3.10.2 How to change the vector length (time)

The vector time provides an estimation of the target's vector and can be adjusted as follows:

Place the cursor on the vector time indication in the [Vector] box, then press the **left button**. The vector time cycles through the following settings with each press of the **left button**.

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

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

3.11 Past Position Display

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

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

Past position orientation, true or relative, is controlled with [TRAIL MODE] in the [TRAIL] context menu. To adjust the trail orientation, see paragraph 1.36.1.

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

Place the cursor on the [PAST POSN] time indication in the [PAST POSN] box, then press the **left button**. The past position points are displayed and their plotting interval changes with each press of the **left button**, as shown below.

[OFF] → [30sec] → [1min] → [2min] → [3min] → [6min] → [OFF]...

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

1. Open the [MAIN MENU].
2. Select [TT•AIS], then press the **ADJUST** knob.
3. Select [TT•AIS SYMBOL], then press the **ADJUST** knob.
4. Select [TT•AIS PAST POSN POINTS], then press the **ADJUST** knob.
5. Select [5] or [10] as appropriate, then press the **ADJUST** knob.
6. Close the menu.

3.12 Set and Drift

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

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

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

To enter set and drift do the following:

1. Select the [SPD] menu box, then press the **right button**. The [SHIP SPEED MENU] is displayed.
2. Select [SET DRIFT], then press the **ADJUST** knob.
3. Select [ON], then press the **ADJUST** knob. The setting can now be adjusted and [SET] is selected.
4. Rotate the **ADJUST** knob to select the appropriate setting (Setting range: 000.0° to 359.9°), then press the **ADJUST** knob. The [DRIFT] setting is now selected.
5. Rotate the **ADJUST** knob to select the appropriate setting (Setting range: 00.0kn to 19.9kn), then press the **ADJUST** knob.
6. 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 is not adjustable.

3.13 Collision Alarm (CPA, TCPA)

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

The TT continuously monitors the predicted range at the Closest Point of Approach (CPA) and predicted time to CPA (TCPA) of each TT. When the predicted CPA of any TT becomes smaller than a preset CPA range and its predicted TCPA less than a preset TCPA limit, the audio alarm sounds and TT COLLISION appears (in red) 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 1.47.

3.13.1 How to set the CPA and TCPA ranges

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

CPA setting ⌐

`CPA LIMIT 4.0NM | 15 min`

TCPA setting ⌐
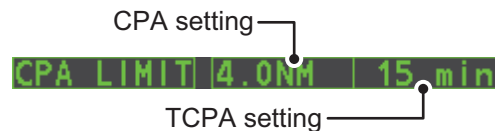
1. Place the cursor on the indication you wish to adjust.
2. Press the **left button**, or rotate the **ADJUST** knob, to adjust the settings as required. The settings options are outlined in the table below.

Indication	Key	Settings options
CPA	Left button	0.5, 1, 1.5, 2, 3, 4, 5, 6 (nm)
	ADJUST knob	0.1-20 (nm), 0-10 nm in 0.1 nm increments, 10 nm increments thereafter
TCPA	Left button	1, 2, 3, 4, 5, 6, 12, 15 (minutes)
	ADJUST knob	1-60 minutes, 1-minute increments

3.13.2 How to acknowledge the TT collision alarm

Press the [ALERT ACK] key on the control unit, or select the [ALERT] box with the Touchpad then press the **left button** to acknowledge the alarm and silence the buzzer. The alert "TT COLLISION" and the flashing of the plotting symbol and vector remain in the Alert Box until the dangerous situation is gone or you intentionally terminate tracking of the target.

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

3.14 Acquisition Zone

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

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

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

Note: The [AZ1] and [AZ2] boxes are not displayed when the setting for [AZ/ALR SELECT] in the [TT•AIS] menu is set to [TARGET ALARM ZONE].

3.14.1 How to activate the first acquisition zone (AZ1)

The No. 1 acquisition zone is available between 3 and 6 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 [AZ] indication at the bottom-right of the screen.
2. Press the **left button** to cycle through the settings and select [SET].
3. Place the cursor on the acquisition zone starting point ("A" in the figure below), then press the **left button**.
4. Place the cursor on the acquisition zone end point ("B" in the figure below), then press the **left button**.
5. Press the **right button** to complete the acquisition zone set up.
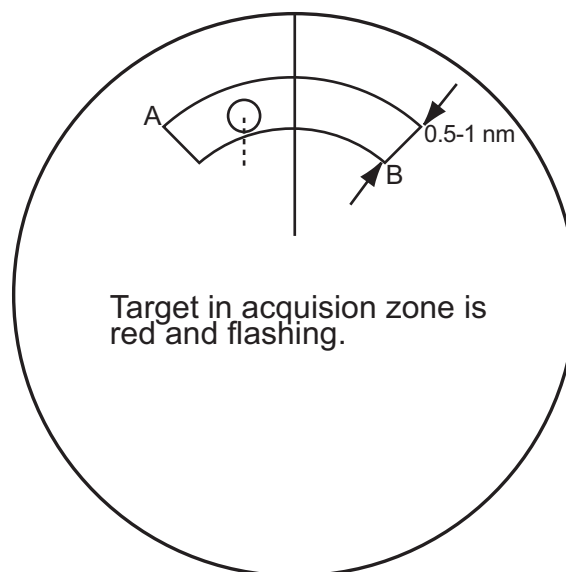
3.14.2 How to set a polygon acquisition zone (AZ2)

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 [AZ] indication at the bottom-right of the screen.
2. Press the **left button** to cycle through the settings and select [SET].
3. Place the cursor on the acquisition zone starting point, then press the **left button**.
4. Place the cursor on the second point, then press the **left button**.
5. Repeat step 4 as required to set the remaining points of the polygon zone.
6. Press the **right button** to complete the acquisition zone set up.

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, then press the left button.
- The default acquisition zone is fan shaped. It can also be a polygon having 3-10 points.
- If both acquisition zones are displayed, a maximum of four polygon points are shown.
- TT and AIS are automatically set to TT=AUTO and AIS=DISP, respectively, when an AZ is activated in the following conditions:

  TT : TT=OFF or TT=MANUAL 50
  AIS : AIS FUNC=OFF or AIS DISP=OFF

3.14.3 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

   Press the **left button** several times until the indication shows "SLEEP".

   ### Deactivating the acquisition zone

   Press and hold the **left button** until the AZ box becomes blank.

3.14.4 How to acknowledge the acquisition zone alert

Press the [ALERT ACK] key on the control unit, or select the [ALERT] box with the Touchpad then press the **left button** to acknowledge the alarm and silence the buzzer.

3.14.5 How to change the acquisition zone reference

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

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

3.14.6 How to set acquisition zone shape and stabilization

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

1. Open the [MAIN MENU].
2. Select [TT•AIS], then press the **ADJUST** knob.
3. Select [ACQUISITION ZONE], then press the **ADJUST** knob.
4. Select [AZ POLYGON], then press the **ADJUST** knob.
5. Select the appropriate setting, then press the **ADJUST** knob.

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.

6. Close the menu.

3.15   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

To acknowledge the alert, press the [ALERT ACK] key on the control unit, or select the [ALERT] box with the Touchpad then press the **left button** to acknowledge the alert and silence the buzzer.

Alert message	Priority	Meaning	Action required
TT 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 [ALERT ACK] key.
TT 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, re-acquire 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.	

3.16 TT Simulation Mode

You can simulate the risk of a collision by using the TT simulation mode. The test can be terminated at any time by pressing the [STBY TX] key.

1. Open the [MAIN MENU].
2. Select [INTIAL SETTING], then press the **ADJUST** knob.
3. Select [TEST], then press the **ADJUST** knob.
4. Select [TT TEST], then press the **ADJUST** knob.

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
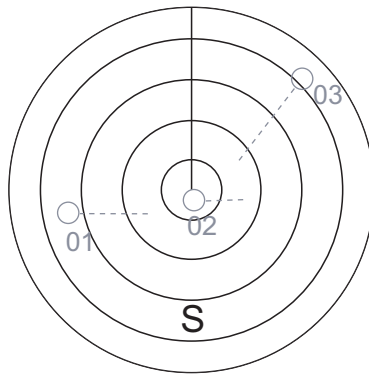
Place the cursor on a target, then press the [TGT ACQ] key to display the target data.

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.

3.17   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 coordinates 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.

3.18   Factors Affecting TT Functions

Low gain

Insufficient or low radar receiver gain will result in some targets not being acquired at long distance. 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 is achieved when the target is detected five times (not necessarily continuously) out of 10 scans. If not detected six times out of 10 scans, the target will become a "lost target". The TT will acquire a radar echo that is present once in every six antenna scans and continue tracking if 1 in 10.

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

Clutter can be acquired and tracked as targets. Adjust the A/C RAIN control. 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 A/C RAIN.

Non-synchronous emissions

No effect.

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 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 can acquire and track the false echo if it is detected by 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.

To receive radar beacon or SART signals, turn on [SART] in the [ECHO] menu.

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 1,000 AIS targets in its storage buffer. When this buffer becomes full of AIS targets, the Alert 190 "TARGET CAPACITY (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), Course Over the Ground (COG), Rate Of Turn (ROT) and heading. 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 40 AIS targets. The Alert 190 "TARGET CAPACITY (AIS CAPACITY FULL)" is generated when 40 AIS targets are activated.

This radar can display a maximum of 300 AIS targets. The Alert 190 "TARGET CAPACITY (AIS CAPACITY FULL)" is generated when 300 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 40 targets are activated, the Alert 190 "TARGET CAPACITY (AIS ACITVATE 95%)" appears. When 40 targets are activated, the Alert 190 "TARGET CAPACITY (AIS ACTIVATE FULL)" appears.

An indication of AIS target display capacity limit is given well before it is reached. When 95% of 300 targets are displayed, the Alert 190 "TARGET CAPACITY (AIS ACTIVATE 95%)" appears. When 300 targets are displayed, the Alert 190 "TARGET CAPACITY (AIS DISPLAY FULL)" appears.

An indication of AIS target processing capacity limit is given well before it is reached. The Alert 190 "TARGET CAPACITY (AIS CAPACITY FULL)" appears when 1,000 targets are in the storage buffer.
This radar generates AIS-related alerts. These are Alert 191 "CPA/TCPA (AIS COLLISION" and Alert 193 "LOST TARGET (AIS 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

Displays AIS target data   Cancel target
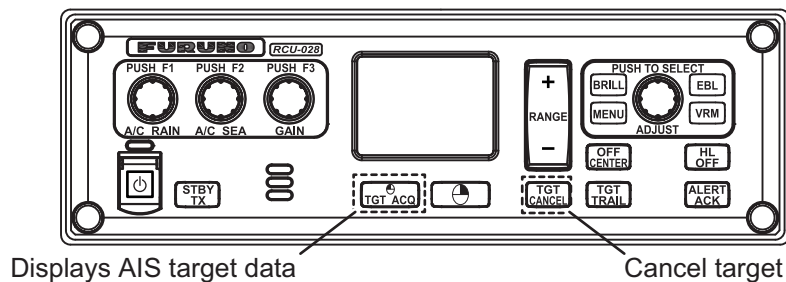
• **TGT ACQ**: Displays the selected target's data.

• **TGT 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).
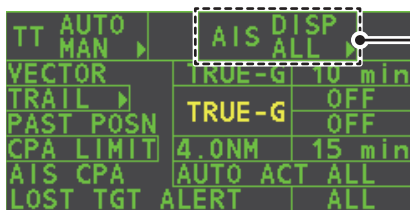
Select the AIS box, then press the **left button** to cycle through AIS display modes.
DISP OFF: Hides AIS targets
DISP FILT: Displays a filtered selection of AIS targets
DISP ALL: Displays all AIS targets
FUNC OFF: Deactivates the AIS function
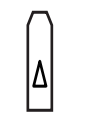
4.2   AIS Symbols and Their Meanings

When the AIS is active, AIS targets are marked with the appropriate AIS symbol, as shown in the table below.

SYMBOL	STATUS	REMARKS
	Activated target	All AIS symbols shown with thick line. Color is selectable from menu.
	ROT higher than preset ROT	Displayed for turning ship.
	Dangerous target	Displayed when CPA/TCPA is within CPA/TCPA limit. Red in color. Flashing until acknowledged.
	Lost target	"X" overlaid on a lost target. Red in color. Erased after acknowledged.
	Sleeping target	Indicates the presence of a target equipped with AIS. Color is selectable from menu.
	Target with neither a reported heading nor a COG	A target with neither a reported heading nor COG is oriented toward the top of the operational display area. The symbol is shown with a solid line.
A	Target selected for data display	Broken square is overlaid on target selected to display its data. A, B or C shown to indicate data box location at right side of the screen.
	Scaled symbol	Symbol shape is based on antenna location, ship length and ship width. Size changes depending on range from own ship.

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

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

Note 3: When no AIS data is received, the message "RECEIVE" appears in the Alert Box. Check the AIS transponder.

Note 4: Physical and virtual AIS AtoN symbols that may appear are listed on the following page.

AIS Physical AtoN Symbol	AIS Virtual AtoN Symbol	Meaning
◇	‹⊕›	Basic shape
⊙ ◇		RACON
✝ ◇	✝ ‹⊕›	Emergency wreck mark
◬ ◇	◬ ‹⊕›	North cardinal mark
◇ ◇	◇ ‹⊕›	East cardinal mark
▽ ◇	▽ ‹⊕›	South cardinal mark
⊠ ◇	⊠ ‹⊕›	West cardinal mark
▯ ◇	▯ ‹⊕›	Port hand mark
▲ ◇	▲ ‹⊕›	Starboard hand mark
⑧ ◇	⑧ ‹⊕›	Isolated danger
○ ◇	○ ‹⊕›	Safe water
⊗ ◇	⊗ ‹⊕›	Special mark
Off Pos ◇		Off position (Displayed with yellow line and yellow text)
Unlit ◇		Light fail or at reduced range (Displayed with yellow text)
Racon err ◇		RACON error (Displayed with yellow text)
	Missing ‹⊕›	Missing (Displayed with yellow dashed line and yellow text)

Note 5: Other AIS symbols that may appear are shown in the table below.

Symbol	Meaning
⊗→⊗ ◇BS ✈ △⊗ shown in red when active	Other AIS symbols (from left, AIS SART (ACTIVE), AIS SART (TEST), AIS Base station, AIS search and rescue (SAR) Aircraft, AIS Search and Rescue (SAR) Vessel.)

Note 6: The CPA and TCPA of SAR aircraft data are not available and are shown as ***.

4. AIS OPERATION

4.3 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 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 [MAIN MENU].
2. Select [TT•AIS], then press the **left button**.
3. Select [AIS DISP FILTER], then press the **left button**.
4. Referring to the table below, select the appropriate filtering type, then press the **left button**.

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.

5. Rotate the **ADJUST** knob to set the selected filter's options, then press the **ADJUST** knob.
6. Close the menu.
7. Place the cursor on the [AIS] box, then press the left button several times to display "DISP FILT" in the [AIS] box.

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

4.4 How to Activate AIS Targets

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

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

4.4.1 How to activate specific targets manually

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

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

Turning direction (ROT)

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

Heading line [*2]

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

4-5
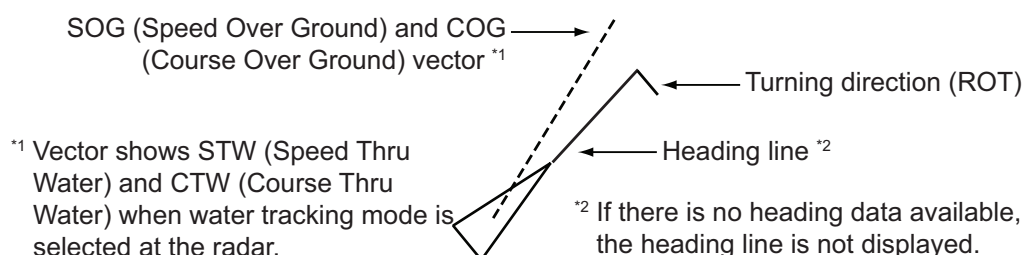
4.4.2 How to enable/disable the AIS auto activate function

Use the [CPA AUTO ACTIVATE] box at the bottom right corner to enable or disable the AIS auto active function.
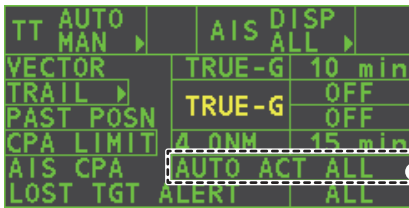
Select the AIS CPA box, then press the **left button** to cycle through AIS display modes.

1. Place the cursor on the [CPA AUTO ACTIVATE] box, then press the left button several times to display the desired auto activate function.

Filter type	Definition
[OFF]	Disable the AIS auto activate function.
[AUTO ACT ALL]	Activation against AIS targets whose CPA or TCPA is less than set in section 3.13
[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 3.13.

4.4.3 How to limit the functions of the AIS auto activate function

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

1. Open the [MAIN MENU].
2. Select [TT•AIS], then press the **ADJUST** knob.
3. Select [CPA AUTO ACTIVATE], then press the **ADJUST** knob.
4. Referring to the table below, select the appropriate filtering type, then press the **ADJUST** knob.

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.

5. Rotate the **ADJUST** knob to set the selected filter's options, then press the **ADJUST** knob.
6. Close the menu.

4.5 How to Sleep AIS Targets

4.5.1 How to sleep individual AIS targets

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

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

1. Place the cursor on the target to be slept, then press the [TGT CANCEL] key. The symbol for the slept target changes as indicated in the table in section 4.2.

4.5.2 How to sleep all AIS targets

1. Select the [AIS DISP] box, then press the **right button** to open the [AIS TARGET] menu.
2. Select [SLEEP ALL TGTS], then press the **ADJUST** knob.
3. Select [YES] or [NO] as appropriate, then press the **ADJUST** knob.
4. Close the menu.

4.6 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.

1. Select the [AIS DISP] box, then press the **right button** to open the [AIS TARGET] menu.
2. Select [VOYAGE DATA], then press the **ADJUST** knob.
3. Select [NAV STATUS], then press the **ADJUST** knob.
4. Select the appropriate navigation status number, referring to the table below, then press the **ADJUST** knob.

Nav Status No.	Meaning
00	Underway using engine (default)
01	At anchor
02	Not under command
03	Restricted maneuverability
04	Constrained by her draft
05	Moored
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
Continued on following page.	

Nav Status No.	Meaning
Continued from previous page.	
14	AIS SART (No use)
15	AIS SART TEST

5. Select [ETA], then press the **ADJUST** knob.

6. Using the **ADJUST** knob, set the estimated day of the month to arrive, then press the **ADJUST** knob.

Currently selected digit is highlighted by the cursor.
Rotate the **ADJUST** Rotokey to adjust the day.
Press the **ADJUST** Rotokey to move to the next digit.

08

7. Select [DESTINATION], then press the **left button**.

8. Using the **ADJUST** knob, set the destination in alphanumeric characters, then press the **ADJUST** knob. (Max. 20 characters)

Currently selected character is highlighted by the cursor.
Rotate the **ADJUST** Rotokey to select the desired character.
Press the **ADJUST** Rotokey to move to the next character.

GOLD COAST

9. Select [DRAUGHT], then press the **ADJUST** knob.

10. Using the **ADJUST** knob, set the ship's draught, then press the **ADJUST** knob.

11. Select [CREW], then press the **ADJUST** knob.

12. Using the **ADJUST** knob, set the number of crew on-board, then press the **ADJUST** knob.

13. Close the menu.

4.7 Target Data

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

4.7.1 How to display target data in the data display area

Place the cursor on a desired tracked target and press the [TGT ACQ] key. The target is highlighted with square box and the selected AIS target's data is shown in AIS target data box in the data display area, on the right side of the screen.
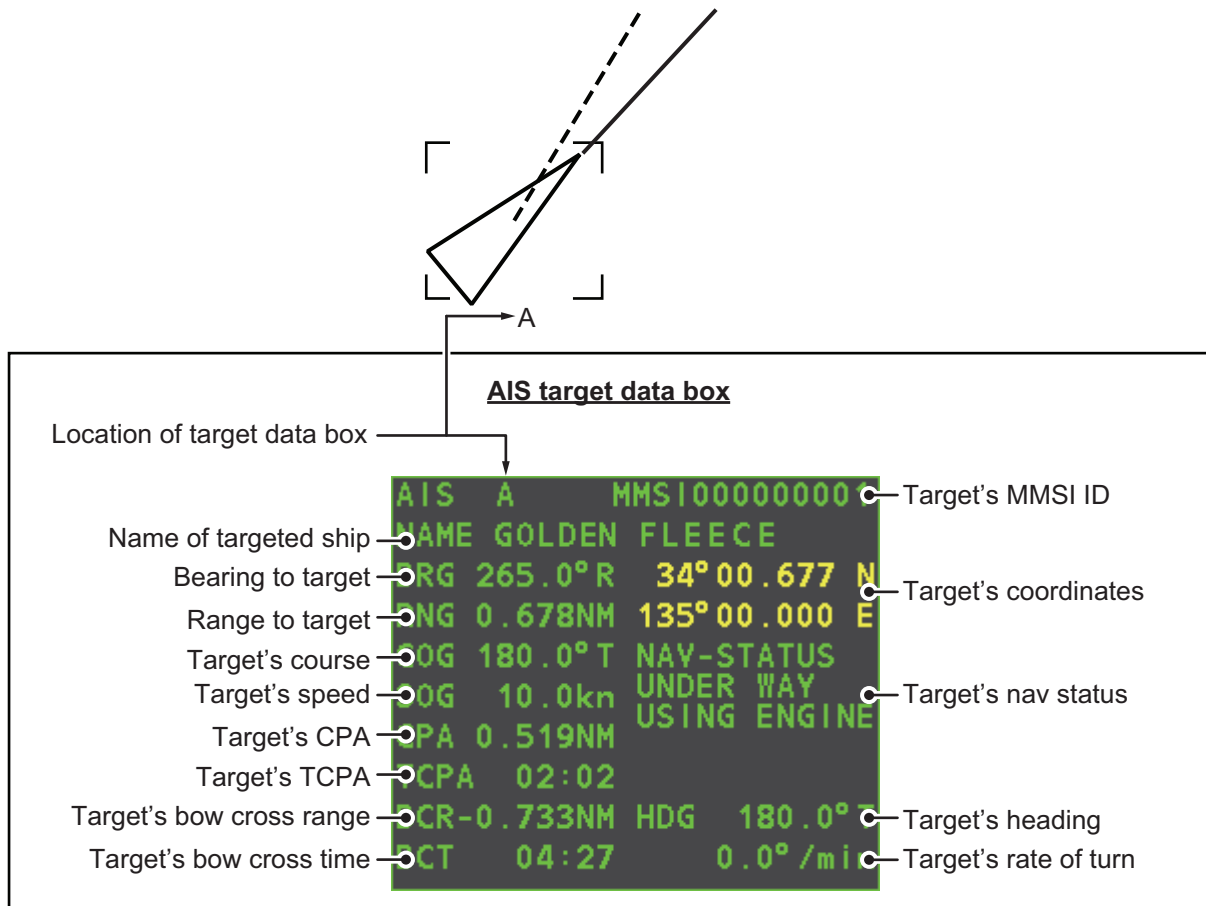
4.7.2 How to remove target data from the display area

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

4.8 How to Adjust AIS Symbol Attributes

The AIS symbol's brilliance, size and color can be adjusted.

4.8.1 How to adjust the AIS symbol brilliance

1. Place the cursor on the [BRILL] box, then press the **right button**. The [BRILL] menu is displayed.

2. Select [AIS SYMBOL], then press the **ADJUST** knob.

3. Using the **ADJUST** knob, adjust the brilliance to the appropriate level, then press the **ADJUST** knob.

4. Press the **right button** to close the menu.

4.8.2 How to adjust the AIS symbol color

1. Open the [MAIN MENU].

2. Select [TT•AIS], then press the **ADJUST** knob.

3. Select [TT•AIS SYMBOL], then press the **ADJUST** knob.

4. Select [SYMBOL COLOR], then press the **ADJUST** knob.

5. To cycle through the colors for the AIS symbols, rotate the **ADJUST** knob.
   To select the color, press the **ADJUST** knob. The available colors, in order, are:
   [GRN] (Green) → [BLU] (Blue) → [CYA] (Cyan) → [MAG] (Magenta) → [WHT] (White) → [GRN]...

6. Select [AIS SCALED SYMBOL], then press the **ADJUST** knob.

7. Select [OFF] or [ON] as appropriate, then press the **ADJUST** knob.
   [OFF]: All AIS symbols are displayed in the same size.
   [ON]: AIS symbols are displayed in scale, according to the ship length.
   The figure to the right shows examples of standard and scaled symbols.

Standard symbol   Scaled symbol

8. Close the menu.

4.8.3 How to adjust the ATON symbol color

1. Open the [MAIN MENU].

2. Select [TT•AIS], then press the **ADJUST** knob.

3. Select [TT•AIS SYMBOL], then press the **ADJUST** knob.

4. Select [ATONSYMBOL COLOR], then press the **ADJUST** knob.

5. To cycle through the colors for the ATON symbols, rotate the **ADJUST** knob.
   To select the color, press the **ADJUST** knob. The available colors, in order, are:
   [GRN] (Green) → [BLU] (Blue) → [CYA] (Cyan) → [MAG] (Magenta) → [WHT] (White) → [GRN]...

6. Close the menu.

4.9 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

4.9.1 How to adjust the past position plotting interval

The plotting interval determines how often the target's past position is refreshed. To change the plotting interval do the following:

Place the cursor on the plotting interval for the [Past POSN] indication in the [TT•AIS] box, then press the **left button** to cycle through the intervals.

Past POSN indication ⎯ TRAIL ▶ / PAST POSN | TRUE-G | OFF / OFF ⎯ Plotting interval

The available options, in order, are:

[OFF] → [30 SEC] → [1 MIN] → [2 MIN] → [3 MIN] → [6 MIN] → [OFF]...

To erase all past position points and disable the past position display, select [OFF].

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

1. Open the [MAIN MENU].
2. Select [TT•AIS], then press the **ADJUST** knob.
3. Select [TT•AIS SYMBOL], then press the **ADJUST** knob.
4. Select [TT•AIS PAST POSN POINTS], then press the **ADJUST** knob.
5. Select [5] or [10] as appropriate, then press the **ADJUST** knob.
6. Close the menu.

4.9.3 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 paragraph 1.36.1.

4.9.4 Stabilization in true motion

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

4.10 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 "LOST" appears in the Alert Box. To acknowledge a lost target, press the [ALERT ACK] key, or use the Touchpad to select the [ALERT] box then press the **left button**.

4.10.1 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 [MAIN MENU].
2. Select [TT•AIS], then press the **ADJUST** knob.
3. Select [AIS LOST FILTER], then press the **ADJUST** knob.
4. Referring to the table below, select the appropriate filtering type, then press the **ADJUST** knob.

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

5. Select [ON], then press the **ADJUST** knob. The settings can now be adjusted.
6. Rotate the **ADJUST** knob to adjust the setting as required, then press the **ADJUST** knob to apply the setting.
7. Close the menu.

4.10.2 How to enable/disable the lost target alert

The [LOST TARGET ALERT] box at the bottom right corner enables and disables the lost target alert. Select the box with the cursor, then press the **left button** to select [OFF], [ALL] or [FILT] as appropriate.
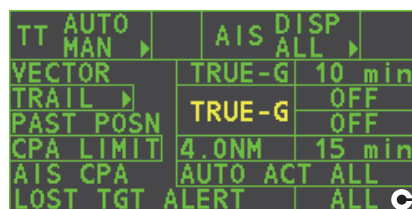
Lost target alert box

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

4.11 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 of turning of the vessel.
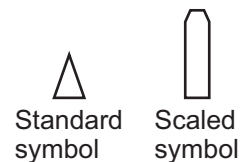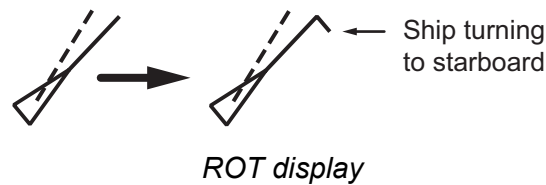

← Ship turning
to starboard

ROT display

1. Open the [MAIN MENU].

2. Select [TT•AIS], then press the **ADJUST** knob.

3. Select [TT•AIS SYMBOL], then press the **ADJUST** knob.

4. Select [AIS ROT TAG LIMIT], then press the **ADJUST** knob. The settings can now be adjusted.

5. Using the **ADJUST** knob, adjust the ROT as appropriate. Rotate the **ADJUST** knob to adjust the value, press the **ADJUST** knob to move to the next digit. The setting range is 000.0°/min to 720.0°/min.

6. Close the menu.

4.12 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 536 "AIS CPA/TCPA". 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 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.

Thicker than
activated target

4.12.1 How to set the CPA and TCPA ranges

CPA and TCPA ranges can be adjusted from the appropriate indication in the [TT•AIS] box. If the CPA/TCPA settings are displayed as "OFF", place the cursor on the CPA limit indication, then press the **left button**.

CPA setting
TCPA setting

`CPA LIMIT 4.0NM  15 min`

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

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2. Press the **left button**, or rotate the **ADJUST** knob, to adjust the settings as required. The settings options are outlined in the table below.

Indication	Key	Settings options
CPA	**Left button**	0.5, 1, 1.5, 2, 3, 4, 5, 6 (nm)
	ADJUST knob	0.1-20 (nm), 0-10 nm in 0.1 nm increments, 10 nm increments thereafter
TCPA	**Left button**	1, 2, 3, 4, 5, 6, 12, 15 (minutes)
	ADJUST knob	1-60 minutes, 1-minute increments

4.13 How to associate TT and AIS Targets

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

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

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

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

TT ACQ MODE indication

2. Open the [MAIN MENU].
3. Select [TT•AIS], then press the **ADJUST** knob.
4. Select [ASSOCIATION], then press the **ADJUST** knob.
5. Select [ASSOCIATION TGT], then press the **ADJUST** knob.
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.

Place the cursor on the association icon, then press the **left button** to change the association setting.
>: Use TT Symbols and data.
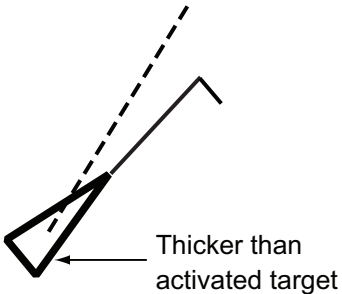<: Use AIS symbols and data.
No indication: Association is disabled.

7. Referring to the table below, set the association criteria. Rotate the **ADJUST** knob to adjust the value, press the **ADJUST** knob to move to the next digit.

[GAP]: Range in bearing direction between AIS target and tracked target. (setting range: 0.000-0.050 (nm))

[RANGE]: Range direction difference from own ship to AIS target and tracked target. (setting range: 0.000-0.100 (nm))

[BEARING]: Bearing difference from own ship to AIS target and tracked target. (setting range: 0.0-9.9 (°))

[SPEED]: Speed difference between AIS target and tracked target. (setting range: 0.0-6.0 (kn))

[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. Further, "ASSOCIATION" appears in the Alert Box.

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

4.14 How to View Own Ship Data

Own ship's static data (type of ship, call sign, name and position of internal and external GPS antennas) can be viewed as follows:

1. Select the [AIS] box at the right of the screen, then press the **right button**. The [AIS TARGET MENU] is displayed.

— AIS box

2. Select [STATIC DATA], then press the **ADJUST** knob.
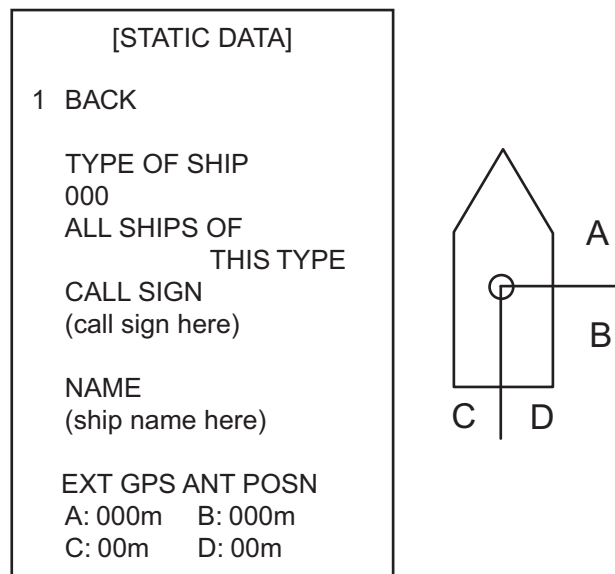
3. Close the menu.

4.15 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.

4.15.1 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. Select the [AIS] box at the right of the screen, then press the **right button**. The [AIS TARGET MENU] is displayed.

2. Select [TRANSMIT MESSAGE], then press the **ADJUST** knob.

3. Select [ADDRESS TYPE], then press the **ADJUST** knob.

4. Select [ADDRESSED] (message for a specific MMSI. Automatically selected if the MMSI is automatically using the data display.) or [BROADCAST] (message to all AIS-equipped vessels within the area), then press the **ADJUST** knob.

5. Select [MESSAGE TYPE], then press the **ADJUST** knob.

6. Select [SAFETY] (for safety messages) or [BINARY] (for routine messages), then press the **ADJUST** knob.

7. 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 [MMSI No.], then press the **ADJUST** knob.

   2) Using the **ADJUST** knob, set the receiving ship's MMSI.

8. Select [CHANNEL], then press the **ADJUST** knob.

9. Select the AIS channel to transmit your message over: [A], [B], [A or B], or [A and B], the press the **ADJUST** knob.

10. Select [EDIT], then press the **ADJUST** knob. A software keyboard appears at the bottom of the menu.

11. Select the character desired, then press the **left button**.
    The maximum number of characters which can be entered depends on the message type, as shown in the table below.

Space
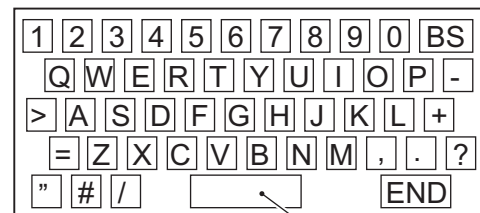
Message type	Max. characters allowed
Safety message broadcast	161
Binary message broadcast	156
Safety message addressed to MMSI	156
Binary message addressed to MMSI	151

12. Select [OK], then press the **ADJUST** knob.

13. Select [SAVE FILE], then press the **ADJUST** knob.

14. Select the appropriate number, then press the **ADJUST** knob.

15. Close the menu.

4.15.2   How to transmit messages

1. Select the [AIS] box at the right of the screen, then press the **right button**. The [AIS TARGET MENU] is displayed.

2. Do one of the following:

    a) Create a message, as described in paragraph 4.15.1.

    b) Use a file saved in the memory by selecting [TRANSMIT MESSAGE] followed by [OPEN FILE].

3. Select [TRANSMIT MESSAGE] to transmit the message.

4. Close the menu.

The indication "AIS TRANSMITTING" appears while sending the message.

"TRANSMIT ERROR" appears if an error occurred while transmitting the message.

4.15.3   How to view messages

When an AIS message is received, the display shows an appropriate icon to alert you. If [AUTO DISP MESSAGE] in the [AIS TARGET MENU] is set to [ON], messages are automatically displayed upon receipt. The system stores up to 20 AIS messages. When the storage capacity is reached the oldest AIS message is automatically erased to make room for the latest. Note that received messages and alarm messages are not backed up when the power is turned off.

1. Select the [AIS] box at the right of the screen, then press the **right button**. The [AIS TARGET MENU] is displayed.

2. Select [RECEIVED MESSAGES], then press the **ADJUST** knob. Up to four messages are displayed per page and a total of 200 messages can be stored.

3. Select the message to be displayed, then press the **ADJUST** knob.

4. The message details are displayed below the message list.
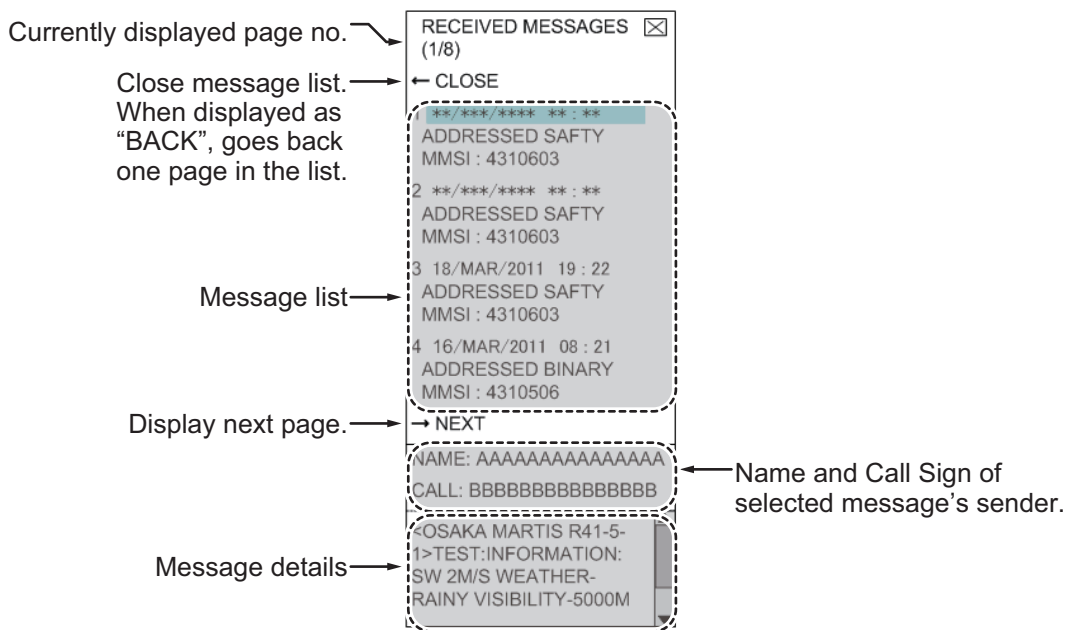
5. Close the menu.

4.15.4 How to automatically display received messages

1. Select the [AIS] box at the right of the screen, then press the **right button**. The [AIS TARGET MENU] is displayed.

2. Select [AUTO DISP MESSAGE], then press the **ADJUST** knob.

3. Select [ON] to display messages as they are received, [OFF] to disable the automatic display, then press the **ADJUST** knob.

4. Close the menu.

4.15.5 How to display AIS alert messages

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

1. Select the [AIS] box at the right of the screen, then press the **right button**. The [AIS TARGET MENU] is displayed.

2. Select [AIS ALERT MESSAGES], then press the **ADJUST** knob.

3. Close the menu.

4.16 AIS System Messages

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

Message	Priority	Meaning
"AIS COLLISION"	Alarm	CPA and TCPA of an activated AIS target are below value set on the menu.
"AIS NEW TARGET"	Warning	AIS target has entered an acquisition zone.
"AIS LOST"	Warning	Lost target. An activated target is declared a lost target when it fails to produce data for six minutes or five reporting intervals, whichever is the shorter.
"AIS TARGET FULL"	Warning	The radar only displays the closest 1000 AIS targets from own ship.
"RECEIVE"	Warning	Not receiving AIS data from own AIS (VDO message).
"AIS TARGET 95%"	Caution	Appears when capacity for AIS targets is 95% full.
"ASSOCIATION"	Caution	Tracked target merged with AIS target. The indication disappears when the target no longer meets the criteria set in section 4.12. When the message "RECEIVE" is displayed, "ASSOCIATION" is not displayed.
"TRANSMIT ERROR"	Caution	Could not send AIS message.
"AIS TRANSMITTING"	Caution	AIS message is being transmitted.

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5. VIDEO PLOTTER OPERATION

The video plotter has the following functions:

- Enter waypoints (up to 98) and marks.
- Creates and displays radar maps.
- Own ship track plotting
- Able to save marks and tracks on removable SD card.

5.1 Orientation Modes

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

Note 1: The [STERN UP RM] orientation mode is only available it has been set to [ON] in [STERN UP RM] in the [INITIAL SETTING] → [OPERATION] menu.

Note 2: The screen may flash when the heading is changed more than one degree in the [HEAD UP RM] or [STAB HEAD UP RM] mode.

Automatic resetting of own ship mark in true motion mode

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

5.2 Radar Map

A radar map is a combination of map lines and symbols whereby the user can define and input the navigation data, route planning and monitoring data. The radar map can contain 5,000 points of data. Inscribed marks are retained when the power is turned off.

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

5.2.1 How to show/hide the radar map

Select the [MAP] indication in the [RADAR CONTROL BOX] at the left-side of the screen, then press the left button to display or hide the radar map.

Radar map indicator ⎯•

5.2.2 Radar map marks

To inscribe/remove marks or change mark colors on the radar map, see "How to Use Marks" on page 1-55. The following mark icons are available.

Non-IMO type[1]	Item on MARK menu	IMO type[2]	Item on MARK menu
△	Mark	Red	Buoy
⊪	Danger Highlight	Green	Buoy
✿	Buoy	Red	Buoy
⛴	Buoy	Green	Buoy
⊓	Buoy	Red	Buoy
O	Buoy	Green	Buoy
.	Buoy	Red	Buoy
✕	Danger Highlight	Green	Buoy
⌒	Mark	⊪ Purple	Danger Highlight
□	Mark	⊗ Purple	Danger Highlight
⚓	Mark	△ Orange	Mark
■	Mark	□ Orange	Mark
◇	Mark	⚓ Orange	Mark
—	Mark	▪▪▪ Purple	Navline (map)
▪▪▪▪	Mark	⬭ White	Coastline
▪▪▪▪	Nav Line (map)	▪▪▪ Gray	Contour Line
⬭	Coastline	⏚ Purple	Danger Highlight
▪▪▪▪	Contour	∿ Purple (cable)	Danger Highlight
⏚	Prohibited Area	— Orange	Mark
∿ (cable)	Danger Highlight	▪▪▪ Orange	Mark
⊙ (w/line)	Buoy		
△ (w/line)	Mark		
⊡ (w/line)	Mark		
◇ (w/line)	Mark		

[1]: Colors for non-IMO marks may be set by the user.

[2]: Colors for IMO marks are fixed as indicated.

5.3 How to Align the Radar Map

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

Note: Activating/deactivating the [MAP ALIGN] function resets own ship track and all trails.

1. Select the operational display area, then press the **right button**. The [CURSOR] menu is displayed.

2. Select [MAP ALIGN], then press the **left button**. The cursor color changes to blue.

3. Move the cursor to align the radar map with the radar screen, then press the **left button**. The indication "MAP ALIGN" appears on the right side of the operational display area.

Display indications affected by map alignment

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

- Radar echoes
- Cursor position co-ordinates
- EBL offsets (STAB HDG & STAB NORTH modes only)
- PI Lines
- Acquisition Zone set area
- Barge mark
- TT symbols
- EBL/VRM reference points
- ZOOM window display
- Anchor Watch
- AIS symbol vector display (REL mode only)
- Own ship location co-ordinates (POSN display only)

Display indication unaffected by map alignment

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

- WPT/Route
- DROP mark
- EBL offsets (STAB GND mode only)
- AIS symbol vector display (TRUE mode only)
- AIS symbols
- MOB
- TT symbol vector display
- Zoom window display (STAB GND mode only)

5.3.1 How to disable the map alignment

1. Select the operational display area, then press the **right button**. The [CURSOR] menu is displayed.

2. Select [MAP ALIGN], then press the **left button**. The cursor color changes to blue.

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

5.4   Own Ship's Track

A total of 1,200 points are allotted for storage of own ship's track, marks and lines. When this memory becomes full, the oldest track is deleted to make room for the latest. For that reason you may want to adjust the recording interval to conserve the memory.

The table below shows the relation between plotting interval settings and maximum track recording time.

Interval	Max. Recording Time	Interval	Max. Recording Time
15 s	5 hours	3 min	60 hours
30 s	10 hours	6 min	120 hours
1 min	20 hours	15 min	300 hours
2 min	40 hours	DRAW ONLY	No track data recorded.

5.4.1   How to set the plotting interval

1. Open the [MAIN MENU].
2. Select [MARK], then press the **ADJUST** knob.
3. Select [OWN TRACK], then press the **ADJUST** knob.
4. Select [SAVE INTERVAL], then press the **ADJUST** knob.
5. Select the appropriate setting, then press the **ADJUST** knob.
6. Close the menu.

5.4.2   How to set the own ship track color

1. Open the [MAIN MENU].
2. Select [MARK], then press the **ADJUST** knob.
3. Select [OWN TRACK], then press the **ADJUST** knob.
4. Select [OWN TRACK COLOR], then press the **ADJUST** knob. The following colors are available.

Non-IMO type	IMO type
• [RED] (Red) • [GRN] (Green) • [BLU] (Blue) • [YEL] (Yellow) • [CYA] (Cyan) • [MAG] (Magenta) • [WHT] (White)	OWN TRACK COLOR is not adjustable for IMO type radars. Own track is displayed in (Cyan) color.

5. Select the appropriate setting, then press the **ADJUST** knob.
6. Close the menu.

5.4.3 How to delete the own ship track

There are three methods to delete the own ship track: by percentage of track, by track color or by cursor selection.

How to erase tracks by percentage

1. Open the [MAIN MENU].
2. Select [MARK], then press the **ADJUST** knob.
3. Select [OWN TRACK], then press the **ADJUST** knob.
4. Select [DELETE OWN TRACK], then press the **ADJUST** knob.
5. Select the percentage of the track you wish to delete, then press the **ADJUST** knob. The available options are: [30%], [50%], [80%] or [ALL].
6. Close the menu.

How to erase tracks by color (For non-IMO type only)

1. Open the [MAIN MENU].
2. Select [MARK], then press the **ADJUST** knob.
3. Select [OWN TRACK], then press the **ADJUST** knob.
4. Select [DELETE OWN TRACK], then press the **ADJUST** knob.
5. Select the color of the track you wish to delete, then press the **ADJUST** knob. The available options are: [RED], [GRN], [BLU], [YEL], [CYA], [MAG] or [WHT].
6. Close the menu.

How to erase tracks with the cursor (For non-IMO type only)

1. Open the [MAIN MENU].
2. Select [MARK], then press the **ADJUST** knob.
3. Select [OWN TRACK], then press the **ADJUST** knob.
4. Select [DELETE OWN TRACK], then press the **ADJUST** knob.
5. Select [2POINTS] or [AREA] as appropriate, then press the **ADJUST** knob. The cursor jumps into the operational display area.
   [2POINTS]: Delete track between two points
   [AREA]: Delete all track within an area

Area to be deleted

[2POINTS] method   [AREA] method
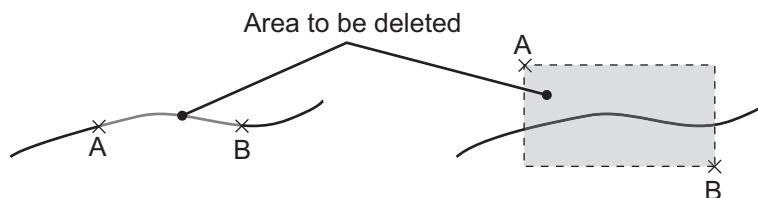
6. Place the cursor on the first point (A), then press the **left button**.
7. Place the cursor on the second point (B), then press the **left button**. If [AREA] was selected at step 5, the two points form a square.
8. Close the menu.

5.5 How to Use Waypoints

A particular location is known as a "waypoint", whether it be a starting point, a destination point or an intermediate point on a voyage. This radar system can store 100 waypoints. Waypoints 1 to 98 are user set waypoints, waypoint 99 is reserved for external input, waypoint 100 is reserved for MOB (Man Over Board). Waypoints can be entered with the cursor, or from the menu (manual input of latitude and longitude). Waypoints 1 to 98 can be edited from the menu.

5.5.1 How to enter waypoints

How to enter waypoints with the cursor

1. Select the [MARK] box, then press the **right button**. The [MARK] menu is displayed.
2. Select [MARK KIND], then press the **ADJUST** knob.
3. Select the appropriate waypoint number group for the new waypoint, then press the **ADJUST** knob.
   The available groups are: [WP1 to WP50] or [WP51 to WP98].
4. Rotate the **ADJUST** knob to select the waypoint number for new waypoint, then press the **ADJUST** knob. The cursor jumps inside the operational display area.
5. Place the cursor on the location where the new waypoint is to be inscribed, then press the **left button**.
6. Repeat steps 4 and 5 to inscribe other waypoints.
7. Press the **right button** to complete waypoint inscription.

How to enter/edit waypoints from the menu

Note: Waypoints which are part of a route that is currently in use cannot be edited.

1. Open the [MAIN MENU].
2. Select [NAVLINE•WPT], then press the **ADJUST** knob.
3. Select [WPT SET], then press the **ADJUST** knob.
4. Select [WPT NO. SELECT], then press the **ADJUST** knob.
5. Rotate the **ADJUST** knob to select a waypoint number, then press the **ADJUST** knob.
6. To edit or input a waypoint name, select [WPT NAME], then press the **ADJUST** knob. The software keyboard is displayed. To skip naming the waypoint, go to step 7.
   1) Select a character, then press the left button. Repeat the process to name the waypoint. A total of 15 characters can be used when naming the waypoint.
   2) Select [END] to complete naming the waypoint.
7. Select [WPT L/L], then press the **ADJUST** knob. The settings can now be adjusted.
8. Rotate the **ADJUST** knob to select a digit, then press the **ADJUST** knob to move to the next digit. Use this method to set the Latitude and Longitude.
9. Close the menu.

5.5.2   How to erase waypoints

1. Open the [MAIN MENU].
2. Select [NAVLINE•WPT], then press the **ADJUST** knob.
3. Select [WPT SET], then press the **ADJUST** knob.
4. Select [WPT NO. SELECT], then press the **ADJUST** knob.
5. Select [CLEAR DATA], then press the **ADJUST** knob.
6. Select [YES] or [NO] as appropriate, then press the **ADJUST** knob.
7. Close the menu.

5.5.3   How to display the waypoint list

1. Open the [MAIN MENU].
2. Select [NAVLINE•WPT], then press the **ADJUST** knob.
3. Select [WPT LIST], then press the **ADJUST** knob.
4. Close the menu.

5.5.4   How to show/hide the waypoint name/number

1. Open the [MAIN MENU].
2. Select [NAVLINE•WPT], then press the **ADJUST** knob.
3. Select [DISP WPT NO.] or [DISP WPT NAME] as appropriate, then press the **ADJUST** knob.
4. Select [YES] to show the waypoint name/number, or [NO] to hide the waypoint name/number, then press the **ADJUST** knob.
5. Close the menu.

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6. MAINTENANCE, TROUBLESHOOTING

Periodic checks and maintenance are important for proper operation of any electronic system. This chapter contains maintenance and troubleshooting instructions to be followed to obtain optimum performance and the longest possible life of the equipment. Before attempting any maintenance or troubleshooting procedure please review the safety information below.

⚠ WARNING

Do not open the equipment.

Hazardous voltage which can cause electrical shock exists inside the equipment. Only qualified personnel should work inside the equipment.

Turn off the radar power switch before servicing the antenna unit. Post a warning sign near the switch indicating it should not be turned on while the antenna unit is being serviced.

Prevent the potential risk of being struck by the rotating antenna.

A transmitting radar antenna emits electromagnetic waves, which can be harmful, particularly to the eyes.

Wear a safety belt and hard hat when working on the antenna unit.

Serious injury or death can result if someone falls from the radar antenna mast.

NOTICE

Do not apply paint, anti-corrosive sealant or contact spray to coating or plastic parts of the equipment.

Those items contain organic solvents that can damage coating and plastic parts, especially plastic connectors.

6.1 Periodic Maintenance Schedule

Regular maintenance is essential to good performance. A regular maintenance program should be established and should at least include the items shown in the table below.

Interval	Check Point	Checks and measures	Remarks
As required	The LCD will in time accumulate a layer of dust which tends to dim the picture	Wipe the LCD carefully to prevent scratching, using tissue paper and an LCD cleaner. To remove stubborn dirt, use an LCD cleaner, wiping slowly with tissue paper so as to dissolve the dirt. Change paper frequently so the dirt will not scratch the LCD.	Do not use chemical-based cleaners to clean the LCD. They can damage the LCD coating.
	Processor unit cleanliness	Dust and dirt may be removed with a soft cloth.	Do not use chemical-based cleaners to clean the processor unit. They can remove paint and markings.
3 to 6 months	Exposed nuts and bolts on antenna unit	Check for corroded or loosened nuts and bolts. If necessary, clean and repaint them thickly. Replace them if heavily corroded.	Sealing compound can be used instead of paint. Apply a small amount of grease between nuts and bolts for easy removal in future.
	Antenna radiator	Check for dirt and cracks on radiator surface. Thick dirt should be wiped off with soft cloth dampened with fresh water. If a crack is found, apply a slight amount of sealing compound or adhesive as a temporary remedy, then call for repair.	Do not use chemical-based cleaners for cleaning. They can remove paint and markings. If you need to remove ice from the antenna unit, use a wooden hammer or plastic head hammer. Cracks on the unit may cause water ingress, causing serious damages to internal circuits.
	Terminal strips and plugs in antenna unit (TECHNICIANS only)	Open antenna cover to check terminal strip and plug connections inside. Also check the rubber gasket of antenna covers for deterioration.	When closing antenna covers in position, be careful not to catch loose wires between covers and unit.
6 months to one year	Terminal strips, sockets, earth terminal on processor unit (TECHNICIANS only)	Check for loose connections. Check contacts and plugs for proper seating, etc.	

6.2 How to Replace the Fuse

A fuse is located on the front of the processor unit. The fuse protects the equipment from reverse polarity of the ship's mains and equipment fault. If a fuse blows, find the cause before replacing it. Use the correct fuse. Using the wrong fuse will damage the equipment and void the warranty.

⚠ **WARNING**

Use the proper fuse.

Use of the wrong fuse can cause fire or electrical shock.
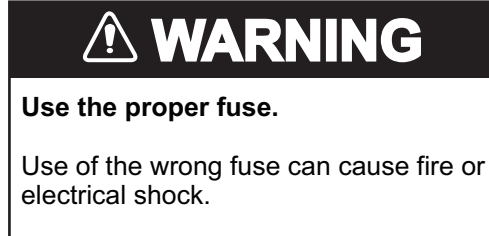
AC/DC	Type	Code No.
DC	FGBO 125V 15A PBF	000-155-827
AC	FGBO 250V 8A PBF	000-155-843

6.3 Life Expectancy of Major Parts

This radar has consumable parts, and the table that follows shows the estimated life expectancy for the consumable parts. Life expectancy estimates are based on use under normal conditions. Request a FURUNO agent or dealer to replace the consumable parts, to get the best performance and longest possible life from the equipment.

Part	Type	Life expectancy	Remarks
Antenna Motor	D8G-516	10,000 hours	
	D8G-571		
Carbon Brush	S885026-1A-61	4,000 hours	Check for wear at, or before, 2,000 hours of Tx time. Replace if worn.
Magnetron	MA1615B	5,000 hours	Check no. of hours used at Tx time. Reset time after replacement.
	MG5436		
	MAF1565N		
	M1458F		
MD Board (FAR-1518)	ECA-1HG101B	55,000 hours	
	ECA-1HHG100B		
MD Board (FAR-1528)	ECA-1CHG101B	66,000 hours	
	ECA-1HHG100B		
MU-150HD(-CV15) Backlight	26-005-2026	60,000 hours	Replace when brilliance is uneven or too low.
MU-150HD(-CV15) Fan Motor	MFB52A-12HA-001	40,000 hours	

Note: The Magnetron is a consumable item. The effectiveness of your magnetron will decrease over time, causing lower-than-normal signal strength and loss of echoes. Magnetrons should be changed regularly. The table above shows the typical life-span of a magnetron used under normal conditions.

6.4   Trackball Maintenance

If the cursor skips or moves abnormally, clean the trackball using the procedure below.

1. Turn the retaining ring counterclockwise 45° to unlock it.

2. Remove the retaining ring and ball.

3. Clean the ball with a soft, lint-free cloth, then blow carefully into the ball-cage to dislodge dust and lint.

Retaining ring

4. Look for a build-up of dirt on the metal rollers. If dirty, clean the rollers using a cotton swab moistened lightly with isopropyl-rubbing alcohol.

5. Make sure that fluff from the swab is not left on the rollers.

6. Replace the ball and retaining ring. Be sure the retaining ring is not inserted reversely.
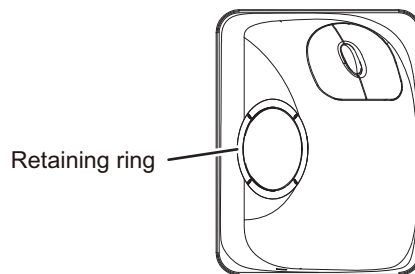
6.5   Easy Troubleshooting

This section provides troubleshooting procedures that the user can follow to restore normal operation. If you cannot restore normal operation, do not attempt to check inside any unit. Any repair work is best left to a qualified technician.

Problem	Possible cause	Remedy
Key beep inaudible.	Key beep turned off.	Adjust key beep level in the [OPERATION] menu, referring to section 1.10.
Picture not updated or picture freeze. 30 seconds after the picture freezes, the buzzer sounds, the **ALERT ACK** key blinks and alarm signal is output.	Video freeze.	Turn the power off and on again to restore normal operation.
Power is ON but nothing appears on monitor.	Brilliance is too low.	Adjust the brilliance, referring to section 1.4.
Marks, indications and noise appear but no echo.	Tx high voltage protection circuit has activated.	Reset the power to restore normal operation.
Range changed but radar picture does not change.	Defective range key or video freeze up.	Adjust the range with the control unit, or the [RANGE] box several times. If unsuccessful, replacement of keypad may be required. If that does not work try to turn the power off and on again to see if the problem might be video freeze up.
Only two PI lines when six lines are wanted	Incorrect setting of PI line interval	Adjust PI line interval, referring to paragraph 1.39.2. Also, the setting for number of PI lines to display may be inappropriate. Check the menu setting for number of PI lines, referring to paragraph 1.39.1.

Problem	Possible cause	Remedy
Range rings are not displayed	Range rings turned off	Try turning on the range rings with [RANGE RING] in the [NAVTOOL] menu. If they do not appear, their brilliance may be too low. Adjust their brilliance in the [BRILL] menu.
Tracked target not tracked correctly	Poor definition of targets in sea clutter	Adjust A/C SEA and A/C RAIN referring to section 1.19 and section 1.20.
Tuning adjusted but poor sensitivity	Second trace echo rejector on or dirt on radiator face	• Disable the second trace echo rejector, referring to section 1.28. • Clean the radiator face.

6.6   Advanced-level Troubleshooting

This section describes how to cure hardware and software troubles that should be carried out by qualified service personnel.

Note 1: This radar equipment contains complex modules in which fault diagnosis and repair down to component level are not practicable by users.

Note 2: When replacement of the SPU board is necessary, the previous settings can be transferred to new SPU board as follows:

• Save your settings to a SD card, referring to section section 1.51.

• After replacing the SPU board, load the entire contents of the SD card to the radar, referring to section section 1.51 for the procedure.

Problem	Possible cause	Remedy
Power turned on but radar does not operate at all	1) Blown fuse. 2) Mains voltage/polarity. 3) Power supply board.	1) Replace blown fuse. 2) Correct wiring and input voltage. 3) Replace power supply board.
Brilliance adjusted but no picture	SPU board	Replace SPU board.
Antenna not rotating	1) Antenna drive mechanism 2) Defective antenna drive motor relay	1) Replace antenna drive mechanism. 2) Press relay reset button.
Data and marks not displayed in Transmit status	SPU board	Replace SPU board.
Adjust GAIN with A/C SEA set at minimum. Marks and indications appear but no noise or echo.	1) IF amplifier 2) Signal cable between antenna and processor unit 3) Video amplifier board	1) Replace IF amplifier. 2) Check continuity and isolation of coaxial cable. **Note:** Disconnect the plug and lugs at both ends of coaxial cable before checking it by ohmmeter. 3) Check video coax line for secure connection. If connection is good, replace SPU board.

Problem	Possible cause	Remedy
Marks, indications and noise appear but no echo (Transmission leak representing own ship position is absent)	1) TX high voltage protection circuit has activated. 2) Magnetron 3) Modulator board 4) SPU board	1) Reset power to restore normal operation. 2) Check magnetron current. Replace magnetron. 3) Replace modulator board. 4) Replace SPU board.
Picture not updated or picture freeze-up	1) Bearing signal generator board (in antenna unit) 2) SPU board 3) Video freeze-up	1) Check the connection of signal cables. 2) Replace SPU board. 3) Turn off and on the radar.
Incorrect orientation of picture	1) SPU board 2) Gyro interface	1) The message "HDG SIG MISSING" appears when the heading pulse is not received during transmitting. 2) Replace the gyro interface.
Cannot operate radar from on-screen boxes	SPU Board	Replace SPU Board.
Radar is properly tuned but poor sensitivity	1) Deteriorated magnetron 2) Detuned MIC 3) Dirt on radiator face 4) Water ingress to the waveguide or other feeder line 5) Second trace echo rejection is ON	1) With the radar transmitting on 48 nm range, check magnetron current. If current is below normal, magnetron may be defective. Replace it. 2) Check MIC detecting current. If it is below normal value, MIC may have become detuned. MIC must be tuned. 3) Clean the radiator surface. 4) Remove water from the feeder line. 5) Disable the second-trace echo rejector referring to section 1.28.
Range changed but radar picture not changing	1) Defective range key 2) SPU board 3) Video freeze up	1) Adjust the range with the control unit, or the [RANGE] box several times. If unsuccessful, replacement of keypad may be required. 2) Replace SPU board. 3) Turn off and on radar.
Interference rejector is inoperative (interference rejection level not displayed)	SPU board	Replace SPU board.
Echo stretch is ineffective (neither ES1, ES2 nor ES3 is displayed)	SPU board	Replace SPU board.
Range rings are not displayed	1) Adjust the brilliance of range rings on the BRILL menu to see if intensity is increased 2) SPU board	1) Replace associated circuit board if unsuccessful. 2) Replace SPU board.
Poor discrimination in range	Sea clutter control not functioning properly	Improper setting of A/C SEA. If A/C SEA is seen only at very close range, suspect inaccurate frequency of reference oscillator.

Problem	Possible cause	Remedy
True motion orientation not working correctly	1) Incorrect menu setting. 2) Speed entry incorrect 3) TM display inaccurate	1) Referring to section 1.29, select TM orientation mode. 2) Enter correct own ship speed referring to section 1.12. 3) Make sure that speed and compass inputs are accurate.
Target not tracked correctly	Poor definition of targets in sea clutter	Adjust A/C SEA and A/C RAIN referring to section 1.19 and section 1.20.
Buttons on trackball module operated but no response	Trackball module	Replace trackball module.
Picture is not updated with each sweep.	1) Slots in rotating disc in antenna unit 2) Motor brushes	1) Remove foreign material (carbon, grease, etc.) from slots. 2) Replace motor brushes if they are shorter than 6 - 7 mm.

6.7   Diagnostics

A diagnostic test program is provided to test major circuit boards in the control unit, processor unit and card I/F unit. Note that the normal radar picture is lost during this test.

Proceed as follows to execute the diagnostic test:

1.   Open the [MAIN MENU].

2.   Select [INITIAL SETTING], then press the **left button**.

3.   Select [TEST], then press the **left button**.

4.   Select [SELF TEST], then press the **left button**.

5.   To stop the test at any time, press the   MENU   key.

In a few moments the results of the test are displayed and the buzzer sounds continuously. The ROMs and RAMs of the SPU, RFC, Control Unit, Trackball Control Unit and SD CARD readers are checked for proper operation. "OK" appears for normal operation. If "NG" (No Good) appears, corresponding components may be defective. Consult your dealer. In the middle of the display the rpm of the antenna unit and various voltages are displayed.

6.8 Fallback Arrangements

If the top priority sensor (for example GPS1) cannot be used, this equipment automatically uses the second priority sensor (for example, GPS2) when multiple sensors (GPS1 and GPS2 for example) are installed. When there is no fallback sensor available, each function is limited as follows:

Sensor	Function limitations
Heading sensor	• The [HDG] indication reads "***.*°" • The orientation mode is automatically set to [HEAD-UP]. • TT, AIS, radar map and echo averaging are disabled.
Speed sensor	When [LOG(WT)] is selected: • The sensor used is automatically switched in the following priority order: GPS(BT) > LOG(BT). • The SPD indication reads "***.* kn" when both GPS(BT) and LOG(BT) cannot be used. When [LOG(BT)] is selected: • The sensor used is automatically switched in the following priority order: GPS(BT) > LOG(WT). • The SPD indication reads "***.* kn" when both GPS(BT) and LOG(WT) cannot be used. When [GPS(BT)] is selected: • The sensor used is automatically switched in the following priority order: LOG(BT) > LOG(WT). • The SPD indication reads "***.* kn" when both LOG(BT) and LOG(WT) cannot be used.
COG/ SOG sensor	• When the GPS sensor cannot be used, the values of COG and SOG are calculated from HDG and LOG(BT). • Additionally when the heading sensor cannot be used, the values of SOG is calculated from LOG(BT). The COG indication reads "***.*°".
Position sensor	• The POSN indication reads all asterisks. • AIS and radar map are disabled.

APPENDIX 1 MENU TREE

MAIN MENU
- **1 ECHO**
- **2 MARK**
- **3 NAVTOOL**
- **4 ALERT**
- **5 TT•AIS**
- **6 FILES (*1)**
- **7 INFORMATION BOX**
- **8 NAV LINE•WPT**
- **9 INITIAL SETTING**

> Default settings are displayed in ***BOLD ITALIC***.

> ***1:** This menu item is available when a SD-Card is inserted.
> When there is no SD-Card inserted, this item is not selectable.

1 ECHO
- 1 BACK
- 2 2ND ECHO REJ (***OFF***, ON)
- 3 TUNE INITIALIZE
- 4 PERFORMANCE MON (***OFF***, ON)
- 5 PM ARC (2, 3, ***5***, 6)
- 6 SART (***OFF***, ON)
- 7 ECHO AREA(*2) (***CIRCLE***, WIDE, ALL, SIMPLE)   (*2): Available on non-IMO type only
- 8 WIPER (***OFF***, 1, 2)
- 9 ACE — — — ┬ 1 BACK
  - ├ 2 SIGNAL ENHANCEMENT (1, ***2***, 3)
  - └ 3 SUPPRESS SECTOR — ┬ 1 START (***000º*** to 359º)
    - └ 2 ANGLE (***000º*** to 180º)
- 0 CUSTOM SELECT ┬ 1 BACK
  - ├ 2 CUSTOM1 (***OFF***, ON)
  - ├ 3 CUSTOM2 (***OFF***, ON)
  - ├ 4 NEAR (***OFF***, ON)
  - ├ 5 FAR (***OFF***, ON)
  - ├ 6 HEAVY RAIN (***OFF***, ON)
  - └ 7 SHIP (***OFF***, ON)

2 MARK
- 1 BACK
- 2 OWN SHIP MARK (***MIN***, SCALED)
- 3 STERN MARK (***OFF***, ON)
- 4 DROP MARK (***OFF***, ON)
- 5 BARGE — — — ┬ 1 BACK
  - ├ 2 BARGE MARK (***OFF***, ON)
  - ├ 3 BARGE SIZE — — ┬ 1 LENGTH (***000 ft***, 000 to 999 ft)
  - └ 4 ARRANGEMENT   └ 2 WIDTH (***000 ft***, 000 to 999 ft)
- 6 INS MARK — — ┬ 1 BACK
  - ├ 2 USER CHART (***OFF***, ON)
  - ├ 3 CURVED EBL (***OFF***, ON)
  - ├ 4 CHART SYMBOL (***OFF, ON***)
  - ├ 5 NOTE BOOK (***OFF***, ON, DISPLAY)
  - ├ 6 ROUTE (***OFF***, CENT, ALL)
  - └ 7 PREDICTOR (***OFF***, ON)
- 7 RADAR MAP — ┬ 1 BACK
  - ├ 2 MARK (OFF, ***ON***)
  - ├ 3 BUOY (OFF, ***ON***)
  - ├ 4 DANGER (OFF, ***ON***)
  - ├ 5 COAST LINE (OFF, ***ON***)
  - ├ 6 CONTOUR LINE (OFF, ***ON***)
  - ├ 7 NAV LINE (OFF, ***ON***)
  - └ 8 PROHIBITED AREA (OFF, ***ON***)
- 8 OWN TRACK — ┬ 1 BACK
  - ├ 2 DISP OWN TRACK (***OFF***, ON)
  - ├ 3 SAVE INTERVAL (OFF, ***DRAW ONLY***, 15 s, 30 s, 1 min, 2 min, 3 min, 6 min, 15 min)
  - └ 4 OWN TRACK COLOR (RED, GRN, BLU, YEL, CYA, MAG, ***WHT***) (Non-IMO type only)

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APPENDIX 1 MENU TREE

Continued from previous page

```
├ 9 DATA DELETE   ┬ 1 BACK
│                 ├ 2 MARK ALL DELETE (YES, NO)
│                 ├ 3 WPT ALL DELETE (YES, NO)
│                 └ 4 OWN TRACK DELETE(*2) (2POINTS, AREA)        (*2) Non-IMO type only
└ 0 GRID (OFF, ON)


3 NAVTOOL
    ├ 1 BACK
    ├ 2 PI LINE  — — — — ┬ 1 BACK
    │                    ├ 2 PI LINE BEARING(*2) (REL, TRUE)      (*2) Non-IMO type only
    │                    ├ 3 SET ALL PI LINE (1, 2, 3, 6)
    │                    ├ 4 PI LINE MODE (PARALLEL, PERPENDIC)
    │                    ├ 5 RESET PI LINE
    │                    ├ 6 TRUNC RANGE 1 (OFF, ON; 0.000 NM to 24.000 NM)
    │                    └ 7 TRUNC RANGE 2 (OFF, ON; 0.000 NM to 24.000 NM)
    ├ 3 EBL•VRM•CURSOR(*1)  ┬ 1 BACK                              (*1) IMO type only
    │                       ├ 2 EBL OFFSET BASE (STAB GND, STAB HDG, STAB NORTH)
    │                       ├ 3 VRM TTG (OFF, 1, 2, 1 and 2)
    │                       ├ 4 VRM OFFSET (OFF, LINK EBL)
    │                       └ 5 EBL•CURSOR BEARING (REL, TRUE)
    ├ 4 EBL•VRM(*2)  — — ┬ 1 BACK                                 (*2) Non-IMO type only
    │                    ├ 2 EBL1 (REL, TRUE)
    │                    ├ 3 EBL2 (REL, TRUE)
    │                    ├ 4 VRM1 (REL, TRUE)
    │                    ├ 5 VRM2 (REL, TRUE)
    │                    ├ 6 EBL OFFSET BASE (STAB GND, STAB HDG, STAB NORTH)
    │                    ├ 7 VRM TTG (OFF, 1, 2, 1 and 2)
    │                    ├ 8 VRM OFFSET (OFF, LINK EBL)
    │                    └ 9 CURSOR  — — ┬ 1 BACK
    │                                    ├ 2 CURSOR BEARING (REL, TRUE)
    │                                    ├ 3 CURSOR RANGE (NM, KM, SM)
    │                                    └ 4 CURSOR SIZE (SMALL, LARGE)
    └ 5 RANGE RING (OFF, ON)


4 ALERT
    ├ 1 BACK
    ├ 2 ALERT SOUND LEVEL (OFF, LOW, MID, HIGH)
    ├ 3 ANCHOR WATCH (OFF, ON; 0.01 NM to 9.99 NM)
    ├ 4 ARRIVAL WPT (OFF, ON; 0 to 999 m)
    ├ 5 TARGET ALARM  — ┬ 1 BACK
    │                   ├ 2 ALR1 MODE (IN, OUT)]
    │                   ├ 3 ALR2 MODE (IN, OUT)
    │                   └ 4 LEVEL (1, 2, 3, 4)
    └ 6 PRIMARY ALERT  — ┬ 1 BACK
                         └ 2 TT NEW TARGET, TT LOST, TT TARGET FULL(AUTO), TT TARGET FULL(MAN),
                             AIS NEW TARGET, AIS LOST, XTE, ARRIVAL, DEPTH, ANCHOR WATCH

5 TT•AIS
    ├ 1 BACK
    ├ 2 ACQUISITION ZONE  — ┬ 1 BACK
    │                       ├ 2 AZ STAB (STAB HDG, STAB NORTH)
    │                       ├ 3 AZ POLYGON (OFF, STAB GND, STAB HDG, STAB NORTH)
    │                       └ 4 AZ/ALR SWITCH (ACQUISITION ZONE, TARGET ALARM ZONE)
    ├ 3 TT•AIS SYMBOL  — — ┬ 1 BACK
    │                      ├ 2 SYMBOL COLOR (GRN, BLU, CYA, MAG, WHT)
    │                      ├ 3 ATON SYMBOL COLOR (GRN, BLU, CYA, MAG, WHT)
    │                      ├ 4 AIS ROT TAG LIMIT (000.0º/min to 720.0º/min)
    │                      ├ 5 TT·AIS PAST POSN POINTS (5, 10)
    │                      └ 6 AIS SCALED SYMBOL (OFF, ON)
    └ 4 CPA AUTO ACTIVATE  ┬ 1 BACK
                           ├ 2 MAX RANGE (OFF, ON; 00 NM to 99 NM)
                           ├ 3 MIN SHIP SPEED (OFF, ON; 1.0 kn to 9.9 kn)
                           └ 4 EXCEPT CLASS B (OFF, ON)
```

Continued on next page

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Continued from previous page

```
├ 5 AIS DISP FILTER      ─     ┬ 1 BACK
│                             ├ 2 MAX RANGE (OFF, ON; 00 NM to 99 NM)
│                             ├ 3 MIN SHIP SPEED (OFF, ON; 1.0 kn to 9.9 kn)
│                             ├ 4 EXCEPT CLASS B (OFF, ON)
│                             ├ 5 EXCEPT BASE STATION (OFF, ON)
│                             ├ 6 EXCEPT PHYSICAL ATON (OFF, ON)
│                             └ 7 EXCEPT VIRTUAL ATON (OFF, ON)
├ 6 AIS LOST FILTER      ─     ┬ 1 BACK
│                             ├ 2 MAX RANGE (OFF, ON; 00 NM to 99 NM)
│                             ├ 3 MIN SHIP SPEED (OFF, ON; 1.0 kn to 9.9 kn)
│                             └ 4 EXCEPT CLASS B (OFF, ON)
├ 7 TT LOST FILTER       ─     ┬ 1 BACK
│                             └ 2 MAX RANGE (OFF, ON; 00 NM to 99 NM)
└ 8 ASSOCIATION      ─   ─     ┬ 1 BACK
                              ├ 2 ASSOCIATION TGT (OFF, AIS, TT)
                              ├ 3 GAP (0.000 NM to 0.050 NM)
                              ├ 4 RANGE (0.000 NM to 0.100 NM)
                              ├ 5 BEARING (00.0º to 9.9º)
                              ├ 6 SPEED (0.0 kn to 6.0 kn)
                              └ 7 COURSE (00.0º to 25.0º)
```

6 FILES*

```
├ 1 BACK
├ 2 DRIVE SELECT (SD-1, SD-2)
├ 3 SAVE DATA      ─   ─     ┬ 1 BACK
│                           ├ 2 MARK/LINE    ─   ─ ┐
│                           ├ 3 SETTING DATA ─ ┤
│                           ├ 4 INSTALL DATA ─ ┼    ┬ 1 BACK
│                           ├ 5 OWN TRACK    ─ ┤    └ 2 NAME (Software keyboard is displayed for input)
│                           ├ 6 ALERT HISTORY ─ ┤
│                           └ 7 LOG FILE     ─   ─ ┘
├ 4 REPLAY (READ) DATA      ┬ 1 BACK
│                           ├ 2 MARK/LINE    ┐          * (Disabled in TX mode, only available in
│                           ├ 3 SETTING DATA*┤                      STBY mode)
│                           ├ 4 INSTALL DATA*┼    ┬ 1 BACK
│                           └ 5 OWN TRACK    ┘    └ (List of available files is displayed)
├ 5 DELETE DATA      ─   ─   ┬ 1 BACK
│                           ├ 2 MARK/LINE    ─   ─ ┐
│                           ├ 3 SETTING DATA ─ ┤
│                           ├ 4 INSTALL DATA ─ ┼    ┬ 1 BACK
│                           ├ 5 OWN TRACK    ─ ┤    └ NAME (Software keyboard is displayed for input)
│                           ├ 6 ALERT HISTORY ─ ┤
│                           └ 7 LOG FILE     ─   ─ ┘
└ 6 REMOVE EXTERNAL MEDIA (SD-1, SD-2)
```

> ***:** This menu item is available when a SD-Card is inserted.
> When there is no SD-Card inserted, this item is not selectable.

7 INFORMATION BOX

```
├ 1 BACK
├ 2 NAVDATA (OFF, ON)
├ 3 SET NAVDATA      ─   ─     ┬ 1 BACK
│                             ├ 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 STAB (APPARENT, NORTH, THEORETICAL)
│                             ├ 8 TEMPERATURE (OFF, ON; ºC, ºF)
│                             └ 9 WPT DATA (OFF, REL, TRUE)
├ 4 ZOOM (OFF, 2TIMES, 3TIMES)
├ 5 ZOOM DISPLAY (STAB GND, STAB HDG, STAB NORTH, TT TRACK)
└ 6 TARGET DATA (1BOX, 2BOX, LARGE)
```

APPENDIX 1 MENU TREE

8 NAV LINE•WPT
├ 1 BACK
├ 2 NAV LINE DATA SOURCE (*OFF*, EXT DATA, WPT MARK)
├ 3 NAV LINE WIDTH (*0.00 NM* to 9.99 NM)
├ 4 WPT SET — ┬ 1 BACK
│ ├ 2 WPT NO. SELECT (01 to 98, default *BLANK*)
│ ├ 3 WPT NAME (*1) (*15 chars max*, default *BLANK*)   (*1) Software keyboard is
│ ├ 4 WPT L/L   displayed for input.
│ └ 5 CLEAR DATA (YES, *NO*)
├ 5 WPT LIST — ┬ 1 BACK
│ └ 0 NEXT
├ 6 DISP WPT NO. (*OFF*, ON)
└ 7 DISP WPT NAME (*OFF*, ON)

9 INITIAL SETTING
├ 1 BACK
├ 2 OPERATION ┬ 1 BACK
│ ├ 2 WHEEL DRIVE
│ ├ 3 KEY BEEP
│ ├ 4 OWN SHIP VECTOR
│ ├ 5 STERN UP RM
│ ├ 6 GUIDANCE (*2)   (*2): Available on non-IMO type only
│ ├ 7 SHUTTLE FERRY
│ └ 8 POINTING DEVICE
├ 3 FUNCTION KEY ┬ 1 BACK
│ ├ 2 F1 ┬ 1 BACK
│ │ ├ 2 ECHO — — ┬ 1 BACK
│ │ │ └ 2 CUSTOM-MENU, IR, ES, EAV, NOISE REJ, ANT
│ │ │   SELECT, PULSE LENGTH, AUTO-SEA, AUTO-RAIN, TUNE
│ │ │   SELECT, 2ND ECHO REJ, PM, SART, ECHO TRAIL, TRAIL
│ │ │   T/R, WIPER, ACE, ACE HIGH SENSITIVITY
│ │ │
│ │ ├ 3 STD KEY — ┬ 1 BACK
│ │ │ └ 2 ALERT ACK, STBY TX, EBL OFFSET, ORIENTATION-
│ │ │   MODE, CU-TM RESET, VECTOR TIME, VECTOR MODE,
│ │ │   TARGET LIST, BRILL, MARK CURSOR, MARK-OS, MENU,
│ │ │   RANGE UP, RANGE DOWN, ACQ, TARGET DATA, TARGET
│ │ │   CANCEL
│ │ ├ 4 TT•AIS — — ┬ 1 BACK
│ │ │ └ 2 TT-DISP, AIS-DISP, PAST POSN INTERVAL, REF MARK,
│ │ │   CPA LIMIT, CPA, TCPA, AZ1, AZ2, AIS SCALED SYMBOL
│ │ ├ 5 DELETE — ┬ 1 BACK
│ │ │   DATA └ 2 MARK DELETE, MARK ALL DELETE, OWN TRK DELETE,
│ │ │   OWN TRK ALL DELETE
│ │ └ 6 OPERATION ┬ 1 BACK
│ │   └ 2 ECHO AREA, ECHO COLOR, RING(ON/OFF), ZOOM,
│ │   MOB, ALARM1, ALARM2, TLL, MAP ALIGN
│ ├ 3 F2 (same as F1, default *AUTO-SEA*)
│ └ 4 F3 (same as F1, default *ACE HIGH SENSTIVITY*)
│
└ 4 TEST — — — — ┬ 1 BACK
  ├ 2 SELF TEST
  └ 3 TT TEST

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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)
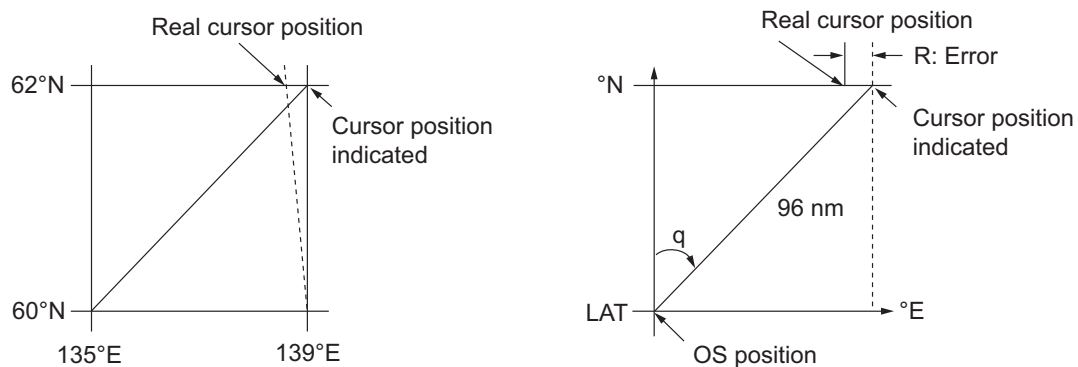
q / LAT	5°	10°	15°	20°	25°	30°	35°	40°	45°
75°	0.2256	0.4444	0.6496	0.8350	0.9950	1.1248	1.2202	1.2786	1.2980
70°	0.21980213	0.43290201	0.632803	0.8134132	0.96923215	1.09551918	1.1884382	1.24517456	1.26402037
65°	0.21229339	0.41810678	0.61115946	0.78556318	0.93600295	1.05790007	1.14755221	1.20224625	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 AND MEANINGS

This radar can output alerts in ALF format or ALR format. The output format is set at installation. A qualified FURUNO technician is required to change the output format.

Alerts are displayed at the bottom right of the screen with the title of the alert and the alert code.

The ALF format outputs a four or five-digit alert code and the ALR format outputs a three-digit code. The tables below show the alert ID, title, priority, category, meaning and the remedy for each alert.

For ALF format alerts, the alert identifier (the first three digits of the alert code), is displayed on the alert list and 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 full code for ALF formats alerts, with the instance separated by a comma.

ALF format alerts

Alert ID	Alert title	Priority & Category	Message and meaning
190,1	TARGET CAPACITY	Caution Cat: A	Message: "TT TARGET 95%(AUTO)" Meaning: Automatically acquired target capacity has reached 95%.
Remedy: Press the **ALERT ACK** key. Remove TT symbols manually.			
190,2	TARGET CAPACITY	Warning Cat: A	Message: "TT TARGET FULL(AUTO)" Meaning: Automatically acquired target capacity has reached 100%.
Remedy: Press the **ALERT ACK** key. Remove TT symbols manually.			
190,3	TARGET CAPACITY	Caution Cat: A	Message: "TT TARGET 95%(MAN)" Meaning: Manually acquired target capacity has reached 95%.
Remedy: Press the **ALERT ACK** key. Remove TT symbols manually.			
190,4	TARGET CAPACITY	Warning Cat: A	Message: "TT TARGET FULL(MAN)" Meaning: Manually acquired target capacity has reached 100%.
Remedy: Press the **ALERT ACK** key. Remove TT symbols manually.			
190,5	TARGET CAPACITY	Caution Cat: A	Message: "AIS DISPLAY 95%" Meaning: AIS display capacity has reached 95% (285 targets).
Remedy: Press the **ALERT ACK** key. Adjust [AIS DISP FILTER] settings to decrease the number of targets displayed.			
190,6	TARGET CAPACITY	Warning Cat: A	Message: "AIS DISPLAY FULL" Meaning: AIS display capacity has reached 100% (300 targets).
Remedy: Press the **ALERT ACK** key. Adjust [AIS DISP FILTER] settings to decrease the number of targets displayed.			
190,8	TARGET CAPACITY	Caution Cat: A	Message: "AIS CAPACITY FULL" Meaning: AIS capacity has reached 100% (1000 targets).
Remedy: Press the **ALERT ACK** key. Adjust [AIS DISP FILTER] settings to decrease the number of targets displayed.			

Alert ID	Alert title	Priority & Category	Message and meaning
190,9	TARGET CAPACITY	Caution Cat: A	Message: "AIS ACTIVATE 95%" Meaning: Active AIS target capacity has reached 95% (38 targets).
Remedy: Press the **ALERT ACK** key. Adjust [AIS DISP FILTER] settings to decrease the number of targets displayed.			
190,10	TARGET CAPACITY	Warning Cat: A	Message: "AIS ACTIVATE FULL" Meaning: Active AIS target capacity has reached 100% (40 targets).
Remedy: Press the **ALERT ACK** key. Adjust [AIS DISP FILTER] settings to decrease the number of targets displayed.			
191,1	CPA/TCPA	Alarm Cat: A	Message: "TT COLLISION" Meaning: TT is within CPA/TCPA threshold, danger of collision.
Remedy: Press the **ALERT ACK** key. Take evasive action if necessary. Adjust CPA/TCPA settings.			
191,2	CPA/TCPA	Alarm Cat: A	Message: "AIS COLLISION" Meaning: AIS target is within CPA/TCPA threshold, danger of collision.
Remedy: Press the **ALERT ACK** key. Take evasive action if necessary. Adjust CPA/TCPA settings.			
192,1	NEW TARGET	Warning Cat: A	Message: "TT NEW TARGET" Meaning: A new TT target has entered the Acquisition Zone.
Remedy: Press the **ALERT ACK** key. Confirm location of new target.			
192,2	NEW TARGET	Warning Cat: A	Message: "AIS NEW TARGET" Meaning: A new AIS target has entered the Acquisition Zone.
Remedy: Press the **ALERT ACK** key. Confirm location of new target.			
193,1	LOST TARGET	Warning Cat: A	Message: "TT LOST" Meaning: TT target is lost.
Remedy: Press the **ALERT ACK** key. Lost target indication (blinking in red) is removed.			
193,2	LOST TARGET	Warning Cat: A	Message: "REF TARGET LOST" Meaning: REF targets is lost.
Remedy: Press the **ALERT ACK** key. Lost target indication (blinking in red) is removed.			
193,3	LOST TARGET	Warning Cat: A	Message: "AIS LOST" Meaning: AIS target is lost.
Remedy: Press the **ALERT ACK** key. Lost target indication (blinking in red) is removed.			
194,1	SYSTEM ERROR	Warning Cat: B	Message: "HEADLINE" Meaning: Heading signal interrupted/lost.
Remedy: Press the **ALERT ACK** key. Restore signal or rectify reason for signal loss.			
194,2	SYSTEM ERROR	Warning Cat: B	Message: "AZIMUTH" Meaning: Azimuth signal is interrupted/lost.
Remedy: Press the **ALERT ACK** key. Restore signal or rectify reason for signal loss.			
194,3	SYSTEM ERROR	Warning Cat: B	Message: "TRIGGER" Meaning: Output trigger interrupted/lost
Remedy: Press the **ALERT ACK** key. Restore signal or rectify reason for signal loss.			
194,4	SYSTEM ERROR	Warning Cat: B	Message: "VIDEO" Meaning: Video signal interrupted/lost.
Remedy: Press the **ALERT ACK** key. Restore signal or rectify reason for signal loss.			
194,5	SYSTEM ERROR	Warning Cat: B	Message: "KEY" Meaning: Control unit signal interrupted/lost.
Remedy: Press the **ALERT ACK** key. Restore signal or rectify reason for signal loss.			

Alert ID	Alert title	Priority & Category	Message and meaning
194,6	SYSTEM ERROR	Warning Cat: B	Message: "PM COMM ERROR" Meaning: PM communication error.
Remedy: Press the **ALERT ACK** key. Restore signal or rectify reason for signal loss.			
194,7	SYSTEM ERROR	Warning Cat: B	Message: "TUNE ERROR" Meaning: TUNE error due to faulty settings or malfunction.
Remedy: Press the **ALERT ACK** key. Restore signal or rectify reason for signal loss.			
485,1	DEPTH	Warning Cat: B	Message: "DEPTH" Meaning: Depth is below set threshold.
Remedy: Press the **ALERT ACK** key. Confirm depth. Adjust [DEPTH] settings as required.			
495,1	ANCHOR WATCH	Warning Cat: B	Message: "ANCHOR WATCH" Meaning: Ship position outside set anchor watch zone.
Remedy: Press the **ALERT ACK** key. Confirm Own Ship location and adjust as necessary.			
540,1	AIS MSG	Caution Cat: B	Message: "TRANSMIT ERROR" Meaning: Unable to transmit AIS binary message.
Remedy: Press the **ALERT ACK** key. Check power to AIS unit.			
540,2	AIS MSG	Caution Cat: B	Message: "AIS TRANSMITTING" Meaning: Transmitting AIS message.
Remedy: Press the **ALERT ACK** key. No other action required.			
560,1	ASSOCIATION	Caution Cat: B	Message: "ASSOCIATION" Meaning: One or more sets of associated targets is displayed.
Remedy: Press the **ALERT ACK** key. Set [ASSOCIATION] to [OFF].			
601,1	SENSOR ERROR	Warning Cat: B	Message: "GYRO" Meaning: No heading information received from gyrocompass for five seconds.
Remedy: Press the **ALERT ACK** key. Match the on-screen indication with the actual gyrocompass. The indication "HEADING SET" appears. Press the **ALERT ACK** key to erase the indication.			
601,2	SENSOR ERROR	Warning/ Caution Cat: B	Message: "LOG(WT)" Meaning: No speed data received for five seconds when [LOG(WT)] is set as speed reference.
Remedy: Press the **ALERT ACK** key. Check SDME sensor. Use a different sensor if necessary.			
601,3	SENSOR ERROR	Warning/ Caution Cat: B	Message: "LOG(BT)" Meaning: No speed data received for thirty seconds when [LOG(BT)] is set as speed reference.
Remedy: Press the **ALERT ACK** key. Check SDME sensor. Use a different sensor if necessary.			
601,4	SENSOR ERROR	Warning Cat: B	Message: "EPFS" Meaning: EPFS Error. No speed or position data received from EPFS device for thirty seconds.
Remedy: Press the **ALERT 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.			
601,5	SENSOR ERROR	Warning Cat: B	Message: "DATUM" Meaning: DTM sentence no received for thirty seconds or erroneous data received.
Remedy: Press the **ALERT ACK** key. Use the WGS-84 datum.			
601,6	SENSOR ERROR	Warning Cat: B	Message: "UTC" Meaning: UTC error. No date or time data received for thirty seconds. No ZDA sentence input.
Remedy: Press the **ALERT ACK** key. Restore the signal to remove this indication.			