

1.49.2 How to preset antenna and display combinations

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

1. Open the menu.
2. Select [9 INITIAL SETTINGS].
3. Select [3 SELECT ANTENNA]. The [SELECT ANTENNA] menu appears.
4. Select the display unit for which to select an antenna (at the next step). For the purpose of this example, select [DISP2] to select the no. 2 display unit. The indication for the antenna is highlighted.
5. Spin the scrollwheel to toggle between [MASTER] and [SLAVE]. The MASTER system passes on settings such as [CPA], [TCPA] and alarm settings to SLAVE radars connected to the same network.
6. Repeat steps 2 and 3 to set other display and antenna combinations.
7. Select [SAVE INTER-SWITCH], then select [YES] to save your selections.
8. Close the menu.

Antenna selection considerations

- The Inter-switch feature for this radar is available only with other radars of the same series. Do not connect radars from other series (EG: FAR-3000, FAR-2××7, etc.).
- An antenna unit cannot be controlled from multiple display units. Select one Master display unit for one antenna unit. If two antenna units are set as masters, the display last-set as master becomes the master and all other displays are automatically changed to slave.
- An antenna unit without a Master display cannot be selected on the sub display units. If there is no antenna unit set as master, the lowest number display is automatically set as master.
- If the Alert "EXT RADAR ERROR" appears, do one of the following, as applicable:
 - If only your antenna is not displayed on the [ANT SELECT] display, the LAN line in the Processor Unit may be faulty. In this case, use the standalone mode.
 - If the antenna that was in use does not appear on the [ANT SELECT] display, the LAN line in other Processor Unit may be faulty. In this case, see the preceding page for how to select a different antenna unit
- When the Network fails, the Interswitch does not work, but standalone operation is possible.
- Radar functions are controlled independently, dependently or commonly depending on selection as [MASTER] or [SLAVE] (see the table on the following page).

1. OPERATIONAL OVERVIEW

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

*¹: When the connected radar antenna is a FAR-3xx0/FAR-2xx8 series magnetron-type, and the radar is assigned as "Slave", the desired value can be set for this functions. For FAR-3xx0/FAR-2xx8 series SSD-types, this functions cannot be controlled.

*²: The desired value can be set when the radar is assigned as "Slave", however the maximum displayable range is dependent on the setting at the "Master" radar.

1.49.3 How to clear the interswitch

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

1. Open the menu.
2. Select [9 INITIAL SETTINGS].
3. Select [3 SELECT ANTENNA]. The [SELECT ANTENNA] menu appears.
4. Select [0 CLEAR INTER-SWITCH].
5. Select [YES] to clear the interswitch settings. The antenna settings are restored to default.

1.50 Performance Monitor

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

Note: The performance monitor and related features are not available from FAR-2x58 monitors which are assigned as [SUB] at installation.

1.50.1 How to activate/deactivate the performance monitor

1. Set the radar to TX (transmit) mode.
2. Open the menu.
3. Select [1 ECHO].
4. Select [5 PERFORMANCE MONITOR].
5. Select the appropriate setting, then press the **ENTER MARK** key.
 - [OFF]: Deactivate the performance monitor.

Note: You can also deactivate the performance monitor by adjusting the range manually.
 - [ON]: Activate the performance monitor and show the graph.
 - [GRAPH ONLY]: Show the performance monitor graph, however the performance monitor is not activated.
6. Close the menu.

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

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

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

Setting	Setting at PM activation	Adjustable while PM is active	Setting at PM deactivation
[GAIN]	70 * ¹	Yes * ³	Setting before PM activation.
[SEA]	0	No	Setting before PM activation.
[SEA AUTO]	MAN	No	Setting before PM activation.
[RAIN]	0	No	Setting before PM activation.

Table continued on the following page.

1. OPERATIONAL OVERVIEW

Setting	Setting at PM activation	Adjustable while PM is active	Setting at PM deactivation
<i>Table continued from the previous page.</i>			
[RAIN AUTO]	MAN	No	Setting before PM activation.
[TUNE] (Shown for magnetron radars only)	AUTO	No	Setting before PM activation.
[TX CH] (Shown instead of [TUNE] for solid-state radars only)	CH1	No	Setting before PM activation.
[ACE]	OFF	No	Setting before PM activation.
[ES]	OFF	No	Setting before PM activation.
[EAV]	OFF	No	Setting before PM activation.
[IR]	2	No	Setting before PM activation.
[NOISE REJECT]	OFF	No	Setting before PM activation.
[VIDEO CONTRAST]	4-B	No	Setting before PM activation.
[PULSE]	LONG	No	Setting before PM activation.
[2ND ECHO REJ]	OFF	Yes	Setting before PM activation.
[LOW LEVEL ECHO]	Previous setting kept, fixed.	No	Setting before PM activation.
[WIPER]	OFF	No	Setting before PM activation.
[CUSTOMIZED ECHO]	Previous setting kept, fixed.	No	Return to active display.
[PRESENTATION MODE]	No change. *2	Yes	Setting at PM deactivation.
[RANGE]	24 NM, 24 SM, 48 km, 48 kyd (Settings other than NM are available for C-types only.)	Yes *4	Setting before PM activation.
[OFF CENTER]	OFF	Yes	Setting at PM deactivation.
ANT REVOLUTION	24 rpm	No	Setting before PM activation.

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

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

*3: The setting is not memorized.

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

1.50.2 How to check the radar's performance

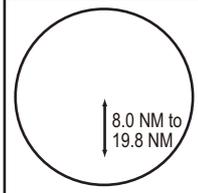
The range scale is automatically set to 24 NM. The radar screen will show arcs. If the radar transmitter and receiver are in good working conditions in as much as the original state when the monitor was turned on, the innermost arcs should appear between 8.0 NM to 19.8 NM. The performance monitor can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

Note: The performance monitor and related features are not available from FAR-2x58 monitors which are assigned as [SUB] at installation.

How to set the number of arcs

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

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

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

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

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

Turn the performance monitor off when finished.

1.51 How to Change the Reference Position

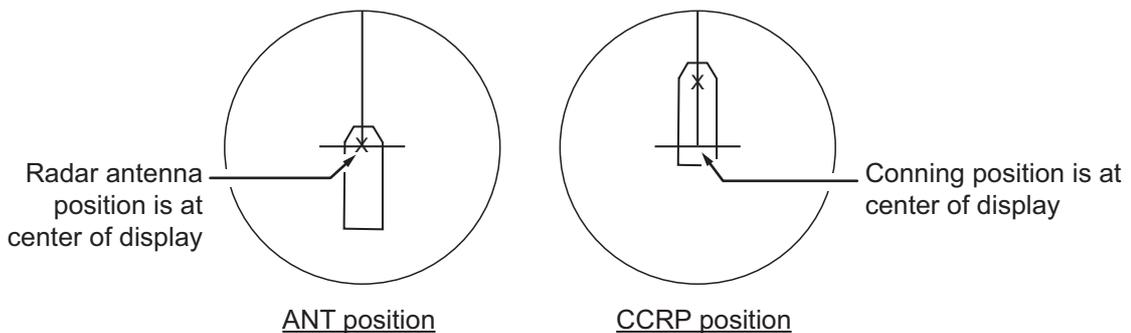
The reference position for measurements (range, bearing, etc.) and markers (heading line, stern mark, etc.) can be the radar antenna position ([ANT]) or the consistent common reference point ([CCRP]).

The reference position is a location on own ship to which all horizontal measurements, for example range, bearing, relative course, relative speed, closest point of approach (CPA) or time to closest point of approach (TCPA), are normally referenced.

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

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

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



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

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

Table continued on following page

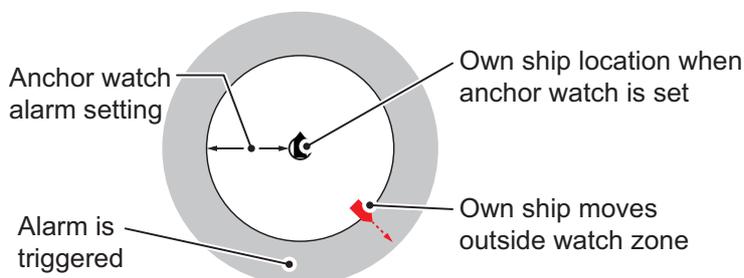
Category	Item	Reference point	
		ANT	CCRP
<i>Table continued from previous page</i>			
CPA, TCPA		Calculated with antenna position at center.	Calculated with CCRP at center.
BCR, BCT		Calculated from bow position.	
Own ship data	Heading	Data is taken from respective sensors, regardless of reference point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

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

1.52 Anchor Watch

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

If your ship drifts more than the anchor watch setting, the alert "ANCHOR WATCH" appears in the [ALERT] box. The alert is escalated from warning level to alarm level if the alert is not acknowledged within one minute. Also, if your vessel returns to within the tolerable radius, the alert status is automatically changed to rectified.



1. Open the menu.
2. Select [4 ALERTS].
3. Select [4 ANCHOR WATCH].
4. Select [ON] to enable [ANCHOR WATCH], then press the **ENTER MARK** key.
5. Spin the scrollwheel to set the distance for the alert. Press the **ENTER MARK** key to apply the setting.
6. Close the menu.

1.53 Alerts

1.53.1 What is an alert?

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

For detailed information regarding specific alerts and alert codes, including possible remedies, see "ALERT CODES, MESSAGES & MEANINGS" on page AP-17.

Alerts are classified according to priority and category.

Alert priority

The level of priority, from highest to lowest, is ALARM → WARNING → CAUTION.

Alarm: Situations or conditions which require immediate attention, decision and (if necessary) action by the bridge team to avoid any kind of hazardous situation and to maintain the safe navigation of the ship.

Warning: Conditions or situations which require immediate attention for precautionary reasons, to make the bridge team aware of conditions which are not immediately hazardous, but may become so.

Caution: Awareness of a condition which continues to require attention out of the ordinary consideration of the situation or of given information.

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

Alert category

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

Category	Description
A	Category A alerts include alerts indicating <ul style="list-style-type: none">• Danger of collision• Danger of grounding
B	Category B alerts are alerts where no additional information for decision support is necessary. Category B alerts are all alerts not falling under category A.
C	Engine-related alert

1.53.2 Alert box overview

When an alert condition is found, the applicable alert message appears in the [ALERT] box. A buzzer sounds for alarm and warning alerts.

Normal display mode (IMO/C-types)

The [ALERT] box is composed of three lines of text information, and several icons, as shown below.



Simple display mode (C-types only)

The icon for the highest priority alert appears at the bottom-right corner of the screen.



1.53.3 How to silence the buzzer

Place the cursor on the buzzer silence icon in the alert box, then left-click. The alert buzzer is temporarily silenced. When the buzzer is silenced, the alert status is also changed (see section 1.53.6).

Note: The buzzer silence box is not visible for C-types using [SIMPLE] display mode.

1.53.4 How to acknowledge an alert

You can acknowledge alerts with one of the following methods:

- Press the **ALARM ACK** (RCU-014) or **ALERT ACK** (RCU-031) key.
- Left-click the alert name in the alert box.
 - Note:** The alert box is not visible for C-types using [SIMPLE] display mode.
- Left-click the alert icon (C-types using [SIMPLE] display mode only)
- Open the alert list and left-click the alert in the list.

When the buzzer is silenced, the alert status is also changed (see section 1.53.6).

1.53.5 Alert list

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

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

You can show the alert list with one of the following methods.

- **IMO/C-types using NORMAL display mode:** place the cursor on the alert list/log button in the [ALERT] box then left-click.
- **C-types using SIMPLE display mode:** place the cursor on the alert icon then left-click.

Displayed page/Pages available

ALERT LIST (1/2)		
1	BACK(L=TOP)	
2	194	23:15 03/FEB RADAR1
3	52601 NO GYRO SIGNAL	20:25 01/FEB RADAR1
4	52001 RPU:FAN2 SPD ERROR	12:18 01/FEB RADAR1
9 REFRESH DATA(L=CLR)		
0 NEXT(L=LAST)		

Alert code and alert message

Alert icon

- When selected at page 1, closes the list.
- When selected at page 2 or later, goes back to the previous page.
- Long-press the **left button** to go to page 1.

Radar which output this alert

Date and time of alert

- Select to refresh the list.
- Long-press the **left button** to remove acknowledged and rectified alerts from the list.

- Select to go to the next page
- Long-press the **left button** to go to the last page.

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

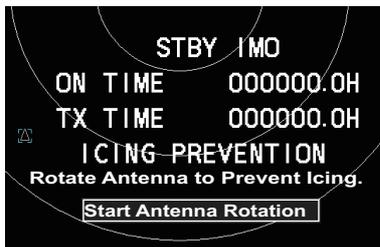
1.53.6 Alert icons and their meanings

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

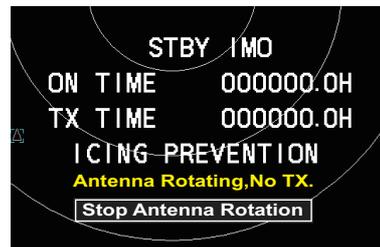
1.54 Icing Prevention

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

1. Open the menu.
2. Select [9 INITIAL SETTINGS].
3. Select [5 OPERATION].
4. Select [7 ICING PREVENTION].
5. Select [ON] or [OFF] as appropriate. If you select [ON], the message "Rotate Antenna to Prevent Icing." appears at the bottom of the screen.
6. Click [Start Antenna Rotation] to rotate the antenna without transmission. The message changes to read "Antenna Rotating, No TX."



When the antenna stops



When the antenna rotates

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

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

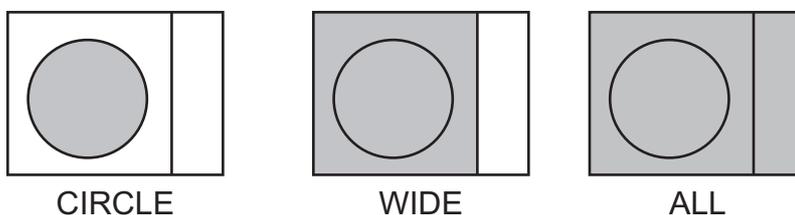
1.55 How to Select an Echo Display Area (C-type Only)

C-type radars of this series have three echo display modes available:

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

Follow the procedure below to change display modes.

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



5. Close the menu.

1.56 How to Use the Watch Alert

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



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

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

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

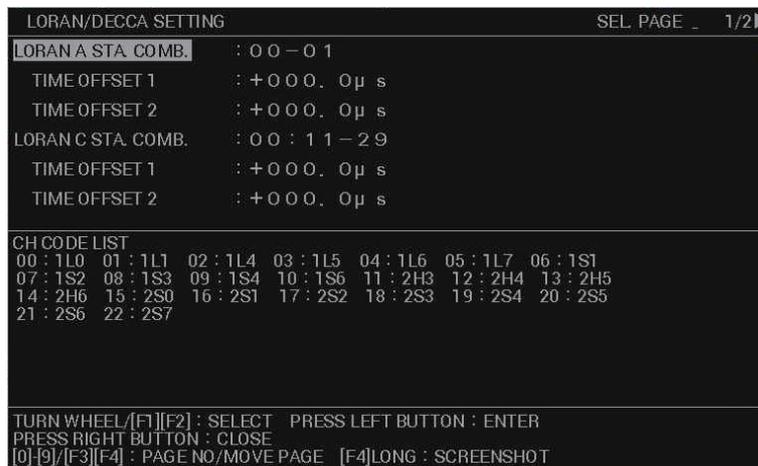
1. OPERATIONAL OVERVIEW

- Left-click the watch box to start the watch timer. You can also reset the countdown by left-clicking the watch box at any time.

1.57 Loran Decca Setup (C-types Only)

When using Loran A time offset

- Open the menu.
- Select [9 INITIAL SETTINGS].
- Select [9 LORAN•DECCA].
The [LORAN•DECCA] menu appears.
- Select [3 LORAN/DECCA SELECT].
- Select [LORAN A].
- Select [2 LORAN•DECCA SETTING]. The setting window appears.



Note: There are two pages for the [LORAN/DECCA SETTING] menu. If page 2 appears, press the **F3** key to go back to page 1.

- Select [LORAN A STA. COMB.], then press the **left button**.
- Set the station combination referring to the [CH CODE LIST] in the lower half of the window.
- Select [TIME OFFSET 1].
- Rotate the **scrollwheel** and press the **left button** to set the time offset value.
- Select [TIME OFFSET 2].
- Rotate the **scrollwheel** and press the **left button** to set the time offset value.
- Close the menu.

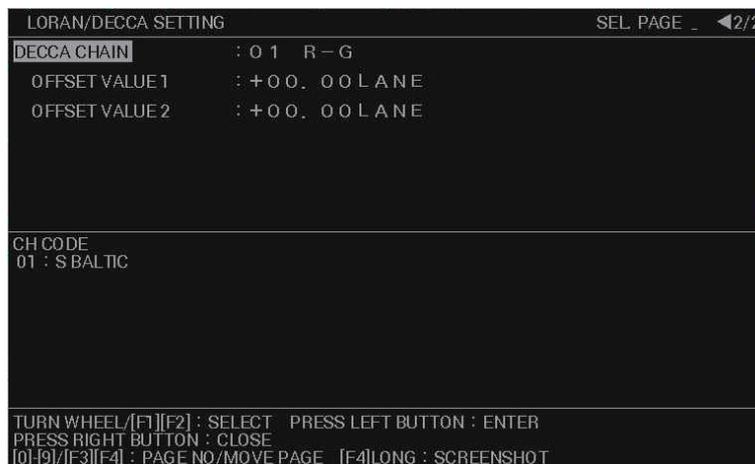
When using Loran C time offset

- Open the menu.
- Select [9 INITIAL SETTINGS].
- Select [9 LORAN•DECCA].
- Select [3 LORAN/DECCA SELECT].
- Select [LORAN C].

6. Select [2 LORAN•DECCA SETTING]. The setting window appears.
Note: There are two pages for the [LORAN/DECCA SETTING] menu. If page 2 appears, press the **F3** key to go back to page 1.
7. Select [LORAN C].
8. Set the station combination referring to the [CH CODE LIST] in the lower half of the window.
9. Select [TIME OFFSET 1].
10. Rotate the **scrollwheel** and press the **left button** to set the time offset value.
11. Select [TIME OFFSET 2].
12. Rotate the **scrollwheel** and press the **left button** to set the time offset value.
13. Close the menu.

When using Decca chain offset

1. Open the menu.
2. Select [9 INITIAL SETTINGS].
3. Select [9 LORAN•DECCA].
4. Select [3 LORAN/DECCA SELECT].
5. Select [DECCA].
6. Select [2 LORAN•DECCA SETTING]. The setting window appears.
Note: There are two pages for the [LORAN/DECCA SETTING] menu. If page 2 appears, skip to step 8.
7. Press the **F4** key to show the second page of the setting window.



8. Select [DECCA CHAIN].
9. Set the station combination referring to the [CH CODE] in the lower half of the window.
10. Select [OFFSET VALUE 1].
11. Rotate the **scrollwheel** and press the **left button** to set the time offset value.
12. Select [TIME OFFSET 2].
13. Rotate the **scrollwheel** and press the **left button** to set the time offset value.
14. Close the menu.

1.58 How to Manage SD Card Data

For IMO-types, the following data can be stored on a SD Card: map marks/lines, user settings, installation settings, own track, alert history and some logs (for example, the alert log).



For C-types, the SD Card is used to store screenshots (see section 1.61).

Note: The procedures and operations outlined in this section are only available when a SD Card is inserted. When there is no SD Card inserted, the operations and procedures are not available.

1.58.1 Formatting the SD card

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

1.58.2 Cautionary notes on handling SD cards

- Handle the cards carefully. Improper use can damage the card and destroy its contents.
- Make sure the card slot cover is closed, unless removing/inserting a card.
- Remove or insert a card using only your fingers. Do not use metal instruments (such as tweezers) to remove the card.
- Do not remove the card when data is loading from, or saving to, the card.

1.58.3 Compatible SD cards

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

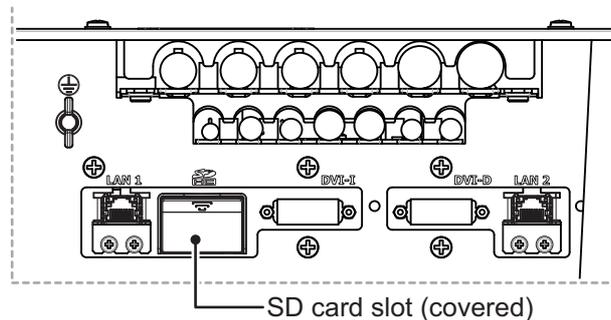
Note 1: The cards were verified using basic functions. All functions were not verified. FURUNO does not guarantee card operations.

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

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

1.58.4 How to insert SD cards

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



Note: Do not use any instruments to insert the card.

1. Remove the rubber cover on the SD card slot.
2. To insert a card, gently push the card into the slot, making sure that the card connectors are facing downwards.
3. Close the rubber cover.

1.58.5 How to remove SD cards

Follow the procedure below to safely remove an SD card.

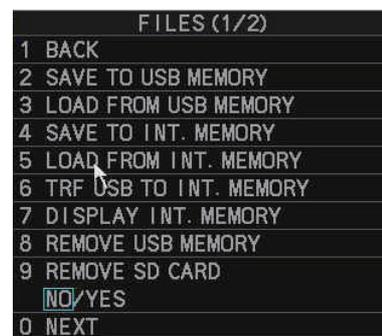
Note 1: When the system power is turned off, skip steps 1 to 3.

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

1. Open the menu.
2. Select [6 FILES]. The [FILES] menu appears.



IMO-types

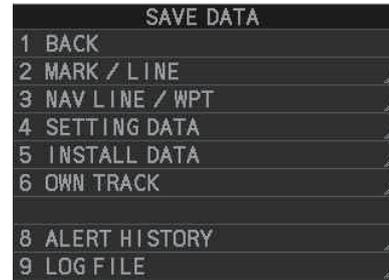


C-types

3. **For IMO-types**, select [REMOVE EXT MEDIA], then select [YES].
For C-types, select [REMOVE SD CARD], then select [YES].
You can now remove the SD card safely.
4. Remove the rubber cover on the SD card slot.
5. Gently push the SD cards to release the card from the card slot.
6. Remove the SD card. Do not use any instruments to remove the card.
7. Close the menu.

1.58.6 How to save data to an SD card (IMO-types only)

1. Open the menu.
2. Select [6 FILES]. The [FILES] menu appears.
3. Select [2 SAVE DATA].
4. Select the data to save, then press the **ENTER MARK** key.
The software keyboard appears.
5. Using the software keyboard, name the file, then select [END] to start saving data.



Note: Depending on the data saved, the first letter of the filename is preset and cannot be changed. The presets are listed below.

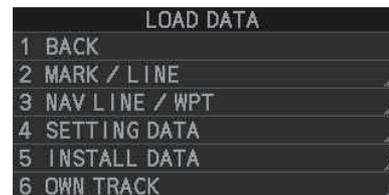
- Marks/Lines: M
- Nav lines/Waypoints: W
- Setting data: S
- Install data: I
- Own track: T
- Alert history: H
- Log file: L

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

6. When the process is complete, the indication "COMPLETED" appears on the screen.

1.58.7 How to read (load) data from an SD card (IMO-types only)

1. Open the menu.
2. Select [6 FILES]. The [FILES] menu appears.
3. Select [3 LOAD DATA].
4. Select the data to load, then press the **ENTER MARK** key.

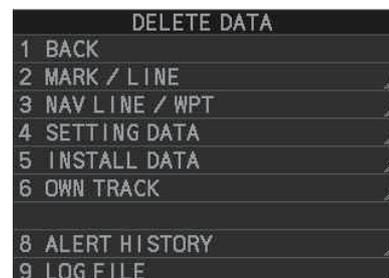


The indication "RD CARD DATA" appears during the read process and the menu closes automatically.

5. When the process is complete, the indication "COMPLETED" appears on the screen.

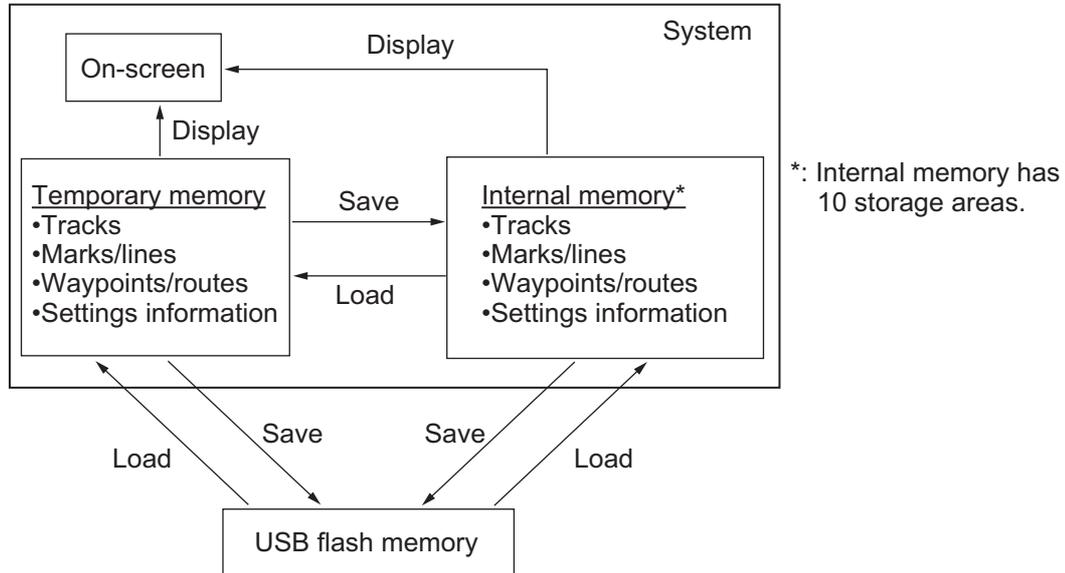
1.58.8 How to delete data from an SD card (IMO-types only)

1. Open the menu.
2. Select [6 FILES]. The [FILES] menu appears.
3. Select [4 DELETE DATA].
4. Select the data to delete, then press the **ENTER MARK** key.
The indication "DELETE CARD DATA" appears during the delete process.
5. Close the menu.



1.59 Internal Memory (C-types only)

The system's internal memory stores data such as own track, other ship's track, marks, lines, routes, waypoints and some settings. When the temporary memory becomes full, the oldest data are deleted and the newest data is stored. You can save data to a USB flash memory, or to the internal memory. The process of saving and loading data uses internal, temporary and USB flash memory in the following manner.



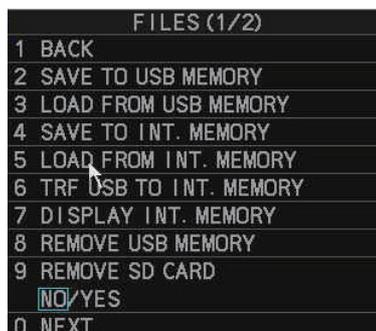
Note: The procedures in this section must be done with the radar in STBY. If the radar is set to transmit, the [FILES] menu is not available.

1.59.1 How to save data to the internal memory

You can save data from the temporary memory to the internal memory. The internal memory has 10 storage areas and each area has the following storage capacity.

- Own ship tracks: 30,000
- Marks/lines: 30,000
- Waypoints: 3,500
- Routes: 200
- Area marks: 50
- Other tracks: 40,000, comprised of:
 - Consort vessels: 10,000;
 - AIS targets: 10,000;
 - TT targets: 10,000;
 - GPS buoys: 10,000.

1. Open the menu.
2. Select [6 FILES]. The [FILES] menu appears.



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3. Select [4 SAVE TO INT. MEMORY]. The [INTERNAL MEMORY RECORDING] window appears.

INTERNAL MEMORY RECORDING					
REC OWN TRK	:	YES			NO
REC OTHER TRK	:	YES			NO
RECORD MARK/TRACK	:	YES			NO
RECORD ROUTE/WPT	:	YES			NO
DOWNLOAD SETTING	:	YES			NO
DATA SELECTION					
DATA	OWN TRK	OTR TRK	MARK	WPT	ROUTE
1:NO DATA					
2:NO DATA					
3:NO DATA					
4:NO DATA					
5:NO DATA					
6:NO DATA					
7:NO DATA					
8:NO DATA					
9:NO DATA					
0:NO DATA					
CURRENT USAGE	OWN TRK	:	2154	/	30000
	OTHER TRK (CONS)	:	0	/	10000
	OTHER TRK (AIS)	:	2358	/	10000
	OTHER TRK (TT)	:	0	/	100000
	OTHER TRK (GPS BUOY)	:	0	/	10000
	MARK/LINE	:	30	/	30050
TURN WHEEL/[F1][F2] : SELECT PRESS LEFT BUTTON : ENTER					
PRESS RIGHT BUTTON : CLOSE					
SELECT THE FILE TO RECORD					
[F4]LONG : SCREENSHOT					

4. Select an item, then select [YES] to save the item to the internal memory.
5. To save other items, repeat step 4 as required.
6. Select an area to save the data. A pop up window appears showing the file name for the saved data. The default name is the date and time at which the data was saved.
7. **To change the filename**, go to the next step.
To keep the default filename, close the menu.
8. Referring to section 1.5.3, enter the desired filename. A confirmation message appears.

	RECORD CURRENT DATA TO INTERNAL MEMORY. ARE YOU SURE?
	RUN CANCEL
PRESS LEFT BUTTON : ENTER	
[F4]LONG : SCREENSHOT	
TURN WHEEL/[F1][F2] : SELECT	

9. Select [ENTER] to save the data, or select [CANCEL] to cancel the procedure. If you selected [ENTER], a progress window appears to show the save progress. When the save is completed, a message appears.
10. Select [OK].
11. Close the menu.

1.59.2 How to view the contents of the internal memory

You can view (replay) items stored in the internal memory.

1. Open the menu.
2. Select [6 FILES]. The [FILES] menu appears.
3. Select [7 DISPLAY INT. MEMORY]. The [DISPLAY INTERNAL MEMORY] window appears.

DISPLAY INTERNAL MEMORY		SEL PAGE _ 1/3▶	
INTERNAL MEMORY 1			
ADD OWN TRCK DISP	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO	522/30000
ADD OTHER TRCK DISP	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	0/40000
ADD MARK/LINE DISP	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	0/30000
INTERNAL MEMORY 2			
ADD OWN TRCK DISP	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	0/30000
ADD OTHER TRCK DISP	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	0/40000
ADD MARK/LINE DISP	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	0/30000
INTERNAL MEMORY 3			
ADD OWN TRCK DISP	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	0/30000
ADD OTHER TRCK DISP	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	0/40000
ADD MARK/LINE DISP	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	0/30000
INTERNAL MEMORY 4			
ADD OWN TRCK DISP	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	0/30000
ADD OTHER TRCK DISP	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	0/40000
ADD MARK/LINE DISP	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	0/30000
TTL ADD DISP			
OWN TRK	:	522	/30000
OTHER TRK (CONS)	:	0	/10000
(AIS)	:	0	/10000
(TT)	:	0	/10000
(GPS BUOY)	:	0	/10000
MARK/LINE	:	0	/30000
TURN WHEEL/[F1][F2] : SELECT PRESS LEFT BUTTON : ENTER			
PRESS RIGHT BUTTON : CLOSE			
[0]-[9]/[F3][F4] : PAGE NO/MOVE PAGE [F4]LONG : SCREENSHOT			

The internal memory areas (1 through 10) appear across three pages. Press **F3** or **F4** to change pages.

4. Select the items whose contents you want to view, then select [YES].
5. Repeat step 4 to add other items you want to view.

Note: The total number of selected items appears at the bottom of the window. If the selected number exceeds the maximum, the indication appears in yellow color and items which are in excess of the maximum are not displayed.
6. Close the window.

The items you selected to view appear on the screen. Displayed tracks, marks and lines cannot be edited or deleted, as this feature only displays these items.

To remove the stored items from the screen, repeat the above procedure, then select [NO] at step 4.

1.59.3 How to load the contents of the internal memory

You can load the data from the internal memory, however, this procedure replaces the temporary memory contents with the contents of the internal memory. If you want to keep the contents of the internal memory, save the contents before continuing with this procedure.

1. Open the menu.
2. Select [6 FILES]. The [FILES] menu appears.
3. Select [5 LOAD FROM INT. MEMORY]. The [INTERNAL MEMORY PLAYBACK] window appears.

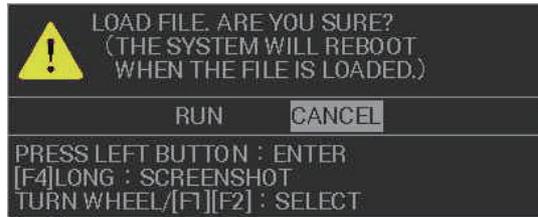


4. Select the item you want to load.
5. Depending on the item selected at step 4, select [ADD], [OVERWRITE] or [NO] as appropriate.
 - [ADD]: selected data is added to the temporary data. Temporary data is not overwritten.
 - [OVERWRITE]: replace (overwrite) the temporary data with the selected data.
 - [NO]: selected data is not used.

Note 1: When [ADD] is selected for [PLAY MARK/TRACK], a limit of 30,050 items applies. When this limit is reached, no more items can be added.

Note 2: When [ADD] is selected for [PLAY OWN TRK] or [PLAY OTHER TRK] and the limit is reached, the oldest items are deleted to make way for new items. For example, if you have 10,000 tracks already saved and add 25,000, the oldest 5,000 tracks from those already saved are deleted.

6. Repeat steps 4 and 5 to add other items you want to load.
7. Select the data to load from the [DATA SELECTION] list. A confirmation message appears.



8. Select [YES] to load the selected data, or select [CANCEL] to cancel the load. If you selected [YES], a progress bar appears to indicate the loading status, followed by a confirmation message when the loading is complete.
9. Select [CONFIRM].
10. Close the window.

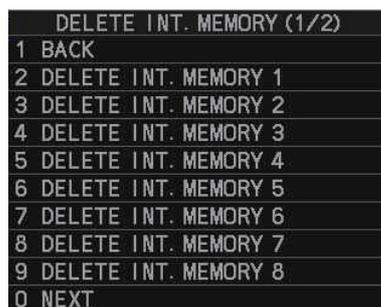
1.59.4 How to delete the contents of the internal memory

You can delete the contents of each internal memory area.

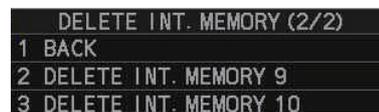
1. Open the menu.
2. Select [6 FILES]. The [FILES] menu appears.
3. Select [0 NEXT] to show the second page of the [FILES] menu.



4. Select [5 DELETE INT. MEMORY]. The internal memory areas appear in a two-page menu.



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5. Select the internal memory area you want to delete. A confirmation message appears.



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6. Select [RUN] to delete the area, or [CANCEL] to cancel the deletion.
If you selected [RUN], the message "PROCESSING. PLEASE WAIT" appears in a window while the memory is deleted. The message disappears when the delete process is complete.
7. Close the menu.

1.59.5 How to backup data in the internal memory

Data can be automatically backed up when the system starts up, or you can manually back up your data at any time.

Note: For automatic backups, the system start-up will take a short while longer than normal, to allow for the data backup.

How to automatically backup your data

1. Open the menu.
2. Select [6 FILES]. The [FILES] menu appears.
3. Select [0 NEXT] to show the second page of the [FILES] menu.
4. Select [2 AUTO BACKUP].

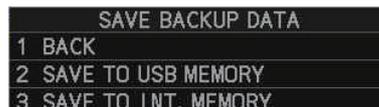


5. Select [3 INTERNAL MEMORY].
6. Select [ON] to activate, or [OFF] to deactivate, the automatic backup.
If you selected [ON], the internal memory is backed up each time you turn the system on.
7. Close the menu.

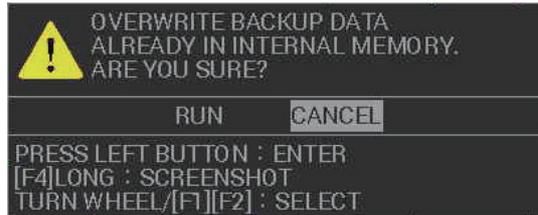
Note: When auto backup is activated, the system starts the backup process after the start-up warning screen is closed. A message appears while the backup is in progress and the message disappears when the backup is complete.

How to manually backup your data

1. Open the menu.
2. Select [6 FILES]. The [FILES] menu appears.
3. Select [0 NEXT] to show the second page of the [FILES] menu.
4. Select [3 SAVE BACKUP DATA].



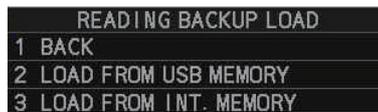
5. Select [3 SAVE TO INT. MEMORY]. A confirmation message appears.



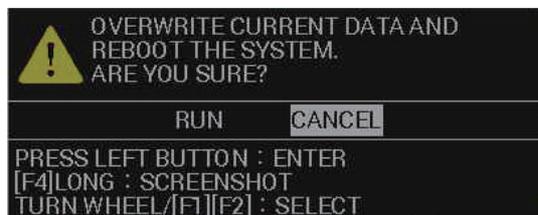
6. Select [RUN] to backup the area, or [CANCEL] to cancel the backup. If you selected [RUN], the message "TRANSFERRING. PLEASE WAIT" appears in a window while the data is backed up and a progress bar indicates the backup progress. The message changes to "TRANSFER COMPLETED" when the backup is completed.
7. Select [CONFIRM] to close the window.

1.59.6 How to load backup data from the internal memory

1. Open the menu.
2. Select [6 FILES]. The [FILES] menu appears.
3. Select [0 NEXT] to show the second page of the [FILES] menu.
4. Select [4 LOAD BACKUP DATA].



5. Select [3 LOAD FROM INT. MEMORY]. A confirmation message appears.



6. Select [RUN] to backup the area, or [CANCEL] to cancel the backup. If you selected [RUN], a progress window appears. When the data load is complete, the system restarts automatically.

1.60 USB Flash Memory (C-types only)

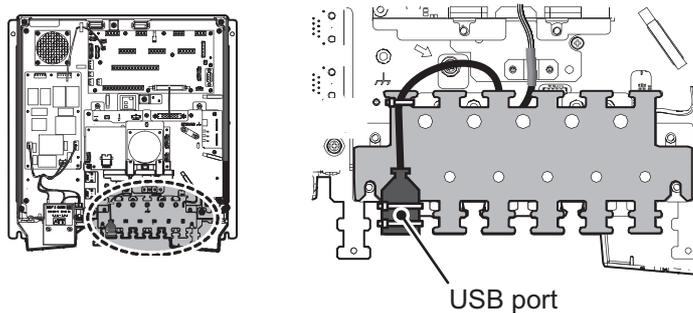
Note 1: This equipment is compatible with USB2.0.

Note 2: The procedures in this section must be done with the radar in STBY. If the radar is set to transmit, the [FILES] menu is not available.

1.60.1 USB Flash memory connection

Connect your flash memory to the USB port on the processor unit.

Note: The following figure is for explanatory purposes, with the cover of the processor unit removed. There is no need to remove the cover when connecting a flash memory.



1.60.2 How to remove the USB flash memory safely

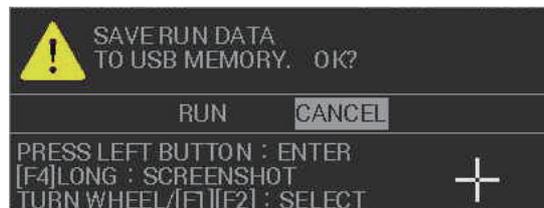
⚠ CAUTION

When removing the USB flash memory, only use the method described in this section.

Use of any other method may result in malfunction or incorrect operation of the USB and/or this equipment.

Note: If this equipment is turned off, steps 1 through 4 (menu operations) are not required.

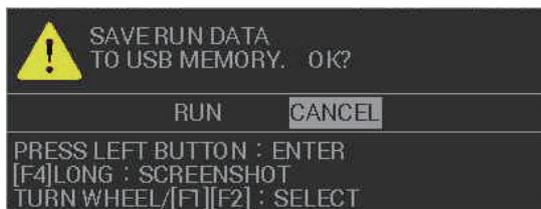
1. Open the menu.
2. Select [6 FILES]. The [FILES] menu appears.
3. Select [8 REMOVE USB MEMORY]. A confirmation message appears.



4. Select [CONFIRM].
5. Remove the USB flash memory from the processor unit.

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- Referring to section 1.5.3, enter the desired filename. A confirmation message, similar to the one below, appears.

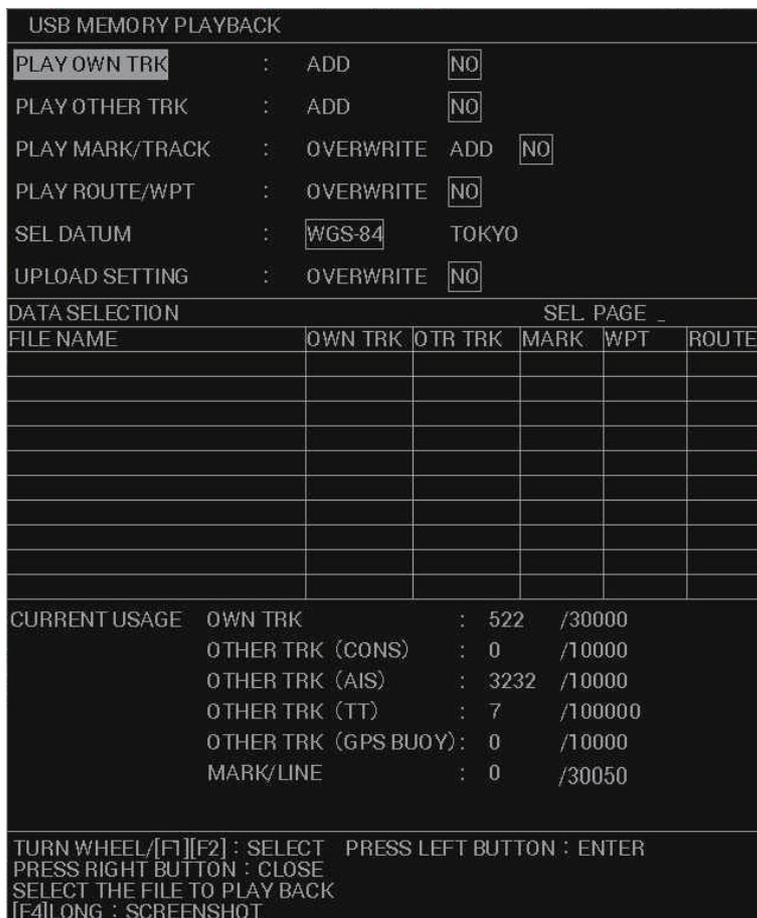


- Select [ENTER] to save the data, or select [CANCEL] to cancel the procedure. If you selected [ENTER], a progress window appears to show the save progress. When the save is completed, a message appears.
- Select [CONFIRM].
- Close the menu.

1.60.4 How to load data from the USB memory

You can load the data from the USB flash memory, however, this procedure replaces the temporary memory contents with the contents of the USB flash memory. If you want to keep the contents of the internal memory, save the contents before continuing with this procedure.

- Open the menu.
- Select [6 FILES]. The [FILES] menu appears.
- Select [5 LOAD FROM INT. MEMORY]. The [INTERNAL MEMORY PLAYBACK] window appears.



4. Select the item you want to load from the [DATA SELECTION] section of the window.
Note: If you are loading multiple items, load the settings information before any other data. If settings information is loaded together with other data, some, or all, of the non-settings data may not load correctly.
5. Depending on the item selected at step 4, select [ADD], [OVERWRITE] or [NO] as appropriate.
 - [ADD]: selected data is added to the temporary data. Temporary data is not overwritten.
 - [OVERWRITE]: replace (overwrite) the temporary data with the selected data.
 - [NO]: selected data is not used.

Note 1: When [ADD] is selected for [PLAY MARK/TRACK], a limit of 30,000 items applies. When this limit is reached, no more items can be added.

Note 2: When [ADD] is selected for [PLAY OWN TRK] or [PLAY OTHER TRK] and the limit is reached, the oldest items are deleted to make way for new items. For example, if you have 10,000 tracks already saved and add 25,000, the oldest 5,000 tracks from those already saved are deleted.
6. Repeat steps 4 and 5 to add other items you want to load.
7. Select [SEL DATUM].
8. Select [WGS-48] or [TOKYO] as required.
9. Select the data to load from the [DATA SELECTION] list. A confirmation message appears.
10. Select [YES] to load the selected data, or select [CANCEL] to cancel the load. If you selected [YES], a progress bar appears to indicate the loading status, followed by a confirmation message when the loading is complete.
11. Select [CONFIRM].
12. Close the window.

1.60.5 How to transfer USB data to the internal memory

You can save your transfer your USB data to the internal memory.

1. Open the menu.
2. Select [6 FILES]. The [FILES] menu appears.

1.60.6 How to save the backup data to the USB flash memory

Data can be automatically backed up when the system starts up, or you can manually back up your data at any time.

Note: For automatic backups, the system start-up will take a short while longer than normal, to allow for the data backup.

How to automatically backup your data to the USB flash memory

1. Open the menu.
2. Select [6 FILES]. The [FILES] menu appears.
3. Select [0 NEXT] to show the second page of the [FILES] menu.
4. Select [2 AUTO BACKUP].



5. Select [2 USB MEMORY].
6. Select [ON] to activate, or [OFF] to deactivate, the automatic backup.
If you selected [ON], the internal memory is backed up each time you turn the system on.
7. Close the menu.

Note: When auto backup is activated, the system starts the backup process after the start-up warning screen is closed. A message appears while the backup is in progress and the message disappears when the backup is complete.

How to manually backup your data to the USB flash memory

1. Open the menu.
2. Select [6 FILES]. The [FILES] menu appears.
3. Select [0 NEXT] to show the second page of the [FILES] menu.
4. Select [3 SAVE BACKUP DATA].
5. Select [2 SAVE TO USB MEMORY]. A confirmation message appears.
6. Select [RUN] to backup the area, or [CANCEL] to cancel the backup.
If you selected [RUN], the message "TRANSFERRING. PLEASE WAIT" appears in a window while the data is backed up and a progress bar indicates the backup progress. The message changes to "TRANSFER COMPLETED" when the backup is completed.
7. Select [CONFIRM] to close the window.

1.60.7 How to load backup data from the USB flash memory

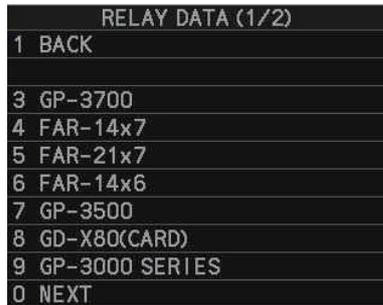
1. Open the menu.
2. Select [6 FILES]. The [FILES] menu appears.
3. Select [0 NEXT] to show the second page of the [FILES] menu.
4. Select [4 LOAD BACKUP DATA].
5. Select [2 LOAD FROM USB MEMORY]. A confirmation message appears.
6. Select [RUN] to backup the area, or [CANCEL] to cancel the backup.
If you selected [RUN], a progress window appears. When the data load is complete, the system restarts automatically.

1.60.8 How to import data from other equipment

You can import data from other compatible equipment into the internal memory.

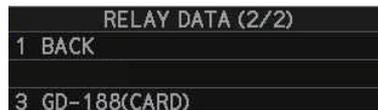
Note: Before importing data, consult your local dealer.

1. Connect the USB with the data you want to import to the USB port on the processor unit.
2. Open the menu.
3. Select [6 FILES]. The [FILES] menu appears.
4. Select [0 NEXT] to show the second page of the [FILES] menu.
5. Select [6 RELAY DATA]. The [RELAY DATA] menu appears.



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Menu item [8 GD-X80] covers GD-280, GD-380, GD-680 and GD-280BB.



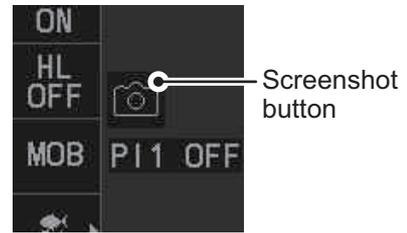
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1.61 How to Take a Screenshot

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

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

Note: The screenshot function can also be assigned to a function key. For how to set up the function keys, see section 1.8



2. RADAR OBSERVATION

2.1 General

2.1.1 Minimum range

The minimum range is defined by the shortest distance at which, using a scale of 1.5 or 0.75 nm, a target having an echoing area of 10 m² is still shown separate from the point representing the antenna position.

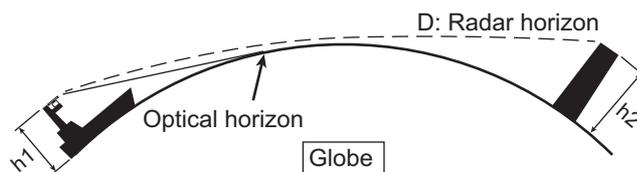
It is mainly dependent on the pulselength, antenna height, and signal processing such as main bang reduction and digital quantization. It is a good practice to use a shorter range scale as far as it gives favorable definition or clarity of picture.

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

2.1.2 Maximum range

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

Under normal atmospheric conditions, the maximum range is equal to the radar horizon or a little shorter. The radar horizon is longer than the optical one by about 6% because of the diffraction property of the radar signal. The R_{max} is given in the following equation.



$$D = 2.2 \times (\sqrt{h_1} + \sqrt{h_2})$$

where D: radar horizon (nautical miles)

h1: antenna height (m)

h2: target height (m)

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

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

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

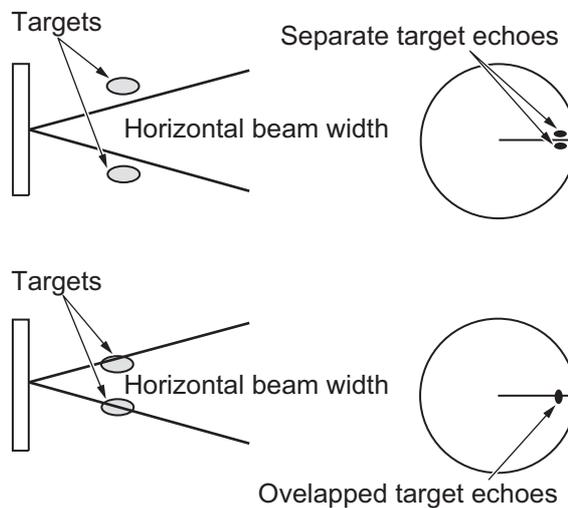
2.1.3 X-band and S-band

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

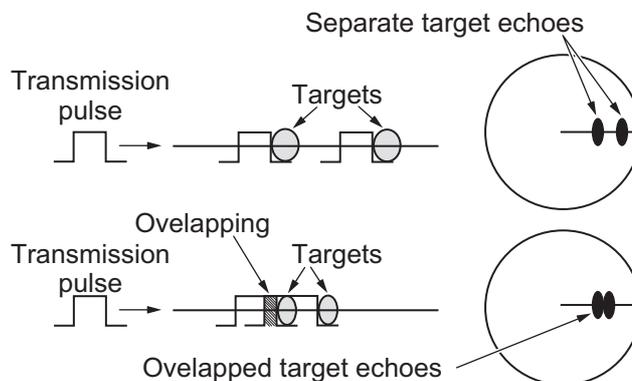
2.1.4 Radar resolution

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

- Bearing resolution is the ability of the radar to display as separate pips the echoes received from two targets that are at the same range and close together. It is proportional to the antenna length and reciprocally proportional to the wavelength. The length of the antenna radiator should be selected for a bearing resolution better than 2.5° (IMO Resolution). This condition is normally satisfied with a radiator of 1.2 m (4 ft) or longer in the X-band. The S-band radar requires a radiator of about 12 feet (3.6 m) or longer.



- Range resolution is the ability to display as separate pips the echoes received from two targets that are on the same bearing and close to each other. This is determined by pulse length only. Practically, a 0.08 microsecond pulse offers the discrimination better than 40 m as do so with all FURUNO radars. Test targets for determining the range and bearing resolution are radar reflectors having an echoing area of 10 m^2 .



2.1.5 Bearing accuracy

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

2.1.6 Range measurement

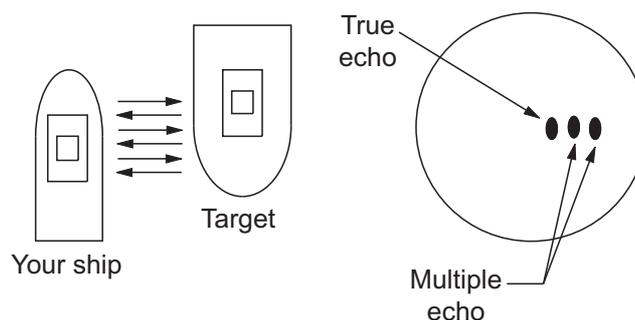
Measurement of the range to a target is also a very important function of the radar. Generally, there are two means of measuring range: the fixed range rings and the variable range marker (VRM). The fixed range rings appear on the screen with a predetermined interval and provide a rough estimate of the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

2.2 False Echoes

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

Multiple echoes

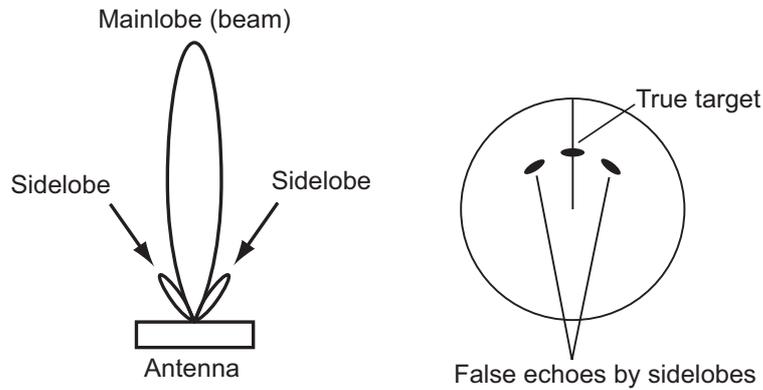
Multiple echoes occur when a transmitted pulse returns from a solid object like a large ship, bridge, or breakwater. A second, a third or more echoes may be observed on the display at double, triple or other multiples of the actual range of the target as shown below. Multiple reflection echoes can be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



2. RADAR OBSERVATION

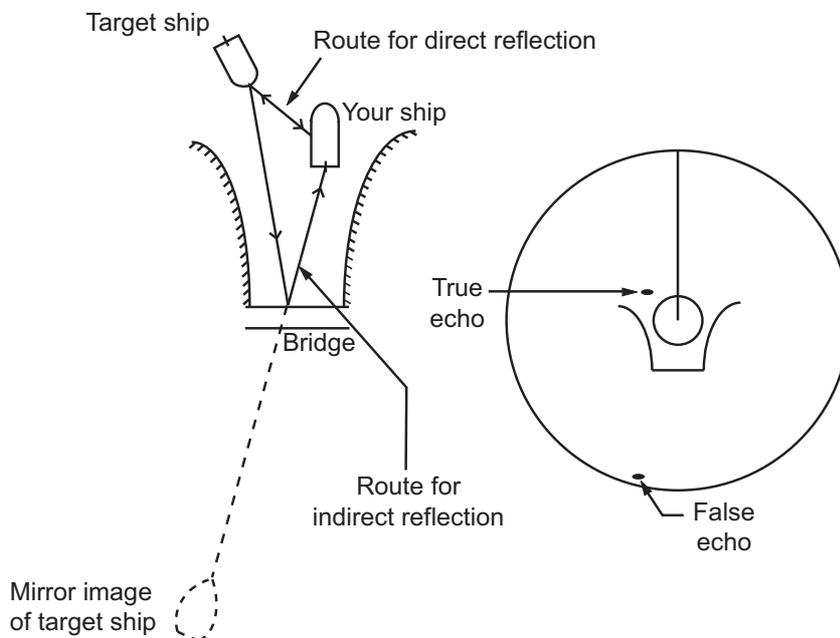
Sidelobe echoes

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



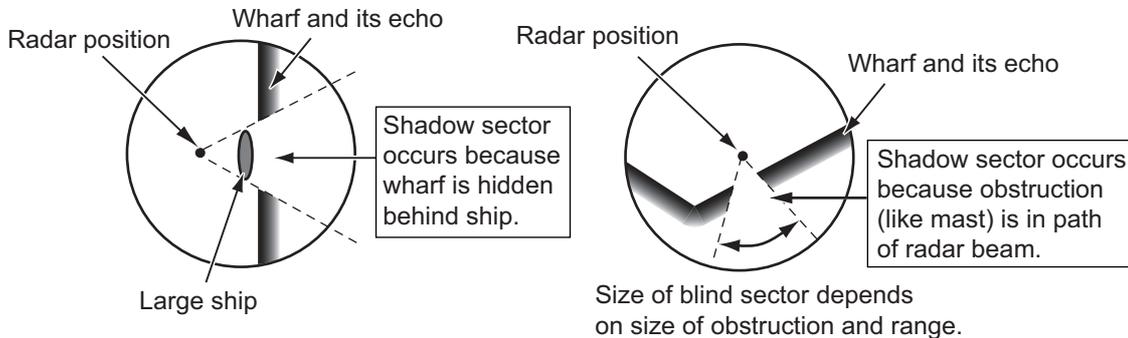
Virtual image

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



Shadow sectors

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

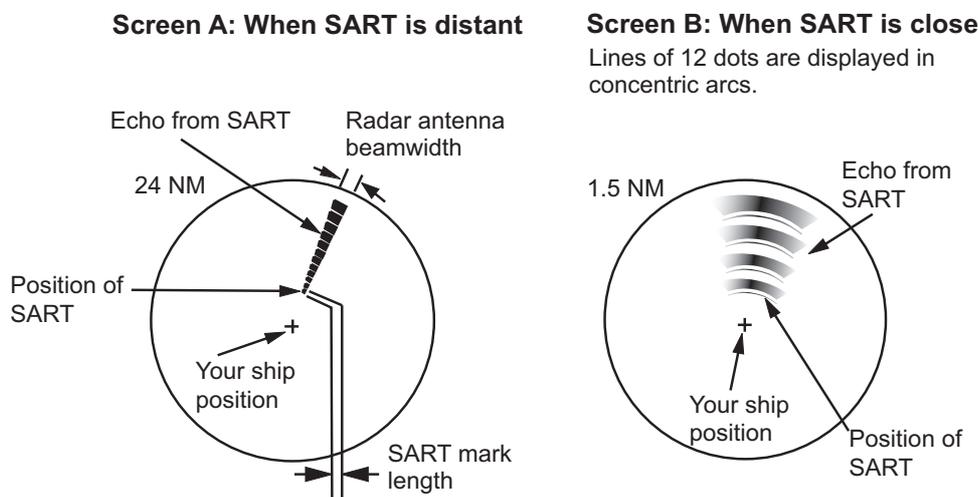


2.3 SART (Search and Rescue Transponder)

2.3.1 SART description

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

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



2.3.2 How to show SART marks on the radar display

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

Note: The following procedure is not available from FAR-2x58 monitors which are assigned as [SUB] at installation.

1. Open the menu.
2. Select [1 ECHO], then press the **ENTER MARK** key.
3. Select [7 SART], then press the **ENTER MARK** key.
4. Select [ON] to show SART marks on the radar display, then press the **ENTER MARK** key. Select [OFF] to hide SART marks.

When the SART function is active, the settings listed in the table on the following page are automatically made to radar functions:

Setting	Changed to
Range	12 NM
Pulselength	Long
Echo Stretch	Off
Noise Rejector	Off
Echo Averaging	Off
Interference Rejector	Off
Performance Monitor	Off
A/C RAIN	Off

5. Close the menu.

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

2.3.3 General remarks on receiving SARTs

SART range errors

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

Radar bandwidth

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

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

Radar sidelobes

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

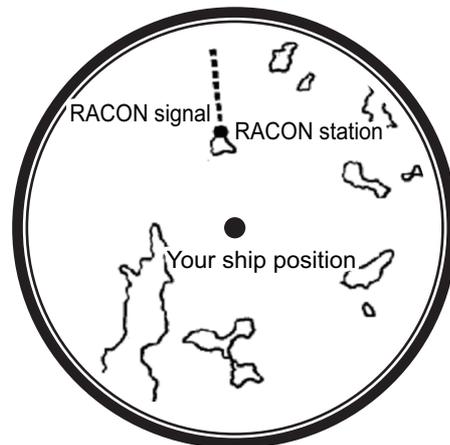
Note: SART information excerpted from IMO SN/Circ 197 OPERATION OF MARINE RADAR FOR SART DETECTION.

2.4 RACON

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



Echoes on the radar screen



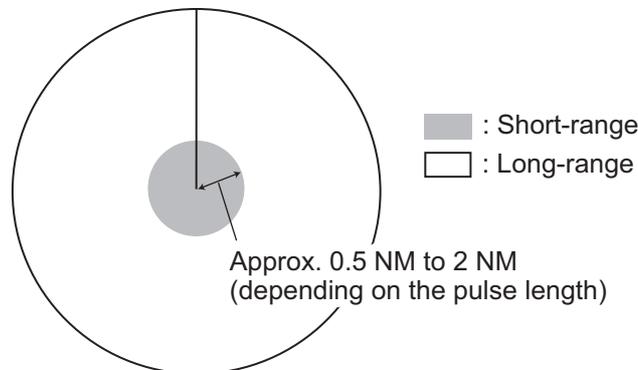
Echo description

2.5 Radar Target Enhancer (RTE)

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

2.6 Solid state radar

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



Range and signal intensity

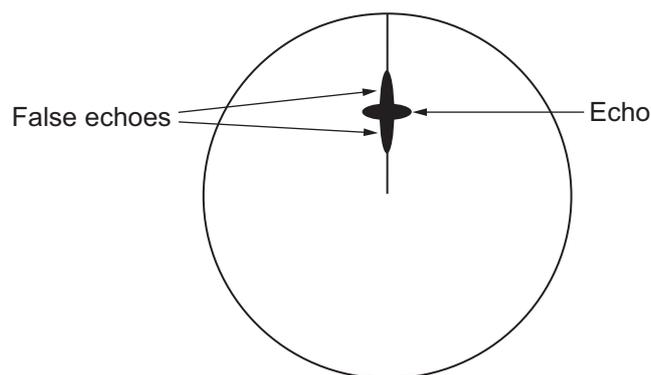
At long-range, even though the Solid State radar has lower transmission power than magnetron radars, the signal intensity is equivalent.

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

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

False echoes fore and aft of the target

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



3. TARGET TRACKING (TT)

3.1 Precautions when Using Target Tracking

WARNING

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

- ◆ This TT automatically tracks automatically or manually acquired radar targets and calculates their courses and speeds, indicating them by vectors. Since the data generated by the auto plotter are based on what radar targets are selected, the radar must always be optimally tuned for use with the auto plotter, to ensure required targets will not be lost or unwanted targets such as sea returns and noise will not be acquired and tracked.
- ◆ A target does not always mean a land-mass, reef, ships or other surface vessels but can imply returns from sea surface and clutter. As the level of clutter changes with environment, the operator should properly adjust the [A/C SEA], [A/C RAIN] and [GAIN] controls to be sure target echoes are not eliminated from the radar screen.

CAUTION

The plotting accuracy and response of this TT meets IMO standards. Tracking accuracy is affected by the following:

- ◆ Tracking accuracy is affected by course change. One to two minutes is required to restore vectors to full accuracy after an abrupt course change. (The actual amount depends on gyrocompass specifications.)
- ◆ The amount of tracking delay is inversely proportional to the relative speed of the target. Delay is on the order of 15 - 30 seconds for high relative speed; 30 - 60 seconds for low relative speed.
- ◆ The target tracking and pertinent vector calculation accuracy is influenced by the following:
 - Echo intensity
 - The range measurement accuracy; characterized by both random and biased measurement errors.
 - The angular measurement accuracy; characterized by beam shape, target glint and bias errors.
 - Radar transmission pulsewidth
 - Gyrocompass heading error
 - Speed log error
 - Current and wind (set & drift)
 - Course change (own ship and target)

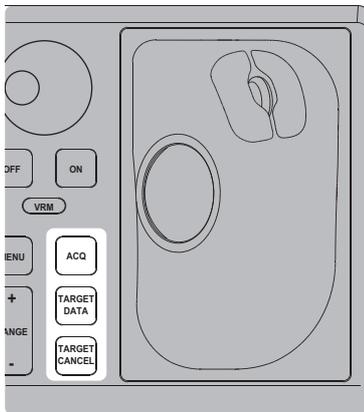
The data generated by TT, AIS and video plotter are intended for reference only.

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

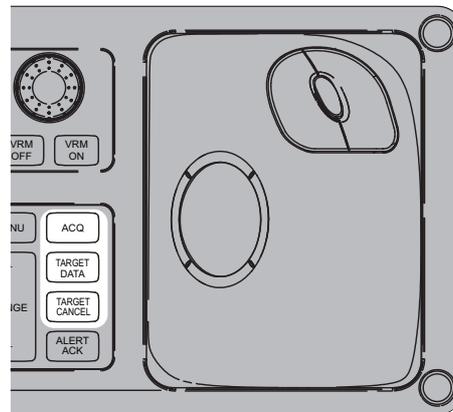
3. TARGET TRACKING (TT)

3.2 TT Controls

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



RCU-014



RCU-031

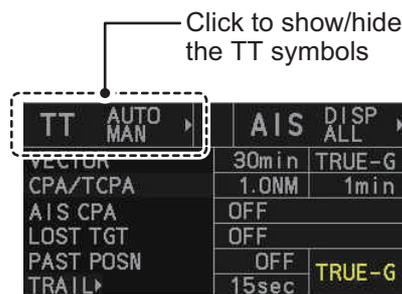
- **ACQ**: Acquires the selected echo as a target.
- **TARGET DATA**: Shows the selected target's data in the information box.
- **TARGET CANCEL**: Deactivates tracking for the cursor-selected target.

These functions, along with other TT functions, can also be accessed from the [CURSOR] menu (See section 1.7.3).

3.3 How to Show/Hide the TT Symbols

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

*: These TT modes and their settings are described in section 3.4.



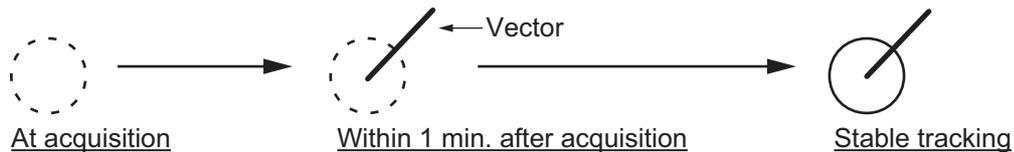
Note: The TT mode indication is hidden when [SIMPLE] display mode is used. To change TT settings in [SIMPLE] mode, first restore [NORMAL] display mode, adjust the settings, then return to [SIMPLE] mode. See section 1.9 for how to change the display mode.

3.4 How to Select the TT mode

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

The number of automatically and manually acquired targets is determined by the setting for [TT SELECT] in the [TT] menu.

A target just acquired automatically is marked with a dashed circle and a vector appears within one minute to indicate the target's motion trend. If the target is consistently detected for three minutes, the plotting symbol changes to a solid circle. If acquisition fails, the target symbol blinks.



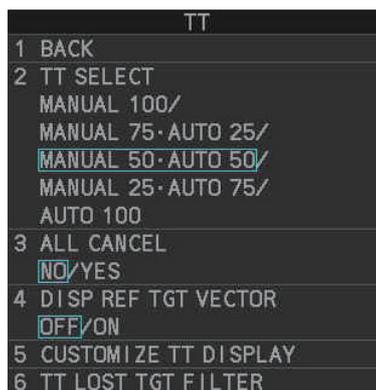
3.4.1 How to setup the acquisition method

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

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



3. **For IMO-types**, select [6 TT].
For C-types, select [5 TT].



Note: You can also right-click the TT indication in the [TT•AIS] box to open the [TT] menu.

4. Select [2 TT SELECT], then select the acquisition condition.

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

3. TARGET TRACKING (TT)

5. Close the menu.

The selected settings change how the TT indication is displayed in the TT•AIS box as follows:

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

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

3.4.2 How to manually acquire targets

Note: The following procedure requires [2 TGT DATA/ACQ SETTING] on the second page of the [CURSOR] menu to be set as [ANY] or [TT ONLY].

Acquire a target from the Control Unit (RCU-014/RCU-031)

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

Acquire a target by the trackball module

1. When the target to acquire and the AIS symbol overlap one another, right-click the operational display area to show the [CURSOR MENU].
2. Select [TT TARGET DATA/ACQ].
3. Place the cursor on the target to acquire then left-click.

Note 1: For successful acquisition, the target should be within 24 NM (or 32 NM, depending on initial setting) from own ship and not obscured by sea or rain clutter.

Note 2: You are alerted when the capacity of manual acquisition is 95% and 100%. These alerts are "TT TARGET95%(MAN)" and "TT TARGET FULL(MAN)". If the capacity is 100% you cannot acquire more targets. Cancel tracking of non-threatening targets if you wish to acquire additional targets manually.

Note 3: When a target being tracked nears another target being tracked, the targets may be "swapped". When two targets acquired either automatically or manually come close to each other, one of the two may become a lost target. If this occurs, manual re-acquisition of the lost target may be necessary after the two have separated.

Note 4: You can reuse a target number. This is useful when you acquire the "wrong" target. Drag and drop the symbol onto the correct target.

3.4.3 How to automatically acquire targets

Targets are automatically acquired when the TT mode is set to other than [MANUAL 100] and a target enters the acquisition zone (see section 3.14). The maximum tracking distance (24 NM, 32 NM or 48 NM*) is set at installation.

*: The maximum track distance of 48 NM is only available for the FAR-2x58.