3.5 How to Enter Own Ship Speed

The TT requires own ship's speed and heading data. The speed can be STW, SOG or echo-referenced speed (based on 3 max. stationary objects). Manual input is also possible. For automatic or manual input, see section 1.11. For echo-referenced speed input follow the procedure below.

3.5.1 Echo-referenced speed input

The use of echo-referenced speed is recommended when:

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

If you select echo-referenced speed, the TT calculates own ship's speed relative to a fixed reference target. The number of targets may be R1, R2 or R3. When a plural of objects are selected, the mean value is used, for stabilization and speed.

1. Right-click the operational display area to show the [CURSOR MENU].
2. Select [REF MARK]. The cursor is highlighted to indicate that the reference mark function is active.
3. Place the cursor on a fixed echo (such as an island, etc.) at a range of 0.1 to 24 NM from own ship, to be used as a reference, then left-click. The cursor changes from the highlighted cross to a circle with dashed lines, indicating that the reference location is now set. See section 3.8 for more information on TT symbols and their attributes.

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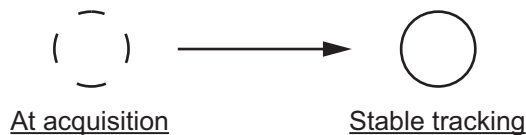
The dashed lines of the reference point change to a solid line over time, as shown in the figure above.

4. Repeat step 3 until to place up to three reference points.
5. Right-click to deactivate the reference mark function.
6. Open the menu.
7. Select [7 INFORMATION BOX].
8. Select [2 OWN SHIP INFO].
9. Select [2 SHIP SPEED].
10. Select [REF].
11. Close the menu.
    It takes approximately one minute for the speed to appear in the own ship information box. When the speed appears, the indication "REF BT" also appears to the right of the speed value.


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

Notes on speed input by reference target

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

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

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

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

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

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

- For IMO-types only, reference targets can be marked with a vector.
  This can be done with [REF TARGET VECTOR] on the [TT TARGET] menu.

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

How to cancel echo-referenced speed input

1. Open the menu.
2. Select [7 INFORMATION BOX].
3. Select [2 OWN SHIP INFO].
4. Select [3 SPEED]. The [SPEED] menu appears.
5. Select any option, other than [REF].
6. Close the menu.

3.6 How to Cancel Target Tracking

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

3.6.1 How to cancel tracking for individual TT targets

Note: The following procedure requires [3 TGT CANCEL SETTING] on the second page of the [CURSOR] menu to be set as [ANY] or [TT ONLY].

Using the control unit (RCU-014/RCU-031)

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

Using the CURSOR menu

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

3.6.2 How to cancel tracking for all TT targets

Using the control unit (RCU-014/RCU-031)

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

Using the menu

1. Open the menu.
2. Select [5 TT•AIS].
3. **For IMO-types**, select [6 TT].
   For C-types, select [5 TT].
4. Select [3 ALL CANCEL].
5. Select [YES] to cancel tracking for all TT targets.
6. Close the menu.

3.7 Lost Target

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

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

3.7.1 How to set the lost target filter

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

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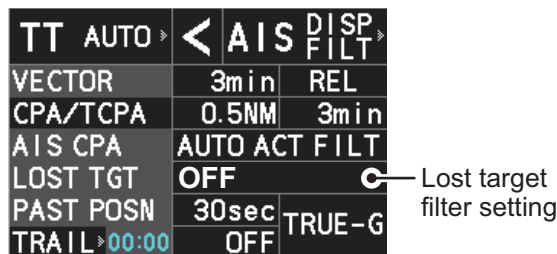8. Close the menu.

```
TT LOST TGT FILTER
1  BACK
2  MAX RANGE
   OFF/ON
   00NM
```

Note: Reference targets are not affected by this filter.

3.7.2 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. This setting is shared for TT and AIS functions.

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

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

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

Note: The 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.

3.8 TT Symbols and Attributes

The TT symbols used in this equipment are compliant with IEC62288. For details regarding the symbols and their meanings, see "TT/AIS symbols" on page AP-34.

3.8.1 How to adjust symbol brilliance

Note: Each color scheme (palettes PLT1 to PL4) can be adjusted individually. For how to select a color scheme, see section 1.46.3.

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 [7 TT SYMBOLS]. The settings are highlighted and can now be adjusted.
6. Spin the scrollwheel to select the desired brilliance, then left-click to apply the setting.
7. Close the menu.
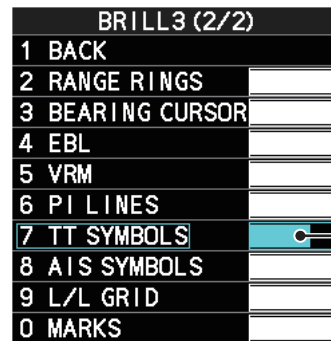
Spin the scrollwheel to adjust the brilliance.

3.8.2 How to set the symbol color

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 [2 TT SYMBOL].
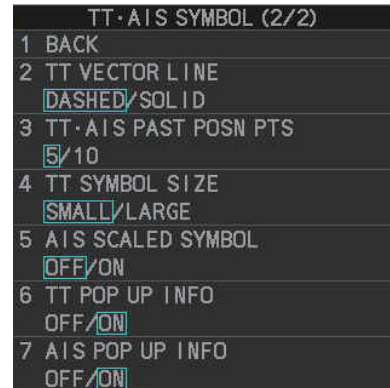   **Note:** For IMO-types, symbol color is shared between TT and AIS.
5. Select the appropriate color, then left-click.
6. Close the menu.

### 3.8.3 How to set the symbol size (C-types only)

C-types radar can show TT symbols in small or large size. You can change the size with the following procedure.

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [3 TT•AIS SYMBOL].
4. Select [0 NEXT] to show the second page of the menu.
5. Select [4 TT SYMBOL SIZE].
6. Select [SMALL] or [LARGE] as required.
7. Close the menu

```
TT·AIS SYMBOL (2/2)
1 BACK
2 TT VECTOR LINE
  DASHED/SOLID
3 TT·AIS PAST POSN PTS
  5/10
4 TT SYMBOL SIZE
  SMALL/LARGE
5 AIS SCALED SYMBOL
  OFF/ON
6 TT POP UP INFO
  OFF/ON
7 AIS POP UP INFO
  OFF/ON
```

3.8.4 How to select a TT symbol (C-type only)

With a C-type radar, you can assign a symbol (other than the standard circle) to TT targets. You can also change the color and naming for the TT symbols. There are 10 preset symbols available.The following figure shows the default presets, in numerical order.
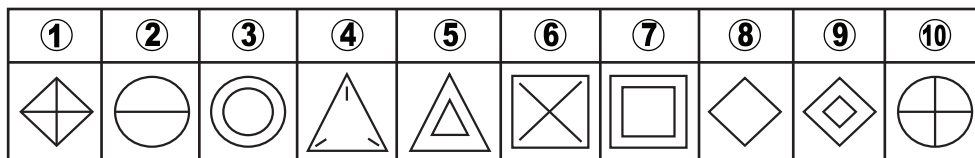

How to select a symbol from the presets

Place the cursor on the TT symbol you want to change, then spin the scrollwheel. The selected target's symbol changes in numerical order. To change the attributes of each preset, see section 3.8.5.

How to change the attributes assigned to a symbol

1. Place the cursor on the symbol whose attributes you want to change, then right-click.
    The editing window appears (either [TT CUSTOM SELECT], or [INPUT TT LA-BEL]). Press **F3** to toggle between the windows.
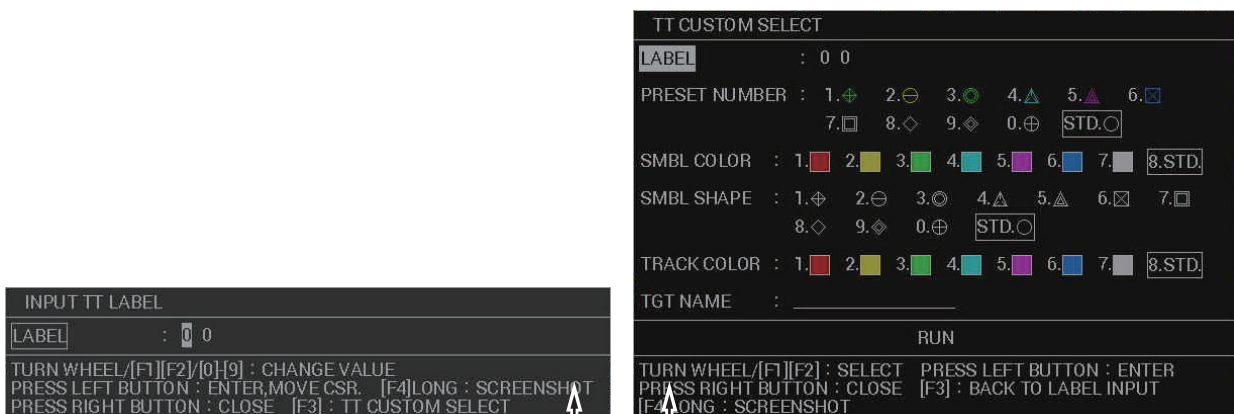
Press **F3** to toggle between the two windows.

Note: You can also left-click the TT target's data in the information box (see section 3.9.2) to show the editing window.

2. If the [INPUT TT LABEL] window is shown, press **F3** to show the [TT CUSTOM SELECT] window.

3. Referring to the following table, select the item you want to edit.

Menu item	Description
[LABEL]	Assigns a number to the target, other than the pre-assigned TT number. **Note 1:** The value set here appears in front of the name (assigned at [TGT NAME]). If no name is set, only the label appears with the target. **Note 2:** If "00" is set as the value, the label does not appear on-screen.
[PRESET NUMBER]	Assign preset attributes to the symbol. **Note:** You can change the symbol color, symbol shape and track color assigned to the preset.
[SMBL COLOR]	Assign a color to the TT symbol.
[SMBL SHAPE]	Assign a shape to the TT symbol.
[TRACK COLOR]	Assign a color to the track for the selected target.
[TGT NAME]	Assign a name to the target. **Note:** The software keyboard appears inside the editing window. See section 1.5.3 for how to use the keyboard.

4. Select [RUN] to apply the changes and close the editing window.

3.8.5 How to change the attributes for a TT symbol preset

The attributes for each preset can be customized to suit your preferences.

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [5 TT].
4. Select [5 CUSTOMIZE TT DISPLAY]. The [TT CUSTOM SETTINGS] window appears.
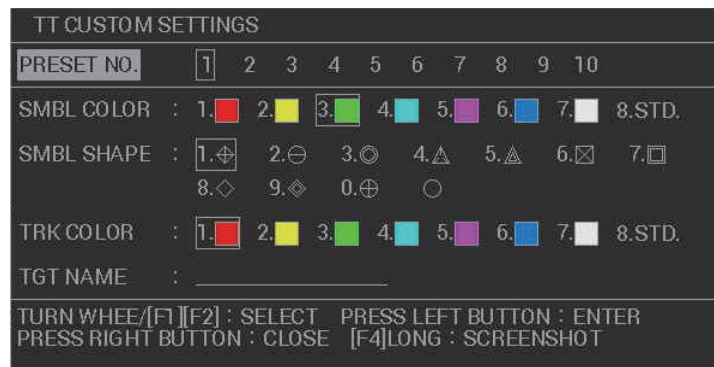
5. Select [PRESET NO.].
6. Select the preset number whose attribute you want to change. The settings indicated at [SMBL COLOR], [SMBL SHAPE], [TRK COLOR] and [TGT NAME] change according to the preset selected.

7. Referring to the following table, select the item you want to edit.

Menu item	Description
[SMBL COLOR]	Change the symbol color for the selected preset.
[SMBL SHAPE]	Change the symbol shape for the selected preset.
[TRACK COLOR]	Change the track color for the selected preset.
[TGT NAME]	Assign/change the target name. **Note:** The software keyboard appears inside the editing window. See section 1.5.3 for how to use the keyboard.

8. Right-click to close the window.

3.9 How to Display/Remove Target Data

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

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

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

3.9.1 TT pop up information

The TT pop-up shows abbreviated TT data for the selected TT. Simply put the cursor on the TT symbol to show the pop-up. The following figure shows pop-up examples.

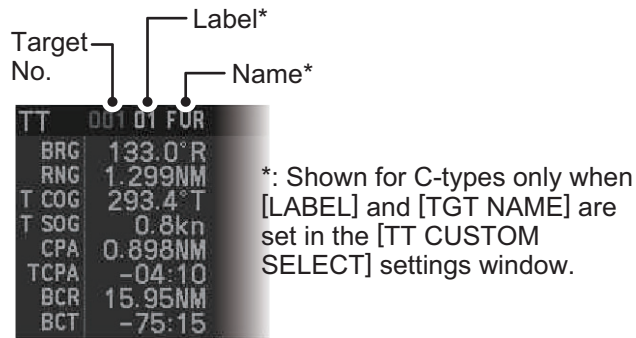

The popup can be enabled or disabled with the following procedure.

1. Open the menu.

2. Select [5 TT•AIS].

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

4. Select [6 TT POP-UP INFO].

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

6. Close the menu

3.9.2 How to show target data in the data display area

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

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

Target No.

Label*

Name*

*: Shown for C-types only when [LABEL] and [TGT NAME] are set in the [TT CUSTOM SELECT] settings window.

Indication	Description
Target No.	Number assigned by the system to this target. Target numbers which have become vacant are not re-used until the system is restarted, or the system tracks more than 100 targets.
Label	Label number assigned to this target (C-types only).
Name	Name assigned to this target (C-types only).
BRG	Bearing from own ship to target in relative (R) or True (T) reference.
RNG	Range from own ship to target.
T COG	Relative (R) or True (T) Course Over Ground of target. Displayed as "T CTW" where speed input is set to [LOG(WT)]. Displayed as "R CRS" where speed data is not available.
T SOG	Relative (R) or True (T) Speed Over Ground of target. Displayed as T STW where speed input is set to [LOG(WT)]. Displayed as R SPD where speed data is not available.
CPA*	Closest Point of Approach of target to own ship.
TCPA*	Time to CPA of target to own ship.
BCR*	Bow crossing range of target.
BCT*	Bow crossing time of target.
*: Not shown for C-types when the following menu settings (see section 1.48) are applied: • Main menu → [7 INFORMATION BOX] → [7 TARGET DATA] is set to [5 BOX]. • Main menu → [7 INFORMATION BOX] → [8 DISPLAY TT COORDS] is set to [ON]. When [8 DISPLAY TT COORDS] is set to [ON], these items are replace with the latitude/longitude of the target, as shown in the following example.	

CPA, TCPA, BCR and BCT are replaced with the lat/lon coordinates for the target.

The number of TT data that can be displayed at one time in the information box depends on your settings for [7 INFORMATION BOX] (see section 1.48).

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

3.9.3   How to display, hide and sort the target list

The target list provides a comprehensive data display of all TT (and AIS) targets being tracked (up to 1303 targets on total).

How to display/hide the target list

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

Target details

The following operations are available when the list is open:

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

To hide the list, do one of the following:

• Place the cursor inside the list, then right-click.

• Press the **MENU** key.

• Left-click the [MENU] box.

How to sort the target list

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

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

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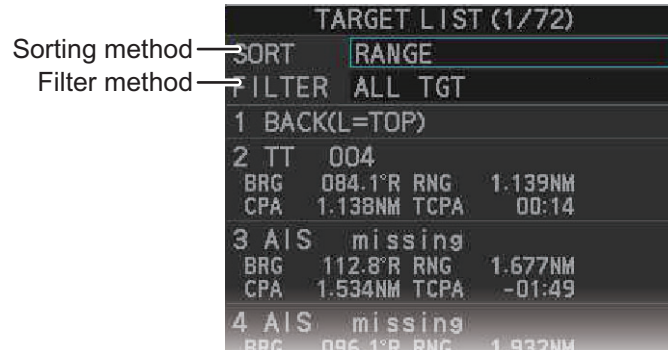
Sorting method	Description
[CPA]	Targets are sorted in order from closest to farthest CPA.
[TCPA]	Targets are sorted in order from shortest to longest TCPA.
[BCR]	Targets are sorted in order from closest to farthest BCR.
[BCT]	Targets are sorted in order from shortest to longest BCT.
[RANGE]	Targets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

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

3. Set the filter method in the same manner.

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

4. Close the menu.

3.10   Vector Modes

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

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

3.10.1   Description of vectors

<u>Stabilization modes</u>

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

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

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

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

Ground stabilization and sea stabilization

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

Sea stabilization is a mode where own ship and all targets are referenced to the sea using a compass heading and single-axis log water speed inputs in the true motion mode. Ground stabilization is a mode where own ship and all targets are referenced to the ground using the ground track or set and drift inputs. If the accuracy seems unsatisfactory, enter set and drift corrections. Note that set and drift should not be used when the radar is displaying AIS targets.

True vector

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

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

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

Relative vector

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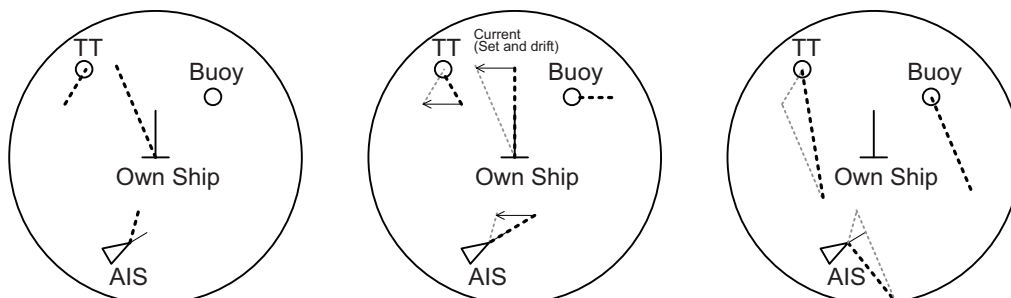
True vectors in ground stabilization

True vectors in sea stabilization

Relative vectors

3.10.2 Vector mode and vector length

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

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

How to change the vector mode

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

[REL] → [TRUE-G/TRUE-S] → [REL]...
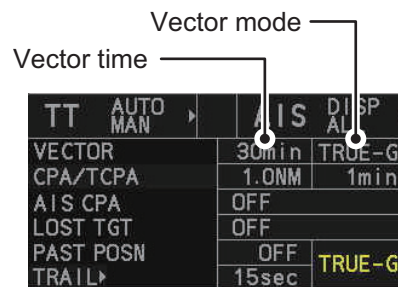
How to change the vector time

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

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

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

Note: When [7 VECTOR TIME LINK] is set to [LINK RANGE], the trail time is also automatically adjusted as the range changes, to provide a "normalized" vector. While linked, the vector time indication appears in yellow color.

3.10.3 How to change the vector appearance (C-types only)

By default, vectors appear as a dashed line. For C-types, you can show vectors as a solid line with the following procedure.

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [3 TT•AIS SYMBOL], then select [0 NEXT].
4. Select [2 TT VECTOR LINE].
5. Select [DASHED] or [SOLID] as required.
6. Close the menu

3.11 Past Position Display

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

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

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

3.11.1 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]...

When [OFF] is selected, all past position tracks are deleted.
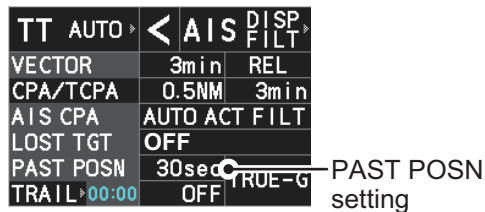
PAST POSN setting

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.

3.11.2 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 POINTS].
5. Select [5] or [10] as appropriate.
6. Close the menu.

3.11.3 How to change the color of TT tracks (C-types only)

You can change the color of the TT tracks with the following procedure.

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [3 TT•AIS SYMBOL].
4. Select [3 TT SYMBOL COLOR].
5. Select the desired color you want to show the TT tracks in.
6. Close the menu.

3.12   Set and Drift

Set, the direction in which a water current flows, can be manually entered in 0.1-degree steps. Drift, also known as "Rate", or the speed of the current, can also be entered manually in 0.1-knot steps.

When course through water and speed through water are available, activate set and drift to get course over ground and speed over ground.

Set and drift corrections are beneficial for increasing the accuracy of vectors and target data. Refer to the tide table on board the ship for setting information. These values are applied to all targets. If stationary targets have vectors, set and drift values should be adjusted until they lose vectors.

To enter set and drift do the following:

1. Open the menu.
2. Select [7 INFORMATION BOX].
3. Select [2 OWN SHIP INFO].
4. Select [3 SPEED]. The [SPEED] menu appears.
    Note: You can also access the [SPEED] menu from the on-screen box. Place the cursor on the [SPD ▶] indication in the speed box at the top-right of the screen, then right-click.
5. Select [4 SET DRIFT].
6. Select [ON], then press the **ENTER MARK** key. The setting can now be adjusted and [SET] is selected.
7. Spin the scrollwheel to select the appropriate setting (Setting range: 000.0° to 359.9°), then left-click. The [DRIFT] setting is now selected.
8. Spin the scrollwheel to select the appropriate setting (Setting range: 00.0kn to 19.9kn), then left-click.
9. Close the menu.

Note 1: Set and drift are available when using manually input speed, speed through the water. The speed source is shown as "WTC" (Water Tracking Count).

Note 2: Set and drift should be checked periodically for correctness.

Note 3: When speed data input from the position sensor is valid, set and drift are not adjustable.

3.13 Collision Alarm (CPA, TCPA)

This radar calculates CPA and TCPA by using own ship and relative target positions.

The TT continuously monitors the predicted range at the Closest Point of Approach (CPA) and predicted time to CPA (TCPA) of each TT. When the predicted CPA of any TT becomes smaller than a preset CPA range and its predicted TCPA less than a preset TCPA limit, the audio alarm sounds and "TT DANGER OF COLLISION" appears (in red, flashing) in the Alert Box. In addition, the symbol of the offending TT is red and flashes together with its vector.

> ⚠ **CAUTION**
>
> **CPA/TCPA Alarm**
>
> The CPA and TCPA alarm feature should never be relied upon as the sole means for detecting the risk of collision. The navigator is not relieved of the responsibility to keep visual lookout for avoiding collisions, whether or not the radar or other plotting aid is in use.

This feature, when used correctly, helps prevent the risk of collision by alerting you to threatening targets. It is important that GAIN, A/C SEA, A/C RAIN and other radar controls are properly adjusted.

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

The reference point for CPA and TCPA calculation can be selected from antenna position or conning position. For further details, see section 1.51.

3.13.1 How to set the CPA and TCPA ranges

CPA and TCPA ranges can be adjusted from the appropriate indication in the [TT] box.

1. Left-click the [CPA/TCPA] indication to activate the feature.

CPA setting

CPA/TCPA | OFF ⟷ CPA/TCPA | 1.0NM | 1min

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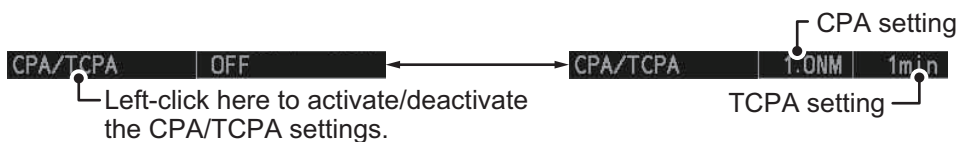
TCPA setting ┘

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

3.13.2 How to acknowledge the TT collision alarm

Press the **ALARM ACK** (RCU-014) or **ALERT ACK** (RCU-031) key on the control unit, or select the [ALERT] box with the trackball then left-click to acknowledge the alarm and silence the buzzer. The alert "TT DANGER OF COLLISION" remains in the Alert Box until the dangerous situation is gone or you intentionally terminate target tracking. The symbol and vector stop flashing and are displayed in a solid red color.

Note that when the "TT DANGER OF COLLISION" alarm is generated the AIS display is automatically turned on.

3.14 Acquisition Zone

The acquisition zone functions both to alert you targets in a specific area and acts as an automatic acquisition area when automatic target acquisition is active. Any targets entering the zone will be automatically acquired.

When a target enters an acquisition zone, the buzzer sounds and the indication "TT NEW TARGET" (or "AIS NEW TARGET") appears (in yellow-orange) in the Alert Box. The symbol of the offending target is red and flashing. Further, the AIS display is automatically turned on if it is off.

There are two types of acquisition zones available, arc and polygon, however, AZ1 can only be set as an arc.

3.14.1 How to enable the acquisition zones

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [2 ACQUISITION ZONE].
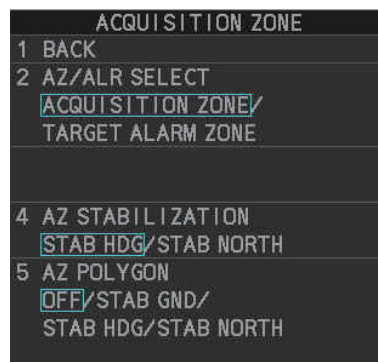
4. Select [2 AZ/ALR SELECT].
5. Select [ACQUISITION ZONE].
   The [ACQUISITION ZONE] box title changes to read "AZ".

Title bar shows "AZ" when [ACQUISITION ZONE] is selected.

AZ zone settings

AZ target settings
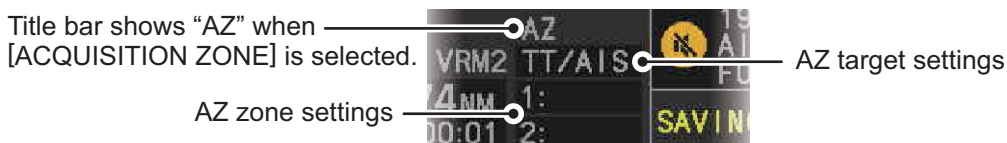
6. Close the menu.

3.14.2 How to activate the first acquisition zone (AZ1)

The No. 1 acquisition zone is available between 3 NM and 6 NM and can have a width between 0.5 NM and 1 NM. The TT/AIS acquisition zone's lines are white and dashed so as to distinguish them from the radar target alarm.

The procedure below shows how to set AZ1, using the example at the bottom of the page.

1. Place the cursor on the [1:] indication at the bottom-right of the screen, then left-click.
   The AZ zone setting reads "1: SET" and the cursor moves inside the operational display area.

2. Place the cursor on the acquisition zone starting point ("A" in the figure to the right), then left-click.

3. Place the cursor on the acquisition zone end point ("B" in the figure to the right), then left-click.
   The AZ zone setting now reads "1: WORK".

0.5 to 1 NM

Target in acquisition zone is red and flashing

3.14.3 How to set a polygon acquisition zone (AZ2)

Note: This procedure is not available if [5 AZ POLYGON] in the [ACQUISITION ZONE] menu is set to [OFF].
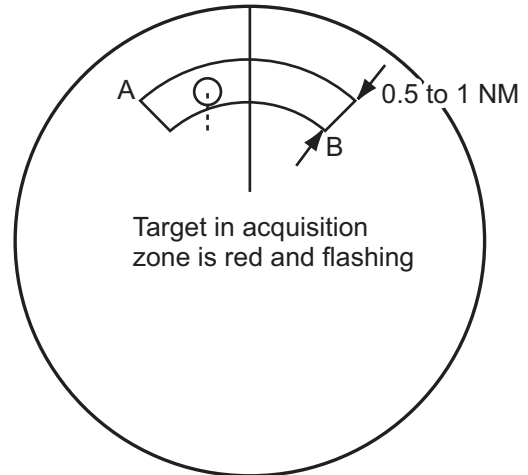
The No. 2 acquisition zone can be set anywhere when the No. 1 zone is already in use.

Polygon zones must have at least three points, and may have a total of 10 points.

To set a polygon shaped acquisition zone:

1. Place the cursor on the [2:] indication at the bottom-right of the screen, then left-click. The AZ zone setting reads "2: SET" and the cursor moves inside the operational display area.

2. Place the cursor on the acquisition zone starting point, then left-click.

3. Place the cursor on the second point, then left-click.

4. Repeat step 3 as required to set the remaining points of the polygon zone.

5. Right-click to complete the acquisition zone set up.
   Note: If 10 points are entered, the zone is automatically completed.

Notes on acquisition zones

- If you wish to create an acquisition zone having a 360-degree coverage around own ship, set point B in almost the same direction (approx. ±3°) as point A.
- The default acquisition zone is fan shaped. It can also be a polygon having 3-10 points.
- If both acquisition zones are displayed, a maximum of four polygon points are shown.
- TT and AIS are automatically set to TT=AUTO MAN and AIS=DISP, respectively, when an AZ is activated in the following conditions:
  TT: TT=OFF or TT=MANUAL 100
  AIS:AIS FUNC=OFF or AIS DISP=OFF

3.14.4 How to sleep/deactivate an acquisition zone

1. Select the appropriate [AZ] box.
2. Sleep, or deactivate, the acquisition zone, as explained below:

<u>**Sleeping the acquisition zone**</u>

Left-click the box several times until the indication shows "SLEEP".

<u>**Deactivating the acquisition zone**</u>

Highlight the box with the cursor, the press and hold the **left-button** until the AZ box becomes blank.

Note: When both zones ([1:] and [2:]) are active, [2:] must be deactivated before [1:] can be deactivated.
If [1:] and [2:] are active when you try to deactivate [2:], the system releases an audible alert and shows the message "DELETE AZ2 FIRST".

3.14.5 How to acknowledge the acquisition zone alert

You can acknowledge the alert, and silence the buzzer, with one of the following methods:

- Press the **ALARM ACK** (RCU-014) or **ALERT ACK** (RCU-031) key;
- Highlight the [ALERT] box with the cursor, then left-click;
- Highlight the alert in the [ALERT LIST], then left-click.

3.14.6 How to select the target type to acquire (C-types only)

You can set the radar to acquire on TT targets, or both AIS and TT targets. To select the target type to acquire, do the following:

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [2 ACQUISITION ZONE].
4. Select [3 TARGET TYPE TO ACQUIRE].
5. Select [TT AND AIS] or [TT ONLY] as appropriate.
6. Close the menu.

3.14.7 How to change the acquisition zone reference

The acquisition zone can be referenced to heading or North using the following procedure:

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [2 ACQUISITION ZONE].
4. Select [4 AZ STABILIZATION].
5. Select [STAB HDG] to reference heading, or [STAB NORTH] to reference North, then press the **ENTER MARK** key.
6. Close the menu.

3.14.8 How to set acquisition zone shape and stabilization

The shape of the No. 2 acquisition zone can be a sector or a polygon having up to 10 points. (The shape of the No.1 acquisition zone is always a sector.)

1. Open the menu.

2. Select [5 TT•AIS].

3. Select [2 ACQUISITION ZONE].

4. Select [5 AZ POLYGON].

5. Select the appropriate setting.

Setting	Description
[OFF]	Acquisition zone is a sector; number of points is limited to four. Stabilized against land.
[STAB GND]	Polygon having 3-10 points. Stabilized against ground.
[STAB HDG]	Polygon having 3-10 points. Stabilized against heading.
[STAB NORTH]	Polygon having 3-10 points. Stabilized against North.
[AROUND CHECK AREA]*	Sets a check area around own ship. See the topic on the following page for details and settings.

*: Shown only for C-types.

6. Close the menu.

How to set the check area around own ship (C-type only)

When [5 AZ POLYGON] is set to [AROUND CHECK AREA], the area details must be set. To setup the check area, do the following procedure. This procedure is abbreviated, and takes into consideration that [AROUND CHECK AREA] is selected.

1. Select [6 CHECK AREA SETTING].

2. Referring to the figure below, use the number keys to enter a distance for [PORT], [STBD], [BOW] and [STERN]. You can also spin the scrollwheel, then left-click to enter these values.
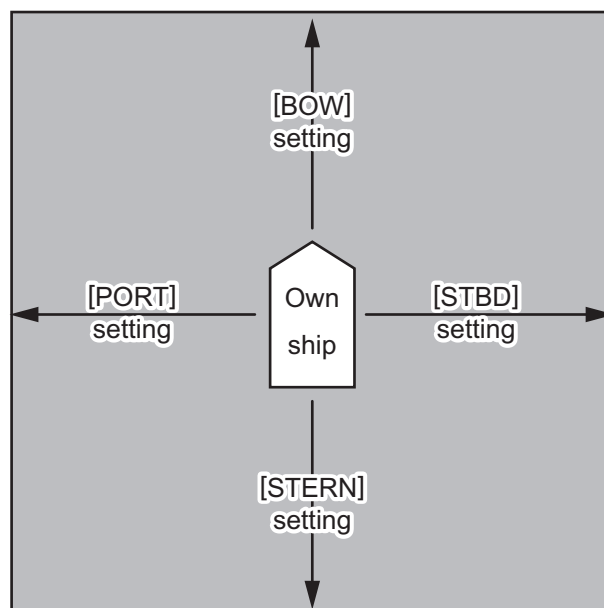
The area shown in gray is the "check area".
The available setting range for all four values is [0.0NM] to [16.0NM]. The default setting for all four values is [1.0NM].

3.15 Trial Maneuvers (IMO-types only)

The trial maneuver feature simulates the effect of own ship's movement against all tracked targets, without interrupting the updating of target information. It is available for use with the TT and AIS functions. For more accurate results, use sea stabilization (water tracking).

3.15.1 Types of trial maneuvers

There are two types of trial maneuvers: dynamic and static.

Dynamic trial maneuver

A dynamic trial maneuver displays predicted positions of the tracked targets and own ship. You enter own ship's intended speed and course with a certain "delay time." Assuming that all tracked targets maintain their present speeds and courses, the targets' and own ship's future movements are simulated in 0.5-second increments indicating their predicted positions in 30-second intervals as illustrated in the right figure.

The delay time represents the time lag from the present time to the time when own ship will actually start to change her speed and/or course. You should therefore take into consideration own ship's maneuvering characteristics such as rudder delay, turning delay and acceleration delay. This is particularly important on large vessels. Regardless of how much the delay is set the situation starts immediately and ends in a minute.

In the example shown below, own ship will advance straight ahead (even after a maneuver) for a delay time of 2:30 and alters speed and course until operator-specified intended speed and course are achieved (position OS7 in this example).
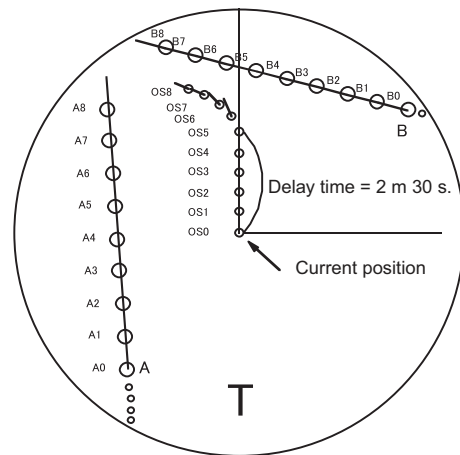
Static trial maneuver

The static trial maneuver shows the relationship between your ship and tracked targets at the completion of the trial maneuver. The expected position of TTs at the end of the trial maneuver are shown on the display.
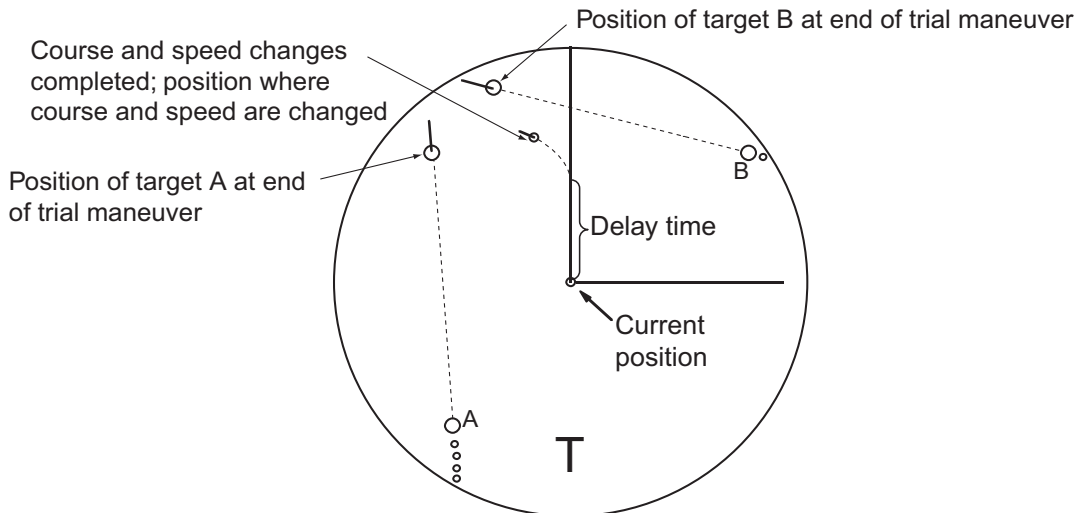
By shortening and extending the trial time you can find the safe time to make a maneuver. Thus, the static trial maneuver will be convenient when you wish to know the maneuver result immediately.

Position of target B at end of trial maneuver

Course and speed changes completed; position where course and speed are changed

Position of target A at end of trial maneuver

Delay time

Current position

B

A

T

3.15.2 How to perform a trial maneuver

To set up and perform a trial maneuver, do the following:

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [3 TRIAL MANEUVER].
4. Select [2 TRIAL MANEUVER].
5. Select [OFF], [STATIC] or [DYNAMIC] as appropriate.
6. Select [3 SPEED RATE].
7. Set the upper and lower speed rate as required.
8. Select [4 TRIAL TURN RATE].
9. Set the upper and lower turn rate for the trial as required.
   Note: Two sets of trial speed and trial turn rate combinations are provided. This is done to provide accurate trial maneuver results for various ship's speeds and turn rates.

```
          TRIAL MANEUVER
1 BACK
2 TRIAL MANEUVER
  OFF/STATIC/DYNAMIC
3 TRIAL SPEED RATE
  0kn  0.00kn/s
  0kn  0.00kn/s
4 TRIAL TURN RATE
  0kn  0.0°/s
  0kn  0.0°/s
```

Setting example for [3 TRIAL SPEED RATE]

5 kn, 0.15 kn/s
10 kn, 0.45 kn/s

Trial maneuver speed
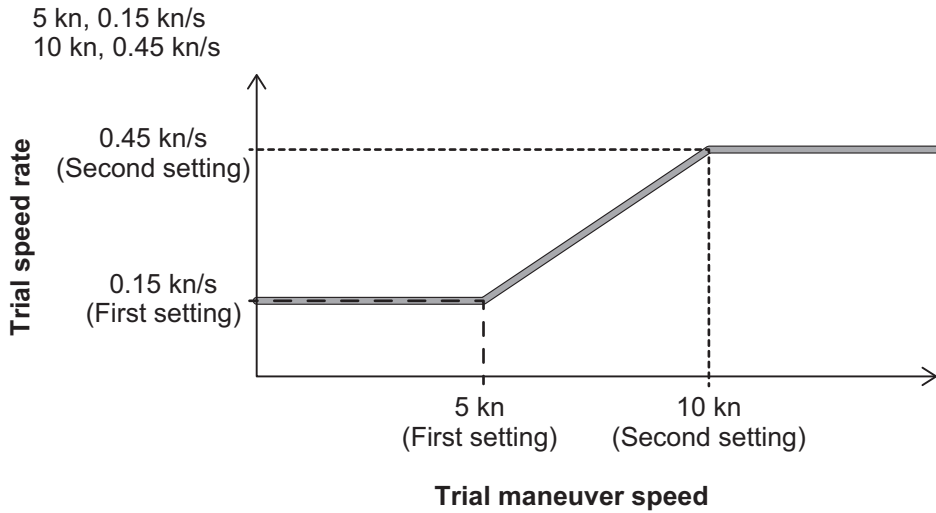
Setting example for [4 TRIAL TURN RATE]

5 kn, 1.5 °/s
10 kn, 4.5 °/s

Trial maneuver speed
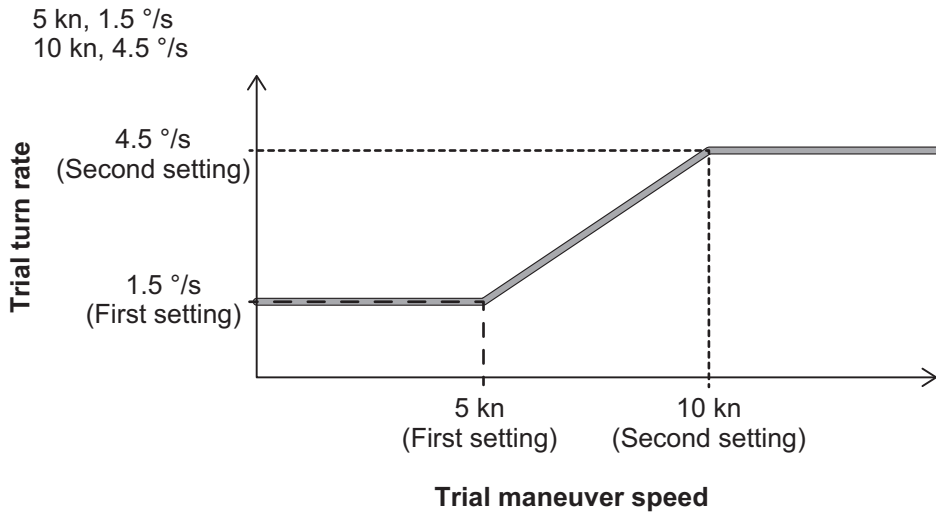
10. Close the menu

11. Highlight the [TRIAL] status indication in the [TRIAL] box, then left-click. The indication changes from "OFF" to "SET" and the trial maneuver settings appear.
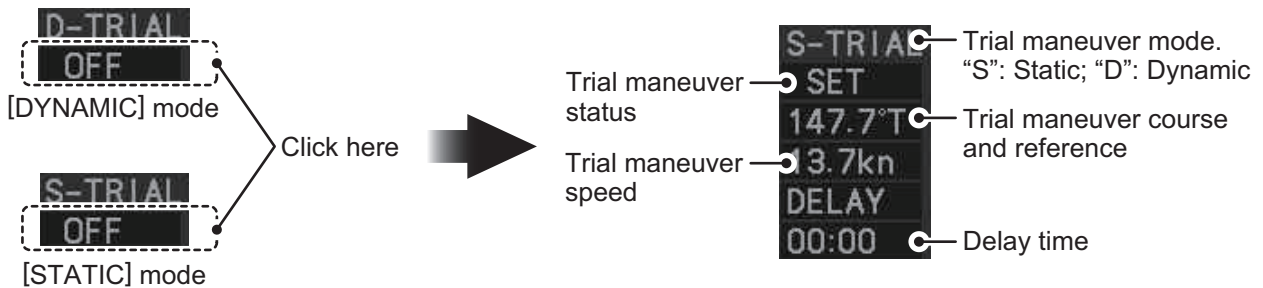
Note: The initial indications for course and speed are derived from own ship's current course and speed at the time when the trial maneuver set up starts.

12. Select the trial maneuver course and reference indication, then left-click.

13. Spin the scrollwheel to set the course, then left-click.
    The reference is not changeable here.

14. Set the speed in the same manner as the course.

15. Select the delay time indication, then left-click.

16. Spin the scrollwheel to set the amount of delay. This is the time after which own ship takes a new situation, not the time the simulation begins. Change the delay time according to own ship loading condition, etc.
The time indication depends on trial type:
[DYNAMIC]: The position of your ship and TTs is displayed every 30 seconds and updating occurs every 0.5 seconds.
[STATIC]: The position of your ship and TTs when set course and speed are reached are displayed. Put the cursor in the Trial time indication and roll the scroll-wheel. Increase or decrease the time to get a safe maneuver. If a maneuver is un-safe, change speed, course and delay until it is safe.

17. Highlight the [TRIAL] status indication, then left-click. The indication changes from "SET" to show a timer for the trial maneuver and the maneuver begins.

The trial maneuver takes place with the letter "T" displayed at the bottom of the screen. The time appears at the top-right position on the display. If any TT is predicted to be on a collision course with own ship (that is, the target ship comes within preset CPA/TCPA limits), the target plotting symbol flashes. If this happens, change own ship's tri-al speed, course or delay time to obtain a safe maneuver.

3.15.3 How to stop the trial maneuver

You can stop the maneuver at any time by placing the cursor on the [TRIAL] status indication, then press and hold the left mouse button until "OFF" is shown.

When [DYNAMIC] is selected as the maneuver type, the maneuver automatically stops when the trial timer reaches 60 minutes.

When [STATIC] is selected as the maneuver type, the maneuver automatically stops when there is no operation of the [TRIAL] box for more than one minute.

3.16 TT System Messages

There are four main reasons the TT may trigger the audio and visual alerts:

- Collision alarm
- Lost target alert
- Acquisition zone alert
- Target capacity

You can acknowledge visual alerts and silence the audio alerts with one of the following methods:

- Press the **ALARM ACK** (RCU-014) or **ALERT ACK** (RCU-031) key
- Click the [ALERT] box, at the bottom-right of the screen.
- Click the alert in the [ALERT LIST].

Alert message	Priority	Meaning	Action required
TT DANGER OF COLLISION	Alarm	A tracked target is on collision course with your vessel.	Take evasive action or terminate tracking of TT.
TT NEW TARGET	Warning	Tracked target has entered an acquisition zone. The tracked target's symbol is red and flashing.	Confirm the tracked target, then press the **ALARM ACK** (RCU-014) or **ALERT ACK** (RCU-031) key.
TT TARGET LOST	Warning	When the system detects a loss of a tracked target, the lost tracked target symbol appears in red and flashes. At the same time, an audio alert is produced for one second. The lost target mark disappears from the screen after the lost target alert is acknowledged.	Confirm the lost target, reacquire if necessary.
REF TARGET LOST	Warning	When the system detects a loss of a reference target, the target symbol turns red and flashes. At the same time, an audio alert is produced for one second. The reference target mark disappears from the screen after the reference target alarm is acknowledged.	To continue using a referenced target for speed input, select another tracked target.
TT TARGET FULL (AUTO) or (MAN)	Warning	Appears when capacity for automatically (manually) acquired targets is full.	To continue acquiring targets, cancel tracking for unnecessary targets.
TT TARGET 95% (AUTO) or (MAN)	Caution	Appears when capacity for automatically (manually) tracked targets is 95% full.	

3.17 TT Simulation Mode

You can simulate the risk of a collision by using the TT simulation mode. This function can be used for familiarization training for your crew. The simulation can be terminated at any time by pressing the **STBY TX** key.

1. Open the menu.
2. Select [9 INITIAL SETTINGS].
3. Select [7 TESTS].
4. Select [4 TT SIMULATION MODE].

The normal operation is suspended then three simulated targets appear on the display.

The indication "S" appears at the bottom of the effective display area during the simulation mode. The simulation may be terminated any time by going to the STBY mode.

Three simulated targets move as the following table. The simulated target is automatically generated with the relative movement in the following table based on own ship's movement at the start of simulation mode.

Note: If own ship moves after the start of simulation mode, the movement of the simulated target is not matched with the values in the following table.

	Range (R)	Bearing (R)	Speed (R)	Course (R)	CPA	TCPA
Target 01	9.5 NM	270.0°	20.0 kn	90.0°	0.0 NM	28.5 min
Target 02	1.1 NM	333.0°	10.2 kn	90.2°	1.0 NM	2.9 min
Target 03	9.3 NM	45.0°	19.9 kn	225.1°	0.0 NM	28.0 min
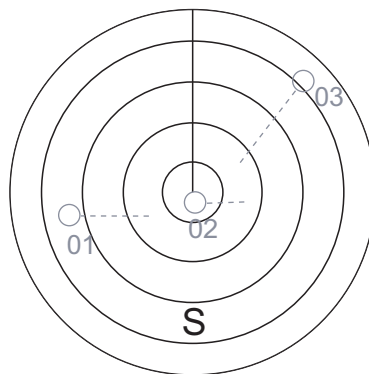
Place the cursor on a target, then press the **ACQ** key to display the target data.

Acquire the simulated targets after the TT simulation mode is performed. The tracking state changes from unstable to stable and the vector appears. You can simulate the movement of each function with changing true/relative vector, stabilization through the water/over the ground, range or length of vector.

Repeat the check for all targets.

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.

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 $\leq$ 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 $\leq$ SOG < 14kn	10 s	50 s
Class A: 14kn $\leq$ SOG $\leq$ 23kn	6 s	30 s
Class A: SOG > 23kn	2 s	10 s
Class B: "CS" SOG $\leq$ 2kn	3 min	10 min
Class B: "CS" SOG > 2kn	30 s	150 s
Class B: "SO" 0 kn $\leq$ SOG $\leq$ 2kn	3 min	10 min
Class B: "SO" 2 kn < SOG < 14kn	30 s	150 s
Class B: "SO" 14 kn $\leq$ SOG $\leq$ 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.
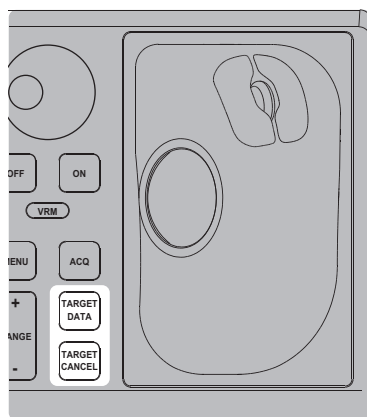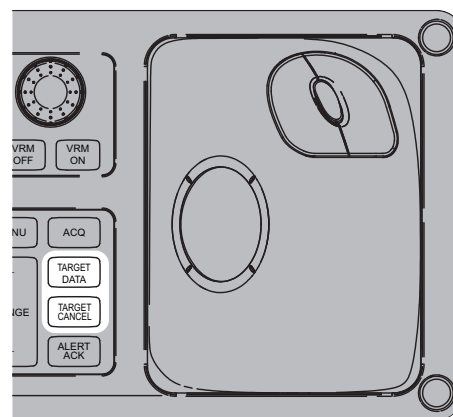
RCU-014   RCU-031

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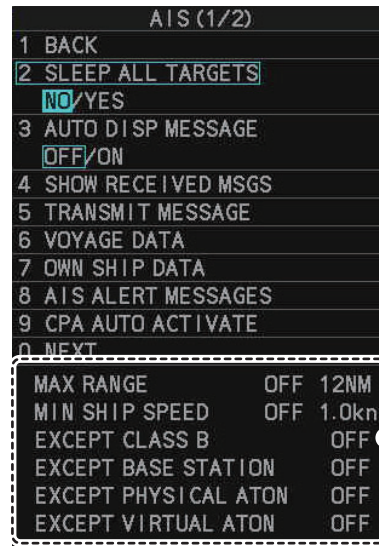
Note: You can also right-click the AIS indication in the [TT·AIS] box to open the [TT] menu.

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.
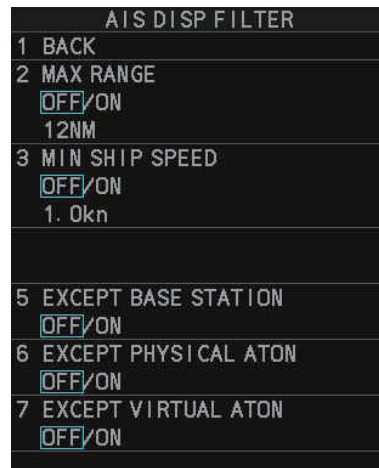
Filter type	Definition
[MAX RANGE]	Any sleeping AIS targets class A/B beyond the range set here will not be shown.
[MIN SHIP SPEED]	Any sleeping AIS targets class A/B slower than this setting will not be shown.
[EXCEPT CLASS B]*	Select [ON] to remove sleeping AIS targets class B.
[EXCEPT BASE STATION]	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.
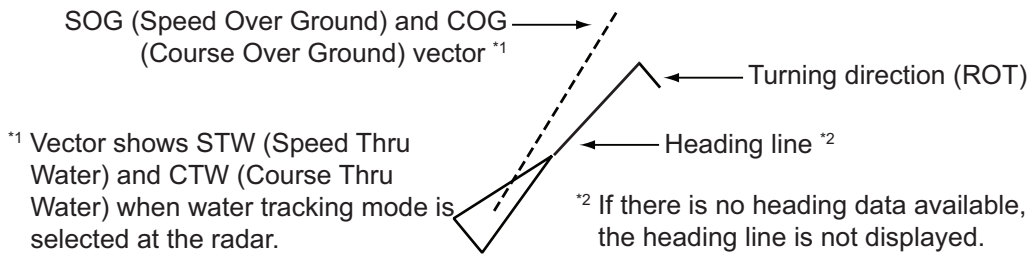Right click to show the [CURSOR] menu→[0 NEXT]→[TGT DATA/ACQ SETTING]→[ANY] or [AIS ONLY].

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.

<u>**Activate a AIS target with the trackball**</u>

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.

<u>**How to set the AIS auto activate function**</u>

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
05	MOORED (DEFAULT)

Nav Status No.	Meaning
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.

NAME	XXXXXXXXX
COG	199.0°T
SOG	15.0kn
CPA	3.663NM
TCPA	-18:35
DEST	XXXXXXXXX

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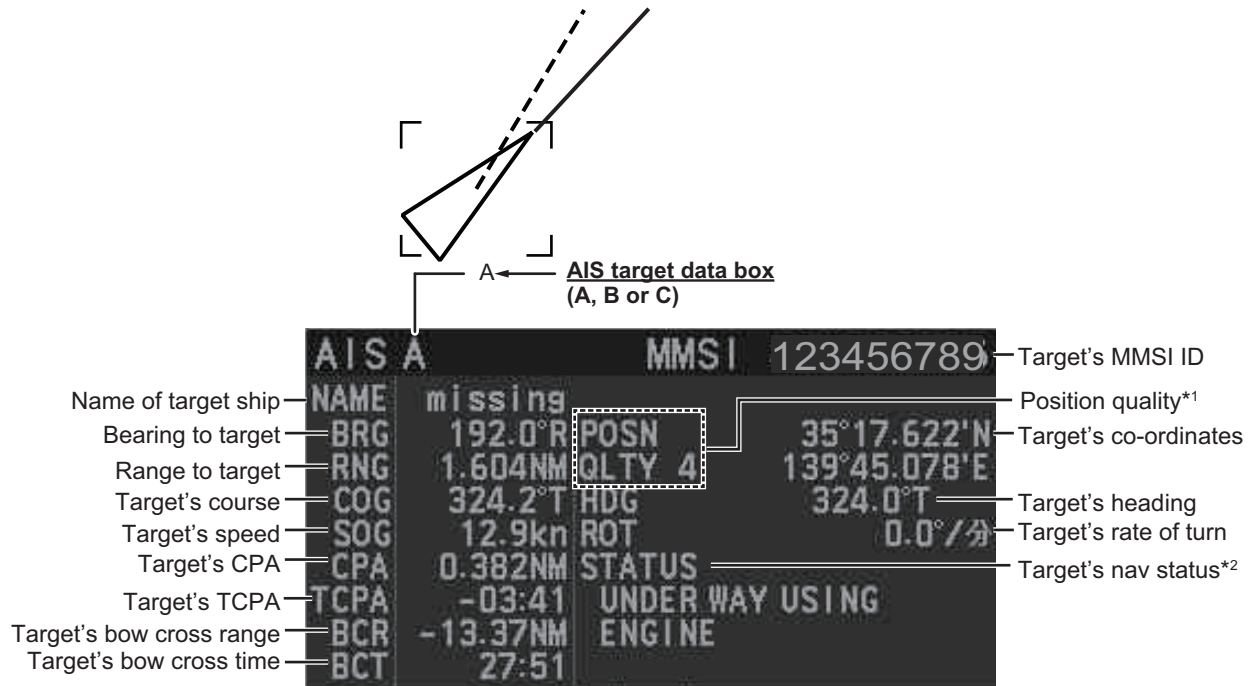
$*1$: Position quality indicates overall accuracy, and is calculated and displayed as shown below.

POSN QLTY value	Position accuracy
1	Position > 10 m
2	Position with RAIM > 10 m
3	Position $\leq$ 10 m
4	Position with RAIM $\leq$ 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.
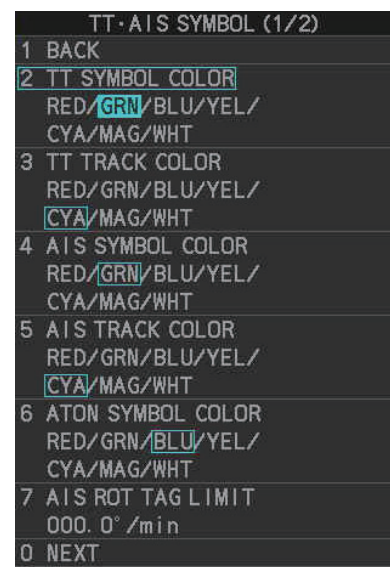
1. Open the menu.
2. Select [9 INITIAL SETTINGS].
3. Select [2 BRILL]. The [BRILL] menu appears.
4. Select [0 NEXT] to show the next menu page.
5. Select [8 AIS SYMBOLS]. The settings are highlighted and can now be adjusted.
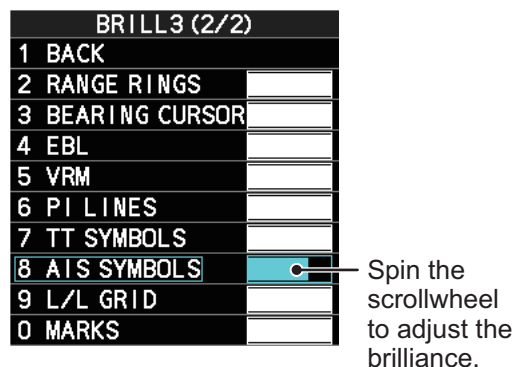
Spin the scrollwheel to adjust the brilliance.

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.
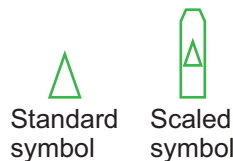6. Close the menu.

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 symbol   Scaled 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.
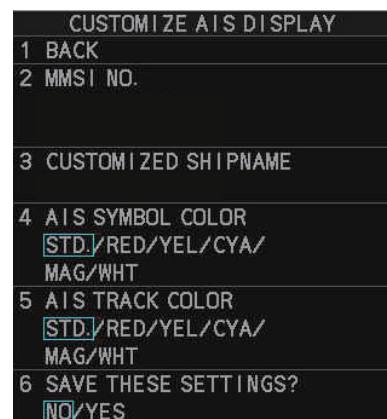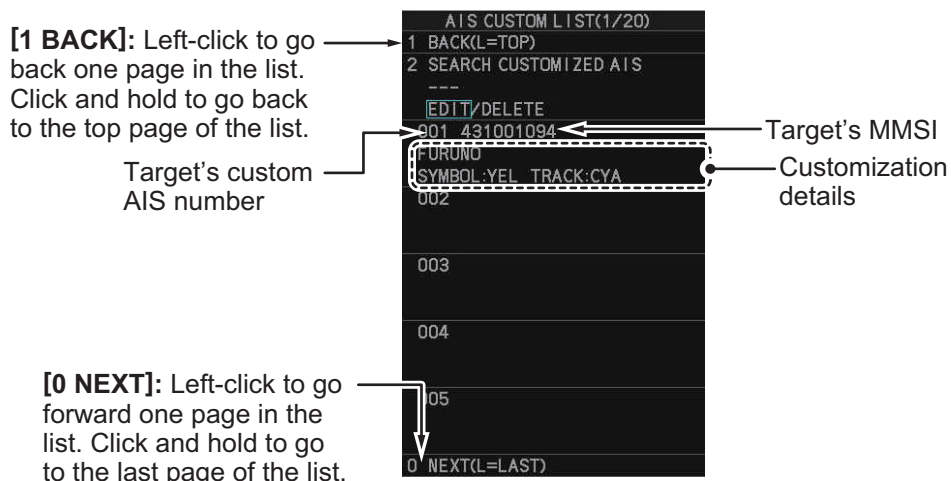
Note: You can also right-click an AIS target to open the [CUSTOMIZE AIS DIS-PLAY] menu with the selected vessel's MMSI field completed.

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
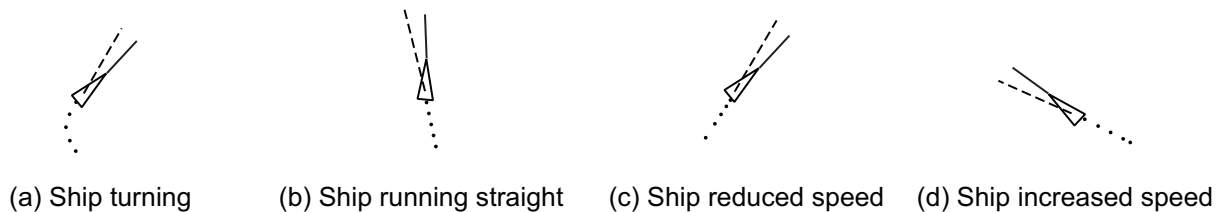
4.10.1 How to display past position points and select the plotting interval

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.