3.5 General Operation

3.5.1 Eliminating radar interference [MENU]

If radar interference occurs, take the following steps to set an interference elimination level:

(a) Press the **[MENU]** key to display MENU.

(b) Select BASIC and then INTERFERENCE pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

(c) The menu below is displayed. Select OFF, IR1, IR2, or IR3, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

```
              BASIC
INTERFERENCE    IR1
OFF             OFF
IR1             OFF
IR2             3 0
IR3             FULL
ZOOM            OFF
```

Note

The interference elimination levels are IR1 → IR2 → IR3 starting with the lowest level. However, if the set level is too high, a problem such as the decrease of sensitivity occurs. The lowest level IR1 should be selected for general use.

3.5.2 When it is raining or snowing [AUTO-RAIN]

> # ⚠CAUTION
>
> 🚫 Do not set the rain/snow clutter function to too high a suppression level.
> Otherwise, not only echoes from rain/snow but also the targets of ships or dangerous objects are suppressed, which may disturb the detection.
> Set the best suppression level whenever you use the ran/snow clutter suppression function.

When it rains or snows, echoes (rain clutters) from rain or snow are displayed on the PPI screen. As a result, the images of echoes from ships or the likes are difficult to observe.

Use of the manual or automatic rain/snow clutter function suppresses rain clutters and makes it easy to observe targets.

While the automatic rain/snow clutter function is working, the manual rain/snow clutter function (control) cannot be used.

To select the manual or automatic rain/snow clutter function of this radar, operate the **[AUTO-RAIN]** control. When the automatic rain/snow clutter suppression function is ON, "A RAIN" is displayed on the upper right of the screen.

(a) Switching the rain/snow clutter suppression mode

If manual rain/snow clutter suppression is currently selected, pressing the **[AUTO-RAIN]** control key changes to automatic rain/snow clutter suppression. If auto rain/snow clutter suppression is currently selected, pressing the **[AUTO-RAIN]** control key changes to manual rain/snow clutter suppression. **The automatic rain/snow clutter suppression mode** and **manual rain/snow clutter suppression mode** are switched back and forth each time the key is pressed.

(b) Turning the rain/snow clutter control

If manual rain/snow clutter suppression is currently selected, as the rain/snow clutter control is turned clockwise, the rain/snow clutter suppression function works more strongly.

3.5.3 When the sea is rough [AUTO-SEA]

⚠CAUTION

🚫 Do not set the sea clutter suppression function to a level at which it clears all sea clutters in short range.
Otherwise, not only echoes from waves but also the targets of ships or dangerous objects are suppressed, which may disturb the detection.
Set the best suppression level whenever you use the sea clutter suppression function.

If the sea becomes rough, echoes (sea clutters) from waves are displayed on the PPI screen. As a result, the images of echoes from ships or the likes are difficult to view. Sea clutters appear more clearly in shorter ranges.

Use of the manual or automatic sea clutter function suppresses sea clutters and makes it easy to observe targets.

While the automatic sea clutter function is working, the manual rain/snow clutter function (control) cannot be used.

To select the manual or automatic rain/snow clutter function of this radar, operate the **[AUTO-SEA]** control. When the automatic sea clutter suppression function is ON, "A SEA" is displayed on the upper right of the screen.

(a) Switching the sea clutter suppression mode

If manual sea clutter suppression is currently selected, pressing the **[AUTO-SEA]** control key changes to automatic sea clutter suppression. If auto sea clutter suppression is currently selected, pressing the **[AUTO-SEA]** control key changes to manual sea clutter suppression. **The automatic sea clutter suppression mode** and **manual sea clutter suppression mode** are switched back and forth each time the key is pressed.

(b) Turning the sea clutter control

If manual sea clutter suppression is currently selected, as the sea clutter control is turned clockwise, the sea clutter suppression function works more strongly.

3.5.4 Using the trackball [TRACK BALL]

[TRACK BALL] enables you to easily measure a distance to a target and the bearing at the same time.

Operate [TRACK BALL] to position the cursor to the target. The distance to the target and the bearing are displayed at the right bottom of the screen.

If a navigator such as a GPS is connected, the latitude and longitude at the target position can also be displayed.

Cursor   45.0° R
Position   4.000NM
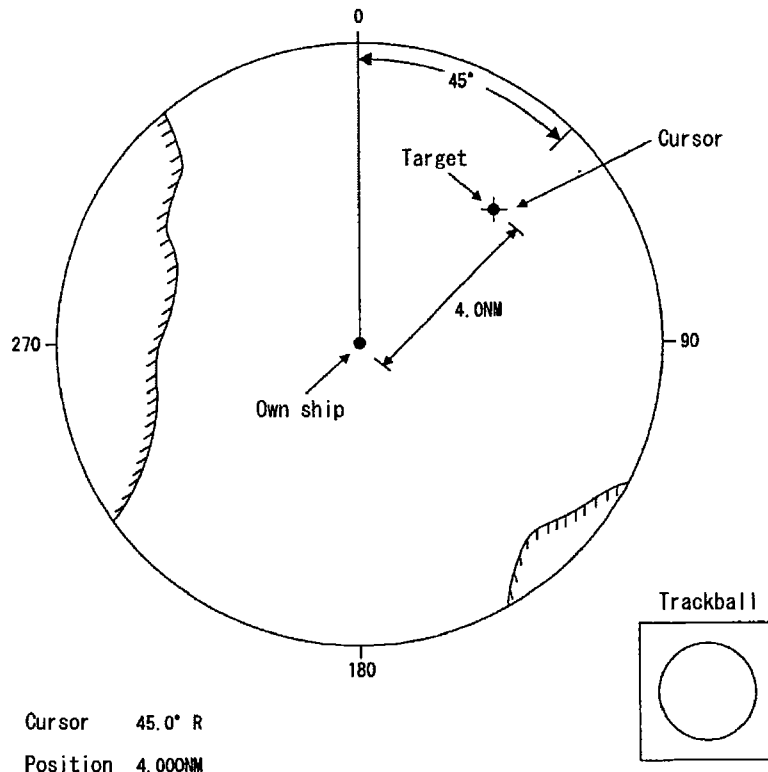
In this case, the target is at a position 4 NM from the own ship.

3.5.5 Using VRM [VRM1/VRM2], [JOG DIAL]

VRM is a line for measuring a distance to the target that is displayed on the PPI screen.

Since the size of the circle of VRM can be changed freely through **[JOG DIAL]**, a distance to an arbitrary target can be measured.

This radar can display 2 VRMs (VRM#1 and VRM#2) concurrently.

To display, select, or erase VRM#1/VRM#2, use the **[VRM1/VRM2]** key.

The VRM status is as follows:

> Neither **VRM#1** nor **VRM#2** is displayed.
>
> **VRM#1** is displayed, and **VRM#2** is not displayed.
>
> **VRM#2** is displayed, and **VRM#1** is not displayed.
>
> Both **VRM#1** and **VRM#2** are displayed.

Use the following methods to select each state above:

How to operate the [VRM1/VRM2] key

> Use the **[VRM1/VRM2]** key to switch between VRM#1 and VRM#2 and turn ON/OFF VRM#1/VRM#2.

1. Selecting VRM#1/VRM#2 [VRM1/VRM2]

> If neither VRM#1 nor VRM#2 is displayed, VRM#1 or VRM#2 can be selected/displayed by pressing the **[VRM1/VRM2]** key.
>
> If both VRM#1 and VRM#2 are displayed, VRM#1 and VRM#2 are selected back and forth by holding down the **[VRM1/VRM2]** key.
>
> The currently operable VRM#1/VRM#2 is shown with the VRM value reversed enclosed in broken lines at the upper right of the screen.

2. Operating VRM#1/VRM#2 [VRM1/VRM2]

> The VRM specified in 1 is operable.
>
> After specifying the VRM you want to operate in 1, press **[JOG DIAL]** several times until the jog dial mode display at the right bottom of the screen changes to "JOG VRM."
>
> **[JOG DIAL]** enters the VRM operation mode.
>
> In this status, the VRM can be zoomed in/out.
>
> Turning **[JOG DIAL]** clockwise **"zooms in"** the VRM.
>
> Turning **[JOG DIAL]** counterclockwise **"zooms out"** the VRM.

3. Erasing VRM#1/VRM#2 [VRM1/VRM2]

> If both VRM#1 and VRM#2 are displayed, press the **[VRM1/VRM2]** key to reverse the value of VRM#1/VRM#2 you want to retain on the screen. In this status, pressing the **[VRM1/VRM2]** key erases the non-reversed VRM.
>
> If only VRM#1 or VRM#2 is displayed, press the **[VRM1/VRM2]** key to reverse the value of VRM#1/VRM#2. It is enclosed in broken lines.
>
> In this status, pressing the **[VRM1/VRM2]** key erases the non-reversed VRM.

4. **Measuring the distance from own ship using VRM#1 [VRM1/VRM2]**

    (a) Press the **[VRM1/VRM2]** key to reverse the value of VRM#1.

    (b) In this status, turn **[JOG DIAL]** to adjust the line of VRM#1 to the target, and read the value of VRM#1 to measure the distance to the target.
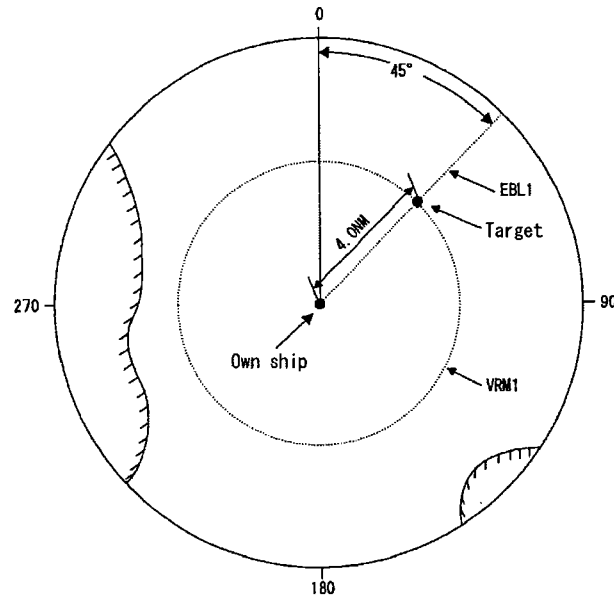
In the figure above, the distance from the own ship to the target is 4 NM.

5. **Measuring the distance from own ship using VRM#2 [VRM1/VRM2]**

    (a) Press the **[VRM1/VRM2]** key to reverse the value of VRM#2.

    (b) In this status, turn **[JOG DIAL]** to adjust the line of VRM#2 to the target, and read the value of VRM#2 to measure the distance to the target.
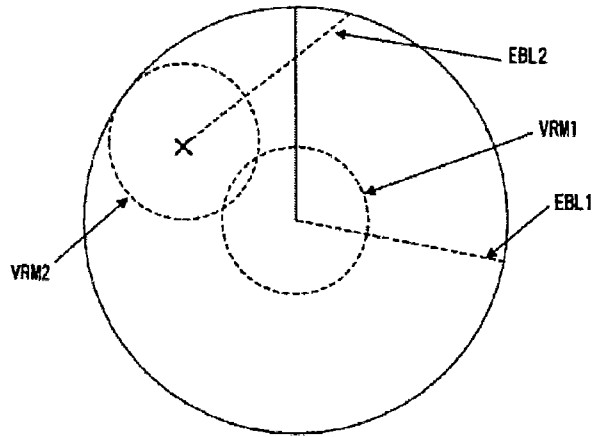
Caution

● **If EBL2 is in floating EBL mode, the center of VRM2 is the fulcrum of EBL2.**

VRM2 display with EBL2 in floating EBL mode

6. Setting KM as range units

The range units of VRM1 or VRM2 can be switched to KM or NM.

The range units can be set for VRM1 and VRM2 separately.

The units "KM" or "NM" is displayed following VRM1/VRM2.

Take the following steps to select the range units of VRM:

(a) Press the **[MENU]** key to display MENU.

(b) Select DISP OPTIONS and then VRM1 UNITS or VRM2 UNITS pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

(c) The menu below is displayed. Turn **[JOG DIAL]** to select KM or NM, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

Setting of the units of VRM2

3.5.6 Using EBL (electronic bearing cursor) [EBL1/EBL2], [TRACK BALL]

EBL (electronic bearing cursor) is a line for measuring the bearing of the target that is displayed on the PPI screen.

Since the angle of the line of EBL can be changed freely through **[JOG DIAL]**, the bearing of an arbitrary target can be measured.

This radar can display 2 EBLs (EBL#1 and EBL#2) concurrently.

To display, select, or erase EBL#1/EBL#2, use the **[EBL1/EBL2]** key.

EBL is displayed on the right side of the screen (horizontal display), or it is displayed in the numeric value display area at the bottom of the screen (vertical display). Operable EBL1 or EBL2 is reversed.

The EBL status is as follows:

Neither **EBL#1** nor **EBL#2** is displayed.

EBL#1 is displayed, and **EBL#2** is not displayed.

EBL#2 is displayed, and **EBL#1** is not displayed.

Both **EBL#1** and **EBL#2** are displayed.

Use the following methods to select each state above:

How to operate the [EBL1/EBL2] key

Use the **[EBL1/EBL2]** key to switch between EBL#1 and EBL#2 and turn ON/OFF EBL#1/EBL#2.

1. Selecting EBL#1/EBL#2 [EBL1/EBL2]

If neither EBL#1 nor EBL#2 is displayed, EBL#1 or EBL#2 can be selected/displayed by pressing the **[EBL1/EBL2]** key.

If both EBL#1 and EBL#2 are displayed, EBL#1 and EBL#2 are selected back and forth by holding down the **[EBL1/EBL2]** key.

The currently operable EBL#1/EBL#2 is shown with the EBL value reversed enclosed in broken lines at the upper right of the screen.

2. Operating EBL#1/EBL#2 [EBL1/EBL2]

The EBL specified in 1 is operable.

After specifying the EBL you want to operate in 1, press **[JOG DIAL]** several times until the jog dial mode display at the right bottom of the screen changes to "JOG EBL."

[JOG DIAL] enters the EBL operation mode.

In this status, the EBL can be turned.

Turning **[JOG DIAL]** clockwise turns the EBL "clockwise."

Turning **[JOG DIAL]** counterclockwise turns the EBL "counterclockwise."

3. Erasing EBL#1/EBL#2 [EBL]

If both EBL#1 and EBL#2 are displayed, press the **[EBL]** key to reverse the value of EBL#1/EBL#2 you want to retain on the screen. In this status, pressing the **[EBL1/EBL2]** key erases the non-reversed EBL.

If only EBL#1 or EBL#2 is displayed, press the **[EBL]** key to reverse the value of EBL#1/EBL#2.

In this status, pressing the **[EBL1/EBL2]** key erases the non-reversed EBL.

4. Measuring the bearing from own ship using EBL#1 [EBL1/EBL2]

    (a) Press the **[EBL1/EBL2]** key to reverse the value of EBL#1.

    (b) In this status, turn **[JOG DIAL]** to adjust the line of EBL#1 to the target, and read the value of EBL#1 to measure the bearing to the target.

5. Measuring the bearing from own ship using EBL#2 [EBL1/EBL2]

    (a) Press the **[EBL1/EBL2]** key to reverse the value of EBL#2.

    (b) In this status, turn **[JOG DIAL]** to adjust the line of EBL#2 to the target, and read the value of EBL#2 to measure the bearing to the target.
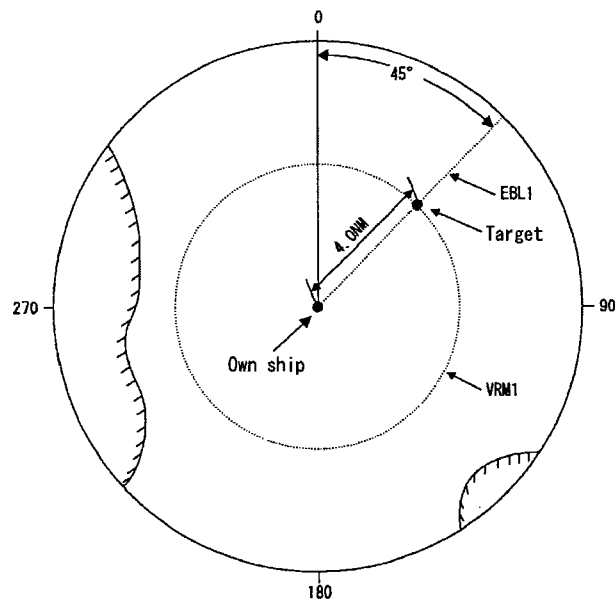
In this case, the target is at a position of the relative bearing 45 degrees from the own ship.

6. Using EBL2 as a floating EBL

EBL2 can be used as a floating EBL (eccentric EBL).

Take the following steps to place EBL2 in floating EBL mode.

    (a) Operate **[TACK BALL]** to determine the fulcrum of EBL2.

    (b) Press the **[MENU]** key to display | MENU |.

    (c) Select | DISP OPTIONS | and then | FLOATING EBL | pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

    (d) The menu below is displayed. Turn **[JOG DIAL]** to select | ON |, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

```
         DISP OPTIONS
EBL BEARING    TRUE
FROATING EBL   OFF
OFF            OFF
ON             NM
VRM2 UNITS     NM
WAYPOINT       OFF
POSITION       LL
LL-TD CONV>
```

As shown in the figure below, EBL2 moves to the cursor position. If VRM2 is displayed at the same time, the center of VRM2 also moves to the fulcrum of EBL2.
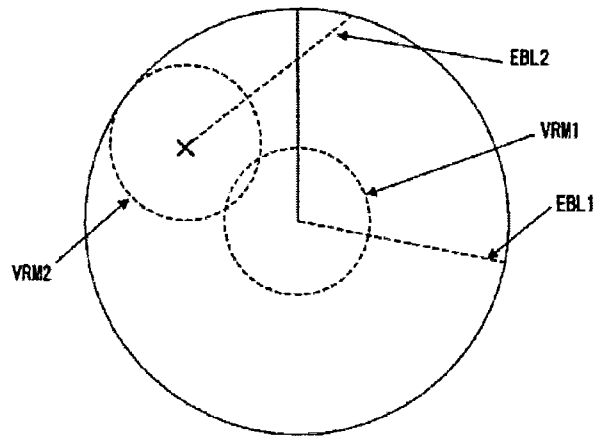
With EBL2 being placed in floating EBL mode

7. Setting EBL display

EBL can select true bearing or relative bearing.

True bearing means that the EBL bearing viewed from the own ship indicates the absolute bearing on the earth.

Relative bearing means that the EBL bearing viewed from the own ship indicates the relative bearing between the own ship and EBL.

Caution

● **True bearing and relative bearing are switched for both EBL1 and EBL2.**
  Thus, they cannot be set for EBL1 and EBL2 separately.

If true bearing presentation is selected, the value of EBL is displayed following by "T." If relative bearing presentation is selected, the value of EBL is displayed following by "R."

Take the following steps to switch between the relative bearing and true bearing of EBL:

(a) Press the [MENU] key to display MENU .

(b) Select DISP OPTIONS and then EBL BEARING pressing the [JOG DIAL] or [ACQ/ENT] key after each selection.

(c) The menu below is displayed. Turn [JOG DIAL] to select RELATIVE or TRUE , and then press the [JOG DIAL] or [ACQ/ENT] key to determine the selection.

```
           DISP OPTIONS
EBL BEARING      TRUE
RELATIVE         OFF
TRUE             OFF
VRM1 UNITS       NM
VRM2 UNITS       NM
WAYPOINT         OFF
POSITION         LL
LL-TD CONV>
```

3.5.7 Changing the bearing presentation method of the PPI screen [AZI MODE]

The following three bearing presentation methods are available for the radar PPI screen:

(a) Relative bearing presentation (Head Up)

Relative bearing is presented with the heading just above (at 0° of bearing marker) the PPI screen.

When the ship's heading changes, the bearing of the echo image on the PPI screen also changes.

If bearing information cannot be received from a navigator such as a gyrocompass, this relative bearing presentation is applied.

To place the screen in Head Up mode, press the [AZI MODE] key on the keyboard several times until the display at the upper left of the screen changes to "HUP."

(b) True bearing presentation (North Up)

True bearing is presented with "North" as due north of the PPI screen.

Even if the ship's heading changes, the bearing of the echo image on the PPI screen does not change.

(A device such as a gyrocompass is necessary for getting bearing information.)

To place the screen in North Up mode, press the [AZI MODE] key on the keyboard several times until the display at the upper left of the screen changes to "NUP."

(c) Course Up [AZI MODE]

The ship's heading at time of setting Course Up mode is presented with right above (at 0° of bearing marker) of the PPI screen.

When own ship's course changes after setting as Course Up mode, the bearing of the echo image on the PPI screen does not change and the ship's heading marker turns by only the change of the ship's heading.

When the course greatly changes, hold down the [AZI MODE] key to set the course again. (Course up reset)

To place the screen in Course Up mode, press the **[AZI MODE]** key on the keyboard several times until the display at the upper left of the screen changes to "CUP."

Caution

● **Course up reset is only available in Course Up mode.**
Hold down the [AZI MODE] key except course reset mode, the mode is shifted to gyro setting mode.
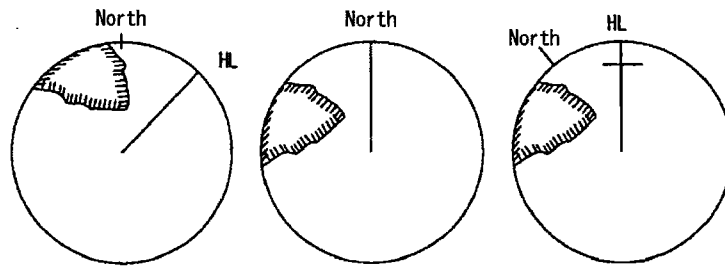
Display in North Up mode   Display in Head Up mode   Display in Course Up mode

---

● **The input of bearing information from the navigator is necessary for changing the bearing presentation method of the PPI screen.**

3.5.8   Changing the center of the PPI screen [OFFCENT]

A display in an arbitrary direction can be lengthened by moving the center (off center) of the PPI screen.

1. Setting a position to which the center is moved

(a) Move the cursor to the position where you want to move the center of the screen.

(b) Press the **[OFFCENT]** key.   The center of the PPI screen moves to the new position.

2. Canceling the position as the new center

(a) To return the center of the screen to the original, press the **[OFFCENT]** key again.   The center of the screen returns to the original.

Press [OFFCENT] key

Note

Even if the center of the PPI screen is moved, this radar does not erase the images on the PPI screen including the display of trails and the likes.

You can observe the heading of another ship at any time by freely moving the center of PPI screen.

Caution

● **The center of the PPI screen can be moved by up to 90% of the maximum screen radius. If the center is moved by the allowable maximum into the SHM direction, the observable range of targets in the heading direction becomes too small, which is dangerous.**

The center of the screen should be moved into the SHM direction for short observation such as confirmation of another ship's position.

---

3. Continuously moving the center

To continuously move the center of the PPI screen, operate **[TRACK BALL]** while pressing the **[OFFCENT]** key. When deciding a position as the new center, release the **[OFFCENT]** key. Moving of the center stops.

4. Canceling the position as the new center

To return the center of the screen to the original, press the **[OFFCENT]** key again. The center of the screen returns to the original.

3.5.9　Using the trail display function [TRAILS] .

Displaying radar trails

The heading of another ship can be confirmed by the trail length and direction. This feature assists in avoiding ship collision.

Timing trail display, continuous trail display, or combination of timing trail display and continuous trail display can be selected for the trail length of the radar.

- Timing trail display :
  A value 30 to 59 seconds or 1 to 99 minutes can be set for the trail length.
- Continuous trail display :
  The trail length is unlimited.
- Timing trail display + continuous trail display :
  The trail length is set in combination of the two modes above.

Even while the trail display function is set to OFF, the trail storage function is always working. Thus, you can display trail data through one-touch operation whenever you want to.

1. Setting the trail display function to ON/OFF [TRAILS]

(a) Press the **[TRAILS]** key. The display changes in the following sequence:
Display OFF → display ON (timing trail display) → display ON (continuous trail display)
→ display ON (timing trail display + continuous trail display) → display OFF.

2. Setting a trail interval [TRAILS]

(a) Hold down the **[TRAILS]** key to display the | TRAILS | menu.

(b) Operate **[JOG DIAL]** to select | TRAIL INTERVAL |, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key.

(c) The menu below is displayed. Turn **[JOG DIAL]** to set a value 30 to 59 seconds or 1 to 99 minutes, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the setting.

TRAILS	
TRAIL INTERVAL	6M
TRAIL REF LVL	8
TRAIL SUPRESS	0.0NM
TRAIL CLEAR	OFF
RANGE TRAIL	CLEAR

TRAILS	
TRAIL INTERVAL	6M
6NM	8
TRAIL SUPRESS	0.0NM
TRAIL CLEAR	OFF
RANGE TRAIL	CLEAR

Caution

● **Because wake time may err by the rotation speed of scanner unit or the setting timing, surely use this as a standard.**

---

3. Clearing stored trail data [TRAILS]

(a) Hold down the **[TRAILS]** key to display the | TRAILS | menu.

(b) Operate **[JOG DIAL]** to select | TRAIL CLEAR |, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key.

(c) Select | ON |, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

TRAILS	
TRAIL INTERVAL	6M
TRAIL REF LVL	8
TRAIL SUPRESS	0.0NM
TRAIL CLEAR	OFF
RANGE TRAIL	CLEAR

TRAILS	
TRAIL INTERVAL	6M
TRAIL REF LVL	8
TRAIL CLEAR	0.0NM
OFF	OFF
ON	CLEAR

(d) The ON selected above is automatically changed back to | OFF | when the stored trail data has been cleared.

4. Setting a trail reference level (trail threshold) [TRAILS]

A trail reference level is used to determine whether to store trail data depending on the strength of targets.

A level 0 to 15 can be set as a threshold.

When level 1 is set, the data of all the targets displayed on the PPI screen is stored/displayed.

As a higher level is set, the trail data of only stronger targets is stored/displayed.

Level 8 is usually set.

If sea clutters are strong and they are also stored/displayed, set a level higher than 8.

Conversely, if the trail data of weak targets is difficult to store/display, set a level lower than 8.

Take the following steps to set a trail reference level (trail threshold):

(a) Hold down the **[TRAILS]** key to display the | TRAILS | menu.

(b) Operate **[JOG DIAL]** to select | TRAIL REF LVL |, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key.

(c) The menu below is displayed. Select the threshold (level) you want to set, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

```
              TRAILS
TRAIL INTERVAL  6M
TRAIL REF LVL   8
8               0.0NM
TRAIL CLEAR     OFF
RANGE TRAIL     CLEAR
```

5. Setting a trail storage suppression distance [TRAILS]

The trail storage suppression distance is a function not to store the data of trails in a specified distance from the own ship.

Use the function not to store the data of unnecessary trails due to wave splash when the own ship sails.

To turn OFF the storage suppression function, set "0" in the procedure below.

Take the following steps to set a trail storage suppression distance:

(a) Hold down the **[TRAILS]** key to display the | TRAILS | menu.

(b) Operate **[JOG DIAL]** to select | TRAIL SUPRESS |, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key.

(c) The menu below is displayed. Turn **[JOG DIAL]** to set a distance from the own ship in which you do not want to store trail data, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the setting.

```
              TRAILS
TRAIL INTERVAL  6M
TRAIL REF LVL   8
TRAIL SUPRESS   0.0NM
0.0NM           OFF
RANGE TRAIL     CLEAR
```

6. Setting a range trail storage [TRAILS]

The range trail storage is a function not to clear the trail storage in temporarily observing a range other than the present range at the time of the trail storage or the trail display.

Normal setting value is "CLEAR", and the trail is automatically cleared by switched the range. The trail is not automatically cleared even if the range is switched, set "KEEP" in the procedure below.

Take the following steps to set a range trail storage:

(a) Hold down the **[TRAILS]** key to display the | TRAILS | menu.

(b) Operate **[JOG DIAL]** to select | RANGE TRAIL |, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key.

(c) The menu below is displayed. Turn **[JOG DIAL]** to select | KEEP |, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

```
                    TRAILS
TRAIL  INTERVAL    6M
TRAIL  REF  LVL    8
RANGE  TRAIL       0 0NM
CLEAR              OFF
KEEP               CLEAR
```

3.5.10   Using the target expansion function [MENU]

The image expansion function extends the images of echoes on the PPI screen into the angle direction and distance direction.

Caution

● **When the image expansion function is used, the echoes of two targets that are close to each other in the distance direction (ahead/behind) and angle direction may turn into a single image on the PPI screen.**

1. **Setting the target expansion function**

   Take the following steps to set the target expansion function:
   (a) Press the **[MENU]** key to display ⎦MENU⎦.
   (b) Select ⎦BASIC⎦ and then ⎦TGT EXPANSION⎦ pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.
   (c) The menu below is displayed. Turn **[JOG DIAL]** to select ⎦ON⎦, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

2. **Canceling the target expansion function**

   To cancel the target expansion function, take the above steps changing step (c) as follows:.
   In step (c) above, select ⎦OFF⎦, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

3.5.11   Changing the transmitter pulse length [GAIN/PL]

The transmitter pulse length can be changed in the range of 1.5, 3, or 6 nautical miles.

If a long pulse is selected, the images of echoes on the PPI screen are lengthened in the distance direction. Conversely, if a short pulse is selected, the images are displayed reduced in size (length).

Unlike the image expansion function, the above function displays the echoes when a pulse becomes longer that have not been displayed previously.

Caution

● **When a longer pulse is selected, the echoes of two targets that are close to each other in the distance direction (ahead/behind) may turn into a single image on the PPI screen.**

Changing the pulse length

(a) Press the **[GAIN/PL]** control during transmission. The pulse length display at the right bottom of the screen changes. At the same time, the pulse length changes, and the size of the echoes on the screen changes.

3.5.12 Using the zoom function [MENU]

The zoom function can double the size of the PPI screen on the basis of own ship position.

Caution

● **This function does not work when the 0.125 nautical mile range is used.**

---

1. Setting the zoom function

Take the following steps to zoom the area:

(a) Press the **[MENU]** key to display │ MENU │.

(b) Select │ BASIC │ and then │ ZOOM │ pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

(c) The menu below is displayed. Turn **[JOG DIAL]** to select │ ON │, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

BASIC	
INTERFERENCE	IR1
TGT EXPANSION	OFF
PROCESS	OFF
ZOOM	3.0
OFF	FULL
ON	OFF

● **The center of the PPI can be moved to a position of 90% of the observation range.**

(e) The area is doubled with own ship as the center.

2. Canceling the zoom function

In step (c) above, select │ OFF │, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key. The zoom function is canceled and the screen returns to the normal display.

3.5.13 Highlighting a target by decreasing unnecessary noise (image processing) [MENU]

┌── **Caution** ─────────────────────────

● **Do not use this function to view the radar beacon, the START signal, or a target moving at a high speed on the radar screen.**

● **This function is used most suitably in TM mode.**
   When you use the function in RM mode, select N-UP or C-UP. Use of the function with H-UP may cause images to be blurred.

└──

1. Setting image processing [MENU]

There are three types of image processing, PROC1, PROC2, and PROC3.

PROC1:   Select PROC1 when there is a target moving at a low speed.

        The image of a relatively unstable target is highlighted and displayed in stable state.

        PROC1 is effective for suppressing irregular signals like sea clutters.

        However, the image of a target moving at a high speed dims.

        Use PROC1 in a range of 1.5 nautical miles or less as a rule of thumb.

PROC2:   Select PROC2 to display images in more stable state than "PROC1" does.

        PROC2 is effective particularly when there are many sea clutters.

        Use PROC2 in a range of 3 nautical miles or more as a rule of thumb.

PROC3:   Select PROC3 when a target is not displayed at the very limit of remote noise.

        Use PROC3 in a range of 6 nautical miles or more as a rule of thumb.

        Disadvantage of PROC3 is that the target may be more difficult to observe because noise or the like also appears clearly.

PROC1+3: PROC1 is performed in a preset processing range (the processing range from own ship), and PROC3 is performed outside the processing range (the processing range or more).

        Use PROC1+3 as navigation when you want to display a target at the very limit of remote noise while performing PROC1 that makes it easy to observe other ships influenced by sea clutters in short range.

PROC2+3: PROC2 is performed in a preset processing range (the processing range from own ship), and PROC3 is performed outside the processing range (the processing range or more).

        Use PROC2+3 as navigation when you want to display a target at the very limit of remote noise while performing PROC2 that makes it easier to observe other ships influenced by sea clutters in short range than PROC1 does.

Take the following steps to set image processing:

(a) Press the **[MENU]** key to display ⎡MENU⎤.

(b) Select ⎡BASIC⎤ and then ⎡PROCESS⎤ pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

(c) The menu below is displayed. Turn **[JOG DIAL]** to select PROC1, PROC2, PROC3, PROC1+3, or PROC2+3, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

```
              BASIC
PROCESS        IR1
OFF            OFF
PROC1          OFF
PROC2          3.0
PROC3          FULL
PROC1+3        OFF
PROC2+3
```

2. Canceling image processing [MENU]

In step (c) above, select OFF to cancel the image processing function.

3. Setting an image processing range [MENU]

Take the following steps to select the processing range of PROC1+3 or PROC2+3:

(a) Press the **[MENU]** key to display MENU.

(b) Select BASIC and then PROC SW RANGE pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

The menu below is displayed. Turn **[JOG DIAL]** to set the range you want, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the setting.

```
              BASIC
INTERFERENCE   IR1
TGT EXPANSION  OFF
PROCESS        OFF
PROC SW RANGE  3.0
3. ONM         FULL
ZOOM           OFF
```

3.5.14 Switching true/relative motion display [TM/RM]

The motion mode determines whether to display the moving of the own ship and another target in relative motion or true motion.

1. Switching the motion mode

(a) Press the **[TM/RM]** key. The screen display and function changes in the following sequence:

"RM" → "TM" → "CTM" → "RM"

RM: Relative motion. This mode displays other targets in relative motion fixing the own ship to the center.
Radar trails are displayed in relative motion.

TM: True motion. This mode displays the own ship and other targets in true motion on the screen with the earth being fixed.
Radar trails are displayed in true motion.

CTM: True motion with own ship fixed. This mode displays other targets in relative motion fixing the own ship to the center.
Radar trails are displayed in relative motion.

"True motion display TM"

The fixed position of own ship on the screen moves according to the ship speed and course. A fixed target like a land target is fixed onto the screen, and an actually moving target moves on the screen. The position of own ship is set to a position about 66% of the radius in the opposite direction of the course on the extension of the ship's heading marker (SHM) when the true motion display is enabled. The ship starts moving from the position according to the specified own ship's speed and course.

After that, when the own ship reaches a position 66% of the radius in the opposite direction, the own ship's position is automatically reset to the position at switching to the true motion display.

Fixed onto the screen

Moving according to the own ship's speed

HL
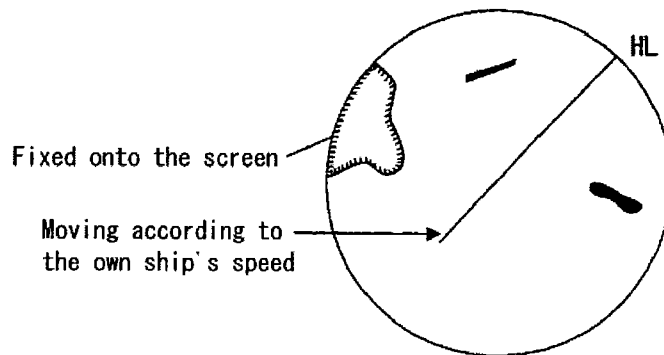
True motion display

2. Resetting own ship's position in true motion display (TM)

Reset method :
Hold down the **[TM/RM]** key.

The own ship's position is reset to the position at switching to true motion display, and the own ship starts moving from the position.

Allowable combinations of azimuth modes and motion modes

Available azimuth modes vary depending on the motion mode.

	H-UP	N-UP	C-UP
RM	○	○	○
TM	×	○	○
CTM	×	○	○

Difference between TM and CTM

The CTM mode always displays TM-mode images with the own ship as the center.

	TM	CTM
Own ship display	True motion	Fixed to the center
Another ship display	True motion display	Relative motion display
Image processing	True motion	True motion
Radar trails	True motion display	True motion display
Off-center	90%	90%

3.5.15 Suppressing the power consumption of the radar [MENU]

Use the intermittent transmitting function to suppress the power consumption.

The transmitting state and standby state are automatically switched while the intermittent transmitting function is used.

The intermittent transmitting function can freely set the periods of the transmitting state and standby state.

> Period of the transmitting state → Set the number of times the antenna rotated.
> Period of the standby state → Set the time while the standby state is placed.

1. Using the intermittent transmitting function [MENU]

Take the following steps to use the intermittent transmitting function:

(a) Press the **[MENU]** key to display | MENU |.

(b) Select | TX PLAN | and then | TX PLAN | pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

(c) The menu below is displayed. Turn **[JOG DIAL]** to select | ON |, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

```
              TX PLAN
TX PLAN        OFF
OFF            10 SCAN
ON             3 MIN
```
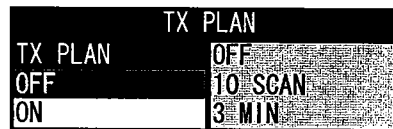
When the intermittent transmitting function is turned ON, the transmitting state is placed only while the antenna rotates the preset number of times. Similarly, the standby state is placed only during the set time.

2. Canceling the intermittent transmitting function [MENU]

In step (c) above, select | OFF |, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

Caution
- Cancelling is possible only when it is under transmitting state. It is not possible under standby state.
---

3. Setting the period of the transmitting state (the number of antenna rotations) [MENU]

Take the following steps to set the number of antenna rotations:

(a) Press the **[MENU]** key to display | MENU |.

(b) Select | TX PLAN | and then | TX PERIOD | pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

(c) The menu below is displayed. Turn **[JOG DIAL]** to set the number of antenna rotations for placing the transmitting state, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the setting.

```
                  TX PLAN
TX PLAN              OFF
TX PERIOD          10 SCAN
1~99 SCAN           3 MIN
```

When the period of the transmitting state is set, the transmitting state is placed only while the
antenna rotates the set number of times and then automatically switched to the standby state.
After the standby state is placed for the set time, it is switched to the transmitting state again.
Likewise, the two states are switched back and forth repeatedly.

4. Setting the period of the standby state [MENU]

Take the following steps to set the period of the standby state:

(a) Press the **[MENU]** key to display $\boxed{\text{MENU}}$.

(b) Select $\boxed{\text{TX PLAN}}$ and then $\boxed{\text{STBY PERIOD}}$ pressing the **[JOG DIAL]** or **[ACQ/ENT]**
      key after each selection.

(c) The menu below is displayed. Turn **[JOG DIAL]** to set the time for placing the standby
      state, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the setting.

```
                  TX PLAN
TX PLAN              OFF
STBY PERIOD        10 SCAN
1~99 MIN            3 MIN
```

When the period of the standby state is set, the standby state is placed only for the set time
and then automatically switched to the transmitting state. After the transmitting state is
placed while the antenna rotates the set number times, it is switched to the standby state
again. Likewise, the two states are switched back and forth repeatedly.

3.5.16 Monitoring the heading of other ships (targets) [ALARM ACK]

A guard zone can be set for warning the invasion of other ships or targets.

There are two guard zone modes - one mode issues an alarm when a ship or target gets into the specified guard zone, and the other mode issues an alarm when a ship or target gets out of the specified guard zone.
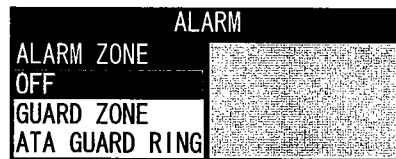
```
┌──── Caution ──────────────────────────────────────────
│
│   ● The volume of the alarm is the same as the volume of the buzzer.  Be careful
│     that if the volume of the buzzer is set too low, you may not recognize that an
│     alarm is issued.
│   ● The alarm does not always respond to all targets.  Thus, the alarm should be
│     used simply as an auxiliary device, and the operator herself/himself should
│     monitor the heading of other ships and targets with her/his eyes and ears.
│
└───────────────────────────────────────────────────────
```

1. Using the radar alarm [ALARM ACK]

Take the following steps to use the alarm function:

(a) Hold down the **[ALARM ACK]** key to display the | ALARM | menu.

(b) Select | ALARM | and then | ALARM ZONE | pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

(c) The menu below is displayed. Turn **[JOG DIAL]** to select | GUARD ZONE |, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

```
┌──────────────────────────────┐
│            ALARM             │
├──────────────┬───────────────┤
│ ALARM ZONE   │░░░░░░░░░░░░░░░│
│ OFF          │░░░░░░░░░░░░░░░│
│ GUARD ZONE   │░░░░░░░░░░░░░░░│
│ ATA GUARD RING│░░░░░░░░░░░░░░│
└──────────────┴───────────────┘
```

Note

Select | ATA GUARD RING | only when you use the optional MARPA function.

2. Canceling the radar alarm function

In step (c) above, select | OFF |, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

3. Creating a radar guard zone [ALARM ACK]

Take the following steps to create a radar guard zone for issuing a radar alarm:

(a) Hold down the **[ALARM ACK]** key to display the | ALARM | menu.

(b) Select | ALARM |, | GUARD ZONE |, and then | SETTING | pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

(c) A line is displayed for setting a guard zone. Operate **[TRACK BALL]** to set the range and the starting angle inside the guard zone, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key.

(d) Operate **[TRACK BALL]** to set the range outside the guard zone and the starting angle of the guard zone, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key.

(e) Operate **[TRACK BALL]** to set the ending angle of the guard zone, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the setting.

```
            GUARD ZONE
 ALARM MODE      IN
 ALARM LEVEL     8
 SETTING
```

Caution

● **Radar guard zone modes**
There are two guard zone modes (invade and leave) - the invade mode issues an alarm when a ship or target gets into the specified guard zone, and the leave mode issues an alarm when a ship or target gets out of the specified guard zone. Note that the range specified as the radar guard zone is displayed only when the radar is in transmitting state. It is not displayed when the radar is in standby state.

---

4. **Setting a radar guard zone [ALARM ACK]**

Take the following steps to set the mode that issues an alarm when a target gets into the specified radar guard zone or when a target gets out of the specified radar guard zone:

(a) Hold down the **[ALARM ACK]** key to display the ALARM menu.

(b) Select ALARM , GUARD ZONE , and then ALARM MODE pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

(c) The menu below is displayed. Turn **[JOG DIAL]** to select IN or OUT , and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

```
            GUARD ZONE
 ALARM MODE      IN
 IN              8
 OUT
```

5. **Setting a radar guard zone detection level [ALARM ACK]**

Take the following steps to set the detection level of a guard zone:

(a) Hold down the **[ALARM ACK]** key to display the ALARM menu.

(b) Select ALARM , GUARD ZONE , and then ALARM LEVEL pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

(c) The menu below is displayed. Turn **[JOG DIAL]** to set an alarm level 0 to 15, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the setting.

```
            GUARD ZONE
 ALARM MODE      IN
 ALARM LEVEL     8
 8
```

```
┌──── Caution ──────────────────────────────────────────────┐
│                                                           │
│  ● An alarm level 0 to 15 can be set as the volume of the alarm.   As a lower value is │
│    specified, the alarm responds to a weaker target.       │
│    Be careful that if a set alarm level is too high, the alarm may not work when it │
│    should.                                                 │
│                                                           │
└───────────────────────────────────────────────────────────┘
```

3.5.17   Resetting an alarm (stopping a warning) [ALARM ACK]

This section explains how to stop the alarm when an alarm is issued as a warning.

Stopping the alarm

Press **[ALARM ACK]** key.

The alarm stops.

3.5.18   Displaying parallel line cursors [MENU], [VRM], [EBL]

Parallel line cursors are displayed across the whole PPI display.

When parallel line cursors are displayed, VRM2 and EBL2 are used to set the turning angle and the spacing of parallel line cursors.

Displaying parallel line cursors

Take the following steps to display parallel line cursors:

(a) Press the **[MENU]** key to display | MENU |.

(b) Select | DISP OPTIONS | and then | PARALLEL LINE | pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

(c) The menu below is displayed.   Turn **[JOG DIAL]** to select | ON |, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

```
┌─────────────────────────────────┐
│        DISP OPTIONS             │
├──────────────────┬──────────────┤
│ EBL BEARING      │ TRUE         │
│ FROATING EBL     │ OFF          │
│ PARALLEL LINE    │ OFF          │
│ OFF              │ NM           │
│ ON               │ NM           │
│ WAYPOINT         │ OFF          │
│ POSITION         │ LL           │
│ LL-TD CONV>      │              │
└──────────────────┴──────────────┘
```

The parallel line cursors turn in the direction in which EBL2 turns.

The spacing of parallel line cursors can be changed in the direction in which VRM2 turns.
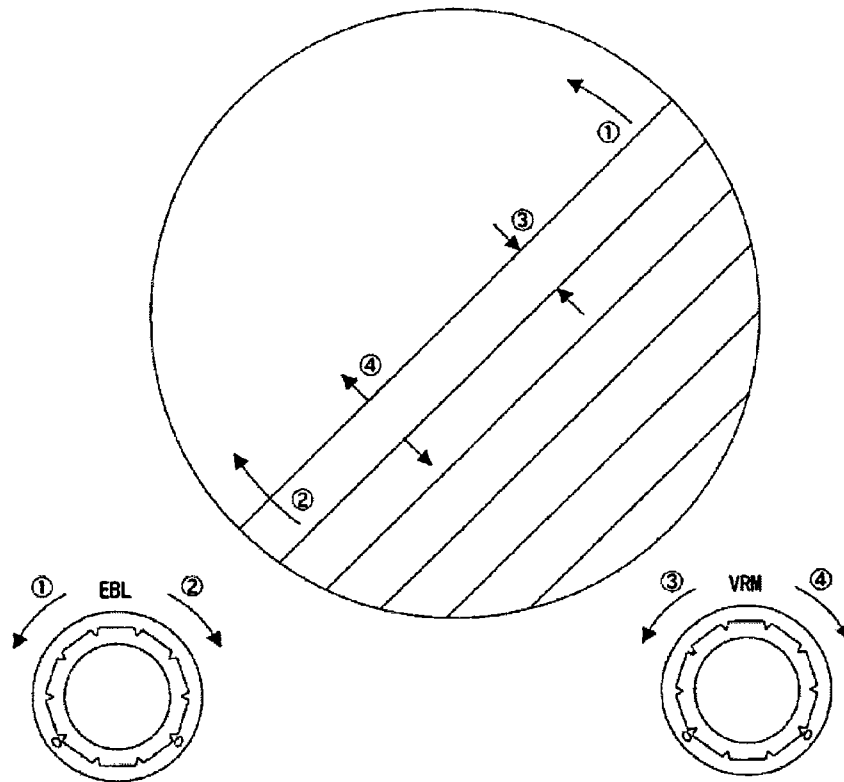
Parallel line cursor display

<Changing the spacing of parallel line cursors>

The bearing and the spacing of parallel line cursors can be changed in EBL2 mode and VRM2 mode, respectively.

3.5.19   Using the MOB function [MOB]

MOB is also called a falling-into-sea mark. If a person or object falls into the sea, press the **[MOB]** key. The latitude and longitude of the position are stored and the MOB mark is displayed. A straight line from the own ship to the mark is also displayed.

The numeric value display area displays the distance from the own ship to the MOB mark, the bearing, and the latitude and longitude of the MOB mark.

1. Displaying the MOB mark
  (a) Press the **[MOB]** key.
  (b) The MOB mark is displayed at the own ship's position. The distance to the MOB mark, the bearing, and the latitude and longitude of MOB mark position are displayed in the numeric value display area.

2. Erasing the MOB mark
  (a) Hold down the **[MOB]** key.
       The MOB mark and numeric value display are erased.

Caution

- ● The MOB mark is displayed only on condition that a navigator is connected and latitude/longitude information is input.
  The MOB function does not work unless latitude/longitude information is input.

3.5.20 Using the WAYPOINT function [MENU]

When the radar receives BWC or RMB from the navigator, it displays the distance to the destination, the bearing, and the latitude and longitude of the destination in the numeric value display area.

1. Displaying WAYPOINT

Take the following steps to display waypoint:

(a) Press the **[MENU]** key to display MENU .

(b) Select DISP OPTIONS and then WAYPOINT pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

(c) The menu below is displayed. Turn **[JOG DIAL]** to select ON , and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

```
            DISP OPTIONS
  EBL BEARING     TRUE
  FROATING EBL    OFF
  PARALLEL LINE   OFF
  VRM1 UNITS      NM
  VRM2 UNITS      NM
  WAYPOINT        OFF
  OFF             LL
  ON
```

2. Erasing WAYPOINT

In step (c) above, select OFF , and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

- ● When WAYPOINT and MOB are operating simultaneously, it can change by holding down the TGT DATA key.

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3.5.21 Own ship display function [MENU]

When you display the own ship's position through the navigator, use this function to determine whether to select the latitude/longitude display or the conventional time difference display LORAN-C.

Switching own ship display

Take the following steps to switch own ship's position information to the latitude/longitude display or the time difference display:

(a) Press the **[MENU]** key to display MENU.

(b) Select DISP OPTIONS and then POSITION pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

(c) The menu below is displayed. Turn **[JOG DIAL]** to select LL for the latitude/longitude display or TD for the time difference display of LORAN-C, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

```
           DISP OPTIONS
 EBL BEARING    TRUE
 FROATING EBL   OFF
 PARALLEL LINE  OFF
 VRM1 UNITS     NM
 VRM2 UNITS     NM
 POSITION       OFF
 LL             LL
 TD
```

3.5.22 Function to convert time difference display to latitude/longitude display [MENU]

This function sets a value necessary when the own ship's position display is converted from the conventional time difference display of LORAN-C to the latitude/longitude display.

Setting LORAN-C values

Take the following steps to set LORAN-C information for switching to the latitude/longitude display:

1. Setting the LORAN chain (base station number)

(a) Press the **[MENU]** key to display MENU.

(b) Select DISP OPTIONS and then LL-TD CONV pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

(c) Turn **[JOG DIAL]** to select LORAN-C GRI.

(d) The menu below is displayed. Turn **[JOG DIAL]** to select the chain you want, and then press the **[JOG DIAL] or [ACQ/ENT]** key to determine the selection.

```
           LL-TD CONV
 LORAN-C GRI    4900
 4900           0
 LORAN-C TD2    0
 TD COR. TD1    0.0
 TD COR. TD2    0.0
```

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2. Setting time difference (TD1 or TD2)

(a) Press the **[MENU]** key to display | MENU |.

(b) Select | DISP OPTIONS | and then | LL-TD CONV | pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

(c) Turn **[JOG DIAL]** to select | LORAN-C TD1 | or | LORAN-C TD2 |.

(d) Turn **[JOG DIAL]** to set the value of TD1 or TD2, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the setting.

```
            LL-TD CONV
 LORAN-C GR      4900
 LORAN-C TD1     0
 0               0
 TD COR  TD1     0.0
 TD COR  TD2     0.0
```

Setting TD1 (Select the item one case lower for TD2.)

3. Setting the correction value (of TD1 or TD2)

(a) Press the **[MENU]** key to display | MENU |.

(b) Select | DISP OPTIONS | and then | LL-TD CONV | pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.

(c) Turn **[JOG DIAL]** to select | TD COR. TD1 | or | TD COR. TD2 |.

(d) Turn **[JOG DIAL]** to set the correction value of TD1 or TD2, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the setting.

```
            LL-TD CONV
 LORAN-C GR      4900
 LORAN-C TD1     0
 LORAN-C TD2     0
 TD COR  TD1     0.0
 0.0             0.0
```

Setting the correction value of TD1 (Select the item one case lower for TD2.)

3.5.23 Cursor/own-ship position output function [CSR POS]

This function outputs the infomation of the bearing and distance from the current own ship's position to cursor position.

The above information is output from the processing unit J8.

Outputting the bearing and distance from the current own ship's position to cursor position.

(a) Press the **[CSR POS]** key.

(b) The J8 outputs the cursor position data. (RSD)

Outputting the bearing and distance when the cursor is the own ship's position.

(Outputs "bearing = 0","distance = 0")

(a) Hold down the **[CSR POS]** key.

(b) The J8 outputs the cursor position data. (RSD)

Caution

● The initial setting item determines whether to output the above data. For details, see the initial setting item 9.8.29, "Setting a NMEA data output frequency [MENU]."

3.6 Use of Function Keys

3.6.1 Overview

The purpose of function keys is to always get the best radar images by :

- Storing and using complex radar signal processing settings in the optimum status by usage, and
- Calling optimum signal processing settings for the sea conditions, weather, ship dimensions, and the like.

Four function key modes are available.

The four modes mean that four different signal processing and radar settings can be stored separately.

In other words, as long as signal processing setting suitable for short-range observation, optimum signal processing for trawling, and trail setting have been registered, each setting can be selected instantaneously by simply pressing the **[FUNC]** key to switch to the mode.

As explained in the above, you can register any setting for functions 1 to 4.   The following are 13 typical signal settings that can be selected:

OFF :	Off
STAND :	Setting for standard situation
COAST :	Setting for coast navigation
DEEPSEA :	Setting for deep-sea navigation
FISHNET :	Setting for fish net detection
STORM :	Setting for storm weather
CALM :	Setting for calm weather
RAIN :	Setting for rain/snow
BIRD :	Setting for bird detection
LONG :	Setting for long-range detection
BUOY :	Setting for buoy detection
USER1 :	User setting 1 (Used for setting not included in the 11 settings above)
USER2 :	User setting 2 (Used for setting not included in the 11 settings above)

The signal processing settings above are defined in accordance with the titles.   Users can make further detailed settings meeting their needs.

Functions 1 to 4 are factory-set to the titles and signal processing settings as follows:

FUNC1 :	COAST
FUNC2 :	DEEPSEA
FUNC3 :	FISHNET
FUNC4 :	RAIN

3.6.2 Operation procedures

1. Calling a function
Each time the [FUNC] key is pressed, the cursor moves in the following sequence:
STANDARD → FUNC1 → FUNC2 → FUNC3 → FUNC4 → STANDARD

The title of the currently called mode is displayed at the upper right of the screen.
Suppose that signal processing settings are defined for FUNC1 with COAST as the title, FUNC2 with DEEPSEA as the title, FUNC3 with FISHNET as the title, and FUNC4 with RAIN as the title. Each time the [FUNC] key is pressed, the function titles are displayed at the upper right of the screen in the order of COAST, DEEPSEA, FISHNET, and then RAIN. You can confirm the currently selected function mode glancing at the screen.

2. Changing the setting of a function key
You can change the settings of a function key just as when performing general operation.
After the title displayed at the upper right of the screen is switched by pressing the [FUNC] key, settings made in that status are stored as they are.
For example, if FUNC1 (COAST) is selected by pressing the [FUNC] key, the title COAST is displayed at the upper right of the screen. This explains that the coast navigation function mode is now active. Settings (e.g., signal processing settings and radar setting) made in the mode are stored for FUNC1 (coast navigation mode).

3. Changing a function key title
The title displayed at the upper right of the screen can be easily changed.
Perform the procedure below to change any of the factory-set titles previously mentioned.

Take the following steps to change a function key title:
(a) Hold down the [FUNC] key to display the ⬚ FUNCTION ⬚ menu.
(b) The menu below is displayed. Select the function key ⬚ FUNC1 ⬚ to ⬚ FUNC4 ⬚ of which title you want to change, and then press the [JOG DIAL] or [ACQ/ENT] key.

```
          FUNCTION
STANDARD      >
FUNC1         >
FUNC2         >
FUNC3         >
FUNC4         >
```
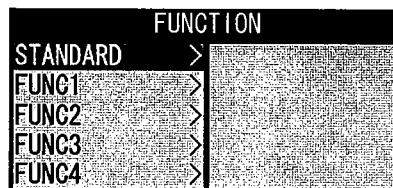
(c) The menu below is displayed. Select ⬚ MODE ⬚, and then press the [JOG DIAL] or [ACQ/ENT] key.

```
          STANDARD
MODE          > COAST
VIDEO         >
TRAILS        >
PULSE LENGTH  >
INITIALIZE    >
```

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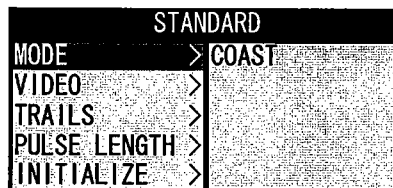
(d) The menu below is displayed. Select the signal processing you want to set by turning **[JOG DIAL]**, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the setting.

You can select the settings of signal processing as shown below.

OFF :	Off
STAND :	Use for standard situation
COAST :	Use for coast navigation
DEEPSEA :	Use for deep-sea navigation.
FISHNET :	Use for detecting fish nets.
STORM :	Use for storm weather.
CALM :	Use for calm weather.
RAIN :	Use for strong rain/snow.
BIRD :	Use for detecting birds flying on the sea.
LONG :	Use for detecting weak targets in longrange.
BOUY :	Use for detecting the radio bouy.
USER1 :	Set it as free uses other than the above.
USER2 :	Set it as free uses other than the above.

```
              STANDARD
 MODE             COAST
 COAST
 TRAILS        >
 PULSE LENGTH  >
 INITIALIZE    >
```
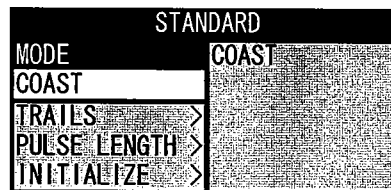
4. Initializing the setting of a function key (Returning to the factory setting)

If you are confused making various settings or want to make a new setting, you can return the current setting to the factory setting for each function mode.

Take the following steps to initialize the setting of a function key:

(a) Take steps (a) and (b) in 3 above, select | INITIALIZE |, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key.

(b) The menu below is displayed. Select | YES |, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

```
               LOAD
 INITIALIZE THIS
 FUNCITON SETTING
 ARE YOU SURE?

 NO
 YES
```
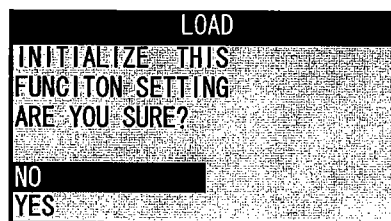
Only the above items can be set in the | FUNCTION | menu. All the other menus are only for confirming the settings. The following shows | FUNCTION | menu lists:

Function key menu lists (display only)

Level 1 menu

Level 2 menu

Level 3 menu

All the level 3 menus at left are only for display.
The settings of menu items can be changed and displayed by changing the settings of the items in other menus.

FUNCTION
- STANDARD
- FUNC1
- FUNC2
- FUNC3
- FUNC4

STANDARD
- MODE   COAST
- VIDEO
- TRAILS
- PULSE LENGTH
- INITIALIZE

VIDEO
- INTERFERENCE   OFF
- TGT EXPANSION   OFF
- PROCESS   OFF
- PROC SW RANGE   3.0NM
- AUTO STC/FTC
- VIDEO LATITUDE OFF
- VD NOISE REJ   NORMAL
- GAIN OFFSET   0
- XMIT REP FREQ   NORMAL
- S-BUOY DETECT   OFF
- NEXT

VIDEO
- BACK
- F-NET DETECT   OFF
- R-SHIFT   OFF
- DR RANGE CONT   OFF
- TGT EXP LEVEL   LEVEL1
- TGT EXP PROC   OFF

TRAILS
- TRAIL INTERVAL 6M
- TRAIL REF LVL   8
- TRAIL SUPRESS   OFF

STANDARD
- MODE
- VIDEO
- TRAILS
- PULSE LENGTH
- INITIALIZE

STANDARD
- MODE
- VIDEO
- TRAILS
- PULSE LENGTH
- INITIALIZE

PULSE LENGTH
- 0.08us
- 0.25us
- 0.5us
- 1.5NM
- 3NM
- 6NM

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3.7 Other Procedures Required

3.7.1 Confirming software versions [MENU]

The versions of software installed in the processor, antenna, and operation unit can be displayed.
If a failure occurs, inform our engineer of the software versions as well as details on the failure.

Take the following steps to confirm the software versions:
(a) Press the **[MENU]** key to display ⌷MENU⌷.
(b) Select ⌷INFORMATION⌷ and then ⌷SOFTWARE VER.⌷ pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.
The software versions are displayed as shown below.

3.7.2 Confirming the operating status of connected units [MENU]

The status of the units (e.g., the processor, antenna, and operation unit) currently connected to this radar can be displayed.
If a failure occurs, inform our engineer of the unit connection status as well as details on the failure.

Take the following steps to confirm the unit connection status:
(a) Press the **[MENU]** key to display ⌷MENU⌷.
(b) Select ⌷INFORMATION⌷ and then ⌷PORT CONNECT⌷ pressing the **[JOG DIAL]** or **[ACQ/ENT]** key after each selection.
The unit connection status is displayed as shown below.

3.7.3 Displaying magnetron current [MENU] [+RANGE-]

The current value of magnetron is displayed. The status of magnetron can be interpreted by the value.

Take the following steps to display magnetron current.
(a) Operate the **[+RANGE-]** key to set 48 mile.
   When the range is already set to "48NM", this operation is not necessary.
(b) Hold down the **[MENU]** key to display the INSTALLATION menu, select RADAR, RADAR ADJUST, and MAG.I, and press the **[JOG DIAL]** or **[ACQ/ENT]** key.
(c) A value and bar "■■■" is displayed, you can interpret the magnetron status by the value.
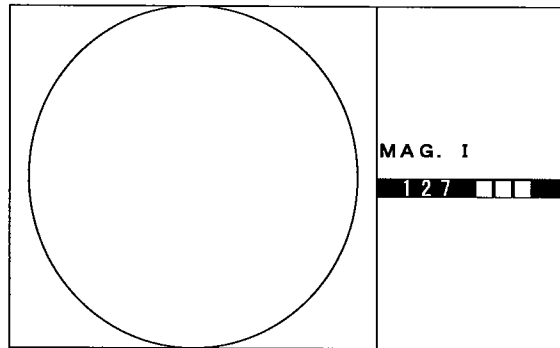
The bar shakes according to the following value.

From 12 to 24	■■
From 25 to 37	■■■
From 38 to 50	■■■■
From 51 to 63	■■■■■
From 64 to 76	■■■■■■
From 77 to 89	■■■■■■■
From 90 to 102	■■■■■■■■
From 130 to 115	■■■■■■■■■
From 116 to 127	■■■■■■■■■■

In the case of 4kw : From 60 to 80 ■■■■■～■■■■■■■■ (Approximately)

In the case of 6kw : From 70 to 90 ■■■■■■～■■■■■■■■■ (Approximately)

In the case of 10kw : From 70 to 90 ■■■■■■～■■■■■■■■■ (Approximately)

The shaking bar may be shifted, even if it is a new magnetron.
Certainly use this display as a reference.

3.7.4 Confirming error logs [ALARM ACK]

If any of the sensors malfunctions, the error log function lists faulty locations.

If a failure occurs, inform our engineer of the error log contents as well as details on the failure.

Take the following steps to confirm error logs:

(a) Hold down the **[ALARM ACK]** key to display the | ALARM | menu.

(b) Select | ERROR LOG |, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key.
Error logs are displayed as shown below.

Error list

When a error occurs, the following error is displayed at the lower right of the screen, and is saved in the error log.

When you connect to our company or an agency, tell contents of the error log at the time of failure.

TRX	No communication error with transmitter or receiver
TRX-DATA	Data error with transmitter or receiver
PANEL	No communication error with control unit
PANEL DATA	Data error with control unit
PANEL2	No communication error with subcontrol unit
PANEL2 DAT	Data error with subcontrol unit
GPS	No communication error with GPS equipment
GPS DATA	Data error with GPS equipment
GPS STATUS	Status error with GPS equipment
COMPASS	No communication error with magnetic compass equipment
COMP DATA	Data error with magnetic compass equipment
PC	No communication error with personal computer
PC DATA	Data error with personal computer
NSK	No communication error with NSK unit
NSK DATA	Data error with NSK unit
GYRO	Status error with NSK unit
LOG	Status error with NSK unit
GPS COMP	No communication error with GPS compass
GCOMP DATA	Data error with GPS compass
TRX-HEATER	Heater error of transmitter or reciever

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TRX-MHV	Moduration error of transmitter or reciever
SSW OFF	Safety switch OFF of scanner unit
TRX-HL	Standard rotation signal error of scanner unit
TRX-AZI	Rotation signal error of scanner unit
TRX-REV	Reverse rotation error of scanner unit
TRX-TRIGER	Transmission trigger error of scanner unit
TRX-VIDEO	Video error of scanner unit
PRC-HL	Standard rotation signal error of display unit
PRC-AZI	Rotation signal error of display unit
PRC-TRIGER	Trigger signal error of display unit
PRC-VIDEO	Video signal error of display unit

3.7.5 Clearing the error log [ALARM ACK]

Take the following steps to clear the error log.

(a) Hold down **[ALARM ACK]** key to display the ⌐ ALARM ⌐ menu.

(b) Select ⌐ ERROR LOG CLR ⌐, and then press **[JOG DIAL]** or **[ACQ/ENT]** .

(c) The menu below is displayed. Turn **[JOG DIAL]** to select ⌐ ON ⌐, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

3.7.6 Operating the self-diagnostic function [MENU]

The self-diagnostic function is installed to activate the self-diagnostic mode after the power is turned on.

This function gets the system to automatically diagnose itself for normal operation.

Take the following step to start the self-diagnostic function:

(a) Turn on the power while pressing the **[EBL]** and **[VRM]** keys at the same time.
The self-diagnostic function starts.

3.7.7 Displaying the help menu

The HELP function is installed to explain keys for operating special functions when the power is turned on.

Take the following steps to operate the HELP function:

(a) Hold down the **[MENU]** key to display ⌐ MENU ⌐.

(b) Operate **[JOG DIAL]** to select ⌐ HELP ⌐, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key.
As shown below, the keys for operating special functions are displayed in two lists when the power is turned.

HELP	
INITIALIZE ALL	ACQENT+MENU
SELF TEST	EBL+VRM
LANGUAGE	DIMM
DISP MOUNT UP	TUNE
DISP MOUNT R	RAIN
DISP MOUNT REV	SEA
DISP MOUNT L	GAIN

3.7.8 Replacing the battery (BT1)

The battery (BT1) needs to be replaced regularly to hold the set information.

(a) Replacing the battery (BT1)

The battery is provided in the main control circuit (CMC-1190).

The battery model is CR2477-1VC.

Ask the nearest sales agent to replace the battery.

(b) Initial settings after battery replacement

- Even if the power is turned off, the settings of menus and software keys are held through this lithium battery. Consequently, when the power is turned on next, the radar is operable in the status in which it was most recently used.
- When the battery reaches the end of its useful life, all the settings including menus are automatically reset.

Therefore, the initial settings need to be made again after battery replacement.

Caution

● **When the battery nears the end of its useful life, the range and bearing may not be measured correctly.**
Replace the battery immediately, and make the initial settings.

(c) If the battery cannot be replaced immediately, as first-aid measures, make the initial settings each time you turn on the power. In this case, note that all the settings are reset when the power is turned off.

● **For the initial settings, see 9.7, "Initialization."**

3.7.9 Procedure if an incomprehensible symptom occurs during use of the radar

If a symptom such as the distortion of screen display or the refusal of switch operation takes place during use of the radar, perform the initialization procedure below.

Caution

- When INITIALIZE is executed, ENGINEERS MENU is initialized. However, the contents stored by BACKUP MEMORY are not initialized.
- When the battery for backup wears down, the contents stored by BACKUP MEMORY are initialized.

(a) Turn on the power while pressing the **[MENU]** key and **[ACQ/ENT]** key at the same time.

(b) The NO and YES menu is displayed after the menu below. Turn **[JOG DIAL]** to select YES, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key to determine the selection.

```
INITIALIZE ALL
INITIALIZE ALL SETTING

ARE YOU SURE?

NO
YES
```
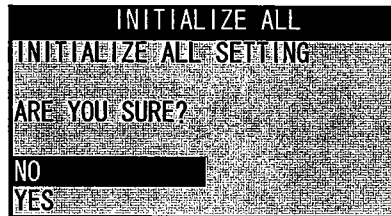
3.8 Options

3.8.1 Operating a second keyboard unit [GAIN/PL] [JOG DIAL]

By adding the optional keyboard (NCE-7640), either of the two keyboards can be used independently to control one antenna.

When one keyboard is being used, it will not be possible to use the other keyboard, with the exception of a few functions (e.g., the keyboard switching operation and changing from transmission to standby).

Take the following steps to switch between keyboard 1 and keyboard 2.

(a) Hold down the **[GAIN/PL]** key to display the following menu.

```
PANEL CONTROL SELECTION
PANEL1
PANEL2
```

(b) Turn the **[JOG DIAL]** to select PANEL 1 or PANEL 2, then press the **[JOG DIAL]** or **[ACQ/ENT]** key.

(c) The menu below is displayed. Select YES, and then press the **[JOG DIAL]** or **[ACQ/ENT]** key.

```
PANEL CONTROL SELECTION
PANEL SELECTED
ARE YOU SURE?
NO
YES
```

(d) When a keyboard other than the one being used is selected from this status, only the **[GAIN/PL]** key and **[STBY]** key will work. The other keys will not function. In order to be able to use the current keyboard, repeat the above process from (a), then select a keyboard other than the one selected in step (b) to set the current keyboard for operation.

Note

Even if the keyboard currently being used does not have the operating rights, the [STBY] key on the keyboard will still be effective as explained above.

This is to allow either keyboard to immediately switch the system from transmission to standby when there is an emergency.

Therefore, a keyboard that does not have operation rights can switch the system to standby, but it cannot change it back to the transmission mode. In order to return the system to the transmission mode, either the keyboard with the operating rights should be used, or the above procedure from (a) should be followed to acquire the operating rights, then switch the system to the transmission mode.
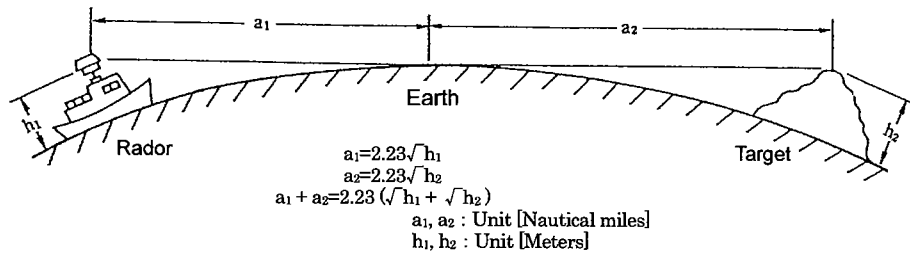
⚠WARNING

Immediately after switching the keyboards, the modes of the **[GAIN/PL]**, **[AUTO-TUNE]**, **[AUTO-SEA]** and **[AUTO-RAIN]** knobs may be different from what they were before switching. Sensitivity might also be lowered, and this could cause a collision.

Each time the active keyboard is switched, be sure to readjust the four knobs above so that they are at their optimum settings.

Chapter 4   How to Interpret the PPI Screen

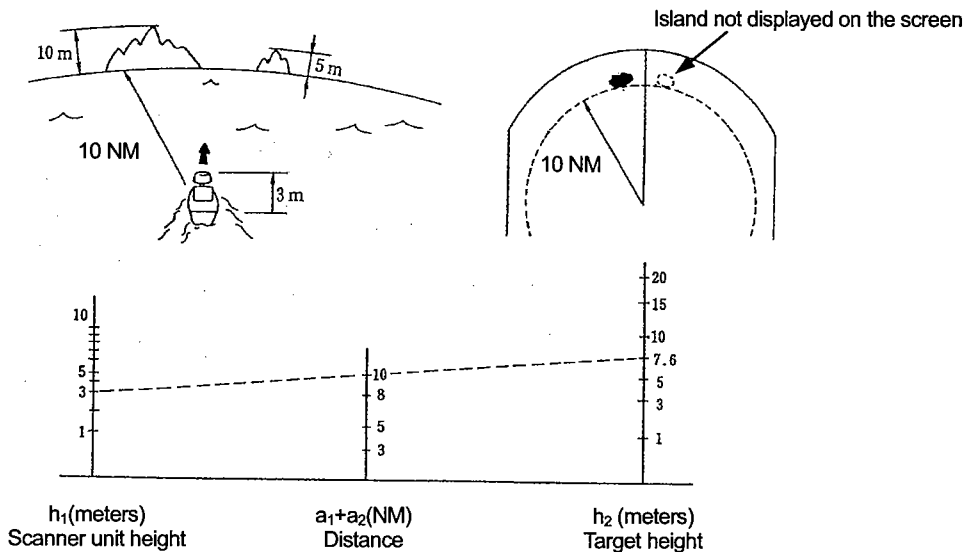## 4.1   Height of and the Distance to the Target

The maximum distance to a target that can be observed with a radar depends not only on the power of the radar's transmitter, beam width of the scanner unit, and the receiver's sensitivity but also on height of a target, distance to a target and height of scanner unit line etc.   This is because the radio wave emitted by a radar runs straight, undergoing no influence by the curvature of the earth surface.

$$a_1 = 2.23\sqrt{h_1}$$
$$a_2 = 2.23\sqrt{h_2}$$
$$a_1 + a_2 = 2.23(\sqrt{h_1} + \sqrt{h_2})$$

a_1, a_2 : Unit [Nautical miles]
h_1, h_2 : Unit [Meters]

[Distance and Target]

For example, when the scanner unit lies 3 meters above the sea level, the radar can detect and display an island with a height of 10 meters at a distance 10 NM away from the scanner unit position but cannot detect and display an island with a height of 5 meters at the same distance. This is theoretically true but does not always hold, depending on weather conditions.

For a target located 10 NM away to be displayed on a radar, it theoretically needs to be 7.6 meters or higher.   Any targets lower than 7.6 meters cannot be displayed on a radar.

● **The target may be unable to be observed when the height of a scanner unit or an target is low.**

Island not displayed on the screen

| h_1(meters) Scanner unit height	a_1+a_2(NM) Distance	h_2 (meters) Target height

4.2 Returns from a Target

The intensity of returns from a target is related not only to the size of the target but also to the materials and shape of the components making up the target. Accordingly, larger objects do not necessarily develop strong returns.
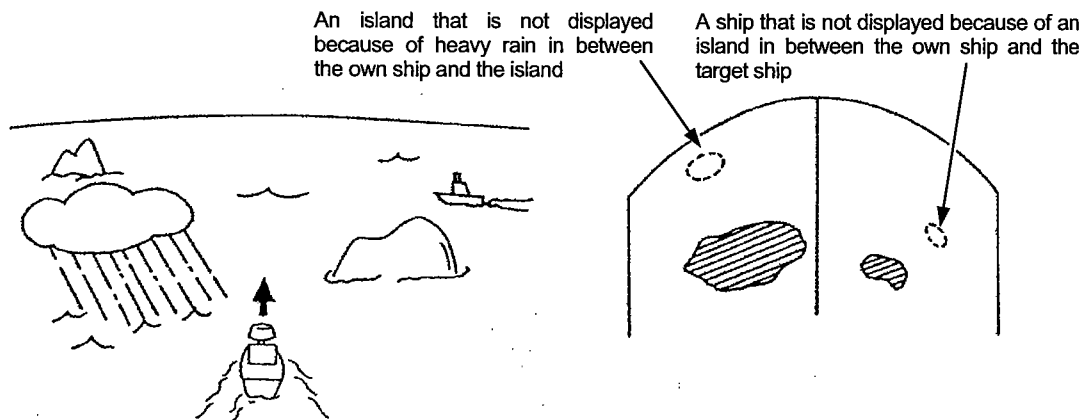
On coastlines, in particular, the intensity of returns is dependent on their physiographic features. For a coastline with a fairly gradual ascent, only inland mountains areas may be displayed as echoes. This fact needs to be kept in mind when measuring the distance to a coastline.

● **Since the echo which returns from a coastline with a fairly gradual ascent is weak, observation of such land may not be able to be performed.**

Mountains that are displayed on the screen

Shoreline that are not displayed on the screen
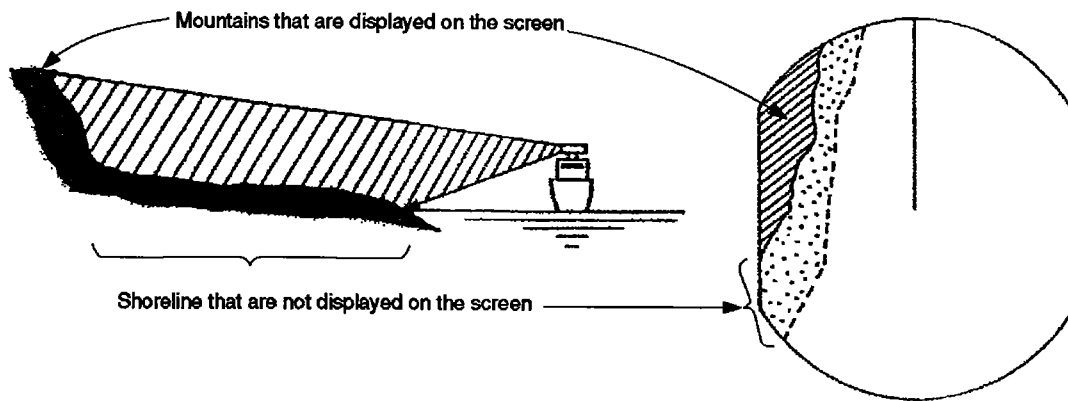
4.3 Propagation Path of Radio Waves

● **Radio waves may be shielded if there is a large intercepting obstacle (e.g., mountains, rain, snow, etc.) in their propagation path and any targets behind the obstacle cannot be observed.**

An island that is not displayed because of heavy rain in between the own ship and the island

A ship that is not displayed because of an island in between the own ship and the target ship

4.3.1 Sea returns

On a wavy sea surface, an echo appears on the PPI screen as a bright defused image at the center of the screen. This echo is developed by returns from the sea surface. The features of the echo depend on the size and range of the wave, and the wind direction.

4.3.2 False echoes

There are cases in which nonexistent targets appear as echoes or in which existing targets do not appear as echoes on the PPI screen. These echoes are called false echoes.
False echoes are produced by the factors explained below.

● **Please observe carefully in consideration of there being always false echoes.**

(a) Ghost

Depending on the location where the scanner unit is installed, radio waves are emitted from nearby chimney stacks or masts, developing ghosts. Consequently, targets that are located in those direction may not appear as echoes on the PPI screen.

The presence of these ghosts can be identified by observing sea returns and checking the returns for dim areas or voids.

If a ghost is detected, remember the direction in which it appears and observe the target carefully.
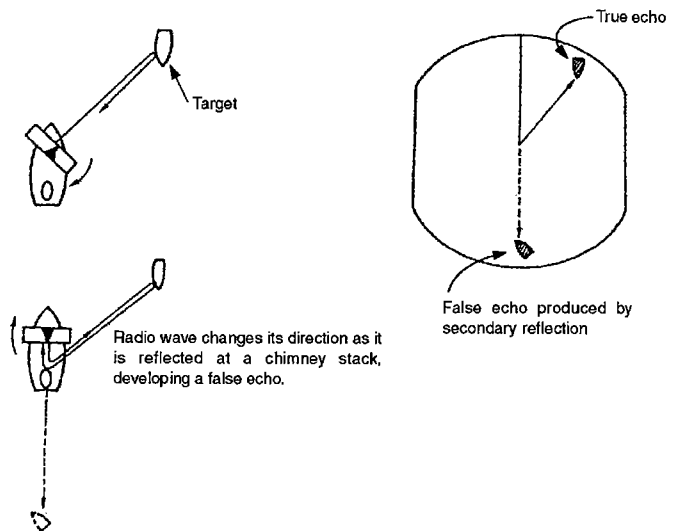
(b) Side echo

There are cases in which an arc-shaped broken line appears over the same range as the echo from the target. This image is caused by the side lobes of the beam emitted from the scanner unit. This type of false echoes can easily be identified if the target stands alone.

(c) Indirect echo

The direction of the radio wave from the radar may be changed by a reflection (secondary reflection) at a chimney stack or mast of a ship, developing a false echo in a direction in which there should be no target.

The indirect echo developed by the secondary reflection appears in the direction of the chimney stack or mast that reflected the radio wave.

Target

Radio wave changes its direction as it is reflected at a chimney stack, developing a false echo.

True echo

False echo produced by secondary reflection

(d) Multiple echo

Multiple echoes are developed by multiple reflections caused by a building or large vessels that has large vertical surfaces. These echoes are spaced at an equal interval, with the one that is closest to the own ship being the true echo.

False echoes

The echo closest to the own ship is the real echo.
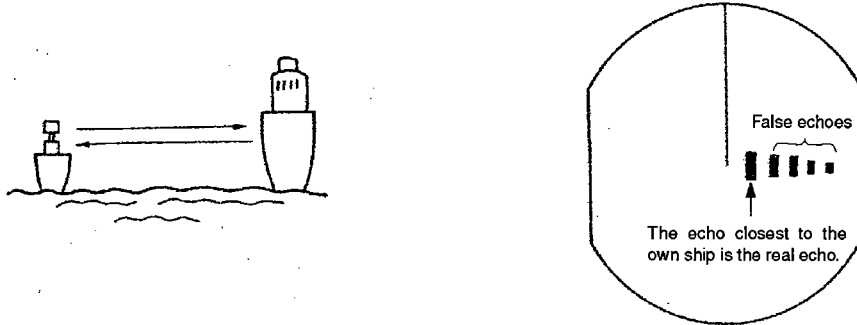
(e) Radar interference

If there is a radar that uses the same frequency as that of the own ship near the own ship, interferences caused by that radar appear on the PPI screen. These interferences appear as clusters of spots of varying patterns. Since they do not occur at the same location with time, they can easily be distinguished from true echoes.

Radar interferences can be reduced or eliminated by choosing "ON" from "FUNCTION"-"IR".
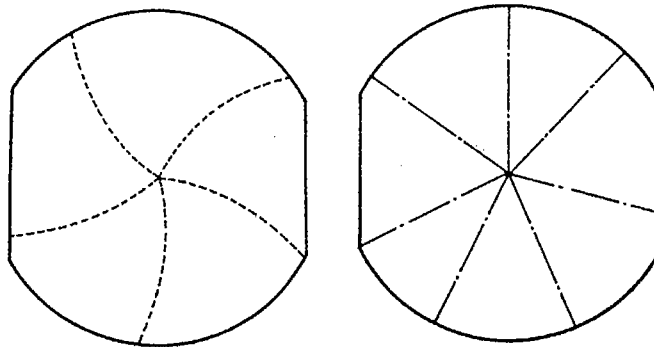
[Examples of radar interferences]

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4.4 Display of Radar Transponder

SART (Search and Rescue Radar Transponder) is life preserving device approved by GMDSS which is used for locating survivors in the event of a disaster or distress. SART operates in the 9GHz frequency band. When it receives a radar signal (interrogating radio wave) of 9GHz transmitted by a rescue ship or aircraft radar, SART transmits a series of respouse signals to the searchers to indicate the distress position.

In order to see the SART or radar beacon mark on the radar screen.

① RANGE SCALE	: Select 6 or 12 nm
② SEA CLUTTER control	: Set to minimum
③ AUTO SEA	: OFF
④ TUNE control	: DETUNED to reduce the clutter
⑤ IR	: Set IR OFF
⑥ PROCESS	: Set PROCESS OFF
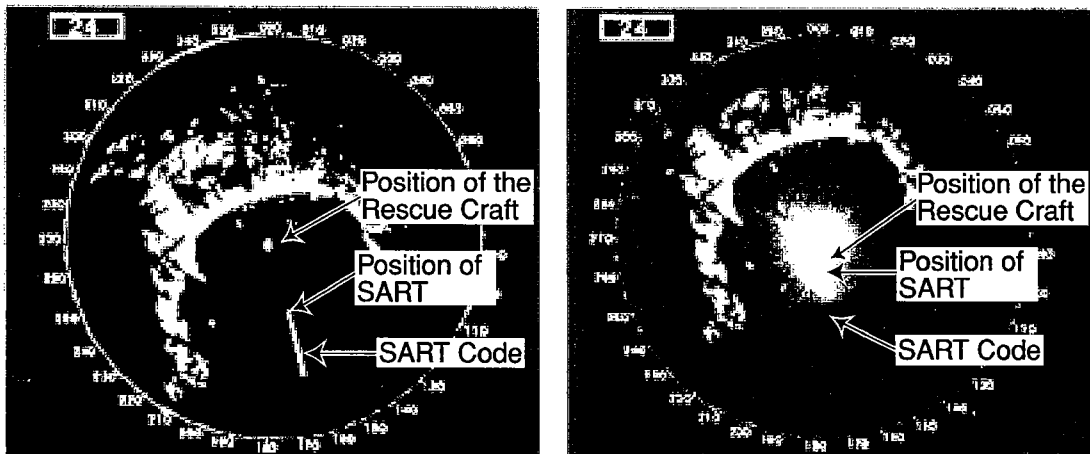
[Example]

Caution

● When above settings ① to ⑥ are made to display SART signals, objects around the own ship will not appear on the radar screen, so perform thorough visual monitoring of the sea area around the own ship to avoid any collision or stranding.

Further, when more than one radar systems are mounted, while using a 9GHz band radar for searching SART signals, be sure to use another radar as an ordinary radar to perform monitoring of objects around the own ship to avoid any collision, check of the position of the own ship to avoid any stranding, and so on.

Need to return the set for normal operation on completion.

Chapter 5　Maintenance and Inspection

5.1　General Maintenance

⚠ DANGER

The customer should refrain from inspecting or repairing the internal parts of this equipment.
Inspection or repair other than by specialized service personnel may cause death or a serious injury of any person.
Please contact the sales department of Japan Radio Co., Ltd. or your local branch, outlet or sales office with respect to maintenance and repair.

When performing maintenance in increment weather, please be sure to shut the main power off.
If maintenance work is performed without shutting the main power off, there is a risk of dying or getting a serious injury of any person by electric shock.

Caution

● When cleaning the surface, please refrain from using organic solvents such as thinner or benzene.
Use of such organic solvents may damage the surface coating.
When cleaning the surface, remove dust and grime and wipe with a clean dry cloth.

The following maintenance steps are required to ensure that the radar always operates in the optimal condition.　Since breakdowns will be reduced through maintenance, periodic maintenance is recommended.
General maintenance steps common to all equipment are as follows.

Cleaning

Remove dust, grime and sea water that has adhered to the unit.　Use dry cloth to clean the unit.　In particular, use a brush to clean the ventilating opening to ensure smooth flow of air.

5.2 Scanner Unit

⚠DANGER

🚫 When performing maintenance or inspection of the scanner unit, be sure to shut off the main power source.
If the scanner suddenly rotates and it hits the human body violently, there is a risk of dying or getting a serious injury of any person.

❗ Be sure to shut off the main power source when approaching the scanner unit for the purposes of maintenance or inspection.
If exposured to electric waves at proximate distances, there is a risk of dying or getting a serious injury of any person.

(1) Radiation unit

If the front of the radiation unit is soiled with soot, salt, paint specks, bird excrement or other alien matter, electric waves may become attenuated and reflection may occur thus causing degradation in the performance of the radar.

The radiation unit should be inspected and always kept clean by wiping with cloth soaked in alcohol or water in the event of soiling.

Solvents such as gasoline, benzene, trichlene or ketone should never be used for this purpose.

(2) Pedestal

The pedestal and attachment bolts of the scanner unit should be inspected periodically for erosion and maintained to ensure safety. Painting is the best measure for preventing erosion and it is recommended that this be undertaken once in half a year.

5.3 Display Unit

Cleaning the LCD

When dust adheres to the LCD, transparency degrades and the images become dark.
Cleaning is performed using cloth soaked in water (flannel or cotton). Wiping vigorously with dry cloth or the use of gasoline or thinner should be avoided.

Caution

● Vigorous wiping with dry cloth or the use of gasoline or thinner should be avoided in cleaning the LCD.
Such action may cause scratches and deterioration.

5.4 Special Parts

JMA-5104

Model Number	Name	Type	Manufacturer	Location of use	JRC Code
V201	Magnetron	MSF1421B	New JRC	Scanner unit	5VMAA00049
A101	Circulator	H-6AJRD00001	Toshiba	Scanner unit	6AJRD00001
A102	Diode limiter	NJS6930	New JRC	Scanner unit	5EZAA00024
E301	Front end	NJT1028	New JRC	Scanner unit	5EZAA00039

JMA-5106

Model Number	Name	Type	Manufacturer	Location of use	JRC Code
V201	Magnetron	MSF1422B	New JRC	Scanner unit	5VMAA00068
A101	Circulator	H-6AJRD00001	Toshiba	Scanner unit	6AJRD00001
A102	Diode limiter	NJS6930	New JRC	Scanner unit	5EZAA00024
E301	Front end	NJT1969	New JRC	Scanner unit	5EZAA00037

JMA-5110

Model Number	Name	Type	Manufacturer	Location of use	JRC Code
V201	Magnetron	MSF1425B	New JRC	Scanner unit	5VMAA00051
A101	Circulator	H-6AJRD00001	Toshiba	Scanner unit	6AJRD00001
A102	Diode limiter	NJS6930	New JRC	Scanner unit	5EZAA00024
E301	Front end	NJT1969	New JRC	Scanner unit	5EZAA00037

5.5 Circuit Blocks for Repair

NKE-2042

Name	Unit/ type of circuit	Remarks
Modulator circuit	CME-322	
Receiver	CAE-475	
Motor unit	H-7BDRD0023	

NKE-2062

Name	Unit/ type of circuit	Remarks
Modulator circuit	CME-323	
Receiver	CAE-475-1	
Motor unit	CBP-153	

NKE-2102

Name	Unit/ type of circuit	Remarks
Modulator circuit	CPA-248	
Receiver	CAE-475-1	
Motor unit	CBP-167	
Power supply circuit	CBD-1645	

NDC-1260

Name	Unit/ type of circuit	Remarks
Main control circuit	CMC-1190	
Power supply circuit	CBD-1638	
MARPA circuit	CDC-1144	Option

NCE-7640

Name	Unit/ type of circuit	Remarks
Keyboard circuit	CCK-892	

NWZ-146

Name	Unit/ type of circuit	Remarks
LCD unit	H-7WZNA0701	
Power supply unit	CBF-30	

5.6 Actions to Deal with Abnormalities and Breakdown

In the case of semiconductor circuits, except in cases of problems in the design or inspection of such circuits or causes that are external or caused by humans, breakdown or deterioration of the circuit does not often occur. In general, the causes of breakdown that are relatively frequently found are wire cut in the high resistance device due to high humidity, defect in the variable resistance and defect in the contact of switches and relays.

Moreover, in many cases the cause for breakdown is not a defect in parts but rather poor adjustment (particularly inadequate tuning adjustment) or poor maintenance (particularly defect in cable contact) and inspecting or readjusting these aspects is often effective in the case of perceived abnormality or breakdown. The following table should be taken into consideration in the case of abnormalities or breakdown.

There is always a cause for a blown fuse and after replacing the fuse, it is necessary to investigate the related circuits even when no abnormality remains. However, consideration should be given to the fact that there is significant variance in the characteristics of fuses.

No.	Condition of the Breakdown	Conceivable Cause
1	Nothing appears on the LCD.	a. Breakdown in the power supply terminal (CBD-1638); Fuse F1 has blown b. Breakdown in the NWZ-146 display c. Breakdown of the main control circuit (CMC-1190) d. The electric power of the ship is inadequate.
2	The scanner unit does not rotate.	a. Fuse F2 and F3 have blownb. b. Breakdown in the motor unit (JMA-5104: CML-674 H-7BDRD0023 inside the scanner unit, JMA-5106/5110: CBP-153/167)
3	The scanner unit rotates but no radar image appears (characters and markers are, however, displayed).	a. Breakdown of the receiver (JMA-5104: CAE-475, JMA-5106/5110: CAE-475-1) b. Breakdown of the main control circuit (CMC-1190). What is the condition of the transmission trigger (TI)? c. Breakdown in the motor unit (JMA-5104: CML-674 H-7BDRD0023 inside the scanner unit, JMA-5106/5110: CBP-153/167) d. Breakdown of the modulator circuit in the scanner unit (JMA-5104: CME-322, JMA-5106: CME-323, JMA-5110: CPA-24)
4	The operation switches do not work.	a. If the switches do not work even after turning the power on again, breakdown is in the main control circuit (CMC-1190). b. Breakdown is in the panel circuit (CCK-892) c. Cut in the cable connecting the operation unit. (H-7ZCNA0855)

Chapter 6　After-sales Service

★ **When asking for repair**

When a system failure is suspended, read Chapter 4, 5 and 9 carefully and re-check the abnormal part.

If it is still considered to be a failure, stop the operation at once and consult with the dealer you purchased the product, our sales department or your nearest branch or business office.

● | Repair within the warranty period |

If the failure occurred under proper operation in accordance with the instruction manual, the dealer or JRC shall repair the product without charging. In case of any other failure occurred due to mis-operation or natural disaster, the repair work will be charged.

● | Repair after the warranty period has expired |

If the product is recoverable by repairing, we will repair it upon your request.

● | Items to be identified |

☆ Product name, model name, manufacturing date and serial number

☆ Failure condition (as detailed as possible: see the Radar Failure Checklist on next page.)

☆ Your company/organization name, location and telephone number

★ **Recommendation of maintenance inspection**

Although it depends on your operating condition, the performance of the product may be lowered due to parts wear.

We recommend maintenance inspection, apart from the normal maintenance work.

For maintenance inspection, consult with the dealer you purchased the product, our sales department, or your nearest branch or business office.

Note that this maintenance inspection will be charged.

For detail of after-sale service, contact the dealer you purchased the product, our sales department, or your nearest branch or business office.

☞Contact: See the list at the end of the manual.

RADAR FAILURE CHECKLIST

When ordering for repair, check the following items, fill in the sheet and send it to us.
If there is any uncertain items, contact your ship and give us correct information on the product.

Ship name : _____ Phone : _____ Fax : _____

Radar general model name : JMA–_____ Serial No. : _____
(Write the full model name correctly)

(1) Check the following items in the order of the number, and circle the applicable answer between YES or NO.
     If the item cannot be determined as YES or NO, explain in detail in the item (15), Others.
(2) If any of the items (1) through (4) is marked as NO, check the fuse of the product (refer to Section 5.6 and 9.4).
(3) Check the items (4) through (14) while the transmission (TX) is ON.

* Functions mentioned in the items (13) through (14) may be optional.   If the function is optional, answer is not necessary.

No.	Check Item	Result	
(1)	Power can be turned on. (The lamp on the keyboard is lit.)	YES	NO
(2)	A few minutes after powering-on, it will become stand-by status (TX Ready).	YES	NO
(3)	When powering-on (or TX ON), the LCD displays something (LCD is lit).	YES	NO
(4)	The scanner unit rotates at the transmission (X-MIT) ON. (Check the following items while transmission is ON.)	YES	NO
(5)	Tuning is enabled. (Check with the range of 6NM or more.)	YES	NO
(6)	Fixed marker is displayed.	YES	NO
(7)	VRM is displayed.	YES	NO
(8)	White noise is displayed while set at SEA, RAIN minimum, GAIN maximum, IR-OFF and maximum range.	YES	NO
(9)	Target reflection echo is displayed.	YES	NO
(10)	Sensitivity of reflection echo is normal.	YES	NO
(11)	EBL is displayed.	YES	NO
(12)	Cursor mark moves.	YES	NO
*(13)	GYRO course can be set and normally displayed.	YES	NO
*(14)	LOG speed can be normally displayed.	YES	NO

(15)   Others (Error message, etc) _____

_____

Chapter 7   Disposal

7.1   Equipment Disposal

Dispose of this equipment by following the ordinances or regulations of the local authorities in charge of the disposal site.

7.2   Disposal of Used Batteries

<table>
<tr><td colspan="2" align="center"><h1>⚠WARNING</h1></td></tr>
<tr><td>⬤!</td><td>Before disposing of used lithium batteries, insulate by affixing tape to the positive and negative terminals or by other means.   Otherwise, short-circuiting may occur, resulting in heat generation, bursting or ignition.</td></tr>
</table>

On this equipment, lithium batteries are used for :
> BT1 in the CPU control circuit (CMC-1190) (Sanyo electric CR2477-1VC).

● Do not keep used lithium batteries but dispose of them immediately after as non-combustible waste.
● Before disposing of used lithium batteries, insulate by affixing tape to the positive and negative terminals or by other means.   In the area where used batteries are separated from other waste, dispose of them by following the   local regulations.

7.3   Disposal of Used Magnetron

The scanner unit in this radar use a magnetron.

● After replacing it, return the used one to your local distributor or our sales office.
For detail, ask your local distributor or our sales office.

Chapter 8   Specifications

8.1   General Specifications

1) Picture	Color PPI by raster scan system
	Resolution : 640 x 480 pixels
2) Display screen	10.4-inch TFT Color LCD
3) Range scale	<JMA-5104>
	0.125nm, 0.25nm, 0.5nm, 0.75nm, 1.5nm, 3nm,
	6nm, 12nm, 24nm, 48nm
	<JMA-5106 / JMA-5110>
	0.125nm, 0.25nm, 0.5nm, 0.75nm, 1.5nm, 3nm,
	6nm, 12nm, 24nm, 48nm, 72nm
4) Minimum range	Better than 25m
5) Range discrimination	Better than 25m
6) Bearing accuracy	Better than 1°
7) Bearing representation	Relative, or true with a compass
8) Environmental condition	<Temperature>
	Scanner unit : -25 °C to +55 °C
	Display unit : -15 °C to +50 °C
	<Relative humidity>
	Scanner unit : 93% maximum at +40 °C
	Display unit : 93% maximum at +40 °C
9) Tolerance of input voltage	<JMA-5104 / JMA-5106>
	DC 12V/24V/32V (from DC 10.8 to 42V)
	<JMA5110>
	DC 24V/32V (from DC 21.6 to 26.4V)
	AC 100/110/115/200/220/230V ± 10%
	(by rectifier unit)
10) Power consumption	<JMA-5104>
	70W
	<JMA-5106>
	85W
	<JMA-5110>
	130W
11) Preheating time	90 seconds
12) Dripproof	Scanner unit IPX6
	Processing unit/Keyboard unit IPX2
	Display unit IPX5
13) Vibrations	ICE60945
14) Language	English, French, Spanish, Norwegian, Italian,
	Danish, Japanese

8.2 Scanner Unit Specification

8.2.1 Scanner unit (NKE-2042 : Redome type)

1) Dimensions	Height : 275mm, Diameter of radome : 620mm
2) Mass	Approx. 10.5kg
3) Polarization	Horizontal
4) Beam width	
Horizontal (-3dB)	4°
Vertical (-3dB)	25°
Side lobe level	Less than -21dB within 10° of main beam
5) Rotation speed	Approx. 27rpm
6) Frequency	9410 ± 30MHz
7) Peak power	4kW
8) Pulse length/repetition frequency	0.08µs/2250Hz : 0.125nm, 0.25nm, 0.5nm, 0.75nm, 1.5nm(S)
	0.25µs/1700Hz : 1.5nm(L), 3nm(S)
	0.5µs/1200Hz : 3nm(L), 6nm(S)
	1.0µs/650Hz : 6nm(L), 12nm, 24nm, 48nm
	(S: Short, L: Long)
9) Modulator	Solid-state modulator
10) Duplexer	Circulator/diode limiter
11) Front end module	Built in
12) IF amplifier	Logarithmic amplifier, Noise figure 6dB maximum.
13) Tuning	Manual/Auto

8.2.2 Scanner unit (NKE-2062 : 6kW rotation type)

1) Dimensions	Height : 432mm, Swing circle : 1220mm
2) Mass	Approx. 24kg
3) Polarization	Horizontal
4) Beam width	
Horizontal (-3dB)	2°
Vertical (-3dB)	30°
Side lobe level	Less than -23dB within 10° of main beam
	Other than -26dB within 10° of main beam
5) Rotation speed	Approx. 27rpm
6) Frequency	9410 ± 30MHz
7) Peak power	6kW
8) Pulse length/repetition frequency	0.08µs/2250Hz : 0.125nm, 0.25nm, 0.5nm, 0.75nm, 1.5nm(S)
	0.25µs/1700Hz : 1.5nm(L), 3nm(S)
	0.5µs/1200Hz : 3nm(L), 6nm(S)
	1.0µs/650Hz : 6nm(L), 12nm, 24nm, 48nm, 72nm
	(S: Short, L: Long)
9) Modulator	Solid-state modulator
10) Duplexer	Circulator/diode limiter

11) Front end module	Built in
12) IF amplifier	Logarithmic amplifier, Noise figure 6dB maximum.
13) Tuning	Manual/Auto

8.2.3　Scanner unit (NKE-2102 : 10kW rotation type)

1) Dimensions	Height : 448mm, Swing circle : 1910mm
2) Mass	Approx. 33kg
3) Polarization	Horizontal
4) Beam width	
Horizontal (-3dB)	1.2°
Vertical (-3dB)	20°
Side lobe level	Less than -26dB within 10° of main beam
	Other than -30dB within 10° of main beam
5) Rotation speed	Approx. 27rpm
6) Frequency	9410 ± 30MHz
7) Peak power	10kW
8) Pulse length/repetition frequency	0.08μs/2250Hz : 0.125nm, 0.25nm, 0.5nm, 0.75nm, 1.5nm(S)
	0.25μs/1700Hz : 1.5nm(L), 3nm(S)
	0.5μs/1200Hz : 3nm(L), 6nm(S)
	1.0μs/650Hz : 6nm(L), 12nm, 24nm, 48nm, 72nm
	(S: Short, L: Long)
9) Modulator	Solid-state modulator
10) Duplexer	Circulator/diode limiter
11) Front end module	Built in
12) IF amplifier	Logarithmic amplifier, Noise figure 6dB maximum.
13) Tuning	Manual/Auto

8.3 Processing Unit Specifications

1) Dimensions	Width： 300mm
	Height： 125mm
	Depth： 210mm
2) Mass	Approx. 2.4kg
3) Installation	Floor setting type
4) Range scale/rings	0.125nm/0.065nm, 0.25nm/0.125nm, 0.5nm/0.1nm,
	0.75nm/0.25nm, 1.5nm/0.5nm, 3nm/0.5nm,
	6nm/1nm, 12nm/2nm, 24nm/4nm, 48nm/8nm,
	72nm/12nm(except JMA-5104)
5) Range accuracy	Better than ±1.5% of maximum range in use or
	±70m whichever is greater
6) Bearing scale	360° scale graduate at intervals of 1°
7) Ship's heading marker	Electronic line suppressible by automatic resetting
	key.
8) EBL(EBL1/EBL2)	Digital read-out on the screen (3 characters)
9) VRM(VRM1/VRM2)	Digital read-out on the screen (3 characters)
10) Off-centering	90% of the picture radius
11) Trails	OFF/30 to 59sec/1 to 59min/continuous
	Mode 1： OFF
	Mode 2： Timing trail display
	Mode 3： Continuous trail display
	Mode 4： Timing trail display and continuous trail
	display
12) Indication on the screen	Selected range
	Selected range ring distance
	Motion mode/azimuth mode
	Interference rejection indication
	Echo stretch
	Wakes time
	Speed/Course indication
	Guard zone mode
	STC/FTC mode
	Pulse
	Tuning indicator
	Own position (lat./lon.)
	EBL1/EBL2 read-out (3 characters)
	VRM1/VRM2 read-out (3 characters)
	Cursor read-out (Bearing and range / or lat./lon.)
	TX/ST-BY indication
13) Color	
Radar echo	
Gradation	16 level
Color	4 colors (yellow, green, orange, color)

Radar trails	
Gradation	1 level (time wakes, continuance, trails)
Color	Time trails : 1 color (sky, white, green)
	Continuance trails : 1 color (sky, white, green)
Fixed marker / VRM1/2 / EBL1/2	
Color	cyan
Character	
Color	white
Heading line/cursor	
Color	white
Background color inside PPI	black, bule, gray
Background color outside PPI	black, bule, gray
14) Heading	Head up/North up/Course up
15) Motion	Relative motion/True motion/Centerd true motion
16) Guard zone alarm	Can be wsitched between "OFF", "IN" and "OUT"
17) Anti-clutter function	Anti-Clutter sea : Manual/Auto
	Anti-Clutter rain : Manual/Auto
18) Scan correlation function	Built in
19) Floating EBL	Built in
20) Echo stretch function	Built in
21) Parallel index	Built in
22) Zoom function	Built in
23) Timed TX	TX : 1 to 99 rotation
	ST-BY : 1 to 99 minutes
24) Cable length	20m (standard)
	30m (option) : DC 24V in only
25) Interface	
Power in	Ship's main
Inputs signal	GPS or GPS receiver
	GPS compass or electronic compass
	GYRO (need NSK unit : option)
26) Output	NMEA data (need GPS data)
	Cursor position (RSD)
	Own data (OSD)
	MARPA target data (TTM) with optional MARPA pcb
	Ext buzz

8.4 Keyboard Unit Specifications

1) Dimensions	Width： 290mm
	Height： 45mm
	Depth： 123mm
2) Mass	1.0kg
3) Controls and keys	Gain control
	Tuning control
	Anti-clutter sea control
	Anti-clutter rain control
	Power on/STBY switch (ON/OFF)
	X-MIT key
	MOB key
	EBL key (ON/OFF/SELECT)
	VRM key (ON/OFF/SELECT)
	Dimmer key
	Alarm ack key
	Function key
	Off center key
	TM/RM key
	Trails key
	Bearing key
	Range ring key
	Cursor position key
	Data key
	Clear key
	Range scale key (UP and DOWN)
	Menu key
	Acq/Enter key
4) Track ball	Built in
5) Cable length	5m

8.5 Display Unit Specifications

1) Dimensions

   Landscape

	Width : 290mm
	Height : 290mm
	Depth : 165mm

   Portrait

	Width : 230mm
	Height : 325mm
	Depth : 165mm
2) Mass	2.8kg
3) Power	DC 12V in
4) Resolution	640 x 480 pixels input signal
5) Signal impedance	Video (R, G, B) : 75 Ω
	Sync horizontal : 1k Ω
	Sync vertical : 1k Ω
6) Cable length	5m

8.6 Option

8.6.1 Interunit cable

Interunit calbe | 30m

8.6.2 Rectifier unit

Rectifier unit | NBA-797

8.6.3 Flash mounting kit

1) Flash mounting kit (For display unit) | MPTG31339
2) Flash mounting kit (For keyboard unit) | MPTG31340

8.6.4 MARPA

MARPA	NCA-868
1) Acquisition	
Acquisition mode	Manual (10 targets max)
Manual canceling of unnecessary target	By 1 target each or all targets
Tracking range	0.1 to 20NM
2) Tracking	
Tracking mode	Automatic
3) Vectors	
Mode	Relative/True
Length	1 to 99minutes
4) Dangerous target limits	
CPA	CPA 0,0 to 9.9NM
TCPA	TCPA 0 to 99minutes
5) Numbering target	Automatic or manual applied
6) Numerical display	
Target Data	Simultaneous and continuous display for 1 target. True Bearing (3 digit), Range (3 digit), True course (3 digit), True speed (3 digit), CPA, TCPA
7) Collision point	Calculate predicted collision point for 1 target collision course. Estimated time to collision

8.6.5 NSK unit

NSK UNIT	NCT-4106
Gyro	
SYNC/PULSE	360X, 180X, 90X and 36X
Log	
SYNCHRO	360X, 180X, 90X and 36X
PULSE	800, 400, 200 and 100

8.6.6 Sub indicator unit signal out

Signal | Trigger, video, bearing pulse and reference pulse

8.6.7 Sub keyboard unit

Sub keyboard unit | NCE-7640

8.7 Rectifier

NBA-797

1) Dimentions	Width : 270mm
	Height : 430mm
	Depth : 175mm
2) Construction	Waterproof construction of wall tapestry type
3) Mass	Approx. 18kg
4) Tolerance of input voltage	AC 100/110/115/200/220/230V ±15%
	50/60Hz, single phase
5) Power consumption	200VA
6) Output	DC 26, 7A

8.8 Cable Length between Equipment Units

	Maximum cable length	Standard cable length
1) From scanner unit to indicator unit	30m	20m
	* In case of JMA-5104 or JMA-5106, the input voltage beyond 24V is required for 30m.	
2) From indicator unit to rectifier unit	2m	2m
3) From indicator unit to keyboard unit	5m	5m
4) From indicator unit to display unit	5m	5m

Chapter 9 Installation

This chapter has been written for the service technicians to read in case of installation.

⚠WARNING

🚫 Only specialized personnel shall perform installation work.
Installation work performed by personnel other than specialized personnel may cause breakdown of the equipment, poor performance, fire, severe elec-tric shock and other property and human damages.

9.1 General

Proper installation of a radar unit is essential for extracting full capability of the unit reliably and for facilitating troubleshooting and maintenance. Follow the guidelines given below when installing the radar unit.

(a) Install the scanner unit as high as possible while taking its weight into consideration.

(b) Install the display unit in the wheel house for comfortable observation.

(c) The scanner unit and display unit are connected by 20m compound cable with an internal shield. The maximum permissible cable length is 30 m (only when DC 24V or DC 32V is input). Cables longer than 30m will deteriorate the radar performance of the radar unit.

9.2 Installing the Scanner Unit

9.2.1 Selecting the installation location

⚠CAUTION

The scanner unit shall be installed where there are not large obstacles in the direction of the ship's heading line in the same plane.
If there is a large impediment in the same plane as the scanner unit, this may cause the generation of folse echoes. In particular, if such folse echoes appear at the ship's heading line, monitoring will be difficult and this may cause inadequate forecasting of danger.

Do not install the scanner unit near chimney's or the exhaust of chimneys.
Soot will cause the performance of the radar to decrease and heat may cause breakdown.

Do not install direction antenna or VHF antenna in the vicinity of the scanner unit.
Doing so may cause noise in the antenna reception.

Consideration should be given to separating the radar cable from the cables for the direction antenna and VHF antenna.
These cables should never be bundled into one. Doing so may cause noise in the antenna reception.

Take the following into consideration when selecting the installation location:

(1) Consider the weight of the scanner unit and decide what height it can be raised for installation in the ship.

(2) Height at which the scanner unit is installed has to do with the maximum detectable range, the higher its position is the better. On the other hand, however, if raised too high, at a point beyond the beam width (-3 dB position) along the vertical direction radio wave energy will be affected noticeably, making it difficult to spot targets lying very near.
When installing the unit, consider its weight, longest permissible cable length, and the requirements during future maintenance.
Refer to 4.1, "Height of and the Distance to the Target" for the relation between the height of the scanner unit and maximum detectable range.

(3) If the width of the radiated beam is 2θ (most energy is concentrated within this width), then the energy reduces considerably in directions outside the 2θ range. Thus, if the scanner unit is raised too high it will be difficult to spot targets lying very close-by. If, on the other hand, the scanner unit is installed low, it will be obvious to miss distance targets, and the ship's mast derrick, funnel, etc. will intercept the radiated beams, making most of your targets unobservable. In general, the lowest position of the scanner unit should be as shown by the line AB in the following figure. For example, angle 2θ is 20° for the radar of JMA-5110.
Normally, when deciding the height of the scanner, it is necessary to make sure that the ship's mast does not obstruct the beams.
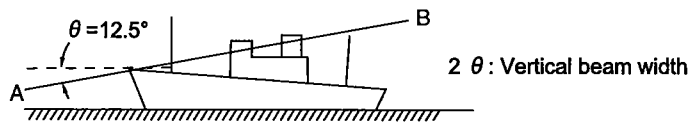
Lowest Position of Scanner Unit

(4) When selecting the position of the scanner along the length of the ship, make sure that the shading caused by the ship's mast on the radio waves does not coincide with the ship's center line. If the ship has no large obstruction towards front, normally the scanner is placed on top of the steering room along the ship's center line.

(5) Avoid placing DF (direction finder) of VHF (communications) antenna near the scanner as these will interfere with the radiated waves.

(6) Soiling of the radiating surface of the scanner by the smoke from funnel affects radar performance, clean the radiating surface form time to time. To facilitate maintenance, place the scanner in the right position and use mast and tower of the right structure.

(7) Note that, if placed near ship's flag or rope may cause by wind to wrap or coil around the radiator and damage it.

(8) Do not select the derrick post as the location for scanner installation. The derrick post is subject to large vibrations.

(9) Note the swing circle of the scanner and allow a distance of at least (swing circle/2)+200 mm between scanner swing center and other installations (say, mast or radio antenna). Scanner swing circle in the radar of JMA-5106/5110 is shown in the following table.
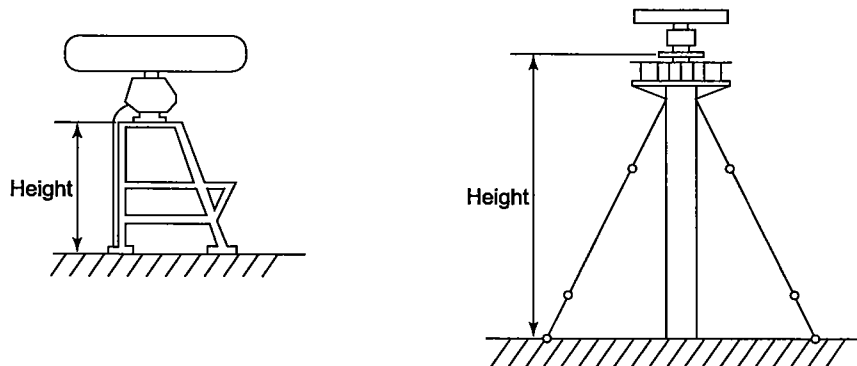
Scanner unit	Feet	Swing circle (mm)	Swing circle/2+200 (mm)
NKE-2062	4	1220	810
NKE-2102	6	1910	1155

9.2.2 Installation procedure

(a) If it is found that there is no height above the roof of the wheel house enough to directly accommodate a scanner unit, install a pedestal or radar mast.

(b) In addition to a pedestal or radar mast, it is necessary to provide an appropriate staging for convenience in installation, maintenance, adjustment, and repair of the scanner unit.

1. Stand

Install the stand as instructed in drawing Fig.1.1, 1.2 and 1.3 in Chapter 1. Direct the cable gland towards ship's stern, making sure that scanner installation base is parallel to surface of the sea. If the stand is installed directly on the top of steering room and find that the scanner is not sufficiently high, use a pedestal or radar mast. Normally, if height of the scanner is not more than 2 m above the roof of the steering room, place the scanner on a pedestal fixed with angle joints. If, on the other hand, the scanner is positioned below a height of 2 m, use a cylindrical radar mast, and place the scanner on top of it. Whether a pedestal of radar mast is used it is necessary to provide proper foothold to facilitate the installation, maintenance, adjustment, and repairs. (Refer to the following figure)

Scanner Stand