

# **FURUNO**

## **OPERATOR'S MANUAL**

*RIVER RADAR*

	<b>FR-1908V-BB</b>
<b>Model</b>	<b>FR-1918V-BB</b>

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(Elemental Chlorine Free)

The paper used in this manual  
is elemental chlorine free.

## FURUNO ELECTRIC CO., LTD.

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• FURUNO Authorized Distributor/Dealer

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# IMPORTANT NOTICES

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## General

- This manual has been authored with simplified grammar, to meet the needs of international users.
- The operator of this equipment must read and follow the descriptions in this manual. Wrong operation or maintenance can cancel the warranty or cause injury.
- Do not copy any part of this manual without written permission from FURUNO.
- If this manual is lost or worn, contact your dealer about replacement.
- The contents of this manual and equipment specifications can change without notice.
- The example screens (or illustrations) shown in this manual can be different from the screens you see on your display. The screens you see depend on your system configuration and equipment settings.
- Save this manual for future reference.
- Any modification of the equipment (including software) by persons not authorized by FURUNO will cancel the warranty.
- All brand and product names are trademarks, registered trademarks or service marks of their respective holders.
- SD, SDHC Logos are trademarks of SD-3C, LLC.

## How to discard this product

Discard this product according to local regulations for the disposal of industrial waste. For disposal in the USA, see the homepage of the Electronics Industries Alliance (<http://www.eiae.org/>) for the correct method of disposal.

## How to discard a used battery

To see if your product has a battery, see the chapter on Maintenance. If a battery is used, tape the + and - terminals of the battery before disposal to prevent fire, heat generation caused by short circuit.

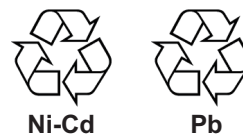
### In the European Union

The crossed-out trash can symbol indicates that all types of batteries must not be discarded in standard trash, or at a trash site. Take the used batteries to a battery collection site according to your national legislation and the Batteries Directive 2006/66/EU.



### In the USA

The Mobius loop symbol (three chasing arrows) indicates that Ni-Cd and lead-acid rechargeable batteries must be recycled. Take the used batteries to a battery collection site according to local laws.



### In the other countries

There are no international standards for the battery recycle symbol. The number of symbols can increase when the other countries make their own recycle symbols in the future.



# SAFETY INSTRUCTIONS

The operator must read the safety instructions before attempting to operate the equipment.



## WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



## CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.



Warning, Caution



Prohibitive Action



Mandatory Action



## WARNING



### Do not open the equipment.

The equipment uses high voltage that can cause electrical shock. Refer any repair work to a qualified technician.



### Before turning on the radar, be sure no one is near the antenna.

Prevent the potential risk of being struck by the rotating antenna, which can result in serious injury or death.



### If water leaks into the equipment or something is dropped into the equipment, immediately turn off the power at the switchboard.

Fire or electrical shock can result.



### If the equipment is giving off smoke or fire, immediately turn off the power at the switchboard.

Fire or electrical shock can result.



### If you feel the equipment is acting abnormally or giving off strange noises, immediately turn off the power at the switchboard and contact a service technician.



## WARNING



### Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can result.



### Make sure no rain or water splash leaks into the equipment.

Fire or electrical shock can result if water leaks into the equipment.



### Do not place liquid-filled containers on or near the equipment.

Fire or electrical shock can result if a liquid spills into the equipment.



## **WARNING**



**Do not operate the equipment with wet hands.**

Electrical shock can result.



**Keep objects away from the antenna unit, so as not to impede rotation of the antenna.**

Fire, electrical shock or serious injury can result.



**Use the proper fuse.**

Use of the wrong fuse can cause fire or electrical shock.



**Do not depend on one navigation device for the navigation of the ship. The navigator must check all aids available to confirm position.**

- The TT (Target Tracking) automatically tracks an automatically or manually acquired radar target and calculates its course and speed, indicating them with a vector. Since the data generated by the TT depends on the selected radar targets, the radar must be optimally tuned for use with the TT, to ensure required targets will not be lost or unnecessary targets like sea returns and noise will not be acquired and tracked.
- A target is not always a landmass, reef, ship, but can also be returns from the sea surface and from clutter. As the level of clutter changes with the environment, the operator must correctly adjust the sea and rain clutter controls and the gain control so that the target echoes do not disappear from the radar screen.

## **CAUTION**

**The TT tracks and plots the movement of up to 100 radar targets and fully complies with IMO standards for TT.**

**Tracking accuracy is affected by the following:**

- Tracking accuracy is affected by course change. One to two minutes is required to restore vectors to full accuracy after an abrupt course change. (The actual amount depends on gyrocompass specifications.)
- The amount of tracking delay is inversely proportional to the relative speed of the target. Delay is approx. 15-30 seconds for the higher relative speed; approx. 30-60 seconds for the lower relative speed. The following factors can affect accuracy:
  - Echo intensity
  - Radar transmission pulse width
  - Radar bearing error
  - Gyrocompass error
  - Course change (own ship and target)

**The data generated by TT and AIS are intended for reference only.**

Refer to official nautical charts for detailed and up-to-date information.

## **CAUTION**

**The data from AIS are intended for reference purposes only.**

Check all available navigation aids to determine target movement.

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# FOREWORD

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## A Word to the Owner of the FR-1908V-BB/FR-1918V-BB Radar

Congratulations on your choice of the FR-1908V-BB/FR-1918V-BB Radar.

Please carefully read the safety information and operating instructions set forth in this manual before attempting to operate the equipment and conduct any maintenance. Your radar set will perform to the utmost of its ability only if it is operated and maintained in accordance with the correct procedures.

## Features

The FR-1908V-BB/FR-1918V-BB consists of an antenna unit, processor unit, and control unit and is designed to meet the requirements of navigation radar used on inland waterways. Radar targets are displayed on a vertically oriented SXGA display, in a single color or gradations of green or cyan according to echo strength. A 17 to 19 inch display with SXGA (or equivalent) resolution is recommended. Larger displays may result in dim images. Further, if the aspect ratio of the display is different from SXGA, images may be distorted. Also, displays larger than 19 inches and having the same aspect ratio as SXGA may have a “blank” display area at the top and bottom of the screen.

Following are the main features.

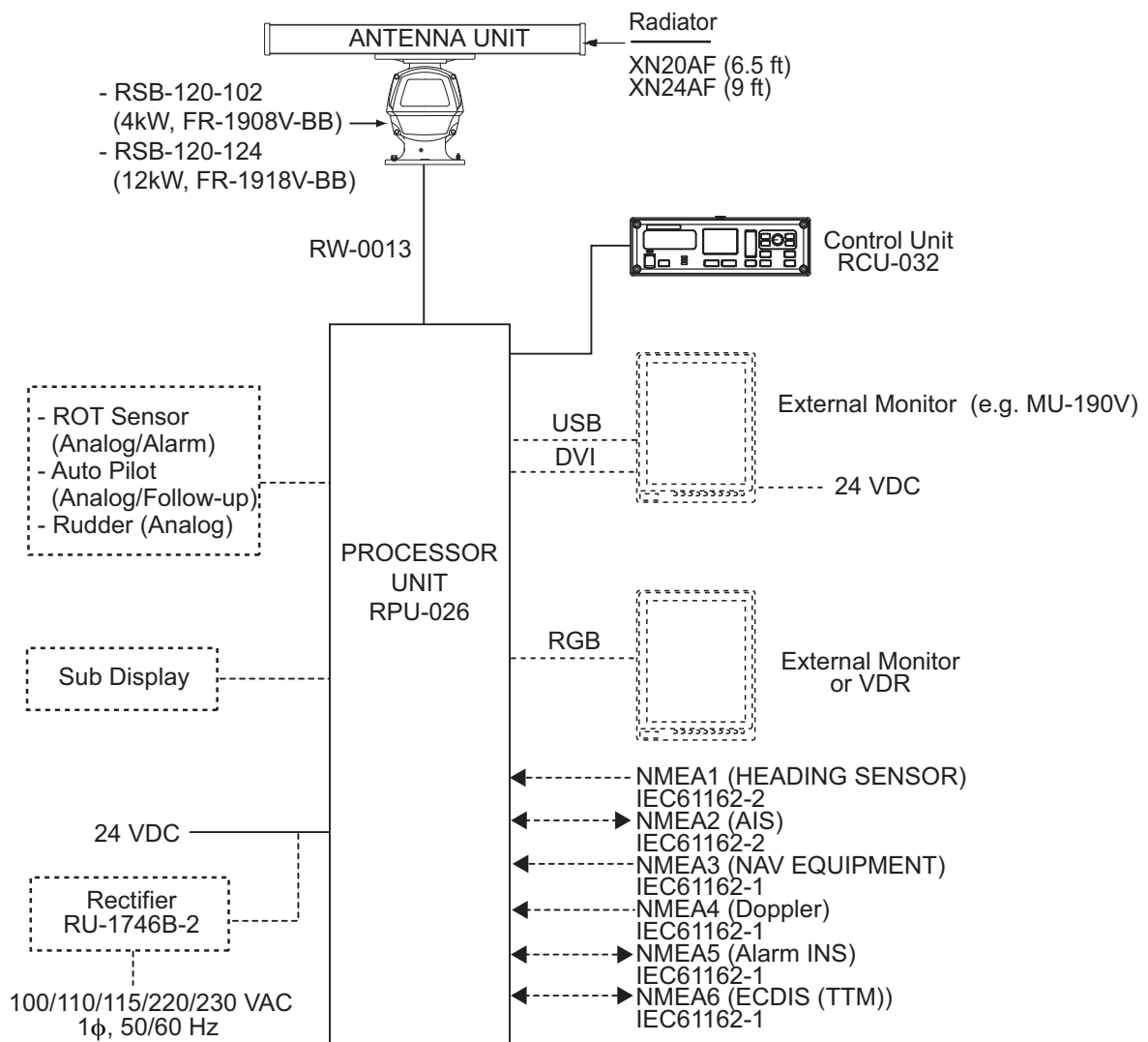
- Displays inland AIS targets
- Easy switching between River and Sea modes
- Automatic capture of the radar display
- Alarm history with Alarm log
- Graph displays: ROT, Rudder and AutoPilot
- TT (Track target) function to watch other ships' movement
- Large capacity memory - Mark/Line: max. 5,000 points, TT: 100 targets, AIS: 300 targets

## Program No.

0359451-01.\*\*

\*\* denotes minor modifications.

# SYSTEM CONFIGURATION



## Category of Units

Antenna Unit: Exposed to the weather

All other units: Protected from the weather

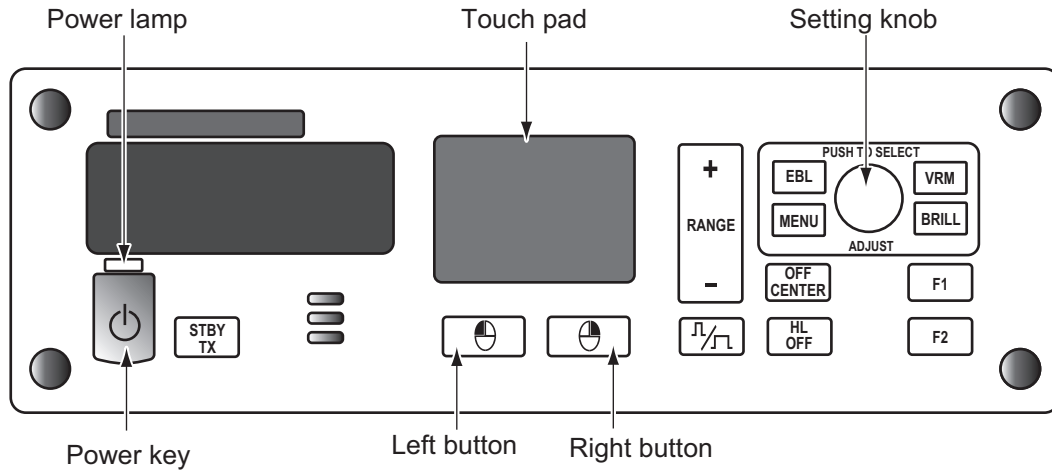
## SYSTEM CONFIGURATION

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# 1. OPERATION

## 1.1 Controls



Control	Function
Power key	Turn On/Off power. Power lamp lights when the power is turned on.
STBY/TX	Switch between stand-by and transmission.
Touch pad	Move the selection or the cursor.
	Left-click
	Right-click
RANGE	Select display range.
	Select the pulse width.
EBL	Display/Hide EBL (Electronic bearing line).
VRM	Display/Hide VRM (Variable range marker).
MENU	Display/Hide Menu window.
BRILL	Move the cursor on the [BRL] (brill) icon.
OFF CENTER	Off-center own ship position.
HL OFF	Hide the heading line temporarily.
F1, F2	Execute menu short cut assigned.
Setting knob	Operate EBL, VRM, Brilliance. Select the menu item.

## 1.2 How to Turn the Radar On/Off

1. Open the cover at the bottom left section on the control unit. Press the **Power** key to turn the radar on.
2. Press the **Power** key on the control unit to turn off the power.

## 1.3 How to Transmit

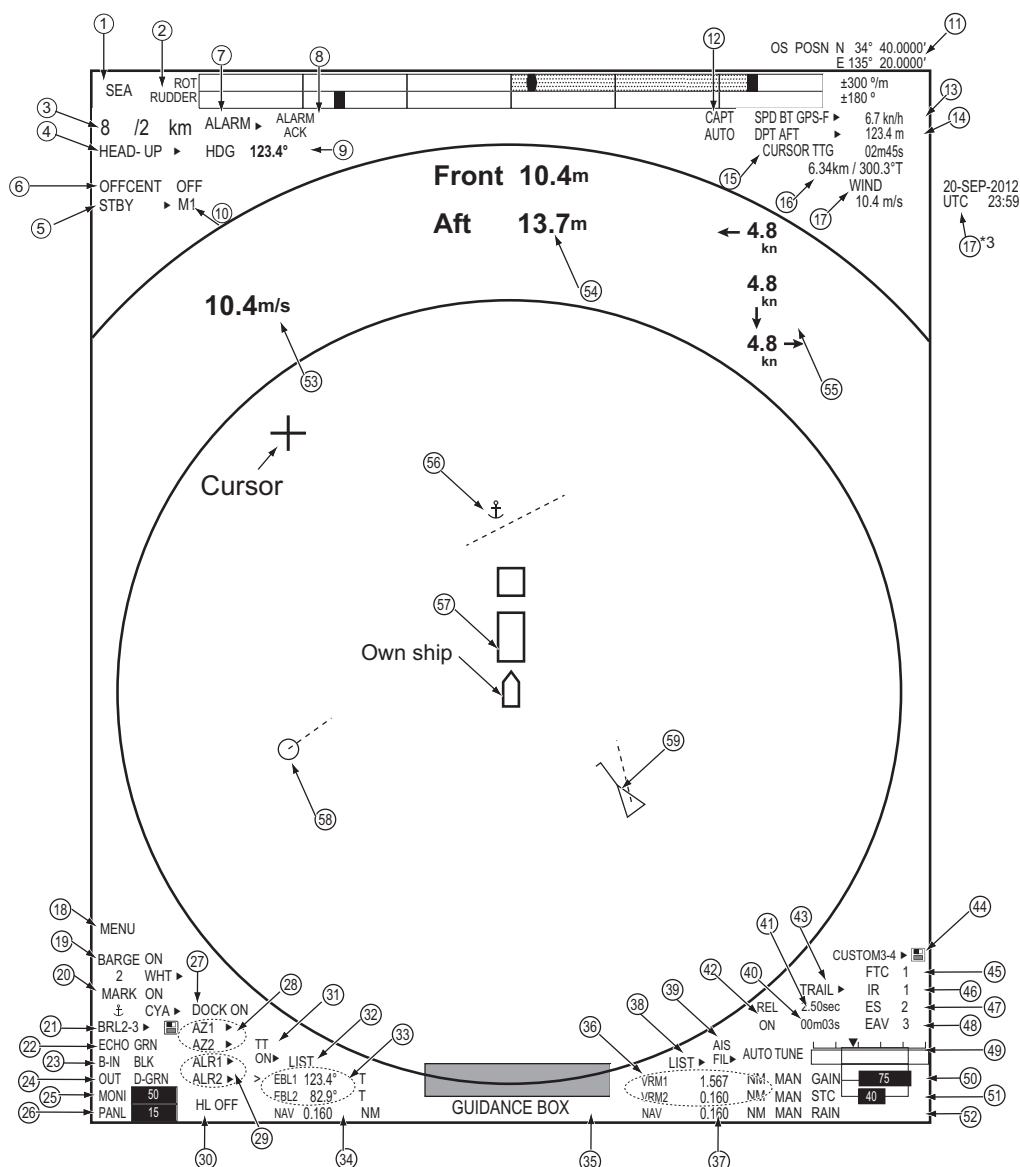
To transmit, press the **STBY/TX** key while [STBY] is displayed. Radar echoes are displayed on the screen with the previously used settings of range.

Each press of the **STBY/TX** key switches between stand-by and transmit (You can also switch between stand-by and transmission by clicking the [STBY/TX] indication.). The antenna is stopped in stand-by, and rotates in transmission.

The magnetron in the antenna unit generates the radar pulses and decays over time. To extend the life of the magnetron, keep the radar in stand-by when its use is not required.

## 1.4 Radar Display Indications

The illustration below shows all the icons and symbols (both in the [RIVER] and [SEA] modes) that may appear on the display. Some icons or symbols may not be shown depending on the display mode.



*Radar display example*

No.	Icon/Symbol	No.	Icon/Symbol
1	Operation mode	2	ROT/Rudder graph
3	Range/Range ring interval	4	Orientation mode
5	Standby/Transmit	6	Off-center
7	Generated alarm	8	Alarm acknowledge
9	Heading	10	Pulse width
11* <sup>3</sup>	Own ship position (Lat/Lon)	12	Capture
13	Ship speed	14	Depth
15	Time to go to cursor position	16	Cursor position
17	Wind speed or Date/Time* <sup>3</sup>	18	Menu
19* <sup>1</sup>	Barge Mark	20* <sup>1</sup>	Mark
21	Brilliance set	22	Echo color
23	Background color (effective display area)	24	Background color (outside effective display area)
25	Monitor brill	26	Panel dimmer
27	Docking mode	28* <sup>2</sup>	Acquisition zone 1, 2
29* <sup>2</sup>	Target alarm 1, 2	30	Heading line Off
31* <sup>2</sup>	Target tracking	32* <sup>2</sup>	TT (Target tracking) list
33	EBL 1, 2	34	Nav line (port)
35	Guidance box	36	VRM 1, 2
37	Nav line (starboard)	38	AIS list
39	AIS	40	Trail elapsed time
41	Trail time	42	Trail mode (Relative or True)
43	Trail	44	Custom setting name
45	FTC	46	Interference rejection
47	Echo stretch	48	Echo average
49	Tuning	50	Gain
51	STC	52	Rain
53	Wind speed	54	Dual depth
55	Ship's speed and movement at fore, midpoint and aft	56* <sup>1</sup>	Mark, Line
57* <sup>1</sup>	Barge	58* <sup>2</sup>	TT symbol
59	AIS symbol		

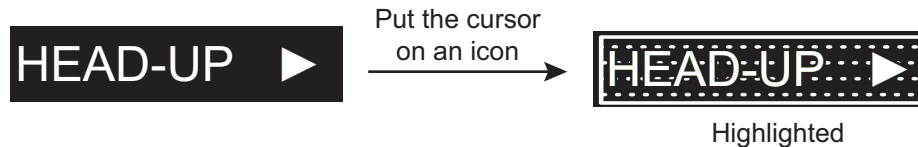
\*<sup>1</sup>: River mode only\*<sup>2</sup>: Sea mode only\*<sup>3</sup>: Off by default

## 1.5 Menu Operation

### 1.5.1 How to operate the radar from the icons

#### How to select the menu icon on the screen

Use the touch pad to select an icon. The icon is highlighted when correctly selected.

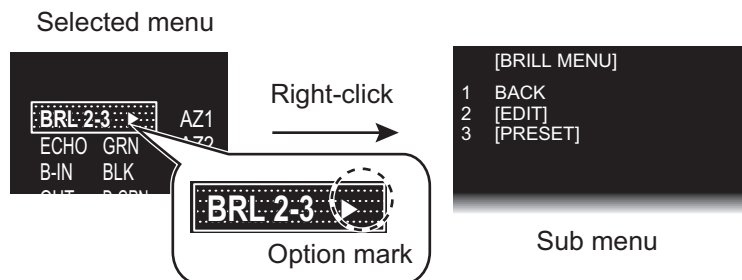


#### Operations available with the left button

- Open the main menu when the [MENU] icon is selected (see paragraph 1.5.2).
- Select options related to the selected icon cyclically.

#### Operations available with the right button

Opens the sub menu window for the menu icon with the option mark (triangle).

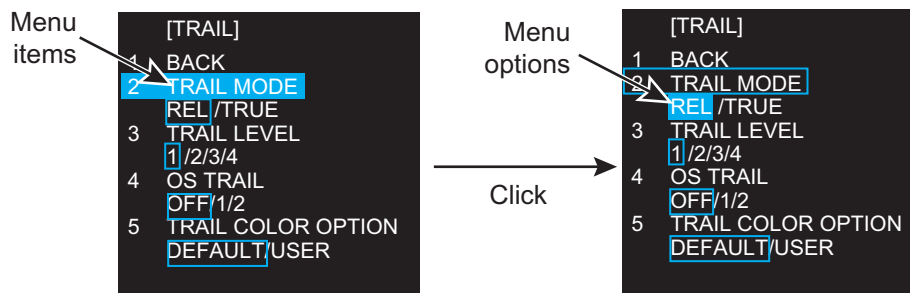


#### Operation available with the setting knob

- Rotation: Change the setting value on the setting box (clockwise to decrease the value, counterclockwise to increase the value).
- Press: Move the cursor on the setting box respectively among [GAIN], [STC] and [RAIN].

#### How to select the menu items on the menu window

1. Use the touch pad to select the menu item. The selected menu item is enclosed with a rectangle.
2. Use the touch pad to select an option. The selected option is enclosed with a rectangle.



Click outside the menu window to close the menu window.

### Mouse operation

A mouse can be connected to the processor unit to control radar functions. The table below compares operation with the control unit and mouse.

**Note:** Connect the USB mouse to the processor unit directly. Do not use a USB hub when connecting the USB mouse to the processor unit.

Control unit	Mouse
Cursor movement by touch pad	Cursor movement by mouse operation
Left button press	Left-click
Right button press	Right-click
Setting knob rotation	<ul style="list-style-type: none"> <li>Wheel rotation</li> <li>Cursor movement when selecting menus</li> </ul>
Setting knob press	Wheel press

## 1.5.2 Menu window

### Main menu

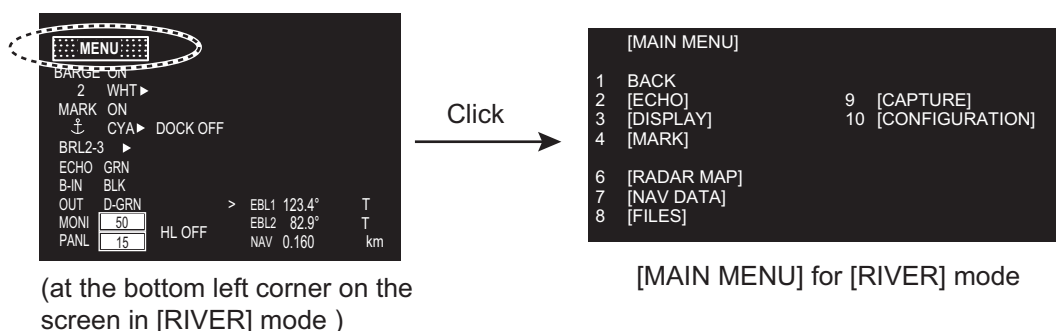
To open the main menu, put the cursor on the [MENU] icon, then left-click (or press the left button).

**Note:** Hereafter, placement of the cursor and operation of the left button are omitted in procedures done with icons. For example, the above sentence would be written as "Click the [MENU] icon."

To close the main menu, left-click or right-click outside the menu window.

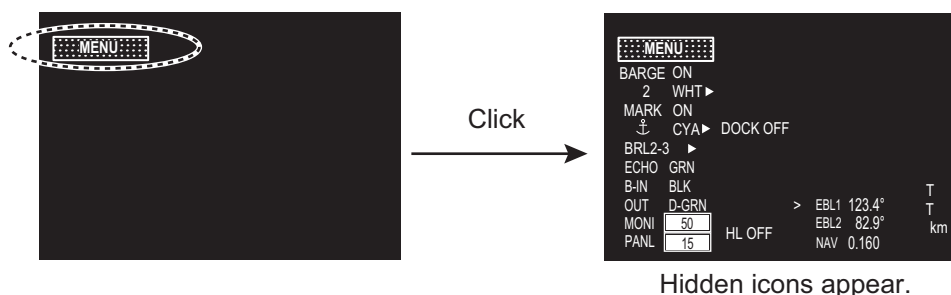
Also, if no operation is detected the specified duration\*, the main menu is closed automatically.

\*: Set the duration at [AUTO-CLOSING TIME] in the [DISPLAY] menu.



## 1.5.3 How to show the hidden icons

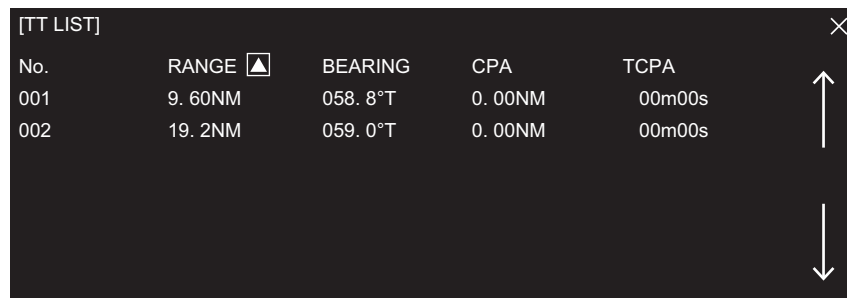
If the radar can be set to hide some icons after a specified interval, click the [MENU] icon to display the hidden icons.



## 1.5.4 List windows


There are three list windows (TT, AIS and Alarm) and they provide information about tracking targets, AIS targets and generated alarms.

- TT list: Click the [LIST] icon for TT at the bottom of the display to show the TT list.



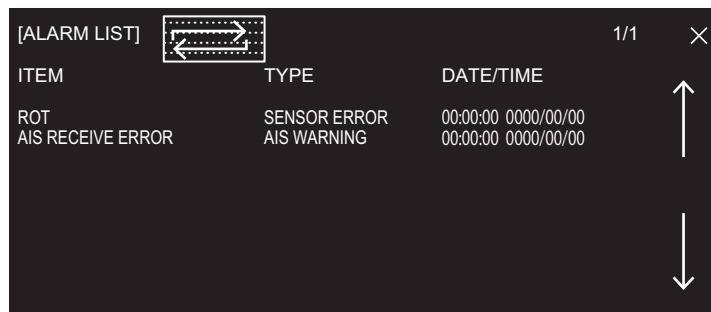
No.	RANGE ▲	BEARING	CPA	TCPA
001	9. 60NM	058. 8°T	0. 00NM	00m00s
002	19. 2NM	059. 0°T	0. 00NM	00m00s

- AIS list: Click the [LIST] icon for AIS at the bottom of the display to show the AIS list.



MMSI	NAME
12XXXXXXXXX	ABCXX
2345XXXXXXX	AXX

- Alarm list: Right-click the [ALARM] icon at the top left corner then click [3 ALARM LIST/HISTORY] to show the Alarm list.



ITEM	TYPE	DATE/TIME
ROT	SENSOR ERROR	00:00:00 0000/00/00
AIS RECEIVE ERROR	AIS WARNING	00:00:00 0000/00/00

### How to close a list window

Click the close button (×) at the top right corner of the list window. Alternately, right-click or left-click outside the window.

## 1.6 How to Adjust Display Brilliance, Panel Dimmer

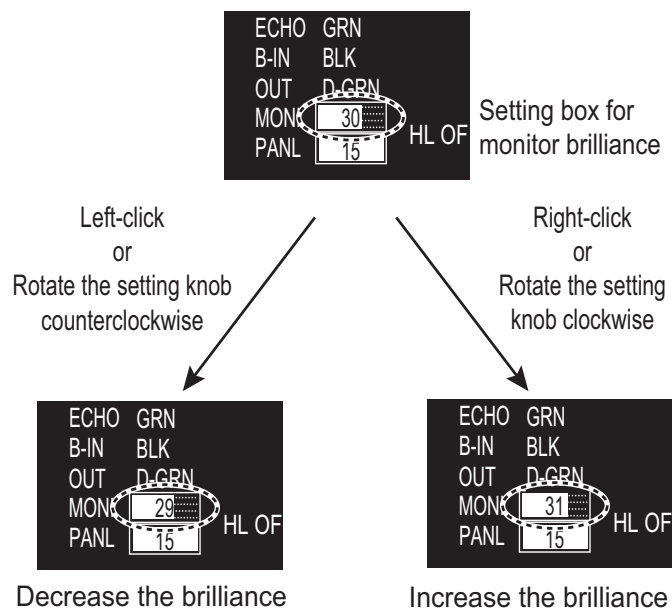
### 1.6.1 Display brilliance

You can adjust the display brilliance (setting range: 0 to 50) with the [MONI] icon. The connection between the processor unit and the monitor unit MU-190V with the USB cable (Option) is required. See the Operator's manual of MU-190V.

**Note:** This function is available when the following menus of MU-190V are set as below:

- [AUTO DIMMER]: [OFF]
- [EXT BRILL CTRL]: [ON]

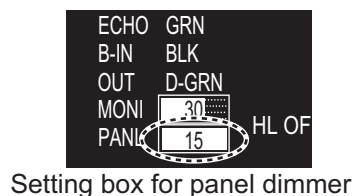
1. Click the setting box for display brilliance at the bottom left corner of the screen.
2. Press the left button to decrease the brilliance; the right button to increase the brilliance. With mouse connection, rotate the wheel or click the right or left button to adjust the brilliance.



### 1.6.2 Panel dimmer

The backlighting for the keys on the control unit can be adjusted as follows:

1. Click the setting box for panel dimmer at the bottom left corner on the screen.

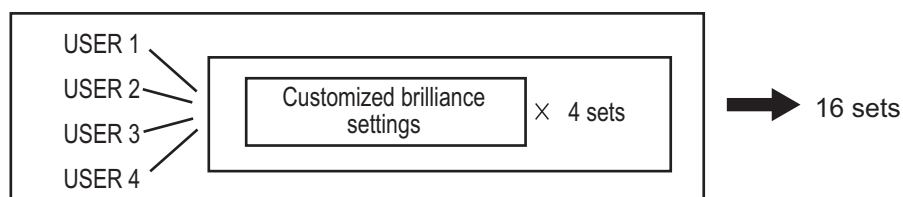


2. Press the left button to decrease the dimmer; the right button to increase the dimmer. With mouse connection, rotate the wheel or click the right or left button to adjust the panel dimmer.

### 1.6.3 Brilliance Sets

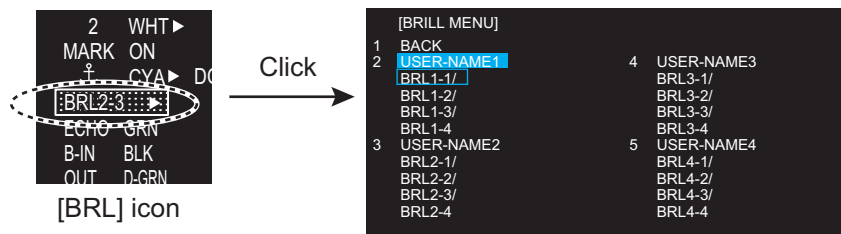
This radar provides customized sets of brilliance to match any ambient lighting condition. Four sets of customized brilliance settings are available for four users each, for a total of 16 sets.

When the radar is powered on, the display is shown with the maximum brilliance setting. Select the appropriate brilliance, depending on the environment.



### How to select a customized brilliance set

- Click the [BRL] icon at the bottom left corner on the screen to show the [BRILL MENU] window.

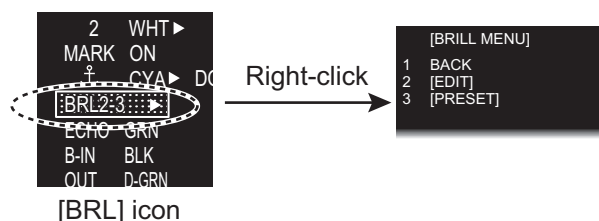


- Click the user name and the required brilliance set.
- Click outside the menu window to close the menu.

### How to edit [BRILL MENU]

You can edit the menu contents for each brilliance set.

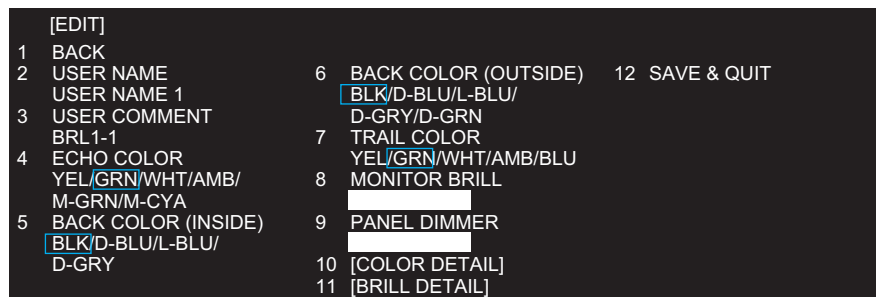
- Right-click the [BRL] icon at the bottom left corner on the screen to show the [BRILL MENU] window.



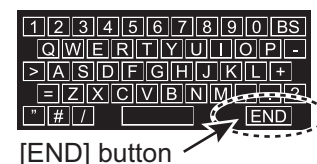
**Note:** The [BRL1-1] setting is fixed as a default setting. You can edit the setting, but

when the system is turned off, the default setting is restored. To save a custom brilliance set, select a setting other than [BRL1-1].

- Click [EDIT].



- Click [USER NAME].
- To edit the name, click the name column then enter the name with the software keyboard. Click the [END] button to finish.



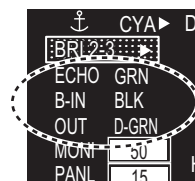
- Change the digit: Rotate scrollwheel.
- Delete a character: Use the [BS] button on the software keyboard.

- Click [USER COMMENT] to edit. The editing procedure is the same as that for [USER NAME]. Refer to step 4.
- To edit the comment, click the respective BRL column then enter the comment with the software keyboard. Click the [END] button to finish.
- Click the menu item, [4 ECHO COLOR] to [11 BRILL DETAIL], to edit.
- Set the option for each menu item as appropriate.
- Click [SAVE & QUIT] to save the settings.



## 1.7 Color Scheme

You can select the color for echo and background color (inside/outside) with the display icons.



Click the icon to change the color.

### Available colors

	Available options (Each color is selectable respectively)					
[ECHO COLOR]	YEL (yellow)	GRN (green)	WHT (white)	AMB (amber)	M-GRN*	M-CYA*
[BACK COLOR (INSIDE)]	BLK (black)	D-BLU (dark blue)	L-BLU (light blue)	D-GRY (dark gray)	—	—
[BACK COLOR (OUTSIDE)]	BLK (black)	D-BLU (dark blue)	L-BLU (light blue)	D-GRY (dark gray)	D-GRN (dark green)	—

You can set the customized color for the following items on [COLOR DETAIL].

- Echo color
- Back color (effective display area)
- Back color (outside effective display area)
- Trail color
- Character color
- Fixed range ring color
- Gyro scale color
- EBL/VRM/NAV LINE color
- Alarm indication
- Cursor color

1. Right-click the [BRL] icon at the bottom left corner on the screen to show the [BRILL MENU] window.
2. Click [EDIT].
3. Click [COLOR DETAIL].



4. Set the option for each menu item as appropriate.
5. Click [SAVE & QUIT] to save the settings.

## 1. OPERATION

### Default settings for [USER 1] to [USER 4]

		Available options (Each color is selectable)			
		[USER 1]	[USER 2]	[USER 3]	[USER 4]
[ECHO COLOR]		GRN (green)		WHT (white)	GRN (green)
[BACK COLOR (INSIDE)]		BLK (black)			
[BACK COLOR (OUTSIDE)]		BLK (black)	D-BLU (dark blue)	D-GRY (dark gray)	D-GRN (dark green)
[TRAIL COLOR]		GRN (green)		WHT (white)	GRN (green)
[COLOR DETAIL]	[CHARACTER]	WHT (white)			
	[FIXED RING]	WHT (white)			
	[GYRO RING]	GRN (green)			WHT (white)
	[EBL/VRM/NAV LINE]	GRN (green)			
	[ALARM]	RED			
	[CURSOR]	GRN (green)			

### Available colors

		Available options (Each color is selectable)					
[ECHO COLOR]		YEL (yellow)	GRN (green)	WHT (white)	AMB (amber)	M-GRN*	M-CYA*
[BACK COLOR (INSIDE)]		BLK (black)	D-BLU (dark blue)	L-BLU (light blue)	D-GRY (dark gray)	—	—
[BACK COLOR (OUTSIDE)]		BLK (black)	D-BLU (dark blue)	L-BLU (light blue)	D-GRY (dark gray)	D-GRN (dark green)	—
[TRAIL COLOR]		YEL (yellow)	GRN (green)	WHT (white)	AMB (amber)	BLU (Blue)	—
[COLOR DETAIL]	[CHARACTER]	GRN (green)	RED	WHT (white)	—	—	—
	[FIXED RING]	GRN (green)	WHT (white)	—	—	—	—
	[GYRO RING]	L-BLU (light blue)	RED	GRN (green)	WHT (white)	—	—
	[EBL/VRM/NAV LINE]	L-BLU (light blue)	GRN (green)	WHT (white)	—	—	—
	[ALARM]	RED	WHT (white)	—	—	—	—
	[CURSOR]	GRN (green)	WHT (white)	—	—	—	—

\*: [M-GRN]: Multi-green (green gradation), for [SEA] mode only

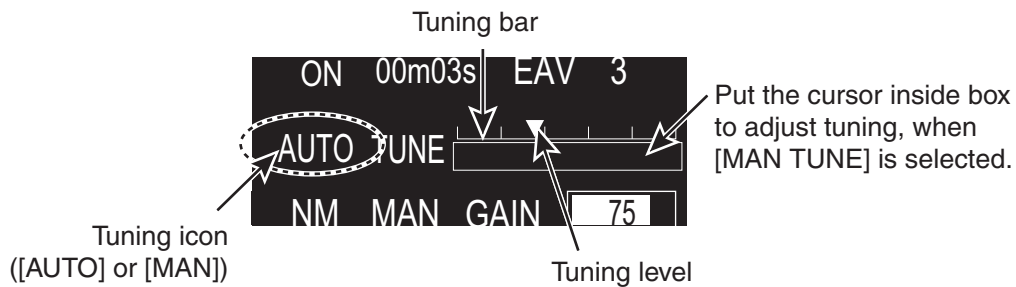
[M-CYA]: Multi-cyan (cyan gradation), for [SEA] mode only

## 1.8 Tuning

### 1.8.1 How to select the tuning method

The tuning method, auto tuning or manual tuning, can be selected with the tuning icon as follows.

Click the tuning icon ([AUTO] or [MAN]) at the bottom right corner on the screen to switch between [AUTO] and [MAN].



### 1.8.2 Automatic tuning

Click the tuning icon to select [AUTO] referring to paragraph 1.8.1.

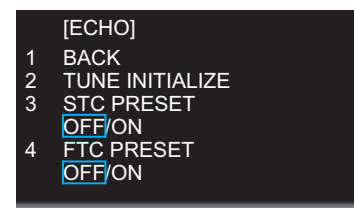
### 1.8.3 Manual tuning

1. Click the tuning icon to select [MAN] referring to paragraph 1.8.1.
2. Put the cursor on the tuning bar.
3. Rotate the setting knob to adjust the tuning. The best tuning point is where the bar swings maximum. The triangle in the bar graph shows tuning level; not the tuning condition.

### 1.8.4 How to initialize tuning

Automatic tuning is initialized during the installation. However, if you feel that automatic tuning is not working properly try re-initializing the tuning. Open [MAIN MENU] then click [ECHO] to open [ECHO] menu. Click [TUNE INITIALIZE] to start the initialization.

The tuning bar turns yellow and moves during the initialization.



Tuning level moves during initialization



**Note 1:** The display may appear incorrect during initialization, caused by changes in pulse or tuning levels.

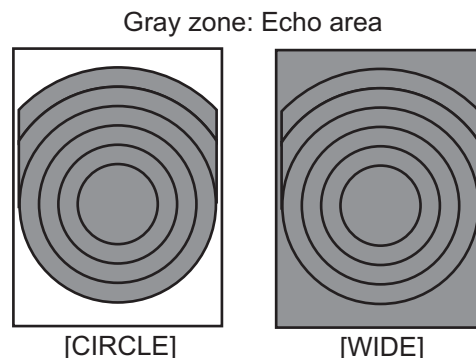
**Note 2:** The following operations cancel the initialization process.

- Change of range
- Go [STBY] mode
- Change of pulse width

## 1.9 Echo Area

The echo display area can be selected for [CIRCLE] or [WIDE], in the [SEA] mode.

1. Open [MAIN MENU], click [DISPLAY].
2. Click [ECHO AREA] then select the option.  
[CIRCLE]: Echoes in the radar circle.  
[WIDE]: Echoes in the whole of the display
3. Click outside the menu window to close the menu.



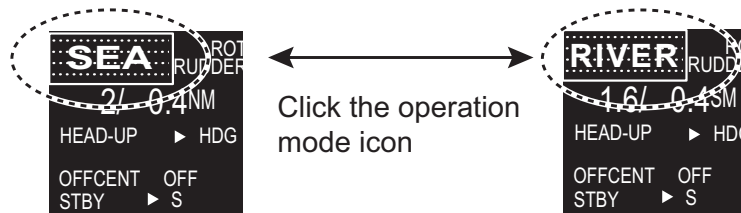
## 1.10 Operation Modes

This radar has two operating modes: river mode and sea mode.

- The river mode provides a specialized radar display for river navigation.
- The sea mode provides the traditional radar display.

### 1.10.1 How to select an operation mode

Click the operation mode icon at the top left corner of the screen to select [RIVER] or [SEA].



**Note 1:** To enable switching of the operation mode, the [OPERATION TYPE] setting, in the [SERVICE MENU], must be set to [RIVER-SEA]. See your dealer.

**Note 2:** To change the operation mode ([RIVER] or [SEA]), go to [STBY] once to select the operation mode then go to [TX] mode.

The following items are set according to the operation mode.

- Orientation mode
- Range
- Units
- Screen size (River mode: circle\* only, Sea mode: circle\* and wide\*)

\*: See section 1.9.

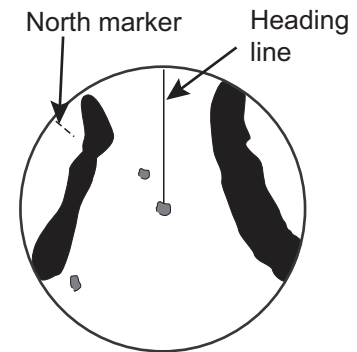
## 1.10.2 Orientation mode

### Relative motion (RM)

In relative motion, own ship position is stationary on the screen to observe relative motion of surrounding targets.

- **HEAD UP**

The head-up mode is a display in which the line connecting own ship and the top of the display indicates own ship's heading. The target pips are painted at their measured distances and in their directions relative to own ship's heading. The short line on the bearing scale is the north marker, which indicates heading sensor north.



- **HEAD UP (TB)**

Radar echoes are shown in the same way as in the head-up mode. The difference from normal head-up presentation lies in the orientation of the bearing scale. The bearing scale rotates in accordance with the heading sensor signal, enabling you to know own ship's heading at a glance.

This mode is available when the radar is interfaced with a gyro heading sensor. If the gyro heading sensor fails, the bearing scale returns to the state of head-up mode.

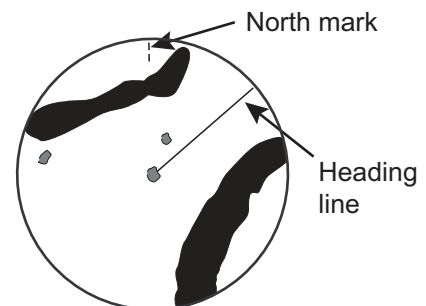
- **STERN UP**

A display without azimuth stabilization in which the line that connects the center with the top of the display indicates your stern.

- **NORTH UP**

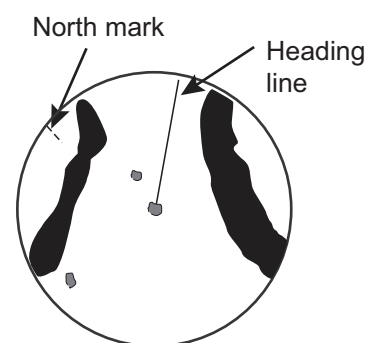
The north-up mode paints target pips at their measured distances and in their true (heading sensor) directions from own ship, north bearing is fixed at the top of the screen. The heading line changes its direction according to the ship's heading. This mode requires heading signal.

If the compass fails, the orientation mode changes to head-up and the north marker disappears.



- **COURSE UP**

The course-up mode is an azimuth stabilized display in which a line connecting the center with the top of the display indicates own ship's intended course (namely, own ship's previous heading just before this mode has been selected). Target pips are painted at their measured distances and in their directions relative to the intended course, which is maintained at the 0-degree position. The heading line moves in accordance with ship's yawing and course change.

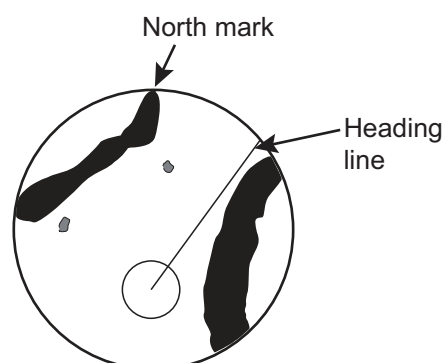


**True motion (TM)**• **NORTH UP**

Ground (or water mass) is stabilized with compass and speed inputs. Your ship and other objects in motion move with their true courses and speed.

• **COURSE UP**

Own ship and other moving objects move in accordance with their true courses and speed. In ground stabilized TM, all fixed targets, such as landmasses, appear as stationary echoes. In the sea stabilized TM without set and drift inputs, the landmass can move on the screen.

**Mode availability**

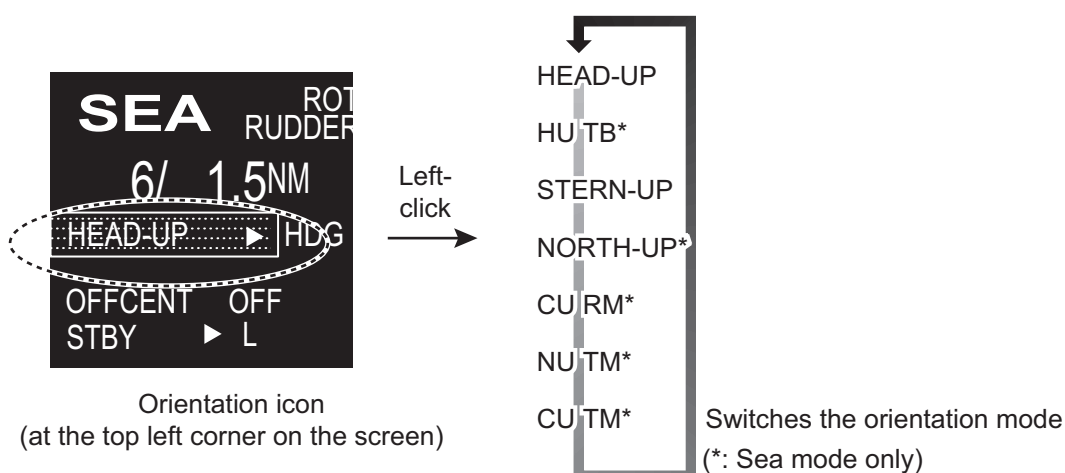
Orientation mode	Data		Availability	
	Heading	L/L	[RIVER] mode	[SEA] mode
Head up RM			Yes	Yes
Head up RM (TB)	✓		No	Yes
Stern up RM			Yes	Yes
North up RM	✓		No	Yes
Course up RM	✓		No	Yes
North up TM	✓	✓	No	Yes
Course up TM	✓	✓	No	Yes

✓: Indicates data required to enable the mode.

**1.10.3 How to select an orientation mode**

Select the orientation mode icon then press the left button to select an orientation mode.

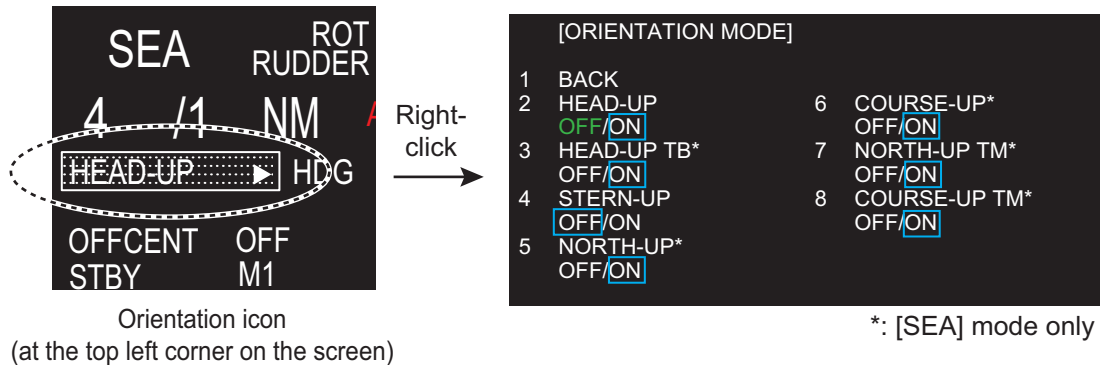
**Note:** You can not set [HEAD-UP] to [OFF].



### 1.10.4 How to change orientation mode presets

Seven orientation modes are available in [SEA] mode, two orientation modes in the [RIVER] mode. You can remove unnecessary modes from the Orientation icon as follows.

1. Right-click the orientation icon to show the [ORIENTATION MODE] window.

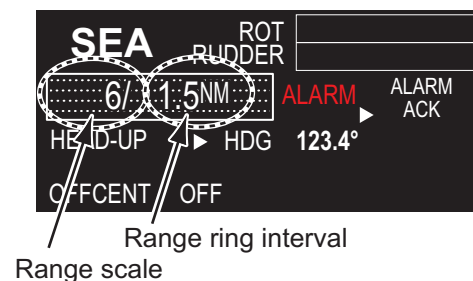


2. Click the mode to set.
3. Click [ON] or [OFF]. Any mode set to [OFF] is removed from the Orientation icon.  
**Note:** You can not set [HEAD-UP] to [OFF].
4. Click outside the menu window to close the menu.

## 1.11 How to Select the Range Scale

The selected range scale, range ring interval and pulse width are shown at the top left corner on the screen. When a target of interest comes closer, reduce the range scale so that it appears in 50-90% of the display radius.

The available units for range are NM, KM, SM, and KYD. You can change the unit when installed.



Left-click the range scale icon to decrease the range: right-click to increase the range.



## 1. OPERATION

### **Range for River mode**

In River mode, the default unit is SM.

<b>Range (SM)</b>	<b>Range ring interval (SM)</b>
0.125	0.025
0.25	0.05
0.5	0.1
0.8	0.2
1.2	0.2
1.6	0.4
2	0.4
4	1
8	2
16	4
32	8
64	16

### **Range for Sea mode**

In Sea mode, the default unit is NM.

<b>Range (NM)</b>	<b>Range ring interval (NM)</b>
0.125	0.025
0.25	0.05
0.5	0.1
0.75	0.25
1	0.25
1.5	0.25
2	0.4
3	0.5
4	1
6	1
8	2
12	2
16	4
24	4
32	8
48	8
64	16



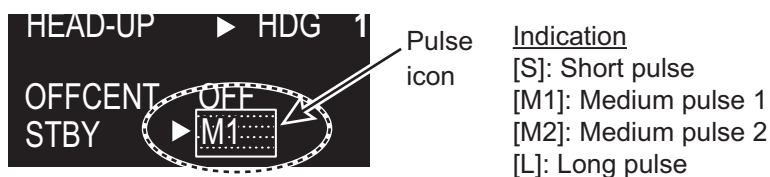
## 1.12 Pulse width

The pulse width in use is displayed at the top left corner on the screen. The pulse widths are set to each range scale and custom setup. Use a longer pulse width when your purpose is long range detection. Use a shorter pulse width when the resolution is important.

### 1.12.1 How to change a pulse width

The pulse width in use is displayed at the top left corner of the screen using the indications shown in the table below.

Left-click the pulse icon to shorten the pulse width or right-click to lengthen the pulse width.



Appropriate pulse widths are preset to individual range scales. If you are not satisfied with the current pulse width settings, you may change them referring to paragraph 1.12.2.

#### Pulse width for [RIVER] mode

Range (SM)	Available pulse width
0.125/ 0.25/ 0.5/ 0.8/ 1.2	S
1.6/2	S/M1
4	M1/M2
8/16	M2/L
32/64	L

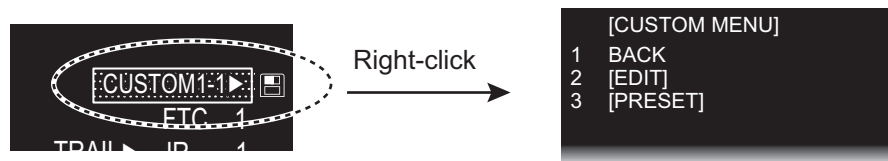
#### Pulse width for [SEA] mode

Range (NM, SM)	Available pulse width
0.125/ 0.25/ 0.5/ 0.75/ 1	S
1.5/ 2	S/M1
3/ 4	M1/M2
6/ 8/ 12/ 16	M2/L
24/ 32/ 48/ 64	L

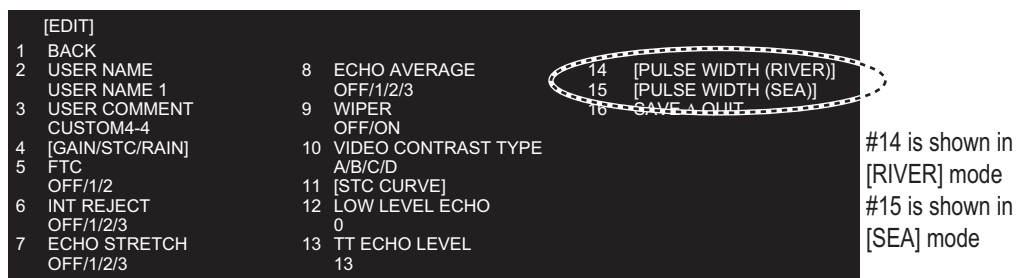
Range (km, kyd)	Available pulse width
0.125/ 0.25/ 0.5/ 0.75/ 1/ 1.5/ 2	S
3/ 4	S/M1
6/ 8	M1/M2
12/ 16/ 24/ 32	M2/L
48/ 64	L

## 1.12.2 How to select a pulse width

1. Right-click [CUSTOM] icon at the bottom right corner on the screen to show [CUSTOM MENU].

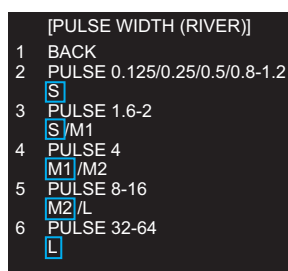


2. Click [EDIT].

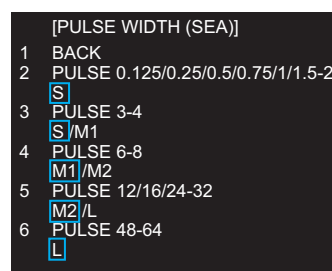
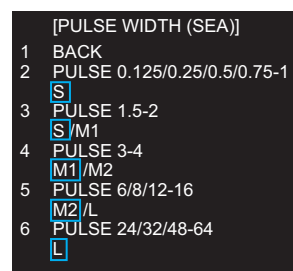


3. Click [PULSE WIDTH].

For [RIVER] mode



For [SEA] mode



Range unit: NM, SM

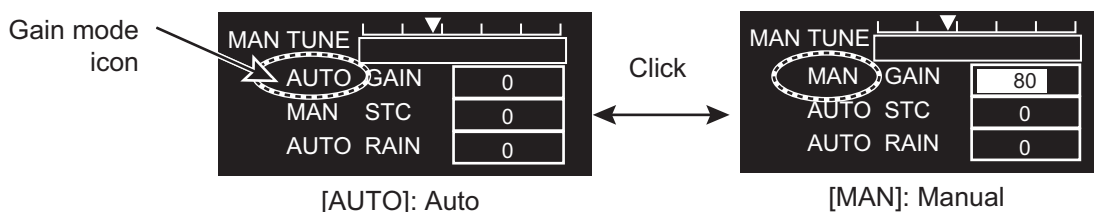
Range unit: km, kyd

4. Click the range in use.
5. Click the desired pulse width.
6. Click outside the menu window to close the menu.

## 1.13 How to Adjust the Gain (sensitivity)

The gain functions to adjust the sensitivity of the receiver for the best reception. The gain can be adjusted automatically or manually.

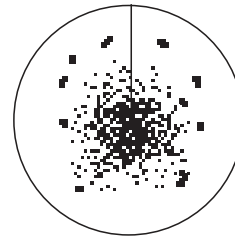
1. Click the gain mode icon at the bottom right corner on the screen to show [MAN] or [AUTO] as appropriate.



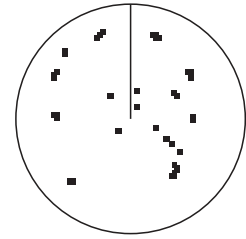
2. For manual adjustment, rotate the setting knob to adjust the gain so that weak noise appears on all of the screen. If the gain is too low, weak echoes may be missed. If the gain is too high, the background noise hides weak targets. For auto mode, the setting range is -50 to 50. For manual mode, 0 to 100.

## 1.14 How to Reduce the Sea Clutter

The reflected echoes from the waves appear around your ship and are called “sea clutter”. The sea clutter extends according to the height of waves and antenna above the water. When the sea clutter hides the targets, reduce the clutter, either manually or automatically.

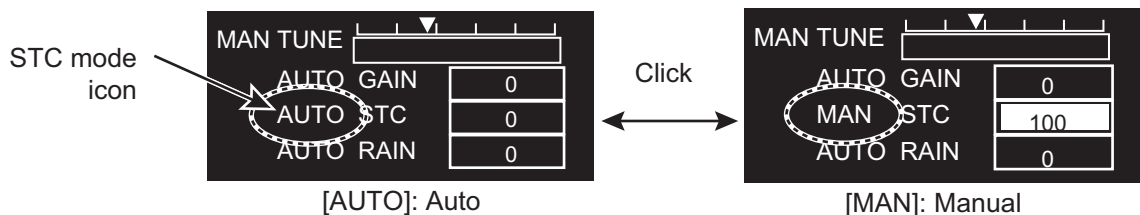


Sea clutter at screen center



STC adjusted; sea clutter suppressed

1. Click the STC mode icon at the bottom right corner on the screen to show [MAN] or [AUTO] as appropriate.

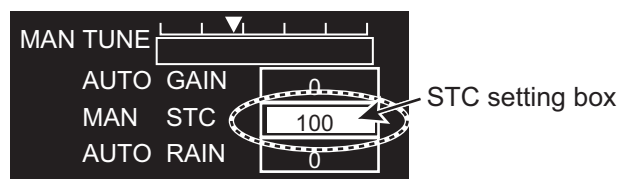


2. For manual adjustment, rotate the setting knob to adjust the sea clutter so that the clutter is broken into small dots, and small targets become identified. If the setting is too low, targets are hidden in the clutter. If the setting is too high, both sea clutter and targets disappear from the display. Normally adjust the control until the clutter has disappeared to leeward, but a small amount of the clutter is visible windward. For auto mode, the setting range is -50 to 50. For manual mode, 0 to 100.

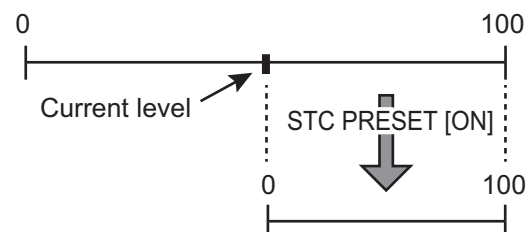
### STC PRESET

You can tune STC properly with the [STC PRESET] function.

1. Click the STC mode icon to set [MAN] (Manual mode).
2. Put the cursor on the STC setting box at the bottom right corner on the screen.



3. Rotate the setting knob to set the level to use as lowest level for STC adjustment.
4. Open [MAIN MENU], click [ECHO].
5. Click [STC PRESET].
6. Click [ON] to activate the [STC PRESET] function. The STC bar is re-scaled to set the STC level to zero.



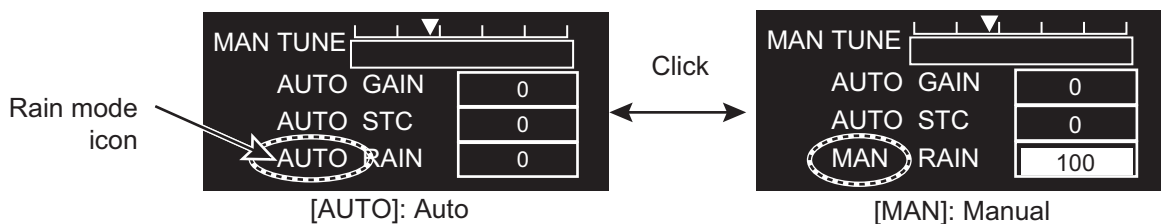
Change of the STC scale bar

## 1.15 How to Reduce the Rain Clutter

The reflections from the rain or snow appear on the screen. These reflected echoes are called “rain clutter”. When the rain clutter is strong, targets in the rain clutter are hidden in the clutter. Reflections from the rain clutter are easily identified from true targets by their wool-like appearance.

The rain control breaks the continuous display of rain or snow reflections into a random pattern. When the rain clutter hides the targets, adjust the rain control (automatic or manual) to reduce the clutter.

1. Click the rain mode icon at the bottom right corner on the screen to show [MAN] or [AUTO] as appropriate.



2. For manual adjustment, rotate the setting knob to reduce the rain clutter. For auto mode, the setting range is -50 to 50. For manual mode, 0 to 100.

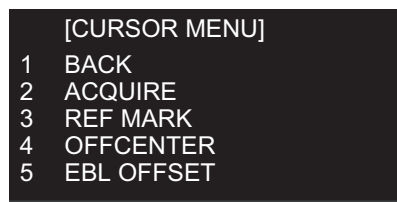
## 1.16 Cursor

Within the radar display, the cursor is shown as a plus sign (+). When the cursor is outside the radar display it is shown as an arrow (↖).

### Cursor menu

Functions that require the use of the cursor, such as EBL offset, may be activated directly from [CURSOR MENU]. This menu is available when the cursor is inside the effective display area.

1. Put the cursor anywhere within the radar display.
2. Press the right button to show [CURSOR MENU].



3. Use the touch pad to select the desired menu.  
 [ACQUIRE]\*: Acquires a target (TT or AIS).  
 [REF MARK]\*: Acquire a target to use to gauge own ship's speed.  
 [OFFCENTER]: Off-center your position.  
 [EBL OFFSET]: Shift the origin of an EBL.

\*: This function is available for [SEA] mode only.

## 1.17 FTC (Fast Time Constant)

If you can not effectively suppress rain clutter with the rain clutter control, use the FTC function. In adverse weather, clouds, rain or snow produce spray-like spurious echoes which impair target detection over a long distance. These echoes can be suppressed by turning on the FTC circuit. There are two FTC settings, [FTC1] and [FTC2]. [FTC2] provides increased rain clutter suppression.



### CAUTION

Switch off FTC if your objective is to receive a radar beacon signal.

Click the [FTC] icon at the bottom right corner on the screen to select an appropriate FTC setting.

### **FTC PRESET**

The [FTC PRESET] function, when active, applies the FTC a little stronger than normal. The combination effect of the [FTC PRESET] and [FTC] functions is shown as below.

Effect		[FTC PRESET]	
		[OFF]	[ON]
[FTC]	[OFF]	—	low
	[FTC1]	mid-low	mid-high
	[FTC2]	mid-high	high

Set the [FTC PRESET] function as follows.

1. Open [MAIN MENU], click [ECHO].
2. Click [FTC PRESET].
3. Click [ON] to activate the [FTC PRESET] function.

## 1.18 How to Measure the Range to a Target (VRM)

You can measure the range to a target by two methods: fixed range rings and the VRM (Variable Range Marker).

### **How to measure the range with the fixed range rings**

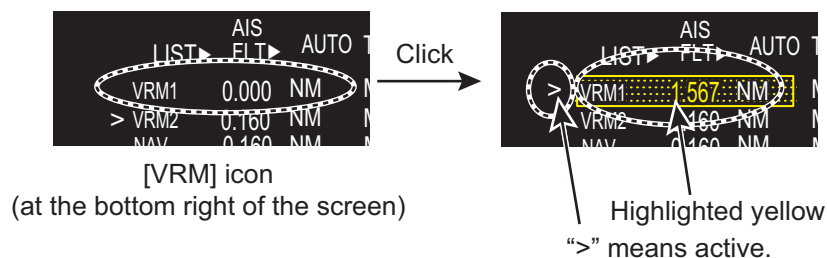
Use the fixed range rings to get a rough estimate of the range to a target. The fixed range rings are the concentric solid circles about your ship. The number of rings changes with the selected range scale. The interval of the range ring is displayed at the upper-left corner of the screen. Count the number of rings between the center of the display and the target. Check the range ring interval and measure the distance of the echo from the nearest ring.

### **How to measure the range with a VRM**

There are two VRMs, VRM1 and VRM2. The VRMs are dashed so that you can identify them from the fixed range rings. You can identify VRM1 from VRM2 by the lengths of their dashes. The dashes of the VRM1 are shorter than those of the VRM2.

## 1. OPERATION

1. Click the [VRM] icon to display the VRM. If the VRM is already shown, go to step 2.
2. Click the [VRM] icon. The icon turns yellow.



3. Move the cursor to align the VRM with the inner edge of the target then click to anchor the VRM.
4. Read the distance at the bottom of the screen. Each VRM ring (VRM1 or VRM2) remains at the same geographical distance when you change the display range. The size of the VRM ring changes in proportion to the selected range scale.
5. To delete a VRM, put the cursor on the appropriate VRM indication then long press the left button (or long press the **VRM** key).

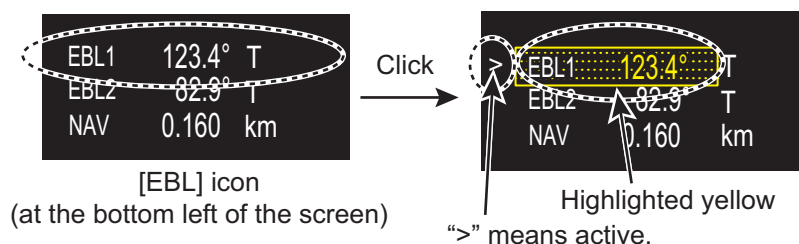
**Note:** If the corresponding EBL is displayed, the VRM is deleted and the value of VRM remains.

## 1.19 How to Measure the Bearing to a Target (EBL)

Use the Electronic Bearing Line (EBL) to take a bearing of a target. There are two EBLs, EBL1 and EBL2. Each EBL is a straight dashed line from the center of the screen to the edge. The dashes of the EBL1 are shorter than those of the EBL2.

### How to measure the bearing with an EBL

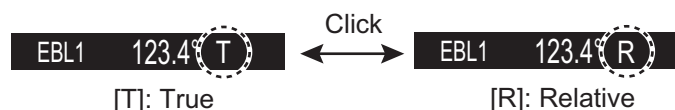
1. Click the [EBL] icon to display the EBL. If the EBL already appears, go to step 2.
2. Click the [EBL] icon ([EBL1] or [EBL2]). The icon turns yellow.



3. Put the cursor on the center of the target then click there to anchor the EBL. Read the bearing at the bottom of the screen.
4. To delete an EBL, put the cursor on the appropriate EBL indication then long press the left button (or long press the **EBL** key).

### How to select bearing reference

The bearing reference can be selected to True or Relative. Click the bearing reference icon to the right of the bearing indication.

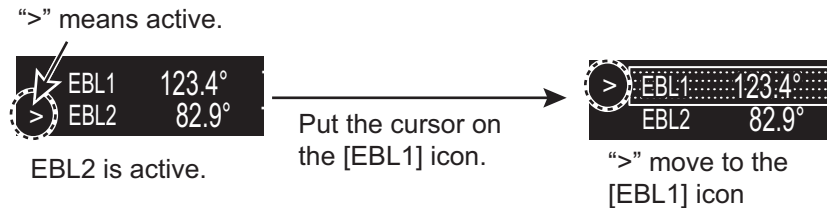


## 1.20 Offset EBL

### How to offset an EBL

You can move the EBL origin to a desired location as follows:

1. Put the cursor on the appropriate [EBL] icon to activate the EBL. The mark (>), which denotes active EBL, moves to the [EBL] icon selected. The example below shows how to activate the EBL1.



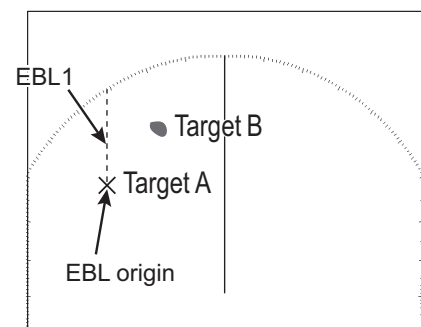
2. Right-click anywhere in the radar display to open [CURSOR MENU].
3. Click [EBL OFFSET].
4. Click anywhere in the radar display to move the EBL origin with cursor.
5. Click the point where to fix the EBL origin there.
6. To return the EBL origin to own ship position again.
7. Right-click to quit the offset EBL.

### 1.20.1 How to measure the range and bearing between two targets

You can move the origin of the EBL to measure the range and bearing between two targets.

1. Click the [EBL1] icon to activate EBL1. If the EBL already appears, go to step 2.
2. Right-click anywhere in the radar display to open [CURSOR MENU].
3. Click [EBL OFFSET].
4. Click anywhere in the radar display to move the EBL origin.

**Note:** If EBL1 is already off-centered, the origin of the EBL moves to own ship's position once. In this case, click anywhere in the radar display again.

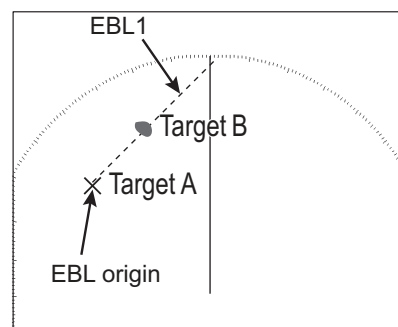


5. Click the center of the target A to fix the EBL.
6. Right-click to quit the offset EBL.
7. Click the [EBL1] icon to change the bearing. The [EBL1] icon turns yellow.

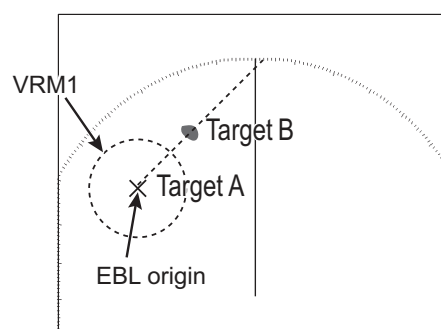


## 1. OPERATION

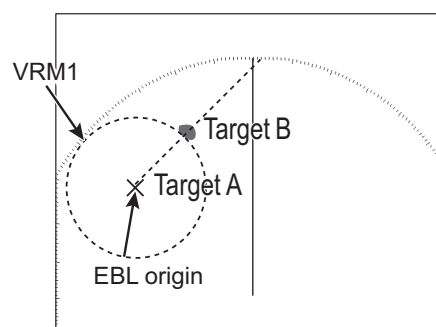
8. Click the center of the target B. The EBL bi-sects target B.



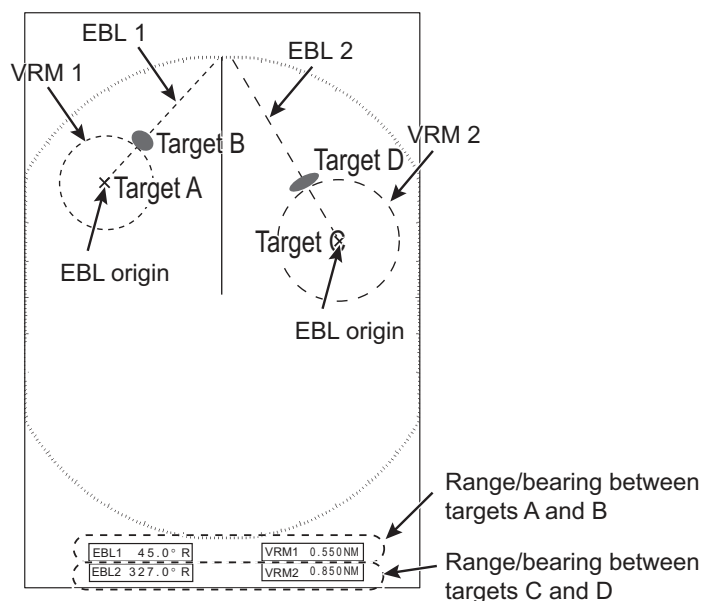
9. Click the [VRM1] icon to change the range. The [VRM1] icon turns yellow. [VRM1] is linked to [EBL1]; [VRM2] is linked to [EBL2].



10. Click the inner edge of the target B. The VRM adjusts to put the VRM ring on the target B. The point selected at step 4 is the center of VRM.



11. Read the bearing at the [EBL] icon and the range at the [VRM] icon.
12. Do the same procedure for [EBL2] and [VRM2] to measure the range and bearing between two other targets (target C and D), use EBL2 and VRM2 similarly.

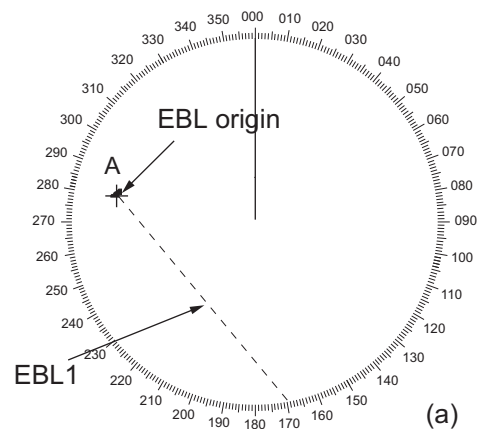




### 1.20.2 Collision assessment by offset EBL

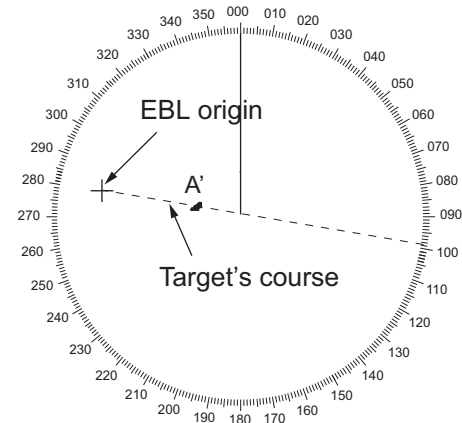
The origin of the EBL can be moved to enable measurement of range and bearing between any targets. This function is also useful for assessment of the potential risk of collision.

1. Move the EBL origin on the target A, following "How to offset an EBL" on page 1-23.



2. Right-click to quit the offset EBL.
3. After waiting for a few minutes, click the appropriate EBL icon to operate the EBL. The icon turns yellow.
4. Click the new target position (A'). The EBL is considered as the course of the target.

**Note:** If the EBL passes through the own ship's position, the target ship is on a collision course.

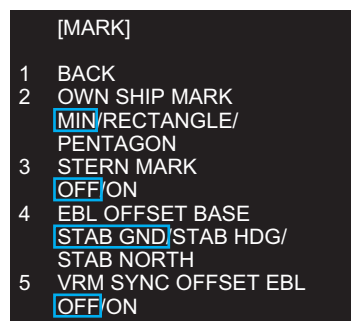


5. To return the EBL origin to the own ship's position, do the following procedure.
  - 1) Right-click inside the display area to open [CURSOR MENU].
  - 2) Click [EBL OFFSET].
  - 3) Click the anywhere in the radar display area. The EBL origin moves to the own ship's position.
6. Right-click to quit the offset EBL.

### 1.20.3 Point of reference for origin point of offset EBL

The origin point of the offset EBL can be ground stabilized (geographically fixed), north stabilized (true) or referenced to own ship's heading (relative). This menu is available in [SEA] mode only. However, the setting is applied in [RIVER] mode also.

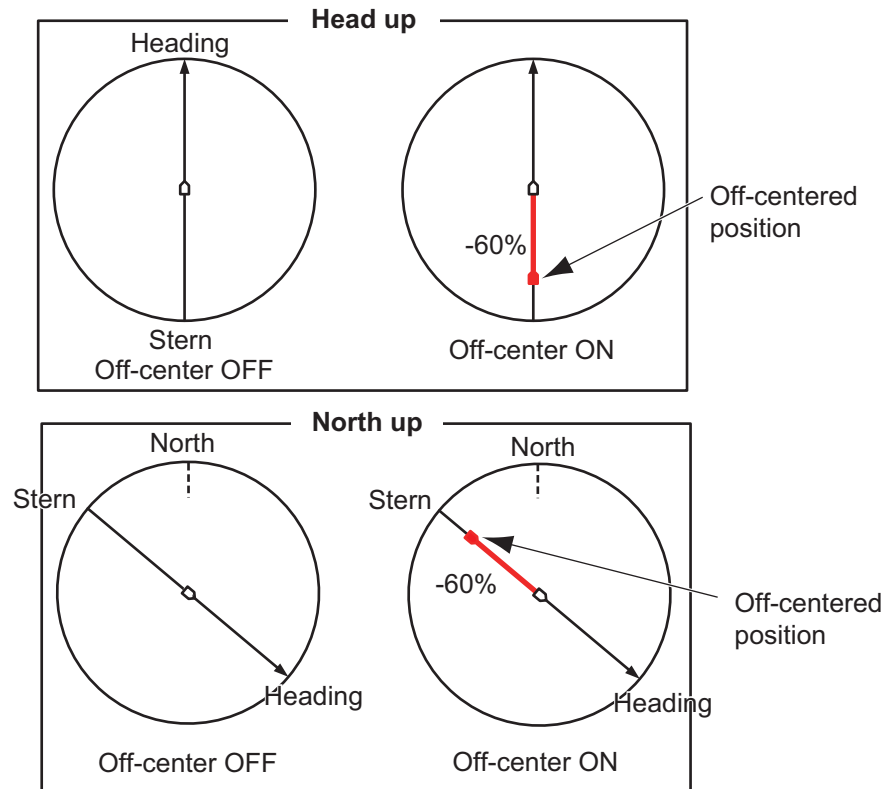
1. In the [SEA] mode, open [MAIN MENU], click [MARK] to show the [MARK] menu.



2. Click [EBL OFFSET BASE].
3. Click the origin point of the offset EBL.  
[STAB GND]: Reference to latitude and longitude of the origin position. Origin position is always fixed regardless of your ship's movement.  
[STAB HDG]: Reference to heading. The relationship between origin position and own position is always kept.  
[STAB NORTH]: Reference to North. The origin position changes with North position.
4. Click outside the menu window to close the menu.

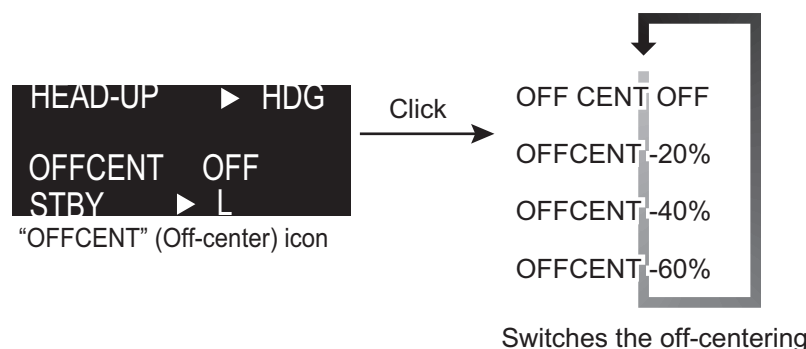
## 1.21 How to Off-center the Display

Own ship position, or sweep origin, can be moved to expand your field of view without switching to a larger range scale. The sweep origin can be off-centered to the cursor position, but not more than 60% of the range in use; if the cursor is set beyond 60% of the range scale, the sweep origin will be off-centered to the point of 60% of the limit. You can select the off-centering rate among, 20%, 40% or 60%.



### How to select the off-centering rate

1. Click the [OFFCENT] (Off-center) icon at the top left corner of the screen.
2. Click to switch the off-centering rate, [-20%], [-40%], [-60%] or [OFF].



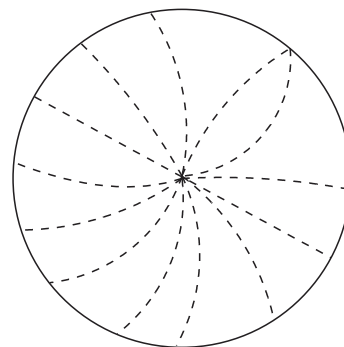
### How to off-center the display

1. Click inside the effective display area to open [CURSOR MENU].
2. Click [OFF CENTER].
3. Click the off-center point to be the center of the radar display.
4. Right-click to complete the off-center the display.

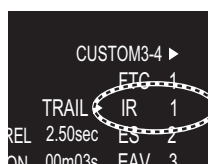
## 1.22 Interference Rejecter

The radar interference can occur when your ship is near the radar of another ship that operates on the same frequency band with your radar.

The interference appears on the screen as many bright dots. The dots can be random or in the shape of dotted lines that run from the center to the edge of the display. Interference is easily identifiable because it does not appear in the same location on the next sweep. When this feature is turned on, "IR 1", "IR 2" or "IR 3" appears at the bottom right corner on the screen.



Click the IR (Interference Rejection) icon to switch the setting among [IR OFF], [IR 1], [IR 2], [IR 3]. [IR 3] provides the highest degree of interference rejection.



"IR" (Interference rejection) icon  
(at the bottom right corner on the screen)

**Note:** When there is no interference, turn off the interference rejecter so that you do not miss small targets.

## 1.23 Echo Stretch

The echo stretch feature enlarges the targets in the range and bearing directions to make the targets easier to see. This feature is available on any range. There are three levels of echo stretch, [1], [2] and [3]. [3] enlarges the targets the most.

**Note:** The echo stretch magnifies the targets, sea and rain clutters, and radar interference. Correctly adjust the sea clutter, rain clutter and radar interference before you activate the echo stretch.

Click the [ES] (echo stretch) icon to switch the setting among [ES OFF], [ES 1], [ES 2] and [ES 3].



"ES" (Echo stretch) icon  
(at the bottom right corner on the screen)

## 1.24 Echo Averaging

To identify true target echoes from sea clutter, echoes are averaged over successive picture frames. If an echo is solid and stable, the echo is shown in its normal intensity. The brilliance of sea clutter is reduced to easily identify true targets from the sea clutter.

**Note 1:** Do not use the echo average function under heavy pitching and rolling to prevent loss of targets.

**Note 2:** This feature requires a heading signal and position data. When either signal becomes lost, echo average is deactivated.

To correctly use the echo average function, first reduce the sea clutter properly. Leave a little sea clutter on the screen so as not to erase weak targets. Then, do as follows:

Click the [EAV] (echo average) icon to switch the setting among [EAV OFF], [EAV 1], [EAV 2], [EAV 3].



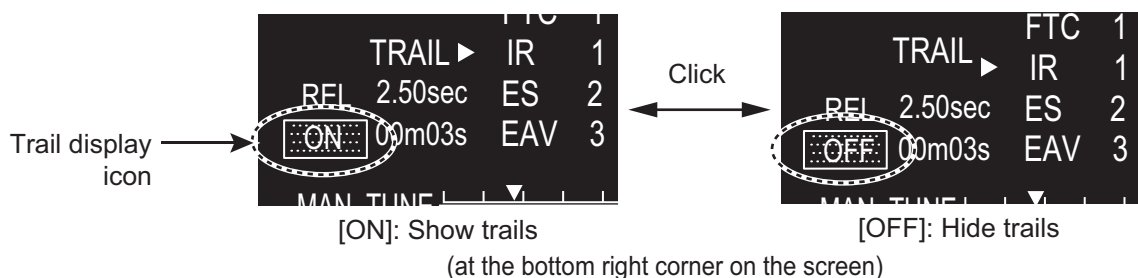
“EAV” (Echo average) icon  
(at the bottom right corner on the screen)

## 1.25 Target Trails

The trails of the radar targets can be shown simulated in afterglow to check target movement. The target trails are referenced as either relative or true. True trails require a heading signal and position data.

### 1.25.1 How to start, stop the trails

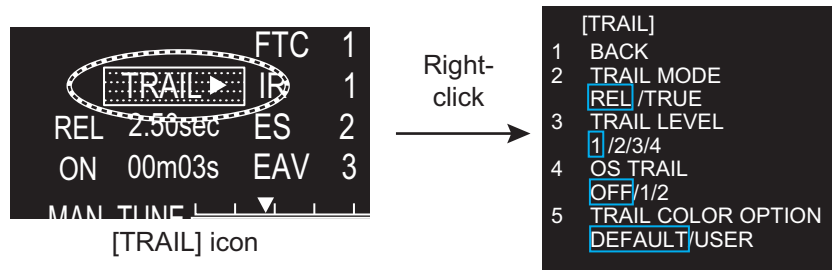
Click the trail display icon to switch between [ON] and [OFF].



## 1.25.2 [TRAIL] menu

You can adjust the detail setting for trails on the [TRAIL] menu.

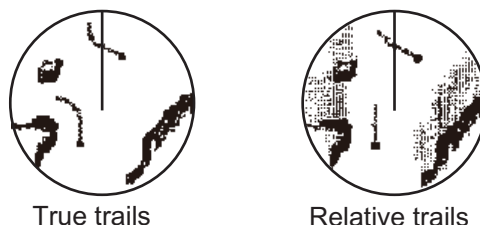
1. Right-click the [TRAIL] icon to show the [TRAIL] menu.



2. Click the required menu item.
3. Click an option for each menu.
4. Click outside the menu window to close the menu.

## 1.25.3 Trail mode

You can display the echo trails in true or relative motion.



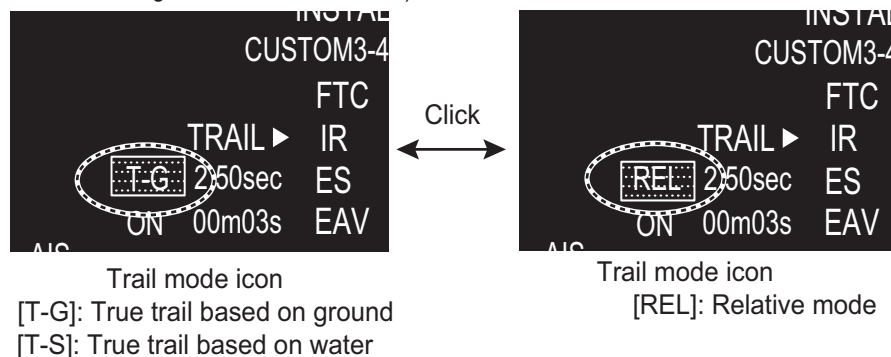
### True mode

The true trails show true target movements according to their over-the-ground speeds and courses. The stationary targets do not show the trails. The true trails require a heading signal and position data.

### Relative mode

The relative trails show other ships' movements relative to your ship. The stationary targets also show the trails.

(at the bottom right corner on the screen)



To select the trail mode, select the trail mode icon to switch the mode, [T-G], [T-S] (True mode) or [REL] (Relative mode). For the ship speed mode ([T-G], [T-S]), see "Speed menu" on page 1-52.

**Note:** [T-S] is available only when [SHIP SPEED] is set to [STW].

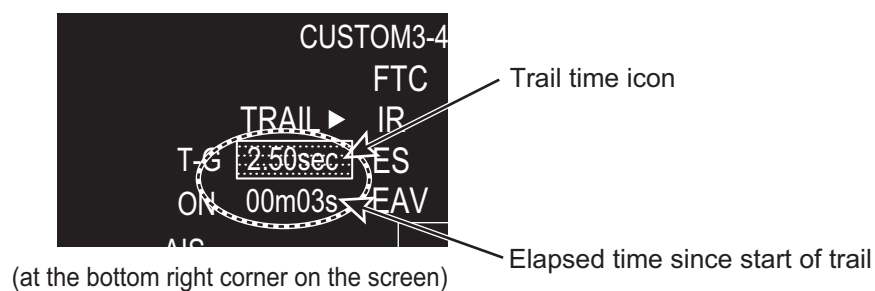
### 1.25.4 Trail level

The level (intensity) of the afterglow that extends from radar targets may be selected as below.

1. Right-click the trail icon to show the [TRAIL] menu.
2. Click [TRAIL LEVEL].
3. Select the trail level among 1 to 4.  
The higher the number the greater the intensity of the afterglow.
4. Click outside the menu window to close the menu.

### 1.25.5 Trail time

Trail time, the trail plotting interval, is selected as follows. The elapsed time since the start of the trail appears below the trail time.



To change the trail time, select the trail time icon. The options for trail time are different according to the operation mode.

- [RIVER] mode: 1.25 sec\*, 2.5 sec, 5 sec  
\*: When the antenna rotation speed is 26 rpm, the [1.25 sec] is the same picture as the [2.5 sec].
- [SEA] mode: 5 sec, 15 sec, 30 sec, 1 min, 3 min, 6 min

### 1.25.6 Own ship trail

You can show the trail of own ship as follows:

1. Right-click the [TRAIL] icon to show the [TRAIL] menu.
2. Click [OS TRAIL].
3. Click the option among [OFF], [1] or [2].  
[OFF]: Hide the trail of own ship.  
[1]: Show the trail of own ship.  
[2]: Show the trail of own ship, but hide the trail of sea clutter near own ship.
4. Click outside the menu window to close the menu.

## 1.25.7 Trail color modes

There are two color modes for the trail color, [DEFAULT] and [USER].


- [DEFAULT]: The trail color becomes the same color as the echo color.
- [USER]: The trail color is set on [TRAIL COLOR] in [BRILL MENU]. See "How to edit [BRILL MENU]" on page 1-8

The trails always begin with the [DEFAULT] color mode. The [USER] color mode is not saved after the power turns off.

1. Right-click the [TRAIL] icon to show the [TRAIL] menu.
2. Click [TRAIL COLOR OPTION].
3. Click the desired color mode, [DEFAULT] or [USER].
4. Click outside the menu window to close the menu.

## 1.26 Target Alarm

The target alarm, available in the [SEA] mode, serves to alert the navigator to targets (ships, landmasses, etc.) entering or leaving the specified area, with audio-visual alarms.

 <b>NOTICE</b>
<ul style="list-style-type: none"> <li>• The alarm should not be relied upon as the sole means for detecting possible collision situations.</li> <li>• [STC], [RAIN] and [GAIN] controls should be properly adjusted to be sure the alarm system does not overlook target echoes.</li> </ul>

### 1.26.1 How to set a target alarm

The procedure below shows how to set a target alarm using the figure below as an example.

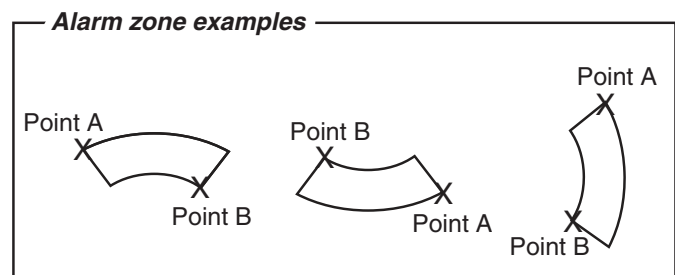
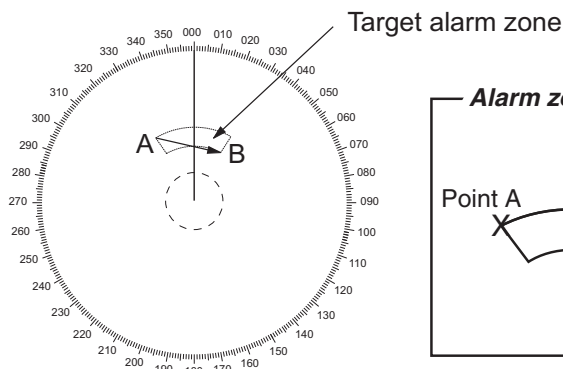
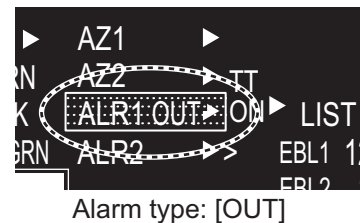
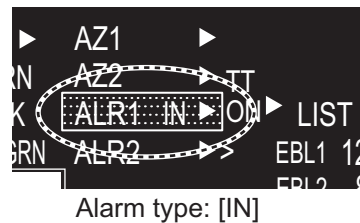
1. Click the [ALR1] or [ALR2] icon. [SET] appears in the [ALR] icon.



2. Use the touch pad to select the point "A" on the radar screen then push the left button.



- Use the touch pad to select the point "B" then push the left button. [IN] (or [OUT]) replaces [SET] in the [ALR] icon. The target alarm zone's lines are shown in dashed lines.

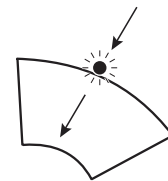


**Note 1:** If you wish to create a target alarm zone having a 360-degree coverage around own ship, set point "B" in almost the same direction as point "A".

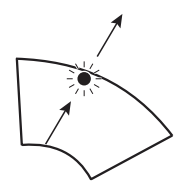
**Note 2:** Two target alarm zones may be set. Note however that the 2nd target alarm zone is available only when the 1st target alarm zone is active.

### 1.26.2 How to select the alarm type

You can set the target alarm to activate against targets entering or exiting the alarm zone.



Target "IN" alarm

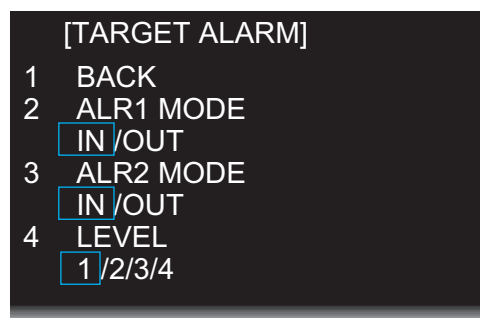


Target "OUT" alarm

- Open [MAIN MENU], click [ALARM] to show the [ALARM] window.



- Click [TARGET ALARM].



- Click [ALR1 MODE] or [ALR2 MODE].
- Click the alarm type, [IN] or [OUT].
- Click outside the menu window to close the menu.

### 1.26.3 How to select the target strength which triggers a target alarm

You can select the target strength which triggers the target alarm as follows.

1. Open [MAIN MENU], click [ALARM].
2. Click [TARGET ALARM].
3. Click [LEVEL].
4. Click the alarm echo strength level, [1] to [4]. [4] is the strongest.
5. Click outside the menu window to close the menu.

### 1.26.4 How to acknowledge the target alarm

A target in the target alarm zone produces both visual (flashing) and audible (beep) alarms. To silence the audio alarm, press the left button or click the appropriate [ALARM ACK] icon. This deactivates the audio alarm but does not stop flashing of the offending target.

### 1.26.5 How to sleep a target alarm temporarily

You can sleep a target alarm zone when its use is not immediately needed. The alarm zone remains on the screen, but any targets that enter (or exit) the alarm zone do not trigger the audio and visual alarms.

1. Click the [ALR1] or [ALR2] icon until the icon reads "ALR1 ACK" or "ALR2 ACK".
2. To activate a sleeping target alarm zone, press the [ALR1] or [ALR2] icon until the alarm indication changes to "ALM1 (or 2)\_IN(or OUT)".

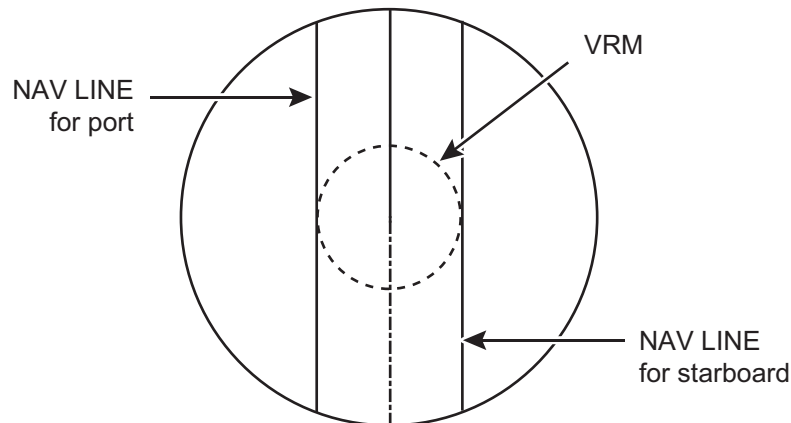
### 1.26.6 How to delete a target alarm

1. Click the appropriate [ALR] icon.
2. Press and hold down the left button until the [ALR] icon goes blank. The target alarm is deleted from the screen.

**Note:** If both acquisition zones are active [ALR1] can not be deleted unless [ALR2] is deleted.

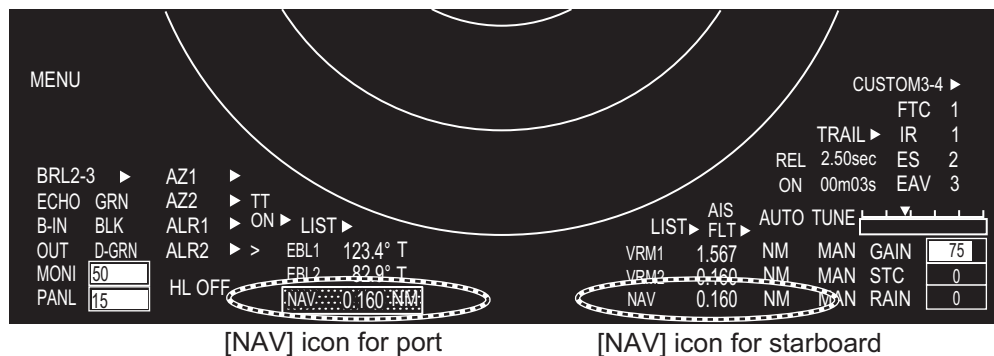
## 1.27 NAV Lines

There are two NAV lines for port and starboard.



### How to display the NAV lines

Click the appropriate [NAV] icon at the bottom of the screen.



### How to set the NAV lines

NAV lines are set on both sides of own ship. The distance to port or starboard is individually determined.

1. Click the appropriate [NAV] icon to display a NAV line. If the NAV line is already displayed, go to step 2.
2. Click the [NAV] icon to activate the NAV line. The icon turns yellow.



3. Click the position where you want to put the NAV line in the radar display area.

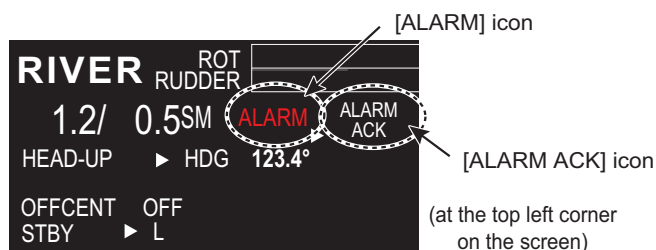
### How to turn off the NAV lines

Long press the appropriate [NAV] icon with the left button. The location of the line is retained in the memory when the power is turned off.

## 1.28 Alarms, Error Messages

### 1.28.1 Alarm indication

When the alarm is generated, the [ALARM] icon flashes (in red) and the audio alarm sounds.



Icon indication	Status	Meaning
		No alarm.
	Red character and flashing.	An alarm is active.
	Red character and not flashing.	All active alarms are acknowledged. Or all alarms are not in alarm status but not acknowledged.

#### How to acknowledge the alarm

Click the [ALARM ACK] icon to acknowledge the alarm and silence the audio alarm. The [ALARM] icon continues flash until the cause of the alarm is cleared.

## 1.28.2 Alarm description

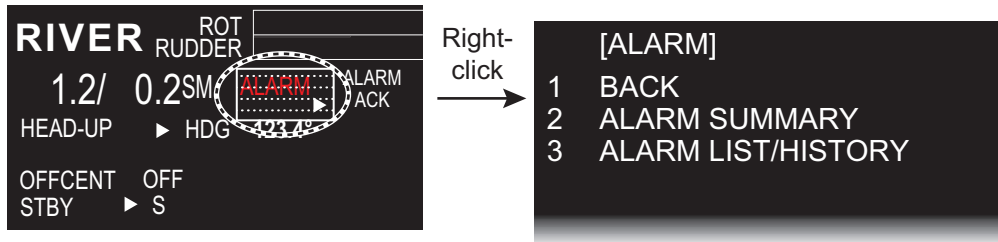
### Alarm description

Alarm type	Alarm message	Meaning
COLLISION ALARM	TT DANGEROUS	CPA and TCPA of a TT is within a preset limit.
	AIS DANGEROUS	CPA and TCPA of an AIS target is within a preset limit.
	DEPTH LIMIT	The depth measured by the depth sensor(s) is within a preset limit.
	TARGET ALARM	A target has entered (or exited) a target alarm zone.
SYSTEM ERROR	NO VIDEO	Loss of video signal.
	NO AZIMUTH	Loss of azimuth signal.
	NO HEADLINE	Loss of heading signal.
	CONTROL HEAD COMMUNICATION ERROR	No communication between control unit and UIP (Control unit may not be connected.)
	CPU TEMPERATURE	CPU has overheated.
	TUNE CONTROL	Radar tuning problem.
	FAN MOTOR	Fan motor has stopped.
SENSOR ERROR	NO GYRO	Loss of gyrocompass (heading) signal.
	NO LOG	Loss of log (speed) signal.
	NO EPFS	No position data.
	NO ECHO SOUNDER	No depth data from echo sounder.
	NO WIND SENSOR	No wind data.
	SPEED	No VTG signal.
	ROT	Abnormal ROT signal.
	EPFS FRONT (AFT) ERROR	GPS sensor is not received.
	ECHO SOUNDER FRONT (AFT) ERROR	Depth data at front or aft sensor is not received.
AIS ALARM	NO CPA/TCPA FOR AIS	No COG or SOG for AIS.
	AIS RECEIVE ERROR	No VRM or VDO sentences for 30 seconds (or the AIS function).
	AIS ACTIVATE 100%	The maximum number of AIS targets has been activated.
OTHER WARNING	TUNE INITIALIZE	Tuning is being initialized.
	RD DATA ERROR	Data of SD card is corrupted.
	WR DATA ERROR	Data of SD card was not written correctly.
	SERVICE ENTRY	Service menu enabled (by serviceman).

### 1.28.3 Alarm summary

When an alarm is generated the color of the [ALARM] icon (top of display) turns red. You can see what alarms have been generated in the [ALARM SUMMARY] menu.

1. Right-click the [ALARM] icon to show the [ALARM] menu.



2. Click the [ALARM SUMMARY]. Active alarms are shown in red.  
Red, flashing: Active and not acknowledged.  
Red, not flashing: Active and acknowledged.

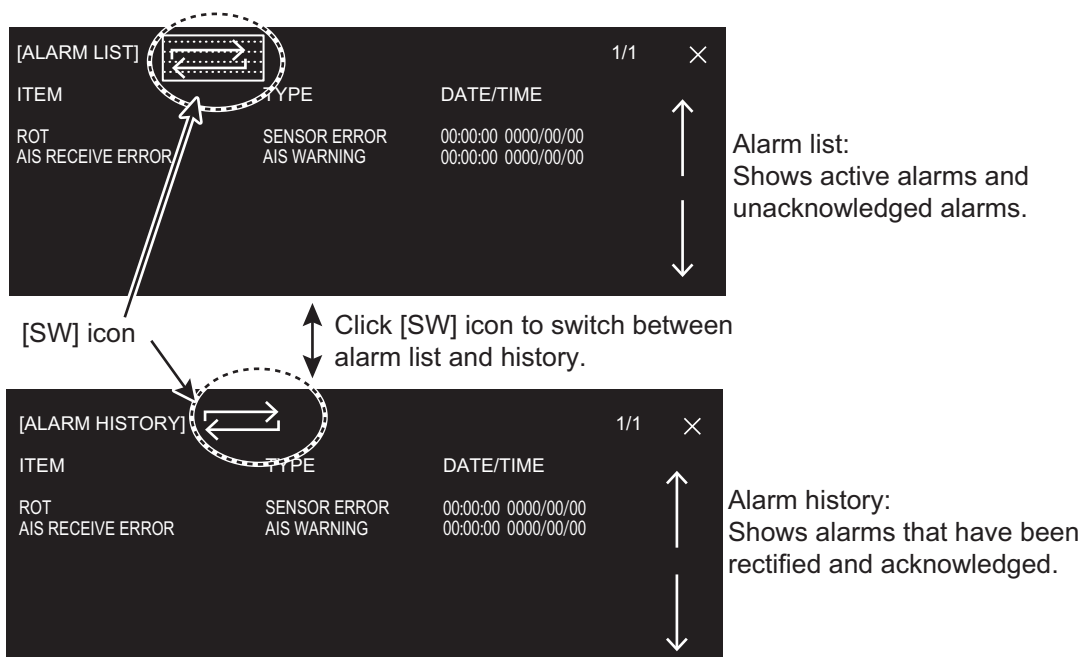


(at the bottom left corner on the screen)

Alarm indication	Meaning	Alarm indication	Meaning
[TRIG]	No trigger	[GYRO]	No gyro
[VIDEO]	No video	[LOG]	No log
[AZ]	No azimuth	[EPFS]	No EPFS
[HL]	No heading	[ROT]	No ROT (Rate of turn)

### 1.28.4 Alarm list/history

The alarm list displays the names of violated alarms, including the time and date violated. Unacknowledged alarms are displayed first in the list (in red text), in order from latest to earliest. When the cause of an alarm is removed, the alarm buzzer stops and the indication stops flashing. However, the alarm remains in the list until it is acknowledged. Acknowledged alarms which are rectified are moved to [Alarm History].



### 1.28.5 Depth alarm

The depth alarm warns you when the depth is shallower than the preset depth value. To change the depth, follow the steps below.

1. Open [MAIN MENU], click [NAV DATA].
2. Click [DEPTH].
3. Click [DEPTH ALARM VALUE] then set the value by rotating the setting knob. The setting range is 0.00 to 9.99 m.

**Note:** When the setting is 0.00, the alarm is not generated.

4. Click outside the menu window to close the menu.

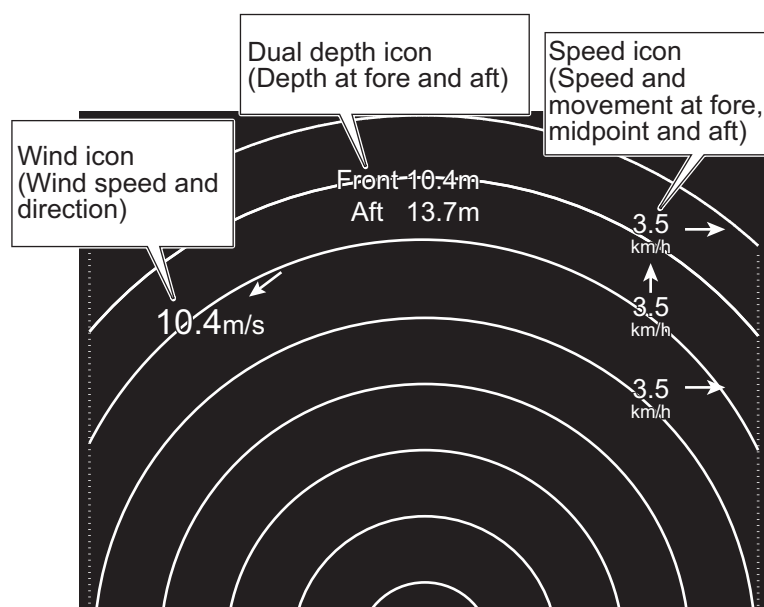
### 1.28.6 ROT alarm

The ROT graph displays ship's rate of turn (degrees/min) using the ROT signal fed from an ROT sensor. If the ROT data is lost, the indication "ROT ALARM" appears in [ALARM LIST] and the audio alarm sounds. To acknowledge loss of the ROT signal, click the [ALARM ACK] icon.

## 1.29 Docking Mode

The docking mode provides;

- Depth at the fore and aft
- Speed and movement at the fore, midpoint and aft
- Wind speed and direction



### 1.29.1 How to activate the docking mode

The docking mode can be shown in TX mode.

1. Open [MAIN MENU], click [DISPLAY].
2. Click [DOCKING MODE].
3. Click [ON] to display the docking icon at the minimum range among the available ranges. The docking icon [DOCK] is shown at the bottom left corner on the screen.

DOCKING MODE: [OFF]



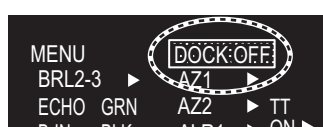
Docking icon is hidden.

DOCKING MODE: [ON]



[DOCK ON]

Docking information is shown.



[DOCK OFF]

Docking information is hidden.

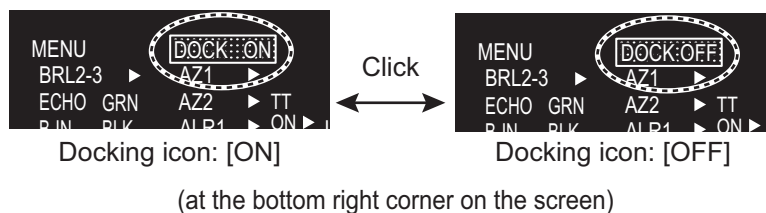
4. Click outside the menu window to close the menu.

### 1.29.2 How to show or hide the docking information display

You can show the docking information automatically at the following ranges. When you show the docking information, the radar display is shown at the minimum range.

- [RIVER] mode: 0.125 SM to 0.25 SM
- [SEA] mode: 0.125 NM to 0.25 NM, 0.125 SM to 0.25 SM, 0.125 km to 0.5 km, 0.125 kyd to 0.5 kyd

The docking information appears at the top of the radar screen. You can show or hide the information with the [DOCK] icon as shown below.



### 1.29.3 Wind speed and direction

Wind speed and direction are provided with the docking information display. Relative speed is indicated digitally and direction is shown with an arrow.



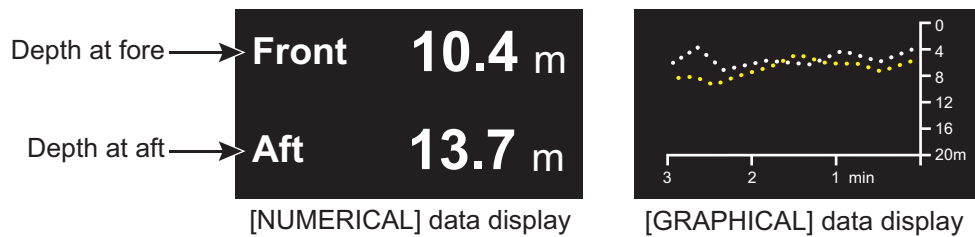
The wind of 10.4 m/s  
coming from 45° (relative)



### 1.29.4 Depth data

Depth at the fore and aft are shown with the docking information display. This feature requires fore and aft depth data.

**Note:** Dual depth requires two transducers.



*Depth data example*

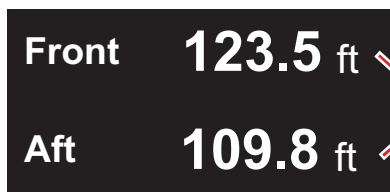
#### How to select the depth sensor

1. Open [MAIN MENU], click [NAV DATA].
2. Click [DEPTH].
3. Click [DUAL SENSOR].
4. Click the required sensor.  
 [BOTH]: Both fore and aft depths.  
 [FRONT]: Fore depth only.  
 [AFT]: Aft depth only.

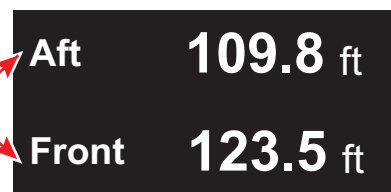
#### Depth indications and orientation mode

The stern mode shows aft depth on top.

Head up mode



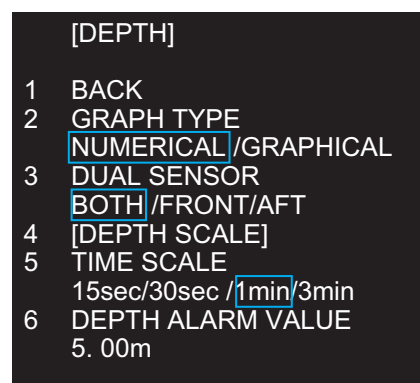
Stern up mode



#### Depth display format

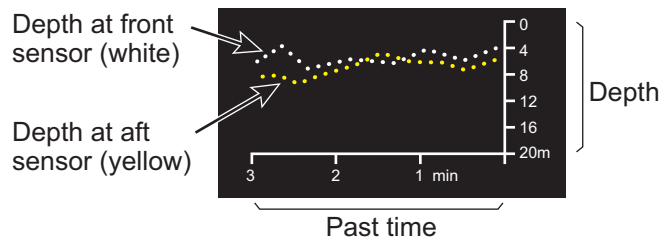
Depth can be shown digitally or in graph form.

1. Open [MAIN MENU], click [NAV DATA].
2. Click [DEPTH].
3. Click [GRAPH TYPE].
4. Click a required option.  
 [NUMERICAL]: Displays the depth data digitally.  
 [GRAPHICAL]: Displays the depth data graphically.



### 1.29.5 Depth graph

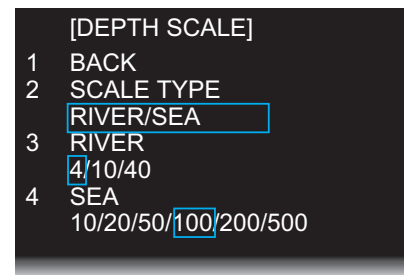
You can see the depth data in graph format by setting [GRAPH TYPE] to [GRAPHICAL] (see step 3 in "Depth display format" on page 1-41). The depth graph shows the depth history with dots, not a line.



*Depth graph example*

#### How to set depth graph

1. Open [MAIN MENU], click [NAV DATA].
2. Click [DEPTH].
3. Click [DEPTH SCALE].
4. Click [SCALE TYPE].
5. Click the scale to use, [RIVER] or [SEA].
6. Click an appropriate option for the scale selected at step 5.  
[RIVER]: 4, 10, 40  
[SEA]: 10, 20, 50, 100, 200, 500
7. Click [BACK] to go back the [DEPTH] window.
8. Click [TIME SCALE].
9. Click the time scale (horizontal axis) for the depth graph, among 15 sec, 30 sec, 1 min and 3 min.
10. Click outside the menu window to close the menu.



#### How to select the depth sensor(s)

The depth graph can show depth data from the front and/or aft. The front data is shown in white; aft data is yellow. See "Depth menu" on page 1-52 to select the depth sensor.

### 1.29.6 Speed and movement indications

The docking mode provides speed and movement indications at the fore, midpoint and aft. This feature requires data from a GPS sensor or satellite compass.

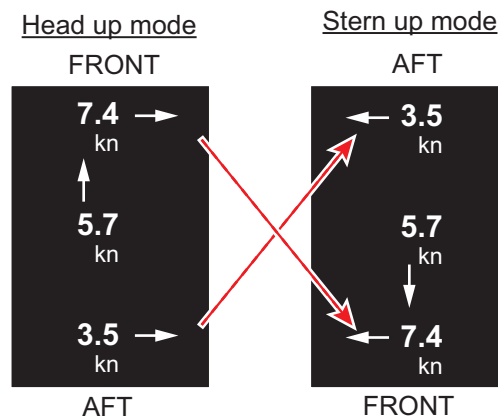
#### How to select the speed sensor

1. Open [MAIN MENU], click [NAV DATA].
2. Click [PREDICTION].
3. Click [OWN SHIP POSITION].
4. Click a sensor.  
[DUAL-GPS]: Display fore-aft and port-starboard speeds, fed from GPS navigator.  
[SC]: The speed data from satellite compass.

5. Click outside the menu window to close the menu.

### **Speed and movement indications and orientation mode**

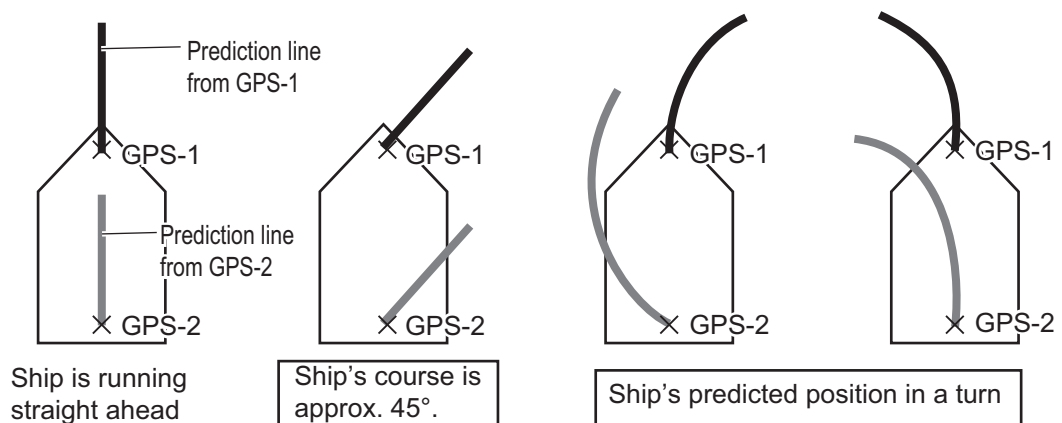
The stern mode shows aft speed on top.



## 1.30 How to Predict Own Ship's Position

You can predict ship's position in the vector time selected. This function requires two GPS sensors and heading data. Some settings for own ship vector are required as follows:

Menu items	Settings	Reference
[OWN SHIP VECTOR]	[COURSE]	paragraph 1.37.4
[VECTOR TIME]	Set a time between 30 seconds to 6 minutes. <b>Note:</b> The shorter the time the more accurate the prediction. [30sec] or [1min] is recommended.	paragraph 2.10.2



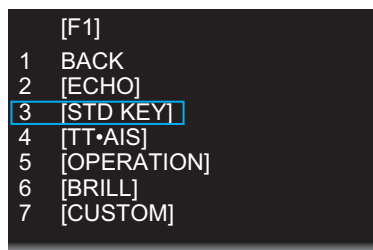
## 1.31 How to Program Function Keys (F1 and F2)

You can program function keys (**F1** and **F2**) to provide one-touch access to a required function. To activate a function, press the applicable function key, **F1** or **F2**.

The default settings for the **F1** and **F2** keys are [ORIENTATION MODE] and [DOCK-ING] respectively.

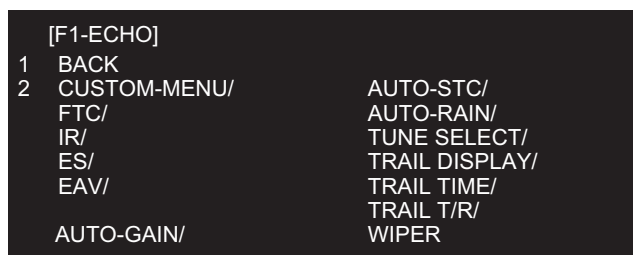
### How to program a function key

1. Open [MAIN MENU], click [CONFIGURATION].
2. Click [FUNCTION KEY].
3. Click the function key ([F1] or [F2]) to program.

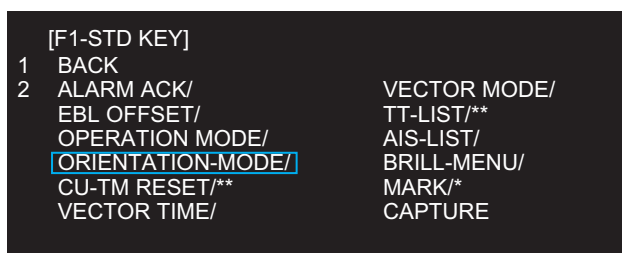


4. Click the appropriate category. The options for each category are shown on the below and on the next page. Some items have multilevel options.

- Options available in the [ECHO] menu

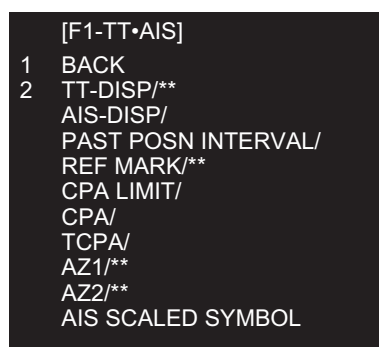


- Options available in the [STD KEY] menu



\*: [RIVER] mode only  
 \*\*: [SEA] mode only

- Options available in the [TT·AIS] menu



\*\* : [SEA] mode only

- Options available in the [OPERATION] menu

[F1-OPERATION]	
1 BACK	
2 ECHO COLOR/	MARK/LINE-ON/*
MONITOR BRILL/	BARGE-ON/*
PANEL DIMMER/	MAP ALIGN/*
TRANSPARENCY/	MARK/LINE ALL DELETE/*
ALARM1/**	BARGE ALL DELETE*
ALARM2/**	
ECHO AREA/**	
DOCKING/	

\*: [RIVER] mode only

\*\*: [SEA] mode only

- Options available in the [BRILL] menu

[F1-BRILL]	
1 BACK	
2 USER NAME 1	4 USER NAME 3
BRL1-1/	BRL3-1/
BRL1-2/	BRL3-2/
BRL1-3/	BRL3-3/
BRL1-4	BRL3-4
3 USER NAME 2	5 USER NAME 4
BRL2-1/	BRL4-1/
BRL2-2/	BRL4-2/
BRL2-3/	BRL4-3/
BRL2-4	BRL4-4

- The available function to program in the [CUSTOM] menu

[F1-CUSTOM]	
1 BACK	
2 USER NAME 1	4 USER NAME 3
CUSTOM1-1/	CUSTOM3-1/
CUSTOM1-2/	CUSTOM3-2/
CUSTOM1-3/	CUSTOM3-3/
CUSTOM1-4	CUSTOM3-4
3 USER NAME 2	5 USER NAME 4
CUSTOM2-1/	CUSTOM4-1/
CUSTOM2-2/	CUSTOM4-2/
CUSTOM2-3/	CUSTOM4-3/
CUSTOM2-4	CUSTOM4-4

- Click outside the menu window to close the menu.

## 1.32 Markers

### 1.32.1 [MARK] menu

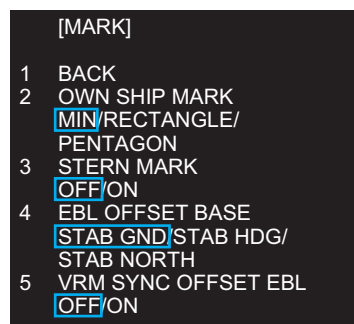
The [MARK] menu lets you:

- Change the configuration of the own ship mark
- Show or hide the stern mark
- Set the reference point for the offset EBL
- Activate VRM with the offset EBL

1. Open [MAIN MENU], click [MARK].



[MARK] menu ([RIVER] mode)



[MARK] menu ([SEA] mode)

2. Click the item.

[OWN SHIP MARK]	Select the shape of own ship mark.
[STERN MARK]	Select on/off the stern mark display.
[EBL OFFSET BASE] ([SEA] mode only)	See paragraph 1.20.3.
[VRM SYNC OFFSET EBL] ([SEA] mode only)	Turn this feature on to automatically activate applicable VRM when using an offset EBL.

3. Click the required option.
4. Click outside the menu window to close the menu.

### 1.32.2 Heading line

The heading line indicates the ship's heading in all orientation modes. The heading line is a line from the own ship position to the outer edge of the radar display area and appears at zero degrees on the bearing scale in head-up mode. It changes its orientation depending on the ship orientation in north-up and true motion modes.

#### How to hide the heading line temporarily

To temporarily hide the heading line to look at targets existing dead ahead of own ship, press the **HL OFF** key on the control unit. Release the key to redisplay the heading line, etc.

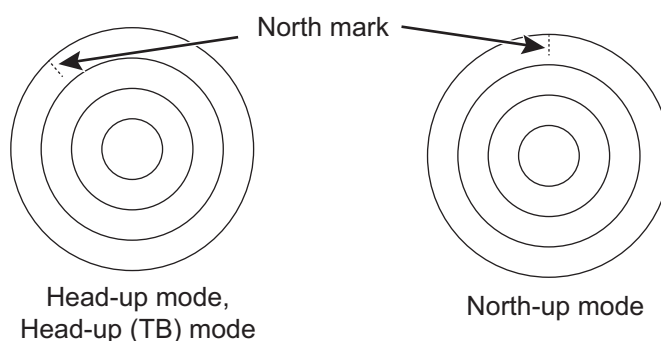
### 1.32.3 Stern mark

The stern marker, which is a dot-and-dash line, appears opposite to the heading line. To display or erase this marker do the following:

1. Open the [MARK] menu, click [STERN MARK].
2. Click [OFF] or [ON] as appropriate.
3. Click outside the menu window to close the menu.

### 1.32.4 North mark

The north mark appears as a short dashed line. The north mark moves around the bearing scale in accordance with the compass signal in the head-up, head-up (TB) or stern-up mode.

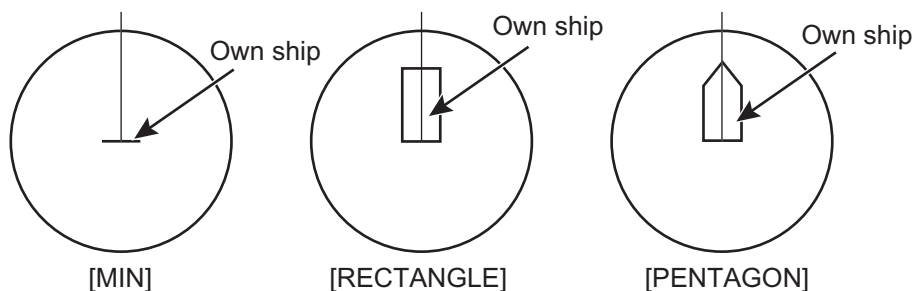


**Note:** It is not possible to delete the north mark. The north mark is always indicated while heading data is input.

### 1.32.5 Own ship mark

The own ship symbol marks own position on the display. The symbol is selected from the [MARK] menu.

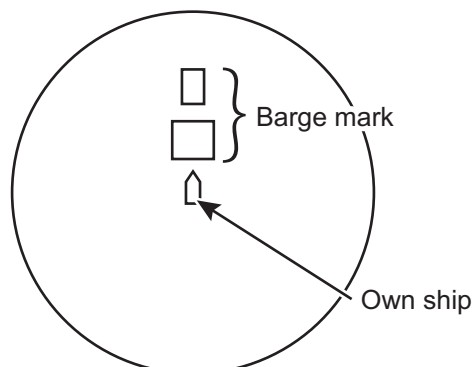
1. Open the [MARK] menu, click [OWN SHIP MARK].
2. Click the own ship mark shape to use.



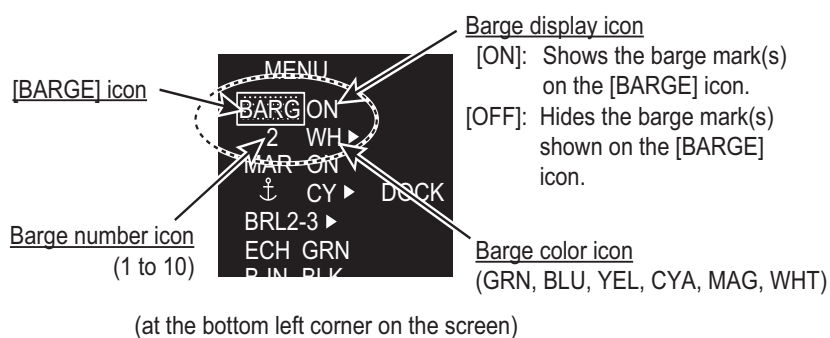
3. Click outside the menu window to close the menu.

### 1.32.6 Barge mark

You may mark the locations of barges on the display with barge mark. This function is available for [RIVER] mode only.

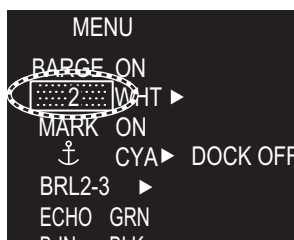


The barge mark is a set of rectangles drawn to indicate the outline of barges. You can create a max. total of 10 barge marks. There are four icons for the barge mark as follows:

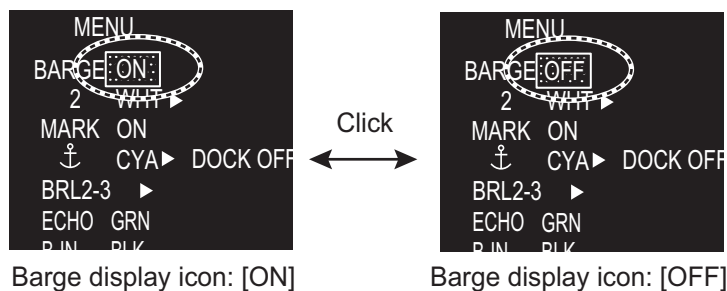


#### How to show a barge mark on the screen

1. Click the barge number icon then rotate the setting knob to select the barge number (1 to 10).



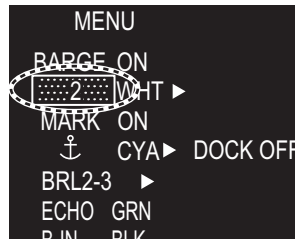
2. Click the barge display icon to show or hide.



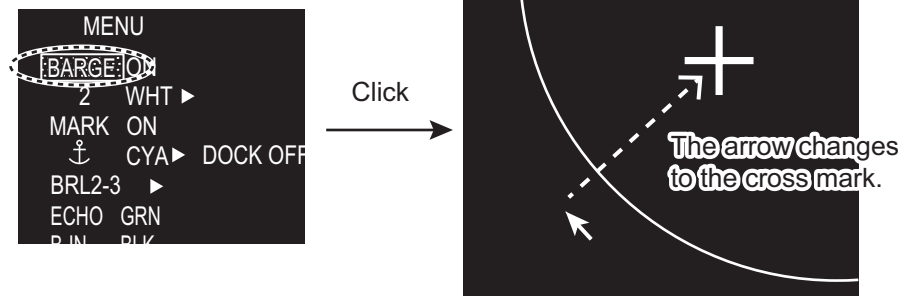


**How to create a barge mark on the screen**

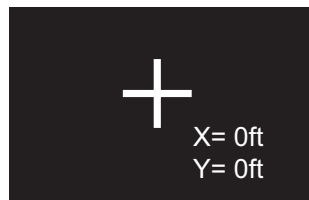
1. Click the barge number icon then rotate the setting knob to select the barge number (1 to 10).



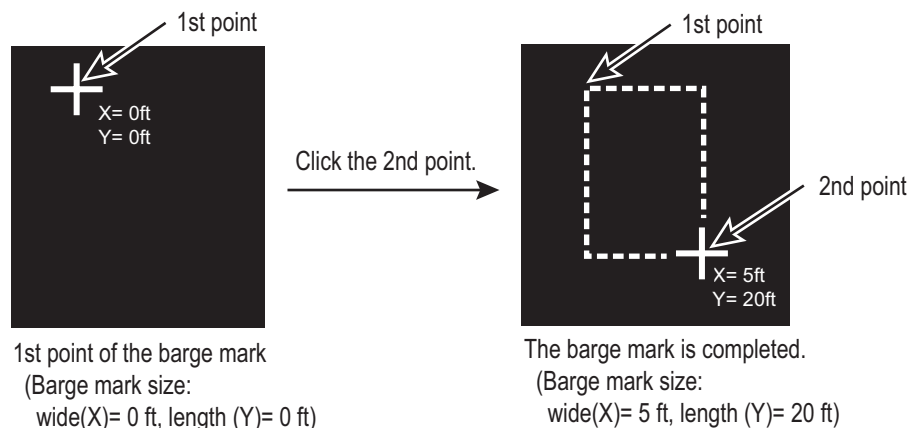
2. Click the [BARGE] icon to enable creation of the barge mark. The cursor shape changes from an arrow to a cross mark.



3. Click the start point (X-axis and Y-axis) of the barge mark.



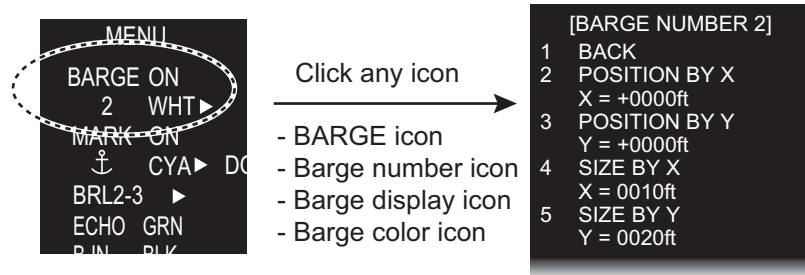
4. Select the 2nd point of the barge mark. As you drag the cursor, the width of the X-axis and Y-axis are displayed and the barge mark is drawn with a dashed line.



5. Click the 2nd point to complete the barge mark. The mark changes to a rectangle with the solid line.

### How to create a barge mark from the [BARGE ICON] menu

1. Right-click the any icon of barge mark to show the [BARGE NUMBER] menu.

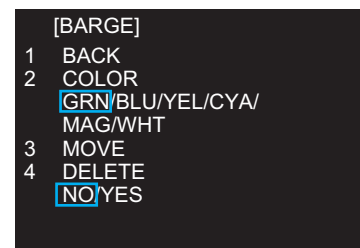


2. Click [POSITION BY X].
3. Set start point in X-axis for drawing the barge mark with the left and right buttons.
4. Click [POSITION BY Y].
5. Set start point in Y-axis for drawing the barge mark with the left and right buttons.
6. Click [SIZE BY X].
7. Set the width of the barge mark with the left and right buttons.
8. Click [SIZE BY Y].
9. Set the length of the barge mark with the left and right buttons.

### How to edit a barge mark on the screen

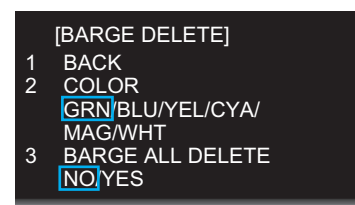
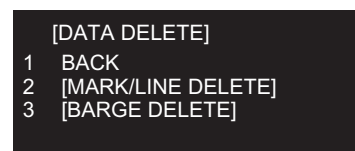
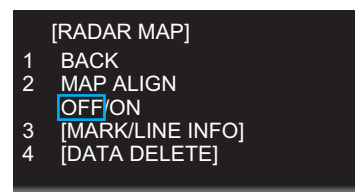
If the barge mark is currently displayed, go to step 3.

1. Select the barge number icon to show the barge number to edit. Also, you can select the barge mark directly by putting the cursor on the line of the barge mark (In this case, go to step 3).
2. Set [ON] at the display icon to display the barge mark to edit. The selected barge mark turns red.
3. Right-click the barge mark.
4. Click the required action and its option.  
[COLOR]: Change the color of the barge mark.  
[MOVE]: Drag and drop the barge mark by the touch pad.  
[DELETE]: Delete the barge mark.



**How to delete barge marks by color**

1. Open [MAIN MENU], click [RADAR MAP].
2. Click [DATA DELETE].
3. Click [BARGE DELETE].
4. Click [COLOR].
5. Click the barge color to delete.
6. Click outside the menu window to close the menu.

**How to delete all barge marks**

1. Do the procedure from step 1 to step 3 in "How to delete barge marks by color" on page 1-51.
2. Click [BARGE ALL DELETE].
3. Click [YES].
4. Click outside the menu window to close the menu.

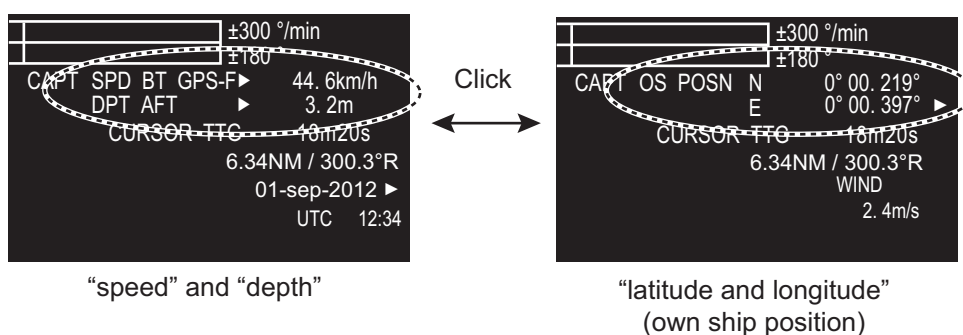
**1.33 NAV Data**

The following navigation data may be set up on the menu.

- |                               |                |                     |
|-------------------------------|----------------|---------------------|
| - Speed                       | - Depth        | - Own ship position |
| - Time to the cursor position | - Wind         | - Date              |
| - ROT graph                   | - Rudder graph | - AUTOPILOT graph   |

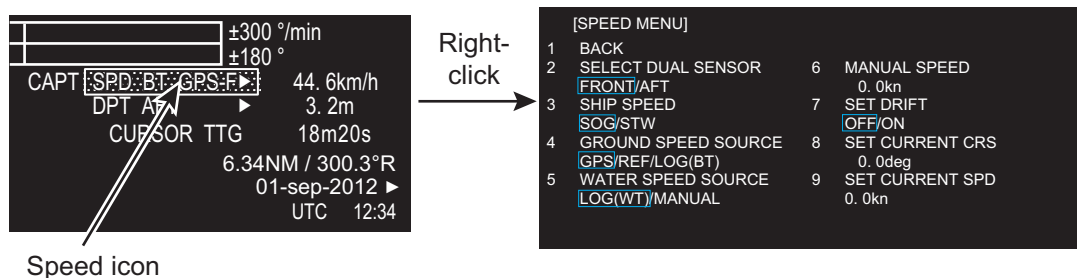
**1.33.1 How to show ship's position or speed and depth alternately**

At the top right corner on the screen, click the icon below to switch between "Speed and Depth" and "Own ship position".



**Speed menu**

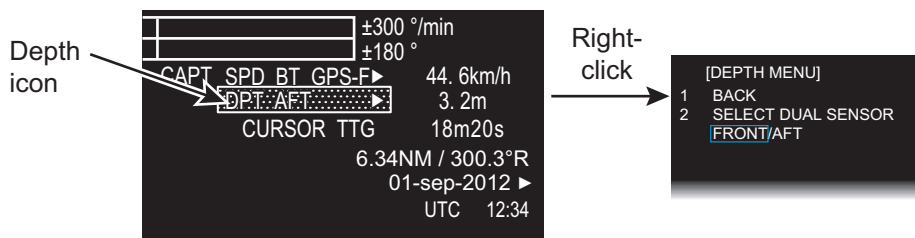
Right-click the speed icon ([SPD]) to show [SPEED MENU].



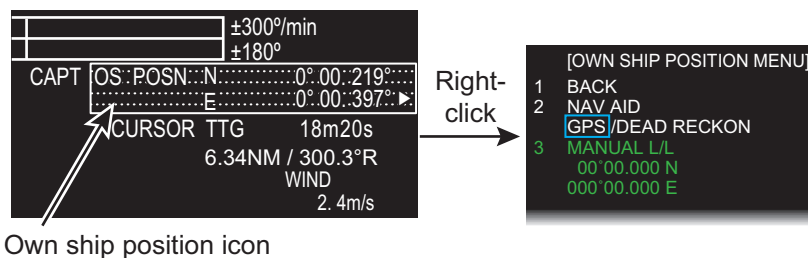
- [SELECT DUAL SENSOR]: Select the sensor data, [FRONT] or [AFT].
- [SHIP SPEED]: Select the speed indication format, [SOG] (speed over ground) or [STW] (speed towards water).
- [GROUND SPEED SOURCE]: Select the input source for SOG.
- [WATER SPEED SOURCE]: Select the input source for STW.
- [MANUAL SPEED]: Input the speed manually.
- [SET DRIFT]: Turn on or off drift.
- [SET CURRENT CRS]: Set the direction of the tide.
- [SET CURRENT SPD]: Set the speed of the tide.

**Depth menu**

Right-click the depth icon ([DPT]) to show [DEPTH MENU].



Click [SELECT DUAL SENSOR]. Then, click the depth sensor to use to show depth data, [FRONT] or [AFT].

**Own ship position menu**

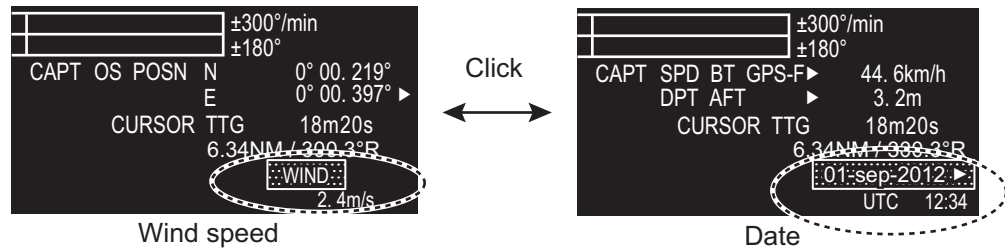
Right-click the own ship position icon to show [OWN SHIP POSITION MENU].

- [NAV AID]: Click the source of ship position data, [GPS] or [DEAD RECKON] (dead reckoning).
- [MANUAL L/L]: For [DEAD RECKON], enter the latitude and longitude, using the software keyboard.

### 1.33.2 How to show wind data or date alternately

Click the icon shown below to show wind data or date alternately.

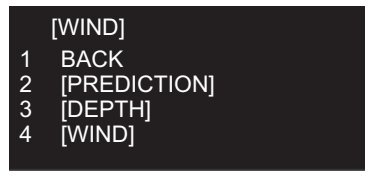
(at the top right corner on the screen)



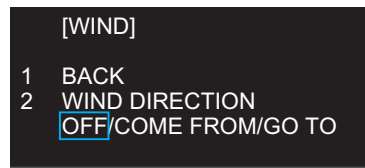
#### Wind direction format

Wind direction format can be selected on the [NAV DATA] menu, with the [WIND] window.

1. Open [MAIN MENU], click [NAV DATA].
2. Click [WIND].



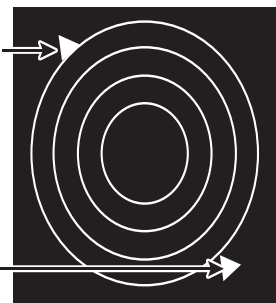
3. Click [WIND].



4. Click [WIND DIRECTION] then click [GO TO] or [COME FROM], referring to the figure right. [OFF] hides the wind direction.

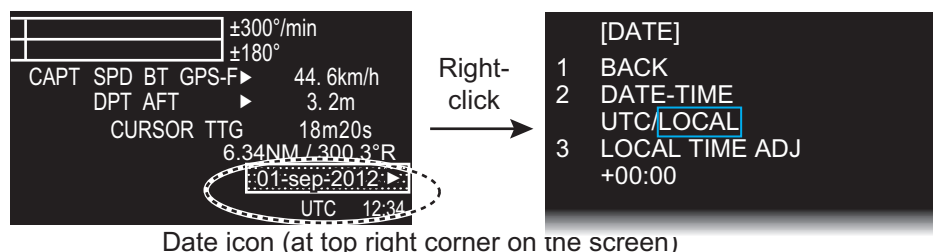
Wind direction symbol:  
[GO TO]

Wind direction symbol:  
[COME FROM]



#### Date menu

The [DATE] menu lets you select the time to display, [UTC] or [LOCAL]. Right-click the Date icon to show the [DATE] window.

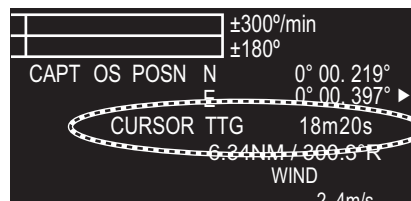


- [DATE-TIME]: Select how to display format of date and time, [UTC] or [LOCAL].  
**Note:** If [LOCAL] is selected, the indication [LOCAL] is not shown.
- [LOCAL TIME ADJ]: If [LOCAL] is selected at [DATE-TIME], set the time difference between local time and UTC time.

## 1. OPERATION

### 1.33.3 Time to the cursor position

The time from own ship to the cursor position (TTG: time-to-go) is shown at the top right corner on the screen.

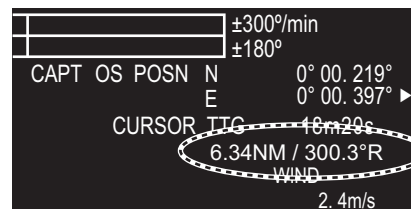


### 1.33.4 Cursor position

The cursor position (range and bearing of cursor from the own ship) is shown at the top right corner on the screen.

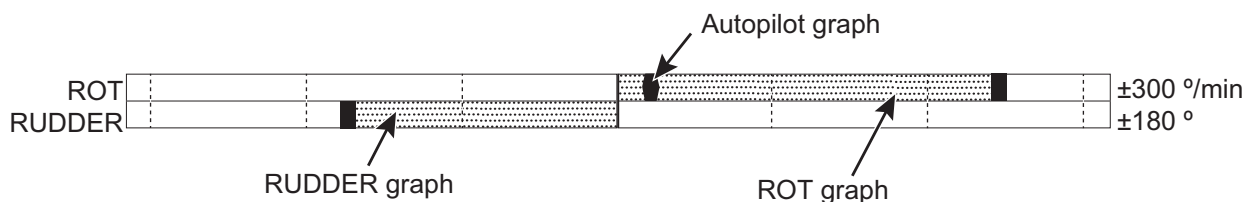
The bearing reference is changed simultaneously with the EBL1 reference.

To change the cursor position's bearing reference, click EBL1's bearing reference icon. See section 1.19 for details.



### 1.33.5 ROT, Rudder and Autopilots Graphs

The ROT (Rate of Turn), RUDDER and AUTOPILOT graphs appear at the top of the screen.



#### ROT graph

The ROT graph displays ship's rate of turn (degrees/min), using the ROT signal fed from an ROT sensor. The ROT graph is not shown if the ROT signal is lost or interrupted.

To set the ROT graph scale:

1. Open [MAIN MENU] then click [NAV DATA].
2. Click [ROT SCALE].
3. Click the desired scale among 30 degrees, 90 degrees and 300 degrees.

#### Rudder graph

The rudder graph shows the rudder angle. The rudder graph is not shown if the rudder signal is lost or interrupted.

To set the rudder graph scale:

1. Open [MAIN MENU] then click [NAV DATA].
2. Click [RUDDER SCALE].
3. Click the desired scale among 30 degrees, 90 degrees, 120 degrees and 180 degrees.

### Autopilot graph

#### 1) **Follow-up (FU) mode**

When the autopilot is in the follow-up mode, the follow-up rudder command is indicated on the RUDDER scale. In addition, "▽ FOLLOW UP" is indicated at the top of the screen. In follow-up mode, the autopilot controls the rudder so that actual rudder angle becomes same as commanded one.

#### 2) **Autopilot (AP) mode**

When the autopilot is in the "autopilot" mode and a ROT signal is available from the autopilot, the autopilot graph shows ROT command. The actual ROT command set on the autopilot is represented by a small circle on the ROT scale. In addition, "△ AUTOPILOT" is indicated at the top of the screen. In "autopilot" mode, the autopilot controls the ROT so that actual heading becomes same as commanded one.

#### 3) **Neither FU nor AP mode**

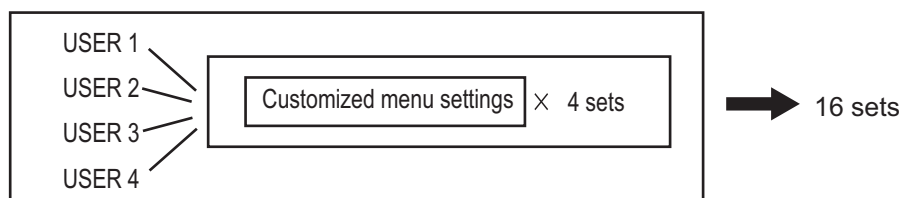
When the autopilot is in neither FU nor AP mode, the autopilot graph shows ROT command as default.

#### 4) **No autopilot or on standby**

The autopilot graph is not shown if the signal is lost/interrupted or if there is no autopilot connected (includes standby mode).

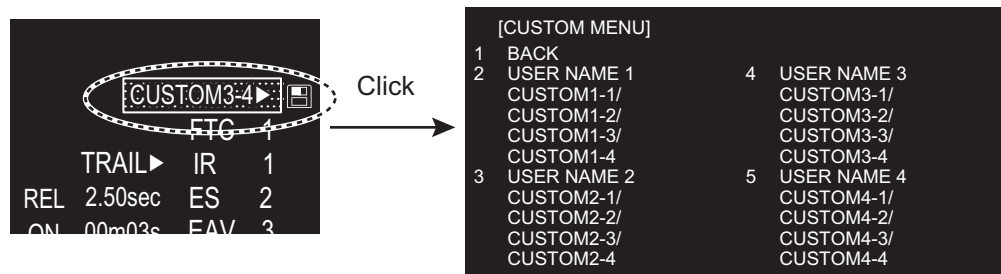
## 1.34 Customized Menus

Up to four customized menu settings can be saved for up to four different user profiles. In other words, you can save up to 16 sets of menu settings.



### How to select the customized set

1. Click the [CUSTOM] icon at the bottom right corner on the screen to show the [CUSTOM MENU] window.

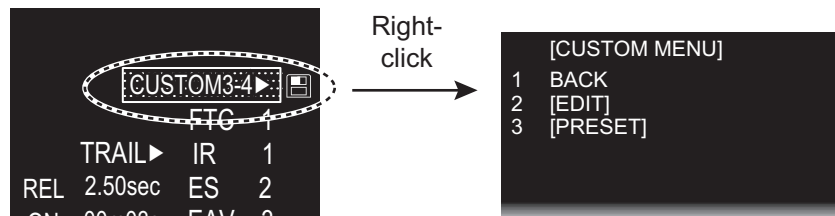


2. Click the required user name.
3. Click the required menu set.
4. Click outside the menu window to close the menu.

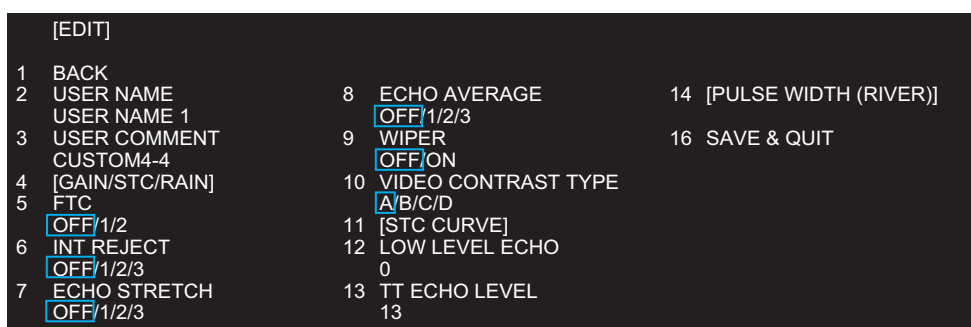
**How to edit the [CUSTOM MENU]**

**Note:** The [CUSTOM1-1] setting is fixed as a default setting. You can edit the setting, but when the system is turned off, the default setting are restored. To save a customized set, select a setting other than [CUSTOM1-1].

1. Right-click the [CUSTOM] icon at the bottom right corner on the screen to show the [CUSTOM MENU] window.



2. Click [EDIT].



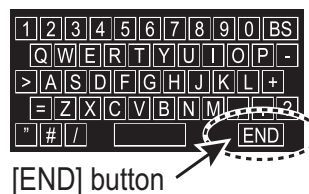
#15 [PULSE WIDTH (SEA)] for [SEA] mode instead of #14

3. Click [USER NAME] to edit.



4. To edit the name, click the name column then enter the name with the software keyboard. Click the [END] button to finish.

- Change the digit: Rotate scroll wheel.
- Delete a character: Use the [BS] button on the software keyboard.



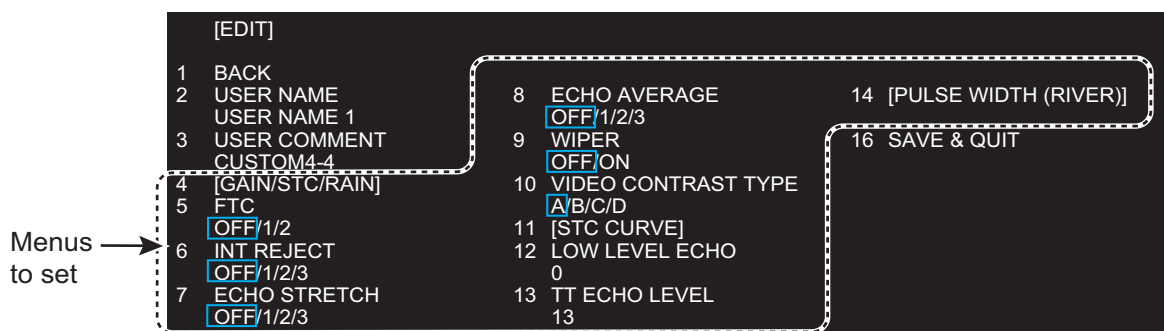
5. Click [USER COMMENT] to edit.  
The editing procedure is the same as that for [USER NAME]. Refer to step 4



6. To edit the name, press the name column then enter the name with the software keyboard. Click the [END] button to finish.



7. Click the menu to set in the [EDIT] menu.



#15 [PULSE WIDTH (SEA)] for [SEA] mode instead of #14

8. Click the setting for each menu.  
9. Click [SAVE & QUIT] to save the setting.

## 1.35 SD Cards

The SD card (including SDHC card) stores the mark data etc.

### 1.35.1 About the SD cards

- Use SD cards carefully. Wrong use can damage the card and destroy its contents.
- Make sure the cover of the card drive is closed at all times.
- Remove a card with only your fingers. Do not use metal tools (like tweezers) to remove the card.
- Do not remove a card during the reading of the card or writing to the card.
- If there is water at the bottom of the card cover, DO NOT open the cover. Remove the water with a dry cloth completely and then open the cover.
- The SD cards with the SD or SDHC logo can be used (max. 32 GB). Some SD cards may not work correctly depending on the card type or maker. The memory cards in the table below have been tested and confirmed:

Type	Capacity	Maker	Class
SDSDB-8192-J95A	8 GB	SanDisk	4
SDSDX-008G-J95	8 GB	SanDisk	10
SD-E008G4	8 GB	TOSHIBA	4
RP-SDW08GJ1K	8 GB	Panasonic	10
SDSDX-016G-J35	16 GB	SanDisk	10
RP-SDWA16GJK	16 GB	Panasonic	10

#### How to format an SD card

You need to format an SD card for use with your PC. If the card becomes corrupted, format the card with a formatting program that is compatible with the specifications of the SD card. The SD Memory Card Formatting Software made by Panasonic is an example.



### **How to set an SD card**

The processor unit has two slots for SD cards. The [SD-1] is upper slot and [SD-2] is lower.

1. Pull the tab on the card drive on the processor unit to open the card drive.
2. Put the SD card in the either card drive, [SD-1] or [SD-2], with the label upward. If the card does not set easily, do not use force.
3. Push the card until the card is in position.

### **How to remove an SD card**

To remove an SD card, select [SD-1] or [SD-2] from the [REMOVE EXTERNAL MEDIA] menu. There are two methods to open [REMOVE EXTERNAL MEDIA] as follows.

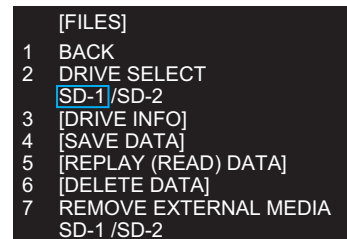
- [MAIN MENU]–[FILES]–[REMOVE EXTERNAL MEDIA]
  - [MAIN MENU]–[CAPTURE]–[REMOVE EXTERNAL MEDIA]
1. On [FILES] or [CAPTURE] menu, select [REMOVE EXTERNAL MEDIA].
  2. Select the SD card to remove, [SD-1] or [SD-2].  
**Note:** Select the same card as the card selected on the [DRIVE SELECT] menu.
  3. Pull the tab on the card drive cover to open the card drive.
  4. Push the card to release the card from the card drive.
  5. Remove the card with your fingers then close the cover.

**Note:** Always remove an SD card by this method to prevent non-recognition of the card the next time when it is inserted. If a card is not recognized, insert the card again and do the above operation.

### **1.35.2 How to save and replay the data**

All SD card operations begin from the [FILES] menu. The [FILES] menu is available in stand-by mode.

The data which is saved in the FR-1908V-BB/FR-1918V-BB do not have the compatibility with other models. Do not let the data read to the other models, and also do not let other models read the data of the FR-1908V-BB/FR-1918V-BB. It may cause the malfunction.



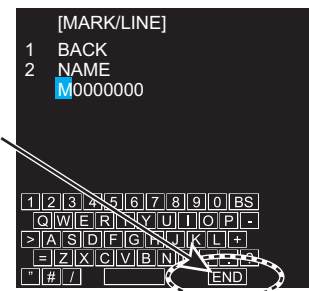
```
[FILES]
1 BACK
2 DRIVE SELECT
  SD-1/SD-2
3 [DRIVE INFO]
4 [SAVE DATA]
5 [REPLAY (READ) DATA]
6 [DELETE DATA]
7 REMOVE EXTERNAL MEDIA
  SD-1 /SD-2
```

**Note:** All settings, except for [BRILL 1-1] and [CUSTOM 1-1], are stored when the radar is turned off. If you want to keep all settings, including [BRILL 1-1] and [CUSTOM 1-1], save the settings to an SD card before turning off the radar. Then replay the saved settings after turning on the radar.

- [DRIVE SELECT]: Click the drive [SD-1] or [SD-2] to use. The [SD-1] is upper slot and [SD-2] is lower.
- [DRIVE INFO]: Confirm the remaining capacity of the SD card selected at [DRIVE SELECT].

- [SAVE DATA]: Save the file stored on the following file group set at [NAME]. Set the name with the software keyboard. Click the [END] key to complete the name setting.  
[MARK/LINE]\* (see the figure shown right)  
[SETTING DATA]  
[ALARM HISTORY]  
[LOG FILE]

[END] key



- [REPLAY (READ) DATA]: Select the data group in the SD card, [MARK/LINE]\* or [SETTING DATA], then select the file to replay (read).
- [DELETE DATA]: Select the data group to delete from SD card, [MARK/LINE]\*, [SETTING DATA], [ALARM HISTORY] or [LOG FILE], then select the file to delete.
- [REMOVE EXTERNAL MEDIA]: Select the SD card ([SD-1] or [SD-2]) to remove from the card slot safely.

**Note:** Select the same card as the card selected on the [DRIVE SELECT] menu.

\*: [RIVER] mode only

## 1.36 How to Set Menu and Icon Behavior

### 1.36.1 Auto closing of menu window

In the [SEA] mode, the menu window can be set to close automatically if there is no menu operation within the specified period.

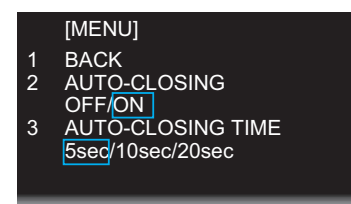
You can close the menu window automatically after a certain period with no operation.

**Note:** This function is for the [SEA] mode only.

1. Open [MAIN MENU], click [DISPLAY].
2. Click [MENU].
3. Click [AUTO-CLOSING].

**Note:** In the [RIVER] mode, auto closing is fixed to [ON]. Go to step 5 to select the closing time.

4. Click the [ON] or [OFF] as applicable.
5. Click [AUTO-CLOSING TIME].
6. Click the appropriate time to close the menu window automatically among 5 sec, 10 sec and 20 sec.
7. Click outside the menu window to close the menu.



## 1.36.2 Icons

You can show or hide some labels and auto hide them after the specified period elapsed.

### How to select the menu icons to display

1. Open [MAIN MENU], click [DISPLAY].
2. Click [HIDDEN ICON].



3. Click each item (from 4 [RANGE] to 13 [DOCKING]) then click [ON] to display the icon, or [OFF] to hide the icon.
4. Click outside the menu window to close the menu.

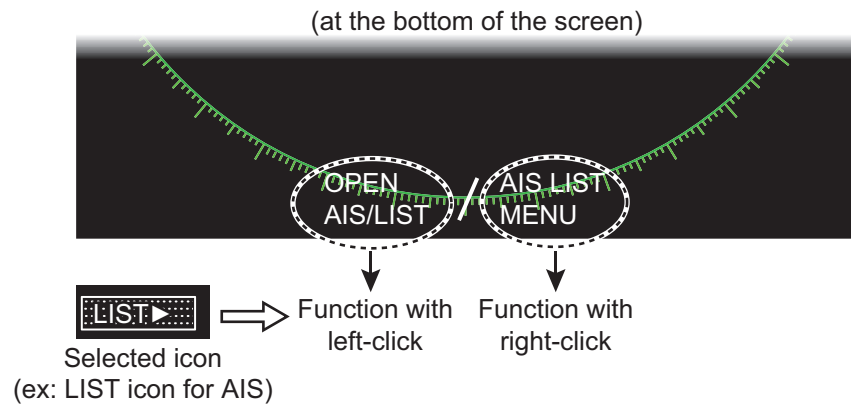
### How to hide the menu icons automatically

1. Open [MAIN MENU], click [DISPLAY].
2. Click [HIDDEN ICON].
3. Click [AUTO-HIDDEN].
4. Click [ON] to enable automatic hiding of the icons. Any icon selected to [OFF] (on [HIDDEN ICON]) is automatically hidden.
5. Click [AUTO-HIDDEN TIME].
6. Click the appropriate time to hide the menu icons automatically among 5 sec, 10 sec and 20 sec.
7. Click outside the menu window to close the menu.

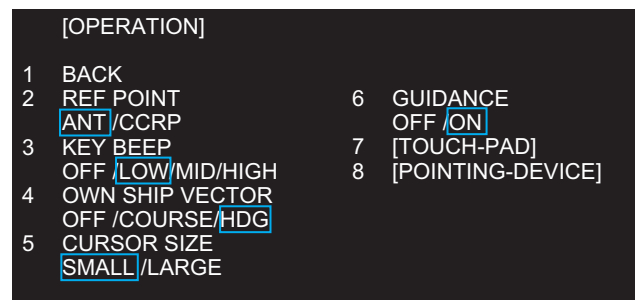
## 1.37 Other Features

### 1.37.1 Guidance box (Help function)

The Guidance box provides operating guidance for a cursor-selected item. You can show or hide the guidance as follows:



1. Open [MAIN MENU], click [CONFIGURATION].
2. Click [OPERATION].



3. Click [GUIDANCE].
4. Click [ON] or [OFF] as appropriate.
5. Click outside the menu window to close the menu.

### 1.37.2 Menu transparency

You can make the menu window transparent or opaque as follows:

**Note:** Alpha blending technology is used for transparency effects.

1. Open [MAIN MENU], click [DISPLAY].
2. Click [TRANPARENCY].
3. Click [ON] or [OFF] as appropriate.  
[ON]: Menu window is transparent.  
[OFF]: Menu window is opaque. Echoes are hidden behind the menu.
4. Click outside the menu window to close the menu.

### 1.37.3 Display capture

You can capture the screen shots to replay them on the PC. The setting for the display capture is set on the [CAPTURE] menu. To open the [CAPTURE] menu, open [MAIN MENU] then click [CAPTURE]. The [CAPTURE] menu is available in the stand-by mode.

#### [CAPTURE]

- 1 BACK
- 2 DRIVE SELECT  
SD-1 /SD-2
- 3 [DRIVE INFO]
- 4 [AUTO CAPTURE]
- 5 [DELETE CAPTURE DATA]
- 6 REMOVE EXTERNAL MEDIA  
SD-1 /SD-2

#### Manual capture

You can capture the screen manually by clicking the [CAPT] icon. The screen shots captured are saved to the SD card.

#### Automatic capture

Automatic capture functions to save images in two data groups ([NORMAL], [FAST]) automatically. The captured data are automatically saved to the SD card.

Data group	Contents of files
NORMAL	Captured files at specified interval set in the [INTERVAL] menu, for the last 24 hours.
FAST	Captured files at 10 seconds interval, for the last one hour.

1. Open [MAIN MENU], click [CAPTURE].
2. Click [AUTO CAPTURE].

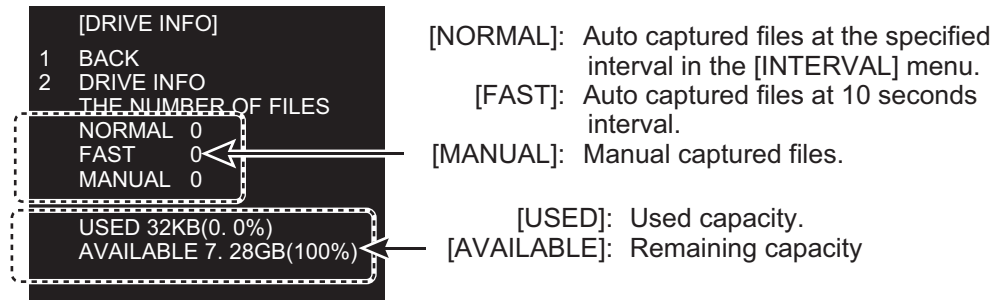
#### [AUTO CAPTURE]

- 1 BACK
- 2 AUTO CAPTURE  
OFF/ON
- 3 INTERVAL  
000min

3. Click [AUTO CAPTURE] then [ON].
4. Click [INTERVAL].
5. Set the time interval for the capture. The setting range is from 1 min to 999 min.
6. Click outside the menu window to close the menu.

**[CAPTURE] menu items**

- [DRIVE SELECT]: Click the drive [SD-1] or [SD-2] to use. The [SD-1] is upper slot and [SD-2] is lower.
- [DRIVE INFO]: Confirm the number of screen shots saved and the remaining capacity of the SD card selected at [DRIVE SELECT].

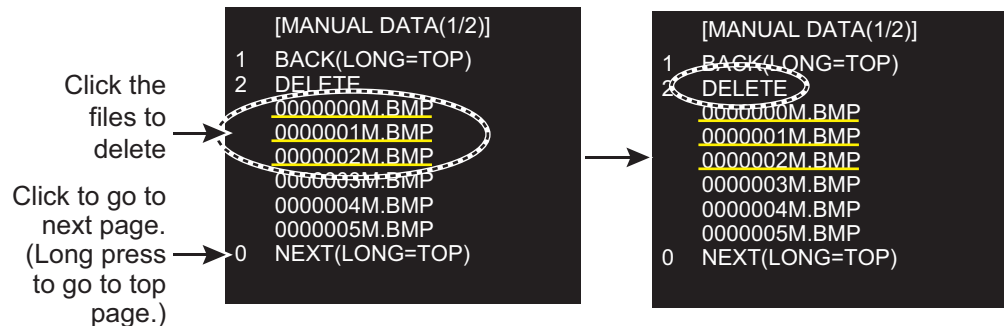
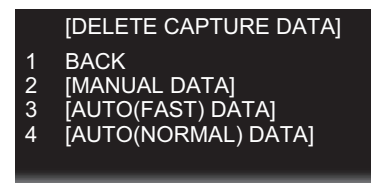


The duration to save the captured files depends on the capacity of an SD card.

Capacity of SD card	Duration (for blank SD card)
8 GB	Latest approx. 21 hours
16 GB	Latest 24 hours

- [DELETE CAPTURE DATA]: Delete the selected files. You can select more than one file to delete.

- 1) Click the data group including files to delete, [MANUAL DATA], [AUTO (FAST) DATA] or [AUTO (NORMAL) DATA].
- 2) Select the files to delete. The yellow lines appear under the names of selected files.
- 3) Select [DELETE].



- [REMOVE EXTERNAL MEDIA]: Select the SD card ([SD-1] or [SD-2]) to remove from the card slot safely.

**Note:** Select the same card as the card selected on the [DRIVE SELECT] menu.

### 1.37.4 How to customize the operation

You can customize the operation on the [OPERATION] menu.

Open [MAIN MENU], click [CONFIGURATION]. Then click [OPERATION] to open the [OPERATION] menu.

[OPERATION]	
1	BACK
2	REF POINT ANT /CCRP
3	KEY BEEP OFF /LOW/MID/HIGH
4	OWN SHIP VECTOR OFF /COURSE/HDG
5	CURSOR SIZE SMALL /LARGE
6	GUIDANCE OFF /ON
7	[TOUCH-PAD]
8	[POINTING-DEVICE]

[REF POINT]:

The reference point for measurements (range, bearing, etc.) and markers (heading line, stern mark, etc.) can be antenna point or consistent common reference point (CCRP), which is a location on own ship to which all horizontal measurements, for example range, bearing, relative course, relative speed, closest point of approach (CPA) or time to closest point of approach (TCPA), are normally referenced. Select reference point, [ANT] or [CCRP], as appropriate.

[KEY BEEP]:

A beep sounds when a keying sequence has been correctly executed.

[OFF]: No key beep

[LOW], [MID], [HIGH]: Loudness of key beep

[OWN SHIP VECTOR]:

Select what the own ship vector displays.

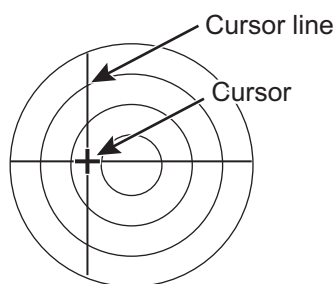
[OFF]: No own ship vector

[COURSE]: Vector shows course.

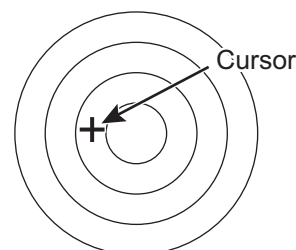
[HEADING]: Vector shows heading direction.

[CURSOR SIZE]:

Select the size of the cursor, [SMALL] or [LARGE].



[LARGE]  
(Cursor with cursor lines)



[SMALL]  
(Cursor only)

[GUIDANCE]:

See paragraph 1.37.1.

[TOUCH-PAD]:

Touch pad settings.

[TOUCH-PAD]: Activate or deactivate the touch-pad.

[SENSITIVITY]: Adjust the sensitivity of the touch-pad operation. [5] is the highest sensitivity.

[POINTING-DEVICE]:

Pointing device (mouse) settings.

[POINTING-DEVICE]: Activate or deactivate the pointing device.

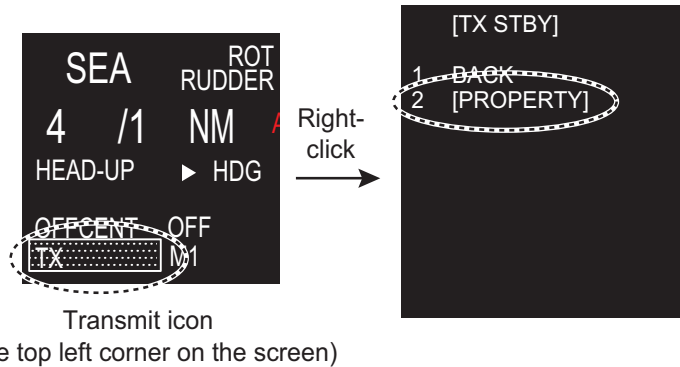
[SENSITIVITY]: Adjust the sensitivity of the pointing device operation. [5] is the highest sensitivity.



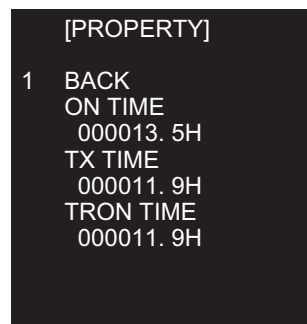
### 1.37.5 Transmit time

ON time, TX time and TRON time are shown on the stand-by display. You can also show these values by using the Transmit icon.

1. Right-Click the transmit icon ([TX] or [STBY]) to open the [TX STBY] menu.



2. Click [PROPERTY] to open the [PROPERTY] window.



- [ON TIME]: Total operation time
- [TX TIME]: Total transmission time
- [TRON TIME]: Total magnetron usage time

## 1. OPERATION

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## 2. TARGET TRACKING (TT)

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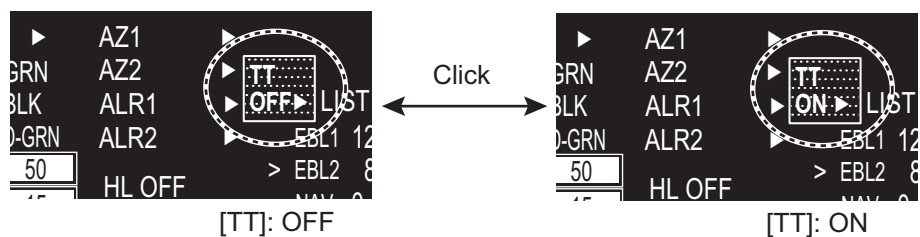
The Target Tracking function requires the heading data and ship's speed data.

### 2.1 TT Display On/Off

To show or hide the TT display, click the [TT] icon at the bottom left corner on the screen.

[TT OFF]: Deactivates TT.

















[TT ON]: Activates TT.



The plotting symbol is drawn by broken circles during the initial acquisition stage. A vector appears in about one minute after acquisition indicating the target's motion trend. If the target is consistently detected for three minutes, the plotting symbol changes to a solid circle. If acquisition fails, the target plotting symbol blinks and disappears shortly.

## 2. TARGET TRACKING (TT)

### TT symbols

	Symbol	Status	Remarks
Automatically acquired targets		Initial stage	Broken circles enclose an echo to indicate the target under acquisition and initial stage of tracking, before steady-state tracking
			Within one minute after acquisition (vector still unreliable).
		Steady tracking	Solid circle with vector indicating steady state tracking (within three minutes after acquisition).
	 (flashing)	CPA alarm	Plotting symbol (red) flashes to indicate the target whose CPA or TCPA is less than the CPA alarm setting.
		CPA alarm acknowledge	Shown in red and flashing. The flashing stops after CPA/TCPA alarm is acknowledged.
	 (flashing)	Lost target	A red X is put on the TT symbol to indicate that it is a lost target. Flashing stops after lost target alarm is acknowledged.
Manually acquired targets (the width of the circle for "steady tracking" TT is thicker than that of the automatically acquired target.)		Initial stage	Plotting symbol selected for a target acquired manually is shown in bold broken lines.
			Within one minute after acquisition (vector still unreliable).
		Steady tracking	Manual plotting symbol in a bold solid circle (within three minutes after acquisition).
	 (flashing)	CPA alarm	Plotting symbol (red) flashes to indicate the target whose CPA or TCPA is less than the CPA alarm setting.
		CPA alarm acknowledge	Flashing stops after CPA/TCPA alarm is acknowledged.
	 (flashing)	Lost target	A red X is put on the TT symbol to indicate that it is a lost target. Flashing stops after lost target alarm is acknowledged.
Acquisition zone	 (flashing)	On target passing through operator-set acquisition zone	Symbol is red and flashing.
Target selected for data readout		On selected target	Target selected data to display its data (range, bearing, course, speed, CPA, TCPA, BCR, BCT, etc.).
Reference target	 After three minutes, changes to  <sub>R</sub>	On reference target	Used to calculate own ship's over-the-ground speed (echo-referenced speed) for ground stabilization.

## 2.2 How to Acquire and Track Targets

This radar can acquire a maximum of 100 targets, the number of automatically and manually acquired targets determined by the [TT TARGET MENU] setting.

1. Right-click the [TT] icon to show the [TT TARGET MENU] window.



2. Click [TT SELECT] then the distribution between manually and automatically acquired targets.  
 [MANUAL 100]: 100 for manual tracking  
 [AUTO 25]: 25 for automatic tracking, 75 for manual tracking  
 [AUTO 50]: 50 for automatic and manual tracking  
 [AUTO 75]: 75 for automatic tracking, 25 for manual tracking  
 [AUTO 100]: 100 for automatic tracking
3. Click outside the menu window to close the menu.

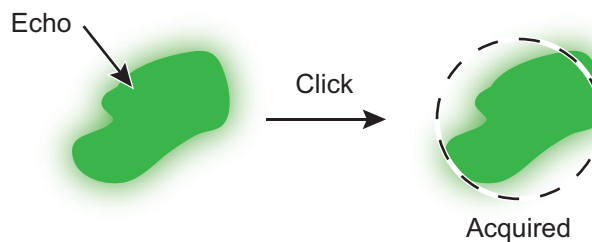
## 2.3 Manual Acquisition

You can acquire targets manually as follows:

1. Right-click anywhere in the radar display to open [CURSOR MENU].



2. Click [ACQUIRE].
3. Click the target to acquire. You can select several targets by clicking consecutively.



4. Right-click to quit.

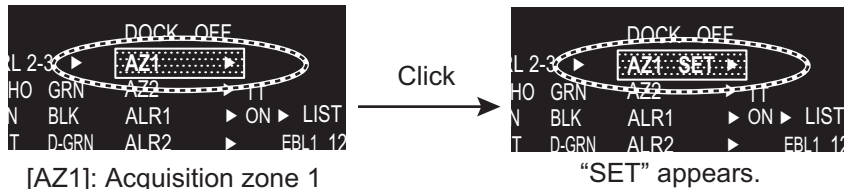
## 2.4 Automatic Acquisition

Targets which enter an acquisition zone (two zones possible) are automatically acquired. Set an acquisition area as follows:

### 2.4.1 How to set an acquisition zone

**Note:** The acquisition zone can not be set within 3 NM from own ship.

1. Click the [AZ1] icon. The [AZ1] icon now reads "AZ1 SET".

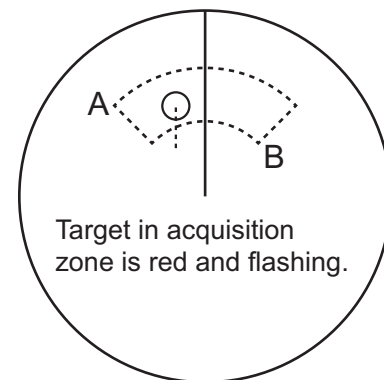


#### Acquisition zone status

[AZ1     ]:	No acquisition zone.
[AZ1   SET ]:	Set acquisition zone.
[AZ1 WORK ]:	Activate acquisition zone.
[AZ1   SLP ]:	Sleep acquisition zone.

2. Click the point A.
3. Click the point B. The [AZ1] icon now reads "AZ1 WORK".

**Note:** [AZ2] can be set when [AZ1] is active. The dashed lines are longer on [AZ2].



### 2.4.2 How to sleep an acquisition zone

1. Click the appropriate [AZ] icon.
2. Click the [AZ] icon to change from [AZ1 (2) WORK] to [AZ1 (2) SLP]. The acquisition zone disappears from the screen. To reactivate and display the acquisition zone, repeat this procedure to display [AZ1 (2) WORK].

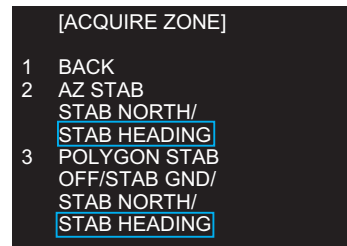
### 2.4.3 How to delete an acquisition zone

1. Click the appropriate [AZ] icon.
2. Press and hold down the left button until the [AZ] icon goes blank. The acquisition zone is deleted from the screen.

**Note:** If both acquisition zones are the active [AZ1] can not be deleted unless the [AZ2] is deleted.

### 2.4.4 Acquisition zone reference

1. Open [MAIN MENU], click [TT-AIS].
2. Click [ACQUIRE ZONE].



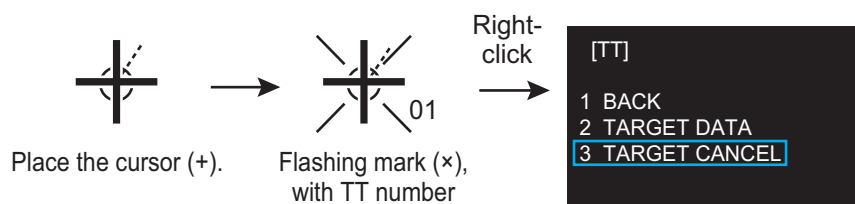
3. Click [AZ STAB] then the acquisition zone reference as appropriate.  
[STAB NORTH]: Acquisition zone is fixed to North.  
[STAB HEADING]: Acquisition zone keeps position related to your ship.
4. Click [POLYGON STAB] then the acquisition zone shape and stabilization as appropriate.  
[OFF]: Acquisition zone is a sector; number of points is limited to four. Stabilized against land.  
[STAB GND]: Polygon having 3-10 points. Stabilized against ground.  
[STAB NORTH]: Polygon having 3-10 points. Stabilized against north.  
[STAB HEADING]: Polygon having 3-10 points. Stabilized against heading.
5. Click outside the menu window to close the menu.

## 2.5 How to Stop Tracking a Target

You can stop tracking specific targets or all targets.

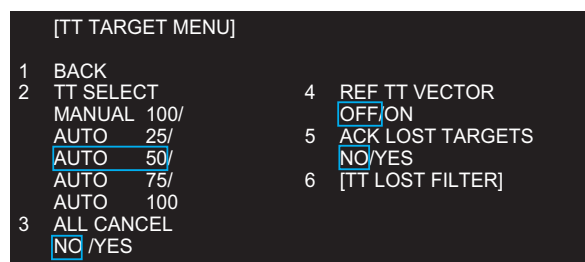
### How to cancel tracking on individual targets

1. Place the cursor (+) on the target. The mark (x) flashes behind the target.
2. Right-click the target to show the [TT] window.
3. Click [TARGET CANCEL] to stop tracking the target.



### How to stop tracking all targets

1. Right-click the [TT] icon to show the [TT TARGET MENU].



2. Click [ALL CANCEL].
3. Click [YES].

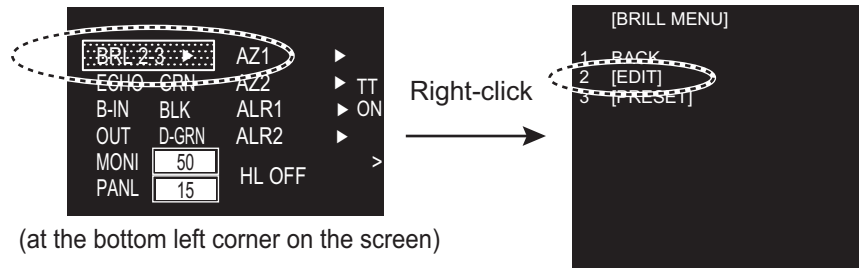
## 2. TARGET TRACKING (TT)

- Click outside the menu window to close the menu.

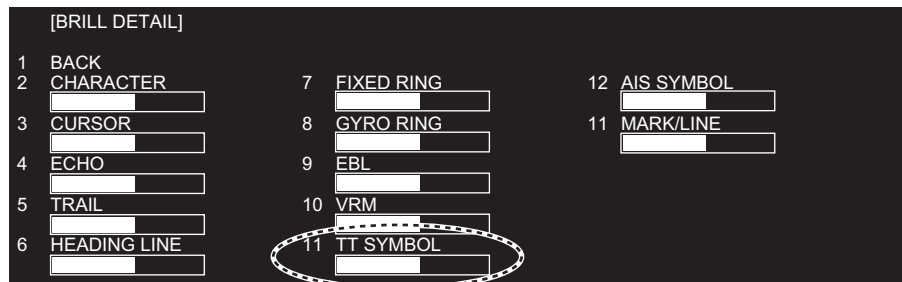
## 2.6 TT Symbol Attributes

### 2.6.1 TT symbol brilliance

- Right-click the [BRL] icon to show the [BRILL MENU] window.



- Click [EDIT].
- Click [BRILL DETAIL] to show the [BRILL DETAIL] window.

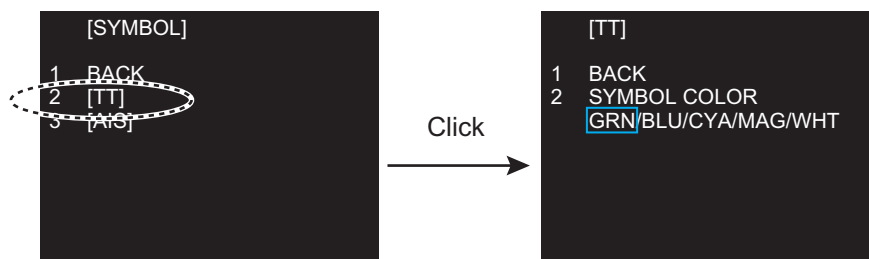


- Click [TT SYMBOL].
- Click the slide bar for [TT SYMBOL] then set the brilliance as appropriate with the setting knob.
- Click outside the menu window to close the menu.

### 2.6.2 TT symbol color

You may select the color of the TT symbol as follows.

- Open [MAIN MENU], click [TT·AIS].
- Click [SYMBOL].
- Click [TT].



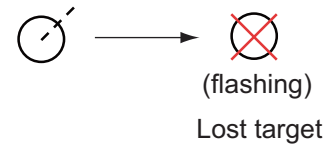
- Click [SYMBOL COLOR].
- Click the desired color.  
[GRN]: green, [BLU]: blue, [CYA]: cyan, [MAG]: magenta, [WHT]: white



- Click outside the menu window to close the menu.

## 2.7 Lost Target

Targets not detected in five consecutive scans become "lost targets." A lost target is shown in the display with a flashing red "X". Flashing stops after the lost target alarm is acknowledged.

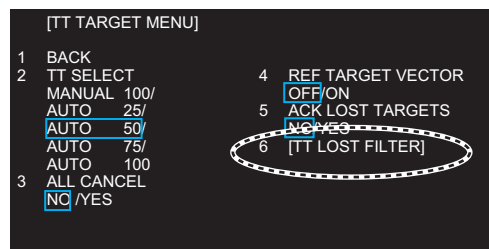


If you are in an area where tracked targets are lost frequently you may want to disable the lost target alarm against tracked targets by maximum range or minimum speed.

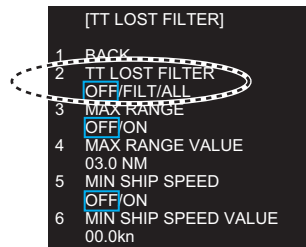
### 2.7.1 Lost target filter

You can set the lost target alarm to sound against lost TTs that meet a specific range or ship speed. Set the criteria as shown below.

- Right-click the [TT] icon.
- Click [TT LOST FILTER].



- Click [TT LOST FILTER].



- Select how to enable or disable the lost target alarm.
  - [OFF]: Disable the alarm.
  - [FILT]: Get the alarm against the targets whose criteria meet the settings on the [TT LOST FILTER] menu.
  - [ALL]: Get the alarm against all lost targets.
- Click [MAX RANGE VALUE] and [MIN SHIP SPEED VALUE] as appropriate, referring to the description below.
  - [MAX RANGE], [MAX RANGE VALUE]: Any TT lost target beyond the range set here will not trigger the lost target alarm.
  - [MIN SHIP SPEED], [MIN SHIP SPEED VALUE]: Any TT lost target slower than this setting will not trigger the lost target alarm.

**Note:** Reference targets are not affected by this filter.

## 2. TARGET TRACKING (TT)

### 2.7.2 How to acknowledge a lost target

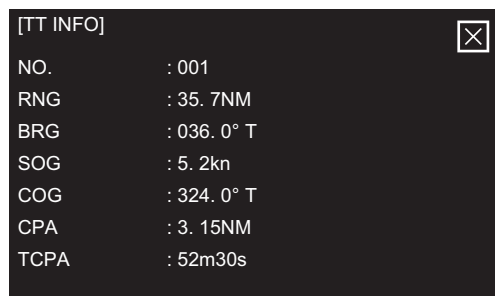
1. Right-click the [TT] icon to show [TT TARGET MENU].
2. Click [ACK LOST TARGETS].
3. Click [YES]. All lost targets disappear from the screen.

## 2.8 TT Data

The TT target list provides a comprehensive data display of all TT targets being tracked.

### How to display TT data

1. Place the cursor (+) on the target to show the target data. The mark (x) flashes behind the target.
2. Right-click the target to show the [TT] window.
3. Click [TARGET DATA] to show the [TT INFO] window. The selected target is enclosed in a broken square.



*[TT INFO] window*

[NO.]: Target No.

[RNG]: Range

[BRG]: Bearing

[SOG]: Speed over ground

[COG]: Course over ground

[CPA]: Target's CPA

[TCPA]: Target's TCPA

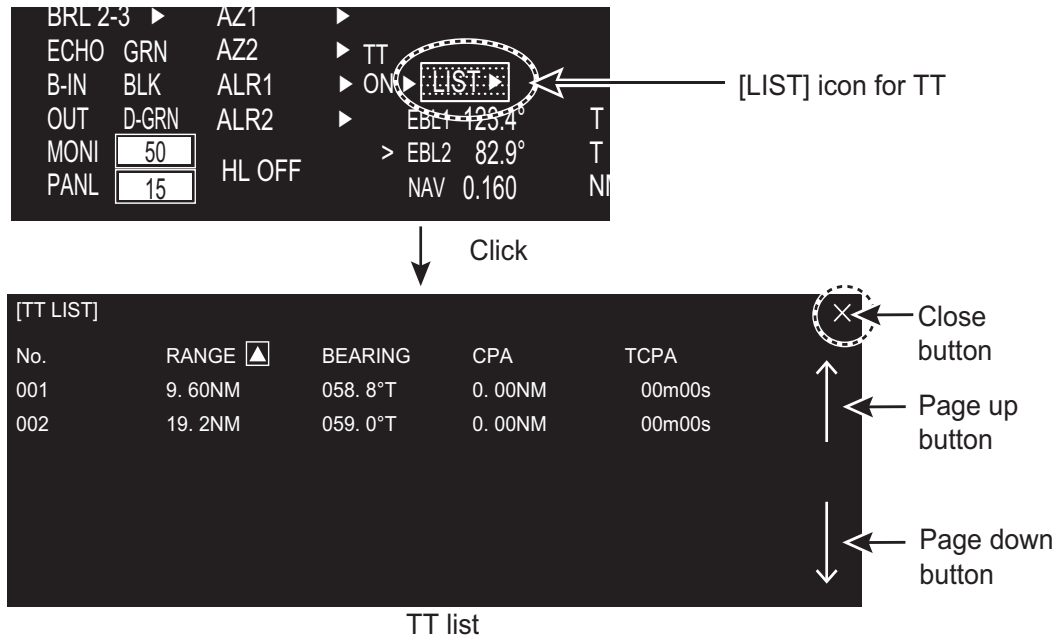
4. Click outside the menu window to close the menu.

## 2.9 TT List

### How to display the TT list

The TT list provides the range, bearing, CPA and TCPA of all tracking targets.

To display the TT list, click the [LIST] icon for TT at the bottom left corner on the screen to show the [TT LIST] window.



To close the [TT LIST] window, click the close button at the top right corner of the window.

[No.]: Target number

[RANGE], [BEARING]: Range and Bearing from own ship to the selected target with suffix "T" (True) or "R" (Relative).

[CPA], [TCPA]: CPA (Closest Point of Approach) is the closest range a target will approach to own ship. TCPA is the time to CPA. Both CPA and TCPA are automatically calculated. A negative TCPA value means that you have already passed the CPA and the target is going away from own ship.

### How to display TT data

Click the target on [TT LIST] to show the [TT INFO] window. See section 2.8.

### How to sort the TT list

You may sort the TT list by RANGE, CPA, TCPA as follows.

1. Right-click the [LIST] icon for TT to show the [TT-LIST] window.



2. Click [SORT BY].
3. Click the sorting item desired, by [RANGE], [CPA] or [TCPA].
4. Click outside the menu window to close the menu.

## 2.10 Vector Modes

Target vectors can be displayed relative to own ship's heading (Relative) or north (True).

### 2.10.1 Description of vectors

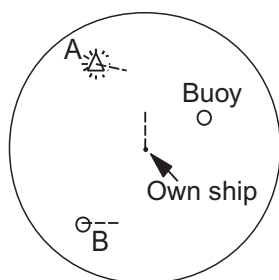
Sea stabilization is a mode where own ship and all targets are referenced to the sea using a compass heading and single-axis log water speed inputs. Ground stabilization is a mode where own ship and all targets are referenced to the ground using the ground track or set and drift inputs. If the accuracy seems unsatisfactory, enter set and drift corrections.

#### True vector

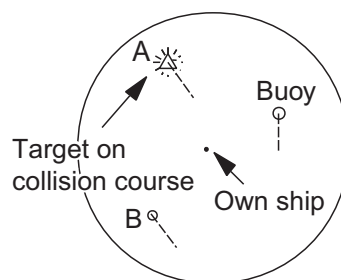
Own ship and other ships move on the display at their true speeds and courses. This mode is useful for distinguishing moving targets from stationary ones.

#### Relative vector

Other ships move relative to your ship. This mode is useful for finding ships on a collision course with your ship. A ship whose vector passes through your ship's position is on a collision course.



True vectors in head-up mode

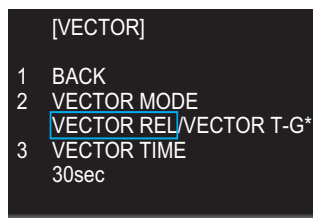


Relative vectors in head-up mode

### 2.10.2 Vector mode and length

Vectors may be displayed in true or relative mode. Vector time (or the length of vectors) can be set from 30 sec, 1 to 6 minutes.

1. Open [MAIN MENU], click [TT-AIS].
2. Click [VECTOR].



\*: For SOG, [VECTOR T-G]  
For STW, [VECTOR T-S]

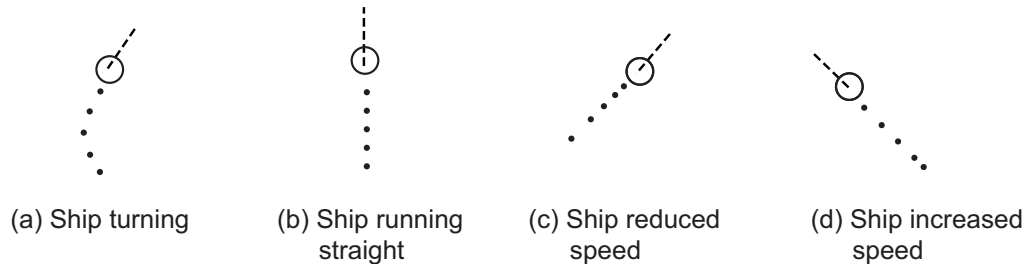
3. Click [VECTOR MODE].
4. Click the appropriate mode.  
[VECTOR REL]: Relative mode  
[VECTOR T-G], [VECTOR T-S]: True mode
5. Click [VECTOR TIME].
6. Select the time (30 sec to 6 min) with the setting knob.
7. Click outside the menu window to close the menu.

## 2.11 Past Position Display

Equally time-spaced dots shows the past position display marking the past positions of any targets being tracked.

A new dot is added every minute (or at other preset time intervals) until the preset number is reached. If a target changes its speed, the spacing will be uneven. If it changes the course, its plotted course will not be a straight line.

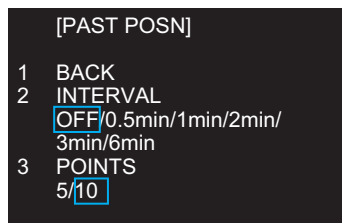
Past position orientation, true or relative, is controlled with [TRAIL MODE] in the [TRAIL] menu. See section 1.25 for the procedure.



### 2.11.1 How to select the dot number and interval of the past position

You may select the number of past points to display per plotting interval as follows.

1. Open [MAIN MENU], click [TT·AIS].
2. Click [PAST POSN].



3. Click [INTERVAL].
4. Click the plot interval desired (0.5 min to 6 min). Click [OFF] to erase all past position points and deactivate the past position display.
5. Click [POINTS].
6. Click the number of dots to display, 5 or 10.
7. Click outside the menu window to close the menu.

### 2.11.2 Past position display mode

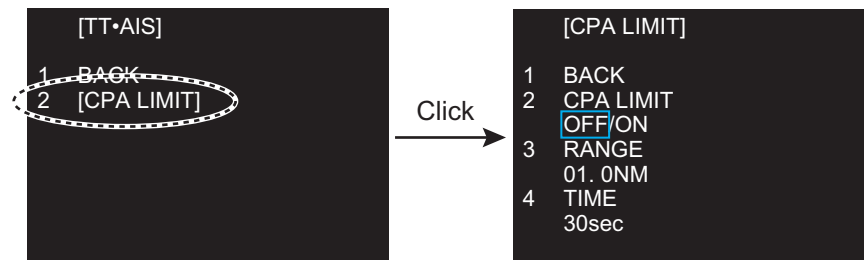
The display mode for the past position display is the same as that set for the TT vector. In the true motion mode, the true vector is displayed. See paragraph 2.10.1.

## 2.12 CPA/TCPA Alarm

The CPA/TCPA alarm alerts you when both the CPA and TCPA of a TT is within a defined limit.

CPA and TCPA of the target is less than the alarm settings.

1. Open [MAIN MENU], click [ALARM].
2. Click [TT·AIS].
3. Click [CPA LIMIT].



4. Click [CPA LIMIT].
5. Click [ON].
6. Click [RANGE].
7. Select the desired distance for CPA (Setting range: 0.1 to 24 NM) with the setting knob.
8. Click [TIME].
9. Select the desired time for TCPA (Setting range: 30 sec to 15 min) with the setting knob.
10. Click outside the menu window to close the menu.

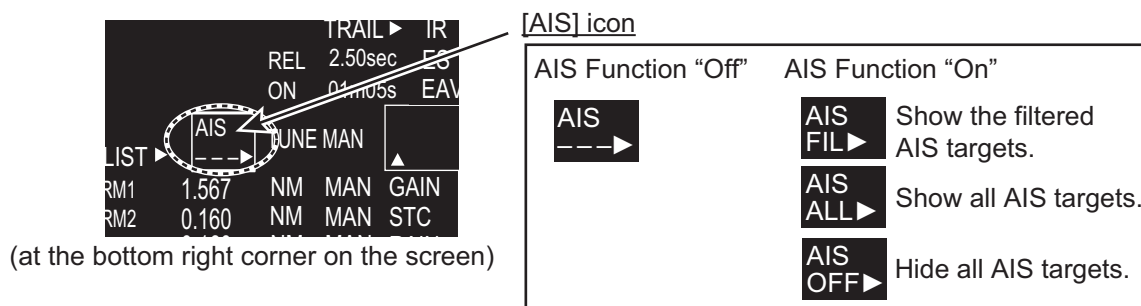
# 3. AIS OPERATION

The AIS (Automatic Identification System) transponder connected to this radar exchanges all data and information required by the SOLAS 1994 with other AIS-fitted ships. AIS information is graphically indicated together with the radar and TT information.

When AIS is active, manual or reference speed selection is not available.

## AIS Function On/Off

You may disable or enable the AIS function from the AIS icon. Long press the AIS icon with the left button to switch function between on and off.



## 3.1 AIS Display On/Off

To show or hide the AIS display, click the [AIS] icon at the bottom right corner on the screen.

- [AIS OFF]: All AIS symbols are hidden, but tracking continues internally.
- [AIS FIL]: AIS targets are displayed according to the criteria set with [CPA AUTO ACTIVE] in [AIS TARGET MENU]. See section 3.10 for details.
- [AIS ALL]: All AIS targets received by the AIS transponder are displayed with symbols.















When the AIS is turned on, AIS targets are marked with appropriate AIS symbol as shown in the table below.

**Note:** If the CPA/TCPA alarm is generated while the setting is [AIS OFF], the AIS target is automatically displayed and the setting in the [AIS] box becomes [AIS ALL].













### 3. AIS OPERATION

#### AIS symbols

Symbol	Status	Remarks
	Sleeping target	Smaller triangle than an active target
	Activated target	Heading line, ship speed/course vectors are displayed. Color is selectable on the menu.
	Turning target	A turning symbol is displayed.
	Dangerous target	Collision alarm symbol is displayed in red. The symbol flashes until acknowledged.
	Lost target	When a target is lost, a red flashing X mark is attached to the symbol. The symbol disappears after acknowledgement.
	Target whose data are being displayed.	Target selected to display its data is enclosed with a broken square.
	Real AIS track sign	—
	Virtual AIS track sign	—
	AIS base station	—
	Airborne SAR aircraft AIS	—
	AIS-SART	—
	AIS target without heading	—



AIS symbols with Blue sign, Blue cones

Blue sign	Not connected or not available		Not set		Set	
The number of Blue cones	No	1 to 3 (Red mark)	No	1 to 3 (Red mark)	No	1 to 3 (Red mark)
With heading	 (Scaled symbol)	 (Scaled symbol)	 (Scaled symbol)	 (Scaled symbol)	 (Scaled symbol)	 (Scaled symbol)
Without heading						

**Note 1:** The equipment continues to process AIS targets when the AIS feature is switched off. When the AIS is again turned on, symbols are immediately displayed.

**Note 2:** AIS symbols are momentarily erased after the screen is redrawn when the orientation mode is changed from the head-up mode.

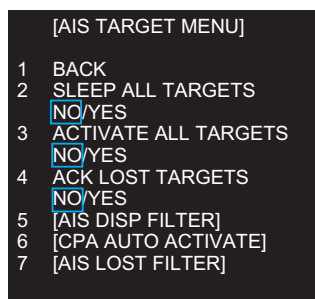
**Note 3:** When no AIS data is received, the message "AIS RECEIVE ERROR" appears. Check the AIS transponder.

**Note 4:** An AIS target is declared as lost target if it is not detected in five consecutive reporting periods.

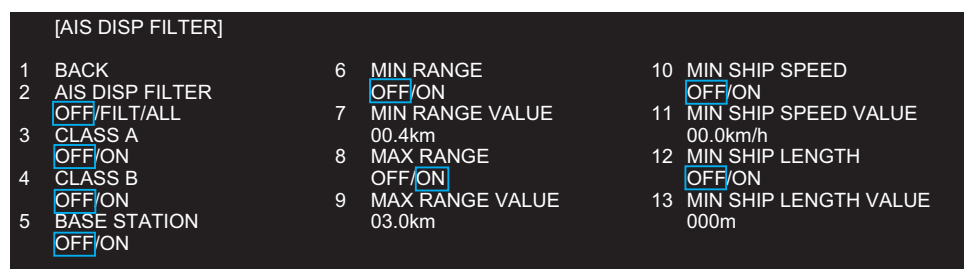
## 3.2 AIS Display Filter

If there are too many AIS targets on the screen you may wish to remove unnecessary ones. You may remove targets by distance from own ship, speed, class and length. For example, you might want to remove slow moving targets, as they normally do not require close monitoring.

1. Right-click the [AIS] icon.



2. Click [AIS DISP FILTER].



### 3. AIS OPERATION

- Set item 3 to 13 referring to the description below.  
[CLASS A]: Hide or show the CLASS A AIS targets.  
[CLASS B]: Hide or show the CLASS B AIS targets.  
[BASE STATION]: Hide or show AIS base stations.  
[MIN RANGE], [MIN RANGE VALUE]: If [MIN RANGE] is set to [ON], only AIS targets further than the range set at [MIN RANGE VALUE] are shown.  
[MAX RANGE], [MAX RANGE VALUE]: If [MAX RANGE] is set to [ON], only AIS targets nearer than the range set at [MAX RANGE VALUE] are shown.  
[MIN SHIP SPEED], [MIN SHIP SPEED VALUE]: If [MIN SHIP SPEED] is set to [ON], only AIS targets faster than the speed set at [MIN SHIP SPEED VALUE] are shown.  
[MIN SHIP LENGTH], [MIN SHIP LENGTH VALUE]: If [MIN SHIP LENGTH] is set to [ON], only AIS targets longer than the length set at [MIN SHIP SPEED VALUE] are shown.
- Click outside the menu window to close the menu.  
**Note:** An AIS target whose data is currently displayed is not affected by the filter setting.

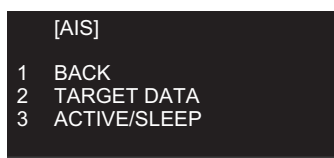
## 3.3 How to Activate Targets

### 3.3.1 How to activate specific targets manually

When you convert a sleeping target to an activated target, the target's course and speed are shown with a vector. You can easily judge target movement by monitoring the vector.

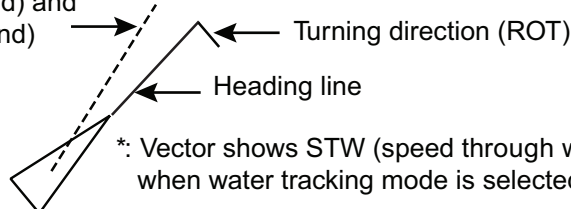
Sleeping targets within an acquisition zone are automatically changed to activated targets and are colored red. See section 3.5 for details.

- Right-click the [AIS] icon to activate to show the AIS window.



- Click [ACTIVE/SLEEP].

SOG (Speed over Ground) and  
COG (Course over Ground)  
vector\*



- Click outside the menu window to close the menu.

### 3.3.2 How to activate all targets

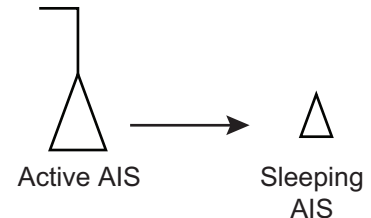
- Open [AIS TARGET MENU] (see step 1 of section 3.2), click [ACTIVATE ALL TARGETS].
- Click [YES].
- Click outside the menu window to close the menu.

## 3.4 How to Sleep Targets

### 3.4.1 How to sleep an individual target

You may “sleep” an AIS target as below when the screen becomes filled with targets, which might prevent important radar and AIS displays from being identified. Note that targets that have been activated automatically cannot be “slept”.

1. Right-click the AIS target to sleep to show the AIS window.
2. Click [ACTIVE/SLEEP].



### 3.4.2 How to sleep all targets

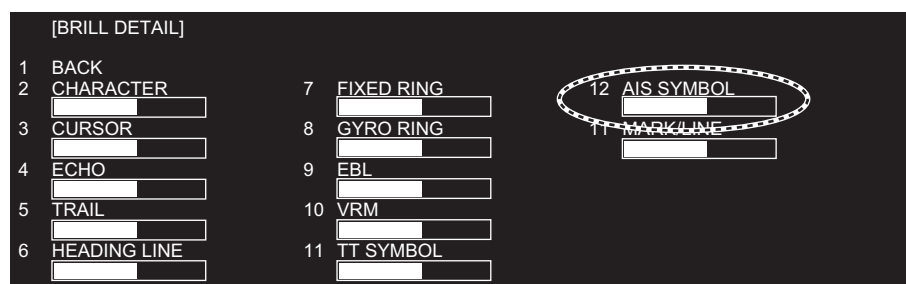
1. Open [AIS TARGET MENU] (see step 1 of section 3.2), click [SLEEP ALL TARGETS].
2. Click [YES].
3. Click outside the menu window to close the menu.

## 3.5 AIS Symbol Attributes

You may adjust the brilliance and select the size and color of the AIS symbol.

### 3.5.1 AIS symbol brilliance

1. Right-click the [BRL] (brill) icon to show the [BRILL MENU] window.
2. Click [EDIT].
3. Click [BRILL DETAIL] to show the [BRILL DETAIL] window.



4. Click [AIS SYMBOL].
5. Set the brilliance as appropriate with the setting knob.
6. Click outside the menu window to close the menu.

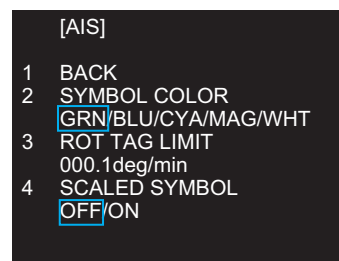
### 3.5.2 AIS symbol size and color

You may select the size and color of the AIS symbol as follows.

1. Open [MAIN MENU], click [TT·AIS].
2. Click [SYMBOL].

### 3. AIS OPERATION

3. Click [AIS] to show the [AIS] window.



4. Click [SYMBOL COLOR] then the desired color.

5. Click [SCALED SYMBOL].

6. Click [OFF] or [ON] as appropriate.

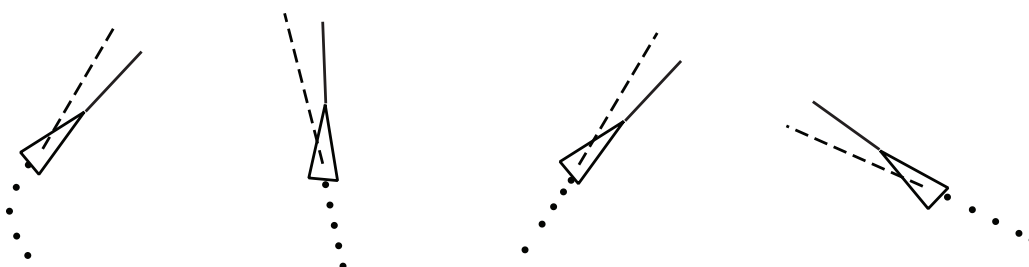
[OFF]: All AIS symbols shown in same size.

[ON]: All AIS symbols are scaled according to ships' lengths.

7. Click outside the menu window to close the menu.

## 3.6 Past Position Display

The past position display shows equally time-spaced dots marking past positions of activated AIS targets. A new dot is added at preset time intervals until the preset number is reached. If a target changes its speed, the spacing is be uneven. If it changes course, its plotted course is not shown by a straight line.



(a) Ship turning

(b) Ship running straight

(c) Ship reduced speed

(d) Ship increased speed

### 3.6.1 How to select the number and interval of the past position

You may select the number of past points to display per plotting interval as follows.

1. Open [MAIN MENU], click [TT-AIS].

2. Click [PAST POSN].



3. Click [INTERVAL].

4. Click the plot interval desired (0.5 min to 6 min). Click [OFF] to erase all past position points and deactivate the past position display.

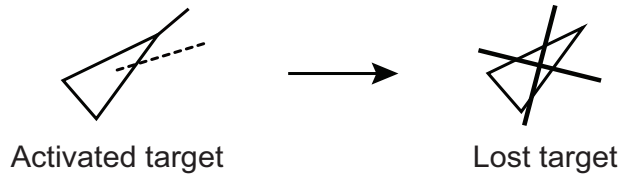
5. Click [POINTS].

6. Click the number of dots to display, 5 or 10.

7. Click outside the menu window to close the menu.

## 3.7 Lost Target

When AIS data is not received from a target within 3-5 report intervals (see Note 2), the target symbol changes to the lost target symbol (flashing). No audio or visual alarm is given for a lost target.

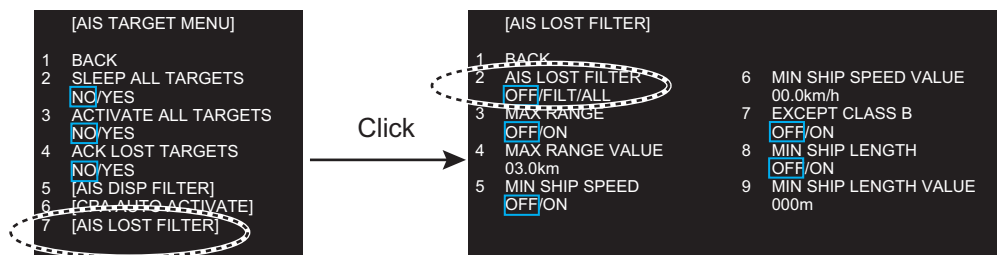


**Note:** The AIS data transmission interval depends on target's speed. For example, the data is transmitted every 10 seconds on ship speed of 0 to 14 knots and every two seconds on the ship speed of more than 23 knots. For details see the operator's manual of the AIS transponder.

### 3.7.1 Lost target filter

If there are a lot of AIS targets in your area, the lost target alarm may sound frequently. In this case you may wish to have the alarm ignore lost targets whose range, speed, class or length are below the threshold value you specify.

1. Right-click the [AIS] icon to show [AIS TARGET MENU].
2. Click [AIS LOST FILTER].
3. Click [AIS LOST FILTER] in the [AIS LOST FILTER] menu.



4. Click the target alarm to enable.  
 [OFF]: Disable the alarm.  
 [FILT]: Get the alarm against the targets whose criteria meet the settings on the [AIS LOST FILTER] menu.  
 [ALL]: Get the alarm against all lost targets.
5. Click [MAX RANGE VALUE] and [MIN SHIP SPEED VALUE] as appropriate, referring to the description below.  
 [MAX RANGE], [MAX RANGE VALUE]: Any AIS lost target beyond the range set here is not shown.  
 [MIN SHIP SPEED], [MIN SHIP SPEED VALUE]: Any AIS lost target slower than this setting is not shown.  
 [EXCEPT CLASS B]: Select [ON] to prevent trigger lost Class B AIS lost target.  
 [MIN SHIP LENGTH], [MIN SHIP LENGTH VALUE]: Any AIS lost target whose length is shorter than this setting is not shown.

### 3.7.2 How to acknowledge a lost target

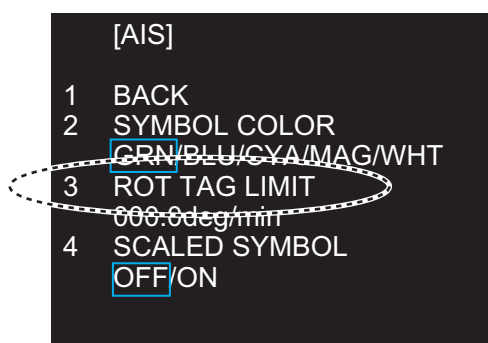
1. Click the [AIS] icon to show [AIS TARGET MENU].
2. Right-click [ACK LOST TARGETS].

3. Click [YES]. The lost target disappears from the screen.

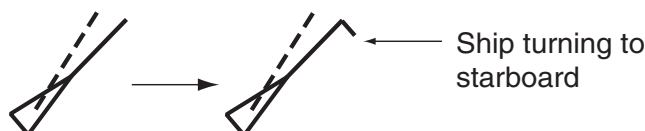
## 3.8 ROT Setting

You may set the lower limit of the ROT (Rate Of Turn) at which the heading line on target symbols points the ship's turning direction.

1. Open [MAIN MENU], click [TT·AIS].
2. Click [SYMBOL].
3. Click [AIS].
4. Click [ROT TAG LIMIT].



5. Click the setting value then enter ROT with the setting knob (setting range: 0.1 to 720.0 (deg/min)).
6. Click outside the menu window to close the menu.



## 3.9 CPA/TCPA Alarm

The AIS continuously monitors the predicted range at the Closest Point of Approach (CPA) and predicted time to CPA (TCPA) of each AIS target. When the predicted CPA of an AIS target becomes smaller than a preset CPA range and its predicted TCPA less than a preset TCPA limit, the audio alarm sounds. In addition, the symbol of the offending AIS target is red and flashes together with its vector.

CPA/TCPA alarm ranges must be set up properly taking into consideration the size, tonnage, speed, turning performance and other characteristics of own ship.

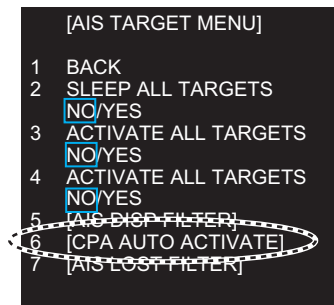
The reference point for CPA, TCPA calculation may be selected from antenna position or conning position.

To set this alarm, see section 2.12 "CPA/TCPA Alarm".

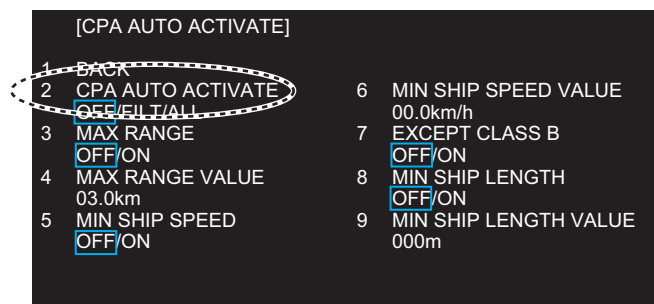
## 3.10 Automatic Target Activation

You can get automatic activation of a sleeping AIS target when its CPA is within the CPA/TCPA alarm setting. Further, you can select which AIS targets to automatically activate.

1. Right-click the [AIS] icon to show the [AIS TARGET MENU] window.
2. Click [CPA AUTO ACTIVATE].



3. Click [CPA AUTO ACTIVATE].



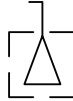
4. Click the activating mode for AIS target.  
[OFF]: Disable automatic activation of AIS target by CPA.  
[FILT]: Activate only the targets that fulfill the requirements set on the [CPA AUTO ACTIVATE] menu.  
[ALL]: For all targets.
5. Set items 3 to 9 referring to the description below.  
[MAX RANGE], [MAX RANGE VALUE]: Any AIS target beyond the range set here will not be activated.  
[MIN SHIP SPEED], [MIN SHIP SPEED VALUE]: Any AIS target slower than this setting will not be activated.  
[EXCEPT CLASS B]: Select [ON] to prevent automatic activation of class B AIS targets.  
[MIN SHIP LENGTH], [MIN SHIP LENGTH VALUE]: Any AIS target whose length is shorter than this setting will not be activated.
6. Click outside the menu window to close the menu.

## 3.11 AIS Target Data

You may display an AIS target's data by selecting it on the display. This data is shown for the activated AIS target only. The selected AIS target is enclosed in a broken square. The target data is shown on the [AIS INFO] window.



AIS

Selected AIS to  
display the information

[AIS INFO]			
NAME	:XXXX	RNG/BRG	:0.77km/324.4°R
FLAG	:NETHERLANDS	SOG/COG	:11.1km/h/100.0°T
CALL SIGN	:PFXXXX	CPA/TCPA	:0.49km/03m10s
MMSI	:123456789	HDG	:missing
IMO NO.	:missing	ROT	:missing
LAT	:51°53.661' N	LEN/BEAM	:135m/14.0m
LON	:004°18.376' E	BLUE SIGN	:NO

*[AIS INFO] window*

[NAME]: Name of ship  
 [FLAG]: Flag state  
 [CALL SIGN]: Call sign  
 [MMSI]: MMSI No.  
 [IMO NO.]: IMO No.  
 [LAT]: Latitude  
 [LON]: Longitude

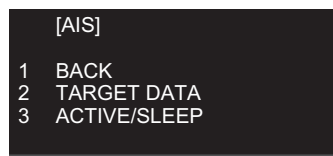
[RNG/BRG]: Range/Bearing to target  
 [SOG/COG] (or [STW/CTW]): Target's speed and course  
 [CPA/TCPA]: Target's CPA/TCPA  
 [HDG]: Heading  
 [ROT]: Rate of turn  
 [LEN/BEAM]: Ship's length/Beam  
 [BLUE SIGN]: Blue sign status

### Symbol operation

Left-click the AIS target to show the selected target's information window.

### Menu operation

1. Right-click the AIS target to show the [AIS] window.



2. Click [TARGET DATA] to show the [AIS INFO] window.
3. Click the close button or outside the information window to close the menu.

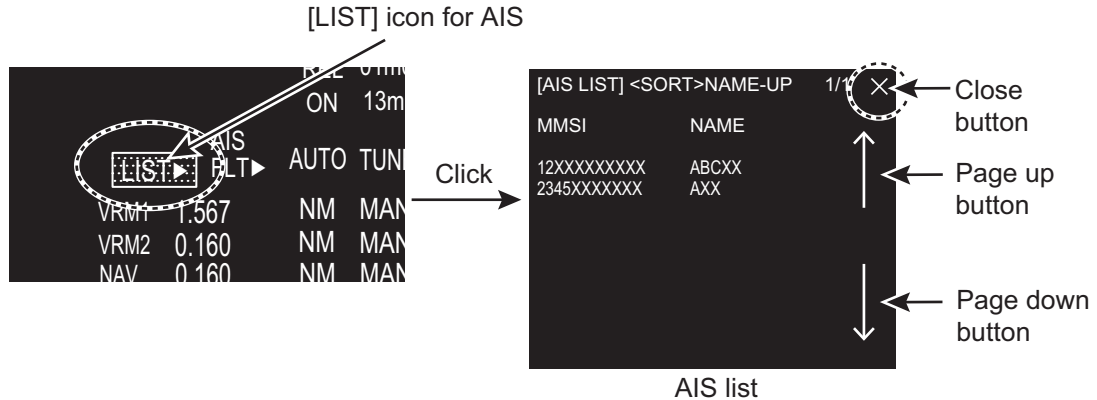


## 3.12 AIS List

The AIS list provides a comprehensive information about all AIS targets being tracked.

### How to display the AIS list

Click the [LIST] icon for AIS at the bottom right corner on the screen.



You can see [MMSI] and [NAME] for AIS targets. To close the [AIS LIST] window, click the close button on the list.

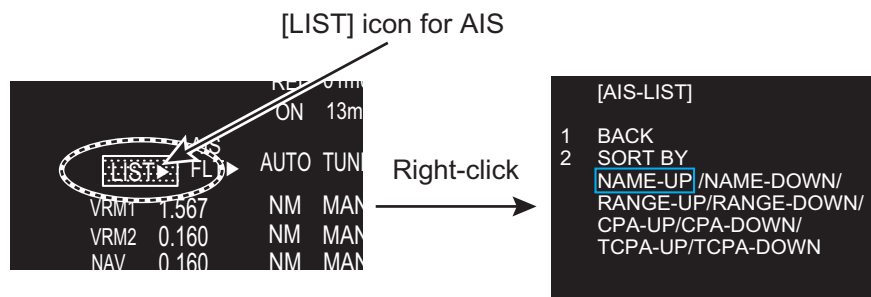
### How to display AIS target data

Click the target on [AIS LIST] to show the [AIS INFO] window. See section 3.11.

### How to sort the target list

You may sort the target list by RANGE, CPA, TCPA. Also, you can sort in ascending or descending order.

1. Right-click the [LIST] icon for AIS to show the [AIS-LIST] window.



2. Click [SORT BY].
3. Click the sorting method desired.  
[NAME-UP], [NAME-DOWN]: Sort by name  
[RANGE-UP], [RANGE-DOWN]: Sort by range  
[CPA-UP], [CPA-DOWN]: Sort by CPA  
[TCPA-UP], [TCPA-DOWN]: Sort by TCPA
4. Click outside the menu window to close the menu.

### 3. AIS OPERATION

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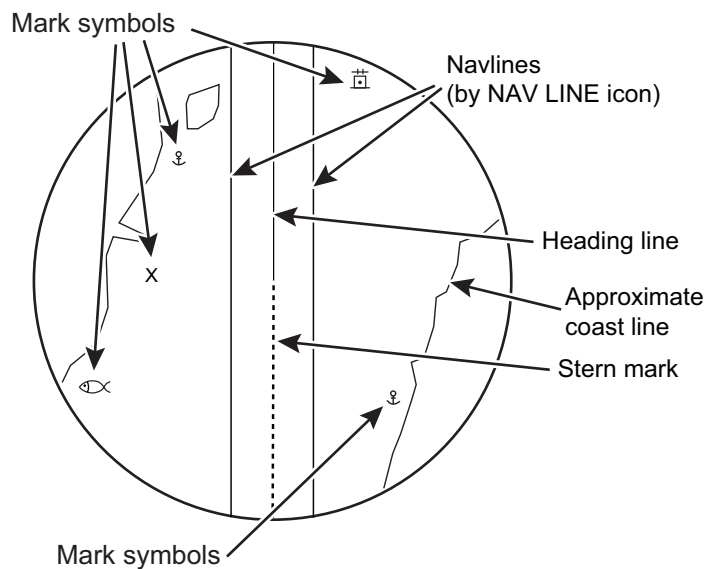
## 4. RADAR MAP

### 4.1 What is a Radar Map?

The radar map feature, available in the [RIVER] mode, is a combination of map lines and symbols whereby the user can define and input the navigation, route planning and monitoring data on the screen. Map lines are a navigational facility whereby the observer can define lines to indicate channels or traffic separation schemes.

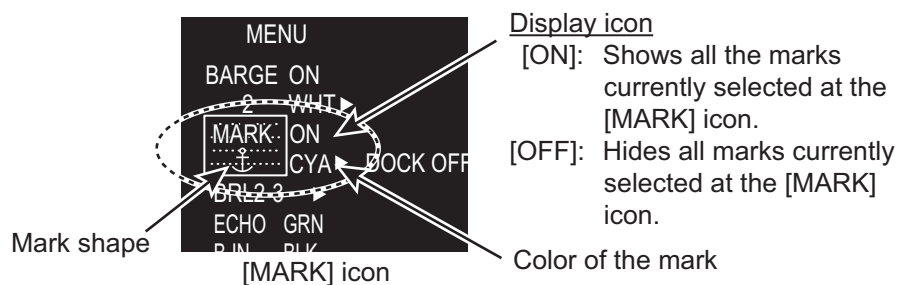
The user can create a radar map on real-time base while using the radar for navigation or at leisure time at anchor. The map data is stored on the Flash ROM memory which is mounted on the main processor board.

**Note:** Radar map function requires heading and positioning data.



### 4.2 [MARK] icon

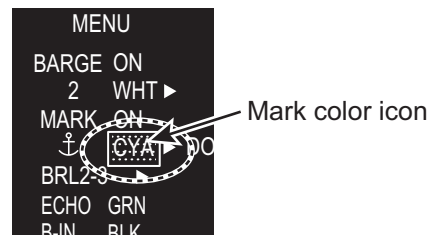
The [MARK] icon, located at the bottom left corner on the screen, is used to create marks and lines, line operations. This radar can save a total of 5,000 marks and lines.



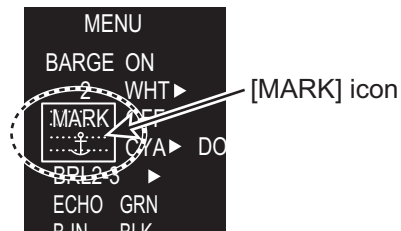
## 4.3 How to Enter Marks, Lines

### 4.3.1 How to enter a mark, line with at the cursor position

1. Click the mark color icon to select the required color for the mark.
















2. Highlighting the [MARK] icon then rotate the setting knob to select a mark.

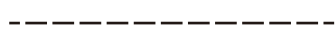


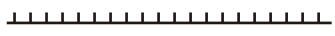



3. Press the left button on the appropriate mark to decide the mark (or line) shape.

#### Marks

Triangle 	Lighthouse 3 	Fish 	Diamond 
Dash with 3 bar-line 	Circle 	Square 	
Lighthouse 1 	Small dot 	Anchor 	
Lighthouse 2 	Cross 	Dot 	

#### Lines

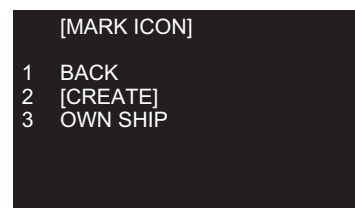
1	Long dashed line	
2	Dashed line	
3	Coast line	
4	Contour line / Prohibited areas	
5	Cable	

4. Press the left button. For lines, press the left button on the next point of the line then repeat this operation to complete the line.
5. Press the right button to quit.

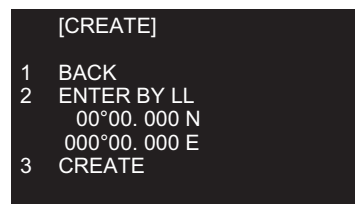
### 4.3.2 How to enter a mark by latitude and longitude position input

This function is not available for entering lines.

1. Right-click the [MARK] icon to show the [MARK ICON] window.



2. Click [CREATE] to show the [CREATE] window.



3. Click [ENTER BY LL].
4. The cursor is on the far left-hand digit on the latitude line. Rotate the setting knob to click a numeral. The cursor moves to the next digit. Enter other numbers similarly.
5. Right-click the last digit to finish.

### 4.3.3 How to enter a mark at current position

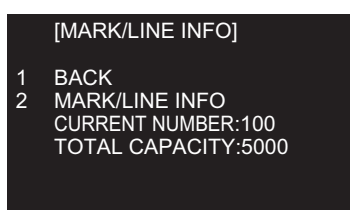
This function is not available for entering lines.

1. Right-click the [MARK] icon to show the [MARK ICON] window.
2. Click [OWN SHIP].

## 4.4 Mark/Line information

You can confirm the number of marks and lines which you have entered.

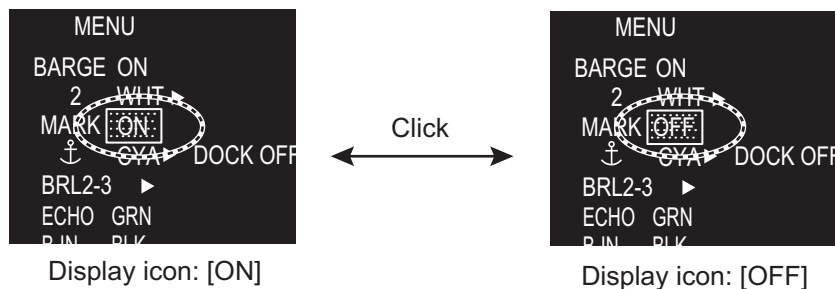
1. Open [MAIN MENU], click [RADAR MAP].
2. Click [MARK/LINE INFO] to open the information window.



## 4.5 How to Show, Hide Marks on the Screen

### By menu icon

Click the mark display icon to show or hide the marks.



### By [DISPLAY] menu

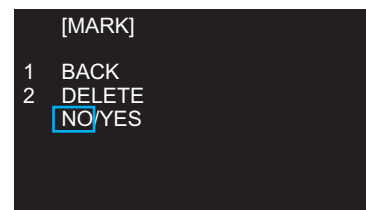
This menu is available in the [RIVER] mode only.

1. Open [MAIN MENU], click the [DISPLAY] menu.
2. Click [MARK/LINE].
3. Click [ON] or [OFF].

## 4.6 How to Delete Marks, Lines

### How to delete marks, lines individually

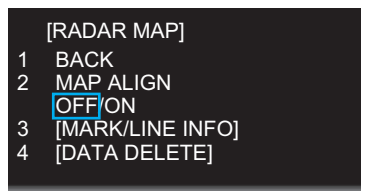
1. Right-click the mark to delete.



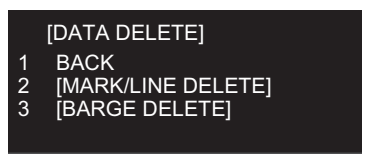
2. Click [DELETE].
3. Click [YES].

### How to delete marks, lines by color, shape

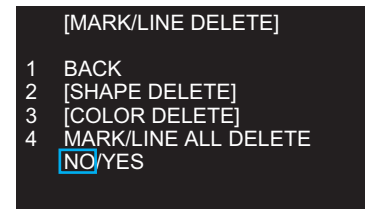
1. Open [MAIN MENU], click [RADAR MAP] to show the [RADAR MAP] menu.



2. Click [DATA DELETE].



- Click [MARK/LINE DELETE].



- Click the sort to delete.  
[SHAPE DELETE]: Select the shape to delete then select [YES] in [DELETE].  
[COLOR DELETE]: Select the color to delete then select [YES] in [DELETE].
- Click [DELETE].
- Click [YES].
- Click outside the menu window to close the menu.

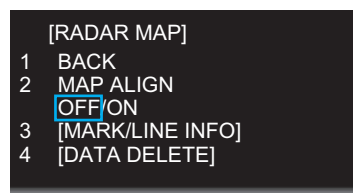
#### **How to delete all marks, lines**

- Open [MAIN MENU], click [RADAR MAP] to show the [RADAR MAP] menu.
- Click [DATA DELETE].
- Click [MARK/LINE DELETE].
- Click [MARK/LINE ALL DELETE].
- Click [YES].
- Click outside the menu window to close the menu.

## **4.7 How to Align the Radar Map**

When the map is not overlaid on the radar picture correctly, you can align the map with the [MAP ALIGN] menu.

- Open [MAIN MENU], click [RADAR MAP].



- Click [MAP ALIGN].
- Click [ON] to align the radar echo to the radar map. The cursor moves the center of the radar display. The mark symbols are moved in conjunction with the cursor movement.
- Click anywhere in the radar display to complete the alignment.






#### 4. RADAR MAP

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## 5. MAINTENANCE, TROUBLE-SHOOTING

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 <b>WARNING</b>	<b>NOTICE</b>
 <p><b>Do not open the equipment.</b></p> <p>Hazardous voltage which can cause electrical shock exists inside the equipment. Only qualified personnel should work inside the equipment.</p>	<p><b>Do not apply paint, anti-corrosive sealant or contact spray to coating or plastic parts of the equipment.</b></p> <p>Those items contain organic solvents that can damage coating and plastic parts, especially plastic connectors.</p>
 <p><b>Turn off the radar power switch before servicing the antenna unit. Post a warning sign near the switch indicating it should not be turned on while the antenna unit is being serviced.</b></p> <p>Prevent the potential risk of being struck by the rotating antenna.</p>	
 <p><b>A transmitting radar antenna emits electromagnetic waves, which can be harmful, particularly the eyes.</b></p>	
 <p><b>Wear a safety belt and hard hat when working on the antenna unit.</b></p> <p>Serious injury or death can result if someone falls from the radar antenna mast.</p>	

## 5.1 Preventive Maintenance

Regular maintenance helps keep your equipment in good condition and prevents future problems. Check the items shown on next page to help keep your equipment in good condition for years to come.

### **Ground terminal on processor units**

Tighten or replace as necessary.

### **Connectors on monitor and processor units**

Tighten if the connectors are loosened.

### **Exposed nuts, bolts on the antenna unit**

Exposed bolts and nuts are subject to corrosion. Further, they may loosen by vibration. Check that bolts and nuts are securely fastened. Refasten if necessary. If corroded, and coat with anti-corrosive sealant.

### **Adhesive (marine sealant) on nuts and bolts**

Check for deteriorations such as splits and peeling every 3 to 6 months. Re-apply as required. For areas with extensive deterioration, remove the existing adhesive before re-applying a fresh coat. Adhesive deterioration can result in water leakage, which can cause corrosion.

### **Antenna radiator**

Dust, dirt and salt deposits on the radiator cause signal attenuation, resulting in loss of sensitivity. Wipe the radiator with a freshwater-moistened cloth. The radiator is made of fiber-glass reinforced plastic. Therefore, do not use gasoline, benzene and the like to clean the radiator. If the radiator is iced, use a wooden or plastic headed hammer to remove the ice.

## 5.2 How to replace the Fuse

A fuse is located on the front of the processor unit. The fuse protects the equipment from reverse polarity of the ship's mains and equipment fault. If a fuse blows, find the cause before replacing it. Use the correct fuse. Using the wrong fuse will damage the equipment and void the warranty.



### **WARNING**

**Use the correct fuse.**

A wrong fuse can damage the equipment and cause fire.

Unit	Type	Code No.	Remarks
Processor Unit	FGBO-A 125V 10A PBF	000-155-826-10	24 VDC

## 5.3 Life Expectancy of Major Parts

This radar has consumable parts, and the table that follows shows the estimated life expectancy for the consumable parts. Life expectancy estimates are based on use under normal conditions. Request a FURUNO agent or dealer to replace the consumable parts, to get the best performance and longest possible life from the equipment.

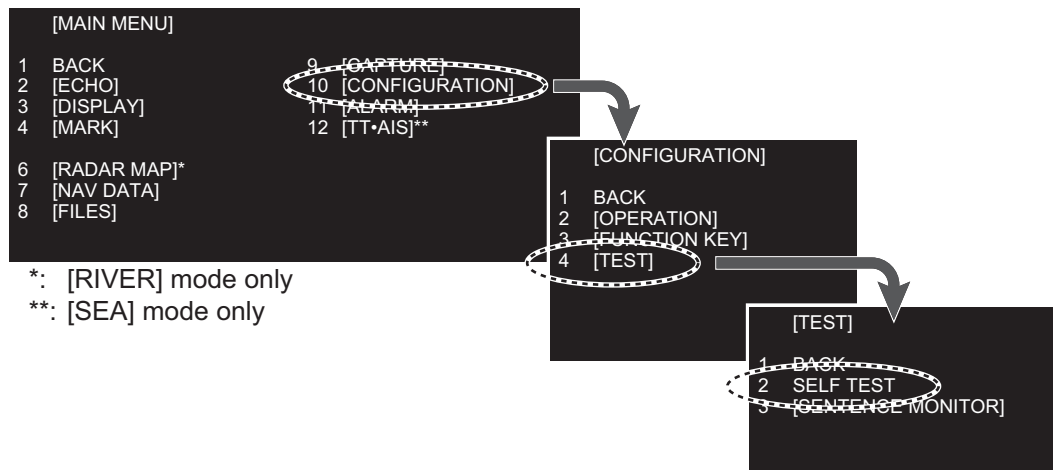
Part	Type	Life expectancy	Remarks
Antenna Motor	D8G-516	10,000 hours	
Carbon Brush	S885026-1A-61	4,000 hours	Check for wear at, or before, 2,000 hours of Tx time. Replace if worn.
Magnetron	MAF1611B (4kW, FR-1908V-BB)	5,000 hours	Check no. of hours used at Tx time. Reset time after replacement.
	MAF1615B (12kW, FR-1918V-BB)		

**Note:** The magnetron is a consumable item. The effectiveness of your magnetron will decrease over time, causing lower-than-normal signal strength and loss of echoes. Magnetrons should be changed regularly. The table above shows the typical life-span of a magnetron used under normal conditions.

## 5.4 Diagnostic Test

### 5.4.1 Self Test

The diagnostic test checks the system for correct operation. This test is for use by service technicians, but the user can do this test to provide the service technician with information.



RPU PROGRAM VERSION			X
1	APPL NO.	0359451-01.**	
2	ECHO FPGA NO.	0359275-01.**	
3	DRAW FPGA NO.	0359276-01.**	
4	STARTER NO.	0359272-01.**	
5	BOOTER NO.	0359273-01.**	
RCU PROGRAM VERSION			
6	APPL NO.	0359252-01.**	
7	BOOTER NO.	0359260-01.**	
RADAR PROCESSING UNIT (RPU)			
8	ROM		OK
9	RAM		OK
10	ECHO FPGA		OK
11	DRAW FPGA		OK
12	MAC ADDRESS	00-D0-1D-05-2A-CB	
13	IP ADDRESS	172. 031. 003. 016	
14	DIP-SW	00000	
CONTROL HEAD (RCU)			
15	ROM		OK
16	RAM		OK

Example of the Self Test result

1. Open [MAIN MENU], click [CONFIGURATION].
2. Click [TEST].
3. Click [SELF TEST]. Test results of processor unit and control unit are displayed. Items 8 to 11, 15 and 16 are displayed [OK] if normal and [NG] if abnormal. When [NG] is displayed, request a service.
4. To close the window, click the close button (×).
5. Click outside the menu window to close the menu.

### 5.4.2 NMEA sentences checks

You can check the sentences read into the equipment.

1. Open [MAIN MENU], click [CONFIGURATION].
2. Click [TEST].
3. Click [SENTENCE MONITOR].

[SENTENCE MONITOR]	
1	BACK
2	NMEA1
3	NMEA2
4	NMEA3
5	NMEA4
6	NMEA5
7	NMEA6

4. Click the item to display. Each item refers to the external equipment connection port in the processor unit.
5. To close the window, click the close button (×).
6. Click outside the menu window to close the menu.

## 5.5 Easy Troubleshooting

This section provides troubleshooting procedures that the user may follow to restore normal operation. If you cannot restore normal operation, do not attempt to check inside any unit. Leave any repair work to a qualified technician.

### Easy troubleshooting

Problem	Remedy
You can not turn on the power.	<ul style="list-style-type: none"> <li>• Check for blown fuse.</li> <li>• Check that the power connector is fastened.</li> <li>• Check for corrosion on the power cable connector.</li> <li>• Check for damaged power cable.</li> <li>• Check the input source for monitor.</li> </ul>
There is no response when a key is pressed.	Long press the <b>POWER</b> key for approx. seven seconds to turn off the power. Then, turn on the power again.
Key beep inaudible	Adjust key beep level on the [OPERATION] menu, referring to paragraph 1.37.4.
Picture not updated or picture freeze.	Long press the <b>POWER</b> key for approx. seven seconds to turn off the power. Then, turn on the power again.
The power is on and you operated the STBY/TX key to transmit. The marks and characters appear, but no echo appears.	<ul style="list-style-type: none"> <li>• Check that the antenna cable is fastened.</li> <li>• Adjust the GAIN and STC levels.</li> <li>• Adjust the echo brilliance.</li> </ul>
Tuning is correctly adjusted, but sensitivity is poor.	<ul style="list-style-type: none"> <li>• Clean the radiator face.</li> <li>• Replace the magnetron. Contact your dealer.</li> </ul>
There are unwanted echo around own ship.	Adjust the STC level.
<ul style="list-style-type: none"> <li>• The icons are automatically hidden.</li> <li>• You can not find the icon.</li> </ul>	Turn [HIDDEN ICON] to [OFF]. See paragraph 1.36.2.
You can not adjust the brilliance of the screen.	Turn [EXT BRILL CTRL] to [ON] on the monitor MU-190V.
You can not set the orientation mode.	<ul style="list-style-type: none"> <li>• Check the connected equipment.</li> <li>• Check the heading input (Sentence monitor, Input port, Baud rate).</li> </ul>
<ul style="list-style-type: none"> <li>• The AIS symbols are not shown.</li> <li>• The true trails are not shown.</li> <li>• The radar map is not shown.</li> </ul>	Check the connected equipment.
Range rings are not shown.	Adjust their brilliance with [FIXED RING]. See paragraph 1.6.3.

## 5.6 Advanced Troubleshooting

This section describes how to cure hardware and software troubles that should be carried out by qualified service personnel.

### Advanced troubleshooting

Problem	Probable causes or check points	Remedy
You cannot turn on the power.	<ul style="list-style-type: none"> <li>• Blown fuse.</li> <li>• Mains voltage/polarity</li> <li>• Power supply board</li> </ul>	<ul style="list-style-type: none"> <li>• Replace blown fuse.</li> <li>• Correct wiring and input voltage.</li> <li>• Replace power supply board.</li> </ul>
Power turned on but radar does not operate at all.	Panel board	Replace panel board.
Antenna not rotating	<ul style="list-style-type: none"> <li>• Antenna switch setting (See the Installation manual.)</li> <li>• Check for the voltage for motor.</li> <li>• Antenna switch of antenna unit</li> <li>• Gear mechanism</li> <li>• RF_TB board</li> </ul>	<ul style="list-style-type: none"> <li>• Check the setting of antenna switch.</li> <li>• Replace PSU board.</li> <li>• Check if antenna switch is ON.</li> <li>• Replace the motor.</li> <li>• Replace RF_TB board.</li> </ul>
Set [GAIN] to maximum with [STC] and [RAIN] settings at minimum. Marks and indications appear but no noise or echo.	<ul style="list-style-type: none"> <li>• IF amplifier</li> <li>• Signal cable between antenna and processor unit</li> <li>• VIDEO_AMP board</li> <li>• SPU cable connection on the VIDEO_AMP board</li> </ul>	<ul style="list-style-type: none"> <li>• Replace IF amplifier.</li> <li>• Check continuity and isolation of coaxial cable.</li> <li>• Replace video amplifier.</li> </ul>
Marks, indications and noise appear but no echo in short range.	<ul style="list-style-type: none"> <li>• Magnetron</li> <li>• Modulator board</li> <li>• SPU board</li> </ul>	<ul style="list-style-type: none"> <li>• Check magnetron current.</li> <li>• Replace modulator board.</li> <li>• Replace SPU board.</li> </ul>
Picture not updated or picture freeze-up.	<ul style="list-style-type: none"> <li>• Bearing signal generator</li> <li>• SPU board</li> </ul>	<ul style="list-style-type: none"> <li>• Check that signal cables are fastened.</li> <li>• Replace SPU board.</li> <li>• Turn off and on the radar.</li> </ul>
GAIN is poor.	Tuning	Do the [TUNE INITIALIZE] setting. See paragraph 1.8.4.
Radar is correctly tuned but sensitivity is poor.	<ul style="list-style-type: none"> <li>• Deteriorated magnetron</li> <li>• Dirt on radiator face</li> </ul>	<ul style="list-style-type: none"> <li>• Check the magnetron current with the radar transmitting on 48 nm range.</li> <li>• Clean radiator.</li> </ul>

# APPENDIX 1 RADIO REGULATORY INFORMATION

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## USA-Federal Communications Commission (FCC)

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. Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### ***Caution: Exposure to Radio Frequency Radiation***

- This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65.
- This equipment should be installed and operated keeping the radiator at least 50 cm for FR-1908V-BB, or 340 cm for FR-1918V-BB from person's body.
- This device must not be co-located or operating in conjunction with any other antenna or transmitter.

## Innovation, Science and Economic Development Canada (ISED)

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil contient un ou plusieurs émetteurs / récepteurs exempts de licence qui sont conformes à la norme « exempts de licence RSS (s) » Canadienne d'Innovation, Sciences et Développement économique. L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage.
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

### ***Caution: Exposure to Radio Frequency Radiation***

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the ISED radio frequency (RF) Exposure rules. This equipment should be installed and operated keeping the radiator at least 50 cm (FR-1908V-BB) , 340 cm (FR-1918V-BB) or more away from person's body.

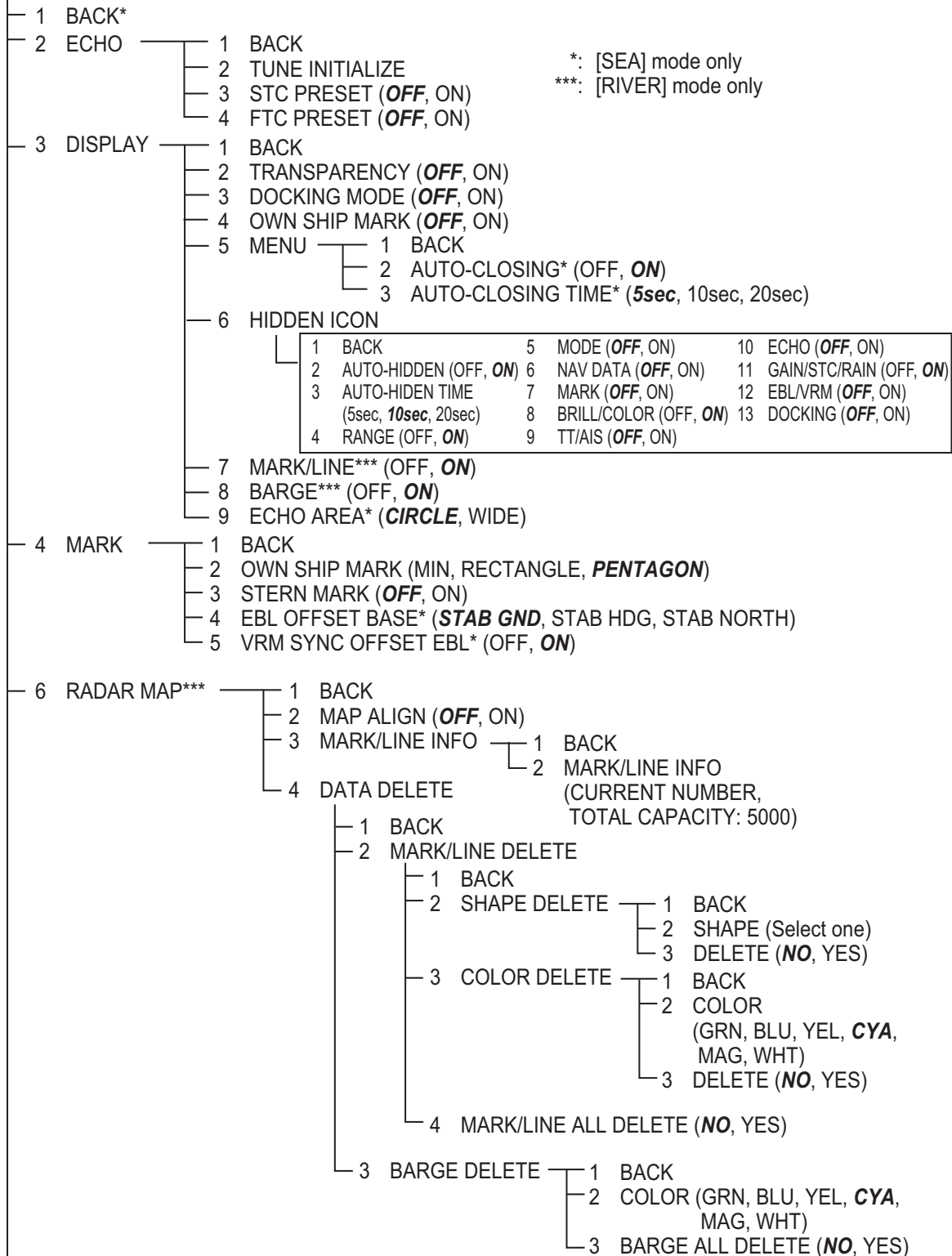
Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'ISED. Cet équipement doit être installé et utilisé en gardant une distance de 50 cm (FR-1908V-BB) , 340 cm (FR-1918V-BB) ou plus entre le dispositif rayonnant et le corps.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that required for successful communication.

# APPENDIX 2 MENU TREE

## MAIN MENU

### MAIN MENU

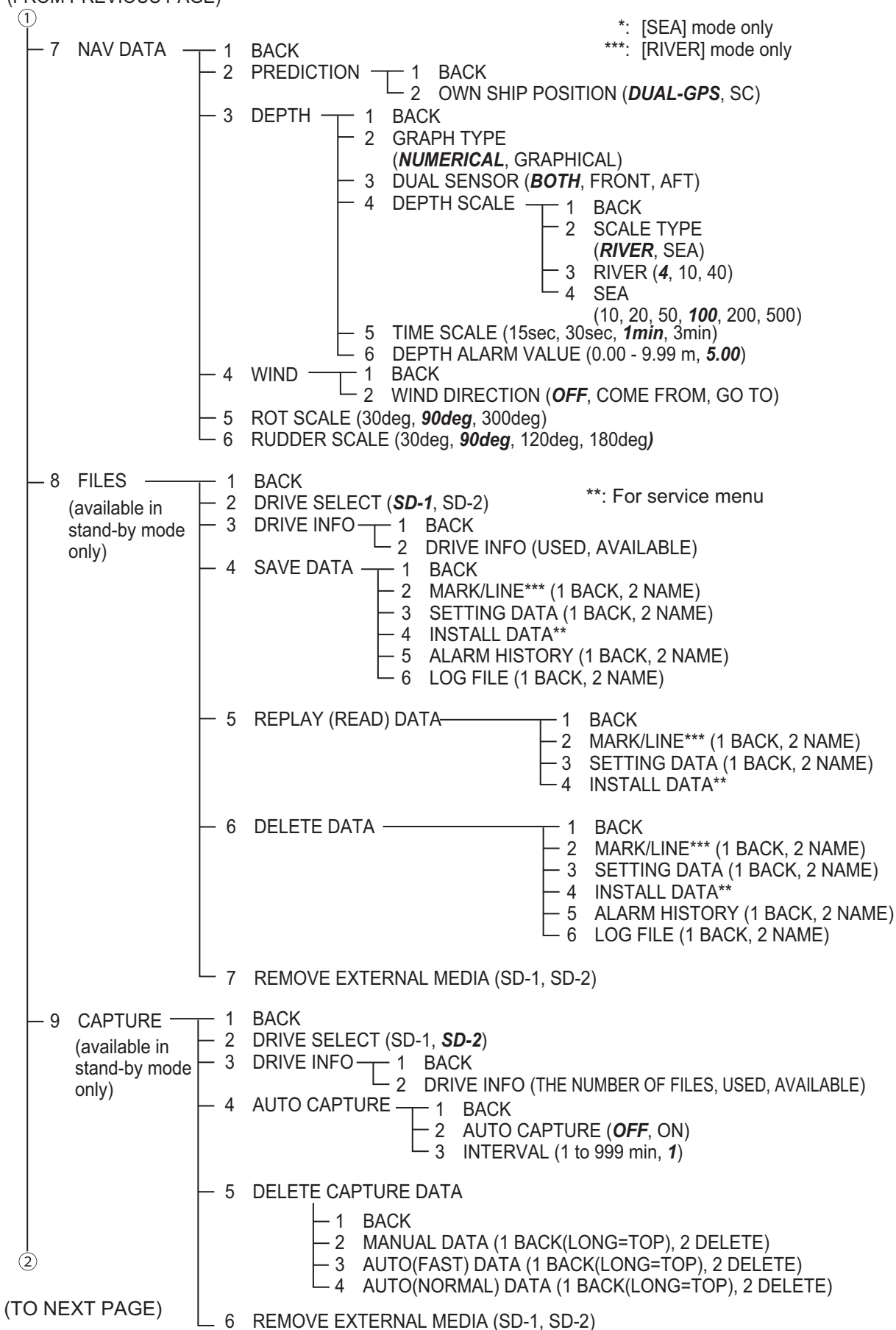


①

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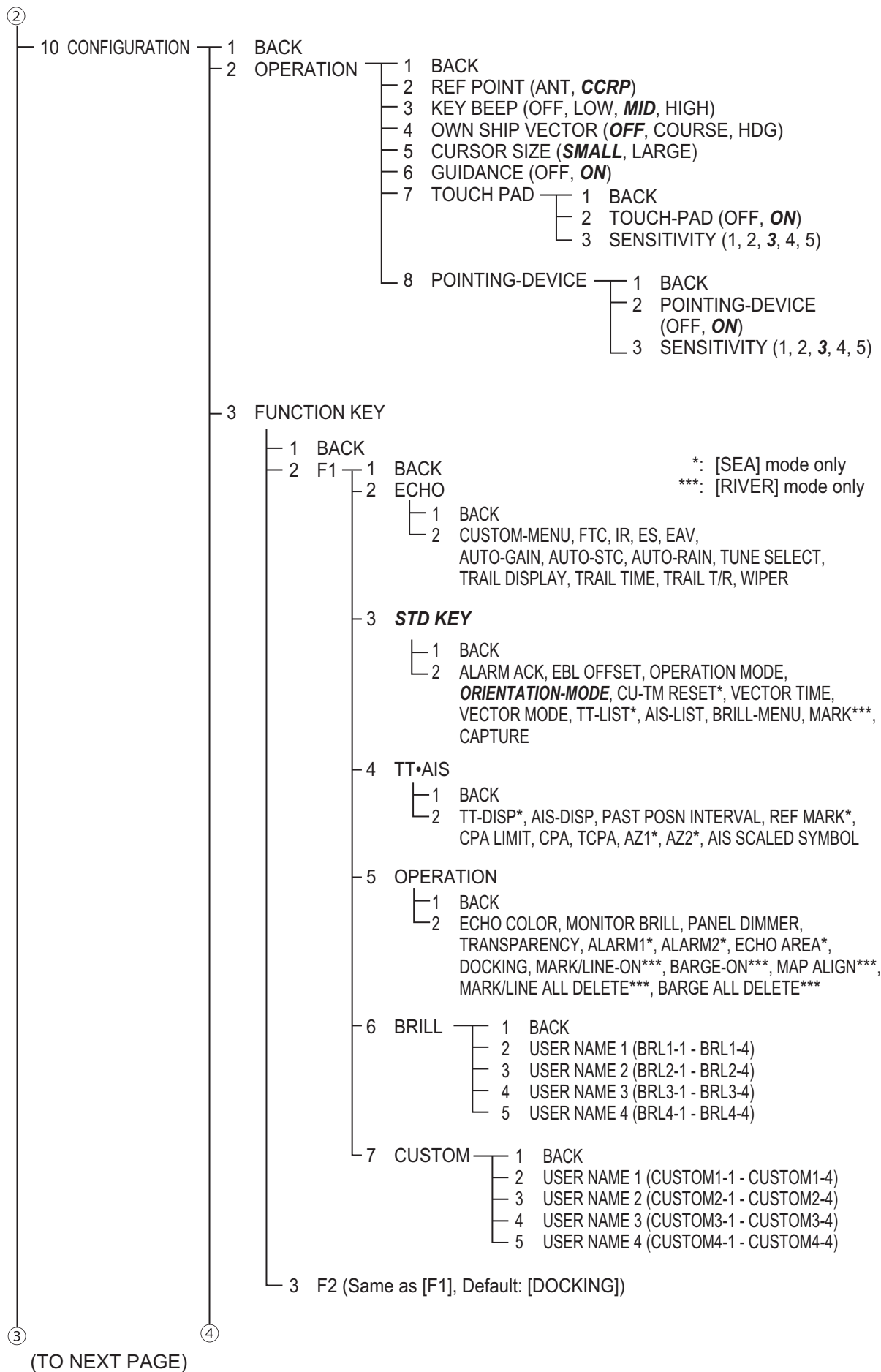


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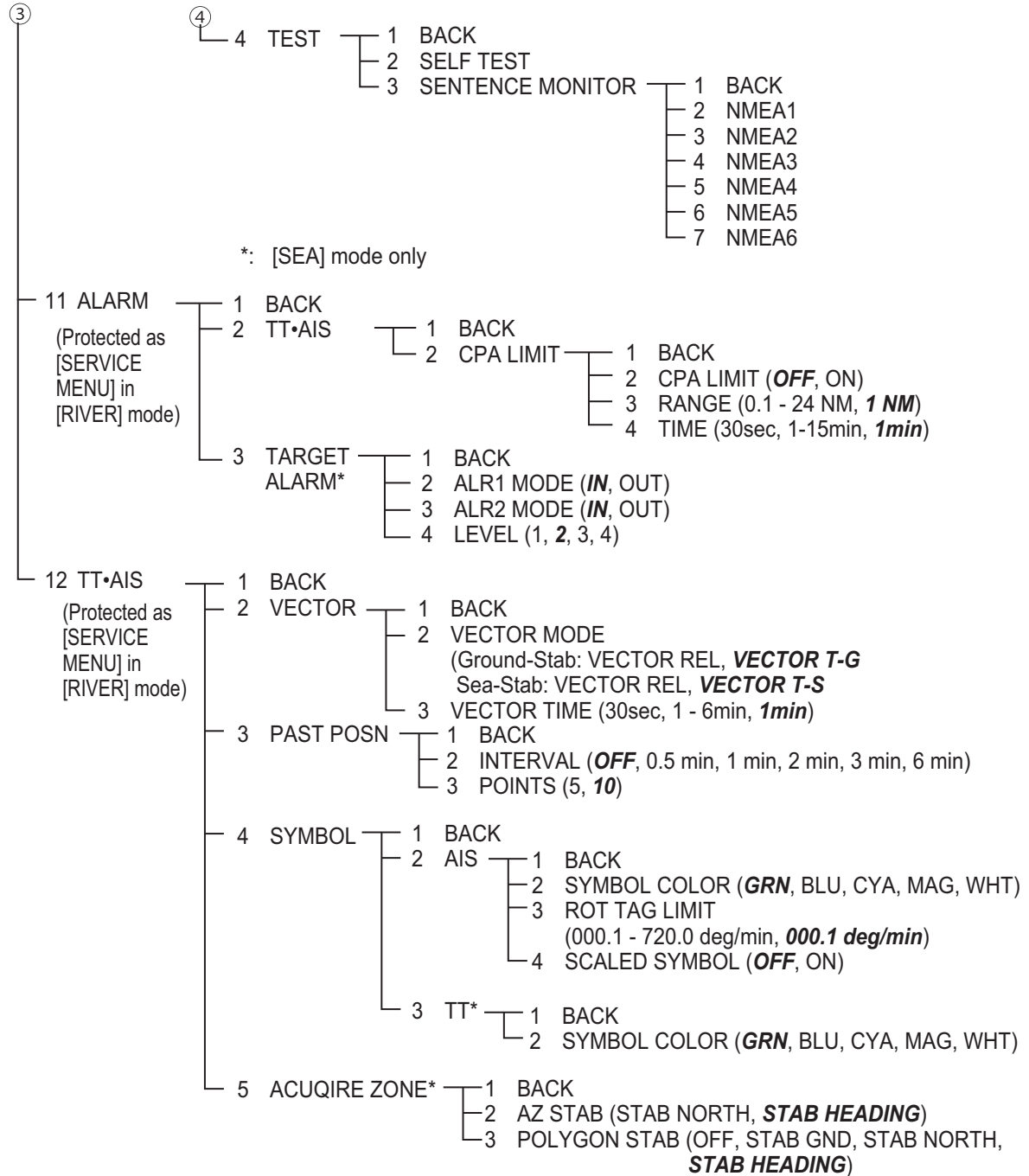


## APPENDIX 2 MENU TREE

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# APPENDIX 3 DIGITAL INTERFACE (IEC61162-1)

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## Input sentences

### ALR : Set alarm state

\$\*\*ALR,Hhmmss.ss,xxx,A,A,c—c,\*hh<CR><LF>  
1 2 3 4 5

1. Time of alarm condition change, UTC (000000.00 - 240001.00)
2. Unique alarm number (identifier) at alarm source (000 - 999)
3. Alarm condition (A=threshold exceeded, V=not exceeded)
4. Alarm acknowledge state (A=acknowledged, V=not acknowledged)
5. Alarm description text (alphanumeric)

### DBS : Depth Below Surface

\$\*\*DBS,x.x,f,x.x,M,x.x,F,\*hh<CR><LF>  
1 2 3 4 5 6

1. Water depth (0.00-99999.99)
2. feet
3. Water depth (0.00-99999.99)
4. Meters
5. Water depth (0.00-99999.99)
6. Fathom

### DBT : Depth Below Transducer

\$\*\*DBT,xxxx.x,f,xxxx.x,M,xxxx.x,F,\*hh<CR><LF>  
1 2 3 4 5 6

1. Water depth (0.00-99999.99)
2. feet
3. Water depth (0.00-99999.99)
4. Meters
5. Water depth (0.00-99999.99)
6. Fathoms

### DPT : Depth

\$\*\*DPT,x.x,x.x,x.x,\*hh<CR><LF>  
1 2 3

1. Water depth relative to the transducer, meters (0.00-99999.99)
2. Offset from transducer, meters (-99.99 - 99.99)
3. Minimum range scale in use (no use)

### DTM : Datum Reference

\$\*\*DTM,ccc,a,x.x,a,x.x,a,x.x,ccc,\*hh<CR><LF>  
1 2 3 4 5 6 7 8

1. Local datum (W84=WGS84 W72=WGS72 S85=SGS85, P90=PE90  
User defined=999, IHO datum code)
2. Local datum subdivision code (NULL or one character)
3. Lat offset, min (-59.99999 - 59.99999)
4. N/S
5. Lon offset, min (no use)
6. E/W
7. Altitude offset, meters (no use)
8. Reference datum (W84=WGS84 W72=WGS72 S85=SGS85, P90=PE90)

**GBS : GNSS satellite fault detection**

\$\*\*GBS,hhmmss.ss,x.x,x.x,x.x,xx,x.x,x.x,x.x\*hh<CR><LF>  
                   1      2  3  4  5  6  7  8

1. UTC time of GGA or GNS fix associated with this sentence
2. Expected error in latitude (0.0 - 999.9)
3. Expected error in longitude (0.0 - 999.9)
4. Expected error in altitude (no use)
5. ID number of most likely failed satellite (no use)
6. Probability of missed detection for most likely failed satellite (no use)
7. Estimate of bias in meters on most likely failed satellite (no use)
8. Standard deviation of bias estimate (no use)

**GGA : Global Positioning System Fix Data**

\$\*\*GGA,hhmmss.ss,lll.lll,a,yyyyy.yyy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx,\*hh<CR><LF>  
                   1      2  3      4      5 6 7  8  9 10 11 12 13 14

1. UTC of position (no use)
2. Latitude (0.00000 - 9000.00000)
3. N/S
4. Longitude (0.00000 - 18000.00000)
5. E/W
6. GPS quality indicator (1 -5, 8)
7. Number of satellite in use (00 -99)
8. Horizontal dilution of precision (0.00 - 999.99)
9. Antenna altitude above/below mean sea level (-999.99 - 9999.99)
10. Unit, m
11. Geoidal separation (-999.99 - 9999.99)
12. Unit, m
13. Age of differential GPS data (0 - 99)
14. Differential reference station ID (0000-1023)

**GLL : Geographic Position**

\$\*\*GLL,lll.lll,a,yyyyy.yyy,a,hhmmss.ss,a,x,\*hh<CR><LF>  
                   1  2      3      4      5      6 7

1. Latitude (0.00000 - 9000.00000)
2. N/S
3. Longitude (0.00000 - 18000.00000)
4. E/W
5. UTC of position (no use)
6. Status (A=data valid V=data invalid)
7. Mode indicator (A=Autonomous D=Differential S=Simulator)

**GNS : GNSS Fix Data**

\$\*\*GNS,hhmmss.ss,lll.lll,a,llll.lll,a,c--c,xx,x.x,x.x,x.x,x.x,x.x,a\*hh<CR><LF>  
                   1      2  3  4  5 6  7  8  9 10 11 12 13

1. UTC of position (no use)
2. Latitude (0.00000 - 9000.00000)
3. N/S
4. Longitude (0.00000 - 18000.00000)
5. E/W
6. Mode indicator  
     N=No fix A=Autonomous D=Differential P=Precise R=Real Time Kinematic  
     F=Float RTK E=Estimated Mode M=Manual Input Mode S=Simulator Mode
7. Total number of satellites in use (00 - 99)
8. HDOP (0.0 - 999.99)
9. Antenna altitude, meters (-999.99 - 9999.99)
10. Geoidal separation (-999.99 - 9999.99)
11. Age of differential data (0 - 999)
12. Differential reference station ID (0000 - 1023)
13. Navigational status indicator



**ROT : Rate of Turn**

\$GPROT,x.x,A\*hh<CR><LF>

1 2

1. Rate of turn, deg/min, "-"=bow turns to port (-9999.9 - 9999.9)
2. Status: A=data valid, V=data invalid

**RSA : Rudder Sensor Angle**

\*\*RSA,x.x,A,x.x,A\*hhCR>&ltLF>

1 2 3 4

1. Starboard(or single) rudder sensor data (-180 - 180.0, NULL)
2. Starboard(or single) rudder sensor status (A=Vaild N=Data invalid)
3. Port rudder sensor data (-180 - 180.0, NULL)
4. Port rudder sensor status (A=Vaild N=Data invalid)

**THS : True heading & status**

\*\*THS,xxx.x,a\*hh<CR><LF>

1 2

1. Heading, degrees True (0.00 to 360.00)
2. Mode indicator (A=autonomous E=estimated M>manual input  
S=simulator V=data not valid)

**VDM: AIS VHF data-link message**

\*\*VDM,x,x,x,x,s--s,x,\*hh<CR><LF>

1 2 3 4 5 6

1. Total number of sentences needed to transfer the message (1 to 9)
2. Message sentence number (1 to 9)
3. Sequential message identifier (0 to 9, NULL)
4. AIS channel Number (A or B)
5. Encapsulated ITU-R M.1371 radio message (1 - 63 bytes)
6. Number of fill-bits (0 to 5)

**VDO: AIS VHF data-link own-vessel report**

!AIVDO,x,x,x,x,s--s,x,\*hh<CR><LF>

1 2 3 4 5 6

1. Total number of sentences needed to transfer the message (1 to 9)
2. Message sentence number (1 to 9)
3. Sequential message identifier (0 to 9, NULL)
4. AIS channel Number (A or B)
5. Encapsulated ITU-R M.1371 radio message (1 - 63 bytes)
6. Number of fill-bits (0 to 5)

**VHW : Water speed and heading**

\$GPVHW,x.x,T,x.x,M,x.x,N,x.x,K,\*hh <CR><LF>

1 2 3 4 5 6 7 8

1. Heading, degrees (0.0 - 359.9, NULL)
2. T=True (fixed)
3. Heading, degrees (0.0 - 359.9, NULL)
4. M=Magnetic (fixed)
5. Speed, knots (0.0 - 9999.9)
6. N=Knots (fixed)
7. Speed, knots (0.0 - 9999.9)
8. K=km/hr (fixed)

**VTG : Course over ground and ground speed**

\$GPVTG,x.x,T,x.x,M,x.x,N,x.x,K,a,\*hh <CR><LF>  
1 2 3 4 5 6 7 8 9

1. Course over ground, degrees (0.0 - 359.9)
2. T=True (fixed)
3. Course over ground, degrees (0.0 - 359.9)
4. M=Magnetic (fixed)
5. Speed over ground, knots (0.00-9999.9)
6. N=Knots (fixed)
7. Speed over ground (0.00 - 9999.9)
8. K=km/h (fixed)
9. Mode indicator (A=Autonomous, D=Differential E = Estimated (dead reckoning)  
M=Manual input S=Simulator N=Data not valid)

**VWR : Wind relative Bearing and Velocity**

\$\*\*VWR,x.x,x,x.x,N,x.x,M,x.x,K<CR><LF>  
1 2 3 4 5 6 7 8

1. Measured wind angle relative to the vessel, degrees (0.0 - 180.0)
2. L=Left semicircle, R=Right semicircle
3. Velocity, knots (0.0 - 9999.9)
4. Unit (N, fixed)
5. Velocity (0.0 - 999.9)
6. Unit (M, fixed)
7. Velocity, km/h
8. Unit (K, fixed)

**VWT : True Wind Speed and Angle**

\$\*\*VWT,x.x,x,x.x,N,x.x,M,x.x,K<CR><LF>  
1 2 3 4 5 6 7 8

1. Measured wind angle relative to the vessel, degrees (0.0 - 180.0)
2. L=Left semicircle, R=Right semicircle
3. Velocity, knots (0.0 - 9999.9)
4. Unit (N, fixed)
5. Velocity (0.0 - 999.9)
6. Unit (M, fixed)
7. Velocity, km/h
8. Unit (K, fixed)

**ZDA : Time and date**

\$GPZDA,hhmmss.ss,xx,xx,xxxx,xx,xx<CR><LF>  
1 2 3 4 5 6

1. UTC (000000 - 235959)
2. Day (01 - 31)
3. Month (01 -12)
4. Year (UTC, 0000 - 9999)
5. Local zone, hours (-13 to ±13)
6. Local zone, minutes (00 to ±59)



Output sentences

TTM : Tracked target message

```
$RATTM,05,12.34,23.4,R,45.67,123.4,T,1.23,8.23,N,c--c,T,R,hhmmss.ss,M*hh<CR><LF>
      1   2   3   4   5       6   7   8   9  10 11 12 13   14   15
```

1. Target number (00 to 99)
2. Target distance from own ship (0.000 - 999.9)
3. Bearing from own ship,degrees (0.0 - 359.9)
4. True or Relative
5. Target speed (0.00 - 99.9, 100.0 - 999.9)
6. Target course, degrees (0.0 - 359.9)
7. True or Relative
8. Distance of closet point of approach (0.000 - 999.9)
9. Time to CPA, min., "-"increasing (-6000 - 6000)
10. Speed/distance units, K=Km, km/h N=nm, km S=sm, mph)
11. Target name (c--c)
12. Target status (L=Lost Q=Acquiring T=Tracking)
13. Reference target (R, NULL otherwise)
14. UTC of data (hhmmss.ss)
15. Type of acquisition (A=automatic M=manual R=reported)

## SPECIFICATIONS OF RIVER RADAR FR-1908V-BB/1918V-BB

### 1 ANTENNA UNIT

- |     |                        |   |
|-----|------------------------|---|
| 1.1 | Radiator type          | Slotted waveguide array   |
| 1.2 | Polarization           | Horizontal  |
| 1.3 | Antenna rotation speed | 26 rpm nominal  |
| 1.4 | Radiator length        | 6.5 ft (XN20AF), 8 ft (XN24AF)  |
| 1.5 | Horizontal beam width  |   |
|     | -3dB                   | 1.23° (XN20AF) 0.95° (XN24AF)   |
|     | -20dB                  | 2.84° (XN20AF), 2.5° (XN24AF)   |
| 1.6 | Vertical beam width    | 20° (-3dB)  |
| 1.7 | Sidelobe attenuation   | -26 dB or less (within ±10° of main-lobe)<br>-32 dB or less (outside ±10° of main-lobe) |
| 1.8 | Antenna gain           | 30.0 dB (XN20AF), 31 dB (XN24AF)  |
| 1.9 | Wind load              | 100 km/h relative   |

### 2 RF TRANSCEIVER

- |     |   |                           |
|-----|---|---------------------------|
| 2.1 | Frequency                                       | 9410 MHz ±30 MHz (X band) |
| 2.2 | Modulation                                      | P0N                       |
| 2.3 | Peak output power                               |                           |
|     | FR-1908V-BB                                     | 4 kW nominal              |
|     | FR-1918V-BB                                     | 12 kW nominal             |
| 2.4 | Range, Pulselength, Pulse Repetition Rate (PRR) |                           |

River mode

	Range (SM)	Pulselength (μs)	PRR (Hz)
S	0.125 to 2	0.04	4000
M1	1.6 to 4	0.12	2000
M2	4 to 16	0.28	2000
L	8 to 64	0.6	1000*

\*: 750 Hz for 64 SM

Sea mode (1)

	Range (NM/SM)	Pulselength (μs)	PRR (Hz)
S	0.125 to 2	0.04	4000
M1	1.5 to 4	0.12	2000
M2	3 to 16	0.28	2000
L	6 to 64	0.6	1000*

\*: 750 Hz for 64 NM/SM

Sea mode (2)

	Range (km/kyd)	Pulselength (μs)	PRR (Hz)
S	0.125 to 4	0.04	4000
M1	3 to 8	0.12	2000
M2	6 to 32	0.28	2000
L	12 to 64	0.6	1000

- 2.5 Modulator FET switching
- 2.6 Intermediate Frequency 60 MHz, Logarithmic amplifier
- 2.7 Tuning Manual/Automatic
- 2.8 Receiver front end MMIC
- 2.9 Duplexer Ferrite circulator with diode limiter

### 3 PROCESSOR UNIT

- 3.1 Orientation mode
  - River mode Head-up or Stern-up, relative motion
  - Sea mode Head-up, Head-up TB or Stern-up (relative motion),  
North-up or Course-up (relative/true motion)

- 3.2 Range, Range ring interval (RRI), Number of rings

River mode

Range (SM)	0.125	0.25	0.5	0.8	1.2	1.6	2	4	8	16	32	64
RRI (SM)	0.025	0.05	0.1	0.2	0.2	0.4	0.4	1	2	4	8	16
Number of rings	5	5	5	4	6	4	5	4	4	4	4	4

Sea mode

Range (NM/SM/km/kyd)	0.125	0.25	0.5	0.75	1	1.5	2	3	4	6	8	12	16	24	32	48	64
RRI (NM/SM/km/kyd)	0.025	0.05	0.1	0.25	0.25	0.25	0.4	0.5	1	1	2	2	4	4	8	8	16
Number of rings	5	5	5	3	4	6	5	6	4	6	4	6	4	6	4	6	4

- 3.3 Minimum range 15 m (FR-1908V-BB), 20 m (FR-1918V-BB)
- 3.4 Range discrimination 15 m (FR-1908V-BB), 20 m (FR-1918V-BB)
- 3.5 Range accuracy 1.5% of range or 5 m, whichever is the greater
- 3.6 Bearing accuracy  $\pm 0.5^\circ$
- 3.7 Echo trail
  - River mode Off/1.25/2.5/5 sec. (relative/true\*)
  - Sea mode Off/5/15/30 sec., 1/3/6 min. (relative/true\*)
- 3.8 Off-center 0/20/40/60 %
- 3.9 Radar map\* Available (mark: 5,000 points)
- 3.10 Target tracking\*\* (TT) 100 targets
- 3.11 AIS 300 targets

\*: compass and L/L data required. \*\*: compass and speed data required.

### 4 INTERFACE

- 4.1 Data format IEC61162-1/2 Ver.1.5/2.0/3.0/4.0: 2 ports (heading, AIS)  
IEC61162-1 Ver.1.5/2.0/3.0/4.0: 4 ports (speed, L/L, others)
- 4.2 Data sentences
  - Input ALR, DBS, DBT, DPT, DTM, GBS, GGA, GLL, GNS, HDT, HTD, MWV, RMC, ROT, RSA, THS, VDM, VDO, VHW, VTG, VWR, VWT, ZDA
  - Output TTM
- 4.3 Radar signal output 1 port (HD, BP, Trg, Video)
- 4.4 Ethernet 1 port (for maintenance)
- 4.5 USB port 2 ports for control monitor brilliance
- 4.6 Picture data output DVI-D, RGB
- 4.7 SD card slot 2 slots, SD/SDHC

**5 POWER SUPPLY**

- 5.1 Processor unit 24 VDC: 3.9 A (FR-1908V-BB), 5.0 A (FR-1918V-BB)
- 5.2 Rectifier (RU-1746B-2, option) 100-115/220-230 VAC, 1 phase, 50/60Hz

**6 ENVIRONMENTAL CONDITIONS**

- 6.1 Ambient temperature
  - Antenna unit -25°C to +55°C (storage: -25°C to +70°C)
  - Processor unit -15°C to +55°C
- 6.2 Relative humidity 93% or less at +40°C
- 6.3 Degree of protection
  - Antenna unit IP46
  - Processor unit IP20
  - Control unit IP22
- 6.4 Vibration IEC 60945 Ed.4

**7 UNIT COLOR**

- 7.1 Antenna unit N9.5
- 7.2 Processor/Control unit N2.5

**8 COMPASS SAFE DISTANCE**

- 8.1 Processor unit Standard: 0.70 m, Steering: 0.40 m
- 8.2 Control unit Standard: 0.60 m, Steering: 0.35 m

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