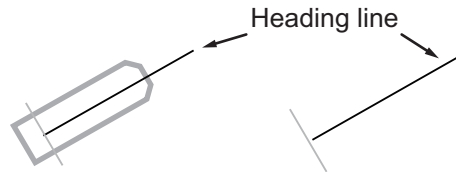# 1.43   How to Use Marks

1.43.1   Heading line mark

The heading line is a line from the own ship position to the outer edge of the radar dis-play area and appears at zero degrees on the bearing scale in HEAD UP mode. The orientation of the line changes depending on the ship orientation in NORTH UP and True Motion modes.


Heading line

How to hide the heading line temporarily

To temporarily extinguish the heading line to look at targets existing dead ahead of own ship, press and hold the **HL OFF** key, or place the cursor on the [HL OFF] box in the InstantAccess bar™ then left-click and hold.

In addition to the heading line, the stern marker and all graphics within the operational display area are also erased. To redisplay the heading line, etc., release the key or the **left button**.

1.43.2   How to hide/show the stern mark

The stern marker, which is a dotted line, appears opposite to the heading line.
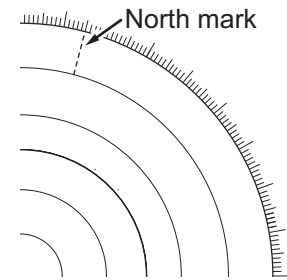

Stern line
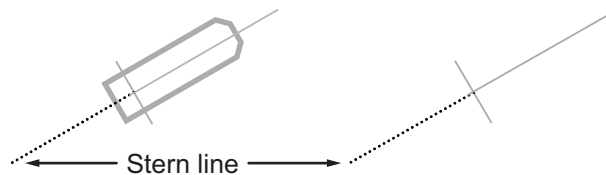
To display or erase this marker do the following:

1.   Open the menu.
2.   Select [2 MARKS].
      For A/B/W-types with Radar Plotter functionality, select [2 MARKS•CHART].
3.   Select [3 STERN MARK].
4.   Select [ON] or [OFF] as appropriate.
5.   Close the menu.

1.43.3 North mark

The north mark is displayed as a short dotted line on the in-side edge of the operational display area. In HEAD UP mode, the north mark moves according to the own ship bearing.

The north mark is hidden when the radar is in standby mode.

North mark

1.43.4 How to set up the own ship symbol

The own ship symbol marks own position on the display. It can be turned on or off and its configuration selected from the [MARK] menu. Two configurations are available: minimized symbol and scaled symbol. If the largest dimension of the symbol gets smaller than 6 mm, the scaled symbol will disappear and the own ship mark will be shown as a minimized symbol. The scaled symbol is scaled to indicate the length and beam of the vessel. Ship's dimensions should be entered at installation to use the scaled ship symbol.
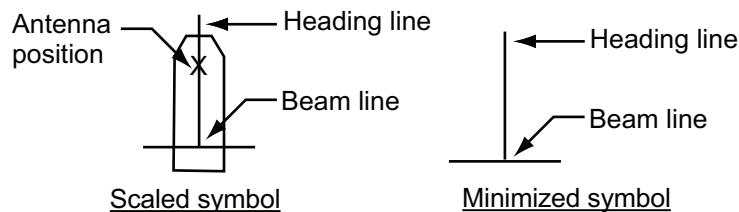
1. Open the menu.
2. Select [2 MARKS].
   For A/B/W-types with Radar Plotter functionality, select [2 MARKS·CHART].
3. Select [2 OWN SHIP MARK].
4. Select [MINIMIZED] or [SCALED] as appropriate.
5. Close the menu.

1.43.5 How to set the barge marker

You can mark the locations of barges on the display with icons.

Note: This function is not available if [ECDIS] is set to [SERIAL] or [LAN] at installation. Consult your dealer for details.

Set up barge information as follows:

1. Open the menu.
2. Select [2 MARKS].
   For A/B/W-types with Radar Plotter functionality, select [2 MARKS·CHART].
3. Select [6 BARGE MARK].
4. Select [2 BARGE MARK DISPLAY].
5. Select [ON] to display barge marks, [OFF] to hide barge marks, as appropriate.
6. Select [3 BARGE SIZE]. Spin the scrollwheel, then left-click to enter the [LENGTH] and [WIDTH] of the barge.

7. Select [4 BARGE ARRANGEMENT]. This item lets you set a single barge or a barge chain. Spin the scrollwheel to select a value, then left click to move the cursor to the next line. Select number of barges (max. 9) to display. As you spin the scrollwheel the squares light or extinguish and the number of barges selected appears at the right side.

First row of barge [ARRANGEMENT] is displayed as the right side of the barge icon on-screen.

Own ship icon

You can also use the number keys on the Control Unit to select the number of barges.

8. Close the menu. The barge mark is now displayed as shown in the example figure on the previous page.

1.43.6 Antenna mark

When [2 OWN SHIP MARK] in the [2 MARKS] (for A/B/W-types with Radar Plotter functionality, this menu appears as [2 MARKS•CHART]) menu is set to [SCALED], the antenna location is shown as a blue cross. The location of the antenna, and therefore the antenna mark, is set at installation.

Antenna mark

1.43.7 Latitude/longitude grid

You can show/hide the lat/lon grid to suit your preferences.

1. Open the menu.

2. Select [2 MARK].
For A/B/W-types with Radar Plotter functionality, select [2 MARKS•CHART].

3. Select [0 NEXT] to show the next page.

4. Select [2 GRID], then select [ON] to show the grid, or [OFF] to hide the grid.

5. Close the menu.

1.44 Drop Mark

The operator can inscribe a drop mark at a selected location to find the range and bearing from own ship to the mark. This can be useful for marking a point to avoid while navigating to a destination.
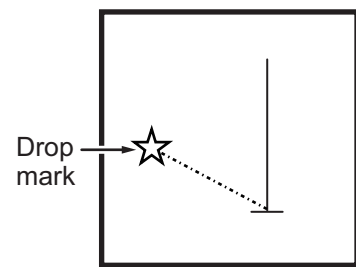
Drop mark

1.44.1 How to activate the drop mark

To active the drop mark feature, do the following:

1. Open the menu.
2. Select [2 MARKS].
   For A/B/W-types with Radar Plotter functionality, this menu appears as [2 MARKS•CHART].
3. Select [4 DROP MARK].
4. Select [ON] to enable [DROP MARK]. Two indications appear at the bottom of the screen.

Drop mark boxes show the mark number, bearing and range to the mark.

5. Close the menu.

1.44.2 How to inscribe a drop mark

1. Select a drop mark box, then left-click.
2. Place the cursor at the location to inscribe the drop mark, then left-click. The drop mark box shows the range and bearing to the marked location.

1.44.3 How to erase drop marks

Select the drop mark to be erased, then press and hold the **left button**. The mark is erased and the range/bearing indications are no longer shown.

1.45 Brilliance and Color Schemes

Brilliance and color schemes are preset "palettes" that let you change the brilliance and color of on-screen data together.

1.45.1 How to select a brilliance and color scheme

The system has four presets of brilliance and color settings to choose from. Each preset is customizable (see section 1.45.3).

The following list shows each preset along with their default settings.

- [PLT1] (default [DAY-GRY]): preset for use in daylight with a gray background.
- [PLT2] (default [DAY-BLU]): preset for use in daylight with a blue background.
- [PLT3] (default [DUSK-BLU]): preset for use at dusk with a blue background.
- [PLT4] (default [NIGHT-GRY]): preset for use at night with a gray background.

To change the current scheme, do the following:

1. Place the cursor on the [PLT] indication, inside the brilliance settings box at the bottom-left of the screen.

   Place cursor here, then left-click to change brilliance preset, right-click to open the [BRILL] menu. ⟶

2. Spin the scrollwheel to show the scheme you want to use, then left-click. You can also left-click the indication to cycle through the schemes.

1.45.2 How to change the color and brilliance assigned to a palette

1. Referring to section 1.45.1, select the scheme whose settings you want to change.
2. Open the menu.
3. Select [9 INITIAL SETTINGS].
4. Select [2 BRILL]. The [BRILL] menu appears.
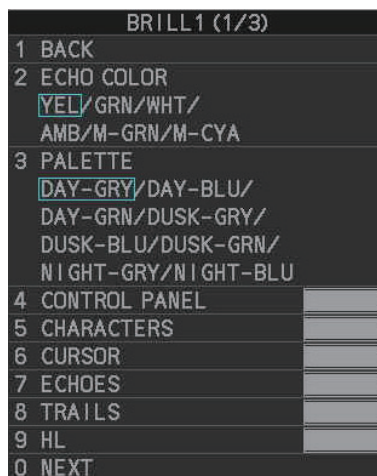
Note: You can also access this menu by right-clicking the [PLT] indication, inside the brilliance settings box at the bottom-left of the screen.

5. Select the appropriate item to adjust.

Menu item	Description
Page 1	
[2 ECHO COLOR]	Changes the color used to display echoes. The available colors are: [YEL] (yellow), [GRN] (green), [WHT] (white), [AMB]* (amber), [M-GRN]* (mutli-green), [M-CYA]* (multi-cyan). *: Shown for B/W-types only. If you select [M-GRN] or [M-CYA], the echo color changes depending on the echo strength. • [M-GRN]: red for strong echoes, ranging through to green for weak echoes. • [M-CYA]: red for strong echoes, ranging through to green for weak echoes.
[3 PALETTE]	Changes the color scheme (see subsection 1.45.3).
[4 CONTROL PANEL]	Adjusts control panel back-light brilliance.
[5 CHARACTERS]	Adjusts on-screen text brilliance.
[6 CURSOR]	Adjusts cursor brilliance.
[7 ECHOES]	Adjusts the echo brilliance.
[8 TRAILS]	Adjusts echo trail brilliance.
[9 HL]	Adjusts heading line brilliance.
Page 2	
[2 RANGE RINGS]	Adjusts range ring brilliance.
[3 BEARING CURSOR]	Adjusts bearing cursor brilliance.
[4 EBL]	Adjusts EBL line brilliance.
[5 VRM]	Adjusts VRM line brilliance.
[6 PI LINES]	Adjusts PI line brilliance.
[7 TT SYMBOLS]	Adjusts target trail symbol brilliance.
[8 AIS SYMBOLS]	Adjusts AIS symbol brilliance.
[9 L/L GRID]	Adjusts latitude/longitude grid brilliance.
Page 3	
[2 MARKS]	Adjusts latitude/longitude grid brilliance.
[3 CHART]	Adjusts chart brilliance. (Appears only for A/B/W-types with Radar Plotter functionality.)

6. Spin the scrollwheel, or press the appropriate menu number to change or adjust the settings, then left-click, or press the **ENTER MARK** key to confirm the setting.

7. Close the menu.

1.45.3 How to change the color palette

This radar provides eight sets of color and brilliance schemes to match any ambient lighting condition and can be assigned to a [BRILL] box preset.

1. Open the menu.
2. Select [9 INITIAL SETTINGS].
3. Select [2 BRILL]. The [BRILL] menu appears.
4. Select [3 PALETTE].
5. Select the appropriate palette. The default settings for each palette are shown in the following table.

Display item	Palette							
	DAY-GRY	DAY-BLU	DAY-GRN	DUSK-GRY	DUSK-BLU	DUSK-GRN	NIGHT-GRY	NIGHT-BLU
Screen brilliance	100	100	100	40	40	40	4	4
Panel brilliance	15	15	15	7	7	7	3	3
Character brilliance	15	15	15	15	15	15	15	15
Cursor brilliance	15	15	15	12	12	12	12	12
Echo brilliance	15	15	15	12	12	12	12	12
Trail brilliance	15	15	15	8	8	8	8	8
Heading Line brilliance	15	15	15	12	12	12	12	12
Range ring brilliance	15	15	15	7	7	7	15	15
Bearing ring brilliance	15	15	15	6	6	6	15	15
EBL brilliance	15	15	15	12	12	12	12	12
VRM brilliance	15	15	15	12	12	12	12	12
PI Line brilliance	15	15	15	12	12	12	12	12
TT symbol brilliance	15	15	15	12	12	12	12	12
AIS symbol brilliance	15	15	15	12	12	12	12	12
LL Grid brilliance	15	15	15	12	12	12	12	12
Mark brilliance	15	15	15	12	12	12	12	12
Chart brilliance[1]	7	7	7	6	6	6	6	6
Character color[2]	White	White	Green	White	White	Green	Orange	White
Background color[2]	Gray/black	Blue/dark blue	Gray/black	Dark gray/dark blue	Dark blue/blue	Dark gray/black	Dark gray/black	Dark blue/blue
ODA color[2]	Black	Dark blue	Black	Dark blue	Blue	Black	Black	Blue

[1]: Available for A/B/W-types only

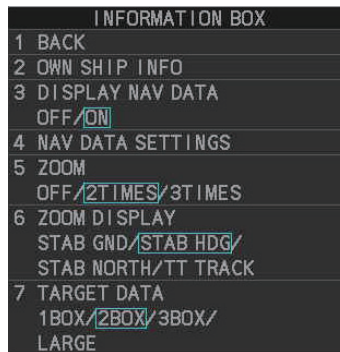[2]: This setting is fixed and cannot be changed.

6. Close the menu.
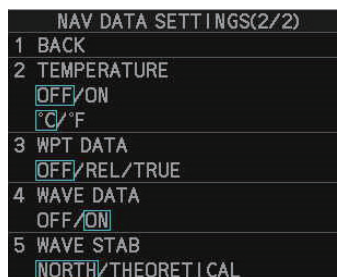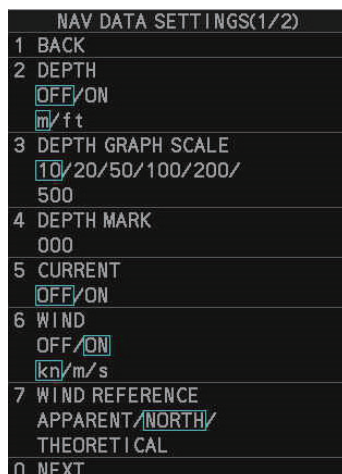
1.46 How to Display and Set Up Navigational Data

Wind, depth, ocean current, wave data, water temperature, date and time and waypoint data can be displayed on this radar, however appropriate sensors are required.

1.46.1 How to set up the navigational data

1. Open the menu.

2. Select [7 INFORMATION BOX].

```
INFORMATION BOX
1 BACK
2 OWN SHIP INFO
3 DISPLAY NAV DATA
  OFF/ON
4 NAV DATA SETTINGS
5 ZOOM
  OFF/2TIMES/3TIMES
6 ZOOM DISPLAY
  STAB GND/STAB HDG/
  STAB NORTH/TT TRACK
7 TARGET DATA
  1BOX/2BOX/3BOX/
  LARGE
```

3. Select [4 NAV DATA SETTINGS].

```
NAV DATA SETTINGS(1/2)
1 BACK
2 DEPTH
  OFF/ON
  m/ft
3 DEPTH GRAPH SCALE
  10/20/50/100/200/
  500
4 DEPTH MARK
  000
5 CURRENT
  OFF/ON
6 WIND
  OFF/ON
  kn/m/s
7 WIND REFERENCE
  APPARENT/NORTH/
  THEORETICAL
0 NEXT
```

```
NAV DATA SETTINGS(2/2)
1 BACK
2 TEMPERATURE
  OFF/ON
  °C/°F
3 WPT DATA
  OFF/REL/TRUE
4 WAVE DATA
  OFF/ON
5 WAVE STAB
  NORTH/THEORETICAL
```

4. Referring to the table below, select the appropriate menu item, then press the **ENTER MARK** key.

Menu item	Available settings
Page 1	
[2 DEPTH]	[OFF], [ON]; [m], [ft]
[3 DEPTH GRAPH SCALE]	[10], [20], [50], [100], [200], [500] (m)
[4 DEPTH MARK]	[000] to [500] (m)
[5 CURRENT]	[OFF], [ON]
[6 WIND]	[OFF], [ON]; [kn], [m/s]
[7 WIND REFERENCE]	[APPARENT], [NORTH], [THEORETICAL]
Page 2	
[2 TEMPERATURE]	[OFF], [ON]; [°C], [°F]
[3 WPT DATA]	[OFF], [REL], [TRUE]
[4 WAVE DATA]	[OFF], [ON]
[5 WAVE STAB]	[NORTH], [THEORETICAL]

Note 1: [4 WAVE DATA] requires connection to a PC with the wave analysis software installed.

Note 2: [4 WAVE DATA] can only be active at one radar at any time. If [4 WAVE DATA] is turned [ON] at another radar in the same network, it is automatically turned [OFF] at this radar.

5. Referring to the table above, select the appropriate setting, then press the **ENTER MARK** key.

6. Close the menu.

Wave data display

You can view wave data when a PC with the wave analysis software installed is connected to the same network as this radar. When [4 WAVE DATA] is set to [ON], the wave data appears in the information box in a manner similar to that shown below.

Significant wave height appears here.

Wind angle and speed appear here

Wind/wave directions appear as colored triangle icons around the compass circle. The center of the compass circle show the own ship and current bearing as an icon.
Purple color: wind direction
Cyan color: 1st wave's direction
Green color: 2nd wave's direction

[5 WAVE STAB] setting appears here.
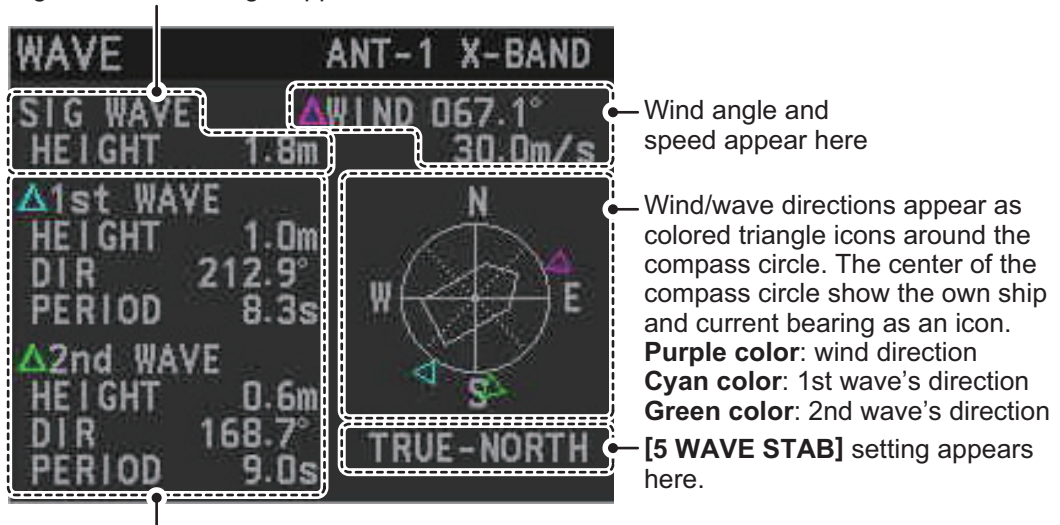
Wave information appears here.
[HEIGHT]: Wave height
[DIR]: Direction from which the wave is approaching.
[PERIOD]: Time until the wave meets own ship.

Note: Analysis data which has low integrity or reliability is displayed in yellow text.

For further details regarding the wave analysis data, see the operator's manual (OMC-36181) supplied with the wave analysis software.

1.46.2 How to display navigational data

1. Open the menu.
2. Select [7 INFORMATION BOX].
3. Select [3 DISPLAY NAV DATA].
4. Select [ON] to display navigational data, [OFF] to hide navigational data.
5. Close the menu.

1.47 How to Use the Information Box

The information box shows target data, navigational data and zoomed areas of the radar display. To set up the information box, do the following:

1. Open the menu.
2. Select [7 INFORMATION BOX].
3. Select and set the appropriate menu item, referring to the table below.
4. Close the menu.

Menu item	Settings	Description
[2 OWN SHIP INFO]	See section 1.11, section 1.12 and section 1.13 for details.	Set up various own ship information, such as sensors used for position fix, date and time format/offsets, heading and speed sensors used.
[3 DISPLAY NAV DATA]	• [OFF] • [ON]	• Disable navigational data display. • Enable navigational data display.
[4 NAV DATA SETTINGS]	See section 1.46 for details.	Set up the format in which various navigational data is displayed in the [INFORMATION BOX].
[5 ZOOM]	• [OFF] • [2TIMES] • [3TIMES]	• Disable zoom magnification. • Set zoom magnification at 2×. • Set zoom magnification at 3×.
[6 ZOOM DISPLAY]	• [STAB GND] • [STAB HDG] • [STAB NORTH] • [TT TRACK]	• Ground stabilized zoom (Geographically fixed). • Heading stabilized zoom (Relative). • North stabilized zoom (True). • Tracked targets are zoomed.
[7 TARGET DATA]	• [1BOX] • [2BOX] • [3BOX] • [LARGE]	See the figure on the following page.

1BOX	2BOX	3BOX	LARGE
Zoom and navigational data are displayed here.	Zoom and navigational data are displayed here.	Zoom and navigational data are displayed here, but can be hidden by TT/AIS data.	Zoom and navigational data are displayed here.
Zoom and navigational data are displayed here.	Zoom and navigational data are displayed here, but can be hidden by TT/AIS data.	Zoom and navigational data are displayed here, but can be hidden by TT/AIS data.	Only TT/AIS Data is displayed in the large box. Up to three AIS targets or up six TT targets. For MU-270W configurations, up to two TT targets can be shown.
Zoom can be displayed here, but can be hidden by TT/AIS data.	Zoom can be displayed here, but can be hidden by TT/AIS data.	Zoom can be displayed here, but can be hidden by TT/AIS data.	

• TT/AIS data displayed in the information box is shown in order of acquisition in the bottom half of the box.

• When the target data is no longer displayed (TT is cancelled, etc.) in the upper box, the previous display is restored.

• When using the 2BOX or 3BOX setting and the bottom half of the information box is full, the upper half is overlayed with the newly aquired TT/AIS target data.

• Each box may display up two TT targets or one AIS target. (For MU-270W configurations, up to three TT targets can be shown)

1.48 Interswitch

The interswitch of this radar uses an Ethernet to transfer video and control signals. A digital signal transfers the video and control signals. You can connect up to four antennas and four display units. Set radar display and antenna groups from the [ANTENNA SELECT] display.

When you switch to a different antenna, the heading skew and timing adjustment (set at installation) for that antenna are automatically applied.

The [ANTENNA] box at the upper left position shows current antenna selection.

Antenna box
ANTx: "x" indicates antenna selected.
(M) or (S): indicates antenna is (M)aster or (S)lave.
X-Band or S-Band: indicates antenna bandwidth.

1.48.1 How to display antenna information

1. Open the menu.
2. Select [9 INITIAL SETTINGS].
3. Select [3 SELECT ANTENNA]. The [SELECT ANTENNA] menu appears.
   Note: You can also right-click the [ANTENNA] box to access this menu.

SELECT ANTENNA	
1 BACK	
ANT 1 :	X-BAND
25UP	Main Top
ANT 2 :	S-BAND
30UP	Main 2nd
ANT 3 :	X-BAND
12	Fore
ANT 4 :	X-BAND
12	Aft
OWN RADAR NO.1	
2 DISP1	ANT1
	MASTER
DISP2	ANT2
	MASTER
DISP3	ANT3
	MASTER
DISP4	ANT4
	MASTER
9 SAVE INTER-SWITCH	
NO / YES	
0 CLEAR INTER-SWITCH	
NO / YES	

Using the information displayed in this example the antenna system configuration would look something like this.
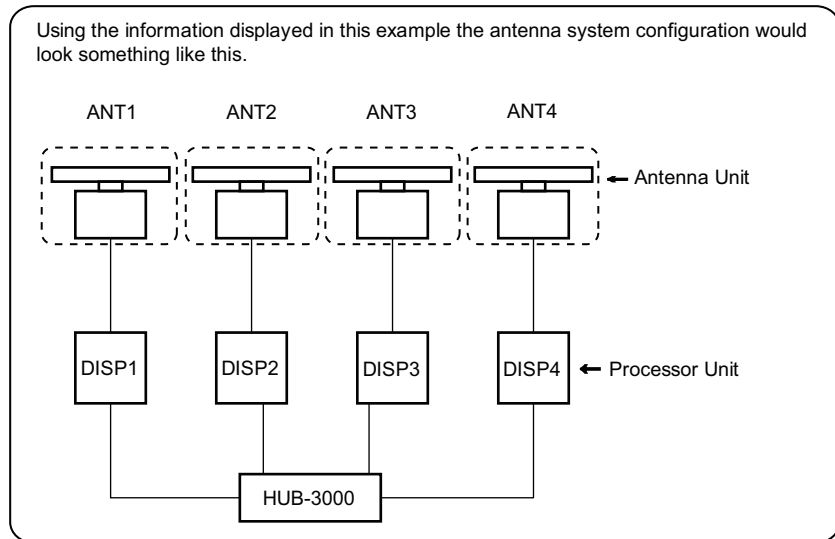
The following information is displayed in the [SELECT ANTENNA] menu:
• Radar band, output power and antenna position of each antenna currently powered. (If an antenna is not powered, its data area is blank.)
• Own ship radar number (radar in use).
• Current antenna and display combinations.

Note: For configurations with processors assigned as [DISP5]/[DISP6]/[DISP7]/[DISP8] at installation, the processor unit automatically connects to the system as [SLAVE] when first turned on. You can change this setting after the first connection. See section 1.48.2.

1.48.2 How to preset antenna and display combinations

You can preset the antenna and display combinations for each antenna and display in the radar system. As an example, the procedure below shows how to select the no. 1 antenna unit for the no. 2 display unit.

1. Open the menu.

2. Select [9 INITIAL SETTINGS].

3. Select [3 SELECT ANTENNA]. The [SELECT ANTENNA] menu appears.
   Note: You can also right-click the [ANTENNA] box to access this menu.

4. Select the display unit for which to select an antenna (at the next step). For the purpose of this example, select [DISP2] to select the no. 2 display unit.
   The indication for the antenna is highlighted.

5. Spin the scrollwheel to toggle between [MASTER] and [SLAVE]. The MASTER system passes on settings such as [CPA], [TCPA] and alarm settings to SLAVE radars connected to the same network.

6. Repeat steps 2 and 3 to set other display and antenna combinations.

7. Select [SAVE INTER-SWITCH], then select [YES] to save your selections.

8. Close the menu.

Antenna selection considerations

• An antenna unit cannot be controlled from multiple display units. Select one Master display unit for one antenna unit. If two antenna units are set as masters, the display last-set as master becomes the master and all other displays are automatically changed to slave.

• An antenna unit without a Master display cannot be selected on the sub display units. If there is no antenna unit set as master, the lowest number display is automatically set as master.

• If the Alert "EXT RADAR ERROR" appears, do one of the following, as applicable:
  - If only your antenna is not displayed on the [ANT SELECT] display, the LAN line in the Processor Unit may be faulty. In this case, use the standalone mode.
  - If the antenna that was in use does not appear on the [ANT SELECT] display, the LAN line in other Processor Unit may be faulty. In this case, see the preceding page for how to select a different antenna unit

• When the Network fails, the Interswitch does not work, but standalone operation is possible.

• Disable the Dual Radar function from the [RADAR INSTALLATION] menu (see the Installation manual IME-36520) before setting up the Interswitch feature.

• When using a FAR-2xx7 series radar for Interswitch connection, the following settings must be done from the FAR-2xx7 [RADAR INSTALLATION] menu.
  • Set [SCANNER] → [DUAL RADAR SETTINGS] → [DUAL RADAR] to [OFF].
  • Set [NETWORK] → [LAN1•3 IP ADDRESS] → CLASS to [C].

• When using a FAR-3xx0 series radar for Interswitch connection, the following settings must be done from the FAR-3xx0 [RADAR INSTALLATION] menu.
  • Set [SCANNER] → [OTHERS] → [COMBINE FUNC] to [OFF].
  • Set [NETWORK] → [LAN1•3 IP ADDRESS] → CLASS to [C].
  • Set the radar number as [1], [2], [3] or [4].
  • Disable the [Icing Prevention] feature.

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- Radar functions are controlled independently, dependently or commonly depending on selection as [MASTER] or [SLAVE] (see the following table).

Radar Functions	Control	Master Display Option	Slave Display Option
AIS function	Independent	Desired value can be set	Desired value can be set
Brilliance			
Echo trails			
EBL			
Lat/long data			
Presentation mode			
Speed data			
Target alarm			
TT, AIS on/off			
TT, AIS track interval			
Vector mode			
Vector time			
VRM			
Wiper			
Zoom			
TT COLLISION alarm			
Range*3			
A/C SEA*1	Dependent Control		Cannot control
A/C RAIN*1			
Automatic Clutter Elimination (ACE)*1			
Gain*1			
IR*2			
Echo stretch*1			
Echo averaging*1			
Picture setting*1 (Customize echo)			
STBY/TX			
Tuning			
Reference Point	Independent		Desired value can be set
TT LOST warning	Common Control	Item Commonly Controlled	Item Commonly Controlled
TT alerts ACK			
TT acquire			
TT/AIS AZ			

*1: When the connected radar is a FAR-2xx8/FAR-3xx0 series radar, these items can be adjusted from the "Slave" radar.

*2: When the connected radar antenna is a FAR-3xx0/FAR-2xx8 series magnetron-type, and the radar is assigned as "Slave", the desired value can be set for these functions. For FAR-3xx0/FAR-2xx8 series SSD-types, these functions cannot be controlled.

*3: The desired value can be set when the radar is assigned as "Slave", however the maximum displayable range is dependent on the setting at the "Master" radar.

Compatibility of display and operation

When connecting with FAR-2xx7 series radar

When switching the antenna from FAR-2xx8 to FAR-2xx7, the image for FAR-2xx7 is displayed on the screen and each function is operative. However, when switching the antenna from FAR-2xx7 to FAR-2xx8, the following functions are not operative.

- Automatic Clutter Elimination (ACE) function.
- Selection of the transmit frequency by the [TX CH] button for solid state radar.
- Target Analyzer function.
- Hatching.
- Berthing STC.

1.48.3 How to clear the interswitch

You can clear the interswitch settings by following the procedure below.

1. Open the menu.
2. Select [9 INITIAL SETTINGS].
3. Select [3 SELECT ANTENNA]. The [SELECT ANTENNA] menu appears.
   Note: You can also right-click the [ANTENNA] box to access this menu.
4. Select [0 CLEAR INTER-SWITCH].
5. Select [YES] to clear the interswitch settings. The antenna settings are restored to default.

1.49 Performance Monitor

The performance monitor, installed in the antenna unit, produces a visual indication on the radar display screen when the radar transmitter power and radar receiver sensitivity are within the prescribed limits.

1.49.1 How to activate/deactivate the performance monitor

1. Set the radar to TX (transmit) mode.
2. Open the menu.
3. Select [1 ECHO].
4. Select [5 PERFORMANCE MONITOR].
5. Select the appropriate setting, then press the **ENTER MARK** key.
   - [OFF]: Deactivate the performance monitor.
     Note: You can also deactivate the performance monitor by adjusting the range manually.
   - [ON]: Activate the performance monitor and show the graph.
   - [GRAPH ONLY]: Show the performance monitor graph, however the performance monitor is not activated.
6. Close the menu.

When the performance monitor is active, the indication "PM" appears in yellow characters at the top of the display.

Note: If the blind sector and the direction of the PM antenna overlap one another, turn off the blind sector in order to display echoes correctly.

The radar is automatically set as follows when the performance monitor is activated.

Setting	Setting at PM activation	Adjustable while PM is active	Setting at PM deactivation
[GAIN]	70 *[1]	Yes *[3]	Setting before PM activation.
[SEA]	0	No	Setting before PM activation.
[SEA AUTO]	MAN	No	Setting before PM activation.
[RAIN]	0	No	Setting before PM activation.
[RAIN AUTO]	MAN	No	Setting before PM activation.
[TUNE] (Shown for magnetron radars only)	AUTO	No	Setting before PM activation.
[TX CH] (Shown instead of [TUNE] for solid-state radars only)	CH1	No	Setting before PM activation.
[ACE]	OFF	No	Setting before PM activation.
[ES]	OFF	No	Setting before PM activation.
[EAV]	OFF	No	Setting before PM activation.
[IR]	2	No	Setting before PM activation.
[NOISE REJECT]	OFF	No	Setting before PM activation.
[VIDEO CONTRAST]	4-B	No	Setting before PM activation.
[PULSE]	LONG	No	Setting before PM activation.
[2ND ECHO REJ]	OFF	No	Setting before PM activation.
[LOW LEVEL ECHO]	Previous setting kept, fixed.	No	Setting before PM activation.
[WIPER]	OFF	No	Setting before PM activation.
[CUSTOMIZED ECHO]	Previous setting kept, fixed.	No	Return to active display.
[PRESENTATION MODE]	No change. *[2]	Yes	Setting at PM deactivation.
[RANGE]	24 NM, 24 SM, 48 km, 48 kyd*[5]	Yes *[4]	Setting before PM activation.
[OFF CENTER]	OFF	Yes	Setting at PM deactivation.
Antenna revolution	24 rpm	No	Setting before PM activation.
[VIDEO CONTRAST TYPE]	4-B*[6]	No	Setting before PM activation.

*[1]: Gain is automatically set according to [PM GAIN ADJ], if it was adjusted at installation.

*[2]: [NORTH UP RM] is selected when the [PRESENTATION MODE] is set to [NORTH UP TM].

*[3]: The setting is not memorized.

*[4]: The performance monitor is deactivated if the range is changed manually.

*[5]: Range units other than NM are available for B/W-types only.

*[6]: When Ice Mode is enabled, the video contrast setting for Ice Mode is used.
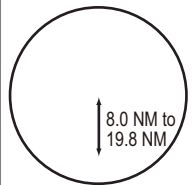
1.49.2 How to check the radar's performance

The range scale is automatically set to 24 NM. The radar screen will show arcs. If the radar transmitter and receiver are in good working conditions in as much as the original state when the monitor was turned on, the innermost arcs should appear between 8.0 NM to 19.8 NM. The performance monitor can observe a total of 10 dB loss in transmitter and receiver.

How to set the number of arcs

1. Open the menu.
2. Select [1 ECHO].
3. Select [6 PM ARC].
4. Select [2], [3], [5] or [6] as appropriate, then press the **ENTER MARK** key.
5. Close the menu.

The figure belows shows an example where [PM ARC] is set to [5].

Display	Radar State	Display	Radar State
8.0 NM to 19.8 NM	**Transmitter:** normal **Receiver:** normal	8.0 NM to 19.8 NM	**Transmitter and receiver:** No arc indicates 10 dB loss. Contact your dealer for advice. (For magnetron radars, have a technician check the magnetron.

Note 1: The lengths of the arcs can vary according to installation environment. Judge the strength of the echo that appears within 60° from the arc location to confirm if the radar is working properly or not.

Note 2: The location of the arcs changes according to the [PM ARC] setting.

Turn the performance monitor off when finished.

1.50 How to Change the Reference Position

The reference position for measurements (range, bearing, etc.) and markers (heading line, stern mark, etc.) can be the radar antenna position ([ANT]) or the consistent common reference point ([CCRP]).

The reference position 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.

[CCRP] for this series of radars is fixed at the conning position and [ANT] is fixed at the radar antenna position.

To change the reference position, use the trackball to place the cursor over the "REF POINT" indication at the top of the screen, then left-click to select [ANT] or [CCRP] as required. You can also change the reference by spinning the scrollwheel when the cursor is placed over the indication.

The position of the own ship marker changes according to reference position as shown below. If the CCRP is positioned outside of the effective display area, the bearing scale is indicated with the appropriate reduced detail.

Radar antenna position is at center of display

Conning position is at center of display

ANT position   CCRP position
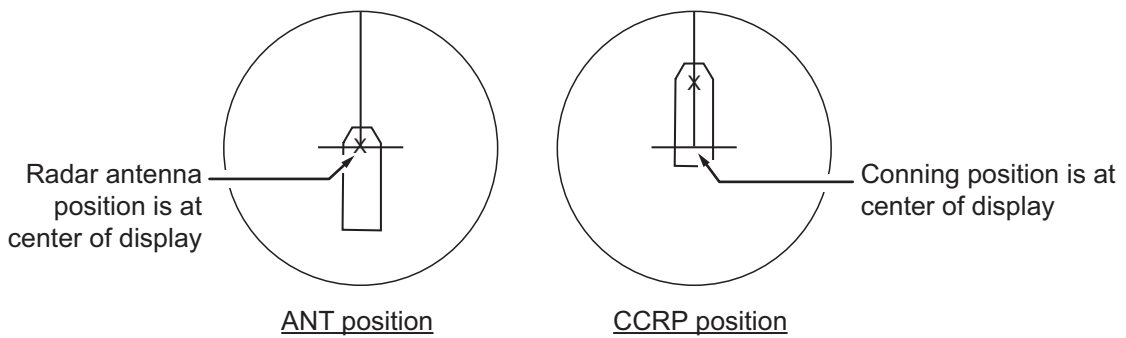
Range and bearing are measured and graphics are drawn according to reference position as in the table below.

Category	Item	Reference point	
		ANT	**CCRP**
Range and bearing measurements	EBL	Range and bearing measured from antenna position.	Range and bearing measured from CCRP.
	VRM		
	Cursor		
	PI line		
	Range ring		
	Drop mark		
Graphics	Heading line	Drawn from antenna position.	Drawn from CCRP.
	Stern mark		
	Beam line		
	Own ship vector		
	Own ship track		
Bearing cursor		Drawn with antenna position at center.	Drawn with CCRP at center.
Course, speed		Calculated with antenna position at center.	Calculated with CCRP at center.
Table continued on following page			

Category	Item	Reference point	
		ANT	**CCRP**
Table continued from previous page			
CPA, TCPA		Calculated with antenna position at center.	Calculated with CCRP at center.
BCR, BCT		Calculated from bow position.	
Own ship data	Heading	Data is taken from respective sensors, regardless of reference point selected.	
	Speed		
	Course over ground		
	Speed over ground		
	Own L/L	Location of the CCRP.	

Note: When the antenna is located some distance from the CCRP, the CCRP can be outside the bearing cursor in true-motion or off-center. Also, when the CCRP is set as a reference point, some parts of the bearing cursor are not displayed.

1.51 Anchor Watch

The anchor watch feature alerts you when your ship has traveled a distance greater than a threshold value, when it should be at rest. When the anchor watch is active, an orange dashed circle marks the anchor watch range.

If your ship drifts more than the anchor watch setting, the alert "ANCHOR WATCH" appears in the [ALERT] box. The alert is escalated from warning level to alarm level if the alert is not acknowledged within one minute. Also, if your vessel returns to within the tolerable radius, the alert status is automatically changed to rectified.
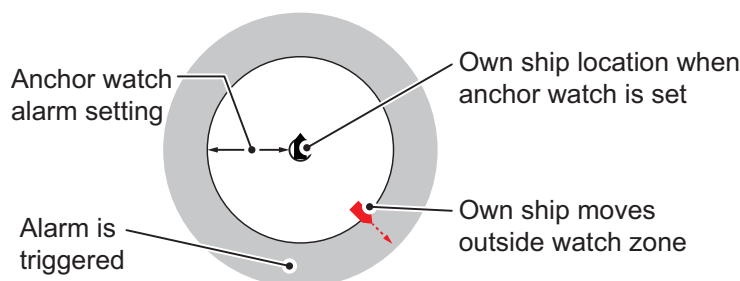
1. Open the menu.
2. Select [4 ALERTS].
3. Select [4 ANCHOR WATCH].
4. Select [ON] to enable [ANCHOR WATCH], then press the **ENTER MARK** key.
5. Spin the scrollwheel to set the distance for the alert. Press the **ENTER MARK** key to apply the setting.
6. Close the menu.

1.52 Alerts

1.52.1 What is an alert?

"Alert" is a generic name for a notice to any unusual or potentially dangerous situation generated within the system.

For detailed information regarding specific alerts and alert codes, including possible remedies, see "ALERT CODES, MESSAGES & MEANINGS" on page AP-11.

Alerts are classified according to priority and category.

Alert priority

The level of priority, from highest to lowest, is ALARM → WARNING → CAUTION. For detailed information regarding specific alerts and alert codes, including possible remedies, see "ALERT CODES, MESSAGES & MEANINGS" on page AP-11.

Note: All active-unacknowledged warnings, except ANCHOR WATCH, are repeated as warnings after 60 seconds (manufacturer's fixed time period). The ANCHOR WATCH alert is escalated from warning level to alarm level if it is not acknowledged within 60 seconds.

Alert category

An alert is further classified by category, A, B or C, according to its degree of severity or source.

Category	Description
A	Category A alerts include alerts indicating • Danger of collision • Danger of grounding
B	Category B alerts are alerts where no additional information for decision support is necessary. Category B alerts are all alerts not falling under category A.
C	Engine-related alert

1.52.2 How to interpret the [ALERT] box

When an alert condition is found, the applicable alert message appears in the [ALERT] box. A buzzer sounds for alarm and warning alerts. The [ALERT] box is composed of three lines of text information, and several icons, as shown below.
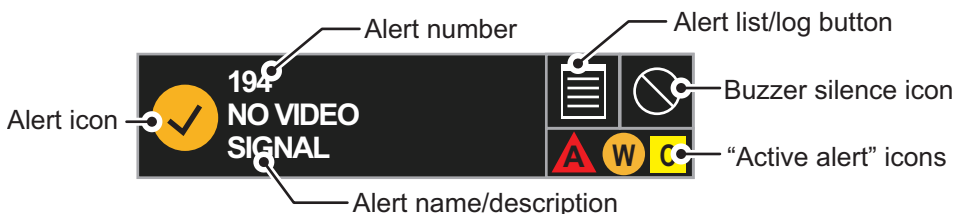
When an Alarm or Warning level alert is released, the alert message flashes in the [ALERT] box. The message is accompanied by the appropriate alert icon and the buzzer sounds. The buzzer and alert continue to flash and sound until the buzzer is silenced or the alert condition is rectified.

The alert also appears in the [ALERT LIST] (see section 1.52.5) until acknowledged and rectified.

1.52.3 How to silence the alert buzzer

You can temporarily silence the buzzer by clicking the buzzer silence icon in the [ALERT] box. The icon for a silenced alert also changes, as show in section 1.52.6.

1.52.4 How to acknowledge an alert

Alerts can be acknowledged in one of the following manners:

• Press the **ALARM ACK** key.

• Click the alert name in the [ALERT] box.

• Click the alert name in the [ALERT LIST].

The icon for an acknowledged alert changes as shown in section 1.52.6.

1.52.5 Alert list

The alert list displays the names of violated alerts, including the time and date violated. Up to 100 alerts are stored in the internal memory. Unacknowledged alarms are displayed first in the list (in red text), in the order in which they appear in the [ALERT] box. Unacknowledged warnings are displayed in the list (in yellow-orange text), in the order in which they appear in the [ALERT] box.

Cautions are displayed in the list (in yellow text), in the order in which they appear in the [ALERT] box.

To display the alarm list, place the cursor on the alert list/log button in the [ALERT] box then left-click.

An unacknowledged alert can be acknowledged from the list by selecting it, then left-clicking. To erase the data for the number selected, left-click again. To refresh the alert list, select [9 REFRESH DATA], then press and hold the **left button**.

1.52.6 Alert icons and their meanings

Icon	Status	Visual indication	Audible alert
	Active - unacknowledged alarm	Red, flashing	3 short, audible alerts repeated every 7 seconds.
	Active - silenced alarm	Red, flashing	Silent
	Active - acknowledged alarm	Red	Silent
	Active - responsibility transferred alarm	Red	Silent
	Rectified - unacknowledged alarm	Red	Silent
	Active - unacknowledged warning	Yellow-orange, flashing	2 short, audible alerts repeated every 60 seconds.
	Active - silenced warning	Yellow-orange, flashing	Silent
	Active - acknowledged warning	Yellow-orange	Silent
	Active - responsibility transferred warning	Yellow-orange	Silent
	Rectified - unacknowledged warning	Yellow-orange	Silent
	Caution	Yellow	Silent

1.53 Icing Prevention

You can rotate the antenna (24 rpm) without transmission to keep the antenna from freezing.

1. Open the menu.

2. Select [9 INITIAL SETTINGS].

3. Select [5 OPERATION].

4. Select [7 ICING PREVENTION].

5. Select [ON] or [OFF] as appropriate. If you select [ON], the message "Rotate Antenna to Prevent Icing." appears at the bottom of the screen.

6. Click [Start Antenna Rotation] to rotate the antenna without transmission. The message changes to read "Antenna Rotating,No TX.".

When the antenna stops   When the antenna rotates

To stop the antenna rotation, left-click [Stop Antenna Rotation].

With this feature active and the antenna stopped, pushing the **STBY TX** key on the Control Unit or click the [STBY TX] button on the Status bar rotates the antenna and transmits pulses. Operating one of the above-mentioned controls again stops transmission but the antenna rotates.

1.54 How to Select a Display Mode (B/W-type Only)

B/W-type radars of this series have three echo display modes available:

- [CIRCLE] mode: The echoes are displayed inside a circle on the screen. This is the default (IMO compliant) mode.
- [WIDE] mode: The echoes are displayed in a square area, but are not displayed in the data display area.
- [ALL] mode: The echoes are displayed across the entire screen.
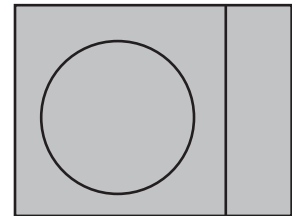
Follow the procedure below to change display modes.

1. Open the menu.
2. Select [1 ECHO]. The [ECHO] menu appears.
3. Select [8 ECHO AREA].
4. Select the appropriate setting, then press the **ENTER MARK** key.
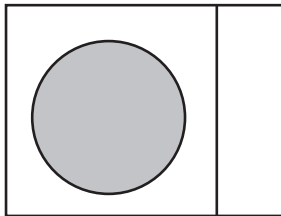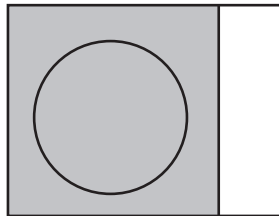
| CIRCLE | WIDE | ALL |

5. Close the menu.

1.55   How to Manage SD Card Data

The following data can be stored on a SD Card: marks, lines, user settings, installation settings, own track, target track (for A/B/W-types only), alert history and some logs (for example, the alert log).

Note: The menu operations outlined in this section are only available when a SD-Card is inserted. When there is no SD-Card inserted, the [FILES] menu is not selectable. SD Cards must be formatted as FAT32. Other formats are not usable.

1.55.1   Formatting the SD card

You do not normally need to format a SD card. If the card becomes unreadable, format the card with a formatting program that is compatible with the specifications of the card.

1.55.2   Cautionary notes on handling SD cards

• Handle the cards carefully. Improper use can damage the card and destroy its contents.

• Make sure the card slot cover is closed, unless removing/inserting a card.

• Remove or insert a card using only your fingers. Do not use metal instruments (such as tweezers) to remove the card.

• Do not remove the card when data is loading from, or saving to, the card.

1.55.3   Compatible SD cards

The table below lists the SD cards that have been verified as compatible for use with this equipment.

Note 1: The cards were verified using basic functions. All functions were not verified. FURUNO does not guarantee card operations.

Note 2: SD cards other than those listed below have not been verified.

Maker	SD card type	Capacity
Panasonic	RP-SDUC16GJK	16GB
	RP-SDUC32GJK	32GB
	RP-SDWA16GJK	16GB
	RP-SDWA-32GJK	32GB
SanDisk	SDSDB-016G-J35U	16GB
	SDSDC-032G-J35U	32GB
	SDSDXPA-016G-JU3	16GB
	SDSDXPA-032G-JU3	32GB
	SDSDXVE-032GB-JNJIP	32GB
TOSHIBA	SDAR40N16G	16GB
	SDAR40N32G	32GB
	SD-L016G4	16GB
	SD-L032G4	32GB
	SDXU-B016G	16GB
	SDXU-B032G	32GB

1.55.4 How to insert SD cards

The SD card slot is located on the front face of the processor unit, between the LAN1 port and the DVI-I port.

SD card slot (covered)
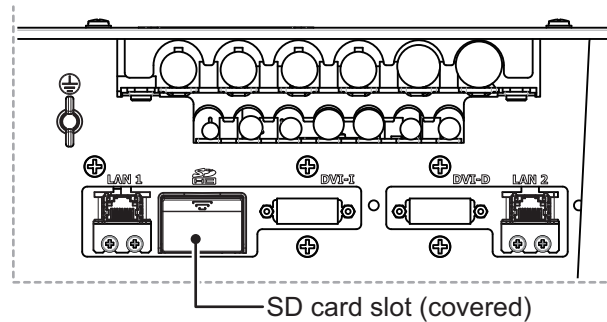
Note: Do not use any instruments to insert the card.

1. Remove the rubber cover on the SD card slot.

2. To insert a card, gently push the card into the slot, making sure that the card connectors are facing downwards.

3. Close the rubber cover.

1.55.5 How to remove SD cards

Follow the procedure below to safely remove an SD card.

Note 1: When the system power is turned off, skip steps 1 to 3.

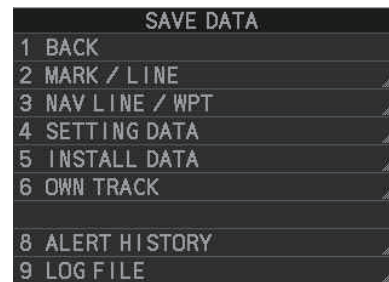**Note 2:** Do not use any instruments/tools top insert or remove the SD card.

1. Open the menu.

2. Select [6 FILES]. The [FILES] menu appears.

3. Select [REMOVE EXT MEDIA], then select [YES].
    You can now remove the SD card safely.

4. Remove the rubber cover on the SD card slot.

5. Gently push the SD cards to release the card from the card slot.

6. Remove the SD card. Do not use any instruments to remove the card.

7. Close the menu.

1.55.6 How to save data to an SD card

1. Open the menu.

2. Select [6 FILES]. The [FILES] menu appears.

3. Select [2 SAVE DATA].

4. Select the data to save.
   The software keyboard appears.

5. Using the software keyboard, name the file, then select [END] to start saving data. The file name can be up to seven characters in length.
   Note: Depending on the data saved, the first letter of the filename is preset and cannot be changed. The presets are listed below.

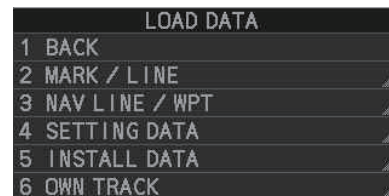|	
• Marks/Lines: M	• Own track: T
• Nav lines/Waypoints: W	• Target track: A*
• Setting data: S	• Alert history: H
• Install data: I	• Log file: L

*: Shown only for A/B/W-types.

The indication "WR CARD DATA" appears during the save process and the menu closes automatically.

When the process is complete, the indication "COMPLETED" appears in the guidance box and the menu automatically closes.

1.55.7 How to read (load) data from an SD card

1. Open the menu.

2. Select [6 FILES]. The [FILES] menu appears.

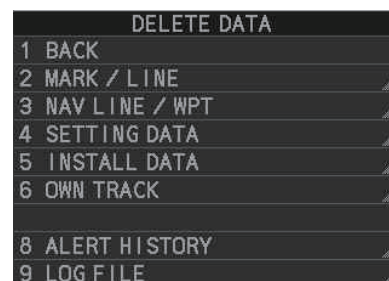3. Select [3 LOAD DATA].

4. Select the data to load.
   The indication "RD CARD DATA" appears during the read process and the menu closes automatically.
   When the process is complete, the menu closes automatically.

1.55.8 How to delete data from an SD card

1. Open the menu.

2. Select [6 FILES]. The [FILES] menu appears.

3. Select [4 DELETE DATA].

4. Select the data to delete.
   The indication "DELETE CARD DATA" appears during the delete process.
   When the process is complete, the menu automatically closes.

1.56 How to Take a Screenshot

The system has an in-built screenshot feature. To use the feature, a SD Card must be inserted in the Processor Unit. If there is no card inserted, the screenshot button on the screen is not active.
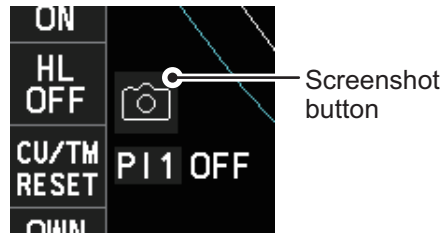
Screenshot button

To take a screenshot of the currently displayed screen, click the screenshot button.

Note: The screenshot function can also be assigned to a function key. For how to set up the function keys, see section 1.9

1.57 How to Use the Watch Alert

The watch alert provides a visual alert at regular intervals to remind you to monitor the radar picture for safety or other purposes. When the watch alert is enabled, the WATCH box appears at the top of the screen.

Watch box

When the timer reaches 00:00, an audible alert is released. To silence the buzzer, click the watch box. The timer is reset and begins to countdown again. You can reset the timer at any time by clicking the watch box.

To enable or disable the watch alert, follow the procedure below.

1. Open the menu.
2. Select [4 ALERTS]. The [ALERTS] menu appears.
3. Select [2 WATCH ALERT].
4. Select the [OFF] to disable the alert, or select the required interval at which the alert is released.
    The available intervals are: [6min], [10min], [12min], [15min] and [20min].
5. Close the menu.

1.58 Dual Radar (A/B-types only)

When installing two FAR-2xx8 series radars, the image from both radars (main radar and external radar) may be shown together on one radar display. This allows you to take advantage of the best characteristics each type of radar has to offer. The dual radar function is available only for A/B-types.

The following should be done from the [DUAL RADAR SETTINGS] menu, located in the [RADAR INSTALLATION] → [SCANNER] menu, at the time of installation in order to enable the dual radar display:

- Set the number of the radar to use for external input at [6 EXT RADAR].

- Set [2 DUAL RADAR] to [COMBINE]. This enables the dual radar function.

- Set the sector and range to combine radar images at [4 COMBINE SECTOR] and [5 COMBINE RANGE] respectively.

- Set the radar image you want to show in the sector at [3 COMBINE MODE]. The manner in which the radar images appear on-screen depends on the combination mode selected.
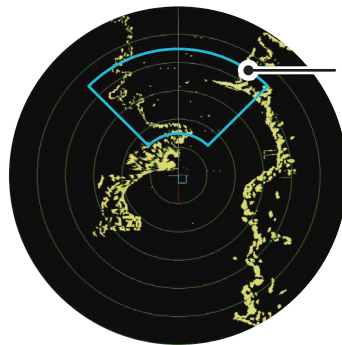
Dual radar function's display area (set at installation). Images shown in this area change depending on the setting for [COMBINE MODE] as follows:
- [OWN] : Own radar images appear inside the display area, external images appear outside the display area.
- [EXT] : External radar images appear inside the display area, own images appear outside the display area.

TT information

When a TT target crosses over the boundary line of the display area, its information is passed to the other radar display. Tracking of the TT continues. The TT number changes depending on the number of the antenna which acquires the TT target.
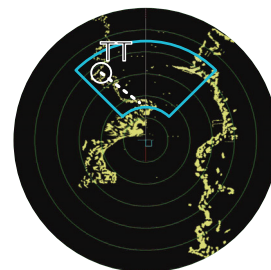
The lowest numbered Processor Unit assigns TT numbers "001" to "100", the other Processor Unit assigns "101" to "200".

Note: Only manually acquired target data is transferred.

TT target crosses over the boundary line of the display area.
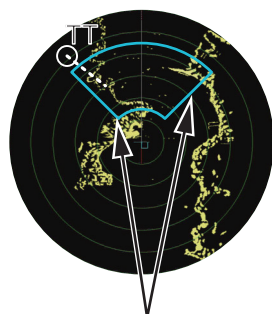
Boundary lines of display area

TT information is passed to the other radar display. Tracking on the TT continues.

1.58.1 How to toggle control of each dual radar display

Note: Dual radar mode must be enabled and both radars must be turned on.

You can switch between radars to control either your own, or the external radar from the antenna box. Left-click to toggle control.

Place the cursor on the [CONTROL] box, then left-click. The indication toggles between "M" (Master) and "S" (Slave) to show the level of control you have for the radar you are currently controlling.

The radar numbers for "Own" and "External" radars appear here. The currently controlled radar's number appears to the left.

Click the box to toggle the level of control of the radars. "M": Main (Master); "S": Sub (Slave)

There can be only one Master radar at any time. If the radar in operation is set to Slave and the operator switches to Master, the other radar is automatically changed to Slave.

Depending on your level of control, available operations are as follows:

Radar Functions	Control	Master	Slave
AIS function	Independent	Desired value can be set	Desired value can be set
Brilliance			
Echo trails			
EBL			
Lat/long data			
Presentation mode			
Speed data			
Target alarm			
TT, AIS on/off			
TT, AIS track interval			
Vector mode			
Vector time			
VRM			
Wiper			
Zoom			
TT COLLISION alarm			
Range**			
A/C SEA			
A/C RAIN			
Automatic Clutter Elimination (ACE)			
Gain adjustment			
Echo stretch			
Echo averaging			
Picture setting (Customize echo)			
STBY/TX			
TT/AIS AZ			

Radar Functions	Control	Master	Slave
IR*	Dependent Control	Desired value can be set	Cannot control
Tuning			
TT LOST warning	Common Control	Item Commonly Controlled	Item Commonly Controlled
TT alerts ACK			
TT acquire			

*: When the connected radar antenna is a magnetron-type, and the radar is assigned as "Slave", the desired value can be set for these functions. For SSD-types, this function cannot be controlled.

**: The desired value can be set when the radar is assigned as "Slave", however the maximum displayable range is dependent on the pulse setting at the "Master" radar.

1.58.2 Operating considerations for the dual radar display

You can toggle each radar between standby and TX in the dual radar display. When switching to standby on either radar, the Alert "EXT RADAR STBY" appears and the radar echoes from the radar in standby are not displayed. Further, when switching to standby, all TT targets are removed and tracking stops on the radar which is in standby. However if a TT target is acquired on the radar which is not in standby, the TT information is passed to the radar which is in standby.

Either radar enters STBY mode
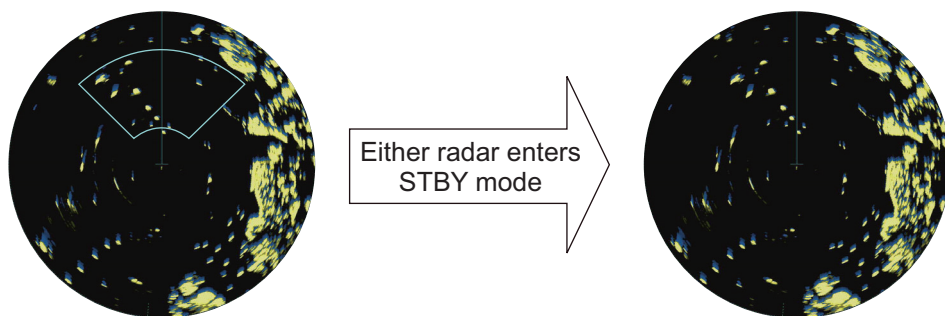
Boundary line is removed and display shows only the Own radar echoes.

Changes made to the following functions are applied to both the own radar echoes and the external echoes, on the display of the radar which made the changes. These settings are not applied to the display of the external radar.

- Off-center display
- CU/TM reset
- Presentation mode
- Range scale
- Electronic chart on/off
- Wiper
- Trail settings
- Echo stretch
- Echo Average
- Color Erase
- TT lost target filter

Notes regarding dual radar operations

- The dual radar function is available between two FAR-2xx8 series radars using the LAN. FAR-2xx7 and FAR-3xx0 series radars are not compatible.

- When a transmission error occurs between two radars in the dual radar mode, the Alert "EXT RADAR COM ERROR" appears and the dual radar function is turned off.

- The dual radar display is not available on external equipment (such as ECDIS, etc) which overlays the main radar image, even though the dual radar is turned on.

- If a TT target passes between the two radars (see page 1-107) while the dual radar function is active, TT data (TTD/TTM) is shared and tracking is continued.

- If the Alert "TT TARGET 95%(AUTO)" is released while the dual radar function is active, disable tracking for unnecessary targets until the Alert condition is rectified. Continuing automatic acquisition after this Alert is released and is still active may cause discrepancies between TT targets on the connected radars.

Restrictions during dual radar operations

The following restrictions are applicable when using the dual radar function.

- A REF (reference) mark can be entered on the display of the main radar but not the external radar.

- Targets acquired and/or tracked prior to activating dual radar mode are all released when dual radar mode is activated.

- Targets acquired and/or tracked prior to deactivating dual radar mode are all released when dual radar mode is deactivated.

- If either radar enters standby mode, all TT targets acquired while the Dual Radar function was active are released (removed).

- TT targets can be acquired manually or automatically. TT target data sharing between the radar in dual radar mode is restricted to manually acquired targets. See "TT information" on page 1-107.

- The reference position is fixed at [CCRP] (see section 1.50) when dual radar mode is enabled. Set the same CCRP position between two radars at the time of installation.

- The following functions are not available in the dual radar mode.

  - Performance monitor
  - SART
  - ICE mode
  - Target Analyzer (B-type only)

  - TT simulation mode
  - Icing prevention
  - Interswitch
  - Hatching (B-type only)

- If the distance between the Own radar antenna and the External radar antenna is larger than 125 meters, the dual radar display area and the sweep area are reduced. In this case, if the range is decreased, only the own radar echoes are displayed on the screen. Further, the following occurs when only the own radar is shown under these circumstances:

  - Dual radar boundary line is not shown.
  - Antenna selection is unavailable (on-screen box and menu item are gray and inactive).
  - Trails are all cleared (removed).

  No alerts is released under these circumstances, however normal dual radar display is restored when the range is increased again.

1.59 Wave Mode

You can output echo data from this radar to a PC with the wave analysis software installed. The wave analysis software calculates incoming waves and gives you an on-screen indication as to wave size, direction and time between waves.

This section covers how to use the wave mode and related functions on your FAR-2xx8 series radar. For details regarding the analysis software and PC indications, see the manual supplied with the software.

Preparations and cautions for wave mode

• Wave mode requires the connection of a PC to the same network as the FAR-2xx8 series radar to be used for data input.

• The connected PC must have the wave analysis software installed. See the software manual for how to install the software.

• Wave mode may only be active on one radar at any time. If a second radar has wave mode activated, wave mode is disabled on the first radar.

• One ore radars must set [8 OUTPUT TO WAVE PC] to [ON]. If all radars set [8 OUTPUT TO WAVE PC] to [OFF], the "WAVE COM ERROR" alert may appear.

• Wave analysis and the output data are intended for reference purposes only, as an aid to safe navigation. Always confirm conditions, visually and with other methods.

1. Establish a LAN connection with the analysis PC.

2. Open the menu.

3. Select [1 ECHO]

4. Select [0 NEXT] to show the second page of the menu.

5. Select [7 WAVE MODE].

6. Select [ON] or [OFF] as appropriate.
   Select [ON] to output echo data to analysis PC.

7. Select [7 WAVE MODE].

8. Select [ON] or [OFF] as appropriate.
   Select [ON] to output navigational data to analysis PC.

9. Close the menu.

1.60 Doppler Feature (X-band Solid State Radars only)

When activated, the doppler feature can help with clutter reduction, making targets easier to find. This feature is only available with FAR-2228-NXT, FAR-2228-NXT-BB or FAR-2328-NXT.

To activate and use the feature, follow the procedure below.

1. Open the menu.
2. Select [1 ECHO].
3. Select [0 NEXT] to show the second page of the menu.
4. Select [9 DOPPLER].
5. Select the required setting, referring to the table below.
   - [0]: Disables the doppler feature.
   - [1]: Reduces noise, making weak targets easier to find.
   - [2]: Reduces clutter from rain, etc, making it easier to find targets previously hidden by clutter.
6. Close the menu.

2. RADAR OBSERVATION

2.1 General

2.1.1 Minimum range

The minimum range is defined by the shortest distance at which, using a scale of 1.5 or 0.75 nm, a target having an echoing area of 10 m^2 is still shown separate from the point representing the antenna position.

It is mainly dependent on the pulselength, antenna height, and signal processing such as main bang reduction and digital quantization. It is a good practice to use a shorter range scale as far as it gives favorable definition or clarity of picture.

The IMO Resolution MSC.192(79) requires the minimum range to be less than 40 m, respectively. This series of radars satisfy this requirement.

2.1.2 Maximum range

The maximum detecting range of the radar, Rmax, varies considerably depending on several factors such as the height of the antenna above the waterline, the height of the target above the sea, the size, shape and material of the target, and the atmospheric conditions.

Under normal atmospheric conditions, the maximum range is equal to the radar horizon or a little shorter. The radar horizon is longer than the optical one by about 6% because of the diffraction property of the radar signal. The Rmax is given in the following equation.
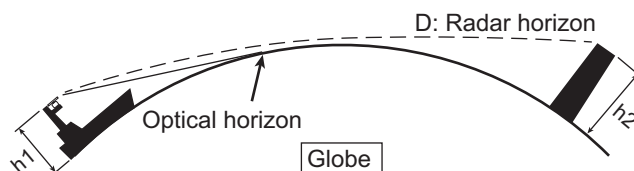
$$D = 2.2 \times (\sqrt{h1} + \sqrt{h2})$$
where D: radar horizon (nautical miles)
h1: antenna height (m)
h2: target height (m)

For example, if the height of the antenna above the waterline is 9 meters and the height of the target is 16 meters, the maximum radar range is;

$$R_{max} = 2.2 \times (\sqrt{9} + \sqrt{16}) = 2.2 \times (3 + 4) = 15.4 \text{ nm}$$

It should be noted that the detection range is reduced by precipitation (which absorbs the radar signal).

2.1.3 X-band and S-band

In fair weather, the equation on the previous page does not give a significant difference between X- and S-band radars. However, in heavy precipitation condition, an S-band radar would have better detection than an X-band radar.

2.1.4 Radar resolution

There are two important factors in radar resolution (discrimination): bearing resolution and range resolution.

- Bearing resolution is the ability of the radar to display as separate pips the echoes received from two targets that are at the same range and close together. It is proportional to the antenna length and reciprocally proportional to the wavelength. The length of the antenna radiator should be selected for a bearing resolution better than 2.5° (IMO Resolution). This condition is normally satisfied with a radiator of 1.2 m (4 ft) or longer in the X-band. The S-band radar requires a radiator of about 12 feet (3.6 m) or longer.
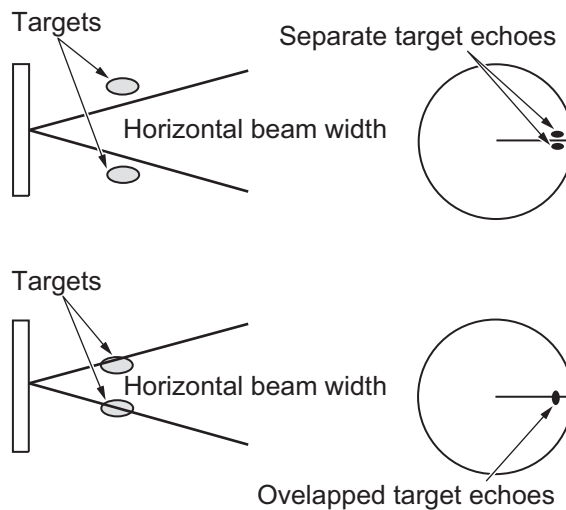
- Range resolution is the ability to display as separate pips the echoes received from two targets that are on the same bearing and close to each other. This is determined by pulselength only. Practically, a 0.08 microsecond pulse offers the discrimination better than 40 m as do so with all FURUNO radars.
Test targets for determining the range and bearing resolution are radar reflectors having an echoing area of 10 m^2.
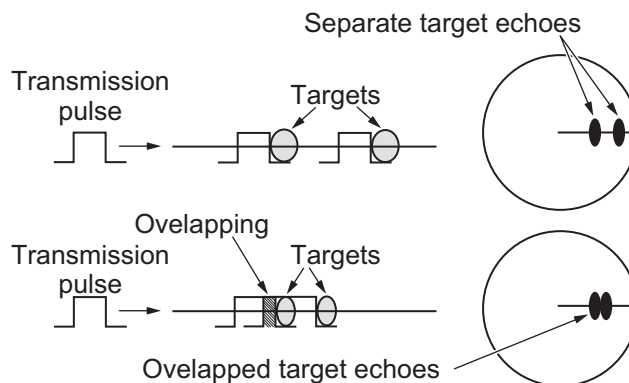
2.1.5 Bearing accuracy

One of the most important features of the radar is how accurately the bearing of a target can be measured. The accuracy of bearing measurement basically depends on the narrowness of the radar beam. However, the bearing is usually taken relative to the ship's heading, and thus, proper adjustment of the heading line at installation is an important factor in ensuring bearing accuracy. To minimize error when measuring the bearing of a target, put the target echo at the extreme position on the screen by selecting a suitable range.

2.1.6 Range measurement

Measurement of the range to a target is also a very important function of the radar. Generally, there are two means of measuring range: the fixed range rings and the variable range marker (VRM). The fixed range rings appear on the screen with a predetermined interval and provide a rough estimate of the range to a target. The variable range marker's diameter is increased or decreased so that the marker touches the inner edge of the target, allowing the operator to obtain more accurate range measurements.

2.2 False Echoes

Occasionally echo signals appear on the screen at positions where there is no target or disappear even if there are targets. They are, however, recognized if you understand the reason why they are displayed. Typical false echoes are shown below.

Multiple echoes

Multiple echoes occur when a transmitted pulse returns from a solid object like a large ship, bridge, or breakwater. A second, a third or more echoes may be observed on the display at double, triple or other multiples of the actual range of the target as shown below. Multiple reflection echoes can be reduced and often removed by decreasing the gain (sensitivity) or properly adjusting the A/C SEA control.
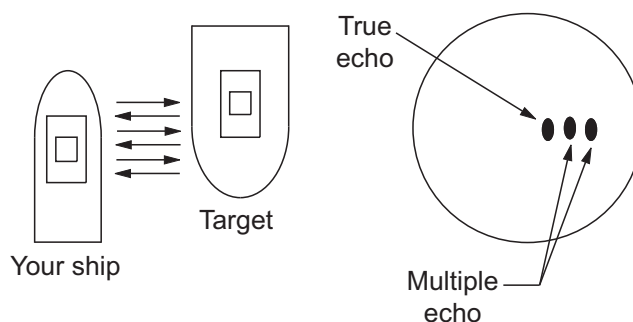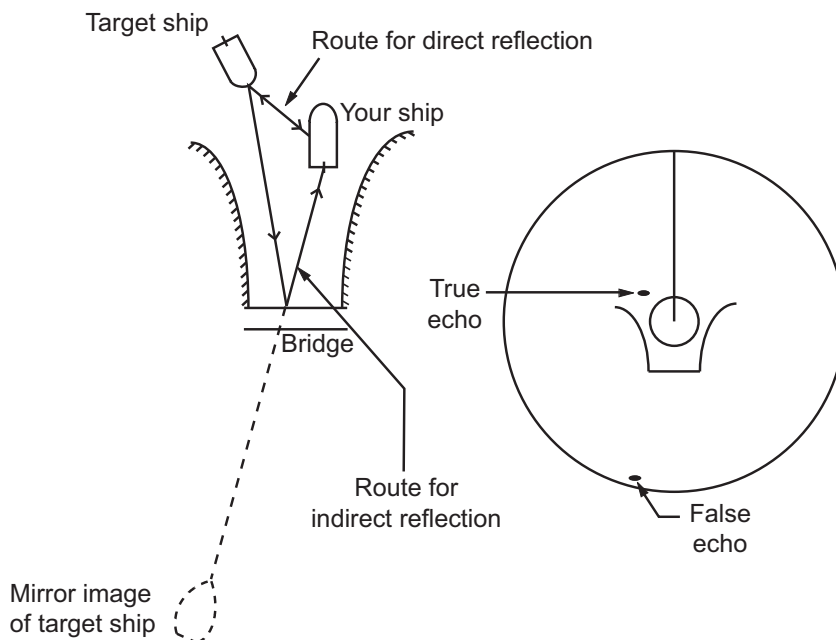
Sidelobe echoes

Every time the radar pulse is transmitted, some radiation escapes on each side of the beam, called "sidelobes". If a target exists where it can be detected by the side lobes as well as the main lobe, the side echoes may be represented on both sides of the true echo at the same range. Side lobes show usually only on short ranges and from strong targets. They can be reduced through careful reduction of the gain or proper adjustment of the A/C SEA control.

Mainlobe (beam)

Sidelobe   Sidelobe

Antenna

True target

False echoes by sidelobes
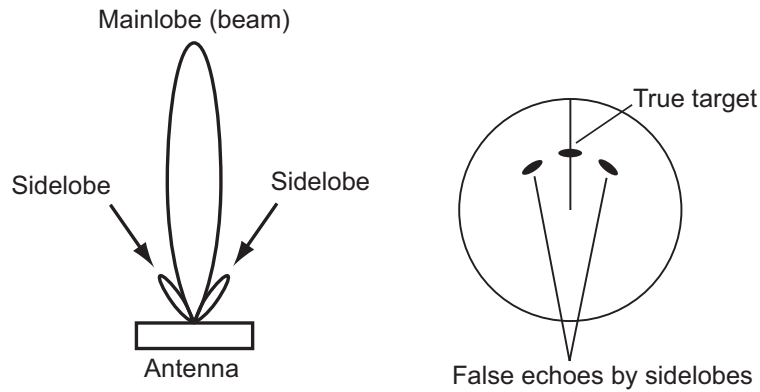
Virtual image

A relatively large target close to your ship may be represented at two positions on the screen. One of them is the true echo directly reflected by the target and the other is a false echo which is caused by the mirror effect of a large object on or close to your ship as shown in the figure below. If your ship comes close to a large metal bridge, for example, such a false echo may temporarily be seen on the screen.

Target ship

Route for direct reflection

Your ship

Bridge

Route for indirect reflection

Mirror image of target ship

True echo

False echo

Shadow sectors

Funnels, stacks, masts, or derricks in the path of the antenna block the radar beam. If the angle subtended at the antenna is more than a few degrees, a non-detecting sector may be produced. Within this sector targets can not be detected.
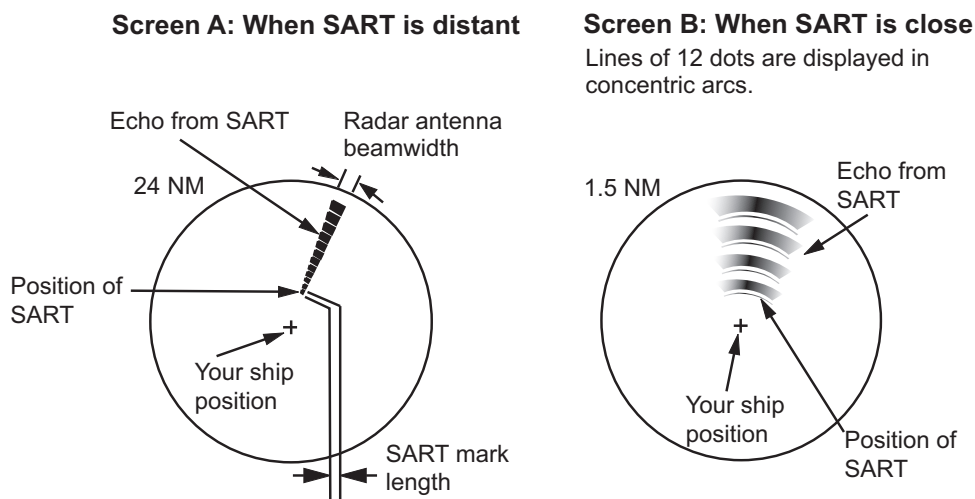
Radar position — Wharf and its echo

Radar position — Wharf and its echo

Shadow sector occurs because wharf is hidden behind ship.

Large ship

Shadow sector occurs because obstruction (like mast) is in path of radar beam.

Size of blind sector depends on size of obstruction and range.
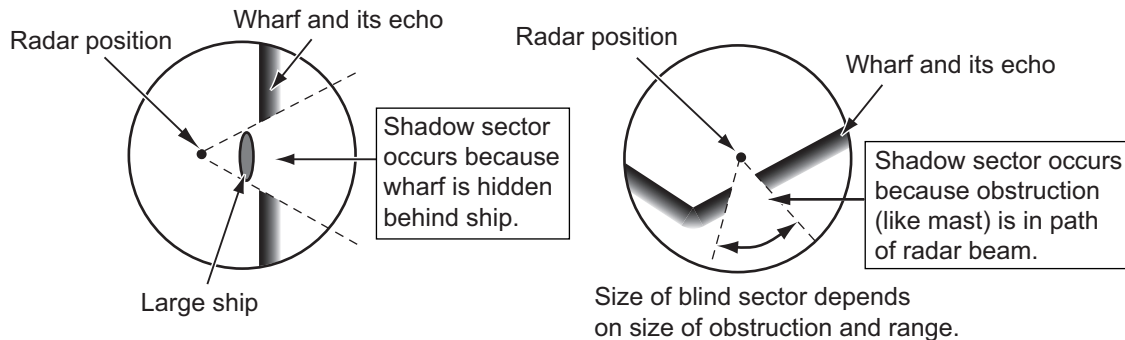
2.3 SART (Search and Rescue Transponder)

2.3.1 SART description

A Search and Rescue Transponder (SART) can be triggered by any X-Band (3 cm) radar within a range of approximately 8 nm. Each radar pulse received causes it to transmit a response which is swept repetitively across the complete radar frequency band. When interrogated, it first sweeps rapidly (0.4 μs) through the band before beginning a relatively slow sweep (7.5 μs) through the band back to the starting frequency. This process is repeated for a total of twelve complete cycles. At some point in each sweep, the SART frequency will match that of the interrogating radar and be within the pass band of the radar receiver. If the SART is within range, the frequency match during each of the 12 slow sweeps will produce a response on the radar display, thus a line of 12 dots equally spaced by about 0.64 nautical miles will be shown.

When the radar to the SART is reduced to about 1 nm, the radar display my show also the 12 responses generated during the fast sweeps. These additional dot responses, which also are equally spaced by 0.64 nautical miles, will be interspersed with the original line of 12 dots. They will appear slightly weaker and smaller than the original dots.

Screen A: When SART is distant

Echo from SART — Radar antenna beamwidth

24 NM

Position of SART

Your ship position

SART mark length

Screen B: When SART is close
Lines of 12 dots are displayed in concentric arcs.

1.5 NM

Echo from SART

Your ship position

Position of SART

2.3.2 How to show SART marks on the radar display

This radar is equipped with a feature that optimally sets up the radar for SART detection. This feature automatically detunes the radar receiver out of its best tuning condition. This erases or weakens all normal radar echoes, but the SART marks are not erased because the SART response signal scans over all frequencies in the 9 GHz band. When the radar approaches the SART in operation, the SART marks will enlarge to large arcs, blurring a large part of the screen.

1. Open the menu.
2. Select [1 ECHO].
3. Select [7 SART].
4. Select [ON] to show SART marks on the radar display, or select [OFF] to hide SART marks.
   When the SART function is active, the settings listed in the following table are automatically made to radar functions:

Setting	Changed to...	
	Magnetron radars	**Solid state radars**
Range	12 NM	24 NM or lower
Pulselength	Long	Dependent on range. See table below.
Echo Stretch	Off	
Noise Rejector	Off	
Echo Averaging	Off	
Interference Rejector	Off	
Performance Monitor	Off	
A/C RAIN	Off	

For X-band solid state radars, the pulselength is fixed as follows while SART is active.

Range (NM)	0.125	0.25	0.5	0.75	1	1.5	2	3	4	6	8	12	16	24
Pulselength	S1		S2	M1		M2		L						

5. Close the menu.

The indication "SART" appears at the top of the screen, in yellow text, when this feature is active. Be sure to turn this feature off when SART detection is no longer your objective.

Note 1: For magnetron radars, any changes made to the range while SART is active will deactivate SART.

Note 2: X-band solid state radars allow the range to be changed while keeping SART active. SART must be turned off manually for X-band solid state radars. SART detection is not available for S-band solid state radars.

2.3.3 General remarks on receiving SARTs

SART range errors

When responses from only the 12 low frequency sweeps are visible (when the SART is at a range greater than about 1 nm), the position at which the first dot is displayed can be as much as 0.64 nm beyond the true position of the SART. When the range closes so that the fast sweep responses are seen also, the first of these will be no more than 150 meters beyond the true position.

Radar bandwidth

This is normally matched to the radar pulselength and is usually switched with the range scale and the associated pulselength. Narrow bandwidths of 3-5 MHz are used with long pulses on long range scales and wide bandwidths of 10-25 MHz with short pulses on short ranges.

A radar bandwidth of less than 5 MHz will attenuate the SART signal slightly, so it is preferable to use a medium bandwidth to ensure optimum detection of the SART.

Radar sidelobes

As the SART is approached, sidelobes from the radar antenna can show the SART responses as a series of arcs or concentric rings. These can be removed by the use of the anti-clutter sea control although it can be operationally useful to observe the side lobes as they may be easier to detect in clutter conditions and also they will confirm that the SART is near to own ship.

Note: SART information excerpted from IMO SN/Circ 197 OPERATION OF MARINE RADAR FOR SART DETECTION.

2.4   RACON

A RACON is a radar beacon that emits radar receivable signals in the radar frequency spectrum (X- or S-band). There are several signal formats; in general, the RACON signal appears on the radar screen as a rectangular echo originating at a point just beyond the position of the radar beacon. It has a Morse coded pattern. Note that the position on the radar display is not accurate.


Echoes on the radar screen
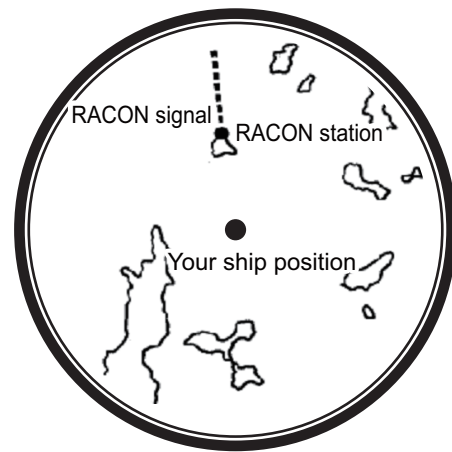
Echo description

2.5   Radar Target Enhancer (RTE)

An RTE is a radar transponder mounted on navigation buoys and masts of small crafts to significantly improve their detection by radar. Unlike a SART or RACON, which are passive, the RTE receives a radar signal, amplifies it and re-transmits it, with the intention of making the target's signal look larger on a radar display. The RTE is available in X-band and S-band types.

2.6 Solid state radar

In Solid State radars, long-range and short-range pictures are mixed before they are displayed on the screen. Due to this mixing process, echoes may be displayed differently when compared with magnetron radars.

☐ : Short-range
☐ : Long-range

Approx. 0.5 NM to 2 NM
(depending on the pulse length)
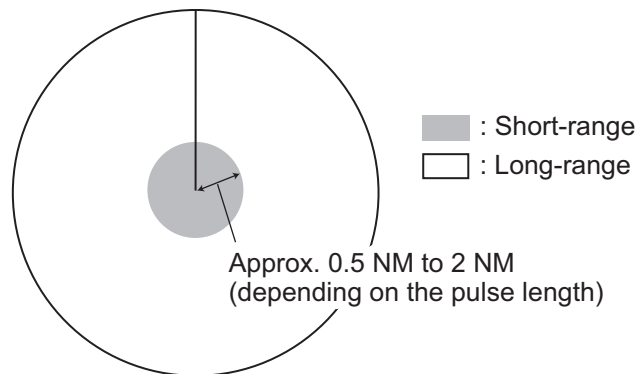
Range and signal intensity

At long-range, even though the Solid State radar has lower transmission power than magnetron radars, the signal intensity is equivalent.

At short-range on the other hand, due to the lower transmission power the signal intensity of closer targets (including sea clutter and rain clutter) is reduced.

For this reason, when a long-range target enters short-range the signal intensity appears weaker.

False echoes fore and aft of the target

At long-range, echoes with a strong reflection may appear with a false echo to their fore and aft. When the target changes direction, the reflection may weaken, causing the false echoes to disappear. You can also reduce the false echoes in these cases by reducing the gain.

False echoes

Echo
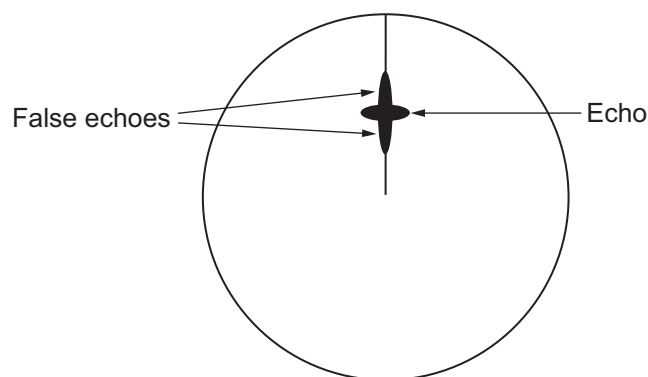
3. TARGET TRACKING (TT)

3.1 Precautions when Using Target Tracking

⚠ WARNING

No one navigational aid should be relied upon for the safety of vessel and crew. The navigator has the responsibility to check all aids available to confirm position. Electronic aids are not a substitute for basic navigational principles and common sense.

◆ This TT automatically tracks automatically or manually acquired radar targets and calculates their courses and speeds, indicating them by vectors. Since the data generated by the auto plotter are based on what radar targets are selected, the radar must always be optimally tuned for use with the auto plotter, to ensure required targets will not be lost or unwanted targets such as sea returns and noise will not be acquired and tracked.

◆ A target does not always mean a land-mass, reef, ships or other surface vessels but can imply returns from sea surface and clutter. As the level of clutter changes with environment, the operator should properly adjust the [A/C SEA], [A/C RAIN] and [GAIN] controls to be sure target echoes are not eliminated from the radar screen.

⚠ CAUTION

The plotting accuracy and response of this TT meets IMO standards. 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 on the order of 15 - 30 seconds for high relative speed; 30 - 60 seconds for low relative speed.

◆ The target tracking and pertinent vector calculation accuracy is influenced by the following:
- Echo intensity
- The range measurement accuracy; characterized by both random and biased measurement errors.
- The angular measurement accuracy; characterized by beam shape, target glint and bias errors.
- Radar transmission pulsewidth
- Gyrocompass heading error
- Speed log error
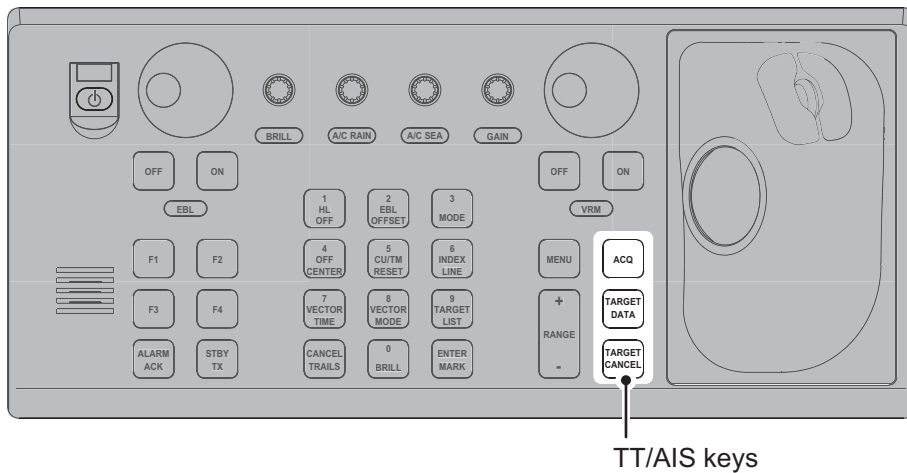- Curent and wind (set & drift)
- Course change (own ship and target)

The data generated by TT, AIS and video plotter are intended for reference only.

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

3.2   TT Controls

The control unit has three keys that are used in the target tracking mode. The keys are indicated in the figure below.


TT/AIS keys

- **ACQ**: Acquires the selected echo as a target.
- **TARGET DATA**: Shows the selected target's data in the information box.
- **TARGET CANCEL**: Deactivates tracking for the cursor-selected target.

These functions, along with other TT functions, can also be accessed from the [CURSOR] menu (See section 1.7).

3.3   TT Box Overview

You can show/hide the TT symbols to suit your requirements. To hide the symbols, left-click the TT indication in the TT•AIS box to show [OFF]. To show the symbols, left-click the indication to show [AUTO], [AUTO/MAN], [MAN].

The TT modes and their settings are described in section 3.4.
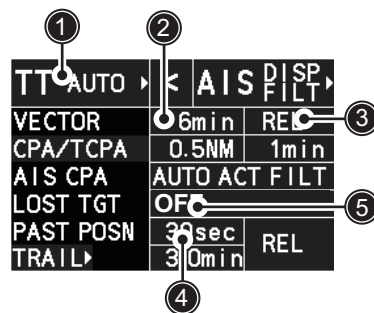
No.	Indication name	Description/remarks
1	TT acquisition mode	Selects the TT mode (see section 3.4).
2	Vector time	Adjusts the vector time for the selected target.
3	Vector reference	True, Relative referencing for this target's vector.
4	Past position time	Sets the interval for the target's trail.
5	Lost TGT Alert	Displays/hides the alert when a target is lost.

3.4 How to Select the TT mode

You can click the TT acquisition mode indication in the TT•AIS box to select the required mode.

TT aquisition mode
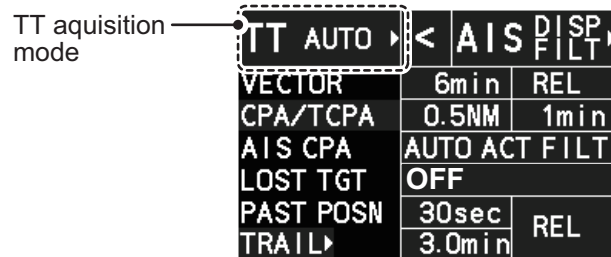
The indication changes depending on the setting for [TT SELECT] in the [TT] menu.

| TT mode selected	Indication change
[MANUAL 100]	"TT OFF" → "TT MAN" → "TT OFF"...
[MANUAL 75 • AUTO 25]	"TT OFF" → "TT MAN/AUTO" → "TT OFF"...
[MANUAL 50 • AUTO 50]	"TT OFF" → "TT MAN/AUTO" → "TT OFF"...
[MANUAL 25 • AUTO 75]	"TT OFF" → "TT MAN/AUTO" → "TT OFF"...
[AUTO 100]	"TT OFF" → "TT AUTO" → "TT OFF"...

You can set the system to acquire targets automatically, manually, or a combination of automatic and manual.

How to set up the acquisition mode

1. Open the menu.
2. Select [5 TT•AIS].

3. Select [6 TT].
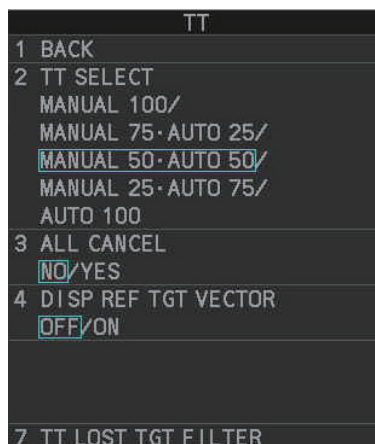
Note: You can also right-click "TT" in the [TT•AIS] box to access this menu.

4. Select [2 TT SELECT], then select the acquisition condition.
   Your selection here changes how many targets can be acquired, both automatically and manually.

| Menu setting	Acquisition condition
[MANUAL 100]	100 targets manually, auto acquisition not available
[MANUAL 75 • AUTO 25]	25 targets automatically, 75 targets manually
[MANUAL 50 • AUTO 50]	50 targets automatically, 50 targets manually
[MANUAL 25 • AUTO 75]	75 targets automatically, 25 targets manually
[AUTO 100]	100 targets automatically, manual acquisition not available

5. Close the menu.

Note: When the menu-set number of automatically acquired targets have been acquired, the Alert "TT TARGET FULL(AUTO)" appears in the [Alert] box.

3.5 How to Acquire and Track Targets

This radar can automatically acquire and track a maximum of 100 targets.

A target just acquired automatically is marked with a dashed circle and a vector appears within one minute to indicate the target's motion trend. Within three minutes, the initial tracking stage is finished and the target becomes ready for stable tracking. At this time, the dashed circle changes to a solid circle.

At acquisition   Within 1 min. after acquisition   Stable tracking
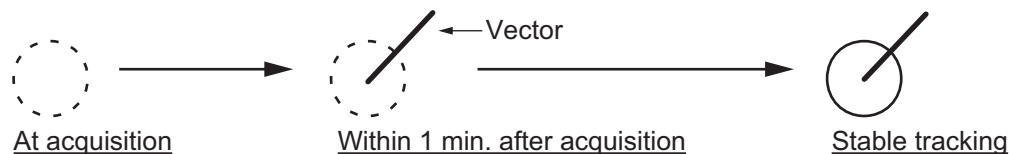
3.5.1 How to manually acquire a target

Acquire a target from the Control Unit (RCU-014)

Use the trackball to place the cursor on the target you want to acquire, then press the **ACQ** key.

Acquire a target by the trackball module

1. When the target to acquire and the AIS symbol overlap one another, right-click the operational display area to show the [CURSOR MENU] then select [TT TARGET DATA/ACQ] to acquire the target.

2. Place the cursor on the target to acquire then left-click.

The plotting symbol is drawn by a dashed circle during the initial acquisition stage. A vector appears approximately one minute after acquisition. The vector indicates the motion trend of the target. If the target is consistently detected for three minutes, the plotting symbol changes to a solid circle. If acquisition fails, the target symbol blinks.

3. TARGET TRACKING (TT)

Note 1: For successful acquisition, the target should be within 24 NM (or 32 NM, depending on initial setting) from own ship and not obscured by sea or rain clutter.
Note 2: You are alerted when the capacity of manual acquisition is 95% and 100%. These alerts are "TT TARGET95%(MAN)" and "TT TARGET FULL(MAN)". If the capacity is 100% you cannot acquire more targets. Cancel tracking of non-threatening targets if you wish to acquire additional targets manually.
Note 3: When a target being tracked nears another target being tracked, the targets may be "swapped". When two targets acquired either automatically or manually come close to each other, one of the two may become a lost target. If this occurs, manual reacquisition of the lost target may be necessary after the two have separated.
Note 4: You can reuse a target number. This is useful when you acquire the "wrong" target. Drag and drop the symbol onto the correct target.

3.5.2 How to automatically acquire targets

Targets are automatically acquired when the TT mode is set to other than [MANUAL 100] and a target enters the acquisition zone (see section 3.16). The maximum tracking distance (24 NM or 32 NM) is set at installation.

3.6 How to Enter Own Ship Speed

The TT requires own ship's speed and heading data. The speed can be STW, SOG or echo-referenced speed (based on 3 max. stationary objects). Manual input is also possible. For automatic or manual input, see section 1.12. For echo-referenced speed input follow the procedure below.

3.6.1 Echo-referenced speed input

The use of echo-referenced speed is recommended when:

- The speed log is not operating properly or not connected to the radar.
- The vessel has no device (doppler sonar, speed log, etc.) that can measure ship's bow-stern, port-starboard movement.

If you select echo-referenced speed, the TT calculates own ship's speed relative to a fixed reference target. The number of targets may be R1, R2 or R3. When a plural of objects are selected, the mean value is used, for stabilization and speed.
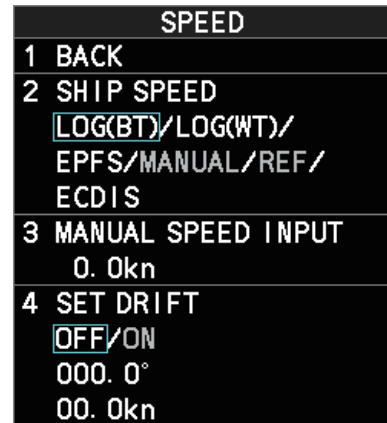
1. Right-click the operational display area to show the [CURSOR MENU].
2. Select [REF MARK]. The cursor is highlighted to indicate that the reference mark function is active.
3. Place the cursor on a fixed echo (such as an island, etc.) at a range of 0.1 to 24 NM from own ship, to be used as a reference, then left-click. The cursor changes from the highlighted cross to a circle with dashed lines, indicating that the reference location is now set. See section 3.9 for more information on TT symbols and their attributes.

At acquisition   Stable tracking
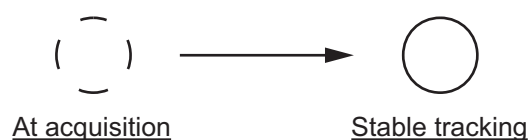
The dashed lines of the reference point change to a solid line over time, as shown in the figure above.

4. Repeat step 3 until to place up to three reference points.

5. Right-click to deactivate the reference mark function.

6. Right-click the [SPD] indication at the top-right of the screen to show the [SPEED] menu.

7. Select [2 SHIP SPEED].

8. Select [REF].

9. Close the menu.
   It takes approximately one minute for the speed to appear in the own ship information box. When the speed appears, the indication "REF BT" also appears to the right of the speed value.

```
          SPEED
1 BACK
2 SHIP SPEED
  LOG(BT)/LOG(WT)/
  EPFS/MANUAL/REF/
  ECDIS
3 MANUAL SPEED INPUT
    0.0kn
4 SET DRIFT
  OFF/ON
  000.0°
  00.0kn
```

Notes on speed input by reference target

• Reference targets are only used for the calculation of true speed.

• Do not use reference target generated true speed to calculate relative speed. Relative speed data is not accurate because response to speed change is slow, hampering the TT's ability to accurately judge the possibility of collision.

• Select a stationary target as a reference target to calculate own ship speed as ground tracking speed. Do not choose a moving target as a reference target. A moving target produces error in the vector for TT and AIS, which results in wrong collision avoidance information. Further, an unstable stationary target produces inaccurate speed data and the target itself may become lost.

• On IMO-type radars with AIS in use, echo-referenced speed is shown in gray to indicate they are not available for selection.

• When a reference target is lost or goes out of the acquisition range, that reference target mark blinks and the indication "REF TARGET LOST" appears in the alert box. If all reference targets are lost, the speed indication reads "*.*" Select a different reference target if currently selected one is lost.

• When all targets are deleted, the reference target mark is also deleted and the target-based speed becomes invalid. The speed is indicated as "BTREF" where BT means Bottom Track (speed over ground).

• Reference targets can be marked with a vector.
  This can be done with [4 DISP REF TGT VECTOR] on the [TT] menu.

• Loss of reference target will affect the calculation of true speed and true course of targets. Further, own ship speed will be inaccurate.

How to cancel echo-referenced speed input

1. Open the menu.

2. Select [7 INFORMATION BOX].

3. Select [2 OWN SHIP INFO].

4. Select [3 SPEED]. The [SPEED] menu appears.

5. Select any option, other than [REF], then press the **ENTER MARK** key.

6. Close the menu.

3.7 How to Cancel Target Tracking

When the number of tracked targets reaches maximum capacity, the alert box shows [TT TARGET FULL (MAN)] or [TT TARGET FULL (AUTO)], based on the selected TT mode. No new targets can be acquired until a tracked target is lost or tracking is canceled. When this occurs, cancel tracking for non-dangerous targets as required.

3.7.1 How to cancel tracking for individual TT targets

Using the control unit (RCU-014)

1. Place the cursor on the tracked target, or tracked target's data, to cancel.
2. Press the **TARGET CANCEL** key.

Using the CURSOR menu

Note: This methods requires [TGT CANCEL SETTING] in the second page of the [CURSOR MENU] to be set as [ANY] or [TT ONLY].

1. Right-click the operational display area to show the [CURSOR MENU].
2. Select [TARGET CANCEL], then left-click.
3. Select the tracked target to cancel, then left-click.
4. Right-click to complete the procedure.

3.7.2 How to cancel tracking for all TT targets

Using the control unit (RCU-014)

Press and hold the **TARGET CANCEL** key.

Using the menu

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [6 TT].
4. Select [3 ALL CANCEL].
5. Select [YES] to cancel tracking for all TT targets.
6. Close the menu.

3.8 Lost Target

Targets not detected in nine consecutive scans become "lost targets". A lost target is shown in the display with a flashing red "×". Flashing stops after lost target alert is acknowledged. Further, the alert box shows the indication "TT TARGET LOST" in orange characters and the audible alert sounds. The symbol disappears when the alert is acknowledged.

If you are in an area where tracked targets are lost frequently, you may want to disable the lost target alert against tracked targets by maximum range.

3.8.1 How to set the lost target filter

You can set the lost target alert to sound against lost targets that are within a specific range. To set the criteria, use the procedure below.

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [6 TT].
4. Select [7 TT LOST TGT FILTER].
5. Select [MAX RANGE].
6. Select [ON]. The settings can now be adjusted.
7. Spin the scrollwheel to adjust the setting as required, then left-click to apply the setting.
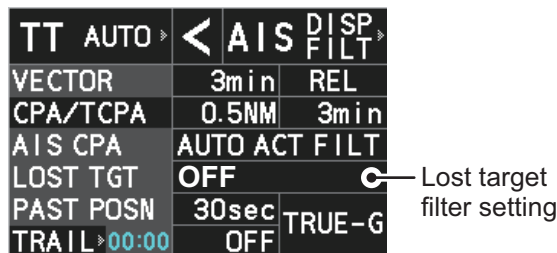8. Close the menu.

```
TT LOST TGT FILTER
1 BACK
2 MAX RANGE
  OFF/ON
  0ONM
```

Note: Reference targets are not affected by this filter.

3.8.2 How to enable/disable the lost target alert

The [LOST TARGET] box, located at the bottom-right corner of the screen, enables and disables the lost target alert.

Select the box with the cursor, then left-click to cycle through the settings in the following order: [OFF] → [FILT] → [ALL] → [OFF]...

```
TT AUTO >  < AIS DISP
                   FILT >
VECTOR        3min    REL
CPA/TCPA     0.5NM   3min
AIS CPA     AUTO ACT FILT
LOST TGT      OFF              ── Lost target
PAST POSN    30sec TRUE-G         filter setting
TRAIL>00:00    OFF
```

- [OFF]: Disable the alert.
- [FILT]: Enable the alert for all lost targets, excluding filtered targets.
- [ALL]: Enable the alert for all lost targets, including filtered targets.

Note: The filter setting is applied to both TT and AIS lost targets.

3.9 TT Symbols and Attributes

The TT symbols used in this equipment are compliant with IEC62288. For details regarding the symbols and their meanings, see "TT symbols" on page AP-31.
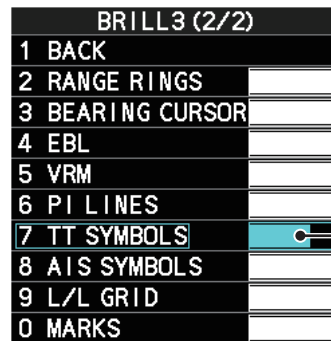
3.9.1 How to adjust symbol brilliance

Note: Each color scheme (palettes PLT1 to PL4) can be adjusted individually. For how to select a color scheme, see section 1.45.2 and section 1.45.3.

1. Open the menu.

2. Select [9 INITIAL SETTINGS].

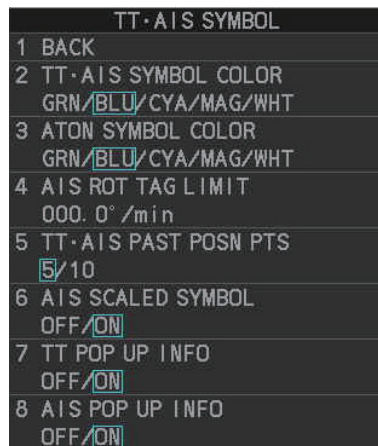3. Select [2 BRILL]. The [BRILL] menu appears.

   Note: You can also right-click the [PLT] indication to access this menu.

4. Select [0 NEXT] to show the next menu page.

5. Select [7 TT SYMBOLS]. The settings are highlighted and can now be adjusted.

6. Spin the scrollwheel to select the desired brilliance, then left-click to apply the setting.

7. Close the menu.

```
        BRILL3 (2/2)
1 BACK
2 RANGE RINGS       [    ]
3 BEARING CURSOR    [    ]
4 EBL               [    ]
5 VRM               [    ]
6 PI LINES          [    ]
7 TT SYMBOLS        [  o ]  ← Spin the
8 AIS SYMBOLS       [    ]    scrollwheel
9 L/L GRID          [    ]    to adjust the
0 MARKS             [    ]    brilliance.
```

3.9.2 How to set the symbol color

```
       TT·AIS SYMBOL
1 BACK
2 TT·AIS SYMBOL COLOR
  GRN/[BLU]/CYA/MAG/WHT
3 ATON SYMBOL COLOR
  GRN/[BLU]/CYA/MAG/WHT
4 AIS ROT TAG LIMIT
  000. 0°/min
5 TT·AIS PAST POSN PTS
  [5]/10
6 AIS SCALED SYMBOL
  OFF/[ON]
7 TT POP UP INFO
  OFF/[ON]
8 AIS POP UP INFO
  OFF/[ON]
```

1. Open the menu.

2. Select [5 TT•AIS].

3. Select [4 TT•AIS SYMBOL].

4. Select [2 TT•AIS SYMBOL COLOR]. The settings can now be adjusted.

5. Select the appropriate color.

6. Close the menu.

3.9.3 How to select a TT symbol (B/W-types only)

In addition to the "standard" circle TT symbol, you may select from the symbols shown below, using the full keyboard. This cannot be done with trackball-type control unit (RCU-015, RCU-016). However, you can program a function key to do so: assign the function key the [TARGET DATA] function from the [STD KEY] category. For function key setup, see section 1.9.

To change the TT symbol, do the following procedure.

1. Place the cursor on the target whose symbol you want to change, then left-click.

2. Press the **TARGET DATA** key to cycle through the symbols and select the desired symbol.
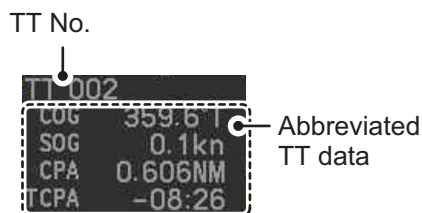
3.10 How to Display/Remove Target Data

The TT mode provides the full functionality of TT as required by the IMO Resolution A.823(19) and IEC 62288, including display of range, bearing, course, speed, CPA and TCPA of all tracked targets.

The target bearing is shown in relative bearing in the HEAD UP mode and true bearing in the COURSE UP, NORTH UP and True Motion modes, with the suffix "R" (Relative) or "T" (True).

The target speed and course are shown as speed over the ground or speed through the water depending on speed source.

3.10.1 TT pop up information

The TT pop-up shows abbreviated TT data (target no., COG, SOG, CPA and TCPA) for the selected TT. Simply put the cursor on the TT symbol to show the pop-up.


The popup can be enabled or disabled with the following procedure.

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [4 TT•AIS SYMBOL].
4. Select [7 TT POP-UP INFO].
5. Select [ON] or [OFF] as required.
6. Close the menu

3.10.2 How to show/remove target data in the data display area

Place the cursor on a desired tracked target and left-click, or press the **ACQ** key. The target's symbol is surround with a broken square and the selected TT target's data is shown in the data display area.

Note: This feature requires [2 TGT DATA/ACQ SETTING] on the second page of the [CURSOR] menu to be set as [ANY] or [TT ONLY].
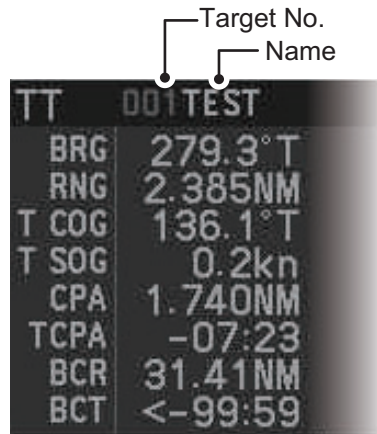
Indication	Description
Target No.	Number assigned by the system to this target. Target numbers which have become vacant are not re-used until the system is restarted, or the system tracks more than 100 targets.
Name	Name assigned to this target (B/W-types only). **Note:** If the assigned name (see section 3.11) is more than six characters in length, only the fist six characters of the name appear here.
BRG	Bearing from own ship to target in relative (R) or True (T) reference.
RNG	Range from own ship to target.
T COG	Relative (R) or True (T) Course Over Ground of target. Displayed as "T CTW" where speed input is set to [LOG(WT)]. Displayed as "R CRS" where speed data is not available.
T SOG	Relative (R) or True (T) Speed Over Ground of target. Displayed as T STW where speed input is set to [LOG(WT)]. Displayed as R SPD where speed data is not available.
CPA	Closest Point of Approach of target to own ship.
TCPA	Time to CPA of target to own ship.
BCR	Bow crossing range of target.
BCT	Bow crossing time of target.

The number of TT data that can be displayed at one time in the information box depends on your settings for [7 INFORMATION BOX] (see section 1.47).

To remove the target data, place the cursor on a desired tracked target, or the displayed data in the data area, then press the **TARGET CANCEL** key, left-click. The select target's data is removed from the data display area.

3.10.3 How to display, hide and sort the target list

The target list provides a comprehensive data display of all TT (and AIS) targets being tracked. A total of 1303 targets can be displayed in the list.

How to display the target list

Select the [TGT LIST] menu item at the bottom-right of the screen, then left-click. The target list appears inside the information box.

The following operations are available when the list is open:

- Go to next page : Click [0 NEXT].
- Go back one page : Click [1 BACK].
- Go to the first (top) page of the list : Select [1 BACK], then press and hold the **left-button**.
- Go to the last (bottom) page of the list : Select [0 NEXT], then press and hold the **left-button**.
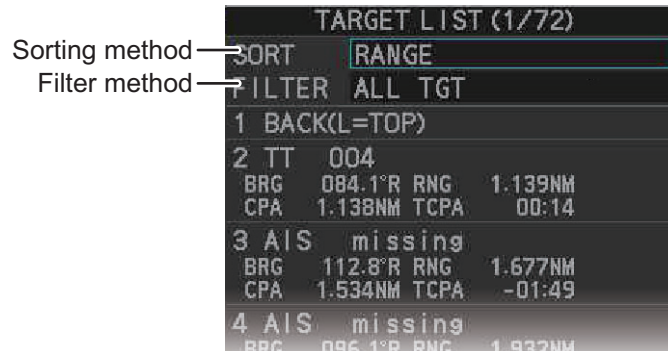- Refresh the list : Click [9 REFRESH DATA].

How to hide the target list

To hide the list, do one of the following:

- Place the cursor inside the list, then right-click.
- Press the **MENU** key.
- Left-click the [MENU] box.

How to sort the target list

1. With the target list displayed, place the cursor on the sorting method indication to the right of [SORT] ("CPA" in the example below). The indication is highlighted.

2. Spin the scrollwheel to select the sort method, referring to the table below, then left-click.

```
                          TARGET LIST (1/72)
Sorting method ——— SORT   RANGE
Filter method  ——— FILTER ALL TGT
                   1 BACK(L=TOP)
                   2 TT  004
                    BRG  084.1°R RNG   1.139NM
                    CPA  1.138NM TCPA     00:14
                   3 AIS  missing
                    BRG  112.8°R RNG   1.677NM
                    CPA  1.534NM TCPA    -01:49
                   4 AIS  missing
                    BRG  096.1°R RNG   1.932NM
```

Sorting method	Description
[CPA]	Targets are sorted in order from closest to farthest CPA.
[TCPA]	Targets are sorted in order from shortest to longest TCPA.
[BCR]	Targets are sorted in order from closest to farthest BCR.
[BCT]	Targets are sorted in order from shortest to longest BCT.
[RANGE]	Targets are sorted in order from closest to farthest range.
[SPEED]	Targets are sorted in order from fastest to slowest.
[NAME]	Targets are sorted in Alphabetical order.

Note: Targets with no data are sorted to the back of the list, regardless of the selected sorting method.

3. Set the filter method in the same manner.

Filter method	Description
[TT ONLY]	Show only TT targets.
[AIS ONLY]	Show only AIS targets.
[DISP FILTER]	Show only filtered targets.
[ALL TGT]	Show all targets (ignore filter settings).

4. Close the menu.
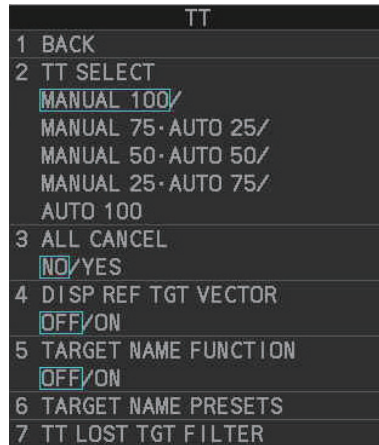
3.11 How to Assign a Preset Name to TT Targets (B/W-type only)

You can assign a preset name to TT targets, which is displayed alongside the TT number in the target list.
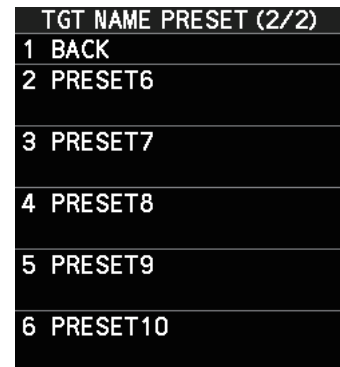
3.11.1 How to activate the preset name function

1. Open the menu.
2. Select [5 TT•AIS].

```
                    TT
1 BACK
2 TT SELECT
  MANUAL 100/
  MANUAL 75·AUTO 25/
  MANUAL 50·AUTO 50/
  MANUAL 25·AUTO 75/
  AUTO 100
3 ALL CANCEL
  NO/YES
4 DISP REF TGT VECTOR
  OFF/ON
5 TARGET NAME FUNCTION
  OFF/ON
6 TARGET NAME PRESETS
7 TT LOST TGT FILTER
```

3. Select [6 TT].
4. Select [5 TARGET NAME FUNCTION].
5. Select [ON], then press the **ENTER MARK** key.

3.11.2 How to setup preset names

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [6 TT].
4. Select [6 TARGET NAME PRESETS].
5. Select the appropriate preset.
   The software keyboard appears.

```
TGT NAME PRESET (1/2)       TGT NAME PRESET (2/2)
1 BACK                      1 BACK
2 PRESET1                   2 PRESET6
3 PRESET2                   3 PRESET7
4 PRESET3                   4 PRESET8
5 PRESET4                   5 PRESET9
6 PRESET5                   6 PRESET10
0 NEXT
```

Select [0 NEXT] to show page 2.

6. Referring to section 1.5.2, set the preset name. A maximum of eight characters may be used for the preset name.
   Note: If the assigned name is more than six characters in length, only the fist six characters of the name appear in the target list (see section 3.10).
7. Close the menu.

3.11.3 How to assign a name to a TT

1. Referring to section 3.11.1, activate the preset name function.

2. Referring to section 3.10.2, show the target's data in the data display area.

3. Place the cursor on the target data, then press the **left button**.
   The [TARGET NAME] menu appears.

```
              TARGET NAME
1   BACK
2   TARGET NAME

3   PRESET LIST
    TEST1
```

   Preset names are listed below [3 PRESET LIST]. In the above example, the name "TEST1" is set as a preset name.

4. Select a name from [3 PRESET LIST], or select [2 TARGET NAME] to assign a different name to the target.
   If you select [2 TARGET NAME], the software keyboard appears. Enter a name for the target, then select [END].
   The selected name (preset or manual input) appears at [2 TARGET NAME] and is also applied to the on-screen target.

5. Close the menu.

Note 1: When a name is assigned to a target, the numerical on-screen indication is replaced with the assigned name, as shown in the example figure below.

To view the named target's TT number, show the target data in the data display area.

Note 2: The same name can be assigned to multiple targets.

3.12 Vector Modes

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

Note: IMO recommends the use of true vector mode in sea stabilization or relative vector mode for collision avoidance.

3.12.1 Description of vectors

Stabilization modes

It is important to select the optimum stabilization mode for the radar display. To assess risk of collision the relative motion of a target gives the clearest indication of CPA and may be monitored by observing either the direction of the target's relative trail, or the CPA predicted by the relative vector. By default, relative motion displays relative target trails and true motion displays true target trails. Where true target trails is selected, a sea stabilized display will indicate all targets' motion through the water. A ground stabilized display will indicate all targets' motion over the ground.

In coastal, estuarine and river waters where a significant set and drift may be experienced, a sea stabilized display will produce significant target trails from all fixed (stationary) objects possibly producing an unacceptably high level of clutter and masking. In such circumstances a ground stabilized display may reduce its effect and enable the observer to detect clearly the trails of moving targets, thus enhancing the observer's situational awareness.

However, the display should be considered only as an approximation of the course and speed made good over the ground. Among other factors, the accuracy of the ground-stabilization is affected by inaccuracies in speed and heading inputs as well as radar measurement imprecision and will require the display to be readjusted periodically. The information displayed should be interpreted with due regard to these factors.

Note: It should be noted that in determining a target's aspect by radar; the calculation of its true track is dependent on the choice and accuracy of the own ship's course and speed input. A ground-stabilized target plot may accurately calculate the ground track of the target, but the target's heading may be significantly different from its track when experiencing set, drift or leeway. Similarly, a sea stabilized target plot may be inaccurate when own ship and the target, are experiencing different rates of set, drift or leeway.

Ground stabilization and sea stabilization

Target vectors can be ground stabilized or sea stabilized in the True Motion mode. To select speed over the ground or speed through the water data, open the page from the menu. Select for ground stabilization or for sea stabilization. The vector mode indication shows the stabilization mode in the true motion as [TRUE-G] or [TRUE-S].

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 in the true motion mode. 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. Note that set and drift should not be used when the radar is displaying AIS targets.

True vector

In the true motion mode, all fixed targets such as land, navigational marks and ships at anchor remain stationary on the radar screen with vector length zero. But in the presence of wind and/or current, the vectors appear on fixed targets representing the reciprocal of set and drift affecting own ship unless set and drift values are properly entered.

In the true vector mode, there are two types of stabilization: ground stabilization (TRUE-G) and sea stabilization (TRUE-S). The stabilization mode is automatically selected according to speed selection, as shown in the table below. Manual selection is available from the [SPD] menu at the top-right of the screen.

Speed selection	True vector mode
LOG(WT)	TRUE-S
LOG(WTC)	TRUE-G
LOG(BT)	TRUE-G
EPFS(BT)	TRUE-G
REF(BT)	TRUE-G
MAN(WT)	TRUE-S
MAN(WTC)	TRUE-G

Relative vector

Relative vectors on targets that are not moving over the ground such as land, navigational marks and ships at anchor will represent the reciprocal of own ship's ground track. A target whose vector passes through own ship is on a collision course. (Dotted lines in the figure are for explanation only.)
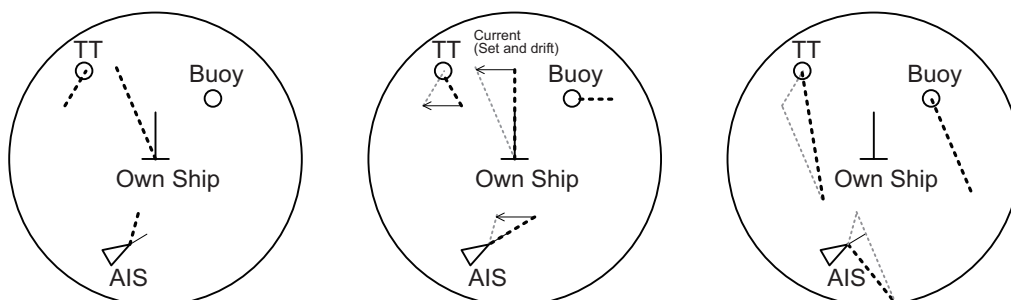
True vectors in ground stabilization

True vectors in sea stabilization

Relative vectors
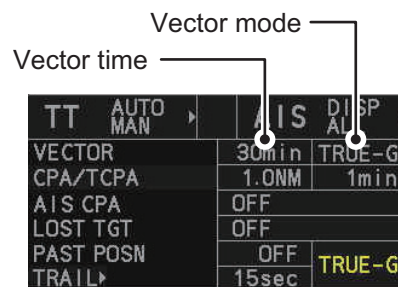
3-17

3.12.2 Vector mode and length

Vectors can be displayed in true or relative modes. Vector lengths can be set between 30 seconds and 60 minutes.

The vector tip shows an estimated position of the target after the selected vector time elapses. It can be valuable to extend the vector length to evaluate the risk of collision with any target.

How to change the vector mode

Place the cursor on the vector reference indication in the [Vector] box, then left-click to cycle through the following settings.

[REL] → [TRUE-G/TRUE-S] → [REL]...

How to change the vector time

Place the cursor on the vector time indication in the [Vector] box, then left-click to cycle through the following settings.

[6min] → [10min] → [20min] → [30min] → [45min] → [60min] → [30sec] → [1min] → [3min] → [5min] → [6min]...

You can also spin the scrollwheel to change the vector time in one-minute increments.