3.8 DISPLAY NAVIGATION INFORMATION (NAV INFORMATION DISPLAY)

Navigation information such as waypoint marks, and a maximum of 256 points of NAV lines, coastlines, depth contours, and NAV marks can be displayed, created, read, saved, corrected, and deleted. (This function is available only when navigation equipment is connected with the system.)

Note: Navigation information is available between latitudes of 85ºN and 85ºS.

3.8.1 Display Waypoint Marks (Waypoint Display)

When waypoint information is received from the navigation equipment, the waypoint mark appears on the radar display. In this case, ◎W is indicated as the waypoint mark on the radar display.

Procedure

1 Press [RADAR MENU] key twice.

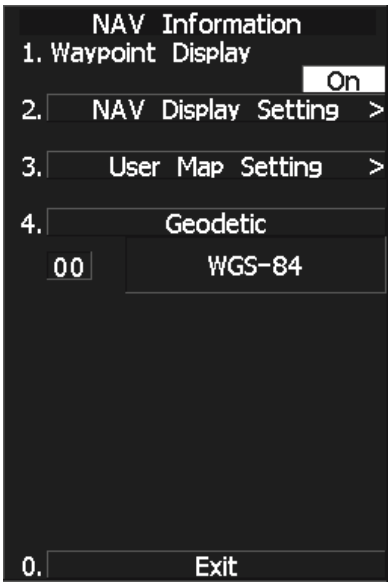
Press [6] key.

The NAV Information Menu will appear.

2 Press [1] key.

The setting of Waypoint Display will be switched between ON and OFF.

ON: Displays waypoint marks.
OFF: Does not display waypoint marks.



Waypoint marks are displayed only when NMEA sentences are used to receive Waypoint information. A plotter function (option) is needed to make Waypoint in this radar.

3.8.2 Display Navigation Information (NAV Display Setting)

The navigation information below can be displayed (ON) or hidden (OFF) individually.

① Line 1 [Line 1] —
② Line 2 [Line 2] ----
③ Line 3 [Line 3] - —
④ Mark 1 [Mark 1] ⧖
⑤ Mark 2 [Mark 2] ★
⑥ Mark 3 [Mark 3] +
⑦ Mark 4 [Mark 4] Y

Procedure

1 Press [RADAR MENU] key.

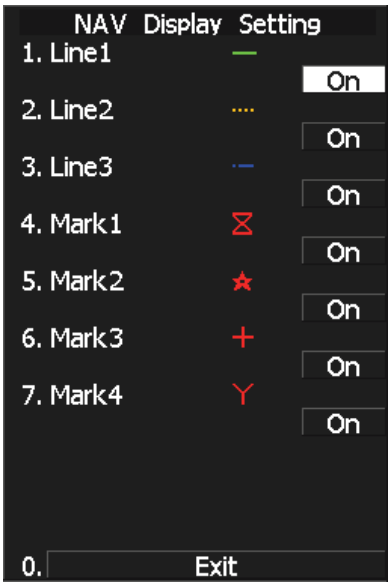
Press [6] key.

Press [2] key.

The NAV Display Setting Menu will appear.

To determine whether to display each type of navigation information, press the corresponding numeric key.

ON: Displays the navigation information.
OFF: Does not display the navigation information.



3.8.3 Create/Edit Navigation Information (Edit User Map)

Procedure

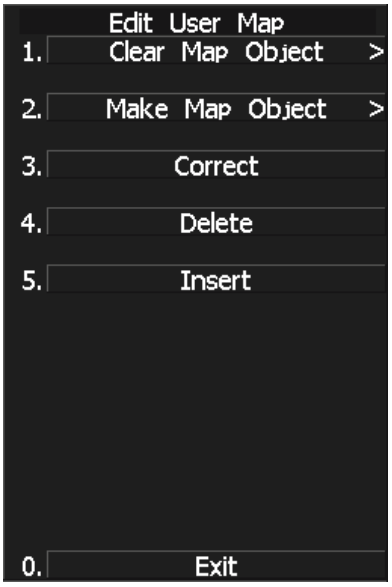
1 Press [RADAR MENU] key.

Press [6] key.

Press [3] key.

Press [6] key.

The Edit User Map Menu will appear.



The Edit User Map enables the operations of the functions below.

Clear Map Object: Clears all or an item of navigation information.
Make Map Object: Creates navigation information.
Correct: Corrects navigation information.
Delete: Deletes one point from navigation information.
Insert: Inserts an element into a line of each type

1 Clearing all or an item of navigation information (Clear Map Object)

Procedure

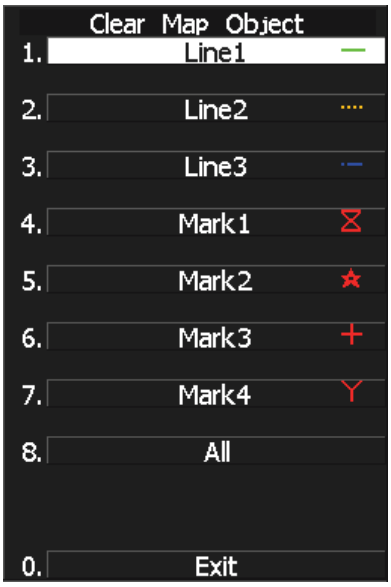
1 Press [1] key while the Edit User MAP Menu is open.

The Clear Map Object Menu will appear.

Select the type of navigation information to be cleared, pressing the corresponding numeric key.

Line1:	Clears Line 1.
Line2:	Clears Line 2.
Line3:	Clears Line 3.
Mark1:	Clears Mark 1.
Mark2:	Clears Mark 2.
Mark3:	Clears Mark 3.
Mark4:	Clears Mark 4.

All: Clears all items of navigation information.



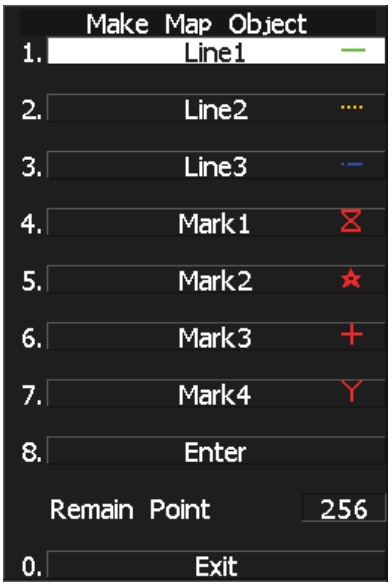
2 Making navigation information (Make Map Object)

Procedure

1 Press [2] key while the Edit User MAP Menu is open.

The Make Map Object Menu will appear.

MAKE will appear in the CURSOR mode field at software button ② located at the bottom right corner of the radar display described in Section 2.3.3.



2 Select the type of navigation information to be made, pressing the corresponding numeric key.

3 Use the trackball to move the cross cursor mark to the starting point of a line or a point where a mark is to be made, and press [ENT] key.

The starting point of a line or one point of a mark will be determined.

4 Repeat step 3, and press [8] key when finishing the making of the line or mark.

The line or mark make mode will terminate.

5 To make another line or mark, repeat steps 2 to 4.

6 Press [0] key when finishing the making of all navigation information.

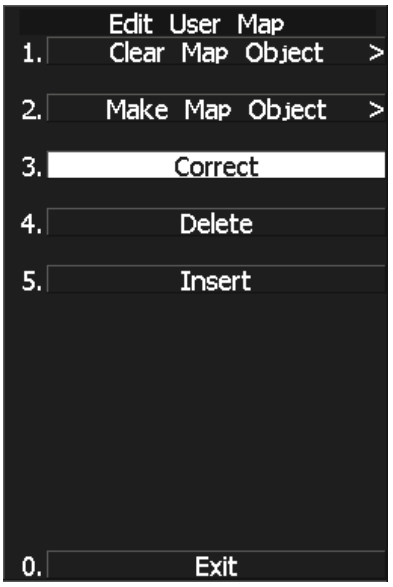
The Edit User Map Menu will reappear.

Note: Navigation information can be created with a maximum of 256 points being plotted. The number of points that can still be plotted (REMAIN POINT in the menu) is decremented each time a line or mark is plotted.

3 Correcting a continuous line or moving a mark (Correct)

Procedure

1 Press [3] key while the Edit User Map Menu is open.



The navigation information correction mode will be activated.
[Correct] will appear in the [CURSOR] mode field at software button ② located at the bottom right corner of the radar display described in Section 2.3.3.

2 Use the trackball to move the pointer to the vertex in a line to be corrected or the mark to be moved, and press [ENT] key.

The cross cursor mark will appear on the selected line or mark.

3 Use the trackball to move the cross cursor mark to a new point to which the line is corrected or the mark is moved.

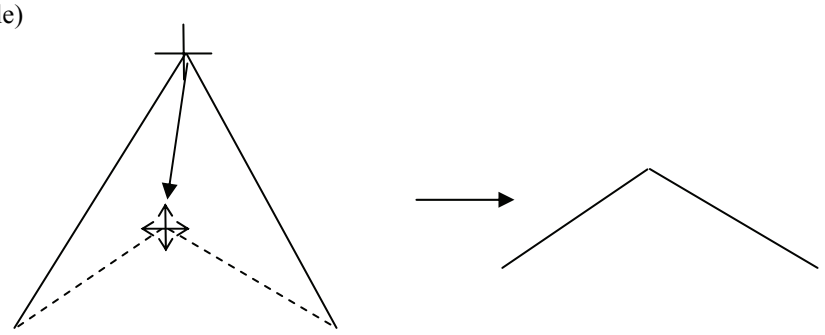
The selected line will be corrected to the new point, or the mark will be moved there.

4 To correct another line or mark, repeat steps 2 and 3.

5 Press [0] key when finishing the correction of lines and marks.

The [CURSOR] mode at the upper right of the radar display will change to the general operation mode, terminating the navigation information correction mode.

(Example)



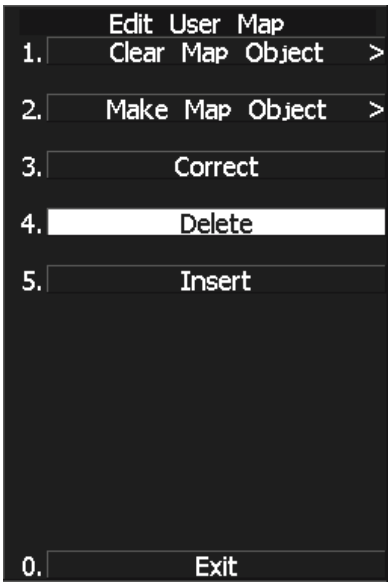
Select a top

4 Deleting a continuous line or mark (Delete)

Procedure

1 Press [4] key while the Edit User Map Menu is open.

The navigation information deletion mode will be activated.
Delete will appear in the CURSOR mode field at software button ② located at the top right corner of the radar display described in Section 2.3.3.



2 Use the trackball to move the pointer to the vertex in a line or the mark to be deleted, and press [ENT] key.

The selected line or mark will be deleted.

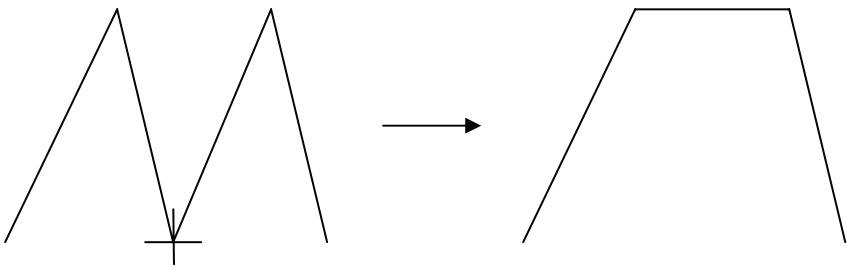
Note: A line drawn by joining two points is all deleted.

3 To delete another line or mark, repeat step 2.

4 Press [0] key when finishing the deletion of lines and marks.

The CURSOR mode at the upper right of the radar display will change to the general operation mode, terminating the navigation information deletion mode.

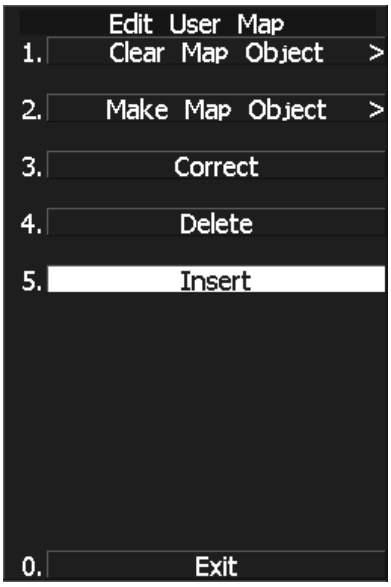
(Example) Deletion of a vertex from a line



5 Inserting a vertex into a line (Insert)

Procedure

1 Press [5] key while the Edit User MAP Menu is open.



The navigation information insertion mode will be activated.
Insert will appear in the CURSOR mode field at software button ② located at the top right corner of the radar display described in Section 2.3.3.

2 Use the trackball to move the pointer to the line that is to become a vertex, and press [ENT] key.

The cross cursor mark will appear on the selected point.

3 Use the trackball to move the cross cursor mark to a new point where a vertex is to be formed, and press [ENT] key.

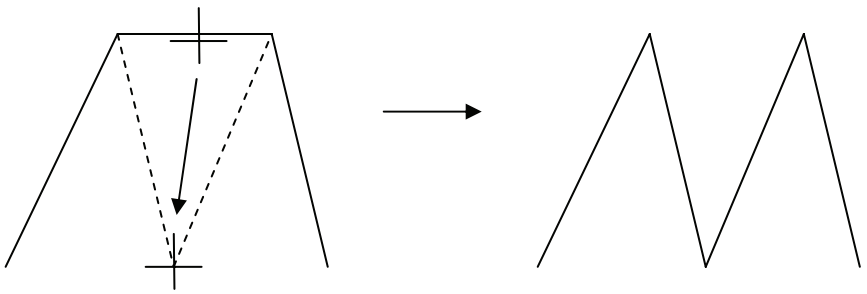
A vertex will be inserted into the selected line.

4 To insert another vertex, repeat steps 2 and 3.

5 Press [0] key when finishing the insertion of all vertices.

The CURSOR mode at the upper right of the radar display will change to the general operation mode, terminating the navigation information insertion mode.

(Example)



3.8.4 Set Navigation Information (User Map Setting)

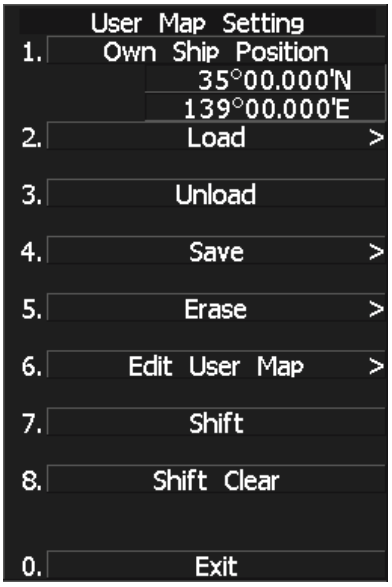
Procedure

1 Press [RADAR MENU] key.

Press [6] key.

Press [3] key.

The User Map Setting Menu will appear.



Select operation for navigation information, pressing the corresponding numeric key. The selected operation will be performed.

Load: Loads navigation information.
Unload: Unloads navigation information.
Save: Saves navigation information.
Erase: Erases navigation information.
Edit User Map: Edits navigation information.
Shift: Shifts the display position of navigation information.
Shift Clear: Clears position correction information.

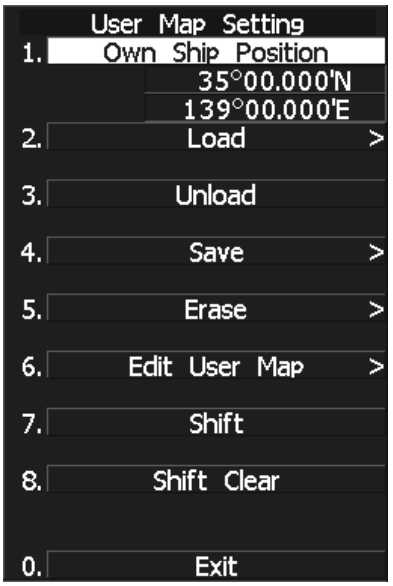
[l] Entering the own ship's position in manual mode (Own Ship Position)

Use this function to edit the navigation information of any positions other than the own ship's position.

Procedure

1 Press [1] key while the User Map Setting Menu is open.

The CODE INPUT Menu for entering latitude and longitude of the own ship position will appear.



2 Enter a value as the latitude (xx° xxx.xx') using the numeric keys [0] to [9].

3 To switch between north latitude and south latitude, turn the [MULTI] control.

Each time the control is turned, N (north latitude) is changed to S (south latitude), or vice versa.

4 Press [ENT] key.

The latitude entered in manual mode will be determined. Subsequently, enter the longitude.

5 Enter a value as the longitude (xx° xxx.xx') using the numeric keys [0] to [9].

6 To switch between east longitude and west longitude, turn the [MULTI] control.

Each time the control is turned, E (east longitude) is changed to W (west longitude), or vice versa.

7 Press [ENT] key.

The longitude entered in manual mode will be determined.

* Button on the CODE INPUT Menu is also available instead of the numeric keys.

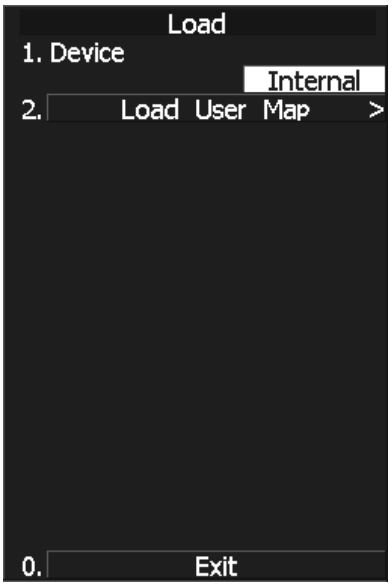
Note: The own ship's position manually entered by using the function above is valid only in the User MAP Setting Menu. When control exits from the menu, the manually entered position data is invalidated.

[II] Loading navigation information (Load User Map)

Procedure

1 Press [2] key while the User Map Setting Menu is open.

The Load User Map Menu will appear.



2 Press [2] key.

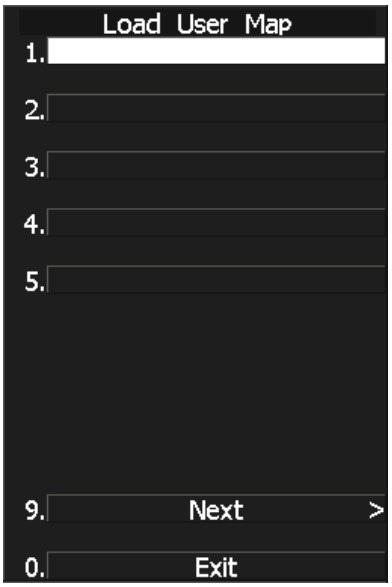
The list of navigation information files saved in the system will appear.

* Each time you press **[1]** key, the Device item is switched between INTERNAL and CARD2.
INTERNAL: Reads saved data from the processor.
CARD2: Reads saved data from CARD2.

To select CARD2, insert the flash memory card, in which data has been saved, into card slot 2 (upper stage).

3 Select the number of the file to be loaded, pressing the numeric key.

The selected navigation information will be loaded and shown on the radar display.



[III] Initializing Navigation Information (Unload)

Procedure

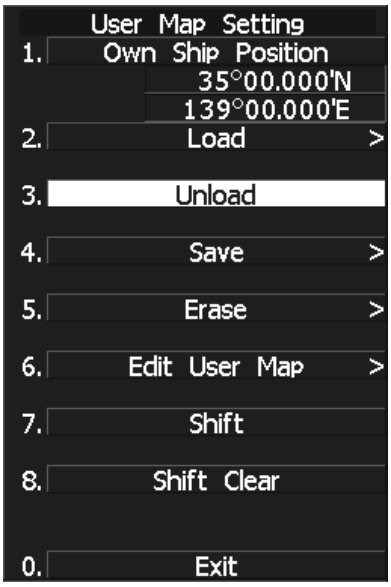
1 Press [3] key while the User Map Setting Menu is open.

Display the window to select whether or not the information is to be initialized.

2 Press [1] key.

The navigation information is initialized.

This function can be executed for files that have been read and new navigation information currently being entered.



[IV] Saving navigation information (Save User Map)

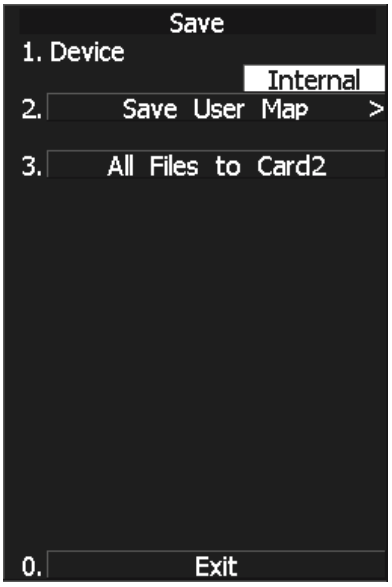
This function is available only when navigation equipment is connected with the system or the own ship's position is entered in manual mode.

Procedure

1 Press [4] key while the User Map Setting Menu is open.

2 Press [2] key.

The Save User Map Menu will appear.



* Each time you press **[1]** key, the Device item is switched between INTERNAL and CARD2.
INTERNAL: Saves data in the processor.
CARD2: Saves data in CARD2.

To select CARD2, insert the flash memory card, in which data has been saved, into card slot 2 (upper stage).

3 Select the number of the file to be saved, pressing the numeric key.

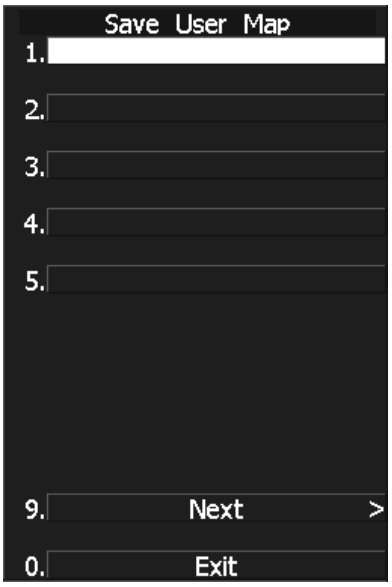
The Name Input Menu will appear.

4 Use the trackball to select an alphabetic character A-Z or 0-9 shown in the menu and press [ENT] key on your required characters.

A maximum of 8 characters can be entered.

5 Repeat step 4 until the file name to be saved is created, move the cursor to ENT, and press [ENT] key.

The currently displayed navigation information will be saved.



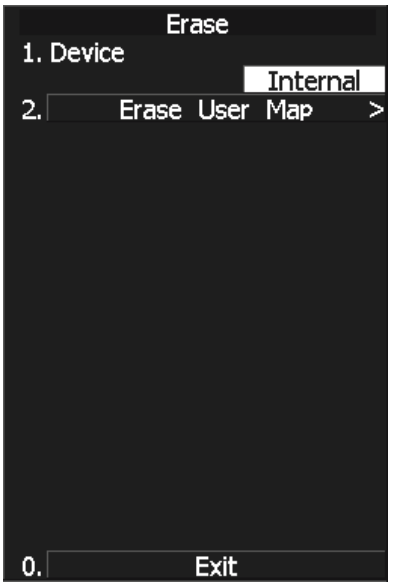
[V] Erasing navigation information from memory (Erase User Map)

Procedure

1 Press [5] key while the User Map Setting Menu is open.

2 Press [2] key.

The Erase User Map Menu will appear.

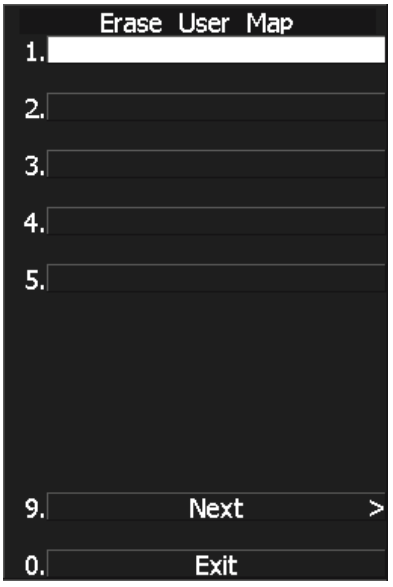


* Each time you press **[1]** key, the Device item is switched between INTERNAL and CARD2.
INTERNAL: Erases saved data from the processor.
CARD2: Erases saved data from CARD2.

To select CARD2, insert the flash memory card, in which data has been saved, into card slot 2 (upper stage).

3 Select the number of the file you want to erase, pressing the numeric keys [1] to [5].

The navigation information file will be erased from the memory, and the file name will disappear from the file list.



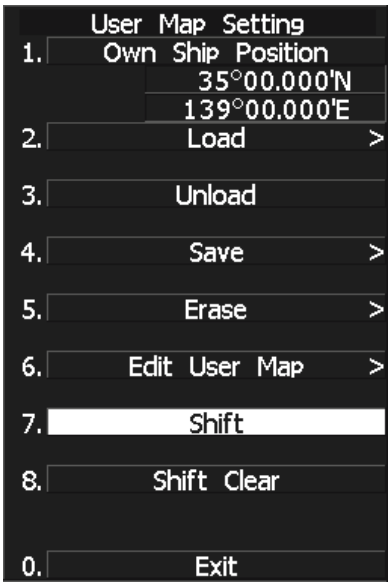
[VI] Shifting the display position of navigation information to a correct position (Shift)

If the display position of navigation information is incorrect, it can be shifted to the correct position in manual mode.

Procedure

1 Press [7] key while the User Map Setting Menu is open.

Shift will appear in the CURSOR mode field of software button ② located at the top right corner of the radar display described in Section 2.3.3, and the navigation information shift mode is activated.



2 Use the trackball to move the pointer to a mark or a point on a NAV line, coastline, or depth contour line, and press [ENT] key.

3 Use the trackball to move the cross cursor mark to the position to which the mark or line is shifted, and press [ENT] key.

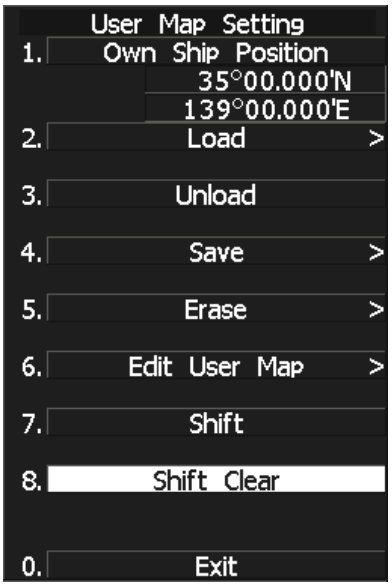
All the marks and lines currently displayed will be shifted to their correct positions.

[VII] Shifting the corrected display position of navigation information back to original (Shift Clear)

Procedure

1 Press [8] key while the User Map Setting Menu is open.

The MAP returns to the original position.



3.8.5 Set and Display Geodetic System

To create navigation information, set the geodetic system that is used with the connected navigation equipment. When navigation information is loaded, the geodetic system used when the navigation information was saved, is displayed. Make sure that the displayed geodetic system is identical to the one used with the navigation equipment. If the two geodetic systems are different, the positions of navigation information on the radar display will be shifted. Therefore, it is important to set the geodetic system of the navigation equipment.

Procedure

1 Press [RADAR MENU] key.

Press [6] key.

The NAV Information Menu will appear.

2 Press [4] key.

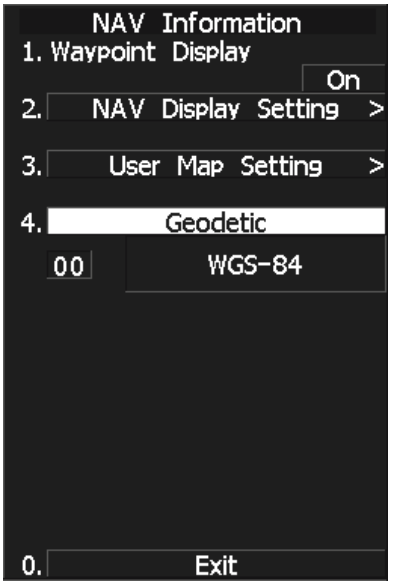
The geodetic system input ten-key screen will appear.

3 Enter the number of the target geodetic system, pressing the numeric keys.

4 The entered geodetic system number can be changed by turning the [MULTI] control.

5 Press [ENT] key.

The entered geodetic system will be determined.



Geodetic System List

No.	Name	Data Display
0	WGS-84	WGS-84
1	WGS-72	WGS-72
2	Japan	Japan
3	North American 1927(U.S)	NAS
4	North American 1927(Canada & Alaska)	NAS
5	European 1950 (Europe)	EUR
6	Australian geodetic 1966 (Australia)	AUA
7	Ordance Survery of Great Britain (England)	UK
8	NAD-83	NAD-83
9	- (No Use)	
10	- (No Use)	
11	ADINDAN (Etiopia & Sudan)	ADI
12	ARC 1950 (Botswana)	ARF
13	AUSTRALIAN GEODETIC 1984 (Australia)	AUF
14	BERMUDA 1957 (the Bermudas)	BER
15	BOGOTA OBSERVATORY (Columbia)	BOO
16	CAMPO INCHAUSPE	CAI
17	CHATHAM 1971	AHI
18	CHUAASTRO (Paraguay)	CHU
19	CORREGO ALEGRE (Brazil)	COA
20	DJAKARTA (VATAVIA) (Sumata)	BAT
21	EUROPEAN 1979 (Europe)	EUS
22	GEODETIC DATUM 1949 (New Zeland)	GEO
23	GUAM 1963 (Guam)	GUA
24	HAYFORD 1910 (Finland)	HAYFORD
25	HJORSEY 1955 (Ice land)	HJO
26	INDIAN (India & Nepal)	IND
27	IRELAND1965 (Ireland)	IRL
28	KERTAU 1948 (West Malaysia)	KEA
29	L.C.5 ASTRO (Cayman Black Island)	LCF
30	LIBERIA 1964 (Liberia)	LIB
31	LUZON (Philippines)	LUZ
32	MERCHICH (Morocco)	MER
33	MINNA (Cameroon)	MIN
34	NAHRWAN (Oman)	NAH
35	NAPARIMA, BWI (Trinidad & Tobago)	NAP
36	OLD EGYPTIAN (Egypt)	OEG
37	OLD HAWAIIAN (Hawaii)	OHA
38	PCO DE LAS NIEVES (Canary)	PLN
39	PROVISIONAL SOUTH AMERICAN 1956 (South America)	PRP
40	PROVISIONAL SOUTH CHILEAN 1963 (South Chile)	HIT
41	PUERTO RICO (Puerto Rico & Virgin Islands)	PUR
42	QORNOQ (South Greenland)	QUO
43	RT90 (Sweden)	RT90
44	SANTA BRAZ (San Miguel island & Saint Mary islands)	44
45	SOUTH AMERICAN 1969 (South America)	SAN
46	SOUTHWEST BASE (Faial & Sao Jorge & Pico & Graciosa & Terceira island)	46
47	TIMBALAI 1948 (Brunei & East Malaysia)	TIL
48	- (No Use)	
49	- (No Use)	

3.9 APPLIED OPERATIONS

3.9.1 Set Radar Signal Processing (Process Setting)

This function enables the setting of detail information about radar signal processing.

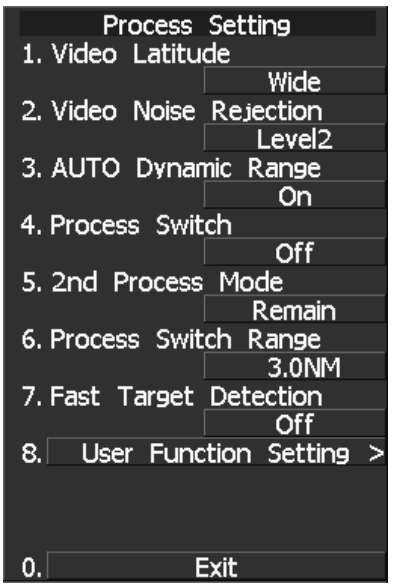
Procedure

1 Press [RADAR MENU] key twice.

Press [6] key.

The Process Setting Menu will appear.

Detail information about radar signal processing can be set by changing the settings of the menu items.



Note: After the settings for radar signal processing are changed, small targets may not be displayed or unwanted waves may not be suppressed. Thus, do not make a significant change in the settings.

[1] Video Latitude

- Select the dynamic range in which receiving signals are to be shown on the radar display.
- Select [NORMAL] in standard, and [WIDE] in rainy weather.
- [NARROW] clearly displays short-range videos when STC is used in manual mode.

[NORMAL]: Standard setting
The dynamic range varies depending on the actual range:
Short range > long range

[WIDE]: Use this mode when rainy weather intensifies unwanted waves.
The dynamic range is about twice as wide as when [NORMAL] is selected.

[SUPER WIDE]: Use this mode when rain cloud remain at [WIDE] mode.
The dynamic range is about twice as wide as when [NORMAL] is selected.

[NARROW]: Narrows the dynamic range at short range.

[2] Video Noise Rejection

- This function rejects signals that assumed as noise and clutter in radar videos.
- Select [OFF] to display radar videos like analog signals.
- Select [LEVEL1] or [LEVEL2] to suppress noise and clutter.
- Select [LEVEL1] or [LEVEL2] to superimpose-display the chart.

[OFF]: Turns off the noise rejection function, and displays all signals.
Targets are popped up from noise and displayed like analog signals.

[LEVEL1]: Rejects the signals of definitely unwanted waves (noise and clutter).
When detection of targets or unwanted waves is not definite, the signals are displayed.
When detection of targets is definite, the signals are displayed.

[LEVEL2]: Rejects the signals of definitely unwanted waves (noise and clutter).
When detection of targets or unwanted waves is not definite, the signals are rejected.
Only when detection of targets is definite, the signals are displayed.

[3] Auto Dynamic Range Control

- This function automatically controls the dynamic range of radar videos when the AUTO SEA (sea clutter suppression)/AUTO RAIN (rain/snow clutter suppression) mode is used.
- When the AUTO SEA (sea clutter suppression) mode is used, this function improves sensitivity by widening the dynamic range of only areas where sea clutter is strong, and narrowing the dynamic range of areas where sea clutter is not detected.
- When the AUTO RAIN (rain/snow clutter suppression) mode is used, this function improves sensitivity by widening the dynamic range of areas where sea clutter or rain/snow clutter is strong, and narrowing the dynamic range of the other areas.
- Land videos become obscure when the AUTO RAIN clutter suppression mode is used.

[OFF]: Does not control the dynamic range automatically.
The dynamic range is set in the same manner as when the MANUAL SEA/RAIN clutter suppression mode is used.

[ON]: Automatically controls the dynamic range. (Standard setting)

[4] Process Switch

- This function sets a specific area and switches the video process mode between the inside and outside of the area.
- In **[5]** 2nd Process Mode, set the second video process mode for the area outside the boundary.
- In **[2]** PROCESS of [Main Menu], set the first video process mode for the area inside the boundary.
- Sensitivity at a distance can be improved by suppressing near sea clutter through the correlative process.
- There are two methods for setting an area:

[OFF]: Disables the Process Switching function. (Standard setting)

[RANGE FIX]: Sets a boundary at a constant range from the center.
Set the boundary range in **[6]** Process Switch Range.
The specific area turns out to be a circle with the own ship's position as the center.

[AUTO]: Automatically sets a specific area.
The area subject to many clutter returns is inside the boundary, and the area less subject to clutter returns is outside the boundary.

[5] 2nd Process Mode

- Set the second video process mode for the outside of a specific area.
- This function is enabled when [RANGE FIX] or [AUTO] is selected in **[4]** Process Switching.

Video process modes

[PROC OFF]	Correlation	Off :	Select this mode in general.
[3 SCAN COREL]	Correlation	Short :	Select this mode when many rain/snow clutter returns are detected.
[4 SCAN COREL]	Correlation	Medium :	Select this mode to highlight targets while suppressing sea clutter returns.
[5 SCAN COREL]	Correlation	Long :	Select this mode to detect small targets hidden by sea clutter returns.
[REMAIN]	Afterimage	Short:	Select this mode when own ship yaws wildly.
[PEAK HOLD]	Afterimage	Long :	Select this mode to detect small targets of which detection probability is low.

[6] Process Switch Range

- Set the boundary range of a specific area.
- This function is enabled when [RANGE FIX] is selected in **[4]** Process Switch.
- The specific area turns out to be a circle with the own ship's position as the center.
- The boundary range can be set in units of 0.1 nm, ranging 0.1 to 25.5 nm.
- After selecting PROC Switch Range, adjust the range using the **[MULTI]** control.
- When finishing the adjustment, press **[ENT]** key to determine the video process switching range.

[7] Fast Target Detection

- This function displays fast moving targets that are suppressed in scan-correlative process mode.
- This function is enabled when [3SCAN CORR], [4SCAN CORR], or [5SCAN CORR] is selected as the video process mode.
- If unwanted waves remain on the radar display, suppress them by using the **[SEA]**, **[RAIN]**, or **[GAIN]** control, or adjusting the interference rejection mode.
  - [OFF]: Disables the Fast Target Detection function.
  - [ON]: Enables the Fast Target Detection function.

[8] User Function Setting

- "Radar Function Setting" is provided for always obtaining the best radar video by storing complex radar signal processing settings in the optimum status by use, and by calling the setting in accordance with the conditions for using the radar signal processing function. The radar signal processing functions are factory-set for general use, and the settings can be fine adjusted through menu operation.
- For detail, refer to Section 3.10.3 "Overview of Function Operations".

3.9.2 Set Radar Trails (RADAR Trails Setting)

This function enables the setting of detail information about radar trails processing.

Procedure

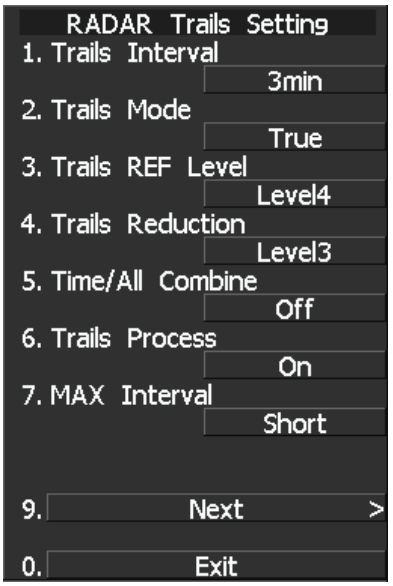
1 Press [RADAR MENU] key twice.

Press [7] key.

Alternatively, hold down the [TRAILS] key until the menu appears.

The RADAR Tails Setting Menu will appear.

Detail information about radar trails processing can be set by changing the settings of the menu items.



Note: After the settings for radar trails processing are changed, targets' trails may not be displayed or trails may be plotted with unwanted waves. Thus, do not make a significant change in the settings.

[1] Trails Interval

- Set the trail intervals at which radar trails are displayed.
- Selection items of trail intervals change depending on the setting of maximum value of radar trail display time.
- The Multi-function control is also available for setting.
- For the decision branches of trail interval, see Section 3.5.10 "Display Radar Trails (Other Ships' Trails)".

[2] Trails Mode

- Set the radar trail display mode.
- Each time the button is pressed, you can switch between True and Relative.
- For details on the trail mode, see "Changing Motion Mode of Trails (Trails mode)" in 3.5.10 "Display Radar Trails (Other Ships' Trails)."

[3] Trails REF Level

- Select a radar video level required for plotting radar trails.
- The radar video level increases in order of [LEVEL1] → [LEVEL2] → [LEVEL3] → [LEVEL4].
- To plot radar trails with unwanted waves, change to a higher level.
- To thin radar trails, change to a higher level.
- If radar trails are plotted in snatches, change to a lower level.

[4] Trails Reduction

- Make a setting for thinning radar trails.
- The effect of thinning increases in order of [LEVEL1] → [LEVEL2] → [LEVEL3].
- Radar videos do not become obscure because of the thinning of radar trails.

[OFF]: Disables the Trails Reduction function.
[LEVEL1]: Enables the Trails Reduction function. (Effect: Low)
[LEVEL2]: Enables the Trails Reduction function. (Effect: Modest)
[LEVEL3]: Enables the Trails Reduction function. (Effect: High)

[5] Time/Cont Combine

- This function superimpose-displays time radar trails and continuous radar trails.
- Operators can distinguish time radar trails from continuous radar trails by setting different colors for both types of trails.

[OFF]: Disables the Time/Cont Combine function.
[ON]: Enables the Time/Cont Combine function.

[6] Trails Process

- Determine whether to use the video process with radar signals for plotting radar trails.
- When Trails Process is [ON], radar trails are never plotted with unwanted waves, but the radar trails of fast moving targets may not be plotted.
- When Trails Process is [OFF], radar trails may be plotted with unwanted waves, but the radar trails of fast moving targets are always plotted.

[OFF]: Disables the Trails Process function.
[ON]: Enables the Trails Process function.

[7] MAX Interval

- Select the maximum time for displaying radar trails.
- Select [Short] when short radar trails are often used in bays and the likes.
- Select [Super Long] when long radar trails are necessary for ocean navigation.
- [Medium] is for specification between [Short] and [Long].
- Continuous trails are available with all the options.

[Short]: Sets 15 minutes as the maximum time for radar trails display.
[Medium]: Sets 30 minutes as the maximum time for radar trails display.
[Long]: Sets 60 minutes as the maximum time for radar trails display.
[Super Long]: Sets 12 hours as the maximum time for radar trails display.

[9] NEXT

- The file menu will appear.

Load and save of the Rdar trails.

Procedure

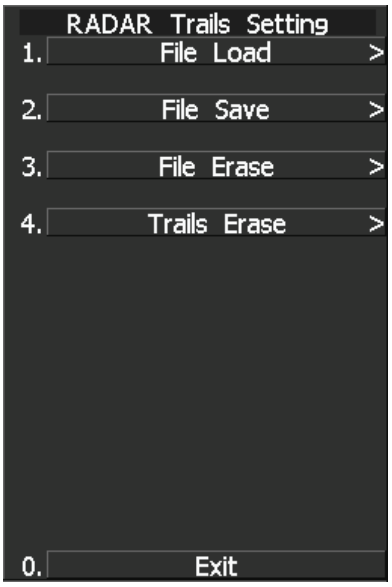
1 Press [RADAR MENU] key twice.

Press [7] key.

Alternatively, hold down the [TRAILS] key until the menu appears.

Press [9] key.

The RADAR Tails Setting Menu will appear.



[1] Loading Trails File

- Presse [1] key.
  The saved trail files are displayed.
- Select the file to be loaded
  Confirmation warining is displayed.
  Select “Yes” for loading.

  It takes a few second to be loded.

Note: When the saved trail position is too far from own ship position, the saved trails can not be loaded.
On the standby mode, however, far trail positions can be loaded. In that case, the own ship position is changed to the loaded trail position temporally.

After loading, Range scale, Trails mode (True / Relative) and Max interval are set to loded settings.

[2] Saving Trails File

- Presse [2] key.
  The File Save menu is displayed.
- Using the cusor, enter the file name and click “ENT”
  Confirmation warining is displayed.
  Select “Yes” for saving.

  It takes a few second to be loded.

Note: When the own ship position data are not available, trails can not be saved.

[3] Erasing Trails File

- Presse [3] key.
  The saved trail files are displayed.
- Select the file to be erased.
  Confirmation warining is displayed.
  Select “Yes” for erasing.

Note: Deleted files can not be restored, so Erase files carefully.

Erasing the displayed trails partially.

Erasing the part of the displayed trails by using the cursor as a eraser.

Note: Deleted trails can not be restored, so Erase them carefully.

Procedure

1 Press [RADAR MENU] key twice.

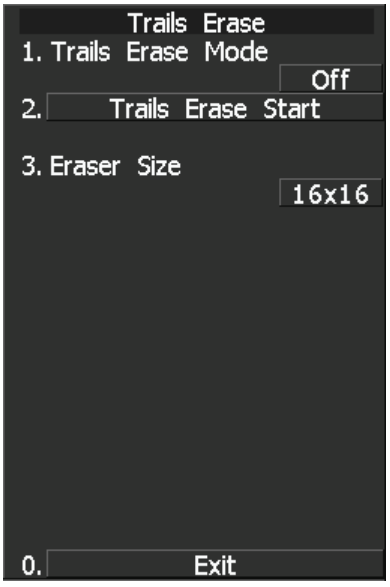
Press [7] key.

Alternatively, hold down the [TRAILS] key until the menu appears.

Press [9] key.

Press [4] key.

Trail erase menu will appear.



[1] Trails Erase Mode

Press [1] key.

- Trail erase mode is enabled.
- On the mode, cusor is fixed on the menu, and the eraser (white box) is displayed on the own ship positon.
- Using the trackball, positon the eraser on the Trail to be deleted.

[2] Trails Erase start

Press [2] key.

- Trail erase function starts.
  Using the track ball, wipe out trails.
- Press [2] key again to disable the function temporally.

The depth input scre

[3] Eraser Size

Press [3] key.

- Eraser size lit is displayed.
- Select the size of the eraser.

2x2	: 2x2 pixels
4x4	: 4x4 pixels
8x8	: 8x8 pixels
16x16	: 16x16 pixels
32x32	: 32x32 pixels

3.9.3 Set Cursor (Cursor Setting)

This function enables the setting of detail information about cursor operation and display.

Procedure

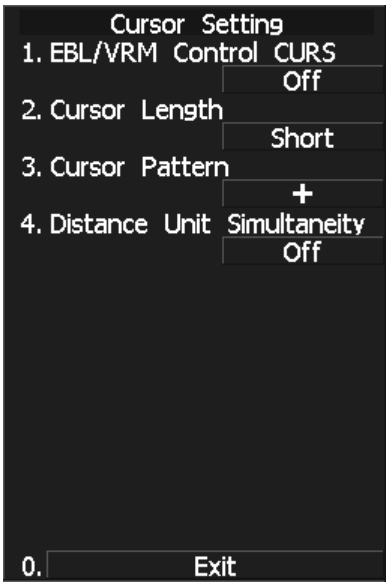
1 Press [RADAR MENU] key.

Press [3] key.

Press [6] key.

The Cursor Setting Menu will appear.

Detail information about cursor operation and display can be set by changing the settings of the menu items.



[1] EBL/VRM Control CURS (device for cursor operation)

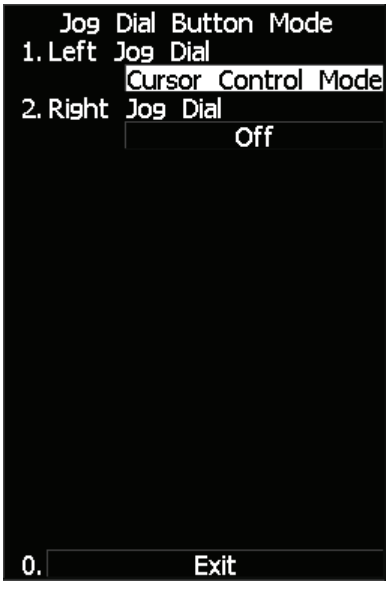
- This function is switched between ON and OFF of EBL/VRM Control CRUS function
- The trackball is provided as a standard device. If the trackball malfunctions, the cursor can be moved by using the **[EBL]** control and **[VRM]** control.
- Set the cursor control mode as the Jog Dial mode.

Procedure

1 Hold down the [EBL] control for two seconds.

Press [1] key.

The Left Jog Dial will open. Select Cursor Control Mode.



- The cursor moves horizontally when **[EBL]** is operated, and moves vertically when **[VRM]** is operated.
- To switch between EBL/VRM operation and cursor operation while ON is selected, press the [EBL] control. Each time the [EBL] control is pressed, EBL/VRM operation is switched to cursor operation, or vice versa.

  ON: Cursor is operated using a **[EBL] [VRM]** control.
  OFF: Cursor is operated using a trackball.

[2] Cursor Length

- Set the length of the cross cursor mark on the radar display.
  SHORT: Cuts the cross cursor mark in length.
  LONG: Makes the cross cursor mark twice as long as when SHORT is selected.

[3] Cursor Pattern

- The type of the cross cursor mark displayed of the display is selected.
  
  : Type 1 is selected for the cross cursor mark 1 displayed in the radar display.
  : Type 2 is selected for the cross cursor mark 2 displayed in the radar display.
  : Type 3 is selected for the cross cursor mark 1 displayed in the radar display.
  : Type 4 is selected for the cross cursor mark 2 displayed in the radar display.

[4] Distance Unit Simultaneity

- Synchronizes the cursor range unit with the VRM1/VRM2 range unit.
  ON: The range units are synchronized between the cursor and VRM1/VRM2. A range unit cannot be selected individually for the cursor or VRM1/VRM2, and the same range unit is selected for all of them.
  OFF: The range units are not synchronized between the cursor and VRM1/VRM2. A range unit can be selected individually for the cursor and VRM1/VRM2.

3.9.4 Set Screen(Screen Setting)

This function enables the setting of detail information about screen display.

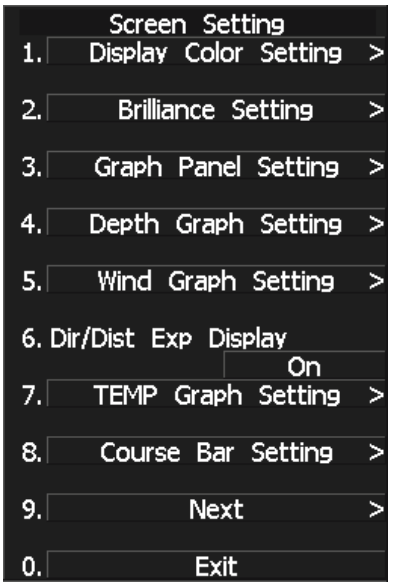
Procedure

1 Press [RADAR MENU] key.

Press [4] key.

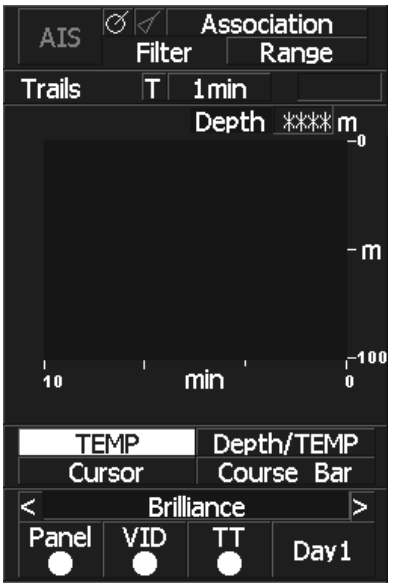
The Screen Setting Menu will appear.

Detail information about screen display can be set by changing the settings of the menu items.

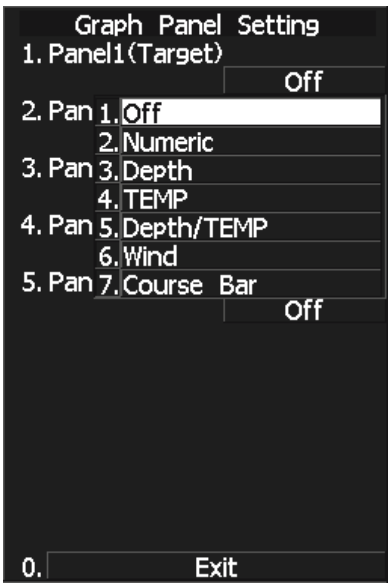


Graph Display

Press the graph button to see the registered graph. To register a graph, hold down the graph button or use Graph Panel Setting menu described on the next page.



[3] Graph Settings (Graph Panel Setting)



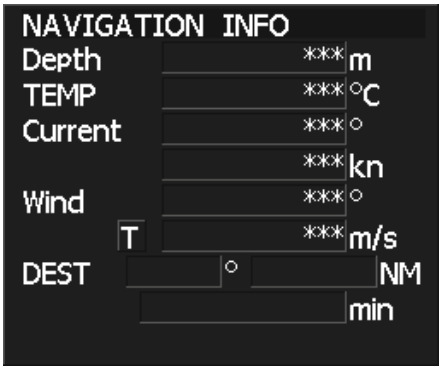
Set the functions of a graph to be associated with the graph button.
The function shown in the parentheses is prioritized. Therefore, specify a graph to be displayed while the prioritized function is not active.

1. Panel 1 (Target):
   A graph registered here can be displayed while target information is not displayed.
2. Panel 2 (Marker):
   A graph registered here can be displayed while the marker function is not in use.
3. Panel 3 (Waypoint):
   A graph registered here can be displayed while destination information is not displayed.
4. Panel 4 (Cursor/EBL/VRM):
   A graph registered here can be displayed while the cursor/EBL/VRM zoom display function is not in use.
5. Panel 5 (Graph):
   A graph registered here can be displayed since there are no priority functions to be displayed.

(*) When using a regular graph, first register it in Panel 5 menu.

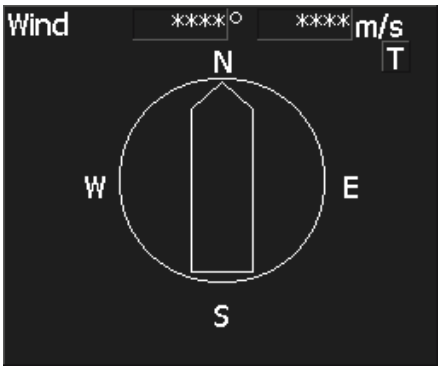
Numeric NAV INFO

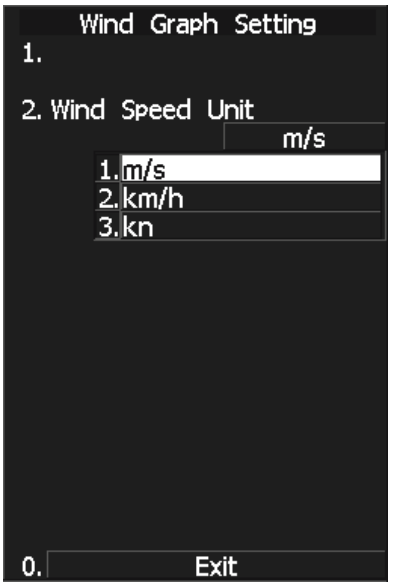
- Select numerical information (Numeric) in graph setting menu to register the Numeric function with the graph button.
- Press the Numeric button to see received navigation information in numerical values.
- Water depth, water temperature, current, wind direction, wind speed, and destination are shown in numerical values.



Wind/Current Graph

- The wind direction and speed display function (Wind) is registered with the graph button when "Wind" is selected in the graph setting menu.
- Press the Wind button to call up numerical values and a graph for the received wind direction and speed information.



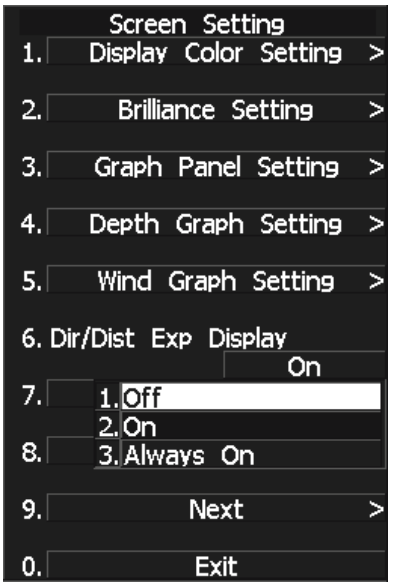


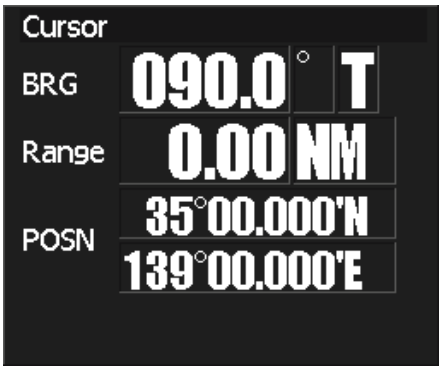
DIR/DIST EXP Display

- Cursor, EBL, and VRM values are displayed in a larger font.
- While the cursor is moving within the PPI screen, the cursor information is displayed in a larger font.
- When EBL and VRM are used, values for each marker are displayed in a larger font.
- Information will not be displayed in a larger font while menu is displayed.

Direction and distance zoom display setting

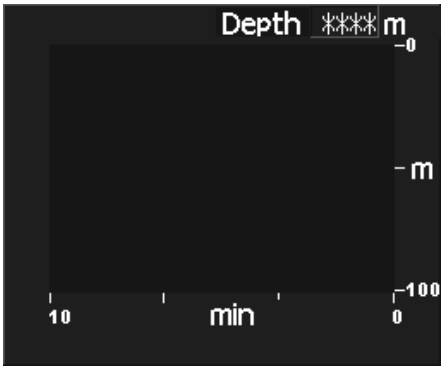
OFF :	No zoom display.
ON :	Zoom display continues for 5 seconds after marker operations end.
Always:ON :	Information is always displayed in a larger font.





Depth Graph Display

- The water depth display function (Depth) is registered with the graph button when "Depth" is selected in the graph setting menu.
- Press the Depth button to call up numerical values and a graph for the received water depth information.



Displaying Water Depth Graph (Depth Graph Setting)

- Set the water depth graph display method.

Procedure

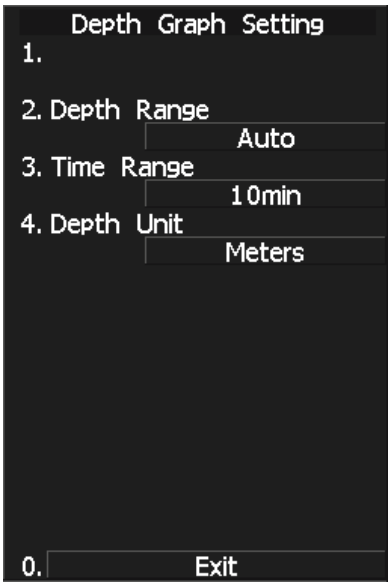
1 Press [RADAR MENU] key.

Press [4] key.

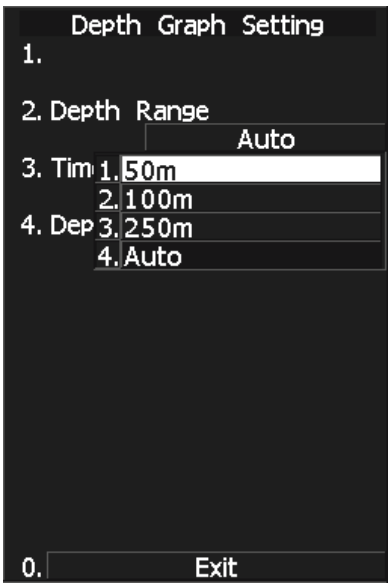
Press [4] key.

The Depth Graph Setting Menu will appear.

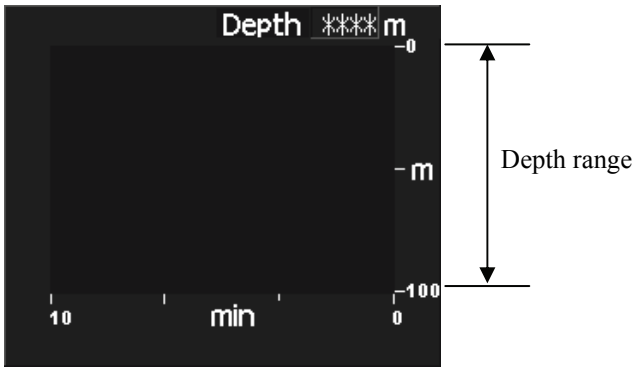
Detail information about screen display can be set by changing the settings of the menu items.



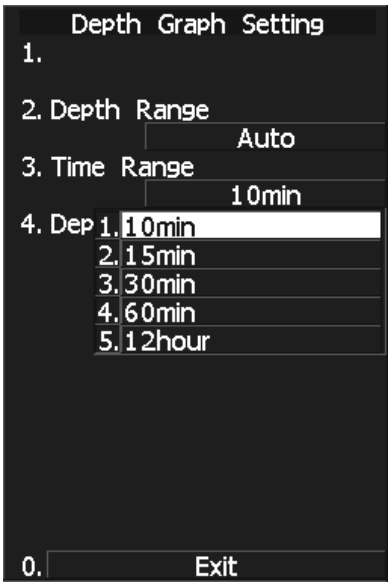
Depth Range



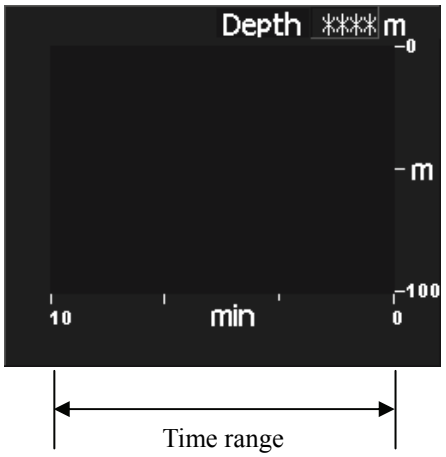
- Select the depth range on the water depth graph.
  - 50m: Sets 50 m as the depth range.
  - 100m: Sets 100 m as the depth range.
  - 250m: Sets 250 m as the depth range.
  - AUTO: Uses the depth range in the DPT sentence included in received data.



Time Table

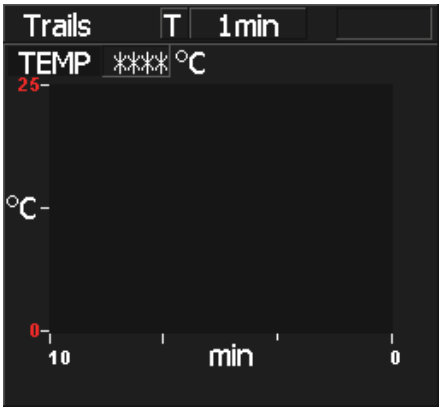


- Select the time range on the water depth graph.
  - 10min: Sets 10 minutes as the time range.
  - 15min: Sets 15 minutes as the time range.
  - 30min: Sets 30 minutes as the time range.
  - 60min: Sets 60 minutes as the time range.
  - 12hour: Sets 12 hours as the time range.



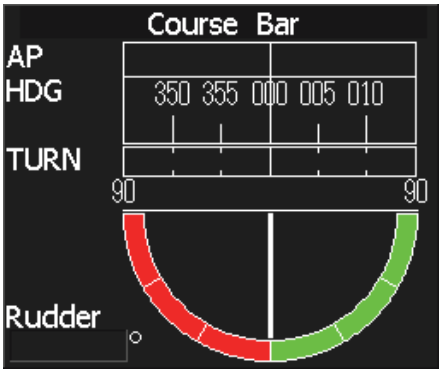
Water Temperature Display (Temp Graph)

- The water temperature display function (Temp) is registered with the graph button when "Temp" is selected in the graph setting menu.
- Press the Temp button to call up numerical values and a graph for the received water temperature information.



Course Bar Display (Course Bar)

- The course bar display function (Course Bar) is registered with the graph button when "Course Bar" is selected in the graph setting menu.
- Press the Course Bar button to call up numerical values and a graph for the received heading, turning ratio, and steering direction information.



Screen Capture Setting

- This equipment can save the currently displayed images onto a memory card (CF card) while they are in bitmap format.
- In order to execute this item, a memory card (optional) must be inserted in the card slot 2 (upper slot) beforehand.
- For use of a CF card, see Section 3.11 "USING CARD."

Note: Once captured images have been saved, this equipment cannot display them.
To display or check a captured image which has been saved, import the capture-image file from the CF card into the PC, and then operate the file on the PC.

[l] Select Capture Item

Select the information to be saved as a captured image when performing the screen capture function. Set a value in accordance with the information to be captured on the display.

Procedure

1 Press [RADAR MENU] key.

Press [4] key.

Press [9] key.

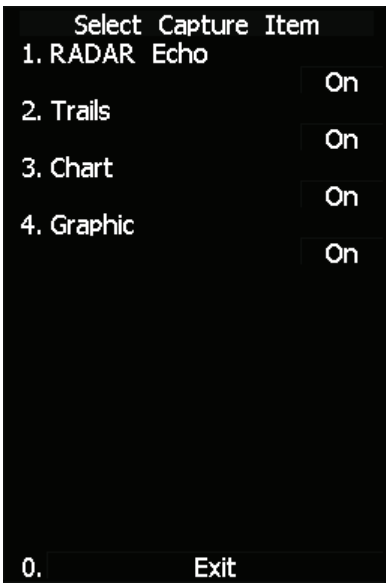
Press [1] key.

The Screen Capture Setting menu will appear.

2 Press [1] key.

The Select Capture Item menu will appear.

Details about the display capture function can be set by changing item settings.



Radar Echo	The radar echoes will be saved.
Trails	The radar trails will be saved.
Chart	The chart, mark, line, own ship's track, target track, route, destination and NAV line will be saved.
Graphic	The radar graphic (EBL, VRM) and characters will be saved.

[II] File Erase

Screen capture files can be deleted.
If the CF card is full, screen capture files which are no longer necessary can be deleted by specifying the file name (date and time).

Procedure

1 Press [RADAR MENU] key.

Press [4] key.

Press [9] key.

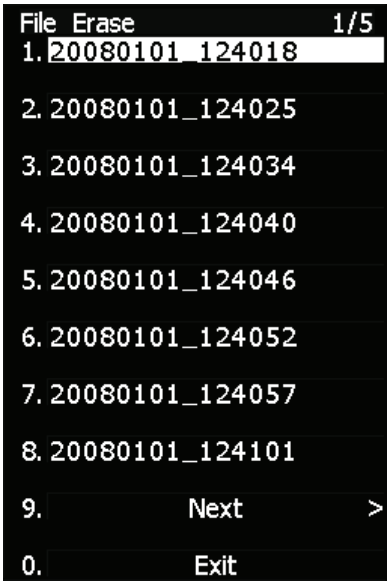
Press [1] key.

The Screen Capture Setting menu will appear.

2 Press [2] key.

The File Erase menu will appear.

Screen capture files are displayed in date and time order, so select the file to be deleted and press the [ENT] key.



The deletion confirmation screen will appear.
To delete the file, press the [1] key according to the displayed instructions.
To cancel the deletion, press the [2] key. The file deletion operation will be cancelled.

[III] AUTO Capture Interval

This function automatically saves a screen capture file at specified time intervals.
Time intervals can be specified in minutes.

Note: The use of the automatic capture function applies a high load to the CPU. As a result, processing is always slow, so use the automatic capture function only when needed. If the function is to be used, the allowable maximum value should be set.

Procedure

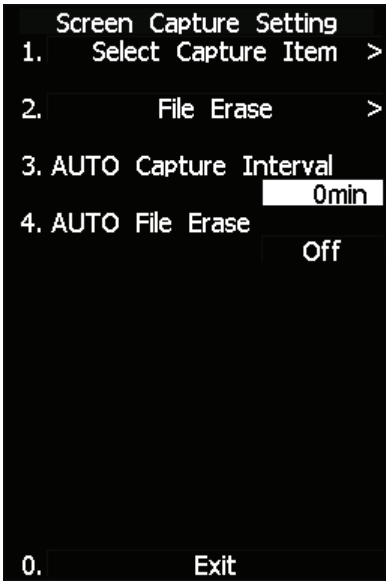
1 Press [RADAR MENU] key.

Press [4] key.

Press [9] key.

Press [1] key.

The Screen Capture Setting menu will appear.



2 Press [3] key.

The AUTO Capture Interval menu will appear.

The screen capture file is saved at specified time intervals in minutes.
When 0 min is specified, the automatic capture function is turned off.
When 1 min or more is specified, the automatic capture function is turned on and performed at the specified time intervals.

[IV] AUTO File Erase

When a CF card is full with screen capture files saved, this function automatically erases files, starting with the oldest one.

Procedure

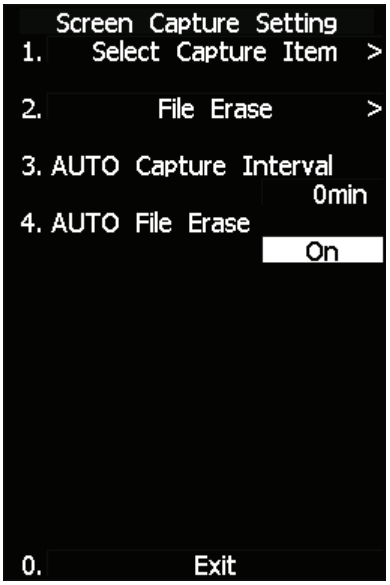
1 Press [RADAR MENU] key.

Press [4] key.

Press [9] key.

Press [1] key.

The Screen Capture Setting menu will appear.



2 Press [4] key.

The AUTO File Erase menu will appear.

AUTO File Erase = Off, the system continues to capture images until the CF card becomes full. Select this item when you do not want to erase captured images that have been saved.

AUTO File Erase = On, the system erases the oldest file so as to save a new screen capture file when the CF card becomes full.
Select this item when you want to always save the latest captured-image data while old files are not necessary.

This function is initially set to Off.

3.9.5 Set Scanner (TXRX Setting)

This function enables the setting of detail information about a scanner

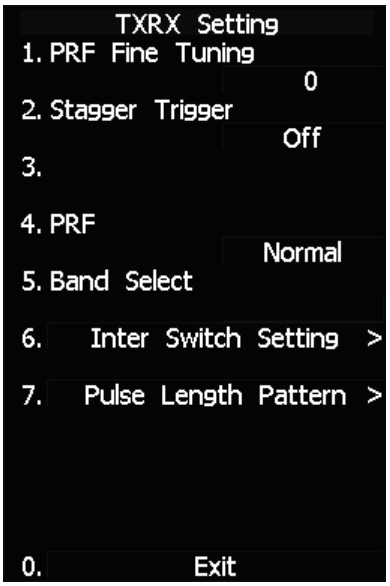
Procedure

1 Press [RADAR MENU] key.

Press [5] key.

The TXRX Setting Menu will appear.

Detail information about antenna operation can be set by changing the settings of the menu items.



[1] PRF Fine Tuning

- Fine-tune the transmitting repetition frequency of the transmitter in the range 90 to 100%.
- If radar's interference patterns are concentrically displayed, increment or decrement the set value by 3 to 4 in order to heighten the effect of interference rejection.
- The same operation can be performed by pressing the **[TX/STBY]** key several times.
- One of 32 levels 0-31 can be set.

[2] Stagger Trigger

- The interference reduction function is activated by using the transmission repetition frequency control of the transmitter.
- This function is effective when radar interference does not go away.

OFF: Stagger Trigger is not used.
ON: Stagger Trigger is used.

[4] PRF

- Select the operation mode the transmitting repetition frequency of the transmitter.

NORMAL	Standard mode:	Both appropriate sensitivity and magnetron's life expectancy are maintained.
ECONOMY	Power saving mode:	Sensitivity slightly lowers, but the service life of magnetron is prolonged when short pulses are used.
HI POWER	High sensitivity mode:	Sensitivity improves when long pulses are used, but the service life of magnetron is slightly shortened.

[5] Band Select

- Select band of antenna. This item is effective only when the antenna in connection supports two frequencies.
  - X-Band: Selects the X-band side from the two frequencies.
  - S-Band: Selects the S-band side from the two frequencies.
  - X/S-band: Supports the two frequencies.

Note: This function is not functioning now. The function is for future use.

[6] Inter Switch Setting

- The master and slave antennas are switched by the simplified interswitch function.
  - master: Images are displayed with the antenna connected to the display unit. The antenna connected can be controlled.
  - slave: The signal of the antenna connected to another display unit is obtained via the display unit and used to display the image. The antenna connected to another display unit cannot be controlled.

Note: The simplified interswitch cannot control the antenna of another display unit. Only the master antenna can be controlled.

[7] Pulse Length Pattern

- Up to 3 pulses can be selected as a pulse width in a range. Select a pulse width in combination of the three pulses.
  (Example) With a 3 NM range:
  Select a combination of pulses as a desired pulse width from the following three patterns:
  SP1/MP1/MP2
  SP1/MP1/LP1
  MP1/MP2/LP1

3.9.6 Set Chart Display (Map Setting)

This function enables the setting of detail information about chart display.

Setting JRC/ERC Chart Display (JRC/ERC Setting)

Procedure

1 Press [RADAR MENU] key.

Press [9] key.

Press [5] key.

Or, hold down the [Map] key.

Sea chart menu (Map Setting) opens.

2 Press [3] key.

The JRC/ERC Setting Menu will appear.

Detail information about the colors and brilliance of JRC/ERC chart display can be set by changing the settings of the menu items.

The data of colors and brilliance can be stored for each day/night mode.

[1] Day/Night

- Select a desired display mode before setting the colors and brilliance of chart display.
- There are four selection items: DAY1, DAY2, DUSK, and NIGHT.

[2] Color of Land

- Select the color of land display.
- There are four selection items: BROWN, YELLOW, GREEN, and WHITE.

[3] Bright of Land

- Select the brilliance of land display.
- There are three selection items: LOW, MEDIUM, and HIGH.

[4] Color of Sea

- Select the color of sea display.
- There are four selection items: GRAY, CYAN, BLUE, and GREEN.

Note: This function is available on the plotter mode only.

[5] Bright of Sea

- Select the brilliance of sea display.
- There are four selection items: OFF, LOW, MEDIUM, and HIGH.

Note: This function is available on the plotter mode only.

[6] Color of Name

- Select the color of a location name.
- There are eight selection items: BLACK, WHITE, CYAN, BLUE, GREEN, YELLOW, PINK, and RED.

[7] Bright of Name

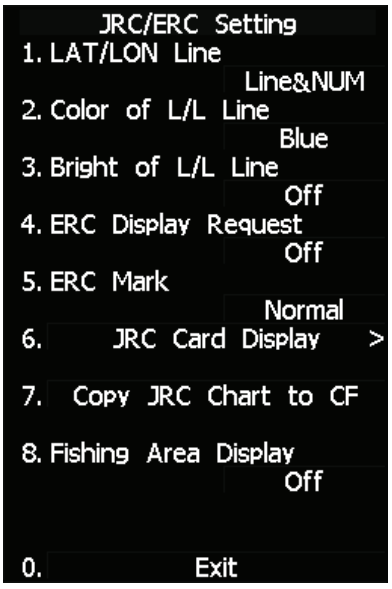
- Select the brilliance of location name display.
- There are four selection items: OFF, LOW, MEDIUM, and HIGH.

[8] Bright of Track/Mark/Line

- Select the brilliance of track, mark and line..
- There are four selection items: LEVEL1, LEVEL2, LEVEL3, and LEVEL4.

[9] Next Page

- Moves to the next page.
- The next page of the JRC/ERC Setting Menu will appear.



[1] LAT/LON Line

- Select the mode to display latitude and longitude lines.
- There are two selection items:

Line NUM:	Displays both latitude/longitude lines and values indicating the latitude and longitude.
NUM:	Displays only the values indicating the latitude and longitude.

[2] Color of L/L Line

- Select the colors that are to represent latitude and longitude lines.
- There are eight selection items:
  BLACK, WHITE, CYAN, BLUE, GREEN, YELLOW, PINK, and RED.

[3] Bright of L/L Line

- Select the brilliance of latitude/longitude line display.
- There are four selection items: OFF, LOW, MEDIUM, and HIGH.

[4] ERC Display Request

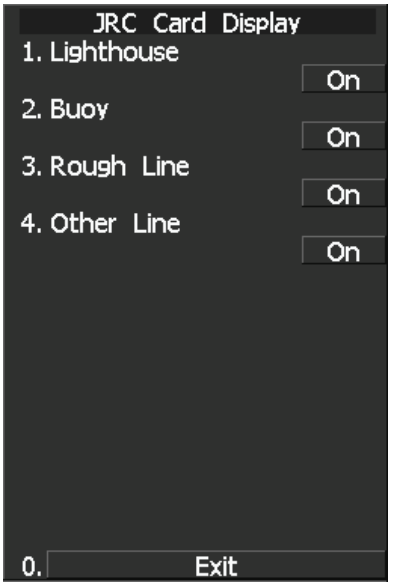
- Display of the information within ERC can be switched between ON and OFF .
- There are two selection items: ON, and OFF.
  On : Data in the ERC is displayed.
  Off : Data in the ERC is not displayed.

[5] ERC Mark

- Select the size of mark display on the ERC chart.
- There are two slection items: NORMAL and SMALL.
  Normal : The ERC mark is displayed in normal size.
  Small : The ERC mark is displayed in a size smaller than normal.

[6] JRC Card Display

- Sets the display contents of the JRC card.
- The JRC Card Display Setting Menu will appear.



[1] Light House

- Determine whether to display lighthouses.
- There are two selection items: ON and OFF.
  On : Light houses are displayed.
  Off : Light houses are not displayed.

[2] Buoy

- Determine whether to display buoys.
- There are two selection items: ON and OFF.
  On : Buoys are displayed.
  Off : Buoys are not displayed.

[3] Rough Line

- Determine whether to display rough lines.
- There are two selection items: ON and OFF.
  On : Rough lines are displayed.
  Off : Rough lines are not displayed.

[4] Other Line

- Determine whether to display other lines.
- There are two selection items: ON and OFF.
  On : Other lines are displayed.
  Off : Other lines are not displayed.

[7] Copy JRC Chart to CF

By copying multiple JRC coastline ROM cards onto a compact flash memory card, this function selectively displays any two charts among the copied charts. For a ship that sails in the wide range, this function is convenient because charts can be selected from the menu without alternately inserting JRC coastline ROM cards.

Note: The copied chart can operate only in the system that originally copied the chart.
The copied chart cannot be operated in other systems. The capacity of the compact flash memory card to be used is 2GB or less.

Procedures

1 Insert a JRC coastline ROM card into card slot 1 (lower) and insert a compact flash memory card into card slot 2 (upper).

Flash memory card (option) is necessary.
A PCMCIA (PC card) adapter for the compact flash memory card is necessary to insert a compact flash memory card.
For the insertion and removal of the card, see HOW TO INSERT AND REMOVE A CARD in the appendix.

2 Press the [Map] key for 2 seconds.

Press [3] key.

Press [9] key.

3 Press the [7] key.

Confirmation Window will appear.

4 Press the [1] key.

Data on the JRC card will be copied onto the compact flash memory card.

5 To copy multiple JRC charts, alternately change JRC coastline ROM cards and repeat procedures 4 and 5.

[8] Fishing Area Display

- If a fishery card is used but the fishery is not displayed, this setting gives priority to the fishery card.
  On : Select this item if the fishery card is inserted in the card slot but the fishery is not displayed. The fishery is displayed by giving priority to the fishery card over other cards.
  Off : Select this item if the fishery card is not to be used. If the fishery card is used but the fishery is displayed, the setting can be left off.

Setting Contour Lines on Chart (Contour Setting)

Procedure

1 Press [RADAR MENU] key.

Press [9] key.

Press [5] key.

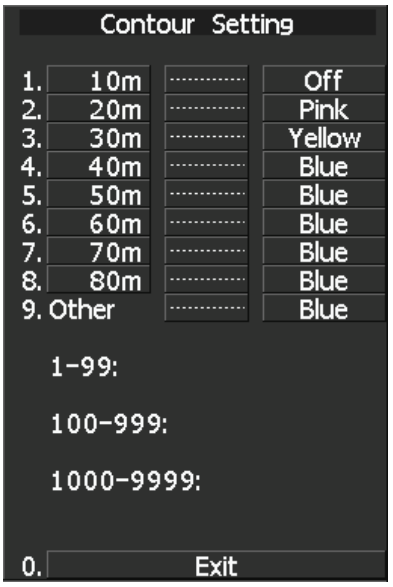
Or, hold down the [Map] key.

Sea chart menu (Map Setting) opens.

2 Press [4] key.

JRC depth contour display menu (Contour Setting) opens.

Depths and display colors can be set for 9 contour lines in total: 8 for depth specification and 1 for other depths.



3 Select the number of depth to be changed, pressing the numeric key.

The depth input screen will appear. Enter the value as the depth to be set.
Subsequently, the display line list will appear.

4 Select the number to be set, pressing the numeric key.

The selected color to represent the contour lines of the depth will be set.
To change the settings of other depths, repeat steps 3 and 4.

Set C-MAP Display

Procedure

1 Press [RADAR MENU] key.

Press [9] key.

Press [5] key.

Or, hold down the [Map] key.

The MAP Setting Menu will appear.

3 Press [2] key.

The C-MAP Setting Menu will appear.

[1] Grid Display

- Sets whether or not latitudinal longitudinal lines are displayed with C-MAP.
- Each time you press **[1]** key, the grid display item is switched between ON and OFF.
- ON: Displayed
  OFF: Not displayed

[2] Sounding Display

- Sets whether or not soundings values are displayed with C-MAP.
- Each time you press **[2]** key, the souding display item is switched between ON and OFF.
- ON: Displayed
  OFF: Not displayed

[3] Sounding Unit

- Sets the units when soundings values are displayed with C-MAP.
- Press **[3]** key to display a list of units.
- 1: FEET
  2: FATHOM
  3: METERS

You can select one from the above three items. Select the item you want to set, pressing the numeric keys **[1]** to **[3]**.

[4] Light Sectors Display

- Sets whether or not the light sectors are displayed.
- Each time you press **[4]** key, the light sectors display item is switched between ON and OFF.
- ON: Displayed
  OFF: Not displayed

[5] Light Sectors Level

- Sets levels when light sectors are displayed with C-MAP.
- Press **[5]** key to display a list of levels.
- Selects one from level settings A to H.

[6] Chart Boundaries

- Sets whether or not the Chart Boundaries are displayed.
- Each time you press **[6]** key, the function is switched between ON and OFF.
- ON: Displayed
  OFF: Not displayed

[7] Buoy and Beacon

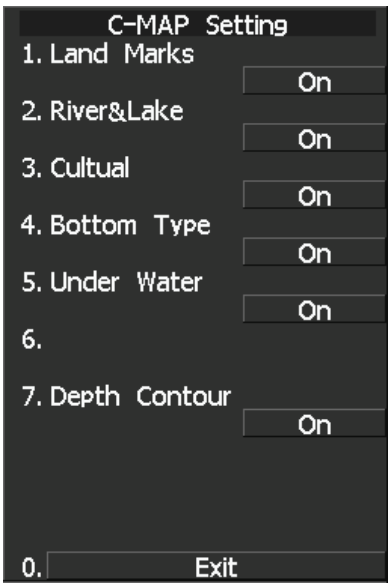
- Sets display style of the buoy and beacon.
- Press **[7]** key to display a list of display style.
  1: OFF
  2: INTER NATIONAL : The style based on the official paper chart presentation.
  3:United States : The style based on the NOAA paper chart.
  4: SIMPLIFIED : Simplified style display.

[8] Geographical Names

- Sets whether or not the geographical names are displayed.
- Each time you press **[8]** key, the geographical name is switched between ON and OFF.
- ON: Displayed
  OFF: Not displayed

[9] NEXT

- Going to Next page.
- Another C-MAP setting menu is displayed..



[1] Land Marks

- Sets whether or not the Land Marks are displayed.
- Each time you press **[8]** key, the Land Marks is switched between ON and OFF.
- ON: Displayed
  OFF: Not displayed

[2] Rivers and Lakes

- Sets whether or not the Inland waters are displayed.
- Each time you press **[8]** key, the Rivers and Lakes is switched between ON and OFF.
- ON: Displayed
  OFF: Not displayed

[3] Cultural Features

- Sets whether or not the cultural features are displayed.
- Each time you press **[8]** key, the Cultural features is switched between ON and OFF.
- ON: Displayed
  OFF: Not displayed

[4] Sea bottom types

- Sets whether or not the types of the seabed are displayed.
- Each time you press **[8]** key, the Sea bottom type is switched between ON and OFF.
- ON: Displayed
  OFF: Not displayed

[5] Under water rocks etc.

- Sets whether or not the rocks, obstructions etc are displayed.
- Each time you press **[8]** key, the Under water is switched between ON and OFF.
- ON: Displayed
  OFF: Not displayed

[7] Depth Contours.

- Sets whether or not the Depth Contours are displayed.
- Each time you press **[7]** key, the Depth Contours is switched between ON and OFF.
- ON: Displayed
  OFF: Not displayed

Correcting Chart Position (Map Display Setting)

Caution

When the chart position is corrected, the display will be shifted away from the actual position. With this in mind, navigate your ship with attention to the surroundings. Otherwise, this may cause accidents.

Procedure

1 Press [RADAR MENU] key.

Press [9] key.

Press [5] key.

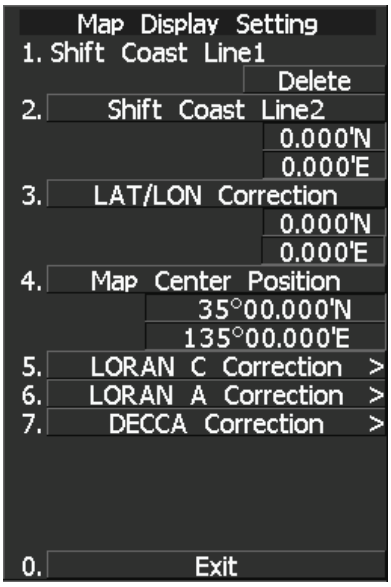
Or, hold down the [Map] key.

Sea chart menu (Map Setting) opens.

2 Press [5] key.

The Map Display Setting Menu will appear.

There are three methods for correcting the chart position.



[1] Shift Coast Line 1

Set the correction value by operating the cursor.

1 Press [1] key while the Map Display Setting Menu is open.

The chart display position correction 1 (Shift Coast Line 1) is set.

2 Move the cursor to the chart on which a position is to be corrected, and press [ENT] key.

3 Move the cursor to the radar video of which position is to be corrected, and press [ENT] key.

SETTING (correcting) will be indicated for Shift Coast Line 1.

At this time, MAP SHIFT will appear at software button ⑪ located at the bottom right corner of the radar display described in Section 2.3.4, indicating that the position is being corrected.

Note: A correction value can be operated in the range -9.999' to +9.999'.

Cancellation of Shift Coast Line 1

1 Press [1] key while the MAP Display Setting Menu is open.

DELETE (no correction) will be indicated for Shift Coast Line 1.
At this time, MAP SHIFT will disappear from software button ⑪ located at the bottom right corner of the radar display described in Section 2.3.4.

[2] Shift Coast Line 2

Set a correction value pressing the numeric values.
A correction value can be entered in the range -9.999' to +9.999'.

1 Press [2] key while the Map Display Setting Menu is open.

The latitude / longitude input screen for the Shift Coast Line2 menu will appear.

2 Enter the correction value for the latitudinal direction, pressing the numeric keys.

To switch between the north and south, turn the **[MULTI]** control.

3 Press [ENT] key.

The correction value for the latitudinal direction will be determined.

4 Enter the correction value for the longitudinal direction, pressing the numeric keys.

To switch between the east and west, turn the **[MULTI]** control.

5 Press [ENT] key.

The correction value for the longitudinal direction will be determined.
At this time, MAP SHIFT will appear at software button ⑪ located at the bottom right corner of the radar display described in Section 2.3.4, indicating that the position is being corrected.

Cancellation of Shift Coast Line 2

1 Press [2] key while the MAP Display Setting Menu is open.

The chart position correction value input screen will appear.

2 Press [0] key, and then [ENT] key.

The correction value for the latitudinal direction will be set to 0.

3 Press [0] key, and then [ENT] key.

The correction value for the longitudinal direction will be set to 0.
At this time, MAP SHIFT will disappear from software button ⑪ located at the bottom right corner of the radar display described in Section 2.3.4.

[3] LAT/LON Correction

This method corrects a chart position by changing the values of latitude and longitude that are sent by the navigation equipment.
Only our service engineers are to use this correction method because the contents of data such as trails data to be saved are changed when the method is used.
A correction value can be entered in the range -9.999' to +9.999'.

1 Press [3] while the MAP Display Setting Menu is open.

The latitude / longitude input screen for the LAT/LON Correction menu will appear.

2 Enter the correction value for the latitudinal direction, pressing the numeric keys.

To switch between the north and south, turn the **[MULTI]** control.

3 Press [ENT] key.

The correction value for the latitudinal direction will be determined.

4 Enter the correction value for the longitudinal direction, pressing the numeric keys.

To switch between the east and west, turn the **[MULTI]** control.

5 Press [ENT] key.

The correction value for the longitudinal direction will be determined.

Cancellation of LAT/LON Correction

1 Press [3] key while the MAP Display Setting Menu is open.

The latitude/longitude correction value input screen will appear.

2 Press [0] key, and then [ENT] key.

The correction value for the latitudinal direction will be set to 0.

3 Press [0] key, and then [ENT] key.

The correction value for the longitudinal direction will be set to 0.

[4] MAP Center Position

This method corrects a chart position by entering the values of latitude and longitude at own ship's position in manual mode.
If latitude and longitude data sent by the navigation equipment has been entered, the data has priority over the manually entered values.

1 Press [4] key while the MAP Display Setting Menu is open.

The latitude / longitude input screen for the Map Center Position menu will appear.

2 Enter the value as latitudinal, pressing the numeric keys.

To switch between the north latitude and south latitude, turn the **[MULTI]** control.

3 Press [ENT] key.

The entered value will be determined as latitude.

4 Enter the value as longitude, pressing the numeric keys.

To switch between the east longitude and west longitude, turn the **[MULTI]** control.

5 Press [ENT] key.

The entered value will be determined as longitude.

Note: The function is available in the plotter mode only.

3.9.7 Set LORAN C (LORAN C Correction)

Note: Plotter option (NDB-44) is necessary to enable LORAN C time difference display.

Setting LORAN C

Procedure

1 Press [RADAR MENU] key.

Press [9] key.

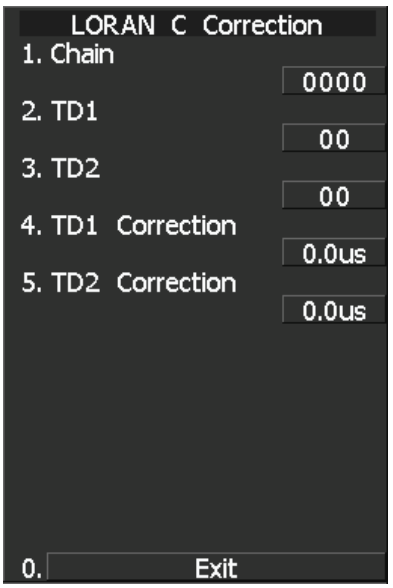
Press [5] key.

Press [5] key.

Press [5] key.

The LORAN C Correction Menu will appear.

The chain and time difference for LORAN C time difference display can be set by changing the settings of the menu items.



[1] Chain

- Set the chain.
- Enter the value in the range 0000 to 9999 by using the numeric keys.
- Only a value in the table can be entered.

[2] TD1, [3] TD2

- Enter the TD value for slave station 1/2.

[4] TD1 Correction, [5] TD2 Correction

- Enter the sound velocity time correction value for the TD value of slave station 1/2.

3.10 USE FUNCTION SWITCH [FUNC]

"Radar Function Setting" is provided for always obtaining the best radar video by storing complex radar signal processing settings in the optimum status by use, and calling the setting in accordance with the conditions for using the function.
Functions are factory-set for general use, and the settings can be fine adjusted by operating the menu.

Four function modes are available, and they are factory-set as follows:

Function 1:	COAST	Useful for observing short-range videos
Function 2:	DEEP SEA	Suitable for general ocean navigation
Function 3:	FISH NET	Useful for small target.
Function 4:	STORM	Useful for observing videos in stormy weather

3.10.1 Operation Procedure

Calling a Function

Procedure **1 Press the [FUNC] key.**

Each time the **[FUNC]** key is pressed, the selection changes cyclically as follows:
Function Off → Function 1 → Function 2 → Function 3 → Function 4 → Function Off
The currently called function mode will be indicated at the lower left of the radar display.

* Switching can be done each time software button ⑤ located at the bottom left corner of the radar display described in Section 2.3.2 is pressed.

Changing Function Setting (temporary change)

- When radar signal processing setting is changed by using the menu or button on the radar display while function 1 to 4 is called, the change is temporarily reflected to the operating state.
- Since this method does not change the memory contents, the new setting is deleted as soon as another function is called.
- When the previous function is called again, operation is performed according to the memory contents.

Changing Function Setting (memory contents change)

- To change the memory contents of functions 1 to 4, use the function setting menu.
- To display the function setting menu, press **[RADAR MENU]** twice, **[6]** key, and then **[8]** key.
- Press the numeric key corresponding to the target function number.
- The function setting menu consists of five pages. To switch between the pages, select **[0]** key Previous Page or **[9]** key Next Page.

3.10.2 Function Setting Menu Items

The function setting menu has the items below.

Page 1

1. Mode	Name of the mode to be used	
2. IR	Radar interference rejection	OFF/LOW/MEDIUM/HIGH
3. Process	Video process	OFF/・・・・
4. Target Enhance	Target expansion	OFF/ LEVEL1/LEVEL2/LEVEL3
5. Auto STC/FTC	Automatic clutter suppression	OFF/AUTO SEA/AUTO RAIN
6. Save Present State	Saving of the present state	

Page 2

1. Pulse Length 0.75nm	Standard pulse length of 0.75 nm range	PL1/PL2
2. Pulse Length 1.5nm	Standard pulse length of 1.5 nm range	PL1/PL2/PL3
3. Pulse Length 3/4nm	Standard pulse length of 3 nm range	PL1/PL2/PL3
4. Pulse Length 6/8nm	Standard pulse length of 6 nm range	PL1/PL2/PL3
5. Pulse Length 12nm	Standard pulse length of 12 nm range	PL1/PL2/PL3
6. Pulse Length 16nm	Standard pulse length of 16 nm range	PL1/PL2/PL3
8. Pulse Length Pattern	Pulse Length Pattern	3NM/6NM/12NM

Page 3

1. Video Latitude	Dynamic range of radar video	NORMAL/WIDE/NARROW /SUPER WIDE
2. Video Noise Rejection	Radar video noise rejection	OFF/LEVEL1/LEVEL2
3. Auto DR Control	Automatic dynamic range control	OFF/ON
4. Process Switch	Radar video process switching	OFF/RANGE FIX/AUTO
5. 2nd Process Mode	Second video process mode	OFF/・・・・
6. Process Switch Range	Video process switching range	Range setting
7. Fast Target Detection	Fast moving target detection	OFF/ON

Page 4

1. Trails Interval	Radar trails length	OFF/・・・・
2. Trails Mode	Radar trails mode	TRUE/RELATIVE
3. Trails REF Level	Radar trails plotting threshold	LEVEL1-4
4. Trails Reduction	Thinning of radar trails	OFF/LEVEL1-3
5. Time/Cont Combine	Superimpose-display of time radar trails and continuous radar trails	OFF/ON
6. Trails Process	Radar trails video process	OFF/ON
7. Max Interval	Maximum time for radar trails display	SHORT/MEDIUM/LONG/SUPER LONG

Page 5

1. Gain Offset	Sensitivity correction	Correction value setting
2. PRF	Transmitting repetition frequency	NORMAL/ECONOMY/HIPOWER
3. Small Buoy Detection	Small target detection mode	OFF/ON
4. Fishnet Detection	Fishnet detection mode	OFF/ON
5. Antenna Height	Antenna height	DEFAULT/-5m/5-10m/10-20m/20m
8. Set Mode Default	Initialization	Yes/No

3.10.3 Overview of Function Operations

The following outlines the operation of each function selected from the function setting menu:

Procedure **1 Press the [FUNC] key for 2 seconds.**

The User Function Setting menu will appear.
Specify the number for the function for which the settings are to be changed.

The following are the operation overviews of each function setting item.

[Page 1] [1] MODE (Mode)

- Selects the function name to be indicated at the lower left of the radar display when the function is selected.
- When the setting is changed back to the factory setting, the initial value of the selected mode is called.
- The following 11 modes are provided:

COAST:	Use this mode to monitor a relatively short range, for example, bays and coasts where many boats and ships are running. (Importance is attached to resolution.)
DEEPSEA:	Use this mode to monitor a relatively long range, for example, the open sea. (Importance is attached to long-range sensitivity.)
FISHNET:	Use this mode to detect small targets such as fishnets of round haul netters hidden by sea clutter returns. (Importance is attached to sea clutter suppression, and sensitivity to moving targets lowers.)
STORM:	Use this mode when many rain/snow clutter returns or sea clutter returns are detected in stormy weather. (Importance is attached to rain/snow clutter and sea clutter suppression, and sensitivity slightly lowers.)
CALM:	Use this mode when only a few rain/snow clutter returns or sea clutter returns are detected.
RAIN:	Use this mode when sea clutter is not strong but rain/snow clutter is strong. (Importance is attached to rain/snow clutter suppression, and sensitivity slightly lowers.)
BIRD:	Use this mode to detect tens of seabirds at low altitude during coastal navigation or hundreds of seabirds at high altitude during ocean navigation.
LONG:	Use this mode to detect small targets at relatively long distance in the open sea.
Buoy:	Use this mode to detect small targets like radio buoys in areas outside the sea clutter area. (This mode displays targets of which detection probability is low.)
USER1:	General mode used when the nine modes above are not applicable
USER2:	General mode used when the nine modes above are not applicable

[Page 1] [2] IR (radar interference rejection)

- Same function as IR in the RADAR Menu

[Page 1] [3] Process (video process)

- Same function as PROCESS in the RADAR Menu

[Page 1] [4] Target Enhance

- Same function as TARGET ENHANCE in the RADAR Menu

[Page 1] [5] Auto SEA/RAIN (Auto STC/FTC)

- Detects unwanted waves such as rain/snow clutter and sea clutter and automatically suppresses them.
- When the sea state or weather changes, this function automatically performs suppression processing in accordance with the situation.
- Suppression processing is not full automatic, and requires the operator to control the afterimages of unwanted waves.
- To control the afterimage of sea clutter, use the **[SEA]** control.
- To control the afterimage of rain/snow clutter, use the **[RAIN]** control.
- In areas where the density of unwanted waves is low, unwanted waves may remain being judged as targets. Thus, use the automatic clutter suppression mode together with the video process mode.
- Characteristics of the automatic clutter suppression function:

OFF:	Disables the automatic clutter suppression function. Select OFF when rain/snow clutter and sea clutter are not strong or when the ship is in a bay.
AUTO SEA:	Automatically detects the strength of sea clutter, and performs the most suitable sea clutter suppression processing. Even when the strength of sea clutter varies depending on the wind direction, AUTO SEA performs the most suitable suppression processing. Land like islands can be displayed naturally. Since rain clouds outside sea clutter areas are recognized as land, there is no effect of suppressing rain/snow clutter.
AUTO RAIN:	Along with AUTO SEA, AUTO RAIN automatically detects the strength of rain/snow clutter, and performs the most suitable rain/snow clutter suppression processing. When rain clouds are scattered about, AUTO RAIN performs rain/snow clutter suppression processing for only the rain-cloud areas. Since land is recognized as rain clouds, land videos become obscure.

[Page 1] [6] Save Present State (Save Present State)

- Registers the currently used settings as function settings.

[Page 2] [1]-[6] PL (Pulse Width)

- Sets the standard transmitter pulse length in each range.
- When the range is called, the pulse range is used.

[Page 2] [8] Pulse Length Pattern

- Select a combination of pulses as a pulse width that can be used for each range of 3/6/12 NM.

[Page 3] [1]-[7] Radar signal processing settings (Process Setting)

- Same functions as those in the Process Setting Menu generally used

[Page 4] [1]-[7] Radar trails settings (Trails Setting)

- Same functions as in the RADAR Trails Setting of the RADAR Menu generally used

[Page 5] [1] Gain Offset

- Corrects sensitivity while the function mode is called.
- Since the displayed noise level varies depending on the combination of the video process mode and the interference rejection level, sensitivity needs fine adjustment for always obtaining the highest level.
- The sensitivity correction function saves the correction value set by the sensitivity control in each function mode, so it can obtain the highest sensitivity without the sensitivity control being operated when the function mode is changed.
- To set high sensitivity, set a value on the "+" side.
- To set low sensitivity, set a value on the "-" side.
- When the radar interference rejection level is increased, the noise level is lowered. Thus, set a sensitivity correction value to the "+" side.
- When the video process mode 3SCAN CORR, 4SCAN CORR, or 5SCAN CORR is used, the noise level is lowered. Thus, set a sensitivity correction value to the "+" side.
- When the video process mode REMAIN or PEAK HOLD is used, noise is hard to disappear. Thus, set a sensitivity correction value to the "-" side.

[Page 5] [2] PRF

- Same function as in the TXRX Setting of the Main Menu generally used

[Page 5] [3] Small Buoy Detection

- Reduces the loss of signal processing during detection of small targets.
  OFF: Activates the general signal processing mode.
  ON: Activates the small buoy detection mode that reduces the loss of signal processing.

[Page 5] [4] Fishnet Detection

- Use this mode to detect small targets hidden by sea clutter returns.
- This function becomes more effective when the AUTO RAIN clutter suppression function is used together.
  OFF: Activates the general signal processing mode.
  ON: Activates the fishnet detection mode.

[Page 5] [5] Antenna Height

- Set the height of radar antenna above sea level.
- The STC/FTC curve is changed.

-5m	: Set the antenna height under 5m.
5-10m	: Set the antenna height 5m to 10m.
10-20m	: Set the antenna height 10m to 20m.
20m-	: Set the antenna height over 20m.

[Page 5] [8] Set Mode Default

- Sets the initial value of a selected function setting mode.
  Select this item to change the current function mode to the initial value.

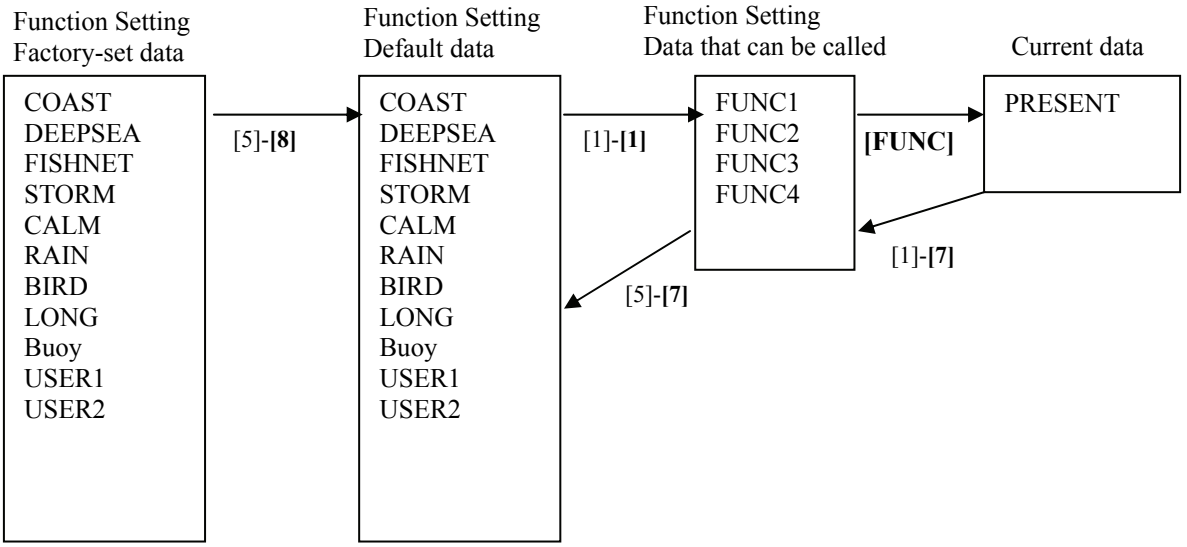
[Page 5] [9] Initialize

- Sets the function settings to the factory-set values.
  Select this item to change all the function settings to the factory-set values.

3.10.4 Overview of Stored Function Setting Data

The overview of stored function setting data is as follows:

- Factory-set data: Stored data that general operation cannot change
- Default data: Standard data of each function mode that users can change
- Data that can be called: Stored data that can be called by pressing the **[FUNC]** key



[Page 1] [1] Call Mode

- Calls the standard setting of the mode, and stores it for the function number.

[Page 1] [6] Save Present State

- The currently operating state can be stored for the function number.
- Use this function to store the state of good setting that will be frequently used.

[Page 5] [8] Save Default of Mode

- Stores the setting of the current function number, as the default setting of the mode.

[Page 5] [9] Initialization

- Changes the memory contents of the mode, which is used with the current function number, back to the factory setting.

3.10.5 Personal Information (PIN Setting)

The operation status of the radar is recorded. If the system is operated by more than one operator, the operators can register operation status as suitable for them and call the status. Operation status for up to five operations can be registered, and a name can be assigned to each status. (Up to 10 alphanumeric characters)

* Data stored as personal information
  - Day/Night mode setting
  - Brilliance
  - Alarm volume
  - Vector length/mode
  - Various types of image processing (IR, ENH, PROC, FUNC)

[I] Calling Operation Status (Load PIN Data)

Procedure

1 Press [RADAR MENU] key twice.

Press [8] key.

The Radar Sub Menu will appear.

2 Press [1] key.

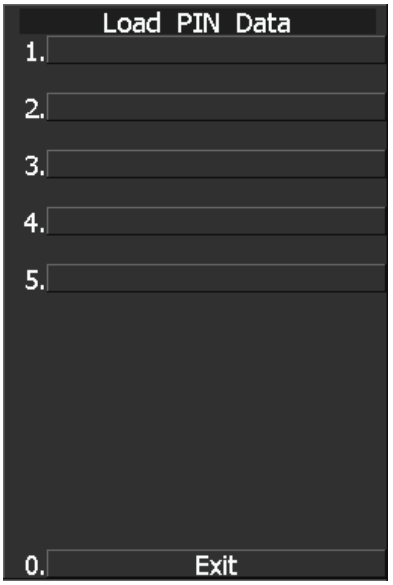
The PIN Setting Menu will appear.

3 Press [1] key.

The Load PIN Data Menu will appear.

4 Select the item you want to load, pressing the numeric keys [1] to [5].

The Load Execution Check Menu will appear.
Select "Yes" for loading.



Exit

1 Press [RADAR MENU] key.

The Target Information Display Menu will reappear.

[II] Saving Operation Status (Save PIN Data)

Procedure

1 Press [RADAR MENU] key twice.

Press [8] key.

The Radar Sub Menu will appear.

2 Press [1] key.

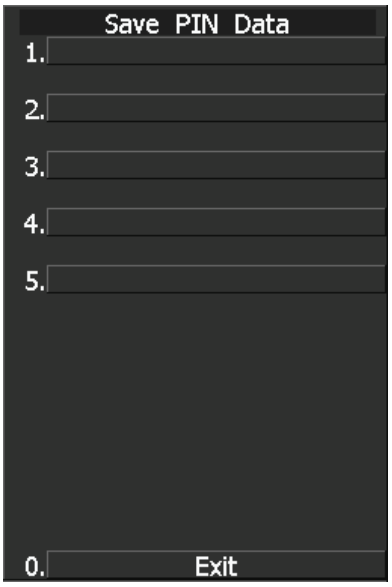
The PIN Setting Menu will appear.

3 Press [2] key.

The Save PIN Data Menu will appear.

4 Select the number corresponding to the place where you want to save status, pressing the numeric keys [1] to [5].

The Code Input Menu will appear.



5 Using numeric key, enter the name and then move the cursor onto the "ENT" button and press [ENT] key.

Data will be saved with the entered name.

Exit

1 Press [RADAR MENU] key.

The Target Information Display Menu will reappear.

[III] Erasing Registered Operation Status (Delete PIN Data)

Procedure

1 Press [RADAR MENU] key twice.

Press [8] key.

The Radar Sub Menu will appear.

2 Press [1] key.

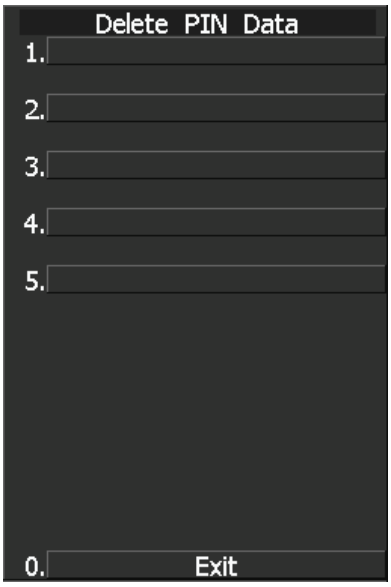
The PIN Setting Menu will appear.

3 Press [3] key.

The Delete PIN Data Menu will appear.

4 Select the file you want to erase, pressing the numeric keys [1] to [5].

The Delete Execution Check Menu will appear.
Select "Yes" for deletion.



Exit

1 Press [RADAR MENU] key.

The Target Information Display Menu will reappear.

3.11 USING CARD

This radar has two card slots. Inserting a flash memory card (option) into a card slot, you can save the following contents, saved in the processor, in the card or can read data from the card to the processor.

- Trails of own ship: 7000 points maximum
- Track of other ship: 20 target×1500 points (TT or AIS option)
- Mark Line: 20000 points maximum (plotter option)
- Waypoint: 99 points maximum (plotter option)
- Route: 10 routes maximum (plotter option)

These pieces of information can be saved in a flash memory card as a file. The internal capacity is as large as only a file. An internally created file can be saved until the flash memory card is full.

⚠ Caution

Compact Flash Cards can be used with this system. The following shows the recommendations in use. However they do not guarantee that CF cards may properly work with this system. Depending on the hardware or software, the cards will not work correctly. Any damage including loss of data caused by using the data created on this system is out of warranty. Important files should be backed up therefore.

◎ Recommendations on using CF cards.
★ Recommended card size.
64 MB, 128 MB, 256 MB, 512 MB, 1GB.

★ Recommended file system.
The Compact card should be formatted to FAT32 in Windows XP (SP2).
Many CF cards are formatted to FAT16 before shipping. Be sure to Format the CF card to FAT32, before use.

★ Recommended OS.
Windows XP (SP2).

★ Operating temperature range
Depending on the CF card specification and the radar specification, -15 to +55 degree Celsius.

◎ **Caution in use.**
Never eject the CF card while files are being written to the card.
Turn the power off before inserting or ejecting a CF card.

3.11.1 Save in and Transfer to Card (MEM CAPA/Copy)

Procedure

1 Press [RADAR MENU] key.

The Radar Menu will appear.

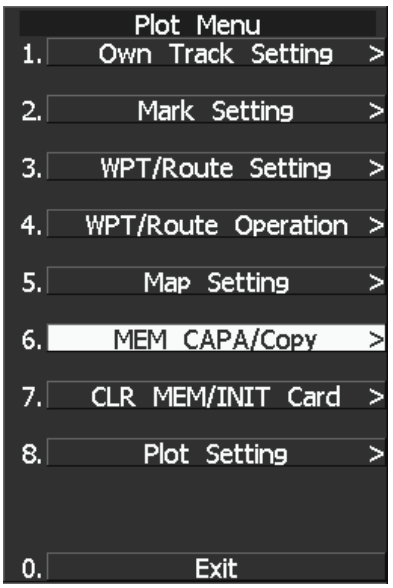
2 Press [9] key.

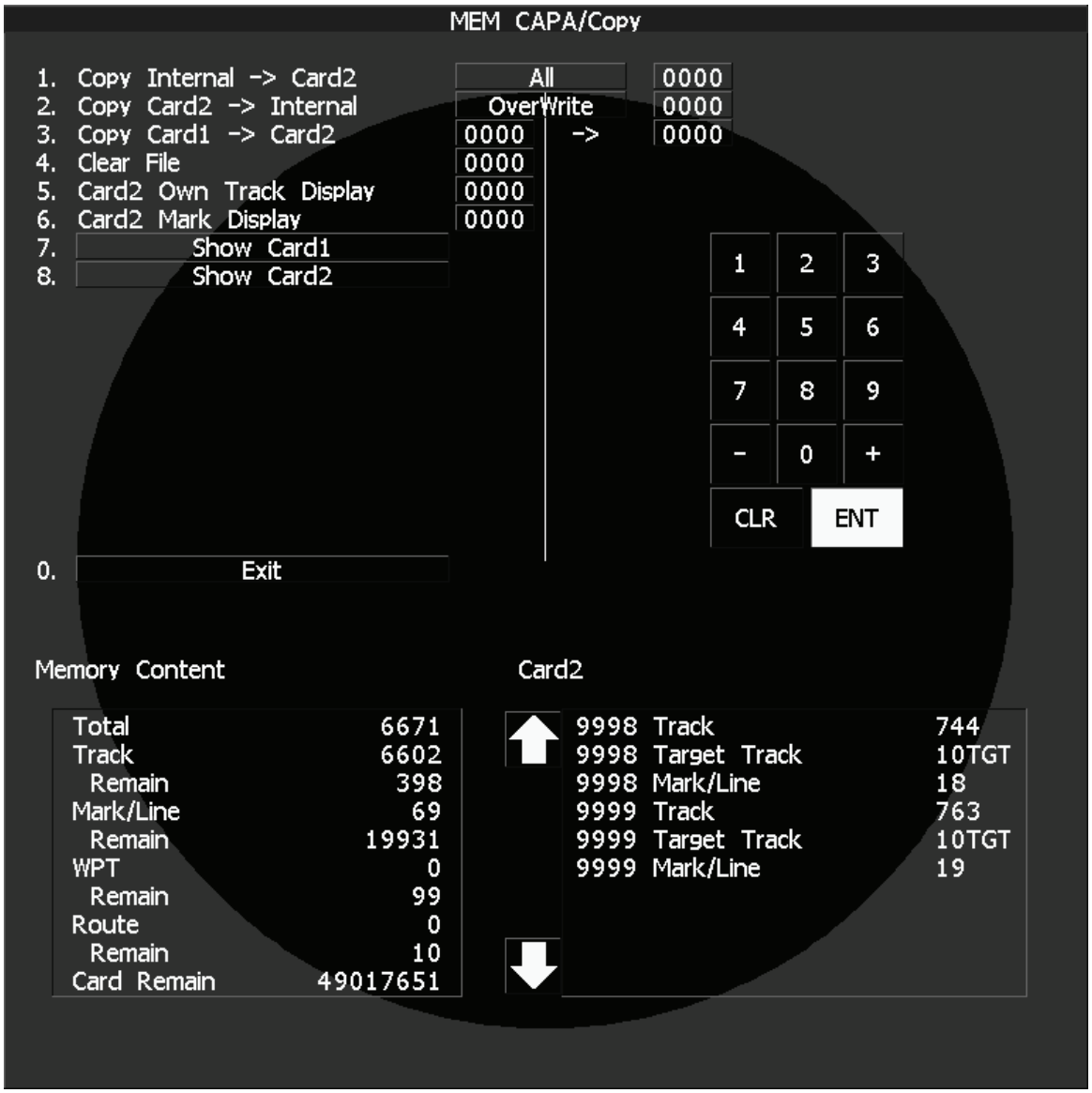
The Plot Menu will appear.

* Software button ④ located at the operation/message area in Section 2.3.9 is also available to save and transfer data.

3 Press [6] key.

The MEM CAPA/Copy window will appear.





- Information saved in the processor is displayed in the Memory Content.
  - Total: Total number of data points
  - Track: Number of data points for own ship's track (7000 points maximum)
  - Remain: Number of remaining data points of own ship's track that can be saved
  - Mark/Line: Number of mark and line points made with user map (20000 points maximum only when a plotter option is installed)
  - Remain: Number of remaining data points of marks and lines that can be saved
  - WPT: Number of data points of created waypoints (99 points maximum)
  - Remain: Remaining waypoints that can be saved
  - Route: Number of data points of created routes (10 routes maximum)
  - Remain: Remaining routes that can be saved

- File names and information saved in the card is displayed in Card 2.

- Arrows next to Card 2 are used to scroll the contents of Card 2.
  Range +/- keys can be used to scroll also.

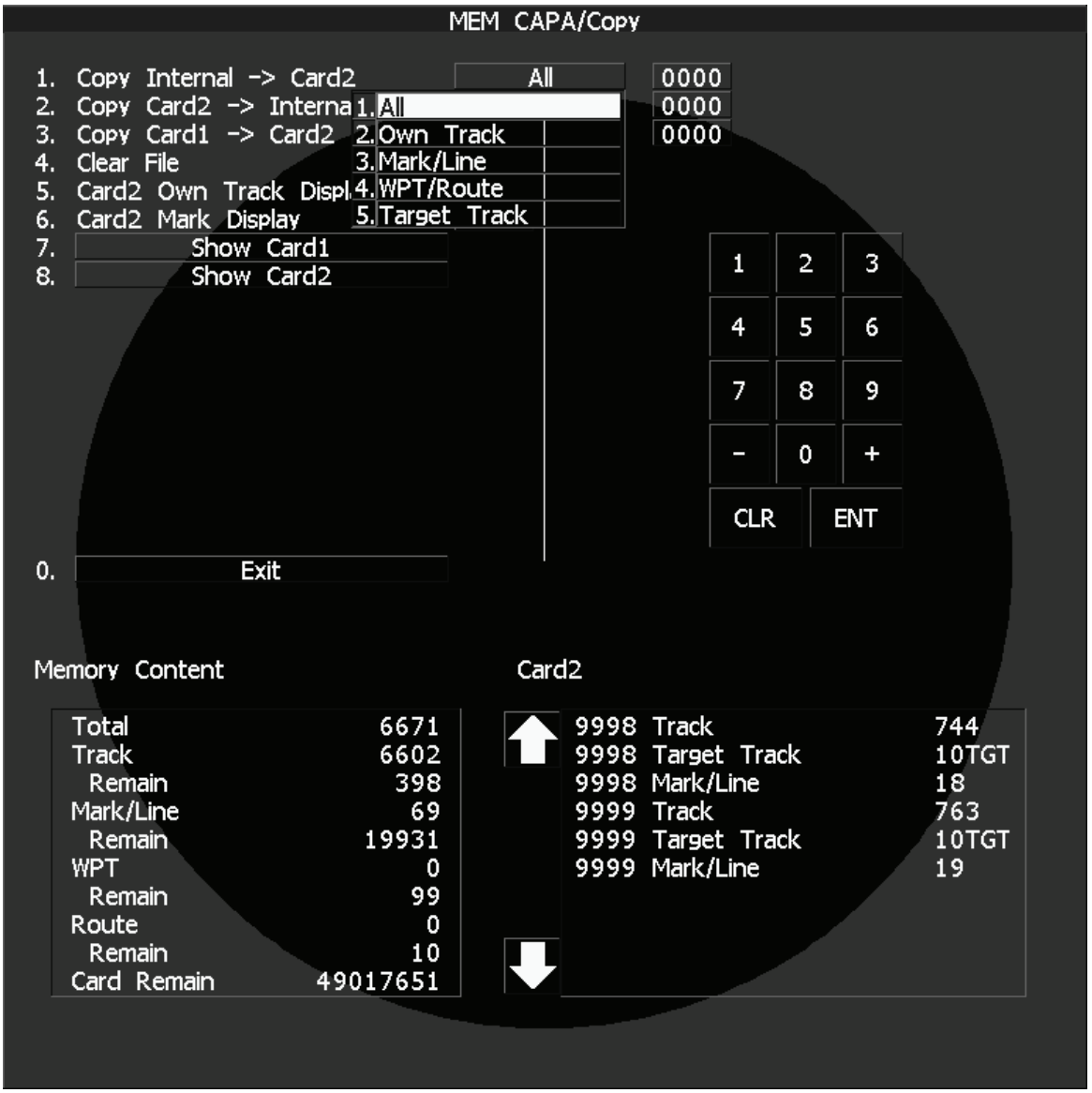
- Numeric key is used to give a file name.

[I] Copy Internal Information to Card 2 (Copy Internal → Card 2)

Procedure

1 Press [1] key while the CAPA/Copy Menu is open.

The items to be saved are displayed.



2 Select the item to be saved, using the numeric keypad on the keyboard.

A file name to copy Internal information to Card 2 can be entered.

3 Using the numeric key, enter a file name.

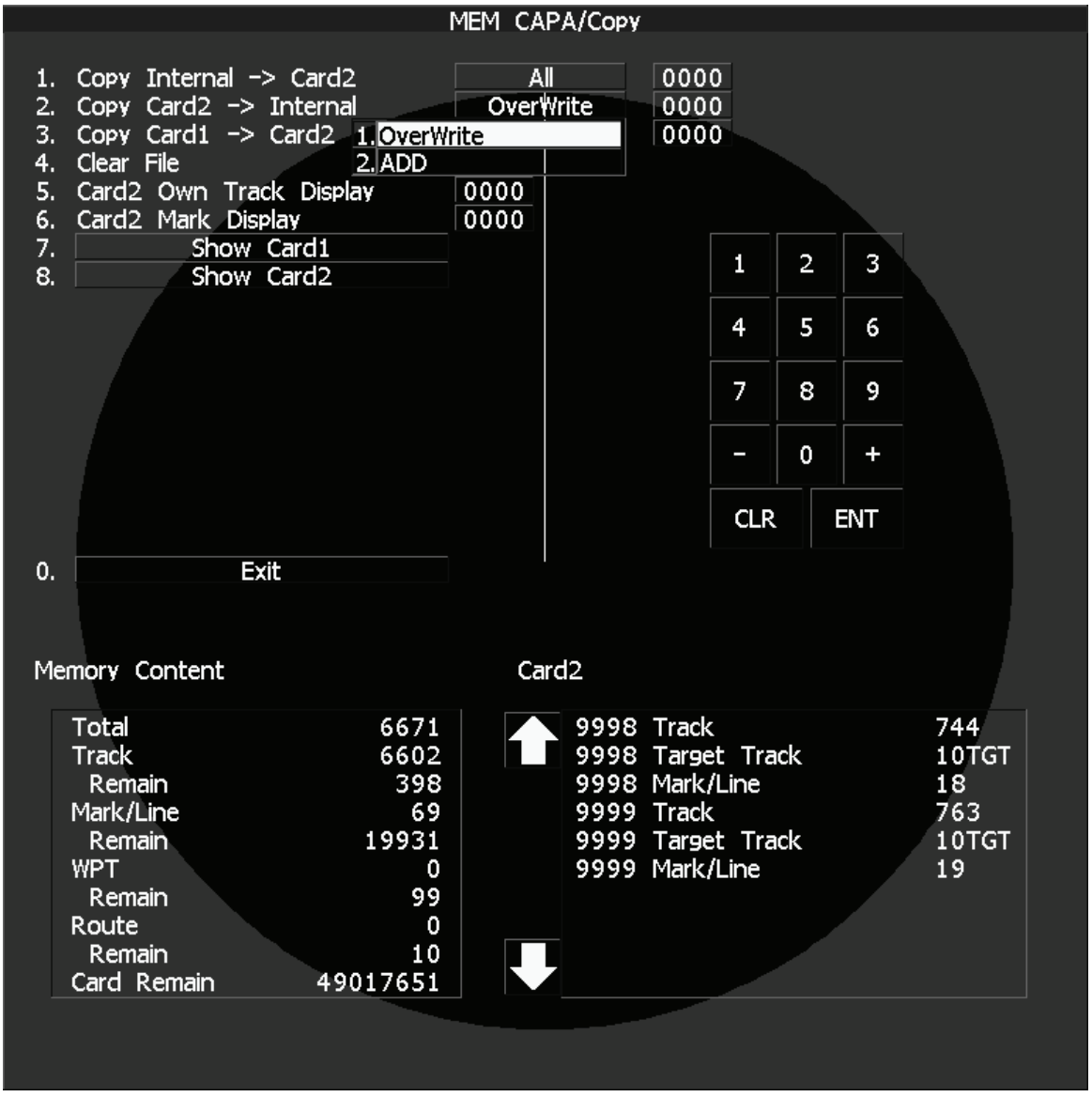
After the input, move the cursor onto the "ENT" button in the Code Input menu, and press [ENT] key.
The system writes internal information into Card 2 with an entered number used as a file name.
The capacity of information that can be saved in the internal portion is limited to the maximum number of points in items described on the previous page. For the capacity of information that can be saved in a card, the system can save information in a card until the card capacity is filled with a file, counting the information saved in the internal portion as a file.

[II] Read Information from Card 2 to Internal Portion(Copy Card 2 → Internal)

Procedure

1 Press [2] key while the CAPA/Copy Menu is open.

2 Using the numeric key, select ADD mode or OVER WRITE mode.



A file name to copy information from Internal portion to Card 2 can be entered.
Read the file name displayed in the Card 2 window.

3 Using the numeric key, enter a file name.

Move the cursor onto the "ENT" button in the Code Input menu, and press [ENT] key.
The entered file name is read from Card 2 to the internal portion.

When information is to be transferred from Card 2 to the internal portion in the ADD mode, the information can be copied from multiple files. However, information cannot be read when the number of points for an item has reached the maximum. In the ADD mode, the WPT and Route are overwritten.

[III] Copy Information from Card 1 to Card 2 (Copy Card 1 → Card 2)

Procedure

1 Press [3] key while the CAPA/Copy Menu is open.

A file name to copy information from Card 1 to Card 2 can be entered.

2 Using the numeric key, enter a file name.

Using the numeric key, euter a file name to be copied.
After having enter the name, move the cursor onto the "ENT" button in the Code Input menu, and press [ENT] key.

3 Using the numeric key, enter a file name to copy.

After having enter the name, move the cursor onto the "ENT" button in the Code Input menu, and press [ENT] key. CLR will be cancelled.
The entered file number is copied from Card 1 to Card 2.

[IV] Delete File from Card 2 (Clear File)

Procedure

1 Press [4] key while the CAPA/Copy Menu is open.

A file name to clear file can be entered.

2 Using the numeric key, enter a file name.

After having enter the name, move the cursor onto the "ENT" button in the Code Input menu, and press [ENT] key. CLR will be cancelled.
The entered file number is deleted from Card 2.

[VI, VII] View Information in Card (Show Card)

Procedure

1 Press [7] or [8] key while the CAPA/Copy Menu is open.

7: Card slot 1
8: Card slot 2

Select a card to be displayed.

Exit

1 Press [0] key.

The MEM CAPA/Copy window will be closed.

3.11.2 Erase/Initialize Card Memory (CLR MEM/INIT Card)

Erase saved information from inside the processor.

[I] Erase Mark/Line (CLR Mark/Line Data)

Erase saved mark/line from inside the processor.

Procedure

1 Press [RADAR MENU] key.

The Main Menu will appear.

2 Press [9] key.

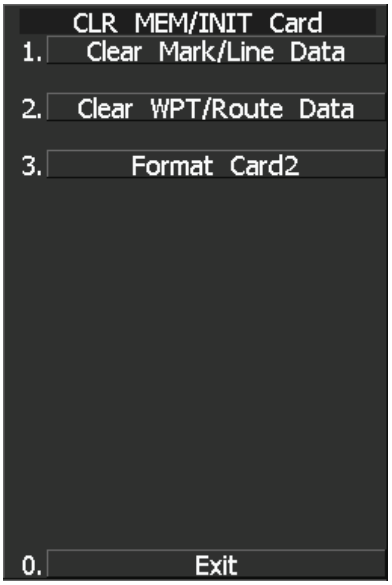
The Plot Menu will appear.

3 Press [7] key.

The CLR MEM/INT Menu will appear.

4 Press [1] key.

A window will appear to select whether or not marks/lines should be erased.
1. Erased
2: Cancel



[II] Erase Waypoint/Route (CLR WPT/Route Data)

Erase saved WPT/Route from inside the processor.

Procedure

1 Press [RADAR MENU] key.

The Main Menu will appear.

2 Press [9] key.

The Main Menu will appear.

3 Press [7] key.

The CLR MEM INIT Card Menu will appear.

4 Press [2] key.

The Waypoint/Route Erase Execution window will appear.
1. Erase
2: Cancel

[III] Initialize Card 2 (Format Card 2)

Initialize Card 2.

Procedure

1 Press [RADAR MENU] key.

The Main Menu will appear.

2 Press [9] key.

The Plot Menu will appear.

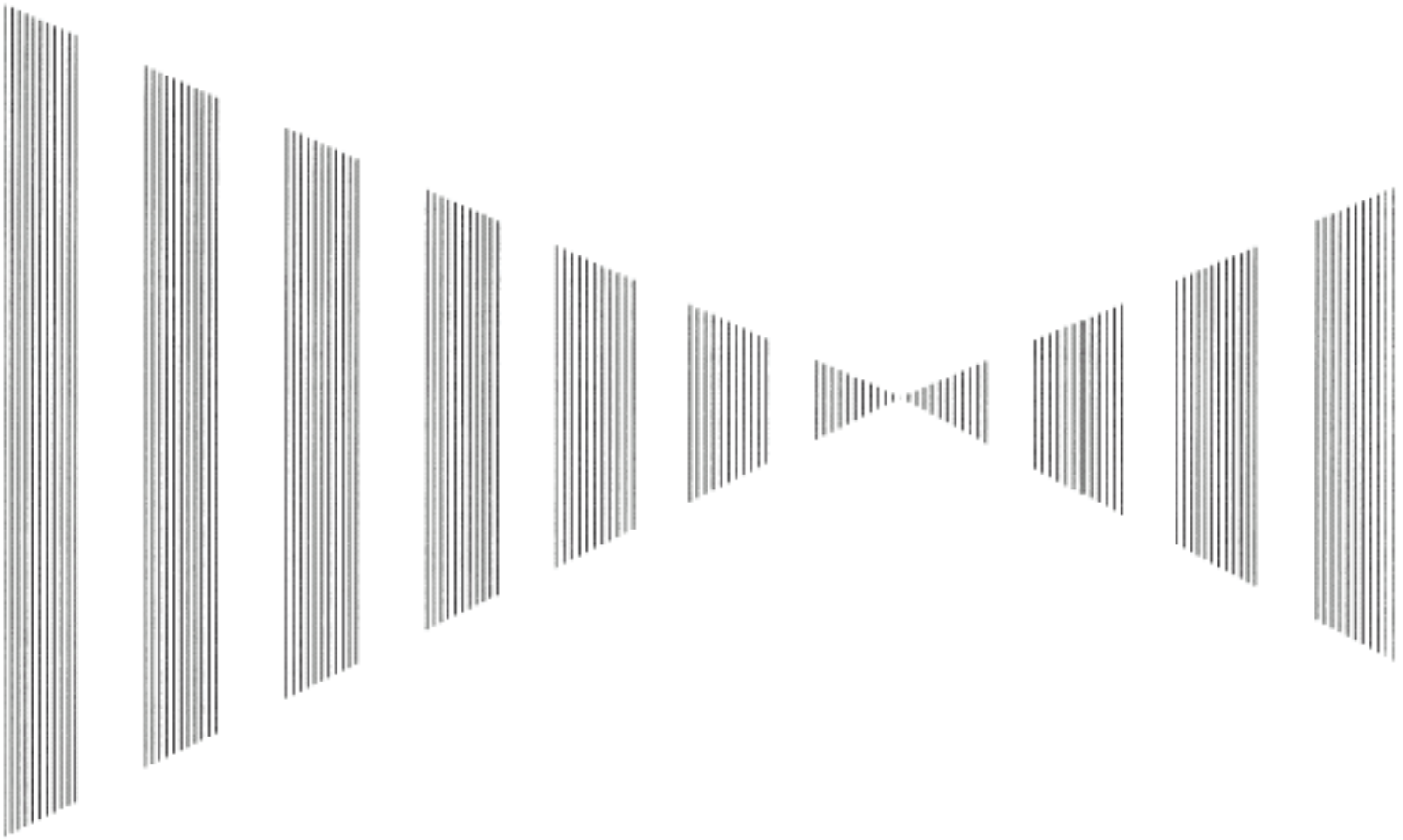
3 Press [7] key.

The CLR MEM INIT Card Menu will appear.

4 Press [3] key.

The window to select whether or not Card 2 is initialized will appear.
1. Initialize
2: Cancel

SECTION 4
MEASUREMENT OF RANGE AND BEARING



4.1 MEASUREMENT USING THE CURSOR WITH THE TRACKBALL

Procedure

1 Check the target echoes on the radar display.

2 Move the cursor mark to a target by the trackball.

The CURSOR on the radar display indicates the bearing and range of the target. The range is a distance from own ship's position.

CURSOR ( )
TRUE 45.0°: True bearing of the cursor relative to own ship
5.0nm: Range between the cursor and own ship
REL 45.0°: Relative bearing of the cursor relative to own ship

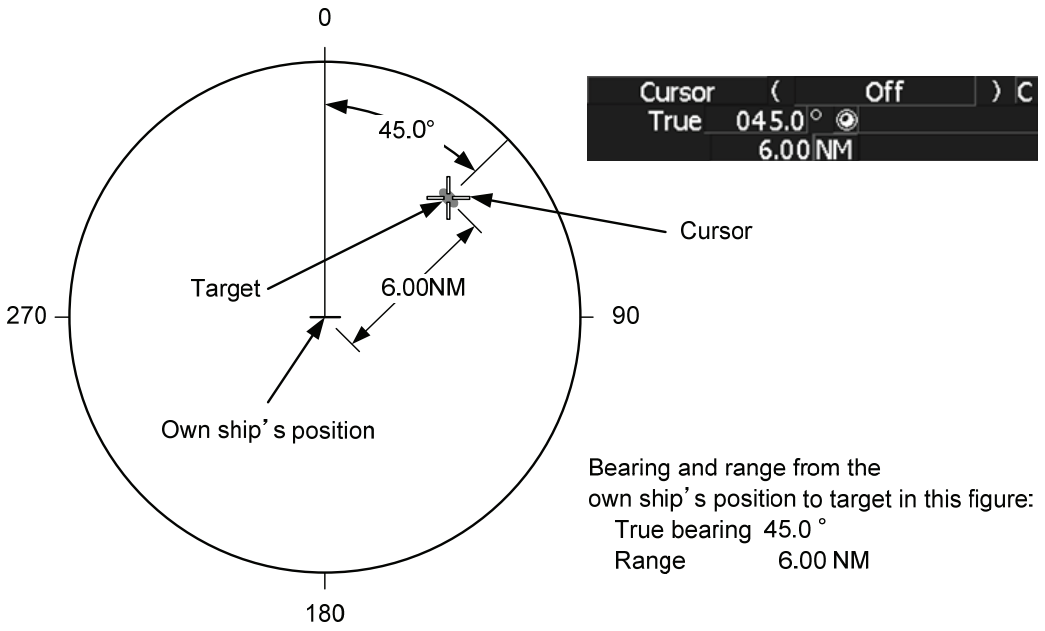


Figure 4.1

4.2 MEASUREMENT BY RANGE RINGS

Procedure **1 Press [RR/HL] key.**

Display and non-display of the scale of the range rings is switched every time the **[RR/HL]** key is pressed. Also, the scale unit is shown on the Range rings display On / Off button (Software button ② located at the top left corner of the radar display described in Section 2.3.1).
Assess the distance to the target based on the location of the target on the range ring scale.
To change brilliance of the range rings scale, refer to Section 3.3.5 “Adjust Brilliance of Information on Radar Display (Brilliance Setting).”

4.3 MEASUREMENT BY EBLS AND VRMS

Procedure

1 Press [EBL1] key to select EBL1 display and operation.

The EBL1 indication at the upper right of the radar display will be selected and the EBL1 will appear as a broken-line on the PPI display.

2 Turn the [EBL] control to put EBL1 on a target.

The bearing of the EBL1 will appear at the upper right of the radar display. The EBL1 bearing represents the target's bearing.

3 Press [VRM1] key to select VRM1 display and operation.

The VRM1 indication at the upper right of the radar display will be selected and the VRM1 will appear as a broken-line circle on the PPI display.

4 Move the broken-line VRM1 to the target by using the [VRM] control.

The range of the VRM1 from own ship will appear at the upper right of the radar display. The range of VRM1 signifies a distance between the target and own ship.

Refer to **Figure 4.2**.

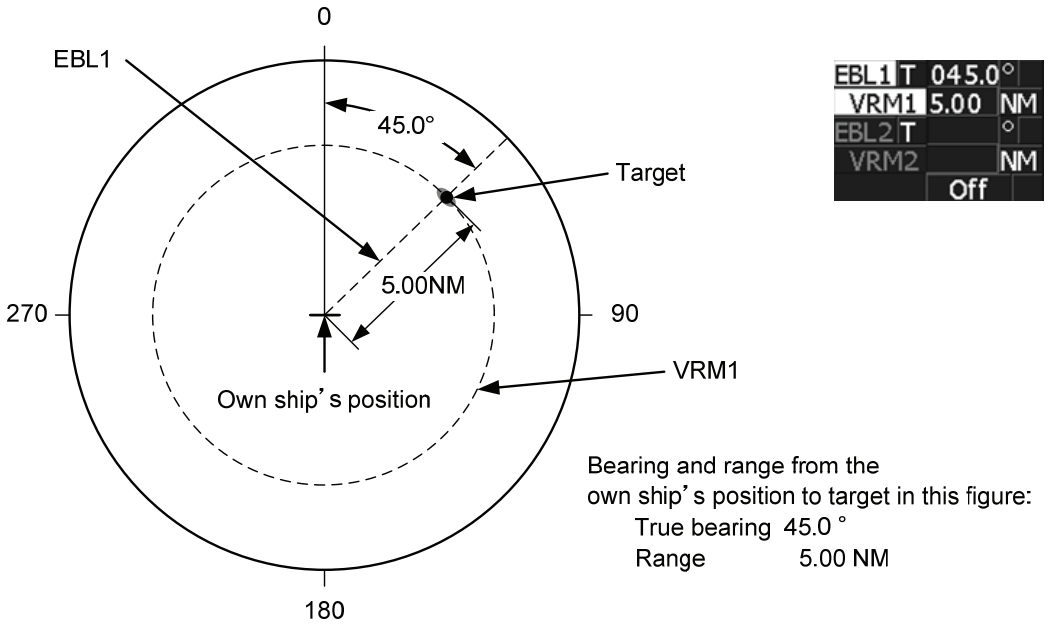


Figure 4.2

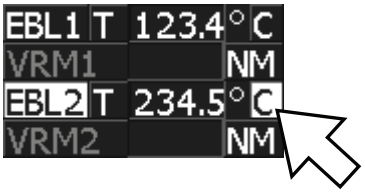
4.4 MEASUREMENT BETWEEN TWO OPTIONAL POINTS

Procedure

1 Press [EBL2] key to select EBL2 display and operation.

The EBL2 indication at the upper right of the radar display will be selected and the EBL2 will appear as a dotted-line on the PPI display.

2 Place the cursor over the ☐ button of EBL2 at the top right corner of the radar screen, and press the [ENT] key.
The EBL cursor mode changes between C and D every time the button is pressed.
Select C.



3 Using the trackball, move the starting point of EBL2 to one (A) of the two points and press [ENT] key.

(See **Figure 4.3**.)

4 Turn the [EBL] control to move EBL2 to the other point (B).

(See **Figure 4.3**.)

5 Press [VRM2] key to select VRM2 display and operation.

○ (VRM marker) will appear on a dotted-line of the EBL2.

6 Using the [VRM] control, move the VRM2 marker on a dotted-line of EBL2 to the point B.

The bearing and range between the two points will appear in the VRM2 and EBL2 area on the lower right of the radar display.

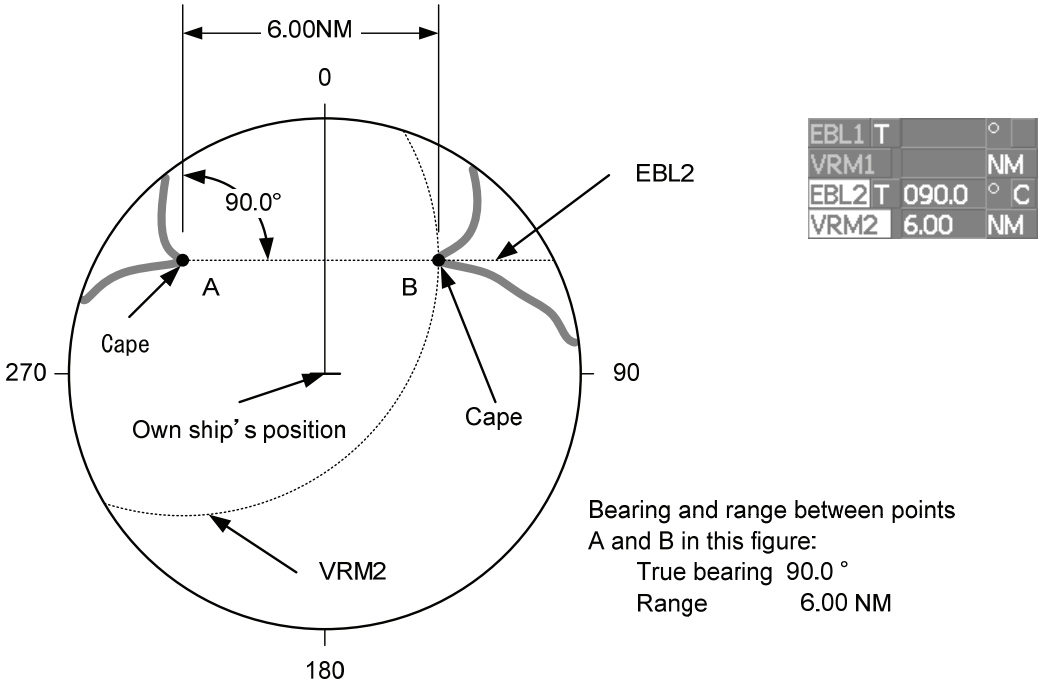
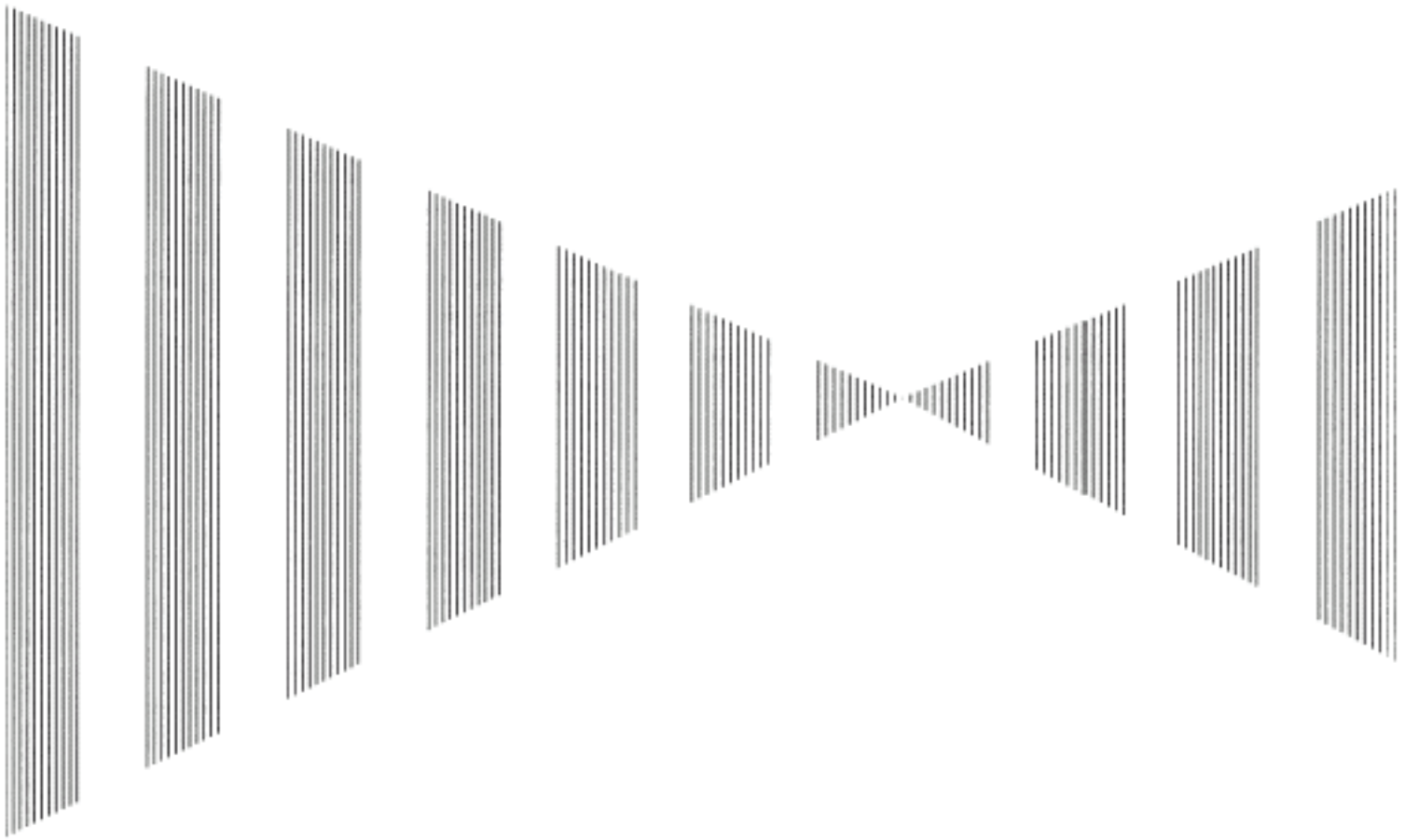


Figure 4.3

It is also possible to use EBL1 instead of EBL2 in measuring the bearing and range between two optional points.
In this case, read EBL2 as EBL1 and VRM2 as VRM1 in the procedure above, point the cursor to C of EBL2 in step 2, and then press [ENT] key.

SECTION 5
OPERATION OF TT AND AIS



USAGE OF TARGET TRACKING FUNCTION

Attention

- **There are the following limitations on use of the target acquisition and target tracking functions.**

[I] Resolution between adjacent targets and swapping during automatic target tracking

Depending on the particular distance and echo size, resolution between adjacent targets during automatic target tracking usually ranges somewhere between 0.03 to 0.05 NM. If multiple targets approach each other, resolution will become about 0.05 NM and this may cause the system to regard them as one target and thus to swap them or lose part of them. Such swapping or less of targets may also occur if the picture of the target being tracked is affected by rain/snow clutter returns or sea clutter returns or moves very close to land.

[II] Intensity of echoes and the target tracking function

The intensity of echoes and the tracking function have a correlationship, and thus the target will be lost if no echoes are detected during six scans in succession. If a lost target exists, therefore, radar gain must be increased to support detection of the target. If, however, radar gain is increased too significantly, sea clutter returns or other noise may be erroneously detected and tracked as a target, and resultingly, a false alarm may be issued.

[III] Adverse effects of error sources on automatic tracking

To execute accurate tracking, it becomes necessary first to appropriately adjust the [GAIN], [SEA] and [RAIN] dials of the radar so that the target to be acquired and tracked id clearly displayed on the radar display. Inappropriate settings of these adjustments reduce the reliability / accuracy of automatic tracking.

5.1 PREPARATION

This section explains the features of the target tracking and AIS functions, and the initial setting for using each function.

Before the target tracking function or AIS function can be used, the corresponding optional device must be installed.

Target Tracking Function

The target tracking function calculates the course and speed of a target by automatically tracking the target's move.
The target tracking function enables the automatic acquisition of targets by using the automatic acquisition zone function.
If the mode is ground stabilization, SOG/COG used for own ship's information in target tracking. If the mode is sea stabilization, SPD (speed through the water) / HDG (heading) used for own ship's information in target tracking.
The target tracking function is available when a target tracking unit (option) is installed.

AIS (Automatic Identification System) function

The AIS function shows the target’s information on the radar display, using other ship's information sent out from the AIS unit.
This function is available when the optional AIS unit is installed.

5.1.1 Collision Avoidance

Problems of Collision Avoidance in Navigation

Marine collision avoidance is one of the problems that have been recognized from of old. Now, it will be described briefly who the collision avoidance is positioned among the navigational aid problems.
The navigation pattern of all mobile craft constitutes a system with some closed loops regardless of the media through which the mobile craft travels, whether air, water, the boundary between air and water, or space. This pattern consists of two closed loops in principle, one of which is a collision with another mobile craft and the other is a loop of finding a right and safe way to reach a predeterminate destination. Fig. 5-1 shows the conceptual diagram of navigation pattern by MR. E.W. Anderson. The closed loop of collision avoidance is shown on the left side and the closed loop of finding a right course on the right side.

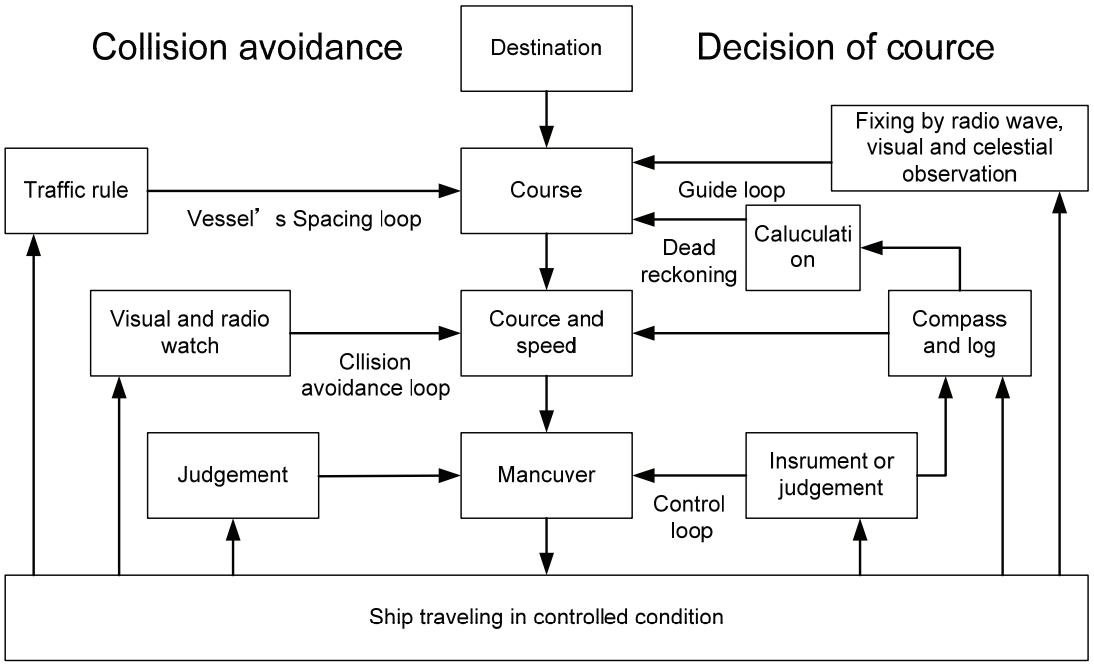


Fig. 5-1 Navigation Pattern

Marine Accidents and Collisions

Among marine accidents, collision accidents have been highlighted as the tonnages and speeds of ships become higher along with the increase in traffic at sea. If a tanker carrying dangerous articles such as crude oil collides with any other vessel, then not only the vessels involved with the accident but other vessels in the vicinity, port facilities, inhabitants in the coastal area as well as marine resources may also suffer immeasurable damages and troubles. Collision accidents have a high percentage of the marine accidents that have occurred in recent years. To cope with these problems, any effective measures are needed and some equipment to achieve collision avoidance requirements have been developed at rapid strides.

Basic Concept of Collision Avoidance

There are two aspects in collision avoidance: collision prediction and avoidance. Collision prediction is to predict that two or more vessels will happen to occupy the same point at the same time, while collision avoidance is to maneuver vessels not to occupy the same point at the same time.
In practical operation of vessels, a spot of collision has to be deemed to be a single point but a closed zone. This closed zone is conceptually defined as a CPA (Closest Point of Approach). In collision prediction, the time to be taken until a ship reaches the CPA is defined as a TCPA (Time to CPA).
Fig. 5-2 shows a diagram caked “Collision Triangle”.

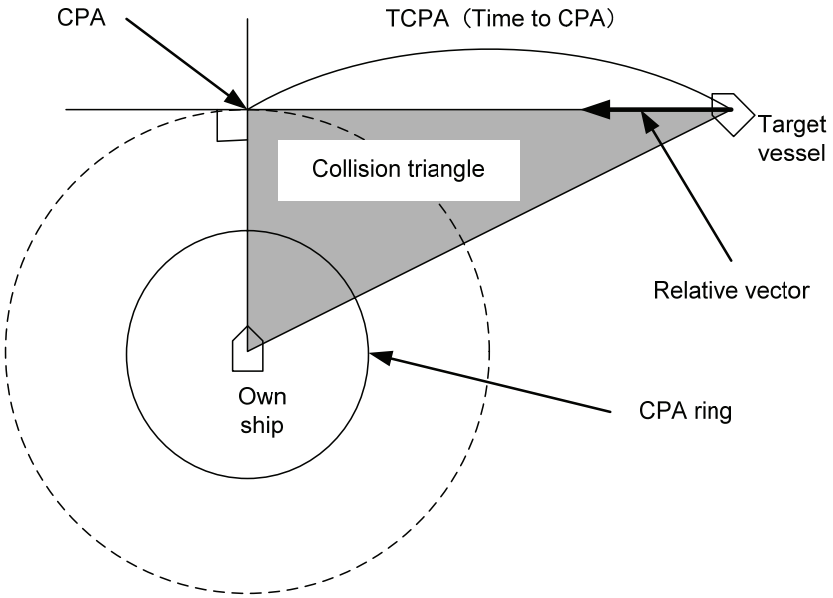


Fig. 5-2 Collision Triangle

Relative Vector and True Vector

From two points of view, collision prediction and avoidance, it is necessary to obtain the relative vector of other ship for prediction and the true vector of other ship for collision avoidance in order to grasp other ship's aspect. The relationship between the relative vector and true vector is shown in Fig. 5-3.
Both rough CPA and TCPA can be obtained easily from the relative speed vector of other ship. This method has an advantage that the risks of collision with all other ships within the radar range can be seen at a glance. On the other hand, the course and speed of other ship can easily be obtained from its true speed vector, enabling other ship's aspect to be seen at a glance. Thus, the aspects of other ships (transverse, outsail, parallel run, reverse run, etc.) as described in the act of prevention of collision at sea can be readily grasped. If there is a risk of collision with other ship, the operator can determine which rule to be applied and how to operate own ship.

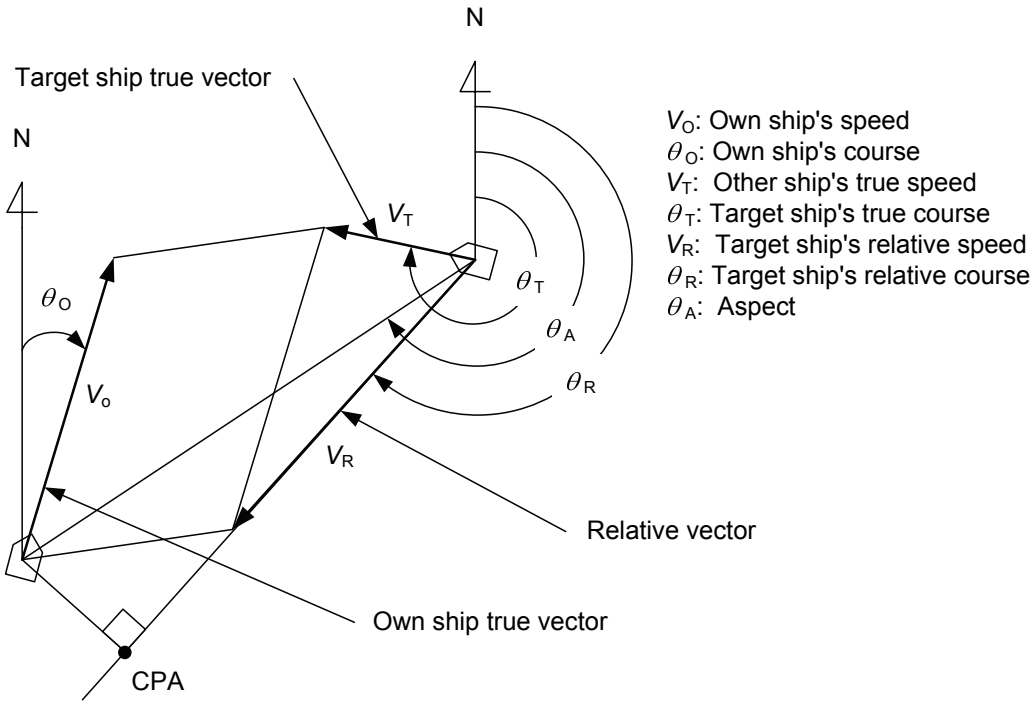


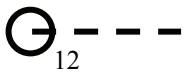
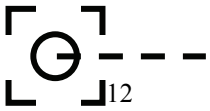
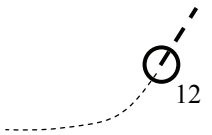
Fig. 5-3 Relative Vector and True vector

Radar and Collision Avoidance

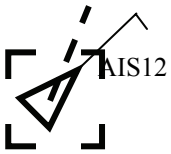
Radar is still playing an important roll for collision prevention and positioning. A plotter is used to further enhance the radar functionality. The plotter is capable of plotting other positions of other ships in 3 to 6 minute intervals to monitor their movement. The plots of other ships represent their tracks relative to own ship, and it is shown whether there is a risk of collision, namely CPA and TCPA can be obtained. This method using a plotter is fairly effective, but the number of target ship, which is manually plotted, is limited and it takes several minutes to measure those.

5.1.2 Definitions of Symbols

Types and Definitions of Target Tracking Symbols

Vector/Symbol	Definition	Remarks
	Initial acquisition target	This symbol is displayed until the vector is displayed after target acquisition.
	Target acquired in automatic acquisition zone	The alarm sounds. The alarm message (New Target) turns red and blinks. The symbol is red colored.
	Tracked target	
	Dangerous target	The alarm sounds. The alarm message (CPA/TCPA) turns red and blinks. The symbol is turns red, and indicates with X mark.
	Numeric displayed target	When the numeric data is displayed, the target symbol is enclosed in a square.
	Lost target	The alarm sounds. The alarm message (Lost) turns red and blinks. The symbol is turns red, and indicates with X mark.
	Past position	The past positions of an AIS target are displayed as well as the target tracking symbol.
	Target track	The track of another ship as an AIS target is displayed as well as the target tracking symbol.

Types and Definitions of AIS Target Symbols

Vector/Symbol	Definition	Remarks
	Sleeping target	This symbol is displayed when received data is valid. The direction of the triangle's vertex indicates the target's bow or course.
	Activated target	The heading direction is displayed with a solid line, and the course vector is displayed with a dotted line. The line perpendicular to the heading direction indicates the direction to which the course is to be changed. This line may not be displayed.
	Target acquired in automatic acquisition zone	The alarm sounds. The alarm message (New Target) turns red and blinks.
	Outline display	The outlines of ships are displayed scaled down.
	Numeric displayed target	When the numeric data is displayed, the target symbol is enclosed in a square.
	Dangerous target	The alarm sounds. The alarm message (CPA/TCPA) turns red and blinks. The symbol is turns red, and indicates with X mark.
	Lost target	The alarm sounds. The alarm message (Lost) turns red and blinks. The symbol is turns red, and indicates with X mark.

Up to a total of 130 activated and sleeping AIS targets can be displayed.
Of which, up to 30 activated AIS targets can be displayed.
If there are more than 130 AIS targets, priority of displaying these targets is as follows:

1. Numeric displayed targets
2. Targets with CPA / TCPA smaller than the set value
   (They are considered as dangerous targets and the alarm sounds.)
3. Targets within the automatic activation area
4. Activated AIS targets
5. Targets within the AIS filter (sleeping AIS targets)

If the number of targets exceeds the maximum number of targets that can be displayed within one priority, these targets are then displayed in accordance with the priority list below:

1. Association targets
2. Activated AIS targets
3. Sleeping AIS targets

The vector of an AIS target is to be displayed with a vector over ground or over water, depending on the speed sensor setting and current offset setting. The type of the currently displayed vector can be confirmed by viewing the setting of the stable mode.

When GND is displayed for the stability mode (⑩ located at the top left corner of the radar display described in Section 2.3.1):
Vector over ground
When Sea is displayed for the stability mode (⑩ located at the top left corner of the radar display described in Section 2.3.1):
Vector over water

When the vector of an AIS target is displayed with a vector over water, the system has converted the AIS target's vector over ground to the vector over water according to the data received from the AIS and the own ship's information.

Note: When the AIS target's symbol is activated but the vector is not displayed, the following are probable causes of the trouble:
COG/SOG is not yet input from the GPS.
The selected speed sensor is malfunctioning.

Types and Definitions of Association Target Symbols

When a tracked target and an AIS target are decided as identical, it is displayed with either of the following symbols:

Vector/Symbol	Definition	Remarks
	Priority for tracked target Association target	
	Priority for AIS target Association target	

TT symbol display setting (TT Symbol Display)

Turn on or off (ON / OFF) the TT symbol display.
This function can be used only when the AIS display function (optional) is on.
This function cannot be used when the AIS display function (The TT display function cannot be deactivated if only TT is used without using the AIS function).
Data is saved even though the TT display is turned off by this function.
Refer to Section 5.3 “AIS OPERATION” for the AIS display function.

Procedure

1 Press the [TT MENU] key.

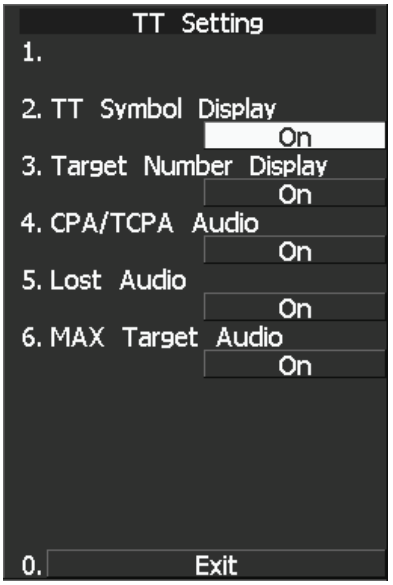
2 Press the [1] key.

TT Setting menu opens.

3 Press the [2] key.

TT Symbol Display is turned on or off.

ON : Enables the TT symbol display function.
OFF : Disables the TT symbol display function.



* Software button ⑨ located at the other ship's information area in Section 2.3.6 is also available for switching.

Setting AIS Symbol Display Function (AIS Symbol Display)

Switch ON or OFF to set the AIS symbol display function.

Procedure

1 Press [TT MENU] key.

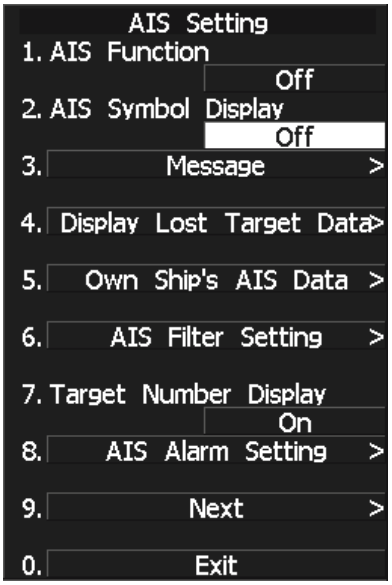
Press [2] key.

The AIS Setting menu will appear.

2 Press [2] key.

The AIS Symbol Display is switched between ON and OFF.

ON: Enables the AIS symbol display function.
OFF: Disables the AIS symbol display function.



* Software button ⑩ located at the other ship's information area in Section 2.3.6 is also available for switching.

5.1.3 TT Data Display

(Refer to Example of Display in Section 2.1 “EXAMPLE OF DISPLAY.”)

Display of Vectors

Attention

- **When a target or own ship changes a course, or when a target is acquired, its vector may not reach a given level of accuracy until three minutes or more has passed after such course change or target acquisition.**
  Even if three minutes or more has passed, the vector may include an error depending upon the tracking conditions.

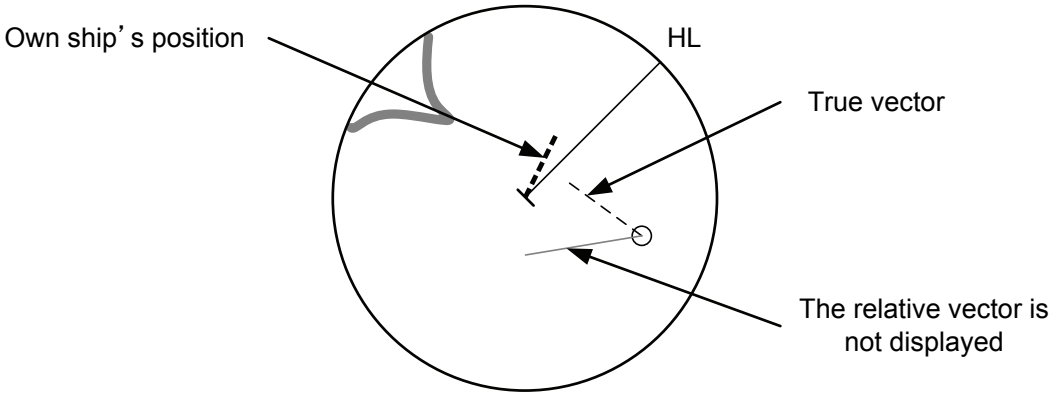
A vector to represent a target’s predicted position can presented in the True vector or Relative vector mode. In each mode, a vector length can be freely changed for a time interval of 1 to 60 minutes.

The True and Relative vector can be switched by using software button ① located at the other ship's information area in Section 2.3.6.

[l] Vector Mode Selection

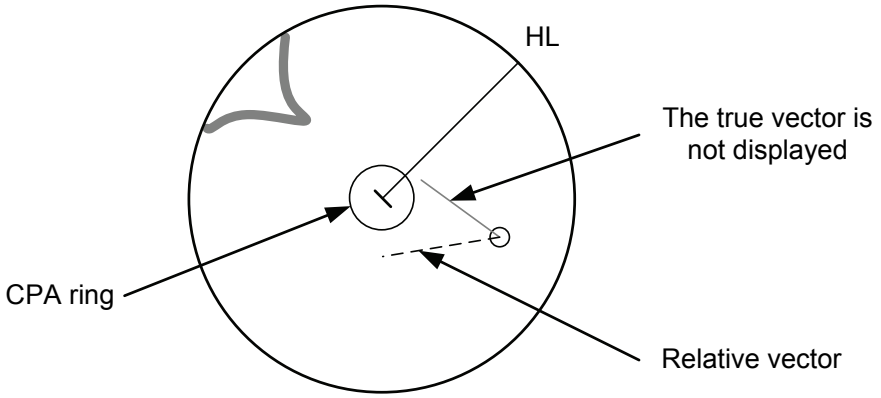
True Vector Mode

In the true vector mode, the direction of a target vector indicates the true course of the target and its vector length is proportional to its speed.
In this mode, own ship’s vector is displayed as shown below.
In this mode, the movements of other ships around own ship can be accurately and easily monitored.
However, no CPA RING can appear in this mode.



Relative Vector Mode

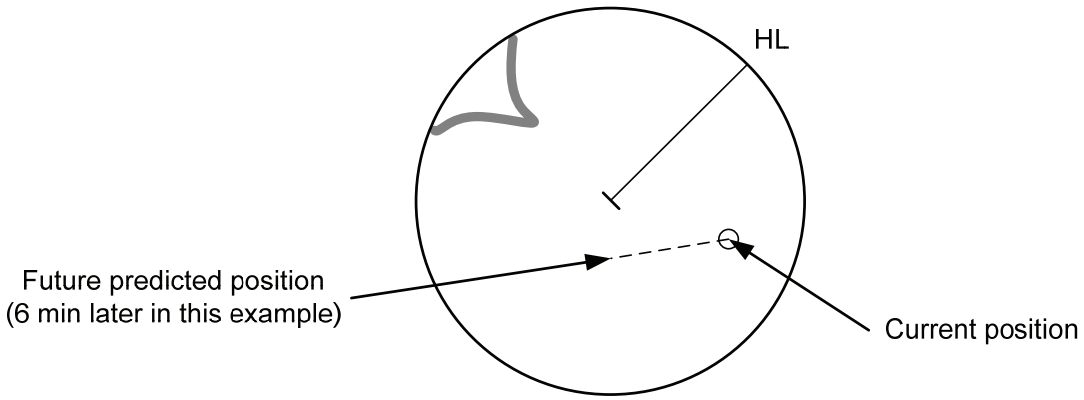
In displaying the relative vector of a target, press the **[VECT R/T]** key to select the Relative Vector mode.
The relative vector does not represent the true motion of the target, but its relative relation with own ship. This means that a target with its relative vector directed to own ship (passing through the CPA LIMIT ring) will be a dangerous target. In the Relative Vector mode, it can be seen at a glance where the CPA LIMIT of the dangerous target is.



Therefore, the TRUE/REL mode shall optionally be used for the purpose of observation: the TRUE vector mode for grasping the true aspect of a target, and the REL vector mode for grasping a target's closest point of approach (CPA)

[II]Vector Length: VECTOR TIME

The vector length of a target is proportional to its speed, and the vector time can be switched in a range of 1 to 60 minutes by used for ten-key.
The diagram below illustrates a vector length of a target for six minutes, and the tip of the vector represents the target's position expected to reach six minutes later.



Refer to Section 5.1.7 "Setting Vectors (Vector Time)" for how to change the vector time.

5.1.4 Cursor Modes (Cursor)

Types and Functions of Cursor Modes

The types of cursor modes are listed in the table below. To use the function of a cursor mode, move the cursor onto the PPI object and press the **[ENT]** key.

Mode	Function
ACQ TT	Enables the target tracking function to acquire a target in manual mode.
ACT AIS	Activates AIS targets, deactivates AIS target and sets a point filter.
TGT Data	Select or deselect a tracking or AIS target whose numerical data is to be displayed.
Cancel	Cancels a target tracking.
Mark	Puts a temporary mark.

Change of Cursor Mode

Procedure

1 Move the cursor to the cursor mode Cursor (software button ① located at the top right corner of the radar display described in Section 2.3.3), and press the [ENT] key.

The selected cursor mode will be shown at the cursor mode (software button ② located at the top right corner of the radar display described in Section 2.3.3).

5.1.5 Setting Collision Decision Criteria (CPA/TCPA Limit)

For details on each operation, see 3.4 BASIC OPERATION and 4 MEASUREMENT OF RANGE AND BEARING.

Attention

- **Set the optimum values of collision decision conditions, depending upon vessel type, water area, weather and oceanographic conditions. (For the relations between those conditions and alarms, refer to Section 5.5 "ALARM DISPLAY.")**

Set and check collision decision criteria before operating the TT system.

Procedure

1 Press [TT MENU] key.

2 Press [3].

The TT Setting menu will appear.

3 Press [5].

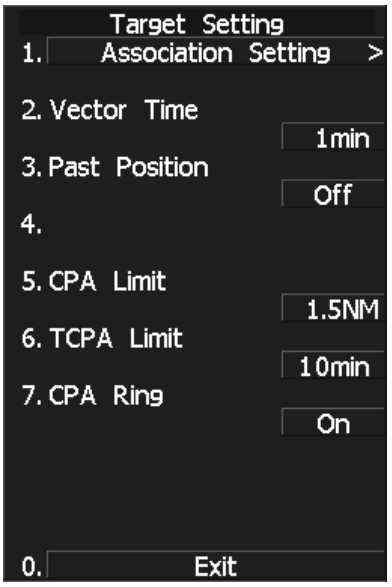
The ten-key screen will appear.

4 Select the value to be set pressing the numeric key, and press [ENT].

The selected CPA Limit value will be determined.

5 Press [6].

The ten-key screen will appear.



6. Select the value to be set pressing the numeric key, and press [ENT].

The selected TCPA Limit value will be determined.

5.1.6 Setting CPA Ring (CPA Ring)

Procedure

1 Press [TT MENU] key.

2 Press [3].

The TT Setting menu will appear.

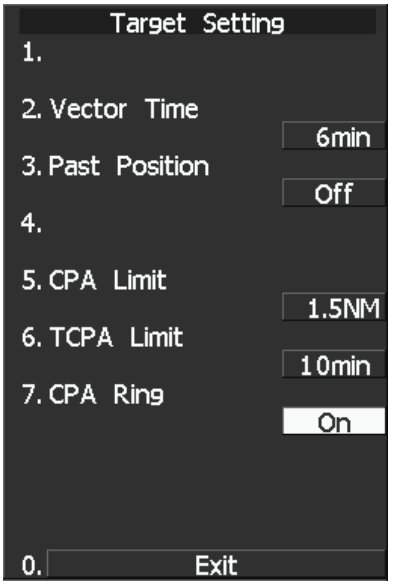
3 Press [7].

The setting of CPA Ring will change between ON and OFF.

ON: Displays the CPA ring.
OFF: Hides the CPA ring.

While the CPA ring is displayed, CPA RING is shown at the lower right of the radar display.

While the distance of the specified CPA Limit value is used as the radius, the CPA ring is displayed with a white circle of which center is the own ship's position.



Note: The CPA ring is not displayed when the true (T) vector mode is selected.

* The CPA ring switch to Display or Hide within software button ⑦ located at the bottom right corner of the radar display described in Section 2.3.4.

5.1.7 Setting Vectors (Vector Time)

Vector time can be set in minutes in the range 1 to 60 min.
A true vector mode or relative vector mode can be selected.

Setting vector time on the display

Procedure

1 Move the cursor to the target vector time setting (Software button ② located at the other ship's information area in Section 2.3.6), and press the [ENT] key.

The Vector Time value input screen will appear.

2 Use number keys, input a vector length, and press the [ENT] key.

The inputted vector length is confirmed.

Setting vector time using the multi-dial [MULTI]

Procedure

1 Press the [MULTI] dial several times to activate the Vector mode.

Vector will be displayed in the multi-dial mode (⑭ located at the bottom left corner of the radar display described in Section 2.3.2).

2 Turn the [MULTI] dial to set the vector time.

Setting vector mode [VECT R / T]

Procedure

1 Press the [VECT R / T] key.

The current vector mode T (true vector) or R (relative vector) will be displayed in the target vector display true / relative switching (software button ① located at the other ship's information area in Section 2.3.6).
The vector mode is switched between T (true vector) and R (relative vector) each time the button is pressed.

5.1.8 Setting the GPS antenna location

Set the GPS antenna location. Set offset ranges in longitudinal direction and latitudinal direction from the own ship's reference position.
For the setting procedure, refer to Section 7.1.6 “Setting of CCRP/Antenna/GPS Antenna Position (CCRP Setting).”

Attention

- **If offset ranges are not set correctly, AIS symbols and radar echoes may be displayed shifted.**
- **When offset ranges are set, latitude and longitude data received from the GPS is offset, and the offset data is displayed as the latitude and longitude of own ship’s position.**

5.2 TT OPERATION

This section explains how to use the target tracking (TT) functions.
Each function is available only when the target tracking (TT) option is installed.
The functions automatically track a target, and store/display vectors as the course and speed.
They calculate CPA and TCPA, and issue an alarm.
The target tracking (TT) function can track up to 30 ships.
Automatic acquisition/activate zone can be set for automatic acquisition.
When the power is turned off or the transmit/standby mode is activated, tracking data is erased from memory.

⚠ Caution

Use the radar only as a navigation aid.
The final navigation decision must always be made by the operator him/herself.
Making the final navigation decision based only on the radar display may cause accidents such as collisions or running aground.

Use target tracking function only as a navigation aid.
The final navigation decision must always be made by the operator him/herself.
Making the final navigation decision based only on tracking target information may cause accidents.
Tracking target information such as vector, target numerical data, and alarms may contain some errors. Also, targets that are not detected by the radar cannot be acquired or tracked.
Making the final navigation decision based only on the radar display may cause accidents such as collisions or running aground.

5.2.1 Acquiring Target [ACQ]

Target acquisition can be performed on two modes, AUTO and MANUAL, and both modes can be used at the same time.

Automatic Acquisition [AUTO]

Attention

- **If untracked targets intrude into automatic acquisition/activate zone in the conditions that maximum number of targets is under tracking, the targets acquired automatically will be cancelled in the order of lower levels of danger.**

Procedure

1 Press the [AZ] key.

Automatic acquisition will be started. The mark " ▽ " and target ID number are put to an acquired target, and they move together with the target. The vectors are displayed within one minute.

2 Press the [AZ] key again.

Automatic acquisition will be turned off, and automatic acquisition/activate zone disappears from the radar display. However, automatically acquired ships are continuously tracked.

For automatic acquisition/activate zone to be called by using the **[AZ]** key, refer to "Setting Automatic Acquisition Key Assignment (Set AZ Key)" on the next page.

Setting Automatic Acquisition Key Assignment (Set AZ Key)

This section explains how to set automatic acquisition/activate zone that is to be assigned to the **[AZ]** key.

The setting enables the operator to select ON/OFF for a generally used automatic acquisition/activate zone by simply operating the **[AZ]** key on the control panel.

Procedure

1 Press [TT MENU] key.

Press [5].

Press [3].

Press [1].

AZ menu will appear.

ON: Turns on automatic acquisition/activate zone when the **[AZ]** key is pressed.
OFF: Does not turn on automatic acquisition/activate zone when the **[AZ]** key is pressed.

The same function also as RADAR Alarm (Sector Alarm) can be given.

Procedure

1 Press [TT MENU] key.

Press [5].

Press [3].

Press [2].

* The setting method is the same as the method of automatic acquisition/activate zone. For the creation method of sector alarm, refer to [IV] "Make Sector Alarm (Make Sector Alarm)" in Section 3.5.21 "Radar Alarm (Radar Alarm)."

Manual Acquisition [MANUAL]

> **Attention**
>
> - **If more targets are acquired manually in the condition that the maximum number of targets are under tracking, the targets under tracking will be cancelled in the order of lower level of danger in order to track the manually acquired targets.**

Procedure

1 Move the cross cursor mark onto the target to be acquired, and press the [ACQ] key.

The target will be acquired. The initial acquisition mark and target ID number are put to the acquired target, and the vectors are displayed within one minute.

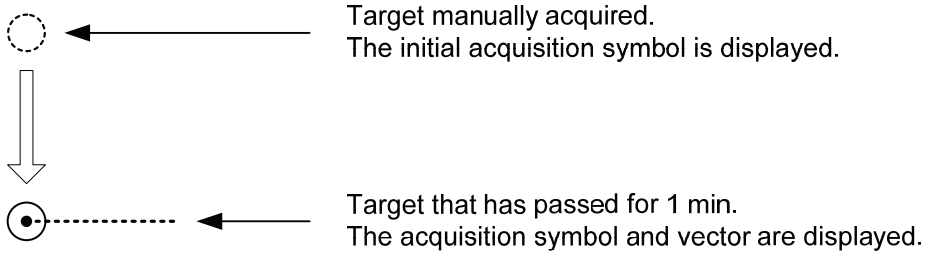
Alternative

1 Press the CURSOR button at the upper right of the radar display several times until ACQ TT appears.

The TT acquisition mode is set as the cursor mode.

2 Move the cross cursor mark onto the target to be acquired, and press the [ENT] key.

The target will be acquired. The initial acquisition mark and target ID number are put to the acquired target, and the vectors are displayed within one minute.



When using only the manual acquisition mode alone, press the [AZ] key to turn off the automatic acquisition mode.

Use of Automatic and Manual Acquisition Modes [ACQ AUTO] / [ACQ MANUAL]

Use the manual acquisition mode while the automatic acquisition mode is on.

Manually acquire the target to which particular attention should be paid, and get the other targets automatically acquired. If a new target appears exceeding the maximum number of targets, the manually acquired target is displayed even in the background until it gets out of the display. However, automatically acquired targets are canceled starting far distance from own ship.

5.2.2 Canceling Unwanted Targets

Unwanted targets can be canceled one by one in the following cases:
- Tracking is no longer necessary for targets with which vectors/symbols are displayed after being acquired and tracked.
- The number of vectors on the radar display needs to be reduced for easy observation.
  When targets are to be re-acquired from the beginning, all the current vectors can also be canceled.

Canceling targets one by one

Procedure

1 Move the cross cursor mark onto the target to be canceled.

2 Press the [TGT CNCL] key.

The target's vectors and symbols will disappear, and only the radar video remains.

Alternative

1 Press the CURSOR button at the upper right of the radar display several times until ACQ TT appears.

The TT acquisition mode is set as the cursor mode.

2 Move the cross cursor mark onto the target to be acquired, and press the [CLR/INFO] key.

The target's vectors and symbols will disappear, and only the radar video remains.

Canceling all targets collectively

Procedure

1 Hold down the [TGT CNCL] key.

The vectors and symbols of all the targets will disappear, and only the radar videos remain.

Note: When all the targets have been canceled, the system stops tracking them. Thus, you need to re-acquire targets in manual or automatic acquisition mode. Do not cancel all the targets unless otherwise required.

5.2.3 Tracking Target Data Display [TGT DATA]

Attention

- **When a target or own ship changes its course, or when a new target is acquired, its vector may not reach a given level of accuracy until three minutes or more has passed after such course change or target acquisition.**
  Even if three minutes or more has passed, the vector may include an error depending upon the. tracking conditions.

Type of Data Display

Target Data

Target identification (TT ID)	ID number of the target
True bearing: BEARING	0.1° unit
Range: RANGE	0.01 NM unit
True course: COURSE	0.1° unit
True speed: SPEED	0.1 knot unit
Closest point of approach (CPA)	0.01 NM unit
Time to CPA (TCPA)	0.1 min unit
Bow crossing range (BCR)	0.01 NM unit
Bow crossing time (BCT)	0.1 min unit

The target for which its numeric data is displayed is marked with a symbol " ⌜◯⌝ " to distinguish from other targets.
If a target's data is displayed, but without the symbol " ◯ ", such a target exists outside the currently displayed radar display.

[I] Method of Displaying Target Data [TGT DATA]

Procedure

1 Move the cross cursor mark onto the target for which numeric data is to be displayed, and press the [TGT DATA] key.
Or, set the cursor mode to TGT Data, place the cross cursor over the target whose numerical data is to be displayed, and press the [ENT] key.

Then, the data of the designated target will appear, it will be marked with a symbol "⌜◯⌝".
The target data will remain on the radar display until the target is lost and its vector disappears, or until another target is designated.
If a target with the mark " ◌ " is designated, only its true bearing (BEARING) and range (RANGE) will appear until its vector appears.

[II] Canceling numerical data display (CNCL Data)

Procedure

1 Set the cursor mode to TGT Data, place the cross cursor over the tracked target whose numerical data is to be displayed, and press the [CLR/INFO] key.

Numerical data display is canceled.

5.2.4 Displaying Target ID No. (Target Number Display)

A target ID number is a value displayed beside the acquisition symbol when a target is acquired.
These numbers are assigned to targets in acquisition order. The numbers 1 to 30 are automatically assigned. Each target is identified by the assigned ID number until it is lost or its acquisition is canceled.

Procedure

1 Press [TT MENU] key.

2 Press [1] key.

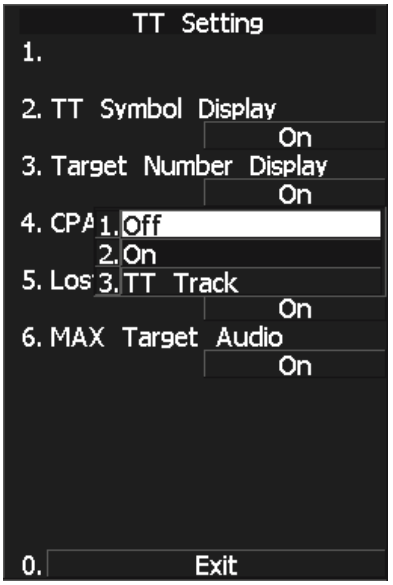
The TT Setting menu will appear.

3 Press [3] key.

The Target Number Display is switched ON or OFF.

ON: Displays target ID numbers.
OFF: Hides target ID numbers.
Target TRACK:
Displays target ID number with target track.

If there are many tracking targets and their symbol display is confusing, set Target Number Display to OFF to view the radar display easily.



Note: An ID number is always displayed for only targets with which numeric data is displayed.

5.2.5 Input of target information (TT Individual Setting)

This radar enables name inputs and target track color changes for individual TT targets acquired.

Procedure

1 Turn OFF the cursor mode.

Software button ① located at the top right corner of the radar display described in Section 2.3.3 is available to change the cursor mode.

2 Place the cursor over the target and then press [CLR/INFO] key.

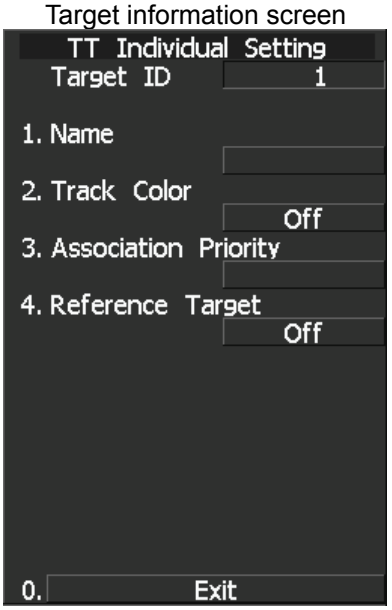
The TT Individual Setting INFO screen opens.

*** This function is available only when the cursor mode is set to OFF.**

Item overview

Target ID : Target ID currently selected.
Name : The name of the target. It is blanked in the initial status. The user is to enter a name.
Track Color : Determines a target track color.
Association Priority :
Specify whose target information is to be displayed between an AIS target and a TT target when an association is made.
Reference Target :
On : Set this target as a reference target.
Off : Stop using this target as a reference target.

Target information screen

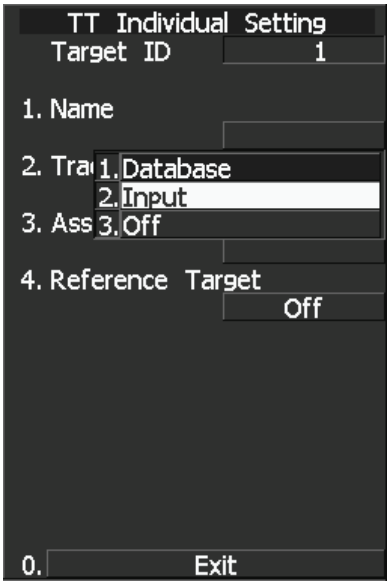


Name entry (Name)

Procedure

1 While the TT Target INFO screen is open, press [1] key.

2 For the entry of a new name
→ 2. INPUT
For the selection of a name from names that have already been entered
→ 1. DATA BASE.



For new entry

Selecting INPUT displays the screen shown below.

After making an entry, place the cursor over [ENT] key and then press it.

When the name entered with INPUT is changed to a target name, it is saved in DATA BASE.

* Up to eight characters can be entered as a name.

For calling a name from the names that have been entered

Selecting DATA BASE lists INPUT names that have already been entered. From the list, select a name you want to use.

* Names for 32 ships can be saved in DATA BASE.

Track Color Setting (Track Color)

Procedure

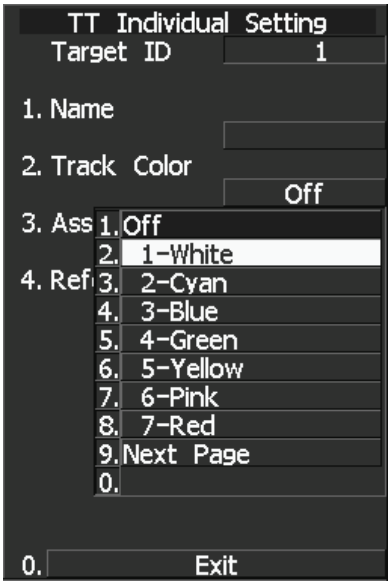
1 While the TT Target INFO screen is open, press [2] key.

2 Pressing numeric key(s), select a color number you want to set.

Colors selectable with Track Color are colors that have been set within the TT Track Setting. When colors are set, individual colors can be set for the 1th to 20th.

On this screen, selection of the 1st track is to select CYAN.

For target tracks, up to 20 ships can be displayed.



5.2.6 Reference Target (Reference)

This equipment can calculate and display the speed of own ship by tracking a target whose position is fixed with respect to the ground and by setting this target as a reference target.

Attention

- **The reference target function is to be used if the own ship's speed cannot be displayed normally due to trouble such as a speed sensor malfunction. Do not use the reference target function except in emergencies.**
- **If the speed or course of the own ship is changed or a new reference target is set, the displayed speed may take 3 minutes or more to reach the specified speed after the speed / course change or the setting.**
  Even after 3 minutes or more has passed, the speed may differ from the specified speed depending on the tracking condition.
- **If a large radar echo such as a land target is set as a reference target, the vectors of the speed and other tracking targets will not be displayed correctly and may cause an accident.**
- **If a sailing ship is set as a reference target, the vectors of the speed and other tracking targets will not be displayed correctly and may cause an accident.**
- **If the REF. is selected for the speed sensor, the AIS function cannot be turned on.**
- **If the reference target is lost or the target tracking function is stopped, the speed sensor is placed in manual mode MAN.**
- **The loss of a reference target may have a major impact on the accuracy of the results for true speed and true course of the target and that own speed will be degraded.**
- **The reference targets are only used for the calculation of true speed.**

Procedure

1 Acquire a target whose position if fixed with respect to the ground.

2 Set the cursor mode to OFF.

3 Place the cursor over the tracked target and press the [CLR/INFO] key.

4 Target information menu is displayed.

5 Press the [4] key.

ON : Set this target as a reference target.
OFF : Stop using this target as a reference target.

When ON is selected, the speed device activates the reference target function.
Then symbol "$\bigcirc_R$" is displayed when the reference target is set.
Only one target can be set as a reference target.
When a new reference target is created, the previous reference target is deleted.
When OFF is selected, the speed device deactivates the reference target function and other functions become available.

5.2.7 TT Test Menu

CAUTION

Target Tracking Function Test is provided to test if the target tracking function is operating normally. Thus, do not use the function except when you test the target tracking function.

In particular, if this mode is used during navigation, pseudo targets appear on the radar display, which may be confused with the actual targets. Do not use this mode during navigation.

Otherwise, this may cause accidents.

The following simulation to be used for TT can be referred to and modified:

[I]	Test Video:	Test video for use in checking the operation of the target detection circuit.
[II]	TT Simulator:	Pseudo targets are generated on the radar display to check whether the TT functions are operating normally.
[III]	Status:	Displays the TT status.
[IV]	Gate Display:	Gate size to acquire and track targets.

[l] Test Video

Attention

- **TEST VIDEO may not appear for targets that are not acquired nor tracked, or if the [GAIN] and [SEA] controls are adjusted properly**

Test Video is used to check whether the video signals under target acquisition and tracking are inputted to and processed in the target processing circuit normally.
However, it is sufficient to check that VDH in TEST VIDEO is displayed.
The start of the Test Video mode is available only in the Standby mode.

Procedure

1 Press [STBY] key.

The equipment will enter the standby state.

2 Press [TT MENU] key.

Press [6] key.

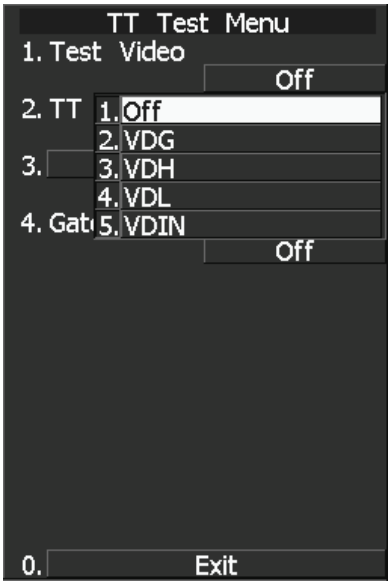
The TT Test Menu will appear.

3 Press [1] key.

The Test Video setting screen will appear.

4 Press a numeric key to select a video signal you want to set.

The selected test video will be set.
The test video is displayed in the background of the radar display.



In general, VDH is sufficient for target display checks in test video mode.

If any target displayed clearly in the radar display is not displayed in the Test Video mode, the target detection circuit of the TT system may have a trouble.

[II] Target Tracking Simulator

Pseudo targets can be generated in certain known positions to check whether the TT processing circuits are operating normally. Since the pseudo targets move depending on known parameters, the values for these pseudo targets can be compared with the known value if the pseudo targets are acquired and tracked, and displayed. Thus, it can be checked if the TT system is operating normally.

Procedure

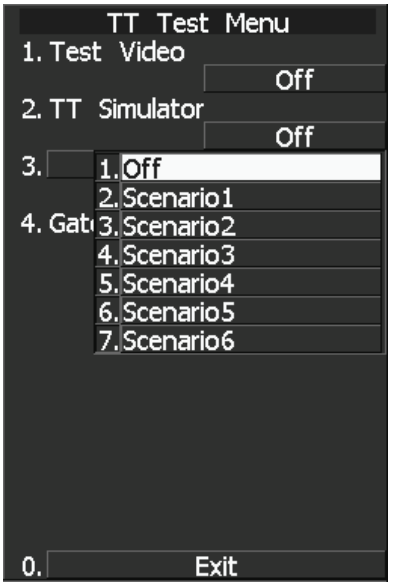
1 Press the [STBY] key.

The equipment will enter the standby state.

2 Press [TT MENU] key.

Press [6] key.

The TT Test Menu will appear.



3 Press [2] key.

Choices for the TT simulator (TT Simulator) are displayed.

4 Select the simulator to be set, pressing the numeric key.

The selected simulator will be set.

5 Press the [TX/PRF] key.

The simulator will be activated and generate pseudo targets. The characters "X" at the bottom of the radar display blinks indicating that the simulation mode is active.

TT simulator/scenario

SCENARIO	TARGET START POINT		TARGET END POINT		TARGET SPEED
	DISTANCE	BEARING	DISTANCE	BEARING	
1	3.2NM	10°	1NM	90°	20kts
2	6NM	0°	0NM	0°	10kts
3	6NM	every 18°	1NM	every 18°	10kts
4	6NM	45°	1NM	45°	105kts
5	6NM	45°	6NM	150°	20kts
6	6NM	45°	6NM	150°	20kts

Note: Set the ship's heading bearing to 0º and the own ship speed to 0 kn while the simulator is operating. When the range between own ship and the pseudo target is 0, the target will disappear.

Exit

1 Press the [STBY] key.

The equipment will enter the standby state.

2 Press [2] key while the TT Test Menu is open.

Choices for the TT simulator (TT Simulator) are displayed.

3 Press [1] key to select OFF.

The TT Simulator is turned off.

[III] Status

The current TT status will appear.

Procedure

1 Press [TT MENU] key.

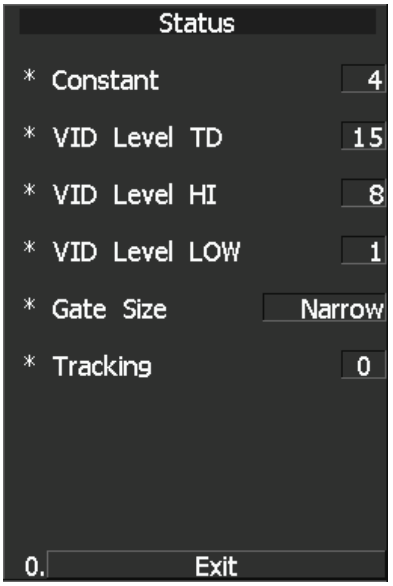
The TT Menu will appear

Press [6] key.

The TT Test Menu will appear.

2 Press [3] key.

The Status screen will appear..



*Constant:	Vector response
*Video Level TD:	Threshold value used for tracking
*Video Level HI:	VD threshold value used for automatic acquisition/activate zone
*Video Level Low:	Unused
*Gate Size:	Size of gate used for tracking
*Tracking:	Number of targets currently acquired

[IV] Gate Display

The gate displays an area monitoring a target using the TT function. This radar equipment allows the gate size to change automatically according to target distance and size. User can check the gate size using the following function.

Procedure

1 Press [TT MENU] key.
Press [6] key.

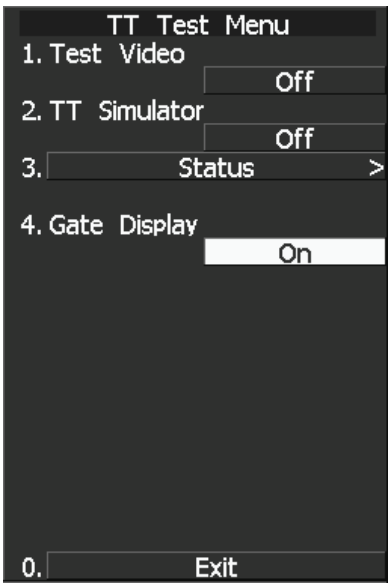
The TT Test Menu will appear.

2 Press [4] key.

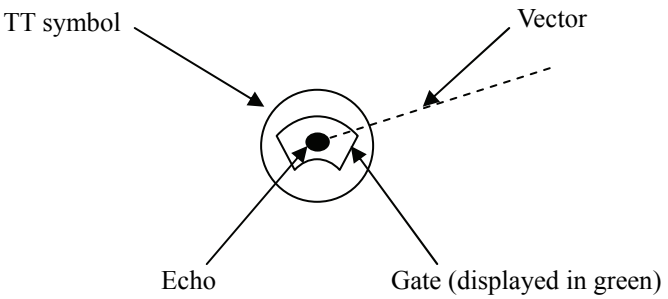
The gate display mode is switched.
ON: Gate is displayed
OFF: Gate is not displayed

3 The gate displays data of a target you want to check using the cursor and [TGT DATA] key. (See Section 5.3.6 "Displaying Numeric Data of AIS Targets (TGT DATA).")

The data is displayed, and the gate is displayed around the TT symbol in green.



Note: The TT function can display the gate of two targets simultaneously.



5.3 AIS OPERATION

5.3.1 Restrictions

Attention

There are the following limitations on use of the AIS function, system, and operation:

[I] This system can display up to a total of 130 targets.
Of which, up to 30 activated targets can be displayed.
There are 3 types of filters for controlling sleeping target display.
(Refer to Section 5.3.8 “Setting AIS Filter (AIS Filter Setting)”.)

[II] The following restrictions are placed on use of the AIS function.

- **The AIS function is unavailable in the following cases:**
  MAN is selected for the speed sensor.
  The current offset (Set/Drift Setting) is set while LOG or 2AXW is selected for the speed sensor.
  The GPS geodetic system is used except WGS-84.
- **LOG or 2AXW cannot be selected for the speed sensor in the following case:**
  The AIS function is turned on and the current offset (Set/Drift Setting) is selected.
- **MAN cannot be selected for the speed sensor in the following case:**
  The AIS function is On.
- **Current offset (Set/Drift Setting) cannot be turned On in the following case:**
  LOG or 2AXW is selected for the speed sensor while

* The AIS function is optional for non-MED ships.
Use of this function requires AIS I/F (option).

5.3.2 Initial Setting

This section explains the initial setting for using the AIS function.

Setting the GPS antenna location

Set the GPS antenna location. Set offset ranges in longitudinal direction and latitudinal direction from the own ship's reference position.
For the setting procedure, refer to Section 7.1.6 “Setting of CCRP/Antenna/GPS Antenna Position (CCRP Setting).”

Attention

- **If offset ranges are not set correctly, AIS symbols and radar echoes may be displayed shifted.**
- **When offset ranges are set, latitude and longitude data received from the GPS is offset, and the offset data is displayed as the latitude and longitude of own ship’s position.**

Setting collision decision criteria (CPA Limit/TCPA Limit)

The collision decision criteria for the TT function are applied to the AIS function.
For the setting procedure, refer to Section 5.1.5 “Setting Collision Decision Criteria (CPA/TCPA Limit).”
Note that the same collision decision criteria must apply to TT.

Attention

- **Set the optimum values of collision decision conditions, depending upon vessel type, water area, weather, and oceanographic conditions.**

Procedure

1 Press [TT MENU] key.

2 Press [3] key.

The Target Setting Menu will appear.

3 Press [5] key.

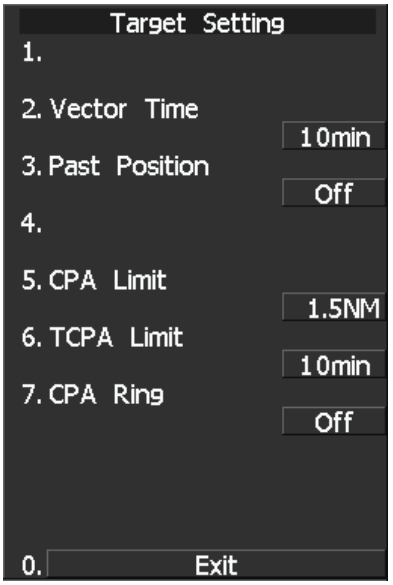
The ten-key screen will appear.

4 Using numeric keys, enter the CPA value you want to set, and then press [ENT] key.

The entered CPA Limit value is determined.

5 Press [6] key.

The ten-key screen will appear.



6 Using numeric keys, enter the TCPA value you want to set, and then press [ENT] key.

The entered TCPA Limit value is determined.

5.3.3 Setting AIS Display Function (AIS Function)

Switch the AIS symbol display function to ON/OFF.

Attention

- **When the AIS display function is set to OFF, no AIS symbols are displayed.**
- **The AIS display function itself is turned OFF.**
- **Once the AIS display function is set to OFF, it is not automatically switched to ON even if a dangerous target exists.**

Procedure

1 Press [TT MENU] key.

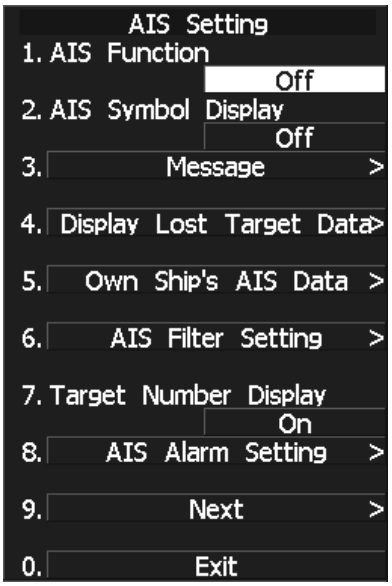
Press [2] key.

The AIS Setting menu will appear.

2 Press [1] key.

The AIS Function is switched between ON and OFF.

ON: Enables the AIS display function.
OFF: Disables the AIS display function.



* Software button ⑧ located at the other ship's information area in Section 2.3.6 is also available to switch the display functions.

* Note that turning OFF this function switches all AIS display functions to OFF.

5.3.4 Activating AIS Targets (Activate AIS)

Activate an AIS target, and display the target's vector and make a collision decision.

Manual activation

Activate an AIS target[*1] in manual mode to display the vector and HL.

Procedure

1 Press the CURSOR button at the upper right of the radar display several times until ACT AIS appears.

The cursor mode is set to the AIS activation mode.

2 Move the cross cursor mark onto the inactive AIS target that is to be activated[*1], and press [ENT] key.

The selected AIS target will be activated[*1].

Automatic activation

Activate an AIS target in automatic mode to display the vector and heading line.
When the automatic activation function is used, AIS targets are automatically activated when they go into the automatic activation zone. The automatic activation zone is identical to the automatic acquisition zone (AZ) used for target tracking. For the zone setting, refer to Section 3.5.20 "Auto Acquisition" and Section 5.2.1 "Acquiring Target [ACQ]."

Reference If an AIS target is activated but the vector is not displayed, refer to "Setting AIS Symbol Display Function (AIS Symbol Display)" in Section 5.1.2 "Definitions of Symbols."

[*1] For activation of targets, refer to "Types and Definitions of AIS Target Symbols" in Section 5.1.2 "Definitions of Symbols."

5.3.5 Deactivating AIS Targets (Deactivate AIS)

Deactivate an AIS target[*2] and clear the display of the vector and HL.

Attention

- **The operation above is effective only for active targets.**

Procedure

1 Press the CURSOR button at the upper right of the radar display several times until CANCEL appears.

The cursor mode is set to the deactivation mode.

2 Move the cross cursor mark onto the active AIS target that is to be deactivated[*2], and press [ENT] key.

The selected AIS target will be deactivated[*2] .

Alternative

1 Press the CURSOR button at the upper right of the radar display several times until ACT AIS appears.

The cursor mode is set to the AIS activation mode.

2 Move the cross cursor mark onto the inactive AIS target that is to be activated[*1], and press [CLR/INFO] key.

The selected AIS target will be deactivated[*2]

[*2] For deactivation of targets, refer to "Types and Definitions of AIS Target Symbols" in Section 5.1.2 "Definitions of Symbols."

5.3.6 Displaying Numeric Data of AIS Targets (TGT DATA)

Numerical data for a specified AIS target is displayed.

Types of numeric data displayed

Display items

- Navigation information

BRG (true bearing)	0.01° unit
RANGE	0.01nm unit
COG (course over ground)	0.1° unit
SOG (speed over ground)	0.1knot unit
CPA (closest point of approach)	0.1nm unit
TCPA (time to CPA)	0.1min unit
HDG (heading bearing)	1° unit
ROT (course change speed)	0.01°/min

- Destination and location information

Destination	
Estimated time of arrival	
L/L (latitude/longitude)	0.0001’ unit
Position fixing device	
RAIM	
Position fixing accuracy	

- Ship information

NAME (ship name)	Up to 20 characters
CALL SIGN	Up to 7 characters
MMSI	Up to 9 characters
IMO number	
Navigation status	

- AtoN information

AtoN class
AtoN type

If missing is displayed in place of the numeric information of ROT, the radar is receiving the AIS data which cannot is displayed. In this case, you can only trust the turning direction which is indicated by the turn indicator. The turn indicator is displayed on the AIS symbol as the line perpendicular to the heading direction. (Refer to Section 5.1.2 "Types and Definitions of AIS Target Symbols")

If the numeric information of SOG or STW is 102.2kn, the target ship's speed is 102.2kn or over. Then the system cannot calculate CPA and TCPA. Therefore, missing is indicated in the CPA and TCPA information.

Displaying numeric data

Procedure

1 Press the CURSOR button at the upper right of the radar display several times until TGT DATA appears.

The cursor mode is set to the numeric data display mode.

2 Move the cross cursor mark onto the active AIS target for which numeric data is to be displayed, and press [ENT] key.

The values of the selected AIS target will appear on the right side of the radar display. The mark ⌜ ⌝ ⌞ ⌟ is displayed around the symbol.

Reference: If the values are displayed but the mark ⌜ ⌝ ⌞ ⌟ is not on the radar display, the target is outside the radar display.

Clearing numeric data

Procedure

1 Press the Cursor button at the upper right of the radar display several times until TGT Data appears.

The cursor mode is set to the numeric data display mode.

2 Move the cross cursor mark onto the active AIS target for which numeric data is to be cleared, and press [CLR] key.

The values of the selected AIS target will be cleared from the right side of the radar display, and the mark ⌜ ⌝ ⌞ ⌟ displayed around the symbol will also disappear.

AIS information panel display setting

A set of AIS information to be preferentially displayed (before other sets of information) on the AIS information panel can be specified.
Information type can be selected from the choices of: navigation information, ship information, and destination and location information.

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

2. AIS setting
9. Next menu list
2. AIS numerical data display setting

Select AIS information panel display setting.
AIS numerical data display setting menu is displayed.

3 Press a number key for the desired setting.

Navigation information :
COG/SOG, CPA/TCPA, azimuth, distance, and turning ratio
Ship information :
ship name, call sign, and MMSI
Destination and location information :
destination, arrival time, and location

AIS information for the selected condition will be displayed.

Received AIS message display

Messages received from AIS can be displayed.
Messages can be displayed while the received AIS message display screen is displayed.

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

2. AIS setting
3. Received AIS message display

1. Messages for a specific address:
Messages sent to own ship are displayed.
2. Broadcasted message:
Messages sent to all vessels are displayed.

Lost target data display

Information of the last lost AIS target can be displayed.
Data can be displayed for the target that was lost most recently.

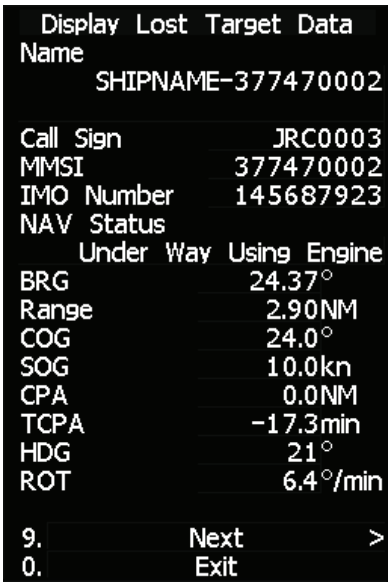
Procedure

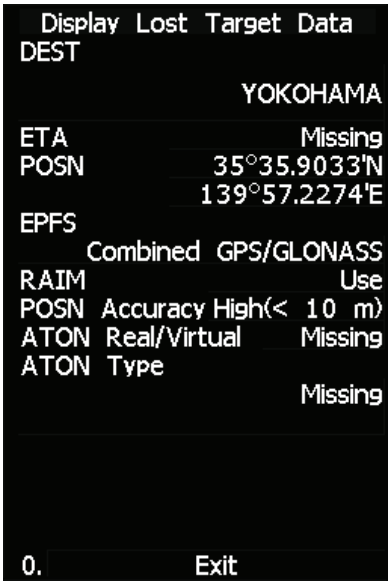
1 Press the [TT menu] key.

2 Press the following buttons.

2. AIS setting
4. Lost target data display

Information of the last lost AIS target is displayed.





5

AIS own ship information display

AIS information for own ship can be displayed.

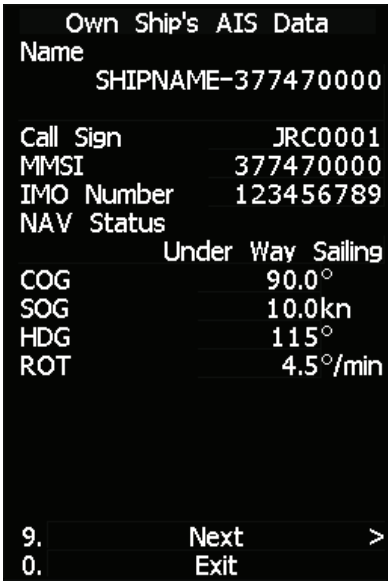
Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

2. AIS setting
5. AIS own ship information display

AIS information for own ship is displayed.



5.3.7 Displaying Target ID No. (Target Number Display)

A target ID number is a value displayed beside the AIS symbol.
ID numbers are assigned to AIS symbols in displayed order. ID numbers 1 to 130 are automatically assigned. Each target is identified by the assigned ID number until it is lost.

Procedure

1 Press [TT MENU] key.

2 Press [2] key.

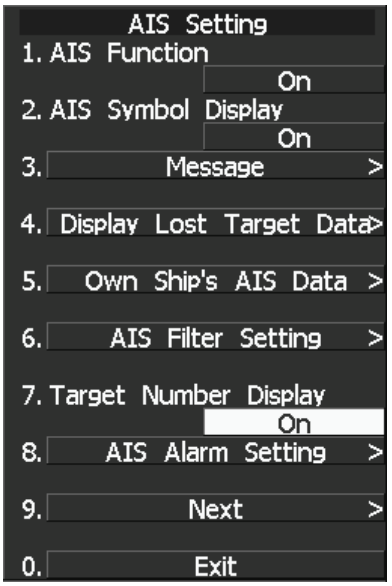
The TT Setting menu will appear.

3 Press [7] key.

The Target Number Display is switched ON or OFF.

ON: Displays target ID numbers.
OFF: Hides target ID numbers.
Target TRACK:
Displays target ID number with target track.

If there are many AIS targets and their symbol display is confusing, set Target Number Display to OFF to view the radar display easily.



Note: An ID number is always displayed for only targets with which numeric data is displayed.

5.3.8 Setting AIS Filter (AIS Filter Setting)

About an AIS filter

Once the AIS filter is set, only the AIS targets that are inside the filter area are displayed (setting can be made such that sleeping targets outside the AIS filter will not be shown).
The filter is initially set in a circle having a radius of 20 [nm] from the own ship's position. If 131 or more targets exist in the filter range, they are displayed according to the priority explained in "Types and Definitions of AIS Target Symbols" of Section 5.1.2 "Definitions of Symbols."

Type of AIS filters (Filter Type)

There are the following three types of AIS filters:
1) RANGE..... A filter is set in a circle with a set range as the radius.
2) SECTOR ..... A filter is set in a sector formed by two bearings with the bow as reference.
3) ZONE..... A filter is set in a zone formed by two bearings and two ranges with the bow as reference.

Procedure

1 Press [TT MENU] key.

Press [2] key.

Press [6] key.

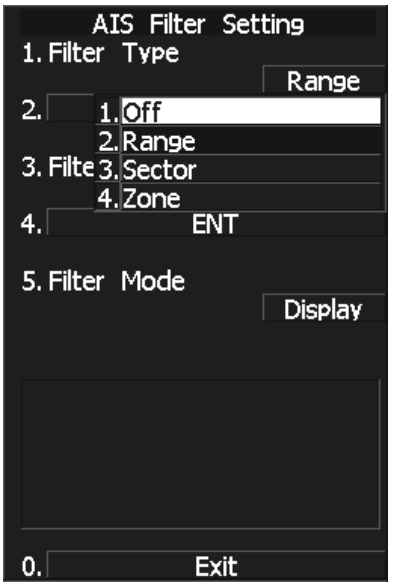
The TT Filter Setting menu will appear.

2 Press [1] key.

The Filter type selection screen will appear.

3 Select the AIS filter type to be set, pressing the numeric key.

The selected AIS filter type will be determined.

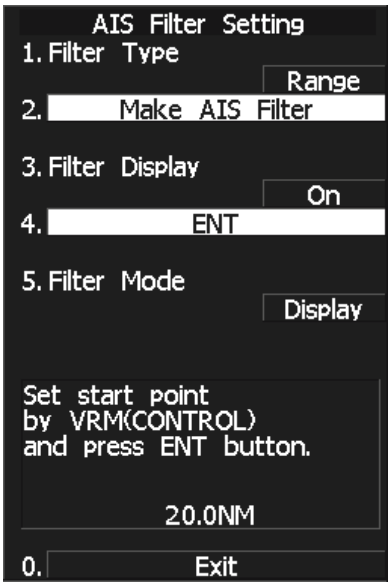


Making an AIS filter (Make AIS Filter)

Procedure

1 Press [2] key while the AIS Filter Setting menu is open.

The Make AIS Filter screen will appear.



[I] Setting a RANGE filter

2 Turn the [VRM] key control to set a filter range, and press [ENT] key.

The range of a RANGE filter will be set.
AIS targets in the set circle are displayed by priority.

[II] Setting a SECTOR filter

2 Turn the [EBL] key control to set the bearing of the port side, and press [ENT] key.

3 Turn the [EBL] key control to set the bearing of the starboard, and press [ENT] key.

A SECTOR filter will be set.
AIS targets in the area formed by the two set bearings are displayed by priority.

[III] Setting a ZONE filter

2 Turn the [EBL] key and [VRM] key controls to set the bearing and range of the port side, and press [ENT] key.

3 Turn the [EBL] key and [VRM] key controls to set the bearing and range of the starboard, and press [ENT] key.

A ZONE filter will be set.
AIS targets in the area formed by the two set bearings and ranges are displayed by priority.

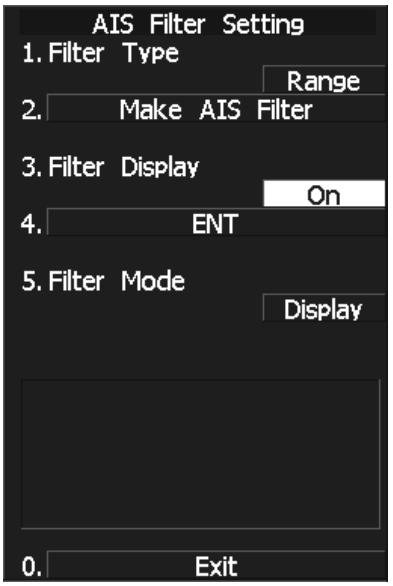
Setting the AIS filter display function to ON/OFF (Filter Display)

Procedure

1 Press [3] key while the AIS Filter Setting menu is open.

The setting of AIS Filter display will be switched ON or OFF.

ON: Displays the AIS filter.
OFF: Hides the AIS filter.



Display of Targets outside AIS Filter (Filter Mode)

Procedure

1 Press [TT MENU] key.

Press [2] key.

Press [6] key.

2 Press the [5] key.

The Filter Mode is switched.

Display	:Displays only AIS targets in the AIS filter.
Priority	:Displays AIS targets in the AIS filter by priority, and also displays targets outside the AIS filter.

Note: Activated AIS targets can be displayed even when they are outside the AIS filter.

Point Filter

AIS targets which are not displayed because they are outside the AIS filter or at low priority levels can be activated by giving a higher priority to them.

Procedure

1 Press a few times the CURSOR button at the top right corner of the screen to call up ACT AIS.

The cursor mode is set to AIS activation mode.

2 Place the cursor over the location where you wish to set a point filter, and press the [ENT] key.

A point filter will be set at the cursor position.
If an AIS target is in the point filter, it will be activated.
When an AIS target is activated or an AIS target is not found within ten seconds, the point filter will be cleared.

5.3.9 Conditions for Deciding AIS Target to be Lost

About a lost target

When the data of an AIS target cannot be received for a specified time, the target is decided to be lost and the target data is deleted. As shown in the table below, the time until target data is deleted varies depending on the class of receive data and the target status.

Deciding AIS Target to be Lost

Target status	Time until data deletion	
	SOLAS ship (Class A)	SOLAS ship (Class B)
Vessel below 3 knots and it is now at anchor or on the berth (Class B: below 2 knots)	**18 min**	**18 min**
Vessel of 3 knots or more and it is now at anchor or on the berth	**60 sec**	**18 min**
Vessel of 0 to 14 knots (Class B: 2 to 14 knots)	**60 sec**	**180 sec**
Vessel of 0 to 14 knots and it is now changing the course	**60 sec**	**180 sec**
Vessel of 14 to 23 knots	**36 sec**	**180 sec**
Vessel of 14 to 23 knots and it is now changing the course	**36 sec**	**180 sec**
Vessel of 23 knots or more	**30 sec**	**180 sec**
Vessel of 23 knots or more and it is now changing the course	**30 sec**	**180 sec**
SAR (Search and Rescue)	**60 sec**	**60 sec**
ATON (Aid to Navigation)	**18 min**	**18 min**
Base station	**60 sec**	**60 sec**

Reference:

- If Active targets (including dangerous ships) and numerically displayed targets is lost, a lost target alarm is issued, and the symbol changes to a lost target symbol. The system continues to display the symbol where it received the last data. If the ALARM ACK switch is pressed, the symbol is cleared.

5.3.10 Setting AIS Alarm (AIS Alarm Setting)

Conditions for setting off a lost AIS target alarm (Lost) and a dangerous target alarm (CPA/TCPA) can be set.

Lost target alarm (Lost)

Procedure

1 Press the [TT menu] key.

Press [2] key.

Press [8] key.

2 Press the [2] key.

The Lost Alarm setting is switched.

Off : Lost target alarm will not be active.
Dangerous ship : Lost target alarm will sound only for the AIS targets for which a dangerous target alarm has already been activated.
Activated and dangerous ship : Lost target alarm will sound only for the AIS targets for which an activated AIS target and dangerous target alarm has already been activated.

Note: Sleeping AIS targets will not set off a lost target alarm.

Dangerous target alarm setting (CPA/TCPA)

Procedure

1 Press the [TT menu] key.

Press [2] key.

Press [8] key.

2 Press the [1] key.

The Target Alarm (CPA/TCPA) setting is switched.

Activated : Dangerous target alarm will be activated only for activated AIS targets.
Activated & sleeping : Dangerous target alarm will be activated for all AIS targets that are displayed.

Off : Dangerous target alarm will not be activated.

5.4 TARGET ASSOCIATION ASSESSMENT (ASSOCIATION SETTING)

Caution

When a large value is set as an association condition, a tracked target near an AIS target is identified as the AIS target and may thus disappear from the display.
For example, when a pilot vessel equipped with the AIS function (a small target which is not a tracked target) goes near a cargo vessel which is a tracked target without the AIS function, the tracked target symbol for the cargo vessel may disappear.

5.4.1 Target Association Assessment

Whether or not the AIS target and the tracked targets are identical is assessed. If they are determined to be identical, an association symbol is displayed.
When this occurs, the AIS target symbol is activated automatically.

Attention

- **Turn off the software button ⑪ Association located at the other ship's information area in Section 2.3.6 if you wish to cancel association assessment or to bring back symbols that are no longer displayed.**

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

3 Target setting
1 Association assessment setting
1 Association assessment

On : Use the association assessment function.
(Targets that are judged to be identical will be indicated as an association symbol.)
Off : Do not use the association assessment function.
(AIS target and tracked target are shown separately even though they are determined to be identical.)

5.4.2 Priority

An association symbol can be created based on either AIS target data or tracked target data.

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

3 Target setting
1 Association assessment setting
2 Priority

AIS : Symbol is created and displayed based on AIS target data.
TT : Symbol is created and displayed based on tracked target data.

5.4.3 Azimuth

Set an azimuth difference between targets to be identified as one target.
Targets that are within the set azimuth range will be identified as one target.

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

3 Target setting
1 Association assessment setting
3 Azimuth

Set an azimuth difference between a tracked target and an AIS target to be identified as one target. Set the azimuth range between 0.0 and 9.9 degrees.

A narrower azimuth range means a stricter condition.
The possibility of mistakenly identify resembling targets will be lower, but targets are less likely to be identified as one target.

A wider azimuth range means a looser condition.
Targets are likely to be identified as one target, but targets with similar parameters are likely to be mistakenly identified.

Adjust the setting in accordance with the intention.

5.4.4 Distance

Set a distance between targets to be identified as one target.
Targets that are within the set distance will be identified as one target.

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

3 Target setting
1 Association assessment setting
4 Distance

Set a distance between a tracked target and an AIS target to be identified as one target.
Set the distance between 0 and 999 m.

A shorter distance means a stricter condition.
The possibility of mistakenly identify resembling targets will be lower, but targets are less likely to be identified as one target.

A longer distance means a looser condition.
Targets are likely to be identified as one target, but targets with similar parameters are likely to be mistakenly identified.

Adjust the setting in accordance with the intention.

5.4.5 Course

Set a course difference between targets to be identified as one target.
Targets that are within the set course angle will be identified as one target.

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

3 Target setting
1 Association assessment setting
5 Course

Set a course difference between a tracked target and an AIS target to be identified as one target. Set the course angle between 0 and 99 degrees.

A narrower course angle means a stricter condition.
The possibility of mistakenly identify resembling targets will be lower, but targets are less likely to be identified as one target.

A wider course angle means a looser condition.
Targets are likely to be identified as one target, but targets with similar parameters are likely to be mistakenly identified.

Adjust the setting in accordance with the intention.

5.4.6 Speed

Set a speed difference between targets to be identified as one target.
Targets that are within the set speed range will be identified as one target.

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

3 Target setting
1 Association assessment setting
6 Speed

Set a speed difference between a tracked target and an AIS target to be identified as one target. Set the speed range between 0 and 99 kn.

A smaller speed range means a stricter condition.
The possibility of mistakenly identify resembling targets will be lower, but targets are less likely to be identified as one target.

A larger speed range means a looser condition.
Targets are likely to be identified as one target, but targets with similar parameters are likely to be mistakenly identified.

Adjust the setting in accordance with the intention.

5.4.7 Hysteresis

Set a hysteresis level at which a tracked target and an AIS target are identified as one target by the association assessment function.
Set the condition for using an association symbol when a tracked target symbol and an AIS target symbol overlap each other.

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

3 Target setting
1 Association assessment setting
7 Hysteresis

Set a level of hysteresis at which targets are identified as one target between 0% and 300%.
The standard percentage is 100%.

In the case of 100%, The level of hysteresis is equal to n/m.
n: The time of judgment which targets are identified as one target
m: The time of judgment
Therefore 50% means that the level of hysteresis is equal to n/(2*m).
200% means that the level of hysteresis is equal to (2*n)/m.

A larger value means a stricter condition.
The possibility of mistakenly identify resembling targets will be lower, but targets are less likely to be identified as one target.

A smaller value means a looser condition.
Targets are likely to be identified as one target, but targets with similar parameters are likely to be mistakenly identified.

Adjust the setting in accordance with the intention.

Caution

When a small value is set as a hysteresis condition, a tracked target near an AIS target is identified as the AIS target and may thus disappear from the display.
For example, when a pilot vessel equipped with the AIS function (a small target which is not a tracked target) goes near a cargo vessel which is a tracked target without the AIS function, the tracked target symbol for the cargo vessel may disappear.

5.4.8 Non-Hysteresis

Set a non-hysteresis level at which targets that were once identified as one target by the association assessment function are identified as separate targets.
Set the condition for separating an association symbol into a tracked target symbol and an AIS target symbol.

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

3 Target setting
1 Association assessment setting
8 Non-Hysteresis

Set a level of non-hysteresis at which an associated target is separated into individual targets between 0% and 300%. The standard percentage is 100%.

In the case of 100%, The level of non-hysteresis is equal to n/m.
n: The time of judgment which an associated target is separated into individual targets
m: The time of judgment
Therefore 50% means that the level of hysteresis is equal to n/(2*m).
200% means that the level of hysteresis is equal to (2*n)/m.

A larger value means a stricter condition.
It becomes harder to separate a tracked target symbol from an AIS target symbol.
Targets that are not separated to start with are less likely to be separated, and also, separated individual symbols are less likely to be displayed properly after separation.

A smaller value means a looser condition.
It becomes easier to separate a tracked target symbol from an AIS target symbol.
Targets that are not separated to start with are more likely to be separated, and also, separated individual symbols are more likely to be displayed soon after separation.

Adjust the setting in accordance with the intention.

Caution

When a small value is set as a hysteresis condition, a tracked target near an AIS target is identified as the AIS target and may thus disappear from the display.
For example, when a pilot vessel equipped with the AIS function (a small target which is not a tracked target) goes near a cargo vessel which is a tracked target without the AIS function, the tracked target symbol for the cargo vessel may disappear.

5.4.9 AIS Target to be Assessed

Specify an AIS target to be assessed for association.

Targets of association assessment can be either activated targets only or both activated and sleeping targets.

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

3 Target setting
1 Association assessment setting
9 AIS target to be assessed

Select AIS targets to be assessed for association.

Activated : Only activated targets will be assessed for association.
Activated & sleeping : All activated and sleeping targets will be assessed for association.

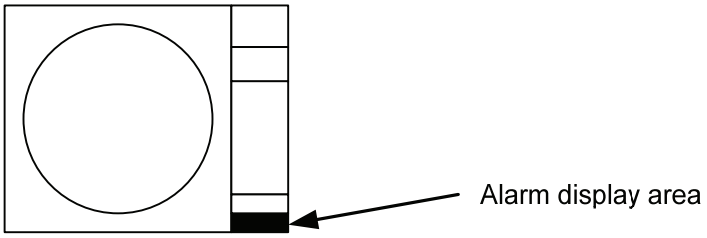
5.5 ALARM DISPLAY

Alarm messages for Target Tracking (TT) and AIS functions:

Error message	Description
TT CPA/TCPA	A dangerous target is detected in target tracking.
AIS CPA/TCPA	A dangerous AIS target is detected.
TT(New Target)	A new target being tracked was acquired in the automatic acquisition area.
AIS(New Target)	A new AIS target was activated in the automatic acquisition area.
TT(Lost)	A lost target is detected in target tracking.
AIS(Lost)	A lost AIS target is detected.
REF TT(Lost)	A reference TT target has been lost. (Accuracy decreased)
TT(MAX 95% Capacity)	The number of TT targets acquired has reached 95% of the maximum acquisition count.
TT(MAX Target)	The number of TT targets acquired has exceeded the maximum acquisition count.
AIS(ACT 95% Capacity)	The number of targets activated has reached 95% of the maximum activation count.
AIS(ACT MAX)	The number of targets activated has exceeded the maximum activation count.
AIS (MAX Target 95%)	The number of AIS targets displayed has reached 95% of the maximum display count.
AIS (MAX Target)	The number of AIS targets displayed has exceeded the maximum display count.
TT processing unit (Communication data error) *	Communication error with the TT processing unit
AIS (No communication)	No communication with AIS. The AIS transponder is not connected correctly or the power is turned off.
AIS (Communication data error)	AIS communication error. The data of communication with the AIS unit contains an error.
AIS I/F (No communication)	No communication with AIS IF. The AIS unit is not connected or is not operating.
AIS I/F (No data communication)	AIS I/F communication error. The data of communication with the AIS unit contains an error.
AIS(Alarm ***)	Alarm information issued with the ALR sentence by the AIS *** is a 3-digit number which is Local Alarm No in the ALR sentence.
AIS Alarm 001	Tx malfunction
AIS Alarm 002	Antenna VSWR exceeds limit
AIS Alarm 003	Rx channel 1 malfunction
AIS Alarm 004	Rx channel 2 malfunction
AIS Alarm 005	Rx channel 70 malfunction

AIS Alarm 006	general failure
AIS Alarm 008	MKD connection lost
AIS Alarm 025	external EPFS lost
AIS Alarm 026	no sensor position in use
AIS Alarm 029	no valid SOG information
AIS Alarm 030	no valid COG information
AIS Alarm 032	Heading lost/invalid
AIS Alarm 035	no valid ROT information

An alarm is displayed in the alarm indication (software button ⑭ located at the operation/message area in Section 2.3.9).



CPA / TCPA Alarm

Caution

Since these alarms may include some errors depending on the target tracking conditions, the navigation officer himself should make the final decision for ship operations such as collision avoidance.
Making the final navigation decision based only on the alarm may cause accidents such as collisions.

In the system, targets are categorized into two types: tracked / activate AIS targets and dangerous targets.
The grade of danger can easily be recognized on the display at a glance. So the officer can easily decide which target he should pay attention to.
The types of target and alarm are shown below.

CPA / TCPA Alarm

Status	Symbol on display	Alarm characters	Alarm sound	Conditions
Dangerous target	  Red blinking	CPA / TCPA	Beep sound (pee-poh) Alarm acknowledgeable	• CPA ≦ CPA LIMIT, • 0 ≦ TCPA ≦ TCPA LIMIT An alarm is issued when all the conditions are met. The AIS targets that issues alarm refer to Section 5.1.5 “Setting Collision Decision Criteria (CPA/TCPA Limit)”.

CPA Limit and TCPA Limit: The Setting Values

Alarm for New Target Acquired in Automatic Acquisition Zone (New Target)

Caution

In setting an automatic acquisition zone, it is necessary to adjust the gain, sea clutter suppression and rain / snow clutter suppression to ensure that target echoes are displayed in the optimum conditions. No automatic acquisition zone alarms will be issued for targets undetected by the radar, and this may cause accidents such as collisions.

The automatic acquisition function sets a zone in a range and issues an alarm when a new target (which is not yet acquired) goes into this zone.
For the setting of an automatic acquisition zone, refer to "Automatic Acquisition [AUTO]" in Section 5.2.1 "Acquiring Target [ACQ]."

Alarm for New Target Acquired in Automatic Acquisition Zone

Status	Symbol on display	Alarm characters	Alarm sound	Conditions
New target in automatic acquisition zone	 Red Blinking	New Target	Beep sound (pipi-pipi) Alarm acknowledgeable	The alarm is issued when a new target is acquired in the automatic acquisition zone.

Note: When an already acquired target goes into automatic acquisition zone, the alarm message is not displayed and the buzzer does not sound either.

Lost Target Alarm

Attention

- **If the gain, sea clutter suppression, rain/snow clutter suppression are not adjusted adequately, the lost target alarm may be easily generated. So such adjustments should be mad carefully.**

When it is impossible to continue tracking any acquired and tracked target, or the data of AIS target cannot received for a specified time, the LOST alarm will be generated. The typical causes for alarm generation are shown below, but not limited to the following:

- The target echo is very weak.
- The target is shadowed by a shore or a large ship and its echo is not received.
- The target echo is blurred by sea clutter returns.

If a target under tracking goes into a range of 32 nm and can no longer be tracked, it is canceled without a lost target alarm being issued.

Lost Target Alarm

Status	Symbol on display	Alarm characters	Alarm sound	Conditions
Lost target	  Red Blinking	Lost	Beep sound (pee) Alarm acknowledgeable	The alarm will sound once when a lost target symbol is displayed.

The AIS symbol blinks for x only.

System Function Alarm (TT Data)

When an abnormal state of an input signal or Target Tracking unit may have a trouble, alarm is generated. When an alarm occurs against any Target Tracking function, TT (Data) will appear in the alarm indication (Software button ⑭ located at the operation/message area in Section 2.3.9), but no indication is made in the Tracked Target information display (panel display area in Section 2.3.8). This status means that there is any operational trouble in the Target Tracking unit. Please, contact the service depot or the manufactures.

System Function Alarm

Alarm characters	Alarm sound	Conditions
TT (DATA)	Beep sound (pipipi) Alarm acknowledgeable	An alarm sound is generated when a Target Tracking circuit error occurs.

Gyro Set Alarm

The GYRO I/F in this system receives signals from a gyro. Even if the power is turned off, the system will follow up the gyro. However, the system stops the follow-up operation when the power of the master gyro is turned off or when any trouble occurs to the line. When the power of the master gyro is recovered, the Set Gyro alarm will be generated.
If this alarm occurs, set the gyro.

Gyro Set Alarm

Alarm characters	Alarm sound	Conditions
Set Gyro	Beep sound (pipi-pipi)	The signals from the gyro are stopped, but the gyro is recovered.

AIS Alarm Display

The following provides a list of the AIS alarm.

Alarm No.	Definition
001	Tx malfunction
002	Antenna VSWR exceeds limit
003	Rx channel 1 malfunction
004	Rx channel 2 malfunction
005	Rx channel 70 malfunction
006	general failure
008	MKD connection lost
025	external EPFS lost
026	no sensor position in use
029	no valid SOG information
030	no valid COG information
032	Heading lost/invalid
035	no valid ROT information

5.6 TRACK DISPLAY

5.6.1 Display Past Tracks (Past Position)

With the past position function (Past Position), up to 6 past tracked and AIS target positions can be displayed (5 set time and distance intervals).
Select one of the time intervals at which past time positions should be displayed: 0.5 minutes, 1 minute, 2 minutes, and 4 minutes. Also, select one of the distance intervals at which past locations should be displayed: 0.1 NM, 0.2 NM, 0.5 NM, and 1 NM.

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

3 Target setting
3 Past position

3 Press a number key for the desired setting.

0.5 minutes, 1 minute, 2 minutes, and 4 minutes :
Past positions are displayed at a specified time interval.
0.1 NM, 0.2 NM, 0.5 NM, and 1 NM :
Past locations are displayed at a specified distance interval.

The selected interval will be displayed on the Past position display interval switching button (Software button ⑥ located at the other ship's information area in Section 2.3.6).
The track display mode is not active when the button shows "Off." Track modes are linked with vector modes to show a true or relative track. In relative vector mode, the relative past position of the target is displayed. In true vector mode, the true past position, which is calculated from the relative bearing/range and the own ship's course/speed, is displayed.
The past position of a target being tracked is stored from when the target is acquired.
The past position of an AIS target is stored from when the target is activated.
If the past position plotted time is short, the indicated past position duration may not have achieved the specified time or range.

5.6.2 Other Ship's Tracks (Target Track Setting)

Make track settings for acquired tracked and AIS targets.
This equipment can display tracks of up to 20 other vessels.
The target track function is available between latitudes of 85°N and 85°S.

* Tracks of other ships will not be recorded with the Target Track Function is deactivated.

[I] Track color setting (Target Track Color)

Procedure

1 Turn OFF the cursor mode.

2 Place the cursor over a tracked target or an AIS target, and press the [CLR/INFO] key.

3 Target information menu opens.

4 Press the [2] key.

Track color choices are listed (Track Color).

5 Press a number key for the desired color.

The track will be shown in the selected color.

[II] Turning on/off the Target Track Function

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

4 Target Track Setting
1 Target Track Color

On : Activate the Target Track Function.
Off : Deactivate the Target Track Function.

* Selecting "Off" deactivates the entire Target Track Function.
Tracks will not be recorded; therefore, they cannot be checked later on.

[III] Other ship's track color setting (Target Track Color)

The track color can be the same for all tracked targets, or different colors can be assigned to the first 20 targets.

* Tracks of other ships will not be recorded with the Target Track Function is deactivated.

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

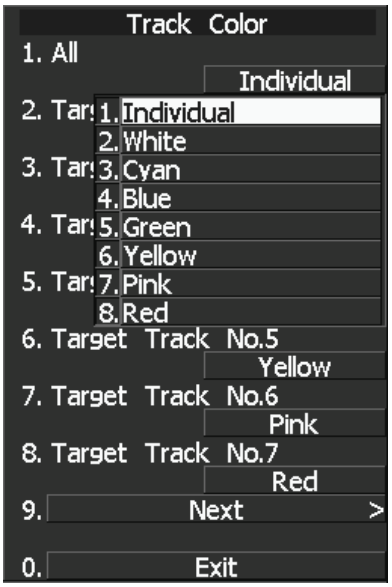
4 Target Track Setting
2 Target Track Color

3 Press the [1] key.

Choices for "All" are displayed.

4 Press a number key for the desired setting.

Individual : Assign different colors to individual tracks.
Color name : The selected color will be assigned to all tracks. Select a track color.



5

When "INDIVIDUAL" is selected

5 Press a number key for the desired track number.

Color choices for the selected track number are displayed.

6 Press a number key that corresponds to the desired track color.

The selected color will be assigned to the selected track.

Selecting "Individual" allows assignment of different colors to the first 20 tracks, from Track No.1 to Track No.20. Select a color for each target. Press the target number to see the list of available colors. Then, select a color.
There are 8 colors: Off/White/Cyan/Blue/Green/Yellow/Pink/Red.

* Note that different colors can be assigned to individual tracks only when "Individual" is selected.

[IV] Other ship's track display setting (Target Track Display)

Other ship's track display can be turned on/off. Also, track display mode can be chosen between display/non-display of all tracks and individual tracks.

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

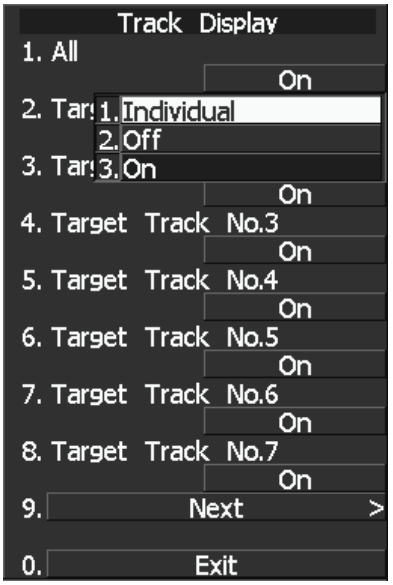
4 Target Track Setting
3 Target Track Display

3 Press the [1] key.

Choices for "All" are displayed.

4 Press a number key for the desired setting.

Individual : Set track display mode for each track.
Off : Hide all tracks for all ships.
On : Show all tracks for all ships.



* Even though the track display mode is set to "Off," tracks of other ships are still recorded as long as the track recording interval is set.

When "INDIVIDUAL" is selected

5 Press a number key for the desired track number.

Display/Non-display of the selected track can be set.

On : Show the track.
Off : Do not show the track.

Selecting "Individual" allows the track display mode to be set for the first 20 tracks, from Track No.1 to Track No.20. For each target, decide whether or not the track should be displayed. The mode changes between On and Off every time the On/Off window is pressed.

* Note that the track display mode can be set for individual tracks only when "Individual" is selected.

[V] Other ship track recording interval setting (Track Memory Interval)

A time interval for recording tracks of other ships can be set.

* This function can be used only when the Target Track Setting function is enabled.

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

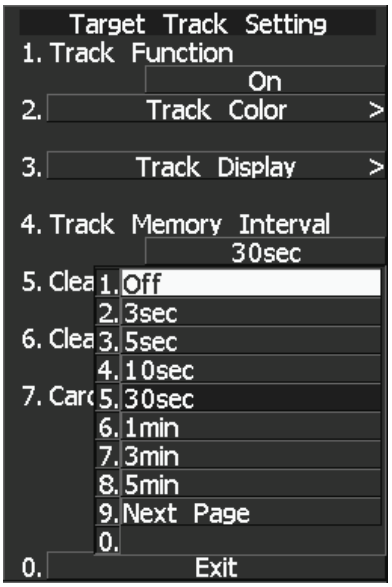
4 Target Track Setting
4 Track Memory Interval

Choices for "Target Memory Interval" are displayed.

3 Press a number key that corresponds to the desired track recording interval.

Select from the following:

Off,
3 sec, 5 sec, 10 sec, 30 sec,
1 min, 3 min, 5 min, 10 min, 30 min, 60 min,
1 NM, 3 NM, 5 NM, and 10 NM



[VI] Deletion of other ship's tracks (Clear Track)

Tracks of other ships can be deleted. They can be deleted by track color or by track number.

* When using the card-based track display function (Card T. TRK Display), tracks of other ships that are loaded from the card cannot be deleted.

Deletion of other ship's tracks by track color (Clear Track Color)

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

4 Target Track Setting
5 Clear Track Color

Choices for "Clear Track Color" are displayed.

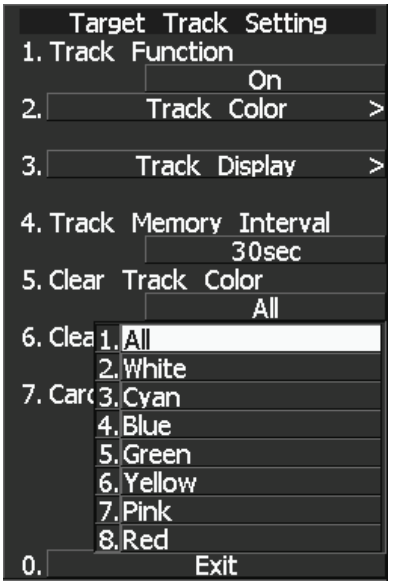
3 Press a number key that corresponds to the track color to be deleted.

The confirmation dialog window opens.

4 Press the [1] key.

Tracks of the selected color will all be deleted.

Select ALL to delete all tracks regardless of the color.



Deletion of other ship's tracks by track number (Clear Track Number)

Procedure

1 Press the [TT menu] key.

2 Press the following buttons.

4 Target Track Setting
6 Clear Track Number

Choices for "Clear Track Number" are displayed.

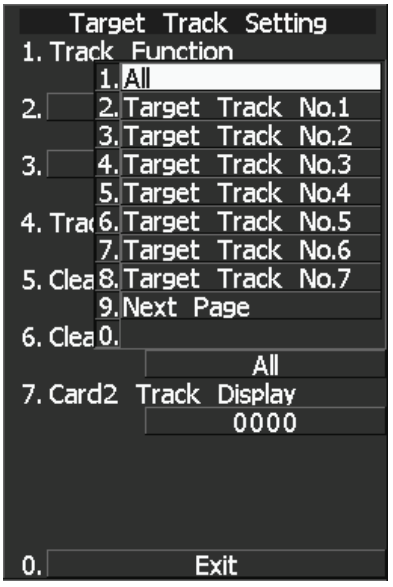
3 Press a number key that corresponds to the track number to be deleted.

The confirmation dialog window opens.

4 Press the [1] key.

Tracks of the selected number will all be deleted.

Select ALL to delete all tracks regardless of the number.



[VII] Loading target tracks from CARD2 (Card2 Track Display)

Target tracks saved in CARD2 can be loaded.

Procedure

1 Insert a Flash memory card into the card slot.

Refer to the attached instruction manual for how to insert/remove the card.

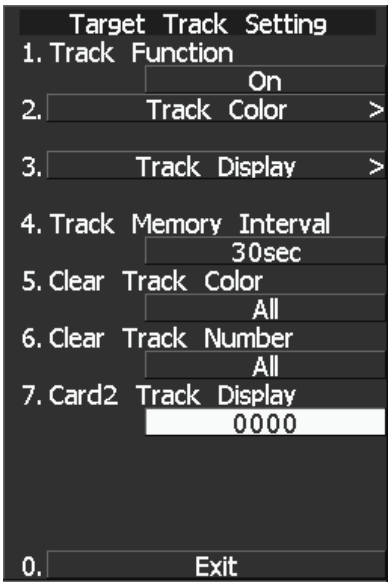
2 Press the [TT menu] key.

3 Press the following buttons.

4 Target Track Setting
7 Card2 Track Display

4 Input the number of track and press the [ENT] key.

Data of the selected track number is loaded and displayed on the radar screen.



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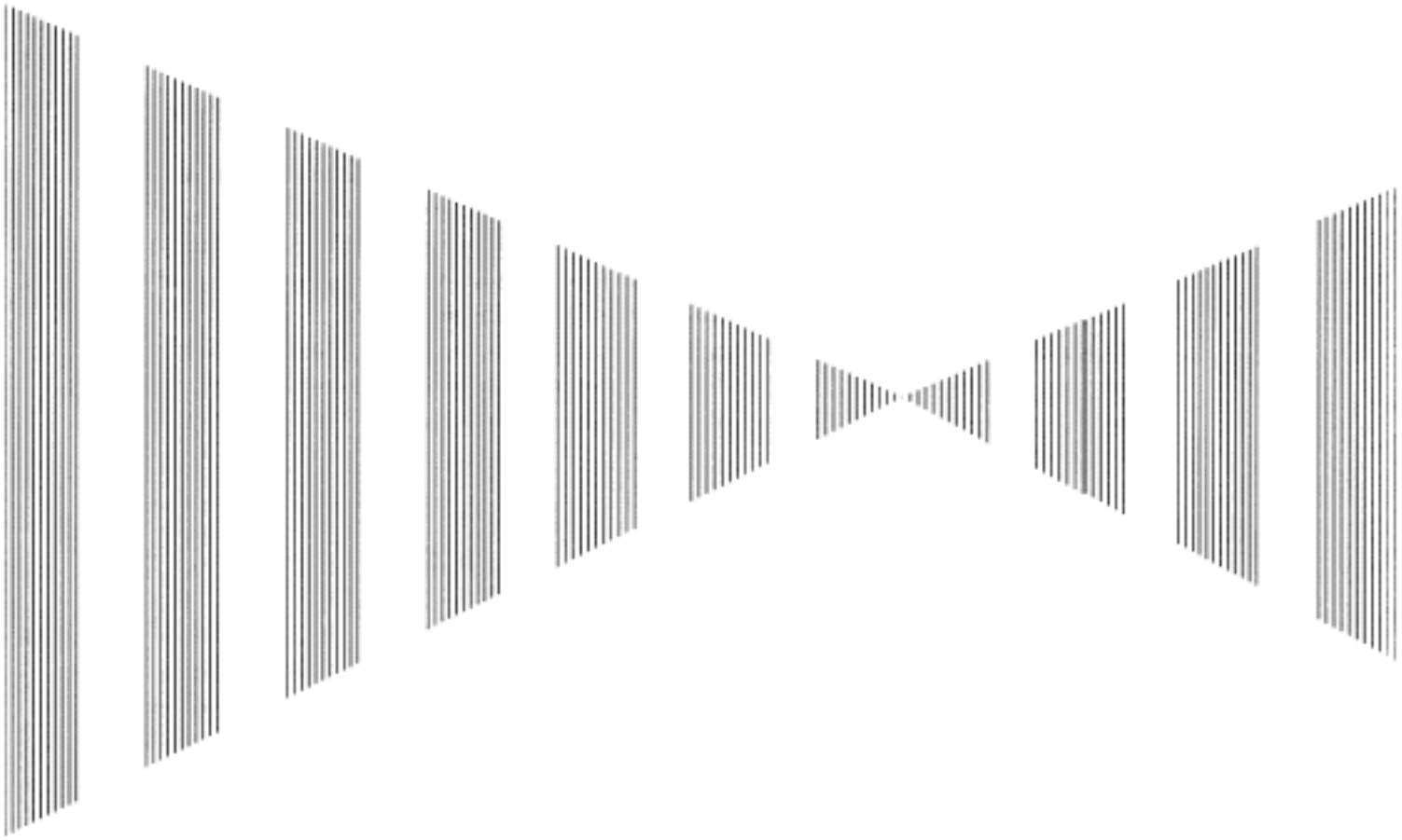
SECTION 6
TRUE AND FALSE ECHOES ON DISPLAY



The radar operator has a role of interpreting the radar displays to provide his best aid in maneuvering the ship. For this purpose, the operator has to observe the radar displays after fully understanding the advantages and disadvantages that the radar has. For better interpretation of radar display, it is important to gain more experiences by operating the radar equipment in fair weathers and comparing the target ships watched with the naked eyes and their echoes on the radar display.

The radar is mainly used to monitor the courses of own ship and other ships in open seas, to check buoys and other nautical marks when entering a port, to measure own ship's position in the coastal waters relative to the bearings and ranges of the shore or islands using a chart, and to monitor the position and movement of a heavy rain if it appears on the radar display.

Various types of radar display will be explained below.

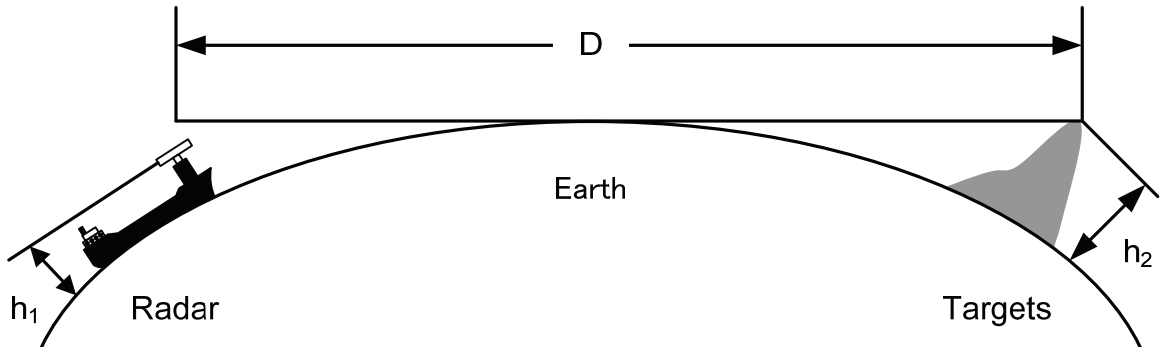
6.1 RADAR WAVE WITH THE HORIZON

Radar beam radiation has the nature of propagating nearly along the curved surface of the earth.
The propagation varies with the property of the air layer through which the radar beam propagates.
In the normal propagation, the distance (D) of the radar wave to the horizon is approximately 10% longer than the distance to the optical horizon. The distance (D) is given by the following formula:

$D=2.23(\sqrt{h1}+\sqrt{h2})(nm)$

h1: Height (m) of radar scanner above sea level
h2: Height (m) of a target above sea level

Figure 6.1 is a diagram for determining the maximum detection range of a target that is limited by the curve of the earth surface in the normal propagation.



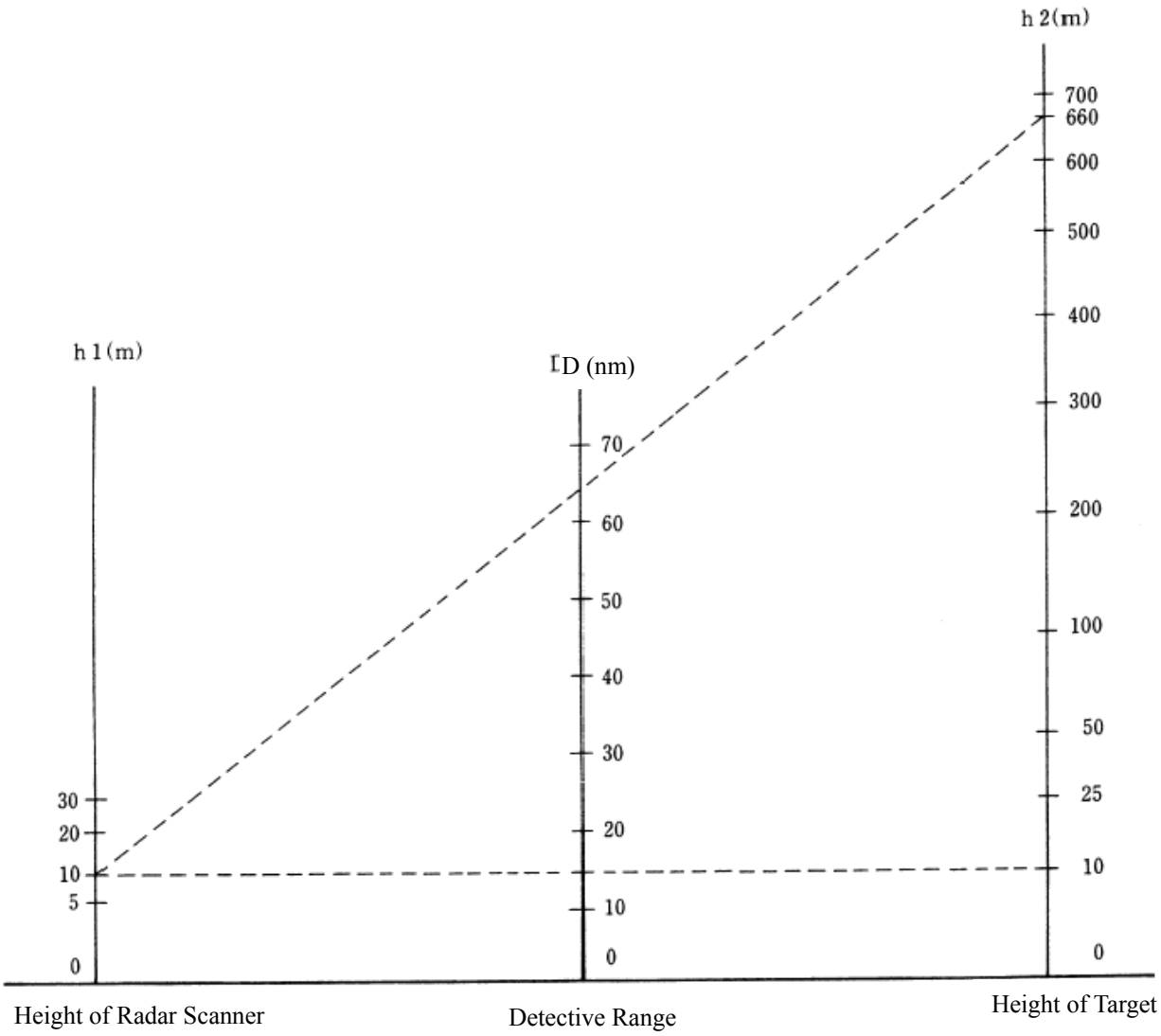


Figure 6.1

When the height of own ship's scanner is 10 m for instance,

(a) A target that can be detected at the radar range of 64 nm on the radar display is required to have a height of 660 m or more.

(b) If the height of a target is 10 m, the radar range has to be approx. 15 nm. However, the maximum radar range at which a target can be detected on the radar display depends upon the size of the target and the weather conditions, that is, the radar range may increase or decrease depending upon those conditions.

6.2 STRENGTH OF REFLECTION FROM THE TARGET

The signal intensity reflected from a target depends not only on the height and size of the target but also on its material and shape. The echo intensity from a higher and larger target is not always higher in general.
In particular, the echo from a coast line is affected by the geographic conditions of the coast.
If the coast has a very gentle slop, the echo from a mountain of the inland appears on the radar display.
Therefore, the distance to the coast line should be measured carefully.

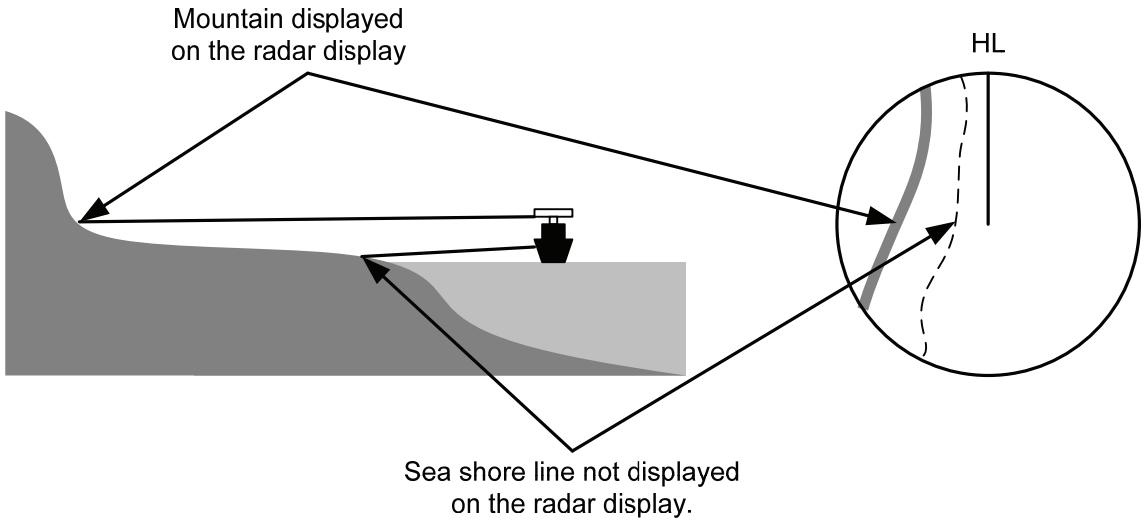


Figure 6.2

Table 6.1 shows the graph indicating the relation between the target detection distance and the radar reflection cross-sectional area (RCS) with regard to the type and the height of the target in a situation in which the weather is good, the sea state is calm and the radio wave propagation is normal. As revealed by this table, even on the same sea shore line, detection distance greatly differs depending on the height of the target from the surface of the sea. Furthermore, because the target detection distance is greatly influenced by the shape and material of the target and environmental conditions, such as the sea state, weather, and radio wave propagation, caution should be taken when detecting distance of target.

Table 6.1 Relation between type and height of target and detection distance and RCS

Type of target	Height from sea surface (m)	Detection distance (NM)		RCS (m²)	
		X band	S band	X band	S band
Sea shore line	60	20	20	50,000	50,000
Sea shore line	6	8	8	5000	5000
Sea shore line	3	6	6	2500	2500
SOLAS target ship (>5000GT)	10	11	11	50,000	30,000
SOLAS target ship (>500GT)	5	8	8	1800	1000
Small boat with IMO standard compatible radar reflector	4	5.0	3.7	7.5	0.5
Marine buoy with corner reflector	3.5	4.9	3.6	10	1
Standard marine buoy	3.5	4.6	3.0	5	0.5
10-meter small boat without radar reflector	2	3.4	3.0	2.5	1.4
Waterway location beacon	1	2.0	1.0	1	0.1

Caution: Detection distance shown in the above table may greatly decrease depending on the shape of the target, sea state, weather and radio wave propagation conditions.

6.3 SEA CLUTTER AND RAIN AND SNOW CLUTTER

In addition to the echo required for observing ships and land radar video image also includes unnecessary echo, such as reflection from waves on the sea surface and reflection from rain and snow. Reflection from the sea surface is called "sea clutter," and reflection from rain and snow is called "rain and snow clutter," and those spurious waves must be eliminated by the clutter rejection function.

[I] Sea clutter

Sea clutter appears as an image radiating outwardly from the center of the radar display and changing depending on the size and the shape of waves. Generally, as waves become larger, image level of the sea clutter is intensified and the clutter far away is also displayed. When waves are large and the sea clutter level is high, it is difficult to distinguish sea clutter from a small boat whose reflection intensity is weak. Accordingly, it is necessary to properly adjust the sea clutter rejection function. Table 6.2 shows the relation between the sea state (SS) showing the size of waves generated by wind and the radar's detection probability.

Table 6.2 Sea state and probability of target detection

RCS	SS1 to 2	SS2 to 3	SS3 to 4	SS4 to 5
0.1m^2	V	V-M	M-NV	
0.5 m^2	V	V	V-M	M-NV
1 m^2	V	V	V	V-M

S band radar (probability to detect a target at a distance of 0.4 NM)

RCS	SS1 to 2	SS2 to 3	SS3 to 4	SS4 to 5
1m^2	V-M	M-NV		
5 m^2	V	V-M	M-NV	
10 m^2	V	V	V	V-M

X band radar (probability to detect a target at a distance of 0.7 NM)

V: Detection probability of 80 %
M: Detection probability of 50 %
NV: Detection probability of less than 50 %

As shown in Table 6.3, the number of SS increases as the wind speed becomes high and the waves become large. Table 6.2 reveals that detection probability decreases from V (80 %) to NV (less than 50 %) as the number of SS increases. Therefore, even if the sea state is calm and a target clearly appears on the radar display, when the sea state becomes rough, target detection probability decreases resulting in difficulty of target detection by the radar.

Table 6.3 Relation between Douglas sea state and average wind speed and significant wave height

Sea state	Average wind speed (kn)	Significant wave height (m)
0	<4	<0.2
1	5-7	0.6
2	7-11	0.9
3	12-16	1.2
4	17-19	2.0
5	20-25	3.0
6	26-33	4.0

Significant wave height: an average of top N/3 higher waves when the number of waves detected within a constant time duration is N

For example, in the case of a standard marine buoy, RCS of X band radar is 5 m2 as shown in Table 6.1. When observing such a target in the sea state (SS3) in which significant wave height exceeds 1.2 meters, detection probability is M-NV, as shown in Table 6.2, which indicates 50 % or less.

[II] Rain and snow clutter

Rain and snow clutter is a video image that appears in a location where rain or snow is falling. The image changes according to the amount of rain (or the amount of snowfall). As precipitation increases, the image of rain and snow clutter becomes intensified on the radar display, and in the case of localized heavy rain, an image similar to the image indicating land is displayed in some cases. Furthermore, because radio waves tend to attenuate due to rain and snow, the ability to detect a target in the rain and snow clutter or a target beyond the rain and snow clutter may decrease. The amount of attenuation depends on the transmission frequency, antenna beam width, and the pulse length. Figure 6.3 and Figure 6.4 show examples in which detection distance is reduced due to the influence of precipitation. Because of this, a target, which clearly appeared up to 10 NM by an X band radar (pulse width of 0.8 μs) when it was not raining, may become dimly visible up to 5 NM when the amount of rain becomes 4 millimeters per hour. Furthermore, when comparing the X band radar with the S band radar, target detection distance decreases less when an S band radar is used, which means it is influenced less by precipitation.

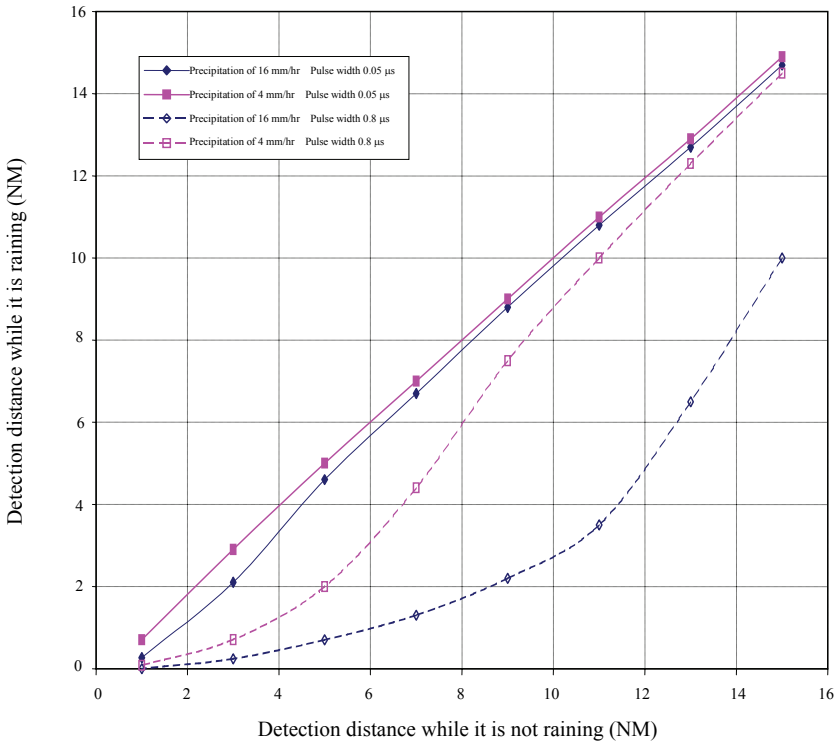


Figure 6.3 Decreased target detection distance by S band radar due to precipitation

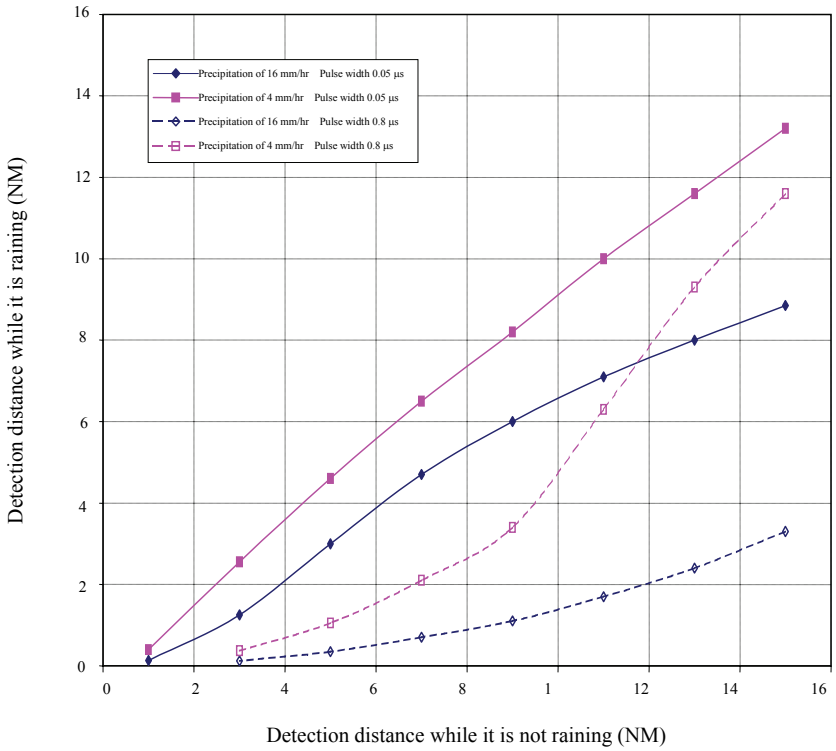


Figure 6.4 Decreased target detection distance by X band radar due to precipitation

[III] Coping with sea clutter and rain and snow clutter

When the weather is bad and the ocean is rough, the use of an S band radar is effective because the radar is not influenced by sea clutter so much and attenuation due to rain drops is small. When an X band radar is used, reducing the pulse width will reduce the influence by spurious waves, and also the spurious wave rejection function effectively works; therefore, the use of short pulse is effective when the weather is bad. By using image processing functions PROCl 1 to 3, it is expected that spurious waves are further suppressed. Since optimal settings for those items can be automatically made by using the function mode, it is recommended that STORM or RAIN be used by selecting the function mode when the weather is bad. For details of the function mode, see Section 3.10 “USE FUNCTION SWITCH [FUNC]”.
However, these functions may make some targets invisible, particularly targets with higher speeds.

6.4 FALSE ECHOES

The radar observer may be embarrassed with some echoes that do not exist actually. These false echoes appear by the following causes that are well known:

[I] Shadow

When the radar scanner is installed near a funnel or mast, the echo of a target that exists in the direction of the funnel or mast cannot appear on the radar display because the radar beam is reflected on the funnel or mast. Whether there are some false echoes due to shadows can be checked monitoring the sea clutter returns, in which there may be a part of weak or no returns.
Such shadows appear always in the same directions, which the operator should have in mind in radar operation.

[II] Side Lobe Effect

A broken-line circular arc may appear at the same range as the main lobe of the radar beam on the radar display. This type of false echo can easily be discriminated when a target echo appears isolated. (See Figure 6.5.)

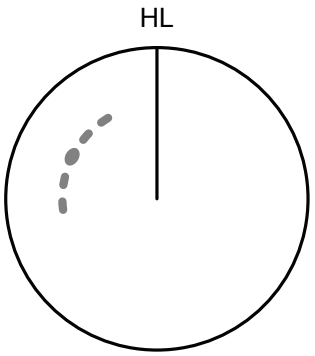


Figure 6.5

[III] False Echo by Secondary Reflection

When a target exists near own ship, two echoes from the single target may appear on the radar display.
One of those echoes is the direct echo return from the target and the other is the secondary reflection return from a mast or funnel that stands in the same direction as shown in Figure 6.6.

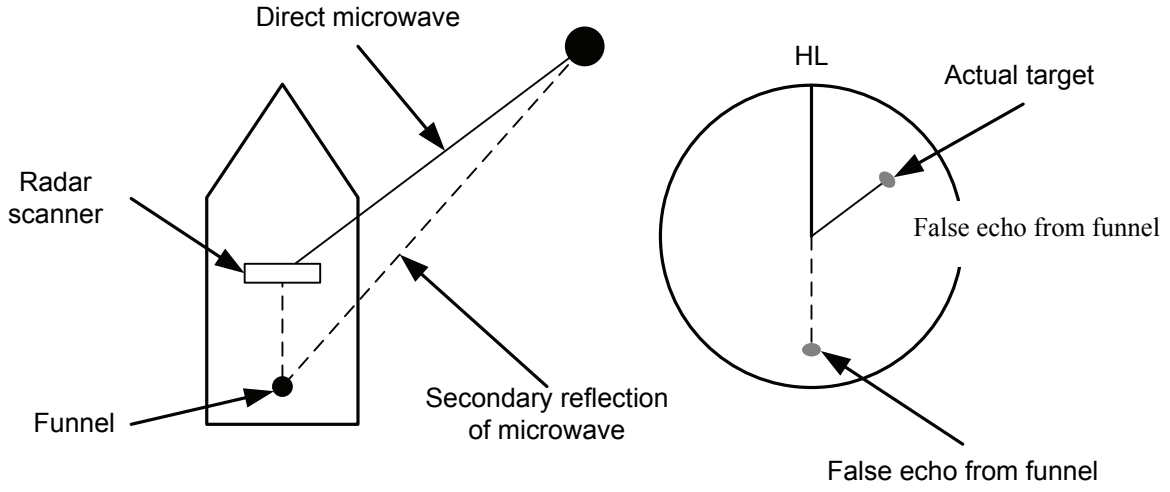


Figure 6.6

[IV] False Echo by Multiple Reflection

When there is a large structure or ship with a high vertical surface near own ship as shown in Figure 6.7, multiple refection returns may appear on the radar display. These echoes appear in the same intervals, of which the nearest echo is the true echo of the target.

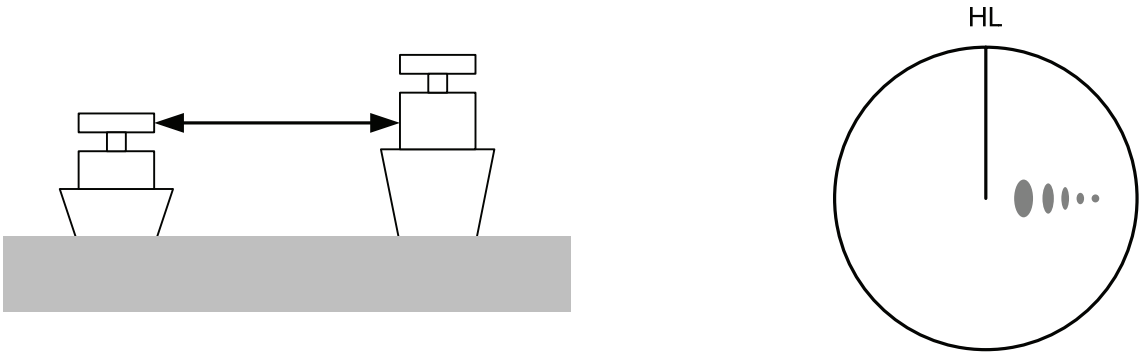


Figure 6.7

[V] Second Time Echoes

The maximum radar detection range depends upon the height of the scanner and the height of a target as described in the Section 6.1 “RADAR WAVE WITH THE HORIZON”. If a so-called "duct" occurs on the sea surface due to a certain weather condition, however, the radar beam may propagate to a abnormally long distance, at which a target may be detected by the radar.

For instance, assuming that the pulse length is MP3 (on the repetition frequency of 1400 Hz), the first pulse is reflected from a target at about 58 NM or more and received during the next pulse repetition time. In this case, a false echo (second time echo) appears at a position that is about 58 NM shorter than the actual distance. If the false echo appears at 5 NM on the radar display, the true distance of the target is 5+58=63 NM. On the pulse length is SP1 (on the repetition frequency of 2250 Hz), a false echo may appear at a position that is about 36 NM shorter than the actual distance.

This type of false echo can be discriminated by changing over the range scale (the repetition frequency), because the distance of the target changes accordingly.

If second time echo is appeared, the use of Economy mode in PRF menu is effective. Otherwise, Stagger Trigger menu set to on. (Refer to Section 3.9.5 “Set Scanner (TXRX Setting)”.)

[VI] Radar Interference

When another radar equipment using the same frequency band as that on own ship is near own ship, a radar interference pattern may appear on the radar display. This interference pattern consists of a number of spots which appear in various forms. In many cases, these spots do not always appear at the same places, so that they can be discriminated from the target echoes. (See Figure 6.8.)

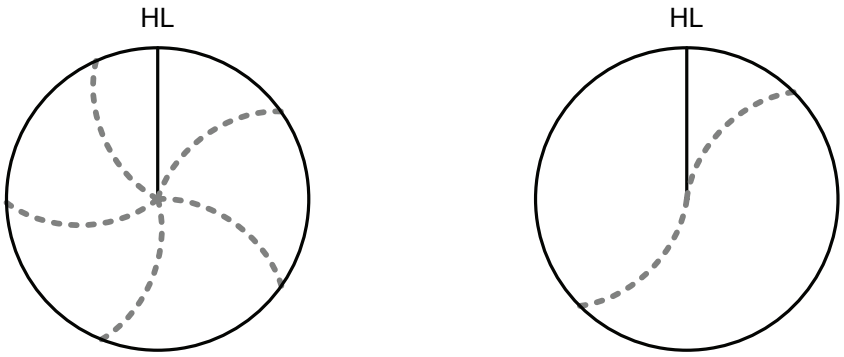


Figure 6.8

If radar equipment causing an interference pattern and this radar are of the same model, their transmitting repetition frequency is nearly the same. As a result, interference patterns may be displayed concentrically.
In this case, the interference patterns cannot be eliminated by using only the interference reflector function, so press **[TX/PRF]** several times to fine-tune the transmitting repetition frequency.
An interference suppressing effect can be heightened by applying a different transmitting repetition frequency to the interference pattern source radar and this radar.

6.5 DISPLAY OF RADAR TRANSPONDER (SART)

The SART (Search and rescue Radar Transponder) is a survival device authorized by the GMDSS (Global Maritime Distress and Safety System), which is used for locating survivors in case that a distress accident occurs at sea. The SART is designed to operate in the 9 GHz frequency band.
When receiving the 9 GHz radar signal (interrogating signal) transmitted from the radar equipment on a rescue ship or search aircraft, the SART transmit a series of response signals to inform the distress position to the rescue and search party.

* This radar provides a shortcut item to make settings for SART signal reception. Execution of this item automatically switches to the setting for SART reception.
  It also functions for detect the beacon or target enhancer.

Procedure

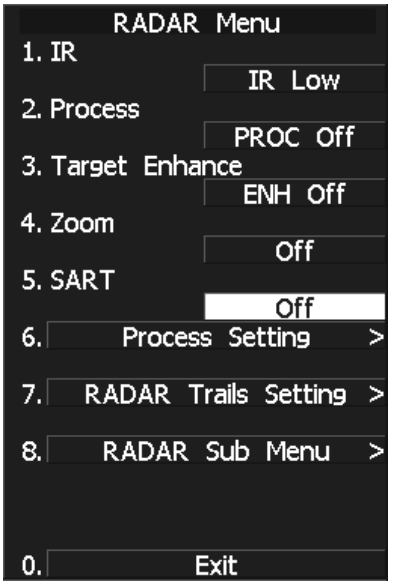
1 Press [RANGE +] or [RANGE -] to set the radar range to 6 NM or 12 NM.

2 Press [RADAR MENU] twice.

The RADAR Menu will appear.

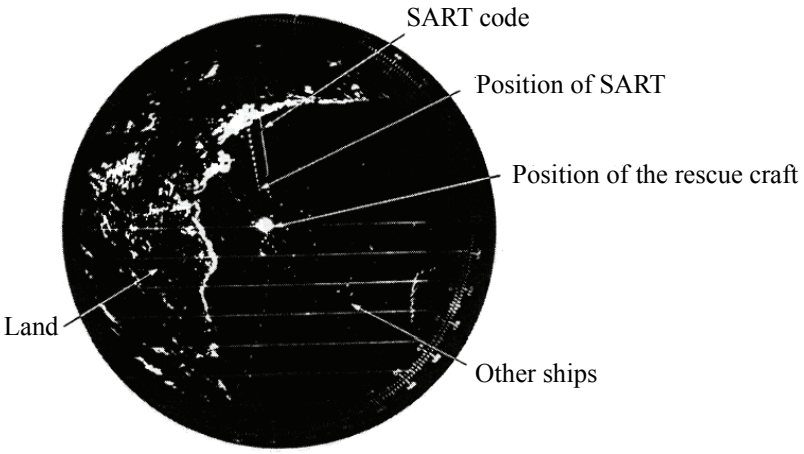
3 Press [5].

Each time the key is pressed, switching between ON and OFF takes place.



With the SART display mode set to ON, settings as shown below are made automatically.

(1)	Sea clutter control:	Minimum (Most counterclockwise)
(2)	AUTO SEA function:	OFF
(3)	Rain and Snow Clutter Control (RAIN):	minimum
(4)	Auto Rain and Snow Clutter function (AUTO RAIN):	OFF
(5)	TUNE control:	No tuning (to weaken clutter echoes)
(6)	Interference rejector (IR):	OFF
(7)	PROCESS:	OFF

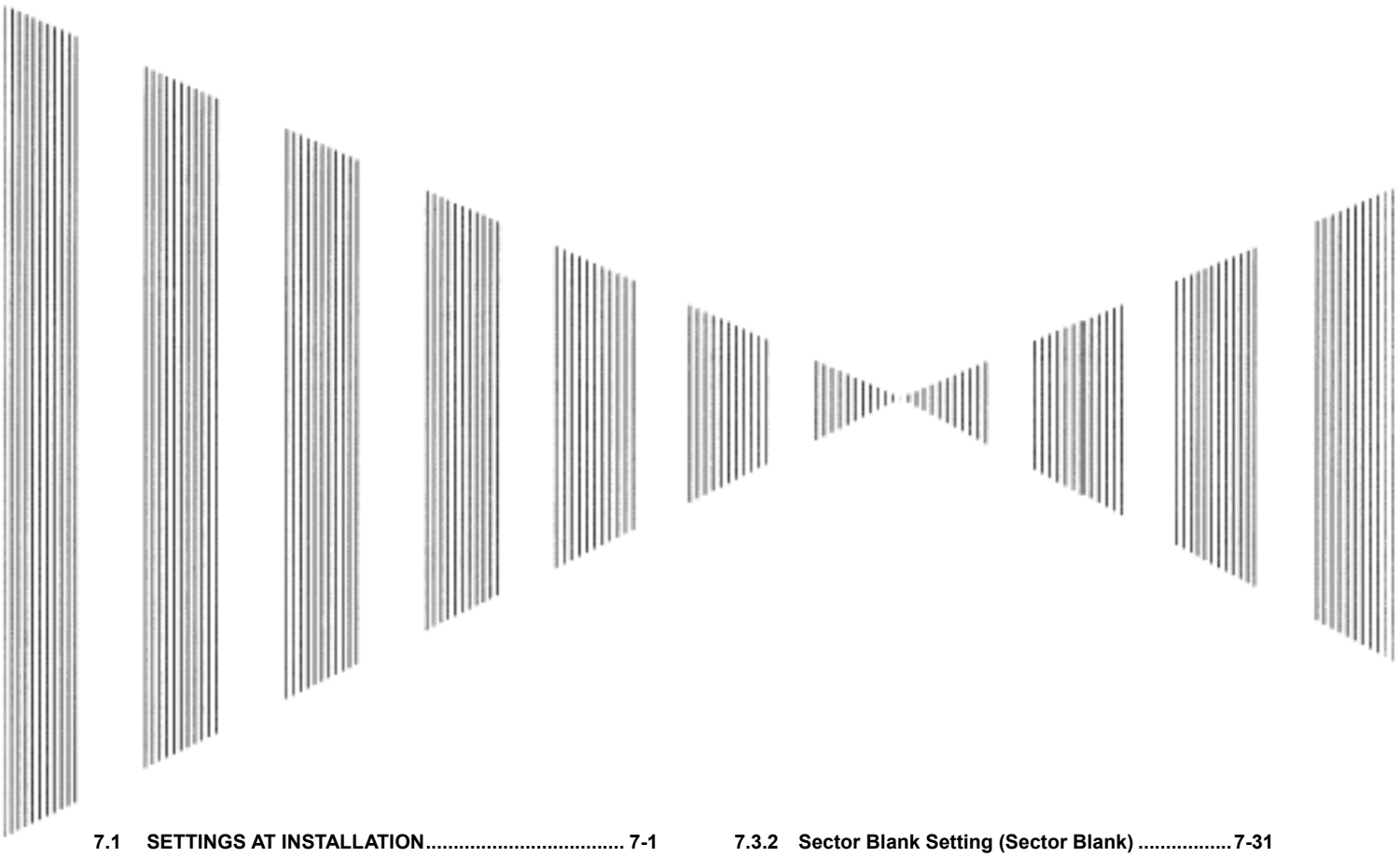


[Example of Display]

Attention

- **When the SART function is set to ON, small targets around own ship will disappear from the radar display. So it is necessary to exercise full surveillance over the conditions around own ship by visual watch in order to avoid any collision or stranding.**
  If two or more sets of radar equipment are installed on own ship, use one set of 9 GHz band radar for detection of the SART signal and operate others as normal radars for avoiding collision, monitoring targets around own ship, and checking on own ship's position and avoidance of stranding.
  After end of detecting the START signal, turn the START display off. Then the radar returns normally to the nautical mode.

SECTION 7
SETTINGS FOR SYSTEM OPERATION



7.1 SETTINGS AT INSTALLATION

This section describes the electrical adjustment procedures to be performed by service engineers during system installation.
The bearing adjustment value is saved to non-volatile memory in the scanner. Other settings are saviedto non-volatile memory in the radar process unit.

⚠ CAUTION
Do not carry out the adjustments of the equipment except authorized service persons. If wrong setting is carried out, this may cause unstable operation.
Do not carry out the adjustments during navigation. Otherwise, the radar performance may be affected, resulting in an accident or trouble.

Tuning, bearing and range adjustments can be made from the operation panel. Start the adjustment mode in the following procedures.

7.1.1 How to open the Adjust Menu

Procedure

1 Continue to press [RADAR MENU] key.

The Code Input Menu will appear.

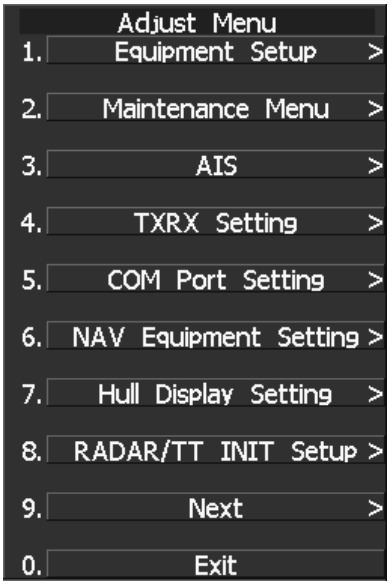
2 Press [0] key.

3 Move the cursor onto the "ENT" button in the Code Input menu, and press [ENT] key.

The Adjust Menu will appear.

4 Press [1] key.

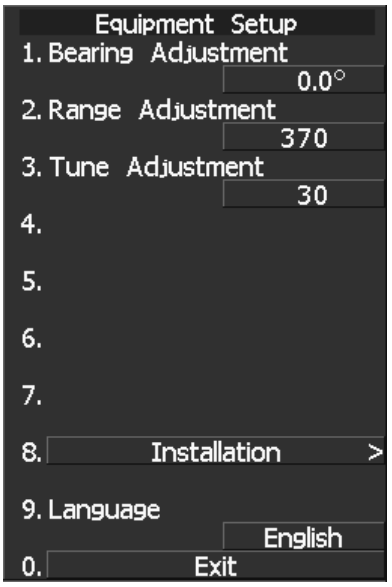
The Equipment Setup Menu will appear.



Exit

1 Press [RADAR MENU] key.

The Main Menu will reappear.



7

7.1.2 Tuning Adjustment

Adjust the tuning control for the transmitter and receiver.
The turning control should be adjusted when the system is installed or when the magnetron is replaced.

Procedure

1 Set a range of 24 NM or more.

2 Hold down [RADAR MENU] key.

The CODE Input screen opens.

3 Press [0] key.

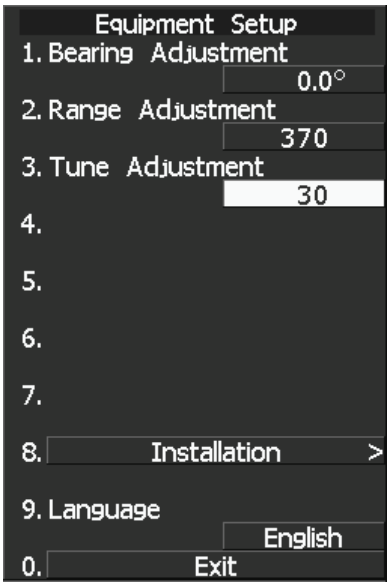
The numeric keypad screen opens.

4 Place the cursor over the "ENT" button of the numeric keypad and press [ENT] key.

Adjust Menu opens.

5 Press [1] key.

Equipment Setup menu opens.



6 Press [3] key.

A numeric keypad screen for Tune Adjustment opens.

7 Adjust the value until the tuning state gauge reaches maximum by inputting a value with the number keys or by turning the multi-dial to change the value.

8 When the adjustment is complete, place the cursor over the "ENT" button of the numeric keypad and press [ENT] key.

The adjustment value is memorized and the adjustment is complete.

Exit

1 Press [RADAR MENU] key.

The Main Menu will reappear.

[I] Tune Indicator Adjustment

Set the scale mark when the tune indicator bar reaches the maximum point.

Procedure

1 Set the range to 24 NM or more.

2 Hold down [RADAR MENU] key.

The CODE Input screen opens.

3 Press [0] key.

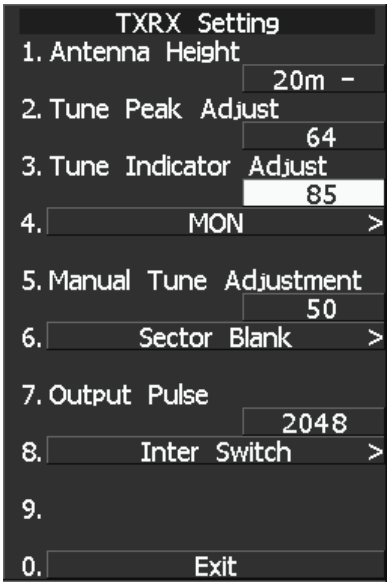
The numeric keypad screen opens.

4 Place the cursor over the "ENT" button of the numeric keypad and press [ENT] key.

Adjust Menu opens.

5 Press [4] key.

TXRX Setting menu opens.



6 Press [3] key.

The Tune Indicator numeric keypad screen opens.

7 Adjust the value until the tune indicator bar at the top left corner of the screen reads 80% to 90% by inputting a value with the number keys or by turning the multi-dial to change the value.

8 Place the cursor over the "ENT" button and press [ENT] key.

The tune level value is memorized and the level adjustment is complete.

Note: Do not let the tune indicator bar reach 100% while adjusting the tune level. The automatic tuning function may not perform properly if the bar reaches 100%.
Set the level such that the tune indicator bar always reads 80% to 90%.

• With the JMA-5212 radar:

For this model, perform Tune Peak Adjustment and Tune Indicator Adjustment explained below. After the above adjustment procedure, perform the adjustment procedure below.

[II] Tune Peak Adjustment

Adjust the tune indicator and echo peak.

Procedure

1 Set the range to 24 NM or more.

2 Hold down [RADAR MENU] key.

The CODE Input screen opens.

3 Press [0] key.

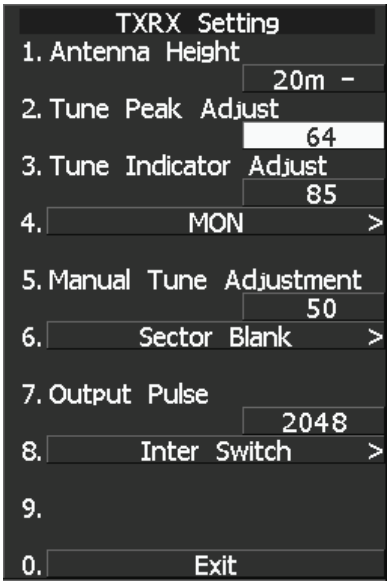
The numeric keypad screen opens.

4 Place the cursor over the "ENT" button of the numeric keypad and press [ENT] key.

Adjust Menu opens.

5 Press [4] key.

TXRX Setting menu opens.



6 Press [2] key.

The Tune Indicator numeric keypad screen opens.

7 Adjust the tune peak value until the tune indicator bar at the top left corner of the screen reaches maximum by inputting a value with the number keys or by turning the multi-dial to change the value.

8 Place the cursor over the "ENT" button and press [ENT] key.

The tune peak value is memorized and the peak adjustment is complete.

Note: Always set the tune peak adjustment value to 64.
When the equipment is used for a long time and the automatic tuning function no longer works properly, adjusting the tune peak adjustment value may result in improvement of the automatic tuning function. It should be noted that an optimal adjustment value is required for proper operation of the automatic tuning function.

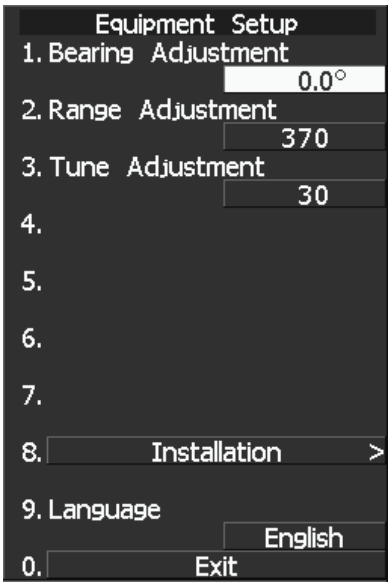
7.1.3 Bearing Adjustment

Adjust the bearing so that bearing of the target measured with the ship's compass matches that of the target echo on the radar display.

Procedure

1 Press AZI MODE to select the relative bearing presentation [H UP] mode. Set Image Processing to OFF.

[AZI MODE] → Software button ⑧ located at the top left corner of the radar display described in Section 2.3.1 → Software button ④ located at the bottom left corner of the radar display described in Section 2.3.2.



2 Measure the bearing of an adequate target (for example, a ship at anchor, a breakwater or a buoy) relative to own ship's heading.

3 Hold down [RADAR MENU] key.

The Code Input Menu will appear.

4 Press [0] key.

5 Move the cursor onto the "ENT" button in the Code Input menu, and press [ENT] key.

The Adjust Menu will appear.

6 Press [1] key.

Equipment Setup menu opens.

7 Press [1] key.

The Code Input Menu will appear.

8 Using numeric key, enter the value and then press "ENT" button, and press "EXIT" button to determine the value.

The multi-function control can also be used to enter the value.
Make adjustment by the 0.1°.

9 Repeat Step 5 above, and adjust to display the target measured in Step 2 to the measured bearing.

Exit

1 Press [RADAR MENU] key.

The Main Menu will reappear.

7.1.4 Range Adjustment

Adjust the range so that the range of the target on the radar video is indicated correctly.

Procedure

1 Search the radar display for a target of which range is already known.

2 Hold down [RADAR MENU] key.

The Code Input Menu will appear.

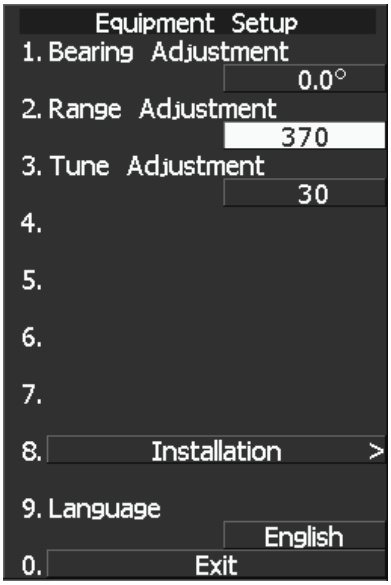
3 Press [0] key.

4 Move the cursor onto the "ENT" button in the Code Input menu, and press [ENT] key.

The Adjust Menu will appear.

5 Press [1] key.

Equipment Setup menu opens.



6 Press [2] key.

The Code Input Menu will appear.

7 Using numeric pad, enter the value and then press "ENT" button, and press "EXIT" button to determine the value.

The multi-function control can also be used to enter the value.

8 Repeat step 4, and adjust until the target range measured in step 1 and the range on the radar display become identical.

Exit

1 Press [RADAR MENU] key.

The Main Menu will reappear.

7.1.5 Antenna Height Setting (Antenna Hight)

Set the antenna height above the sea level, but change this setting carelessly.

Procedure

1 Measure the height from the sea level to the antenna in advance.

2 Hold down [RADAR MENU] key.

The Code Input Menu will appear.

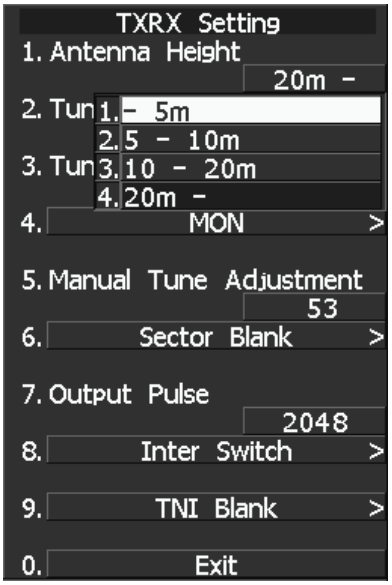
3 Press [0] key.

4 Move the cursor onto the "ENT" button in the Code Input menu, and press [ENT] key.

The Adjust Menu will appear.

5 Press [4] key.

The TXRX Setting Menu will appear.



6 Press [1] key.

The Antenna Height Set Value window will appear.

7 Select the antenna height measured in step 1 from the pull-down menu by pressing the numeric key [1] to [4].

The antenna height will be determined.

Exit

1 Press [RADAR MENU] key.

The Main Menu will reappear.

7.1.6 Setting of CCRP/Antenna/GPS Antenna Position (CCRP Setting)

Set the own ship's CCRP location, radar antenna installation location, and GPS installation location.

GPS : Up to 4 locations can be inputted (select one through the receiving port setting when using the GPS).
Radar antenna : 1 location can be inputted (one master and one slave).
CCRP : 1 location can be inputted (another location is reserved as an antenna location).

Procedure

1 Measure the CCRP, radar antenna, and GPS antenna positions beforehand.

2 Hold down [RADAR MENU] key.

The Code Input Menu will appear.

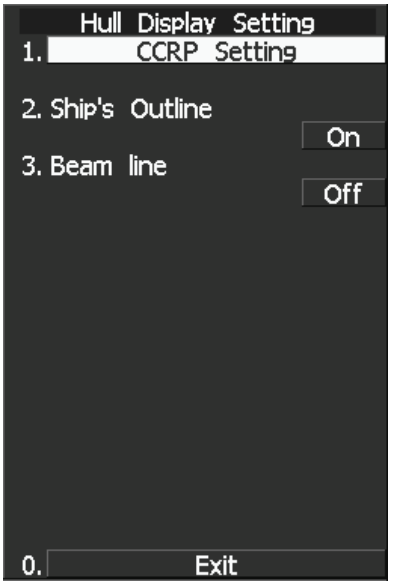
3 Press [0] key.

4 Move the cursor onto the "ENT" button in the Code Input menu, and press [ENT] key.

The Adjust Menu will appear.

5 Press the following keys.

7 Hull Display Setting
1 CCRP Setting



6 Input the vessel length in the Length field and the vessel width in the Beam field at the top right corner of the CCRP Setting screen.

7 Move the cursor to the X and Y values of CCRP1. Press the ENT key and input the CCRP1 position.

CCRP is on the starboard side of the ship when X>0 and is on the port side of the ship when X<0.

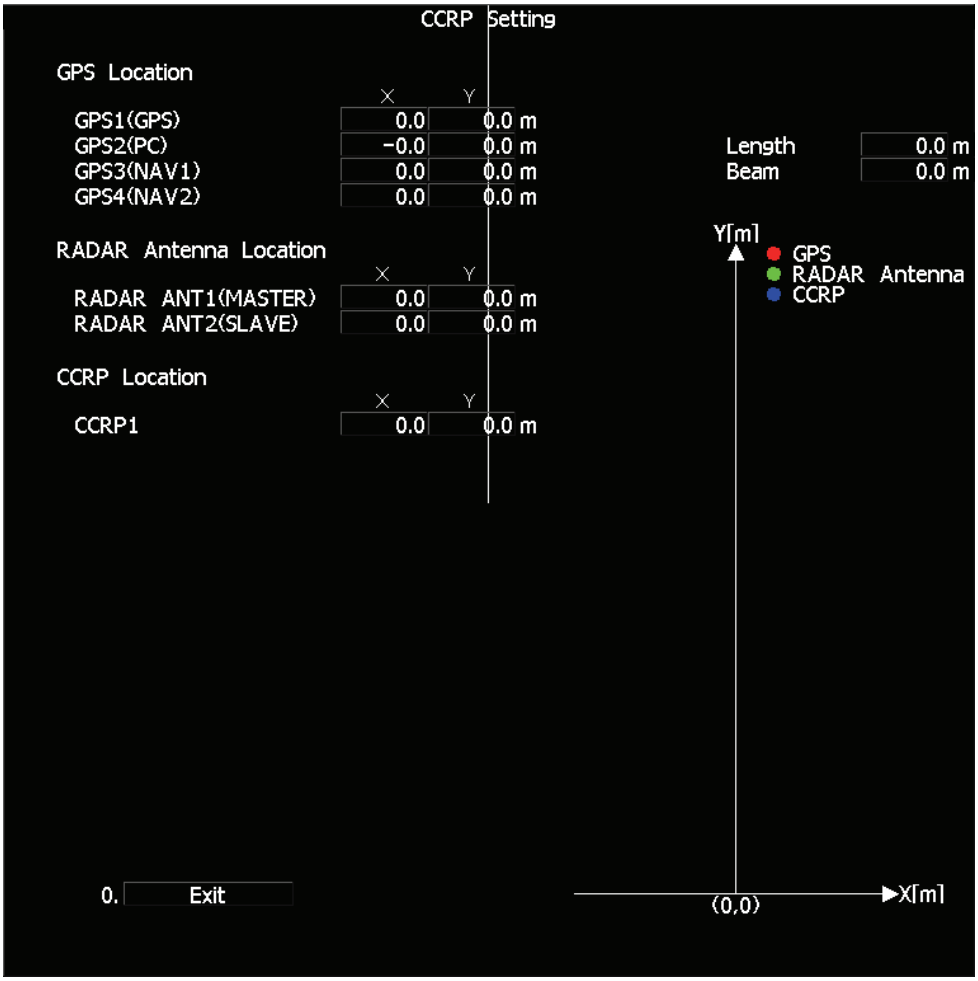
8 In the same manner, input the GPS antenna and radar antenna positions.

9 Press [0] key and exit the CCRP setting screen.

GPS position :
If you wish to connect multiple GPS systems to a COM port and select a GPS position to be used, select it through the receiving port setting of the GPS you wish to use.
Reference: Section 7.3.1.2 “Reception Port Setting (RX Port)”

Radar antenna position :
The radar antenna position changes as the antenna mode is switched between the master mode and the slave mode by the simplified inter-switch.

CCRP position :
Only one position can be set.
If CCRP1 is outside the display area, ANT1 or ANT2 becomes the CCRP.
ANT1: Radar antenna position (MASTER)
ANT2: Radar antenna position (SLAVE)



CCRP is changed on the condition as following.
- Radar antenna position is outside of the off center limit.
- The CCRP position is outside of PPI.

This condition occurs with for example off center, true motion, turn of own ship, etc.