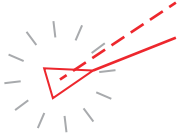
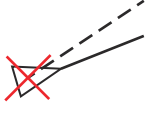


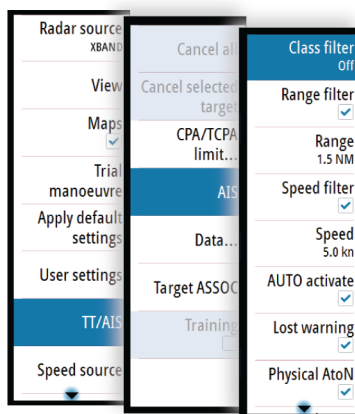
Symbol	Description
	Dangerous AIS target indicated with bold line and with red color. The symbol flashes until the target alarm is acknowledged by the operator
	Lost AIS target , indicated with crossed lines centered on the target symbol. The symbol is located at the last received position from the target
	Associated target - using AIS data
	AIS SART (AIS Search And Rescue Transmitter)
	AIS Base station
	Real AtoN (Aids To Navigation)
	Virtual AtoN

For a complete list of AIS and AtoN symbols, refer to "*Target symbols*" on page 70.

→ **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.



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

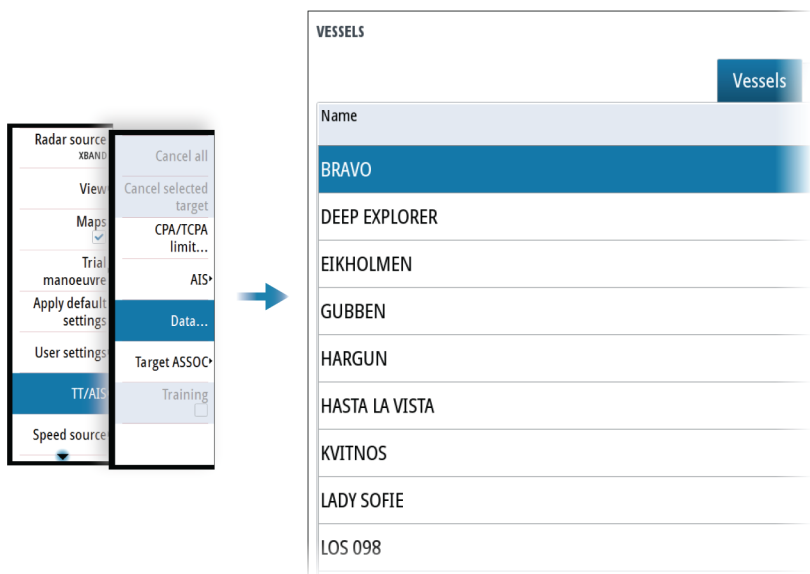
The vessels dialog displays a list of all AIS and MARPA targets.

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.

The vessels dialog also lists received AIS messages.

To display the vessels dialog:

- select the data option in the menu
- press and hold the AIS key

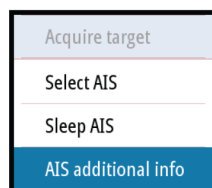


AIS vessel details

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



AIS VESSEL DETAILS	
LOS 098 (MMSI: 257380500)	
Callsign: LJGH	Status: Safe
IMO:	NavStatus: Under engine
AIS Class: A	Draught (m): 1.5
Type: Pilot	Latitude: N 58°26.690'
Length (m):	Longitude: E 5°59.400'
Beam (m):	Accuracy: Low
	ROT (°/s):
	STW (kn): 0.50
	CTW (°T): 61
	Heading (°T):
	Destination: REKEFJORD
	ETA: 08/03/2018 18:10
Bearing (°T): 150	
Distance (NM): 0.77	
CPA (NM): 0.77	
TCPA (hrs): PAST	
Relative speed (kn): 0.00	
Relative course (°T): 0	

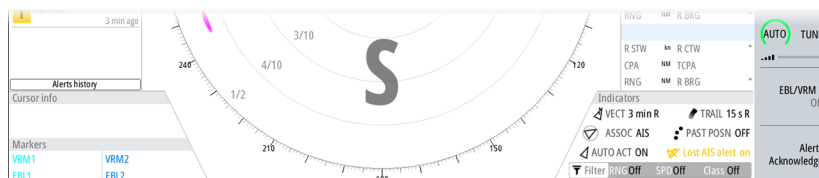
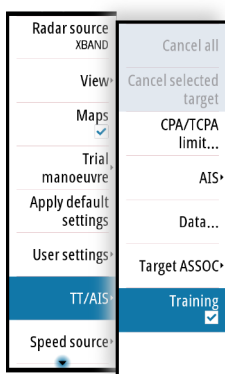
Training simulator

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:

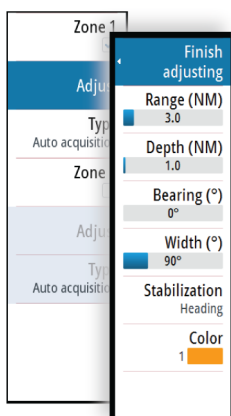
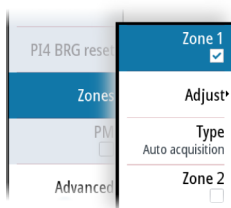
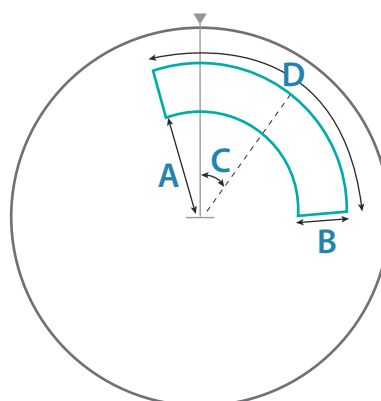
- radar targets are acquired and AIS targets activated
- warning about new target is activated
- the target icon turns red and flashing

When the warning is acknowledged, the target change 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

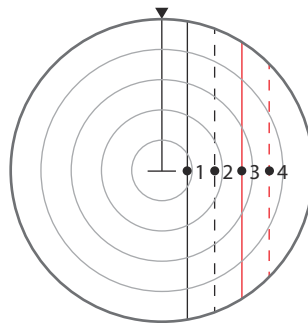
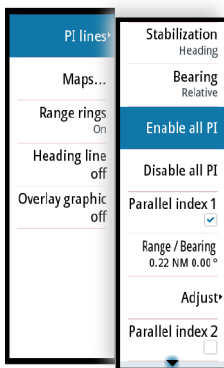
Parallel Index (PI) lines are used to visualize the distance to own vessel, other vessels or to land objects. Two index lines can be used to indicate a corridor - typically used to visualize an area you want to maneuver within.

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

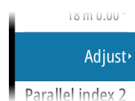
You can define four PI lines in the system, and they are identified with different color and style:

- 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

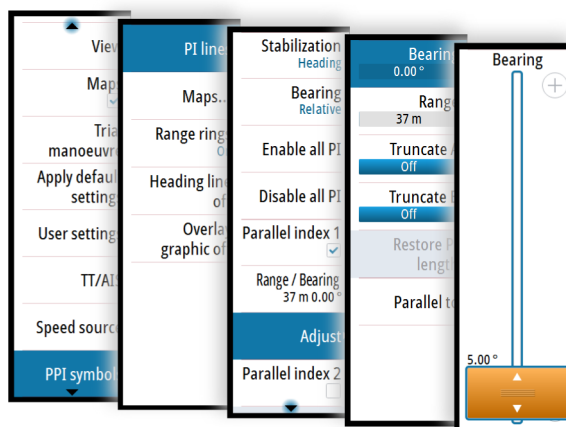
Each PI line's range and bearing are shown in PI lines submenu.

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

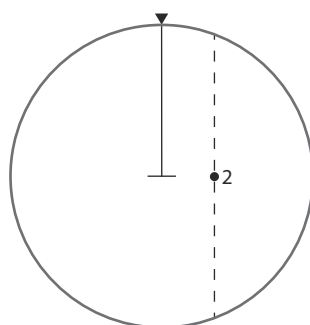
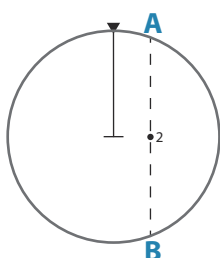
→ **Note:** Max range for a bearing line is 12 NM.



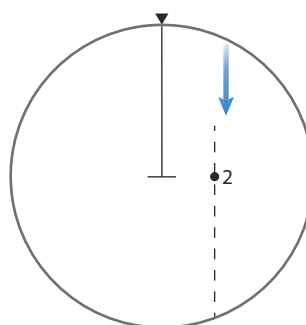
Truncating a PI line

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.

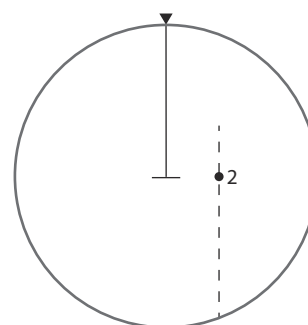
1. Select the truncate A or B option in the menu.
- The slider bar is displayed
2. Turn the rotary knob to extend or reduce the line
3. Press the exit key to confirm the selection



Function activated

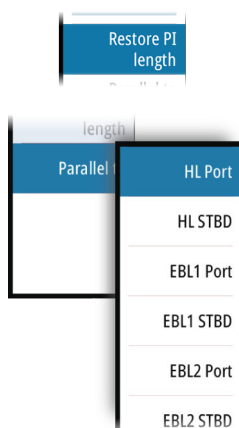


End point adjusted



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.

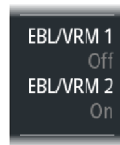
Two different EBL/VRMs can be placed on the radar image. They are identified as dashed rings/lines with different colors to discriminate them from each other and from the fixed range rings:

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

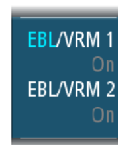
The EBL presentation can be defined with true or relative presentation:

- 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)

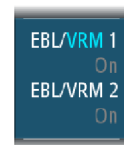
The marker's line width indicates whether the marker is in edit mode (bold lines) or at a fixed position (thin lines).



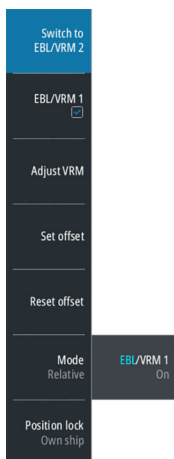
*EBL/VRM1 OFF,
function not active*



*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

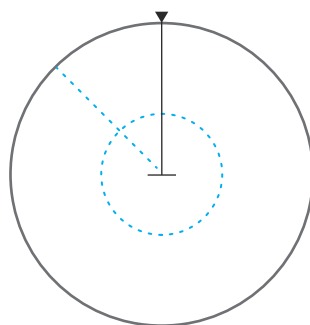
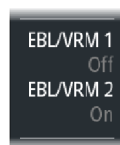
Turning the EBL/VRM marker on and off

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

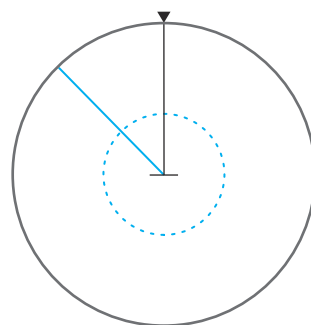
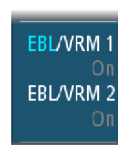
- Turn ON EBL/VRM 1 by pressing the EBL/VRM key once
- Switch between EBL/VRM 1 and EBL/VRM 2 from the function's pop-up
- Turn OFF an EBL/VRM from the function's pop-up

Adjusting the EBL/VRM marker

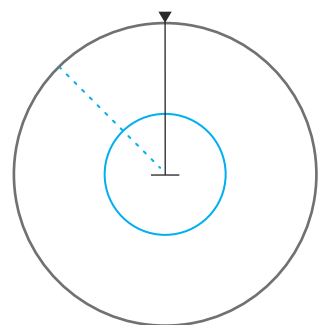
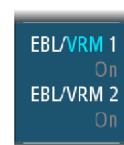
The text in the EBL/VRM short-cut button and the EBL/VRM marker's line width indicate which item that is in edit mode.



*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.

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 31.

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

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

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.

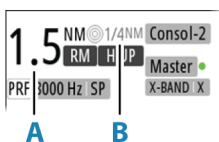
This measuring option gives a fast and precise measurement of distance to a target.

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)	1
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

Range (NM)	Range rings interval (NM)	Number of range rings
24	4	5
36	6	5
48	8	5
64	16	3
72	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.

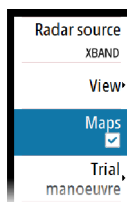
10

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.

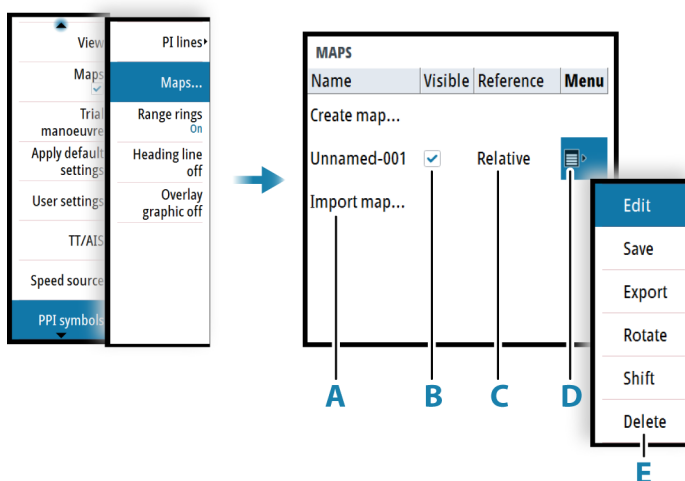
For maximum number of maps, symbols and segments, refer to "*Technical specifications*" on page 78.

→ **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.

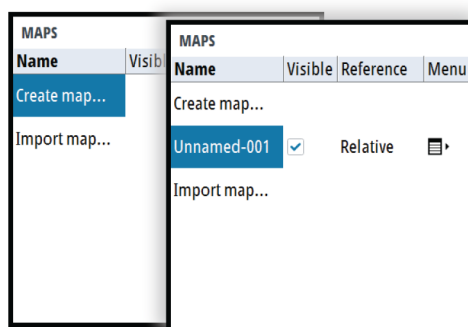
Map colors and symbols

Lines and map symbols can be presented in various colors.

The following map symbols are available:

Sym bol	Description	Sym bol	Description	Sym bol	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.

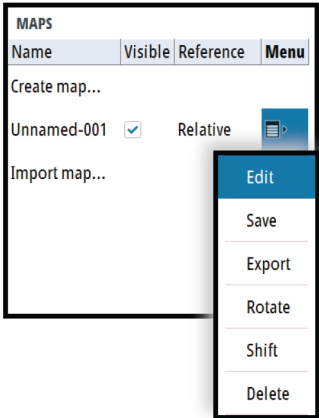
- Select the map name to display the keyboard if you want to give the map a unique name
- Set the map reference
- Select the menu option to enter map details. See *"Modifying a map"* on page 52.

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:

Add line	
Style	Solid
Color	White
Add symbol	
Symbol	Buoy North
Color	White

No map details at cursor position

Insert point	
Style	Solid
Color	White
Delete	

Map line at cursor position

Move	
Style	Solid
Color	White
Delete	

Vertex at cursor position

Move	
Symbol	Buoy North
Color	White
Delete	

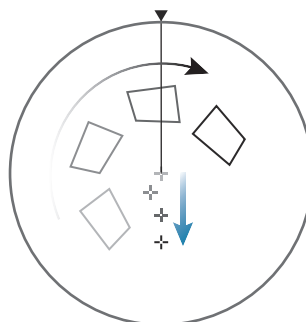
Symbol at cursor position

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.

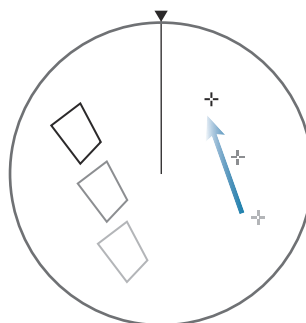
- Use the arrow keys to move the cursor and to rotate the map around the vessel's position
- Press the exit key to leave edit mode



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



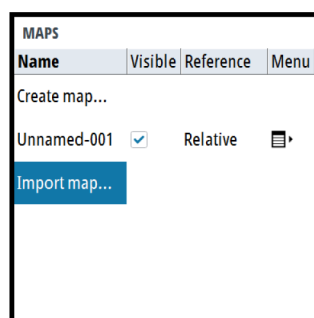
Exporting maps

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

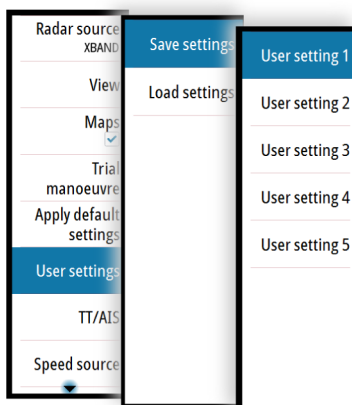
Compatible maps created on other units can be imported to the system. Imported maps are added to the units' non-volatile memory, and the maps are added to the list of loaded maps.



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 23.

Customizing radar control settings table

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

Function	Default setting
Band	<i>X-band</i>
Gain, Rain and Sea	Automatic
Tuning	Automatic
Range	6 NM
Fixed range rings	Off
VRMs	One VRM on at 0.25 NM
EBLs	<i>Off or last settings</i>
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

Rejecting radar interference

The IR (Interference rejection) 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 does cause some loss of target discrimination.

Target boost

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

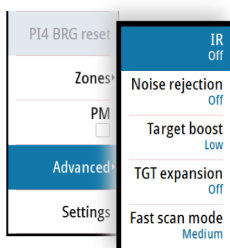
TGT expansion

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 option is not available for 12 feet X-band antennas and for HSC radar sensors.



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 30, and to *"Selecting speed source"* on page 20.

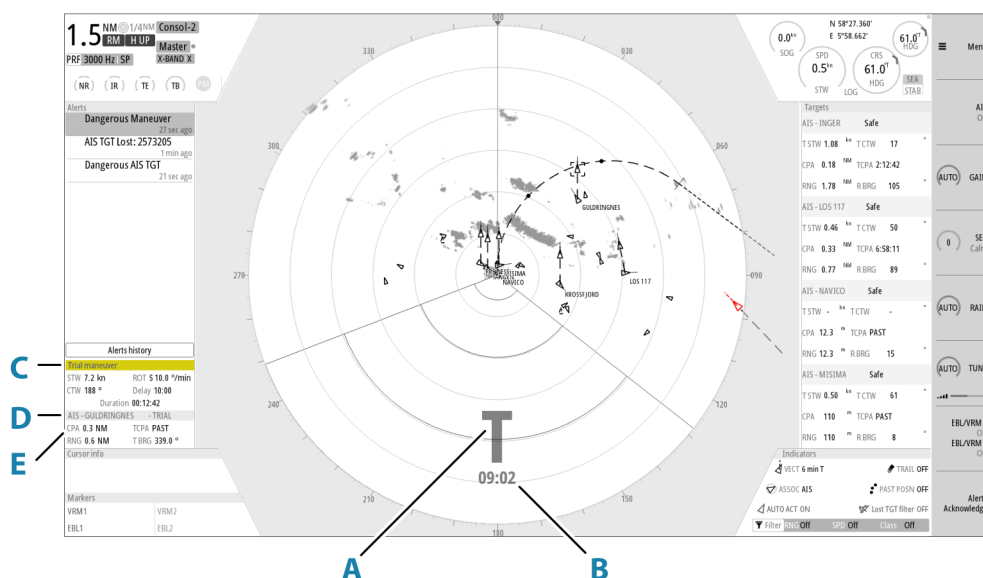
Trial maneuver symbology

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

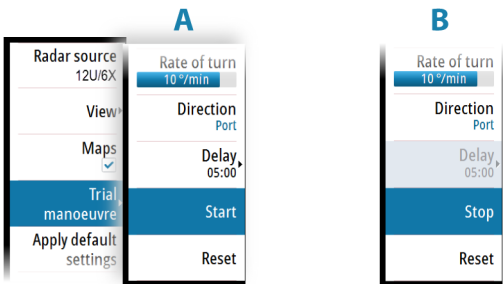
The following indications are used to indicate that a target's position is a dangerous at the end of the trial maneuver:

- 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 from the menu when the final speed or final course is defined.

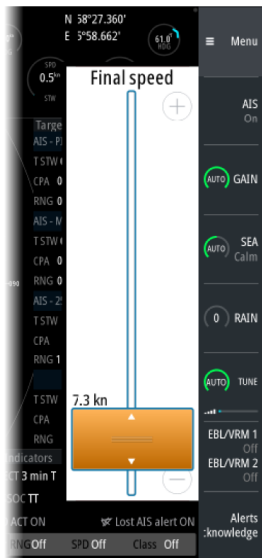
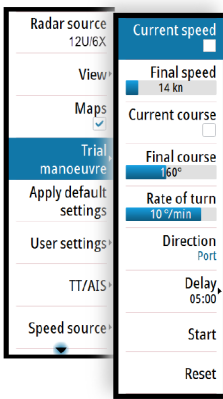
You can at any time stop the trial maneuver. The function will automatically stop when the delay time has expired.



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 installation manual(s).

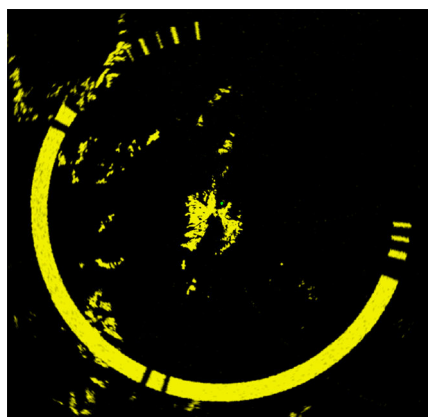
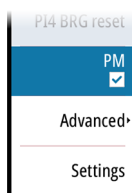
Performance monitor

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.

Radar data

The Radar data dialog displays status for vital radar components.

SETTINGS

 Access control

 System

 Radar

Installation...

Radar video palette

Target trails palette

Radar data...

RADAR DATA

System BITE

System Timers

Modulator, Receiver and Power supply BITE

+50 VDC main line voltage	49.72 VDC
+50 VDC main line voltage status	OK
Inner transceiver temperature	14 °C
Inner transceiver temperature status	OK
Communication link status	OK
CRC error reception status	OK
Interlock test status	OK
Safety controls status	OK
Antenna speed	0 RPM
Motor current status	OK

The system displays an alert when the magnetron has to be replaced.
For replacement procedures refer to the separate Commissioning manual.

15

The alert system

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

Type of alerts

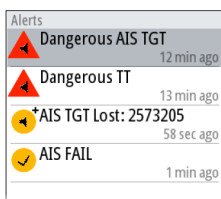
There are 3 alert types in the system:

- **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.
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.



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 are 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.

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

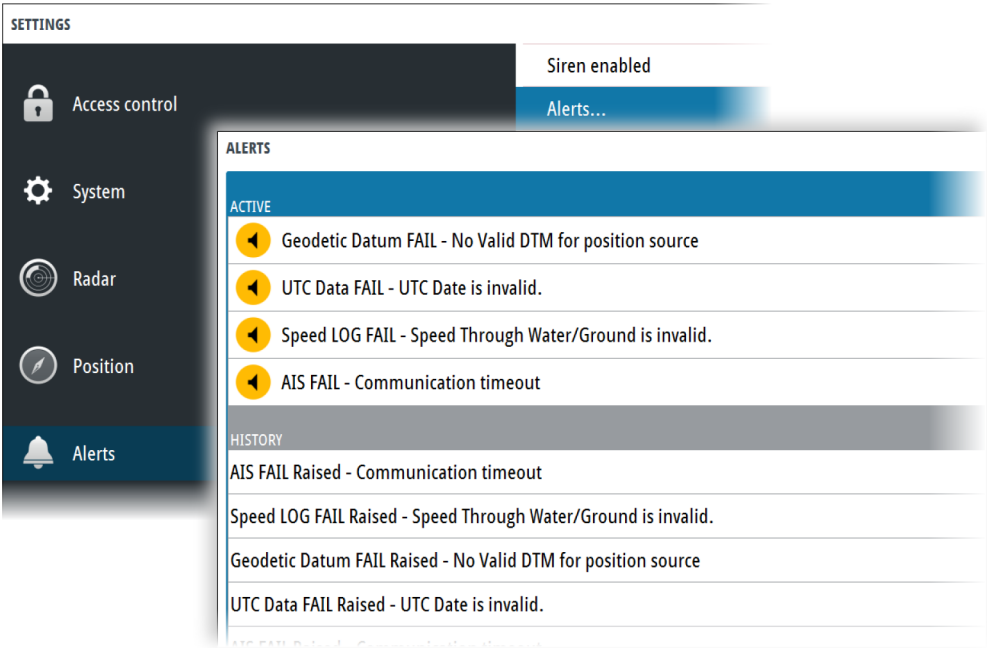
Alert type	Icon	State	Indication
Alarm		Active - not acknowledged, not silenced	- Flashing symbol and descriptive text - Audible signal
		Active - acknowledged	- Steady symbol and descriptive text - No audible signal
		Rectified - not acknowledged	- Flashing symbol and descriptive text - No audible signal
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 - e.g. Danger target alarm - can only be acknowledged from the system itself. Global alarms - e.g. Position timeout or Gyro failure - 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	Category
AIS Capacity 95%	AIS target processing/displaying is about to be exceeded.	C	B
AIS Capacity Full	AIS capacity exceeded.	W	A
AIS FAIL	AIS failure	W	B
	Not used AIS failure	C	B
AIS TGT in GZ	AIS Target in Guard zone	W	A
AIS TGT Lost: #	AIS target # is lost	W	A
BAM HBT Lost	BAM Heartbeat lost	C	B
Dangerous AIS TGT	CPA or TCPA values of an activated AIS target less than set limits	A	A
Dangerous TT	CPA or TCPA values of a tracked target less than set limits	A	A
Door switch open	The radar enclosure is open due to maintenance. The radar is not operational	A	A
EPFS FAIL	Not used position source failure	C	B
	Position source failure	W	B
Geodetic Datum FAIL	Geodetic Datum failure	W	B
GYRO FAIL	Gyro failure	W	B
	Not used gyro failure	C	B
Heading Line FAIL	Heading line failure	W	B
Magnetron EOL	Magnetron end of life reached	C	B
POSN Invalid	Position invalid	W	B
POSN Unavailable	Position unavailable	W	B
Radar Antenna FAIL	Radar antenna failure	W	B
RADAR FAIL	Radar TXRX failure	W	B
REF TGT Lost	Reference target lost	W	A
Safety switch open	The safety switch is open due to maintenance. The radar is not operational	A	A
SOG FAIL	Speed Over Ground failure	W	B
Speed LOG FAIL	Not used speed LOG failure	C	B
	Speed LOG failure	W	B
SPD Long. Axis FAIL	Speed longitudinal axis data failure	W	B
SPD Tran. Axis FAIL	Speed transversal axis data failure	W	B
STW FAIL	Speed Through Water failure	W	B
Test alarm	The Test alarm is enabled to verify audible alarm operation	A	A
TGT in GZ	Tracked target # within the vessel's guard zone	W	A

Alert text	Description	Type	Category
Train TGT CPA FAIL	Training target CPA out of range	W	A
Train TGT TCPA FAIL	Training target TCPA out of range	W	A
Trigger FAIL	Trigger failure	W	B
TT Capacity 95%	Tracked target processing/displaying is about to be exceeded	C	B
TT Capacity Full	Tracked target capacity exceeded	W	A
TT Lost: #	Tracked target # is lost	W	A
UTC Data FAIL	UTC data failure	W	B
Radar Video FAIL	Radar video failure	W	B

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 >
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
	Drift/Set
	Drift

Level 1	Level 2
	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 >	IR
	Noise rejection
	Target boost
	TGT expansion
	Fast scan mode
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 ...
	About
Radar	Installation
	Radar video palette
	Target trails palette

Level 1	Level 2
	Radar data
	Expanded PPI
Position	Satellites
	Ignore position quality
Alerts	Siren enabled
	Alerts ...
	Test alarm
Units	Distance small
	Own vessel rate of turn
Network	Info
	Control display units ...
	Sources ...
	Priorities table ...
	Device list
	Diagnostics
	NMEA 0183 >
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 with the O5000 Trackball unit.

The table gives an overview of key operation for both units.

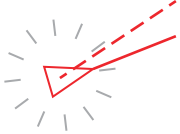
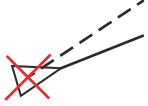
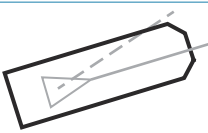
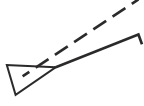
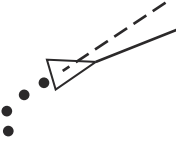
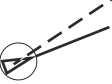
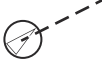
→ **Note:** The cursor must be located over an open menu or over the quick access pop-up to be able to use the scroll function.

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

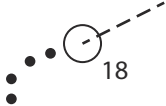
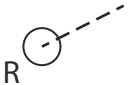
18

Target symbols

This section lists the target symbols used in this system.

Symbol	Description
	AIS Base station
	AIS SAR aircraft
	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 (dotted line) around the target symbol
	AIS target - Sleeping , aligned with received heading information or with COG information if heading is not available
	AIS target, activated - True scaled outlines
	AIS target with heading line and SOG/COG (dotted line), and with indicated turn direction
	AIS target with heading line, SOG/COG (dotted line) and past track
	Associated target - using AIS data
	Associated target - using radar data
	Physical AIS AtoN , basic shape (AIS aids to navigation)
	Physical AIS AtoN - East cardinal mark
	Physical AIS AtoN - Emergency wreck mark

Symbol	Description
	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
	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

Symbol	Description
	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
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
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
ENC SOG	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
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
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
OS	Own Ship
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
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
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
TWOL	Time To Wheel Over Line
TX	Transmit, Transmitter
TX/RX	Transceiver
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- and S-Band 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.2.0, 2014 • EN 60945 Ed.4.0, 2002 incl. Corr.1, 2008 • EN 61162-1 Ed.4.0, 2010 • EN 61162-2 Ed.1.0, 1999
Type approval	European Council Directive 2014/90/EU on Marine Equipment modified by Commission Implementing Regulation (EU) 2018/773 (May 2018) - Wheelmark

Performance

RPM	>20 and >40
Nominal peak power	
X-band up-mast	12 kW or 25 kW depending on transceiver
X-band down-mast	25 kW
S-band	30 kW
Operating frequency	
X-band	9410 ± 30 MHz
S-band	3050 ± 30 MHz
Pulse length	
Short pulse	60 ns (25 kW, 30 kW), 80 ns (12 kW)
Medium pulse	250 ns
Long pulse	800 ns
PRF	
Short pulse	3000 Hz
Medium pulse	1500 Hz
Long pulse	750 Hz
Modulator	MOSFET Solid State
IF amplifier	Logarithmic
IF dynamic	95 dB
IF center frequency	60 MHz
IF bandwidth	
Short pulse	24 MHz

Medium pulse	5 MHz
Long pulse	2 MHz
Horizontal Beam width	1.35°
Vertical Beam width	22°
VSWR	< 1.20
Overall noise figure	< 5 nominal dB
MDS on long pulse	-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	24, 36, 48, 64, 72 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

Acquisition	Manual and automatic, up to 100 targets
Tracking	Manual and automatic, up to 100 targets

Tracking range	24 NM
-----------------------	-------

AIS

Presentation	• Maximum 300 target (all can be activated) • AIS overflow mechanism of priority
Safe checking	300 targets in total

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

