ONWA®

KR-12X8/15X8
OPERATOR'S MANUAL

TFT LCD COLOR MARINE RADAR

CE

Radio Frequency Exposure

This device is a mobile transmitter and receiver that uses its antenna to send and receive low levels of radio frequency (RF) energy for data communications. The device emits RF energy below the published limits when operating in its maximum output power mode and when used with Express Communication & Navigation Company Ltd. authorized accessories. To comply with FCC RF exposure compliance requirements, the device should be used in a compatible mount or as mounted per the installation instructions only. The device should not be used in other configurations. The device must be mounted a 100 cm(KR-1238/1538/1338) and 240cm (KR-1268/1568/1668) away from the body of the user. This device must not be co-located or operated in conjunction with any other transmitter or antenna.

FCC Compliance

This product has been tested and found to comply with Part 15 of the FCC interference limits for Class B digital devices FOR HOME OR OFFICE USE. These limits are designed to provide more reasonable protection against harmful interference in a residential installation, and are more stringent than "outdoor" requirements.

Operation of this device is subject to the following conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment generates, uses, and can radiate radio frequency energy and may cause harmful interference to radio communications if not installed and used in accordance with the instructions. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet that is on a different circuit from the GPS device.
- Consult the dealer or an experienced radio/TV technician for help.

This product does not contain any user-serviceable parts. Repairs should only be made by an authorized Express Communication & Navigation Company Ltd. service center. Unauthorized repairs or modifications could result in permanent damage to the equipment, and void your warranty and your authority to operate this device under Part 15 regulations.

⚠ SAFETY INSTRUCTIONS

"DANGER","WARNING" and "CAUTION" notices throughout this manual. It is the responsibility of the operator and the installer of the equipment to read, understand and follows these notices. If you have any questions regarding these safety instructions, please contact a ONWA agent or dealer.

⚠ WARNING

Do not open the equipment.
Hazardous voltage which can cause electrical shock, burn or serious injury exists inside the equipment. Only qualified personnel should work inside the equipment.

Wear a safety belt and hard hat when working on the antenna unit.
Serious injury or death can result if someone falls from the radar antenna mast.

Stay away from transmitting antenna.
The radar antenna emits microwave radiation which can be harmful to the human body, particularly the eyes. Never look directly into the antenna radiator from a distance of less than 1 m when the radar is in operation.

Turn off the radar power switch before servicing the antenna unit. Post a warning sign near the switch indicating it should not be turned on while the antenna unit is being serviced.
Prevent the potential risk of someone begin struck by the rotating antenna and exposure to the RF radiation hazard.

Do not disassemble or modify the equipment.
Fire electrical shock or serious injury can result.

Turn off the power immediately if water leaks into the equipment or the equipment is emitting smoke or fire.
Continued use of the equipment can cause fire or electrical shock.

Do not place liquid-filled containers on the top of the equipment.
Fire or electrical shock can result if a liquid spills into the equipment.

⚠ CAUTION

Use the proper fuse.
Use of a wrong fuse can result in fire or permanent equipment damage.

Do not use the equipment for other than its intended purpose.
Personal injury can result if the equipment is used as a chair or stepping stool, for example.

Do not objects on the top of the equipment.
The equipment can overheat or personal injury can result if the object falls.

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FOREWORD

Thank you for your choice of ONWA MODEL KR-12X8/15X8 Marine Radar. The radar is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless properfly installed and maintained. Please carefully read and follow the recommended procedures for installation, operation and maintenance. While this unit can be installed by the purchaser, any purchaser who has doubts about his or her technical abilities may wish to have the unit installed by a ONWA representative or other qualified techician. The importance of a through installation can not be overemphasized. We would appreciate hearing from you, the enduser, about whether we are achieving our purposes. Thank you for considering and Purchasing ONWA equipment.

Features

Your radar has a large variety of functions, all contained in a remarkably small cabinet.

The main features of the MODEL KR-12X8/15X8 are.

- Traditional ONWA reliability and quality in a compact, lightweight and low-cost radar.
- Durable brushless antenna motor.
- On-screen alphanumeric readout of all operational information.
- Standard features include EBL (Electronic Bearing Line), VRM (Variable Range Marker), Guard Alarm, Display Off Center, and Echo Trail.
- Watchman feature periodically transmits the radar to check for radar targets which may be entering the alarm zone.
- Ship's position in latitude and longitude and range and bearing to waypoint, and ship's speed/ heading/course can be shown in the right hand side text area. (Requires a navigation aid which can output such data in IEC61162 format.)
- Zoom feature provided.

KR-1238/1538 SPECIFICATION

ANTENNA UNIT

1. Radiator: Slotted waveguide array
2. Radiator length: 55 cm
3. Horizontal beamwidth: 4°
4. Vertical beamwidth: 25°
5. Sidelobe:
   Within ± 20° off mainlobe; less than -18 dB
   Outside ± 20° off mainlobe; less than -23 dB
6. Polarization: Horizontal
7. Antenna rotation speed: 24 rpm (±2)
8. Wind resistance: Relative wind speed 100 knots (51.5 m/s)

TRANSCEIVER MODULE (contained in radome)

1. Transmitting tube: MSF1421B or MAF1421B
2. Frequency: 9410 MHz ± 30MHz
3. Peak output power: 4kW nominal
4. Pulselength & pulse repetition rate:
   0.08 μ S, 2100 Hz (0.125, 0.25, 0.5, 0.75, 1.5nm)
   0.3 μ S, 1200 Hz (1.5, 2, 3nm)
   0.8 μ S, 600 Hz (3, 4, 6, 8, 12, 16, 24, 36nm)
5. Warm up time: 1:30 minutes
6. Modulator: FET switching method
7. I.F.: 60MHz
8. Tuning: Automatic or manual
9. Receiver front end: MIC (Microwave IC)
10. Bandwidth:
    Tx pulselength 0.3 μ S and 0.08 μ S: 25MHz
    Tx pulselength 0.8 μ S: 3MHz
11. Duplexer: Circulator with diode limiter

DISPLAY UNIT

1. Indication system: LCD digital display
2. Display: 12″ or 15″ LED backlight, 32-bit TFT Color LCD Display
3. Range scale (nm):
   Range, Range interval and no. of Rings:
   0.125(0.0625,2), 0.25(0.125,2), 0.5(0.125,4), 0.75(0.25,3), 1(0.25,4), 1.5(0.25,6), 2(0.5,4), 3(0.5,6), 4(1,4), 6(1,6), 8(2,4), 12(2,6), 16(4,4), 24(4,6), 36(6,6)
4. Bearing resolution: 4°
5. Bearing accuracy: Within 1°
6. Range discrimination: Better than 30 m
7. Range ring accuracy: 0.9% or range in use or 8 m, whichever is larger
8. Minimum range: Better than 25 m
9. Markers:
   Heading line, Bearing scale, Range ring, VRM, EBL Tuning indicator, Cursor, Alarm zone, North mark (heading sensor input required)
10. Alphanumeric indication:
    Range, Range ring interval, Pulselength, Interference rejection (IR), VRM, EBL, Stand-by (ST-BY), Radar alarm, Echo stretch (ES), Range to cursor, Bearing to cursor, Echo trailing (TRAIL), Trail time, Trail elapsed time, Navigation data (navigation input required), heading (HDG, heading sensor input required)
11. Vibration:
    Vibration Total amplitude:
    1 to 12.5 Hz ± 1.6mm
    12.5 to 25 Hz ± 0.38mm
    25 to 30 Hz ± 0.10mm
12. Temperature:
    Antenna unit; -25℃ to + 70℃
    Display unit; -10℃ to + 50℃
13. Humidity:
    Relative humidity 93% or less at + 40℃
14. Power supply & power consumption : 12V, 24V or 32VDC (10.5V to 40 VDC) 60W
15. Compass safe distance:

	Standard Compass	Steering Compass
Antenna unit	130cm	95cm
Display unit	75cm	60m

KR-1268/1568 SPECIFICATION

ANTENNA UNIT

1. Radiator: Slotted waveguide array
2. Radiator length: 120 cm
3. Horizontal beamwidth: 1.9°
4. Vertical beamwidth: 22°
5. Sidelobe:
   Within ± 20° off mainlobe; less than -24 dB
   Outside ± 20° off mainlobe; less than -30 dB
6. Polarization: Horizontal
7. Antenna rotation speed: 24 rpm
8. Wind resistance: Relative wind speed 100 knots(51.5 m/s)

TRANSCEIVER MODULE (contained in antenna)

1. Transmitting tube: MAF1422 or MSF1422
2. Peak output power: 6KW nominal
3. Pulselength & pulse repetition rate:
   0.08μS, 2100 Hz (0.125, 0.25, 0.5, 0.75, 1.5nm)
   0.3μS, 1200 Hz (1.5, 2, 3nm)
   0.8μS, 600 Hz (3, 4, 6, 8, 12, 16, 24, 36, 48, 64, 72nm)
4. Bandwidth:
   Tx pulselength 0.3μS and 0.08μS: 25MHz
   Tx pulselength 0.8μS: 3MHz
5. Other: See KR-1238/1538

DISPLAY UNIT

1. Range scale (nm):
   Range, Range interval and no. of Rings:
   0.125(0.0625,2), 0.25(0.125,2), 0.75(0.25,3), 1(0.25,4), 1.5(0.25,6), 2(0.5,4), 3(0.5,6), 4(1,4), 6(1,6), 8(2,4), 12(2,6), 16(4,4), 24(4,6), 36(6,6), 48(8,6), 64(16,4)，72（12，6）
2. Compass safe distance:

	Standard Compass	Steering Compass
Antenna unit	130cm	95cm
Display unit	75cm	60cm
Performance Monitor	60cm	35cm

3. Power supply & power consumption: 12V, 24V or 32VDC (10.5V to 40VDC) 60W.

INTERFACE IEC61162(NMEA0183)

Input data sentences:

Own ship`s position:	GGA>RMA>RMC>GLL
Speed:	RMA>RMC>VTG>VHW
Heading (True):	HDT>HDG*>HDM*>VHW*
Course (True):	RMA>RMC>VTG
Course (Magnetic):	VTG>RMA*>RMC
Waypoint (Range, Bearing):	RMB>BWC>BWR
Loran time difference:	RMA>GLC>GTD
Water depth:	DPT>DBT
Water temperature:	MDA>MTW
XTE:	RMB>XTE>APB

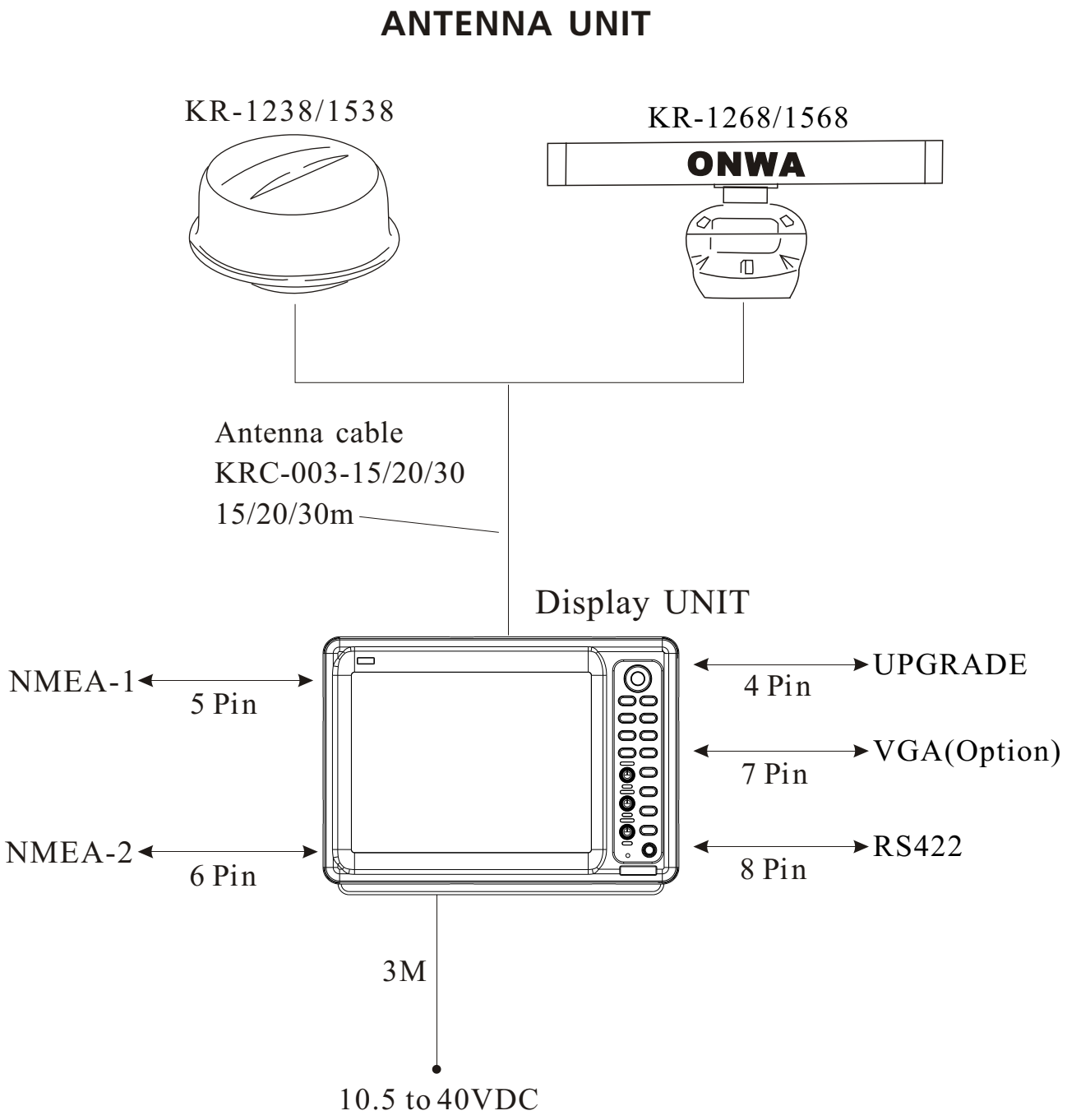
*: Calculated value based Magnetic variation.

AIS:	VDO>VDM>ACA>ACS>ALR>ACK

Output data sentences:

Own ship data:	OSD
Radar system data:	RSD
Target label:	TLB
Target latitude and longitude:	TLL
Tacked target data:	TTD
Tracked target message:	TTM

CONFIGERATION OF KR-1238/1268/1538/1568



1. PRINCIPLE OF OPERATION

1.1 What is Radar?

The term "RADAR" is an acronym meaning "RAdio Detection And Ranging". Although the basic principles of radar were developed during World War II, echoes as an aid to navigation is not a new development.

1.2 How Ships Determined Position Before Radar

Before the invention of radar, when running in fog near a rugged shoreline, ships would sound a short blast on their whistles, fire a shot, or strike a bell. The time between the origination of the sound and the returning of the echo indicated how far the ship was from the cliffs or theshore. The direction from which the echo was heard indicated the relative bearing of the shore.

1.3 How Radar Determines Range

Radar determines the distance to the target by calculating the time difference between the transmission of a radar signal and the reception of the reflected echo. It is a known fact that radar waves travel at a nearly constant speed of 162,000 nautical miles per second. Therefore the time required for a transmitted signal to travel to the target and return as an echo to the source is a measure of the distance to the target. Note that the echo makes a complete round trip, but only half the time of travel is needed to determine the one-way distance to the target. This radar automatically takes this into account it making the range calculation.

1.4 How Radar Determines Bearing

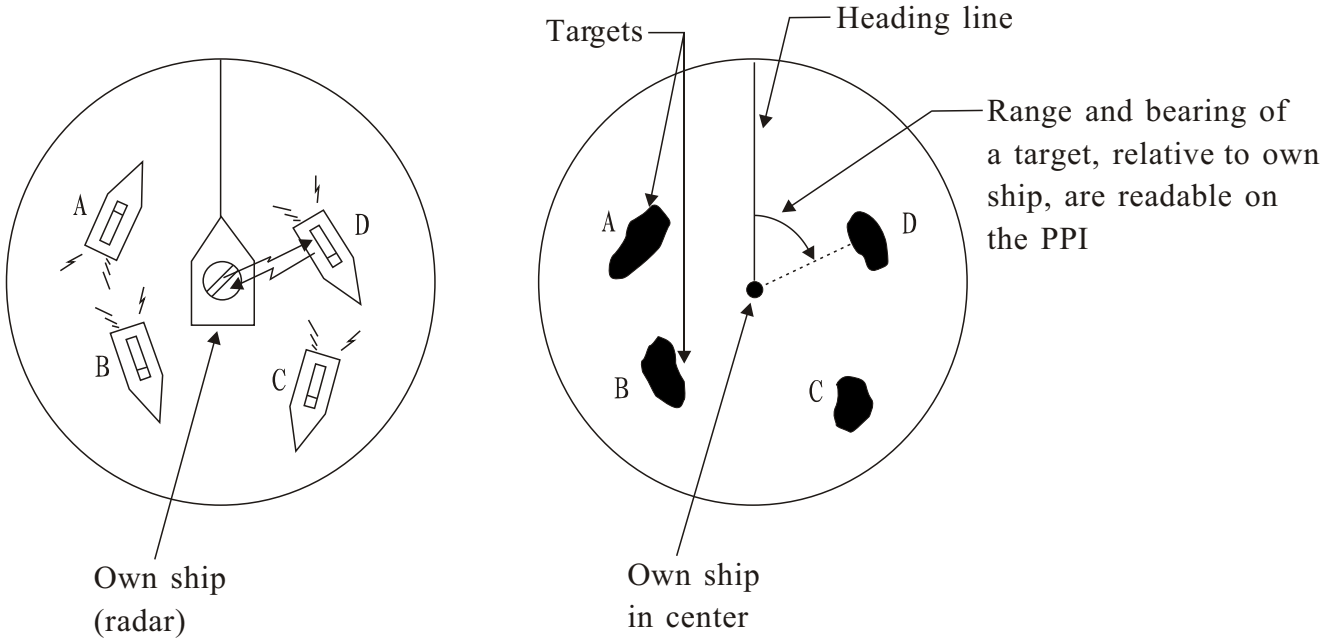
The bearing to a target found by the radar is determined by the direction in which the radar scanner antenna is pointing when it emits an electronic pulse and then eceives a returning echo. Each time the scanner rotates pulses are transmitted in the full 360 degree circle, each pulse at a slightly differentbearing from the previous one. Therefore, if one knows the direction in whichthe signal is sent out, one knows the direction from which the echo must return.

1.5 Radar Wave Speed and Antenna Rotation Speed

Note that the speed of the radar waves out to the target and back again as echoes is extremely fast compared to the speed of totation of the antenna. By the time radar echoes have returned to the scanner, the amount of scanner rotation after initial transmitting of the radar pulse is extremely small.

1.6 The Radar Display

The range and bearing of a target is displayed on what is called a Plan Position Indicator (PPI). This display is essentially a polar diagram, with the transmitting ship's position at the center. Images of target echoes are received and displayed at their relative bearings, and at their distance from the PPI center. With a continuous display of the images of targets, the motion of the transmitting ship is also displayed.

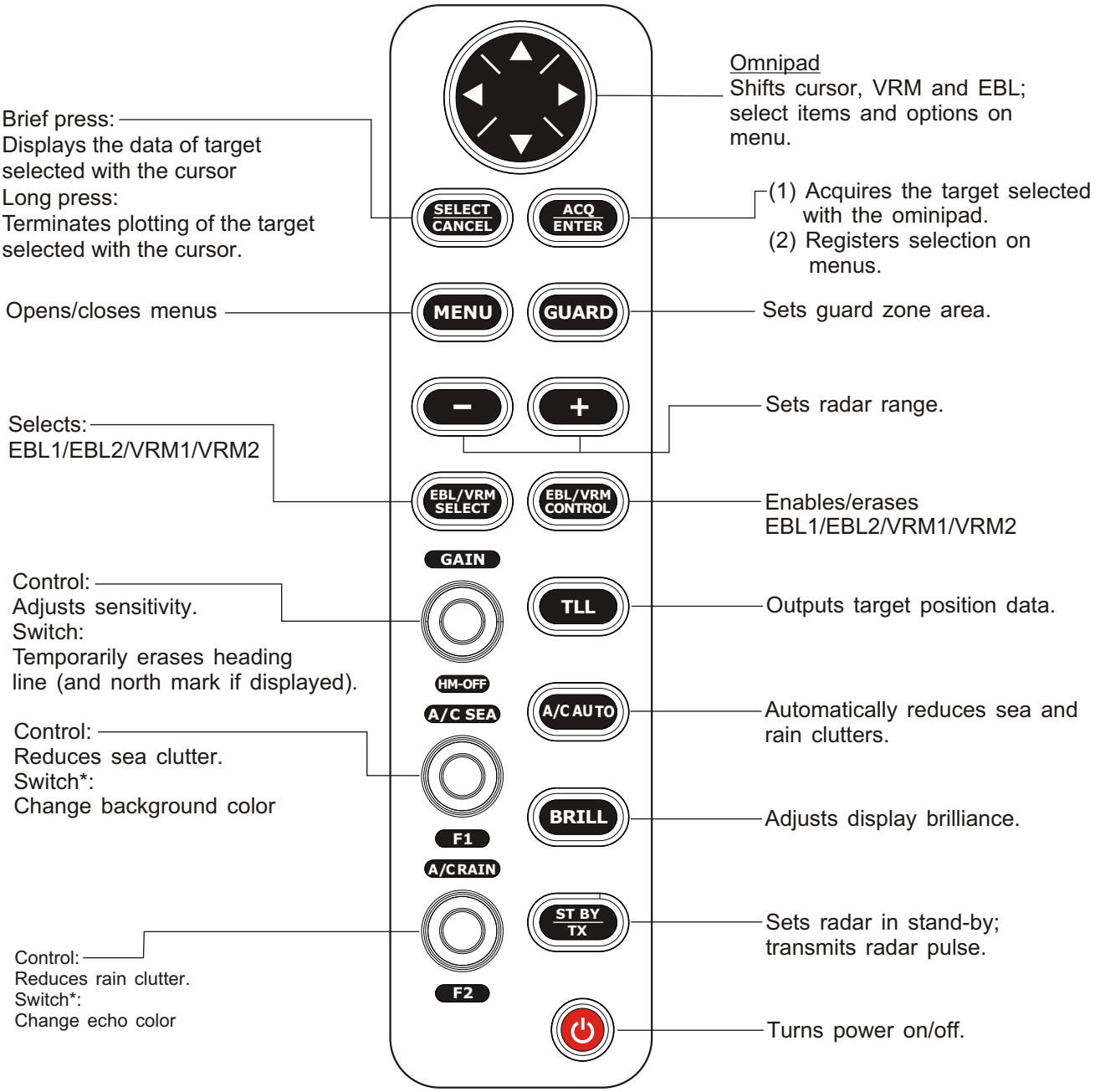


(A) Bird's eye view of situation **(B) Radar picture of (A)**

Figure 1-1 How radar works

2. BASIC OPERATION

2.1 Control Description



*Default switch function.

Figure 2-1 Control panel

2.2 Display Indication and Markers

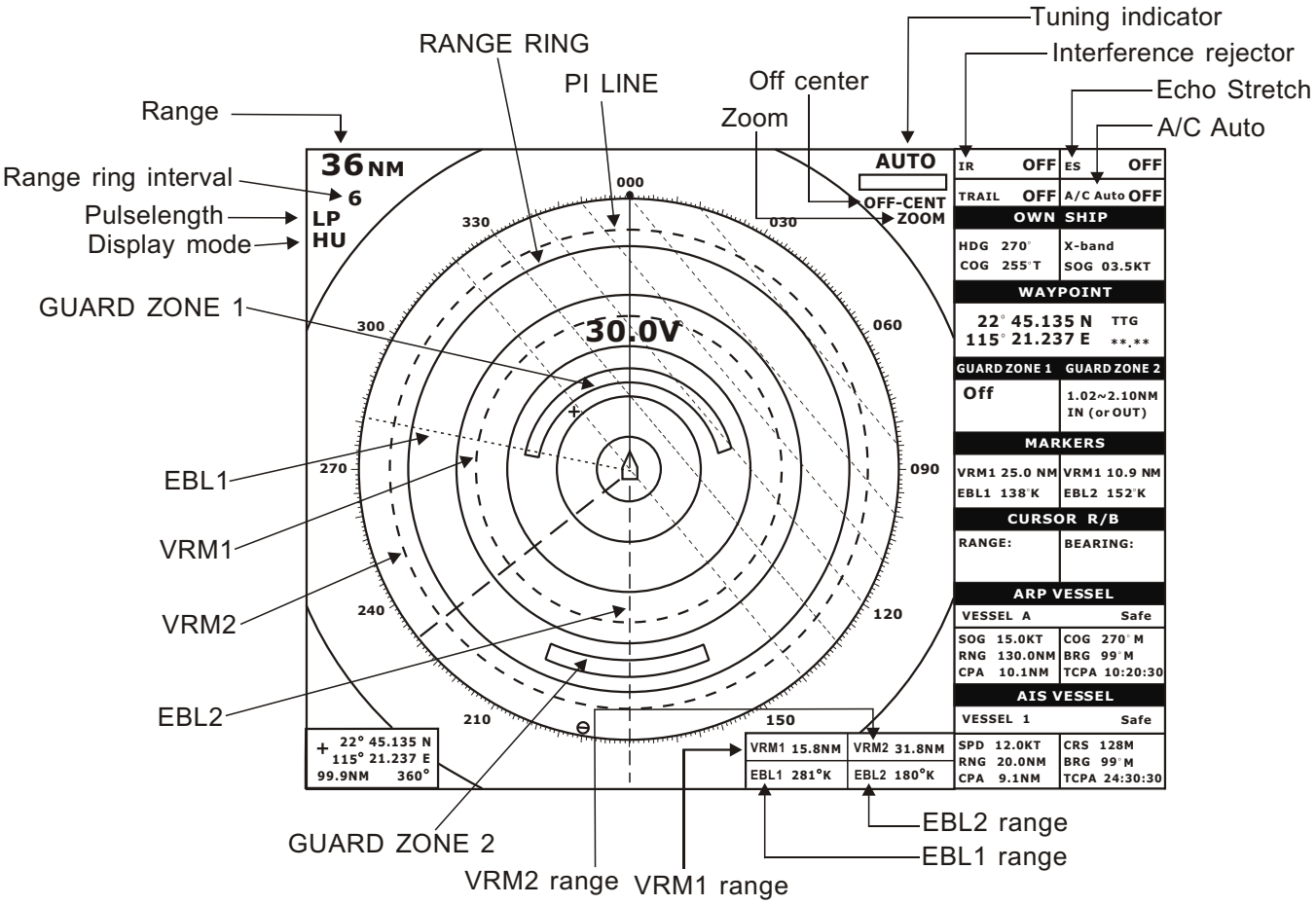


Figure 2-2 Display indications

2.3 Turning the Radar On/Off

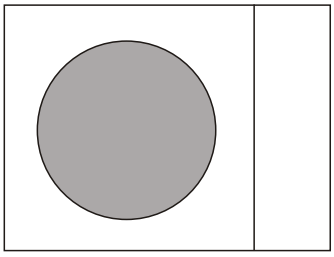
Press the [**POWER**] key to turn the radar on or off.
The control panel lights and a timer displays the time remaining for warm up of the magnetron (the device which produces radar pulses), counting down from 1:30 to 0:01.

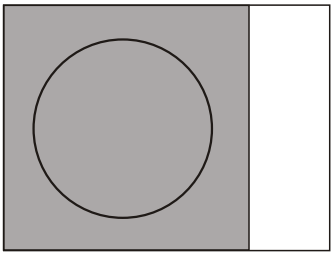
2.4 Transmitting

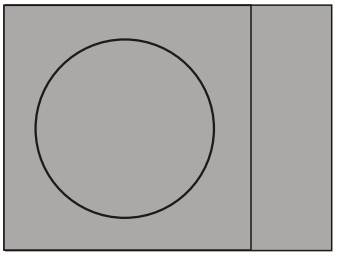
After the power is turned on and the magnetron has warmed up, STAND-BY appears at the screen center. This means the radar is now fully operational. In stand-by the radar is available for use at anytime - but no radar waves are being transmitted. Press the [**ST-BY/TX**] key to transmit. When transmitting, any echoes from targets appear on the display. This radar displays echoes in eight tones of green according to echo strength.

2.5 Echo area

The echo display area for the B, C and W types is available in three configurations: round, wide, and full screen. You can select a configuration with 7 ECHO AREA on the ECHO menu.

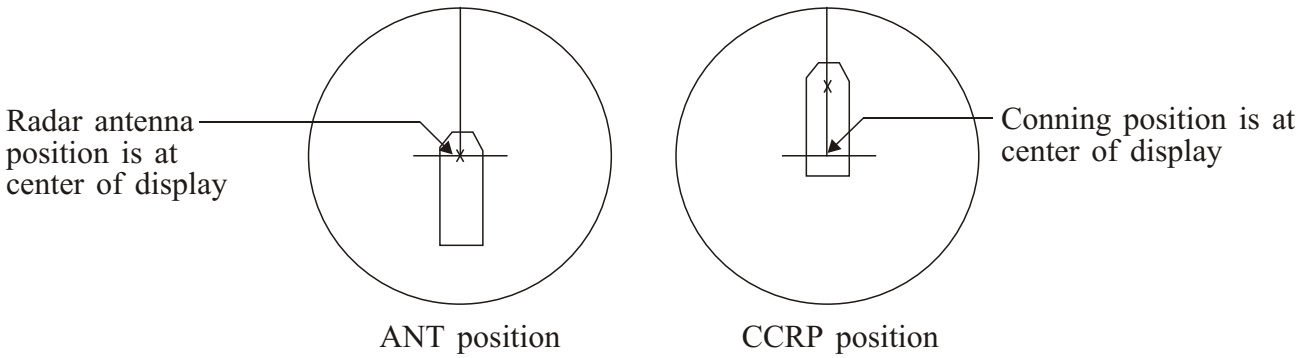

Round


Wide


Full

2.6 Reference Position

The reference position for measurements (range, bearing, etc.) and markers (heading line, stern mark, etc.) can be antenna position or consistent common reference point (CCRP), which is a location on own ship to which all horizontal measurements, for example range, bearing, relative course, relative speed, closest point of approach (CPA) or time to closest point of approach (TCPA), are normally referenced.
To select reference position, press the [**MENU**] key to enter the Main Menu, select "REFERENCE POINT" and press [**ACQ/ENTER**] key, in the pop-up window select "ANT" or "CCRP" and press [**ACQ/ENTER**] key.
The position of the own ship marker changes according to reference position as shown below. If the CCRP is positioned outside of the effective display area, the bearing scale is indicated with the appropriate reduced detail.



Range and bearing are measured and graphics are drawn according to reference position as in the table below.

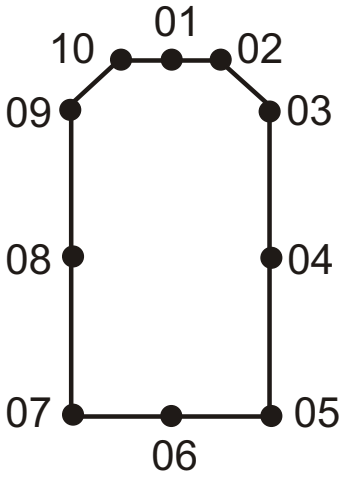
Marks, measurements and reference point

Category	Item	Reference point	
		CCRP	Antenna position
Range and bearing measurement	EBL	Range and bearing measured from CCRP	Range and bearing measured from antenna position
	VRM		
	Cursor		
	PI line		
	Range ring		
Graphics	Heading line	Drawn from CCRP	Drawn from antenna position
	Stern mark		
	Beam line		
	Own ship vector		
	Own ship track		
Bearing cursor		Drawn with CCRP at center	Drawn with antenna position at center
Course, speed		Calculated with CCRP at center	Calculated with antenna position at center
CPA,TCPA		Calculated with CCRP at center	Calculated with antenna position at center
BCR, BCT		Calculated from bow position	
Own ship data	Heading	Data from sensor, regardless of reference point selected	
	Speed		
	Course over ground		
	Speed over ground		
	Own L/L		

2.7 Own Ship Marker

Own ship marker ( ) may be inscribed on the screen as below.

1. Go to "INSTALLATION SETUP" menu;
2. Select the "OWN SHIP SHAPE" and press [**ACQ/ENTER**] key;
3. Select the "DRAW" and press [**ACQ/ENTER**] key;
4. Drawing interface pops up on the screen as follows:



5. At this time , the cursor is locked point 1, press the arrow keys to adjust the position of point 1 , while the lower right corner of this screen will show the coordinates of the point , after adjustment Press [**ACQ/ENTER**] key to confirm;
6. Cursor jumps to the point 2 , according to the actual size of the ship followed by the above method is set to point 10 When finished, press [**ACQ/ENTER**] key to confirm;
7. Cursor jumps to the CCRP symbols inverted "T word " place, this symbol can only move forward and backward, press the arrow key to the design of the ship with a CCRP coincide , press [**ACQ/ENTER**] key to confirm;
8. Cursor jumps to the position of the antenna symbol "X" , press the arrow keys to move the symbol to the actual installation of the radar antenna position and press [**ACQ/ENTER**] key to confirm;
9. Then, in the lower right corner of the interface position you'll be prompted"Save or None", if you choose to save confirm the settings are correct, For re-set then choose None , and press the [**ACQ/ENTER**] key to confirm that the ship silhouette setting ;
10. If you want to display on the radar screen of the ship shape, in the "Own Ship Shape" menu, select "ON" item and press [**ACQ/ENTER**] key to confirm .

2.8 Stand-by

When you won't be using the radar for an extended period, but you want to keep it in a state of readiness, place it in stand-by by pressing the [**ST-BY/TX**] key. The display shows "STAND-BY," navigtion data, or goes into the economy mode depending on menu setting. (More on menu operation later.)

Economy mode

The LCD display can be set to automatically turn itself off when in stand-by, to reduce power consumption. This feature is called the "economy mode." Power consumption in the economy mode is 28W.

Navigation data or AIS data display during stand-by

If a navigation aid inputs navigation data to this radar, navigation data can be displayed during stand-by. You can turn the navigation data display on/off through the menu. Figure 2-3 shows a typical navigation data display during standby. Similarly, if the AIS data input case , AIS data can be display during Stand-by.

Note 1: Availability of a particular display item depends on incoming data.

Note 2: When Range to Waypoint reaches 0.1nm, the WPT mark jumps to dead ahead even though a difference may exist between heading and BRG to WPT.

Note 3: When cross track error exceeds 1 nm on either side, the XTE mark Stars Blinking.

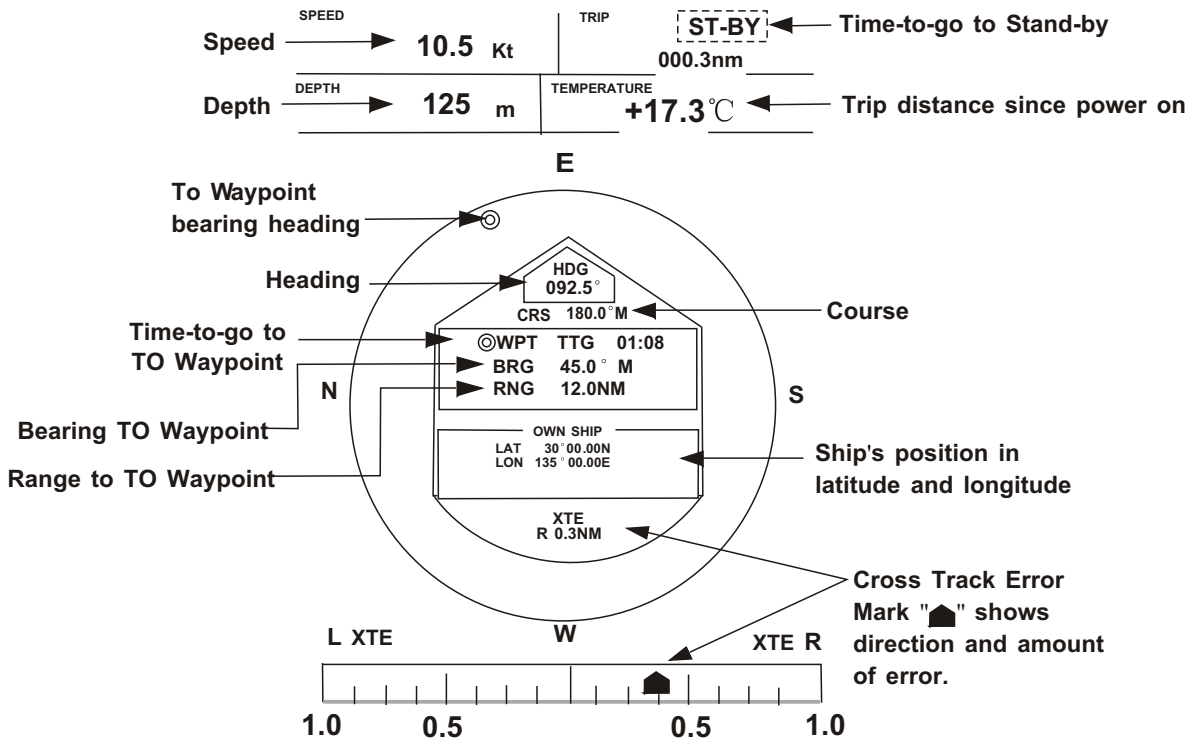


Figure 2-3 Typical navigation data display during stand-by

2.9 Selecting the Range

The range selected automatically determines the range ring interval, the number of range rings, pulselength and pulse repetition rate, for optimal detection capability in short to long ranges. You can select which ranges and pulselength (for 1 mile range) to use through the menu. The range, range ring interval and pulselength appear at the botton left-hand corner of the display.

To select a range;

- When navigating in or around crowded harbors, select a short range to watch for possible collision situations.
- If you select a lower range while on open water, increase the range occasionally to watch for vessels that may be heading your way.

2.10 Adjusting Picture Brilliance

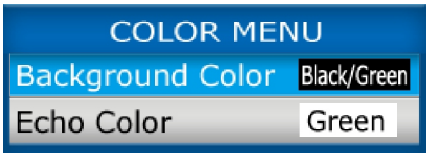
The [**BRILL**] key adjusts the brilliance of the radar picture in eight levels.
Press the [**BRILL**] key to set the brilliance level.
The current level momentarily appears on the screen.

2.11 Setup display color

In order to adapt to the different environments, the radar echo display the back-ground color and echo color can be set by users themselves, there are five kinds of background colors and three kinds of echo colors available. Setting methods are as follows:

1.By menu

1) Press [**MENU**] key open main menu;
2) Select "FUNCTION MENU" and press [**ACQ/ENTER**] key;
3) Press [▲]or [▼] key select "COLOR SETTING" & press [**ACQ/ENTER**] key open the color setup menu;



4) Press [▲] or [▼] key select "BACKGROUND COLOR" or "ECHO COLOR" press [**ACQ/ENTER**] key;
5) Press [▲] or [▼] select color desired and press [**ACQ/ENTER**] key;
6) Press [**MENU**] key to close the menu.

2.Using the function key

The function keys [**F1**] function default setting for "BACKGROUND COLOR" , [**F2**] key default setting for "ECHO COLOR". Directly on the keyboard you can press these two keys select the desired color setting.

2.12 Adjusting Receiver Sensitivity

The [**GAIN**] control adjusts the sensitivity of the receiver. It works in precisely the same manner as the volume control of a broadcast receiver, amplifying the signals received. The proper setting is such that the background noise is just visible on the screen. If you set up for too little sensitivity, weak echoes may be missed. On the other hand excessive sensitivity yields too much background noise; strong targets may be missed because of the poor contrast between desired echoes and the background noise on the display. To adjust receiver sensitivity, transmit on long range, and adjust the [**GAIN**] control so background noise is just visible on the screen.

2.13 Adjusting the A/C SEA Control (reducing sea clutter)

Echoes from waves can be troublesome, covering the central part of the display with random signals known as "sea clutter." The higher the waves, and the higher the scanner above the water, the further the clutter will extend. Sea clutter appears on the display as many small echoes which might affect radar performance. (See the Figure 2-4.) When sea clutter masks the picture, adjust the A/C SEA control to reduce the clutter.

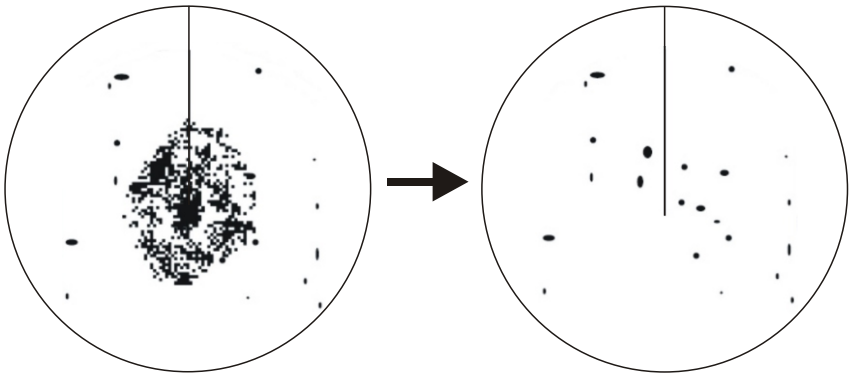
How the A/C SEA control works

The [**A/C SEA**] control reduces the amplification of echoes at short ranges (where clutter is the greatest) and progressively increases amplification will be normal at those ranges where there is no sea clutter.

Adjusting the A/C SEA control

The proper setting of the A/C SEA should be such that the clutter is broken up into small dots, and small targets become distinguishable. If the control is set Too low, targets will be hidden in the clutter, while if it is set too high, both sea clutter and targets will disappear from the display. In most cases adjust the control until clutter has disappeared to leeward, but a little is still visible windward.

1. Confirm that the sensitivity is properly adjusted, and then transmit on short range.
2. Adjust the [**A/C SEA**] control so small targets are distinguishable but some clutter remains on the display.



Sea clutter at display center **A/C SEA control adjusted; sea clutter suppressed.**

Figure 2-4 How to adjust the STC control

Tip for adjusting the A/C SEA

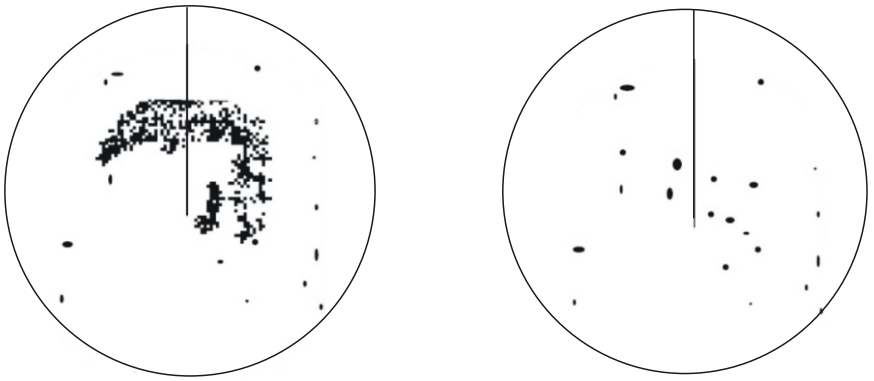
A common mistake is to over-adjust the circuit so all the clutter is removed. As an example set up for maximum STC. You will see how the center of the display becomes dark. This dark zone can be dangerous (targets may be missed), especially if the sensitivity is not properly adjusted. Always leave a little clutter visible on the display to be sure weak echoes will not be suppressed. If there is no clutter visible on the display, turn off the circuit.

2.14 Apply the A/C RAIN (reducing rain clutter)

The vertical beamwidth of the antenna is designed to see surface targets even when the ship is rolling. However, by this design the unit will also detect rain clutter (rain, snow, hail, etc.) in the same manner as normal targets. Figure 2-5 Shows the appearance of rain clutter on the Display.

Adjusting A/C RAIN

When rain clutter masks echoes, adjust the [**A/C RAIN**] Control, This control splits up these unwanted echoes into a speckled pattern, making recognition of solid targets easier.



Appearance of rain clutter **A/C RAIN control adjusted; rain clutter suppressed.**

Figure 2-5 Effect of A/C RAIN

Note: In addition to reducing clutter, the [**A/C RAIN**] control can be used in fine weather to clarify the picture when navigating in confined waters. However, with the circuit activated the receiver is less sensitive. Therefore, turn off the circuit when its function is not used.

Automatic adjustments of A/C SEA and A/C RAIN

Push the [**A/C Auto**] key. "A/C AUTO" appears at the bottom left-hand corner of the display when the A/C AUTO circuit is on. You can fine tune by adjusting the [**GAIN**] controls.

2.15 Erasing the Heading Line

The heading line may occasionally mask a target. To view the target, you can temporarily erase the heading line by pressing and holding down the [**GAIN (HM OFF)**] control. Release the control to re-display the marks.

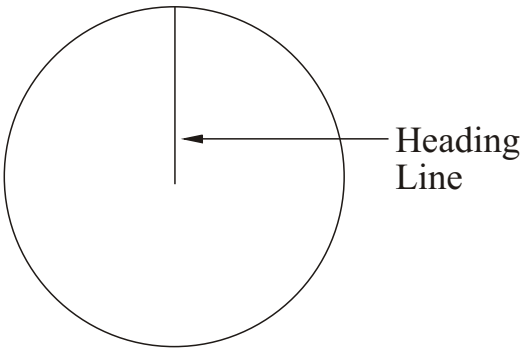


Figure 2-6 Heading line

2.16 Stern marker

The stern marker, which is a dot-and-dash line, appears opposite to the heading line. To display or erase this marker do the following:

1. Go to "FUNCTION MENU" ;
2. Select "STERN MARK" item and press [**ACQ/ENTER**] key ;
3. Select "OFF" or "ON" as appropriate.
4. Push the [**MENU**] key twice to close the menu.

2.17 Measuring the Range

You can measure the range to a target three ways: by the range rings, by the cursor, and by the VRM (Variable Range Marker).

By range ring

Count the number of rings between the center of the display and the target. Check the range ring interval and judge the distance of the echo from the echo from the inner edge of the nearest ring.

By cursor

Operate the omnipad to place the cursor intersection on the inside edge of the target echo, The range to the target, as well as the bearing, appears at the bottom right-hand corner of the display.

By VRM

1. Press the [**EBL/VRM SELECT**] key to circumscribe a VRM readout (at the bottom center).Each press of the key selects the readout of EBL1,EBL2,VRM1 or VRM2 in that order.

VRM1 25.0NM	VRM2 10.9NM
EBL1 138°R	EBL2 152°R

Figure 2-7 Display bottom, showing location of EBL and VRM readouts

2. Press the [**EBL/VRM CONTROL**] key enable control of the VRM by the omnipad.
3. Operate the omnipad to place the outside edge of the VRM on the inside edge of the target.
4. Check the VRM readout at the bottom right-hand corner of the display to find the range to the target.
5. To anchor the VRM, press the [**EBL/VRM CONTROL**] key.
6. To erase the VRM, press and hold down the [**EBL/VRM CONTROL**] key about two seconds.

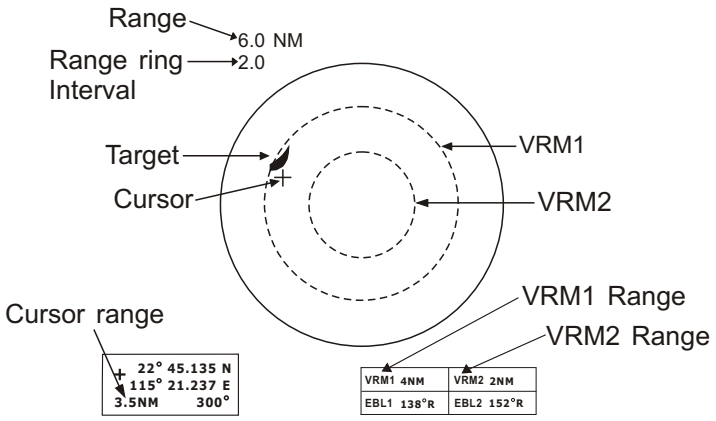


Figure 2-8 Measuring range by the cursor, range rings and VRM

Note: You can display the range readout of the VRM and cursor in nautical miles, statute miles or kilometers. For details see the next chapter

2.18 Measuring the Bearing

There are two ways to measure the bearing to a target: by the cursor, and by the EBL (Electronic Bearing Line).

By cursor

Operate the omnipad to bisect the target with the cursor intersection. The bearing to the target appears at the bottom of the display.

By EBL

1. Press the [**ERL/VRM SELECT**] key to display an EBL readout (at the bottom right-hand corner). Each press of the key selects the readout of EBL1, EBL2, VRM1 or VRM2 in that order.
2. Press the [**EBL/VRM CONTROL**] key to enable control of the omnipad.
3. Operate the omnipad to bisect the target with the EBL.
4. Check the EBL readout at the bottom left-hand corner of the display to find the bearing to the target.
5. To anchor the EBL, press the [**EBL/VRM CONTROL**] key.
6. To erase the EBL and its readout; press and hold down the [**EBL/VRM CONTROL**] key about two seconds.

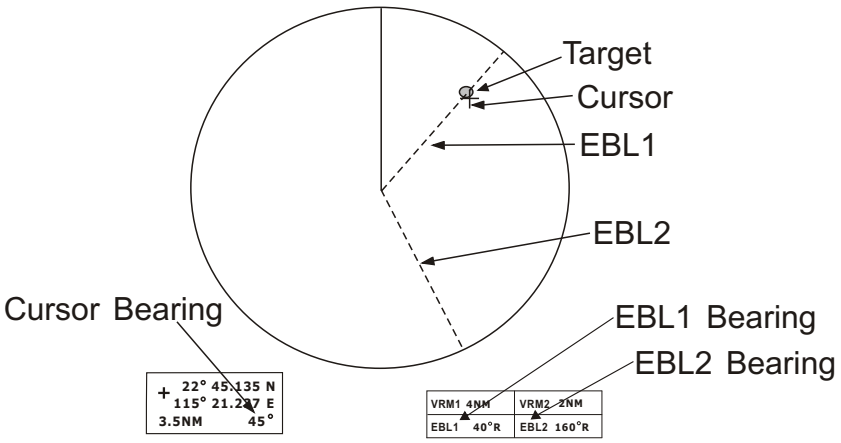


Figure 2-9 How to measure bearing by EBL and cursor

Note: The bearing readout for the EBL and the cursor can be display in relative or true bearing (true bearing requires heading sensor input) For north up and course up display modes the bearing reference is always true. For details see the next chapter.

Tips for measuring bearing

- Bearing measurements of smaller targets are more accurate; the center of larger target pips is not as easily identified.
- Bearings of stationary or slower moving targets are more accurate than Bearings of faster moving targets.
- To minimize bearing errors keep echoes in the outer half of the picture by changing the range scale; angular difference becomes difficult to resolve as a target approaches the center of the display.

2.19 Using the Offset EBL

The offset EBL provides two functions: predict collision course of radar target and measure the range and the bearing between two targets.

Predicting collision course

1. Press the omnipad to place the cursor on the center of the target.
2. Press the [**EBL/VRM SELECT**] key to choose EBL1 readout and then press the [**EBL/VRM CONTROL**] key.
3. Select "EBL OFFSET" on the menu and press the [**ACQ/ENTER**] key.
4. Press [▲] or [▼] key select "ON" and press [**ACQ/ENTER**] key.
5. Press the [**EBL/VRM CONTROL**] key.
6. Operate EBL1 so it passes through the center of the target.
   If the target tracks along the EBL towards the center of the display (you vessel's Position), the target may be on a collision course.
   To cancel, select "EBL OFFSET" and press the [**ACQ/ENTER**] key. Press [▲] or [▼] key select "OFF" and press [**ACQ/ENTER**] key.

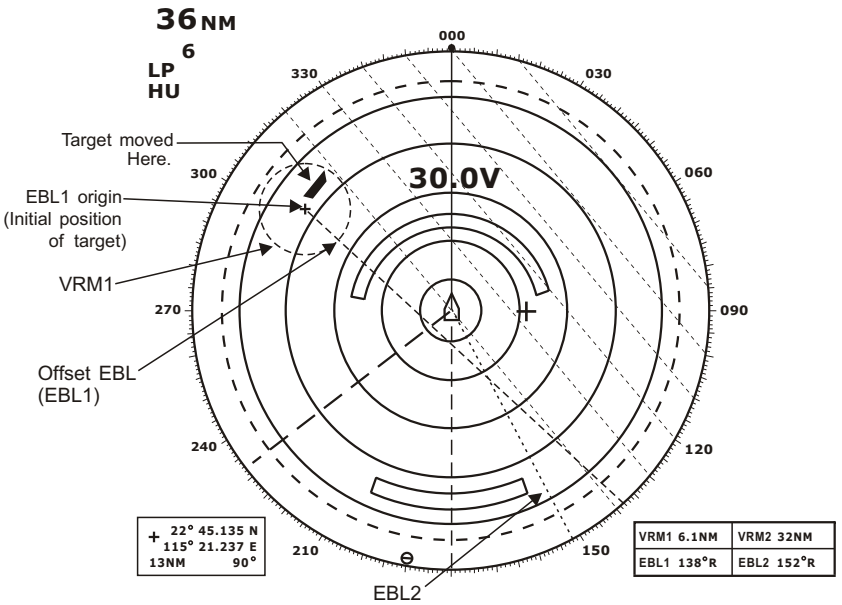


Figure 2-10 Predicting collision course by using the offset EBL

Measuring range and bearing between two targets

The procedure which follows shows how to measure the range and bearing between target "A" and target "B" in Figure 2-11.

1. Press the omnipad to place EBL1's origin (cursor) on the center of target "A".
2. Press the [**EBL/VRM SELECT**] key to choose EBL1 readout and then press the [**EBL/VRM CONTROL**] key.
3. Select EBL OFFSET on the menu and press the [**ACQ/ENTER**] key. EBL1's origin shifts to cursor.
4. Press the [**EBL/VRM CONTROL**] key.
5. Press the onmipad to bisect target "B" with EBL1. Check the EBL1 readout to find the bearing between target "A" and target "B".
6. Press the [**EBL/VRM SELECT**] key to choose VRM1 readout. Press the omnipad to place the outside edge of VRM1 on the inside edge of target "B". Check the VRM1 readout to find the range between target "A" and target "B".
7. To cancel, select EBL OFFSET on the menu and press the [**ACQ/ENTER**] key.

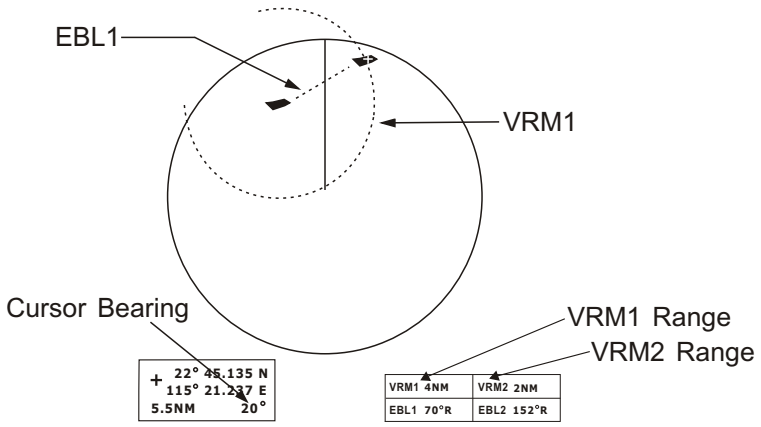


Figure 2-11 Measuring the range and bearing between two targets by using the offset EBL

2.20 Point of reference for origin point of offset EBL

The origin point of the offset EBL can be ground stabilized (geographically fixed), north stabilized (true) or referenced to own ship's heading (relative).

1. Go to "FUNCTION MENU";
2. Select "EBL OFFSET BASE".
3. Select "STAB GND", "STAB HDG" or "STAB NORTH" as applicable.

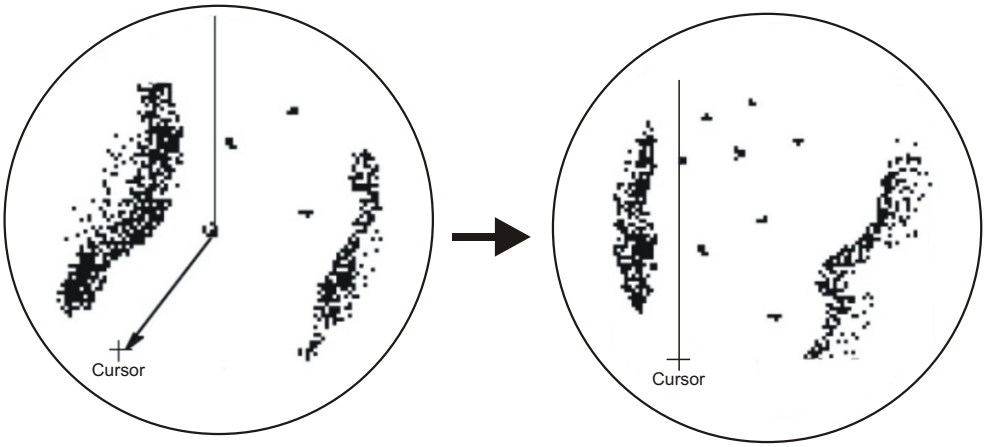
- **STAB GND:** Reference to latitude and longitude. Origin position is always fixed regardless of your ship's movement.
- **STAB HDG:** Reference to heading. The relationship between origin position and own position is kept always.
- **STAB NORTH:** Reference to North. The origin position changes with North position.

4. Push the [**MENU**] key twice to close the menu.

2.21 Shifting (off centering) the Picture

Your vessel's position can be shifted up to 75% (not available on 48nm range) of the range in use to view the situation around your vessel without changing the range or size of targets.

1. Press the omnipad to set cursor where desired.
2. Press the [**MENU**] key ,select "SHIFT" and press [**ACQ ENTER**] key;
3. Press [▲] or [▼] key select "ON" and press [**ACQ/ENTER**] key.
   "OFF-CENT" appears at the top right corner of the display when the picture is shifted.



① **Place cursor Where desired** ② **Press [OFF CENTER] key to off center display**

Figure 2-12 Shifting the picture

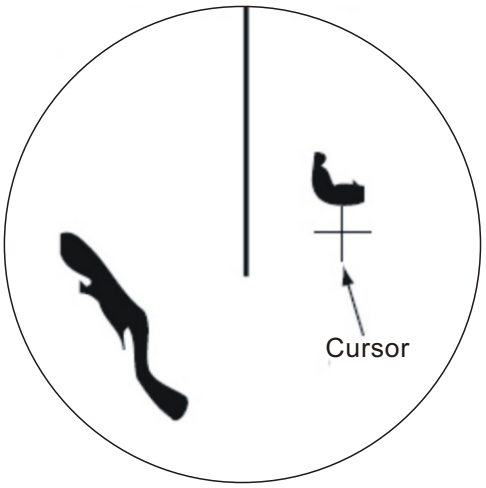
Cancelling shifted picture

Repeat the above steps and select "OFF"

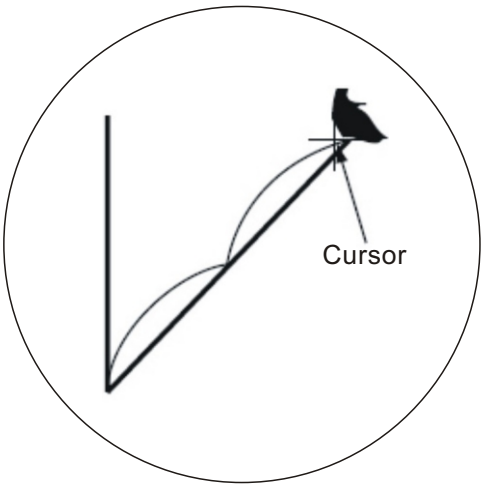
2.22 Zoom

The zoom feature allows you to double the size of the area between your vessel and any location within the current range to take a closer look at an area of interest.

1. Select location with the cursor.
2. Select ZOOM on the menu, ZOOM appears at the top right corner when the ZOOM function is on .



① **Place cursor Where desired**



② **Press [ZOOM] key to zoom**

Figure 2-13 Zoom Function

Note: Zoom is cancelled when presentation mode is changed.

Cancelling Zoom

Repeat the above steps and select "OFF"

2.23 Outputting Target Position

Target position data can be output to the navaid in IEC61162 format. Press and hold down the [**TLL**] key to output the data. This function requires position data and heading signal.

3. MENU OPERATION

3.1 Basic Menu Operation

The menu mostly contains less-often used functions which once preset do not require regular adjustment. To open or close the menu, press the [**MENU**] key. You can select items on the menu with the omnipad.

1. Press the [**MENU**] key to display the main menu.

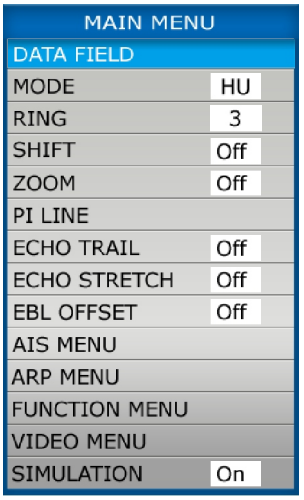


Figure 3-1 Main menu

2. Press the omnipad to select the item. For example, select RINGS. A message appears at the right of the menu window.
3. Press the [▲] or [▼] key to select setting below.

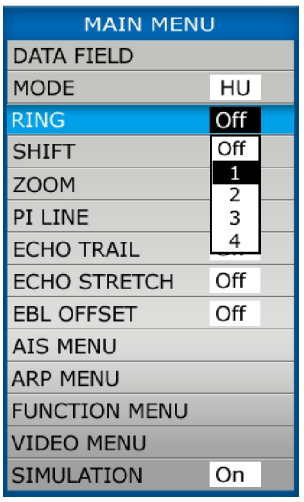


Figure 3-2 Messages for RING menu

4. Press the [**MENU**] key to close the menu.

3.2 Selecting the presentation mode

This radar provides four presentation modes. Head-up, course-up, north-up and true motion.

1. Press the [**MENU**] key.
2. Operate the omnipad to select "MODE".
3. Press the [**ACQ/ENTER**] key.

With heading sensor connection the display and the display and the display mode indication at the top lefthand corner of the display. Press [▲] or [▼] key select want mode and press [**ACQ/ENTER**] key.If there is no heading sensor connection, the display mode is always HU.

4. Press the [**MENU**] key to close the menu.

Note: The radar begins operation with last selected display mode (except course up) whenever the unit is turned on. Note however that head up is selected when course up was the last used mode.

Head up

The picture is oriented so the heading line is at the top of the display. This mode is useful for navigation in congested waters.

Course up

The course up mode shows Ship's heading by the heading line, at the top of the display. To get heading desired, steer vessel in direction desired, and the show" CU"at the top lefthand corner of the display.

North up

North is at the top of the display and the heading line moves with Ship's heading. This mode is useful for determining ship's position and as a navigation monitor on a nautical chart. The picture is stabilized against yaw of vessel, thereby reducing of target echoes.

True motion

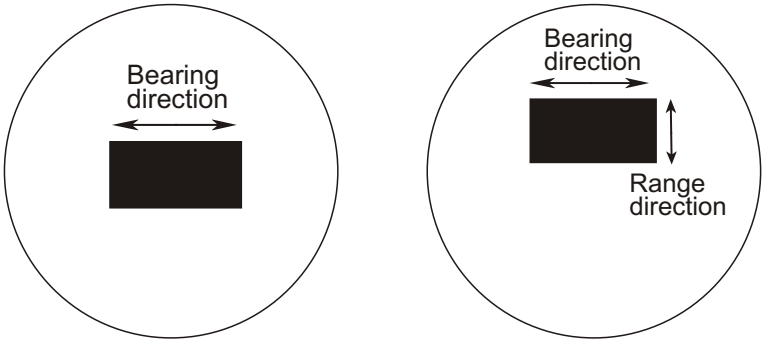
True motion displays own ship and moving objects in their true motion.

3.3 Magnifying long range echoes (echo stretch)

Normally, the reflected echoes from long range target appear on the display as weaker and smaller blips even though they are compensated by the radar's internal circuitry. The echo stretch function magnifies these small blips in all ranges. Two types of echo stretch are available: ES1 which stretches echoes in bearing direction and ES2 which stretches them in both range and bearing directions.

To turn the echo stretch on or off;

1. Press the [**MENU**] key to open the menu.
2. Select "ECHO STRETCH".
3. Press the [**ACQ/ENTER**] key.
4. Press [▲] or [▼] Key select ES1, ES2 or Off.



Echo stretch 1 Echo stretch 2

Figure 3-3 Echo stretch

Note: This function magnifies not only targets but also sea clutter and radar interference. For this reason be sure the controls for adjustment of sea clutter and radar interference are properly adjusted before activating the echo stretch.
Note: ES1 and ES2 is not available on Short Range.

3.4 Echo Trail

You can show the movement of all radar targets relative to your vessel in afterglow vessel in afterglow. This function is useful for alerting you to possible collision situations.

Starting echo trail

1. Press the [**MENU**] key to open the menu.
2. Select "ECHO TRAIL" by the omnipad.
3. Select "ON" by pressing the [**ACQ/ENTER**] key.

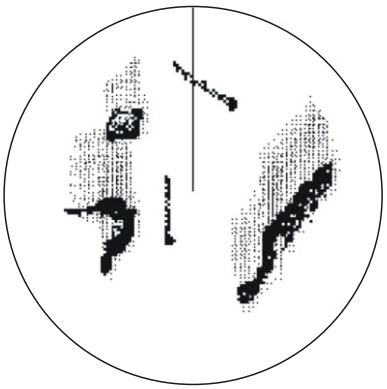


Figure 3-4 How the echo trail feature work

TRAIL, the echo trail time selected (on "VIDEO MENU") and elapsed time appear at the top right-hand corner of the display. Then, afterglow starts extending from all target.
Note: Trails are restarted when range or mode is changed or zoom or shift is turned on.

Fixed time trail

1. When the elapsed time clock counts up to the trail time selected, the elapsed time display freezes.
2. The oldest portions of trails are erased so only the latest trail, equal in length to the trail time selected, is shown.
3. Trail continues.

For example, the one minute trail time is selected. When the elapsed time clock counts up to 60 seconds, the elapsed time clock counts up to 60 seconds, the elapsed time display freezes at "60," but the latest one minute of trail are erased and then trail continuous.

Continuous trail

The maximum continuous trail time is 99 minutes and 59 seconds. When the elapsed time clock counts up to that time the elapsed time display is reset to zero and trail begins again.

Cancelling echo trail

Select "OFF(deactivate)" at "ECHO TRAIL" on the menu.

Changing trail attributes

Trail gradation and trail time can be selected on the VIDEO MENU.

Item In OTHERS menu	Description
Trail Tone	Trails can be shown in single or multiple gradations. Multiple paints trails getting thinner with time just like the afterglow on an analog PPI radar. **Single** **Multiple**
Trail Time	Trail time can be set for 15sec, 30sec, 1min, 3min, 6min, 15min, 30min or continuous.

Table 3-1 Trailing attributes

3.5 Suppressing Radar Interference

Radar interference may occur when near another shipborne radar operating in the same frequency hand as you radar. Its on-sereen appearance is many bright dots either scattered at random or in the form of dotted lines extending from the center to the edge of the display. Figure 3-6 illustrates interference in the from of curved spokes. Interference effects are distinguishable from normal echoes because they do not appear in the same place on successive rotations of the antenna.

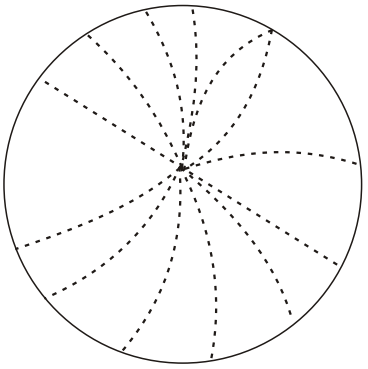


Figure 3-6 Radar interference

Four levels of interference are available, including off; IR1, IR2, IR3 and OFF,IR3 provides the highest level of rejection.

1. Press the [**MENU**] key.
2. Select "VIDEO MENU" and press the [**ACQ/ENTER**] key.
3. Select "INT REJECT".
4. Select level desired by operation the omnipad.
5. Press the [**ACQ/ENTER**] key.
6. Press the [**MENU**] key to close the menu.

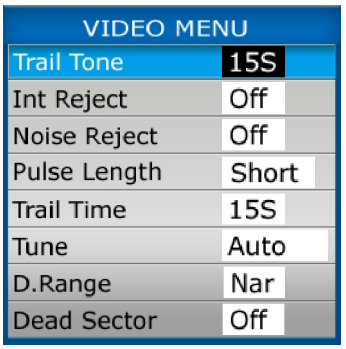


Figure 3-7 VIDEO MENU

3.6 Selecting Pulse Length

Pulse length is the transmission time of a Single radar pulse. The longer the pulse length the greater the direction range capability, however range accuracy and range resolution are reduced.

1. Press [**MENU**] key.
2. Select "VIDEO MENU" and press [**ACQ/ENTER**] key.
3. Select "PULSE LENGTH".
4. Select "SHORT" or "LONG" by operation the omnipad.
5. Press the [**ACQ/ENTER**] key.
6. Press the [**MENU**] key to close the menu.

Note:

"LONG" : 1.5NM-MP, 3NM-LP, "SHORT" : 3NM-MP, 1.5NM-SP

3.7 Guard Alarm

The guard alarm allows the operator to set the desired range and bearing for a guard zone. When ships, islands, landmasses, etc. Violate the guard zone an audible alarm sounds and the offending target brinks to call the operator's attention.

Selection of guard zone type

The guard alarm can be set to sound when a target either enters or exits the guard zone. You can select which type of guard alarm you want through the menu.

In alarm

The alarm sounds on targets entering the guard zone. "IN" appears in the guard zone data field , the guard zone will flash display.

Out alarm

The alarm sounds on targets exiting the guard zone. "OUT" appears in the guard zone data field , the guard zone will flash display.

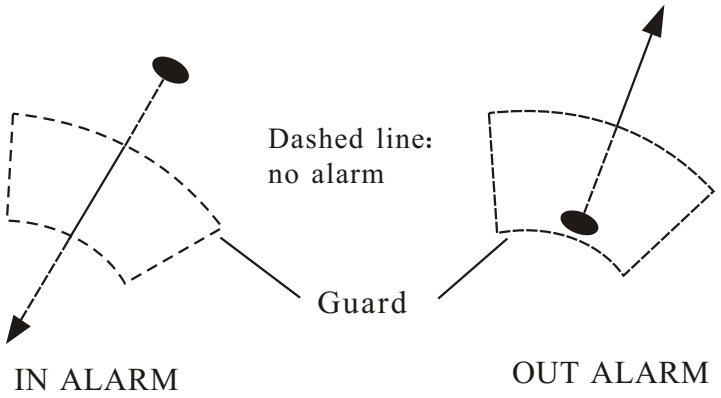


Figure 3-8 In and Out alarm

Setting a guard zone

Preparation

1. Press the [**MENU**] key, and the select "FUNCTION MENU" and pressing the [**ACQ/ENTER**] key.
2. Select "GUARD MODE" and "IN" (alarm on target entering zone) or "OUT" (alarm on target exiting zone) by operating the omnipad.
3. Press the [**ACQ/ENTER**] key.
4. Press the [**MENU**] key to close the menu.

To set a guard zone

1. Press the [**GUARD**] key to open the guard zone setting function.
2. Press [▲] or [▼] key select the guard zone number.
3. Mentally create the guard zone you want to set.
4. Operate the onipad to set the cursor on point A or B. Press the [**ACQ/ENTER**] key. See Figure 3-9
5. Operate the omnipad to set the cursor on point C or D. See Figure 3-9 (3).
6. Press the [**ACQ/ENTER**] key. Alarm zone set, the red dotted line appears on the screen See Figure 3-9 (4).

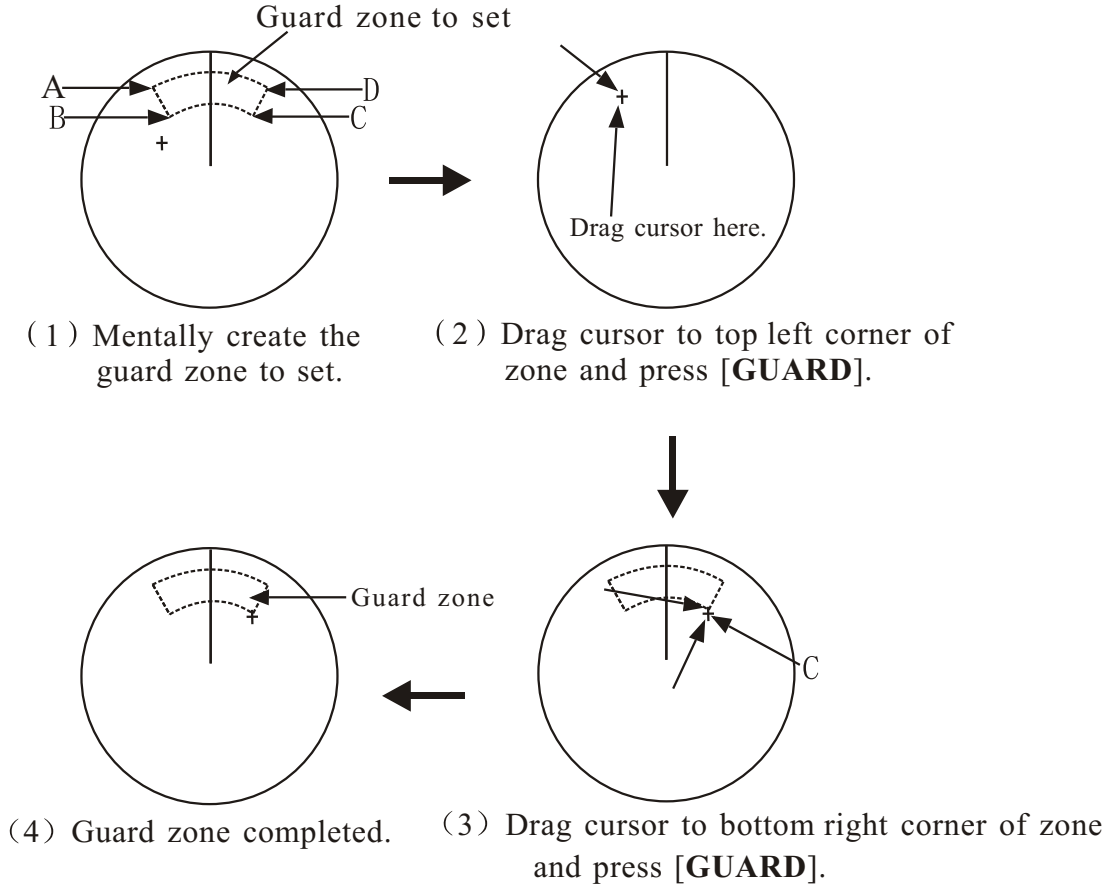


Figure 3-9 How to set the guard zone

3.8 Watchman

The watchman function periodically transmits the radar for minute to check for targets in a guard zone. If it finds change in the zone from the previous transmission it sounds the radar continuously. This feature is useful when you do not need the radar's function continuously but want to be alerted to radar targets in a specific area.

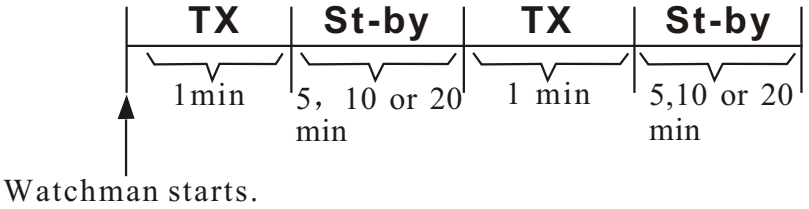


Figure 3-10 How watchman works

How watchman works

When the time selected for the watchman restperiod has elapsed, the radar automatically transmits for one minute to check the condition inside the guard zone. If there is no change, the radar goes into stand-by ("WATCHMAN" appears during stand-by.) If there is change, the radar sounds the audible alarm, cancels the watchman function and transmits continuously.

Turning on watchman

1. Create a guard zone (usually 360 degrees) with the guard alarm function.
2. Press the [**MENU**] key.
3. Select "FUNCTION MENU".
4. Press the [**ACQ/ENTER**] key.
5. Select "WATCHMAN".
6. Press the omnipad to select watchman rest period; 5 minutes, 10 minutes or 20 minutes.

"WATCHMAN"appears at the top of the screen, the radar transmits for one minute to check for targets inside the guard zone. And the the LCD display shuts off and the radar goes into stand-by.

Cancelling watchman

Go into the "FUNCTION MENU", and set "WATCHMAN" for off.

Note 1: Watchman can be used without a guard zone.

Note 2: The alarm sounds just before the radar starts and stops transmitting.

3.9 Displaying Navigation Data

Navigation data can be displayed in the data boxes if this radar receives navigation input in IEC 61162 format. Navigation data include.

- position in latitude and longitude
- range, bearing and time-to-go to both waypoint selected on the navigator and the cursor.
- speed.

AIS information, has been received AIS ship information;

(If the navigation input includes destination data, waypoint position is denoted on the radar display by a dashed ring.)

To turn navigation data on or off;

1. Press the [**MENU**] key.
2. Select the "DATA FIELD".
3. Press the [**ACQ/ENTER**] key.
4. Press the [**ACQ/ENTER**] key to select the message for Navigation display. For example:OWN SHIP , POSITION or WAYPOINT etc.
5. Prss the [**ACQ/ENTER**] key to set.
6. Press the [**MENU**] key to close the menu.

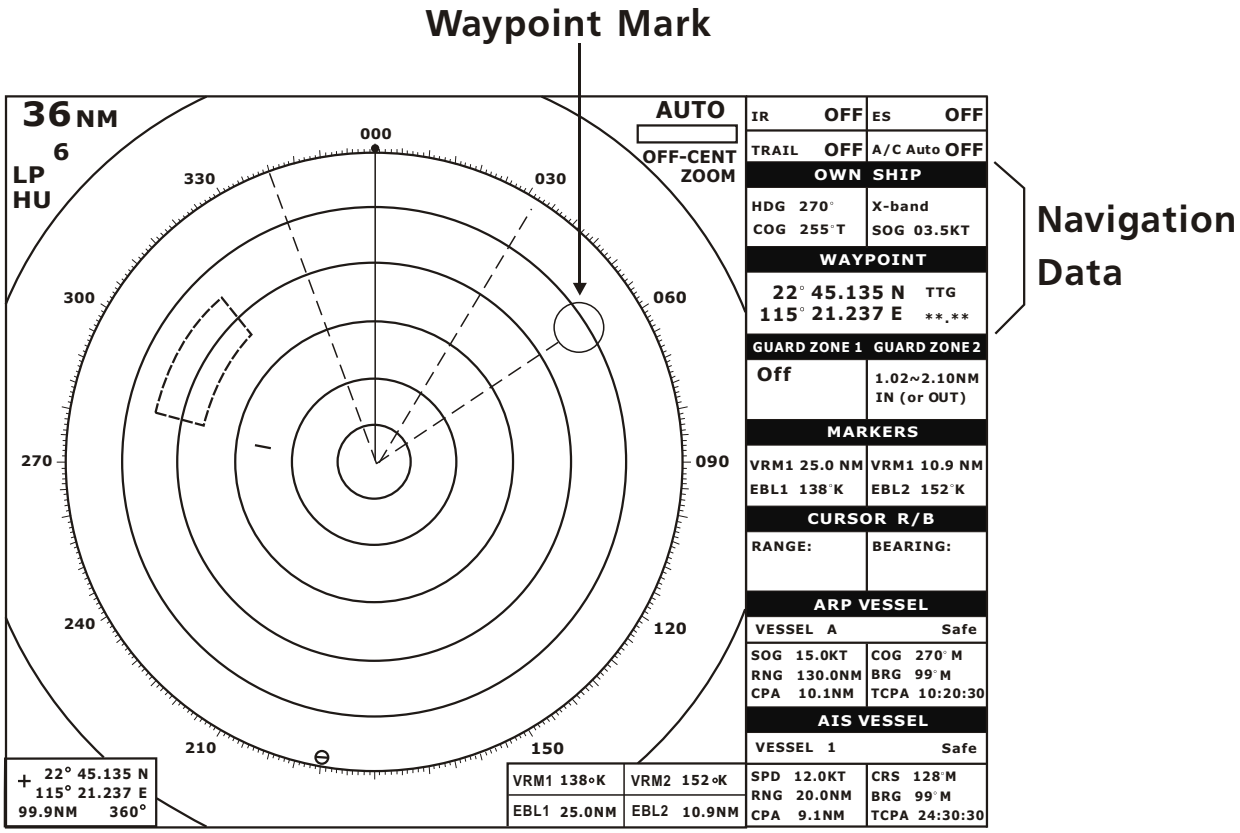


Figure 3-11 Typical navigation data display

3.10 FUNCTION MENU Description

Item	Description
Panel Dimmer	Select level of panel backlight.
Mark Brill	Select brilliance of VRM, EBL, cursor, guard zone and WP marks.
HD Mark	Select brilliance of heading mark.
Characters	Select brilliance of characters.
WPT Mark	Select"On"to display the waypoint mark.
EBL Ref	Select EBL reference for relative or true.
VRM Unit	Select VRM unit
STBY Disp	Select the display on stand-by; display "STBY" or navigation data, or go into the economy mode.
Guard Mode	Select condition which triggers guard alarm; in or out.
Alm sense LV	Select minimum echo strength which triggers guard alarm.
Watchman	Turn watchman on (set rest period) or off.
Color setting	Set background color & Echo color
Speed Menu	Go to the speed menu.
Range	Select ranges in use.
Self Test	Test keys, ROM and RAM, check antenna rotation speed, and display program number
Installation Setup	Go to the installation setup menu.

Table 3-2 FUNCTION MENU Description

3.11 VIDEO MENU Description

Item	Description
Trail Tone	Select brillance of echo trails.
Int Reject	Select level of interference rejection.
Pulselength	Select pulselength for 1.5 and 3 mile ranges.
Trail Time	Select the trail time.
Noise Reject	Select "ON□to reject noise.
Tune	Select automatic or manual tuning. To tune manually; 1.Select "MANUAL□ by the omnipad. 2.Press the [**ENTER**] key to enable manual tuning. 3.While pressing and holding down the [**GAIN**] control operate the omnipad. "MANUAL"appears at the top right-hand corner when manual tuning is in effect.
D.Range	Select the video signal sampling ranges.
Dead Sector	Select "ON" to display the dead sector.

Table 3-3 VIDEO MENU Description

3.12 Function Keys

The function keys (F1 and F2) work like the auto-dialing feature of a telephone, automatically executing the function assigned to them. The function can be turned off by pressing appropriate function key again.

Default settings

F1: Background Color
F2: Echo Color

How to register menu items

1. Press the [**MENU**] key.
2. Press [**A/C SEA**] (F1) or [**A/C RAIN**] (F2) to open the function menu.
3. Press [▲] or [▼] key select item, press [▶] or [◀] key page turning; Select function desired.
4. Press the [**ACQ/ENTER**] key.

5. Press the [**MENU**] key to close the menu.

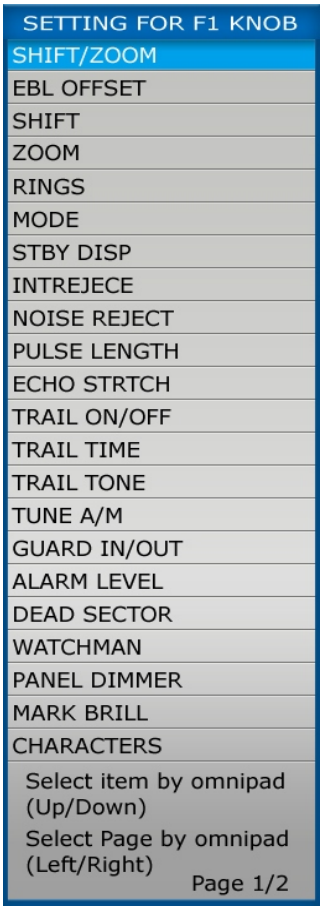


Figure 3-12 Function menu

3.13 Suppressing Noise

Electrical noise can be suppressed by turning on "NOISE REJ" on the VIDEO menu.

3.14 Adjusting Brilliance of Markers

"MARK BRILL" on the FUNCTION menu adjusts the brilliance of markers such as the cursor.

4. FALSE ECHOES

Occasionally false echoes appear on the screen at positions where there is no target. In some cases the effects can be reduced or eliminated. The operator should familiarize himself or herself with the appearance and effects of these false echoes, so as not to confuse them with echoes from legitimate contacts.

4.1 Multiple Echoes

Multiple echoes occur when a short range, strong echo is received from a ship, bridge, or breakwater. A second, a third or more echoes may be observed on the display at double, triple or other multiples of the actual range of the target as shown in Figure 4-1. Multiple reflection echoes can be reduced and often removed by decreasing the sensitivity or properly adjusting the A/C SEA.

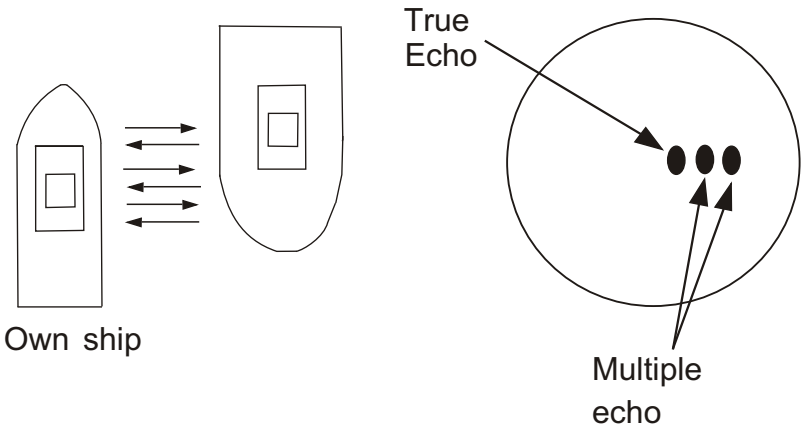


Figure 4-1 Multiple echoes

4.2 Side-lobe Echoes

Every time the antenna rotates, some radiation escapes on each side of the beam called "side-lobes." If a target exists where it can be detected by the side-lobes as well as the main-lobe, the side-lobe echoes may be represented on both sides of the true echo at the same range, as shown in Figure 4-2. Side-lobes show usually only at short ranges and from strong targets. They can be reduced through careful reduction of the sensitivity or proper adjustment of the A/C SEA.

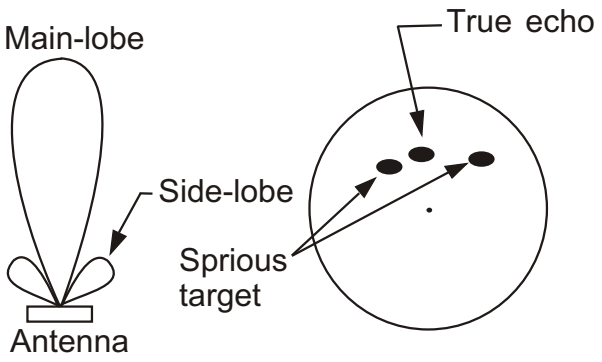


Figure 4-2 Side-lobe echoes

4.3 Indirect Echoes

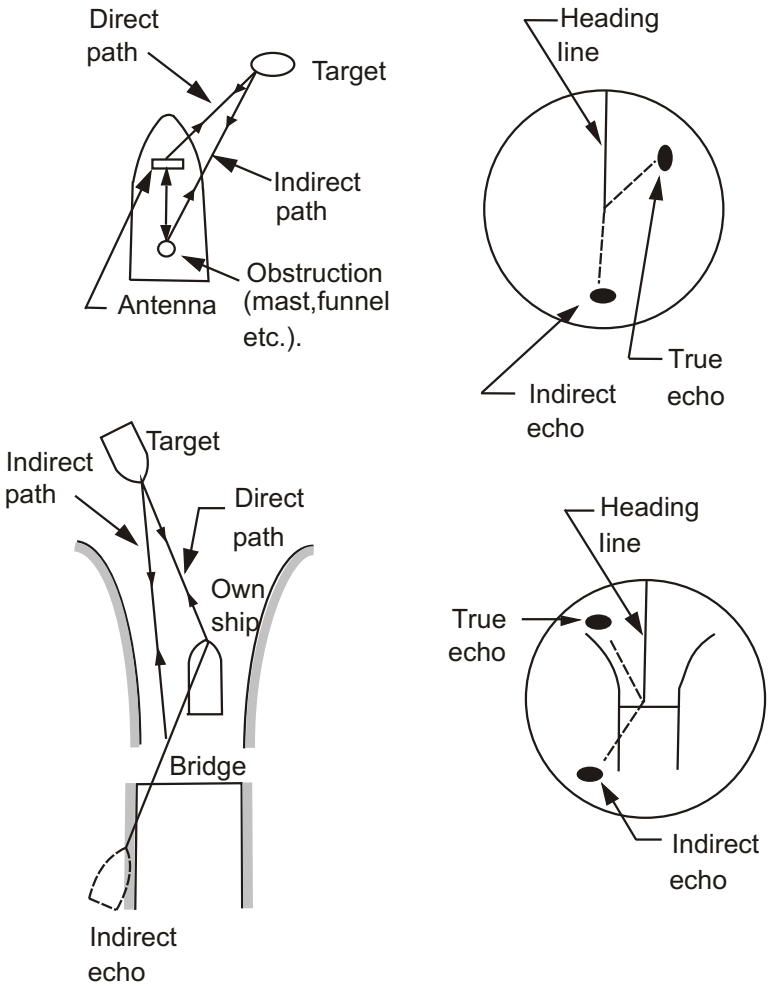


Figure 4-3 Indirect echoes

Indirect echoes may be returned from either a passing ship or returned from a reflecting surface on your own ship, for example, a stack. In both cases, the echo will return from a legitimate contact to the antenna by the same indirect path. The echo will appear on the same bearing of the reflected surface, but at the same range as the direct echo. Figure 4-3 illustrates the effect of an indirect echo. Indirect echoes may be recognized as follows :

- they usually occur in a shadow sector
- they appear on the bearing of the obstruction but at the range of the legitimate contact
- when plotted, their movements are usually abnormal, and
- their shapes may indicate they are not direct echoes.

4.4 Blind and Shadow Sectors

Funnels, stacks, masts, or derricks in the path of antenna may reduce the intensity of the radar beam. If the angle subtended at the antenna is more than a few degrees a blind sector may be produced. Within the blind sector small targets at close range may not be detected while larger targets at much greater ranges may be detected. See Figure 4-4.

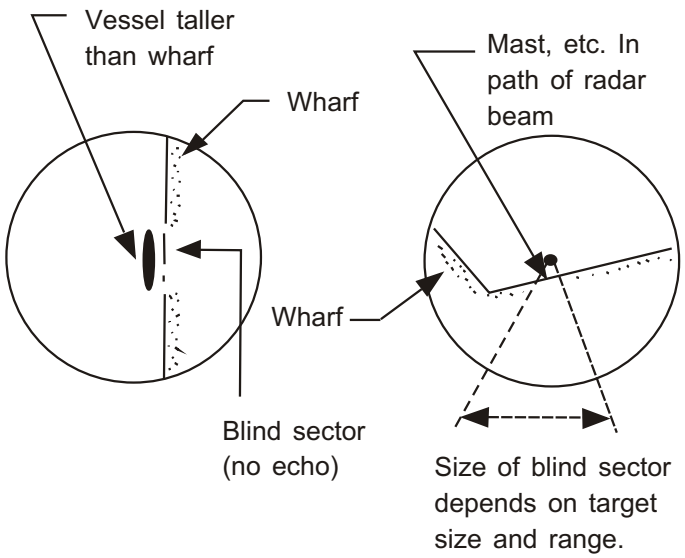


Figure 4-4 Blind and shadow sectors

5. MAINTENANCE & TROUBLESHOOTING

This chapter tells you how to keep your radar in good working order. Before reviewing this chapter please read the safety information which follows.

DANGER

Turn off the power before performing any maintenance or troubleshooting procedure.

Hazardous voltages can shock, burn or cause death. Only qualified personnel totally famillier with electrical circuits should work inside the units.

RF RADIATION HAZARD

The radar antenna emits high frequency radio radiation which can be harmful, particularly to your eyes. Never look directly into the antenna from a distance of less than two feet when the radar is in operation as you could injure the cornea of your eyes. Always make sure the radar is set to stand-by or is turned off before starting work on the antenna unit.

Period	Item	Check point	Remarks
3 to 6 months	Exposed nuts and bolts on antenna unit	Check for corroded or loosened nuts and bolts. If necessary, clean and repaint them thickly. Replace them if heavily corroded.	Sealing compound may be used instead of paint. Apply a small amount of grease between nuts and bolts for easy removal in future.
	Radome cover (KR-1538)	Check for wear. Permanent damage to the antenna's internal circuitry will result if water leaks into the radome.	If a crack is found it should be temporarily repaired by using a samll amount of sealing compound or adhesive. You should then contact your dealer for service.
6 months to 1 year	Display unit connectors	Check for tight connection and corrosion.	If corroded, contact your dealer for replacement.

Table 5-1 Recommended maintenance program

5.1 Preventative Maintenance

Regular maintenance is important for good performance. Always keep the equipment as free as possible from dirt, dust, and water splashes. Make sure all screws securing the components are properly tightened. A maintenance program should be established and should at least include the items listed in table 5-1.

5.2 Replacing the Fuse

The fuse in the power cable protects the equipment against reverse polarity or ship's mains, over current, and equipment fault. If the fuse blows, find the cause before replacing it. Never use an incorrect fuse - serious damage to equipment may result and void the warranty.

12 V : 10 A fuse

24/32 V : 5 A fuse

5.3 Troubleshooting

Table 5-2 contains simple troubleshooting procedures which you can follow to try to restore normal operation. If you cannot restore normal operation, do not attempt to check inside any unit of the radar system. Any repair work is best left to a qualified technician.

5.4 Self Test

The self test facility checks the keyboard, ROM and RAM for proper operation.

1. Press the [**MENU**] key.
2. Select "FUNCTION MENU".
3. Select "SELF TEST" and press the [**ACQ/ENTER**] key. The following display appears.

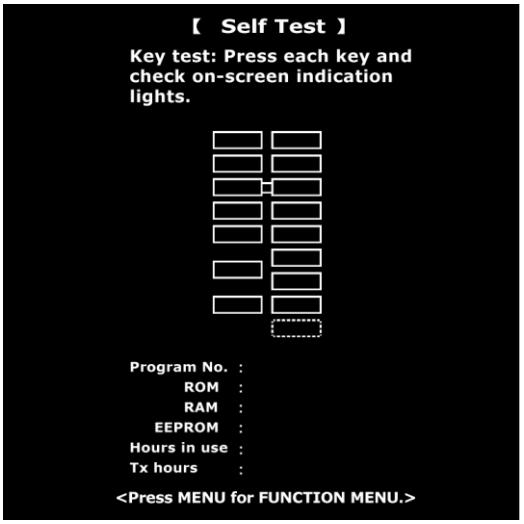


Figure 5-1 Self test screen

If...	But...	Then...
you pressed the [POWER] key to turn on the radar	the control panel does not light	• try adjusting the control panel backlighting on the Function menu. • battery may have discharged. • check fuse.
	nothing appears on the display or display contrast is poor	• try adjusting the brilliance.
	characters are distorted	• request service.
the radar has warmed up and you pressed the [ST-BY/TX] key to transmit	the antenna does not rotate	• the problem may be in antenna Unit request service.
	Characters and indications are abnormal	• have a qualified technician check the set.
you have adjusted the gain with A/C RAIN and A/C SEA off	neither noise nor targets appear (indications and markers do)	• check signal cable for damage.
	neither indications nor markers appear (noise and targets do)	• have a qualified technician check the set.
	the sweep (radial line sweeping around the,display) is not synchronized with antenna rotation	• the problem may be in the antenna unit. Request service.
	there is no change in sensitivity	• request service.
a key is pressed	nothing happens	• key may be faulty. Request service.

Table 5-2 Troubleshooting table