XINUO

Operation Manual

10" Color LCD Marine Navigation Radar

XLR1004R
XLR1006L

⚠ SAFETY INSTRUCTIONS

⚠ WARNING

Radio Frequency Radiation Hazard

The radar antenna sends the electromagnetic radio frequency (RF) energy. This energy can be dangerous to you, especially your eyes. Do not look at the radiator or near the antenna when the antenna is rotating.

The distances at which RF radiation levels of 100 W/m2 and 10 W/m2 exist are shown in the table.

If the antenna unit is installed at a close distance in front of the wheel house, prevent the transmission in that area to protect passengers and crew from microwave radiation. Set the [Sector Blanks] in the [System] menu.

Output Power	Distance to the 100W/m² Radiation Point	Distance to the 10W/m² Radiation Point
4kW	Nil	Minimum Distance is 1.2 m
6kW	Nil	Minimum Distance is 1.5 m

Note: Safe Distance when Power Density is less than 0.5W/㎡.Protective Distance Required when Power Density is greater than 10W/㎡.Dangerous Distance when Power Density is greater than 50W/㎡.

Do not open the equipment.
Only qualified persons can work inside the equipment.

- **Use the correct fuse.**

  A wrong fuse can damage the equipment and cause fire.

Turn off the power before you service the antenna unit. Post a warning sign near the power switch not to turn on the power while you service the antenna unit.

- **Do not operate the equipment with wet hands.**

  Electrical shock can occur.

When you work on the antenna unit, wear a safety belt and hard hat.

- **Do not put liquid-filled containers on the top of the equipment.**

  Fire or electrical shock can occur if a liquid spills into the equipment.

Turn off the power immediately if water leaks into the equipment or smoke or fire is coming from the equipment.

- **Do not disassemble or modify the equipment.**

  Fire or electrical shock can occur.

Do not depend on one navigation-device for the navigation of the-ship. The navigator must check al-laids available to confirm position. Electronic aids are not areplace-ment for basic navigationprinciples and common sense.

- **Keep heater away from the equipment.**

  Heat can change the equipment shape and melt the power cord, which can cause fire or electrical shock.

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Instructions

Information in this manual is subject to update without notice. XINUO reserves the right to change or update the contents without obligation to notify any person or organizations. You can visit the XINUO web site, www.xinuo.com to know the latest updated information and operation of this or other XINUO products.

Warning. Please read through the cautions of the manual to understand the product's cautions and other more important information.

Statements. Other products and company names involved in this manual are only for identification. Those names may be registered trademarks owned by other company. Version information is displayed in the system only and will not be described in details in this manual. "XINUO" and "XINUO TECH" mentioned in this manual all refers to "Xinuo Information Technology (Xiamen) Corporation Limited".

This manual is only for reference, the detail operations should depend on device. It applies to the following models.

☐ XLR1004R

☐ XLR1006L

Introduction to XLR1004R/XLR1006L Radar

Features

1. 10-inch High-Resolution LED-backlit Color LCD Display
2. Stable images without flickering.
3. Clear and full echoes at all ranges.
4. High integration and reliability using multifunctional microprocessors and large-scale integrated circuits.
5. AIS connection for displaying AIS data.
6. EPA function capable of plotting up to 10 targets.
7. Target Tracking (TT) function for recording up to 20 targets.
8. Echo colors available in red, green, yellow, orange, and multi-color.

The XLR1004R/XLR1006L radar complies with international and national standards

IEC 61162: Maritime navigation and radio communication equipment and systems Digital interfaces

IEC 60945-2002: Maritime navigation and radio communication equipment and systems, General requirements — Methods of testing and required results

EN 62252:2004 Maritime navigation and radiocommunication equipment and system

Performance of XLR1004R/XLR1006L Radar

1.Overview of the Radar Functions

(1) Range, Pulse Width & Pulse Repetition Frequency（PRF）

Range scale（NM/KM）	PW（us）	PRF（Hz approx.）
0.125、0.25、0.5、0.75、1	0.08	2200
1.5	0.08	2200
	0.3	1200
2	0.3	1200
3	0.3	1200
	0.8	600
4、6、8、12、16、24、32、36、48、64、72	0.8	600

(2) Distance Resolution: 20 m

(3) Bearing Resolution: XLR1004R： Not exceeding 4°； XLR1006L： Not exceeding 1.9°

(4) Distance Accuracy: 1% of the range or 30 m, whichever is greater

(5) Bearing Accuracy: ±1°

(6) Minimum Detection Range: 30 m

2.Antenna

Type: Slot Waveguide Array

Polarization: Horizontal

Rotation Speed: 24 rpm

Radar Model / Indicators		XLR1004R	XLR1006L	
Length		RSC-R004	RSC-0006	
		2 feet	4 feet（Standard）	6 feet（Optional）
Beamwidth	Horizontal	4°	1.9°	1.3°
	Vertical	25°	22°	22°
Sidelobe		Within ±20° -18dB	Within ±20° -24dB	Within ±10° -24dB
		Outside ±20° -23dB	Outside ±20° -30dB	Outside ±10° -30dB

3.Transmitter

Frequency: 9410 MHz ± 30 MHz (X-band)

Emission Type: P0N

Modulation Switch: FET

Output Power:

XLR1004R：4 kW

XLR1006L：6 kW

4.Receiver

Microwave Front-End: MIC

Noise Figure:

XLR1004R：8 dB

XLR1006L：6 dB

Intermediate Frequency (IF): 60 MHz

Bandwidth:

Pulse Width: Bandwidth

0.08 μs, 0.3 μs: 25 MHz

0.8 μs: 3 MHz

5. Display Unit

(1) 10-inch LED-backlit LCD Display, resolution 800*600, effective diameter 150 mm. Echo colors available in 32 levels of red, green, yellow, orange, and multi-color.

(2) Range: 0.125, 0.25, 0.5, 0.75, 1, 1.5, 2, 3, 4, 6, 8, 12, 16, 24, 32, 36, 48, 64, 72 NM/KM

(3) Display Modes: Head-Up, Course-Up, True North-Up, True Motion

(4) Target Alarm Zone: 1 target alarm zone

(5) EBL/VRM (Electronic Bearing Line/Variable Range Marker): 2 sets

(6) Parallel Lines: 2, 4, 6 lines

(7) TT (ARPA) Function: Automatic acquisition + manual acquisition (up to 20 targets)

(8) AIS Function: Display up to 100 targets

(9) EPA Function: Plotting up to 10 targets

(10) Radar Map: Set navigation lines, coastlines, buoys, etc.

6. Interfaces

GNSS Data Input: Data format is NMEA0183/IEC61162-1

$--RMC $--RMB$--GGA

$--GLL $--ZTG $--VTG

AIS Data Input: Data format is IEC61162-2

$--VDM $--VDO

Heading Data Input: Data format is IEC61162-1/IEC61162-2

$--HDT

Log Data Input: Data format is IEC61162-1

$--VBW

TT（ARPA）Output：Data format is IEC61162-1

$RATTM

Video Output: VGA monitor

7. Power Supply

Rated DC Voltage: 24V

DC Voltage Range: 18.0V-34.0V

Operating Current (no wind resistance):

XLR1004R: 1.8A (24V)

XLR1006L: 2.5A (24V)

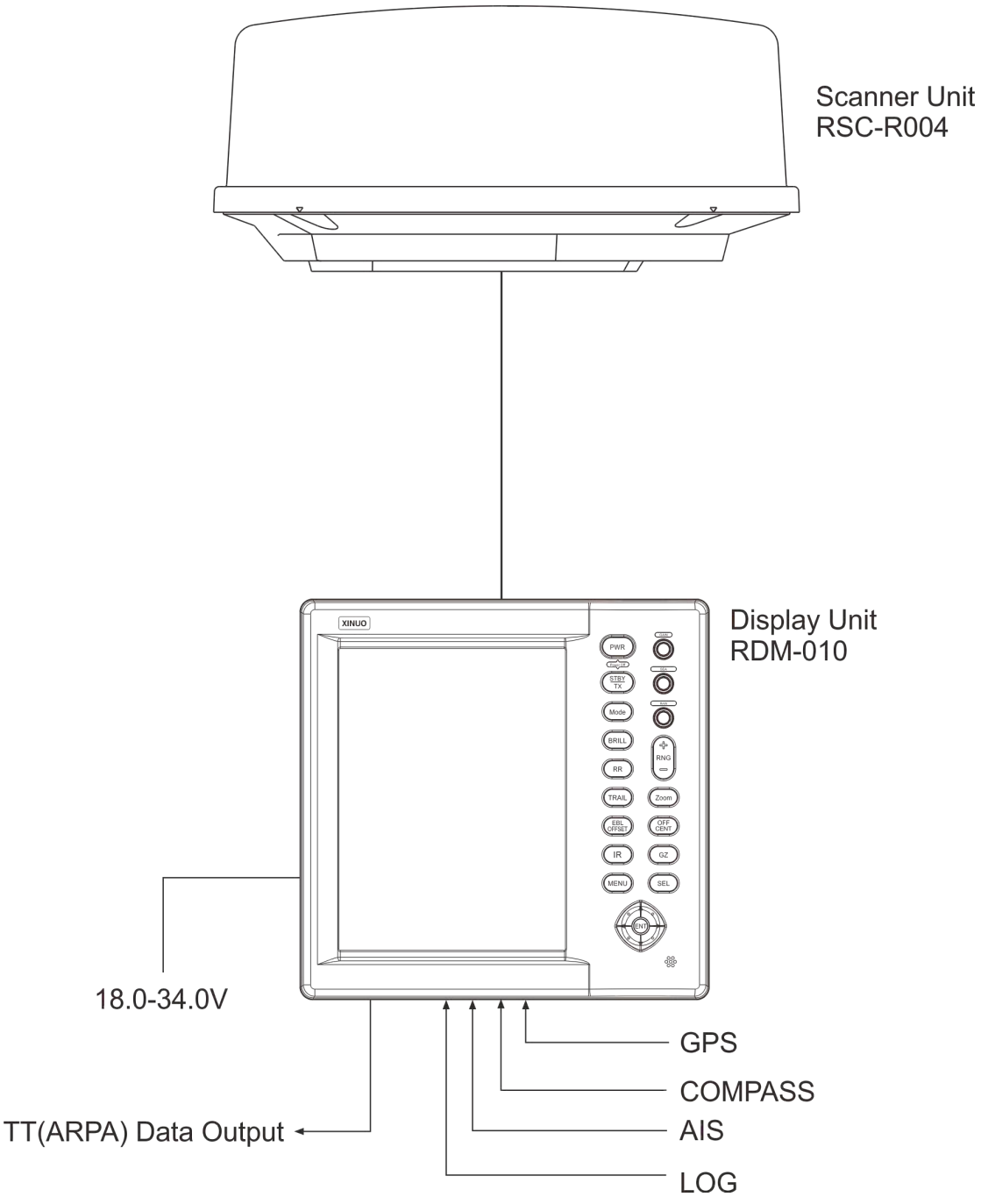
8. Operating Temperature

Display Unit: -15°C to +55°C

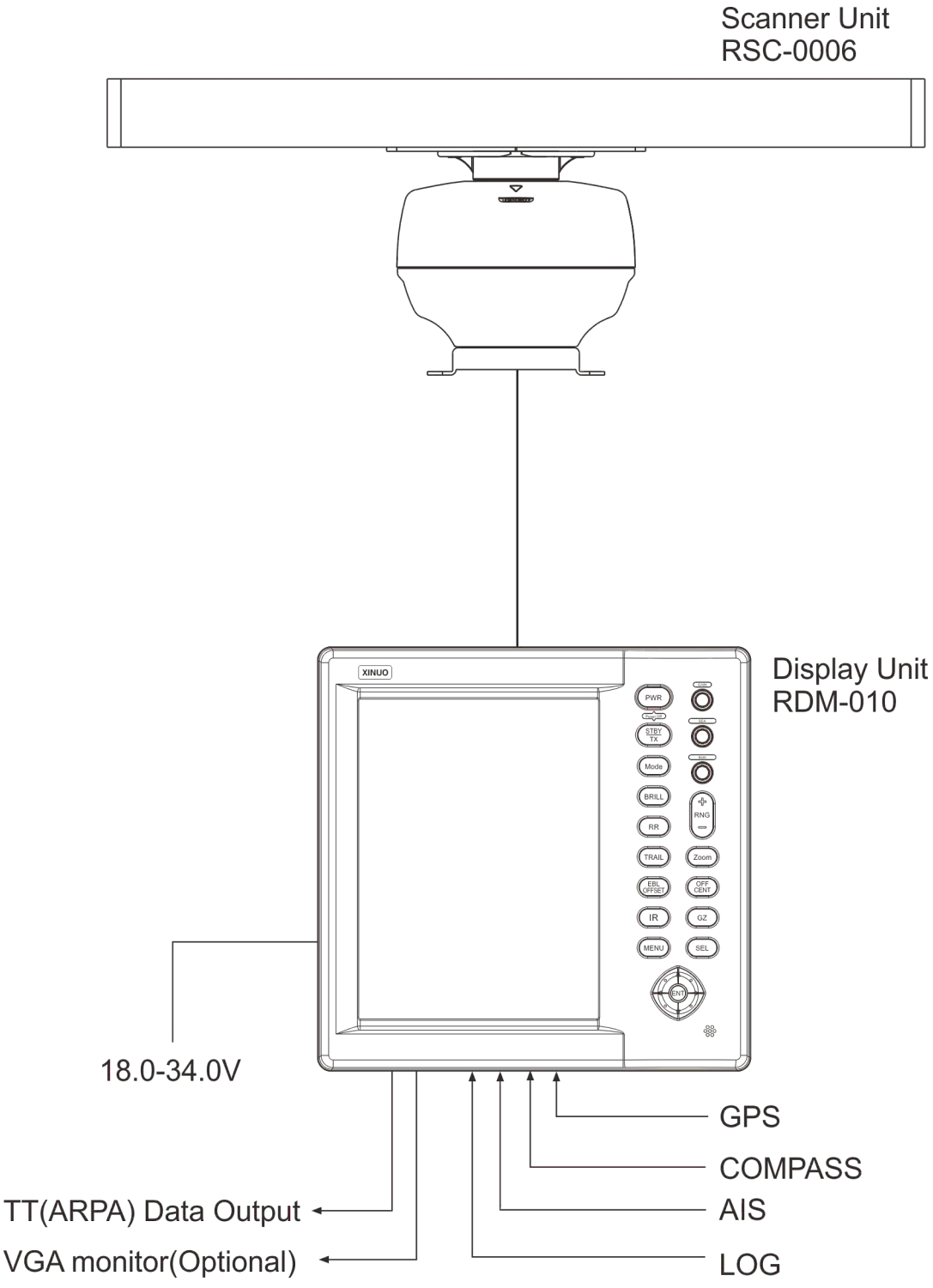
Scanner Unit: -25°C to +55°C

SYSTEM CONFIGURATION

XLR1004R



XLR1006L


Scanner Unit
RSC-0006
Display Unit
RDM-010
XINUO
PWR
STBY TX
Mode
BRILL
RR
TRAIL
EBL OFFSET
IR
MENU
RNG
Zoom
OFF CENT
GZ
SEL
ENT
18.0-34.0V
GPS
COMPASS
AIS
LOG
TT(ARPA) Data Output
VGA monitor(Optional)

1. Radar Operation

1.1 Power On/Off

Press the **PWR** button to turn on the radar. To turn it off, press and hold the **PWR** button for 3 seconds,or hold the **PWR** button and then press the **STBY/Transmit** button. Approximately 2 seconds after powering on, the screen will display the bearing scale and a timer. The timer counts down from 1 minute and 30 seconds, during which the magnetron warms up before transmission. When the timer reaches 0:00, the screen will display "Standby," indicating that the radar is ready for transmission.

1.2 Transmit/Standby

After powering on and once the magnetron warm-up is complete, "ST-BY" will be displayed in the center of the screen, indicating that the radar is ready for transmission. Press the **STBY/TX** button to enter transmission mode. If you are not using the radar for a period of time but wish to keep it in standby mode, press the **STBY/TX** button again to enter standby mode, with "ST-BY" displayed on the screen.

1.3 Control Panel

1.3.1 Knob Functions Overview

- **Gain/Heading Control Knob:**

This is a combined control knob. Rotating it left or right adjusts the gain. When pressed, it temporarily hides the heading line to facilitate observation of targets in the heading direction. Releasing it will restore the heading line display.

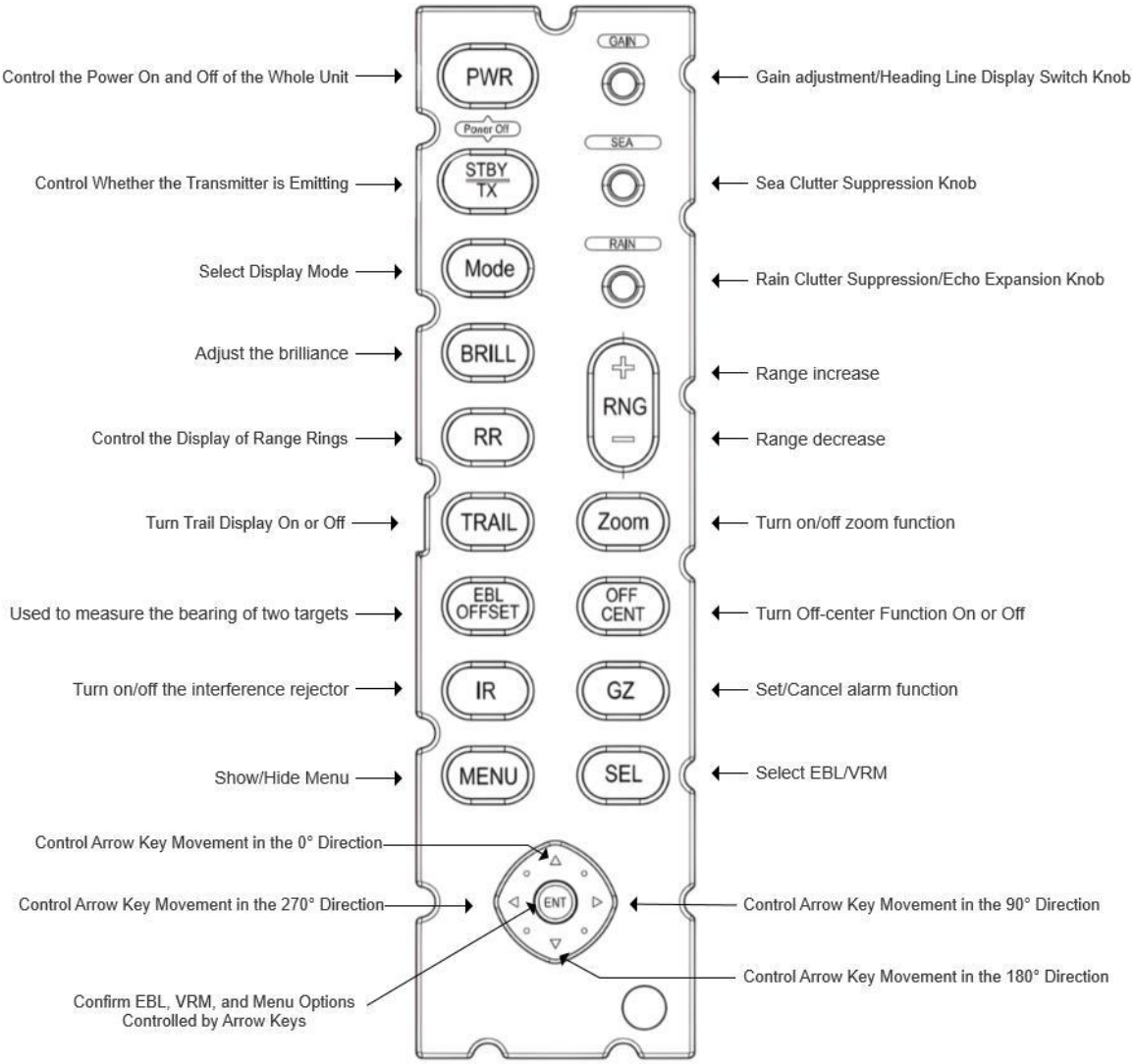
- **Sea Clutter Suppression Knob:**

This is a combined control knob. Rotating it left or right adjusts the suppression intensity of sea clutter. Pressing the knob turns the automatic sea clutter suppression function on or off.

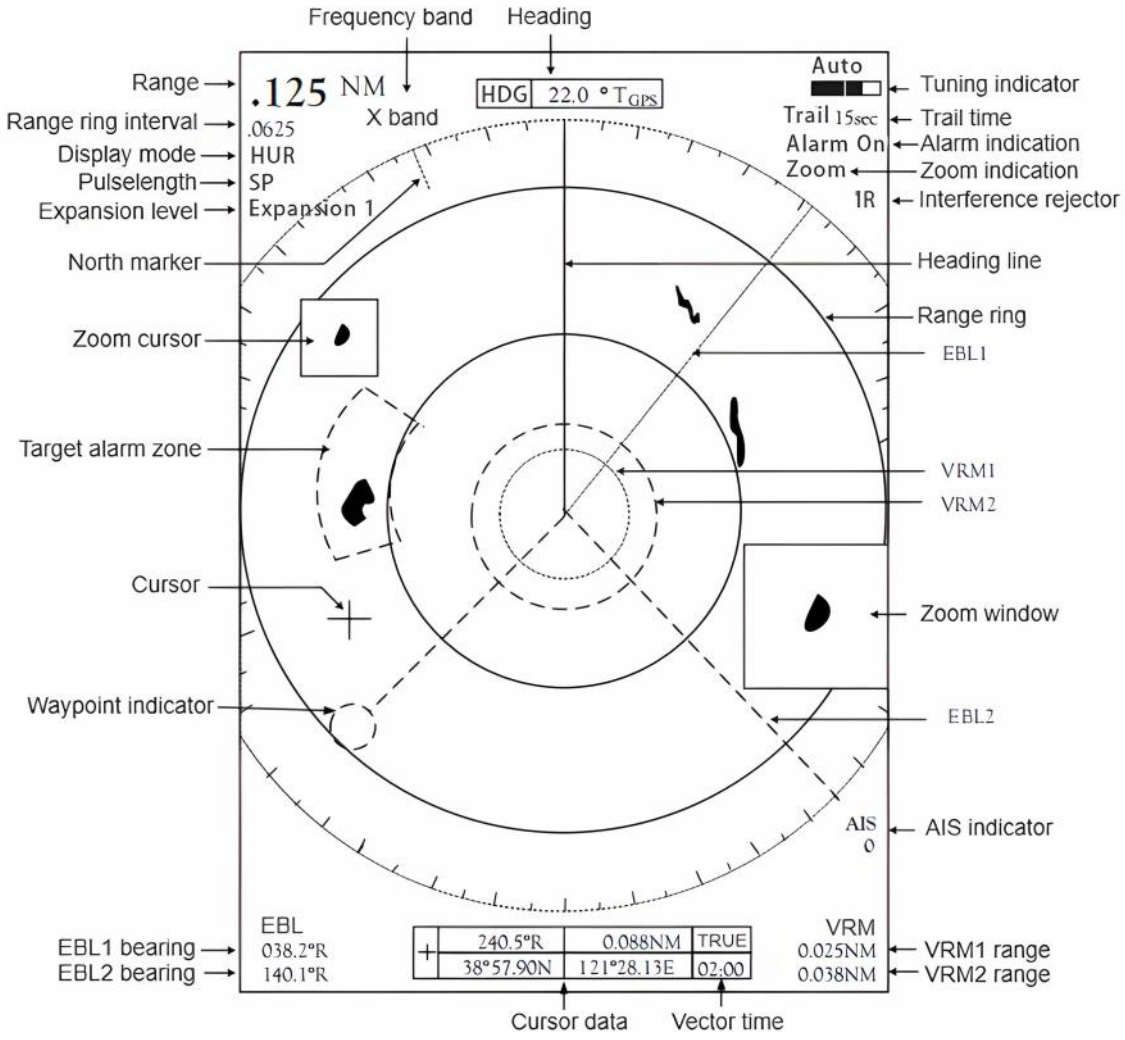
- **Rain/Snow Suppression/Echo Expansion Knob:**

This is a combined control knob. Rotating it left or right adjusts the suppression intensity of rain and snow clutter. Pressing the knob turns the echo expansion function on or off, and allows you to select the level of echo expansion.

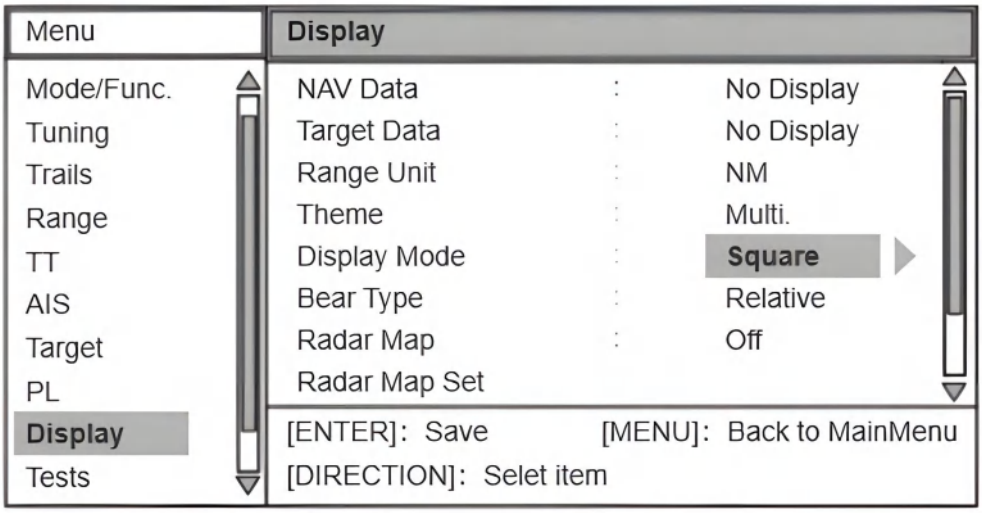
1.3.2 Controls



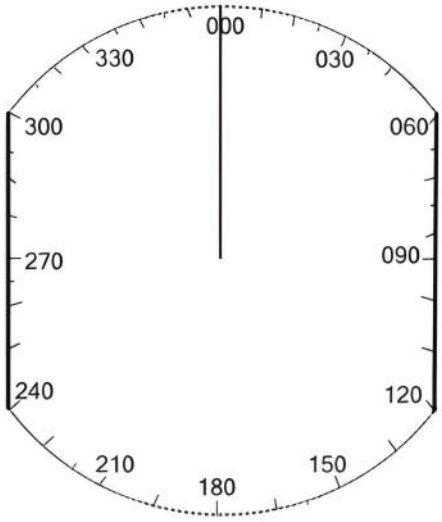
1.4 Display Indications



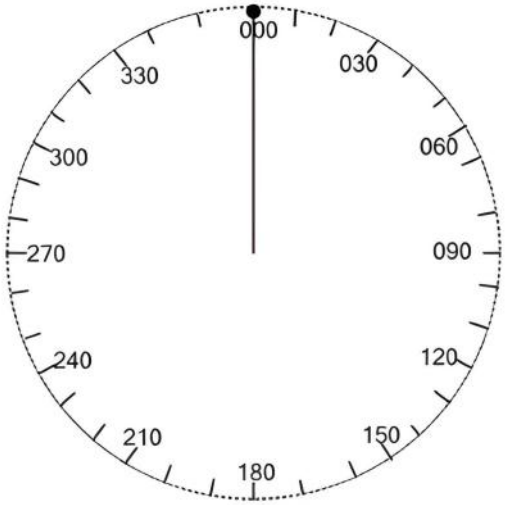
Note: The interface display has two modes, 'Square' and 'Rotundity' display. You can select in the 'Display mode' section of the 'Display' submenu, with the default setting being 'Square' display.



In this operation manual, descriptions are primarily based on the "square" format. The only difference between the square and rotundity displays is the effective display area.

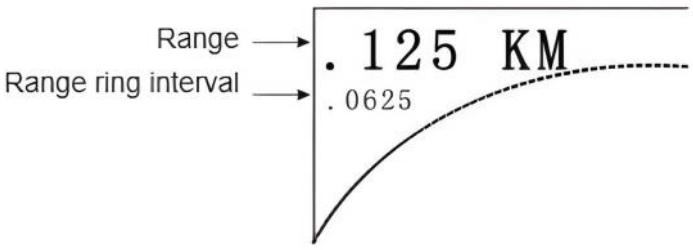


Display Mode--Square



Display Mode--Rotundity

Note: When the "Use Type" menu item in the system menu is set to "River" the top left corner of the screen displays as follows, and the entire radar system operates in the metric system (kilometers).



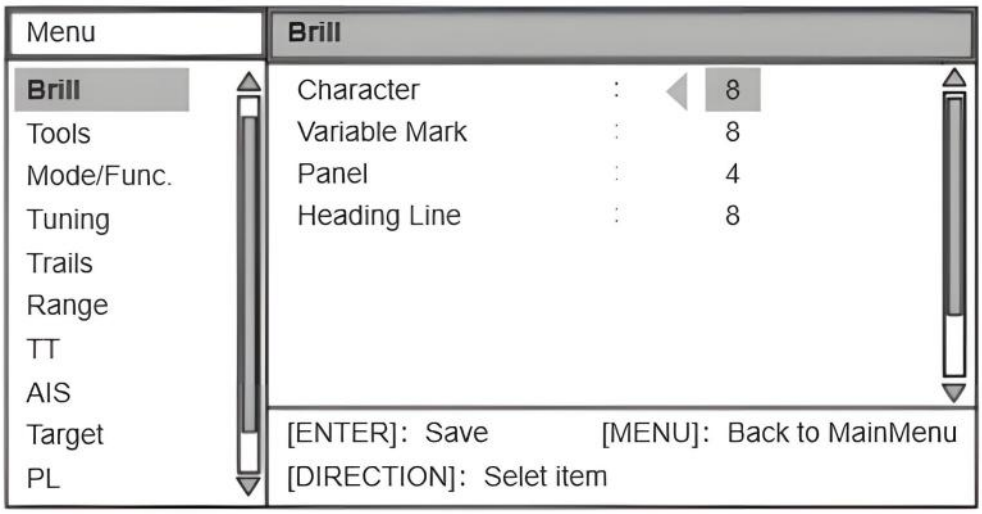
1.5 Brilliance Adjustment

1.5.1 Display Brilliance Adjustment

1. Press the **BRILL** button to display the brilliance indicator bar on the right side of the screen.
2. Use the up and down arrow keys to adjust the display brilliance.
3. After adjustment is complete, press the **BRILL** button again to close the brilliance indicator bar.

1.5.2 Character Brilliance Adjustment

1. Press the **MENU** button to enter the main menu.
2. Use the arrow keys to select the "Brill" menu item and press the **ENT** button to access it.



3. Use the arrow keys to select the desired brilliance level under the “Character” option and press the **ENT** button.
4. Press the **MENU** button twice to close the menu.

1.5.3 Marker Brilliance Adjustment

1. Press the **MENU** button to enter the main menu.
2. Use the arrow keys to select the "Brill" menu item and press the **ENT** button to access it.
3. Use the arrow keys to choose the desired brilliance level under the “Variable Mark” option and press the **ENT** button.
4. Press the **MENU** button twice to close the menu.

1.5.4 Panel Brilliance Adjustment

1. Press the **MENU** button to enter the main menu.
2. Use the arrow keys to select the "Brill" menu item and press the **ENT** button to access it.
3. Use the arrow keys to select the desired panel brilliance level under the “Panel” option and press the **ENT** button.
4. Press the **MENU** button twice to close the menu.

1.5.5 Heading Line Brilliance Adjustment

1. Press the **MENU** button to enter the main menu.
2. Use the arrow keys to select the "Brill" menu item and press the **ENT** button to access it.
3. Use the arrow keys to choose the desired brilliance level under the “Heading Line ” option and press the **ENT** button.
4. Press the **MENU** button twice to close the menu.

1.5.6 Range ring Brilliance Adjustment

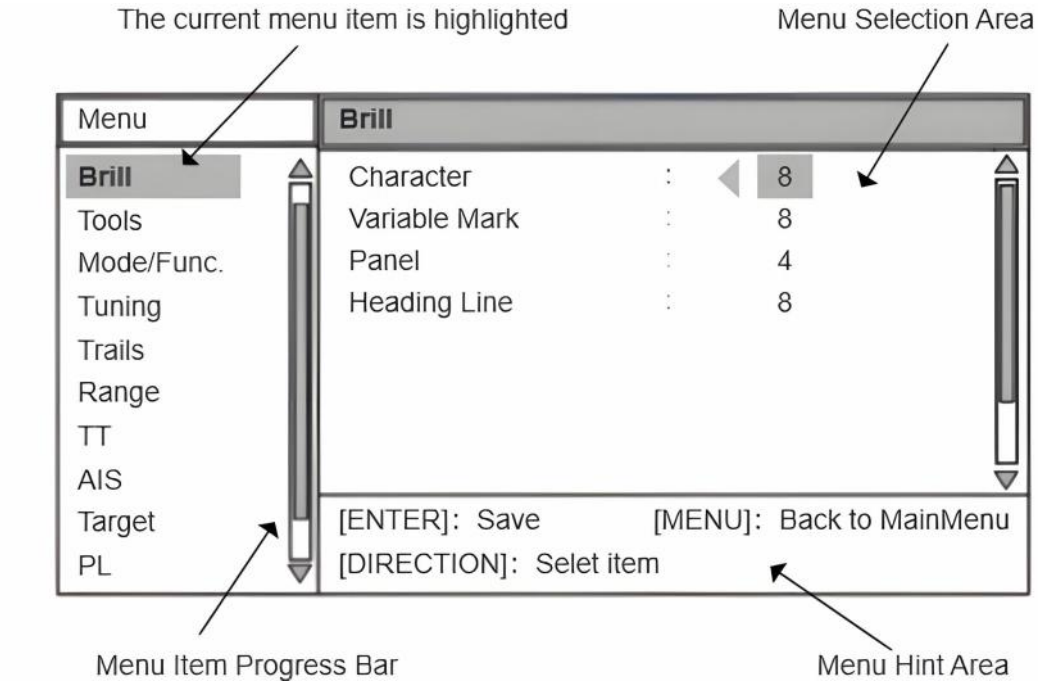
Press the **RR** button to adjust the range ring brilliance. The range ring brilliance levels are 0 – 1 – 2 – 3 – Brightest.

1.6 Menu

The menu consists of a main menu and 15 submenus. Press the **MENU** button to display or close the menu. Use the arrow keys to select options within the menu, and press the **ENT** button to confirm.

1.6.1 Menu Operation

Press the **MENU** button to display the main menu, which appears as shown. Use the arrow keys to select the corresponding submenu. The selected menu item will be highlighted, and press the **ENT** button to enter the submenu.When using the arrow keys, the menu prompt area will display the current menu prompt.



1.6.2 Menu Overview

Brilliance

- **Character**: 1, 2, 3, 4, 5, 6, 7, 8
- **Variable Mark**: 1, 2, 3, 4, 5, 6, 7, 8
- **Panel**: 1, 2, 3, 4
- **Heading Line**: 1, 2, 3, 4, 5, 6, 7, 8

Tools

- **Index Line Number**: 0,2,4,6
- **Index Line Interval**: 0.000NM~64.000NM
- **Index Line Bearing**: 0.0°R~359.9°R

Mode and Function

- **HDG Sensor**: GPS, Compass
- **Alarm Zone Mode**: Enter, Leave
- **Key Beep**: On, Off
- **Language**: Chinese, English
- **Ship Speed**: SOG(LOG), BT(LOG), STW(LOG), SOG(GPS), STW(MAN)
- **Manual Speed**: 0.0 kt – 50.0 kt
- **Set & Drift**: On, Off

- **Flow Direction Value**: 0.0°T – 359.9°T
- **Flow Speed Value**: 0.0 kt – 20.0 kt

Tuning

- **Tuning Mode**: Auto, Manual

Trails

- **Trails gradation**: On, Off
- **Trails Color**: Purple,White,Blue,Red,Green

Range

0.125, 0.25, 0.5, 0.75, 1, 1.5, 2, 3, 4, 6, 8, 12, 16, 24, 32, 36, 48, 64, 72

TT

- **Function Mode**:TT,EPA
- **TT**: On, Off
- **TT Target Auto Track**
- **EPA**: On, Off
- **Mark Number Display**: On, Off
- **TT Level**: Low, Medium, High

AIS

- **AIS**: On, Off
- **Target Number**: 20, 50, 80, 100
- **Lost Keep**: 0 sec, 30 sec, 1 min, 3 min, 5 min, 10 min
- **Sort By**: Radius, Sector
- **Range**: 0.1 NM – 64.0 NM
- **Sector Start**: 0° – 359°
- **Sector End**: 0° – 359°
- **Target a Auto Mark**: On, Off
- **Target a MMSI**
- **Target b Auto Mark**: On, Off
- **Target b MMSI**

Target

- **Vector Type**: True Vector, Relative Vector
- **Vector Time**: 30 sec, 1 min, 2 min, 5 min, 10 min, 30 min
- **History Dots**: 0, 5, 10
- **History Interval**: 30 sec, 1 min, 2 min, 3 min, 6 min, 12 min
- **Range Alarm**: On, Off
- **Range**: 0.5 NM – 12.0 NM
- **CPA/TCPA Alarm**: On, Off
- **CPA**: 0.5 NM – 12.0 NM
- **TCPA**: 30 sec, 1 min, 2 min, 3 min, 4 min, 5 min, 6 min, 12 min

Pulse Width

- **Range1.5 PL:** Short, Medium
- **Range3 PL:** Medium, Long

Display

- **NAV Data: Display, No display**
- **Target Data: Display, No display**
- **Range Unit: NM, KM**
- **Theme: RED/BLK, GRN/BLK, YLE/BLU, ORG/BLK, Multi.**
- **Display Mode: Square, Rotundity**
- **Bear Type: Relative, True**
- **Radar Map: On,Off**
- **Radar Map Set**
- **Wiper: On, Off**

Tests

- **Self Test**
- **LCD Test**

TX Setup

- **Antenna Rotation:** Rotate,No rotate
- **Sect-Blank 1:** Off, On
- **Sect-Blank 1 Start:** 0°–359°
- **Sect-Blank 1 End:** 0°–359°

- **Sect-Blank 2:** Off, On
- **Sect-Blank 2 Start:** 0°–359°
- **Sect-Blank 2 End:** 0°–359°

Alarm

- **Target**
- **Heading**
- **Bearing**
- **HDT**
- **GPS**
- **AlarmZ**
- **Video**

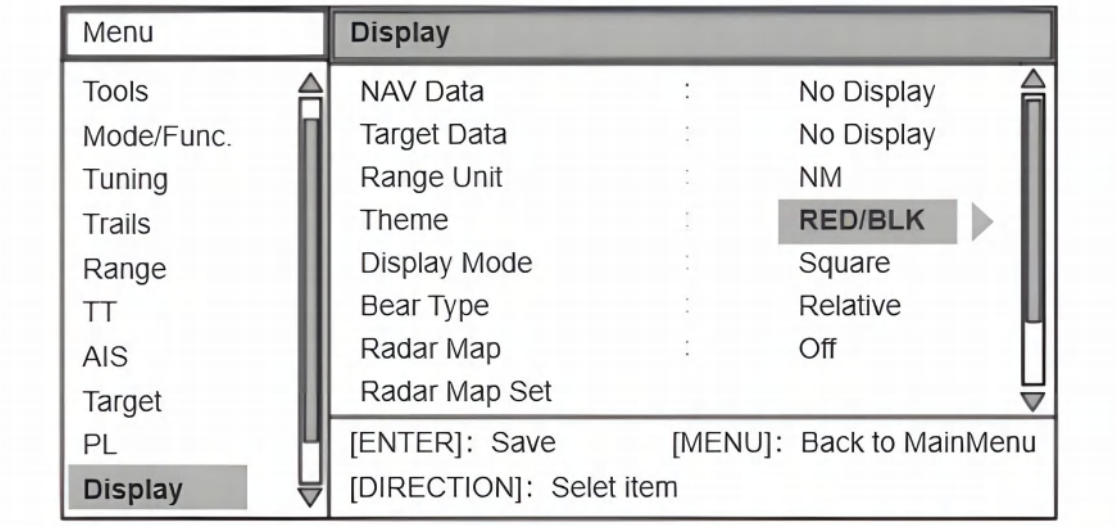
System

- **Heading Adjust**
- **Timing Adjust**
- **Antenna Height:** 5m, 10m, 15m
- **Use Type:** Sea, River
- **HDT Baud Rate:** 4800, 38400
- **TT Test:** Off, On
- **MBS:** 0~30
- **Video Initial Adjust**
- **Auto Installation Adjustment**
- **Restore Factory Settings**
- **Time Reset**
- **System Information**

1.7 Echo and Background Color Adjustment

Adjust Theme Color in the Menu:

1. Press the **MENU** button to enter the main menu.
2. Use the arrow keys to select the “Display” option and press the **ENT** button to access it.



3. Use the arrow keys to select the desired echo and background colors under the “Theme” option and press the **ENT** button to confirm. The color options are listed in the table below.

Theme	Echo Color	Background Color
RED/BLK	RED	BLACK
GRN/BLK	GREEN	BLACK
YLE/BLU	YELLOW	BLUE
ORG/BLK	ORANGE	BLACK
Multi.	Multicolor	BLACK

4. Press the **MENU** button twice to close the menu.

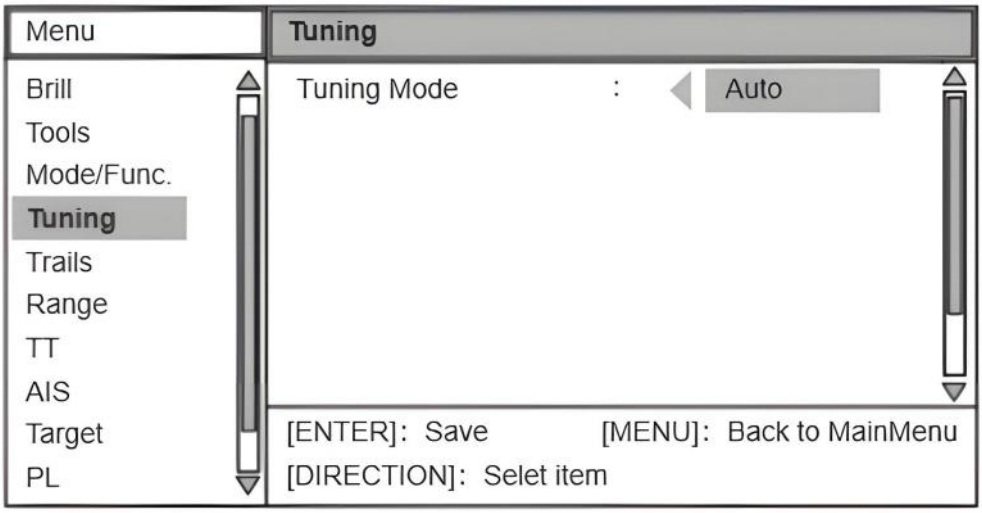
Adjust Theme Color with Buttons:

Press the **Color** button in sequence to cycle through the echo and background colors listed in the table.

1.8 Receiver Tuning

1.8.1 Automatic Tuning

1. When the current tuning mode is set to “Manual,” press the **MENU** button to enter the main menu.
2. Use the arrow keys to select the “Tuning” option and press the **ENT** button to access it.



3. Use the arrow keys to select “Auto” under the “Tuning” option and press the **ENT** button to confirm. This will initiate the tuning initialization process. Do not press any other buttons; wait for the tuning initialization to complete.
4. Press the **MENU** button twice to close the menu.

1.8.2 Manual Tuning

Manual tuning can only be performed when the current tuning method is set to “Manual”

1. If the current tuning method is set to “Auto” press the **MENU** button to enter the main menu.
2. Use the arrow keys to select the “Tuning” option and press the **ENT** button to access it.
3. Use the arrow keys to select “Manual” under the “Tuning” option and press the **ENT** button to confirm.
4. Press the **MENU** button twice to close the menu.

Adjustment: Press and hold the **GAIN** knob, then use the left or right arrow keys to slowly adjust while observing the echoes on the screen. Find the best

tuning point (where the echoes are optimal), then release the **GAIN** knob to complete the manual tuning.

1.8.3 Tuning Initialization

When the radar is in transmission mode and the current tuning method is "Manual":

1. Press the **MENU** button to enter the main menu.
2. Use the arrow keys to select the "Tuning" option and press the **ENT** button to access it.
3. Use the arrow keys to select "Auto" under the "Tuning" option and press the **ENT** button. A "Tuning…" message will appear slightly above the center of the screen as the system performs tuning initialization. The system will automatically search for the best tuning points (optimal echoes) at long, medium, and short ranges. Once tuning is complete, the "Tuning…" message will disappear, and you can perform other operations.
4. Press the **MENU** button twice to close the menu.

Note: Do not operate other buttons during the tuning initialization process.

1.9 Display Mode

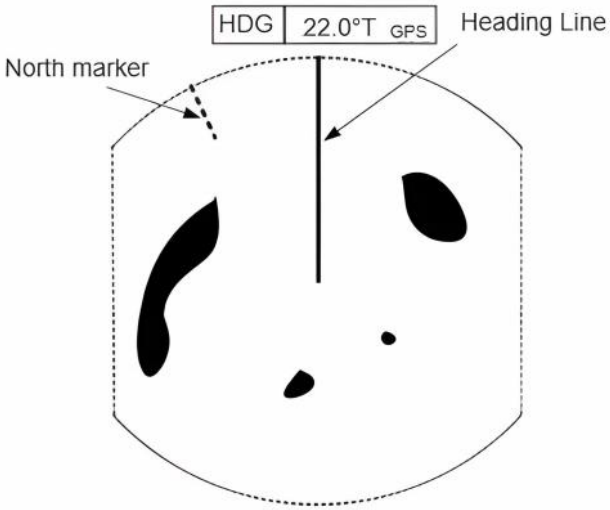
The radar has four display modes: **Heading Up**, **Course Up**, **True North Up**, and **True Motion**. When the heading signal is valid, press the **Mode** button to switch between display modes. The current display mode will be shown in the top left corner of the screen. If the heading data is invalid and you press the **Mode** button, you will hear three alarm sounds.

Note: Except for the Heading Up mode, other display modes require a stable heading signal. If the heading signal is lost, the display mode will automatically switch back to Heading Up mode. The True North marker will disappear, and the heading display will show ---.-°T.

1.9.1 Heading Up

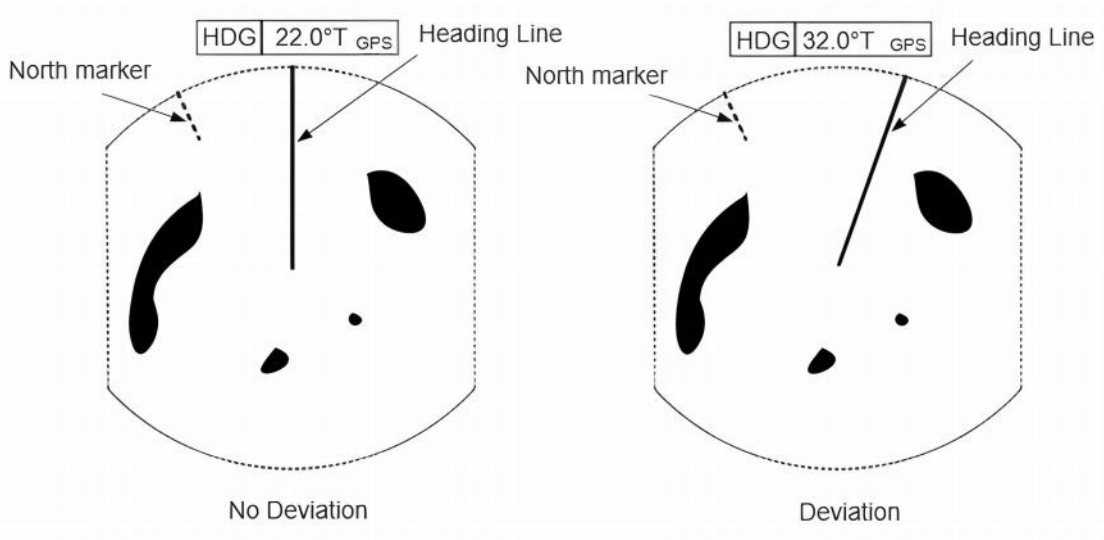
This is a display mode without a stable bearing reference. A line from the center to the top of the screen represents the heading direction. Target echoes on the screen are referenced to the heading. The bearing scale has a dashed

line pointing to the center of the image, indicating True North, known as the True North marker, as shown in the diagram below.



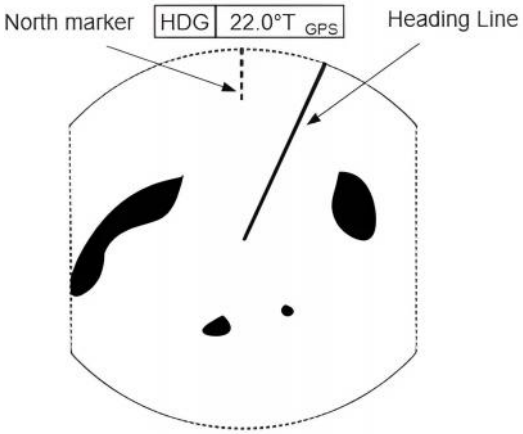
1.9.2 Course Up

This is a display mode based on a stable bearing reference from the compass signal. In this mode, the display of target echoes on the screen is relative to the preset course, which is set to 0 degrees on the bearing scale. When the heading direction matches the preset course, the heading line will be at the 0-degree mark. If the heading line deviates from the 0-degree mark on the bearing scale, it indicates a deviation from the course. The bearing scale where the heading line is located shows the magnitude of this deviation. This mode helps avoid screen blurring during course changes. This mode can only be used when the heading signal is valid, as shown in the diagram below.



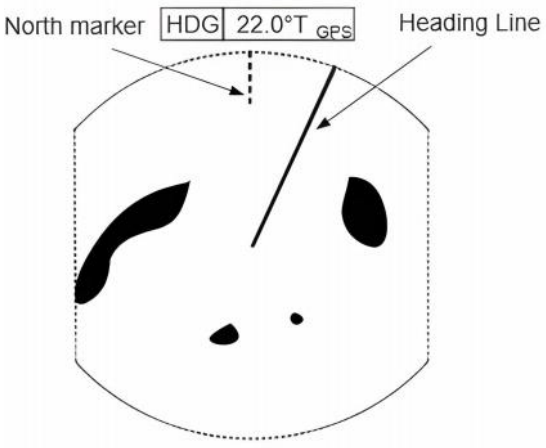
1.9.3 True North Up

In this mode, True North is always positioned at the top of the screen. The heading line will adjust according to the vessel's heading. If the compass is faulty, the display mode will automatically switch to Heading Up, the True North marker will disappear, and the heading reading at the top of the screen will show ---.-°T.



1.9.4 True Motion

In this mode, both the vessel and other moving objects move according to their true heading and speed. In the ground-stabilized True Motion mode, all fixed targets are displayed as stationary echoes.
When the vessel reaches 75% of the screen, its position will automatically reset to 75% on the opposite side of the screen in the direction opposite to the heading line. Press the **OFFCENT** button to return the vessel's position to the center of the screen.



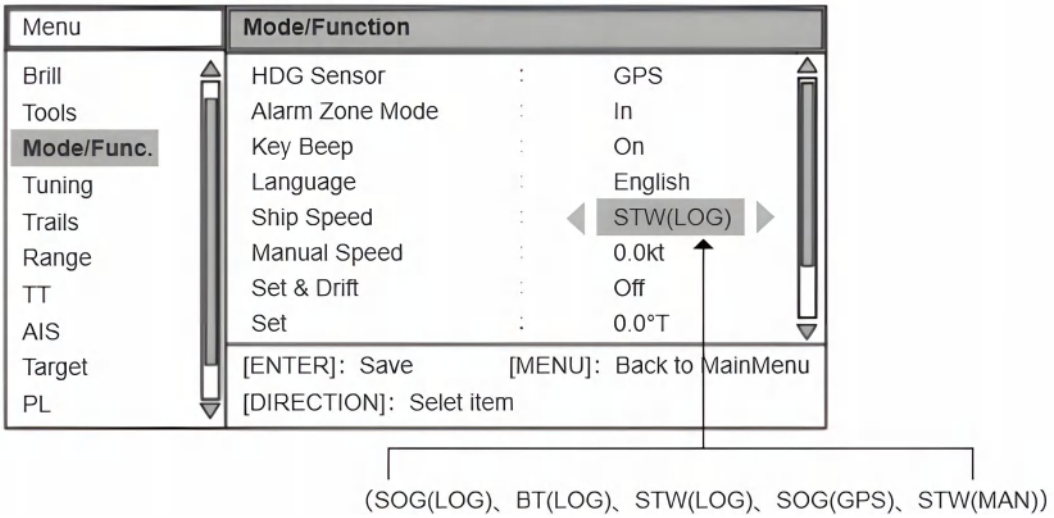
Note: In True Motion mode, pressing the **OFFCENT** button performs the reset function.

1.10 Input Ship Speed

The ship's speed can be input automatically from the LOG or GNSS, or manually.

1.10.1 Automatic Speed Input Using LOG or GNSS

1. Press the **MENU** button to enter the main menu.
2. Use the arrow keys to select the “Mode/Func.” option and press the **ENT** button to access it.



3. Move the cursor to the “Ship Speed” option, use the arrow keys to select the appropriate ship speed input mode, and press the **ENT** button to confirm.
   - **SOG(LOG):** Speed over ground from the LOG.
   - **BT(LOG):** Speed over ground from the LOG. Requires flow direction and speed input; otherwise, BT(LOG) speed cannot be generated. (Enable flow direction and speed input in the Mode/Function menu, then set the appropriate flow direction and speed values.)
   - **STW(LOG):** Speed through water from the LOG.
   - **SOG(GPS):** Speed input from the GPS navigator.
4. Press the **MENU** button twice to close the menu.

Note:

Do not select LOG options if the speed LOG is not connected. If the LOG is malfunctioning, manually input the speed.

The STW cannot be selected when the AIS function is enabled.

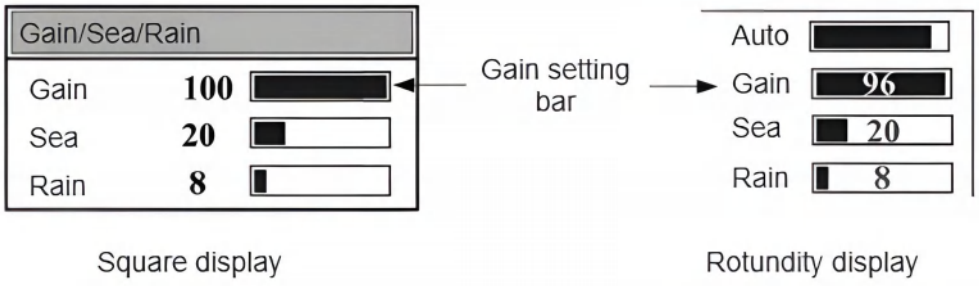
1.10.2 Manual Speed Input

If the speed LOG is not operational, manually input the speed as follows:

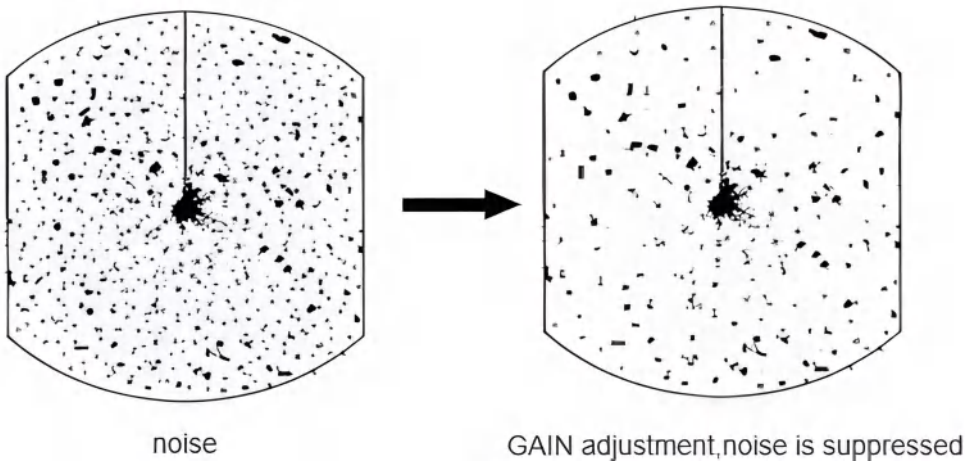
1. Press the **MENU** button to enter the main menu.
2. Use the arrow keys to select the “Mode/Function” option and press the **ENT** button to access it.
3. Move the cursor to the “Ship Speed” option, use the arrow keys to select the “STW(MAN)” input mode, and press the **ENT** button to confirm.
4. Move the cursor to the “Manual Speed” option, use the arrow keys to adjust the value, and press the **ENT** button.
5. Press the **MENU** button twice to close the menu.

1.11 Receiver Sensitivity Adjustment

Use the **GAIN** knob to adjust the receiver sensitivity. Rotate left to decrease and right to increase. The corresponding gain control strength is displayed in the control suppression indicator box at the bottom of the screen (circular scale in the top right corner of the screen). If no operation is performed for 5 seconds, the control suppression indicator box will disappear (the circular scale does not have this limitation).



Note: The correct adjustment is to set the background noise just visible on the screen. If the noise is too low, sensitivity is too low and weak echoes will be lost; conversely, if sensitivity is too high, the background noise will be too strong, making it difficult to distinguish between echoes and background noise. When adjusting sensitivity, it should be done at long ranges. Adjust the **GAIN** knob so that the background noise is just visible on the screen.

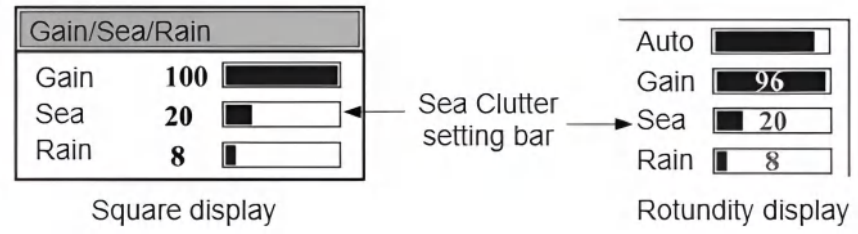


1.12 To Reduce the Sea Clutter

Irregular reflections of radar waves from nearby sea waves can appear as continuous bright areas in the center of the screen, known as “sea clutter,” which makes it difficult to distinguish echoes from close-range targets. The higher the sea waves, the greater the clutter. If sea clutter obscures the target echoes, it can be suppressed by adjusting the **A/C SEA** knob. Pressing the **A/C SEA** knob will enable or disable the automatic sea clutter suppression function.

1.12.1 To Reduce the Sea Clutter Manually

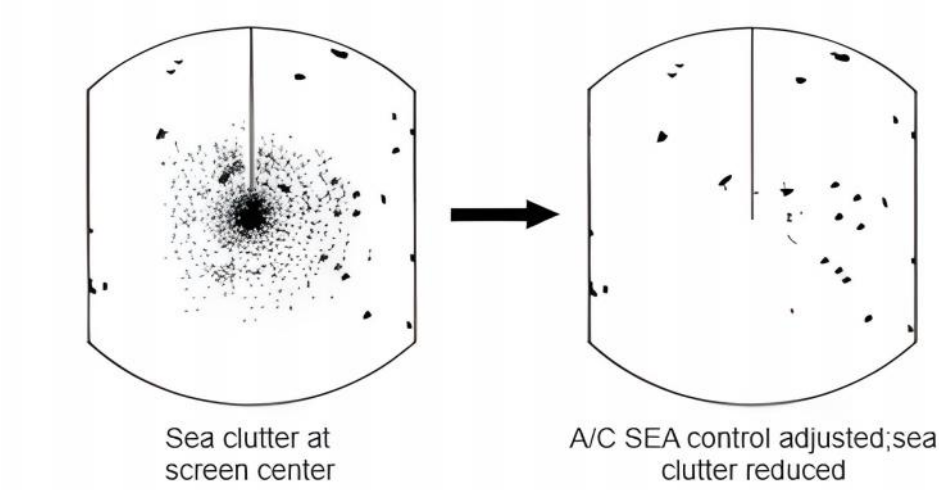
Adjust the **A/C SEA** knob while observing the screen until you achieve the desired effect; turning the knob clockwise increases suppression, while turning it counterclockwise decreases it. The corresponding sea clutter suppression strength is displayed in the control suppression indicator box at the bottom of the screen (circular scale in the top right corner). If no operation is performed for 5 seconds, the control suppression indicator box will disappear (the circular scale does not have this limitation).



Sea clutter suppression is achieved by “reducing the amplification of echoes at close range; gradually increasing amplification with distance; and using normal amplification at distances without sea clutter.” The correct setting for **A/C SEA**

is when clutter appears as small dots, and small targets become clearly visible. If the setting is too low, targets will be drowned in clutter; if the setting is too high, both targets and clutter will disappear. Generally, in calm conditions, adjust the knob until the clutter just disappears; in windy conditions, adjust the knob until the clutter is just visible.

1. Confirm that sensitivity has been correctly adjusted, then operate at short range.
2. Adjust the **A/C SEA** knob so that small targets are clearly visible with a slight amount of clutter present, as shown in the diagram below.



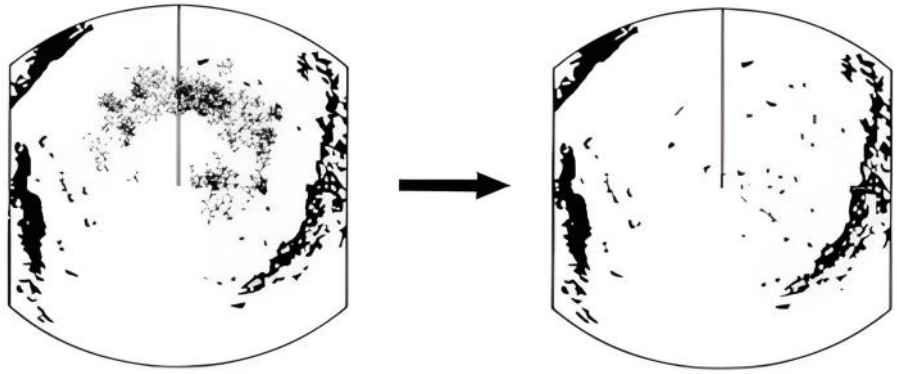
1.12.2 To Reduce the Sea Clutter Automatically

Press the **A/C SEA** knob to turn the automatic sea clutter suppression function on or off. When the automatic sea clutter suppression function is enabled, the “Auto” indicator will appear in the control suppression indicator box. If no operation is performed for 5 seconds, the control suppression indicator box will disappear (the circular scale does not have this limitation).

Note: The automatic sea clutter suppression function may eliminate weak echoes. Carefully observe the echoes on the screen and adjust accordingly.

1.13 To Reduce Rain and Snow Clutter

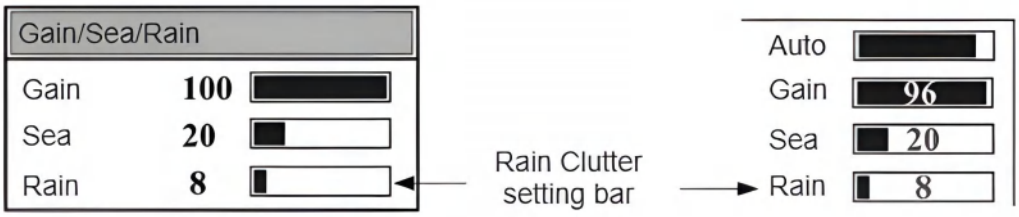
The vertical beam of the antenna is wide enough to detect surface targets even when the ship is bouncing in wind and waves; similarly, rain and snow can cause reflections of radar waves, creating rain and snow clutter. The rain and snow clutter suppression function helps to reduce the impact of such clutter, as shown in the diagram below.



Rain clutter at screen center

A/C Rain control adjusted;rain clutter reduced

Rotate the **A/C RAIN** knob clockwise to increase the suppression effect, and counterclockwise to decrease it. The corresponding rain and snow suppression strength is displayed in the control suppression indicator box at the bottom of the screen (circular scale in the top right corner). If no operation is performed for 5 seconds, the control suppression indicator box will disappear (the circular scale does not have this limitation).



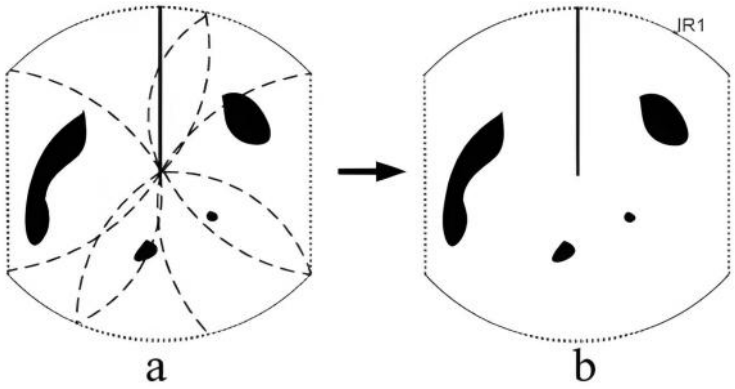
Square display

Rotundity display

1.14 Interference Rejector

When other radars in the vicinity operate at the same frequency (9GHz) as the ship's radar, interference can occur, resulting in numerous small bright spots on the screen. These spots may appear as irregular patterns or as dashed lines extending from the center of the screen to the edges (as shown in Figure a). Activating the interference suppression function can reduce this

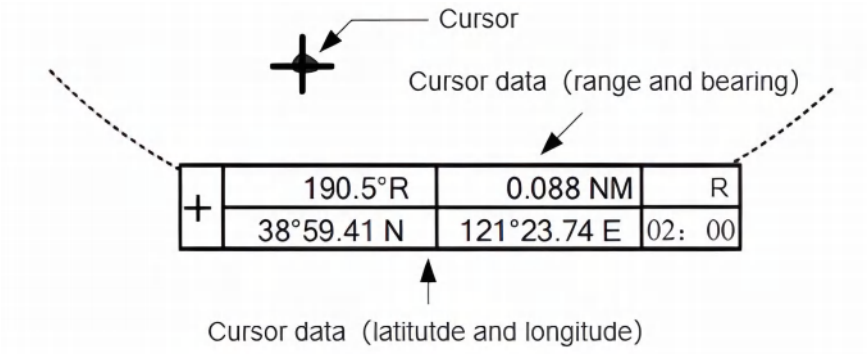
interference (as shown in Figure b). Press the **IR** button to turn the interference suppression function on or off and select the suppression level.



Note: Ensure that the interference suppression function is turned off when there are no interference sources nearby to avoid losing small targets.

1.15 Cursor

The cursor display area shows the bearing, range, and latitude/longitude of a particular target (navigation data needs to be connected externally). Use the arrow keys to place the cursor on a target, and the cursor data will be displayed at the bottom of the screen. See the diagram below.



Cursor Range Unit Switching

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the “Display” option and press the **ENT** key to proceed.
3. Use the arrow keys to choose “Range Unit” from the options and select either “NM” or “KM,” then press the **ENT** key to confirm.
4. Press the **MENU** key twice to close the menu.

Note: After switching the range unit, the range units for active marks, waypoints, and target categories will also change accordingly.

1.16 Bearing/Range Measurement

1.16.1 Measuring the Range to a Target

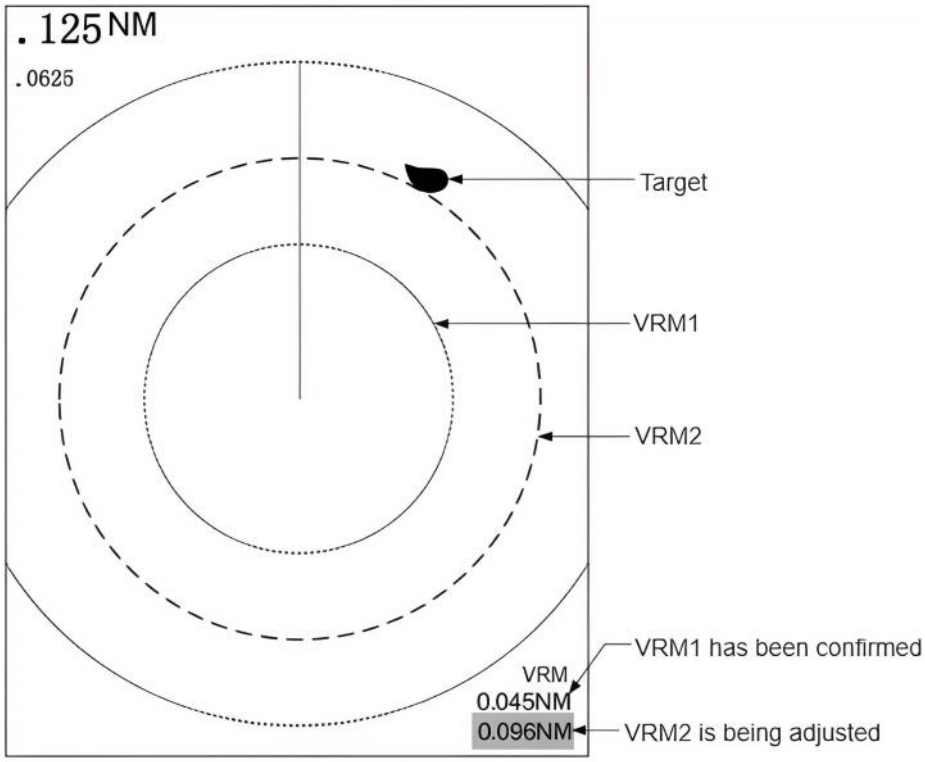
Using Range Rings

The range rings can be used to estimate the range to a target. The range rings are a set of concentric circles centered on the radar screen's scan center. The number and spacing of these rings depend on the selected range. By observing the position of the target relative to the range rings and their spacing, you can roughly determine the range from the target to the ship.

Using VRM (Variable Range Marker)

The VRM (Variable Range Marker) allows for a more precise measurement of the range from the target to the ship. The VRM is an adjustable-radius circle, and the radar provides two VRMs, VRM1 and VRM2, displayed in different dashed line styles to distinguish them from the range rings.

Settings: Press the **VRM** key to select a VRM (the key cycles through VRM1 and VRM2, starting with the last used position).Press the **ENT** key, and a rectangular box will appear at the bottom of the currently active VRM data; adjust the VRM radius size using the arrow keys until it fits the inner edge of the target.Press the **ENT** key to confirm, and the rectangular box will disappear. If you do not press the **ENT** key to confirm, the selected VRM will be automatically confirmed after 10 seconds of inactivity, and the rectangular box will disappear.



Cancel VRM: Press the **VRM** key to select a VRM.Press and hold the **ENT** key for 1 second to cancel the currently selected VRM.

Selecting VRM Unit

Range units can be either nautical miles (NM) or kilometers (KM). When the range unit changes, the VRM display data will be updated according to the selected range unit.

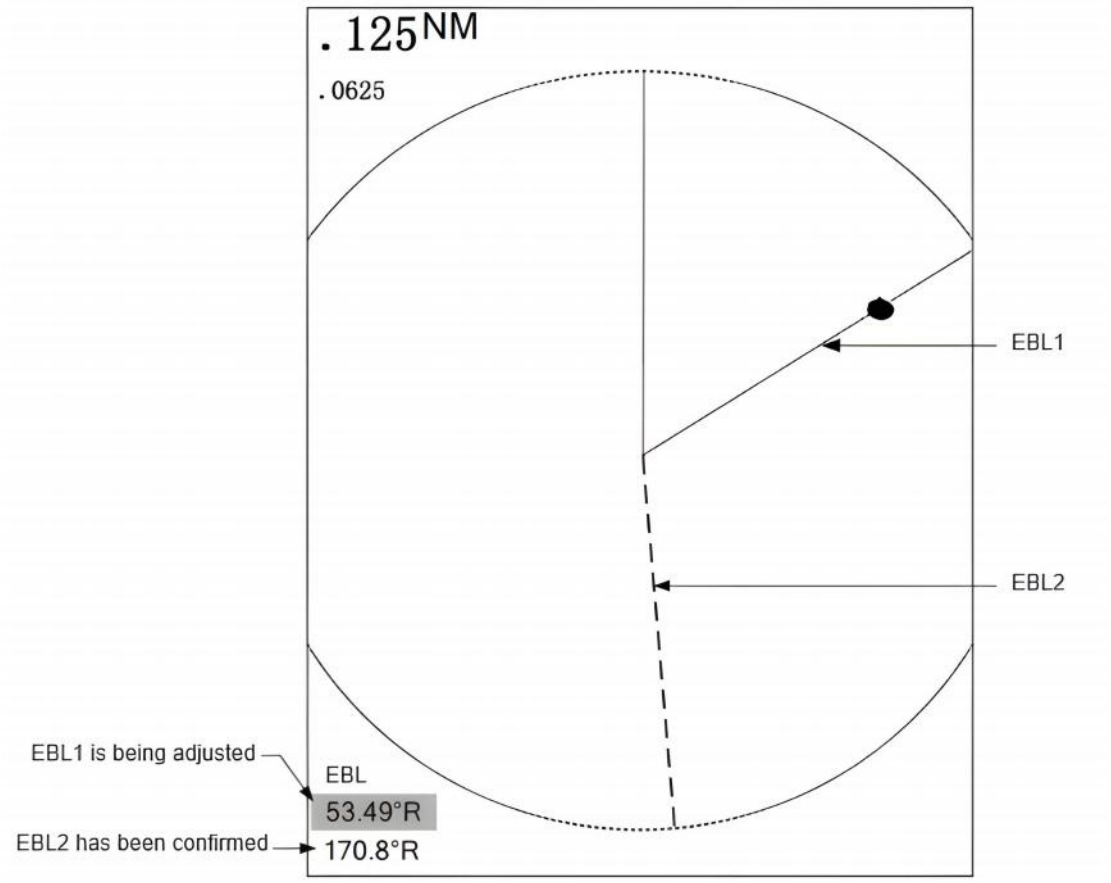
1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the “Display” option and press the **ENT** key to proceed.
3. Use the arrow keys to choose “Range Unit” from the options and select either “NM” or “KM,” then press the **ENT** key to confirm.
4. Press the **MENU** key twice to close the menu.

1.16.2 Measuring the Bearing to a Target

Using EBL (Electronic Bearing Line) The EBL (Electronic Bearing Line) can be used to measure the bearing of a target. The radar provides two EBLs, EBL1 and EBL2, which are displayed in different dashed line styles to distinguish them.

Settings: Press the **EBL** key to select an EBL.Press the **ENT** key, and a rectangular box will appear at the bottom of the currently active EBL data; use

the arrow keys to adjust the EBL's bearing until it aligns with the target.Press the **ENT** key to confirm, and the rectangular box will disappear. If you do not press the **ENT** key to confirm, the selected EBL will be automatically confirmed after 10 seconds of inactivity, and the rectangular box will disappear.

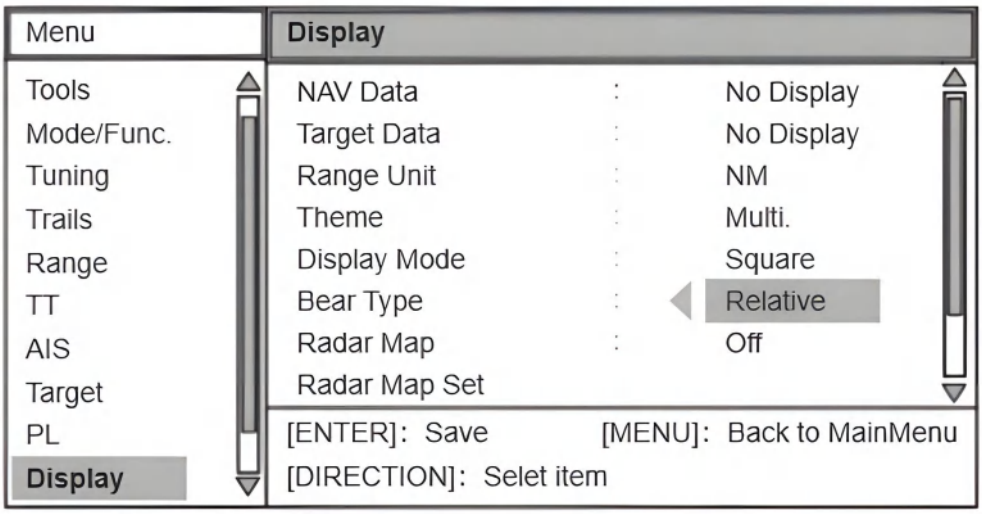


Cancel EBL: Press the **EBL** key to select an EBL.Press and hold the **ENT** key for 1 second to cancel the currently selected EBL.

1.16.3 Relative/True Bearing

If the EBL reading suffix is 'R', it indicates that the reading is relative to the ship's heading. If the suffix is 'T', it is relative to true north. This can be set through the menu.

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the “Display” option and press the **ENT** key to proceed.
3. Move the cursor to the “Bear Type” option. Use the arrow keys to select “Relative” or “True,” then press the **ENT** key to save the change.

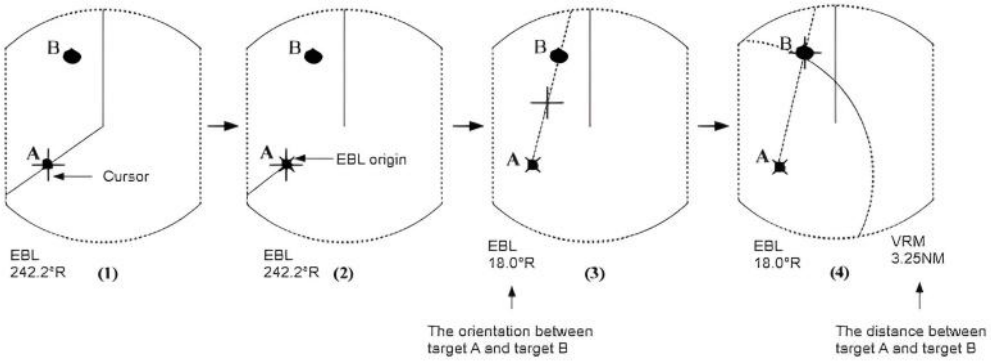


4. Press the **MENU** key twice to close the menu.
5. Note:The cursor's bearing display also changes according to the bear type option.

1.16.4 Measuring the Range and Bearing Between Two Targets

Using EBL offset allows measurement of the bearing and range between two targets.

1. Move the cursor to the center of Target A, press the **EBL** key, select EBL1, and press **ENT**.
2. Press the **EBL OFFSET** key to move the origin of EBL1 (indicated by an "×") to the cursor position.
3. Press the **EBL** key, select EBL1, and press **ENT**. Then use the arrow keys to adjust the bearing of EBL1 so that it bisects Target B. Check the EBL1 reading to determine the bearing between Targets A and B.
4. Press the **VRM** key, select VRM1, and press **ENT**. Then use the arrow keys to adjust the radius of VRM1 so that it is positioned at the inner edge of Target B. Check the VRM1 reading to determine the range between Targets A and B.



1.17 Alarm Zone

Operators can set the size and orientation of the alarm zone based on their needs. When the ships, islands, large land masses, or other objects enter or exit the alarm zone, the system will issue both an audible alarm (beeping sound) and a visual alarm (flashing target) to alert the navigator.

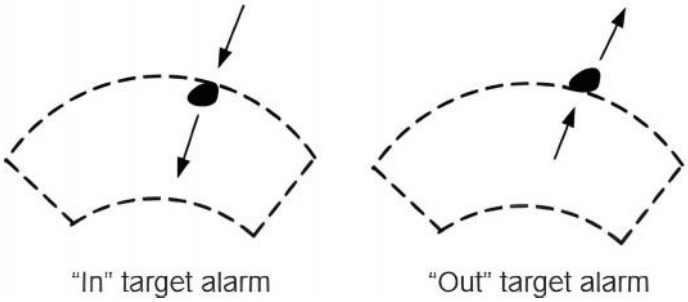
WARNING

Do not depend on one navigation device for the navigation of the ship. The navigator must check all aids available to confirm position. Electronic aids are not a replacement for basic navigation principles and common sense.

- The ARPA automatically tracks an automatically or manually acquired radar target and calculates its course and speed, indicating them by a vector. Since the data from the auto plotter depend on the selected radar targets, the radar must be optimally tuned for use with the auto plotter, to ensure required targets will not be lost or unnecessary targets like sea returns and noise will not be acquired and tracked.
- A target is not always a landmass, reef, ship, but can also be returns from the sea surface and from clutter. As the level of clutter changes with the environment, the operator must correctly adjust the **A/C SEA**, **A/C RAIN** and **GAIN** controls so that the target echoes do not disappear from the radar screen.

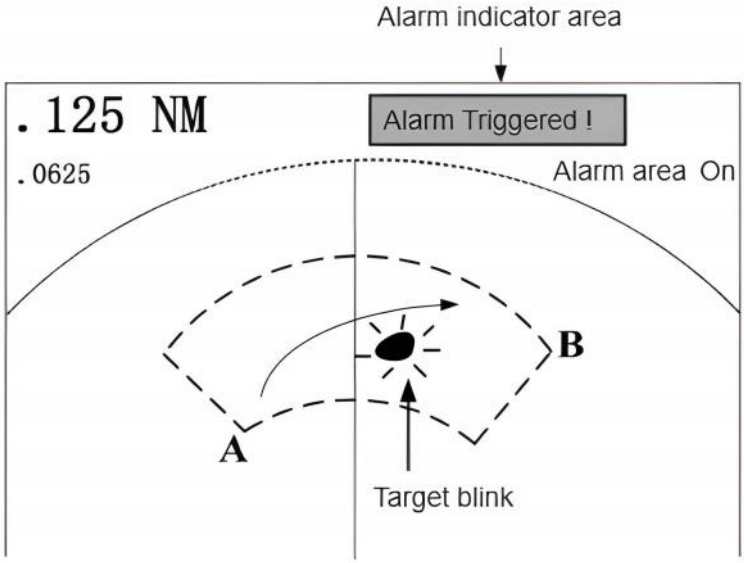
1.17.1 Setting Alarm Mode

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "Mode/Function" submenu and press the **ENT** key.
3. Use the arrow keys to select the alarm zone mode as "In" or "Out" and press the **ENT** key to confirm.
4. Press the **MENU** key twice to close the menu.
   - **In**: The system alarms when there is an echo within the alarm zone.
   - **Out**: The system alarms when there is no echo within the alarm zone.



1.17.2 Setting and Cancelling Alarm Zones

Setting: Move the cursor to the desired starting point A and press the **GZ** key. The screen will display "Alarm ●" in the top right corner, indicating that you can now adjust the alarm zone.Use the arrow keys to move the cursor to the endpoint B. The screen will display a sector-shaped alarm zone drawn clockwise from the starting point to the endpoint.Press the **GZ** key to confirm the alarm zone, or if no further action is taken within 5 seconds, the system will automatically confirm the alarm zone.After confirming the alarm zone, the "Alarm ●" text in the top right corner will disappear, and "Alarm Zone On" will appear.**When the alarm mode is "In"**: The system will sound an alarm (with target flashing and a red warning indicator in the warning area, accompanied by an audible alarm) when an echo is detected within the alarm zone.**When the alarm mode is "Out"**: The system will sound an alarm when there is no echo detected within the alarm zone.



Cancel: For a configured alarm zone, press and hold the **GZ** key for 1 second to cancel the alarm zone.

1.17.3 Mute Alarm

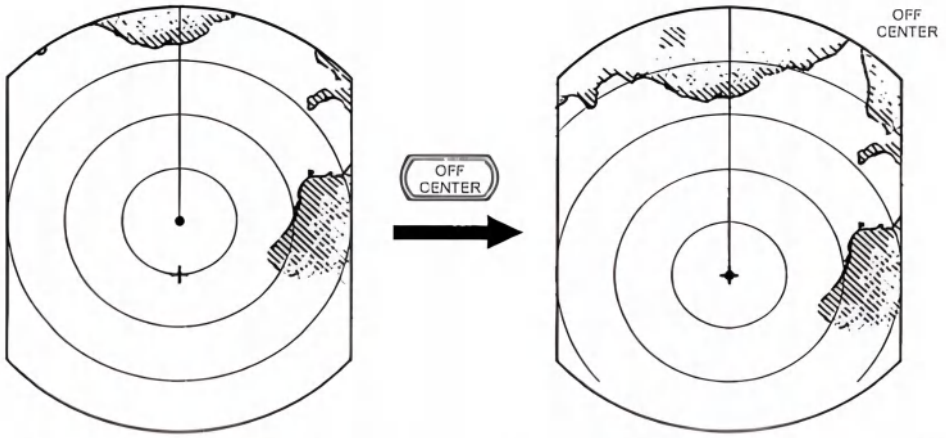
To Mute the Alarm Sound: After setting the alarm zone, press any key to mute the alarm sound. The visual warning (flashing target) will remain active.

To Disable the Alarm Zone Completely: Press the **GZ** key once. The screen will display "Alarm Zone Off" in the top right corner, indicating that both the sound and visual alarms are turned off, but the alarm zone remains set.

To Re-enable the Alarm Zone: Press the **GZ** key again. The screen will display "Alarm Zone On," and the alarm functionality will be reactivated (including both sound and visual alarms).

1.18 Off-center

Without changing the range, the scan center can be shifted to expand the field of view, allowing for a farther view in a specific direction.
Use the arrow keys to place the cursor at a point (the point where you want to set the scan center offset), then press the OFF CENT key. The scan center will shift to the cursor position. Press the OFF CENT key again to cancel the offset function, returning the scan center to the screen center.



①Place the cursor at the desired location

②Press OFFCENTER to move the ship's position to the cursor

Note: If the cursor position exceeds 75% of the current range, pressing the **OFF CENT** key will sound three alarms, indicating that the operation is invalid. Please position the cursor within 75% of the current range and press the key again.

1.19 Zoom

The zoom function allows you to zoom in on a selected area, enlarging it to twice its normal size for a closer view of targets.

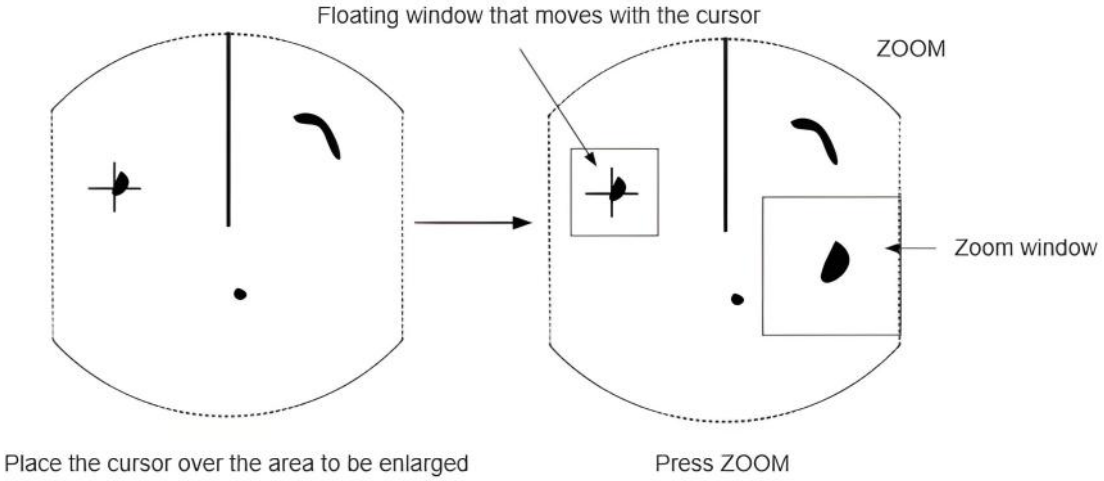
When the zoom function is active, the word “ZOOM” will appear in the upper right corner of the screen, and a floating window that follows the cursor will display the area to be magnified. The position of the zoom window depends on the cursor's location; if the cursor is on the left side of the screen, the zoom window will be on the right side, and vice versa.

Settings:

Press the **Zoom** key to display a floating window that follows the cursor.Use the arrow keys to position the floating window over the area you want to magnify.Press the **Zoom** key again to confirm, or the system will automatically confirm after 5 seconds of inactivity.

Cancel:

Long press the **Zoom** key to cancel the zoom function.



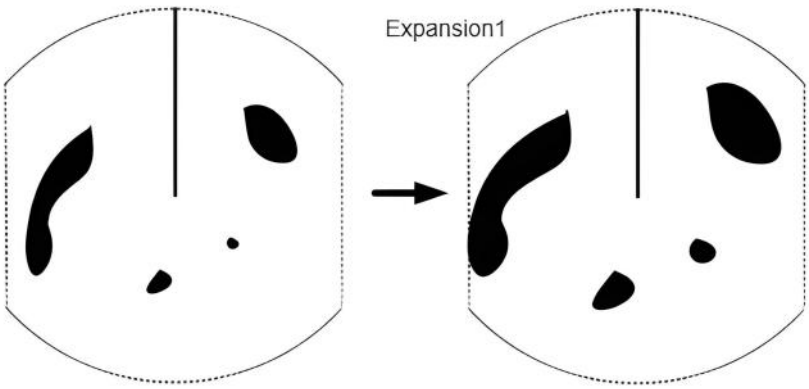
Note: If the cursor is outside the current range, pressing the **Zoom** key will trigger three beeps. Please reposition the cursor within the current range and press the key again.

1.20 Echo Expansion

The echo expansion function enhances the target in both range and bearing to make it easier for the observer to observe the target. In short pulse mode, only the "Expansion 1" function is available. In medium pulse and long pulse modes, there are three functions available: "Expansion 1," "Expansion 2," and "Expansion 3."

Echo Expansion	Bearing	Distance
1	3-point enhancement	1-point enhancement
2	3-point enhancement	1-point enhancement
3	3-point enhancement	1-point enhancement

Press the **A/C RAIN** knob to display "Expansion 1" in the upper left corner of the screen, which enhances the echo (see below).When the current pulse width is set to short pulse, pressing the **A/C RAIN** knob again will turn off the expansion function.When the current pulse width is set to medium pulse or long pulse, pressing the **A/C RAIN** knob again will display "Expansion 2."Pressing the **A/C RAIN** knob once more will display "Expansion 3."Pressing it again will turn off the expansion function.



Note: This function not only expands the target echoes but also enlarges sea clutter and radar co-frequency interference. Therefore, before enabling the echo expansion function, appropriately suppress sea clutter and radar co-frequency interference.

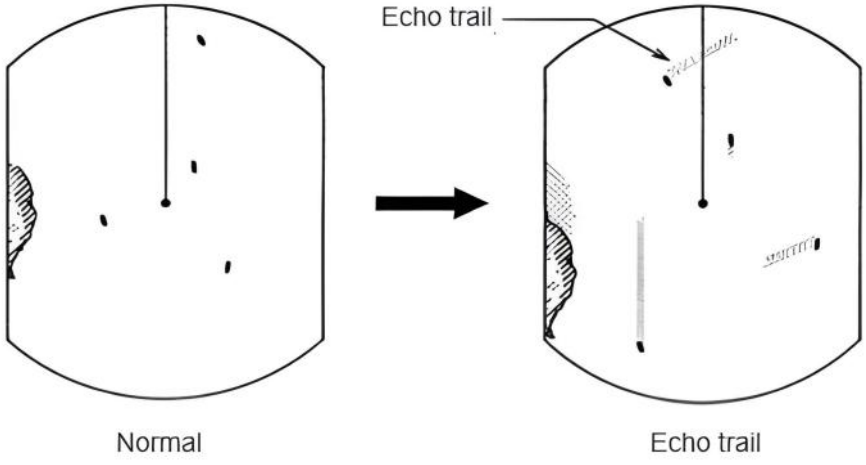
1.21 Echo Trail

Using the echo trail function displays the relative movement of moving targets and the ship through afterglow, which helps alert the operator to potentially dangerous targets.

1.21.1 Trail Time

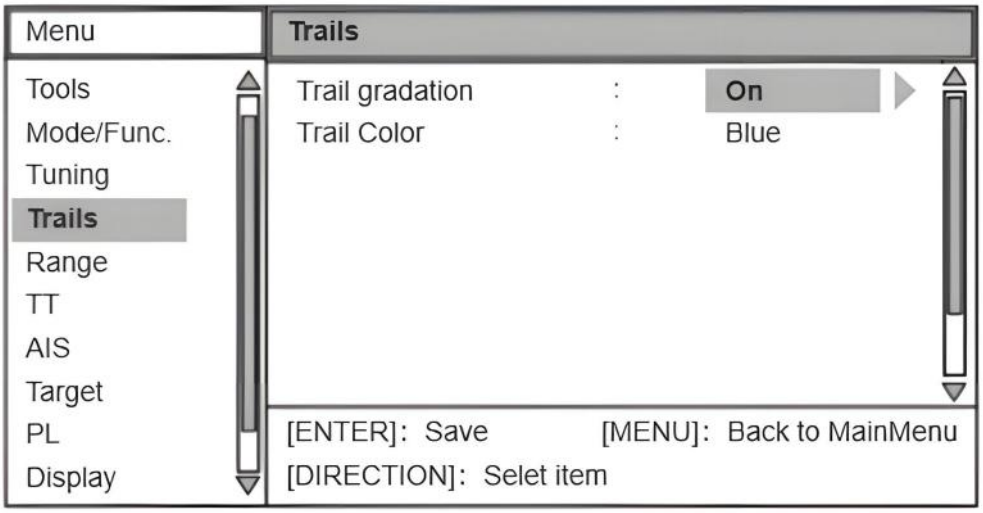
Press the **TRAIL** key to activate the echo trail function. Press the key again to select different trail times. The available trail times are: 15 seconds, 30 seconds, 1 minute, 3 minutes, 6 minutes, 15 minutes, 30 minutes, or continuous trail. The selected trail time is displayed in the top right corner of the screen.

Press and hold the **TRAIL** key for 1 second to turn off the echo trail function.



1.21.2 Trail Gradation Display

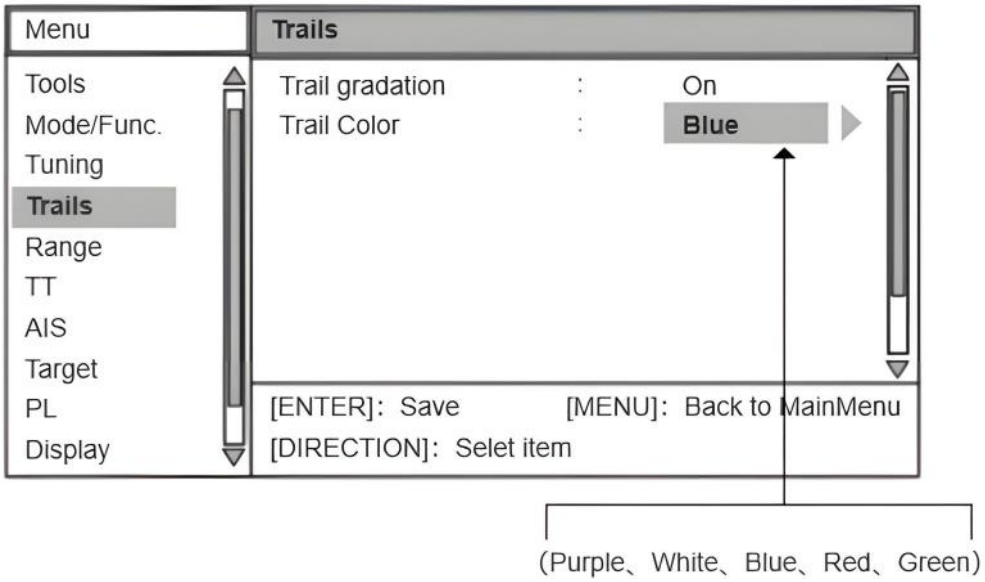
1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "Trails" option and press **ENT** to enter.



3. Move the cursor to the “gradation” option and use the arrow keys to select On or Off. Press **ENT** to confirm.
4. Press **MENU** twice to exit the menu.

1.21.3 Trail Color

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "Trails" option and press **ENT** to enter.



3. Move the cursor to the “Trail Color” option and use the arrow keys to select the desired trail color. Press **ENT** to confirm.
4. Press the **MENU** key twice to exit the menu.

Note: When using the echo trail, if the range, mode changes, or offset is activated, the trail will restart.

1.22 To hide Heading Line

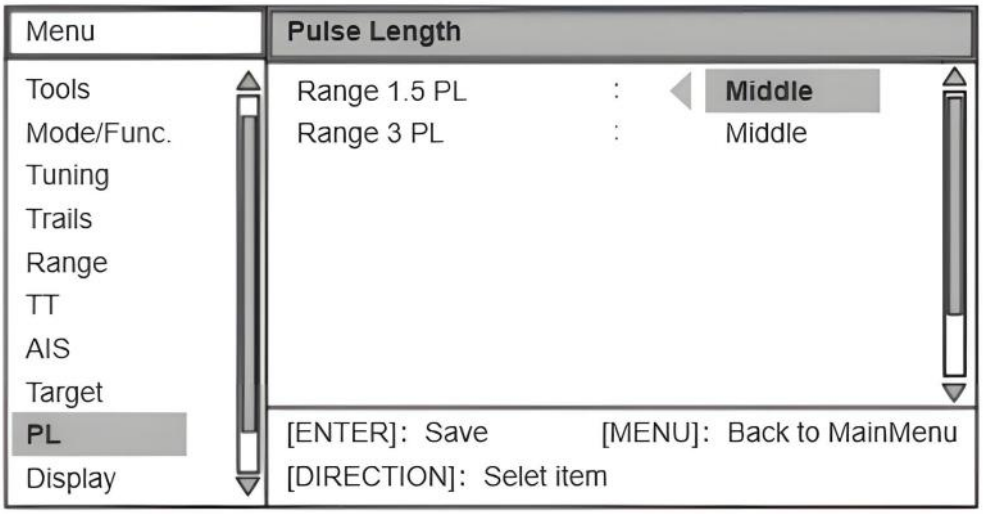
In all display modes, the ship's heading line indicates the ship's direction. In the "Head Up" mode, the ship's heading line is a straight line from the ship to the 0-degree mark at the top of the screen. In other display modes, the ship's heading line changes with the heading data. Disappearing the ship's heading line is useful for observing targets directly in front of the ship.

Hold down the **GAIN** knob to hide the ship's heading line. Release the knob to restore the ship's heading line to its normal display.

1.23 Pulse Selection

The pulse length is displayed in the upper left corner of the screen. It is important to pre-set the appropriate pulse length for a specific range or usage. Choose a long pulse for observing distant targets and a short pulse for closer targets.

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the “PL” option and press **ENT** to enter.



3. Use the arrow keys to select the pulse type under “Range 1.5 PL” or “Range 3 PL” then press **ENT** to confirm.
4. Press the **MENU** key twice to exit the menu.

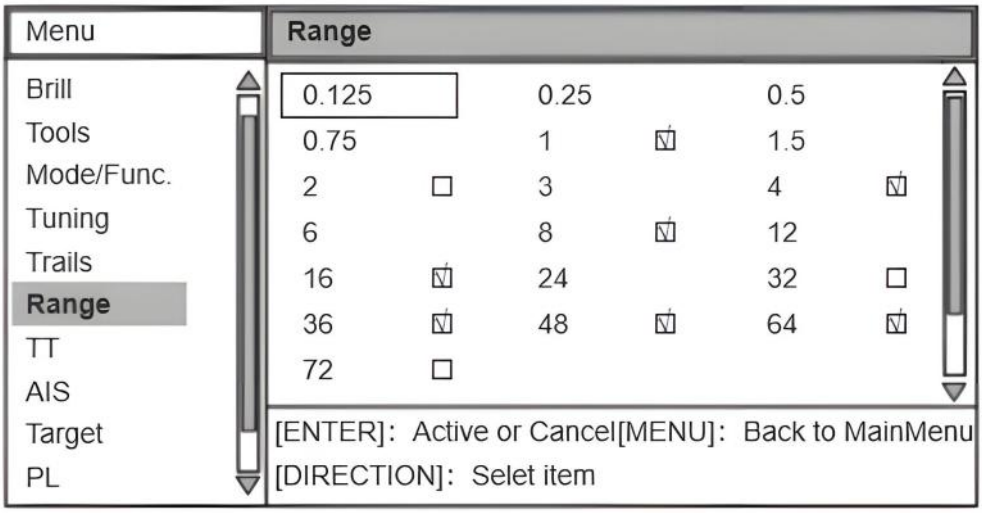
Note: Pulse selection only affects the 1.5 NM and 3 NM ranges.

1.24 Range Selection

Press the **+ RNG -** key to change the range. The selected range and the spacing of the range rings will be displayed in the upper left corner of the screen. Available ranges are: 0.125, 0.25, 0.5, 0.75, 1, 1.5, 2, 3, 4, 6, 8, 12, 16, 24, 32, 36, 48, 64, and 72 NM/KM.

To select a range using the menu, follow these steps:

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the “Range” option and press **ENT** to enter.

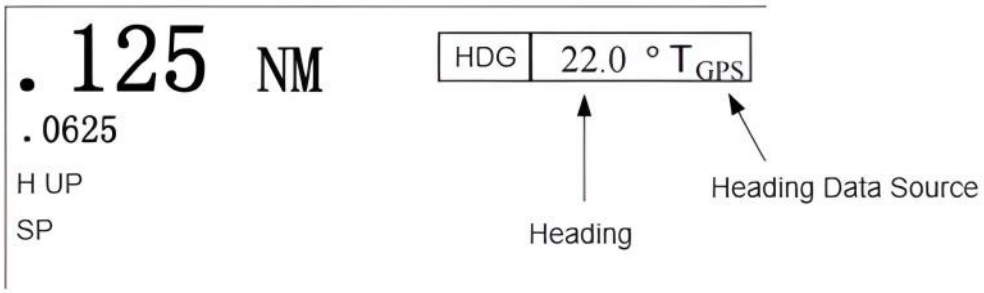


3. Use the arrow keys to select the desired range and press **ENT** to confirm. A checkmark will appear in the rectangle next to the selected range; pressing **ENT** again will remove the checkmark and cancel the selection.
4. Press the **MENU** key twice to exit the menu.

Note: A range with a rectangle around it indicates that it is a user-selectable range. A range without a rectangle is a fixed range and cannot be adjusted by the user.

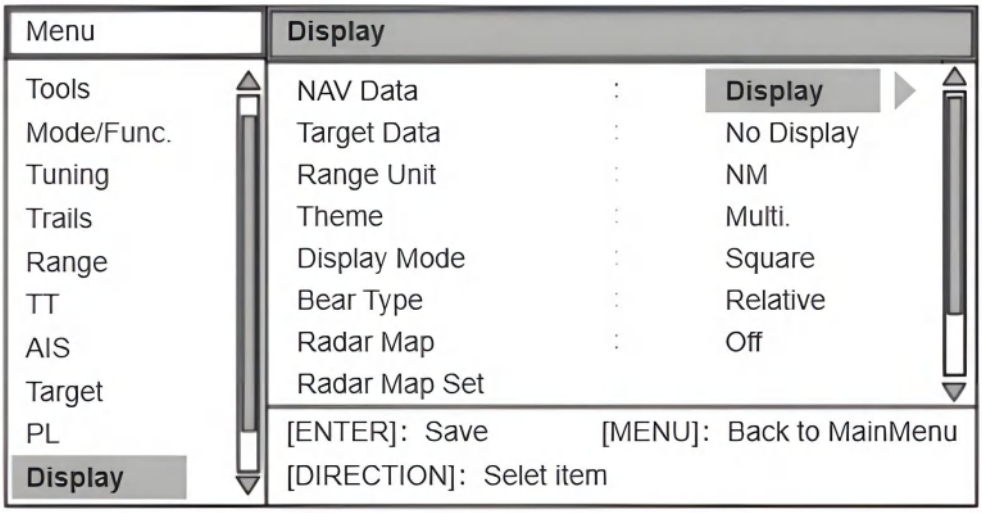
1.25 Navigation Data

If navigation data is input, it will be displayed at the bottom (navigation data) and the top (heading data) of the screen. Heading data will show "T" for true heading or "M" for magnetic heading. The source of heading data will display "GPS" if it comes from the GPS, or "GYRO" if it comes from the gyrocompass. The navigation data at the bottom of the screen can be shown or hidden via the menu.

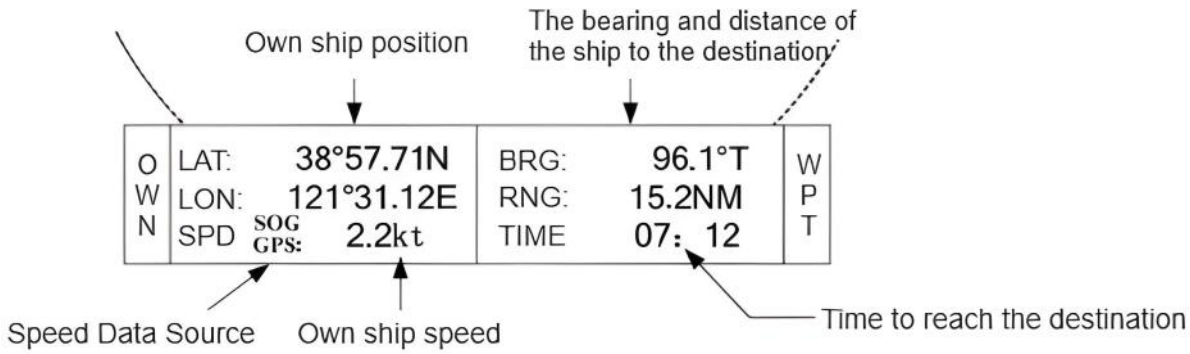


1.25.1 Turning Navigation Data On/Off

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "Display" option and press **ENT** to enter.



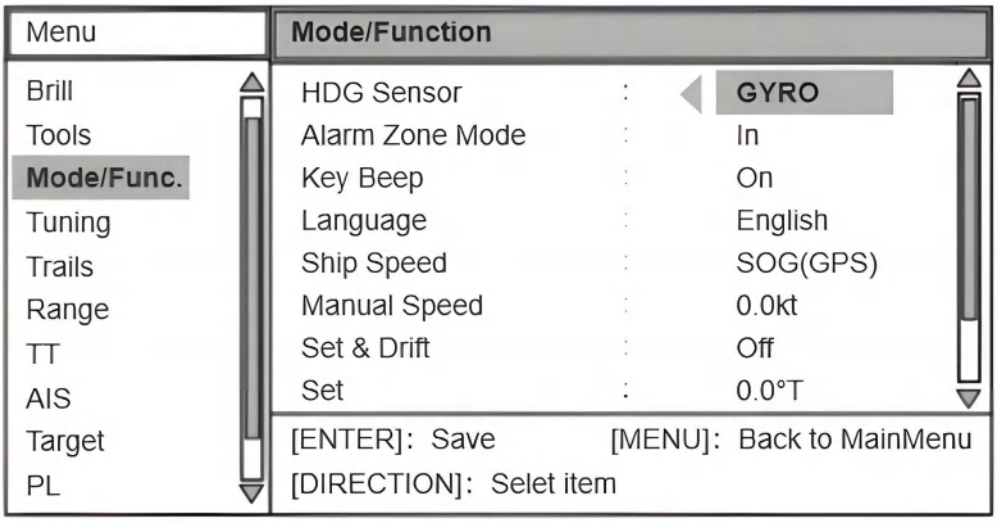
3. Use the arrow keys to choose "Display" (to show navigation data) or "No Display" (to hide navigation data) under "NAV Data," and press **ENT** to confirm.
4. Press the **MENU** key twice to exit the menu.
5. The navigation data will be displayed as follows:



1.25.2 Heading Input Source Selection

The source of heading data displayed at the top of the screen can be selected from two options: "GPS" or "GYRO" You can switch the heading data input source via the **MENU** key.

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "Mode/Function" option and press **ENT** to enter.



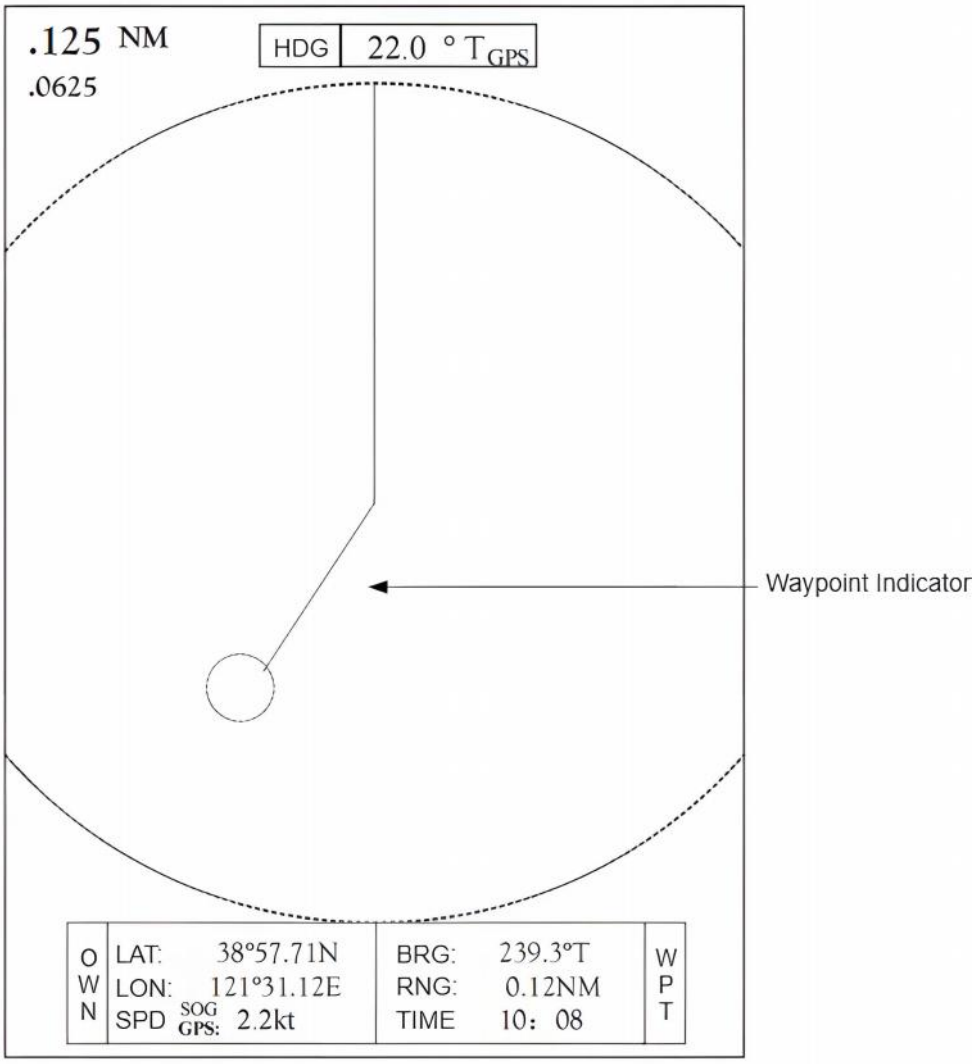
3. Use the arrow keys to choose "Heading Sensor" and select either "GPS" or "GYRO" Press **ENT** to confirm. The heading data displayed at the top of the screen will now reflect the selected input source.
4. Press the **MENU** key twice to exit the menu.

1.26 Waypoint Display

The waypoint display feature allows showing the range and bearing from the ship to the waypoint.

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "Display" menu item and press **ENT** to enter the display submenu.
3. Use the arrow keys to select "Display" under "NAV Data" and press **ENT** to confirm. If valid navigation data is available, the waypoint display will appear as shown in the figure below. If "No Display" is selected under "NAV Data," the waypoint display will disappear.

4. Press the **MENU** key twice to exit the menu.

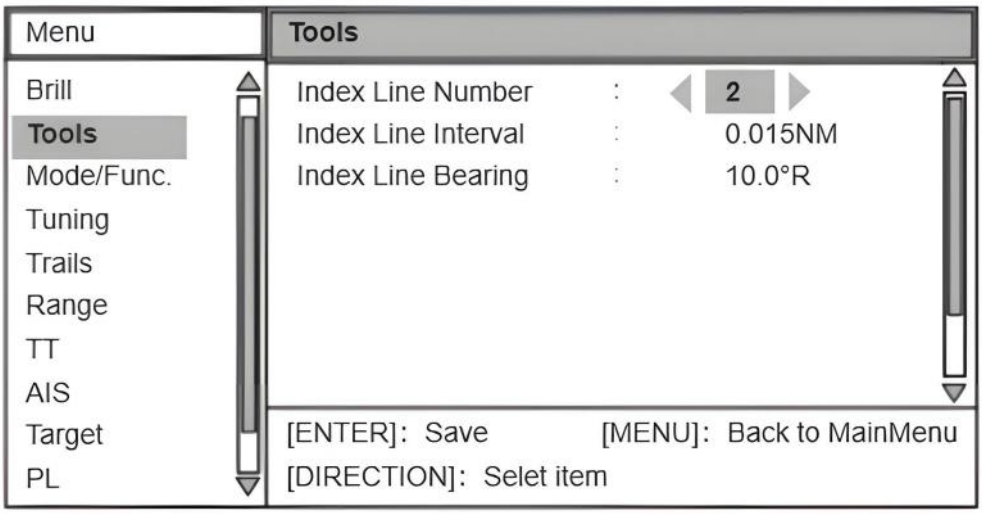


1.27 Index Lines

During navigation, the parallel lines feature is crucial for maintaining a constant distance between the ship and the coastline or between the ship and cooperating ships.

1.27.1 Number of Index Lines

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "Tools" menu item and press **ENT** to enter.



3. Move the cursor to the "Index Line Number" option, use the arrow keys to choose "0", "2", "4", or "6", and press **ENT** to save the change.
4. Press the **MENU** key twice to exit the menu.

1.27.2 Index Line Interval Adjustment

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "Tools" menu item and press **ENT** to enter.
3. Move the cursor to the "Index Line Interval" option, use the arrow keys to adjust the interval, and press **ENT** to save the change.
4. Press the **MENU** key twice to exit the menu.

1.27.3 Index Line Bearing Adjustment

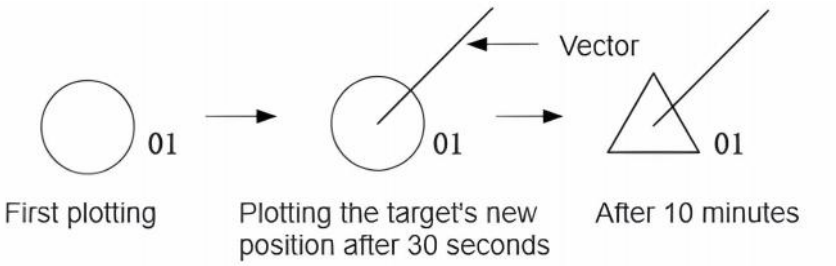
1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "Tools" menu item and press **ENT** to enter the tools submenu.
3. Move the cursor to the "Index Line Bearing" option, use the arrow keys to adjust the bearing, and press **ENT** to save the change.
4. Press the **MENU** key twice to exit the menu.

1.28 Electronic Plotting Aid (EPA)

The EPA feature allows plotting up to 10 targets to estimate their movement trends.

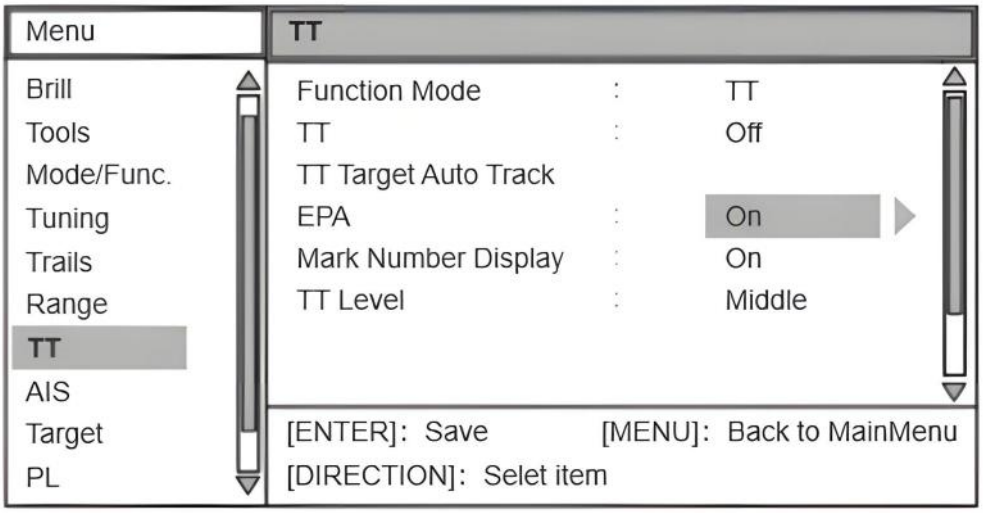
Note: The EPA function requires input of heading and speed data.

You can use target markers to number the targets, and the numbering allows for target data display. Target data is shown in the data display area and includes the target's number, time since the last plot, distance, bearing, heading, speed, CPA (Closest Point of Approach), and TCPA (Time to Closest Point of Approach).



1.28.1 EPA On/Off

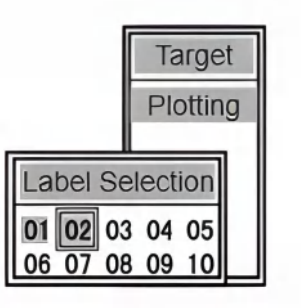
1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "TT" menu item and press **ENT** to enter.



3. Move the cursor to the "Function Mode" option, use the arrow keys to select "EPA", and press **ENT** to save the change.
4. Move the cursor to the "EPA" option, use the arrow keys to select "On" or "Off", and press **ENT** to save the change.
5. If you want to display mark number, move the cursor to the "Mark Number Display" option, use the arrow keys to select "On" or "Off", and press **ENT** to save the change.
6. Press the **MENU** key twice to exit the menu.

1.28.2 Plotting Targets

1. Place the cursor on the target you want to set, and press **ENT**. A small "Target" menu will appear in the bottom right corner of the screen. Use the arrow keys to select the "Plotting" option and press **ENT**. A "Label Selection" menu will appear. Use the arrow keys to choose the desired number and press **ENT**. A plotting symbol will appear at the cursor position. You can correct the plot within 10 seconds by re-plotting the target.



2. After waiting at least 30 seconds, move the cursor to the new position of the target and press **ENT**. The plotting symbol will move to the target's new position.
3. Repeat the same operation for other targets (up to 10 targets).

Note: Plotted targets will be automatically removed after 15 minutes.

1.28.3 True or Relative Vectors

Vectors can be displayed relative to the ship(relative) or with true north as reference (true). The currently used vector mode and vector time will be displayed at the bottom of the screen.

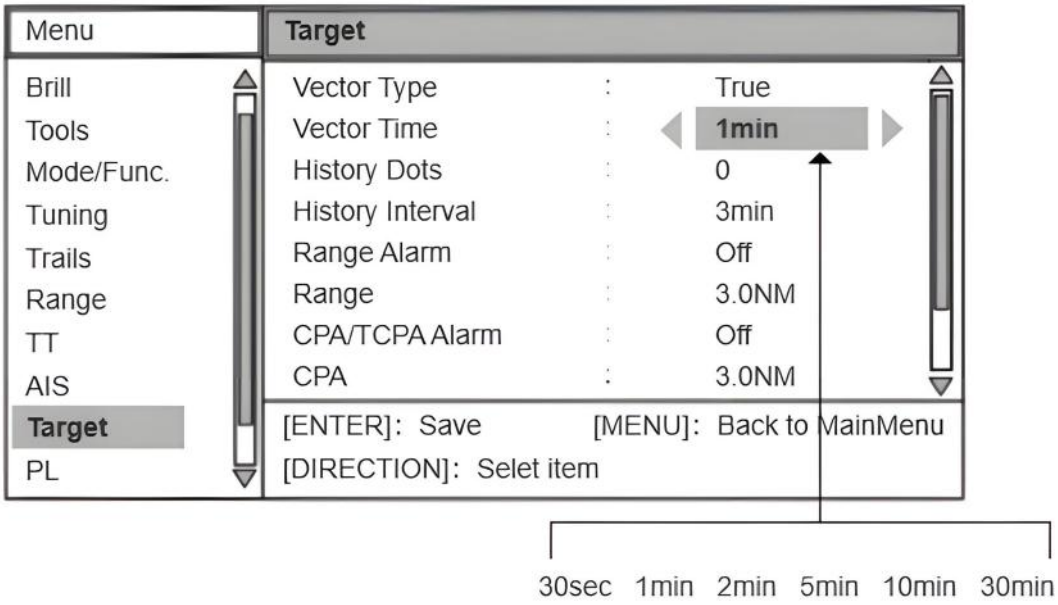
1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "Target" menu item and press **ENT** to enter.
3. Move the cursor to the "Vector Type" option, use the arrow keys to select "True" or "Relative", and press **ENT** to save the change.
4. Press the **MENU** key twice to exit the menu.

1.28.4 Vector Time

Vector time can be set to 30s, 1min, 2min, 5min, 10min or 30min.

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "Target" option and press **ENT** to enter.

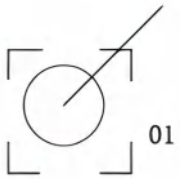
3. Use the arrow keys to select the desired vector time in the "Vector Time" option, and press **ENT** to confirm.
4. Press **MENU** key twice to close the main menu.



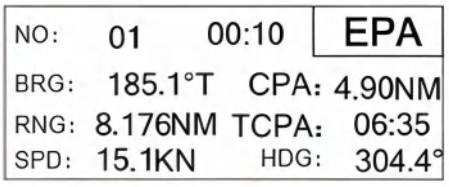
1.28.5 Plotted Target Data

When the EPA function on, move the cursor to the target on the screen and press the **ENT** key. A small menu will appear in the bottom right corner of the screen. Use the arrow keys to select the "Select" option and press the **ENT** key. When the "Display" submenu has the "Target Data" option set to "Display," the target data will be shown in the data display area at the bottom of the screen.

Press to select



Selected target



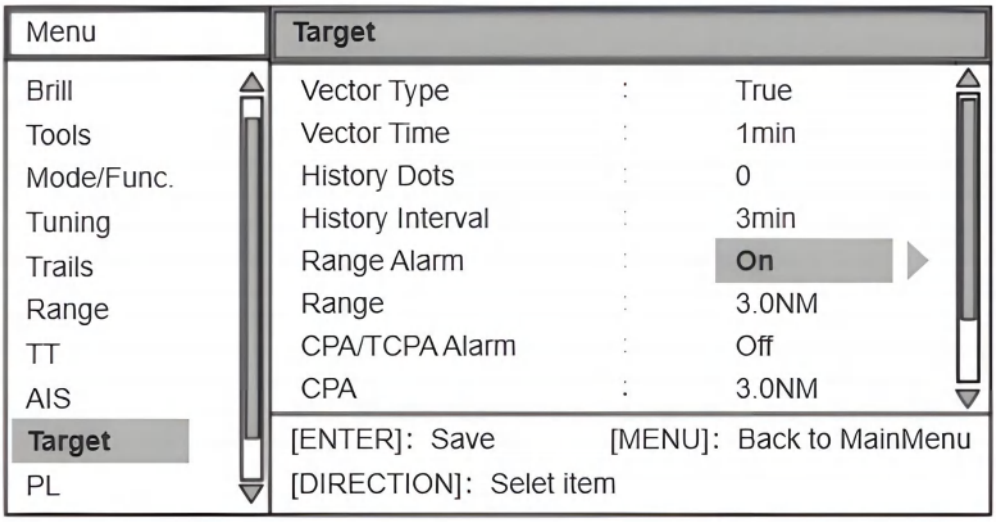
Display data for the selected target

1.28.6 Range Alarm

When an EPA target is within the set alarm range, the range alarm will sound and flash the dangerous target to alert the operator. Press any key to stop the sound alarm. The target will stop flashing only when it is no longer within the set range.

1. Press the **MENU** key to enter the main menu.

2. Use the arrow keys to select the "Target" option and press **ENT** to enter the target submenu.
3. Move the cursor to the "Range Alarm" option, use the arrow keys to select "On" or "Off," and press **ENT** to save the change.
4. Move the cursor to the "Range" option, use the arrow keys to adjust the alarm radius, and press **ENT** to save the change.

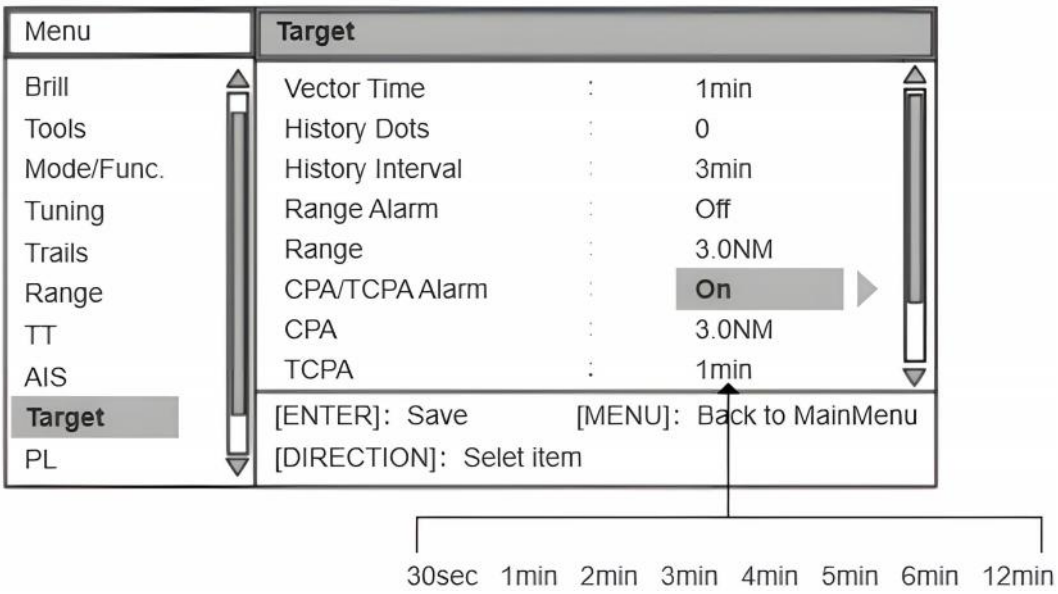


5. Press the **MENU** key twice to exit the menu.

1.28.7 CPA/TCPA Alarm

When any EPA target's predicted CPA is less than the preset CPA alarm range and its predicted TCPA is less than the preset TCPA alarm time, a sound alarm will sound, and the dangerous target will flash. Press any key to stop the sound alarm.

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "Target" option and press **ENT** to enter the target submenu.
3. Move the cursor to the "CPA/TCPA Alarm" option, use the arrow keys to select "On" or "Off," and press **ENT** to save the change.

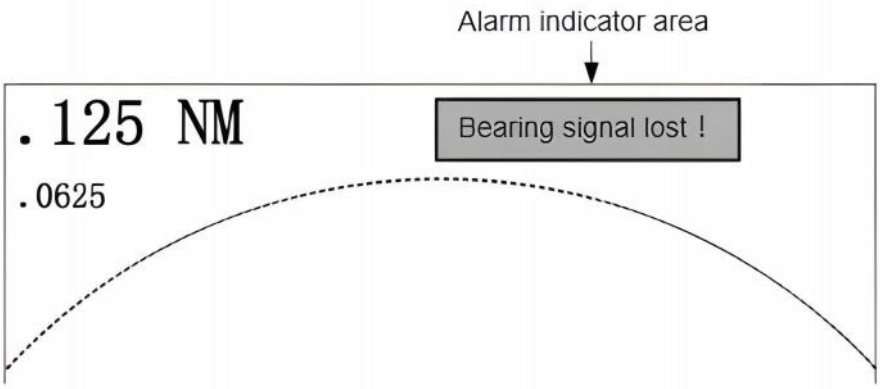


4. Move the cursor to the "CPA" option, use the arrow keys to adjust the CPA alarm range, and press **ENT** to save the change.
5. Move the cursor to the "TCPA" option, use the arrow keys to adjust the TCPA alarm range, and press **ENT** to save the change.
6. Press the **MENU** key twice to exit the menu.

Note: The EPA, TT, and AIS functions share the "Target" submenu features.

1.29 Fault Alarms

When a fault occurs, the radar will issue corresponding visual and audio alarms. To cancel the sound alarm, press any key. The alarm indicator area will display the current alarm signal.



1.29.1 Alarm List

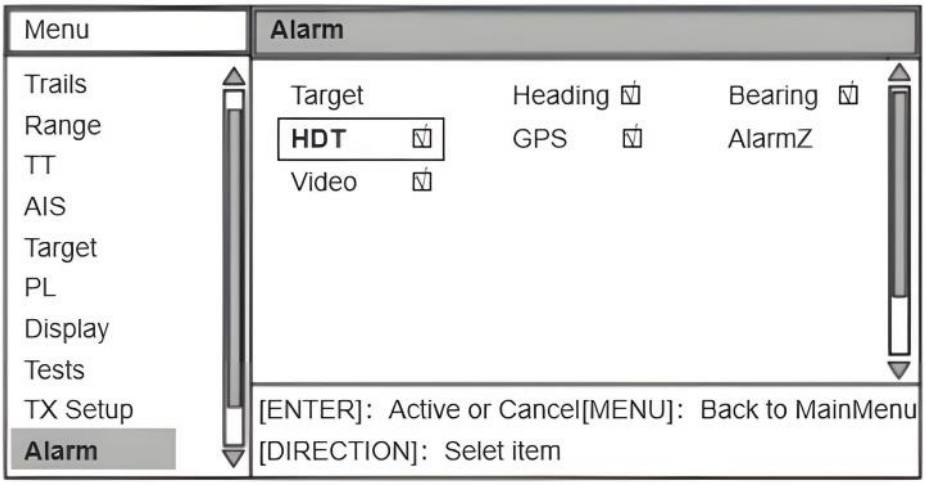
The radar has the following primary alarms:

Alarm Description	Audio Alarm	Visual Alarm
Key Error	Three "beep" sounds	None
HDT Failure	"Beep-beep..." sound	Red "HDT Signal Lost!" in the alarm indicator area; Heading data shows ---.-°T
GPS Failure	"Beep-beep..." sound	Red "GPS Signal Lost!" in the alarm indicator area; Latitude and longitude data show ---°--.--
Route Point Information	"Beep-beep..." sound	Red "Route Point Information ---.---" in the alarm indicator area
Bow Signal Failure	"Beep-beep..." sound	Red "Bow Signal Lost!" in the alarm indicator area
Bearing Signal Failure	"Beep-beep..." sound	Red "Bearing Signal Lost!" in the alarm indicator area
Alarm Zone Triggered	"Beep-beep..." sound	Red "Alarm Zone Triggered!" in the alarm indicator area; Dangerous target will flash
Target Alarm	"Beep-beep..." sound	Red "Target Triggered Alarm!" in the alarm indicator area; Dangerous target will flash
Video Alarm	"Beep-beep..." sound	Red "Video Signal Lost!" in the alarm indicator area

1.29.2 Alarm Settings

To access the alarm settings menu, press and hold the **GAIN** knob and press the **MENU** key five times.

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "Alarm" menu item and press **ENT** to enter.

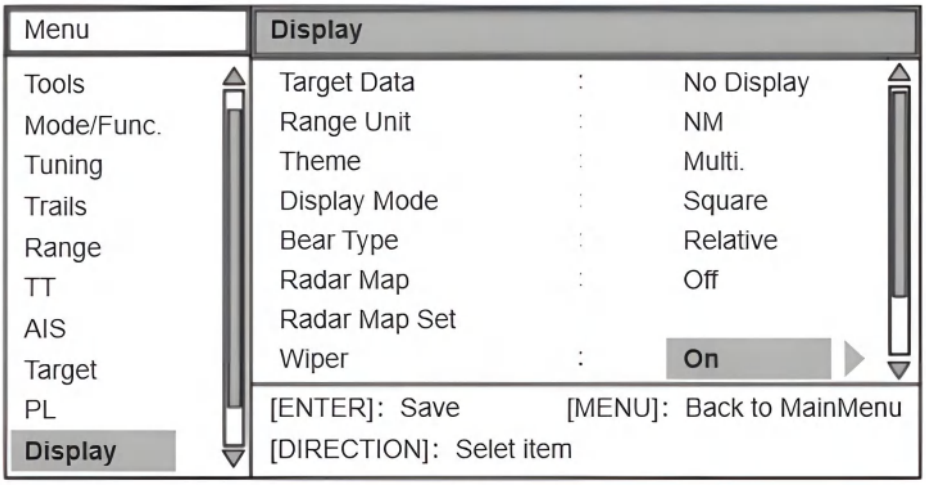


3. Use the arrow keys to select the signals for which you want to set alarms and press **ENT** to save the changes. A checkmark will appear next to the selected alarm signals. To cancel an alarm signal with a checkmark, press **ENT** again.
4. Press the **MENU** key twice to exit the menu.
5. Note: Signals with a rectangular box are user-configurable; signals without a box are non-configurable.

1.30 Wiper Display

The wiper function automatically suppresses weak signals (noise, sea clutter, rain/snow clutter, etc.).

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "Display" menu item and press **ENT** to enter.

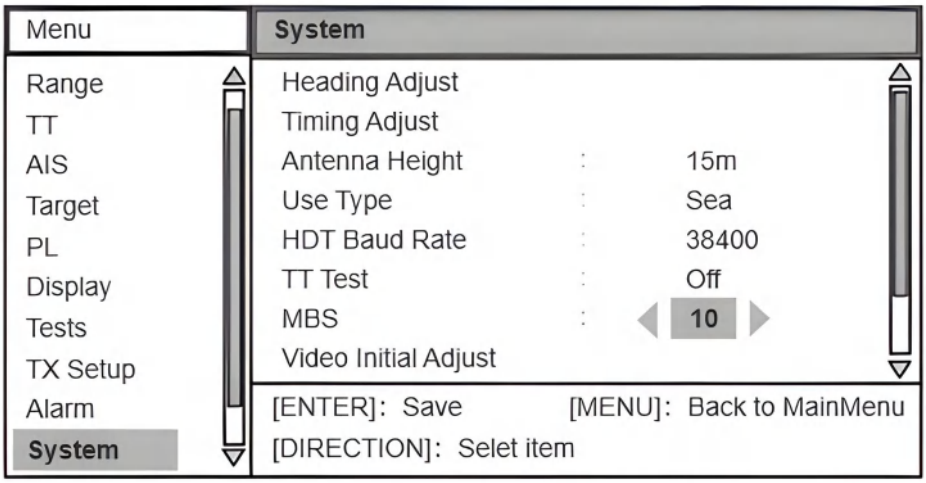


3. Move the cursor to the "Wiper" option, use the arrow keys to select "On" or "Off," and press **ENT** to save the change.
4. Press the **MENU** key twice to exit the menu.

1.31 MBS Adjustment

If there is a missing pulse signal in the center of the screen, perform MBS adjustment.

1. On a long-range radar, wait for ten minutes. Adjust the gain to display a minimal amount of noise on the screen.
2. Select 0.25 nautical miles and adjust the **A/C SEA** knob to suppress sea clutter.
3. Press the **MENU** key to enter the main menu.
4. Use the arrow keys to select the "System" menu item and press **ENT** to enter.

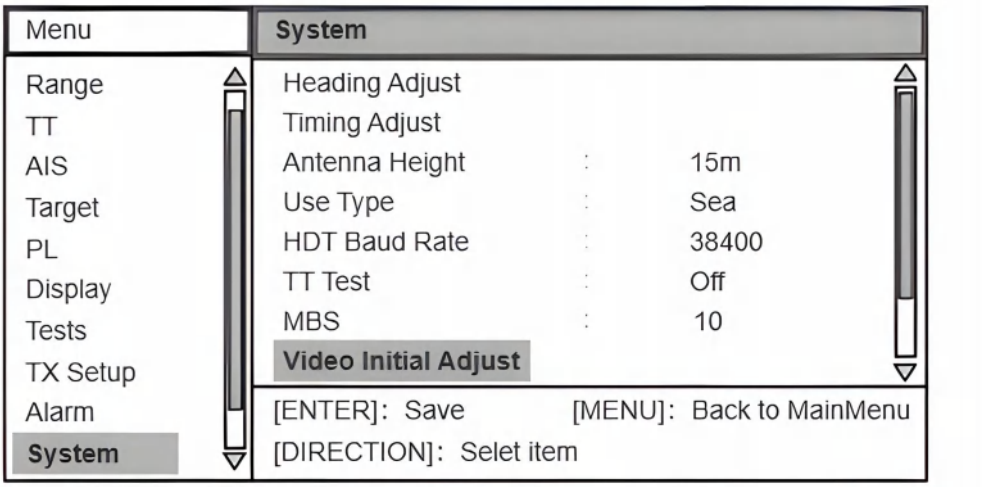


5. Move the cursor to the "MBS" option, use the arrow keys to select the appropriate value (range: 0-30), and press **ENT** to save the changes.
6. Press the **MENU** key twice to close the menu.

1.32 Automatic Video Adjustment

Automatic video adjustment is required during the initial installation of the radar.

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "System" menu item and press **ENT** to enter.



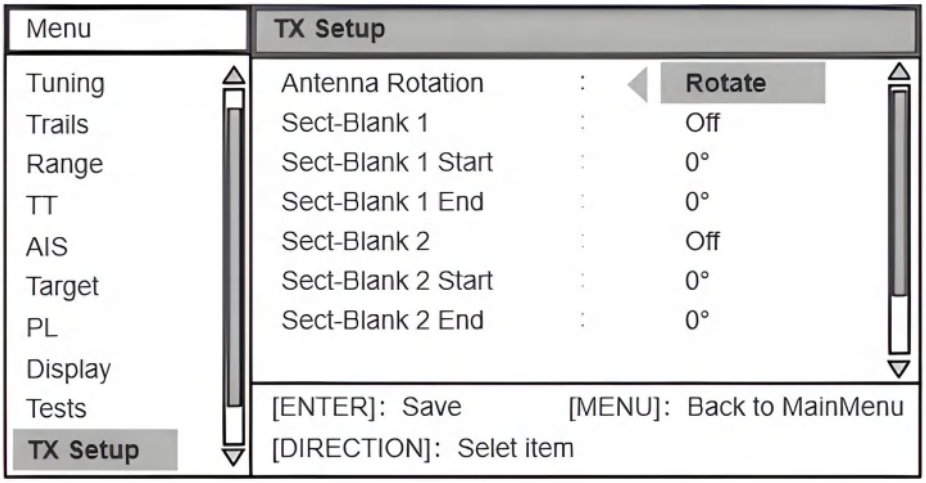
3. Move the cursor to the "Video Initial Adjust" option and press **ENT**. The screen will display "Adjusting..." in the center of the screen. Do not press any other keys during this process. The "Adjusting..." message will disappear once the adjustment is complete.
4. Press the **MENU** key twice to close the menu.

1.33 Transmission Settings

Press and hold the **GAIN** knob and press the **MENU** key five times to access the transmission settings menu.

1.33.1 Transmission Mode

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "TX Setup" menu item and press **ENT** to enter.



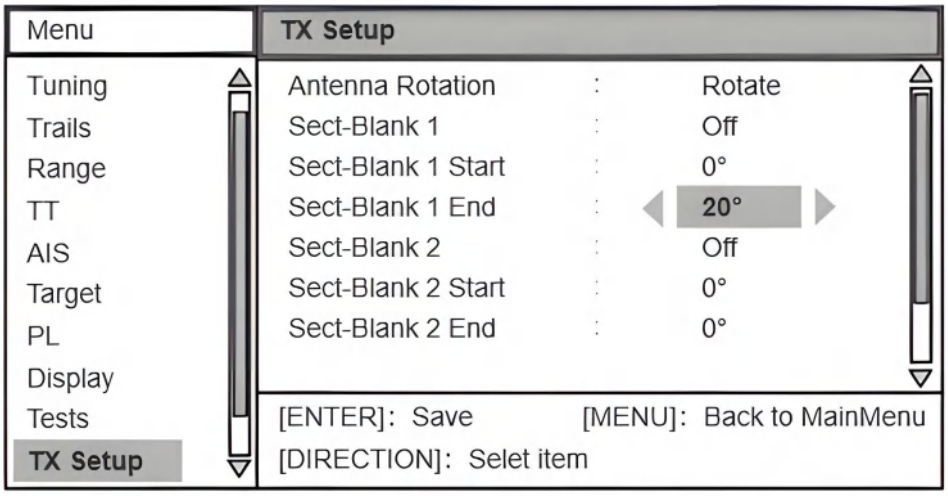
3. Move the cursor to the "Antenna Rotation" option and select either "Rotate" or "No rotate" Press **ENT** to save the changes.

4. Press the **MENU** key twice to close the menu.

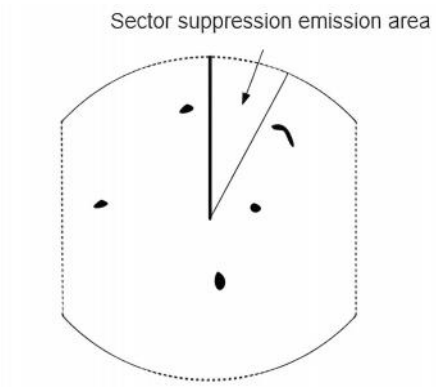
1.33.2 Sector Suppression Transmission

The sector suppression transmission function protects personnel from microwave radiation in selected areas. Two sector suppression zones can be set.

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "TX Setup" menu item and press **ENT** to enter.



3. Move the cursor to the "Sect-Blank 1 (or 2) " option and use the arrow keys to select "On." Press **ENT** to save the changes.
4. Move the cursor to the "Sect-Blank 1 (or 2) Start" option and use the arrow keys to select an appropriate value (range: 0°-359°). Press **ENT** to save the changes.
5. Move the cursor to the "Sect-Blank 1 (or 2) End" option and use the arrow keys to select an appropriate value (range: 0°-359°). Press **ENT** to save the changes.
6. Press the **MENU** key twice to close the menu. The sector suppression effect is as follows.



2. Target Tracking (TT)

The automatic tracking system can manually or automatically acquire and track up to 20 targets. Once a target is acquired, it will be automatically tracked.

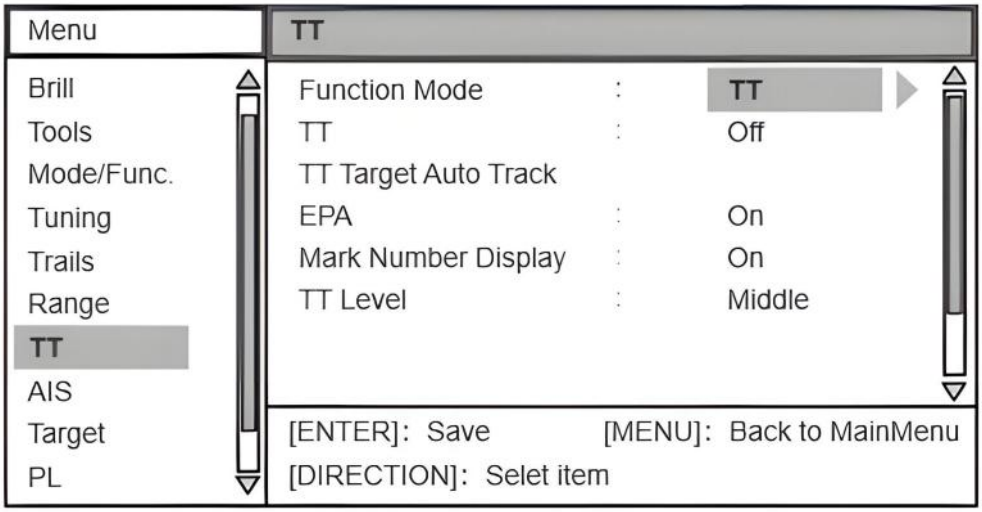
Note: TT functionality requires input from heading data and speed data.

2.1 TT Control Buttons

- **ENT:** Acquire or cancel target acquisition, mark the target.
- **MENU:** Access TT operation targets and TT target data.
- **ARROW KEYS:** Select the target to be acquired, cancel tracking, or display target data.

2.2 TT Function On/Off

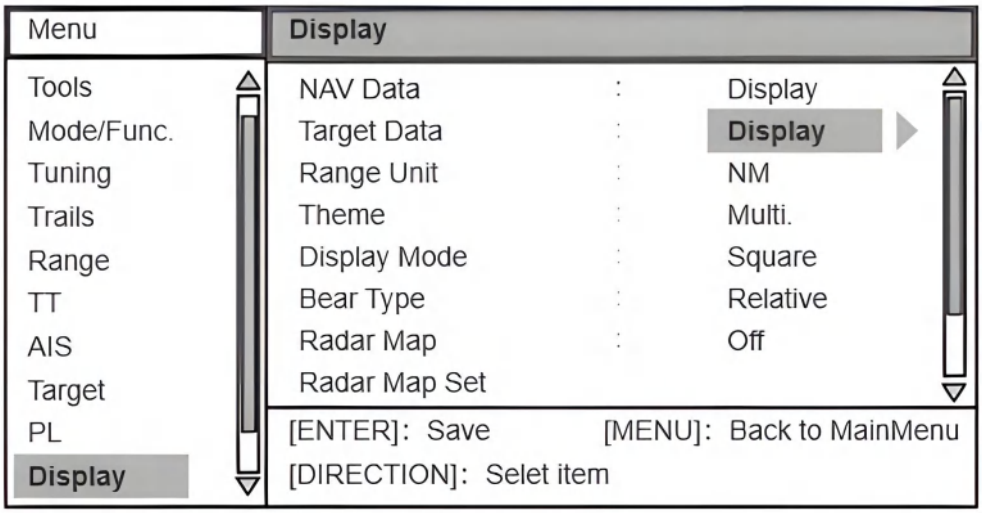
1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "TT" menu item and press **ENT** to enter.



3. Move the cursor to the "Function Mode" option, use the arrow keys to select "TT," and press **ENT** to save the changes.
4. Move the cursor to the "TT" option, use the arrow keys to select "On," and press **ENT** to save the changes.
5. If you want to display target numbers, move the cursor to the "Mark Number Display" option, use the arrow keys to select "On," and press **ENT** to save.
6. Press the **MENU** key twice to close the menu.

2.3 TT Data Display On/Off

1. Press the **MENU** key to open the main menu.
2. Use the arrow keys to select the "Display" menu item and press **ENT** to enter.
3. Select the "Target Data" option, use the arrow keys to select "Display," and press **ENT** to save.
4. Press the **MENU** key twice to close the menu.

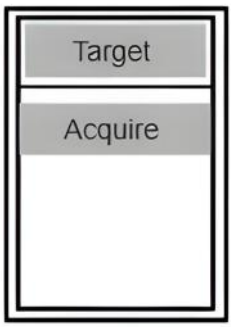


2.4 Acquiring and Tracking Targets

You can manually or automatically acquire and track up to 20 targets.

2.4.1 Manual Acquisition

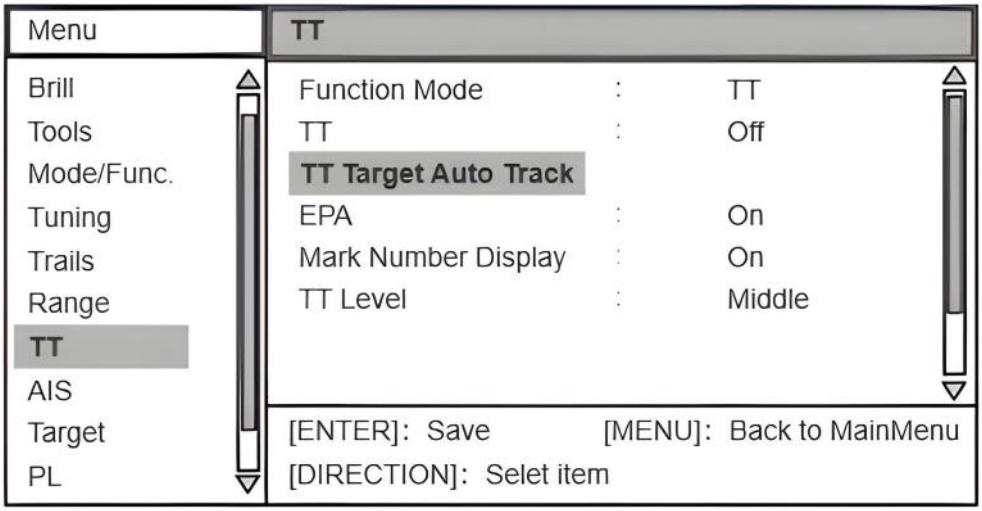
1. Move the cursor to the target you want to acquire.
2. Press **ENT** to enter the "Target" menu.
3. Select the "Acquire" option and press **ENT**.
4. Press the **MENU** key to exit the "Target" menu.



2.4.2 Automatic Acquisition

By setting an automatic acquisition area, TT can automatically acquire up to 20 targets. When TT targets are present, only the remaining number of targets can be automatically acquired. For example, if 16 targets have already been acquired, only 4 targets can be automatically acquired.

1. Press the **MENU** key to enter the main menu.
2. Use the arrow keys to select the "TT" menu item and press **ENT** to enter.

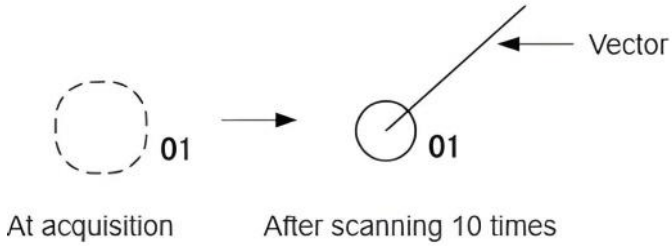


3. Use the arrow keys to select "TT Target Auto Track" and press **ENT** to enable it. The screen will display "AUTOS" in the lower-left corner, indicating that you can set the automatic acquisition range. Press **ENT** once to set the starting point of the automatic acquisition range, move the cursor, and press **ENT** again to set the endpoint. Once the automatic acquisition range is set, the "AUTOS" message will disappear and return to the "TT" submenu.
4. Press the **MENU** key twice to close the menu.

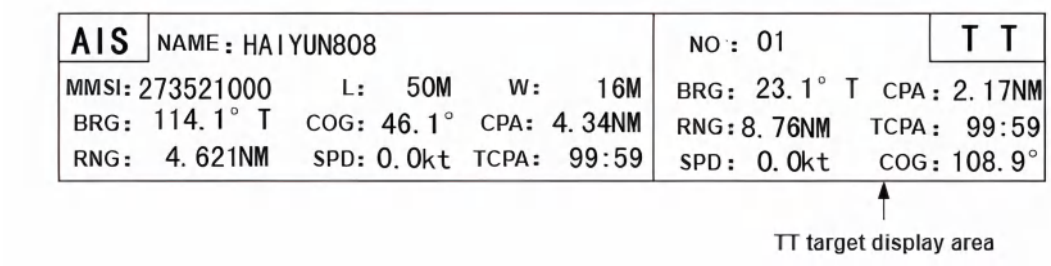
Note: If the automatic acquisition range is not set within 10 seconds, the automatic acquisition function will automatically cancel.

2.5 Target Data

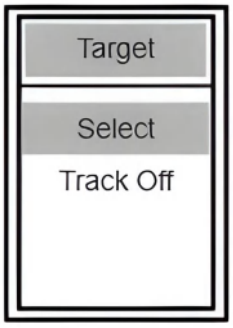
The following changes in marking symbols over time are shown. After acquiring a target, a vector will appear after about 10 sweeps, indicating the target's movement trend.



You can use target numbers to display TT target data. Target data (such as bearing, distance, heading, speed, CPA, and TCPA) is displayed in the TT data display area at the bottom of the screen. To display TT target data, TT display must be enabled, and "Target Data" in the "Display" submenu must be set to "Display" The displayed TT data is as shown below.



1. Move the cursor to the TT target for which you want to display data.
2. Press **ENT** to display the "Target" menu.
3. Select the "Selected" option and press **ENT**.



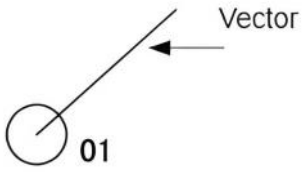
The corresponding target data will be displayed in the data display area.

2.6 Terminating TT Target Tracking

1. Move the cursor to the acquired target.
2. Press **ENT** to enter the "Target" menu.
3. Use the arrow keys to select the "Track Off" option.
4. Press **MENU** to exit the "Target" menu.

2.7 Vector Attributes

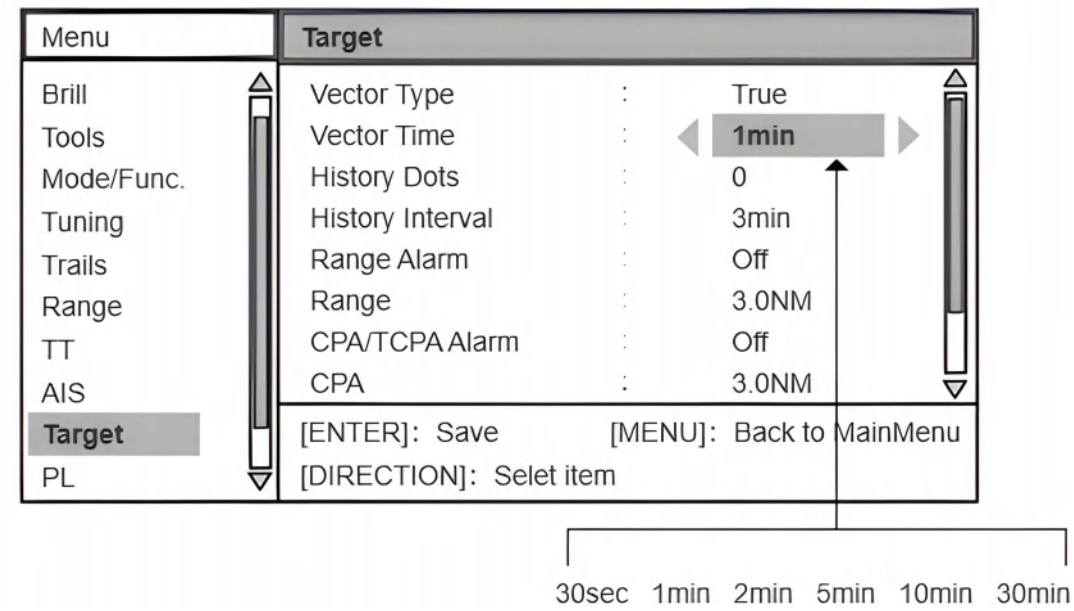
A vector extends from a tracked target and shows the target's speed and heading. At the end of the selected vector time, the vector head displays the predicted position of the target. It can be used to estimate collision risks with all targets by extending the vector length (time). The currently used vector mode and vector time are displayed at the bottom of the screen.



Vector Time

Vector time can be set to 30s, 1min, 2min, 5min, 10min, or 30min.

1. Press **MENU** to enter the main menu.
2. Use the arrow keys to select the "Target" option and press **ENT** to enter.
3. Use the arrow keys to select the desired vector time and press **ENT** to confirm.



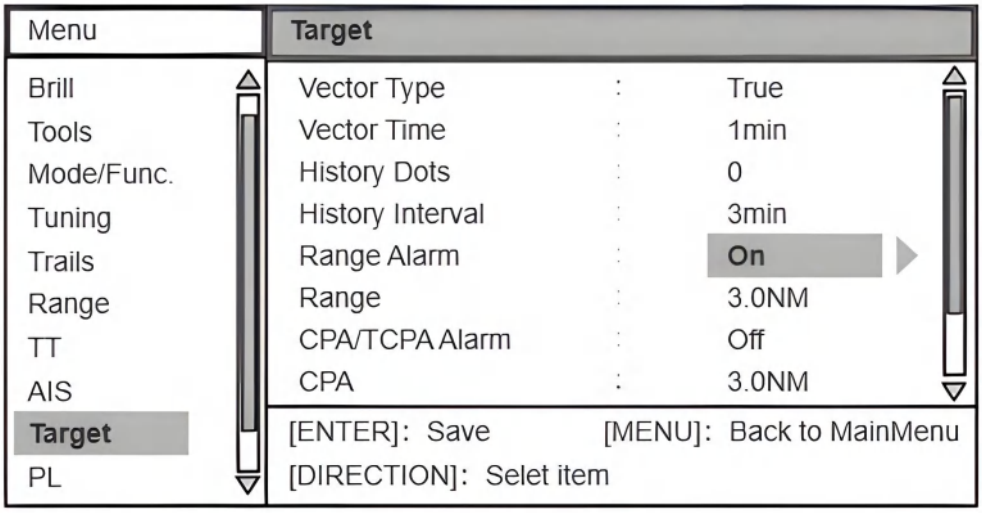
4. Press **MENU** twice to close the menu.

2.8 Range Alarm

When a TT target is within the set alarm range, a range alarm will sound and the dangerous target will flash to alert the operator. Press any key to stop the

sound alarm. The target will only stop flashing when it is no longer within the set distance.

1. Press **MENU** to enter the main menu.
2. Use the arrow keys to select the "Target" option and press **ENT** to enter.
3. Move the cursor to the "Range Alarm" option, use the arrow keys to select "On" or "Off," and press **ENT** to save the changes.
4. Move the cursor to the "Range" option, use the arrow keys to adjust the alarm radius, and press **ENT** to save the changes.

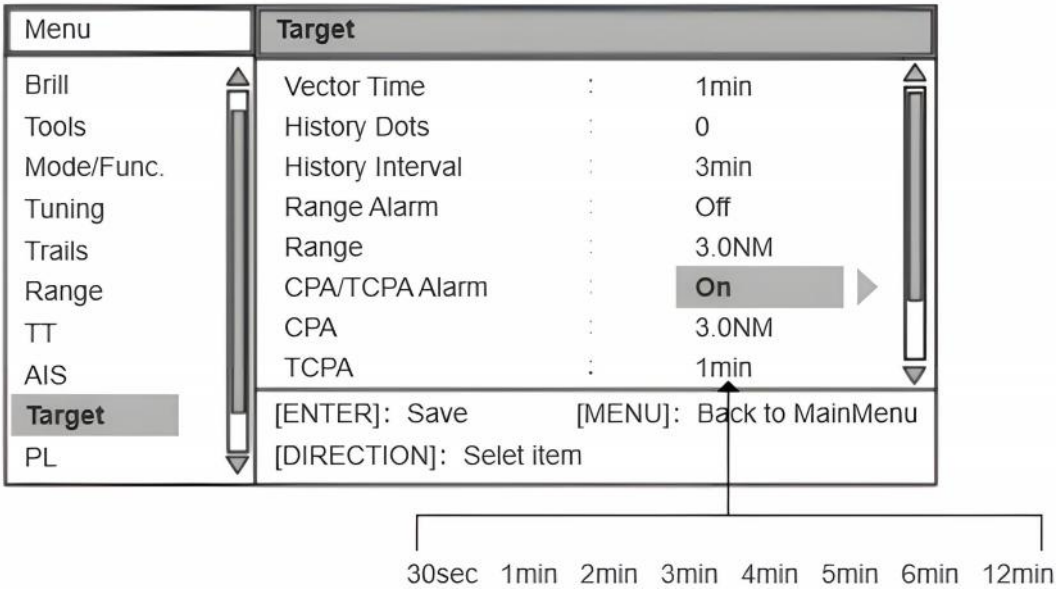


5. Press **MENU** twice to close the menu.

2.9 CPA/TCPA Alarm

When any TT target's predicted CPA is less than the preset CPA alarm range and its predicted TCPA is less than the preset TCPA alarm time, a sound alarm will activate and the dangerous target will flash. Press any key to stop the sound alarm. The target will stop flashing when the ship's CPA and TCPA exceed the CPA and TCPA alarm settings.

1. Press **MENU** to enter the main menu.
2. Use the arrow keys to select the "Target" option and press **ENT** to enter the target submenu.
3. Move the cursor to the "CPA/TCPA Alarm" option, use the arrow keys to select "On" or "Off," and press **ENT** to save the changes.

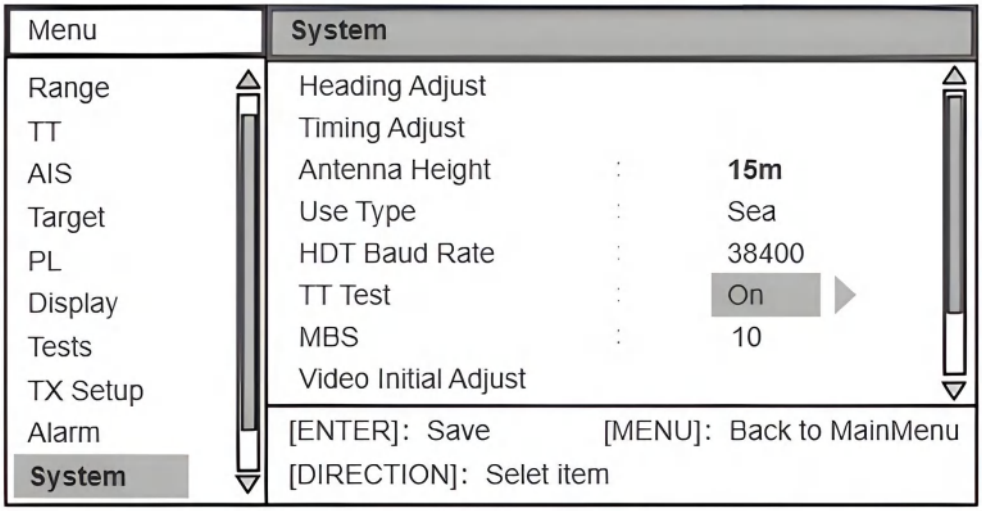


4. Move the cursor to the "CPA" option, use the arrow keys to adjust the alarm CPA range, and press **ENT** to save the changes.
5. Move the cursor to the "TCPA" option, use the arrow keys to adjust the alarm TCPA range, and press **ENT** to save the changes.
6. Press **MENU** twice to close the menu.

2.10 TT Performance Test

TT Test is provided to evaluate the overall performance of TT. Once the TT Test is activated, an "S" will appear at the bottom of the screen. You can terminate the test at any time using the menu (select "Close" in the TT Test option in the menu).

1. Press **MENU** to enter the main menu.
2. Use the arrow keys to select the "System" option and press **ENT** to enter.
3. Move the cursor to the "TT Test" option, use the arrow keys to select "On" or "Off," and press **ENT** to save the changes.
4. Press **MENU** twice to close the menu.



2.11 Factors Affecting TT Function

Sea Wave Echo: If the radar sea clutter control knob is properly adjusted, it should not be severely affected, as it will filter out the corresponding clutter.

Rain and Snow Clutter: Clutter may interfere with detecting and tracking targets. Adjust the A/C RAIN control knob appropriately.

Low Cloud Layers: Usually do not cause significant issues. If necessary, adjust the A/C RAIN control knob appropriately.

Non-Synchronous Transmission: No impact.

Low Gain: When the radar receiver gain is insufficient or too low, some distant targets may not be detected. One or more targets may be missed and will only appear after increasing the gain control (GAIN knob).

Second Echo: When radar beams experience super refraction, some strong echoes may be received, which will appear as different scans due to the long distance. This indicates incorrect distance. If the second and third tracking echoes meet detection and tracking standards, they can be tracked, but target heading and speed data may be inaccurate.

Blind Spots and Shadow Areas: Radar shadow areas or blind spots caused by obstacles such as ship's chimneys and masts can block the radar beam, reducing its intensity in a particular direction. This may cause some targets to be undetectable. After a target disappears from the radar screen, if it remains

in a blind spot, the TT system will quickly lose the target. However, when these targets move out of the blind spot, they can be detected and tracked again.

Indirect Echoes: Close targets can usually be directly detected but may also receive reflected waves from large flat surfaces. This can lead to multiple echoes at different distances displayed on the radar screen. If false echoes are detected after several scans, TT will also detect and track them. Reducing radar gain can eliminate multiple echoes, but it also reduces distance detection capability, so it should be handled carefully.

Radar Interference: If other radars are operating nearby, strong interference signals may be received, and spiral patterns or false targets may briefly appear. Proper adjustment of interference suppression can clear these displays.

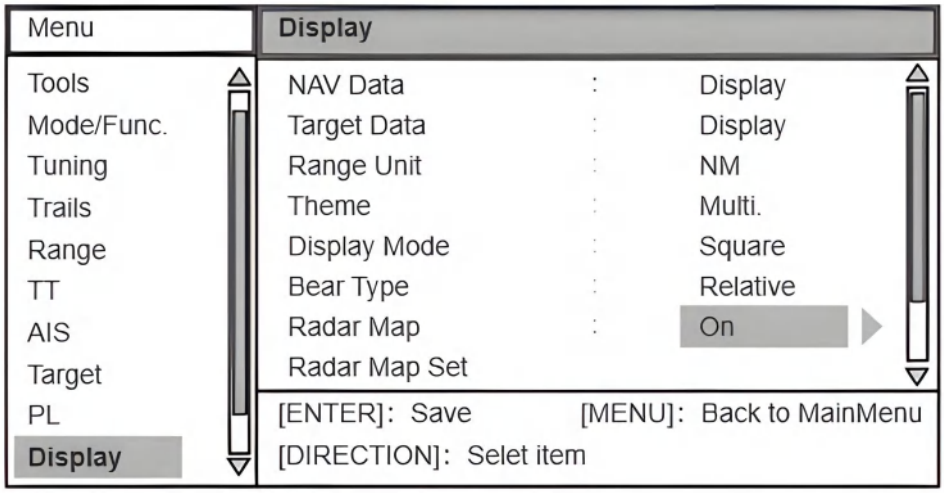
3. Radar Map

The radar map is a combination of various map lines and symbols, which users can create in real time. Map data can be stored for repeated use. The radar map function is only available in True North Up mode. The radar map reference coordinate system is WGS_84.

3.1 Radar Map On/Off

Turning the radar map on or off is done through the menu.

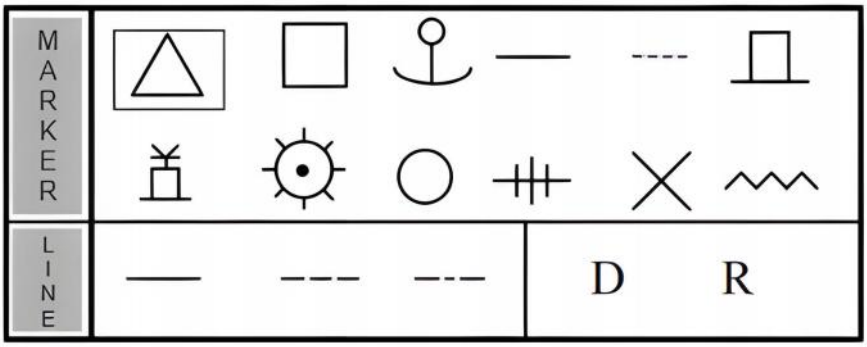
1. Press **MENU** to enter the main menu.
2. Use the arrow keys to select the "Display" menu item and press **ENT** to enter.



3. Move the cursor to the "Radar Map" option, use the arrow keys to select "Display" or "No Display" and press **ENT** to save the changes.
4. Press **MENU** twice to close the menu.

3.2 Adding Radar Map Symbols and Lines

1. Press **MENU** to enter the main menu.
2. Use the arrow keys to select "Display" and press **ENT** to enter the display settings submenu.
3. Move the cursor to the "Radar Map Set" option and press **ENT**. The menu will disappear, and a small menu for symbols and lines will appear at the bottom right of the screen.



4. In the small menu, use the arrow keys to select the desired symbol or line, press **ENT** to select it, and then move the cursor to the appropriate location and press **ENT** to set it. To set the next symbol or line, press **MENU** to reselect and repeat the steps.

3.3 Clearing Radar Map Symbols and Lines

1. Press **MENU** to enter the main menu.
2. Use the arrow keys to select "Display" and press **ENT** to enter the display settings submenu.
3. Move the cursor to the "Radar Map Set" option and press **ENT**. In the small menu, select "D" to delete, press **ENT**, then use the arrow keys to select the symbol or line to delete on the screen, and press **ENT** again to delete it.

3.4 Adjusting Radar Map Symbols and Lines

1. Press **MENU** to enter the main menu.

2. Use the arrow keys to select "Display" and press **ENT** to enter the display settings submenu.
3. Move the cursor to the "Radar Map Set" option and press **ENT**. In the small menu, select "R" to adjust, press **ENT**, then use the arrow keys to select the symbol or line to adjust on the screen. Press **ENT** again to select it, and the symbol or line will move with the cursor. Move the symbol or line to the new position and press **ENT** again to complete the adjustment.

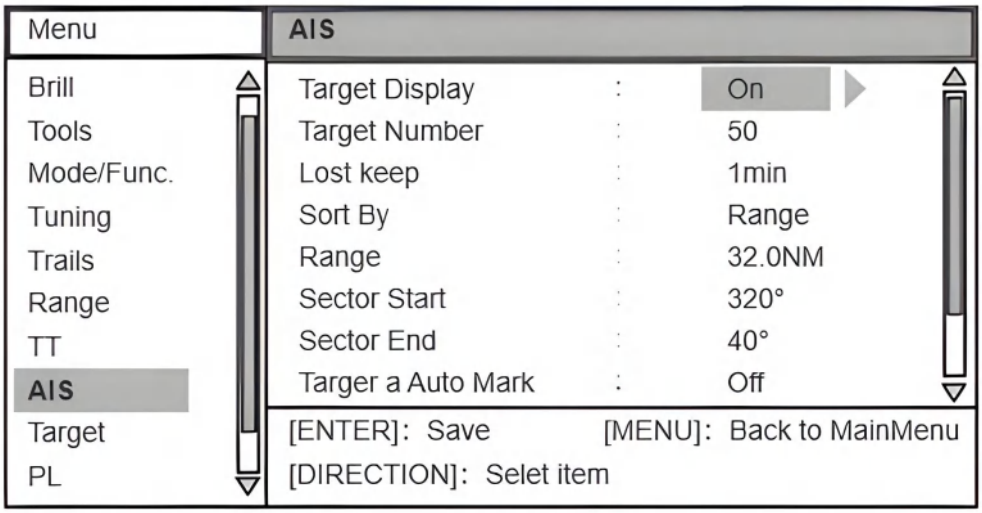
4. AIS Operations

Connected to the AIS (Automatic Identification System), the radar can display the names, positions, and other navigation data of up to 100 ships equipped with AIS.

4.1 AIS Function On/Off

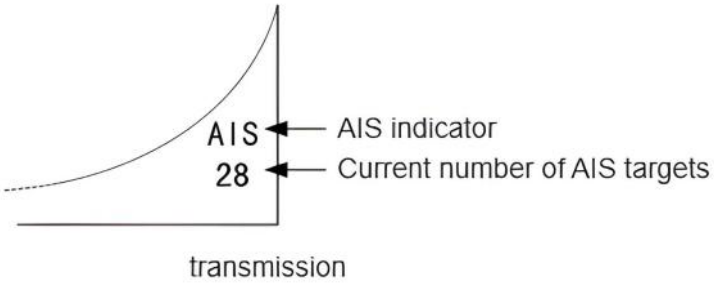
The AIS function is controlled through the menu. When AIS is on, the radar processes AIS data and displays AIS targets on the screen (transmitting status).

1. Press **MENU** to enter the main menu.
2. Use the arrow keys to select the "AIS" menu item and press **ENT** to enter.



3. Move the cursor to the "Target Display" option, use the arrow keys to select "On" or "Off" and press **ENT** to save the changes.
4. Press **MENU** twice to close the menu.

The screen will display an "AIS" indicator in the bottom right corner, indicating that the AIS function is on. When transmitting, the number of current AIS targets will be shown below the "AIS" indicator.



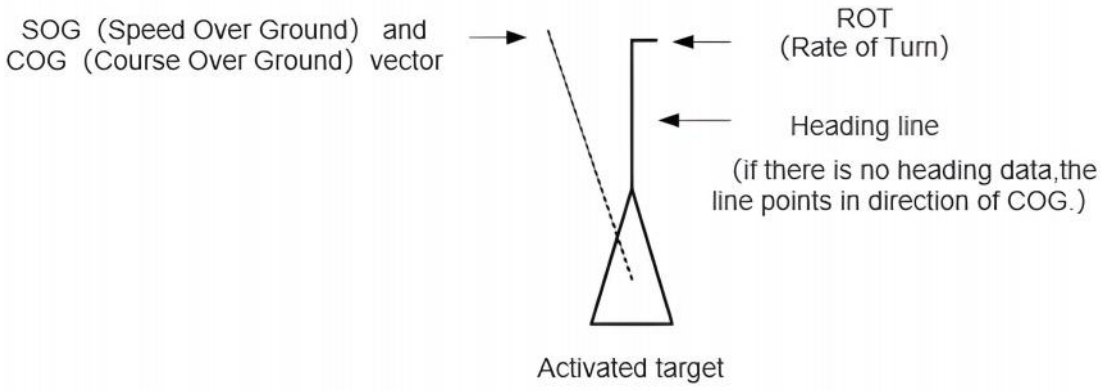
4.2 AIS Targets

4.2.1 Basic Target Status

When the AIS function is on and transmitting, AIS targets will be displayed in one of three basic statuses:

Sleeping Target: Default display mode, showing the target's position and heading direction.

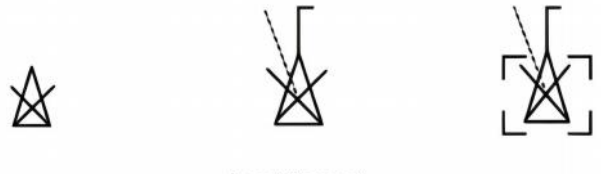
Active Target: Enlarges the target display, adds Rate of Turn (ROT) and Speed Over Ground (SOG) and Course Over Ground (COG) vectors.



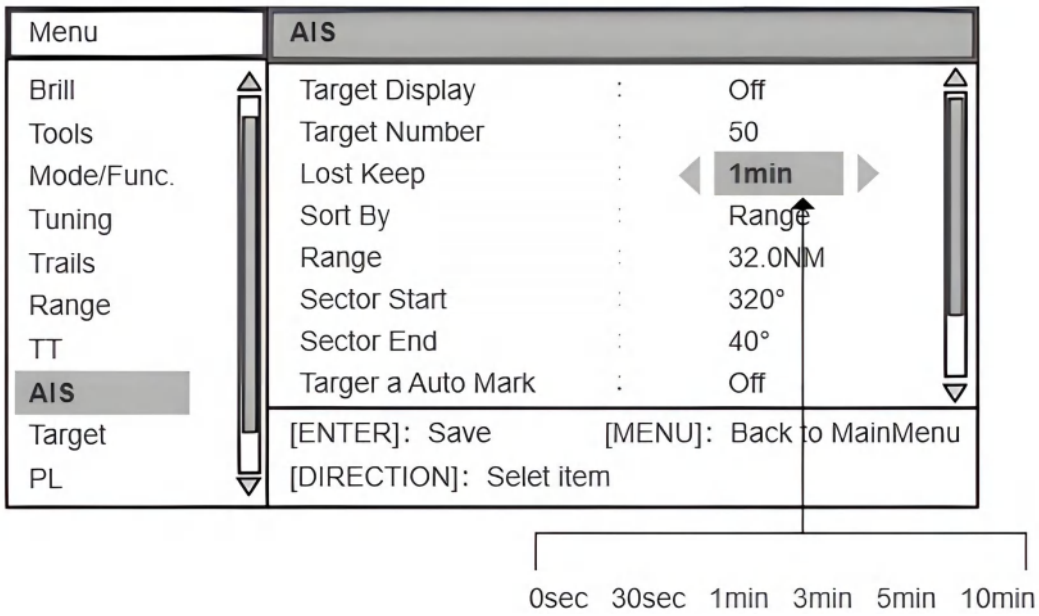
Selected Target: Adds a selection box to the active target, and when AIS data display is on, additional information about the target will be shown. Only one target can be selected at a time.

4.2.2 Lost Targets

If data from a target is not received within the specified time, it becomes a lost target. The display will show this status. Lost targets will be automatically deleted after a certain period, which can be set through the AIS submenu:



1. Press **MENU** to open the main menu.
2. Use the arrow keys to select the "AIS" menu item and press **ENT** to enter.
3. Select "Lost Keep" use the arrow keys to set the time, and press **ENT** to save.



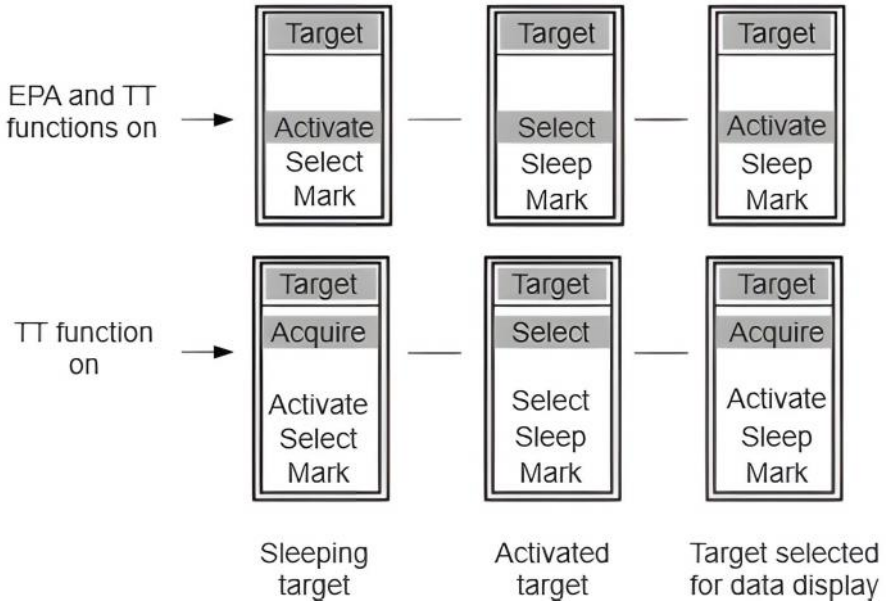
4. Press **MENU** twice to close the menu.

4.2.3 Changing Target Status

You can manually switch between the three basic target statuses to meet different needs:

1. Move the cursor to the target you want to change and press **ENT** to select it.
2. A target operation menu will appear in the bottom right corner. Use the arrow keys to make a selection.
3. After selecting the desired target status, press **ENT** to change it. Press **MENU** to exit if you do not want to make changes.

Different status targets will have different menu options. For example, a sleeping target will have options for "Activate" and "Select," while an active target will have options for "Select" and "Sleep." The menu will also vary depending on whether EPA and TT functions are enabled.



Note: When a selected target is set to automatic marking, any previously selected target will become active.

4.2.4 Marking Targets

Marking a target involves adding a specific symbol to distinguish it from others:

Marked target

Marked targets are not restricted by the target classification method. They will be processed and displayed as long as data is received. However, marked targets can still become lost targets and will be deleted if lost.

Manual Marking:

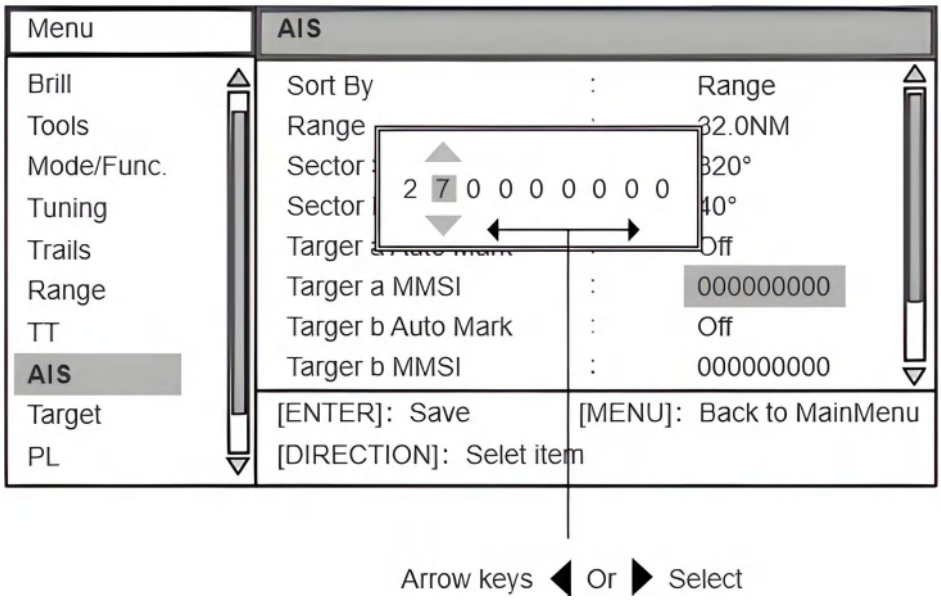
1. Move the cursor to the target you want to mark and press **ENT** to select it.
2. The target operation menu will appear. Use the arrow keys to select "Mark" and press **ENT** to mark the target. Press **MENU** to exit if you do not want to mark it.

Sleeping target

3. You can manually mark up to 10 targets using symbols "1" to "10," following the principle of using smaller symbols first.

Automatic Marking:

1. Press **MENU** to open the main menu.
2. Use the arrow keys to select the "AIS" menu item and press **ENT** to enter.
3. Set "Target a Auto Mark" to "On" and press **ENT** to save.
4. Select "Target a MMSI," press **ENT**, and set the MMSI for target a.



5. Set the MMSI for target a, press **ENT** to save.
6. Press **MENU** to return to the main menu, and press **MENU** again to exit.

Automatic marking can mark 2 targets using symbols "a" and "b." If a manually marked target is set to automatic marking, the manual marking will be canceled, and only the automatic marking will be displayed.

Canceling Manual Marking:

1. Move the cursor to the target you want to unmark and press **ENT** to select it.
2. The target operation menu will appear. Use the arrow keys to select "Mark Off" and press **ENT** to unmark it. Press **MENU** to exit if you do not want to unmark it.

Sleeping target

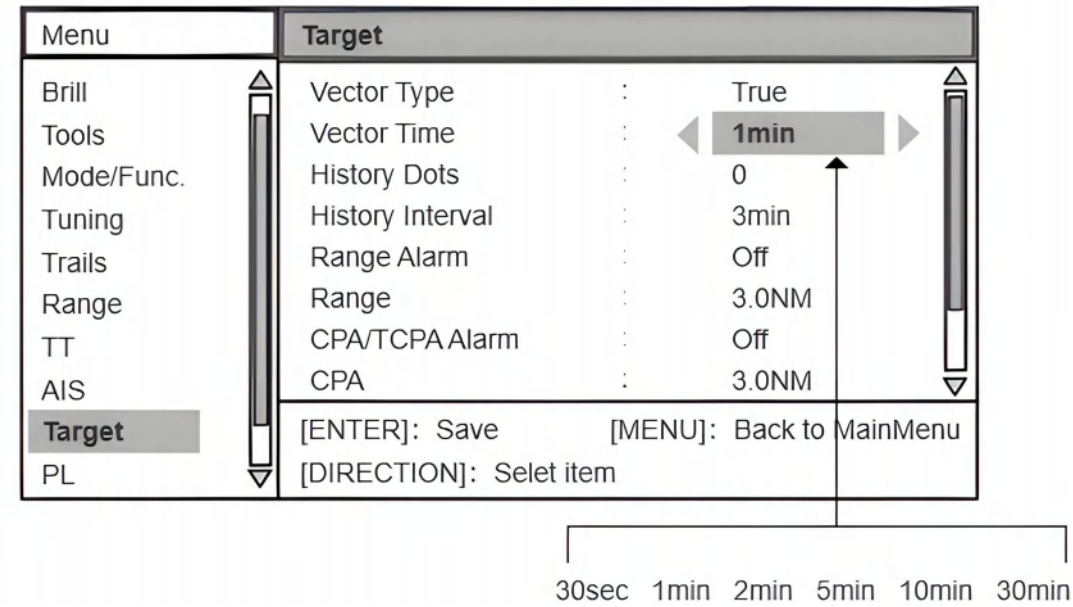
3. Automatic marking can also be canceled in the target submenu by setting the relevant automatic marking menu item to "Off."

4.2.5 Target Vector Attributes

Vectors are lines extending from the tracked target to show the AIS target's heading. The vector's end point displays the predicted position of the target after the vector time ends. It helps estimate collision risks by extending the vector length (time). The screen will show the active vector mode and vector time.

Vector Time Settings:

1. Press **MENU** to open the main menu.
2. Use the arrow keys to select "Target" and press **ENT** to enter.

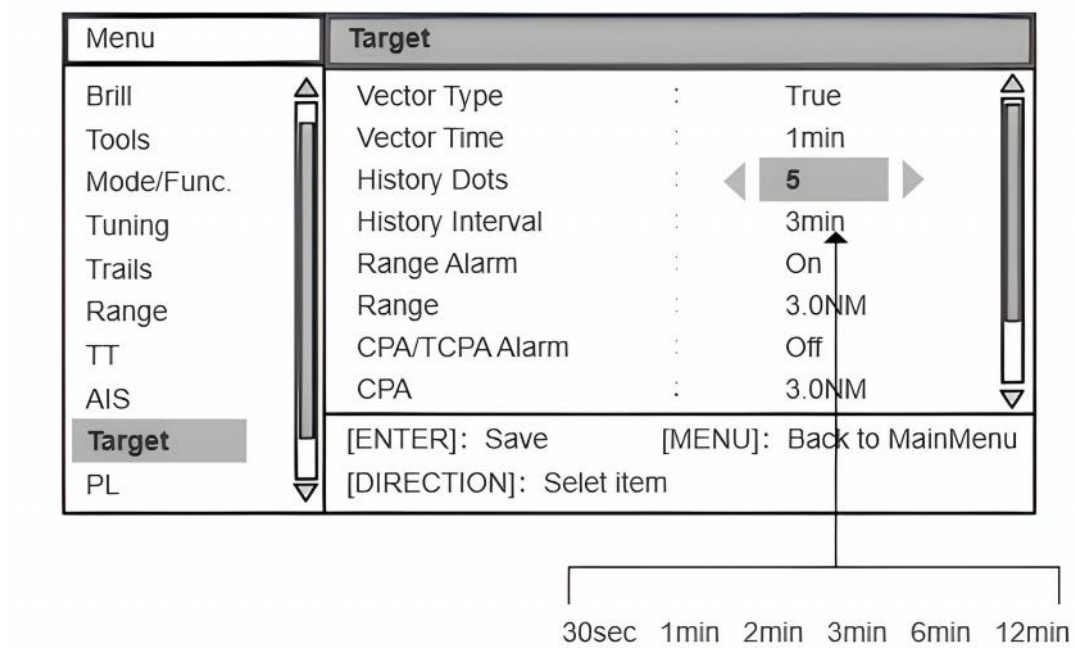


3. Choose the "Vector Time", use the arrow keys to select the desired time, and press **ENT** to save.
4. Press **MENU** twice to close the menu.

4.2.6 Historical Display

The radar can display historical points (up to 10) to mark the path of all tracked AIS targets.

1. Press **MENU** to enter the main menu.
2. Use the arrow keys to select the "Target" option and press **ENT** to enter.



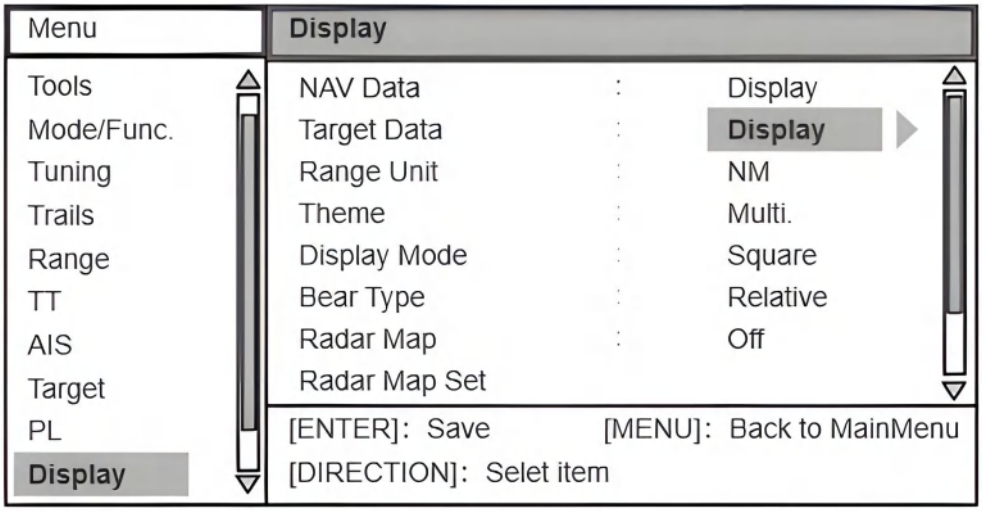
3. Select the "History Dots" and press **ENT**.
4. Select the "History Interval" and press **ENT**.

5. Press **MENU** twice to close the menu.

4.3 Displaying AIS Target Data

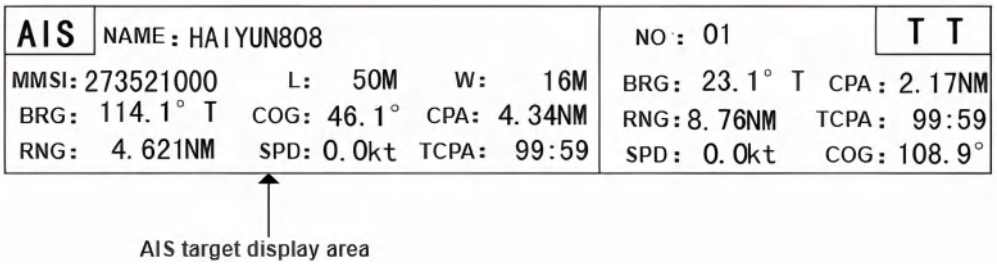
By default, AIS target data indication boxes are not displayed. To enable the indication box:

1. Press **MENU** to open the main menu.
2. Use the arrow keys to select the "Display" menu item and press **ENT** to enter.
3. Select "Target Data," use the arrow keys to select "Display" and press **ENT** to save.



4. Press **MENU** twice to close the menu.

The screen will show an AIS data display box at the bottom, including MMSI, ship name, bearing, distance, heading, speed, length, width, CPA, and TCPA. If the displayed target is lost, "Lost" will appear in the data box, and CPA and TCPA will not be displayed.



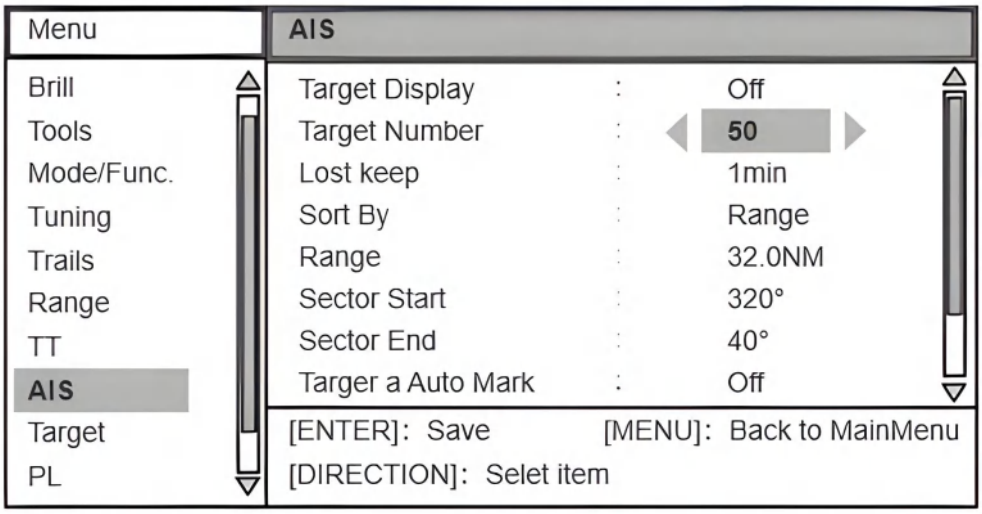
4.4 Target Display Constraints

AIS targets are processed and displayed based on proximity, showing the closest targets. Further constraints can be applied by setting "Maximum Target Display" and "Target Classification Method."

4.4.1 Maximum Target Display

The radar supports displaying up to 100 AIS targets. Set the maximum number through the menu:

1. Press **MENU** to open the main menu.
2. Use the arrow keys to select the "AIS" menu item and press **ENT** to enter.
3. Select the "Target Number" and press **ENT** to save.

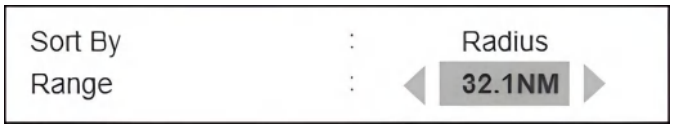


4. Press **MENU** twice to close the menu.

4.4.2 Target Classification Display

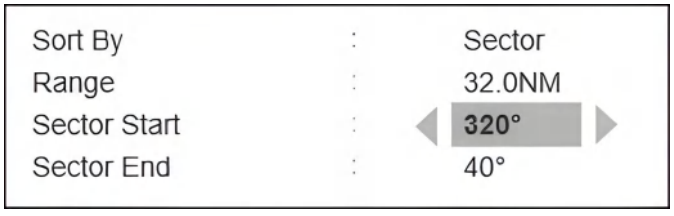
Targets can be classified and displayed by "Radius" or "Sector"

Radius Classification:



1. Press **MENU** to open the menu.
2. Use the arrow keys to select "AIS" and press **ENT** to enter.
3. Select "Radius" for classification and press **ENT** to save.
4. Set the radius range and press **ENT** to save.
5. Press **MENU** twice to close the menu.

Sector Classification:



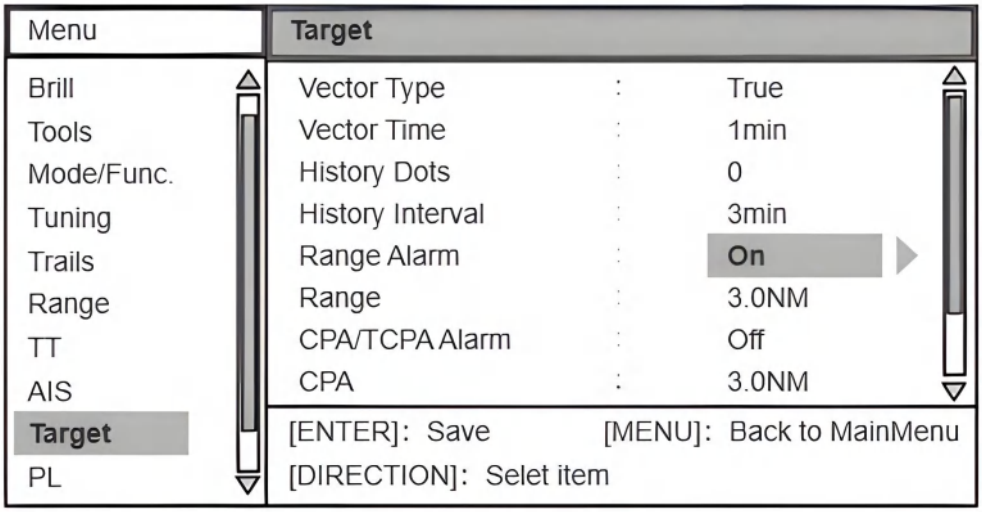
1. Press **MENU** to open the main menu.
2. Use the arrow keys to select "AIS" and press **ENT** to enter.
3. Select "Sector" for classification and press **ENT** to save.
4. Set the sector start and end bearings and press **ENT** to save.
5. Press **MENU** twice to close the menu.

Note: Bearings are relative to the ship's heading; sectors are defined clockwise from start to end bearings.

4.5 Range Alarm

When an AIS target enters the set alarm range, the range alarm will emit an audible alert and flash the hazardous target to notify the operator. Press any key to turn off the audible alarm.

1. Press the **MENU** key to enter the main menu.
2. Use the up or down arrow keys to select the "Target" option, then press the **ENT** key to enter.
3. Move the cursor to the "Range Alarm" option and use the left or right arrow keys to select "On" or "Off," then press the **ENT** key to save changes.
4. Move the cursor to the "Range" option, adjust the alarm radius using the left or right arrow keys, and press the **ENT** key to save changes.



5. Press **MENU** twice to close the menu.

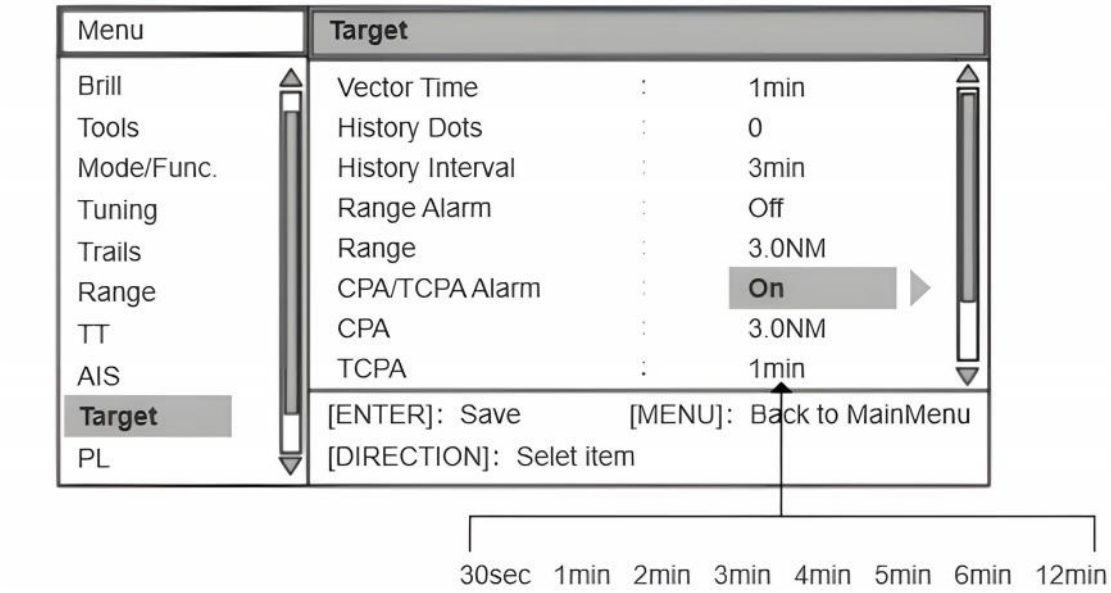
4.6 CPA/TCPA Alarms

When the CPA (Closest Point of Approach) of any AIS target is less than the preset CPA alarm distance and the TCPA (Time to Closest Point of Approach)

is less than the preset TCPA alarm time, an audible alarm will sound and the dangerous target will flash. Press any key to stop the audible alarm.

Steps to Set Up CPA/TCPA Alarms:

1. Press **MENU** to enter the main menu.
2. Use the arrow keys to select the "Target" option and press **ENT** to enter.
3. Move the cursor to the "CPA/TCPA Alarm" option, use the arrow keys to select "On" or "Off" and press **ENT** to save the change.
   Move the cursor to the "CPA" option, use the arrow keys to adjust the CPA alarm range, and press **ENT** to save the change.



4. Move the cursor to the "TCPA" option, use the arrow keys to adjust the TCPA alarm time, and press **ENT** to save the change.
5. Press **MENU** twice to close the menu.

5. Radar Observation Basics

5.1 Basic Parameters

5.1.1 Minimum and Maximum Detection Range

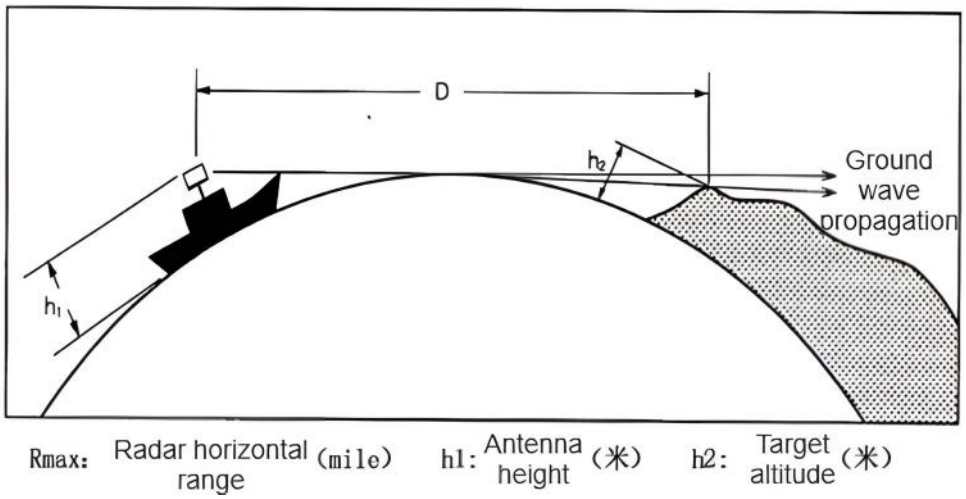
Minimum Detection Range

The minimum detection range depends on pulse width, antenna height, and signal processing (e.g., main pulse suppression and digital quantization). According to IMO Resolution A.447 (XII), the minimum range should be less than 40 meters. This radar meets this requirement.

Maximum Detection Range

The maximum detection range (R_max) is influenced by factors such as the antenna height above the water, the target height and size, the target's shape and material, and atmospheric conditions. Under normal atmospheric conditions, the maximum detection range is usually close to the radar’s horizontal range. Due to the diffraction characteristics of radar signals, the horizontal range is approximately 6% greater than the line-of-sight distance.

Calculation: $R\text{max} = 2.2\times(\sqrt{h_1}+\sqrt{h_2})$



For example, with an antenna height of 9 meters and a target height of 16 meters:

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

X-Band vs. S-Band

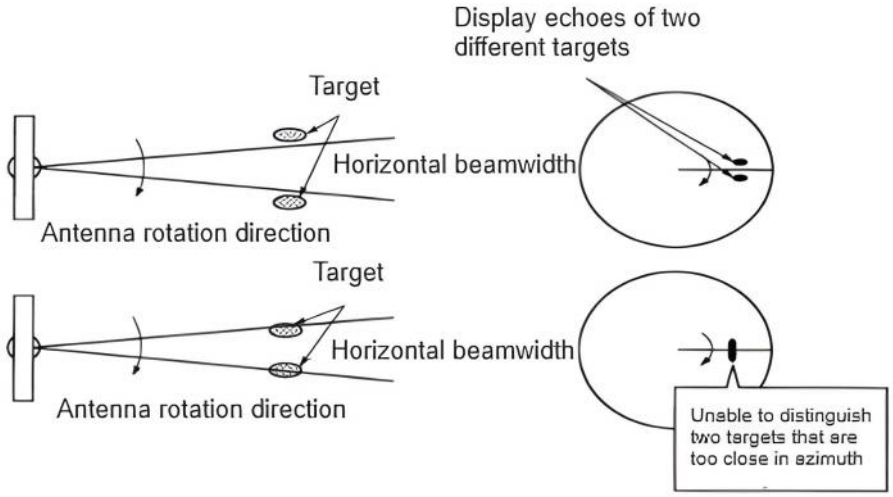
In clear weather, the above formula applies similarly to both X-band and

S-band radars. However, in adverse weather conditions, S-band radars have better detection capability compared to X-band radars.

5.1.2 Radar Resolution

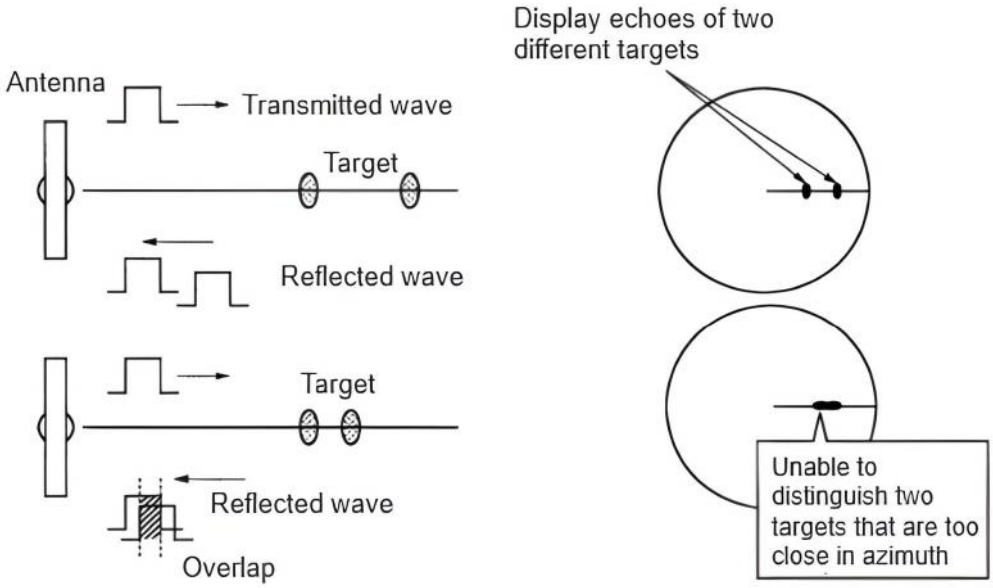
Azimuth Resolution

Azimuth resolution measures the radar's ability to distinguish between two targets at the same range but close in angle. It is primarily affected by the horizontal beamwidth. Targets must be separated by more than one beamwidth to be displayed as distinct points.



Range Resolution

Range resolution measures the radar's ability to distinguish between two targets in the same direction but close in range. It is mainly affected by pulse width. If the distance between two targets is less than half the pulse width, their echoes cannot be separated.



5.1.3 Azimuth Accuracy

The accuracy of azimuth measurements is crucial and depends on the correct alignment of the ship's heading line. To minimize errors, it's best to position targets near the screen's edge when measuring their azimuth.

5.1.4 Range Measurement

The radar provides two methods for measuring range to targets:

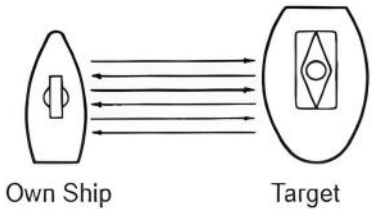
- **Range Rings**: Displayed at fixed intervals on the screen, suitable for rough measurements.
- **Variable Range Marker (VRM)**: The VRM's diameter can be adjusted and placed on the target’s edge for more accurate measurements.

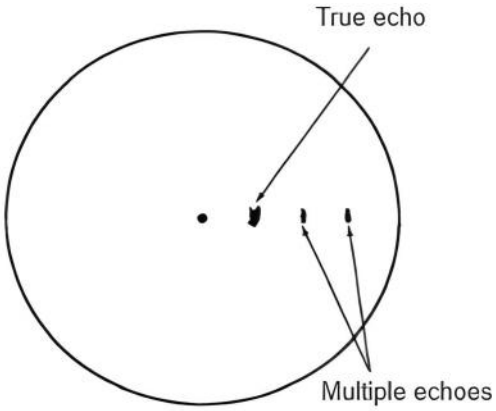
5.2 False Echoes

False echoes are signals displayed on the screen where no actual targets exist. Understanding their causes can help differentiate them from real echoes. Typical causes include:

5.2.1 Multiple Echoes

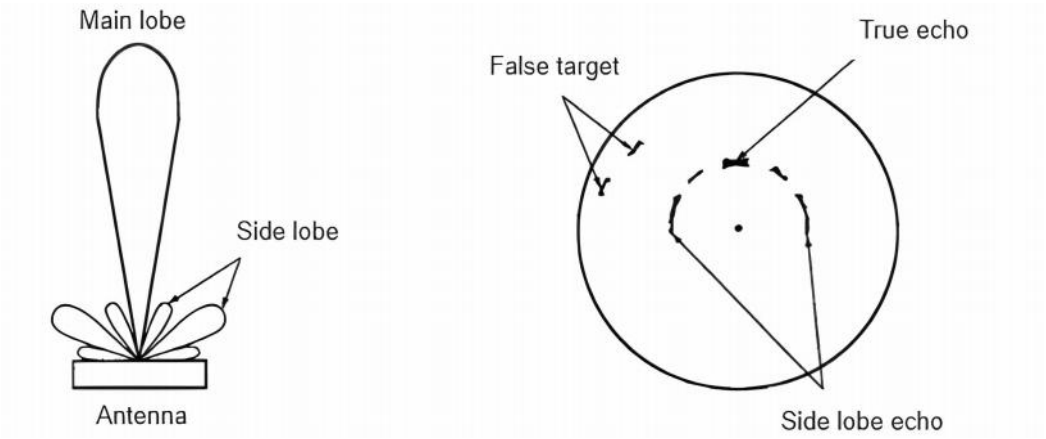
Occur when the radar pulse reflects off large objects like ships or bridges, creating echoes at 2, 3, or more times the actual distance. This can be mitigated by reducing sensitivity or adjusting A/C SEA.





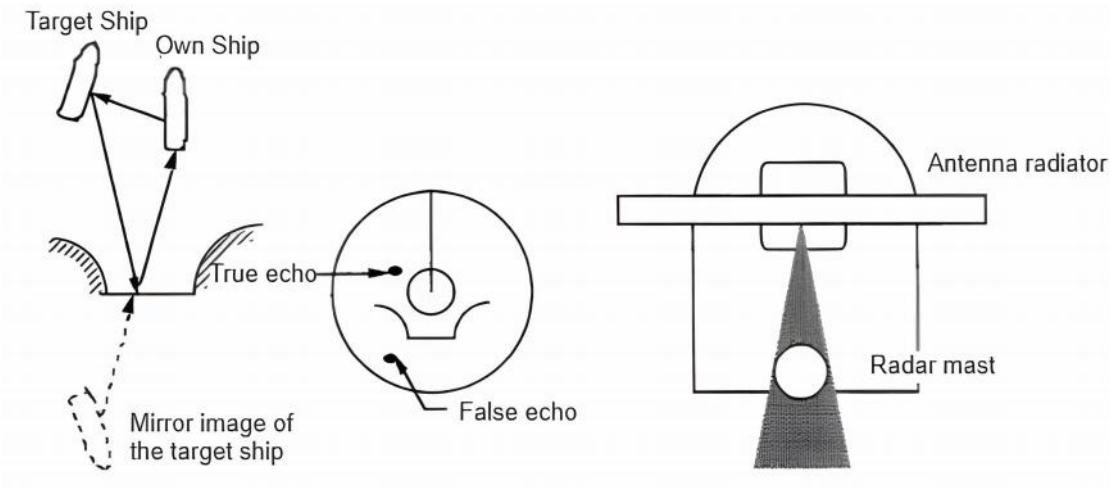
5.2.2 Side-Lobe Echoes

Some radiation leaks from the main beam of the antenna, creating side-lobe echoes. If a target is detectable by both the main and side lobes, side-lobe echoes will appear beside the true echoes. These are usually found at close range and can be suppressed by adjusting sensitivity or A/C SEA.



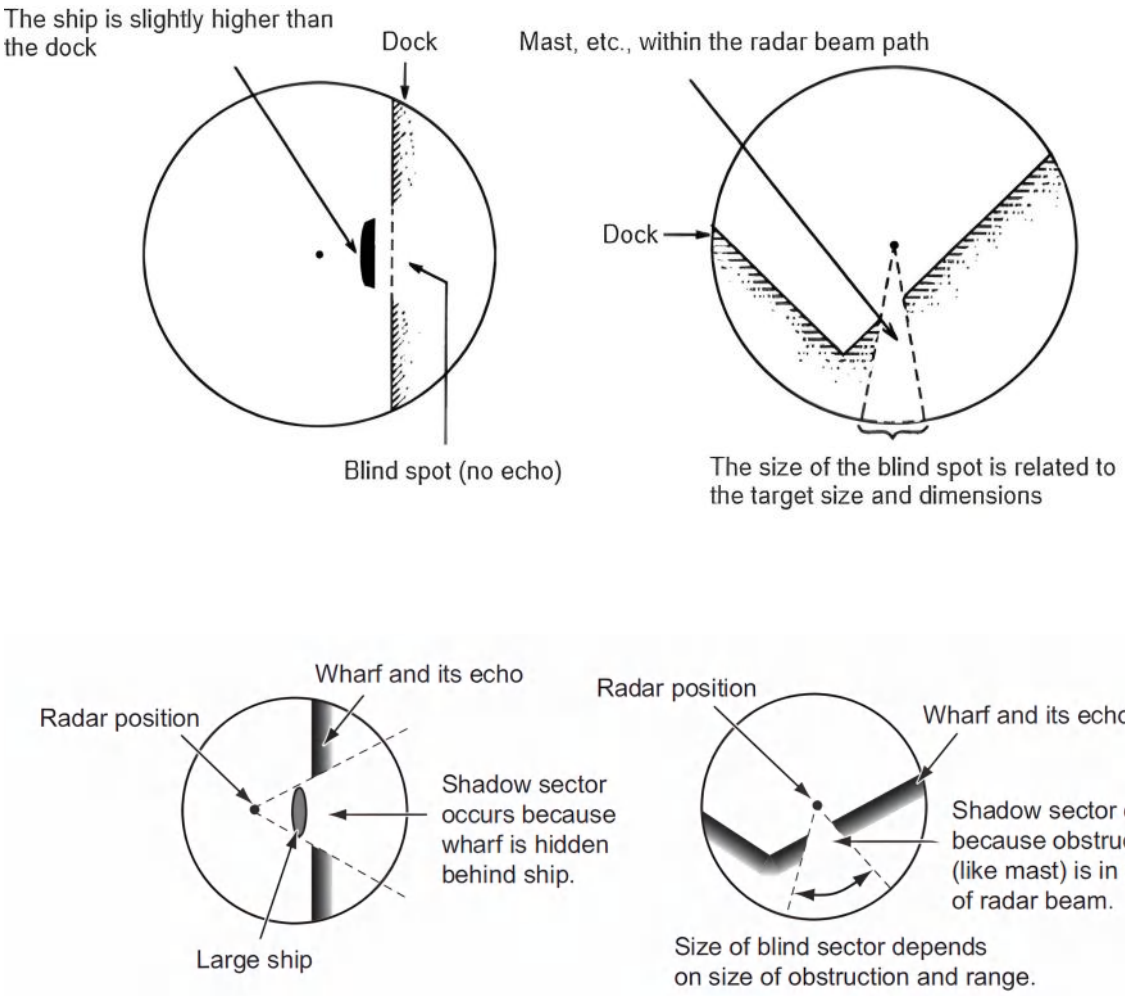
5.2.3 Ghost Images

Large targets close to the vessel can produce ghost images at two positions on the screen—one as the true echo and the other due to mirror effects. For example, a large metal bridge near the vessel can cause temporary ghost echoes.



5.2.4 Blind Spots and Shadow Zones

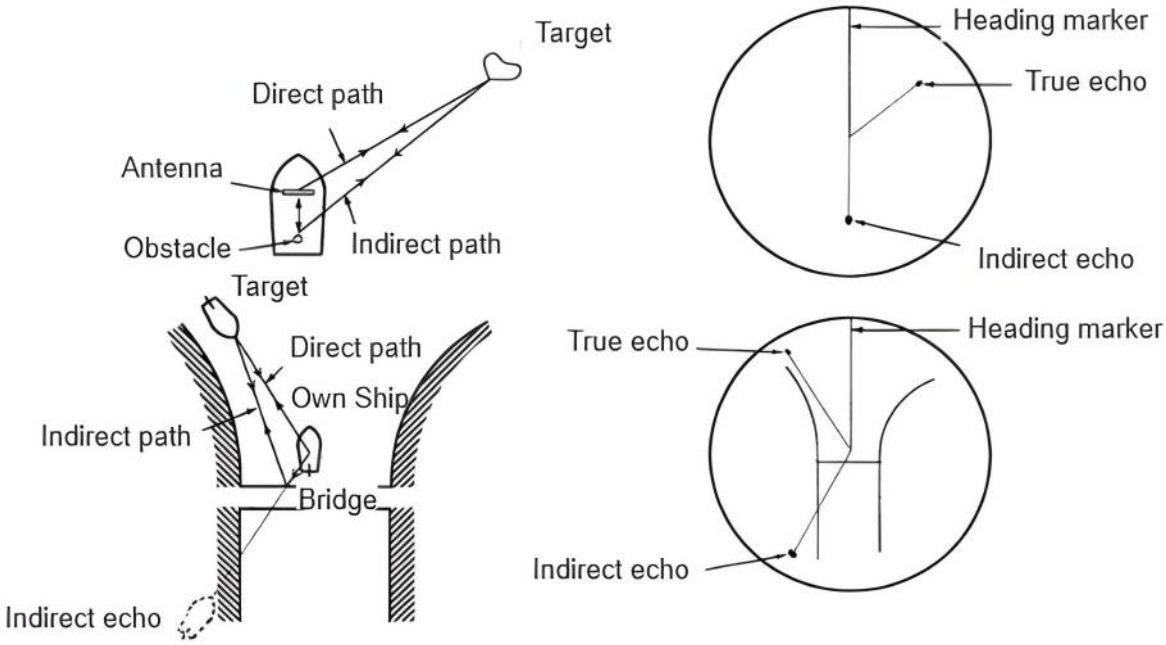
Objects like smoke stacks, cargo, masts, or cranes around the antenna can weaken the radar beam, creating blind spots where small targets cannot be detected close to the vessel, but larger targets further away might still be detected.



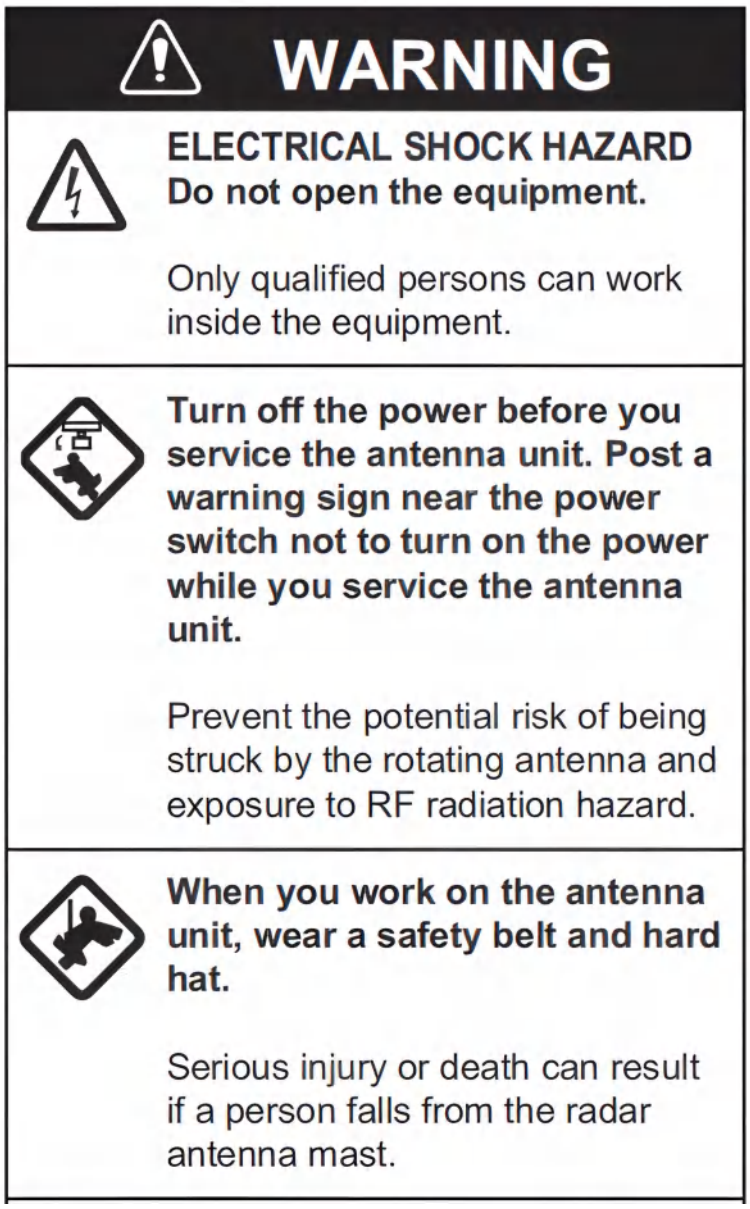
5.2.5 Indirect Echoes

These are reflections from passing vessels or the vessel's own reflective surfaces (e.g., cargo). Indirect echoes appear at the same range as the true echoes and the same direction as the reflecting surface. They can be identified by:

- Frequently appearing in shadow zones
- Often aligning with the direction of obstacles
- Displaying abnormal movement patterns
- Showing shapes inconsistent with true echoes


Target
Direct path
Antenna
Obstacle
Indirect path
Heading marker
True echo
Indirect echo
Target
Direct path
Own Ship
Indirect path
Bridge
Indirect echo
True echo
Heading marker
Indirect echo

6.Maintenance and Repair



6.1 Regular Maintenance

To ensure optimal performance, regular maintenance is essential. Here are the recommended intervals and tasks:

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

6.2 Basic Repairs

Here's how to handle common issues:

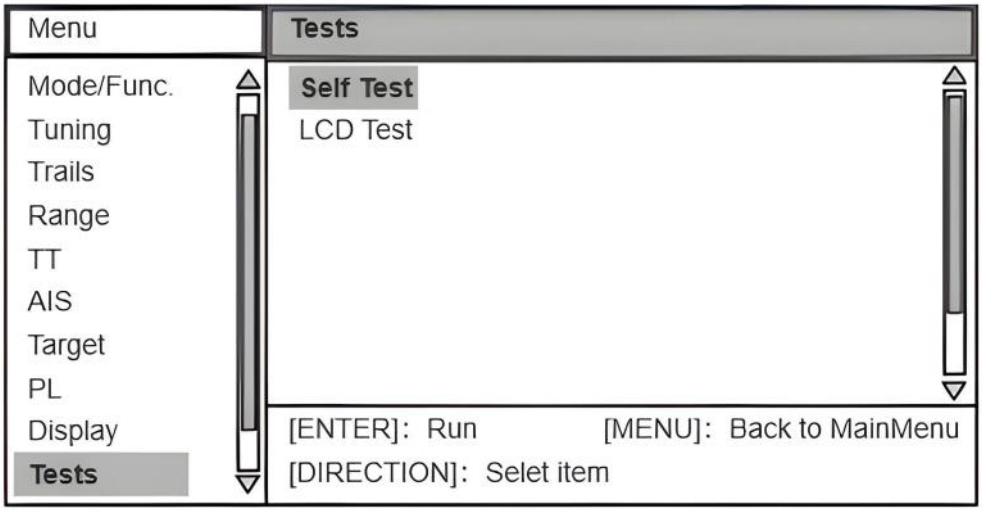
Issue	Repair
Control panel light not on	Check the fuse, increase the panel brightness setting.
Display not lighting, but panel light is on	Increase display brightness.
Screen freezes	Check signal cable connections; restart after powering off.
Radar does not transmit after warming up and pressing [STBY/TX]	Check the antenna motor and ensure "Antenna Rotation" is set to "Rotate" in the menu.
Poor echo quality after transmission	Switch from "Manual" to "Automatic" in the menu.

6.3 Testing

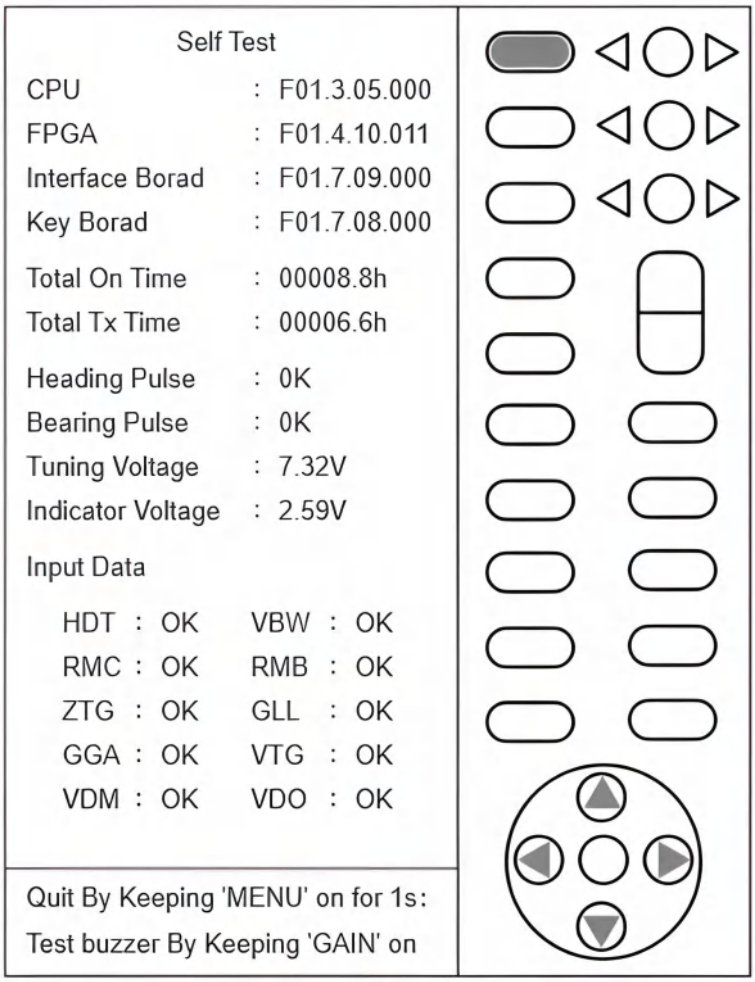
Testing ensures the system operates correctly.

6.3.1 Self-Test

1. Press **MENU** to open the main menu.
2. Use the arrow keys to select "Tests" and press **ENT**.



3.Select “Self Test” and press **ENT** to enter the self-test screen.



The self-test screen

The self-test screen shows version numbers, total operational and transmission hours, signal checks, and tuning voltages.Test control buttons by

pressing them. Functional buttons will be highlighted.Press **GAIN** to test the buzzer. Press again to turn it off.

1. Press and hold **MENU** to exit the self-test screen.
2. Press **MENU** twice to close the menu.

6.3.2 Screen Test

The screen test checks whether the display colors are shown correctly.

1. Press **MENU** to open the main menu.
2. Use the arrow keys to select “Tests” and press **ENT**.
3. Select “LCD Test” and press **ENT** to enter the screen test mode.The screen will initially show black and then cycle through five colors (red, green, blue, cyan, and white).

4. Press and hold **MENU** to exit the screen test mode.
5. Press **MENU** twice to close the menu.

7. Installation

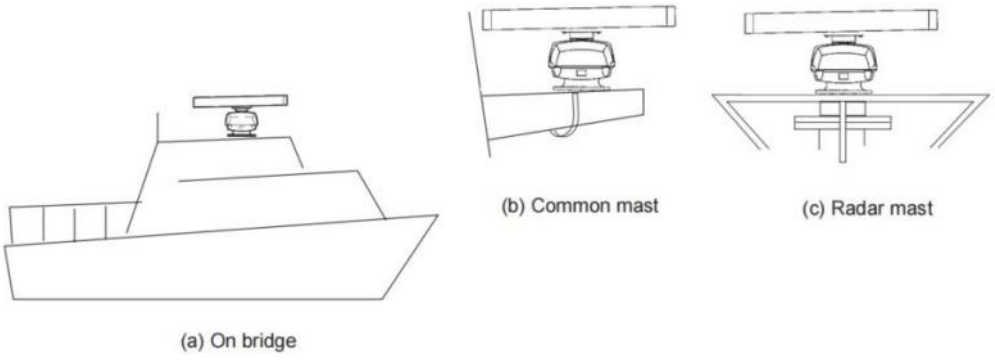
This section provides the installation steps, which include:

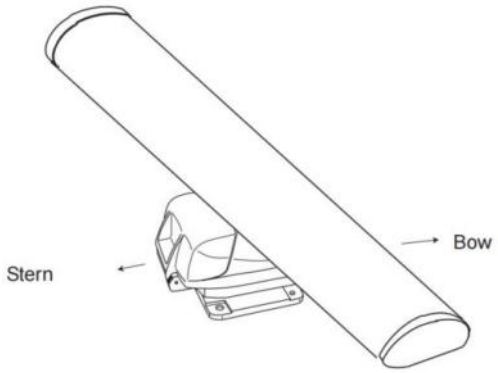
- Installing the display unit and the antenna unit
- Connecting signal cables and power cables
- Connecting additional equipment
- Checking the installation
- Adjustments

7.1 Installation of the Antenna Unit

7.1.1 Selection of Installation Location

- The antenna unit is typically installed on the roof of the bridge or on a suitable radar mast. Position the antenna unit as high as possible on the vessel, ensuring it is clear of obstructions and in an open space. Obstacles can create shadow and blind spots. For example, a mast with a diameter much smaller than the width of the antenna will create a small blind spot, but a horizontal crossbar or a cross-shaped structure at the same level as the radar antenna will cause significant obstruction. The antenna unit should be placed just above or below such obstacles.
- Ideally, the antenna unit should have a clear view in all directions. Once installed, determine the beam width and the direction of shadow areas impacting the radar.
- Keep the antenna unit away from any radio direction finders to avoid interference. Maintain a distance of at least 2 meters between the antenna unit and the direction finder. To reduce electrical interference, avoid running signal cables near other electrical equipment on the deck or running them parallel to power cables.
- Maintain a safety distance of 1.9 meters from standard compasses and 1.2 meters from steering compasses.
- Do not paint the radar radiator (antenna) to ensure proper radar wave emission.
- For large vessels, consider cable lengths of 15, 20, and 30 meters between the antenna unit and the display unit. Ensure cables are not broken and avoid connecting two cables together. Deposits and smoke from exhaust pipes can significantly affect antenna performance. Do not install the antenna in environments exceeding 70°C.





Antenna unit

⚠ CAUTION

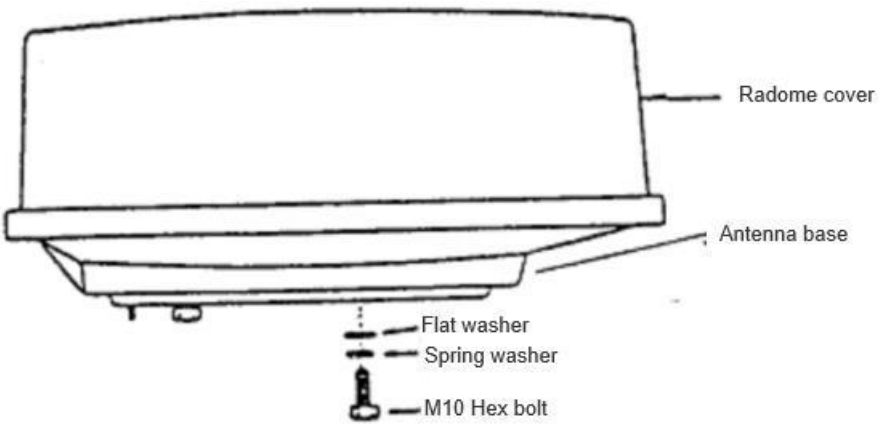
Do not lift the Antenna unit by the radiator; lift it by the housing.

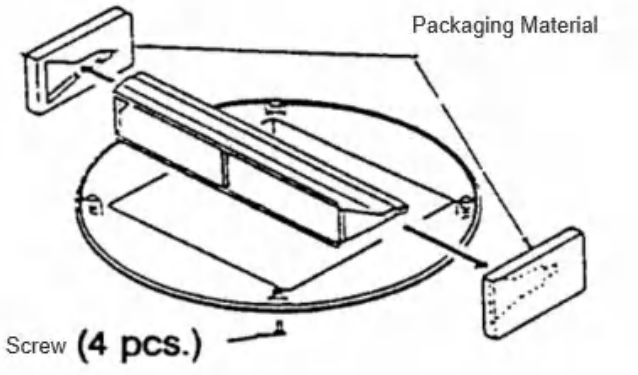
The radiator may be damaged.

7.1.2 Installation

7.1.2.1 Installation of RSC-R004

1. Open the antenna unit packaging, remove the packaging materials, and remove the four M10 bolts (with washers and spring washers) from the antenna base. These bolts are not used for mounting.
2. Loosen the four bolts on the transceiver's top and bottom covers, open the antenna cover, and remove the packaging materials from the radiator.



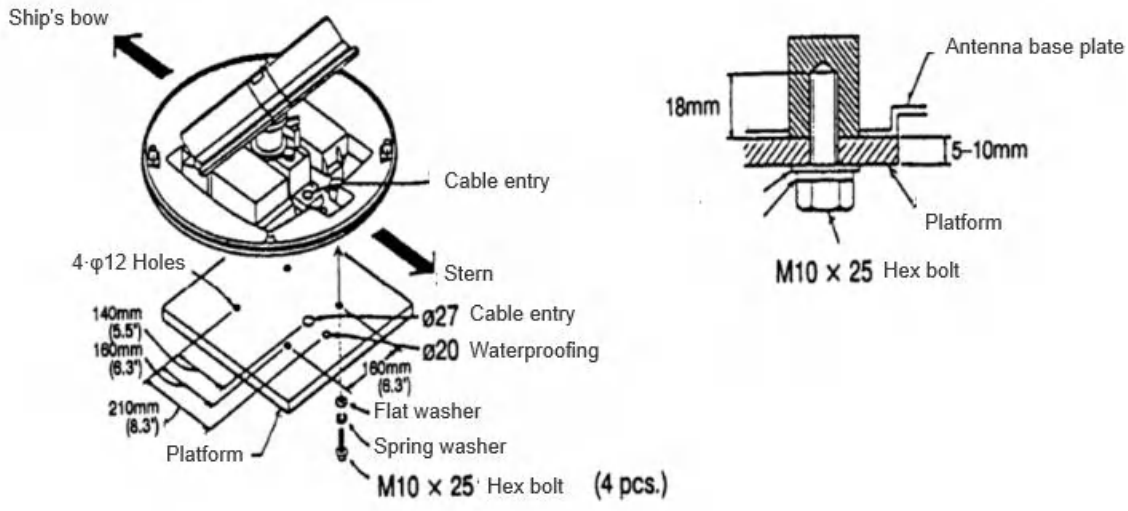


Ensure the mounting plate is parallel to the waterline and drill 6 holes: 4 of 12mm for mounting, 1 of 20mm for drainage, and 1 of 27mm for the cable entry.

Adjust the antenna unit direction so that target echoes from the bow direction are displayed at the 0-degree mark (bow marker) on the screen. Ensure the drilling is aligned both front and rear.

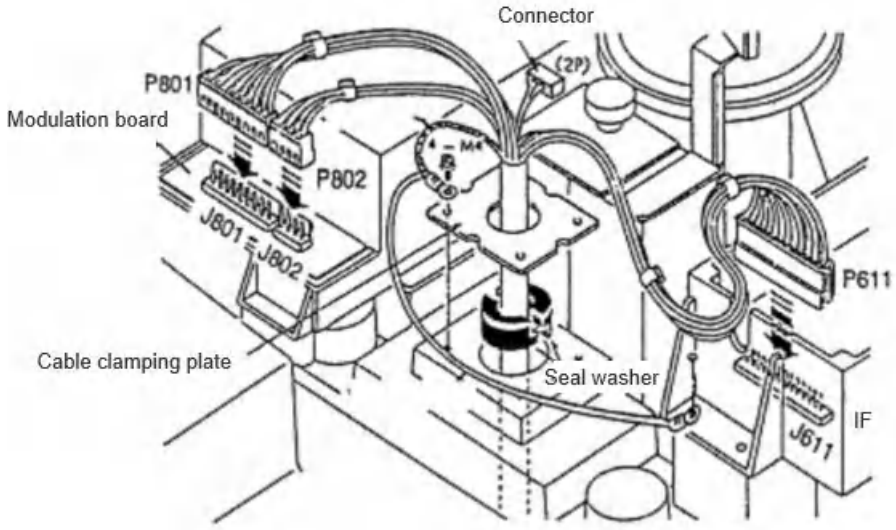
Moisture inside the antenna cover can cause corrosion, so a drainage pipe is provided for "exhaling". Ensure it is not compressed and is unobstructed. The drainage pipe extends 27mm downward from the antenna base. Confirm it is correctly extended during installation.

3. Prepare a mounting platform 5-10mm thick. Find the cable entry on the antenna base and place the antenna base on the mounting platform with the cable entry facing the stern (as precisely as possible). Drill a 20mm hole on the mounting platform for the drainage pipe. Ensure proper positioning of the drainage pipe. Fix the antenna base with 4 M10×25 hex bolts (with washers and spring washers).

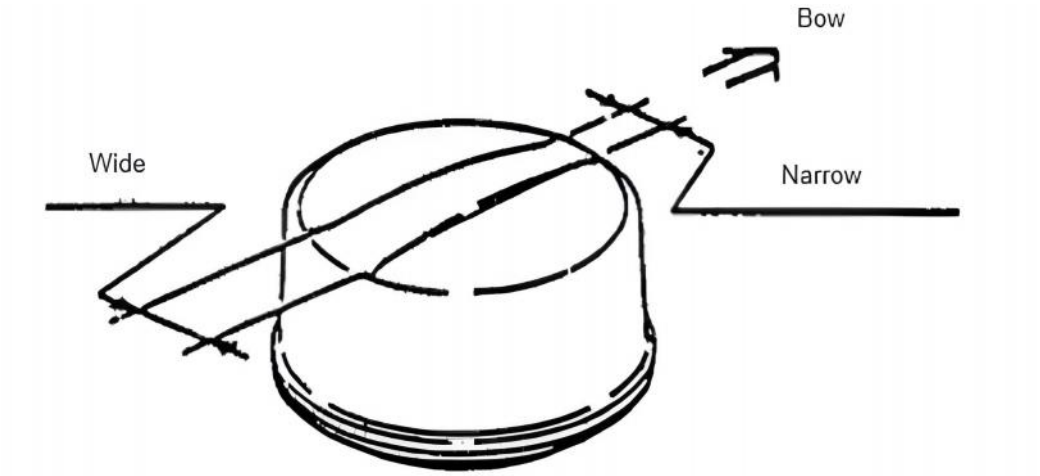


Wiring and preparation

1. Make a hole of at least 20 millimeters in diameter through the deck or bulkhead to run the signal cable. (To prevent electrical interference, do not run the signal cable near other electrical equipment. Do not run the cable in parallel to power cables.) Set the cable through the hole.
2. Loosen four screws and remove the cable clamping plate and the gasket.
3. Set the signal cable through the hole at the bottom of the radome base.
4. Fasten the signal cable with the cable clamping plate and gasket. Connect the shield and vinyl wire to the ground by one of the screws of the cable clamping plate.
5. Connect plug P801 (9 pins) to J801 on the modulation board, and plug P802 (4 pins) to J802. Remove the junction box cover and connect plug P611 (13 pins) to J611.

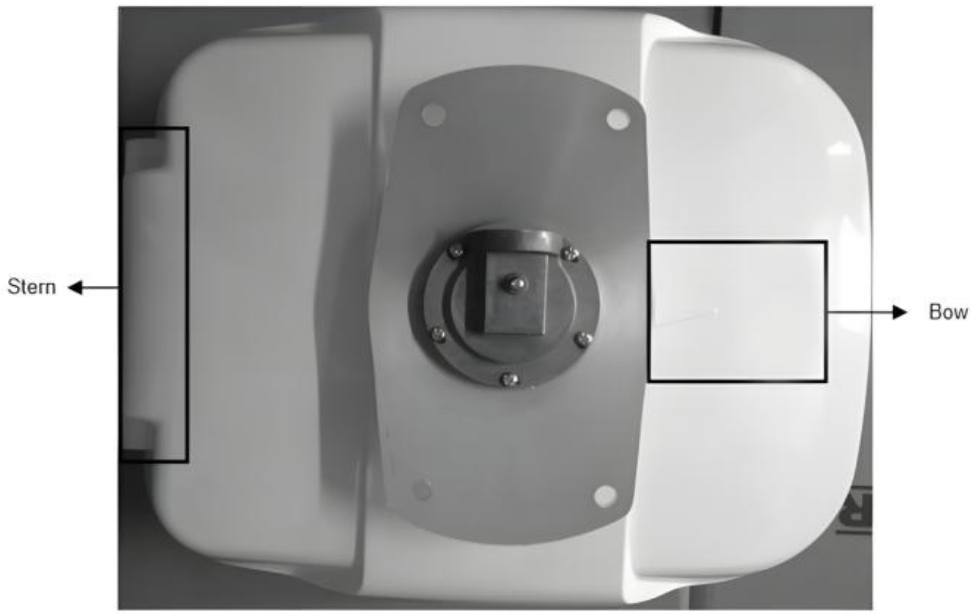


6. Attach the shield cover, ensuring it does not entangle with the cables.
7. Attach the shield covers. Make sure the cable is not caught by the cover.
8. Attach the radome cover. Align the triangle mark on radome cover with that on radome base.Fasten the radome bolts.



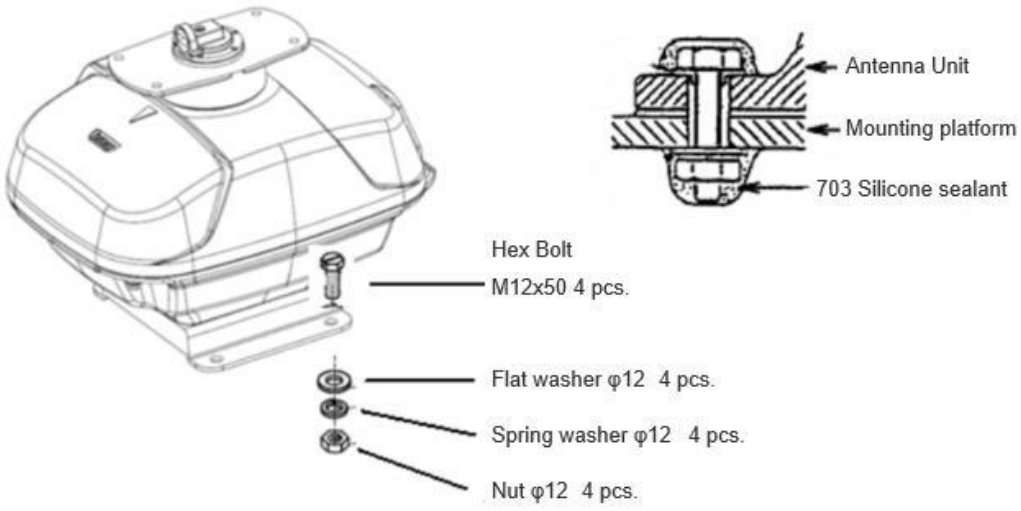
7.1.2.2 Installation of RSC-0006

Drill 5 holes on the mounting platform: 4 holes with a diameter of 15mm for fixing the scanner unit and one hole with a diameter of 25-30mm for the signal cable.

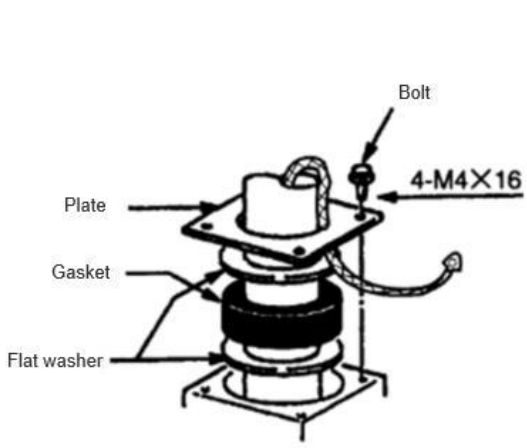


Scanner Unit:

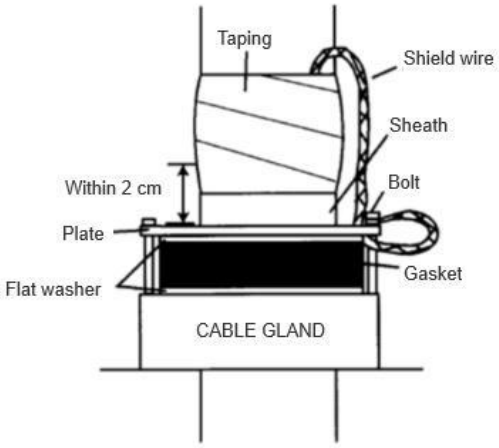
1. Place the scanner unit on the mounting platform and secure it with screws as shown.



2. After securing the transceiver, proceed with wiring. Loosen the corner screws of the scanner unit, open the cover, and fix the support. Pass the signal cable through the bottom entry hole.
3. Pass the signal cable through the cable mounting platform component and secure it as shown in the diagram.

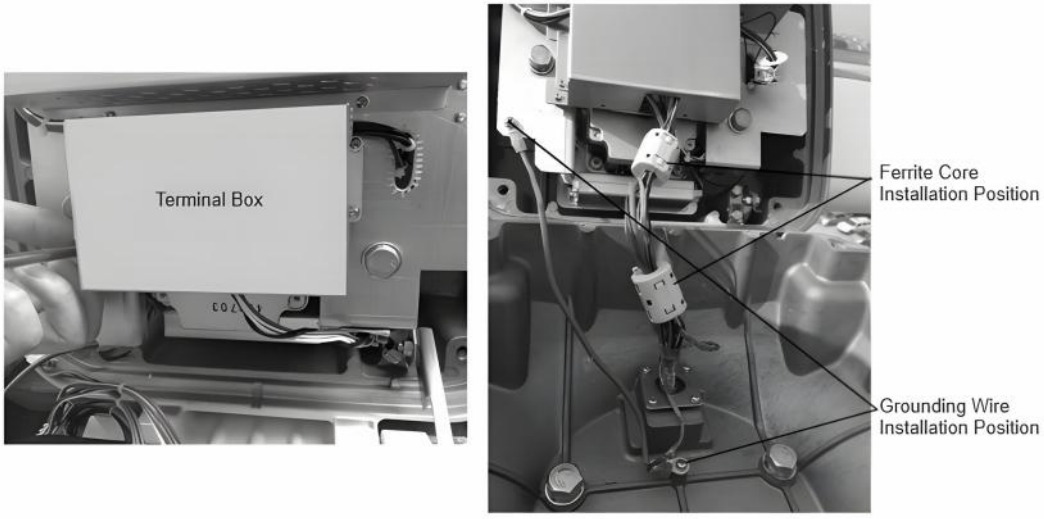


How to put the signal cable through the cable gland assembly



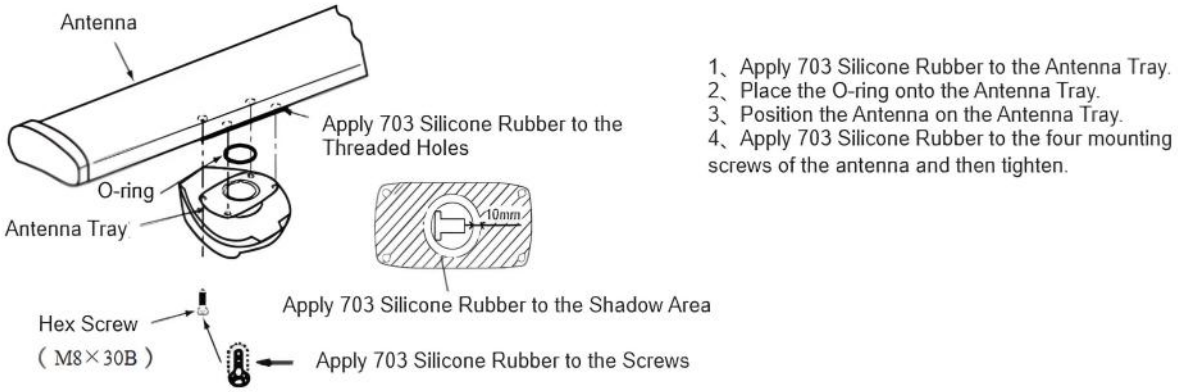
How to fasten signal cable in cable gland

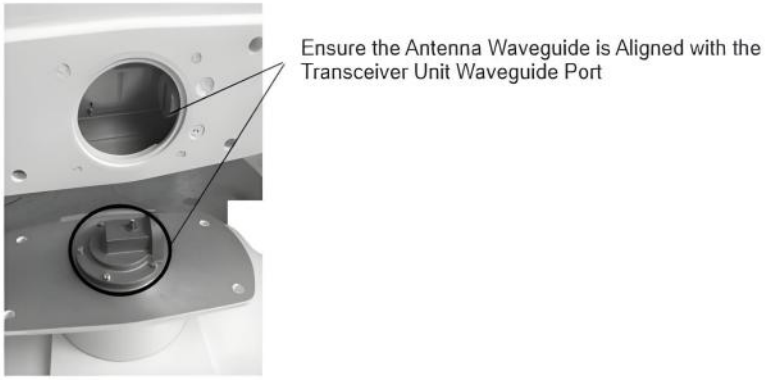
4. Open the junction box cover and connect the 13-pin, 9-pin, and 4-pin connectors of the signal cable to J704, J701, and J702 on the antenna unit respectively. Close the junction box cover. Install the ferrite ring and grounding wire as shown, secure the scanner unit's top and bottom covers, and tighten the corner screws before mounting the antenna unit.



Antenna Installation

1. Remove Yellow Tape: Tear off the yellow tape from the waveguide opening on the antenna.
2. See the draft:





7.2 Installation of the Display Unit

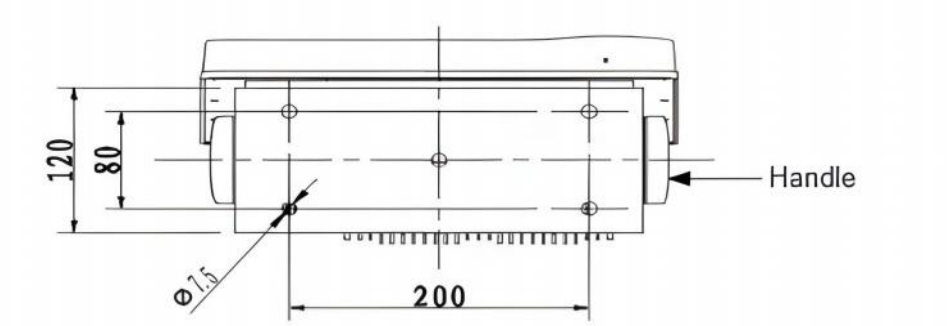
7.2.1 Installation Conditions

When selecting the installation location for the display unit, consider the following points:

- The structure of the display unit can withstand humidity and atmospheric corrosion in the wheelhouse, but it should not be used outdoors.
- If installing the radar on a small vessel, ensure the display unit is in an enclosed cabin to prevent corrosion of the rear wiring. To avoid saltwater corrosion, tie and seal the wiring properly.
- Provide adequate space around the display unit for air circulation and access to the rear wiring.
- Avoid direct sunlight on the display screen, even if the image is clear in bright light, to prevent overheating.
- Position the display unit in a location that is convenient for observation and operation but not exposed to seawater spray or splashes.
- The display unit should be positioned so that the radar screen is visible when the operator faces the bow, allowing for easy determination of the ship's position.
- Ensure there is enough space behind the display unit for wiring and adjusting the bracket knobs. Leave an extra 30 cm of cable length for easy movement of the display during maintenance.
- Maintain a safe distance of 0.6 m (standard compass) and 0.4 m (steering compass) from the compass to avoid interference.

7.2.2 Installation

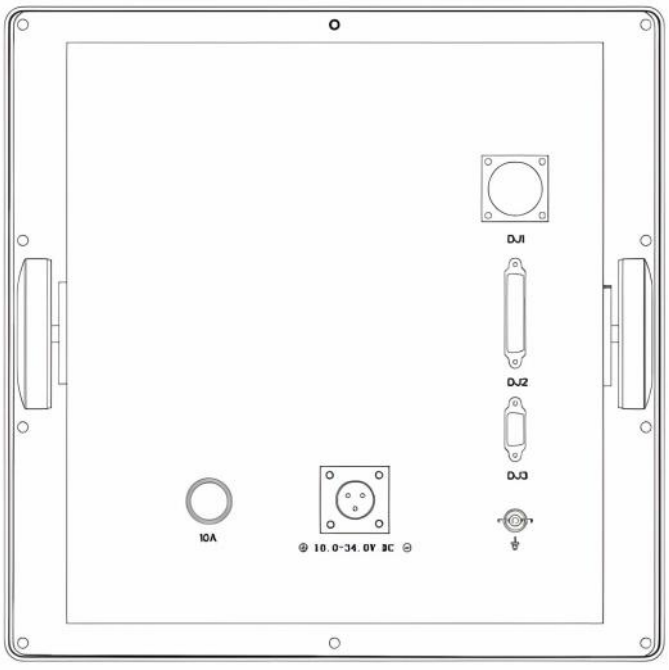
1. Stick the anti-vibration pads inside the bracket.
2. Place the U-bracket on the installation surface and secure it with five self-tapping screws (6x20).
3. Attach the two handles to the display unit without tightening them.
4. Place the display unit onto the U-bracket and tighten the handles.
5. Adjust the display to the operator's preferred viewing angle.



Bottom Surface of U-shaped Bracket

7.2.3 Wiring

1. Insert the power cable into the "18.0-34.0V DC" power interface on the rear panel of the display unit.
2. Connect the signal cable from the transceiver to DJ1.
3. Connect GNSS, heading, AIS, and log signal cables to DJ2.
4. Connect the VGA signal cable to DJ3.
5. Connect the ground terminal to the ship's hull.



7.3 External Device Connections

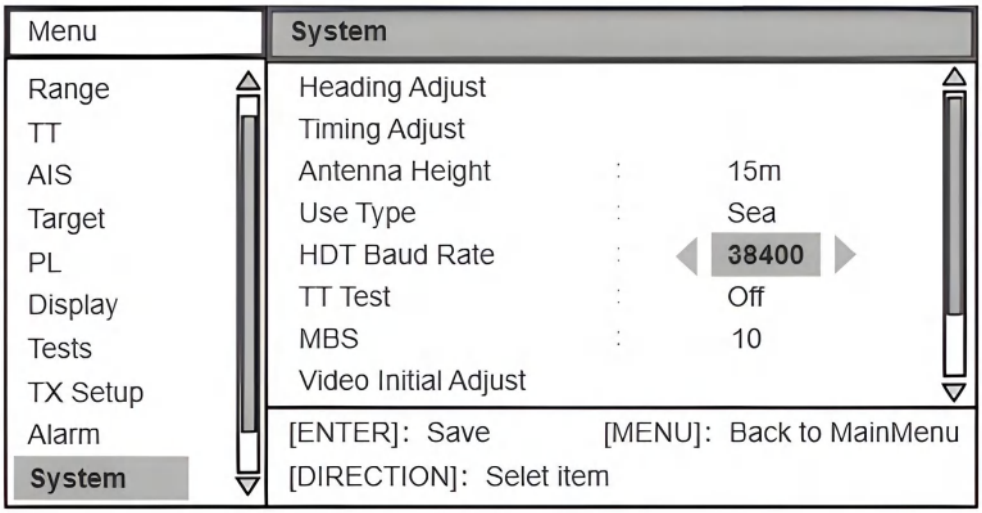
- **GPS Data**: The radar can receive NMEA0183/IEC61162-1 formatted data for the ship's latitude, longitude, speed, and heading. The

connection should be made to DJ2 (GPS_H, GPS_C) on the radar main unit, as per the general wiring diagram.

Note: If AIS data includes GPS data, separate GPS input is not necessary.

- **Log Data**: The radar can receive the ship's speed data in IEC61162-1 format, displaying it on the screen. Connect to DJ2 (LOG_H, LOG_C) on the radar main unit.
- **AIS Data**: Connect AIS data in IEC61162-2 format to DJ2 (AIS_H, AIS_C) on the radar main unit.
- **Heading Data**: For heading data in IEC61162-1/IEC61162-2 format, connect to DJ2 (HD_H, HD_C) on the radar main unit. Set the HDT baud rate to 4800 for IEC61162-1 and 38400 for IEC61162-2.

1. Press the **MENU** button to open the main menu.
2. Use the arrow keys to select the "System" menu and press **ENT**.
3. In the HDT Baud Rate option, select the appropriate baud rate and press **ENT** to save the settings.



4. Press the **MENU** button twice to exit the menu.

7.4 Installation Check

After installation, check the following to ensure accuracy:

- Waterproofing of the transceiver signal cable.
- Secure fixing of the signal cable to the antenna bracket or platform to prevent damage from vibration.
- Sealing of cable entries on the deck.
- Proper polarity and secure connection of the power cable.

- The rear panel fuse of the display unit is rated at 10A.

7.5 Adjustment

After installation, the radar system requires several adjustments:

- Input antenna height.
- Automatic installation adjustment.
- Tuning initialization.
- Automatic video adjustment.
- Bow alignment.
- Delay adjustment.
- Usage type setting.
- Time reset.
- Blind sector measurement.

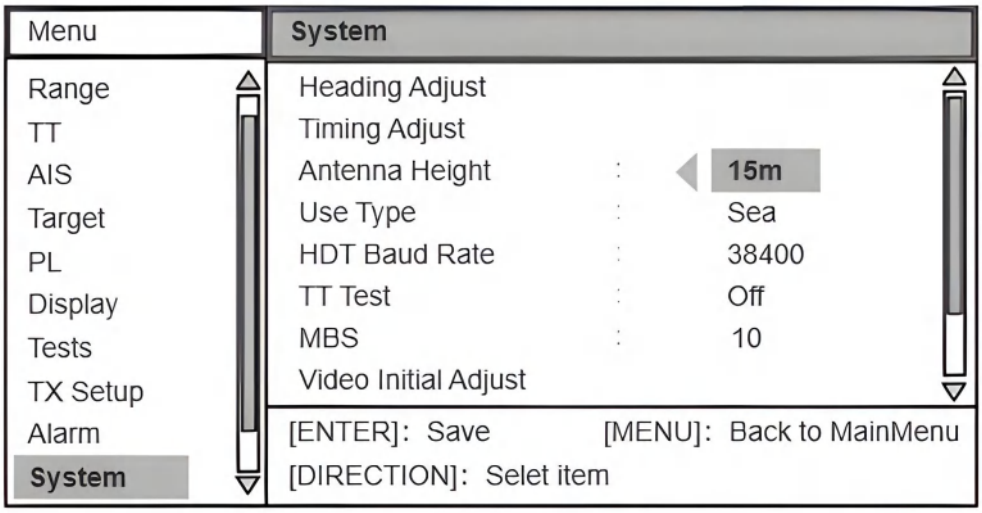
7.5.1 System Settings

In the radar transmission state, to configure the system settings, press and hold the [GAIN] knob, then press the [Menu] key 5 times to gain access to the system menu.

Antenna Height Input

The STC curve changes with the antenna height above the horizontal plane.

1. Press the **MENU** button to enter the main menu.
2. Use the arrow keys to select the "System" menu and press **ENT**.



3. Select the antenna height (5m, 10m, or 15m) and press **ENT**.
4. Press the **MENU** button twice to exit the menu.

Note: The lower the antenna height, the smaller the sea clutter suppression range.

Automatic Installation Adjustment

1. Press the **MENU** button to enter the menu.
2. Use the arrow keys to select the "System" menu and press **ENT**.
3. Select "Automatic Installation Adjustment" and press **ENT**. The system will perform tuning initialization and automatic video adjustment. Do not operate any other buttons during this process. The "Adjusting..." message will disappear once complete.
4. Press the **MENU** button twice to exit the menu.

Note: If automatic installation adjustment is performed, separate tuning initialization and automatic video adjustment are unnecessary.

Tuning Initialization

Tuning initialization is required when initially installing or replacing the magnetron, MIC, or intermediate frequency board.

1. Press the **MENU** button to enter the main menu.
2. Use the arrow keys to select the "Tuning" option and press **ENT**.
3. Select "Manual" tuning and press **ENT**, then select "Auto" and press **ENT**. The system will automatically perform tuning initialization. Do not operate any other buttons during this process. The "Tuning..." message will disappear once complete.
4. Press the **MENU** button twice to exit the menu.

Video Initial Adjust

1. Press the **MENU** button to enter the main menu.
2. Use the arrow keys to select the "System" menu and press **ENT**.
3. Select "Video Initial Adjust" and press **ENT**. The system will perform automatic video adjustment. Do not operate any other buttons during this process. The "Adjusting..." message will disappear once complete.
4. Press the **MENU** button twice to exit the menu.

Heading Adjust

The antenna unit should be adjusted to face the bow of the ship. This way, small but distinct targets ahead will be displayed along the bow line (0°). In

practice, achieving the exact starting position of the antenna unit can be challenging, so a slight error in the display may be observed. The following adjustments will compensate for this error.

1. At a range of 0.125 to 0.25 nautical miles, find a suitable target (such as a stationary ship or buoy) near the bow line, ensuring that electronic zoom and off-center functions are not active. Align the bow with the target.
2. Press the **MENU** button to enter the main menu.
3. Use the arrow keys to select the "System" menu and press **ENT**.
4. In the "System" submenu, select "Heading Adjust" and press **ENT**.
5. In the Heading Adjust menu, use the arrow keys to align the target with the heading line and press **ENT**.
6. Press the **MENU** button three times to exit the menu.
7. As a final check, move the vessel towards the target to confirm that the target's echo on the screen matches the actual target.

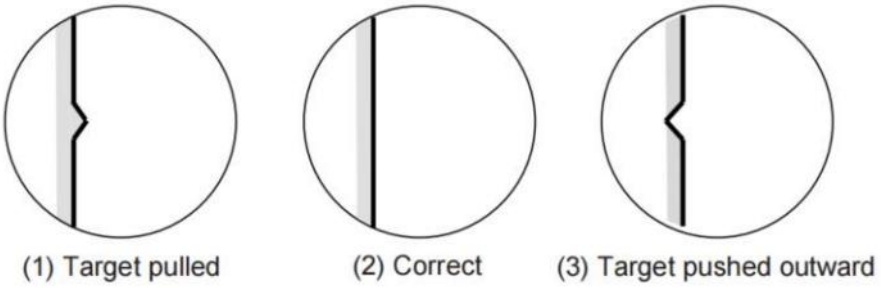
Use Type

1. Press the **MENU** button to enter the main menu.
2. Use the arrow keys to select the "System" menu and press **ENT**.
3. Select the usage type ("River" or "Sea") and press **ENT** to confirm.
4. Press the **MENU** button twice to exit the menu.

Delay Adjustment

The trigger pulse generated on the display unit is transmitted through the signal cable into the antenna unit. The time required for the signal to reach the antenna unit mainly depends on the length of the signal cable. If the display unit is not correctly adjusted, echoes reflected from nearby linear objects will not appear straight, but will instead look protruding or recessed as shown in the figure below. In such a case, the distance to the target cannot be accurately measured.

1. Set the radar to a short range (e.g., 0.25 NM) and adjust GAIN and A/C SEA settings. Visually select a long straight target (e.g., a breakwater).
2. Press the **MENU** button to enter the main menu.
3. Use the arrow keys to select the "System" menu and press **ENT**.
4. In the "System" submenu, select "Timing Adjust" and press **ENT**.
5. Use the arrow keys to adjust to the correct image, as shown in the diagram.



Examples of wrong and correct sweep timings

6. Press the **MENU** button three times to exit the menu.

Note: Ensure the correct "Use Type" is selected in the system settings menu before performing delay adjustment.

Time Reset

The system information menu displays the radar's usage and transmission time. When replacing the magnetron, the transmission time should be reset to zero.

1. Press the **MENU** button to enter the main menu.
2. Use the arrow keys to select the "System" menu and press **ENT**.
3. In the "System" submenu, select "Time Reset" and press **ENT**. The usage time and transmission time in the system information menu will be reset.
4. Press the **MENU** button three times to exit the menu.

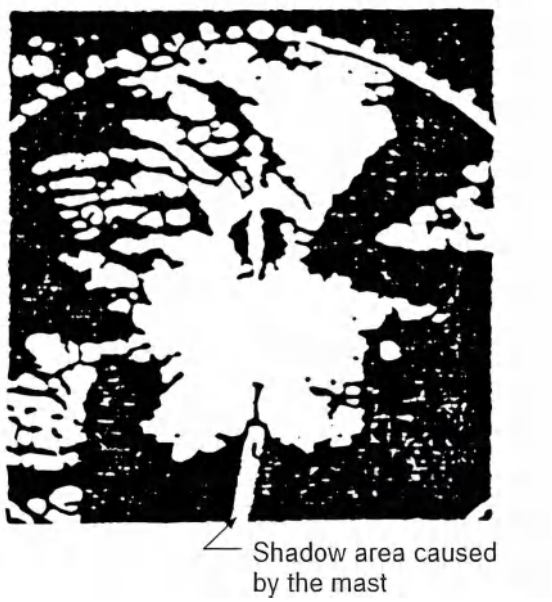
7.5.2 Blind Sector Test

This test is conducted during sea trials for new ships or as the first task after radar installation on other vessels. Even a small blind sector can hide potentially dangerous targets on a collision course, leading to catastrophic consequences. Two methods can be used to determine the angular width of the blind sector:

1. Identify a small, clearly visible target about 1 nautical mile away, and slowly rotate the vessel 360 degrees (avoid using buoys with reflectors, as their response may not provide accurate results). If the echo disappears, the target is in a blind sector. When the target reappears, the echo will become visible again. This test should be performed in calm conditions to ensure reliable results, as rough seas can cause the buoy to disappear in clutter or be temporarily submerged, and vessel motion instability can lead

to large errors. In any case, take the average value of several observations for each blind sector.

2. Observe the blind sector against a background of sea clutter. All blind sectors appear as dark areas against the clutter, as shown in the diagram. In heavy clutter, the blind sector cannot be estimated accurately, as echoes from either side may enter the area and create a false impression of brightness. In certain waters, satisfactory test results may not be achievable due to indirect echoes, false echoes, or multiple echoes from nearby structures or other vessels.



Record the measured results in the blind sector chart. The example diagram (B) shows the blind sector for an antenna unit setup (A). The blind sector chart should be placed near the display unit.

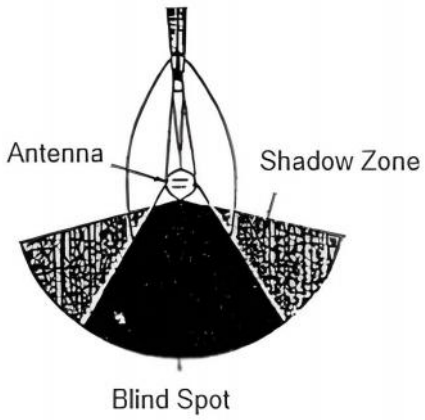


Figure A

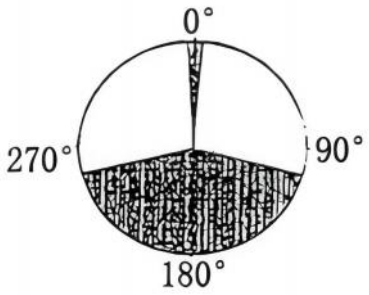
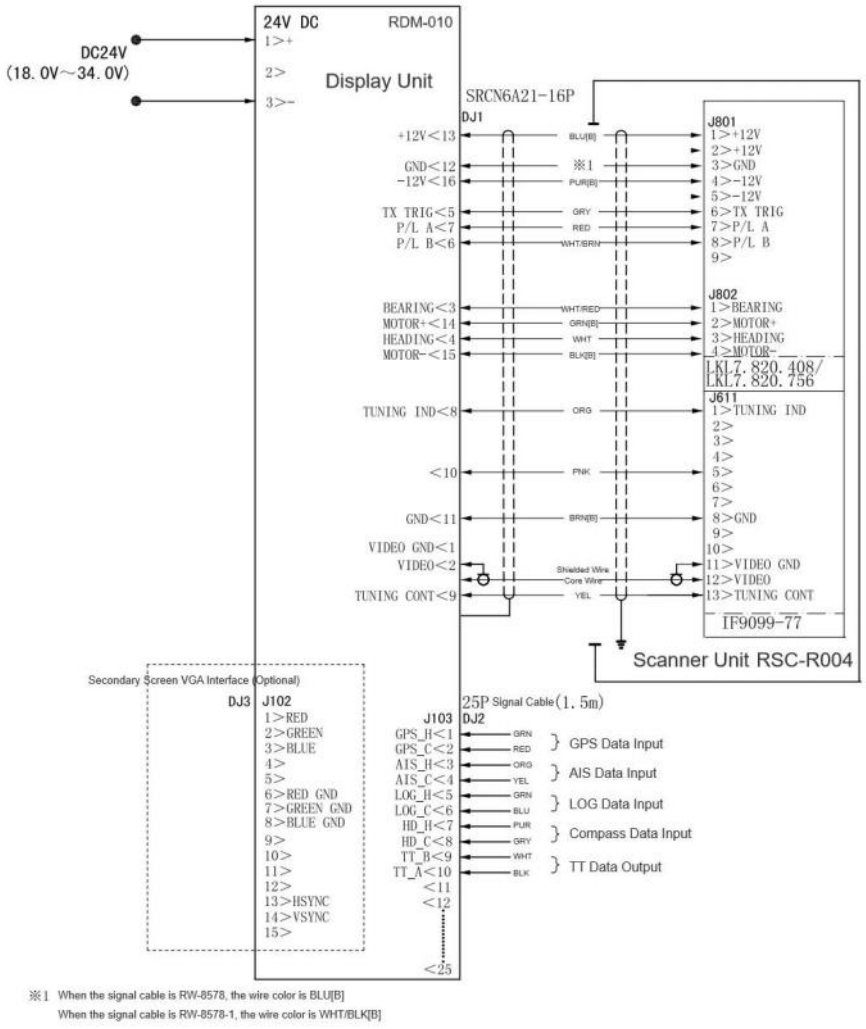


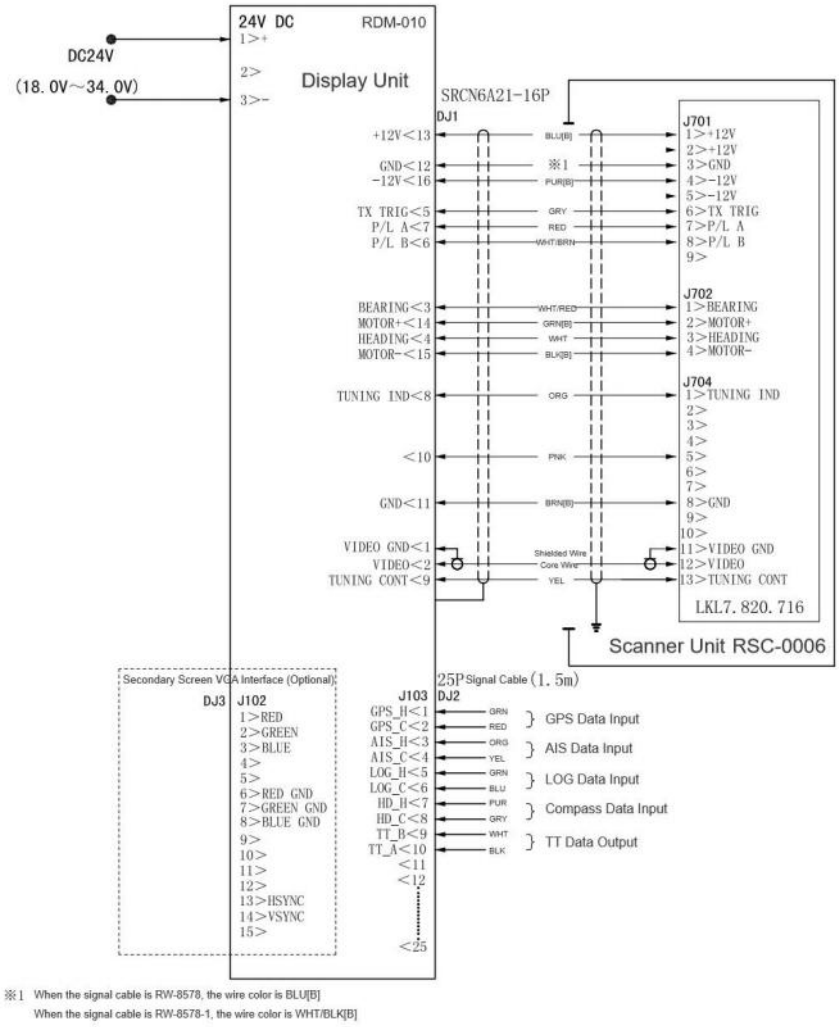
Figure B

XLR1004R
Marine Navigation Radar
Cable Connection Diagram

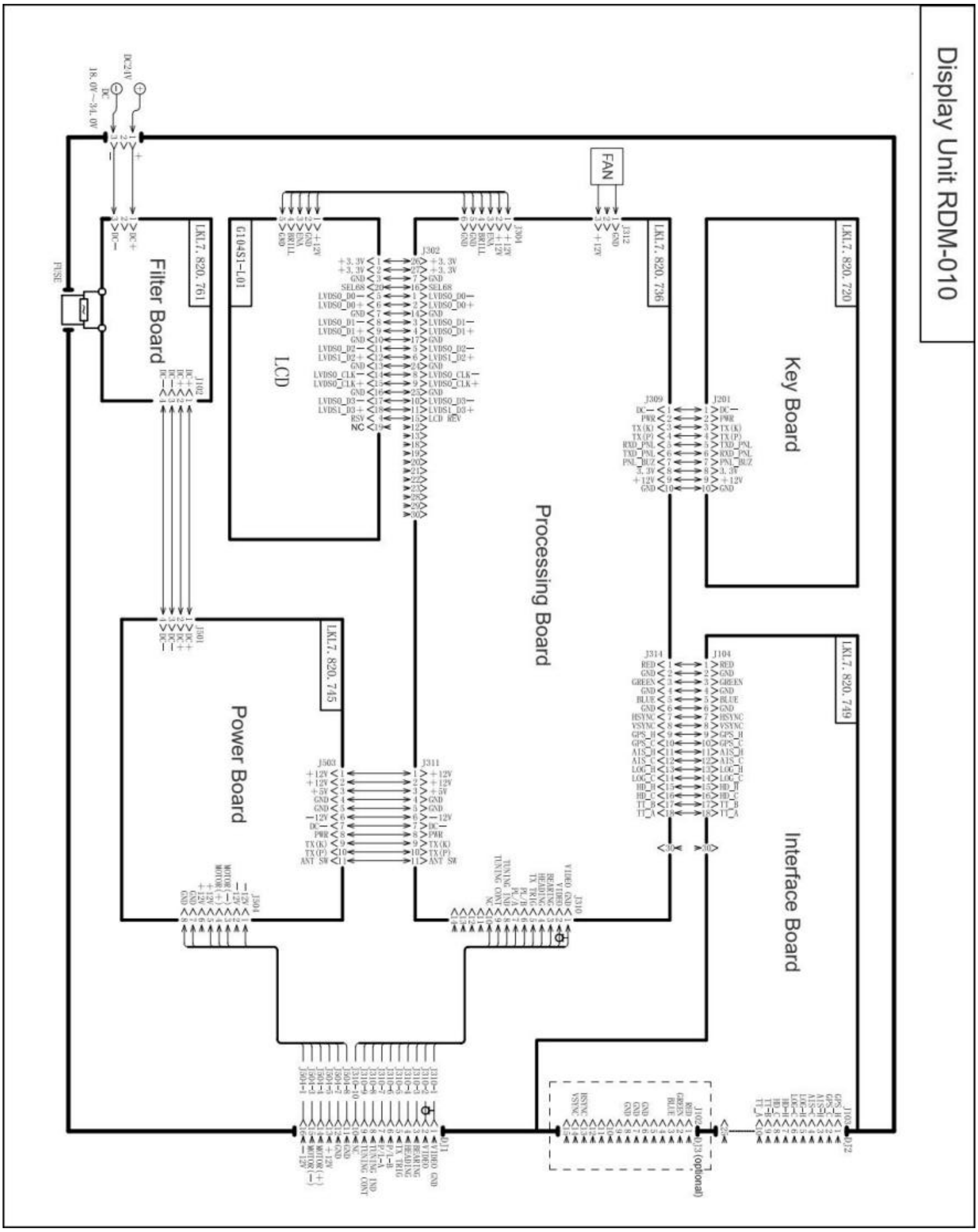


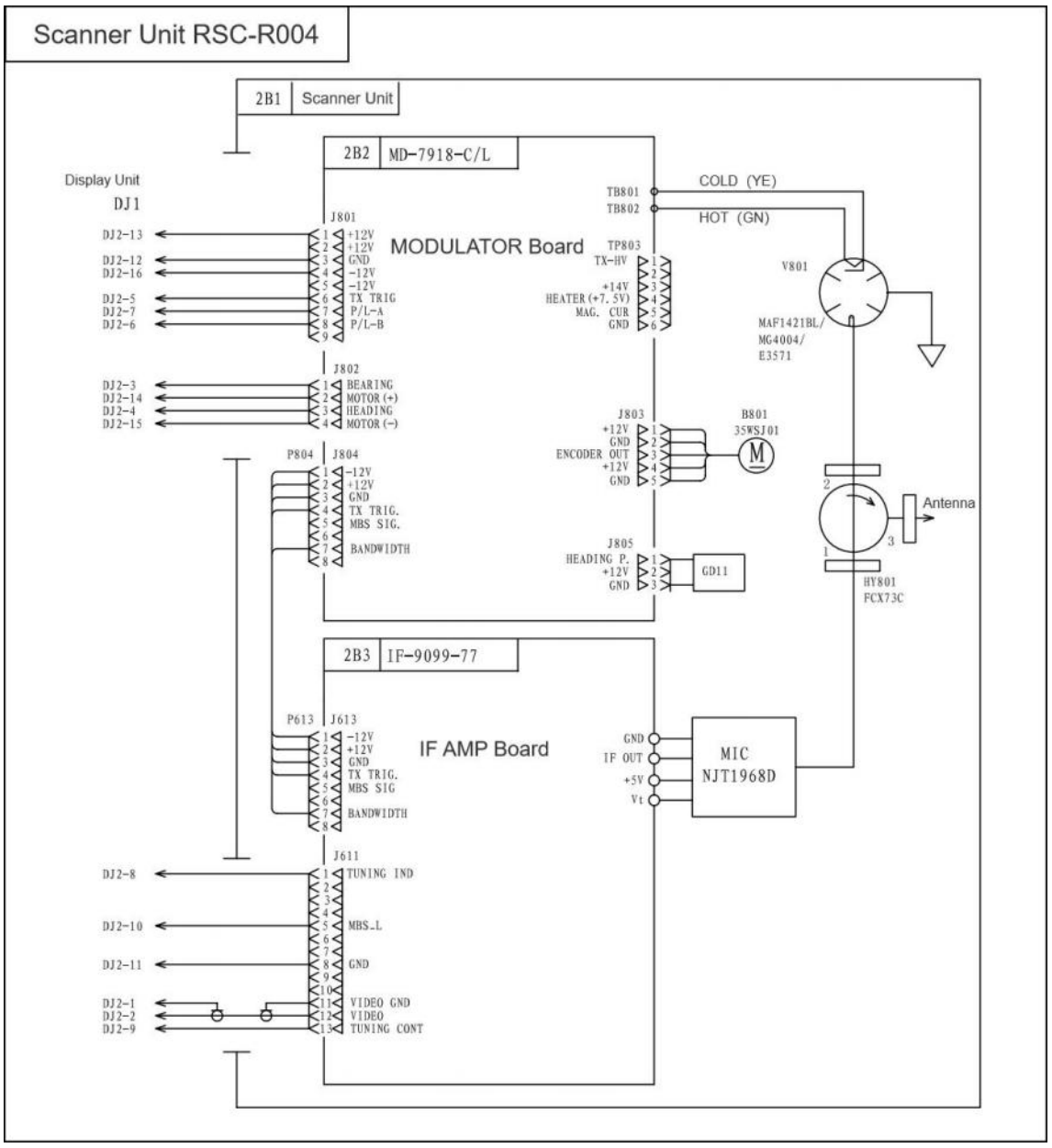
※1 When the signal cable is RW-8578, the wire color is BLU[B]
When the signal cable is RW-8578-1, the wire color is WHT/BLK[B]

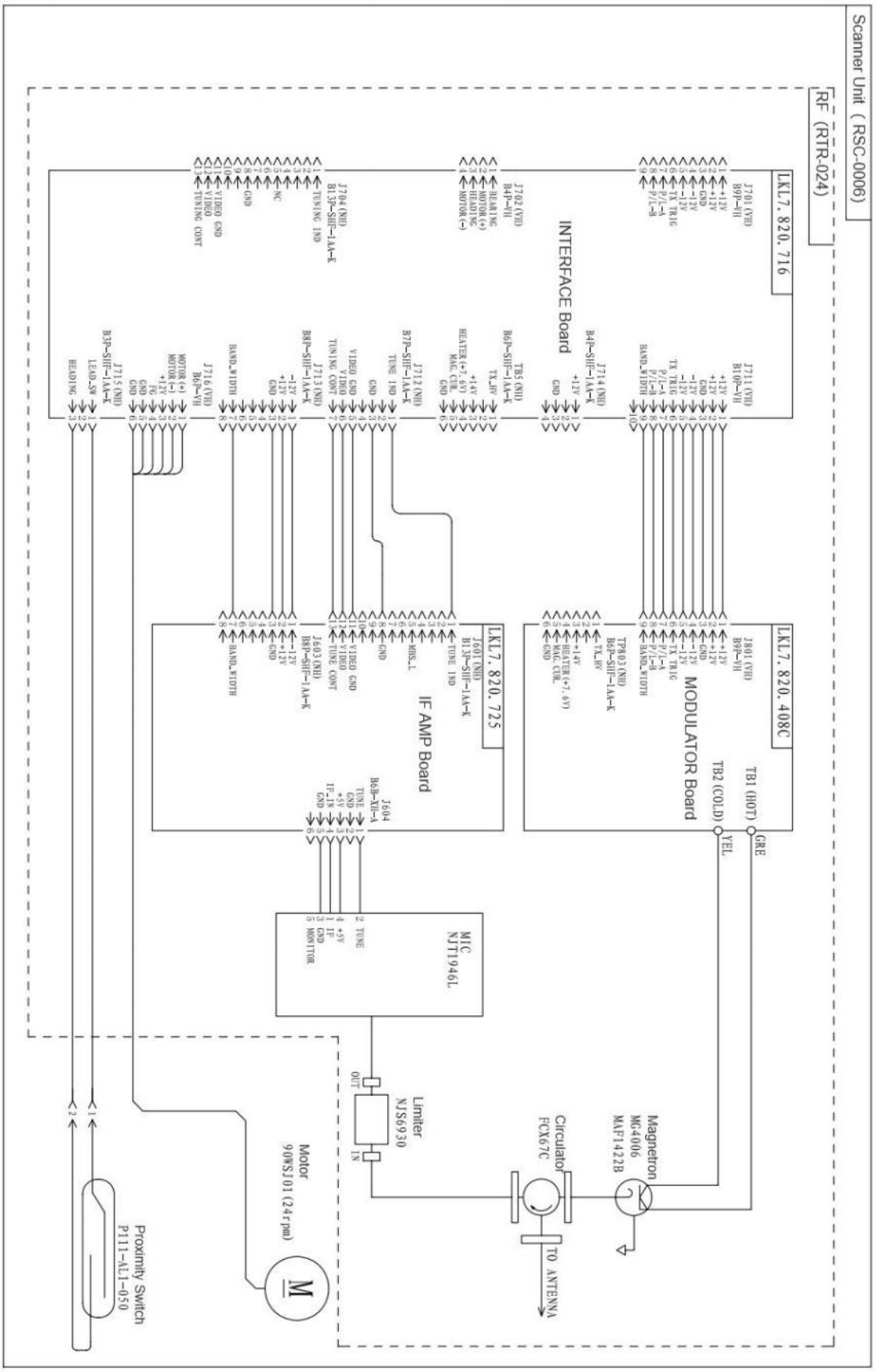
XLR1006L
Marine Navigation Radar
Cable Connection Diagram



※1 When the signal cable is RW-8578, the wire color is BLU[B]
When the signal cable is RW-8578-1, the wire color is WHT/BLK[B]


Display Unit RDM-010
Filter Board
LKL7.820.761
LCD
G104S1-L01
Processing Board
LKL7.820.736
Key Board
LKL7.820.720
Power Board
LKL7.820.745
Interface Board
LKL7.820.749
FAN
FUSE


Scanner Unit RSC-R004
2B1 Scanner Unit
2B2 MD-7918-C/L
MODULATOR Board
Display Unit
DJ1
J801
DJ2-13 +12V
+12V
DJ2-12 GND
DJ2-16 -12V
-12V
DJ2-5 TX TRIG
DJ2-7 P/L-A
DJ2-6 P/L-B
J802
DJ2-3 BEARING
DJ2-14 MOTOR (+)
DJ2-4 HEADING
DJ2-15 MOTOR (-)
P804 J804
-12V
+12V
GND
TX TRIG.
MBS SIG.
BANDWIDTH
TB801 COLD (YE)
TB802 HOT (GN)
TP803
TX-HV
+14V
HEATER (+7.5V)
MAG. CUR
GND
V801
MAF1421BL/
MG4004/
E3571
J803
+12V
GND
ENCODER OUT
+12V
GND
B801
35WSJ01
M
J805
HEADING P.
+12V
GND
GD11
2
3
1
Antenna
HY801
FCX73C
2B3 IF-9099-77
IF AMP Board
P613 J613
-12V
+12V
GND
TX TRIG.
MBS SIG
BANDWIDTH
GND
IF OUT
+5V
Vt
MIC
NJT1968D
J611
DJ2-8 TUNING IND
DJ2-10 MBS_L
DJ2-11 GND
DJ2-1 VIDEO GND
DJ2-2 VIDEO
DJ2-9 TUNING CONT


Scanner Unit (RSC-0006)
RF (RTR-024)
LKL7. 820. 716
INTERFACE Board
LKL7. 820. 408C
MODULATOR Board
LKL7. 820. 725
IF AMP Board
MIC
NJT1946L
Limiter
NJS6930
Circulator
FCX67C
Magnetron
MG4006
MAF1422B
TO ANTENNA
Motor
90WSJ01(24rpm)
Proximity Switch
P111-AL1-050

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