

2. DESCRIPTION OF RADAR

2.1 General

2.1.1 Minimum and maximum ranges

Minimum range

The minimum range is defined by the shortest distance at which, using a scale of 0.0625 or 0.125 nm, a target that has an echoing area of 10 m² is shown separate from the point that shows the antenna position.

The minimum range depends on the pulselength, antenna height, and signal processing (like main bang suppression and digital quantization). Use a shorter range scale as far as it gives favorable definition or clarity of picture.

Maximum range

The maximum detection range, R_{max} , changes depending on the height of the antenna, the height of the target above the sea, the size, shape and material of the target, and the atmospheric conditions.

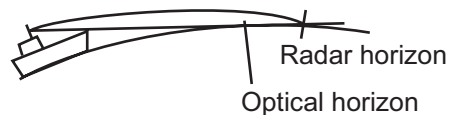
Under normal atmospheric conditions, the maximum range is equal or a little shorter than the optical horizon. The radar horizon is longer than the optical one by approximately 6%, because of the diffraction property of the radar signal. The R_{max} is shown in the following formula.

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

where R_{max} : radar horizon (nautical miles)

h_1 : antenna height (m)

h_2 : target height (m)



If the height of the antenna is 9 m and the height of the target is 16 m, the maximum radar range is;

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

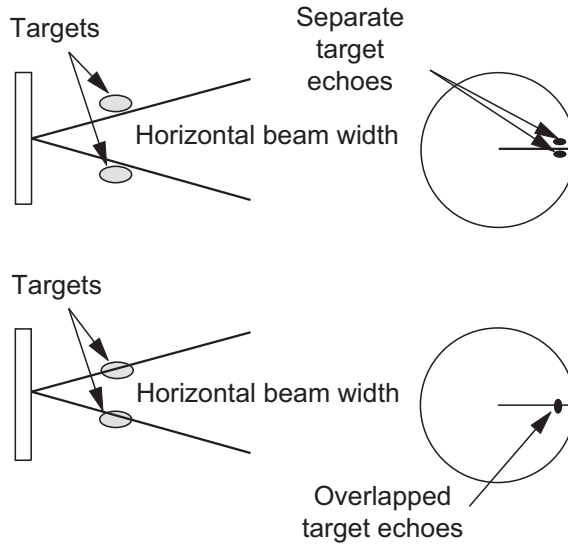
Note: The detection range is reduced by any precipitation (which absorbs the radar signal).

2.1.2 Radar resolution

The bearing resolution and range resolution are important in radar resolution.

Bearing resolution

The bearing resolution is the ability of the radar to display the echoes received from two targets at the same range as the separate echoes. The bearing resolution is proportional to the antenna length and the wavelength.

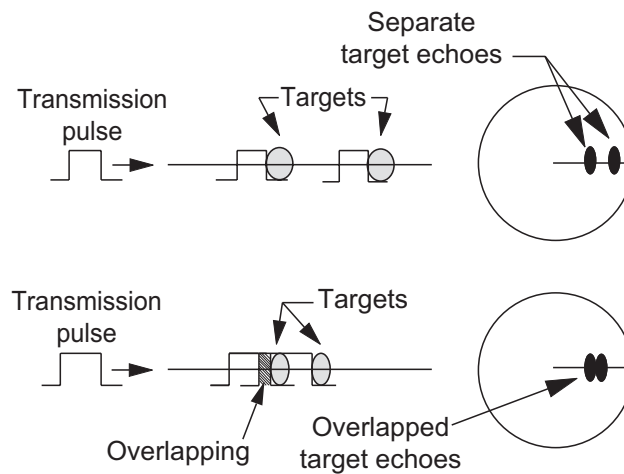


Bearing resolution

Range resolution

The range resolution is the ability to display the echoes received from two targets on the same bearing as separate echoes. The range resolution is calculated by only pulselength.

The test targets used to calculate the range and bearing resolution are radar reflectors that have an echoing area of 10 m².



Range resolution

2.1.3 Bearing accuracy

One of the most important features of the radar is how accurately the bearing of a target can be measured. The accuracy of bearing measurement depends on the narrowness of the radar beam. The bearing taken is relative to the heading of the ship. Correct adjustment of the heading line at installation is important to get accurate bearings. To minimize the error when you measure the bearing of a target, put the target echo at the extreme position on the screen by selecting a suitable range.

2.1.4 Range measurement

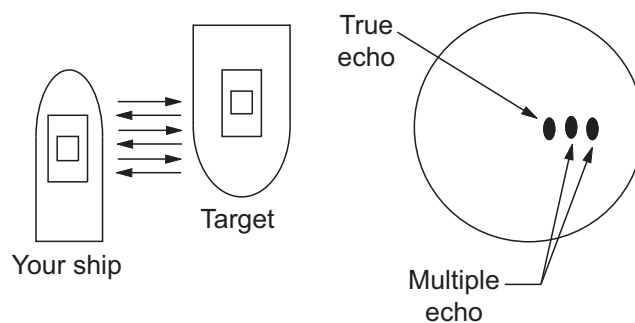
Measurement of the range to a target is important function of the radar. There are three methods to measure range: the fixed range rings, the Variable Range Marker (**VRM**), and the cursor (if the cursor is set to measure range and bearing). The fixed range rings appear on the screen with a given interval and provide a rough estimate of the range to a target. The diameter of **VRM** is increased or decreased so that the marker touches the inner edge of the target (see paragraph 1.15.2). The **VRM** is a more accurate range measurement than the fixed range rings. For cursor, see section 1.13.

2.2 False Echoes

The echo signals can appear on the screen at positions where there is no target or disappear when there are targets. These false echoes are shown below.

2.2.1 Multiple echoes

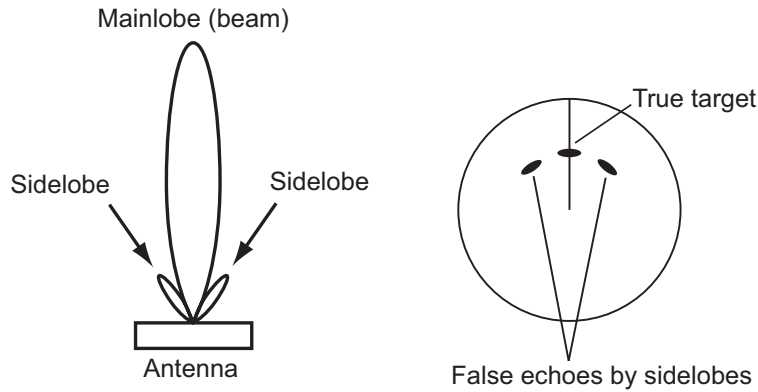
Multiple echoes occur when a transmitted pulse returns from a solid object like a large ship, bridge, or breakwater. A second, a third or more echoes can be seen on the display at double, triple or other multiples of the actual range of the target as shown below. You can reduce and remove the multiple reflection echoes with the **A/C SEA** control.



Multiple echoes

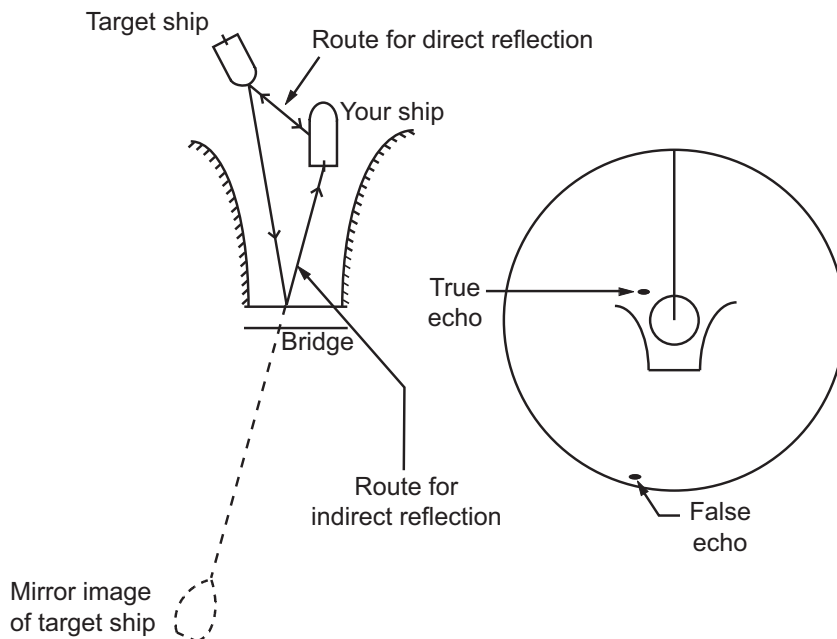
2.2.2 Sidelobe echoes

When the radar pulse is transmitted, some radiation escapes on each side of the beam, called "sidelobes". If a target is where a target can be detected by the sidelobes as well as the mainlobe, the side echoes can be shown on both sides of the true echo at the same range. Sidelobes show normally only on short ranges and from strong targets. You can reduce the sidelobes with the **A/C SEA** control.



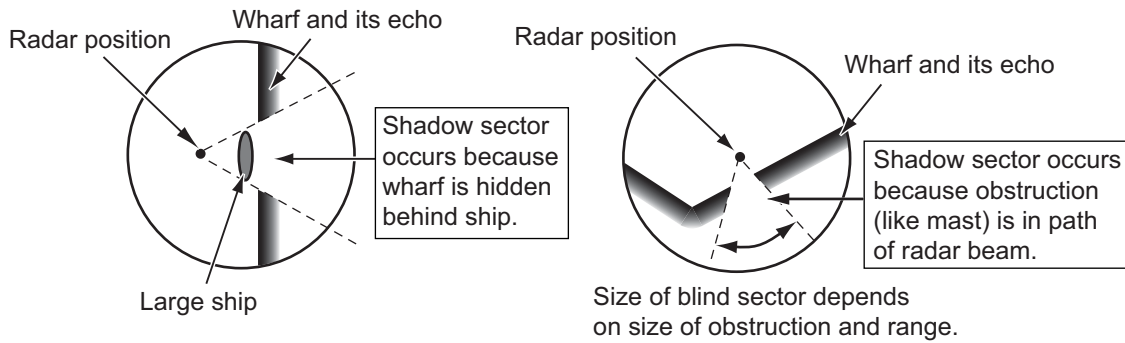
2.2.3 Virtual image

A large target close your ship can appear at two positions on the screen. One of them is the true echo reflected by the target. The other is a false echo which is caused by the mirror effect of a large object on or close your ship as shown in the following figure. If your ship comes near a large metal bridge, for example, a false echo can temporarily appear on the screen.



2.2.4 Shadow sector

Funnels, stacks, masts, or derricks near the antenna interrupt the radar beam, and a non-detecting sector can occur. Radar can not detect targets within this sector.

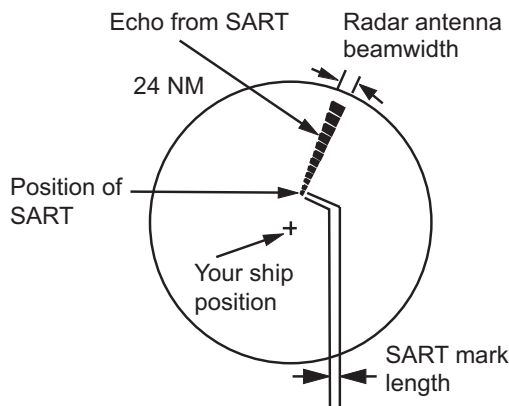


2.3 SART (Search and Rescue Transponder)

2.3.1 SART description

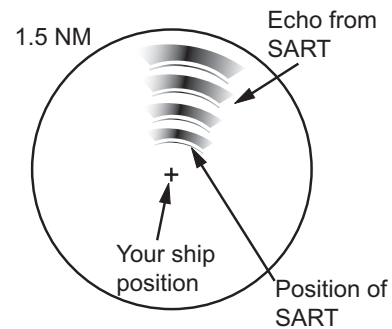
A Search and Rescue Transponder (SART) responds to any X-band (3 cm) radar within a range of approximately 8 nm. Each radar pulse received causes the SART to transmit a response which is swept continuously across the complete radar frequency band.

Screen A: When SART is distant



Screen B: When SART is close

Lines of 12 dots are displayed in concentric arcs.



2.3.2 General remarks on receiving SART

SART range errors

When the SART is at a range greater than approximately 1 nm, the first dot is displayed at 0.64 nm past the true position of the SART. When the range closes so that the fast-sweep responses are also seen, the first range echoes are displayed at 150 m past the true position.

Range scale

When you find the SART position, do as follows:

1. Use the **RANGE** key to set the range scale to 6 nm or 12 nm.
2. Turn off [A/C Auto].
3. Turn off [Int Rejector].

SART display

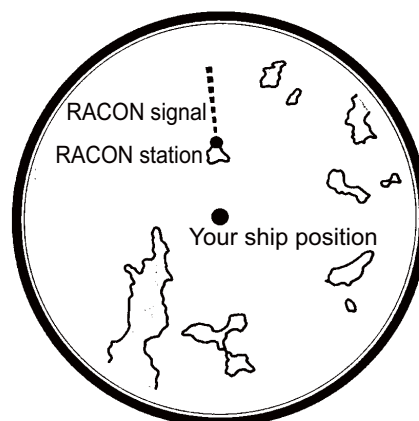
To display only the SART echo clearly on the radar screen, reduce the tuning on manual mode. The normal radar echoes get weak, but the SART echoes remain. Your ship comes near the SART, the arc for the SART display becomes larger. Most of the radar screen becomes fuzzy. Adjust the **A/C SEA** and **GAIN** controls to display the necessary screen.

2.4 RACON

The RACON is a RADar beaCON which sends radar-receivable signals in the radar frequency spectrum (X- or S-band). There are several signal formats; in general, the RACON signal appears on the radar screen as an echo in the shape of a rectangle originating at a point just past the position of the radar beacon. It has a Morse coded pattern. Note that the position on the radar display is not accurate.



Echoes on the radar screen





Echo description

3. ARPA OPERATION

The Automatic Radar Plotter ARP-11 (option) manually or automatically acquires and tracks ten targets. When a target is acquired automatically or manually, a target is automatically tracked within 0.1 to 16 nm.

3.1 Precautions for Use

 CAUTION
<p>Do not depend on one navigation device for the navigation of the ship. The navigator must check all aids available to confirm position. Electronic aids are not a replacement for basic navigation principles and common sense.</p> <ul style="list-style-type: none">· The ARPA automatically tracks an automatically or manually acquired radar target and calculates its course and speed, indicating them by a vector. Since the data from the auto plotter depend on the selected radar targets, the radar must be optimally tuned for use with the auto plotter, to ensure required targets will not be lost or unnecessary targets like sea returns and noise will not be acquired and tracked.· A target is not always a landmass, reef, ship, but can be returns from the sea surface and clutter. As the level of clutter changes with the environment, the operator must correctly adjust the A/C SEA, A/C RAIN and GAIN controls so that the target echoes do not disappear from the radar screen.

 CAUTION
<p>The plotting accuracy and response of this ARPA meets IMO standards. The tracking accuracy is affected by the following:</p> <ul style="list-style-type: none">· The tracking accuracy is affected by course change. One to two minutes is required to restore vectors to full accuracy after a sudden course change. (The actual amount depends on gyrocompass specifications.)· The amount of tracking delay is inversely proportional to the relative speed of the target. Delay is on the order of 15-30 seconds for high relative speed; 30-60 seconds for low relative speed.
<p>The display accuracy is affected by the following:</p> <ul style="list-style-type: none">· Echo intensity· Pulse width of radar transmission· Radar bearing error· Gyrocompass error· Course change (your ship or target)

3.2 Controls for Use with ARPA

ENTER: Acquire the cursor-selected target. Display data for tracked target (in the data box at the bottom of the screen).

CANCEL/HL OFF: Remove data of cursor-selected tracked target from the data box. Stop tracking the cursor-selected target (when its data is not displayed in the data box).

MENU: Access the [Target] and [ARPA] menus for ARPA operations.

CursorPad: Select a target to acquire (or cancel the tracking). Select a target to show (or remove) target data.

3.3 ARPA Display On/Off

You can turn the ARPA display on or off. The system continuously tracks ARPA targets regardless of this setting.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [ARPA] and press the **ENTER** key.
3. Use ▲ or ▼ to select [Display] and press the **ENTER** key.



ARPA Display options

4. Use ▲ or ▼ to select [Off] or [On] then press the **ENTER** key.
5. Press the **MENU** key to close the menu.

3.4 How to Acquire and Track the Targets

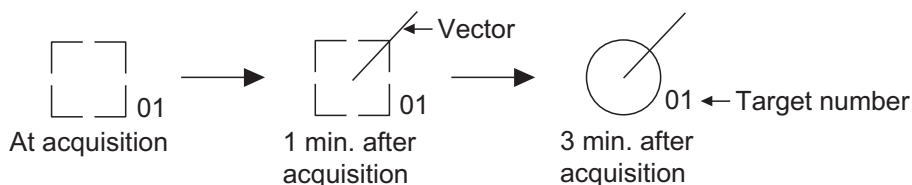
Ten targets are acquired and tracked manually or automatically.

3.4.1 Manual acquisition

You can acquire a maximum of ten ARPA targets. When the automatic acquisition ([Auto Acquisition] on the [ARPA] menu) is set to on, you can manually acquire a maximum of five targets.

1. Use the **CursorPad** to put the cursor on the target to acquire.
2. Press the **ENTER** key.

The ARPA target symbol changes over time as shown below. A vector which indicates the motion direction of the target appears approximately one minute after the acquisition.



ARPA target symbol

Target number

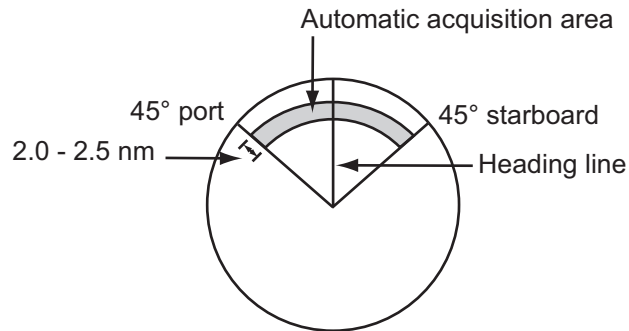
[River] and [Sea] (Non-IEC system): An acquired target gets the youngest unused number. When a target is lost and disappears from the number list, the next acquired target takes the number of that lost target (ie: In a five-target list, if the target 2 is lost, the next acquired target takes the number of target 2).

[IEC] and [Russian-River] (IEC system): An acquired target gets the youngest unused number. When a target is lost and disappears from the number list, the next acquired target takes the next sequential number until reaching a maximum 10. If the target number reaches a maximum 10, the next acquired target takes the number of a previously lost target.

3.4.2 Automatic acquisition

When you set an automatic-acquisition area, the ARPA can acquire a maximum of five targets automatically.

The automatic acquisition area is 2.0 to 2.5 nm in range and $\pm 45^\circ$ on either side of the heading line in bearing. When you change the automatic acquisition to the manual acquisition, targets tracked in automatic acquisition are continuously tracked.



Automatic acquisition area

1. Press the **MENU** key to open the menu.
2. Use **▲** or **▼** to select [ARPA] and press the **ENTER** key.
3. Use **▲** or **▼** to select [Auto Acquisition] and press the **ENTER** key.



Auto Acquisition options

4. Use **▲** or **▼** to select [On] and press the **ENTER** key.
5. Press the **MENU** key to close the menu.

3.5 How to Stop the Tracking of ARPA Target

When ten targets have been acquired, there is no more acquisition, unless targets are cancelled. If you acquire additional targets, you must cancel one or more separate targets, or all targets. Use one of the following procedures.

3.5.1 How to stop the tracking of selected targets

1. Use the **Cursorpad** to put the cursor on the target to cancel the tracking.
2. Press the **CANCEL/HL OFF** key to cancel the tracking and erase the ARPA symbol. The unit beeps twice and the symbol is erased from the screen.

3.5.2 How to stop the tracking of all targets

1. Press the **MENU** key to open the menu.
2. Use the CursorPad to put the cursor on the target to cancel the tracking.
3. Use **▲** or **▼** to select [ARPA] and press the **ENTER** key.

3. ARPA OPERATION

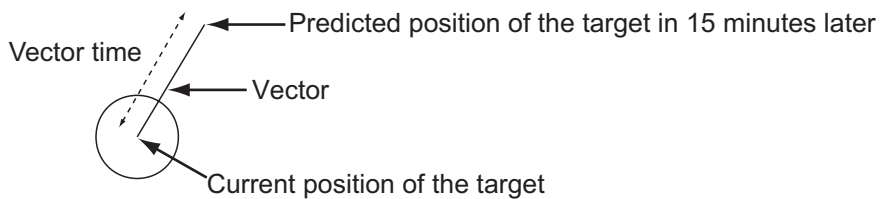
4. Use ▲ or ▼ to select [All Cancel] and press the **ENTER** key.
5. Use ▲ to select [Yes] and press the **ENTER** key. All symbols are erased from the screen and the long beep sounds.
6. Press the **MENU** key to close the menu.



3.6 Vector Attributes

3.6.1 What is a vector?

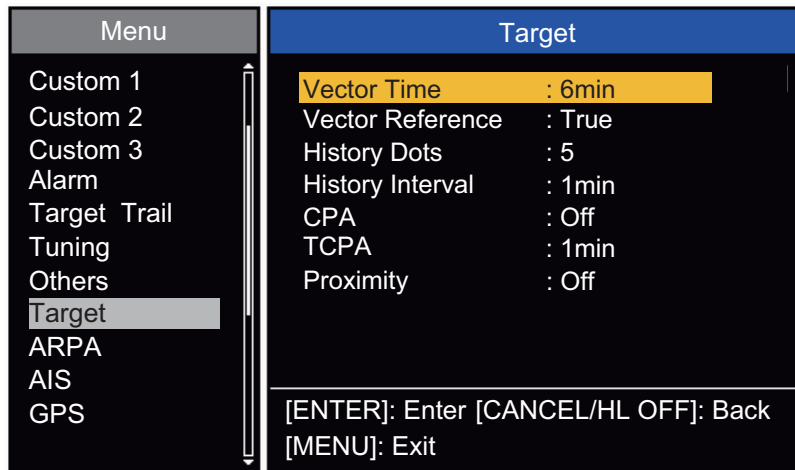
A vector is a line extending from a tracked target. A vector shows speed and course of the target. The top of a vector shows estimated position of the target after the selected vector time elapses. If you increase the vector length (time), you can evaluate the risk of collision with any target.



When vector time is 15 minutes

3.6.2 Vector time and vector reference

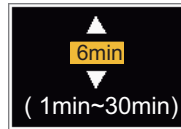
1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [Target] and press the **ENTER** key.



Adjusting a vector time to be displayed

Target menu

3. Use ▲ or ▼ to select [Vector Time] and press the **ENTER** key.



Vector Time setting window

4. Use ▲ or ▼ to select time and press the **ENTER** key.
 5. Use ▲ or ▼ to select [Vector Reference] and press the **ENTER** key.



Vector Reference options

6. Use ▲ or ▼ to select [Relative] or [True] then press the **ENTER** key. This function is not activate for [IEC] or [Russian-River] purpose. The mode is set to [True].
[Relative]: Other ships' vectors are displayed relative to your ship. This mode helps find the targets on a collision course. If a ship is on a collision course with your ship, the vector of a ship points toward your ship position.
[True]: Your ship's and other ships' vectors are displayed at their true motions. This mode helps see the differences between moving and stationary targets.
 7. Press the **MENU** key to close the menu.

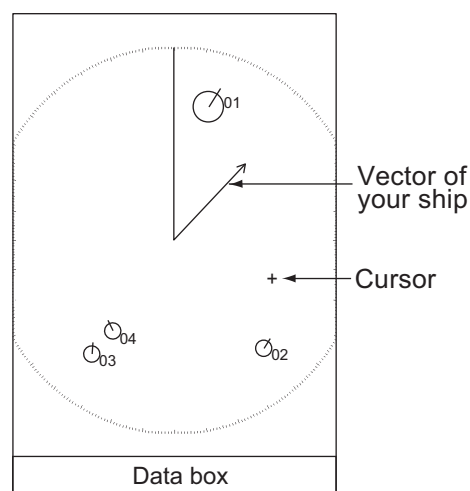
Note: The functions of the [Target] menu are shared by ARPA and AIS.

3.6.3 Vector of your ship

The vector of your ship is shown as an arrow from your ship position. The vector of your ship is shown on the following conditions:

- Connect ARP-11 (option)
- Select [True] on the menu item [Vector Reference] on the [Target] menu
- Independent of on/off on the menu item [Display] on the [ARPA] menu

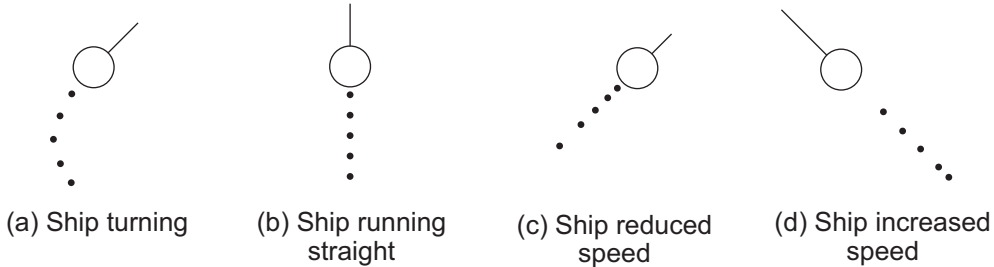
Note: The vector of your ship is shown in the same color as the ARPA symbol color (see section 3.12).



Example of vector display

3.7 History Display (target past position)

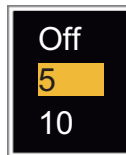
This radar can display time-spaced dots (maximum ten dots) that mark the past positions of any tracked ARPA target. You can evaluate actions of a target by the spaces in between the dots. Below are examples of dot spacing and target movement.



Target movement and history display

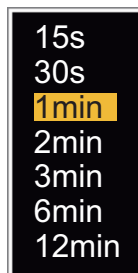
You can select the number of history dots to display and the time interval to display the history dots.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [Target] and press the **ENTER** key.
3. Use ▲ or ▼ to select [History Dots] and press the **ENTER** key.



History Dots options

4. Use ▲ or ▼ to select number of history dots to display (5 or 10) or select [Off] to turn off the history display.
5. Press the **ENTER** key.
6. Use ▲ or ▼ to select [History Interval] and press the **ENTER** key.



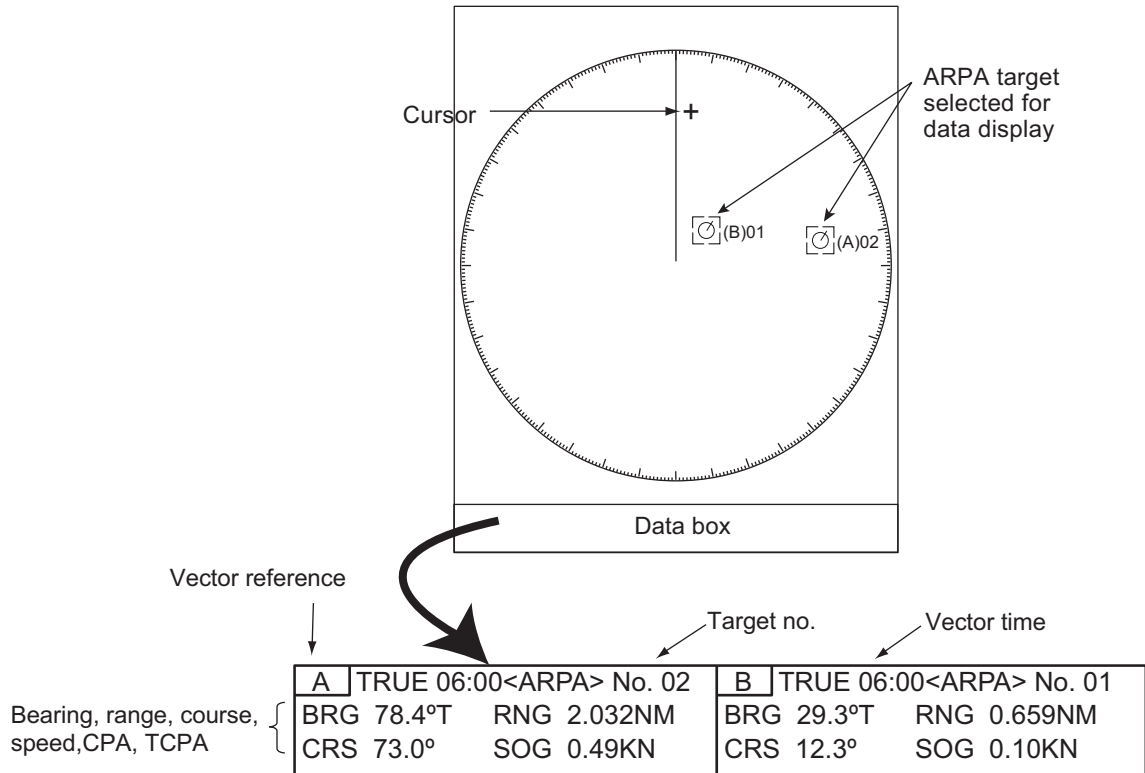
History Interval options

7. Use ▲ or ▼ to select the time interval and press the **ENTER** key.
8. Press the **MENU** key to close the menu.

3.8 ARPA Target Data

You can show the data for a tracked ARPA target in the data box at the bottom of the screen. To display ARPA target data, the menu item [Display] on the [ARPA] menu must be set for [On] and the menu item [Data Box] on the [Display] menu must be set for [Target] or [All].

1. Use the CursorPad to put the cursor on an ARPA target.
2. Press the **ENTER** key to show the data of the target.



ARPA target data

The symbol for the selected ARPA target is enlarged double to identify it from other symbols.

To remove the data of a target from a data box, put the cursor on its target symbol and press the **CANCEL/HL OFF** key.

3.9 CPA/TCPA Alarm

Set [CPA] (Closest Point of Approach) alarm range and [TCPA] (predicted Time to CPA) alarm time to alert you to the targets that can be on a collision course. When [CPA] and [TCPA] of any ARPA target become less than the preset [CPA] and [TCPA] alarm settings, the audio alarm sounds. The alarm message "COLLISION" appears. The target symbol changes to a dangerous target symbol (triangle) and its vector flashes. You can stop the audio alarm with any key. The flashing of the triangle stops when the tracked CPA and TCPA of an ARPA target is not in the [CPA] and [TCPA] alarm setting. The ARPA continuously monitors [CPA] and [TCPA] of all tracked ARPA targets.



Dangerous target symbol

This feature helps identify the targets that can be on a collision course. Correctly adjust **GAIN**, **A/C SEA**, **A/C RAIN** and other radar controls.

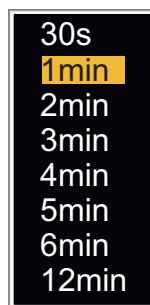
CAUTION

Do not depend on the CPA/TCPA alarm as the only method to detect the risk of collision. The navigator is not released of the responsibility to keep visual caution for collision situations, whether or not the radar or other plotting aid is in use.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [Target] and press the **ENTER** key.
3. Use ▲ or ▼ to select [CPA] and press the **ENTER** key.
4. Use ▲ or ▼ to select [CPA] distance and press the **ENTER** key.



CPA distance settings



TCPA settings

5. Use ▲ or ▼ to select [TCPA] and press the **ENTER** key.
6. Use ▲ or ▼ to select TCPA and press the **ENTER** key.
7. Press the **MENU** key to close the menu.

3.10 Proximity Alarm

The proximity alarm alerts you when an ARPA target is within the range you set. The audio alarm sounds and the alarm message "PROXIMITY" appears. The target symbol changes to a dangerous target symbol (triangle, see section 3.9) and flashes with its vector. Press any key to stop the audio alarm. The flashing continues until the target is not within the range set, the alarm range is changed to exclude the target, or the proximity alarm is deactivated.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [Target] and press the **ENTER** key.
3. Use ▲ or ▼ to select [Proximity] and press the **ENTER** key.



Proximity settings

4. Use ▲ or ▼ to select the range and press the **ENTER** key.
5. Press the **MENU** key to close the menu.

3.11 Lost Target

When the system detects a lost target, the audio alarm sounds and the alarm message "LOST" appears. The target symbol becomes a flashing square like the illustration to the right. When the system detects the target again, the target symbol becomes a normal symbol.

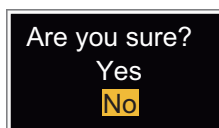


Lost target symbol

To erase a lost target symbol, put the cursor on the symbol and press the **CANCEL/HL OFF** key. If you leave a lost target symbol flashing, the symbol disappears after one minute.

You can remove all lost ARPA targets from the screen as follows:

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [ARPA] and press the **ENTER** key.
3. Use ▲ or ▼ to select [ACK Lost Targets] and press the **ENTER** key.



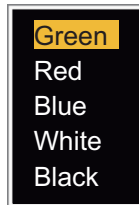
ACK Lost Targets options

4. Use ▲ to select [Yes] and press the **ENTER** key. All lost targets symbols are erased from the screen and the long beep sounds.
5. Press the **MENU** key to close the menu.

3.12 Symbol Color

You can select the ARPA symbol color from Green, Red, Blue, White or Black.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [ARPA] and press the **ENTER** key.
3. Use ▲ or ▼ to select [Color] and press the **ENTER** key.



Color options

4. Use ▲ or ▼ to select the color and press the **ENTER** key.
5. Press the **MENU** key to close the menu.

Note: Symbols can not be shown in the same color as the background color.

4. AIS OPERATION

Connected to the FURUNO AIS Transponders FA-150, FA-100, FA-50 or the AIS Receiver FA-30, the FR-8045/FR-8065/FR-8125/FR-8255 series can show the name, position and other navigation data of the nearest 100 AIS transponder-equipped ships.

This radar accepts heading and position data fixed by WGS-84 geodetic datum. Set the datum to WGS-84 on the GPS navigator connected to this radar. If this radar is connected with the FURUNO GPS Navigator GP-320B, see section 5.2 for the procedure.

4.1 Controls for Use with AIS

ENTER: Activate the cursor-selected target. Display data for the selected active target (in the data box at the bottom of the screen).

CANCEL/HL OFF: Remove data of cursor-selected AIS target from the data box. Sleep the cursor-selected target (when its data is not displayed in the data box).

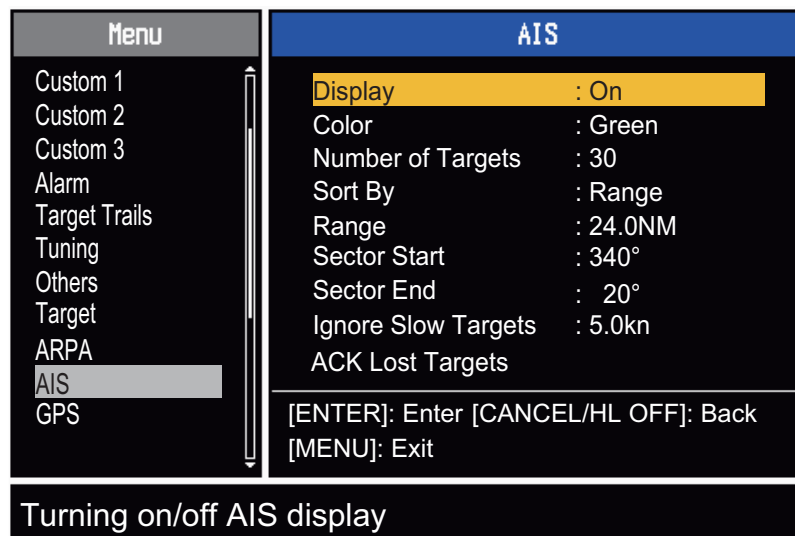
MENU: Access the [Target] and [AIS] menus for AIS operations.

CursorPad: Select a target to activate (or sleep). Select a target to show (or remove) target data.

4.2 AIS Display On/Off

You can turn the AIS display on or off. The system continues processing AIS targets regardless of on/off for AIS display when the AIS transponder is turned on.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [AIS] and press the **ENTER** key.



AIS menu

- Use ▲ or ▼ to select [Display] and press the **ENTER** key.



AIS-Display options

- Use ▲ or ▼ to select [Off] or [On] then press the **ENTER** key.
- Press the **MENU** key to close the menu.

4.3 AIS Symbols

When the AIS is turned on, AIS targets are displayed with AIS symbol as shown below.

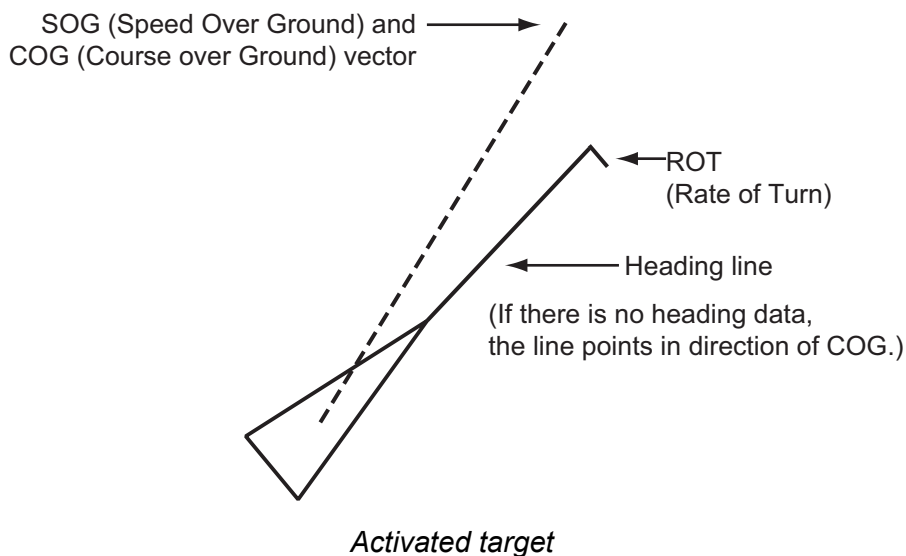


AIS symbols

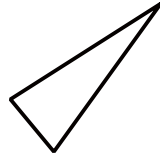
Note: When the heading is changed on the head up mode, the AIS symbols are erased, after the screen is changed, for a short time.

4.4 Activating, Sleeping Targets

When you change a sleeping target to an activated target, a vector shows the course and speed of that target. You can easily judge the target movement by the vector.



When there are many activated targets on the screen, you can not easily identify the activated targets from the radar images or ARPA targets. You can sleep an activated target for easy view of radar images.



Sleeping target

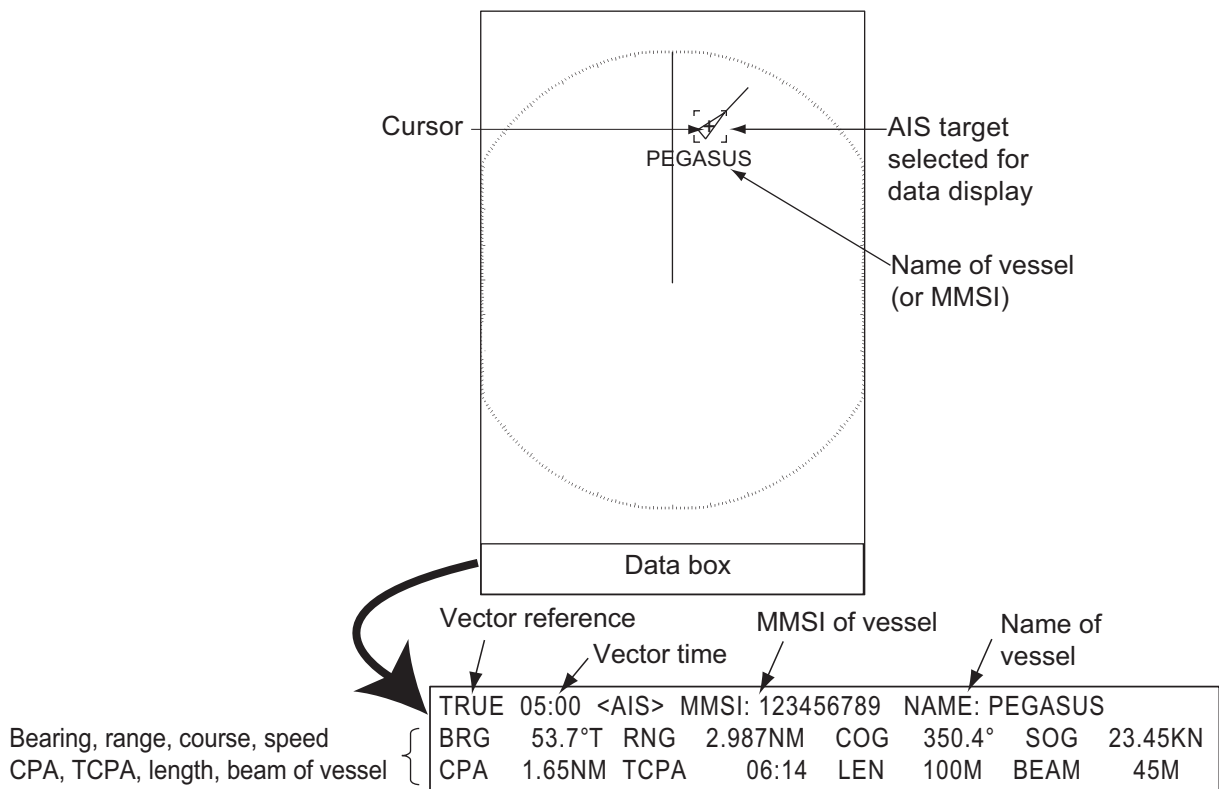
To activate a target: Put the cursor on the target and press the **ENTER** key.

To sleep a target: Put the cursor on the target and press the **CANCEL HL/OFF** key.

4.5 AIS Target Data

You can show the AIS target data in the data box at the bottom of the screen. To display AIS target data, the menu item [Display] on the [AIS] menu must be set for [On] and the menu item [Data Box] on the [Display] menu must be set for [Target] or [All].

1. Use the CursorPad to put the cursor on an activated target.
2. Press the **ENTER** key to show the data of the target.

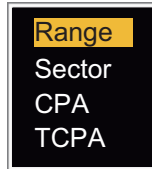


To remove the target data from a data box, put the cursor on its target symbol and press the **CANCEL/HL OFF** key.

4.6 How to Sort Targets

You can sort the AIS targets received from the AIS transponder by range from your ship, by sector, by CPA or TCPA.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [AIS] and press the **ENTER** key.
3. Use ▲ or ▼ to select [Sort By] and press the **ENTER** key.



Sort By options

4. Use ▲ or ▼ to select sorting method and press the **ENTER** key.
 - [Range]**: Sort targets within the display range set (see section 4.7), from nearest to furthest.
 - [Sector]**: Sort targets within the display sector set (see section 4.8) and within 24 nm, from nearest to furthest.
 - [CPA]**: Sort targets within 24 nm by CPA, from closest to furthest.
 - [TCPA]**: Sort targets within 24 nm by TCPA, from earliest time to latest time.
5. Press the **MENU** key to close the menu.

4.7 Display Range

You can set the AIS system to show only those AIS targets within the range you set. The setting range is 0.1NM - 48.0NM for FR-8045, 0.1NM - 72.0NM for FR-8125/FR-8065 and 0.1NM - 96.0NM for FR-8255. Actual range depends on the AIS Transponder. If the target sorting method is selected to [Range], the target data within the range set here are transmitted to this radar.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [AIS] and press the **ENTER** key.
3. Use ▲ or ▼ to select [Range] and press the **ENTER** key.



AIS-Range setting window (for FR-8255)

4. Use ▲ or ▼ to set the display range and press the **ENTER** key.
5. Press the **MENU** key to close the menu.

Note: The unit of measurement for range is NM.

4.8 How to Display the Targets within a Specific Sector

You can display AIS targets only within a specified sector. If the target sorting method is selected to [Sector], the target data within the sector set here are transmitted to this radar.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [AIS] and press the **ENTER** key.
3. Use ▲ or ▼ to select [Sector Start] and press the **ENTER** key.



Sector Start setting window

4. Use ▲ or ▼ to set the start point for the sector and press the **ENTER** key.
5. Use ▲ or ▼ to select [Sector End] and press the **ENTER** key.



Sector End setting window

6. Use ▲ or ▼ to set the end point for the sector and press the **ENTER** key.
7. Press the **MENU** key to close the menu.

4.9 Number of Targets to Display

You can select the maximum number of AIS targets to display. The setting value is 10 to 100. When the screen becomes full of AIS targets, you can limit the number of AIS targets to show. Targets are selected and displayed according to sort method. (See section 4.6.)

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [AIS] and press the **ENTER** key.
3. Use ▲ or ▼ to select [Number of Targets] and press the **ENTER** key.



Number of Targets setting window

4. Use ▲ or ▼ to select the number of targets to display and press the **ENTER** key.
5. Press the **MENU** key to close the menu.

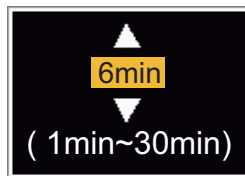
4.10 Vector Attributes

4.10.1 What is a vector?

A vector is a line extending from a tracked target. A vector shows speed and course of the target. The top of a vector shows estimated position of the target after the selected vector time elapses. If you increase the vector length (time), you can evaluate the risk of collision with any target.

4.10.2 Vector time and vector reference

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [Target] and press the **ENTER** key.
3. Use ▲ or ▼ to select [Vector Time] and press the **ENTER** key.



Vector Time setting window

4. Use ▲ or ▼ to select time and press the **ENTER** key.
5. Use ▲ or ▼ to select [Vector Reference] and press the **ENTER** key.

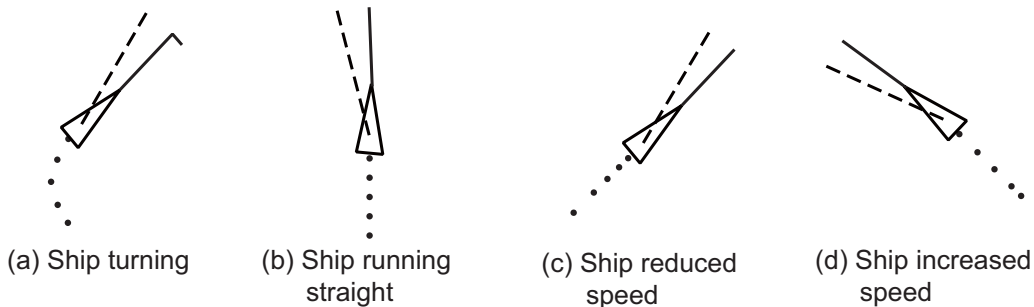


Vector Reference options

6. Use ▲ or ▼ to select [Relative] or [True] then press the **ENTER** key. This function is not activate for [IEC] or [Russian-River] purpose. The mode is set to [True].
[Relative]: Other ships' vectors are displayed relative to your ship. This mode helps find targets on a collision course. If a ship is on a collision course with your ship, the vector of a ship points toward your ship position.
[True]: Your ship's and other ships' vectors are displayed at their true motions. This mode helps see the differences between moving and stationary targets.
7. Press the **MENU** key to close the menu.

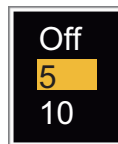
4.11 History Display (target past position)

This radar can display time-spaced dots (maximum ten dots) that marks the past positions of any tracked AIS target. You can evaluate actions of a target by the spaces between the dots. Below are examples of dot spacing and target movement.



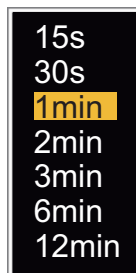
You can select the number of history dots to display and the time interval to display the history dots.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [Target] and press the **ENTER** key.
3. Use ▲ or ▼ to select [History Dots] and press the **ENTER** key.



History Dots options

4. Use ▲ or ▼ to select number of history dots to display (5 or 10) or select [Off] to turn off the history display.
5. Press the **ENTER** key.
6. Use ▲ or ▼ to select [History Interval] and press the **ENTER** key.



History Interval options

7. Use ▲ or ▼ to select time interval and press the **ENTER** key.
8. Press the **MENU** key to close the menu.

4.12 CPA/TCPA Alarm

Set CPA (Closest Point of Approach) alarm range and TCPA (predicted Time to CPA) alarm time to alert you to targets that can be on a collision course. When CPA and TCPA of any AIS target (including a sleeping target) become less than the preset CPA and TCPA alarm settings, the audio alarm sounds. The alarm message "COLLISION" appears. The target symbol changes to a dangerous target symbol (red) and its vector flashes. You can stop the audio alarm and flashing with any key. The dangerous target symbol is displayed until the AIS target is not in the CPA and TCPA alarm setting. The AIS continuously monitors CPA and TCPA of all AIS targets.

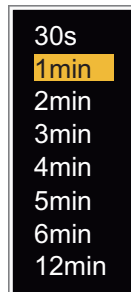
This feature helps identify the targets that can be on a collision course.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [Target] and press the **ENTER** key.
3. Use ▲ or ▼ to select [CPA] and press the **ENTER** key.



CPA options

4. Use ▲ or ▼ to select [CPA] distance and press the **ENTER** key.
5. Use ▲ or ▼ to select [TCPA] and press the **ENTER** key.



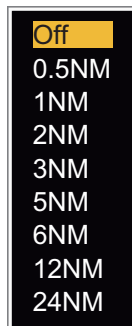
TCPA options

6. Use ▲ or ▼ to select [TCPA] and press the **ENTER** key.
7. Press the **MENU** key to close the menu.

4.13 Proximity Alarm

The proximity alarm alerts you when an AIS target is within the range you set. The audio alarm sounds and the alarm message "PROXIMITY" appears. The target symbol changes to a dangerous target symbol (red) and its vector flashes. Press any key to stop the audio alarm and flashing. The dangerous target symbol is displayed until the target is not within the range set, or the alarm range is changed to exclude the target, or the proximity alarm is deactivated.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [Target] and press the **ENTER** key.
3. Use ▲ or ▼ to select [Proximity] and press the **ENTER** key.



Proximity options

4. Use ▲ or ▼ to select the range and press the **ENTER** key.
5. Press the **MENU** key to close the menu.

4.14 Lost Target

When AIS data is not received from a target at fixed interval (3-5* report intervals), the target symbol changes to the lost target symbol (flashing). No audio or visual alarm is given for a lost target.

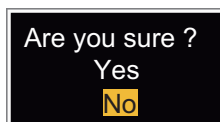


Lost target symbol

* The interval at which AIS data is sent depends on speed of the AIS transponder. For detailed information, refer to the Operator's Manual for the AIS transponder.

You can remove all lost AIS targets from the display as follows:

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [AIS] and press the **ENTER** key.
3. Use ▲ or ▼ to select [ACK Lost Targets] and press the **ENTER** key.



ACK Lost Targets options

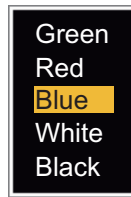
4. AIS OPERATION

4. Use ▲ to select [Yes] and press the **ENTER** key. All lost targets symbols are erased from the screen and the long beep sounds.
5. Press the **MENU** key to close the menu.

4.15 Symbol Color

You can select the AIS symbol color from Green, Red (not available in the [IEC] or [Russian-River] purpose), Blue, White or Black.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [AIS] and press the **ENTER** key.
3. Use ▲ or ▼ to select [Color] and press the **ENTER** key.



Color options

4. Use ▲ or ▼ to select the color and press the **ENTER** key.
5. Press the **MENU** key to close the menu.

Note: Symbols can not be shown in the same color as the background color.

4.16 How to Ignore Slow Targets

You can prevent activation of the CPA/TCPA alarm against AIS targets that move at a speed lower than set here. The AIS symbols are not affected by this setting.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [AIS] and press the **ENTER** key.
3. Use ▲ or ▼ to select [Ignore Slow Targets] and press the **ENTER** key.



Ignore Slow Targets settings window

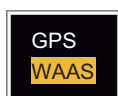
4. Use ▲ or ▼ to select speed (0.0 - 9.9 kn) and press the **ENTER** key.
5. Press the **MENU** key to close the menu.

5. GPS OPERATION

If the FURUNO GPS Navigator GP-320B is connected to this radar, you can set GP-320B from this radar.

5.1 Navigator Mode

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [GPS] and press the **ENTER** key.
3. Use ▲ or ▼ to select [Mode] and press the **ENTER** key.



Mode options

4. Use ▲ or ▼ to select [GPS] or [WAAS] then press the **ENTER** key.
5. Press the **MENU** key to close the menu.

5.2 Datum

Select the type of datum which matches the paper charts you use for navigation. Select [WGS-84] if the radar is connected to an AIS Transponder.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [GPS] and press the **ENTER** key.
3. Use ▲ or ▼ to select [Datum] and press the **ENTER** key.



Datum options

4. Use ▲ or ▼ to select the type of datum and press the **ENTER** key. If you select [WGS-84] or [Tokyo], go to step 7. If you select [Other], go to the next step.
5. Use ▲ or ▼ to select [Datum No] and press the **ENTER** key.



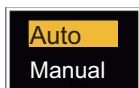
Datum No setting window

6. Use ▲ or ▼ to select the datum number and press the **ENTER** key. (The setting range is 001 - 192 and 201 - 254. Refer to the page AP-5 "GEODETIC CHART LIST").
7. Press the **MENU** key to close the menu.

5.3 WAAS Setup

Geostationary satellites, the type used with WAAS, provide more accurate position data when compared to GPS. These satellites can be tracked automatically or manually. Auto tracking automatically searches for the best geostationary satellite from your current position.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [GPS] and press the **ENTER** key.
3. Use ▲ or ▼ to select [WAAS] and press the **ENTER** key.



WAAS options

4. Use ▲ or ▼ to select [AUTO] or [MANUAL] and press the **ENTER** key. If you select [Auto], go to step 7. If you select [Manual], go to the next step.
5. Use ▲ or ▼ to select [WAAS No] and press the **ENTER** key.



WAAS No setting window

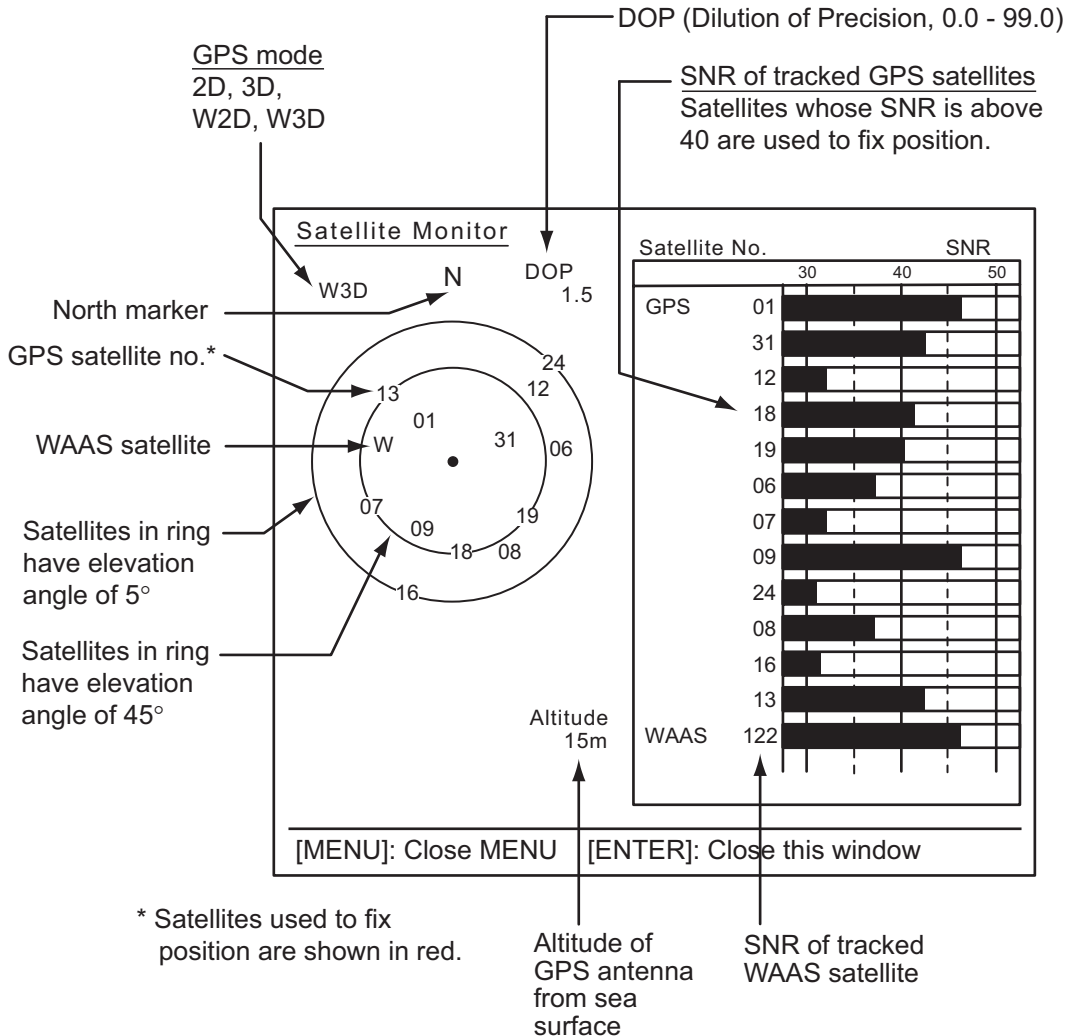
6. Use ▲ or ▼ to select WAAS number and press the **ENTER** key. (The setting range is 120 - 158. Refer to the following table.)
7. Press the **MENU** key to close the menu.

Provider	Satellite type	Longitude	Satellite No
WAAS	Inmarsat-3-F4 (AOR-W)	142°W	122
	Inmarsat-3-F3 (POR)	178°E	134
	Intelsat Galaxy XV	133°W	135
	TeleSat Anik F1R	107.3°W	138
EGNOS	Inmarsat-3-F2 (AOR-E)	15.5°W	120
	Artemis	21.5°E	124
	Inmarsat-3-F5 (IOR-W)	25°E	126
MSAS	MTSAT-1R	140°E	129
	MTSAT-2	145°E	137

5.4 Satellite Monitor

The Satellite Monitor provides the information about GPS and WAAS satellites. See your GPS navigator's owner's manual for detailed information.

1. Press the **MENU** key to open the menu.
2. Use **▲** or **▼** to select [GPS] and press the **ENTER** key.
3. Use **▲** or **▼** to select [Satellite Monitor] and press the **ENTER** key.



Satellite monitor

4. Press the **ENTER** key to close only the satellite monitor display.

5.5 Cold Start

Cold start, which clears the Almanac from the GPS receiver, can be necessary in the following conditions:

- If you have turned off the power of the GPS receiver for a long time.
- The ship has moved far away from the previous fixing position (e.g., more than 500 km).
- Other reason that prevents the receiver from finding its position within five minutes after you turn on the power.

To cold start, do the following:

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [GPS] and press the **ENTER** key.
3. Use ▲ or ▼ to select [Cold Start] and press the **ENTER** key.







Cold Start options

4. Use ▲ or ▼ to select [Yes] and press the **ENTER** key. After processing cold start, the long beep sounds. (To stop cold start, press the **CANCEL/HL OFF** key instead of the **ENTER** key.)
5. Press the **MENU** key to close the menu.

6. MAINTENANCE, TROUBLE-SHOOTING

This chapter has information about maintenance and troubleshooting that the user can follow to care for the equipment.

 WARNING	
	ELECTRICAL SHOCK HAZARD Do not open the equipment. Only qualified personnel can work inside the equipment.
	Turn off the power before you service the antenna unit. Post a warning sign near the power switch not to turn on the power while you service the antenna unit.
	Prevent the potential risk of being struck by the rotating antenna and exposure to RF radiation hazard.

NOTICE
Do not apply paint, anti-corrosive sealant or contact spray to plastic parts or equipment coating.
These items contain products that can damage plastic parts and equipment coating.

6.1 Preventative Maintenance


Regular maintenance helps keep your equipment in good condition and prevents future problems. Check the items shown in the table below to help keep your equipment in good condition for years to come.

Maintenance

Interval	Item	Check Point	Remedy
When necessary	LCD	Dust on the LCD	Remove the dust from the LCD with the tissue paper and an LCD cleaner. To remove dirt or salt, use the LCD cleaner. Change the tissue paper often so as not to damage the LCD.
3 to 6 months	Ground terminal on display unit	Check for tight connections and corrosion	Tighten or replace as necessary.
	Display unit connectors	Check for tight connection.	Tighten if the connectors are loosened.
	Exposed nuts and bolts on the antenna unit.	Check for corroded or loosened bolts.	Clean and repaint as necessary. Use sealing compound instead of paint.
	Antenna radiator	Check for dirt and cracks on the radiator surface.	Clean radiator surface with a fresh-water-moistened cloth. Do not use plastic solvents to clean.

6.2 Fuse Replacement

A fuse is in the fuse holder on the power cable and inside the power supply unit, and they protect the equipment from reverse polarity of the ship's mains and equipment fault. If a fuse blows, find out 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 a wrong fuse can result in damage to the equipment and cause fire.

Unit	Type	Code No.	Remarks
Display unit (fitted on power cable)	FGBO 125V 10A PBF	000-155-826-10	24VDC
Power supply unit (for FR-8255)	FGBO 125V 7A PBF	000-155-831-10	24VDC

6.3 Magnetron Life

When the life of the magnetron is reached, the targets do not appear on the display. If long-range performance appears to have decreased, contact a FURUNO agent or dealer about replacement of the magnetron. The magnetron changes with the type of antenna unit.

Model	Magnetron Type	Code No.	Estimated life expectancy
FR-8045	E3571	000-146-867-12	App. 2,000 hours
FR-8065	MAF1422B	000-158-788-12	App. 3,000 hours
FR-8125	MAF1565N	000-174-559-11	App. 3,000 hours
FR-8255	M1458F	000-159-904-12	App. 2,000 hours

6.4 LCD Backlight Life

The life of the LCD backlight, which provides the illumination for the LCD, is approximately 70,000 hours at 25°C (ambient temperature).

6.5 Simple Troubleshooting

This section provides simple troubleshooting procedures which the user can follow to restore normal operation. If you cannot restore normal operation, do not check inside the unit. Have a qualified technician check the equipment.

Problem	Remedy
You cannot turn on the power.	<ul style="list-style-type: none"> • Check for blown fuse. • Make sure that the power connector is fastened. • Check for corrosion on the power cable connector. • Check for damaged power cable. • Check the battery for correct voltage output.
There is no response when a key is pressed.	Turn the power off, then on. If you do not get a response, the key is damaged. Contact your dealer for instructions.
The power is on and you operated the STBY/TX key to transmit. The marks and letters appear, but no echo appears.	Make sure that the antenna cable is fastened.
Tuning is correctly adjusted, but sensitivity is poor.	Replace the magnetron. Contact your dealer.
The range is changed, but radar picture does not change.	<ul style="list-style-type: none"> • Try to press the RANGE key again. • Turn the display unit off then on.
Poor discrimination in range because of too many echoes from the waves.	Adjust the A/C SEA control.
The true motion presentation is not working correctly.	<ul style="list-style-type: none"> • Make sure that the setting of [Display Mode] in the [Display] menu is set to [True Motion]. • Make sure that the heading and position data are inputted and correct.
The range rings are not displayed.	Make sure that the setting of [Rings Brill] in the [Brill/Color] menu is not set to [Off].
Target is not tracked correctly because of sea clutter.	Adjust A/C SEA and A/C RAIN controls.

6.6 Advanced-level Troubleshooting

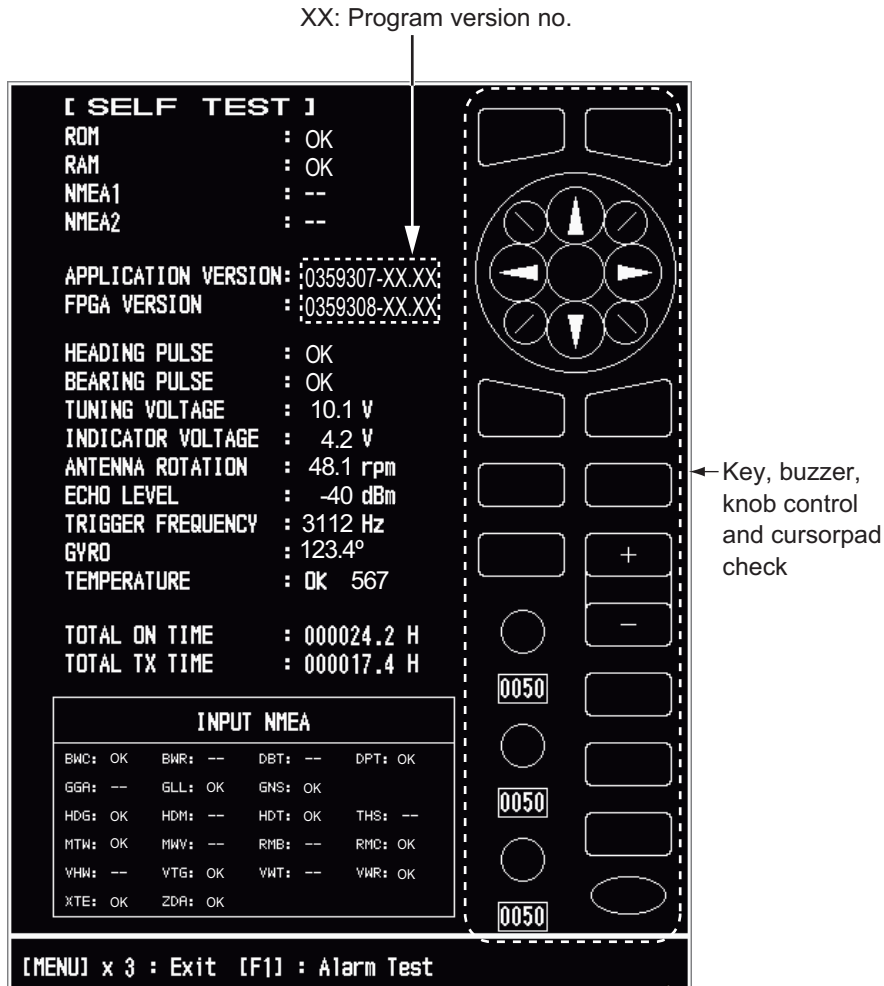
This section describes how to cure hardware and software troubles which only qualified service persons must do.

Problem	Possible cause or check points	Remedy
Power cannot be turned on.	1) Mains voltage/polarity 2) Power supply board	1) Correct the wiring and input voltage. 2) Replace the power board.
Brilliance adjusted but no picture.	1) SPU Board	1) Replace SPU Board.
Antenna not rotating.	1) Antenna drive mechanism	1) Replace the antenna drive mechanism.
Data and marks not displayed in transmit.	1) SPU board	1) Replace SPU board.
Set GAIN to the maximum with A/C SEA set at minimum. Marks and indications appear but no noise or echo.	1) Signal between antenna and display unit 2) IF amplifier 3) Video amplifier board	1) Check continuity and isolation of coaxial cable. 2) Replace IF amplifier. 3) Check coax line for fasten connection. If the connection is good, replace SPU board.
Marks, indications and noise appear but no echo. (Transmission leak show your ship position is not present.)	1) Magnetron 2) Modulator board 3) SPU board	1) Check magnetron current. 2) Replace modulator board. 3) Replace the SPU board.
Picture not updated or picture freeze-up.	1) Bearing signal generator 2) SPU board 3) Video freeze-up	1) Make sure that the signal cables are fastened. 2) Replace the SPU board. 3) Turn the radar off, then on.
Radar is correctly tuned but sensitivity is weak.	1) [2nd Echo Rejector] is [ON] 2) Dirt on radiator face 3) Deteriorated magnetron 4) Detuned MIC	1) Turn off the [2nd Echo Rejector] from the [Echo] menu. 2) Clean the radiator. 3) Check the magnetron current with the radar transmitting on 48 nm range. If the current is below normal, magnetron may be defective. Replace the magnetron. 4) Check the MIC detecting current. If MIC detecting current is below normal value, the MIC may be detuned.
Range changed but picture does not change.	1) RANGE key has defaults 2) SPU board 3) Video freeze-up	1) Try to operate the RANGE key. If you can not operate the RANGE key, replace the keypad. 2) Replace the SPU board. 3) Turn the radar off, then on.
Range rings are not displayed.	1) Adjust their brilliance on the [Brill/Color] menu. 2) SPU board	1) Replace the associated circuit board if unsuccessful. 2) Replace the SPU board.

6.7 Diagnostic Test

The diagnostic test checks the system for correct operation. This test is for use by service technicians, but the user can do this test to provide the service technician with information.

1. Press the **MENU** key to open the menu.
2. Use **▲** or **▼** to select [Tests] and press the **ENTER** key.
3. Use **▲** or **▼** to select [Self Test] and press the **ENTER** key.



Test Results

- ROM, RAM: The results of the ROM and RAM test are displayed as "OK" or "NG" (No Good).
- NMEA1, NMEA2: The results of the ports NMEA1 and NMEA2 are displayed as "OK" or "- -". Ports NMEA1 and NMEA2 require a special connector to test them. When a special connector is not connected, "- -" is shown. If "- -" is displayed with a special connector, contact your dealer for instruction.
- APPLICATION VERSION, FPGA VERSION: The program numbers and program version numbers are displayed.

- **HEADING PULSE, BEARING PULSE:** The results of the pulse input are displayed as "OK" or "NG". When [Antenna Rotation] is set to [Stop], or [Watchman] is set to [Off] in the STBY mode, this test is skipped and [- -] is shown for both heading and bearing.
- **TUNING VOLTAGE, INDICATOR VOLTAGE, ANTENNA ROTATION, ECHO LEVEL, TRIGGER FREQUENCY:** The results of measurement are displayed.
- **GYRO:** The current gyrocompass reading is displayed.
- **TEMPERATURE:** The result of the temperature test is displayed as "OK" or "NG" and the temperature is measured and shown.
- **TOTAL ON TIME, TOTAL TX TIME:** The total number of hours, for which the radar has been powered and has transmitted, are displayed.
- **INPUT NMEA window:** The condition of all the NMEA sentences being input to this radar are displayed as "OK", or "- -". "- -" indicates no data input. Sentences are updated every second.

Key check

Press each key one by one. A key's on-screen location becomes green if the key is normal.

Buzzer check

The **F1** key tests on/off for the panel buzzer or external buzzer. To stop the buzzer, press the **F1** key again.

Knob control check

Rotate each control knob. The four digits below the on-screen location for the **GAIN**, **A/C SEA** and **A/C RAIN** knob controls show the control position. Press each knob. The knob related on-screen circle changes in green if the knob is normal.

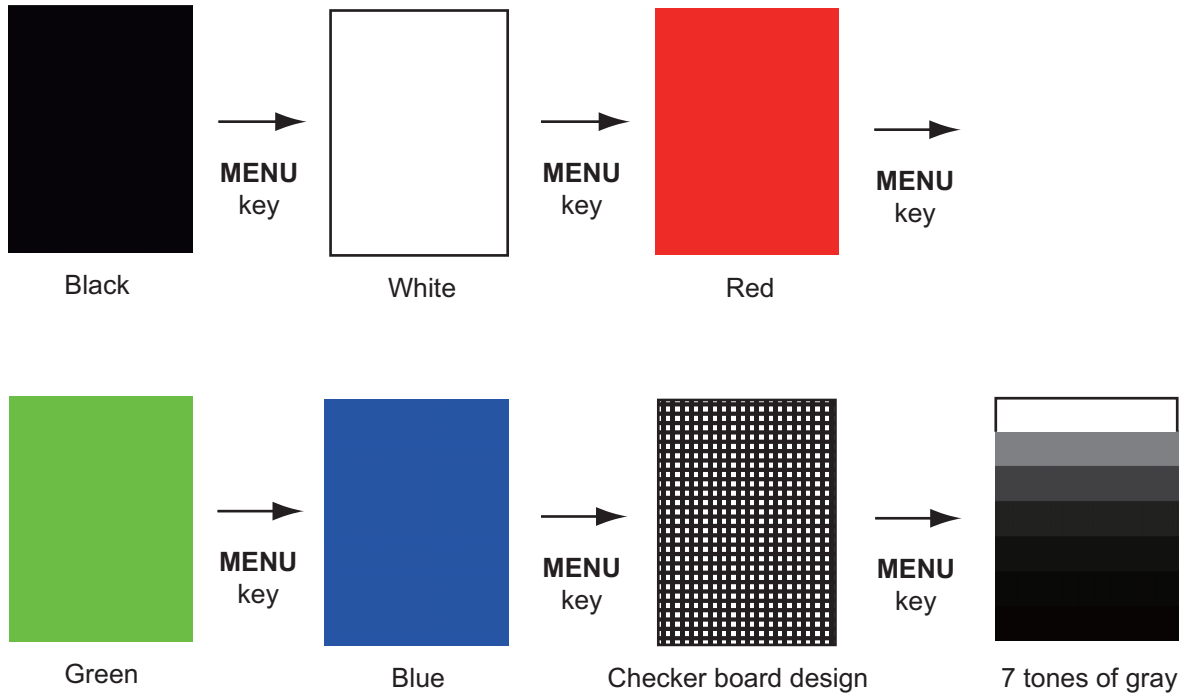
CursorPad check

Press each arrow and diagonal dot one by one. The on-screen location changes in green if the key is normal.

4. Press the **MENU** key three times to leave the test.
5. Press the **MENU** key to close the menu.

6.8 LCD Test

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [Tests] and press the **ENTER** key.
3. Use ▲ or ▼ to select [LCD Pattern] and press the **ENTER** key.



4. Press the **MENU** key several times to close the menu.

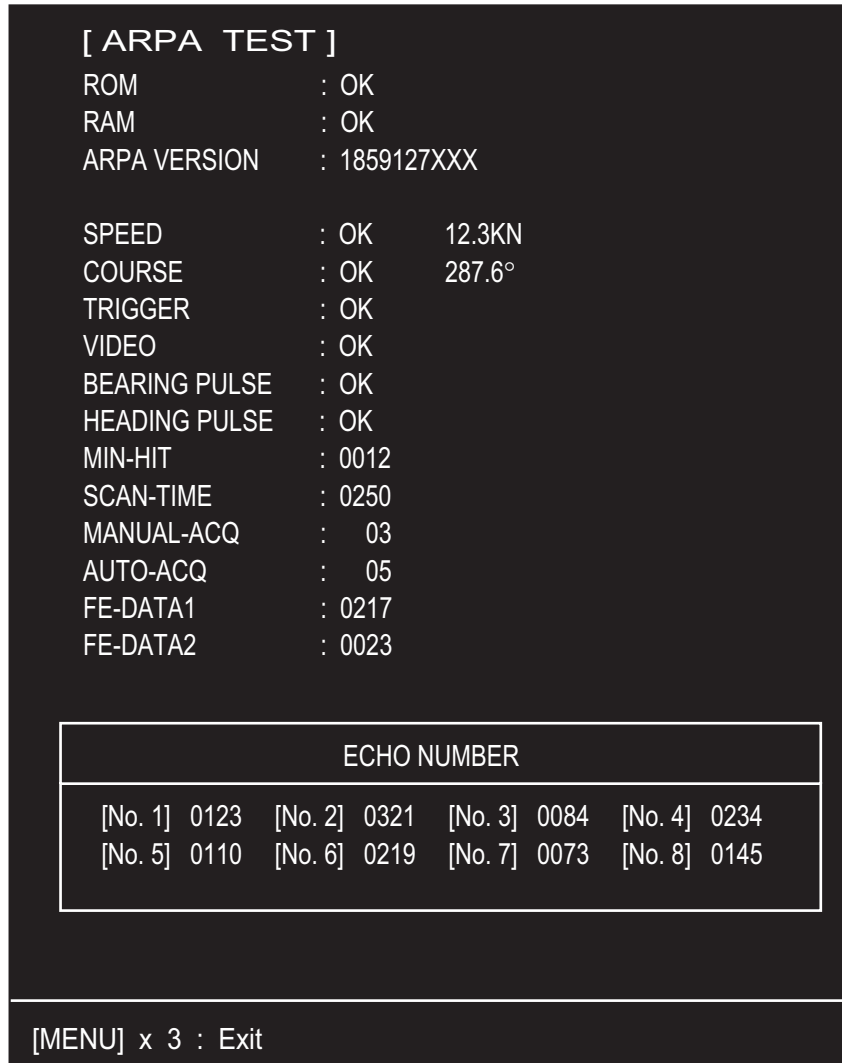
Note 1: You can cancel the test at any time when you press the **CANCEL/HL OFF** key.

Note 2: You can adjust the screen brilliance with the  key during the test.

6.9 ARPA Test

If the optional ARPA board is installed, its program number and test results ("OK" or "NG") are shown on the screen. [ARPA Test] menu item does not operate when there is no ARPA board. The radar must be transmitting to test the ARPA function.

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [Tests] and press the **ENTER** key.
3. Use ▲ or ▼ to select [ARPA Test] and press the **ENTER** key.



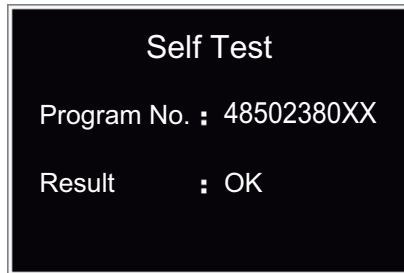
XXX: Program version no.

4. Press the **MENU** key three times to close the menu.

6.10 GPS Test

You can check the FURUNO GPS receiver GP-320B interfaced with this radar for correct operation as follows:

1. Press the **MENU** key to open the menu.
2. Use ▲ or ▼ to select [GPS] and press the **ENTER** key.
3. Use ▲ or ▼ to select [Self Test] and press the **ENTER** key. The program no. and result of the test are shown, as "OK" or "NG" (No Good). When "NG" appears, check the GPS receiver.



XX: Program version no. varies according to equipment connected.

GPS Self Test screen

4. Press any key to close the test screen.
5. Press the **MENU** key to close the menu.

APPENDIX 1 MENU TREE

Main Menu

- 1 — Brill/Color
- 2 — Display
- 3 — Echo
- 4 — Custom 1
- 5 — Custom 2
- 6 — Custom 3
- 7 — Alarm
- 8 — Target Trails
- 9 — Tuning
- 10 — Others
- 11 — Target
- 12 — ARPA
- 13 — AIS
- 14 — GPS
- 15 — System

Default settings and values shown in bold italics

1 BrillColor

- Echo Brill (1 - **8**)
- Rings Brill (1 - **4**)
- Mark Brill (1 - **4**)
- HL Brill (1 - **4**)
- Character Brill (1 - **4**)
- Echo Shading (1 - 5) **Default: 3**
- Display Color (Day, Night, Twilight, **Custom**)
- Echo Color (**Yellow**, Green, Orange, Multi)
- Background Color (**Black**, DK Blue, Blue, White)
- Character Color (Green, Red, White) **Default: Green**
- Menu Transparency (**OFF**, 1, 2, 3, 4)
- Echo Color Mode (**System**, Custom)
- Custom Echo Color
 - Rank (1 - **31**)
 - Red (0 - **63**)
 - Green (0 - **63**)
 - Blue (0 - 63) **Default = 35**
 - Fitting to Curve (-20 - 20) **Default=0**
 - Copy to Custom (Yes, **No**)

2 Display

- Display Mode (**Head Up**, Course Up, North Up, True Motion, True View)
- Zoom (**Off**, On)
- Zoom Mode (**Relative**, True, Target)
- Offcenter Mode
 - Manual (**Off**, On)
 - Custom (**Off**, On)
 - Auto (**Off**, On)
 - EXT (**YES**, NO)
- Save Offcenter (**Yes**, No)
- Echo Area (**Normal**, Full Screen)
- Base Text Display
 - Range (**Off**, On)
 - Mode (**Off**, On)
 - Alarm (**Off**, On)
 - Echo (**Off**, On)
 - EBL/VRM (**Off**, On)
 - +Cursor (**Off**, On)
 - EXT (**YES**, NO)
- Data Box (**Off**, Nav, Target, All)
- Gain/Sea/Rain Bar
 - GAIN (0 - 100)
 - SEA (0 - 100)
 - RAIN (0 - 100)
- STBY Display (**Normal**, Nav, Economy)

APPENDIX 1 MENU TREE

- 3 Echo
 - Gain Mode (Auto , **Manual**)
 - Sea Mode (Auto , **Manual**)
 - Auto Sea (Coastal, **Advanced**)
 - Rain Mode (Auto , **Manual**)
 - Auto Rain (Calm, **Moderate**, Rough)
 - A/C Auto (**Off**, On)
 - Pulse Length (**Short**, Medium, Long)
 - Echo Stretch (**Off**, 1, 2, 3)
 - Echo Average (**Off**, 1, 2, Auto)
 - Noise Rejector (**Off**, On)
 - Wiper (**Off**, 1, 2)
 - Int Rejector (Off , 1, 2, 3)
 - Display-Dynamic (Narrow, **Normal**, Wide)
 - Display-Curve (1, 2, 3)
 - Color Erase (0 - 11)
 - 2nd Echo Rejector (**Off**, On)

- 4 Custom 1
 - Custom1 (Off, **On**)
 - Copy
 - Gain Mode (Auto , **Manual**)
 - Manual Gain (0 - 100) **Default: 80**
 - Sea Mode (Auto , **Manual**)
 - Auto Sea (Coastal, **Advanced**)
 - Manual Sea (0 - 100)
 - Rain Mode (Auto , **Manual**)
 - Auto Rain (Calm, **Moderate**, Rough)
 - Manual Rain (0 - 100)
 - A/C Auto (**Off**, On)
 - Pulse Length (**Short**, Medium, Long)
 - Echo Stretch (**Off**, On)
 - Echo Average (**Off**, On)
 - Noise Rejector (**Off**, On)
 - Wiper (**Off**, 1, 2)
 - Int Rejector (Off , 1, 2, 3)
 - Display-Dynamic (Narrow, **Normal**, Wide)
 - Display-Curve (1, 2, 3)
 - Color Erase (0 - 11)

- 5 Custom 2 (Same as Custom 1)

- 6 Custom 3 (Same as Custom 1)

- 7 Alarm
 - Target Alarm 1 (**In**, Out)
 - Target Alarm 2 (**In**, Out)
 - Alarm Level (Low, **Med**, High)
 - Watchman (**Off**, 5min, 10min, 20min)
 - Panel Buzzer (Off, **On**)
 - External Buzzer (Off, **On**)
 - Alarm Status

8 Target Trails

- Time
 - 15s (Off, **On**)
 - 30s (Off, **On**)
 - 1min (Off, **On**)
 - 3min (Off, **On**)
 - 6min (Off, **On**)
 - 15min (Off, **On**)
 - 30min (Off, **On**)
 - Continuous (**Off**, On)
 - EXIT (**YES**, NO)
- Gradation (Single, **Multi**)
- Color (Green, Red, **Blue**, White, Black)
- Mode (Relative, **True**)
- Level (1, **2**, 3)
- Restart (Off, **On**)
- Narrow (**Off**, On)
- Own Ship (**Off**, 1, 2)
- All Cancel (Yes, **No**)

9 Tuning

- Tuning Mode (**Auto**, Manual)
- Manual Tuning (0.00V - 12.00V) **Default 6.00V**
- Tuning Init Adjust (Yes, **No**)

10 Others

- F1 Setup
- F2 Setup
- F3 Setup
- WPT Mark (On, **Off**)
- EBL Reference (**Relative**, True)
- VRM Unit (**NM**, KM, SM, KYD, NM&YD)
- Cursor Position (**Rng/Brg**, Lat, Lon)
- TLL Key Mode (**TLL Output**, Origin Mark, Both)

11 Target

- Vector Time (1min - 30min) **Default=6min**
- Vector Reference (Relative, **True**)
- History Dots (Off, **5**, 10)
- History Interval (15s, 30s, **1min**, 2min, 3min, 6min, 12min)
- CPA (**Off**, 0.5NM, 1NM, 2NM, 3 NM, 5NM, 6NM)
- TCPA (30s, **1min**, 2min, 3min, 4min, 5min, 6min, 12min)
- Proximity (**Off**, 0.5NM, 1NM, 2NM, 3NM, 5NM, 6NM, 12NM, 24NM)

12 ARPA

- Display (**Off**, On)
- Color (**Green**, Red, Blue, White, Black)
- Auto Acquisition (**Off**, On)
- ACK Lost Targets (Yes, **No**)
- All Cancel (Yes, **No**)

13 AIS

- Display (**Off**, On)
- Color (**Green**, Red, Blue, White, Black)
- Number of Targets (10 - 100) **Default=30**
- Sort by (**Range**, Sector, CPA, TCPA)
- Range (0.1NM - 72.0NM*) **Default: 24.0 NI**
- Sector Start (0° - 359°) **Default: 340°**
- Sector End (0° - 359°) **Default: 20°**
- Ignore Slow Targets (0.0 - 9.9kn) **Default=5.0kn**
- ACK Lost Targets (Yes, **No**)

*: FR-8255 - (0.1NM - 96.0NM)
FR-8045 - (0.1NM - 48.0NM)

APPENDIX 1 MENU TREE

14 GPS

- Mode (GPS, **WAAS**)
- Datum (**WGS-84**, Tokyo, Other)
- Datum No. (**001** - 192, 201 - 254)
- WAAS (**Auto**, Manual)
- WAAS No. (**120** - 158)
- Sattelite Monitor
- Self Test
- Cold Start (Yes, **No**)

15 System

- Initial
 - Key Beep (**Off**, On)
 - Offcenter Speed (1kn - 99kn) **Default=15kn**
 - Compass Type (Magnetic, **True**)
 - Range Preset
 - Wind Direction (**Apparent**, True)
 - NMEA Port 1 (**Auto**, 4800bps, 38400bps)
 - NMEA Port 2 (**Auto**, 4800bps, 38400bps)
 - NMEA Mixing Out (**Off**, On)
- Tests
 - Self Test
 - LCD Pattern
 - ARPA Test
- Sector Blanks
 - Sect-Blank 1 Status (**Off**, On)
 - Sect-Blank 1 Start (**0°** - 359°)
 - Sect-Blank 1 End (**0°** - 359°)
 - Sect-Blank 2 Status (**Off**, On)
 - Sect-Blank 2 Start (**0°** - 359°)
 - Sect-Blank 2 End (**0°** - 359°)
- Units
 - Range Unit (**NM**, KM, SM)
 - Ship Speed Unit (**kn**, km/h, mph)
 - Depth Unit (m, **ft**, fa, pb, HR)
 - Temperature Unit (°C, **°F**)
 - Wind Speed Unit (**kn**, km/h, mph, m/s)
- Installation (For use by the installer. Not accessible by the user)
- Factory (For use by the installer. Not accessible by the user)

APPENDIX 2 GEODETIC CHART LIST

001: WGS84		
002: WGS72		
003: TOKYO	: Mean Value (Japan, Korea & Okinawa)	
004: NORTH AMERICAN 1927	: Mean Value (CONUS)	
005: EUROPEAN 1950	: Mean Value	
006: AUSTRALIAN GEODETIC 1984	: Australia & Tasmania	
007: ADINDAN-MN	: Mean Value (Ethiopia & Sudan)	
008: ADINDAN-E	: Ethiopia	
009: ADINDAN-SE	: Mali	
010: ADINDAN-SU	: Senegal	
011: ADINDAN-SU	: Sudan	
012: AFG	: Somalia	
013: AIN EL ABD 1970	: Bahrain Is.	
014: ANNA 1 ASTRO 1965	: Cocos Is.	
015: ARC 1950-MN	: Mean Value	
016: ARC 1950-B	: Botswana	
017: ARC 1950-L	: Lesotho	
018: ARC 1950-M	: Malawi	
019: ARC 1950-S	: Swaziland	
020: ARC 1950-ZR	: Zaire	
021: ARC 1950-ZM	: Zambia	
022: ARC 1950-ZB	: Zimbabwe	
023: ARC 1960-MN	: Mean Value (Kenya & Tanzania)	
024: ARC 1960-K	: Kenya	
025: ARC 1960-T	: Tanzania	
026: ASCENSION IS. 1958	: Ascension Is.	
027: ASTRO BEACON "E"	: Iwo Jima Is.	
028: ASTRO B4 SOR. ATOLL	: Tern Is.	
029: ASTRO POS 71/4	: St. Helena Is.	
030: ASTRONOMIC STATION 1952	: Marcus Is.	
031: AUSTRALIAN GEODETIC 1966	: Australia & Tasmania	
032: BELLEVUE (IGN)	: Efate & Erromango Is.	
033: BERMUDA 1957	: Bermuda Is.	
034: BOGOTA OBSERVATORY	: Columbia	
035: CAMPO INCHAUSPE	: Argentina	
036: CANTON IS. 1966	: Phoenix Is.	
037: CAPE	: South Africa	
038: CAPE CANAVERAL	: Mean Value (Florida & Bahama Is.)	
039: CARTHAGE	: Tunisia	
040: CHATHAM 1971	: Chatham Is. (New Zealand)	
041: CHUA ASTRO	: Paraguay	
042: CORREGO ALEGRE	: Brazil	
043: DJAKARTA (BATAVIA)	: Sumatra Is. (Indonesia)	
044: DOS 1968	: Gizo Is. (New Georgia Is.)	
045: EASTER IS. 1967	: Easter Is.	
046: EUROPEAN 1950-WE	: Western Europe	
047: EUROPEAN 1950-CY	: Cyprus	
048: EUROPEAN 1950-EG	: Egypt	
049: EUROPEAN 1950-ESC	: England, Scotland, Channel & Shetland Is.	
050: EUROPEAN 1950-EIS	: England, Ireland, Scotland & Shetland Is.	
051: EUROPEAN 1950-GR	: Greece	
052: EUROPEAN 1950-IR	: Iran	
053: EUROPEAN 1950-SA	: Italy, Sardinia	
054: EUROPEAN 1950-SI	: Italy, Sicily	
055: EUROPEAN 1950-NF	: Norway & Finland	
056: EUROPEAN 1950-PS	: Portugal & Spain	
057: EUROPEAN 1979	: Mean Value	
058: GANDAJIKA BASE	: Republic of Maldives	
059: GEODETIC DATUM 1949	: New Zealand	
060: GUAM 1963	: Guam Is.	
061: GUX 1 ASTRO	: Guadalcanal Is.	
062: HJORSEY 1955	: Iceland	
063: HONG KONG 1963	: Hong Kong	
064: INDIAN-TV	: Thailand & Vietnam	
065: INDIAN-BIN	: Bangladesh, India & Nepal	
066: IRELAND 1965	: Ireland	
067: ISTS 073 ASTRO 1969	: Diego Garcia	
068: JOHNSTON IS. 1961	: Johnston Is.	
069: KANDAWALA	: Sri Lanka	
070: KERGUELEN IS.	: Kerguelen Is.	
071: KERTAU 1948	: West Malaysia & Singapore	
072: LA REUNION	: Mascarene Is.	
073: L. C. 5 ASTRO	: Cayman Brac Is.	
074: LIBERIA 1964	: Liberia	
075: LUZON	: Philippines (excl. Mindanao Is.)	
076: LUZON-M	: Mindanao Is.	
077: MAHE 1971	: Mahe Is.	
078: MARCO ASTRO	: Salvage Islands	
079: MASSAWA	: Eritrea (Ethiopia)	
080: MERCHICH	: Morocco	
081: MIDWAY ASTRO 1961	: Midway Is.	
082: MINNA	: Nigeria	
083: NAHRWAN-O	: Masirah Is. (Oman)	
084: NAHRWAN-UAE	: United Arab Emirates	
085: NAHRWAN-SA	: Saudi Arabia	
086: NAMIBIA	: Namibia	
087: MAPARIMA, BWI	: Trinidad & Tobago	
088: NORTH AMERICAN 1927WU	: Western United States	
089: NORTH AMERICAN 1927EU	: Eastern United States	
090: NORTH AMERICAN 1927AK	: Alaska	
091: NORTH AMERICAN 1927BH	: Bahamas (excl. San Salvador Is.)	
092: NORTH AMERICAN 1927SS	: Bahamas, San Salvador Is.	
093: NORTH AMERICAN 1927CN	: Canada (incl. Newfoundland Is.)	
094: NORTH AMERICAN 1927AB	: Alberta & British Columbia	
095: NORTH AMERICAN 1927EC	: East Canada	
096: NORTH AMERICAN 1927MO	: Manitoba & Ontario	
097: NORTH AMERICAN 1927NE	: Northwest Territories & Saskatchewan	
098: NORTH AMERICAN 1927YK	: Yukon	
099: NORTH AMERICAN 1927CZ	: Canal Zone	
100: NORTH AMERICAN 1927CR	: Caribbean	
101: NORTH AMERICAN 1927CA	: Central America	
102: NORTH AMERICAN 1927CU	: Cuba	
103: NORTH AMERICAN 1927GR	: Greenland	
104: NORTH AMERICAN 1927MX	: Mexico	
105: NORTH AMERICAN 1983AK	: Alaska	
106: NORTH AMERICAN 1983CN	: Canada	
107: NORTH AMERICAN 1983CS	: CONUS	
108: NORTH AMERICAN 1983MX	: Mexico, Central America	
109: OBSERVATORIO 1966	: Corvo & Flores Is. (Azores)	
110: OLD EGYPTIAN 1930	: Egypt	
111: OLD HAWAIIAN-MN	: Mean Value	
112: OLD HAWAIIAN-HW	: Hawaii	
113: OLD HAWAIIAN-KA	: Kauai	
114: OLD HAWAIIAN-MA	: Maui	
115: OLD HAWAIIAN-OA	: Oahu	
116: OMAN	: Oman	
117: ORDANCE SURVEY OF GREAT BRITAIN 1936-NM	: Mean Value	
118: ORDANCE SURVEY OF GREAT BRITAIN 1936-E	: England	
119: ORDANCE SURVEY OF GREAT BRITAIN 1936-IM	: England, Isle of Man & Wales	
120: ORDANCE SURVEY OF GREAT BRITAIN 1936-SSI	: Scotland & Shetland Is.	
121: ORDANCE SURVEY OF GREAT BRITAIN 1936-WL	: Wales	
122: PICO DE LAS NIVIES	: Canary Is.	
123: PITCAIRN ASTRO 1967	: Pitcairn Is.	
124: PROVISIONS SOUTH CHILEAN 1963: South Chile (near 53°S)		
125: PROVISIONAL SOUTH AMERICAN 1956MN: Mean Value		
126: PROVISIONAL SOUTH AMERICAN 1956BO: Bolivia		
127: PROVISIONAL SOUTH AMERICAN 1956NC: Chile-Northern Chile (near 19°S)		
128: PROVISIONAL SOUTH AMERICAN 1956SC: Chile-Southern Chile (near 43°S)		
129: PROVISIONAL SOUTH AMERICAN 1956CO: Columbia		
130: PROVISIONAL SOUTH AMERICAN 1956EC: Ecuador		
131: PROVISIONAL SOUTH AMERICAN 1956GY: Guyana		
132: PROVISIONAL SOUTH AMERICAN 1956PR: Peru		
133: PROVISIONAL SOUTH AMERICAN 1956VN: Venezuela		
134: PUERTO RICO	: Puerto Rico & Virgin Is.	
135: QATAR NATIONAL	: Qatar	
136: QORNOQ	: South Greenland	
137: ROME 1940	: Sardinia Is.	
138: SANTA BRAZ	: Sao Miguel, Santa Maria Is. (Azores)	
139: SANTO (DOS)	: Espirito Santo Is.	
140: SAPPER HILL 1943	: East Falkland Is.	
141: SOUTH AMERICAN 1969MN	: Mean Value	
142: SOUTH AMERICAN 1969AG	: Argentina	
143: SOUTH AMERICAN 1969BO	: Bolivia	
144: SOUTH AMERICAN 1969BR	: Brazil	
145: SOUTH AMERICAN 1969CH	: Chile	
146: SOUTH AMERICAN 1969CO	: Columbia	
147: SOUTH AMERICAN 1969EC	: Ecuador	
148: SOUTH AMERICAN 1969GY	: Guyana	
149: SOUTH AMERICAN 1969PA	: Paraguay	
150: SOUTH AMERICAN 1969PR	: Peru	
151: SOUTH AMERICAN 1969TT	: Trinidad & Tobago	
152: SOUTH AMERICAN 1969VZ	: Venezuela	
153: SOUTH ASIA	: Singapore	
154: SOUTHEAST BASE	: Porto Santo & Madeira Is.	
155: SOUTHWEST BASE	: Faial, Graciosa, Pico, Sao Jorge & Terceira Is.	
156: TIMBALAI 1948	: Brunei & East Malaysia (Sarawak & Sabah)	
157: TOKYO JP	: Japan	
158: TOKYO KP	: Korea	
159: TOKYO OK	: Okinawa	
160: TRISTAN ASTRO 1968	: Tristan da Cunha	
161: VITI LEVU 1916	: Viti Levu Is. (Fiji Is.)	
162: WAKE-ENIWETOK 1960	: Marshall Is.	
163: ZANDERIJ	: Surinam	
164: BUKIT RIMPAH	: Bangka & Belitung Is. (Indonesia)	
165: CAMP AREA ASTRO	: Camp Marmur Area, Antarctica	
166: G. SEGARA	: Kalimantan Is. (Indonesia)	
167: HERAT NORTH	: Afghanistan	
168: HU-TZU-SHAN	: Taiwan	
169: TANANARIVE OBSERVATORY 1925	: Madagascar	
170: YACARE	: Uruguay	
171: RT-90	: Sweden	
172: TOKYO	: Mean Value (Japan, Korea & Okinawa)	
173: AIN EL ABD 1970	: Bahrain Is.	
174: ARC 1960	: Mean Value (Kenya, Tanzania)	
175: ARS-A	: Kenya	

APPENDIX 2 GEODETIC CHART LIST

176: ARS-B	: Tanzania	221: INDIAN 1960	: Con Son Is. (Vietnam)
177: ASCENSION IS. 1958	: Ascension Is.	222: INDIAN 1975	: Thailand
178: CAPE CANAVERAL	: Mean Value (Florida & Bahama Is.)	223: INDONESIAN 1974	: Indonesia
179: EASTER IS. 1967	: Easter Is.	224: CO-ORDINATE SYSTEM 1937 OF ESTONIA	: Estonia
180: EUROPEAN 1950	: Portugal & Spain	225: EUROPEAN 1950	: Malta
181: JHONSTON IS. 1961	: Jhonston Is.	226: EUROPEAN 1950	: Tunisia
182: NAHRWAN	: Saudi Arabia	227: S-42 (PULKOVO 1942)	: Hungary
183: NAPARIMA, BWI	: Trinidad & Tobago	228: S-42 (PULKOVO 1942)	: Poland
184: NORTH AMERICAN 1927	: Caribbean	229: S-42 (PULKOVO 1942)	: Czechoslovakia
185: OLD HAWAIIAN	: Oahu	230: S-42 (PULKOVO 1942)	: Latvia
186: SAPPER HILL 1943	: East Falkland Is.	231: S-42 (PULKOVO 1942)	: Kazakhstan
187: TIMBALAI 1948	: Brunei & East Malaysia (Sarawak & Sabah)	232: S-42 (PULKOVO 1942)	: Albania
188: TOKYO	: Japan	233: S-42 (PULKOVO 1942)	: Romania
189: TOKYO	: South Korea	234: S-JTSK	: Czechoslovakia
190: TOKYO	: Okinawa	235: NORTH AMERICAN 1927	: East of 180W
191: WAKE-ENIWETOK 1960	: Marshall Is.	236: NORTH AMERICAN 1927	: West of 180W
192: HU-TZU-SHAN	: Taiwan	237: NORTH AMERICAN 1983	: Aleutian Is.
201: ADINDAN	: Burkina Faso	238: NORTH AMERICAN 1983	: Hawaii
202: ADINDAN	: Cameroon	239: SOUTH AMERICAN 1969	: Baltra, Galapagos Is.
203: ARC 1950	: Burundi	240: ANTIGUA IS. ASTRO 1943	: Antigua, Leeward Is.
204: AYABELLE LIGHTHOUSE	: Djibouti	241: DECEPTION IS.	: Deception Is., Antarctica
205: BISSAU	: Guinea-Bissau	242: FORT THOMAS 1955	: Nevis, St. Kitts, Leeward Is.
206: DABOLA	: Guinea	243: ISTS 061 ASTRO 1968	: South Georgia Is.
207: EUROPEAN 1950	: Tunisia	244: MONTSERRAT IS. ASTRO 1958	: Montserrat, Leeward Is.
208: LEIGON	: Ghana	245: FEUNION	: Mascarene Is.
209: MINNA	: Cameroon	246: AMERICAN SAMOA 1962	: American Samoa Is.
210: M' PORALOKO	: Gebon	247: INDONESIAN 1974	: Indonesia
211: NORTH SAHARA 1959	: Algeria	248: KUSAIE ASTRO 1951	: Caroline Is., Fed. States of Micronesia
212: POINT58	: Mean Solution (Burkina Faso & Niger)	249: WAKE Is. ASTRO 1952	: Wake Atoll
213: POINTE NOIRE 1948	: Congo	250: EUROPEAN 1950	: Iraq, Israel, Jordan, Kuwait, Lebanon, Saudi Arabia, and Syria
214: SIERRA LEONE 1960	: Sierra Leone	251: HERMANNSKOGEL	: Yugoslavia (Prior to 1990) Slovenia, Croatia, Bosnia and Herzegovina, Serbia
215: VOIROL 1960	: Algeria	252: INDIAN	: Pakistan
216: AIN EL ABD 1970	: Saudi Arabia	253: PULKOVO 1942	: Russia
217: INDIAN	: Bangladesh	254: VOIROL 1874	: Tunisia/Algeria
218: INDIAN	: India & Nepal		
219: INDIAN 1954	: Thailand		
220: INDIAN 1960	: Vietnam (near 16N)		

**SPECIFICATIONS OF MARINE RADAR
FR-8045/8065/8125/8255**

1 GENERAL

1.1 Range, Pulse length (PL) and Pulse repetition rate (PRR)

Range (NM)	PL (μs)	PRR (Hz)
0.0625 to 1.6	0.08	2100
1.5 to 3.2	0.3	1200
3 to 96	0.8	800

- 1.2 Maximum range 48 NM (FR-8045), 72 NM (FR-8065/8125), 96 NM (FR-8255)
- 1.3 Range resolution 15 m (FR-8045), 20 m (FR-8065/8125/8255)
- 1.4 Bearing resolution 1.9° (XN-12A), 1.2° (XN-13A)
- 1.5 Minimum range 18 m (FR-8045), 25 m (FR-8065/8125/8255)
- 1.6 Bearing accuracy Within ±1.0°
- 1.7 Range ring accuracy 0.9 % of range or 8 m, which is the greater

2 ANTENNA UNIT

- 2.1 Radiator Slotted wave-guide array
- 2.2 Polarization Horizontal
- 2.3 Rotation speed 24 rpm (RSB-0070), 48 rpm (RSB-0073)
- 2.4 Radiator length 120 cm (XN-12A), 180 cm (XN-13A)
- 2.5 Horizontal beamwidth 1.9° (XN-12A), 1.35° (XN-13A)
- 2.6 Vertical beamwidth 22°
- 2.7 Sidelobe
 - XN-12A -24 dB or less (within ±10% of main-lobe)
-30 dB or less (outside ±10% of main-lobe)
 - XN-13A -28 dB or less (within ±10% of main-lobe)
-35 dB or less (outside ±10% of main-lobe)

3 TRANSCEIVER MODULE

- 3.1 Frequency and modulation 9410 MHz ±30MHz (X-band), P0N
- 3.2 Peak output (nominal) FR-8045: 4 kW, FR-8065: 6 kW, FR-8125: 12 kW, FR-8255: 25 kW
- 3.3 Range scale, Ring interval (RI) and Number of rings

Range (NM)	0.125	0.25	0.5	0.75	1	1.5	2	3	4	6	8	12	16
RI (NM)	0.025	0.05	0.1	0.25	0.2	0.25	0.5	0.5	1	1	2	3	4
Rings	5	5	5	3	5	6	4	6	4	6	4	4	4

24	36	48	64	72	96
6	6	8	16	12	16
4	6	6	4	6	6

- 3.4 Modulation FET switching method
- 3.5 IF amplifier 60 MHz
- 3.6 Tuning Automatic or manual
- 3.7 Warm-up time 90 s approx. (FR-8045/8065/8125), 180 s approx. (FR-8255)

4 DISPLAY UNIT

- 4.1 Indication system 12.1 inch TFT color LCD,800 x 600 dots (SVGA)
- 4.2 Radar indication pixel 300 dots in radius
- 4.3 Effective radar diameter 184 mm
- 4.4 Marks Heading line, Bearing scale, Range ring, Tuning indicator, Cursor,

- North mark, Variable range marker (VRM), Electric Bearing Line (EBL), Target alarm zone, Zoom window, Waypoint mark, Origin mark
- 4.5 Alphanumeric indication Range, Range ring interval, Pulse length, Display mode, Off-center, Heading data*, Target trail, Tuning indicator, Target alarm, Echo stretch (ES), Echo average (EAV), EBL, Vector time*, Range and bearing to cursor or cursor position*, Interference rejecter (IR), Auto anti-clutter (A/C auto), VRM, Navigation data* (position, speed, course), ARPA/ATA/AIS data*
- *: external data required
- 4.6 Audio alarm volume 74 dB (A)

5 INTERFACE

- 5.1 Number of port
- Serial 2 ports: IEC61162-1/2 (NMEA0183 V1.5/2.0/3.0/4.0)
- Heading sensor 1 port: AD-10 or NMEA format
- USB 1 port: USB2.0 for maintenance
- Contact closure 1 port for buzzer, 12 mA max.
- Video output 1 port for sub monitor
- 5.2 I/O sentences
- Input BWC, BWR, DBT, DPT, GGA, GLL, GNS, HDG, HDM, HDT, MTW, MWV, RMB, RMC, THS, TTM (for radiotelephone only), VHW, VTG, VWR, VWT, XTE, ZDA
- Output RSD, TLL, TTM (ARP-11 required)
- 5.3 Output proprietary sentence pidat

6 POWER SUPPLY

- FR-8045 24 VDC: 3.7 A (48 rpm only)
- FR-8065 24 VDC: 3.6 A (24 rpm), 3.9 A (48 rpm)
- FR-8125 24 VDC: 3.9 A (24 rpm), 4.5 A (48 rpm)
- FR-8255 Display unit: 24 VDC: 3.0 A
Power supply unit: 24 VDC: 2.3 A (24 rpm), 2.7 A (48 rpm)

7 ENVIRONMENTAL CONDITIONS

- 7.1 Ambient temperature
- Antenna unit -25°C to +55°C
- Display/power supply unit -15°C to +55°C
- 7.2 Relative humidity 93% or less at +40°C
- 7.3 Degree of protection
- Antenna unit IP56
- Display unit IP25 (panel), IP22 (chassis)
- Power supply unit IP22
- 7.4 Vibration IEC 60945 Ed.4

8 UNIT COLOR

- 8.1 Antenna unit N9.5
- 8.2 Display unit N2.5
- 8.3 Power supply unit N2.5

INDEX

A

A/C RAIN key	1-12
A/C SEA control	1-11
A/C SEA key	1-28, 2-3, 2-4
Adjust sensitivity	1-10
Advanced troubleshooting	6-5
AIS operation	4-1
activate/sleep a target	4-2
controls	4-1
CPA/TCPA alarm	4-8
display on/off	4-1
display range	4-4
display targets in specific sectors	4-5
history display	4-7
lost target	4-9
number of targets displayed	4-5
proximity alarm	4-9
slow target ignore	4-10
symbol colors	4-10
symbols	4-2
target data	4-3
target sorting	4-4
vector attributes	4-6
vector time and reference	4-6
Alarm message	1-45
meanings	1-46
ARPA operation	3-1
acquire and track target	3-2
automatic acquisition of target	3-3
controls	3-1
CPA/TCPA alarm	3-8
display on/off	3-2
history display	3-6
lost target	3-9
manual acquisition of target	3-2
proximity alarm	3-9
stop tracking	3-3
symbol colors	3-10
target data	3-7
target number	3-2
target symbols	3-2
vector attributes	3-4
vector of your ship	3-5
vector time and reference	3-4
ARPA test	6-9
Auto adjust clutter	1-13

B

Brill/color menu items	1-52
------------------------------	------

C

CANCEL/HL OFF key	1-34
Characteristics curve	1-44
Color selection	1-40
custom	1-41

presets	1-40
Controls	
overview	1-1
Course-up mode	1-8
Cursor	1-14
data	1-14
CUSTOM key	1-20, 1-34
Custom setup	1-34
description of items	1-35
how to setup	1-36

D

Diagnostic test	6-6
Display brilliance	1-4
Display indications	1-3
Display menu items	1-53
Display mode	
course-up mode	1-8
head-up mode	1-8
north-up mode	1-8
relative motion	1-7
selection	1-7
true motion	1-7
true motion mode	1-9
true view mode	1-9
Dynamic range	1-43

E

EBL	
measure range to target with EBL	1-18
EBL key	1-18
EBL reference	1-19
Echo area	1-47
Echo average	1-28
Echo menu items	1-53
Echo stretch	1-28

F

Function keys	1-37
available options	1-37
changing function key program	1-37
F1 key	1-37
F2 key	1-37
F3 key	1-37

G

Gain	
manual mode	1-10
Gain adjustment	1-10
GAIN key	1-10
GPS operation	5-1
cold start	5-4
datum	5-1
navigator mode	5-1
satellite monitor	5-3
WAAS setup	5-2

INDEX

GPS test.....6-10

H

Heading line
 how to hide temporarily 1-34
Head-up mode 1-8
How to measure the range and bearing between
two targets 1-19

I

Initial sub-menu.....1-48
 description of menu items 1-48
 how to open.....1-48
Interference rejector 1-15

L

LCD backlight life 6-3
LCD test 6-8

M

Magnetron life 6-3
MENU key 1-4
Menu overview 1-4

N

Navigation data
 screen bottom 1-42
 standby.....1-42
Noise rejector 1-38
North-up mode 1-8

O

OFF CENTER key 1-19, 1-24, 1-25
Off center the display
 automatic shift formula 1-25
Off-center the display 1-24
 auto mode 1-25
 custom mode 1-25
 manual mode 1-24
 mode selection 1-24
Origin mark 1-33

P

Panel dimmer 1-4
Power on/off 1-2
Power/BRILL key 1-2, 1-4
Presentation brilliance 1-34
Preventative maintenance 6-2
Pulselength selection 1-20

Q

Quick start 1-2

R

RACON 2-6
Radar 2-1
 bearing accuracy 2-3
 false echoes 2-3
 minimum and maximum ranges 2-1
 multiple echoes 2-3
 range measurement 2-3
 resolution 2-2
 shadow sector 2-5

 sidelobe echoes 2-4
 virtual image 2-4
Rain clutter adjustment 1-12
 auto mode 1-12
 manual mode 1-13
RANGE key 1-10, 2-6
Range scale selection 1-10
Range to a target 1-16
 fixed range rings 1-16
 VRM 1-17
Remote display 1-54
 appearance 1-54
 unavailable functions 1-54
 unavailable items 1-54

S

SART 2-5
 display 2-6
 range errors 2-6
 range scale 2-6
Sea clutter adjustment
 auto mode 1-11
 manual mode 1-11
Second-trace echo reduction 1-39
Sector blank 1-51
Simple troubleshooting 6-4
Start-up screen 1-2
STBY/TX key 1-2, 1-39
System configuration xi

T

Target alarm 1-21
 alarm level options 1-23
 buzzer on/off 1-23
 deactivate 1-23
 selecting type 1-22
 setting a zone 1-21
 stopping audio 1-22
 temporary sleep 1-23
TARGET ALARM key 1-21, 1-23
Target position 1-33
Target trails 1-29
 color 1-31
 gradation 1-31
 narrow trails 1-33
 own ship trail 1-33
 relative mode 1-30
 restart/stop 1-32
 start/stop 1-30
 trail level 1-32
 trail time 1-29
 true mode 1-30
TLL key 1-33
 modes 1-33
TRAILS key 1-30
True motion mode 1-9
True view mode 1-9
Tuning 1-6

U

Units sub-menu 1-50

V

VRM key..... 1-17

W

Watchman 1-39

Waypoint marker 1-45

Wiper..... 1-38

Z

Zoom 1-26

mode selection 1-26

relative mode..... 1-26

target mode 1-27

true mode 1-26