3.13 Past Position Display

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

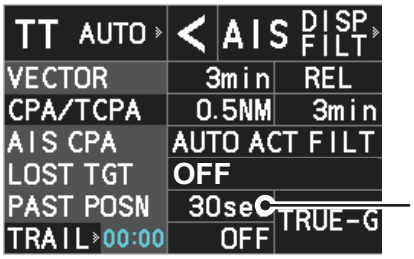
A new dot is added every minute (or at other preset time intervals) until the preset number is reached. If a target changes its speed, the spacing will be uneven. If it changes the course, its plotted course will not be a straight line.

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.

3.13.1 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 on-screen display of past positions changes in accordance with the selected setting.

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

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [4 TT•AIS SYMBOL].
4. Select [5 TT•AIS PAST POSN POINTS].
5. Select [5] or [10] as appropriate.
6. Close the menu.

3.14 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].
   Note: You can also right-click the [SPD] box to access this menu.
5. Select [4 SET DRIFT].
6. Select [ON]. 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.

3.15 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.

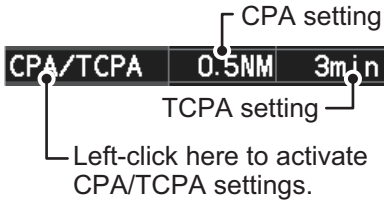
This feature, when used correctly, helps prevent the risk of collision by alerting you to threatening targets. It is important that GAIN, A/C SEA, A/C RAIN and other radar controls are properly adjusted.

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 1.50.

3.15.1 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.
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, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0, 6.0 (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

3.15.2 How to acknowledge the TT collision alarm

Press the **ALARM ACK** 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: When the "TT DANGER OF COLLISION" alarm is generated the AIS display is automatically turned on.

3.16 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.

Note: The acquisition zones are disabled when the setting for [2 AZ/ALR SELECT] in the [ACQUISITION ZONE] menu is set to [TARGET ALARM ZONE].

3.16.1 How to enable the acquisition zones

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

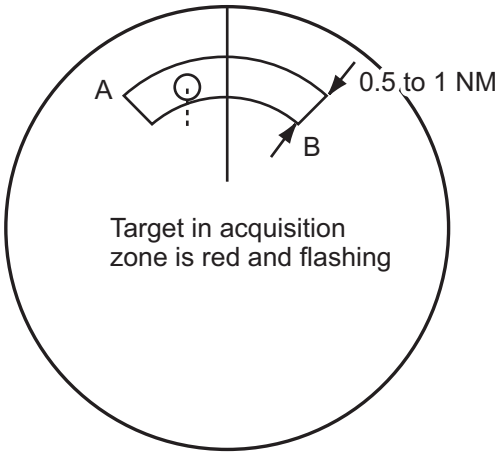
4. Select [2 AZ/ALR SELECT].
5. Select [ACQUISITION ZONE].
6. Close the menu.

3.16.2 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".



3.16.3 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.

To set a polygon shaped acquisition zone:

1. Place the cursor on the [2:] acquisition zone indication at the bottom-right of the screen, then left-click. 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 used for the polygon, the zone setup is automatically completed and there is no need to right-click.

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 AZ1 and AZ2 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

3.16.4 How to sleep/deactivate an acquisition zone

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

Sleeping the acquisition zone

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

Deactivating the acquisition zone

Left-click the box 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 [1:], the system releases an audible alert and shows the message "DELETE AZ2 FIRST".

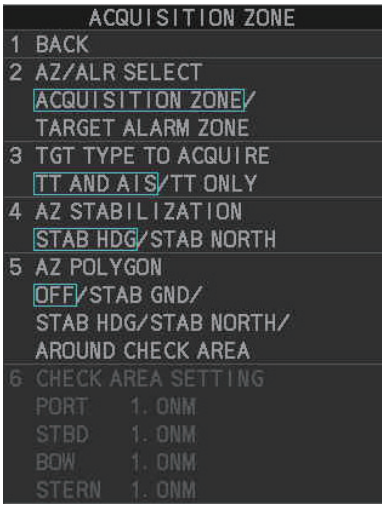
3.16.5 How to acknowledge the acquisition zone alert

Press the **ALARM ACK** key on the control unit, or select the [ALERT] box with the trackball then left-click to acknowledge the alarm and silence the buzzer.

3.16.6 How to select the target type to acquire (B/W-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.

3.16.7 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.
6. Close the menu.

3.16.8 How to set acquisition zone shape and stabilization (B/W-types only)

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.

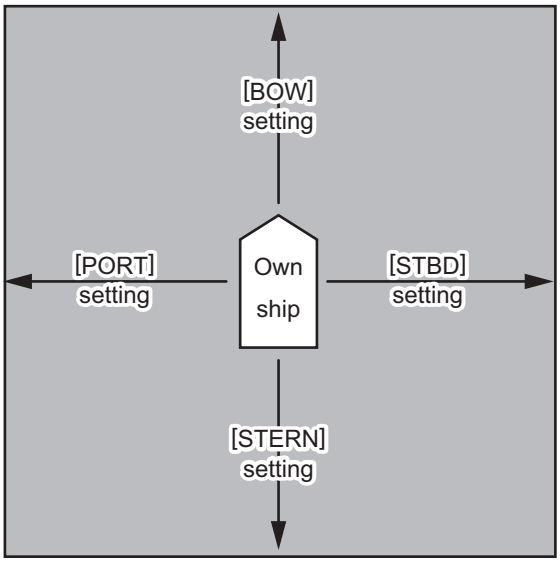
*: Shown only for B/W-type.

6. Close the menu.

How to set the check area around own ship (B/W-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].

3.17 Trial Maneuvers

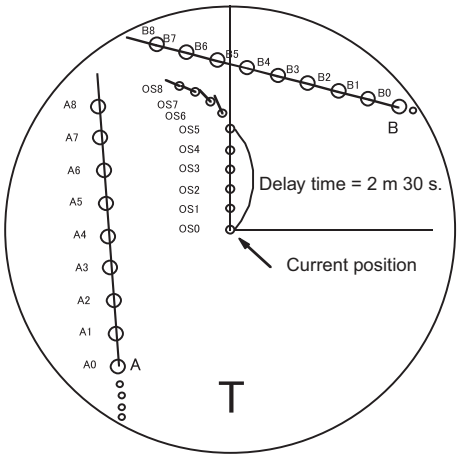
The trial maneuver feature simulates the effect of own ship's movement against all tracked targets, without interrupting the updating of target information. It is available for use with the TT and AIS functions. For more accurate results, use sea stabilization (water tracking).

3.17.1 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.



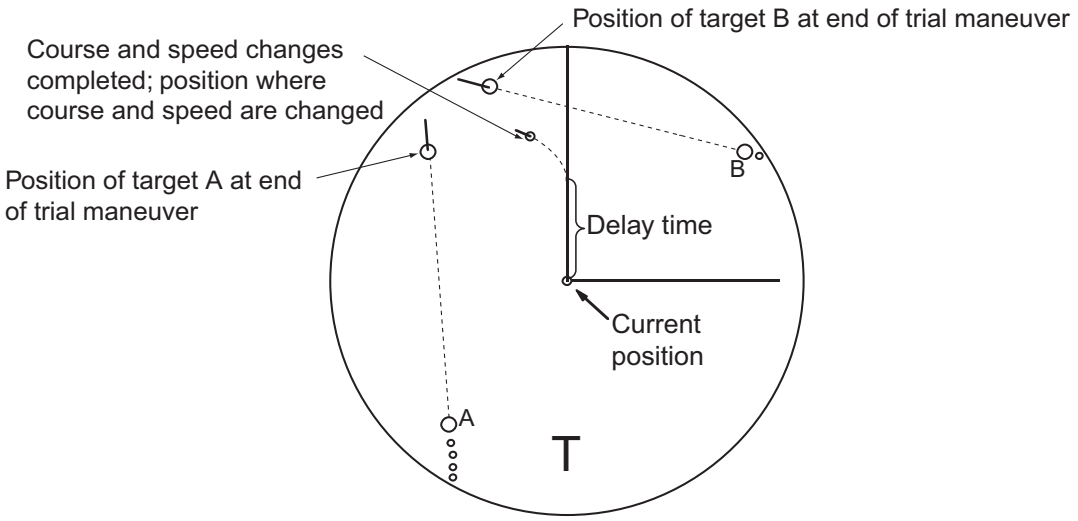
The delay time represents the time lag from the present time to the time when own ship will actually start to change her speed and/or course. You should therefore take into consideration own ship's maneuvering characteristics such as rudder delay, turning delay and acceleration delay. This is particularly important on large vessels. 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.

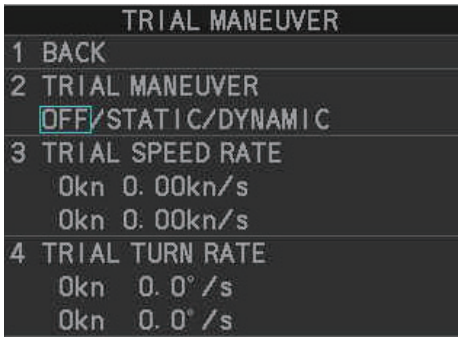
By shortening and extending the trial time you can find the safe time to make a maneuver. Thus, the static trial maneuver will be convenient when you wish to know the maneuver result immediately.



3.17.2 How to perform a trial maneuver

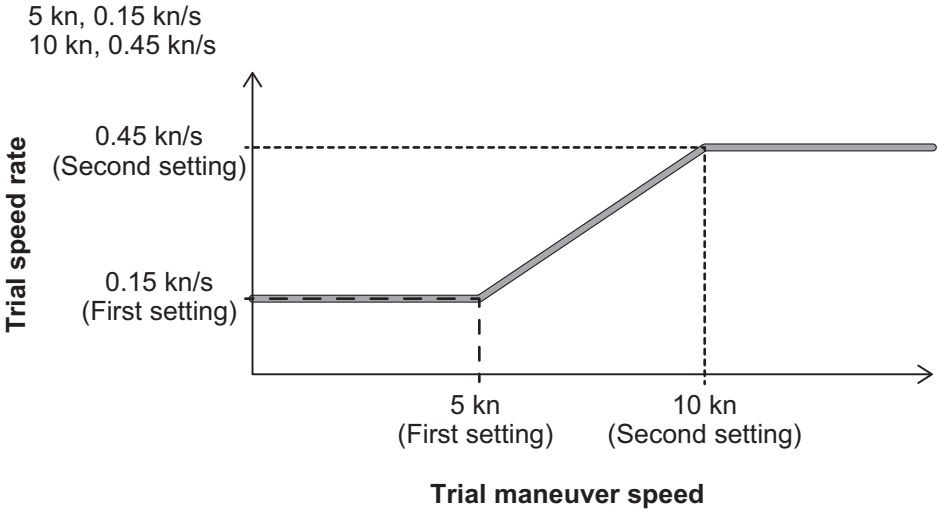
To set up and perform a trial maneuver, do the following:

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 speed rate as required.
8. Select [4 TRIAL TURN RATE].
9. Set the turn rate for the trial as required.

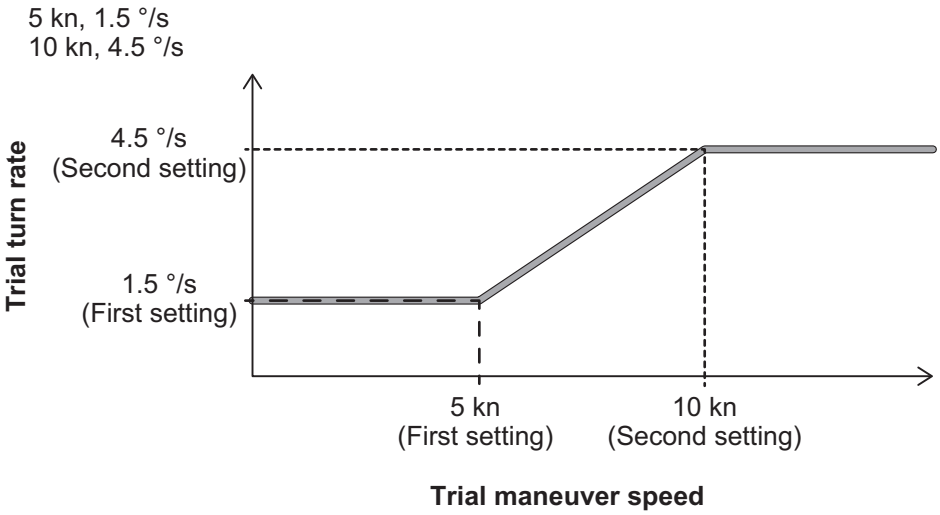


Note: Two sets of trial speed and trial turn rate combinations are provided. This is done to provide accurate trial maneuver results for various ship's speeds and turn rates.

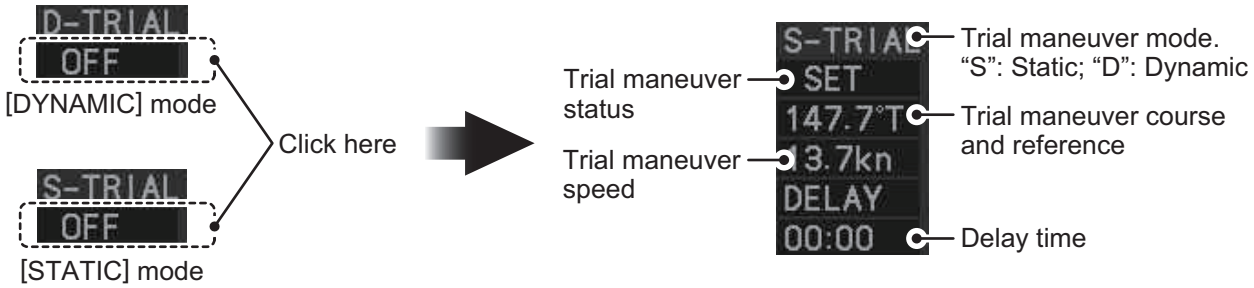
Setting example for [3 TRIAL SPEED RATE]



Setting example for [4 TRIAL TURN RATE]



10. For A/B/W-type radars, select [5 TRIAL TARGET DATA].
    Note: For IMO/R-types, [5 TRIAL TARGET DATA] is not shown; skip to step 12 if your radar is an IMO/R-type.
11. Select the target data to use for the trial. The available options are: [ACTUAL] and [TRIAL].
12. 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.

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

14. Spin the scrollwheel to set the course, then left-click.
    The reference is not changeable here.
15. Set the speed in the same manner as the course.
16. Select the delay time indication, then left-click.
17. 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 scrollwheel. Increase or decrease the time to get a safe maneuver. If a maneuver is unsafe, change speed, course and delay until it is safe.
18. 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 trial speed, course or delay time to obtain a safe maneuver.

3.17.3 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.

3.18 TT System Messages

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

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

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

- Press the **ALARM ACK** key on the control unit
- 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** 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.	

3.19 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].

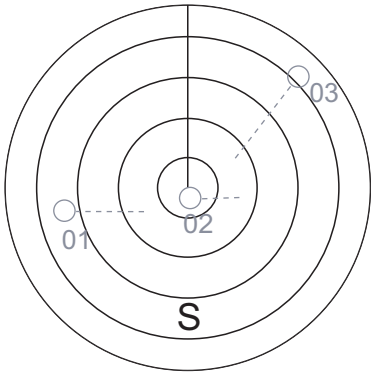
The normal operation is suspended then three simulated targets appear on the display.

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.

3.20 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.

3.21 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.

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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 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).

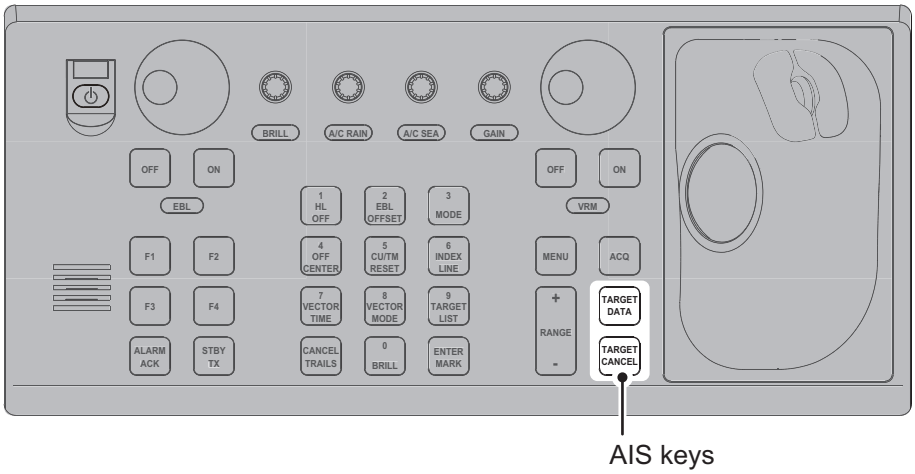
There can be several hundreds or several thousands of AIS targets, and of those only a few will be significant for your ship. To remove unnecessary AIS targets from the radar display, the feature "active and sleeping AIS targets" is available. Initially any new AIS target received by an AIS transponder 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. 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 4.5.

This radar generates AIS-related alerts. These are Alert "AIS DANGER OF COLLISION" 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

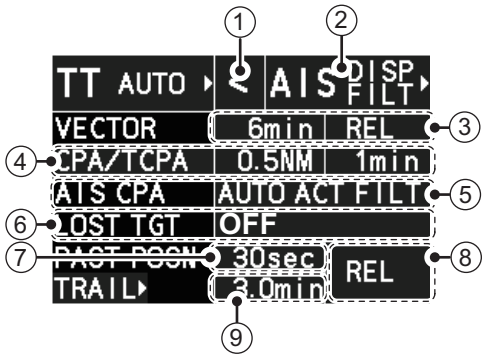
The control unit has three keys that are used in the AIS mode. The keys are indicated in the figure below.



- **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.

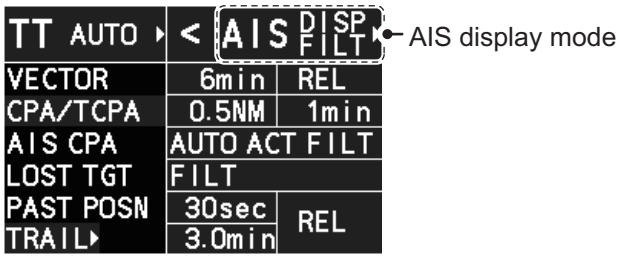
These functions, along with other AIS functions, can also be accessed from the [CURSOR] menu (See section 1.7).

4.2 AIS Box Overview



No.	Indication name	Description/remarks
1	Association indication	Shows the association setting. See section 4.15 for details.
2	AIS mode setting	Shows the current filter setting for AIS target display. • [FUNC OFF]: AIS display is disabled. • [DISP OFF]: AIS symbols are hidden. • [DISP FILT]: Only filtered AIS targets are displayed. • [DISP ALL]: All AIS symbols are displayed.
3	[VECTOR]	• Adjusts the vector time for the selected target. • True, Relative referencing for this target's vector. See section 3.12 for details.
4	[CPA/TCPA]	Adjusts the CPA/TCPA settings.
5	[AIS CPA]	Adjusts the AIS auto activate settings.
6	[LOST TGT]	Adjusts the settings for lost targets and related alerts.
7	[PAST POSN]	Adjusts the setting for past position tracks. See section 3.13 fro details.
8	Trail mode	Changes the trail mode in use. See section 1.37 for details.
9	Trail time	Shows the interval setting for trails. See section 1.37.2 for details.

4.3 How to Select the 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.

4.4 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 "AIS symbols" on page AP-32.

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

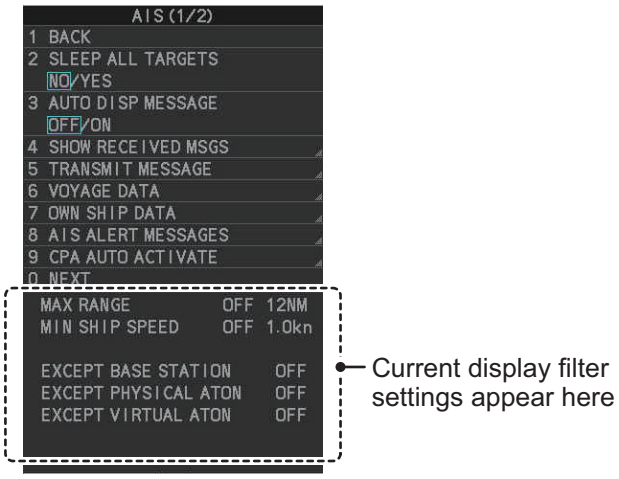
Note 2: AIS symbols are momentarily erased and the screen is redrawn after the heading is changed in the HEAD UP mode.

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 for IMO/R-types. A/B/W-types do not show this alert.
When the AIS function is active: Above message is prioritized as a Warning level alert for all radar types.

4.5 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.

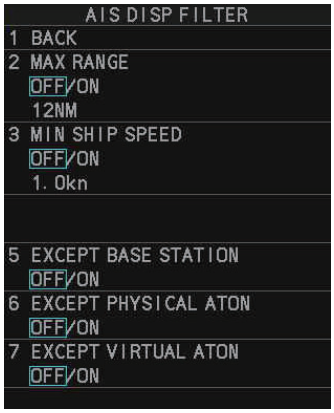
1. Open the menu.
2. Select [5 TT•AIS].
3. Select [5 AIS].



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 B/W-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 NM), 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.

4.6 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 3.15 for how to use acquisition zones.

4.6.1 How to activate specific targets manually

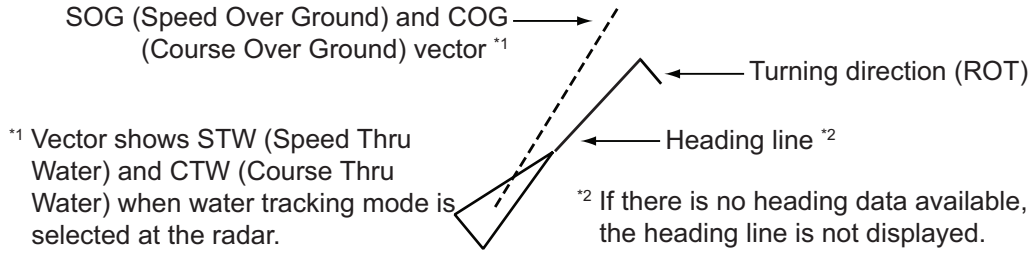
Note: Enable target data and acquisition beforehand.
Right click to show the [CURSOR] menu→[0 NEXT]→[TGT DATA/ACQ SETTING]→[ANY] or [AIS ONLY].

Activate an AIS target from the control unit (RCU-014)

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

Activate an AIS target from the trackball unit

Place the cursor on the target you wish to activate for AIS tracking, then press the **left button**.

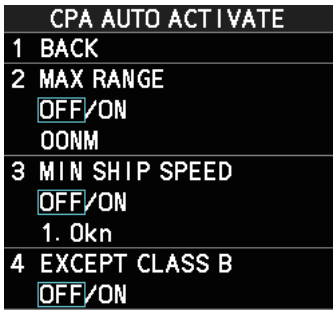


4.6.2 How to set the AIS auto activate function

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. Select [5 AIS].
4. Select [9 CPA AUTO ACTIVATE] to show the [CPA AUTO ACTIVATE] menu.
5. Referring to the table below, select the appropriate filter.

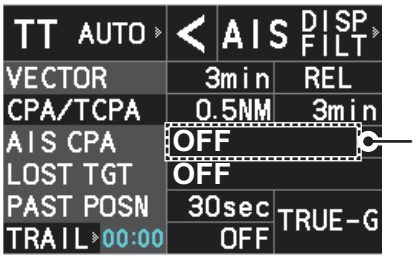


Filter type	Definition
[MAX RANGE]	Any AIS targets beyond the range set here will not be automatically activated.
[MIN SHIP SPEED]	Any AIS targets slower than this setting will not be automatically activated.
[EXCEPT CLASS B]	Select [ON] to prevent activation of AIS targets class B.

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.



Place the cursor on the [CPA AUTO ACTIVATE] box, then left-click 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 section 3.15.

Filter type	Definition
[AUTO ACT ALL]	Activation against AIS targets whose CPA or TCPA is less than set in section 3.15

4.7 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: Dangerous targets and targets that have been activated automatically cannot be “slept”.

4.7.1 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 keyboard (RCU-014)

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.

4.7.2 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.

4.8 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.

4.8.1 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].

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)
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.
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 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].

4.9.1 AIS pop-up information

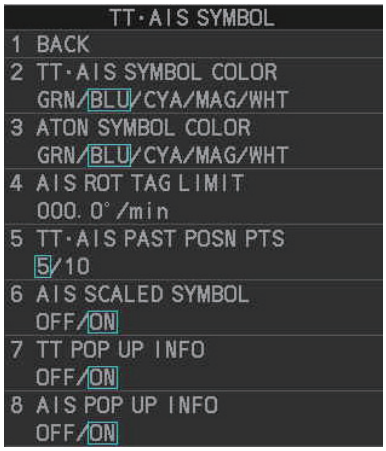
The AIS pop-up shows abbreviated AIS data (Vessel name, COG, SOG, CPA, TCPA and destination*) for the selected AIS target. Simply put the cursor on the AIS target to show the pop-up.

*: 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".

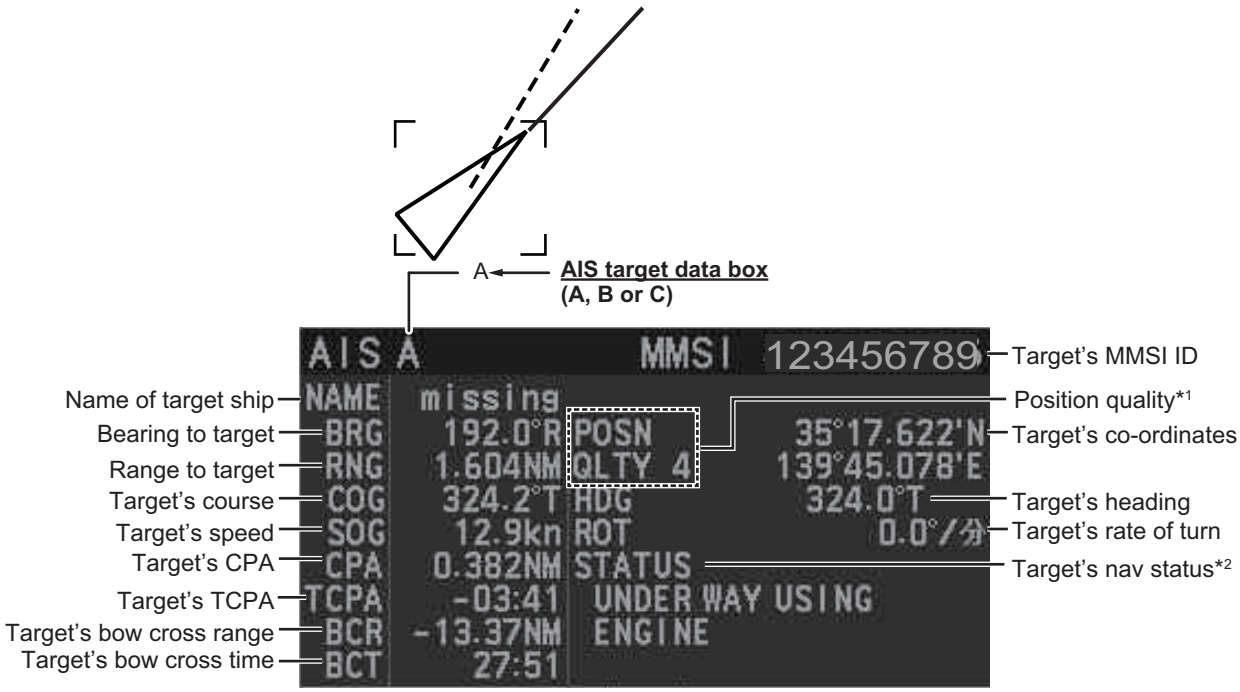
The pop-up can be enabled or disabled with the following procedure.



1. Open the menu.
2. Select [5 TT•AIS].
3. Select [4 TT•AIS SYMBOL].
4. Select [8 AIS POP UP INFO].
5. Select [ON] or [OFF] as appropriate.
6. Close the menu.

4.9.2 How to display basic AIS target data

Place the cursor on a desired AIS target and press the **TGT ACQ** key. 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.



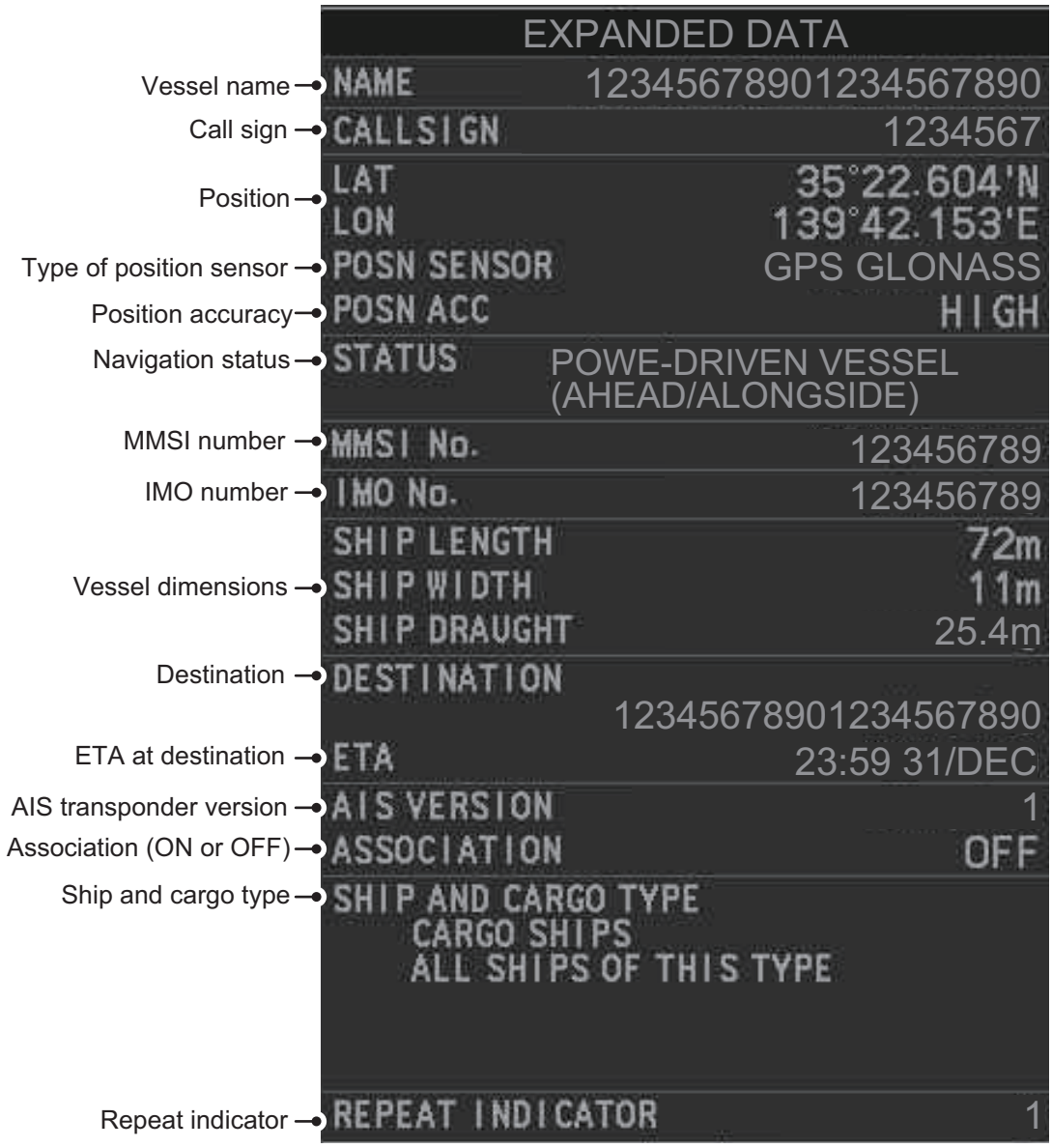
*1: Position quality indicates overall accuracy, and is calculated and displayed as shown below.

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.

4.9.3 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.



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.

4.9.4 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.

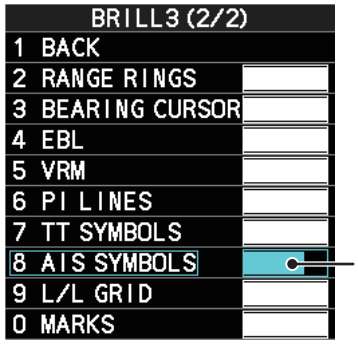
4.10 How to Change AIS Symbol Attributes

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

4.10.1 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 1.45.1.

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.



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

4.10.2 How to change the color of the AIS symbol

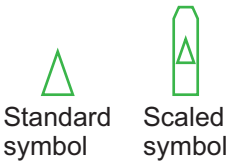
1. Open the menu.
2. Select [5 TT•AIS].
3. Select [4 TT•AIS SYMBOL].
4. Select [2 TT•AIS SYMBOL COLOR].
5. Select the appropriate color.
6. Close the menu.

4.10.3 How to change the color of the ATON symbol

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [4 TT•AIS SYMBOL].
4. Select [3 ATON SYMBOL COLOR].
5. Select the appropriate color.
6. Close the menu.

4.10.4 How to change the size of the AIS symbol

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [4 TT•AIS SYMBOL].
4. Select [6 AIS SCALED SYMBOL].
5. Select [OFF] or [ON] as appropriate.
   [OFF]: All AIS symbols are displayed in the same size.
   [ON]: AIS symbols are displayed in scale, according to the ship length.



   The figure above shows examples of standard and scaled symbols.
6. Close the menu.

4.11 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.

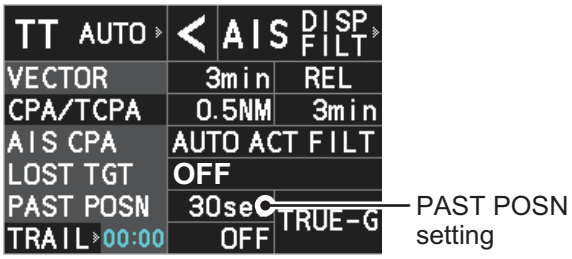
Below are examples of past position displays.

(a) Ship turning (b) Ship running straight (c) Ship reduced speed (d) Ship increased speed

4.11.1 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]...



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

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

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [4 TT•AIS SYMBOL].
4. Select [5 TT•AIS PAST POSN POINTS].
5. Select [5] or [10] as appropriate.
6. Close the menu.

4.11.3 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.

4.11.4 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).

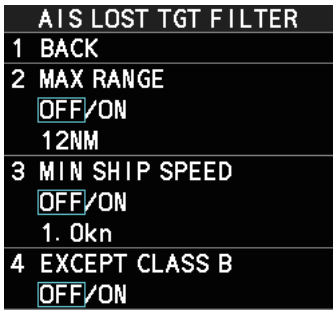
4.12 Lost Target

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**.

4.12.1 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. Select [5 AIS].
4. Select [0 NEXT].
5. Select [3 AIS LOST TGT FILTER].
6. Referring to the following table, select the appropriate filter.



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 class B AIS targets from triggering the lost target alert.

7. Select [ON] to activate the filter, or select [OFF] to deactivate the filter.
   The setting range for [MAX RANGE] and [MIN SHIP SPEED] are listed below.
   - [MAX RANGE]: [00NM] to [99NM]
   - [MIN SHIP SPEED]: [0.0kn] to [9.9kn]
8. Spin the scrollwheel to adjust the setting as required, then left-click to apply the setting.
9. Close the menu.

4.12.2 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]...

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

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

4.13 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.

ROT display

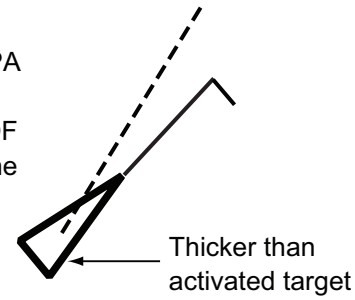
1. Open the menu.
2. Select [5 TT•AIS].
3. Select [4 TT•AIS SYMBOL].
4. Select [4 AIS ROT TAG LIMIT], then left-click. The settings can now be adjusted.
5. Spin the scrollwheel to adjust the ROT as appropriate, then left-click. The setting range is 000.0°/min to 720.0°/min.
6. Close the menu.

4.14 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.

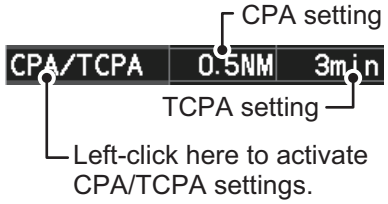
Dangerous target

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. Press the **ALARM ACK** key (or click the [ALERT] box with the left button) to acknowledge the CPA/TCPA alarm. The audible alarm is silenced and the symbol stops flashing.
Take appropriate action to avoid collision.



4.14.1 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.
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, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0, 6.0 (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

4.15 How to Associate TT and AIS Targets

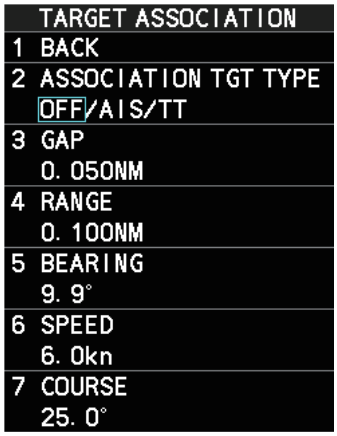
An AIS-equipped ship is usually displayed by two symbols on the radar display. This is because the AIS ship position is measured by a GPS navigator (L/L) whereas the radar detects the same ship by PPI principle (range and bearing relative to own ship radar antenna).

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".

2. Open the menu.
3. Select [5 TT•AIS].
4. Select [7 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: Association can also be switched on and off from the screen by left-clicking the Association Usage icon, shown below.

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

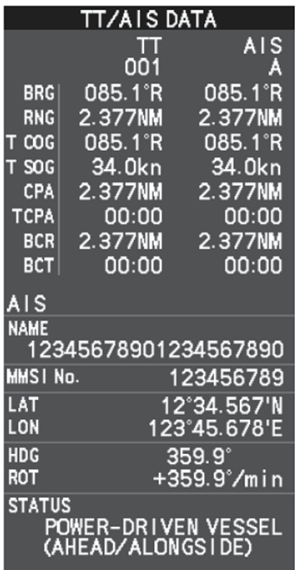
[3 GAP] : Range between AIS target and tracked target. (setting range: 0.000-0.050 (NM))
[4 RANGE] : Range direction difference from own ship to AIS target and tracked target. (setting range: 0.000-0.100 (NM))
[5 BEARING] : Bearing difference from own ship to AIS target and tracked target. (setting range: 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.

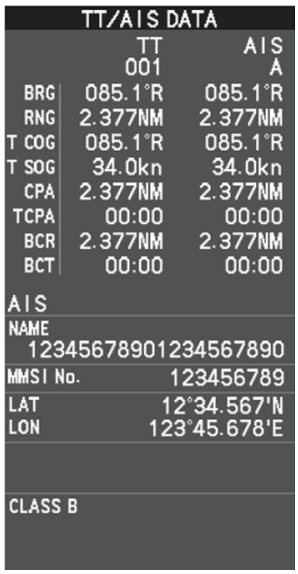
When the association criteria (gap, range, bearing, speed, and course) is met, and the ASSOCIATION TARGET setting is [AIS], the TT symbol is erased and only the AIS symbol is displayed.

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.



Combined TT/AIS data for a CLASS A vessel

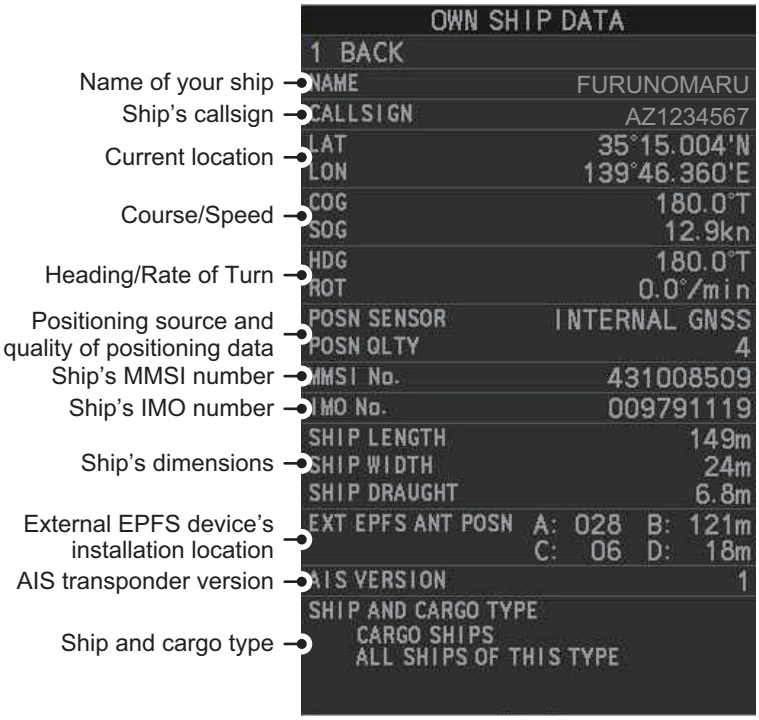


Combined TT/AIS data for a CLASS B vessel

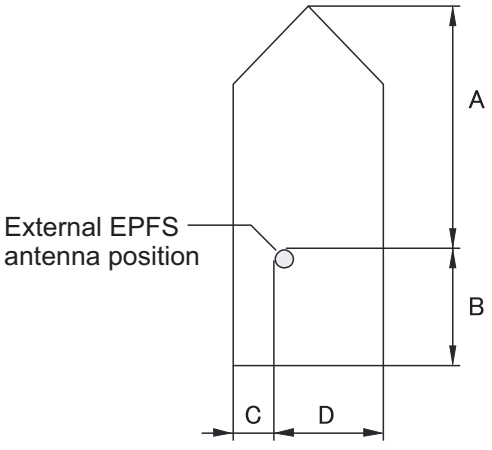
4.16 How to View Own Ship Data

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. Select [5 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.

4.17 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.

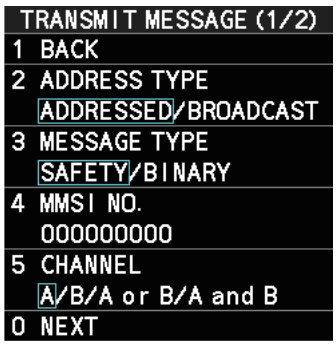
Short safety related messages are only an additional means to broadcast safety information. They do not remove the requirements of the GMDSS.

4.17.1 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:

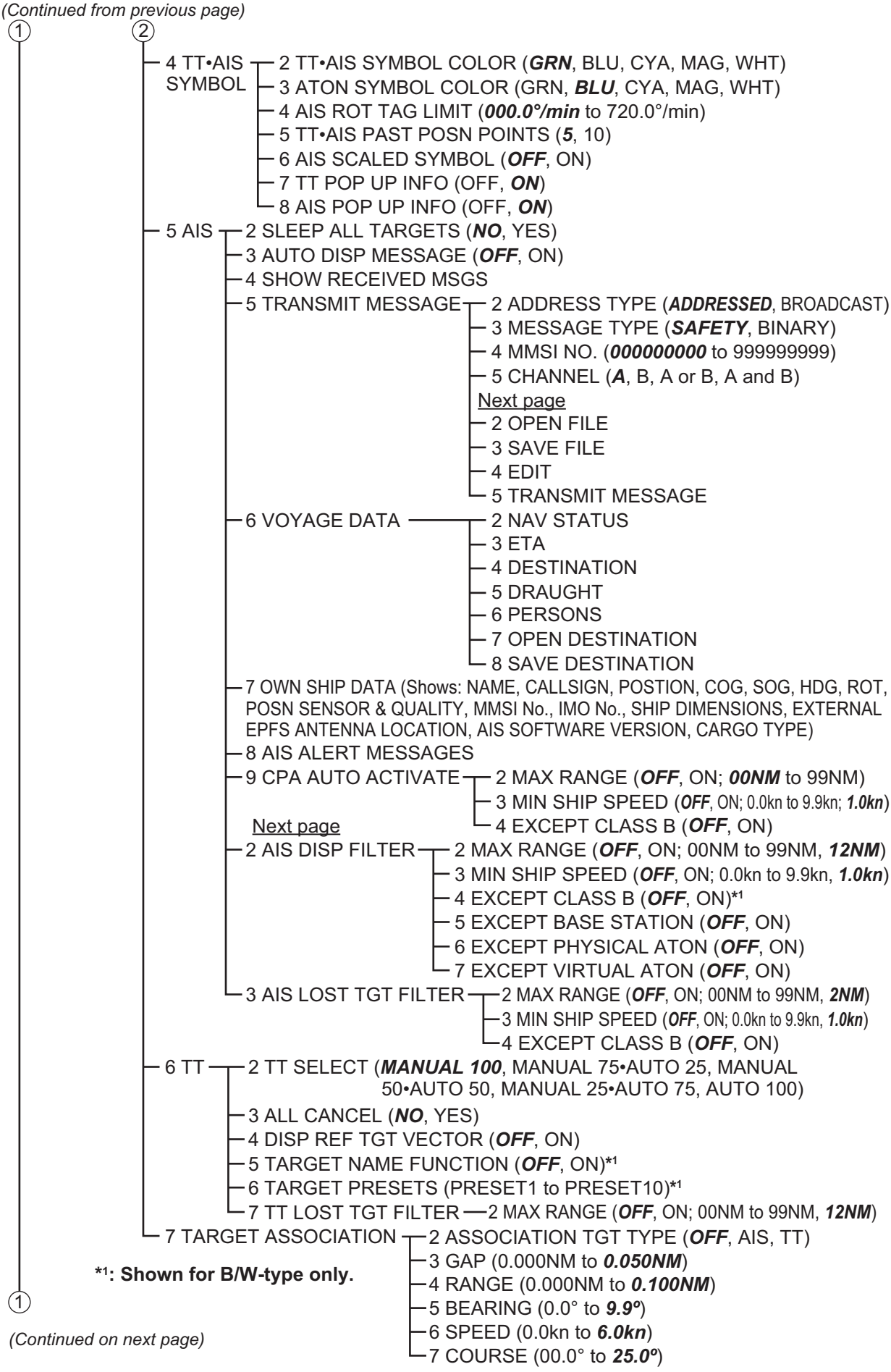
Note: The MMSI of the receiving ship can be automatically set by selecting [TRANSMIT MESSAGE] from the pop up menu. To show the pop up menu, select the receiving ship's data in the AIS data display area, then press the **right button**.

1. Open the menu.
2. Select [5 TT•AIS].
3. Select [5 AIS].
4. Select [5 TRANSMIT MESSAGE].

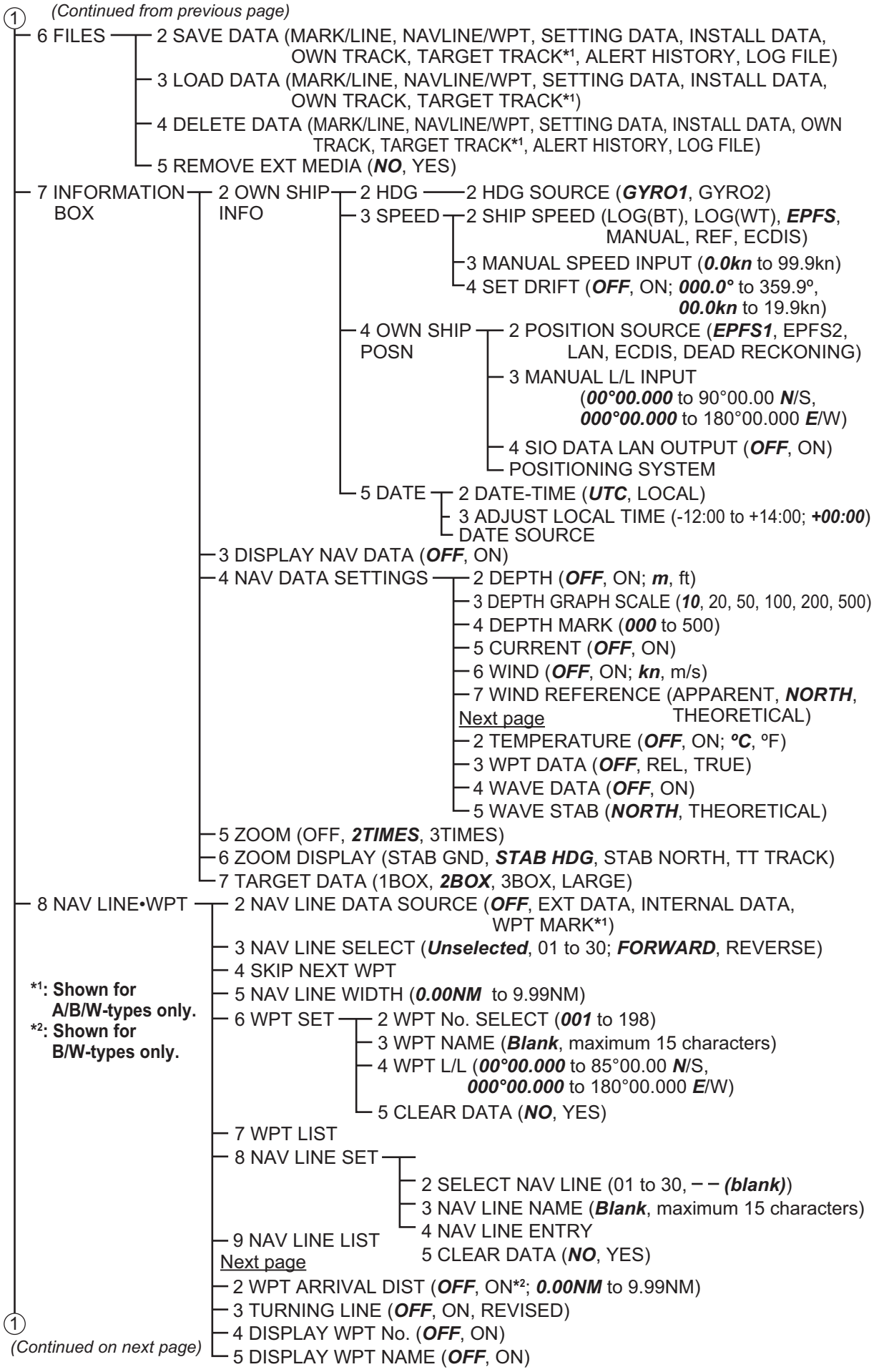


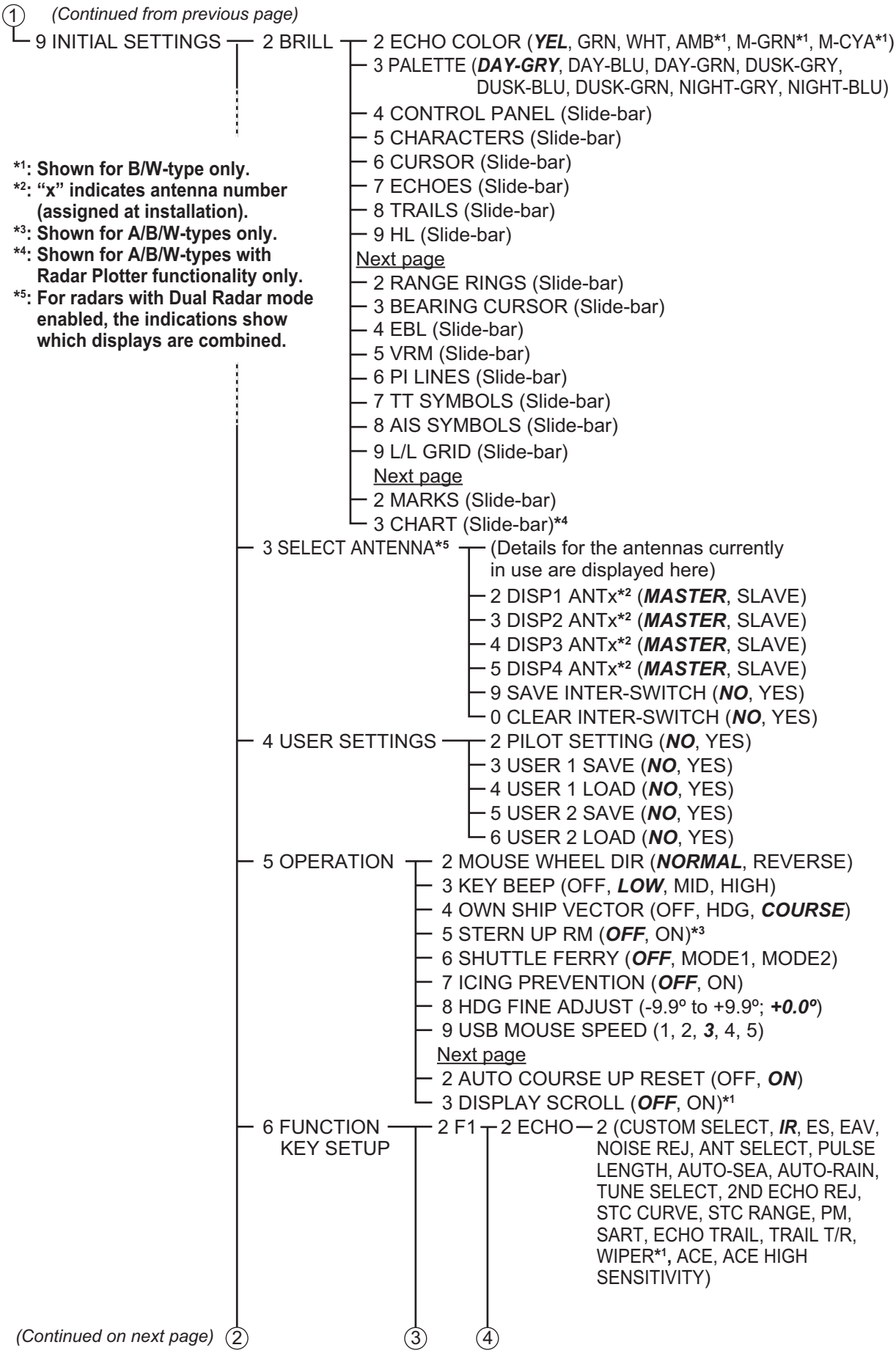
5. Select [2 ADDRESS TYPE].
6. Select [3 MESSAGE TYPE].
7. Select [SAFETY] (for safety messages) or [BINARY] (for routine messages).
8. For [ADDRESSED] message, do this step. For [BROADCAST] message, or if [TRANSMIT MESSAGE] was selected from the AIS data display pop up menu, go to step 8.
   1) Select [4 MMSI No.].
   2) Use the number keys to set the receiving ship's MMSI.
9. Select [5 CHANNEL].
10. Select the AIS channel to transmit your message over: [A], [B], [A or B], or [A and B].
11. Select [0 NEXT] to show the next menu page.
12. Select [4 EDIT]. A software keyboard appears at the bottom of the menu.
13. Select the character desired, then left-click.
    The maximum of 80 characters can be entered for the message.

(Continued from previous page)



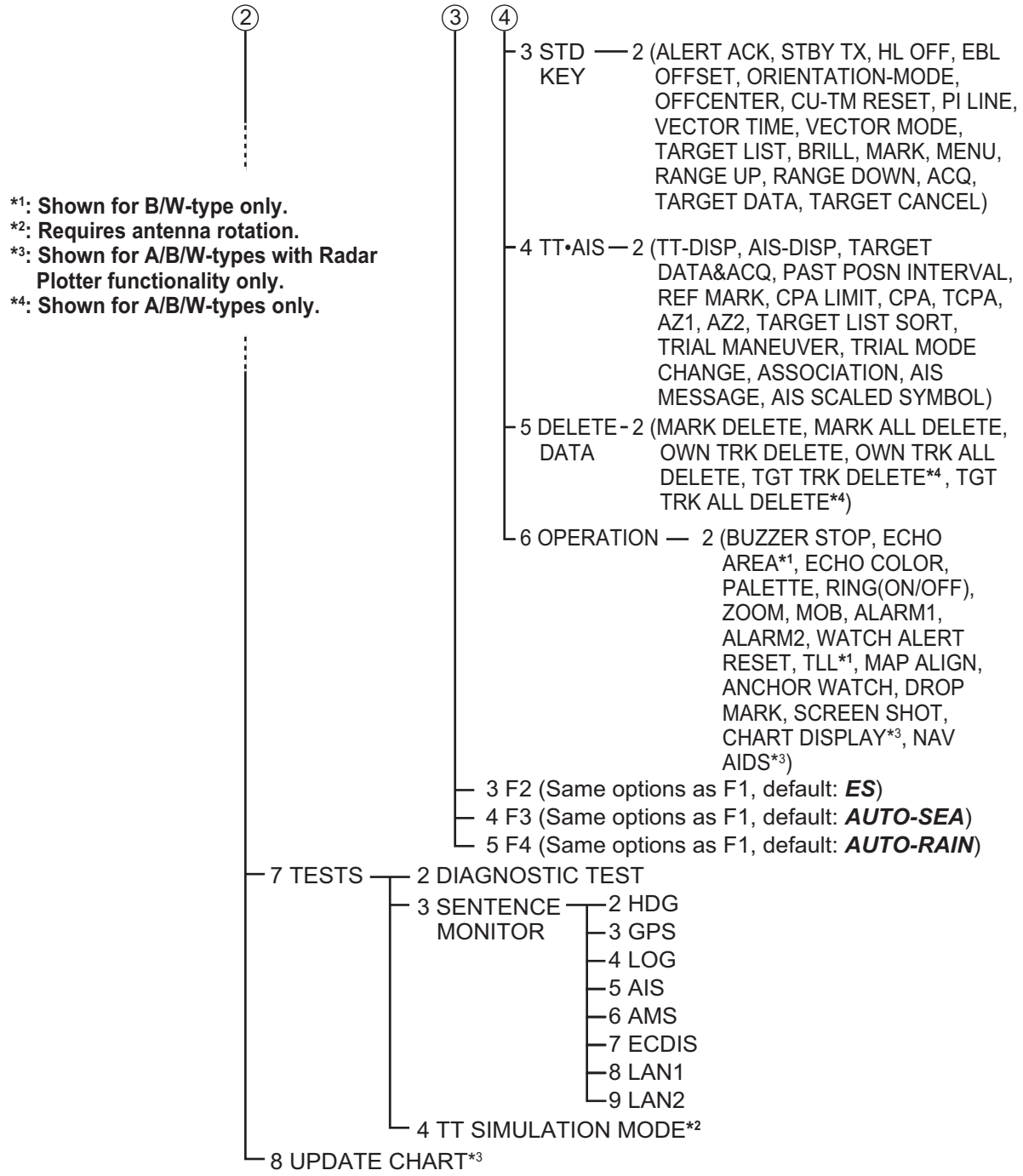
(Continued on next page)


(1) (Continued from previous page)
6 FILES
2 SAVE DATA (MARK/LINE, NAVLINE/WPT, SETTING DATA, INSTALL DATA, OWN TRACK, TARGET TRACK*1, ALERT HISTORY, LOG FILE)
3 LOAD DATA (MARK/LINE, NAVLINE/WPT, SETTING DATA, INSTALL DATA, OWN TRACK, TARGET TRACK*1)
4 DELETE DATA (MARK/LINE, NAVLINE/WPT, SETTING DATA, INSTALL DATA, OWN TRACK, TARGET TRACK*1, ALERT HISTORY, LOG FILE)
5 REMOVE EXT MEDIA (NO, YES)
7 INFORMATION BOX
2 OWN SHIP INFO
2 HDG
2 HDG SOURCE (GYRO1, GYRO2)
3 SPEED
2 SHIP SPEED (LOG(BT), LOG(WT), EPFS, MANUAL, REF, ECDIS)
3 MANUAL SPEED INPUT (0.0kn to 99.9kn)
4 SET DRIFT (OFF, ON; 000.0° to 359.9°, 00.0kn to 19.9kn)
4 OWN SHIP POSN
2 POSITION SOURCE (EPFS1, EPFS2, LAN, ECDIS, DEAD RECKONING)
3 MANUAL L/L INPUT (00°00.000 to 90°00.00 N/S, 000°00.000 to 180°00.000 E/W)
4 SIO DATA LAN OUTPUT (OFF, ON)
POSITIONING SYSTEM
5 DATE
2 DATE-TIME (UTC, LOCAL)
3 ADJUST LOCAL TIME (-12:00 to +14:00; +00:00)
DATE SOURCE
3 DISPLAY NAV DATA (OFF, ON)
4 NAV DATA SETTINGS
2 DEPTH (OFF, ON; m, ft)
3 DEPTH GRAPH SCALE (10, 20, 50, 100, 200, 500)
4 DEPTH MARK (000 to 500)
5 CURRENT (OFF, ON)
6 WIND (OFF, ON; kn, m/s)
7 WIND REFERENCE (APPARENT, NORTH, THEORETICAL)
Next page
2 TEMPERATURE (OFF, ON; ºC, ºF)
3 WPT DATA (OFF, REL, TRUE)
4 WAVE DATA (OFF, ON)
5 WAVE STAB (NORTH, THEORETICAL)
5 ZOOM (OFF, 2TIMES, 3TIMES)
6 ZOOM DISPLAY (STAB GND, STAB HDG, STAB NORTH, TT TRACK)
7 TARGET DATA (1BOX, 2BOX, 3BOX, LARGE)
8 NAV LINE•WPT
2 NAV LINE DATA SOURCE (OFF, EXT DATA, INTERNAL DATA, WPT MARK*1)
3 NAV LINE SELECT (Unselected, 01 to 30; FORWARD, REVERSE)
4 SKIP NEXT WPT
5 NAV LINE WIDTH (0.00NM to 9.99NM)
6 WPT SET
2 WPT No. SELECT (001 to 198)
3 WPT NAME (Blank, maximum 15 characters)
4 WPT L/L (00°00.000 to 85°00.00 N/S, 000°00.000 to 180°00.000 E/W)
5 CLEAR DATA (NO, YES)
7 WPT LIST
8 NAV LINE SET
2 SELECT NAV LINE (01 to 30, – – (blank))
3 NAV LINE NAME (Blank, maximum 15 characters)
4 NAV LINE ENTRY
5 CLEAR DATA (NO, YES)
9 NAV LINE LIST
Next page
2 WPT ARRIVAL DIST (OFF, ON*2; 0.00NM to 9.99NM)
3 TURNING LINE (OFF, ON, REVISED)
4 DISPLAY WPT No. (OFF, ON)
5 DISPLAY WPT NAME (OFF, ON)
*1: Shown for A/B/W-types only.
*2: Shown for B/W-types only.
(1) (Continued on next page)



***1: Shown for B/W-type only.**
***2: "x" indicates antenna number (assigned at installation).**
***3: Shown for A/B/W-types only.**
***4: Shown for A/B/W-types with Radar Plotter functionality only.**
***5: For radars with Dual Radar mode enabled, the indications show which displays are combined.**

(Continued from previous page)



***1: Shown for B/W-type only.**
***2: Requires antenna rotation.**
***3: Shown for A/B/W-types with Radar Plotter functionality only.**
***4: Shown for A/B/W-types only.**

CURSOR MENU (Right-click the operational display area to show this menu)

- 2 ↓ (*scrolls selection cursor downwards*)
  (TARGET DATA / ACQ, TARGET CANCEL, TT TGT DATA / ACQ, REF MARK, EBL OFFSET, OFF CENTER, ZOOM, TARGET TRACK ON*4, TARGET TRACK OFF*4, MARK DELETE, OWN TRACK DELETE, TGT TRACK DELETE*4, MAP ALIGN, TRAIL ERASER*1)
- 8 ↑ (*scrolls selection cursor upwards*)

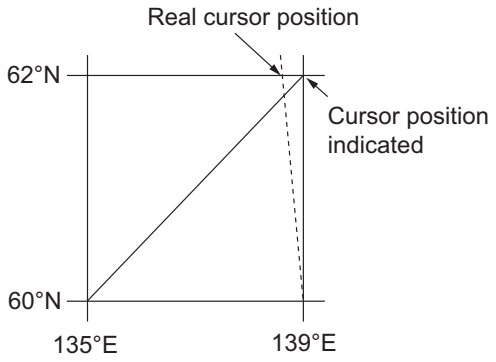
Next page

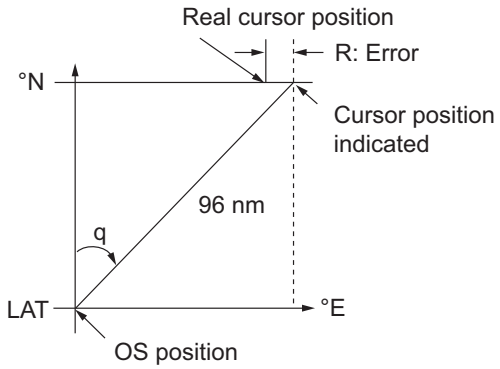
- 2 TGT DATA/ACQ SETTING (***ANY***, TT ONLY, AIS ONLY)
- 3 TGT CANCEL SETTING (***ANY***, TT ONLY, AIS ONLY)

APPENDIX 2 LONGITUDE ERROR TABLE (96 NM SCALE)

The longitude lines concentrate on the north pole and south pole, namely, 1 nm is equivalent to 1 minute at 0 degree latitude, 2 minutes at 60 degrees latitude, 3 minutes at 70 degrees latitude and so on. For this reason, a longitude error occurs on the radar display.

For example, when own ship is at 60°N and 135°E, even if the cursor indication is 62°N and 139°E, the real cursor position is deviated to the left (west) side. The table below shows the longitude error, represented from 0° to 90° at 96 nm from the radar center (own ship).





(nm)

q / LAT	5°	10°	15°	20°	25°	30°	35°	40°	45°
75°	0.2256	0.4444	0.6496	0.8350	0.9950	1.1248	1.2202	1.2786	1.2980
70°	0.21980213	0.43290201	0.632803	0.8134132	0.96923215	1.09551918	1.1884382	1.24517456	1.26402037
65°	0.21229339	0.41810678	0.61115946	0.78556318	0.93600295	1.05790007	1.14755221	1.20224625	1.22034042
60°	0.20316898	0.40012949	0.58486463	0.75173456	0.89565021	1.0122297	1.09793265	1.15016811	1.16737294
55°	0.19249832	0.37910698	0.55411863	0.71218478	0.84848102	0.95885565	1.03998717	1.08933651	1.10552105
50°	0.18036264	0.35519924	0.51915545	0.66721485	0.79485438	0.89818413	0.97406698	1.02021439	1.03525547
45°	0.16685429	0.32858822	0.48024119	0.61716701	0.73517843	0.83067689	0.90076355	0.94332783	0.95711098
40°	0.15207608	0.29947644	0.437672	0.56242216	0.66990732	0.7568477	0.82060477	0.85926197	0.87168229
35°	0.13614047	0.26808546	0.39177186	0.53339693	0.59953781	0.67725844	0.73420069	0.76865661	0.77961957
30°	0.11916876	0.2346542	0.3428901	0.44054055	0.52460545	0.59251483	0.6422089	0.67220131	0.68162348
25°	0.10129001	0.19943707	0.29139874	0.37433139	0.44568053	0.50326182	0.54532952	0.57063015	0.57843983
20°	0.08264056	0.16270211	0.23768966	0.30527334	0.36336372	0.41017869	0.44429984	0.46471615	0.47085389
15°	0.06336208	0.12472888	0.18217162	0.23389198	0.27828148	0.31397386	0.33988878	0.35526538	0.35968447
10°	0.04360137	0.0858064	0.12526714	0.16073056	0.19108136	0.21537949	0.23289096	0.24311083	0.24577764
5°	0.02350833	0.04623087	0.0674093	0.08634588	0.10242699	0.11514595	0.1241207	0.12910605	0.13000029
0°	0.00323737	0.0063035	0.00903844	0.01130406	0.01299309	0.01403609	0.0144058	0.0141187	0.01323356

APPENDIX 2 LONGITUDE ERROR TABLE (96 NM SCALE)

(nm)

LAT \ q	50°	55°	60°	65°	70°	75°	80°	85°	90°
75°	1.2780	1.2192	1.1233	0.9933	0.8332	0.6479	0.4431	0.2249	0
70°	1.24442563	1.18701379	1.09356117	0.96694117	0.81103484	0.3061092	0.43117887	0.21881975	0
65°	1.20131324	1.14577786	1.05546143	0.93315023	0.78260251	0.60843159	0.41596331	0.21107193	0
60°	1.14905813	1.09582188	1.00932899	0.89225746	0.74821409	0.58162173	0.397582	0.20171772	0
55°	1.08805799	1.03752602	0.95551494	0.84457408	0.70813132	0.55038538	0.37617487	0.19082831	0
50°	1.0187708	0.97133397	0.89442885	0.79046297	0.66265924	0.51496026	0.35190481	0.17848659	0
45°	0.94174265	0.89774948	0.82653562	0.73033596	0.61214392	0.47561599	0.32495654	0.16478648	0
40°	0.85754099	0.81733258	0.75235195	0.66465066	0.55696981	0.43265198	0.29553516	0.14983224	0
35°	0.76681293	0.73069528	0.63744242	0.59390696	0.49755683	0.38639524	0.26386458	0.13373769	0
30°	0.67024897	0.63849695	0.58741521	0.51864327	0.43435714	0.33719779	0.23018583	0.11662531	0
25°	0.568584	0.54143927	0.49791741	0.43943239	0.36785173	0.28543407	0.19475522	0.09862535	0
20°	0.46259176	0.44026091	0.40463016	0.35687717	0.29854675	0.23149802	0.15784242	0.07987479	0
15°	0.35307892	0.3357319	0.30826343	0.2716059	0.22696965	0.17580013	0.11972833	0.06051633	0
10°	0.2487894	0.22864776	0.20955062	0.18426754	0.15366517	0.1187643	0.08070304	0.0406973	0
5°	0.12684572	0.11982348	0.10624302	0.09552679	0.0791912	0.04106355	0.04106355	0.02056855	0
0°	0.01184713	0.01008727	0.008104	0.00605903	0.00411455	0.00111154	0.00111154	0.00028325	0

APPENDIX 3 ALERT CODES, MESSAGES & MEANINGS

For ALF format alerts, the alert identifier (the first three/five digits of the alert code), is displayed on the alert list and in the alert box. The alert instance (the last one or two digits of the alert code), is transferred along with it's identifier to the connected Bridge Alert Management System. The table below shows the alert ID for ALF formats alerts, with the instance separated by a comma. ALR format alerts have no instance assigned.

ALR Alert ID	ALF Alert ID	Alert title	Priority & Category	Alert description
-	52190,1	TARGET CAPACITY	Caution Cat: B	Message: "TT TARGET 95%(AUTO)" Meaning: Automatically acquired target capacity has reached 95%.
Remedy: Press the **ALARM ACK** key. Remove TT symbols manually.				
523	190,2	TARGET CAPACITY	Warning Cat: A	Message: "TT TARGET FULL(AUTO)" Meaning: Automatically acquired target capacity has reached 100%.
Remedy: Press the **ALARM ACK** key. Remove TT symbols manually.				
-	52190,3	TARGET CAPACITY	Caution Cat: B	Message: "TT TARGET 95%(MAN)" Meaning: Manually acquired target capacity has reached 95%.
Remedy: Press the **ALARM ACK** key. Remove TT symbols manually.				
525	190,4	TARGET CAPACITY	Warning Cat: A	Message: "TT TARGET FULL(MAN)" Meaning: Manually acquired target capacity has reached 100%.
Remedy: Press the **ALARM ACK** key. Remove TT symbols manually.				
-	52190,5	TARGET CAPACITY	Caution Cat: B	Message: "AIS DISPLAY 95%" Meaning: AIS display capacity has reached 95% (333 targets).
Remedy: Press the **ALARM ACK** key. Adjust [AIS DISP FILTER] settings to decrease the number of targets displayed.				
531	190,6	TARGET CAPACITY	Warning Cat: A	Message: "AIS DISPLAY FULL" Meaning: AIS display capacity has reached 100% (350 targets).
Remedy: Press the **ALARM ACK** key. Adjust [AIS DISP FILTER] settings to decrease the number of targets displayed.				
-	52190,7	TARGET CAPACITY*3	Caution Cat: B	Message: "AIS CAPACITY 95%" Meaning: AIS display capacity has reached 95% (1140 targets).
Remedy: Press the **ALARM ACK** key. Adjust [AIS DISP FILTER] settings to decrease the number of targets displayed.				
533	52190,8	TARGET CAPACITY*8	Caution Cat: B	Message: "AIS CAPACITY FULL" Meaning: AIS capacity has reached 100% (1200 targets).
Remedy: Press the **ALARM ACK** key. Adjust [AIS DISP FILTER] settings to decrease the number of targets displayed.				
-	52190,9	TARGET CAPACITY	Caution Cat: B	Message: "ACTIVE AIS 95%" Meaning: Active AIS target capacity has reached 95% (48 targets).
Remedy: Press the **ALARM ACK** key. Sleep all unnecessary AIS targets.				

ALR Alert ID	ALF Alert ID	Alert title	Priority & Category	Alert description
535	190,10	TARGET CAPACITY	Warning Cat: A	Message: "ACTIVE AIS FULL" Meaning: Active AIS target capacity has reached 100% (50 targets).
Remedy: Press the **ALARM ACK** key. Sleep all unnecessary AIS targets.				
526	191,1	CPA/TCPA	Alarm Cat: A	Message: "TT DANGER OF COLLISION" Meaning: TT is within CPA/TCPA threshold, danger of collision.
Remedy: Press the **ALARM ACK** key. Take evasive action if necessary. Adjust CPA/TCPA settings.				
536	191,2	CPA/TCPA	Alarm Cat: A	Message: "AIS DANGER OF COLLISION" Meaning: AIS target is within CPA/TCPA threshold, danger of collision.
Remedy: Press the **ALARM ACK** key. Take evasive action if necessary. Adjust CPA/TCPA settings.				
521	192,1	NEW TARGET	Warning Cat: A	Message: "TT NEW TARGET" Meaning: A new TT target has entered the Acquisition Zone.
Remedy: Press the **ALARM ACK** key. Confirm location of new target.				
529	192,2	NEW TARGET	Warning Cat: A	Message: "AIS NEW TARGET" Meaning: A new AIS target has entered the Acquisition Zone.
Remedy: Press the **ALARM ACK** key. Confirm location of new target.				
527	193,1	LOST TARGET	Warning Cat: A	Message: "TT TARGET LOST" Meaning: TT target is lost.
Remedy: Press the **ALARM ACK** key. Lost target indication (blinking in red) is removed.				
528	193,2	LOST TARGET	Warning Cat: A	Message: "REF TARGET LOST" Meaning: REF targets is lost.
Remedy: Press the **ALARM ACK** key. Lost target indication (blinking in red) is removed.				
537	193,3	LOST TARGET	Warning Cat: A	Message: "AIS TARGET LOST" Meaning: AIS target is lost.
Remedy: Press the **ALARM ACK** key. Lost target indication (blinking in red) is removed.				
720	194,1	SYSTEM ERROR	Warning Cat: B	Message: "NO HEADLINE SIGNAL" Meaning: Heading marker signal interrupted/lost.
Remedy: Press the **ALARM ACK** key. Restore signal or rectify reason for signal loss.				
721	194,2	SYSTEM ERROR	Warning Cat: B	Message: "NO AZIMUTH SIGNAL" Meaning: Antenna signal is interrupted/lost.
Remedy: Press the **ALARM ACK** key. Restore signal or rectify reason for signal loss.				
722	194,3	SYSTEM ERROR	Warning Cat: B	Message: "NO TRIGGER SIGNAL" Meaning: Antenna trigger interrupted/lost
Remedy: Press the **ALARM ACK** key. Restore signal or rectify reason for signal loss.				
723	194,4	SYSTEM ERROR	Warning Cat: B	Message: "NO VIDEO SIGNAL" Meaning: Video signal interrupted/lost.
Remedy: Press the **ALARM ACK** key. Restore signal or rectify reason for signal loss.				
70	194,5	SYSTEM ERROR	Warning Cat: B	Message: "CTRL UNIT COM ERROR" Meaning: Keyboard (RCU-014/015/016) signal interrupted/lost.
Remedy: Press the **ALARM ACK** key. Restore signal or rectify reason for signal loss.				

ALR Alert ID	ALF Alert ID	Alert title	Priority & Category	Alert description
782	194,6	SYSTEM ERROR	Warning Cat: B	Message: "PM COM ERROR" Meaning: PM communication error.
Remedy: Press the **ALARM ACK** key. Restore signal or rectify reason for signal loss.				
48	194,7	SYSTEM ERROR	Warning Cat: B	Message: "TUNE ERROR" Meaning: TUNE error due to faulty settings or malfunction.
Remedy: Press the **ALARM ACK** key. Restore signal or rectify reason for signal loss.				
727	194,8	SYSTEM ERROR	Warning Cat: B	Message: "RADAR ANT COM ERROR" Meaning: Signal between processor and antenna interrupted/lost.
Remedy: Press the **ALARM ACK** key. Restore signal or rectify reason for signal loss.				
781	194,9	SYSTEM ERROR	Warning Cat: B	Message: "MTR-DRV COM ERROR" Meaning: Signal between antenna's SPU and MTR-DRV interrupted/lost.
Remedy: Press the **ALARM ACK** key. Restore signal or rectify reason for signal loss.				
783	194,10	SYSTEM ERROR	Warning Cat: B	Message: "RF-CONVERTER COM ERROR" Meaning: Signal between antenna's SPU and RF-CONVERTER interrupted/lost.
Remedy: Press the **ALARM ACK** key. Restore signal or rectify reason for signal loss.				
784	194,11	SYSTEM ERROR	Warning Cat: B	Message: "LAN1 NETWORK ERROR" Meaning: LAN1 IP address is use by other equipment.
Remedy: Press the **ALARM ACK** key. Check IP settings and assign a unique IP address.				
785	194,12	SYSTEM ERROR	Warning Cat: B	Message: "LAN2 NETWORK ERROR" Meaning: LAN1 IP address is use by other equipment.
Remedy: Press the **ALARM ACK** key. Check IP settings and assign a unique IP address.				
786	194,13	SYSTEM ERROR*6	Warning Cat: B	Message: "RP COM ERROR" Meaning: Signal between MAIN board and RP board in the processor is interrupted or lost.
Remedy: Press the **ALARM ACK** key. Restore the signal or rectify the reason for the signal loss.				
788	194,15	SYSTEM ERROR*6	Warning Cat: B	Message: "RP VERSION MISMATCH" Meaning: MAIN board and RP board software versions do not match.
Remedy: Press the **ALARM ACK** key. Consult you local dealer for a software update.				
495	52495,1	ANCHOR WATCH	Warning Cat: B	Message: "OUT OF ANCHOR WATCH ZONE" Meaning: Ship position outside set anchor watch zone.
Remedy: Press the **ALARM ACK** key. Confirm Own Ship location and adjust as necessary.				
-	52540,1	AIS MSG	Caution Cat: B	Message: "TRANSMIT ERROR" Meaning: Unable to transmit AIS binary message.
Remedy: Press the **ALARM ACK** key. Check power to AIS unit.				

ALR Alert ID	ALF Alert ID	Alert title	Priority & Category	Alert description
450	52601,1	SENSOR ERROR	Warning Cat: B	Message: "NO GYRO SIGNAL" Meaning: No heading information received from gyrocompass for five seconds.
Remedy: Press the **ALARM ACK** key. Match the on-screen indication with the actual gyrocompass.				
278	52601,2	SENSOR ERROR*1	Warning/ Caution Cat: B	Message: "NO LOG(WT) SINGAL" Meaning: No speed data received for five seconds when [LOG(WT)] is set as speed reference.
Remedy: Press the **ALARM ACK** key. Check SDME sensor. Use a different sensor if necessary.				
284	52601,3	SENSOR ERROR*2	Warning/ Caution Cat: B	Message: "NO LOG(BT) SIGNAL" Meaning: No speed data received for thirty seconds when [LOG(BT)] is set as speed reference.
Remedy: Press the **ALARM ACK** key. Check SDME sensor. Use a different sensor if necessary.				
170	52601,4	SENSOR ERROR	Warning Cat: B	Message: "NO POSITION SIGNAL" Meaning: EPFS Error. No position data received from EPFS device for thirty seconds.
Remedy: Press the **ALARM ACK** key. Restore the signal. This indication cannot be erased if the position signal is missing. The indication is automatically removed when the signal is restored.				
469	52601,5	SENSOR ERROR	Warning Cat: B	Message: "POSITION DATUM UNKNOWN" Meaning: DTM sentence not received for thirty seconds, or erroneous data received.
Remedy: Press the **ALARM ACK** key. Use the WGS-84 datum.				
272	52601,6	SENSOR ERROR	Warning Cat: B	Message: "NO UTC SIGNAL" Meaning: UTC error. No date or time data received for thirty seconds. No ZDA sentence input.
Remedy: Press the **ALARM ACK** key. Restore the signal to remove this indication.				
-	52601,7	SENSOR ERROR*7	Warning Cat: B	Message: "AIS COM ERROR" Meaning: No AIS data received for thirty seconds.
Remedy: Press the **ALARM ACK** key. Check power and connection to AIS unit.				
279	52601,8	SENSOR ERROR	Warning Cat: B	Message: "NO COG/SOG SIGNAL" Meaning: EPFS Error. No COG/SOG data received from EPFS device for thirty seconds.
Remedy: Press the **ALARM ACK** key. Restore the signal. This indication cannot be erased if the COG/SOG signal is missing. The indication is automatically removed when the signal is restored.				
50	52601,9	SENSOR ERROR	Warning Cat: B	Message: "ECDIS COM ERROR" Meaning: No ECDIS data received for thirty seconds.
Remedy: Press the **ALARM ACK** key. Check power and connection to ECDIS unit.				
798	52601,10	SYSTEM ERROR*6	Warning Cat: B	Message: "WAVE UNIT COM ERROR" Meaning: Wave data not received from PC when WAVE mode is enabled.
Remedy: Press the **ALARM ACK** key. Check connections with the PC or disable WAVE mode.				

ALR Alert ID	ALF Alert ID	Alert title	Priority & Category	Alert description
-	52602,1	SOURCE CHANGE	Caution Cat: B	Message: "POSN SOURCE CHG" Meaning: Positioning sensor input lost, automatically changed sensors.
Remedy: Press the **ALARM ACK** key. The indication is automatically removed when the signal is restored or a different sensor is selected.				
-	52602,2	SOURCE CHANGE	Caution Cat: B	Message: "SPD SOURCE CHG" Meaning: Speed sensor input lost, automatically changed sensors.
Remedy: Press the **ALARM ACK** key. The indication is automatically removed when the signal is restored or a different sensor is selected.				
-	52602,3	SOURCE CHANGE	Caution Cat: B	Message: "HDG SOURCE CHG" Meaning: Heading sensor input lost, automatically changed sensors.
Remedy: Press the **ALARM ACK** key. The indication is automatically removed when the signal is restored or a different sensor is selected.				
740	52740,1	EXT RADAR ERROR	Warning Cat: B	Message: "EXT RADAR NO SIGNAL" Meaning: Selected radar has an error. (Only displayed when Interswitch is active.)
Remedy: Press the **ALARM ACK** key. Restore the external radar to normal operating condition.				
750	52740,2	EXT RADAR ERROR	Warning Cat: B	Message: "EXT RADAR COM ERROR" Meaning: Communication with external radar interrupted or lost. (Only displayed when Interswitch is active.)
Remedy: Press the **ALARM ACK** key. Check connection and power to the external radar.				
760	52740,3	EXT RADAR ERROR*[9]	Warning Cat: B	Message: "EXT RADAR STBY" Meaning: External radar entered standby mode.
Remedy: Press the **ALARM ACK** key. Check transmission status of the external radar.				
760	52740,4	EXT RADAR ERROR*[9]	Warning Cat: B	Message: "EXT RADAR NO SENSOR" Meaning: No heading data was received from the external radar for more than five seconds.
Remedy: Press the **ALARM ACK** key. Check heading data input status for the external radar.				
790	52790,1	ARRIVAL	Warning Cat: B	Message: "ARRIVED AT WPT" Meaning: Ship has entered the destination arrival alert zone. **Note:** This alert appears on B/W-type radars only.
Remedy: Press the **ALARM ACK** key. No other action required.				
791	52791,1	XTD LIMIT	Warning Cat: B	Message: "XTD LIMIT EXCEEDED" Meaning: Cross-track error, ship is off-course. **Note:** This alert appears on B/W-type radars only.
Remedy: Press the **ALARM ACK** key. Check course and adjust as necessary.				

ALR Alert ID	ALF Alert ID	Alert title	Priority & Category	Alert description
793	793,1	WAVE ERROR	Caution Cat: B	Message: "WAVE ERROR (UTC)" Meaning: With the wave radar active ([4 WAVE DATA] set to [ON]), the connected PC has an error in time/date input.
Remedy: Press the **ALARM ACK** key. Check that data input to the wave analysis software is correct, or disable WAVE mode.				
794	793,2	WAVE ERROR	Caution Cat: B	Message: "WAVE ERROR (COG/SOG)" Meaning: With the wave radar active 4 WAVE DATA set to ON), the connected PC has an error in speed data input.
Remedy: Press the **ALARM ACK** key. Check that data input to the wave analysis software is correct, or disable WAVE mode.				
795	793,3	WAVE ERROR	Caution Cat: B	Message: "WAVE ERROR (WIND)" Meaning: With the wave radar active 4 WAVE DATA set to ON), the connected PC has an error in wind data input.
Remedy: Press the **ALARM ACK** key. Check that data input to the wave analysis software is correct, or disable WAVE mode.				
796	793,4	WAVE ERROR	Caution Cat: B	Message: "WAVE ERROR (RADAR)" Meaning: With the wave radar active 4 WAVE DATA set to ON), the connected PC has an error in gyro data input.
Remedy: Press the **ALARM ACK** key. Check that the radar number selected in the wave analysis software is correct, or disable WAVE mode.				
797	793,5	WAVE ERROR	Caution Cat: B	Message: "WAVE ERROR (GYRO)" Meaning: With the wave radar active 4 WAVE DATA set to ON), the connected PC has incorrect radar number settings.
Remedy: Press the **ALARM ACK** key. Check that data input to the wave analysis software is correct, or disable WAVE mode.				
950	52950,1	BAM COM ERROR*3	Caution Cat: B	Message: "BAM COM ERROR" Meaning: Communication with the Bridge Alert Management System interrupted.
Remedy: Press the **ALARM ACK** key. Check connection to BAM. Check power to BAM.				
-	52001,1	HW STATUS NOTICE	Caution Cat: B	Message: "RPU:FAN1 SPD ERROR" Meaning: FAN1 in the processor unit has low RPM.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the fan.				
-	52001,2	HW STATUS NOTICE	Caution Cat: B	Message: "RPU:FAN2 SPD ERROR" Meaning: FAN2 in the processor unit has low RPM.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the fan.				
-	52001,3	HW STATUS NOTICE	Caution Cat: B	Message: "RPU:FAN3 SPD ERROR" Meaning: FAN3 in the processor unit has low RPM.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the fan.				

ALR Alert ID	ALF Alert ID	Alert title	Priority & Category	Alert description
-	52001,4	HW STATUS NOTICE	Caution Cat: B	Message: "RPU:HIGH TEMP" Meaning: Temperature in the processor unit is above limit.
Remedy: Press the **ALARM ACK** key. Lower the temperature.				
-	52001,5	HW STATUS NOTICE	Caution Cat: B	Message: "MONITOR:HIGH TEMP" Meaning: Temperature in the monitor unit is above limit.
Remedy: Press the **ALARM ACK** key. Lower the temperature.				
-	52001,6	HW STATUS NOTICE*6	Caution Cat: B	Message: "RPU:FAN (RP) SPD ERROR" Meaning: The RPU fan on the RP board, in the processor unit, has low RPM.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the fan.				
-	52001,11	HW STATUS NOTICE	Caution Cat: B	Message: "MD TYPE MISMATCH"*4 Meaning: Unable to detect the MD board bandwidth.
Remedy: Press the **ALARM ACK** key. Check connections to the antenna.				
-	52001,12	HW STATUS NOTICE	Caution Cat: B	Message: "PM TYPE MISMATCH"*4 Meaning: FAN1 in the processor unit has low RPM.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the fan.				
-	52001,21	HW STATUS NOTICE	Caution Cat: B	Message: "MTR-DRV:TEMP HIGH" Meaning: MTR-DRV board temperature is above limit.
Remedy: Press the **ALARM ACK** key. Lower the temperature.				
-	52001,22	HW STATUS NOTICE	Caution Cat: B	Message: "MTR-DRV:OVER CURRENT" Meaning: MTR-DRV board power input from the motor is outside rating.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the motor.				
-	52001,23	HW STATUS NOTICE	Caution Cat: B	Message: "MTR-DRV:MOTOR POWER ERROR" Meaning: MTR-DRV board motor's voltage is outside rating.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the motor.				
-	52001,24	HW STATUS NOTICE	Caution Cat: B	Message: "MTR-DRV:P12V POWER ERROR" Meaning: Voltage in the +12V line of the MTR-DRV motor is outside rating.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the power supply.				
-	52001,25	HW STATUS NOTICE	Caution Cat: B	Message: "MTR-DRV:HALL SENSOR ERROR" Meaning: Error in the hall sensor signal detected by the MTR-DRV board.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the hall sensor.				
-	52001,26	HW STATUS NOTICE	Caution Cat: B	Message: "MTR-DRV:ANTENNA LOCK" Meaning: Antenna lock detected by the MTR-DRV board.
Remedy: Press the **ALARM ACK** key. Unlock the antenna.				

ALR Alert ID	ALF Alert ID	Alert title	Priority & Category	Alert description
-	52001,27	HW STATUS NOTICE	Caution Cat: B	Message: "MTR-DRV:POWER SUPPLY ERROR" Meaning: MTR-DRV board detected an drop in power.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the power supply.				
-	52001,28	HW STATUS NOTICE	Caution Cat: B	Message: "MTR-DRV:BRAKE RESISTANCE ERROR" Meaning: MTR-DRV board detected an error in the brake resistance.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the antenna brake.				
-	52001,29	HW STATUS NOTICE	Caution Cat: B	Message: "MTR-DRV:OVERLOAD" Meaning: MTR-DRV board detected an overload.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the motor.				
-	52001,31	HW STATUS NOTICE	Caution Cat: B	Message: "PM:P12V POWER ERROR" Meaning: Voltage in the +12V line of the PM board is outside rating.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the power supply.				
-	52001,32	HW STATUS NOTICE	Caution Cat: B	Message: "PM:PLL UNLOCK" Meaning: PM board's PLL is unlocked.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the PM board.				
-	52001,41	HW STATUS NOTICE	Caution Cat: B	Message: "RF-CONV:P6V POWER ERROR"*5 Meaning: Voltage in the +6V line of the RF-Converter is outside rating.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the power.				
-	52001,42	HW STATUS NOTICE	Caution Cat: B	Message: "RF-CONV:P48V POWER ERROR"*5 Meaning: Voltage in the +6V line of the RF-Converter is outside rating.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the power.				
-	52001,43	HW STATUS NOTICE	Caution Cat: B	Message: "RF-CONV:IF PLL UNLOCK"*5 Meaning: PLL lock on the IF side of the RF-Converter is unlocked.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the RF-Converter.				
-	52001,44	HW STATUS NOTICE	Caution Cat: B	Message: "RF-CONV:PLL UNLOCK"*5 Meaning: PLL lock on the RF side of the RF-Converter is unlocked.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the RF-Converter.				
-	52001,45	HW STATUS NOTICE	Caution Cat: B	Message: "RF-CONV:OUTPUT SIGNAL LEVEL ERROR"*5 Meaning: Signal output from the RF Converter is outside rating.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the RF-Converter.				

ALR Alert ID	ALF Alert ID	Alert title	Priority & Category	Alert description
-	52001,46	HW STATUS NOTICE	Caution Cat: B	Message: "RF-CONV:INTPUT SIGNAL LEVEL ERROR"*5 Meaning: Signal input to the RF Converter is outside rating.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the RF-Converter.				
-	52001,47	HW STATUS NOTICE	Caution Cat: B	Message: "HPA:OUTPUT SIGNAL LEVEL ERROR"*5 Meaning: Signal output from the HPA board is outside rating.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the HPA board.				
-	52001,48	HW STATUS NOTICE	Caution Cat: B	Message: "HPA:OUTPUT PEAK CURRENT ERROR"*5 Meaning: Peak current detected in the signal output from the HPA board.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the HPA board.				
-	52001,51	HW STATUS NOTICE	Caution Cat: B	Message: "HPA:TEMP HIGH"*5 Meaning: Excessively high temperature detect on the HPA board.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the HPA board.				
-	52001,52	HW STATUS NOTICE	Caution Cat: B	Message: "VSWR ERROR"*5 Meaning: Abnormal VSWR detected by the RF Converter.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the antenna.				
83	52002,01	HW STATUS ERROR	Warning Cat: B	Message: "RPU FAN1 NO ROTATION" Meaning: Fan1 in the processor unit is stopped or disconnected.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the processor unit.				
84	52002,02	HW STATUS ERROR	Warning Cat: B	Message: "RPU FAN2 NO ROTATION" Meaning: Fan2 in the processor unit is stopped or disconnected.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the processor unit.				
85	52002,03	HW STATUS ERROR	Warning Cat: B	Message: "RPU FAN3 NO ROTATION" Meaning: Fan3 in the processor unit is stopped or disconnected.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the processor unit.				
86	52002,04	HW STATUS ERROR*6	Warning Cat: B	Message: "RPU FAN (RP) NO ROTATION" Meaning: The RPU fan on the RP board, in the processor unit, is stopped or disconnected.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the processor unit.				
87	52002,05	HW STATUS ERROR*6	Warning Cat: B	Message: "RPU RP HW ERROR" Meaning: The RP board has stopped working.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the processor unit.				

ALR Alert ID	ALF Alert ID	Alert title	Priority & Category	Alert description
-	52729,01	POSN INT ERROR	Caution Cat: B	Message: "POSN INTERVAL ERROR" Meaning: Positioning interval (Lat/Lon) cycle has exceeded 10 seconds for a period of three minutes or more.
Remedy: Press the **ALARM ACK** key. Check the output settings for the connected EPFS device. Adjust output interval (cycle) as required.				
792	52792,01	CHART ERROR*6	Warning Cat: B	Message: "CHART MEMORY ERROR" Meaning: An error has occurred while loading chart data.
Remedy: Press the **ALARM ACK** key. Have a qualified technician check the processor unit.				
755	52795,01	SART DETECTED*10	Warning Cat: B	Message: "SART DETECTED" Meaning: A SART signal was detected.
Remedy: Press the **ALARM ACK** key. Show the SART marks on the radar display, referring to section 2.3.2.				

*1: When LOG(WT) is not selected, the alert priority for this alert is changed to “Caution”. Caution level alerts are not shown on B/W-type radars.

*2: When LOG(BT) is not selected, the alert priority for this alert is changed to "Caution". Caution level alerts are not shown on B/W-type radars.

*3: This alert is output only on R-type radars.

*4: This alert is output for magnetron radars only.

*5: This alert appears on S-BAND SSD radars only.

*6: This alert is output only on A/B/W-types with radar plotter functionality.

*7: 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 for IMO/R-types. A/B/W-types do not show this alert.
When the AIS function is active: Above message is prioritized as a Warning level alert for all radar types.

*8: For R-type radars only, this alert has the following attributes: ALR number: 533, Priority: Warning, Category: A.

*9: This alert appears only on A/B-type radars when Dual Radar mode is active and enabled.

*10: This alert appears only for FAR-2228-NXT(-BB) and FAR-2328-NXT. Keep in mind the following points:
- The "SART DETECTED" alert can occur when this equipment receives interference simultaneously from multiple radars
- The "SART DETECTED" alert may not occur under the bad weather conditions such as at rain.

APPENDIX 4 DATA COLOR AND MEANING

Validity and integrity of input data (mode indicator)

Data color	HDG	L/L	SPD	COG/SOG
Normal color (normal data)	THS-A, E HDT	GNS-A, D *1, F, P, R and (NAV status: S, V) GGA-1, 2 *1, 3, 4, 5 GLL-A, D and (status: A) RMC-A, D, F, P, R and (status: A) and (NAV status: S, V)	VBW-A VHW	VTG-A, D, P RMC-A, D, F, P, R and (status: A) and (NAV status: S, V).
Yellow-or-ange color (invalid data)		GNS-E, M, S GGA-6, 7, 8 GLL-E, M, S and (status: A) RMC-E, M, S and (Status: A)		VTG-E, M, S RMC-E, M, S, and (status: A)
Yellow color (low integrity)		GNS-A, D*1, F, P, R, and (NAV status: C, U) RMC-A, D, F, P, R and (status: A) and (NAV status: C, U)		RMC-A, D, F, P, R and (status: A) and (NAV status: C, U)
***.*	THS-M, V, S	GNS-N GGA-0 RMC-N, (status: V), (NAV status: N) GLL-N, (status: V)	VBW-V	VTG-N RMC-N (status: V)

*1: “Age of differential GPS data” in GGA and GNS sentences is ten seconds or higher. In this case, ship’s latitude and longitude are displayed in yellow.

APPENDIX 5 ABBREVIATIONS

A:

Abbreviation	Word	Abbreviation	Word
ACE	Automatic Clutter Elimination	ACK	Acknowledge
ACQ	Acquire	Act	Activate
AID	Aid	AIS	Automatic Identification System
ALF	ALF sentence	ALR	Alarm
AMB	Amber	AMS	Alert Management System
ANT	Antenna	AP	Autopilot
APR	April	ARC	Arc
ATON	Aids to Navigation	AUG	August
AUTO	Automatic	A/C RAIN	Anti Clutter Rain
A/C SEA	Anti Clutter Sea		

B:

Abbreviation	Word	Abbreviation	Word
BCR	Bow Crossing Range	BCT	Bow Crossing Time
BLU	Blue	BRG	Bearing
BRILL	Brilliance	BT	Bottom Tracking

C:

Abbreviation	Word	Abbreviation	Word
CALC	Calculated	CALIB	Calibrate
CCRP	Consistent Common Reference Point	CHG	Change
CH	Channel	COG	Course Over Ground
CONT	Continue	CORR	Corrected/Correction
CPA	Closest Point of Approach	CPU	Central Processing Unit
CRS	Course	CTW	Course Through the Water
CU	Course Up	CYA	Cyan

D:

Abbreviation	Word	Abbreviation	Word
DEC	December	deg	degree(s)
DEST	Destination	DGPS	Differential GPS
DISP	Display	DIST	Distance
DR	Dead Reckoning	DTM	Datum

E:

Abbreviation	Word	Abbreviation	Word
E	East	EAV	Echo Averaging
EBL	Electronic Bearing Line	EBRL	Electronic Bearing Range Line
ECDIS	Electronic Chart Display and Information System	EP	Estimated Position
EQUIP	Equipment	ERR	Error
ES	Echo Stretch	ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure	EXT	External

F:

Abbreviation	Word	Abbreviation	Word
FEB	February	FILT	Filter/Filtered
FUNC	Function		

G:

Abbreviation	Word	Abbreviation	Word
GAP	Gap	GC	Great Circle
GND	Ground	GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System	GRAD	Gradation
GRN	Green	GRY	Gray
GT	Gross Tonnage		

H:

Abbreviation	Word	Abbreviation	Word
HD	Heading	HDG	Heading
HL	Heading Line	HSC	High Speed Craft

I:

Abbreviation	Word	Abbreviation	Word
IBS	Integrated Bridge System	ID	Identification
IMO	International Maritime Organization	INT	Interval
INS	Integrated Navigation System	INFO	Information
IR	Interference Rejection	IP ADDRESS	Internet Protocol Address

J:

Abbreviation	Word	Abbreviation	Word
JAN	January	JUN	June
JUL	July		

L:

Abbreviation	Word	Abbreviation	Word
L	Long pulse	LAT	Latitude
LAN	Local Area Network	LCD	Liquid Crystal Display
LIM	Limit	L/L	Latitude/Longitude
LOG	Log	LON	Longitude
LOP	Line Of Position		

M:

Abbreviation	Word	Abbreviation	Word
MAG	Magnetic	MAG	Magenta
MAN	Manual	MAR	March
MAX	Maximum	MAY	May
MBS	Main Bang Suppression	M-CYA	Multi Cyan
MD	Modulator	MENU	Menu
MFDF	Medium Frequency Direction Finder	MIC	Monolithic Integrated Circuit
M-GRN	Multi Green	M1	Medium pulse 1
MID	Middle	M3	Medium pulse 3
M2	Medium pulse 2	MON	Monday
MOB	Man Over Board	MSC	Maritime Safety Committee
Msgs	Messages	MTR-DRV	Motor Drive

N:

Abbreviation	Word	Abbreviation	Word
N	North	NAV	Navigation
NLT	Not Less Than	NMT	Not More Than
NOV	November	NR	Noise Rejector

O:

Abbreviation	Word	Abbreviation	Word
OS	Own Ship	OCT	October

P:

Abbreviation	Word	Abbreviation	Word
PAST POSN	Past Positions	PC	Personal Computer
PI	Parallel Index Line	PLT	Palette
PLL	Phase Locked loop	PM	Performance Monitor
PNK	Pink	POSN	Position
PPI	Plan Position Indicator		

R:

Abbreviation	Word	Abbreviation	Word
RACON	Radar beacon	RAD	Radius
RAM	Random Access Memory	RAIN	Anti Clutter Rain
RD	Read	RED	Red
REF	Reference/Echo Reference	R, REL	Relative
REJ	Rejection	RENC	Regional ENC Co-ordinating Centre
RFC board	RF Control board	RL	Rhumb Line
RM	Relative Motion	RNG	Range
ROM	Read Only Memory	ROT	Rate Of Turn
RTE	Route	RTGT	Reference Target
RX	Receive		

S:

Abbreviation	Word	Abbreviation	Word
S	South	S1	Short pulse1
S2	Short pulse2	S57	IHO Special Publication 57
SAR	Search and Rescue	SART	Search and Rescue Transponder
SD	Secure Digital	SEA	Anti Clutter Sea
SEL	Select	SENC	System ENC
SEP	September	SIG WAVE	Significant Wave
SIO	Serial Input Output	SOG	Speed Over Ground
SOLAS	Safety of Life at Sea	SPD	Speed
SPU	Signal Processing Unit board	STAB	Stabilized
STBD	Starboard	STBY	Standby
STC	Sensitivity time control	Std	Standard
STW	Speed Through Water	SW	Switch
SYM	Symbol	Symb	Symbol(s)

T:

Abbreviation	Word	Abbreviation	Word
T	True	TAG	Tag
TCPA	Time to CPA	TGT	Target
TM	True Motion	TPL	Transferred Line Of Position
True-G	True ground stabilized	True-S	True sea stabilized
TT	Target Tracking/Tracked Target	TTG	Time To Go
TX	Transmit		

U:

Abbreviation	Word	Abbreviation	Word
UNCAL	Uncalibrated	UTC	Coordinated Universal Time

V:

Abbreviation	Word	Abbreviation	Word
VECT	Vector	VRM	Variable Range Marker

W:

Abbreviation	Word	Abbreviation	Word
W	West	WAT	Water
WGS	World Geodetic System	WHT	White
W/O	Without	WOP	Wheel Over Point
WP	Waypoint	WPT	Waypoint
WR	Write	WT	Water Tracking
WTC	Water Tracking Current		

X:

Abbreviation	Word
XTE	Cross Track Error

Y:

Abbreviation	Word
YEL	Yellow

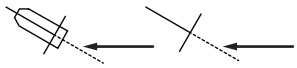
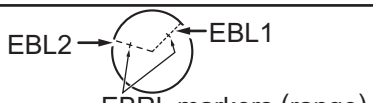
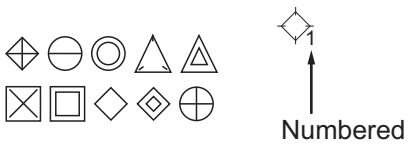
Units of measurement

Unit abbreviation	Meaning		Unit abbreviation	Meaning
deg	Degree(s)		ft	Foot/feet
H	Hour(s)		km	Kilometer(s)
KM	Kilometer(s)		kn	Knot(s)
KYD	Kiloyard(s)		min	Minute(s)
m	Meter(s)		MHz	Megahertz
NM	Nautical miles		sec	Second(s)
SM	Statute mile(s)		°	Degree(s)

APPENDIX 6 SYMBOLS

The pages following list the symbols which can be displayed on your radar.

General radar symbols

Symbol/Icon	Name/Meaning
(on power switch)	Power Symbol
	Own Ship Marker. Appears at the CCRP location as either a scaled symbol (left figure) or minimized symbol (right figure).
	Own Ship Marker. (Shown for B/W-types with Radar Plotter functionality only).
	Antenna mark. Indicates the location of your antenna and appears only when ship symbol is scaled.
	Heading line. Appears at the CCRP location and indicates your current heading.
	Stern line. Appears at the CCRP location and indicates your current stern direction.
	Fixed Range Rings. Appear with the CCRP location as the center and allow you to estimate range.
 VRM 1 VRM 2	Variable Range Markers. Appear with the CCRP as the center*1 and allow for range measurement. The dashed line length for each VRM is different.
 EBL2 EBL1 EBRL markers (range)	Electronic Bearing Lines. Indicate bearing. Shown as a dashed line with different line length from the heading line and eachother. The small line that intersects the EBL is the EBRL, used for measuring range.
	North mark. Indicates the NORTH direction. Appears a thin dotted line at the edge of the operational display area.
	Cursor. Indicates the cursor location.
	Barge Icon. Inidcates the barge localtion.
	Drop Mark. Appears at the location a drop mark is entered. Range and bearing from OS to the drop mark appear on-screen.
 1 Numbered	Origin Marks Used to mark any prominent target or a point of particular interest. When entered, the distance and bearing from the cursor position to the mark appear at the bottom of the screen.
	MOB (Man Over Board) Mark
	Waypoint Mark Used to indicate a start point, turn point or destination point.
	Chart status (A/B/W-types with Radar Plotter functionality only) Left: Chart scale displayed correctly; Center: Chart scale displayed incorrectly; Right: There is no chart file.

Radar map symbols (B/W radar types)

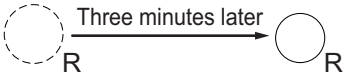
For B/W-types, the color of some symbols can be changed (see section 5.4.2).

Symbol	Name
△	Mark
⫿	Danger Highlight
☼	Buoy
⍋	Buoy
⊓	Buoy
○	Buoy
▪	Buoy
✕	Danger Highlight
◁	Mark
□	Mark
⚓	Mark
■	Mark
◇	Mark
—	Mark
••••	Mark
••••	Nav Line (map)
▭	Coastline
••••	Contour
⩍	Prohibited Area
∿ (cable)	Danger Highlight
⊖ (w/line)	Buoy
△ (w/line)	Mark
⊡ (w/line)	Mark
◇ (w/line)	Mark

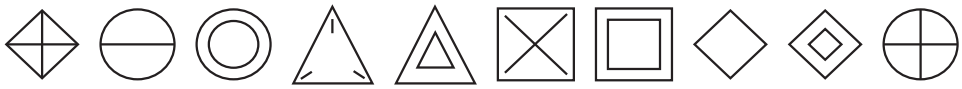
Radar map symbols (IMO/A/R radar types)

Symbol	Name	Symbol	Name
Red	Buoy	Orange	Mark
Green	Buoy	Orange	Mark
Red	Buoy	Orange	Mark
Green	Buoy	Magenta	Navline (map)
Red	Buoy	White	Coastline
Green	Buoy	Gray	Contour Line
Red	Buoy	Magenta	Danger Highlight
Green	Buoy	Magenta (cable)	Danger Highlight
Magenta	Danger Highlight	Orange	Mark
Magenta	Danger Highlight	Orange	Mark

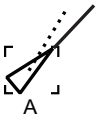
TT symbols

TT symbols	
Symbol	**Name**
	Manually acquired target. Appears as a dashed circle at intial acquisition, changes to solid circle when tracking is stable.
	Automatically acquired target. Appears as a dashed red circle at intial acquisition, changes to solid circle when tracking is stable.
	Vector on acquired target (approx. 1 minute after acquisition)
	Stable tracking on acquired target (approx. 3 minute after acquisition)
	Dangerous target. Symbol flashes in red color to indicate that this target may be on a collision course with your vessel.
	Associated TT target. Appears when the target is associated and TT is given priority.
	Associated dangerous TT target. Appears in red color when the target is associated, TT is given priority and the target may be on a collision course with your vessel.
	Lost TT target. Indicates that this target is lost and is no longer being tracked. Appears as a flashing symbol with a red colored “X”.
	Acquisition zone target. Appears when a target is acquired by the acquisition zone. Target symbol flashes in red color.
	Selected target. Indicates that the target is selected for data display (range, bearing, speed, etc.).
	Reference target. Indicates that this target is selected as a reference point for speed calculations.
T	Trial maneuver indication (IMO-types only)
S	TT simulation mode indication

Note: For B/W-types, In addition to the "standard" circle TT symbol, you may select from the symbols shown below. You can also change the symbol’s attributes (name, color, etc). See section 3.9.3.



AIS symbols

AIS symbols	
Symbol	**Name**
	Activated AIS target. Appears a thick-lined symbol. Color is selectable from the menu.
	Activated AIS target with vector. Indicates the target's ROT (Rate Of Turn). Vector appears when the target's ROT is higher than the menu setting.
	Dangerous AIS target. Flashing red symbol indicates that the target matches then CPA/TCPA criteria. Symbol stops flashing after the alert is acknowledged.
	Lost AIS target. Indicates that this target is lost and is no longer being tracked. Appears as a flashing symbol with a red colored "X" until the alert is acknowledged.
	Sleeping AIS target. Color is selectable from the menu.
	AIS target with no heading/speed data. Symbol appears as a dashed line and faces the top of the screen.
	AIS target selected for data display. Location of data display in the information box is indicated below the target as "A", "B" or "C".
	Associated AIS target. Appears when the target is associated and AIS is given priority.
	Dangerous associated AIS target. Appears in red color when the target is associated, AIS is given priority and the target may be on a collision course with your vessel.
	Active AIS target with scaled ship symbol. Indicates the target vessel's dimensions (length, width, antenna location) and changes on-screen size according to display range.
	AIS SART (TEST)
	AIS SART (ACTIVE)
	AIS Base station
	AIS Aircraft. Note: AIS aircraft are not regarded as a collision hazard. CPA and TCPA for AIS aircraft appears as "***".
	AIS Search and Rescue (SAR) Vessel

AIS Physical AtoN Symbol	AIS Virtual AtoN Symbol	Meaning
		Basic shape
	No virtual symbol	RACON
		Emergency wreck mark
		North cardinal mark
		East cardinal mark
		South cardinal mark
		West cardinal mark
		Port hand mark
		Starboard hand mark
		Isolated danger
		Safe water
		Special mark
	No virtual symbol	Off position (Displayed with yellow line and yellow text)
	No virtual symbol	Light fail or at reduced range (Displayed with yellow text)
	No virtual symbol	RACON error (Displayed with yellow text)
No physical symbol		Missing (Displayed with yellow dashed line and yellow text)

APPENDIX 7 PARTS LOCATION

Control Unit RCU-014

Control unit RCU-015/RCU-016