Chapter 5 Basic Operation

5.1 Introduction

In this chapter, all necessary operating instructions are given from getting started to turning off the system. The following panel layout illustration will give you an idea what sort of key switches and controls are available as well as their brief functional descriptions.

5.2 Control Panel Layout

The following illustration shows the layout of the control panel. All controls and key switches are grouped for respective functions.

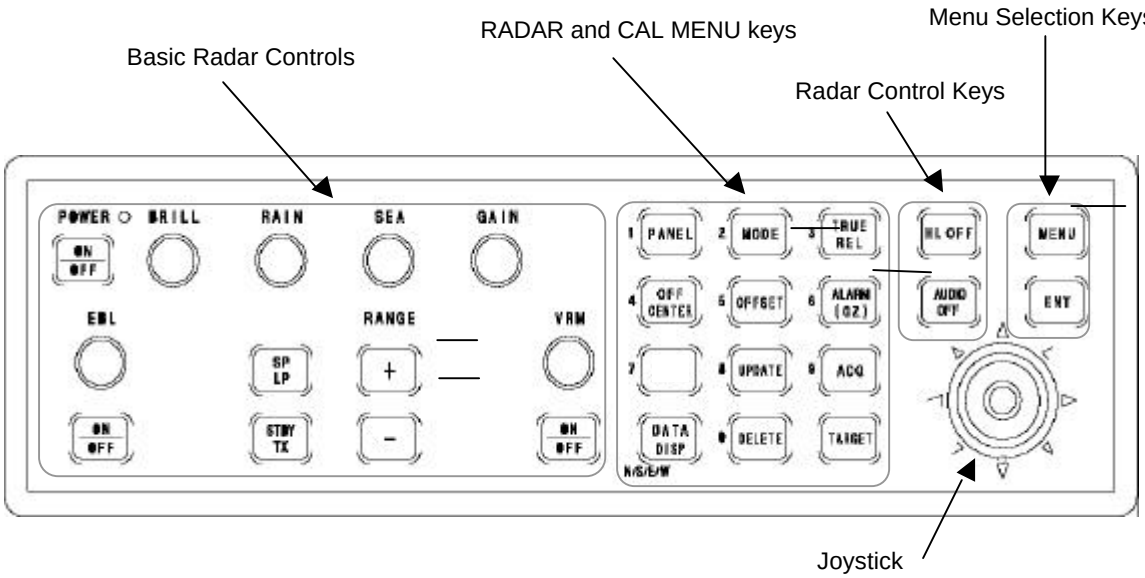


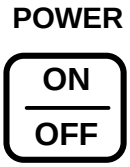
Figure 5.1 Control panel layout

5.3 Operating Controls

All necessary radar controls and functional settings can be made on the display control panel. For fundamental radar operations, such as turning on and off the radar, transmit, range change, gain control, anti-clutter rain and sea controls, the respective dedicated controls and key switches are provided, which are grouped on the left side of the control panel. For setting up various functions and ATA operations, relevant key switches and the Joystick are provided on the right side of the control panel.

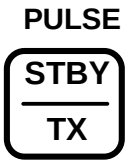
SWITCHES AND CONTROLS

POWER switch



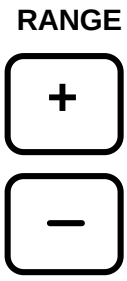
The POWER key switch turns on and off the mains supply to the radar system.

STBY/TX switch



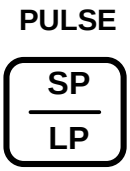
When the system goes into standby mode after 3 minutes preheating period, the STBY/TX key switch functions as a transmission switch. To temporarily stop the transmission, press the STBY/TX key again. The system returns to standby mode.

RANGE +/- switches



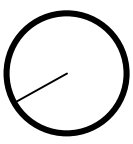
The RANGE key changes the range scale. A press of the + key or – key increases or decreases the range scale, respectively.

SP/LP switch



The SP/LP key is used to change the transmission pulse length to either long or short. Default is a standard pulse length. Subsequent pressing of the key toggles the pulse length between standard and long pulses.

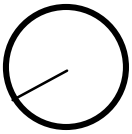
BRILL control



The BRILL control is used to set the brilliance of the display tube. Turning the control CW increases the picture brilliance and CCW decreases the brilliance.

GAIN control

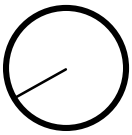
GAIN



The GAIN control is used to vary the receiver gain. Turning the GAIN control CW increases the receiver gain, and CCW decreases the gain. Select AUTO1, AUTO2, or HARBOR by ADJUST/ADJUST MENU, the automatic gain control will come into effect. The GAIN MANUAL sign will change to GAIN AUTO on the screen. In this mode, no manual control is available.

SEA control

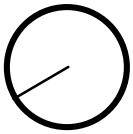
SEA



The SEA control is used to reduce the clutter echo returned from the sea surface. Turning the control CW reduces the clutter and its effect becomes the largest at a full CW position and minimum at a full CCW position. Select AUTO1, AUTO2, or HARBOR by ADJUST/ADJUST MENU, Harbor STC and the Automatic STC functions will come into effect. The HARBOR STC that provides a preset Anti-clutter sea effect, optimized for narrow areas. The AUTO1 and AUTO2 STC provides a hands-free Anti-clutter sea effect. The mode will display as AUTO1, AUTO2, HARBOR and SEA MANUAL in sequence. In the HARBOR and Auto Anti-clutter Sea modes, the manual control is disabled.

RAIN control

RAIN



The RAIN control is used to reduce the clutter echo from rain or snow. Turning the control CW reduces the clutter echo with maximum effect at a full CW position and minimum at a full CCW position. Select AUTO1 or AUTO2 by ADJUST/ADJUST MENU, the automatic anti-rain clutter control will come into effect. The RAIN MANUAL sign will change from RAIN to RAIN AUTO on the screen. In this mode, the manual control is disabled.

EBL ON/OFF key

EBL

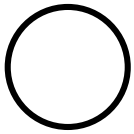
The EBL SEL key is used to switch EBL control at every press of the key. When the second EBL and Parallel Index Line (PI) feature are selected, this key is used to select these markers in the following cyclic order.

- First press: First EBL
- Second press: Second EBL
- Third press: Parallel Cursor
- Subsequent press of the key repeats the above steps.

To select the second EBL, press MENU key and select 2nd EBL item from the DISP/MARK menu. Then press ENT key and select ON. To erase the second EBL, select OFF from the menu. To select the Parallel Index line, select PI from the same menu and select ON.

EBL control

EBL



The EBL control is a rotary type control used to move the EBL position and parallel Index line.

VRM SEL key

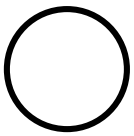
The VRM SEL key is used to switch VRM control at every press of the key. When the second VRM and Parallel Index Line (PI) feature are ON, this key is used to select these markers in the following cyclic order.

- First press: 1st VRM
- Second press: 2nd VRM
- Third press: Parallel Cursor
- Subsequent press of the key repeats the above steps.

To select the second VRM, press MENU key and select 2nd VRM from the DISP/MARK menu. Then press ENT key and select ON.
To erase the second VRM, select OFF from the menu.
To select the Parallel Index line, select PI from the same menu and select ON.

VRM control

VRM



The VRM control is a rotary type used to move the VRM position.

PANEL key

The PANEL key is used to change the brilliance of the panel illumination. Every press of the key will increase or decrease the brilliance in sequential order. The illumination level will be set to an appropriate level when the radar is first turned on.

OFFCENTER key

OFF CENTER

The OFFCENTER key is used to offset the picture to an assigned point determined by the cross cursor. First, move the cross cursor with Joystick to the point where the picture is to be offset. Second, press the OFF CENTER key. A further press of the key will reset the picture to the screen center.

DATA DISP .key

DATA DISP

The DATA DISP key is used to show navigational information on the upper right of the screen. Every press of the key displays the following information in sequence.

First press:	Own ship's course and speed data
Second press:	Own ship's position obtained from LORAN Receiver.
Third press:	Own ship's position obtained from (D) GPS in lat/long coordinate.
Fourth press:	Own ship's position and the distance/bearing to a waypoint en route.

⚠ **Caution:** The navigation data shown in this step is directly received from external navigator equipment. Note that the COG (Course Over Ground) and the SOG (Speed Over Ground) data supplied from the navigator device may slightly differ from what is shown in the top right corner of the screen as own ship's bearing and speed data.

MODE key

MODE

The MODE key is used to change the picture mode. Every press of the key will change the mode in the following sequence.

First press:	H UP RM (Head Up, Relative Motion)
Second press:	N UP RM (North Up, Relative Motion)
Third press:	C UP RM (Course Up, Relative Motion)
Fourth press:	N UP TM (North Up, True Motion)

Further press of the key returns the picture mode to the H UP RM mode.

OFFSET key

OFFSET

The OFFSET key is used to set the EBL 1 and VRM 1 off-centered on the screen. Every press of the key toggles the EBL 1 and VRM 1 off-centered and centered.

UPDATE key

The UPDATE key is used in the EPA function, in conjunction with the TARGET key and Joystick, to correct a plotted target position. For detail, refer to Para 6.6.11 “Correcting the latest plotting position”.

DELETE key

The DELETE key is used in the EPA/ATA function, in conjunction with the TARGET key, to cancel a plotted target. For detail, refer to Para 6.6 Operation of EPA or Para 6.7.4 Using ATA.

ACQ key

The ACQ key is used in the EPA/ATA function, in conjunction with the TARGET key, to acquire a target for tracking. For detail, refer to Para. 6.6 Operation of EPA or Para. 6.7.4 Using ATA.

TARGET key

The TARGET key is used in the EPA/ATA function, to assign the target number to acquire, delete or display the ATA/EPA information of each tracked target. For detail, refer to Para 6.6 Operation of EPA or Para 6.7.4 Using ATA.

TRUE/REL key

The TRUE/REL key is used to change EPA or ATA target vectors to Relative or True.

ALARM (GZ) key

The ALARM key is used to turn on and off the Guard Zone Alarm.

HL OFF Key

The HL OFF key is used to momentarily remove the Heading Line from the screen. When the key is pressed and held, the Heading Line will be removed and, when released it appears again.

AUDIO OFF

The AUDIO OFF key is used to temporarily turn off the audio alarm. A press of the key will silence the alarm.

MENU key

The MENU key is used to display the MENU on the screen. Every press of the key will change the contents of the menu as follows:

First press: RADAR MENU. This menu contains all the preset items for radar functions, sensor data display and EPA/ATA operational settings.

Second press: CAL MENU. This menu contains all technical settings for the radar operation and Performance Monitor.

ENT key

The ENT key is used to activate and fix the selected menu items by the joystick.

5.4 Getting Started

(1) Press the POWER ON/OFF key switch. The red LED lamp lights accordingly and a 3-minute timer starts to count down. At the same time, the following information will be shown on the screen.

- Application software name
- Range scale
- Range ring interval

(2) When the countdown timer finishes, the STANDBY sign will appear on the screen.

(3) Press the STBY/TX key to transmit. The radar starts transmission and the radar video, alphanumeric and graphic information will be shown on the screen at a preset brilliance level. Refer to Figure 5.2 for possible screen presentation.

5.5 Basic Radar Operations

Basic radar controls can be set up using dedicated keys and controls on the control panel. These include:

- Range scale selection
- Pulse selection
- Gain control
- Anti-clutter SEA
- Anti-clutter RAIN
- Bearing measurement with EBL and two EBLs
- Range measurement with VRM and two VRMs
- Picture off-centering
- Selection of presentation mode
- Guard Zone Alarm
- Control panel brilliance

All available screen presentations are shown in Figure 5.2 and respective meanings are given under the illustration.

5.5.1 Range scale selection

A press of the RANGE + or RANGE – key will increase or decrease the range scale by step.

5.5.2 Transmission Pulse selection

Press the SP/LP key if required, to change the pulse length according to your requirement. The pulse change function is available on specific range scales, ranging from 3/4 NM to 12 NM. Available pulse lengths vs range scales are shown in Table 5.1 “Range vs Transmission Pulse Length”.

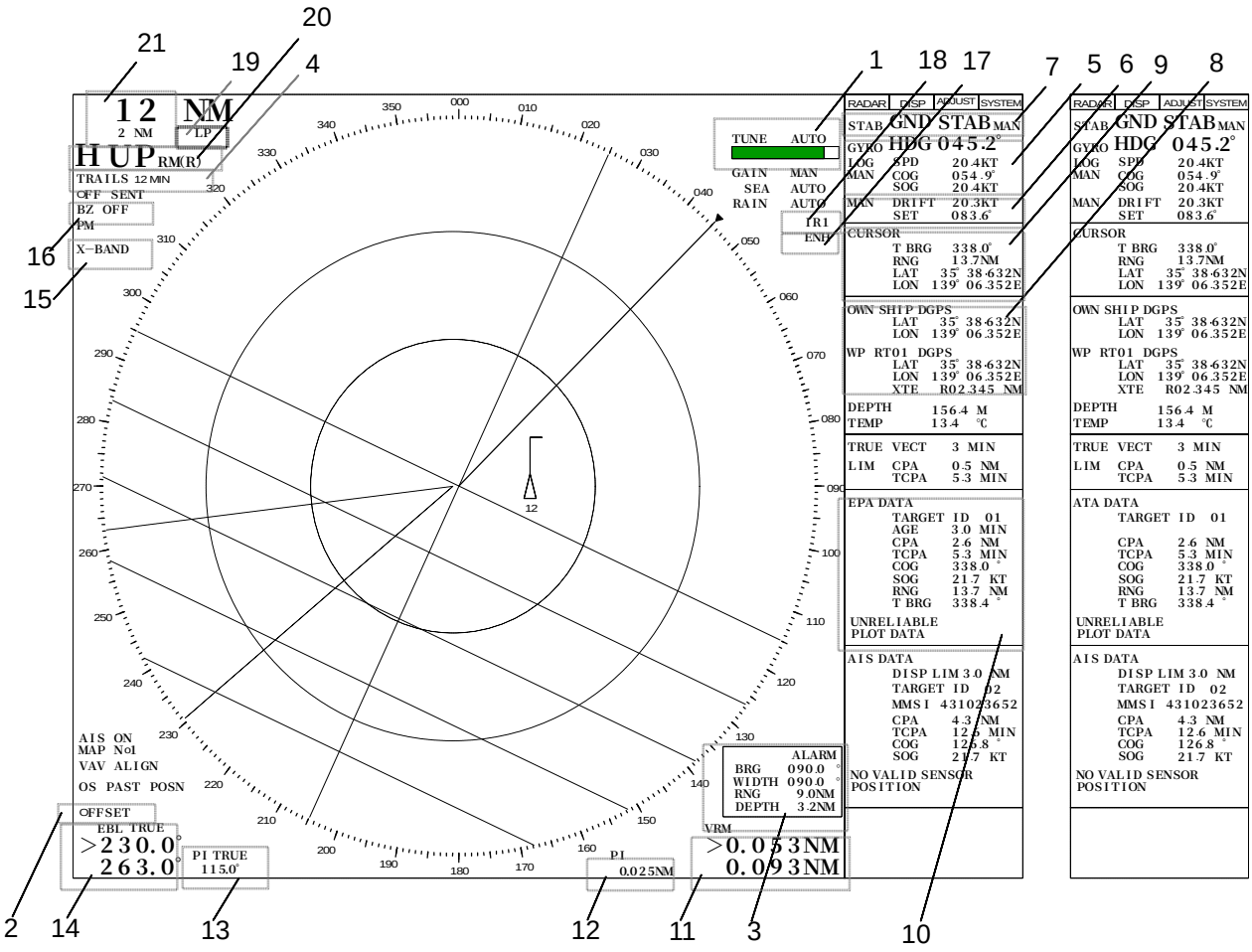


Figure 5.2 RA83/84/85/93/94/95 On-screen information

No.	Descriptions
1	Tuning bar graph & tuning mode display
2	Screen & EBL/VRM offsets display
3	Guard zone position (Range/Bearing)
4	Trail length in time
5	Bearing/Speed Data & signal source names
6	Tidal data & track mode
7	Own ship's data & sensor name
8	Ship's and Waypoint position data with position sensor name
9	Cross cursor position data (lat/long or Range/Bearing)
10	EPA (ATA) data

No.	Descriptions
11	VRM (No.1/No.2) distance data
12	Parallel Index Line interval
13	Parallel Index Line bearing
14	EBL (No.1/No.2) bearing data
15	TX Frequency Band display
16	Electronic Buzzer status
17	Picture Enhancement status (ON)
18	Interference Rejection status
19	TX Pulse length status
20	Picture mode status
21	Range scale and Rings interval display

Table 5.1 Range vs Transmission Pulse Length

RANGE (NM)	Pulse code	Pulse length (6/12kW)	Pulse length (25kW)
0.125	SP	0.08 us	0.08 us
0.25	SP	0.08 us	0.08 us
0.5	SP	0.08 us	0.08 us
0.75	SP	0.08 us	0.08 us
	M1P	0.25 us	0.3 us
1.5	SP	0.08 us	0.08 us
	M1P	0.25 us	0.3 us
3	M1P	0.25 us	0.3 us
	M2P	0.5 us	0.6 us
6	M1P	0.25 us	0.3 us
	M2P	0.5 us	0.6 us
12	M2P	0.5 us	0.6 us
	LP	1.0 us	1.2 us
24	LP	1.0 us	1.2 us
48	LP	1.0 us	1.2 us
64 (6KW)	LP	1.0 us	—
72 (12KW)	LP	1.0 us	—
96 (25KW)	LP	—	1.2 us

5.5.3 Gain control

The GAIN control is used to change the receiver gain. The gain control can be switched to manual or auto mode by ADJUST/ADJUST MENU. When the equipment is turned on at first, the gain control will be defaulted to manual mode.

Set the gain control as appropriate to your operational needs. As a standard setting, turn the GAIN control clockwise to 3/4 of the full excursion. This provides slight noise speckles on the mid ranges and adequate speckles on the long ranges.

To set the auto gain mode, select AUTO1, AUTO2, or HARBOR by ADJUST/ADJUST MENU. The receiver gain will be automatically set and the manual gain control will accordingly become inactive.

5.5.4 Anti-clutter SEA control

The Anti-clutter SEA control is used to reduce the clutter echo appearing around the center of the screen, which is caused by the echo return from the sea surface. The effect of the control is highest at the center of the screen and reduces with distance. The Anti-clutter SEA control is effective up to approximately 6 NM, which can be switched to either manual or auto mode by ADJUST/ADJUST MENU. When first

turned on, the anti-clutter sea control is defaulted to manual mode. To set the auto Anti-clutter mode, select AUTO1, AUTO2, or HARBOR by ADJUST/ADJUST MENU. The receiver gain will be automatically set and the manual SEA clutter control will accordingly become inactive. The HARBOR STC provides a preset Anti-clutter sea effect, optimized for narrow areas. The AUTO1 and AUTO2 STC provides a hands-free Anti-clutter sea effect. The mode will display as AUTO1, AUTO2, HARBOR, and MANUAL. In HARBOR and Auto Anti-clutter Sea modes, the manual control is set ineffective.

5.5.5 Anti-clutter RAIN control

The RAIN control is used to reduce the clutter echo appearing on the screen caused by the rain or snow. The effect of the anti-clutter rain control increases as you turn the control clockwise and is the greatest at a fully clockwise position. The anti-clutter RAIN control can be switched to either a manual or auto mode by ADJUST/ADJUST MENU.

When first turned on, the anti-clutter RAIN function is defaulted to manual mode. To set the auto RAIN-clutter control, select AUTO1 or AUTO2 by ADJUST/ADJUST MENU. The clutter echo from rain or snow will be reduced automatically and the manual rain clutter control will become inactive.

5.5.6 Bearing measurement using a single EBL

(1) Activate the 1st EBL from the DISP/MARK menu with select ON. The EBL will be displayed in a dashed line with the bearing display in the bottom left of the screen. An arrow mark will be shown on the front of the digital display to indicate the EBL is active.
(2) Select the bearing mode if necessary, either RELATIVE or TRUE by DISP/[BRG TRUE/REL] MENU.
(3) Rotate the EBL control to measure the bearing of a target. To measure a single target, always set the EBL on the center of the target. To measure the bearing of the edge of a landmass, move EBL towards the inside of the landmass by half of the aerial horizontal beam width.
(4) To erase the EBL, select OFF from the DISP/MARK/1st EBL menu item.

5.5.7 Bearing measurement using two EBLs

(1) Activate the 2nd EBL from the DISP/MARK menu with select ON. The 2nd EBL will be shown with the 1st EBL in a dotted line with the bearing display underneath the 1st EBL bearing display. An arrow mark will be shown on the front of the digital display to indicate the selected EBL is active.

(2) Use the same step as step (2) and (3) in the 1st EBL operation.
(3) To switch the active EBL to another, press the EBL SEL key.
(4) To erase the second EBL, select OFF from the DISP/MARK/2nd EBL menu item.

5.5.8 Range measurement using Range Rings

Display the RANGE RINGS on the screen from the DISP/MARK menu with select ON. The range ring's interval is indicated on the top left corner of the screen under the range indication. Approximate target range can be estimate with range rings.

5.5.9 Range measurement using VRM

(1) Activate the 1st VRM from the DISP/MARK menu with select ON to show VRM on the screen. The VRM will be shown in a dashed line with the distance displayed in the bottom right of the screen. An arrow mark will be shown in front of the digital display indicating that VRM is active.
(2) Rotate the VRM control to measure the distance to a target. Always place the VRM on the right front of the target.
(3) To erase the VRM, select OFF from the DISP/MARK/1st VRM menu item.

5.5.10 Range measurement with two VRMs

(1) Activate the 2nd VRM from the DISP/MARK menu with select ON. The 2nd VRM will be shown with 1st VRM, in a dotted line with the distance displayed shown underneath the 1st VRM display. An arrow mark will be shown on the front of the digital display to indicate which VRM is active to control.
(2) Rotate the VRM control to measure the distance to a target. Always place the VRM on the right front of the target.
(3) To switch the active VRM to another, press the VRM SEL key.
(4) To erase the second VRM, select OFF from the DISP/MARK/2nd VRM menu item.

5.5.11 Measuring the distance and bearing between any two points by offset 1st EBL / 1st VRM

(1) Activate the 1st EBL and 1st VRM from the DISP/MARK menu with select ON to display 1st EBL and 1st VRM.
(2) Place the cross cursor on the first target.
(3) Press the OFFSET key. The origin of 1st EBL / 1st VRM is now set on the first target.
(4) Move 1st EBL to fall in the center of the second target.

(5) Move 1st VRM to touch the right front of the second target. The distance between the two targets will be shown on the bottom right center of the screen.

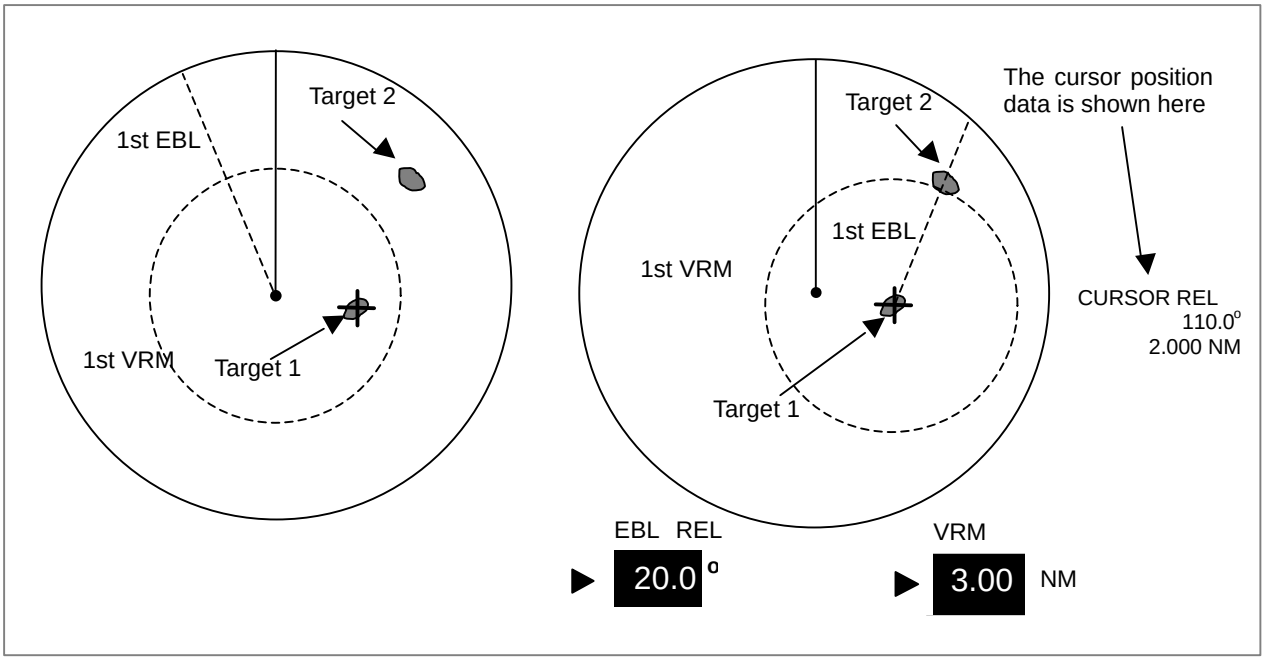


Figure 5.3 Measuring the distance between two points

5.5.12 Picture off-centering

The radar picture can be offset to any position within 2/3 of the screen radius. Use the following procedure.

(1) Move the cross cursor to a desired point to be offset.
(2) Press the OFF CENTER key. The entire radar picture will be moved to the specified point.
(3) A further press of the key will reset the picture to the center position.

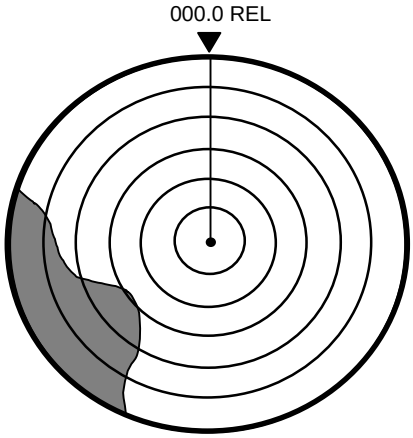
5.5.13 Selection of presentation mode

The following four kinds of presentation modes are available.

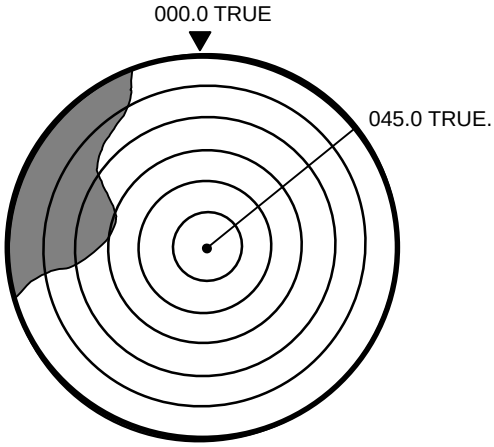
(1) Head Up, Relative Motion
(2) North Up, Relative Motion (Note: Bearing information must be provided)
(3) Course Up, Relative Motion (Note: Bearing information must be provided)
(4) True Motion (Note: The bearing and speed information must be provided)

To select the presentation mode, press the MODE key. Every press of the key will change the presentation mode in the above sequence.

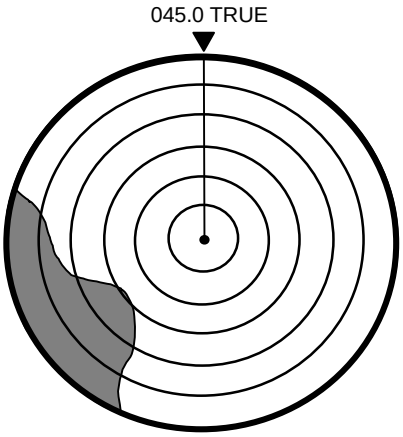
Head Up, Relative Motion (H UP RM)
Ship's position and heading line are always fixed to the screen center and 0 degree of the bearing scale, respectively. Bearings of the objects displayed on the screen are relative to ship's heading. When own ship changes her course, all displayed objects will move in azimuth, accordingly. (Bearing Un-stabilized)



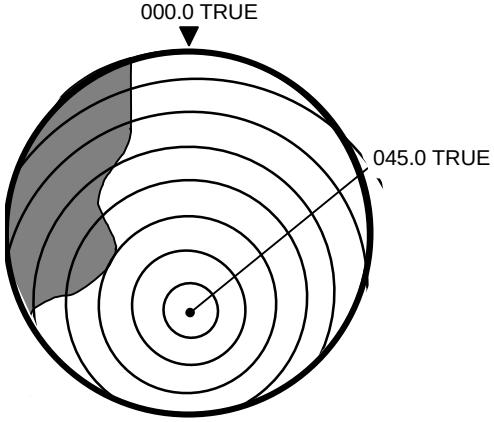
North Up, Relative Motion (N UP RM)
Own ship's position is fixed to the center of the screen, meanwhile, the azimuth bearing scale is stabilized in which true north refers to the cursor scale of 000.0 degree. When own ship changes her course, all displayed objects will stay stationary in azimuth, accordingly. (Bearing stabilized) To allow the bearing to be stabilized, the true bearing data must be provided from a bearing sensor such as a gyrocompass.



Course Up, Relative Motion (C UP RM)
The picture mode is the same as the North Up, Relative Motion mode except, the ship's intended course pointed by the ship's heading line is brought to top of the display.



True Motion (N UP TM)
Own ship and each target moves with its true motion on the radar screen. When own ship reaches 2/3 of the screen radius, it is reset backwards to a specified point to repeat the display. To achieve the True Motion display, a bearing sensor and a speed sensor must be connected to the radar system to provide true bearing and true speed information.



5.5.14 Setting the Guard Zone

The Guard Zone Alarm warns the operator a target has entered the preset alarm zone. When the target stays in the zone for more than 8 seconds, the ALARM sign will flicker and an audio alarm sounds. Press the AUDIO OFF key to silence the alarm.

To set up the position of the Guard Zone

(1) Press the ALARM (GZ) key. This allows the EBL and VRM controls to be used for moving the Alarm Zone in azimuth and range, respectively.

(2) Move the EBL control to set the position of the Guard Zone in azimuth. The center bearing of the Guard Zone will be displayed in the lower right corner of the screen.

(3) Move the VRM control to set the position of the Guard Zone in range. The distance of the outer edge of the Guard Zone will be displayed in the same place as the bearing display. The minimum distance is limited to 0.6 NM.

To set up the depth and width of the Guard Zone

(Reference drawing: Figure 5.4 The outline of the Guard Zone Alarm)

(1) Press the EBL SEL key and rotate the EBL control to set up the width of the alarm zone. An arrow mark will be shown on the front of the WIDTH to indicate width is active to control. A further press of the key will return to control the Guard Zone in azimuth.

(2) Press and hold the VRM SEL key and rotate the VRM control to set up the depth of the alarm zone. An arrow mark will be shown on the front of the DEPTH to indicate depth is active to control. A further press of the key will return to control the Guard Zone in range. The minimum distance of the inner zone to own ship is limited to 0.5 NM.

(3) Press the ENT key to fix the settings. The Guard Zone will be shown on the screen.

CAUTION: In the following case, the alarm function will become inoperative. The ALARM range and bearing displays accordingly flicker to notify that the function is inoperative.

- When the alarm zone is set beyond the viewable screen area caused by improper range scale setting such as, the range scale is too short, off-centering is too much, etc.

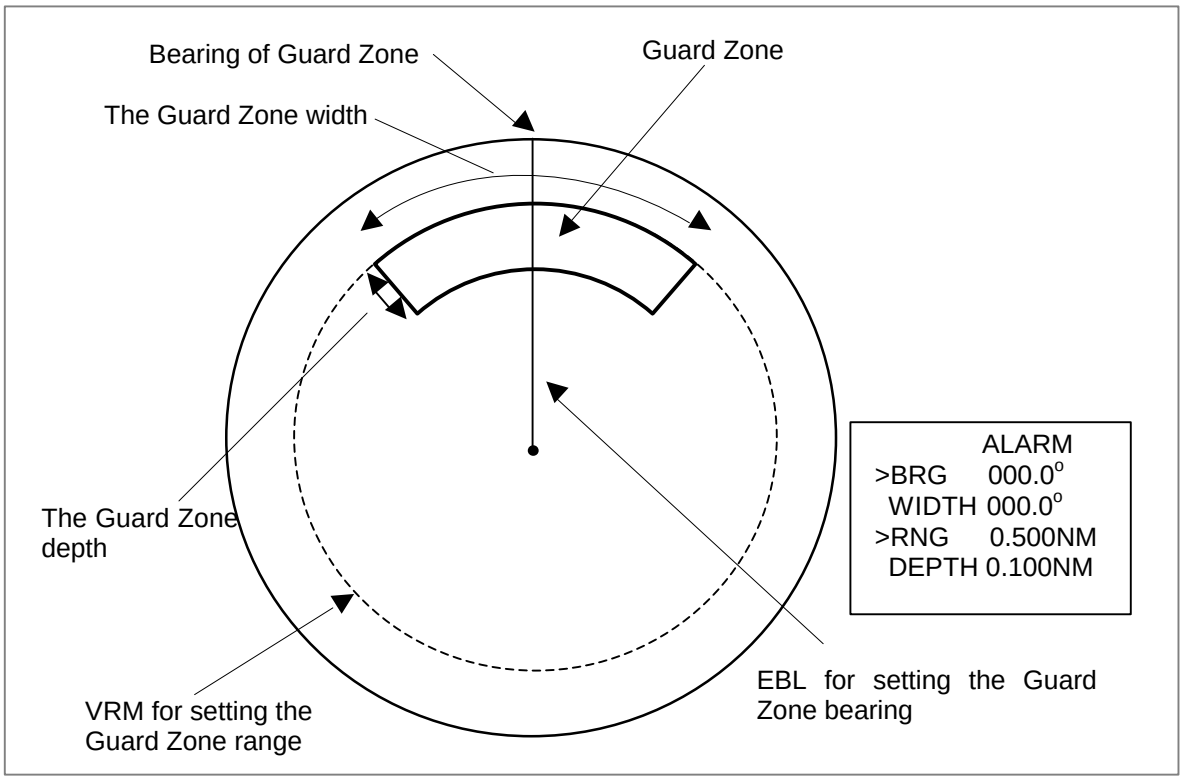


Figure 5.4 The outline of the Guard Zone Alarm

5.5.15 Control panel brilliance

The control panel illumination is set by default. To change the brilliance, use either the following procedure.

(1) Keep pressing the PANEL key to change the panel illumination in 10 cyclic steps, starting from OFF, increasing, decreasing and finally to OFF again.

5.5.16 Displaying the navigational data

Navigational data such as own ship's position, waypoint position and the distance and bearing to a waypoint can be shown on the screen. Press the DATA DISP key to display this data on the screen.

NOTE:
1. A navigator unit must be connected to the processor unit.
2. The serial data format must be selected. Refer to Para 6.3 "SYSTEM: I/O SETUP MENU" for detail.

Each press of the DATA DISP key changes the contents of the navigation display in the following sequence.

OFF: The navigation display is turned off.
OWN SHIP (COG/SOG): Own ship's bearing and speed.
OWN SHIP (TD): Own ship's position in the LOP (Lane of Position) coordinate.
OWN SHIP (L/L): Own ship's position is expressed in latitude and longitude.
OWN SHIP (L/L) / WP (Bearing/Distance): Own ship's position in latitude/longitude and waypoint position in bearing and distance.
OWN SHIP (L/L) / WP (L/L): Own ship's position and waypoint position in latitude/longitude grid.

OWN SHIP'S POSITION DISPLAY

OWN SHIP DGPS
12 O 34. 567 N
34 O 43. 568 E

Own ship's position is obtained from a Differential GPS receiver.

WAYPOINT POSITION DISPLAY

WP RT01 DGPS
12 O 37. 123 N
34 O 42. 432 E

The position of Waypoint No.RT01 is obtained from a Differential GPS receiver.

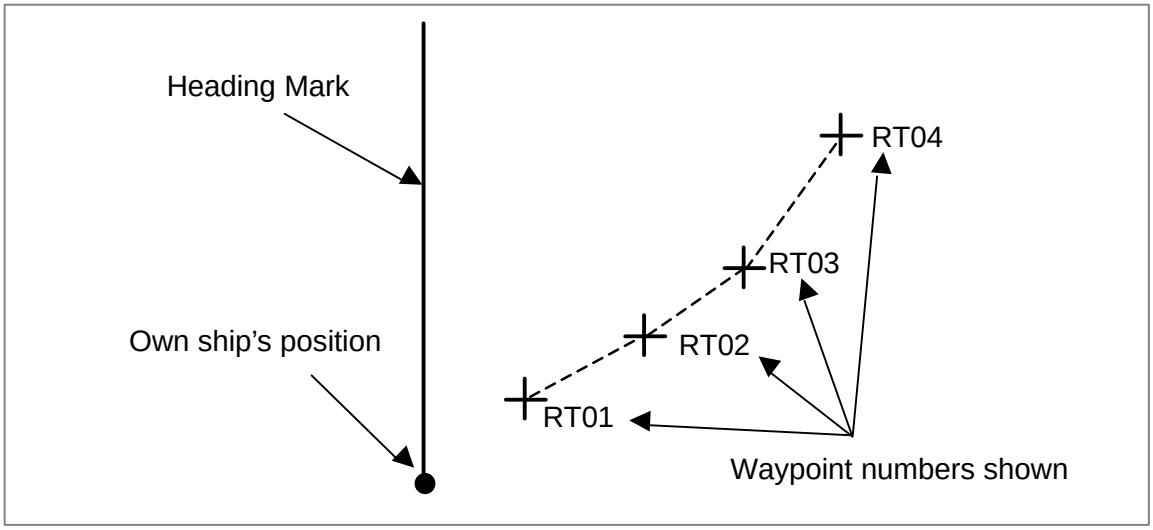


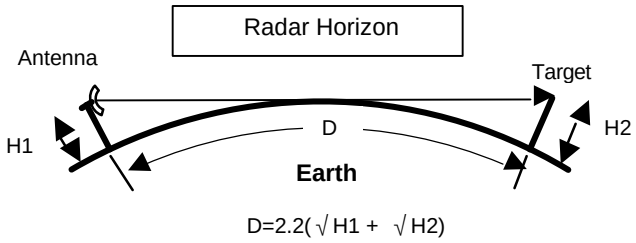
Figure 5.5 The waypoint number display on the screen

APPENDIX 1: Interpretation of Radar Images

Factors that affect the radar detection range

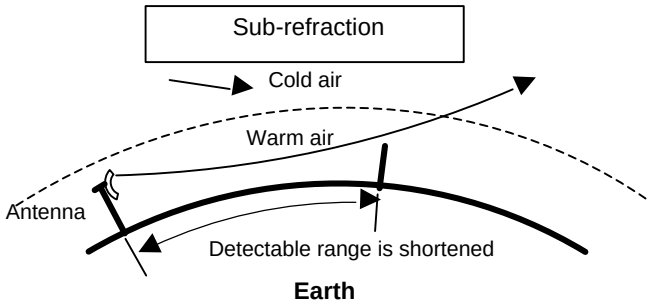
Radar Horizon

The radar uses microwave energy that travels in a straight line like light. Light is reflected towards the surface of the earth due to the temperature, humidity, and the atmospheric pressure changes in the air. This causes the visual range to extend beyond the physical horizon. This is called the optical horizon. Microwave has the same effect and this is called the radar horizon. Meanwhile, its wavelength is longer than that of light. The radar visual range is therefore longer than light by approximately 6%.



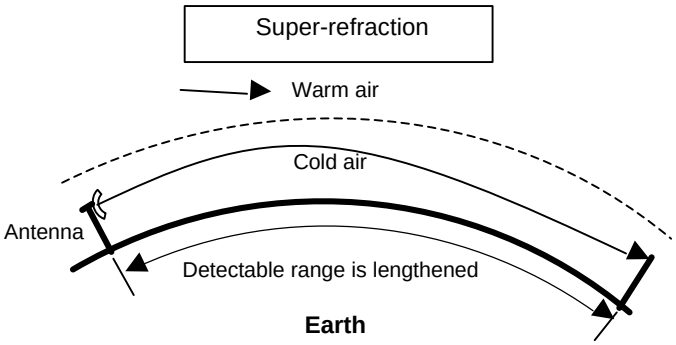
Sub-refraction

When cold air flows over a warm surface, the microwave is bent upwards as shown in the figure. This phenomenon is called sub-refraction. As a result, the detectable range may be reduced. This situation is likely to occur in the Polar Regions, or in warm current waters where cold air from the Polar Regions flow over the sea surface.



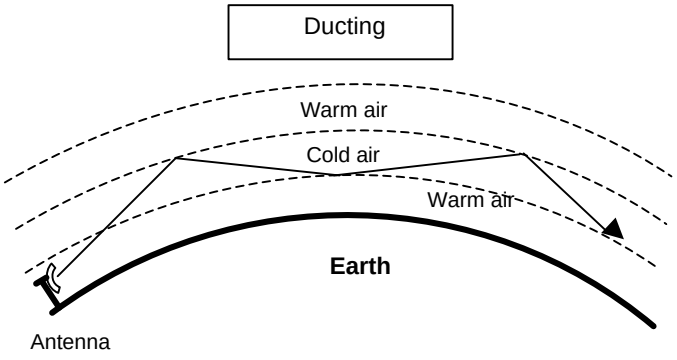
Super-refraction

When the air being warmed up in an inland area flows over the cold sea, the microwave is bent downwards. In this case, a detectable radar range may increase. This situation may occur produced in warm coastal regions, and it becomes noticeable as the temperature difference becomes larger.



Ducting

When two or more layers of different temperature come into contact with one another, the radar wave may be reflected from the boundary surface where different refraction indices exist. As a result, the microwave propagates along the curvature of the earth while being reflected on the wave passage situated between the interface and the surface of the earth. This passage is called “Duct”, and an abnormal propagation of the radio wave caused by the duct is called “Ducting”. If the air layers with mutually different temperature or atmospheric pressures are alternately present along the different altitudes, radar may be able to detect a target far beyond its maximum detectable range.

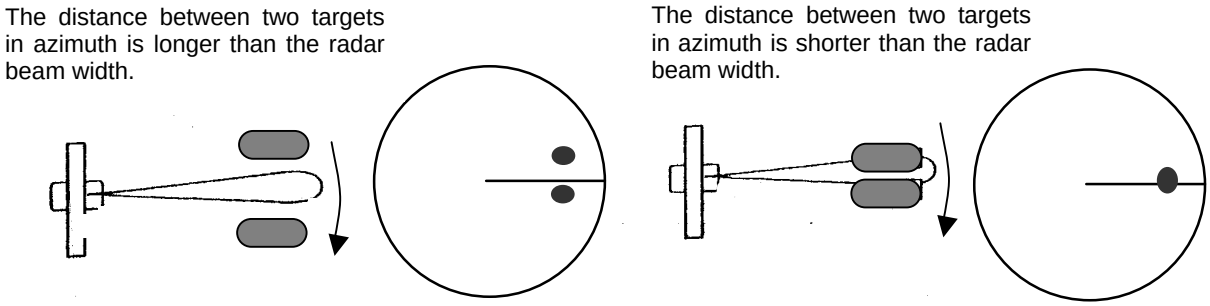


Picture resolution

The picture resolution depends on the bearing and range discriminations that are solely determined by the antenna horizontal beam width and the transmission pulse length. These factors are defined in the following explanations and illustrations.

(1) Bearing discrimination

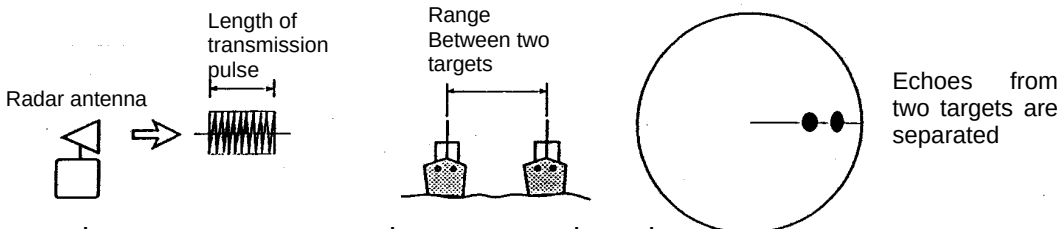
The bearing discrimination is defined as the minimum bearing where two targets of the same distance are displayed as two independent images on the screen. The bearing discrimination is determined by the aerial horizontal beam width.



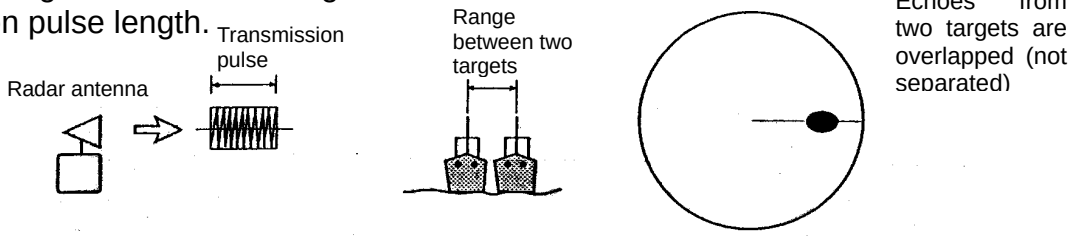
(2) Range discrimination

The range discrimination is defined as the minimum distance where two different targets situated in line on the same bearing are shown separated. The range discrimination is dependent on the transmission pulse length.

When the range between two targets is wider than the transmission pulse length.

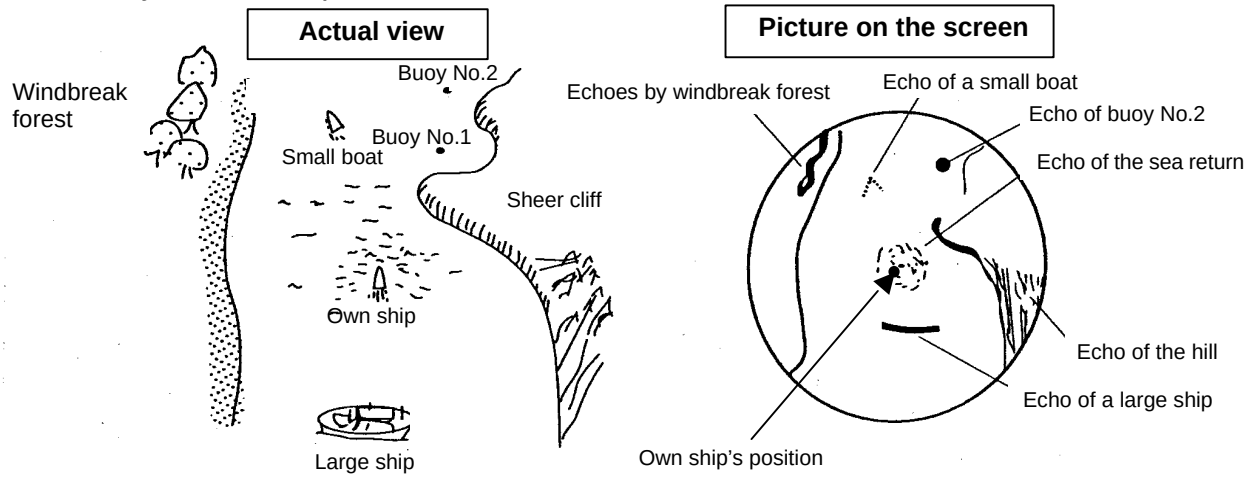


When the range between two targets is narrower than the transmission pulse length.



Reading the radar images

The following pictures illustrate how the radar picture is constituted from an actual situation around your own ship.

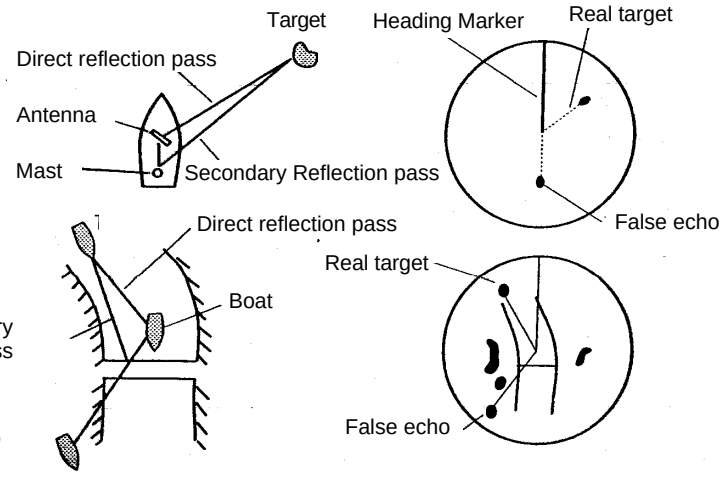


- The buoy No.1 is not detected because the cape blocks it.
- The echo of the large boat is painted similar to its actual profile because of short distance.
- The echo of a small boat is shown as a spot because it has a small echoing area.
- The hill located on the starboard (in the bearings of 90 deg to 130 deg) has a deep forest zone, and its echoing area is large. It is represented as wide spreading echoes on the screen.
- Since the sand beach on the port side is deep, but is not topographic. The echoes are shown weak.
- The windbreak forest produces strong echoes, and it is shown as massive echoes in high contrast.
- The echoes reflected from the sea surface change from time to time, depending on the wind speed and direction. These echoes are shown as a group of spots.

False echoes

The operator should be fully aware of various false echoes caused by the radar performance, terrain and structures on the land, as mentioned below.

(1) False echo caused by secondary reflection

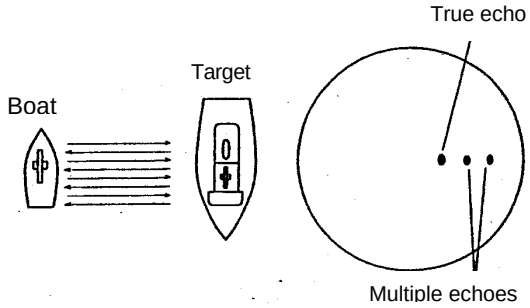


An example of false echo caused by the radar beam reflected by an aft mast.

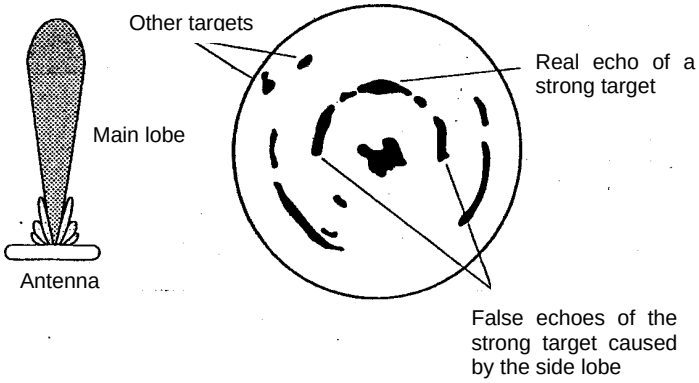
An example of a temporarily produced false echo caused by the radar beam reflected by a large bridge.

(2) False echo caused by multiple echoes

When a boat passes near a large boat, radio waves are repeatedly reflected between own boat and the nearby boat, causing several echoes at regular intervals to appear in the same bearing. These false echoes produced by multiple reflection are called multiple echoes. In this case, the real target is the other boat moves from the reflection echoes soon disappear when your boat moves from the boat that caused the multiple reflections or, the boat has changed her course. For this reason, the true image can easily be identified.

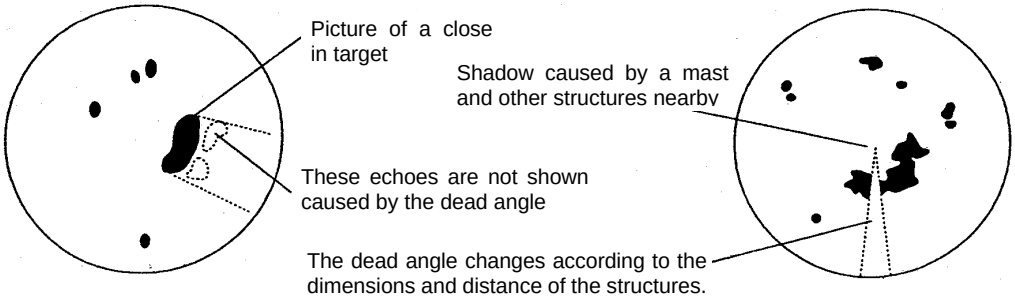


The radio beam emitted from a rada antenna contains some residual smalle beams on both sides of the main beam. These components are called the side lobes. A closely located target with high reflectivity can be displayed as an arc caused by the side lobes. To reduce these false echoes, reduce the gain slightly or apply A/C sea control.

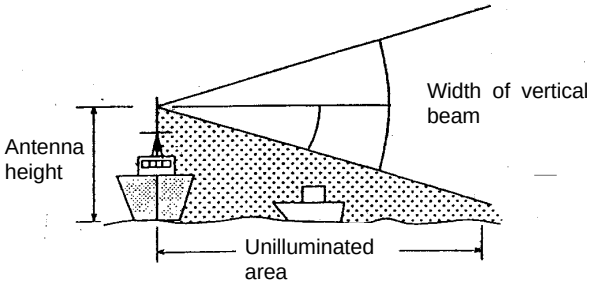


(4) Shadow and dead angle

If the funnel, mast or other structures are located near a radar antenna, the radar beam will be blocked, causing a shadow area where no object will be detected by the radar. The angle of the shadow is called the dead angle. To avoid the shadow, the radar antenna position should be changed to a better place to minimize this effect. If this is not possible, the operator should be aware this dead angle exists while operating the radar.



Height of antenna affects the short range target detection. If the antenna is mounted too high, the radar beam may skip the target, causing no echo detection. The vertical beam width of the radar antenna also affects the close range detection.



APPENDIX 2: Receiving the Radar Beacons and SART

The X-band radar system is required to be capable of receiving signals emitted from a Radar Beacon and a SART (Search and Rescue Transponder). To receive those signals by the radar system, use the following procedures.

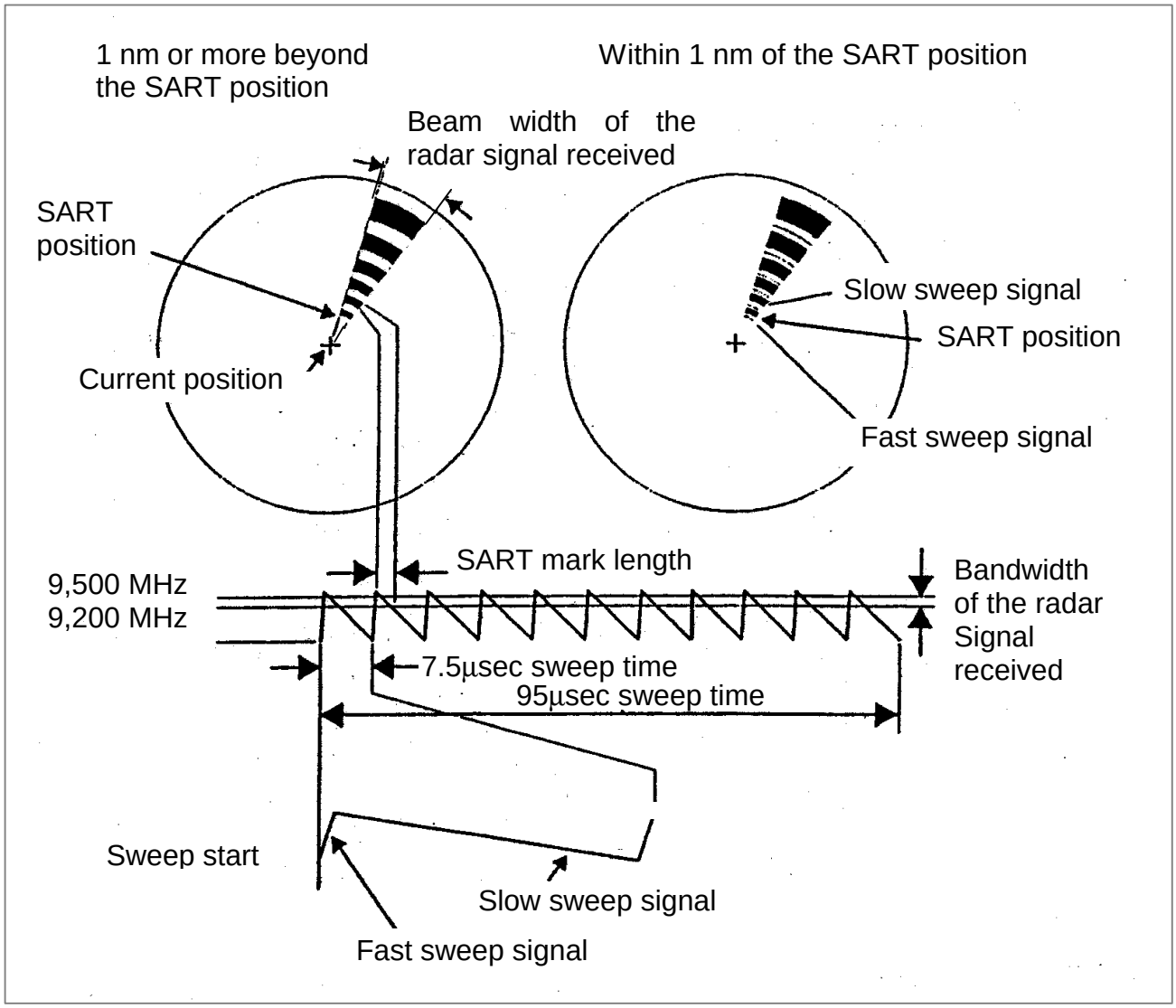
(1) Set the range scale to 6 or 12 NM.
(2) Turn off the Interference Rejection function from DISP/ECHO/IR menu item. Refer to Para. 6.1.2 “IR (Interference Rejection).
(3) In case the radar picture is obscured with too many echo signals, detune the receiver a little for better observation.
(4) When your vessel approaches the transmitting Radar Beacon or the SART, the echoes will become blurred in an arc. For better observation of those signals, adjust the Gain, Anti-clutter Sea and RAIN controls, as appropriate.

About SART

According to the GMDSS (Global Maritime Distress and Safety Systems) requirement, the IMO/SOLAS class ships must be equipped with a SART. When a ship is in distress, a signal will be automatically emitted from the SART so that other ships and/or aircrafts can identify its location. When your ship carrying the X-band radar comes within 8 miles of a ship in distress, the SART picks up the radar signal and responds to it. The signal consists of 12 sweeps and is emitted in the frequency range of 9.2 GHz through to 9.5 GHz. The SART has two sweep times that switch from slow sweep (7.5 us) to fast sweep (0.4 us) and vice versa, according to the distance. When the radar receives this signal, a line of 12 dots, which is equally spaced at about 0.64 NM, appears on the screen. The nearest blip of the SART indicates the location of the ship in distress. When your vessel comes within 1 NM to the SART, a fast sweep signal is displayed on the radar and a thin line connects the 12 blips.

Actual location of the ship carrying the SART

If your vessel is located at 1 NM or more away from the SART, the position at which the first echo is displayed is 0.64 NM behind the actual SART position when the 12 SART echoes are identified. If your vessel comes within 1 NM from the SART, the fast sweep signal is indicated. The position of this echo is displayed 150 meter beyond the actual SART position.



The SART signal presentation and its signal timing