3.18   Criteria for Tracking Target Selection

The FURUNO TT video processor detects targets in midst of noise and discriminates radar echoes on the basis of their size. Target whose echo measurements are greater than those of the largest ship in range or tangential extent are usually land and are displayed only as normal radar video. All smaller ship-sized echoes that are less than this dimension, are further analyzed and regarded as ships and displayed as small circles superimposed over the video echo.

When a target is first displayed, it is shown as having zero true speed but develops a course vector as more information is collected. In accordance with the International Marine Organization Automatic Radar Plotting Aid (IMO TT) requirements, an indication of the motion trend should be available within 20 scans of antenna and full vector accuracy within 60 scans. The FURUNO TTs comply with these requirements.

Acquisition and tracking criteria

A target which is hit by five consecutive radar pulses, is detected as a radar echo. Manual acquisition is done by designating a detected echo with the trackball.Automatic acquisition is done in the acquisition areas when a target is detected 5-7 times continuously depending upon the congestion. Tracking is achieved the target is clearly distinguishable on the display for 5 out of 10 consecutive scans, whether acquired automatically or manually. Required tracking facilities are available within 0.1-32 nm on range scales including 3, 6, 12 nm, full plotting information is available within one scan when the range scale has been changed.

Targets not detected in five consecutive scans become "lost targets".

Quantization

The entire picture is converted to a digital from called "Quantized Video". A sweep range is divided into small segments and each range element is"1" if there is radar echo return above a threshold level, or "0" if there is no return.

The digital radar signal is then analyzed by a ship-sized echo discriminator. As the antenna scans, if there are five consecutive radar pulses with 1's indicating an echo presence at the exact same range, a target "start" is initiated. Since receiver noise is random, it is not three-bang correlated, and it is filtered out and not classified as an echo.

The same is true of radar interference. Electronic circuits track both the closet and most distant edges of the echo. At the end of the scanning of the echo, the discriminator indicates the measured maximum range extent and total angular extent subtended by the echo. If the echo is larger than a ship-sized echo in range extent and/or angular width, adjusted as a function of range, it is declared to be a coastline and the closet edge is put into memory as a map of the area.

This land outline is used to inhibit further acquisition and tracking of ship-sized echoes beyond the closest coast outline. Five consecutive scans of coastal outline are retained in memory to allow for signal variation. All smaller echoes are declared to be ship sized and the middle of the leading edge is used to provide precise range and bearing co-ordinates of each echo on every scan. This range/bearing data is matched to previous data and analyzed from scan-to-scan for consistency. When it is determined to be as consistent as a real target, automatic acquisition occurs and tracking is initiated. Continued tracking and subsequent calculation develop the relative course and speed of the target.

The true course and speed of own ship are computed from own ship's gyro and speed inputs, and the resulting course and speed of each tracked target is easily computed by vector summing of the relative motion with own ship's course and speed. The resulting true or relative vector is displayed for each of the tracked targets. This process is updated continually for each target on every scan of the radar.

Qualitative description of tracking error

The FURUNO TT's accuracy complies with or exceed IMO standards.

Own ship maneuvers

For slow turns there is no effect. For very high turning rates (greater than 150°/minute, depending on gyro), there is some influence on all tracked targets that lasts for a minute or two then all tracked targets revert to full accuracy.

Other ship maneuvers

Target ship courses, lag 15 to 30 seconds at high relative speed, or 3 to 6 seconds at low (near 0) relative speed. It is less accurate during a turn due to lag, but accuracy recovers quickly.

3.19   Factors Affecting Target Tracking

Sea returns

If the radar anti-clutter control is adjusted properly, there is no serious effect because distant wave clutter, not eliminated by this control, is filtered out by more than one bang correlation and scan-to-scan matching of data.

Rain and snow

Rain clutter can be acquired and tracked as targets. Adjust the rain clutter control to suppress the clutter. If it is heavy rain, switch to S-band if provided, or switch on the interference rejector on the radar. If heavy clutter still exists, switch to manual acquisition. Accuracy can be affected.

Low clouds

Usually no affect. If necessary, adjust the rain clutter control.

Non-synchronous emissions

No effect.

Low gain

Insufficient or low radar receiver gain will result in some targets not being acquired at long distance. The TT display will be missing on one or more targets that could only be visible if the radar sensitivity control (**GAIN** control) were increased.

The setting of the correct radar receiver gain is not critical but the target should be on the radar PPI and be clearly visible and well defined.

Manual acquisition is done if a target is positively displayed more than once. Automatic acquisition is done when the target is detected 5-7 times continuously.

Tracking continues if a return echo is received at least once in nine antenna rotations. However, the fewer the return echoes the lower the accuracy. If no return echo is received within nine antenna rotations the target is declared a lost target.

Second trace echoes

When the radar beam is super refracted, strong echoes may be received at such long ranges that they appear on a different timebase sweep than the transmitted pulse. This gives an incorrect range indication. Second- and third-trace echoes can be tracked if they are consistent enough to meet acquisition and tracking criteria but target course and speed data will be in error.

Blind and shadow sectors

Radar shadow or blind areas caused by obstructions aboard the ship, for example, funnels and masts, in the path of the radar beam can result in reduction of radar beam intensity in that particular direction. This may eliminate the detection of some targets. The TT system will lose track of targets shortly after they are lost on the radar picture and if they remain in a blind zone. These targets will however be acquired and tracked when they pass out of the blind zone and again present normal radar echo. The angular width and bearing of any shadow sector should be determined for their influence on the radar. In certain cases false echoes in the shadow sector cause the TT system to acquire, track, and vector them. Shadow sectors should be avoided.

Indirect echoes

A target at close range is usually picked up directly, but it can also be received as reflection from a large, flat surface. This will result in the radar presenting two or more echoes on the display, each at a different range. The TT system can acquire and track a false echo if it is detected in five consecutive scans. Reduction in radar gain can eliminate the multiple echoing but care should be taken as range detection also will be reduced.

Radar interference

If interference is extreme due to another radar operating at close range, spiral "dotting" and/or false targets may appear momentarily. The interference rejector can clear the display.

Delay of sensor input

If the refresh rate of the gyrocompass signal is too slow, error in target bearing occurs when own ship turns. To prevent this error, the refresh rate of the gyrocompass signal must be as indicated in the System Configuration drawings.

3. TARGET TRACKING (TT)

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4. AIS OPERATION

An AIS transponder can be connected to this radar to overlay AIS targets on the radar display. The radar can store up to 1,200 AIS targets in its storage buffer. When this buffer becomes full of AIS targets, the Alert "AIS CAPACITY FULL" is generated to alert you to a full storage buffer. The storage buffer contains automatic dead reckoning for all AIS targets, which is based on reported Speed Over the Ground (SOG) and Course Over the Ground (COG). The storage buffer also contains calculation of range, bearing, CPA, TCPA, etc. The CPA and TCPA limits set for dangerous targets are common for TT and AIS targets.

This radar can activate 50 AIS targets. The Alert "ACTIVE AIS FULL" is generated when 50 AIS targets are activated.

This radar can display a maximum of 350 AIS targets. The Alert "AIS DISPLAY FULL" is generated when 350 AIS targets, which includes both activated and sleeping targets, are displayed.

The frequency for update of AIS transponder-sent data depends on speed and course of tracked AIS target. The table below shows the IMO standardized reporting rates for the AIS transponder. Based on the table below, the radar defines which AIS targets are in tracking or lost. When you acknowledge a lost target alert, the corresponding AIS symbol will be removed from the display.

Type of Ship	IMO nominal reporting interval	Lost target indication (reporting interval >)
Class A: Navigation status is "anchor" or "not under command" or "moored" or "aground", and SOG ≤ 3kn	3 min	10 min
Class A: Navigation status is "anchor" or "not under command" or "moored" or "aground", and SOG > 3kn	10 s	50 s
Class A: 0kn ≤ SOG < 14kn	10 s	50 s
Class A: 14kn ≤ SOG ≤ 23kn	6 s	30 s
Class A: SOG > 23kn	2 s	10 s
Class B: "CS" SOG ≤ 2kn	3 min	10 min
Class B: "CS" SOG > 2kn	30 s	150 s
Class B: "SO" 0 kn ≤ SOG ≤ 2kn	3 min	10 min
Class B: "SO" 2 kn < SOG < 14kn	30 s	150 s
Class B: "SO" 14 kn ≤ SOG ≤ 23kn	15 s	75 s
Class B: "SO" SOG > 23kn	5 s	25 s
Class A and Class B: no SOG available	N/A	10 min
AIS SAR aircraft	10 s	50 s
AIS aid to navigation	3 min	10 min
AIS base station	10 s	50 s
AIS search and rescue transponder	N/A	10 min

An AIS transponder "sees" all ships fitted with an AIS transponder belonging to either a Class A or Class B AIS. Additionally, the AIS transponder receives messages from ships and non-ships (AIS SAR aircraft, AIS aid to navigation, AIS base station, and AIS search and rescue transmitter).

There can be several hundreds or several thousands of AIS targets, and of those only a few will be significant for your ship. To remove unnecessary AIS targets from the radar display, the feature "active and sleeping AIS targets" is available. Initially any new AIS target received by an AIS transponder is not active (="sleeping"). Such sleeping targets are shown with a small triangle. The operator can pick any AIS target and change it from sleeping to active (see section 4.5 and section 4.6), or filter the targets to display on-screen (see section 4.4). Active AIS targets are shown with a large triangle with speed vector, headline, ROT indicator, etc. Further, the operator can pick active AIS targets and change their status to sleeping.

An indication of AIS target activated capacity limit is given well before it is reached. When 95% of 50 targets are activated, the Alert "ACTIVE AIS 95%" appears. When 50 targets are activated, the Alert "ACTIVE AIS FULL" appears. Sleep any unnecessary AIS targets to allow acquisition of new targets.
An indication of AIS target display capacity limit is given well before it is reached. When 95% of 350 targets are displayed, the Alert "AIS DISPLAY 95%" appears. When 350 targets are displayed, the Alert "AIS DISPLAY FULL" appears.
An indication of AIS target processing capacity limit is given well before it is reached. The Alert "AIS CAPACITY FULL" appears when 1,200 targets are in the storage buffer. When capacity-related AIS alerts occur, you can reduce the number of AIS targets to display from [AIS DISP FILTER] in the [AIS] menu. See section 4.4.

This radar generates AIS-related alerts. These are Alert "AIS DANGER OF COLLI-SION" and Alert "AIS TARGET LOST". Only active AIS targets generate alerts. The operator can activate or sleep AIS target alerts as desired. The feature "active and sleeping AIS targets" is very effective for focusing on only those AIS targets that need supervision. This radar further eases the task of the operator by automatically changing non-active targets to active targets, if their CPA and TCPA are within a preset limit.

4.1   Controls for AIS

The control unit has three keys that are used in the AIS mode. The keys are indicated in the figure below.
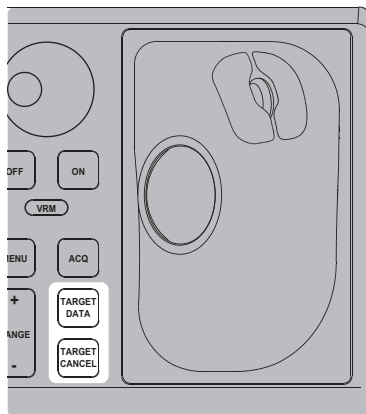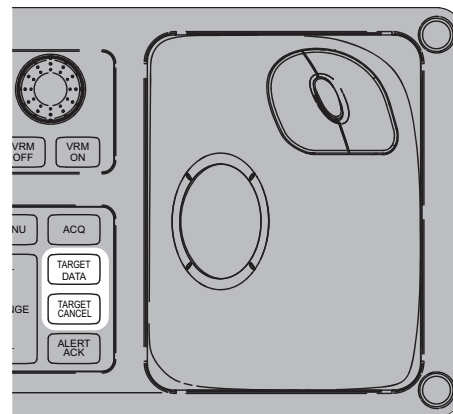
RCU-014   RCU-031

- **TARGET DATA**: Shows the selected target's data in the information box. If the target is sleeping, activates the target.

- **TARGET CANCEL**: Sleeps the cursor-selected target.

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

4.2 How to Select the AIS Display Mode

AIS display mode

- [DISP OFF]: AIS symbols are hidden.
- [DISP FILT]: Only filtered AIS targets are displayed.
- [DISP ALL]: All AIS symbols are displayed.

To disable the AIS function, put the cursor on the AIS display mode indication, then long right-click. The AIS display mode indication shows [FUNC OFF] when the AIS function is disabled.

Note: The AIS mode indication is hidden when [SIMPLE] display mode is used. To change AIS 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.

4.3 AIS Symbols and Their Meanings

When the AIS display is active, each AIS target is marked with a symbol that indicates the target's status. For the meaning of each AIS symbol, see "TT/AIS symbols" on page AP-34.

Note 1: The equipment continues to process AIS targets when the AIS feature is deactivated. When the AIS is activated again, symbols are immediately displayed.

Note 2: AIS symbols are momentarily erased and the screen is redrawn after the heading is changed in the HEAD UP mode.

Note 3: When no AIS data is received, the message "AIS COM ERROR" appears in the Alert Box. Check connection with the AIS transponder.
**When the AIS function is disabled**: Above message is prioritized as a Caution level alert.
When the AIS function is active: Above message is prioritized as a Warning level alert.

4.4   How to Use the AIS Display Filter

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

1. Open the menu.
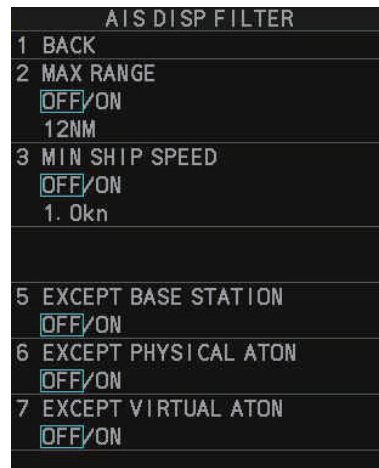2. Select [5 TT•AIS].
3. Select [4 AIS].
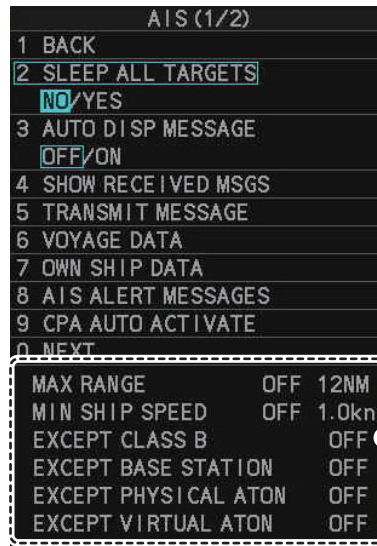
Current display filter settings appear here

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

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

5. Select [2 AIS DISP FILTER].

6. Referring to the table below, select the appropriate filter.

Filter type	Definition
[MAX RANGE]	Any sleeping AIS targets class A/B beyond the range set here will not be shown.
[MIN SHIP SPEED]	Any sleeping AIS targets class A/B slower than this setting will not be shown.
[EXCEPT CLASS B]*	Select [ON] to remove sleeping AIS targets class B.
[EXCEPT BASE STATION]	Select [ON] to remove the BASE STATION symbol.
[EXCEPT PHYSICAL ATON]	Select [ON] to remove the AIS PHYSICAL ATON symbol.
[EXCEPT VIRTUAL ATON]	Select [ON] to remove the AIS VIRTUAL ATON symbol.

*: This menu item appears only on C-type radars.

7. Do one of the following depending on your selection at step 6.

- [MAX RANGE]: Select [ON], spin the scrollwheel to set the maximum range (00 to 99 N), then click to confirm selection.

- [MIN SHIP SPEED]: Select [ON], spin the scrollwheel to set the minimum speed (0.0 to 9.9 kn), then click to confirm selection.

- [EXCEPT CLASS B], [EXCEPT BASE STATION], [EXCEPT PHYSICAL ATON], [EXCEPT VIRTUAL ATON]: Select [ON] to hide the corresponding AIS target.

8. Close the menu.

Set the AIS display mode to [DISP FILT] to show only the AIS symbols selected for display on the [AIS DISP FILTER] menu.

Note: This function is not available for an activated target.

4.5 How to Activate AIS Targets

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

Sleeping targets within an acquisition zone are automatically changed to activated targets and are colored red. See section 3.14 for how to use acquisition zones.

4.5.1 How to activate specific targets manually

Note: Enable target data and acquisition beforehand.
Right click to show the [CURSOR] menu→[0 NEXT]→[TGT DATA/ACQ SETTING]→[ANY] or [AIS ONLY].
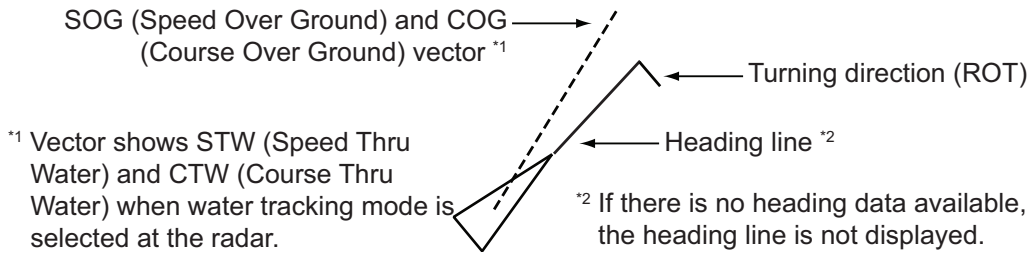
Activate an AIS target from the control unit (RCU-014/RCU-031)

Put the cursor on the symbol of the AIS target to activate, then press the **TARGET DATA** key.

Activate a AIS target with the trackball

Put the cursor on the symbol of the AIS target to activate, then click.

SOG (Speed Over Ground) and COG (Course Over Ground) vector [1]

Turning direction (ROT)

[1] Vector shows STW (Speed Thru Water) and CTW (Course Thru Water) when water tracking mode is selected at the radar.

Heading line [2]

[2] If there is no heading data available, the heading line is not displayed.

4.5.2 How to set the AIS auto activate function

You can limit the function of the AIS auto activate function by distance from own ship, ship's speed, ship class, and ship's length.

How to set the AIS auto activate function

1. Open the menu.
2. Select [5 TT•AIS].
3. **For IMO-types**, select [5 AIS].
   For C-types, select [4 AIS].
4. Select [9 CPA AUTO ACTIVATE] to show the [CPA AUTO ACTIVATE] menu.

```
CPA AUTO ACTIVATE
1 BACK
2 MAX RANGE
  OFF/ON
  00NM
3 MIN SHIP SPEED
  OFF/ON
  1. 0kn
4 EXCEPT CLASS B
  OFF/ON
```

5. Referring to the table below, select the appropriate filter, then left-click.

Filter type	Definition
[MAX RANGE]	Any AIS targets beyond the range set here will not be automatically activated.
[MIN SHIP SPEED]	Any AIS targets slower than this setting will not be automatically activated.
[EXCEPT CLASS B]	Select [ON] to prevent activation of AIS targets class B.

6. Do one of the following depending on your selection at step 5.
   • [MAX RANGE]: Select [ON], spin the scrollwheel to set the maximum range (00 to 99 N), then click to confirm selection.
   • [MIN SHIP SPEED]: Select [ON], spin the scrollwheel to set the minimum speed (0.0 to 9.9 kn), then click to confirm selection.
   • [EXCEPT CLASS B], [EXCEPT BASE STATION], [EXCEPT PHYSICAL ATON], [EXCEPT VIRTUAL ATON]: Select [ON] to hide the corresponding AIS target.
7. Close the menu.

How to enable/disable the AIS auto activate function

Use the [CPA AUTO ACTIVATE] box at the bottom right corner to enable or disable the AIS auto activate function.

CPA auto-activate setting

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

1. Place the cursor on the [CPA AUTO ACTIVATE] box, then left-click display to cycle through the auto activate settings.

Filter type	Definition
[OFF]	Disable the AIS auto activate function.
[AUTO ACT FILT]	Activation against AIS targets which meet the following criteria: • AIS target that meets the criteria set with [CPA AUTO ACTIVATE] on the [TT•AIS] menu. • CPA or TCPA of an AIS target is smaller than that set in section 3.13.
[AUTO ACT ALL]	Activation against AIS targets whose CPA or TCPA is less than set in section 3.13

4.6 How to Sleep AIS Targets

You can "sleep" an AIS target as below when the screen becomes filled with radar echoes and TTs, which might prevent important radar and AIS displays from being identified.

Note: Targets that have been activated automatically and dangerous targets cannot be "slept".

4.6.1 How to sleep individual AIS targets

Note: Enable target data and acquisition beforehand.
Right click to show the CURSOR menu→[0 NEXT]→[TGT DATA/ACQ SETTING]→[ANY] or [AIS ONLY].

Sleep a AIS target from the control unit (RCU-014/RCU-031)

Place the cursor on the symbol of the AIS target to sleep, then press the **TARGET CANCEL** key.

Sleep a AIS target with the trackball

1. Place the cursor inside the operational display area, then right-click. The [CURSOR] menu appears.

2. Select [TARGET CANCEL].

3. Place the cursor on the symbol of the AIS target to sleep, then click.

4.6.2 How to sleep all AIS targets

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [5 AIS].
4. Select [2 SLEEP ALL TARGETS].
5. Select [YES] or [NO] as appropriate.
6. Close the menu.

4.7 How to Set Up For a Voyage

At the start of a voyage, following five items must be input from the [VOYAGE DATA] menu: navigational status, ETA, destination, draught and crew.

4.7.1 How to access the [VOYAGE DATA] menu

There are two methods by which you can access the [VOYAGE DATA] menu: from the InstantAccess bar™, or from the menu. The following procedure shows the menu method. If you click the [OWN AIS] button on the lower half of the InstantAccess bar™, skip to step 5 in the below procedure.

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [5 AIS].
4. Select [6 VOYAGE DATA].

```
            VOYAGE DATA
1  BACK
2  NAV STATUS
   05
   MOORED

3  ETA
   --/---/---- --:--
4  DESTINATION

5  DRAUGHT
   0. 0m
6  PERSONS
   0000
7  OPEN DESTINATION    1
8  SAVE DESTINATION    1
```

5. Select [2 NAV STATUS].
6. Spin the scrollwheel to select the navigation status number, then left-click.

Nav Status No.	Meaning
00	UNDERWAY USING ENGINE
01	AT ANCHOR
02	NOT UNDER COMMAND
03	RESTRICTED MANEUVERABILITY
04	CONSTRAINED BY HER DRAUGHT
Continued on following page	

Nav Status No.	Meaning
Continued from previous page	
05	MOORED (DEFAULT)
06	AGROUND
07	ENGAGED IN FISHING
08	UNDER WAY SAILING
09	RESERVED FOR HIGH SPEED CRAFT (HSC)
10	RESERVED FOR WING IN GROUND (WIG, FOR EXAMPLE, HYDROFOIL)
11	POWER-DRIVEN VESSEL (AHEAD/ASTERN)
12	POWER-DRIVEN VESSEL (AHEAD/ALONGSIDE)
13	RESERVED FOR FUTURE USE
14	SART ACTIVE
15	UNDEFINED

7. Select [3 ETA].

8. Spin the scrollwheel to set the estimated day of the month to arrive, then left-click.

   Currently selected digit is highlighted by the cursor. ——— 01/JAN/
   Spin the scrollwheel to adjust the day.
   Left-click to move to the next digit.

9. Select [4 DESTINATION], then left-click. The software keyboard appears.

10. Use the trackball to highlight a letter or digit on the software keyboard, then left-click. Repeat until the destination name is entered. (Max. 20 characters)

11. Use the trackball to highlight [END] on the software keyboard, then left-click.

12. Spin the scrollwheel to assign a destination number (1 to 10) to the destination entered at step 9, then left-click. The next time you use this place as your destination, simply select the corresponding destination number.

13. Select [5 DRAUGHT].

14. Spin the scrollwheel to set the ship's draught (0.0 to 25.5 m), then left-click.

15. Select [6 PERSONS].

16. Spin the scrollwheel to set the number of people on-board (0000 to 8191), then left-click.

17. Close the menu.

4-9

4.8 How to Display AIS Target Data

You can display an AIS target's data by selecting it on the display, when the AIS function is set for [DISP FILT] or [DISP ALL].

4.8.1 AIS pop-up information

The AIS pop-up shows abbreviated AIS data (Vessel name, COG, SOG, CPA, TCPA and destination*) for the selected AIS target. Simply put the cursor on the AIS target to show the pop-up.

*: Destination appears for Class A targets only.

Pop-up AIS data

Note: When the received AIS sentence does not contain certain data, the appropriate section of the pop-up shows "missing".

The pop-up can be enabled or disabled with the following procedure.

1. Open the menu.
2. Select [5 TT•AIS].
3. **For IMO-types**, select [4 TT•AIS SYMBOL].
    For C-types, select [3 TT•AIS SYMBOL].
4. **For C-types**, select [0 NEXT].
    For IMO-types, go to the next step.
5. Select [8 AIS POP UP INFO].
6. Select [ON] or [OFF] as appropriate.
7. Close the menu.

4.8.2   How to display basic AIS target data

Place the cursor on a desired AIS target and press the **TGT ACQ** key, or left-click. The target is highlighted with a square box and the selected AIS target's data is shown in AIS target data box inside the information box, on the right side of the screen. Unavailable data appears with the indication "missing".

Note 1: This feature requires [2 TGT DATA/ACQ SETTING], on the second page of the [CURSOR] menu, to be set as [ANY] or [AIS ONLY].

Note 2: A total of three AIS targets' data can be shown inside the information box. To change the information box settings, see section 1.48.

AIS target data box (A, B or C)

Label	Description
Name of target ship — NAME	Target's MMSI ID — MMSI 123456789
Bearing to target — BRG 192.0°R	POSN — Position quality*1
Range to target — RNG 1.604NM	QLTY 4 — Target's co-ordinates 35°17.622'N 139°45.078'E
Target's course — COG 324.2°T	HDG 324.0°T — Target's heading
Target's speed — SOG 12.9kn	ROT 0.0°/分 — Target's rate of turn
Target's CPA — CPA 0.382NM	STATUS — Target's nav status*2
Target's TCPA — TCPA -03:41	UNDER WAY USING
Target's bow cross range — BCR -13.37NM	ENGINE
Target's bow cross time — BCT 27:51	

*1: Position quality indicates overall accuracy, and is calculated and displayed as shown below.

POSN QLTY value	Position accuracy
1	Position > 10 m
2	Position with RAIM > 10 m
3	Position ≤ 10 m
4	Position with RAIM ≤ 10 m

*2: For Class B targets, "CLASS B" appears in place of nav status.

4.8.3   How to display expanded AIS target data

The expanded AIS data display provides additional information about an AIS target, including call sign, IMO No., etc. To display expanded AIS data, show the basic data for a target, then left-click the target data display. The expanded data appears.

	EXPANDED DATA	
Vessel name →	NAME	12345678901234567890
Call sign →	CALLSIGN	1234567
Position →	LAT	35°22.604'N
	LON	139°42.153'E
Type of position sensor →	POSN SENSOR	GPS GLONASS
Position accuracy →	POSN ACC	HIGH
Navigation status →	STATUS	POWER-DRIVEN VESSEL (AHEAD/ALONGSIDE)
MMSI number →	MMSI No.	123456789
IMO number →	IMO No.	123456789
Vessel dimensions →	SHIP LENGTH	72m
	SHIP WIDTH	11m
	SHIP DRAUGHT	25.4m
Destination →	DESTINATION	12345678901234567890
ETA at destination →	ETA	23:59 31/DEC
AIS transponder version →	AIS VERSION	1
Association (ON or OFF) →	ASSOCIATION	OFF
Ship and cargo type →	SHIP AND CARGO TYPE CARGO SHIPS ALL SHIPS OF THIS TYPE	
Repeat indicator →	REPEAT INDICATOR	1

Note: Navigation status is not available for Class B targets. Where the selected AIS target is an aircraft, the [STATUS] box shows the aircraft's altitude.

If data for an item is unknown, "missing" appears.

4.8.4   How to remove target data from the display area

Place the cursor on a desired tracked target and press the **TARGET CANCEL** key. The select target's data is no longer displayed in the data display area.

4.9 How to Change AIS Symbol Attributes

To change the brilliance, size and color of AIS symbols follow the appropriate procedure in this section.

4.9.1 How to adjust the AIS symbol brilliance

Note: The brilliance of the AIS symbols can be adjusted from the [PLT] button on the Instant Access bar™. See section 1.46.1.
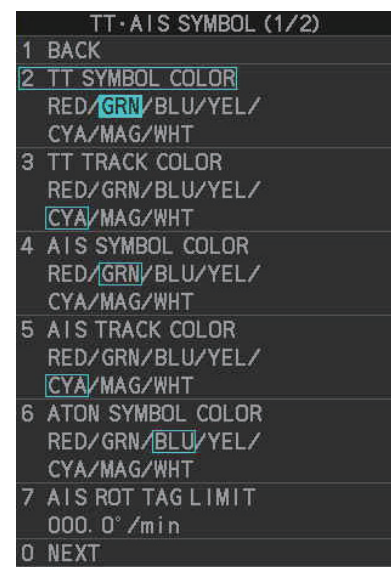
1. Open the menu.
2. Select [9 INITIAL SETTINGS].
3. Select [2 BRILL]. The [BRILL] menu appears.
4. Select [0 NEXT] to show the next menu page.
5. Select [8 AIS SYMBOLS]. The settings are highlighted and can now be adjusted.

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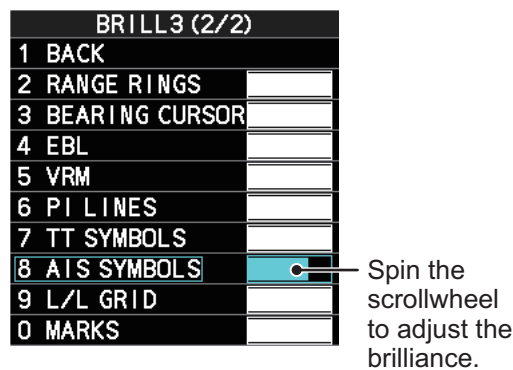
6. Spin the scrollwheel to select the desired brilliance, then left-click to apply the setting.
7. Close the menu.

4.9.2 How to change the color of the AIS symbol

1. Open the menu.
2. Select [5 TT•AIS].
3. **For IMO-types**, select [4 TT•AIS SYMBOL].
   For C-types, select [3 TT•AIS SYMBOL].
4. **For IMO-types**, select [2 TT•AIS SYMBOL COLOR].
   For C-types, select [4 AIS SYMBOL COLOR].
   (For IMO-types, the color is shared between AIS and TT.)
5. Select the appropriate color, then left-click.
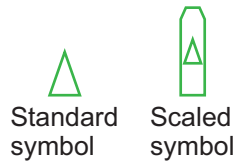6. Close the menu.

4.9.3   How to change the color of the ATON symbol

1. Open the menu.

2. Select [5 TT•AIS].

3. **For IMO-types**, select [4 TT•AIS SYMBOL].
    For C-types, select [3 TT•AIS SYMBOL].

4. **For IMO-types**, select [3 ATON SYMBOL COLOR].
    For C-types, select [6 ATON SYMBOL COLOR].

5. Select the appropriate color, then left-click.

6. Close the menu.

4.9.4   How to change the size of the AIS symbol

1. Open the menu.

2. Select [5 TT•AIS].

3. **For IMO-types**, select [4 TT•AIS SYMBOL].
    For C-types, select [3 TT•AIS SYMBOL], then select [0 NEXT].

4. **For IMO-types**, select [6 AIS SCALED SYMBOL].
    For C-types, select [4 AIS SCALED SYMBOL].

5. Select [OFF] or [ON] as appropriate, then left-click.
    [OFF]: All AIS symbols are displayed in the same size.
    [ON]: AIS symbols are displayed in scale, according to the ship length.


Standard   Scaled
symbol   symbol

The figure above shows examples of standard and scaled symbols.

6. Close the menu.

4.9.5   How to customize the AIS symbol display (C-types only)

You can customize how the ship name, symbol color and trail color are displayed for up to 100 AIS targets.

1. Open the menu.

2. Select [5 TT•AIS].

3. Select [4 AIS].

4. Select [0 NEXT].

5. Select [4 CUSTOMIZE AIS DISPLAY].

6. Select [2 MMSI NO.].

7. Enter the MMSI of the vessel whose AIS display you want to customize.
    If name data is available for the entered MMSI, the vessel name appears below the MMSI. If no name is available, the indication "missing" appears.
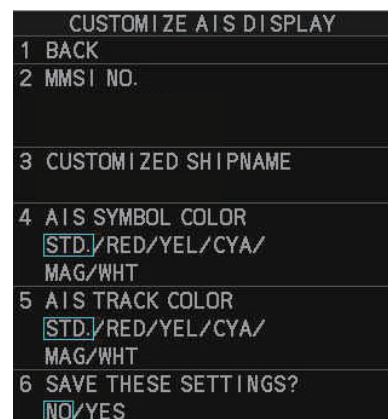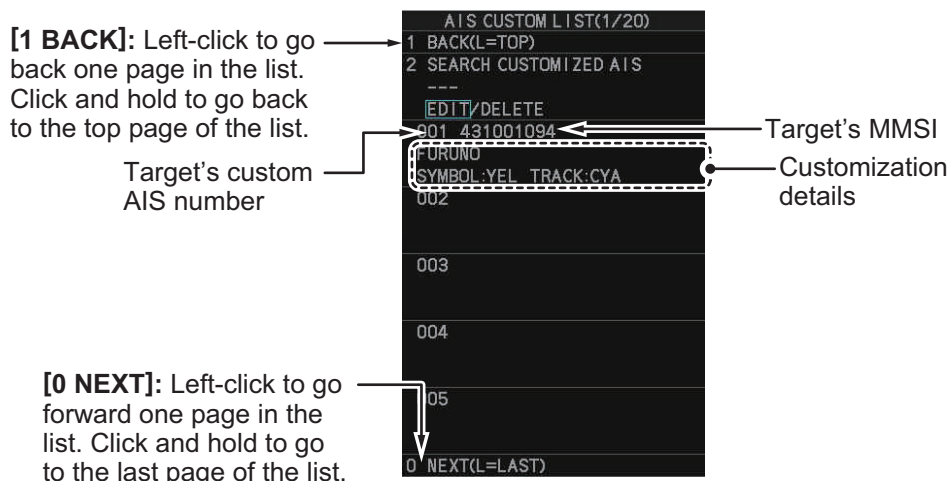
Note: You can also right-click an AIS target to open the [CUSTOMIZE AIS DIS-PLAY] menu with the selected vessel's MMSI field completed.

8. Select [3 CUSTOMIZE SHIP NAME].

9. Referring to section 1.5.3, enter a custom name for the vessel.
   If [6 DISP CUSTOMIZED NAME] is set to [ON], the name set here appears near the AIS symbol. If [DISP CUSTOMIZED NAME] is set to [OFF] and the vessel is transmitting its name in the AIS data, the received name appears near the AIS symbol.

10. Select [4 AIS SYMBOL COLOR].

11. Select the color you want to show the selected AIS target's symbol with.
    Select [STD.] to keep the color selected at section 4.9.2.

12. Select [5 AIS TRACK COLOR].

13. Select the color you want to show the selected AIS target's track with.
    Select [STD.] to keep the color selected at section 4.9.2.

14. Select [6 SAVE THESE SETTINGS?].

15. Select [YES] to assign the customization to the selected AIS target.
    Select [NO] to go back and change the customization.

16. Close the menu.

4.9.6 How to edit or remove AIS customizations (C-types only)

1. Open the menu.

2. Select [5 TT•AIS].

3. Select [4 AIS].

4. Select [0 NEXT].

5. Select [5 CUSTOM AIS LIST].

[1 BACK]: Left-click to go back one page in the list. Click and hold to go back to the top page of the list.

Target's custom AIS number

Target's MMSI

Customization details

[0 NEXT]: Left-click to go forward one page in the list. Click and hold to go to the last page of the list.

6. Select [2 SEARCH CUSTOMIZED AIS].

7. Enter the custom AIS number for the target whose details you want to edit.

8. **To change the customizations** for the selected AIS target, select [EDIT].
   To remove all customizations for the selected AIS target, select [DELETE].
   The [CUSTOMIZE AIS DISPLAY] menu appears.

9. Referring to section 4.9.5, change the customization settings as required.

10. Close the menu.

### 4.9.7 How to show/hide the customized AIS name (C-types only)

You can display a vessel's name below the corresponding AIS symbol.

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [4 AIS].
4. Select [0 NEXT].
5. Select [6 DISP CUSTMIZED NAME].
6. **To show the name**, select [ON]. The name set at section 4.9.5 appears below the icon for the selected vessel.
   To hide the name, select [OFF]. Although the customized name is hidden, if the selected vessel is transmitting the vessel name in the AIS data, the vessel name received in the AIS data appears below the icon. If the AIS data does not contain the vessel's name, the class (A/B/C) appears instead.
7. Close the menu.

4.10 Past Position Display

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

Below are examples of past position displays.

| (a) Ship turning | (b) Ship running straight | (c) Ship reduced speed | (d) Ship increased speed |
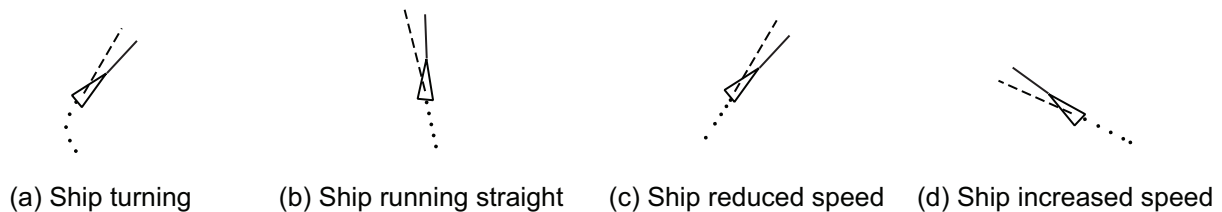
4.10.1 How to display past position points and select the plotting interval

Select the [PAST POSN] setting, then left-click to cycle through the following settings.
[OFF] → [30sec] → [1min] → [2min] → [3min] → [6min] → [OFF]...

The past positions are displayed in accordance with the selected setting.

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

4.10.2 How to select the number of past position points to be displayed

1. Open the menu.
2. Select [5 TT•AIS].
3. **For IMO-types**, select [4 TT•AIS SYMBOL].
   For C-types, select [3 TT•AIS SYMBOL], then select [0 NEXT].
4. **For IMO-types**, select [5 TT•AIS PAST POSN POINTS].
   For C-types, select [3 TT•AIS PAST POSN PTS]
5. Select [5] or [10] as appropriate.
6. Close the menu.

4.10.3 Past position display orientation

Past position orientation, true or relative, is controlled with [TRAIL MODE] in the [TRAIL] context menu. To adjust the trail orientation, see section 1.37.1.

4.10.4 Stabilization in true motion

True motion past position display can be ground stabilized or sea stabilized. The [TRAIL] box shows current stabilization as "TRUE-G" or "TRUE-S". To change stabilization mode, open the [SHIP SPEED MENU] menu and set [SHIP SPEED] to [LOG(BT)] (ground stabilization) or [LOG(WT)] (sea stabilization).

4.10.5 How to set the AIS track color (C-types only)

You can set the AIS track color with the following procedure.

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [3 TT•AIS SYMBOL].
4. Select [4 AIS TRACK COLOR].
5. Select the appropriate color, then left-click.
6. Close the menu.

4.11 Lost Target

A target is declared a lost target when it fails to produce data for six minutes or five reporting intervals, whichever is the shorter. When this occurs, the target is marked with the (flashing) lost target symbol and the message "AIS TARGET LOST" appears in the Alert Box. To acknowledge a lost target, press the **ALARM ACK** key, or use the trackball to select the [ALERT] box then press the **left button**.

4.11.1 How to set the lost target filter

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

1. Open the menu.
2. Select [5 TT•AIS].
3. **For IMO-types**, select [5 AIS].
   For C-types, select [4 AIS].
4. Select [0 NEXT].
5. Select [3 AIS LOST TGT FILTER].
6. Select [MAX RANGE].
7. Referring to the following table, select the appropriate filter, then press the **ENTER MARK** key.

Filter type	Definition
[MAX RANGE]	Any AIS targets beyond the range set here will not trigger the lost target alert.
[MIN SHIP SPEED]	Any AIS targets slower than this setting will not trigger the lost target alert.
[EXCEPT CLASS B]	Select ON to prevent AIS targets class B triggering the lost target alert.

8. Select [ON], then press the **ENTER MARK** key. The settings can now be adjusted.
9. Spin the scrollwheel to adjust the setting as required, then left-click to apply the setting.
10. Close the menu.

4.11.2 How to enable/disable the lost target alert

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

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


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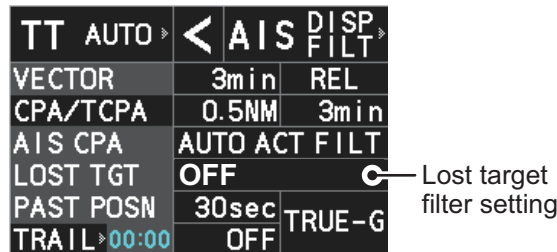
- [OFF]: Disable the alert.
- [FILT]: Enable the alert for all lost targets, excluding filtered targets.
- [ALL]: Enable the alert for all lost targets, including filtered targets.

Note: The lost target filter setting 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.

4.12 ROT Setting

You can set the lower limit of the ROT (Rate Of Turn) at which the heading line on target symbols will point in direction which the vessel is turning.
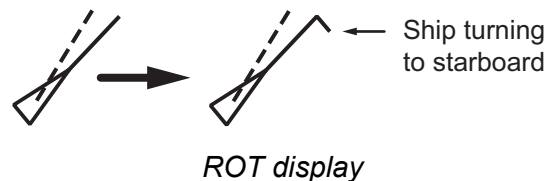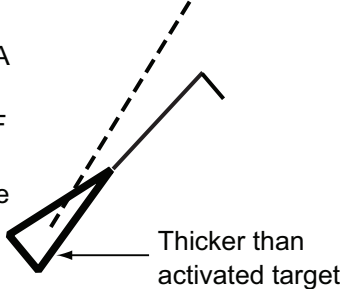

Ship turning to starboard

ROT display

1. Open the menu.
2. Select [5 TT•AIS].
3. **For IMO-types**, select [4 TT•AIS SYMBOL].
   For C-types, select [3 TT•AIS SYMBOL].
4. **For IMO-types**, select [4 AIS ROT TAG LIMIT].
   For C-types, select [7 AIS ROT TAG LIMIT].
5. Spin the scrollwheel to adjust the ROT as appropriate, then left-click. The setting range is 000.0°/min to 720.0°/min.
6. Close the menu.

4.13 AIS Collision Alarm (CPA, TCPA)

This radar calculates CPA and TCPA by using own ship and relative target positions. An AIS dangerous target is one whose CPA and TCPA are within the range of the CPA and TCPA limits set in the TT/AIS box. The AIS symbol of an AIS dangerous target is red and flashing, and is announced with the Alert "AIS DANGER OF COLLISION". After the alert is acknowledged the target symbol is displayed in red color.

Dangerous target

When a sleeping or an activated target violates the CPA/TCPA alarm setting its symbol changes to the dangerous target symbol (red and flashing) and the message "AIS DANGER OF COLLISON" appears. To acknowledge the CPA/TCPA alarm, press the **ALARM ACK** key, click the [ALERT] box, or click the CPA/TCPA alarm in the ALERT LIST. The audible alarm is silenced and the symbol stops flashing.
Take appropriate action to avoid collision.

Thicker than activated target

4.13.1 How to set CPA and TCPA

The CPA/TCPA function can be activated and deactivated from the [CPA/TCPA] box at the bottom-right of the screen.

1. Left-click the [CPA/TCPA] indication to activate the feature.
    Click the indication to toggle between active (settings are visible and can be changed) and inactive (indication shows "OFF").

CPA setting

CPA/TCPA OFF ⟵⟶ CPA/TCPA 1.0NM 1min

Left-click here to activate/deactivate the CPA/TCPA settings.
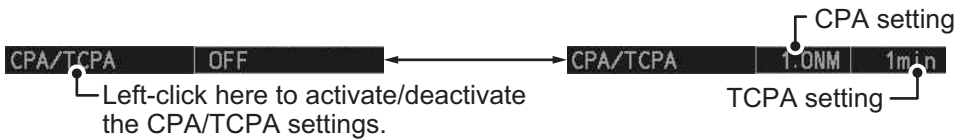
TCPA setting

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

2. Place the cursor on the indication you wish to adjust.

3. Left-click, or spin the scrollwheel, to adjust the settings as required. The settings options are outlined in the table below.

Indication	Method	Settings options
CPA	Left-click	0.5, 1, 1.5, 2, 3, 4, 5, 6 (NM)
	Scrollwheel	0.1 to 20; 0 to 10 in 0.1 NM increments, 1 NM increments thereafter
TCPA	Left-click	1, 2, 3, 4, 5, 6, 12, 15 (minutes)
	Scrollwheel	1 to 60 minutes in 1-minute increments

4.14 How to Associate TT and AIS Targets

An AIS-equipped ship is usually displayed by two symbols on the radar display. This is because the AIS ship position is measured by a GPS navigator (L/L) whereas the radar detects the same ship by PPI principle (range and bearing relative to own ship radar antenna).

To avoid the presentation of two target symbols for the same physical target, use the "association" function. If target data from both AIS and TT are available and if the association criteria are fulfilled, either the AIS or TT symbol is presented according to the association method selected.

Association will not happen between AIS and TT if the AIS target is sleeping or the AIS target is lost.

1. Confirm that the [TT ACQ MODE] indication shows "AUTO", "AUTO MAN" or "MAN".

   TT ACQ MODE indication → TT AUTO ⟩ ◁ AIS DISP FILT ⟩

2. Open the menu.

3. Select [5 TT•AIS].

4. **For IMO-types**, select [7 TARGET ASSOCIATION]. **For C-types**, select [6 TARGET ASSOCIATION].

5. Select [2 ASSOCIATION TGT TYPE].

6. Select [OFF], [AIS] or [TT], as appropriate, to select which symbols and data to display when the association criteria are met.

[OFF]	: Disable association.
[AIS]	: Use AIS symbols and AIS data.
[TT]	: Use TT symbols and TT data.

   Note: In NORMAL display mode, association can also be switched on and off from the screen by left-clicking the Association Usage icon, shown below.

   ```
   TARGET ASSOCIATION
   1 BACK
   2 ASSOCIATION TGT TYPE
     OFF/AIS/TT
   3 GAP
     0.050NM
   4 RANGE
     0.100NM
   5 BEARING
     9.9°
   6 SPEED
     6.0kn
   7 COURSE
     25.0°
   ```

   TT AUTO ◁ AIS DISP FILT ⟩

   Left-click the association icon to change the association setting.
   ⟩: Use TT Symbols and data.
   ◁: Use AIS symbols and data.
   No indication: Association is disabled.

7. Referring to the table below, set the association criteria. Spin the scrollwheel to adjust the value, then left-click to confirm the setting.

[3 GAP]	: Range between AIS target and tracked target. (setting range: 0.000-0.050 (nm))
[4 RANGE]	: Range direction difference from own ship to AIS target and tracked target. (setting range: 0.000-0.100 (nm))
[5 BEARING]	: Bearing difference from own ship to AIS target and tracked target. (setting range: 0.0-9.9 (°))
[6 SPEED]	: Speed difference between AIS target and tracked target. (setting range: 0.0-6.0 (kn))
[7 COURSE]	: Course difference between AIS target and tracked target. (setting range: 0.0-25.0 (°))

8. Close the menu.

When the association criteria (gap, range, bearing, speed, and course) is met, and the ASSOCIATION TARGET setting is [AIS], the TT symbol is erased and only the AIS symbol is displayed.

All default association settings are restored whenever the power is turned on.

To show the association information, place the cursor on the target data box at the right side of the screen, then press the **ACQ** key. The selected target's AIS and TT data are displayed together as shown in the examples below.

		TT/AIS DATA	
		TT	AIS
		001	A
Bearing	BRG	085.1°R	085.1°R
Range	RNG	2.377NM	2.377NM
Course Over Ground	T COG	085.1°R	085.1°R
Speed Over Ground	T SOG	34.0kn	34.0kn
Closest Point of Approach	CPA	2.377NM	2.377NM
Time to Closest Point of Approach	TCPA	00:00	00:00
Bow Crossing Range	BCR	2.377NM	2.377NM
Bow Crossing Time	BCT	00:00	00:00

AIS

Target's name	NAME	12345678901234567890
Target's MMSI	MMSI No.	123456789
Target's coordinates (latitude, longitude)	LAT	12°34.567'N
	LON	123°45.678'E
Target's heading	HDG	359.9°
Target's Rate Of Turn	ROT	+359.9°/min
Target's navigational status*	STATUS	POWER-DRIVEN VESSEL (AHEAD/ALONGSIDE)

*: Not shown for Class B targets.

4.15 How to View Own Ship Data

Own ship's static data (type of ship, call sign, etc.) can be viewed as follows:

1. Open the menu.

2. Select [5 TT•AIS].

3. **For IMO-types**, select [5 AIS].
   For C-types, select [4 AIS].

4. Select [7 OWN SHIP DATA]. The [OWN SHIP DATA] menu appears.

Note: The indications "A", "B", "C" and "D" at [EXT EPFS ANT POSN] show the location of the external EPFS antenna, calculated in the following manner:
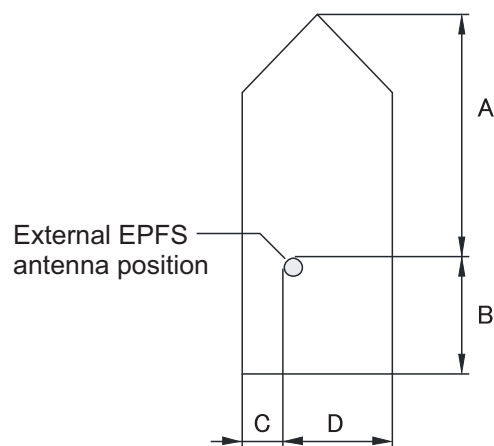
5. Close the menu.

4.16 How to Use AIS Messages

You can transmit and receive messages via the AIS, to a specified destination (MMSI) or all ships in the area. Messages can be sent to warn of safety of navigation, for example, an iceberg sighted. Routine messages are also permitted.

Short safety related messages are only an additional means to broadcast safety information. They do not remove the requirements of the GMDSS.

4.16.1 How to create and save messages

Up to ten messages can be saved at any time. To create and save a message, do the following:

Note: The MMSI of the receiving ship can be automatically set by selecting [TRANSMIT MESSAGE] from the pop up menu. To show the pop up menu, select the receiving ship's data in the AIS data display area, then press the **right button**.

1. Open the menu.
2. **For IMO-types**, select [5 AIS].
    For C-types, select [4 AIS].
3. Select [5 AIS].
4. Select [5 TRANSMIT MESSAGE].
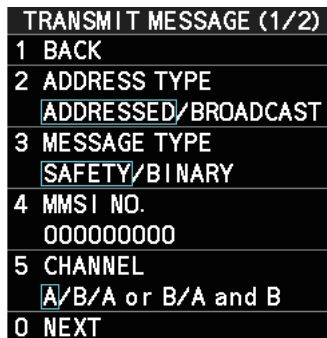
5. Select [2 ADDRESS TYPE].
6. Select [ADDRESSED] (message for a specific MMSI. Automatically selected if the MMSI is automatically using the data display.) or [BROADCAST] (message to all AIS-equipped vessels within the area), then press the **ENTER MARK** key.
7. Select [3 MESSAGE TYPE].
8. Select [SAFETY] (for safety messages) or [BINARY] (for routine messages), then press the **ENTER MARK** key.
9. For [ADDRESSED] message, do this step. For [BROADCAST] message, or if [TRANSMIT MESSAGE] was selected from the AIS data display pop up menu, go to step 8.
    1) Select [4 MMSI No.].
    2) Use the number keys to set the receiving ship's MMSI.
10. Select [5 CHANNEL].
11. Select the AIS channel to transmit your message over: [A], [B], [A or B], or [A and B], the press the **ENTER MARK** key.
12. Select [0 NEXT] to show the next menu page.
13. Select [4 EDIT]. A software keyboard appears at the bottom of the menu.

14. Select the character desired, then left-click.
    The maximum of 80 characters can be entered for the message.
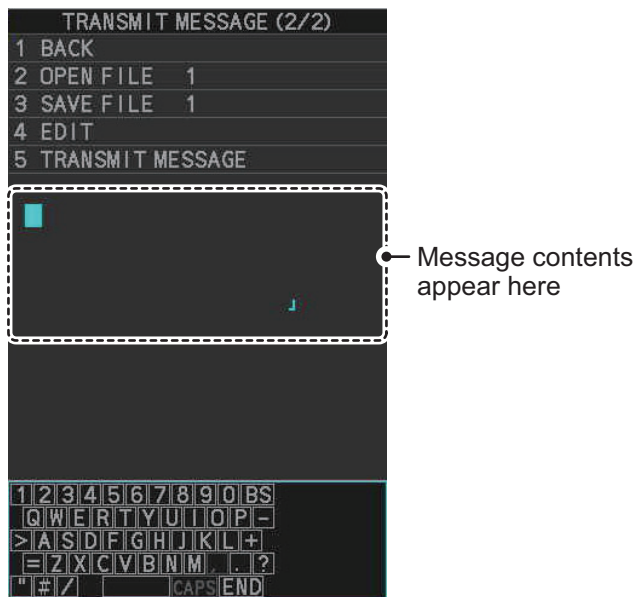
15. Select [END] to complete message input, then left-click.

16. Select [3 SAVE FILE].

17. Spin the scrollwheel to select the appropriate number, then left-click.

18. Close the menu.

4.16.2 How to transmit messages

1. Do one of the following:

   a) Create a message, as described in subsection 4.16.1.

   b) Use a file saved in the memory by selecting [5 TRANSMIT MESSAGE] followed by [2 OPEN FILE] from the second page of the [TRANSMIT MESSAGE] menu.

2. Select [5 TRANSMIT MESSAGE] from the second page of the [TRANSMIT MESSAGE] menu to transmit the message.
   "TRANSMIT ERROR" appears in the alert box if an error occurred while transmitting the message.
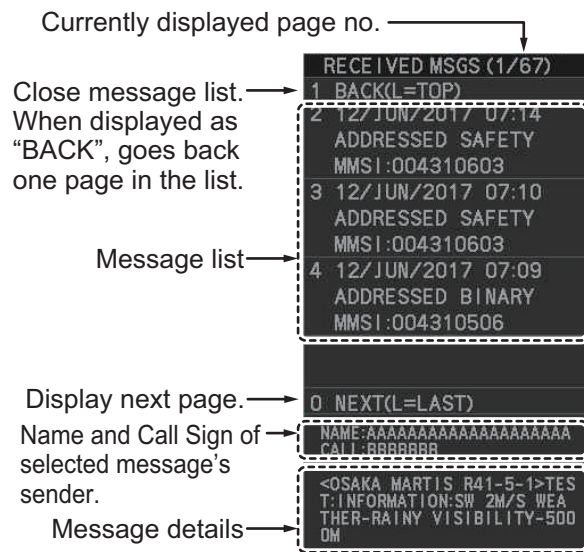
3. Close the menu.

4.16.3 How to view messages

When an AIS message is received, the system automatically stores the message in the message list. If [AUTO DISP MESSAGE] in the [AIS TARGET MENU] is set to [ON], the envelope icon on the [AIS message] button, on lower half of the InstantAccess bar™, changes to a blue color to indicate a new, unread message is stored.

The system stores up to 200 AIS messages. When the storage capacity is reached the oldest AIS message is automatically erased to make room for the latest. Note that only received messages are backed up when the power is turned off. AIS alert messages are not backed up.
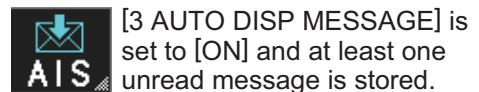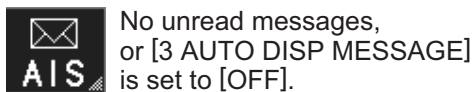
You can access the received messages from the InstantAccess bar™, or from the menu. The following procedure shows the menu method. **If you click the [AIS message] button on the lower half of the InstantAccess bar™**, skip to step 5.

1. Open the menu.

2. **For IMO-types**, select [5 AIS]. **For C-types**, select [4 AIS].

3. Select [5 AIS].

4. Select [4 SHOW RECEIVED MSGS].

5. Select the message to be displayed, then left-click.

6. The message details are displayed below the message list.

7. Close the menu.

Currently displayed page no.

Close message list. When displayed as "BACK", goes back one page in the list.

Message list

Display next page.

Name and Call Sign of selected message's sender.

Message details

```
RECEIVED MSGS (1/67)
1 BACK(L=TOP)
2 12/JUN/2017 07:14
  ADDRESSED SAFETY
  MMSI:004310603
3 12/JUN/2017 07:10
  ADDRESSED SAFETY
  MMSI:004310603
4 12/JUN/2017 07:09
  ADDRESSED BINARY
  MMSI:004310506

0 NEXT(L=LAST)
NAME:AAAAAAAAAAAAAAAAAAAAA
CALL:BBBBBBB
<OSAKA MARTIS R41-5-1>TES
T:INFORMATION:SW 2M/S WEA
THER-RAINY VISIBILITY-500
OM
```

4.16.4 How to set up the AIS message notification

1. Open the menu.

2. Select [5 TT•AIS].

3. **For IMO-types**, select [5 AIS]. **For C-types**, select [4 AIS].

4. Select [3 AUTO DISP MESSAGE].

5. Select [ON] to show the received message indication (blue envelope icon) when a new message is received, [OFF] to disable the notification.
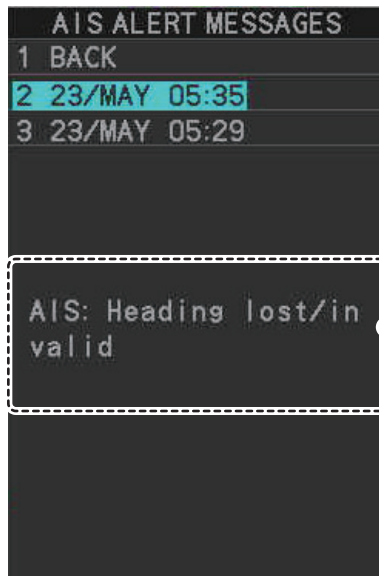
No unread messages, or [3 AUTO DISP MESSAGE] is set to [OFF].

[3 AUTO DISP MESSAGE] is set to [ON] and at least one unread message is stored.

6. Close the menu.

4.16.5 How to display AIS alert messages

The AIS transponder outputs various alert messages. To view the alert list:

1. Open the menu.

2. Select [5 TT•AIS].

3. **For IMO-types**, select [5 AIS].
   For C-types, select [4 AIS].

4. Select [8 AIS ALERT MESSAGES].

5. Select the date and time of the message to display, then left-click.

```
AIS ALERT MESSAGES
1 BACK
2 23/MAY 05:35
3 23/MAY 05:29




AIS: Heading lost/in
valid
```
◄── Message contents appear here

6. Close the menu.

4.17 AIS System Messages

AIS system messages are displayed at the bottom right corner of the screen. The table below shows the AIS system messages, their alert priority and their meanings.

Message	Priority	Meaning
"AIS DANGER OF COLLISION"	Alarm	CPA and TCPA of an activated AIS target are below value set on the menu.
"AIS NEW TARGET"	Warning	AIS target has entered an acquisition zone.
"AIS TARGET LOST"	Warning	Lost target. An activated target is declared a lost target when it fails to produce data for six minutes or five reporting intervals, whichever is the shorter.
"AIS DISPLAY FULL"	Warning	The radar only displays the closest 350 AIS targets from own ship.
"ACTIVE AIS FULL"	Warning	Number of active AIS targets has reached 50.
"AIS COM ERROR"	Warning	Not receiving AIS data from own AIS (VDO message). **Note:** When [AIS FUNC] is set to [OFF], this message is prioritized as a Caution level alert; when [AIS FUNC] is set to [ON], it is prioritized as a Warning level alert.
"AIS CAPACITY FULL"	Caution	Number of AIS targets has reached 1200.
"AIS DISPLAY 95"%	Caution	Number of displayed AIS targets has reached 333.
"ACTIVE AIS 95%"	Caution	Number of active AIS targets has reached 48.
"TRANSMIT ERROR"	Caution	Could not send AIS message.

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5. PLOTTER OPERATION (IMO-TYPES)

The video plotter has the following functions:

- Enter waypoints (up to 198) and marks.
- Creates and displays radar maps.
- Own ship track plotting.
- Display charts and chart-related information (requires a valid chart card).

5.1 Orientation Modes

Five orientation modes are available: [HEAD UP RM], [STAB HEAD UP RM], [COURSE UP RM], [NORTH UP RM], [NORTH UP TM] (True Motion).

Note: The screen may flash when the heading is changed more than one degree in the [HEAD UP RM] or [STAB HEAD UP RM] mode.
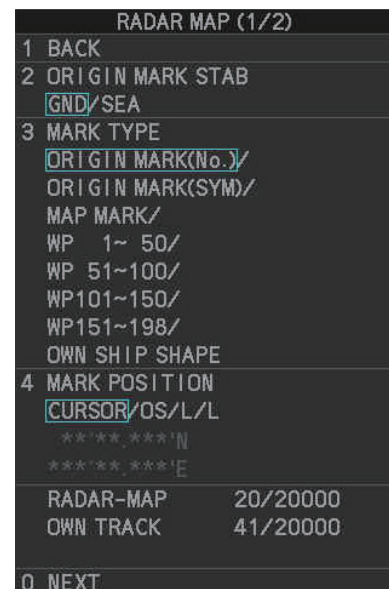
Automatic resetting of own ship mark in true motion mode

In the true motion mode, the own ship mark is automatically returned stern-ward 75% from the screen center when it reaches a location 50% of the display radius.

To select an orientation mode, see section 1.30.

5.2 How to Select a Mark Type

1. Open the menu.
2. Select [2 MARKS].
3. Select [5 RADAR MAP].
   The [RADAR MAP] menu appears.
   Note: You can also right-click the [MARK] box to open the [RADAR MAP] menu.
4. Select [3 MARK TYPE].
5. Select the appropriate type of marker, referring to the list below.

   - [ORIGIN MARK(No.)]: Inscribes the standard origin mark symbol (◇), with mark number (1 to 10). For detailed information regarding origin marks, see section 5.5.

RADAR MAP (1/2)
1 BACK
2 ORIGIN MARK STAB
  GND/SEA
3 MARK TYPE
  ORIGIN MARK(No.)/
  ORIGIN MARK(SYM)/
  MAP MARK/
  WP 1~ 50/
  WP 51~100/
  WP101~150/
  WP151~198/
  OWN SHIP SHAPE
4 MARK POSITION
  CURSOR/OS/L/L
  °.***'N
  °**.'E
  RADAR-MAP   20/20000
  OWN TRACK   41/20000
0 NEXT

- [ORIGIN MARK(SYM)]: Inscribes an origin mark symbol, with no mark number. You can set one of the following symbols as the origin mark. See section 5.5 for details.

◈ ⊖ ◎ △ ▲ ⊠ ▣ ◇ ◈ ⊕

- [MAP MARK]: Inscribes the selected map mark.
- [WP1-50], [WP51-100], [WP101-150], [WP151-198]: Inscribes a waypoint marker number within the selected range. For detailed information regarding waypoints, see section 5.9.
- [OWN SHIP SHAPE]: Inscribes a mark with the same shape as own ship. For detailed information regarding the own ship mark, see section 5.6.

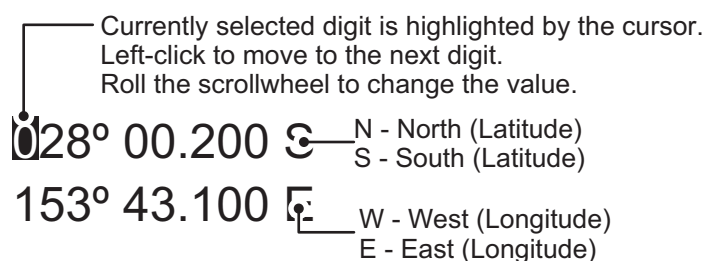6. Close the menu.

5.3 How to Select the Mark Inscription Position

You can select the location at which the marker is inscribed from the following:

Location	Description
[CURSOR]	You can select the location using the Control Unit.
[OWN SHIP]	Marker is placed at own ship position.
[L/L]	Marker is placed at the co-ordinates selected.

1. Open the menu.
2. Select [2 MARKS].
3. Select [5 RADAR MAP].
   The [RADAR MAP] menu appears.
   Note: You can also right-click the [MARK] box to open the [RADAR MAP] menu.
4. Select [4 MARK POSITION].
5. Referring to the table above, select the appropriate location, then press the **ENTER MARK** key.

How to set the co-ordinates

Where [4 MARK POSITION] is set to [L/L], the co-ordinates settings are displayed. Co-ordinates can be set one digit at a time, as shown in the figure below.

Currently selected digit is highlighted by the cursor.
Left-click to move to the next digit.
Roll the scrollwheel to change the value.

028° 00.200 S — N - North (Latitude)
                    S - South (Latitude)

153° 43.100 E — W - West (Longitude)
                    E - East (Longitude)

1) Spin the scrollwheel to change the value, then left-click to move to the next digit.
2) Repeat step 1 to adjust the Latitude and Longitude as appropriate.

6. Close the menu.

5.4 Radar Map

A radar map is a combination of map lines and symbols whereby the user can define and input the navigation data, route planning and monitoring data. The radar map can contain 20,000 points of data. Inscribed marks are retained when the power is turned off.

The radar map is referenced to the WGS-84 datum and appears only when there is valid position data input. The radar map does not affect any radar functions.

Note: The location and orientation of mark symbols and mark lines can change, depending on the display presentation mode, as shown in the table below.

Presentation mode	Mark symbol	Mark line
HEAD UP RM/STERN UP RM/STAB HEAD UP RM	Location is changed according to heading and own ship position. Orientation is unchanged.	Location and orientation are changed according to heading and own ship position.
COURSE UP RM/NORTH UP RM/NORTH UP TM	Location is changed according to own ship position. Orientation is unchanged.	Location and orientation are changed according to own ship position.

5.4.1 How to show/hide the radar map

You can show or hide the radar map from the InstantAccess bar™. Click the [Radar Map] button to toggle between show and hide.
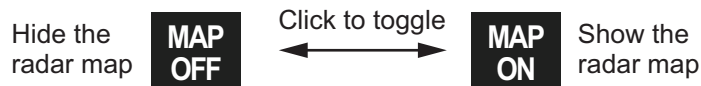
You can also show or hide the radar map from the menu. Open the [MAIN MENU] then select [2 MARKS] → [0 NEXT] → [2 RADAR MAP]. Select [OFF] or [ON] as appropriate.

5.4.2 How to inscribe marks

You can inscribe marks anywhere inside the operational display area, however, marks cannot be inscribed in the same location as a menu box.

Depending on the setting for [4 MARK POSITION] the method to inscribe a mark is slightly different.

Where [4 MARK POSITION] is set to [CURSOR]

1. Referring to section 5.2, select the mark type you want to use.
2. Place the cursor on the [MARK] box, at the bottom-left of the screen.
3. Spin the scrollwheel to select the appropriate mark, then left-click. The cursor moves inside the operational display area.
4. Place the cursor on the location (inside the operational display area) you wish to inscribe the mark, then left-click to anchor the mark.
5. Repeat steps 3 to 4 for multiple mark inscription.
6. Right-click to complete the procedure.

Where [4 MARK POSITION] is set to [OWN SHIP]

1. Referring to section 5.2, select the mark type you want to use.

2. Place the cursor on the [MARK] box, at the bottom-left of the screen.

3. Spin the scrollwheel to select the appropriate mark, then left-click. The selected mark is inscribed at the OS position.

4. Repeat steps 1 to 2 for multiple mark inscription, or right-click to complete the procedure.

Where [4 MARK POSITION] is set to [L/L]

1. Referring to section 5.2, select the mark type you want to use.

2. Place the cursor on the [MARK] box, at the bottom-left of the screen.

3. Spin the scrollwheel to select the appropriate mark, then left-click. [RADAR MAP] menu appears and the first digit of the latitude is selected.

4. Referring to section 5.3, set the latitude and longitude.

5. Repeat steps 1 to 3 for multiple mark inscription, or right-click to complete the procedure.

Note: You can see the number of radar map marks, lines used, on the [RADAR MAP] menu: [MENU]→[2 MARKS]→[5 RADAR MAP].

```
         RADAR MAP (1/2)
1  BACK
2  ORIGIN MARK STAB
   GND/SEA
3  MARK TYPE
   ORIGIN MARK(No.)/
   ORIGIN MARK(SYM)/
   MAP MARK/
   WP   1~ 50/
   WP  51~100/
   WP101~150/
   WP151~198/
   OWN SHIP SHAPE
4  MARK POSITION
   CURSOR/OS/L/L
   **'**.***'N
   - - - - - - - - - - - - - - - -
   RADAR-MAP    20/20000    ◄── Radar map marks, lines
   OWN TRACK    41/20000         entered/total number of
                                 marks, lines available
0  NEXT
```
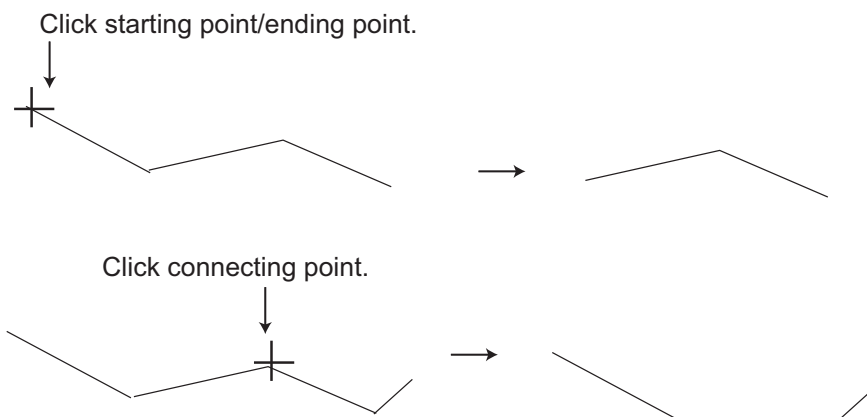
5.4.3 How to delete marks

Marks can be deleted one at a time, or all at once.

How to delete marks individually

1. Select the operational display area, then right-click to show the [CURSOR] context menu.
2. Select [MARK DELETE]. The cursor changes to a highlighted cursor.
3. Place the highlighted cursor on the mark to be deleted, then left-click.
   Note: The position of the cursor determines how lines are deleted. To deleted a line segment, put the cursor on the starting point (or end point). To delete consecutive line segments, put the cursor on the connecting point.

Click starting point/ending point.

Click connecting point.

4. Repeat step 3 to delete another mark, or press the **right button** to return the cursor to normal function.

How to delete all marks

1. Open the menu.
2. Select [2 MARKS].
3. Select [8 DELETE DATA].

```
          DELETE DATA
1 BACK
2 ALL MARKS
   NO/YES
3 ALL WAYPOINTS
   NO/YES
4 ALL NAV LINES
   NO/YES
5 OS TRACK-COLOR/TIME
   RED/GRN/BLU/YEL/
   CYA/MAG/WHT/30%/
   50%/80%/ALL
```

4. Select [2 ALL MARKS].
5. Select [YES], then press the **ENTER MARK** key.
6. Close the menu.

5.4.4 How to align the radar map

When there is positional error between the radar screen and radar map marks and lines, do the following to correct it.

1. Right-click the operational display area to show the [CURSOR MENU].

2. Select [MAP ALIGN]. The cursor is now highlighted and the [MAP ALIGN] function is active.

3. Left-click the map at the location you want to move. The map is now "anchored" to the cursor.

4. Move the cursor to align the radar map with the radar screen, then left-click. The indication "MAP ALIGN" appears on the right side of the operational display area.

5. Right-click to deactivate the [MAP ALIGN] function.

Display indications affected by map alignment

The following items are also re-aligned when the [MAP ALIGN] function is activated.

- Map marks
- Drop marks
- Anchor watch settings
- Target tracks
- AIS symbols
- EBL offsets (STAB GND mode only)
- Origin marks
- NAV lines and waypoints

- MOB marks
- Own ship tracks
- Latitude/Longitude Grid
- AIS symbol vector display
- Zoom window display (STAB GND mode only)
- Cursor position coordinates (when CURSOR L/L ALIGN is set to [ON] only)

Display indications unaffected by map alignment

The following items are not re-aligned when the [MAP ALIGN] function is activated.

- Radar echoes
- TT symbol vector display
- PI lines
- Own ship mark

- TT symbols
- EBL/VRM reference point
- OS coordinates ([POSN]) display
- Barge mark

How to disable the map alignment

1. Right-click the operational display area to show the [CURSOR MENU].

2. Select [MAP ALIGN], then left-click. The cursor is now highlighted and the [MAP ALIGN] function is active.

3. Press and hold the **left button**. The "MAP ALIGN" indication is cleared and the map alignment is cleared.

4. Right-click to deactivate the [MAP ALIGN] function.

5.5 Origin Mark

You can mark any prominent target or a point of particular interest using the origin mark feature. When an origin mark in entered, the distance and bearing from the cursor position to the mark are shown at the bottom of the screen, as in the figure below. 20 origin marks may be entered.

Distance from cursor position to origin mark

Bearing from cursor position to origin mark

5.5.1 How to inscribe origin marks

The method in which an origin mark is inscribed depends on the setting of [MARK POSITION] (section 5.3). Below are the procedures for each method.

Heading and position inputs are necessary to inscribe an origin mark.

Where [MARK POSITION] is set to [CURSOR]

1. Referring to section 5.2, set [3 MARK TYPE] to [ORIGIN MARK No.] or [ORIGIN MARK SYM].

2. Put the cursor on the [MARK] box at the bottom of the screen.

3. Spin the scrollwheel to select the origin mark to inscribe.

4. Click the [MARK] box.

5. Click the location where to put the origin mark.
   The origin mark is inscribed at the location selected. To re-inscribe the origin mark at a different location, click the desired location for the mark.

6. To enter an origin mark at another location, spin the scrollwheel to change the origin mark, then click the desired location for the origin mark.

7. Right click to finish.

Where [MARK POSITION] is set to [OWN SHIP]

1. Referring to section 5.2, set [3 MARK TYPE] to [ORIGIN MARK No.] or [ORIGIN MARK SYM].

2. Put the cursor on the [MARK] box at the bottom of the screen.

3. Spin the scrollwheel to select the origin mark to inscribe.

4. Click the [MARK] box.
   The origin mark is inscribed at own ship position.

5. Right click to finish.

5-7

Where [MARK POSITION] is set to [L/L POSITION]

1. Referring to section 5.2, set [3 MARK TYPE] to [ORIGIN MARK No.] or [ORIGIN MARK SYM].

2. Put the cursor on the [MARK] box at the bottom of the screen.

3. Spin the scrollwheel to select the origin mark to inscribe.

4. Click the [MARK] box.
    The [RADAR MAP] menu appears with a window for entering latitude and longitude position.

5. Referring to section 5.3, enter latitude and longitude position of the origin mark. After the position is entered, the origin mark appears at the position entered.

6. To continue inscribing origin marks in this method, do steps 2 to 5.

5.5.2 How to set origin mark stabilization

Origin marks can be geographically fixed (ground stabilized) or moving (sea stabilized).

1. Select the [MARK] box at the bottom-left of the screen then right-click to open the [RADAR MAP] context menu.

2. Select [2 ORIGIN MARK STAB].

3. Select [GND] or [SEA] as appropriate, then press the **ENTER MARK** key.

4. Close the menu.

5.5.3 How to delete origin marks

Origin marks can be erased as follows.

1. Right click anywhere within the radar effective inside diameter to show the [CURSOR MENU].

2. Select [MARK DELETE].

3. Click the origin mark to delete.

4. To delete another origin mark, repeat step 3.

5. Right click to finish.

5.6 How to Change the Shape of the Own Ship Mark

Ten locations on the own ship mark (section 1.44.5) can be adjusted to depict the shape of own ship more realistically. The ten points are as shown below.
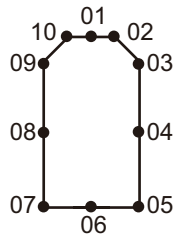
1. Referring to section 5.2, set [3 MARK TYPE] to [OWN SHIP SHAPE].

2. Put the cursor in the [MARK] box at the bottom of the screen.

3. Spin the scrollwheel to select the point no. to change.
   The cursor movies to the selected point position.

4. Use the trackball to move the point to the position desired, then click.
   Point position information appears in the [MARK] box, as shown in the figure below.

Distance from own ship to point

Distance from port side of own ship to point
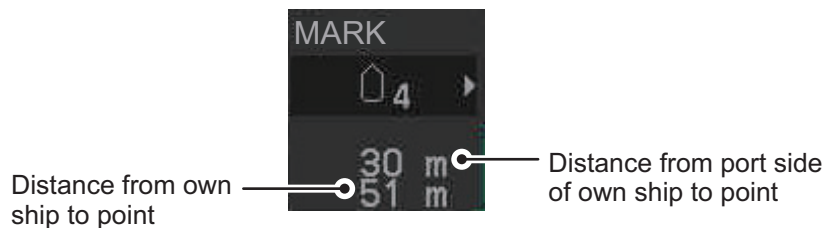
5. Repeat steps 3 to 4 to adjust other points.

5.7 How to Use ECDIS Chart Marks

Note: This function is only available if [ECDIS] is set to [SERIAL] or [LAN] at installation. Consult your dealer for details.

You can display marks received from an ECDIS on the radar screen. If the received mark also contains predicted position data, the predicted position is also displayed on-screen.

1. Open the menu.
2. Select [2 MARKS].
3. Select [6 ECDIS MARKS DISPLAY].
4. Select the appropriate item.

   - [2 USER CHART]: Shows/hides received user charts.
   - [3 CURVED EBL]: Shows/hides the received Curved EBL.
   - [4 CHART SYMBOL]: Shows/hides the received chart symbols.
   - [5 NOTE BOOK]: Shows/hides the received notes. [ON] shows notes only when they are received. [DISPLAY] shows notes continuously. The notes are shown in the information box at the right-side of the screen.
   - [6 ROUTE]: Shows/hides the received route. [CENT] shows only the route line; [ALL] shows both the route line and the route width.
   - [7 PREDICTOR]: Shows/hides the received predicted position with a symbol (dotted line) of the same size as the own ship.
5. Select [ON] or [OFF] as appropriate, then press the **ENTER MARK** key. [ON] shows the selected item's ECDIS mark when received, [OFF] hides the ECDIS mark.
6. Close the menu.

5.8 Own Ship Track

A total of 20,000 points are allotted for storage of own ship's track, marks and lines.

When this memory becomes full, the oldest track is deleted to make room for the latest. For that reason you may want to adjust the recording interval to conserve the memory.

Note: You can check how many tracks have been used at any time from the [RADAR MAP] menu. The number of points used and the total number available are shown at the bottom of the [RADAR MAP] menu's first page.
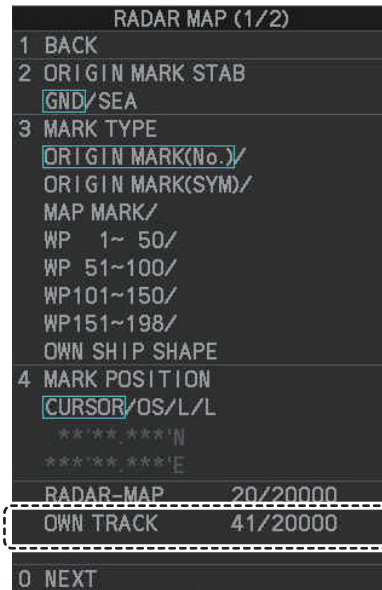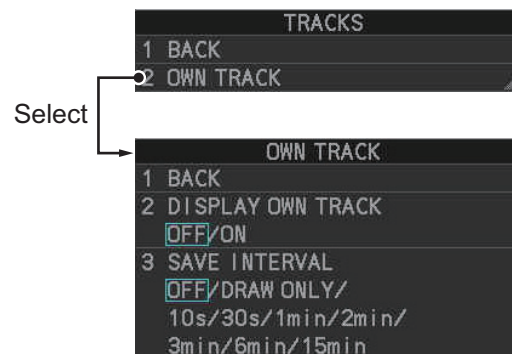
Own ship track points used/total number of own ship track points available

5.8.1 How to show/hide tracks

You can show or hide tracks for own ship.

1. Open the menu.
2. Select [2 MARKS].
3. Select [7 TRACKS].
4. Select [2 OWN TRACK].
5. Select [2 DISPLAY OWN TRACK].
6. Select [ON] to show tracks, or [OFF] to hide tracks.
7. Close the menu.

5.8.2 How to set the plotting interval

The system plots tracks at regular intervals in order to "paint" the track. You can adjust this interval. A shorter interval gives a "smoother" track, however the maximum recording time is reduced.

1. Open the menu.
2. Select [2 MARKS].
3. Select [7 TRACKS].
4. Select [2 OWN TRACK].
5. Select [3 SAVE INTERVAL].
6. Select the appropriate setting, then left-click.
   The table below shows the relation between plotting interval settings and maximum track recording time.

Own track recording times

Interval	Max. Recording Time	Interval	Max. Recording Time
10 s	56 hours	3 min	1000 hours
30 s	167 hours	6 min	2000 hours
1 min	333 hours	15 min	5000 hours
2 min	667 hours	DRAW ONLY	No track data recorded.

Set the interval to [OFF] to hide tracks made from the time you make this setting. To hide both new and old tracks, set [2 DISPLAY OWN TRACK] to [OFF].

7. Close the menu.

5.8.3 How to delete tracks

Track can be deleted partially (based on length) or completely, as follows.

1. Open the menu.
2. Select [2 MARKS].
3. Select [8 DELETE DATA].
4. Select [5 OS TRACK-COLOR/TIME].
5. Select the percentage of the track you wish to delete, then left-click. The available options are: [30%], [50%], [80%] or [ALL].
6. Close the menu.

5.9 How to Use Waypoints

A particular location is known as a "waypoint", whether it be a starting point, a destination point or an intermediate point on a voyage. This radar system can store 200 waypoints. Waypoints 1 to 198 are user set waypoints, waypoint 199 is reserved for external input, waypoint 200 is reserved for MOB (Man Over Board). Waypoints can be entered with the cursor, or from the menu (manual input of latitude and longitude). Waypoints 1 to 198 can be edited from the menu.

5.9.1 How to set the data source for waypoints

1. Open the menu.

2. Select [8 NAVLINE•WPT].

3. Select [2 NAV LINE DATA SOURCE].

4. Select the appropriate data source, referring to the list below.

   • [OFF]: Waypoints and nav lines (such as tracks) are not shown.
   • [EXT DATA]: Use navigational data from an external EPFS device for waypoints and nav lines (waypoint 199).
   • [INTERNAL DATA]: Use waypoints and nav lines saved internally (waypoints 1 to 198).

5. Close the menu.
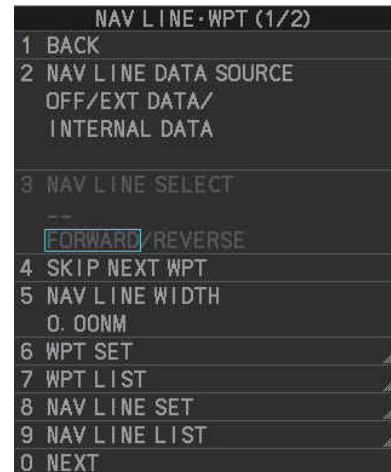
5.9.2 How to enter waypoints

A waypoint can be entered two ways: with the cursor or manual entry of latitude and longitude position. After a waypoint is entered, the distance and bearing from own ship to the waypoint are show in the [MARK] box.

Distance from own ship to waypoint

Bearing from own ship to waypoint

How to enter waypoints with the cursor

1. Referring to section 5.2, select the appropriate waypoint number group. The available groups are: [WP1 to WP50], [WP51 to WP100], [WP101 to WP150] or [WP151 to WP198].

2. Place the cursor on the [MARK] box. Spin the scrollwheel to select the waypoint number for new waypoint, then left-click. The cursor jumps inside the operational display area.

Spin scrollwheel to select number.

3. Place the cursor on the location to inscribe the waypoint, then left-click.

4. Repeat steps 2 to 3 to inscribe other waypoints.

5. Right-click the operational display area to complete waypoint inscription.
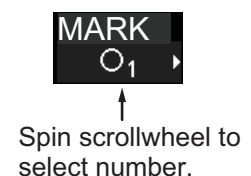
How to enter/edit waypoints from the menu

Note: A waypoint cannot be edited if it is part of an active route.

1. Open the menu.

2. Select [8 NAVLINE•WPT].

3. Select [2 WPT SET].

```
             WPT SET
1 BACK
2 WPT No. SELECT
  006
3 WPT NAME

4 WPT L/L
    --°--.---'-
   ---°--.---'-
5 CLEAR DATA
  NO/YES
```

4. Select [2 WPT NO. SELECT].

5. Spin the scrollwheel, or use the control unit numbered keys, to select a waypoint number, then left-click.
    To edit or input a waypoint name, go to step 6.
    To skip naming the waypoint, go to step 7.

6. Select [3 WPT NAME], then left-click. The software keyboard appears. Referring to section 1.5.3, name the waypoint.

7. Select [4 WPT L/L]. The latitude and longitude settings can now be adjusted.

8. Input the latitude and longitude with the number keys, or spin the scrollwheel to select a digit, then left-click to move to the next digit.

```
4 WPT L/L
   00°00.000'N
  000°00.000'E
        |
        v
4 WPT L/L
   30°00.000'N
  000°00.000'E
```
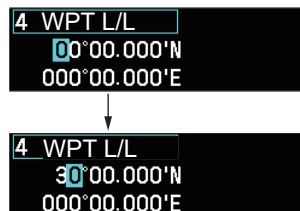
Use the scrollwheel to select a numeral, then left-click. The cursor jumps to to next right place. Repeat to enter the latitude and longitude.

9. Close the menu.

5.9.3 How to edit waypoints

Note: A waypoint cannot be edited if it is part of an active route.

1. Open the menu.

2. Select [8 NAVLINE•WPT].

3. Select [2 WPT SET].

4. Select [2 WPT NO. SELECT].

5. Select the waypoint number to edit.

6. Select the waypoint data to edit, then make necessary changes.

    • [WPT NAME]: Use the software keyboard to change the name.

    • [WPT L/L]: Spin the scrollwheel to change the latitude and longitude position of the waypoint.

7. Close the menu.

5.9.4   How to erase waypoints

There are two methods to erase individual waypoints: cursor selection or from the menu.

How to erase a waypoint by cursor selection

1. Place the cursor inside the operational display area, then right-click.

2. Select [MARK DELETE]. The mark delete function is activated and the cursor is highlighted when inside the operational display area.

3. Select the waypoint you wish to delete, then left-click.

4. Right-click inside the operational display area to deactivate the mark delete function.

How to erase a waypoint from the menu

1. Open the menu.

2. Select [8 NAVLINE•WPT].

3. Select [6 WPT SET].

4. Select [2 WPT NO. SELECT]. Then select the waypoint to erase.

5. Select [5 CLEAR DATA].

6. Select [YES] or [NO] as appropriate, then left-click.

7. Close the menu.

How to erase all waypoints

You can erase all waypoints from the menu. If there is an active route, this procedure cannot be completed.

1. Open the menu.

2. Select [2 MARKS].

3. Select [8 DELETE DATA].

4. Select [3 ALL WAYPOINTS].

5. Select [YES] to erase all waypoints. Select [NO] to cancel the procedure.
    Note: All routes are also deleted with this procedure.

6. Close the menu.

5.9.5 How to display the waypoint list

1. Open the menu.
2. Select [8 NAVLINE•WPT].
3. Select [7 WPT LIST] to show the [WPT LIST].

- Click while on page No.1 to close the list.
- Click while on page No.2 or after to go back on page.
- Long-push the left button to go to page No.1.

Displayed page/Total no. of pages

WPT No., WPT name

Latitude and longitude position of waypoint

- Go to next page.
- Long-push the left button to go to last page.

```
        WPT LIST (1/40)
1 BACK(L=TOP)
 001 WP1
       35°20.561'N
       139°41.386'E
 002 WP2
       35°20.257'N
       139°41.023'E
 003 WP3
       35°20.691'N
       139°40.494'E
 004 WP4
       35°21.111'N
       139°40.231'E
 005 WP5
       35°21.509'N
       139°40.176'E
 0 NEXT(L=LAST)
```

4. Close the menu.

5.9.6 How to show/hide the waypoint name/number

1. Open the menu.
2. Select [8 NAVLINE•WPT], then select [0 NEXT] to show the next page.

```
      NAV LINE·WPT (2/2)
1 BACK
2 WPT ARRIVAL DIST

    0. 00NM
3 TURNING LINE
    OFF/ON/REVISED
4 DISPLAY WPT No.
    OFF/ON
5 DISPLAY WPT NAME
    OFF/ON
```

3. Select [4 DISP WPT NO.] or [5 DISP WPT NAME] as appropriate.
4. Select [ON] to show the waypoint name/number, or [NO] to hide the waypoint name/number, then left-click. he waypoint number and/or waypoint name appear to the right of the waypoint mark.

Waypoint number

Waypoint name

5. Close the menu.

5.10 Routes

You can display one route (NAV LINE), which is either received from a connected EPFS device (GPS, etc), or stored internally.

5.10.1 How to set/edit an internal route

You can store up to 30 routes, each with up to 30 waypoints, in the internal memory.

The procedure for new routes and route editing is the same. To edit a route, you can skip setting other items and only edit the items you wish to change.

Note: While a route is active, tracks and waypoints cannot be deleted and data cannot be loaded from an SD card.

1. Open the menu.

2. Select [8 NAVLINE•WPT].

3. Select [8 NAV LINE SET] to show the [NAV LINE SET] menu.

4. Select [2 SELECT NAV LINE].

5. Spin the scrollwheel, or input the number from the keyboard, to assign a number to the route. The input areas for [3 NAV LINE], [4 NAV LINE ENTRY] and [5 CLEAR DATA] become active.

6. Select [3 NAV LINE NAME].

7. Referring to section 1.5.3, assign a name to the route. You can use up to 15 characters in the name.

8. Select [4 NAV LINE ENTRY].

9. Spin the scrollwheel to select a waypoint, then left-click.

10. Repeat step 9 until all waypoints for the route are entered.
When the last waypoint is entered, move the cursor to the next blank input area, then left-click, or assign the last waypoint as "000" using the numeric keys. If 30 waypoints are entered, the setting process for waypoints is automatically completed.

11. Close the menu.

5.10.2 How to display routes

To display internal routes or received routes, follow the procedure below.

1. Open the menu.

2. Select [8 NAV LINE•WPT]. The [8 NAV LINE•WPT] menu appears.

3. Select [2 NAV LINE DATA SOURCE].

4. Select the desired source, referring to the list below.

   - [OFF]: No routes are displayed.

   - [EXT DATA]: Routes received from external sources are displayed.

   - [INTERNAL DATA]: Routes saved in the internal memory are displayed.
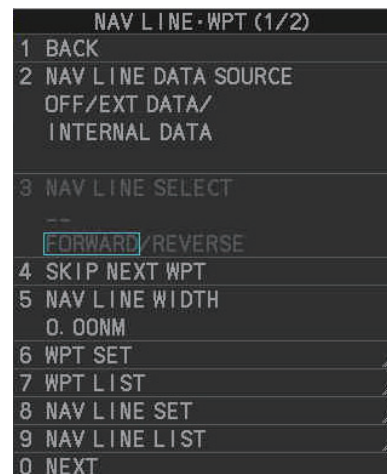
   For [INTERNAL DATA], see step 5; for [EXT DATA], see step 8.

5. Select [NAV LINE SELECT].

6. Spin the scrollwheel to select the desired route number, then left-click.

7. Select the direction you want to navigate the route in.
   [FORWARD]: Navigate the route in the direction in which it was created.
   [REVERSE]: Navigate the route in reverse of the direction in which it was created.

8. Close the menu.

```
        NAV LINE·WPT (1/2)
1  BACK
2  NAV LINE DATA SOURCE
   OFF/EXT DATA/
   INTERNAL DATA

3  NAV LINE SELECT
   --
   FORWARD/REVERSE
4  SKIP NEXT WPT
5  NAV LINE WIDTH
   0.00NM
6  WPT SET
7  WPT LIST
8  NAV LINE SET
9  NAV LINE LIST
0  NEXT
```

5.10.3 How to skip a waypoint

On a voyage similar to the below example, you may want to skip a waypoint to save time. You can skip the next waypoint on the current leg of your route by using the procedure below.
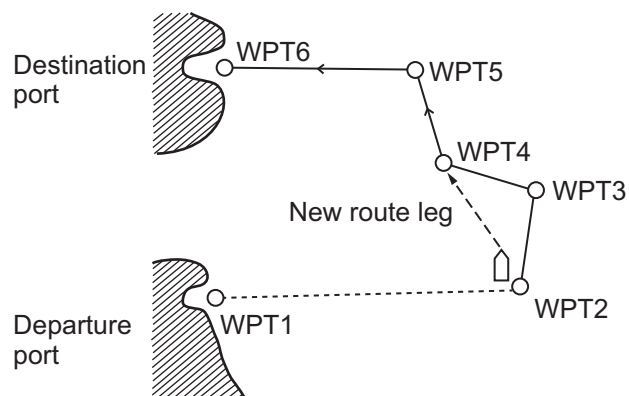
1. Open the menu.

2. Select [8 NAV LINE•WPT] to show the [8 NAV LINE•WPT] menu.

3. Select [4 SKIP NEXT WPT].

4. Close the menu.

5.10.4 How to set the route width

You can set a width for each route (NAV LINE). For example, if you set a 5 NM route width, the route width is 5 NM to port and starboard, with the own ship as the center. The route width is displayed as orange dotted lines to either side of the route line.

To set a route width, do the following:

1. Open the menu.
2. Select [8 NAVLINE•WPT].
3. Select [5 NAV LINE WIDTH].
4. Spin the scrollwheel, or use the numeric keys, to set a width for the route. To disable the route width alert and hide the route width lines, set the width to [0.00 NM].
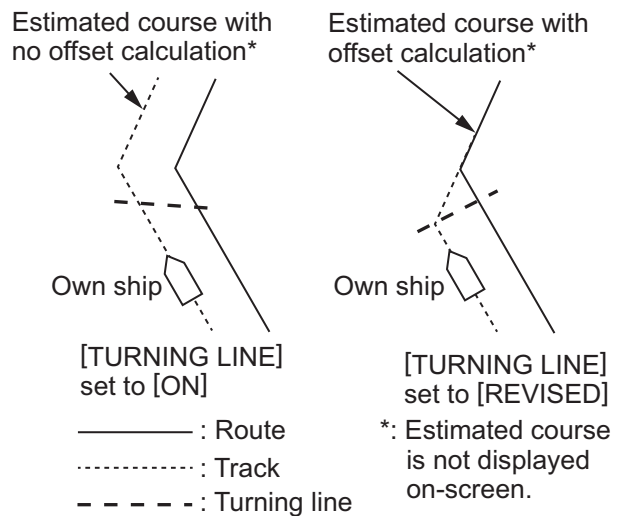   **Note:** This width is applied to all routes.
5. Close the menu.
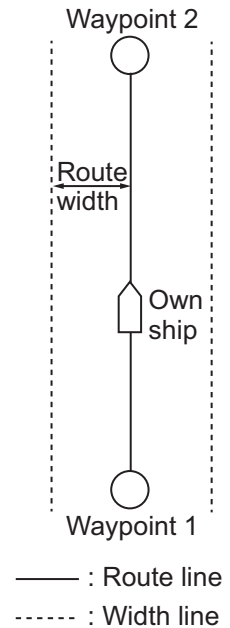
5.10.5 How to show/hide the turning line

You can show or hide the turning line, the point at which your vessel starts a turn in a route.

1. Open the menu.
2. Select [8 NAVLINE•WPT].
3. Select [0 NEXT].
4. Select [3 TURNING LINE].
5. Select the appropriate setting, referring to the list below.
   - [OFF]: Turning line is hidden.
   - [ON]: Turning line is displayed.
   - [REVISED]: Turning line is displayed, but offset based on the route and current own ship position.
6. Close the menu.

Waypoint 2

Route width

Own ship

Waypoint 1

——— : Route line
------ : Width line

Estimated course with no offset calculation*

Estimated course with offset calculation*

Own ship

Own ship

[TURNING LINE] set to [ON]

[TURNING LINE] set to [REVISED]

——— : Route
·········· : Track
– – – – – : Turning line

*: Estimated course is not displayed on-screen.

5.10.6 How to use the waypoint arrival distance function

The waypoint arrival distance function lets you know when you are within a preset distance from the next waypoint. When the waypoint arrival area is set, the next waypoint is shown circumscribed with an dashed orange-colored circle, whose radius is equivalent to waypoint arrival distance setting. When your vessel comes within the destination arrival radius, the system places the arrival radius marker on the next destination.

Waypoint arrival radius
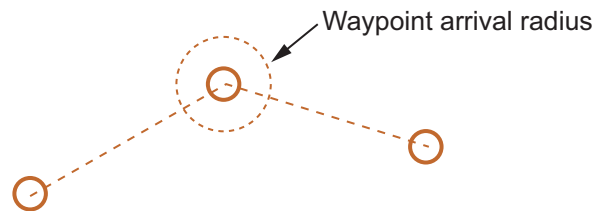
To set and use the waypoint arrival area function, follow the procedure below.

1.   Open the menu.
2.   Select [8 NAVLINE•WPT].
3.   Select [0 NEXT] to show the second page of the [NAVLINE•WPT] menu appears.
4.   Select [2 WPT ARRIVAL DIST].
5.   Set the width (radius) of the arrival area.
6.   Close the menu.

5.10.7 How to delete internal routes

You can delete a specified route, or all routes.

Note: Active routes and routes from external sources cannot be deleted.

How to delete individual internal routes

1.   Open the menu.
2.   Select [8 NAVLINE•WPT].
3.   Select [8 NAVLINE SET].
4.   Select [2 SELECT NAV LINE].
5.   Spin the scrollwheel, or input the number from the keyboard, to select the route you want to delete.
6.   Select [5 CLEAR DATA].
7.   Select [YES] to delete the selected route.
8.   Close the menu.

How to delete all internal routes

1.   Open the menu.
2.   Select [2 MARKS].
3.   Select [8 DELETE DATA].
4.   Select [4 ALL NAV LINES].
5.   Select [YES] to delete all internal routes.
6.   Close the menu.

5.10.8 How to view the routes list

Routes saved to the internal memory can be view by following the procedure below.

1. Open the menu.

2. Select [8 NAVLINE•WPT].

3. Select [9 NAVLINE LIST] to show the [NAVLINE LIST]

- Click while on page No.1 to close the list.
- Click while on page No.2 or after to go back on page.
- Long-push the left button to go to page No.1.

Displayed page/Total no. of pages

NAV LINE LIST (1/30)
1 BACK(L=TOP)
01 ROUTE
001 – 002 – 003 –
004 – 005 – 006 –
007 – 008 – 009 –
0 NEXT(L=LAST)

Route number/ route name*

Waypoints registered to the route

- Go to next page.
- Long-push the left button to go to last page.

* Route name is blank if no name is registered.

4. Close the menu.

5.11 How to Show/Hide Grid Lines

1. Open the menu.

2. Select [2 MARK].

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

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

5. Close the menu.

MARK (2/2)
1 BACK
2 GRID
OFF/ON
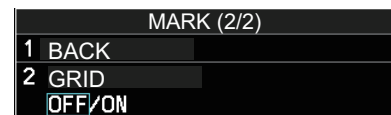
This page is intentionally left blank.

6. PLOTTER OPERATION (C-TYPES)

Plotter operation is available in both IMO- and C-type specifications, with the functions and menus different for each type. This chapter covers the operations for the C-type. For the IMO-type, see chapter 5.

The following plotter functions are available with the C-type radar:

- Display own ship track and other ship track.
- Enter waypoints.
- Enter marks.

- Create routes.
- Set destination.
- Display charts and chart-related information (requires a valid chart card).

6.1 Tracks

Own ship track is traced on the display based on position data sent from position-fixing equipment. Additionally, with connection of a AIS transponder or GPS buoy, other ships' tracks can also be shown.
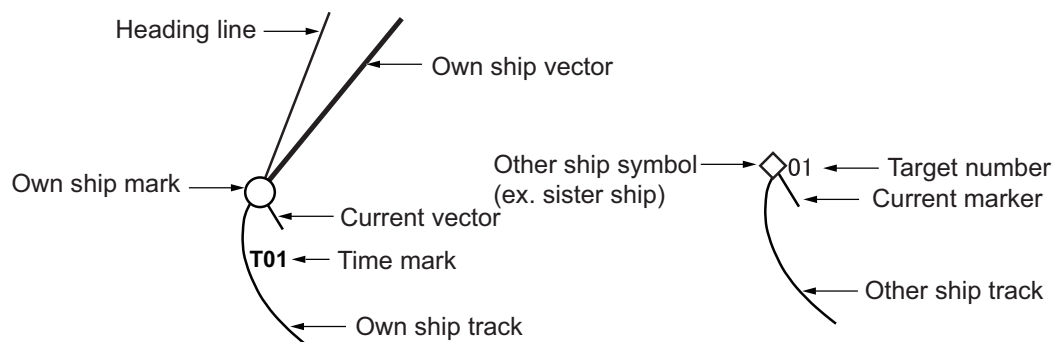

Own ship track and other ship track can be saved as a route. For details see "Creating a route from existing tracks" on page 6-53.

Note: Own ship track and other ship track are automatically saved every ten minutes and when the radar goes into standby (STBY) mode.

6.1.1 Symbols

Own ship mark

The own ship mark appears at current position. The mark changes as shown in the figure to the right, depending on whether you are plotting a track.

Plotting a track

Track plotting stopped
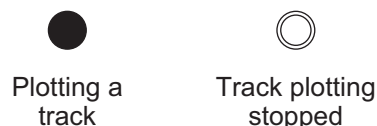
In addition to marking own ship position, the mark has the following functions:

- The **own ship vector** line (thick, white) points in the direction of ship's course.

- The **heading line**, colored light blue, points in the direction of ship's heading.

- The **current vector** points in the direction of the tide flow for a maximum of five depth layers. (Layer #1, yellow; layer #2, purple; layer #3, blue; layer #4, green, layer #5, white.). Requires tide data in NMEA 0183 format.

How to show/hide the own ship vector

Follow the procedure below to show or hide the own ship vector.

1. Open the menu.
2. Select [9 INITIAL SETTINGS].
3. Select [5 OPERATION].
4. Select [4 OWN SHIP VECTOR].
5. Select one of the following:
   - [OFF]: Hide the own ship vector.
   - [HDG]: The own ship vector points in heading direction.
   - [COURSE]: The own ship vector points in course direction.
6. Close the menu.

How to show/hide other ships' tracks

The following are required in order to show other ships' tracks.

- A AIS transponder or GPS buoy
- Own ship position data
- Set up on this radar
- See "SYMBOLS" on page AP-32 for TT and AIS symbols.

Do the following to show or hide the consort symbol, GPS buoy symbol.

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [5 CONSORT•GPS BUOY].
4. Select [5 CONSORT DISPLAY] or [6 GPS BUOY DISPLAY].
5. Select [ON] or [OFF] as appropriate. The following symbols may appear when [ON] is selected.

   ☐ : GPS buoy symbol

   ◇ : Consort ship symbol
6. Close the menu.
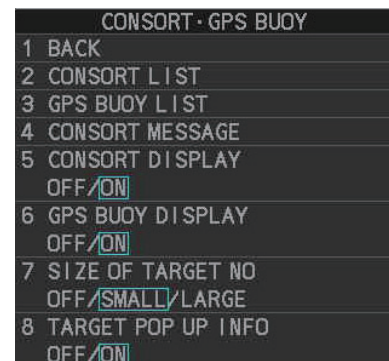
How to change the size of the target no. display for consort ship, GPS buoy

Do the following to change the size of the target no. display for consort ship, GPS buoy.

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [5 CONSORT•GPS BUOY].
4. Select [7 SIZE OF TARGET NO].
5. Select [OFF] (hide target no. display), [SMALL] or [LARGE] as appropriate.
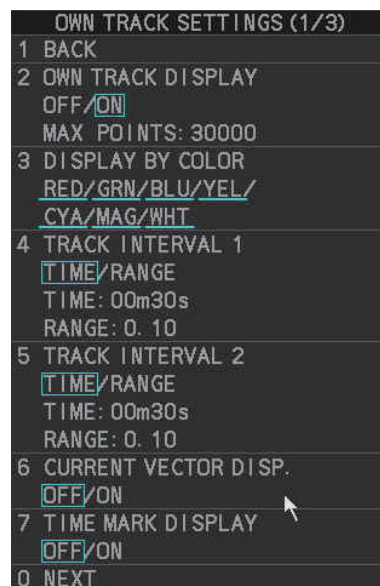6. Close the menu.

6.1.2   How to show/hide ships' tracks

Show/hide own ship's tracks

Do the following to show or hide own ship's tracks.

1. Open the menu.
2. Select [2 MARKS•PLOTTER].
3. Select [3 TRACK].
4. Select [8 OWN TRACK SETTINGS].
5. Select [2 OWN TRACK DISPLAY].
6. Select [ON] or [OFF] as required. For [ON], the cursor moves to the [MAX. POINTS] indication.
7. You can set the max. number of track points to save. Spin the scrollwheel to set desired value.
8. Close the menu.

Note: Time can be marked hourly with the time mark (T). Set [7 TIME MARK DISPLAY] to [ON] to show the time mark. The time is updated every hour, on the hour and appears as two digits (T01, T02, etc.), in 24-hour format, regardless of the setting selected in the [DATE] menu.

```
OWN TRACK SETTINGS (1/3)
1 BACK
2 OWN TRACK DISPLAY
  OFF/ON
  MAX POINTS: 30000
3 DISPLAY BY COLOR
  RED/GRN/BLU/YEL/
  CYA/MAG/WHT
4 TRACK INTERVAL 1
  TIME/RANGE
  TIME: 00m30s
  RANGE: 0. 10
5 TRACK INTERVAL 2
  TIME/RANGE
  TIME: 00m30s
  RANGE: 0. 10
6 CURRENT VECTOR DISP.
  OFF/ON
7 TIME MARK DISPLAY
  OFF/ON
0 NEXT
```

Show/hide other ships' tracks

Do the following to show or hide other ships' tracks.

1. Open the menu.
2. Select [2 MARKS•PLOTTER].
3. Select [3 TRACK].
4. Select [8 OTHER TRACK SETTINGS].
5. Select [2 AIS TRACK DISPLAY], [3 CONSORT TRACK DISPLAY], [4 TT TRACK DISPLAY], or [5 GPS BUOY TRACK DISPLAY].
6. Select [ON] or [OFF] as required.
7. Close the menu.

```
OTHER TRACK SETTINGS
1 BACK
2 AIS TRACKS DISPLAY
  OFF/ON
3 CONSORT TRACKS DISP.
  OFF/ON
4 TT TRACKS DISPLAY
  OFF/ON
5 GPS BUOY TRACKS DISP.
  OFF/ON
6 OTHER TRK REC INTVL
  TIME/RANGE
  TIME: 00m30s
  RANGE: 0. 10
7 OTHER CURR VCT DISP.
  OFF/ON
8 AUTO TT TRACK
  OFF/ON
```
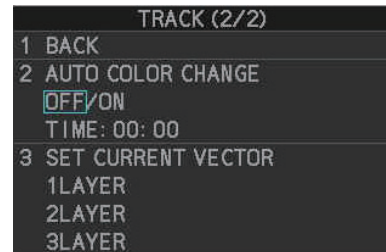
Show/hide current vector display on other ships' tracks

Do the following to show or hide the current vector display on other ships' tracks.

1. Open the menu.
2. Select [2 MARKS•PLOTTER].
3. Select [3 TRACK].
4. Select [8 OTHER TRACK SETTINGS].
5. Select [2 AIS TRACK DISPLAY], [3 CONSORT TRACK DISPLAY], [4 TT TRACK DISPLAY], or [5 GPS BUOY TRACK DISPLAY].

6.   Select [ON] or [OFF] as required.

7.   Select [1 BACK] to return to the [TRACK] menu.

8.   Select [8 OTHER TRACK SETTINGS].

9.   Select [7 OTHER CURR VCT DISP.].

10. Select [ON] or [OFF] as required. For [ON], go to the next step to set the current measuring layers to use.

11. Select [1 BACK] to return to the [TRACK] menu.

12. Select [0 NEXT].

13. Select [3 SET CURRENT LAYER].

14. Select [1LAYER]. Spin the scrollwheel to set the measuring layer (1 to 5) to use.

15. Do the same for [2LAYER], [3LAYER].

16. Close the menu.

```
              TRACK (2/2)
1  BACK
2  AUTO COLOR CHANGE
   OFF/ON
   TIME: 00: 00
3  SET CURRENT VECTOR
   1LAYER
   2LAYER
   3LAYER
```

How to automatically display the tracks of acquired TT

You can automatically display the tracks of acquired TT as follows.

1.   Open the menu.

2.   Select [2 MARKS•PLOTTER].

3.   Select [3 TRACK].

4.   Select [9 OTHER TRACKS DISPLAY].

5.   Select [4 TT TRACKS DISPLAY].

6.   Select [ON] or [OFF] as required.

- • [ON]: Track of all TT is displayed.

- • [OFF]: Track of TT is not displayed. To show the track of a TT, do the following:

  1) Put the cursor within the radar effective radius, then right click to show the [CURSOR] menu.

  2) Select [TRACK ON-OFF].

  3) Click the TT whose track you want to show.

  4) Right-click to finish.

7.   Close the menu.

6.1.3 How to set own ship track recording

How to start/stop recording own ship track

You can stop recording own ship track when the ship is anchored for an extended period or in port. This will help present unnecessary recording of track points.

1. Put the cursor within the radar effective radius, then right click.
2. Select [TRACK ON-OFF].
3. Right-click within the radar effective radius until the "Hold" icon (H) appears. Each click selects a track recording interval or stops recording in the following sequence.

Recording interval 1   Recording interval 2   Hold

When recording is stopped, the appearance of the own ship mark changes from filled circle (●) to a pair of concentric circles (◎).

4. Right-click to finish.

To restart recording, repeat the above procedure to show the recording interval 1 icon ( ) or recording interval 2 icon ( ). The own ship mark changes from (◎) to (●).

Note: For RCU-031 users, you can also press **TRACK ON/OFF** to toggle recording.
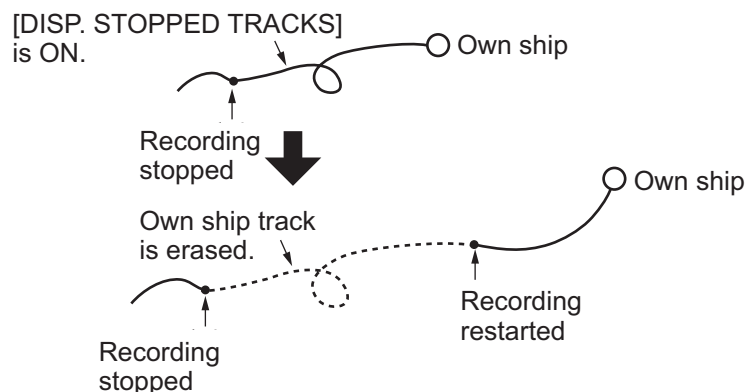
How to show/hide track without recorded them

1. Open the menu.
2. Select [2 MARKS•PLOTTER].
3. Select [3 TRACK].
4. Select [6 DISP. STOPPED TRACKS].
5. Select [ON] or [OFF] as required.

   - [OFF]: Tracks made while recording is off are not shown.

   - [ON]: Tracks made while recording is off are shown. However, since tracks are not recorded, tracks are erased when the power is turned off or the track is not within the display area. Also, own ship tracks made while recording is off are erased whenever recording is restarted, or the display is zoomed in or out.
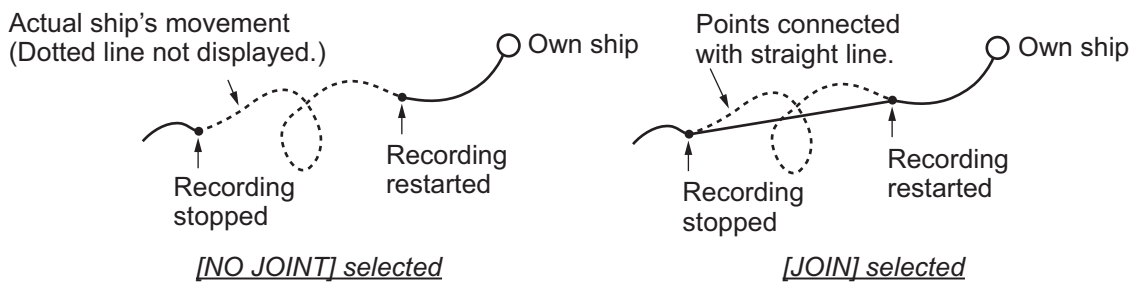
6.   Close the menu.

How to connect non-recorded tracks after restarting recording

1.   Open the menu.

2.   Select [2 MARKS•PLOTTER].

3.   Select [3 TRACK].

4.   Select [7 JOIN STOPPED TRACKS].

5.   Select [NO JOINT] or [JOIN] as required.

   •   [NO JOINT]: The point where recording was stopped is not connected to the point where recording was resumed.

   •   [JOIN]: The point where recording was stopped is connected to the point where recording was resumed.

[NO JOINT] selected   *[JOIN] selected*

6.   Close the menu.

6.1.4   How to stop and re-start tracks

You can stop, or "pause" tracks, then re-start the same track as desired.

1.   Right-click within the radar effective radius to show the [CURSOR] menu.

2.   Select [TRACK ON-OFF].

3.   Select the vessel whose tracks you want to stop (or re-start), then left-click.

4.   Right-click within the radar effective radius to complete the procedure.

6.1.5   How to change track color

Track color is available in seven colors: red, yellow, green, light blue, purple, blue, and white. For example, you may want to show track in red on the day you leave port to distinguish from track related to other activities. The own ship track can color can be automatically changed according to water temperature or depth.

How to change own ship's track color

1.   Right-click within the radar effective radius to show the [CURSOR] menu.

2.   Select [TRACK COLOR].

3.   Click within the radar effective radius. The [CHANGE TRACK COLOR] window appears.
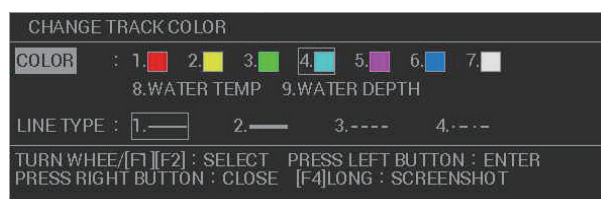
Note: For RCU-031 users, you can also press **TRACK COLOR** to open the [CHANGE TRACK COLOR] window.

4. Select [COLOR].

5. Select desired reference for track color.
[WATER TEMP]: The track color changes according to water temperature. (Requires water temperature data.)
[WATER DEPTH]: The track color changes according to depth. (Requires depth data.)
The color of the track changes at the point when the new color is selected.

6. Close the window.

Note: You can also change the color partially, from the [EDIT TRACK] menu. See "How to change own ship's track color" on page 6-6.

How to change own ship's track color according to water temperature

If you selected [WATER TEMP] as the track color reference, the track changes color according to temperature changes in the water. This makes it easier to find changes in the temperature, which makes it easier to find specific fishing areas. There are two methods to change the track color:

• Method 1: change the color based on a temperature range

• Method 2: change the color based on a preset difference

Note: This feature requires valid water temperature data input.

Method 1: temperature-range-based color change

1. Open the menu.

2. Select [MARKS•PLOTTER].

3. Select [TRACK].

4. Select [OWN TRACK SETTINGS].

5. Select [NEXT].

6. Select [TRACK COLOR BY TEMP].

7. Select [RANGE].

8. Set the color for the temperature range.
For example, to show water temperatures above 20 degrees centigrade in red color, do the following:

   1) Select [RED].

   2) Rotate the **scrollwheel** to set "+20.0", then press the **left button**.

   3) Set the other colors in a similar manner.

   Note 1: The water temperature steps should be ascending order.

   Note 2: Temperatures below the [BLUE] setting appear in white color.

9. Select [TEMP DATA DISPLAY].

```
OWN TRACK SETTINGS (2/3)
1 BACK
2 TRACK COLOR BY TEMP
  RANGE/EV. 0.2/EV. 2.0
3 BLUE
  +05.0
4 MAGENTA
  +10.0
5 CYAN
  +12.5
6 GREEN
  +15.0
7 YELLOW
  +17.5
8 RED
  +20.0
9 TEMP DATA DISPLAY
  OFF/ON
0 NEXT
```

10. Select [ON] or [OFF] as required.
    - [ON]: Show water temperature on the track.
    - [OFF]: Hide water temperature on the track.
11. Close the menu.

Method 2: preset-difference-based color change

According to the setting, there are five colors which are used in a cycle to color the track. In the example figure below, the preset difference is set to [EV. 0.2] and the temperature ranges from 17.0°C to 18.2°C. The color changes every 0.2°C.
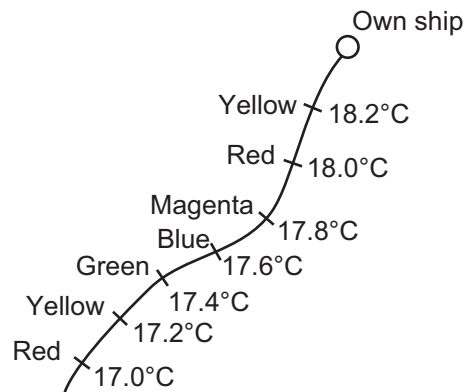
1. Open the menu.
2. Select [MARKS•PLOTTER].
3. Select [TRACK].
4. Select [OWN TRACK SETTINGS].
5. Select [NEXT].
6. Select [TRACK COLOR BY TEMP].
7. Select [EV. 0.2] or [EV. 2.0] as required.
    - [EV. 0.2]: changes the color with every temperature increase/decrease of 0.2°C.
    - [EV. 2.0]: changes the color with every temperature increase/decrease of 2.0°C.
8. Set the color for the temperature range.
   For example, to show water temperatures above 18 degrees centigrade in red color, do the following:
    1) Select [RED].
    2) Rotate the **scrollwheel** to set "+18.0", then press the **left button**.
    3) Set the other colors in a similar manner.

    Note 1: The water temperature steps should be in ascending order.

    Note 2: Temperatures below the [BLUE] setting appear in white color.
9. Select [TEMP DATA DISPLAY].
10. Select [ON] or [OFF] as required.
    - [ON]: Show water temperature on the track.
    - [OFF]: Hide water temperature on the track.
11. Close the menu.

How to change own ship's track color according to depth

If you selected [WATER DEPTH] as the track color reference, the track changes color according to depth changes in the water. This makes it easier to see changes in depth directly below your boat. there are two methods to change the track color:

• Method 1: change the color based on a depth range

• Method 2: change the color based on a preset difference

Note: This feature requires valid depth data input.

Method 1: depth-range-based color change

This method gives depths within the same range the same color. For example, if you set the range between 200 m and 300 m, and the depth remains shallower than 300 m and deeper than 200 m, the color remains the same.

1. Open the menu.
2. Select [MARKS•PLOTTER].
3. Select [TRACK].
4. Select [OWN TRACK SETTINGS].
5. Select [NEXT] twice.
6. Select [TRACK COLOR BY DEPTH].
7. Select [RANGE].
8. Set the color for the depth range.
   For example, to show depths from 400 m and below in red color, do the following:

   1) Select [RED].

   2) Rotate the **scrollwheel** to set "0400.0", then press the **left button**.

   3) Set the other colors in a similar manner.

   Note 1: The depth intervals should be in ascending order.

   Note 2: Depths below the [BLUE] setting appear in white color.

9. Select [DEPTH DATA DISPLAY].
10. Select [ON] or [OFF] as required.
    • [ON]: Show water temperature on the track.
    • [OFF]: Hide water temperature on the track.
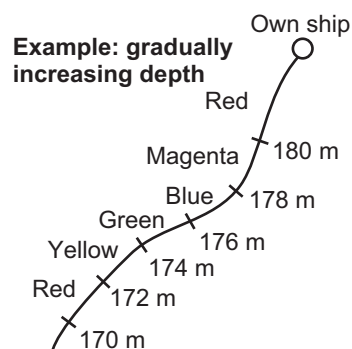11. Close the menu.

```
OWN TRACK SETTINGS (3/3)
1 BACK
2 TRACK COLOR BY DEPTH
  RANGE/EV. 2/EV. 20/
  EV. 200
3 BLUE
  0010. 0
4 MAGENTA
  0050. 0
5 CYAN
  0100. 0
6 GREEN
  0200. 0
7 YELLOW
  0300. 0
8 RED
  0400. 0
9 DEPTH DATA DISPLAY
  OFF/ON
```

Method 2: preset-difference-based color change

According to the setting, there are five colors which are used in a cycle to color the track. In the example figure below, set the preset difference is set to [EV. 2] and the Depth ranges from 170 m to 180 m. The color changes every 2 m.

1. Open the menu.

2. Select [MARKS•PLOTTER].

3. Select [TRACK].

4. Select [OWN TRACK SETTINGS].

5. Select [NEXT] twice.

6. Select [TRACK COLOR BY DEPTH].

7. Select [EV. 2], [EV. 20] or [EV. 200] as required.
   - [EV. 2]: changes the color with every depth increase/decrease of 2 m.
   - [EV. 20]: changes the color with every depth increase/decrease of 20 m.
   - [EV. 200]: changes the color with every depth increase/decrease of 200 m.

8. Select [DEPTH DATA DISPLAY].

9. Select [ON] or [OFF] as required.
   - [ON]: Show water temperature on the track.
   - [OFF]: Hide water temperature on the track.

10. Close the menu.

How to change own ship's track color based after a specified time

You can use the [AUTO COLOR CHANGE] feature to change your track color at a specific time.

1. Open the menu.

2. Select [MARKS•PLOTTER].

3. Select [TRACK].

4. Select [NEXT].

5. Select [AUTO COLOR CHANGE].

6. Select [ON] or [OFF] as required.
   If you select [ON], the cursor moves to the time indication.

7. Set the time at which you want the track to change color.
   Tracks will change colors every day at this time.

8. Close the menu.