing
	Alerts ...
	Test alarm
Units	Distance small
	Own vessel rate of turn
Network	Info
	Control display units ...
	Sources ...
	Priorities table ...
	Device list
	Diagnostics
	NMEA 0183® ...
	LWE Own configuration ...
Own ship	Setup ...
	MMSI
	Own ship AIS data
	Trial maneuver
Simulator	Simulate
	Demo mode
	Files ...
	Advanced ...

17 O2000/O5000 trackball, key function comparison

Most functions can be operated both with the O2000 controller and O5000 trackball unit. The following table gives an overview of key operations for both units.

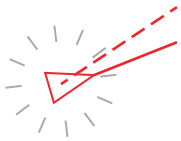
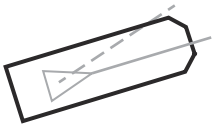
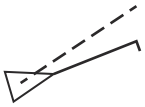
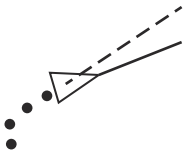
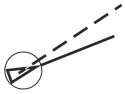
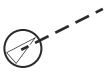
→ ***Note:*** To use the scroll function, the cursor must be located over an open menu or over the quick access pop-up.

Action	O5000 trackball	Expanded keyboard trackball	O2000
Operate menu			
Activate	Left key	Left key	Enter key - single press
Scroll	Scroll wheel		Rotary knob or arrow keys
Return to previous level	Right key	Right key	Exit key - single press
Exit	Left key outside menu area	Left key outside menu area	Exit key - press and hold
Operate quick access keys			
Select	Left key	Left key	
Open pop-up	Right key	Right key	
Close pop-up	Right key	Right key	
Scroll pop-up options	Scroll wheel		
Select target			
Activate/de-activate AIS target	Left key	Left key	Enter key - single press
Acquire radar target	Left key	Left key	Enter key - single press
Display target menu	Right key	Right key	Enter key - press and hold

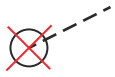
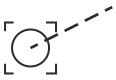
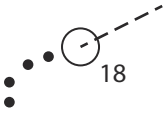
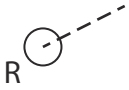
18 Target symbols

This section lists the target symbols used in this system.

Symbol	Description
 Basic shape	**AIS base station**
	**AIS mobile**
	**Virtual AIS mobile**
	**AIS mobile**, self-propelled, but direction not reported or unavailable
	**Virtual AIS mobile**, self-propelled, but direction not reported or unavailable
	**Tethered AIS mobile**
	**AIS mobile (COG information provided)** sector 0°
	**AIS mobile (COG information provided)** sector 45°
	**AIS mobile (COG information provided)** sector 90°
	**AIS mobile (COG information provided)** sector 135°
	**AIS mobile (COG information provided)** sector 180°
	**AIS mobile (COG information provided)** sector 235°
	**AIS mobile (COG information provided)** sector 270°

Symbol	Description
	**AIS mobile (COG information provided)** sector 315°
	**AIS SAR aircraft - fixed wing**
	**AIS SAR aircraft - helicopter**
	**AIS SAR vessel**
	**AIS SART** (AIS Search And Rescue Transmitter)
	**AIS target - dangerous**, indicated with bold line and with red color. The symbol flashes until the target alarm is acknowledged by the operator
	**AIS target - lost**, indicated with crossed lines centered on the target symbol. The symbol is located at the last received position from the target
	**AIS target - selected**, indicated with a square (dashed line) around the target symbol
	**AIS target - sleeping**, aligned with received heading information or with COG information if heading is not available
	**AIS target - sleeping** with neither a reported heading nor COG
	**AIS target - activated** with true scaled outlines
	**AIS target** with heading line and SOG/COG (dashed line), and with indicated turn direction
	**AIS target - activated** with neither reported heading nor COG
	**AIS target** with heading line, SOG/COG (dashed line) and past track
	**Associated target** - using AIS data
	**Associated target** - using radar data

Symbol	Description
	**Physical AIS AtoN**, basic shape (AIS aids to navigation)
	**Physical AIS AtoN - east cardinal mark**
	**Physical AIS AtoN - emergency wreck mark**
	**Physical AIS AtoN - isolated danger**
	**Physical AIS AtoN - north cardinal mark**
	**Physical AIS AtoN - off position**
	**Physical AIS AtoN - port hand mark**
	**Physical AIS AtoN - racon failure**
	**Physical AIS AtoN - racon**
	**Physical AIS AtoN - safe water**
	**Physical AIS AtoN - south cardinal mark**
	**Physical AIS AtoN - special mark**
	**Physical AIS AtoN - starboard hand mark**
	**Physical AIS AtoN - unlit** (failure of lights)
	**Physical AIS AtoN - west cardinal mark**
	**Radar target - dangerous**, 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
	**Radar target - in acquisition state**, indicated as a broken circle centered at the position of target acquisition

Symbol	Description
	**Radar target - lost**, indicated with crossed lines centered on the target symbol. The symbol is located at the last received position from the target
	**Radar target - selected**, indicated with a square (dotted line) around the target symbol
	**Radar target - tracked**, with velocity vector
	**Radar target** with past position and velocity vector
	**Reference target**
	**Signal station**
	**Virtual AIS AtoN**, basic shape
	**Virtual AIS AtoN - east cardinal mark**
	**Virtual AIS AtoN - emergency wreck mark**
	**Virtual AIS AtoN - isolated danger**
	**Virtual AIS AtoN - north cardinal mark**
	**Virtual AIS AtoN - port hand mark**
	**Virtual AIS AtoN - safe water**
	**Virtual AIS AtoN - south cardinal mark**
	**Virtual AIS AtoN - special mark**
	**Virtual AIS AtoN - starboard hand mark**
	**Virtual AIS AtoN - west cardinal mark**
	**Virtual AIS AtoN missing**

19 Terms and abbreviations

ACK	Acknowledge
ACQ	Acquire
ACT	Activate
ADJ	Adjust, Adjustment
ALT	Altitude
AIS	Automatic Identification System
AM	Amplitude Modulation
ANCH	Anchor Watch
ANT	Antenna
AP	Autopilot
APR	April
ARPA	Automatic Radar Plotting Aid
ATON	Aid to Navigation
AUD	Audible
AUTO	Automatic
AZ	Acquisition Zone
AZI	Azimuth Indicator
BCR	Bow Crossing Range
BCT	Bow Crossing Time
BDS	BeiDou Navigation Satellite System
BI	Binary Image
BKGND	Background
BMD	Brush Motor Drive - brushless controller for the S_Band
BRG	Bearing
BRILL	Display Brilliance
BWW	Bearing Waypoint To Waypoint
C UP	Course Up
CCRP	Consistent Common Reference Point
CENT	Centre
CNCL	Cancel
COG	Course Over Ground
CONT	Contrast
CPA	Closest Point Of Approach
CPU	Central Processing Unit
CRS	Course
CTS	Course To Steer
CURS	Cursor
DAY/NT	Day/Night
DECR	Decrease
DEG	Degrees
DEL	Delete
DFLT SET	Default Settings
DGPS	Differential GPS

DISP	Display
DIST	Distance
DPTH	Depth
DR	Dead Reckoning
DSC	Digital Selective Calling
DW	Deep Water
EBL	Electronic Bearing Line
ECDIS	Electronic Chart Display And Information System
ECS	Electronic Chart System
EGNOS	European Geo-Stationary Navigational Overlay System
ENCSOG	Automatic Navigational Chart
EP	Estimated Position
EPFS	Electronic Position Fixing System
EPIRB	Emergency Position Indicating Radio Beacon
EQUIP	Equipment
ERBL	Automatic Range And Bearing Line
ETA	Estimated Time Of Arrival
ETD	Estimated Time Of Departure
EZ	Exclusion Zone
FK	User Function Key
FMCW	Frequency Modulated Continuous Wave
FS	Fast Scan
FWD	Forward
GAS	Grounding Avoidance System
GEOG	Geographic
GLONASS	Global Orbiting Navigation Satellite System
GMDSS	Global Maritime Distress And Safety System
GND TRK	Ground Track
GNDSTAB	Ground Stabilized
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GZ	Guard Zone
H UP	Head Up
HDG	Heading
HL	Heading Line
HR	Hours
I/O	Input/Output
IBS	Integrated Bridge System
ID	Identification
IN	Input
INIT	Initialization
INS	Integrated Navigation System
IR	Interference Rejection
IRCS	Integrated Radio Communication System
ISW	Interswitch

Km	Kilometer
KN	Knots
LBL	Label
LIM	Limit
LOST TGT	Lost Target
LP	Long Pulse
LWE	Lightweight Ethernet
m	Meters
MIN	Minimum
MIN	Minutes
MKR	Marker
MOB	Man Over Board
MP	Medium Pulse
MSTR	Master
N UP	North Up
NAV	Navigation
NC	Normally Closed
NF	Network Function
NLT	Not Less Than
NM	Nautical Mile
NMT	Not More Than
NR	Noise Rejection
NUC	Not Under Command
OFF CENT	Off Centre
OFFTRK	Off Track
ONF	Other Network Function
OS	Own Ship
OSD	Own Ship Data
OUT	Output
PAD	Predicted Area Of Danger
PAST POSN	Past Position
PCB	Printed Circuit Board
PI	Parallel Index Line
PL	Pulse Length
PM	Performance Monitor
POSN	Position
PPC	Predicted Point Of Collision
PPI	Plan Position Indicator
PRF	Pulse Repetition Frequency
PWR	PWR
R BRG	Relative Bearing
R CRS	Relative Course
R VECT	Relative Vector
RAD	Radius
RAIN	Anti Clutter Rain

RCDS	Raster Chart Display System
REF	Echo Reference
REF SOG	Echo Reference Speed
REL or R	Relative
RM	Relative Motion
RM (R)	Relative Motion (Relative Trails)
RM (T)	Relative Motion (True Trails)
RNC	Raster Navigational Chart
RNG	Range
ROT	Rate Of Turn
RR	Range Rings
RSD	Radar System Data
RTE	Route
RX	Receiver
SAF CON	Safety Contour
SAR	Search And Rescue
SC/SC	Scan To Scan
SDME	Speed and Distance Measuring Equipment
SEA	Anti Clutter Sea
SEL	Select
SENC	System Electronic Navigational Chart
SFI	System Function Identifier
SNGF	Serial to Network Gateway Function
SNR	Signal To Noise Ratio
SOG	Speed Over Ground
SP	Short Pulse
SPD	Speed
SRNC	System Raster Navigational
SRT	Small Radar Transceiver
STAB	Stabilized
STBD	Starboard
STC	Sensitivity Time Control
STW	Speed Through Water
T BRG	True Bearing
T CRS	True Course
T SPD	True Speed
T VECT	True Vector
TB	Target Boost
TCPA	Time To Closest Point Of Approach
TE	Target Expand
TGT	Target
Tgt exp	Target expansion
Th	Target threshold
TM	True Motion
TPR	Transponder

TRIAL	Trial Maneuver
TRIG	Trigger Pulse
TRK	Track
TRKG	Tracking
Tracking	Time To Go
TS	Target separation
TT	Tracking Target
TWOL	Time To Wheel Over Line
TX	Transmit, Transmitter
TX/RX	Transceiver
UDP	User Data Protocol
UPS	Uninterruptible Power Supply
VRM	Variable Range Marker
VTS	Vessel Traffic Services
WOL	Wheel Over Line
WOP	Wheel Over Point

20 Technical specifications

The most up-to-date specifications list is available at:

- www.navico-commercial.com

→ ***Note:*** Hardware specifications for the individual units included in the system are found in the documentation following the units.

General

Description	Type-approved X-Band, S-Band, and HALO 5000 radar systems aboard CAT 1, CAT 2 and CAT 3 SOLAS vessels, including high-speed craft
Standards	• IMO-Resolution A.278 (VIII), A.694 (17), A.823 (19), MSC 191 (79), MSC 192 (79) • EN 62388 Ed.2.0, 2014 • EN 62288 Ed.3, 2021 • EN 60945 Ed.4.0, 2002 incl. Corr.1, 2008 • EN 61162-1 Ed.4.0, 2010 • EN 61162-2 Ed.1.0, 1999 • IEC61162-450 Ed. 2, 2018 • IEC 62923-1, 2018 • IEC 62923-2, 2018
Type approval	European Council Directive 2014/90/EU on Marine Equipment modified by Commission Implementing Regulation (EU) 2023/1667 (8 August 2023) - Wheelmark

Performance

RPM		>20 and >40
Nominal peak power		
SRT LAN X-band up-mast		12 kW or 25 kW depending on transceiver
SRT LAN X-band down-mast		25 kW
SRT LAN S-band		30 kW
HALO 5000 radar systems		130 W
Operating frequency		
SRT LAN X-band		9410 ± 30 MHz
SRT LAN S-band		3050 ± 30 MHz
HALO 5000 X-band radar systems		Synthesized 9.380 - 9.430 GHz
		Synthesized 9.360 - 9.480 GHz
Pulse length		
SRT LAN X- and S-band radar systems	Short pulse	60 ns (25 kW, 30 kW), 80 ns (12 kW)
	Medium pulse	250 ns
	Long pulse	800 ns
HALO 5000 X-band radar systems		0.04 µsec
PRF		

SRT LAN X- and S-band radar systems	Short pulse	3000 Hz
	Medium pulse	1500 Hz
	Long pulse	750 Hz
HALO 5000 X-band radar systems	• Chirp length: 2÷64 µsec • Chirp bandwidth: 2÷48 MHz • Up to 1 pulse and 2 chirps in a burst with burst repetition rate of 500-3000Hz. Range and mode dependent • Effective pulse compression ratio less than 150 in all modes	
Modulator		
SRT LAN X- and S-band radar systems		MOSFET Solid State
IF amplifier		
SRT LAN X- and S-band radar systems		Logarithmic
IF dynamic		
SRT LAN X- and S-band radar systems		95 dB
IF center frequency		
SRT LAN X- and S-band radar systems		60 MHz
HALO 5000 X-band radar systems		31.25 MHz
IF bandwidth		
SRT LAN X- and S-band radar systems	Short pulse	24 MHz
	Medium pulse	5 MHz
	Long pulse	2 MHz
HALO 5000 X-band radar systems		50 MHz max.* A/D; 16 bit 125 MSPS *Narrower bandwidths defined by signal processing
Horizontal beam width		
SRT LAN 6 ft X-band		1.3°
SRT LAN 9 ft X-band		0.9°
SRT LAN 12 ft S-band		1.9°
HALO 5004		1.8°
HALO 5006		1.2°
Vertical beam width		
SRT LAN X- and S-band radar systems		22°
HALO 5000 X-band radar systems		25°
VSWR		< 1.20
Overall noise figure		< 5 nominal dB
MDS		-105 dBm

Display features

Presentation mode	Day or Night
Typical viewing distance (m)	
16"	0.75
19", 24", 27"	1.00
Resolution (pixels)	
16", 19"	1366x768

24", 27"	1920x1080
PPI diameter (mm)	
16"	180
19"	210
24"	280
27"	320
Short range	
Available scales	1/8, 1/4, 1/2, 3/4, 1.5 and 3 NM
Range video resolution	11.25 m
Azimuth on-screen resolution	0.1°
Medium range	
Available scales	6 and 12 NM
Range video resolution	45 m
Azimuth on-screen resolution	0.1°
Long range	
Available scales	
SRT LAN X- and S-band radar systems	24, 36, 48, 64, 72 NM
HALO 5000 X-band radar systems	24, 36, 48 NM
Range video resolution	125 m
Azimuth on-screen resolution	0.1°
Relative motion (RM)	Head up (HU), Course up (CU) and North up (NU)
True motion (TM)	Course up (CU) and North up (NU)
Off-centering	Up to 75% of range scale in use
Cursor	Polar and Geographical coordinates, continuously displayed when cursor is activated

Target tracking

Target tracking minimum processing capacity	Automatic, 2500
Target tracking minimum display capacity	Manual and automatic, 100
Tracking range	24 NM

AIS capacity

AIS reported processing capacity	300
AIS reported display capacity	300
AIS data reports processing capacity	100
AIS data reports display capacity	100
AIS locating device processing capacity	40
AIS locating device display capacity	40

Mapping

Map drawing	Operator compiled maps • Up to 32 maps, each may contain up to 120 segments and 32 symbols • Selectable colors and line styles
Map stabilization	• Relative • Geographic
Map storage	• By name • Built-In non-volatile memory used • SD® Card transfer available
Map adjustments	• Rotate • Shift
Parallel index	Four independent parallel index lines
Data readout	• Own ship data • Target tracking data • AIS target data

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