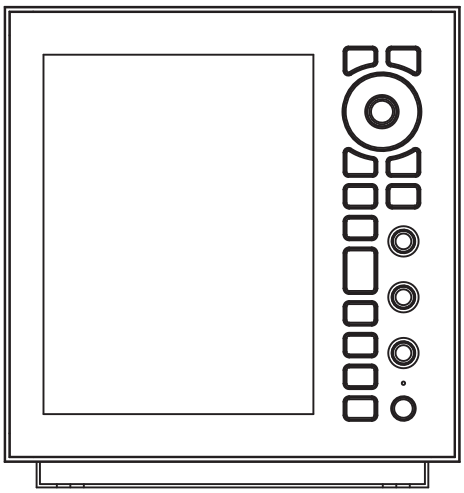
navtiX

KNR-1X0 series

OPERATOR'S MANUAL

10.1"/12.1"/15" TFT LCD COLOR MARINE RADAR

Model: KNR-100
KNR-120
KNR-150



FC CE

⚠SAFETY INSTRUCTIONS

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

⚠ WARNING



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



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



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



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

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

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

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

⚠ CAUTION

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

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

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

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FOREWORD

Thank you for choosing Navtix KNR-1X0 Marine Radar. The radar is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless properly installed and maintained. Please carefully read and follow the recommended procedures for installation, operation and maintenance. While this unit can be installed by the purchaser, any purchaser who has doubts about his or her technical abilities may wish to have the unit installed by an Navtix representative or other qualified technician.

We want to Hear from you!
Your suggestions and comments are highly important to us, to further develop our equipment let us know if we are achieving our purpose.
Again, Thank you for purchasing an Navtix Equipment.

Features

The main features of the MODEL KNR-100/120/150 are:

- Traditional Navtix quality and reliability in a compact, lightweight and low-cost radar.
- Durable brushless antenna motor.
- Target Tracking function (TT) up to 40 targets.
- AIS target and radar target overlay. (external AIS input is needed).
- Digital radar target technology.
- On-screen alphanumeric readout of all operational information.
- Standard features include: EBL (Electronic Bearing Line), VRM (Variable Range Marker), Guard Alarm, Display Off Center, and Echo Trail.
- Watchman feature periodically transmits the radar to check for radar targets which may be entering the alarm zone.
- Ship's position in latitude and longitude and range and bearing to waypoint, and ship's speed/ heading/course can be shown in the bottom of the screen. (Requires a navigation aid which can output such data in IEC61162 format.)
- Zoom feature provided.

KNR-100/120/150 SPECIFICATION

ANTENNA UNIT

		KNR-100/120/150	
Model		KRA-1011	KRA-4003
Radiator		Slotted waveguide array	
Radiator length		60cm	120cm
Horizontal beamwidth		4º	1.9º
Vertical beamwidth		25º	22º
Sidelobe	within±20ºoff mainlobe	Less than-18dB	Less than -24dB
	outside±20ºoff mainlobe	Less than -23dB	Less than -30dB
Polarization		Horizontal	
Antenna rotation speed		48 ± 3rpm	24/48 ± 3rpm
Wind resistance		Relative wind speed 100 knots (51.5m/s）	

TRANSCEIVER MODULE (contained in radome)

	KNR -100/120/150	
Model	KRA-1011	KRA-4003
Transmitting tube	MAF1421B/MSF1421B	MAF1422/MSF1422
Frequency	9410 ± 30MHz	
Peak output power	4.0KW	
Pulselength & pulse repetition rate	0.08μs, 2100 Hz (S1 : 0.125 nm to 1.5 nm)	
	0.35 μs,1200 Hz (M1 : 1.5 nm to3 nm)	
	0.8 μs, 600 Hz (L1 : 3 nm to 36 nm)	0.8 μs, 600 Hz (L1 : 3 nm to 72 nm)
Modulator	FET switching method	
Receiver front end	MIC	
Tuning	Automatic or Manual	
I.F.	60 MHz	
Bandwidth	25 MHz (0.08μs, 0.35μs), 3 MHz (0.8μs)	

DISPLAY UNIT

1. Indication system: LCD digital display
2. Display: 10.1"(KNR-100)/12.1"(KNR-120)/15"(KNR-150)
   LED backlight, 32-bit TFT Color LCD Display
3. Range scale (nm):
   Range, Range interval and no. of Rings:
   0.125(0.0625,2), 0.25(0.125,2), 0.5(0.125,4), 0.75(0.25,3), 1(0.25,4), 1.5(0.25,6), 2(0.5,4), 3(0.5,6), 4(1,4), 6(1,6), 8(2,4), 12(2,6), 16(4,4), 24(4,6), 36(6,6)
4. Bearing resolution: 4°
5. Bearing accuracy: Within 1°
6. Range discrimination: Better than 30 m
7. Range ring accuracy: 0.9% or range in use or 8 m, whichever is larger
8. Minimum range: Better than 25 m
9. Markers:
   Heading line, Bearing scale, Range ring, VRM, EBL Tuning indicator, Cursor, Alarm zone, North mark (heading sensor input required)
10. Alphanumeric indication:
    Range, Range ring interval, Pulselength, Interference rejection (IR), VRM, EBL, Stand-by (ST-BY), Radar alarm, Echo stretch (ES), Range to cursor, Bearing to cursor, Echo trailing (TRAIL), Trail time, Trail elapsed time, Navigation data (navigation input required), heading (HDG, heading sensor input required)
11. Vibration:
    Vibration Total amplitude:
    1 to 12.5 Hz ± 1.6mm
    12.5 to 25 Hz ± 0.38mm
    25 to 30 Hz ± 0.10mm
12. Temperature:
    Antenna unit; -25℃ to + 70℃
    Display unit; -15℃ to + 55℃
13. Humidity:
    Relative humidity 93% or less at + 40℃
14. Power supply & power consumption : 12V, 24V or 32VDC (10.5V to 40 VDC) 80W
15. Compass safe distance:

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

INTERFACE IEC61162(NMEA0183)

Input data sentences:

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

*: Calculated value based Magnetic variation.

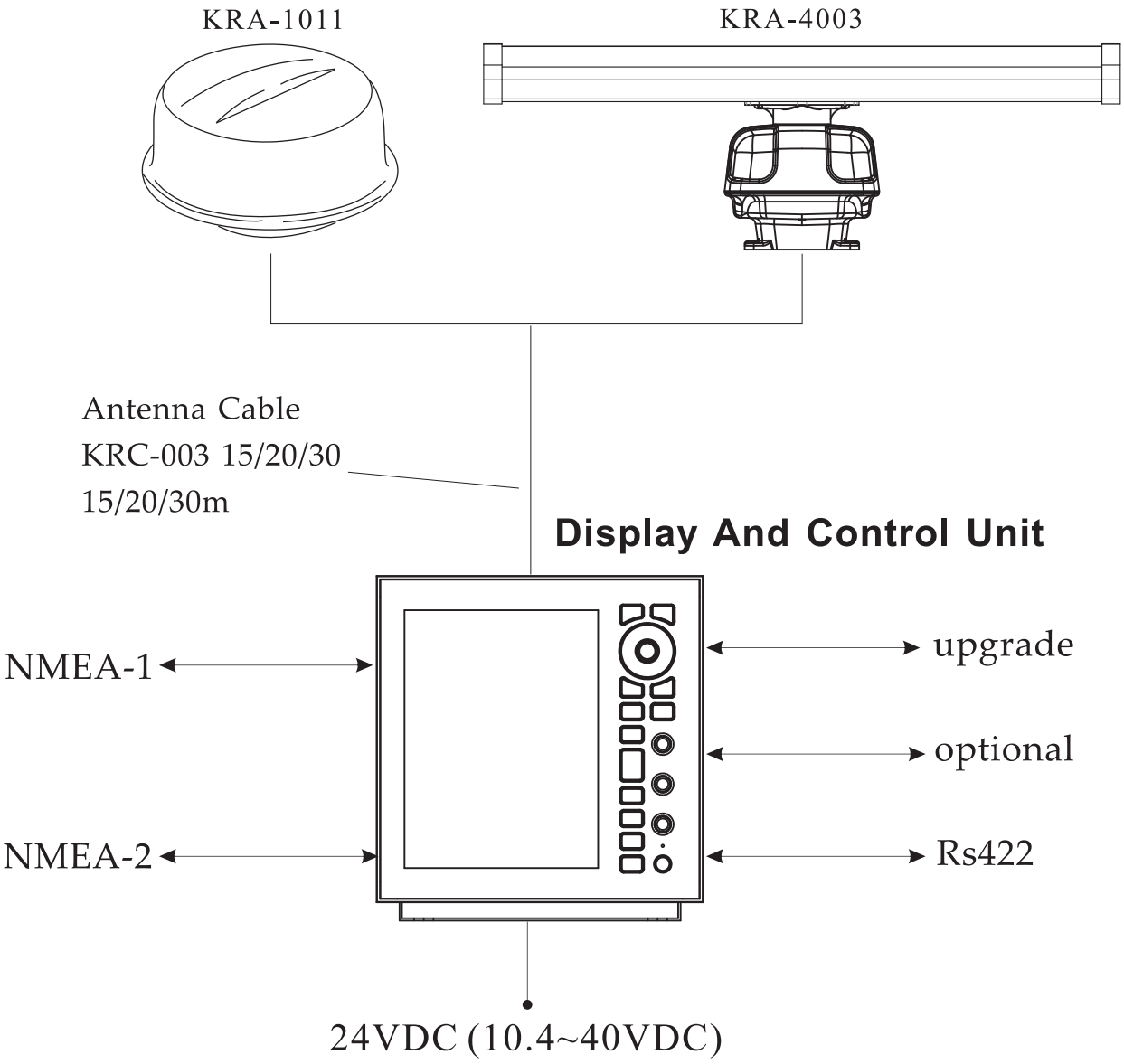
AIS:	VDO>VDM>ACA>ACS>ALR>ACK

Output data sentences:

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

CONFIGURATION OF KNR-1X0

Antenna And Transceiver Unit



Configuration Table For Various Radar Equipment Models

Model	Display and Control Unit	Transmit receive Unit	Antenna Unit
KNR-100	KND-1010	KRT-1011	KRA-1011
KNR-120	KND-1210	KRT-1011	KRA-1011
KNR-150	KND-1510	KRT-4003	KRA-4003

1. PRINCIPLE OF OPERATION

1.1 What is Radar?

The word radar is an acronym derived from Radio Detection And Ranging. Applies to electronic equipment designed for detecting and tracking objects (targets) at considerable distances.The main purpose of a marine radar is to provide bearing and distance of ships and land targets in vicinity from own ship for collision avoidance and navigation at sea.

1.2 How Ships Determine Position Before Radar

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

1.3 How Radar Determines Range

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

1.4 How Radar Determines Bearing

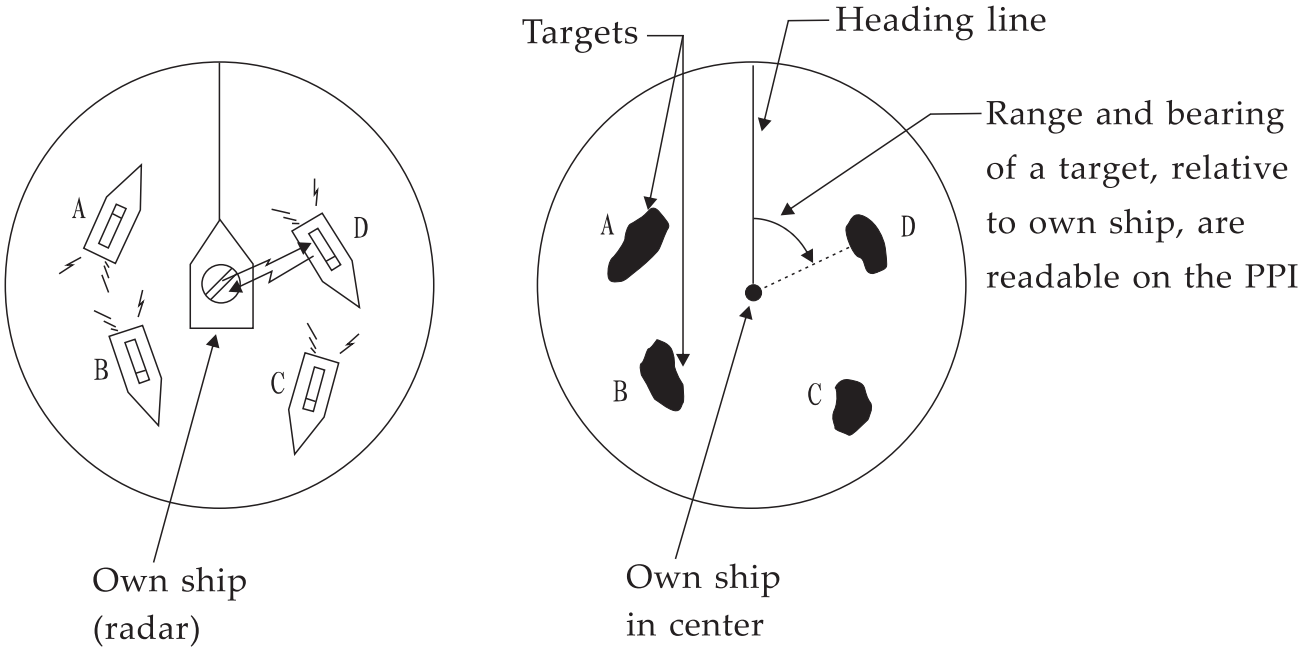
The bearing to a target found by the radar is determined by the direction in which the radar scanner antenna is pointing when it emits an electronic pulse and then receives a returning echo. Each time the scanner rotates pulses are transmitted in the full 360 degree circle, each pulse at a slightly different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

1.5 Radar Wave Speed and Antenna Rotation Speed

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

1.6 The Radar Display

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



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

How radar works

2. BASIC OPERATION

2.1 Control Description



Open/Close Menu
Cancel menu operation: long press to hide the bow line

Control with the up, down, left, and right arrow keys

Measure the target bearing: briefly press to toggle between electronic bearing lines 1 and 2; press and hold to deactivate the bearing lines 1 and 2

Image shift

Send the latitude and longitude of the target to the navigation plotting device. Then, input the origin marker at the cursor position on the radar display screen

Range of volume reduction

Allows users to customize their key shortcut functions

Press briefly to toggle the trajectory duration; press long to clear the trajectory

Adjust brigthness display

Switch to standby transmission mode

display, then release to restore it. Also, cancel the tracking of the TT target, and remove the selected TT or AIS target data from the data box.

Confirm the save menu option; when selecting a target, press "Confirm Capture" to select whether to display TT or AIS target data

Measure the target range: briefly press to toggle between variable-range scales 1 and 2; hold down to deactivate the variable-range scales 1 and 2

Press and hold to set the target alarm zone 1.2; press and hold longer to clear the alarm zone 1.2

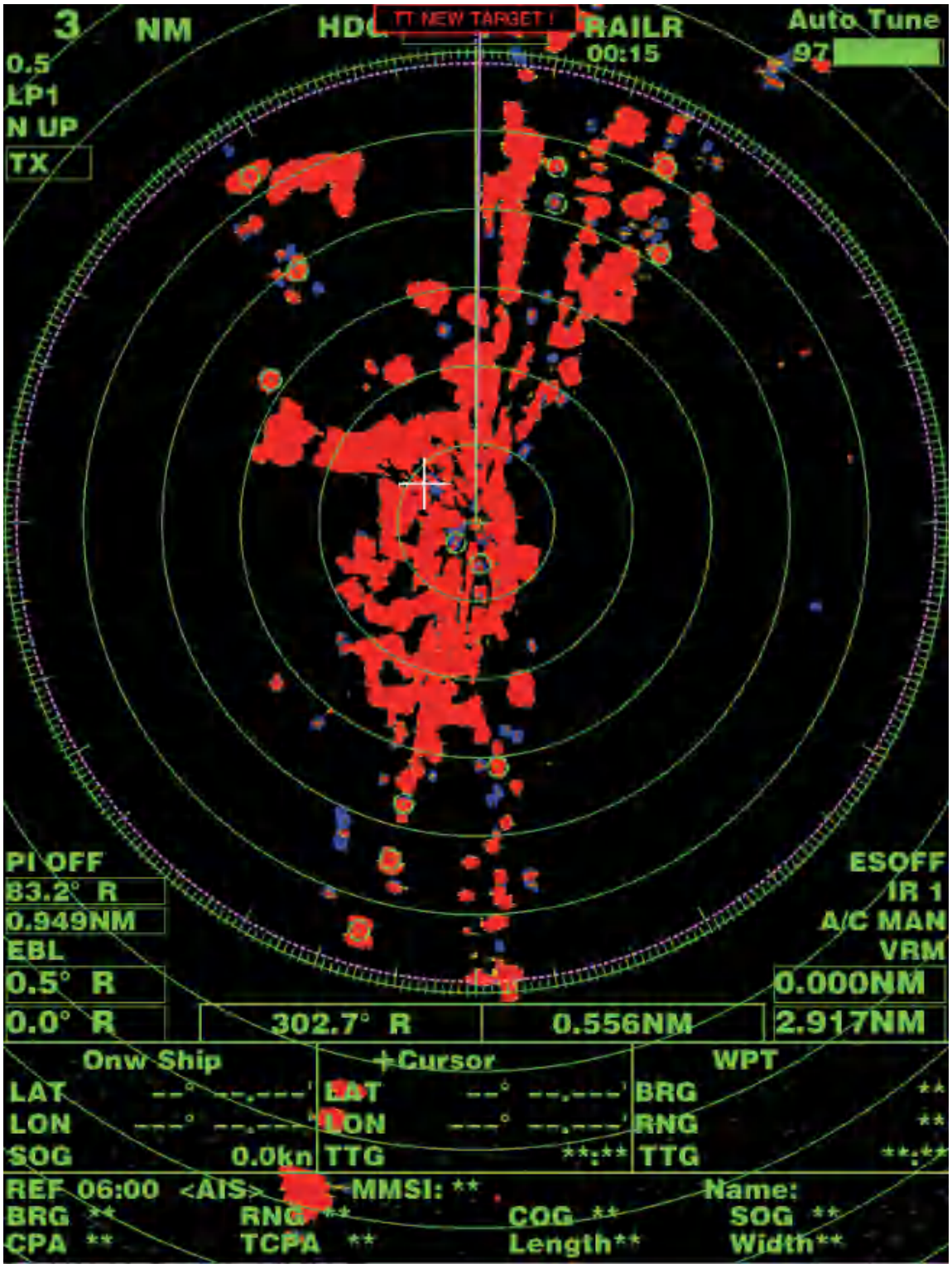
Rotation: Adjust the sensitivity of the radar receiver; briefly press to activate its custom shortcut function F1, or press and hold to toggle automatic gain

Rotation: Reduces sea clutter; press and hold the custom shortcut key F2 to activate it, or hold it down to switch to automatic sea mode

Rotation: Reduces rain and snow clutter; press and hold the custom shortcut key F3 to activate it, or long-press to toggle between automatic rain/snow modes

Power ON/OFF

2.2 Display Indication and Markers



2.3 Turning the Radar On/Off

Press the [⏻] key to turn the radar on or off.

The control panel lights and a timer displays the time remaining for warm up of the magnetron (the device which produces radar pulses), counting down from 1:30 to 0:01.

2.4 Transmit

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

*Eight tones of yellow or multi-color selectable.

2.5 Stand-by

When you won't be using the radar for an extended period, but you want to keep it in a state of readiness, place it in stand-by by pressing the [ST-BY/TX] key.

The display shows "STAND-BY", navigation data, or goes into economy mode, depending on menu setting. (Will discuss more in the menu operation section)

2.6 Select measurement range

When adjusting the range from small to large, the radar automatically selects the fixed-range scale, transmit pulse width, and pulse repetition frequency to achieve optimal detection performance. You can select the transmit pulse width for 1. 5 and 3 nautical mile ranges via the menu; other parameters cannot be adjusted manually. These values are displayed in the upper-left corner of the screen. To select a range, press the [-Range+]button. Both the range value and the fixed-range scale indicator in the lower-left corner of the screen will increase or decrease in response to your operation.

How to select the measurement range

①When navigating through narrow waterways or busy ports, it is advisable to select a smaller range of operation to facilitate the detection of small targets and the handling of emergency situations.

②In open water, a larger range should be selected to facilitate the detection of obstacles along the route when aligning from greater distances.

2.7 Adjust image brightness

The [BRILL] button is used to adjust the brightness of the echo display, offering 16 levels. Pressing the [Brightness] button selects a brightness level; each press increases the brightness by one level. Once the brightest level is reached, another press returns the display to the lowest brightness level. This operation is cyclic, and the default brightness is set to level 6.

2.8 Menu description



1. Use ▲or▼to select a menu or a sub-menu. The cursor (green) within the menu bar indicates the currently selected menu. The menu items in the right-hand window update accordingly based on the selected menu.

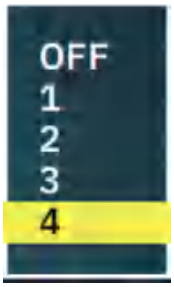
Menu Description

[Brill / Color]: Adjust brightness and color
[Diaplay]: Configure display settings
[Echo]: Adjust echo function
[PI]: Set parallel index lines
[AIS. TT Menu]: Set up the AIS. TT menu
[Speed Menu]: Set up the speed menu
[Unit Steup]: Setting Unit
[Alarm]: Configure alert items
[User Menu1]: User-defined settings
[User Menu2]: User-defined settings
[Initial Menu]: For use by installation personnel
[Factory Menu]: For use by installation personnel

2. Press the [ENT/ACQ] key to move the cursor to the menu bar. The cursor in the menu bar will immediately turn gray, while the cursor within a menu item will turn yellow. The control knob will then move to the menu bar.

To move the cursor from the menu bar back to the main menu area, use the [CANCEL/HL OFF] key. The title bar of the active toolbar appears blue, whereas the title bar of the non-active toolbar appears gray.

3. Use ▲or ▼arrow to select a menu item, then press the [ENT/ACQ] key. This will open the option window for the selected menu item.



4. Use ▲or ▼to select an option or a value.

5. Press the [ENT/ACQ] key to save your selection. To close the window without saving, press the Cancel key.

6. Press the Menu button to close the menu.

2.9 Adjust The Receiving Sensitivity

The [Gain] knob is used to adjust the reception sensitivity; its operation is identical to the volume control on a broadcast radio, serving to enhance signal reception. The correct adjustment method is to set the sensitivity until just enough background noise appears on the display screen. If the sensitivity is set too low, weak echoes may be lost; if the sensitivity is set too high, excessive background noise may occur, causing echoes from larger targets to be lost, as the overwhelming background noise makes it impossible to distinguish them from the desired echoes. To adjust the sensitivity, first select the far range setting（beyond 6 nautical miles）, then turn the [Gain] knob until just enough background noise appears on the screen.

2.10 Adjust Wave Suppression

The presence of cluttered echoes in the display center area can be problematic; the interfering signals responsible for this phenomenon are referred to as ″sea clutter.″ The range of such interference increases with higher operating frequencies and antennas positioned higher above the water surface. When sea clutter appears on the display, it manifests as numerous small echoes, which may degrade radar performance. If sea clutter obscures the target image, adjusting the [Sea Clutter Suppression] knob can mitigate this interference.

How does wave suppression work?

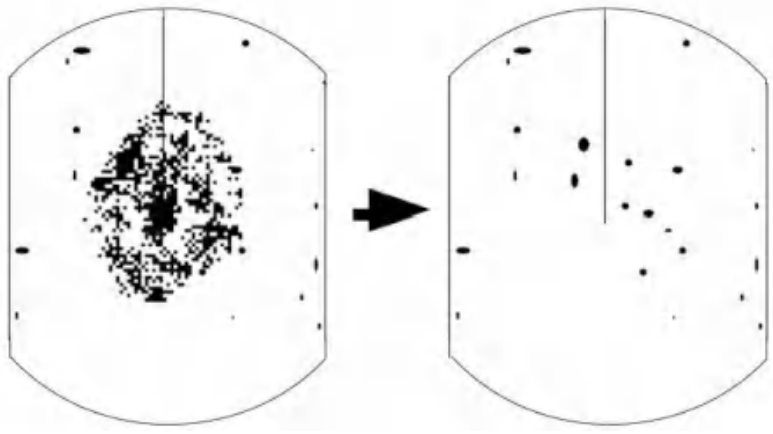
The [Wave Suppression] knob reduces the gain of near-range echoes (where wave interference is most pronounced), and its effect follows a logarithmic curve with increasing distance—meaning the suppression weakens as the distance grows. Once the wave interference falls outside the effective range, the wave suppression effect also disappears.

◆Adjust wave suppression

When properly adjusted, sea clutter appears as faint, discrete dots, while echoes from small targets remain visible and can be clearly distinguished. If the setting is set too low, targets may be obscured by sea clutter; if set too high, both sea clutter and targets will disappear from the display. In most cases, the optimal setting is achieved when the knob is adjusted so that sea clutter vanishes in the downwind direction, while in the upwind direction, sea clutter remains faintly visible.

①Verify that the sensitivity adjustment is correct and that the transmission is within the near-range setting.

②Adjust the [Wave Suppression] knob to a low setting so that the target remains distinguishable, while a small amount of wave interference remains visible.



Wave interference display In the central area

After wave suppression adjustment Interference is suppressed

◆Correct wave suppression adjustment methods:

A common misconception is that sea clutter should be completely eliminated. For example, if you set the sea clutter suppression to its maximum, the central portion of the display may be come blank; this blank area can be hazardous (leading to target loss), particularly when the sensitivity is not properly adjusted. The standard practice is to maintain a small amount of sea clutter on the display;

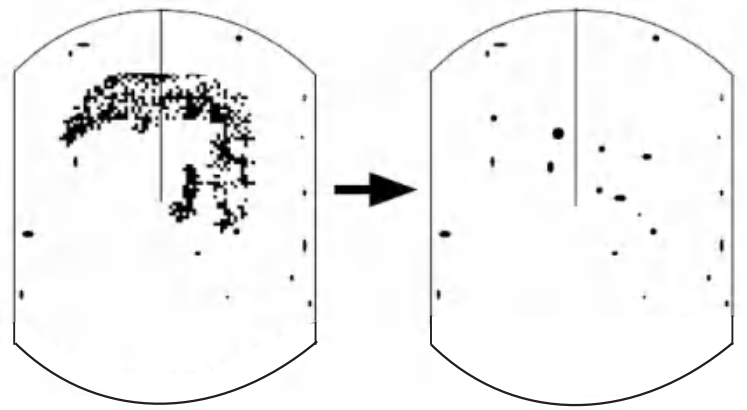
this approach prevents the loss of small targets, and if no sea clutter is present, you may turn the knob to its minimum setting.

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

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

Adjusting A/C RAIN

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



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

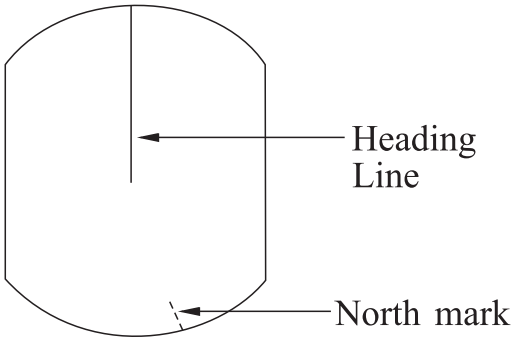
Note: In addition to reducing clutter, the [A/C RAIN] control can be used in fine weather to clarify the picture when navigating in confined waters. However, with the circuit being activated, the receiver is less sensitive. Therefore, turn off the circuit by turning the control fully counter clockwise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

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

Push the [A/C Auto] key. "A/C Auto"appears on the bottom left-hand corner of the display when the A/C AUTO circuit is turned on. You can fine tune by adjusting [GAIN] and [A/C RAIN] controls, the [A/C SEA] control is disabled.

2.12 Erasing the Heading Line, North Mark

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



Heading line and north mark

2.13 Measuring the Range

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

By range ring

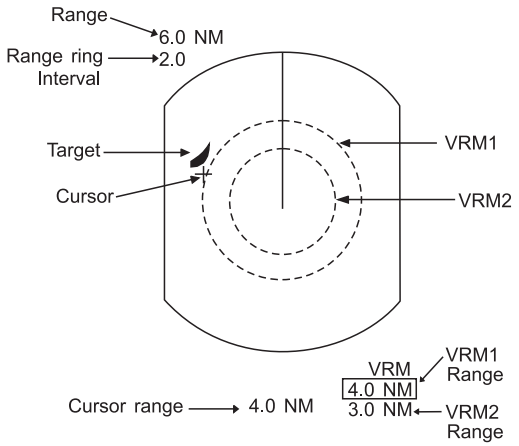
Count the number of rings between the center of the display and the target. Check the range ring interval and judge the distance of the echo from the inner edge of the nearest ring.

By cursor

Operate the omnipad to place the cursor intersection on the inside edge of the target echo, the range to the target, as well as the bearing, appears at the bottom center of the display.

By VRM

1. Press the [EBL/VRM SELECT] key to circumscribe a VRM readout (at the bottom center).Each press of the key selects the readout of EBL1,EBL2,VRM1 or VRM2 in that order.
2. Press the [EBL/VRM CONTROL] key to enable control of the VRM by the omnipad.
3. Operate the omnipad to place the outside edge of the VRM on the inside edge of the target.
4. Check the VRM readout at the bottom right-hand corner of the display to find the range to the target.
5. To erase the VRM, press [EBL/VRM SELECT] to select the VRM you want to erase then hold down the [EBL/VRM CONTROL] key for about 2 seconds.

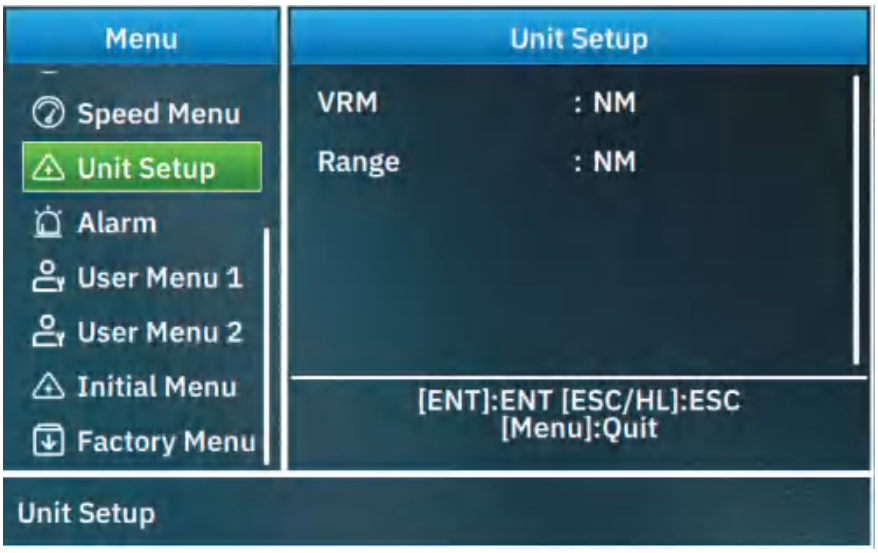


Measuring range by the cursor, range rings and VRM

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

You can select the measurement unit for the variable-rangescale, with options including nautical miles (NM), kilometers(KM), and miles(SM). When the VRM unit is changed, the scale unit of the indicator will also change accordingly.

1. Press the Menu button to open the menu.
2. Use ▲or▼to select [UnitSetup], then press the[ENT/ACQ] key.



3. Use▲or▼to select[VRM], then press the[ENT/ACQ] key.



4. Use▲or▼to select the unit, then press the [ENT/ACQ] key.
5. Press the Menu button to close the menu.

2.14 Measuring the Bearing

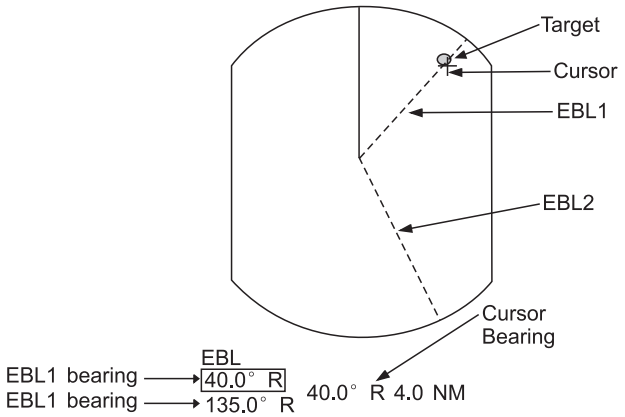
There are two ways to measure the bearing to a target: by the cursor, and by the EBL (Electronic Bearing Line).

By cursor

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

By EBL

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



How to measure bearing by EBL and cursor

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

Tips for measuring bearing

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

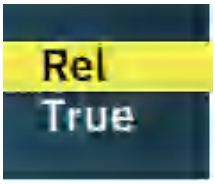
2.15 EBL Consult

If the bearing is relative to the bow direction of the vessel, the EBL indicator will display ″R″ (relative). If the bearing is referenced to true north, the EBL indicator will display ″T″ (Rrue). The selection between relative or true can be made in the ″Bow Up″ and ″True″ observation modes. In all other modes, the bearing indicator always displays ″T″. The true bearing requires the bow direction sensor.

1. Press the Menu Key to open the menu.
2. Use▲or▼to select [Display], then press the [ENT/ACQ] key



3. Use ▲ or ▼ to select [EBL Ref], then press the [ENT/ACQ] key.

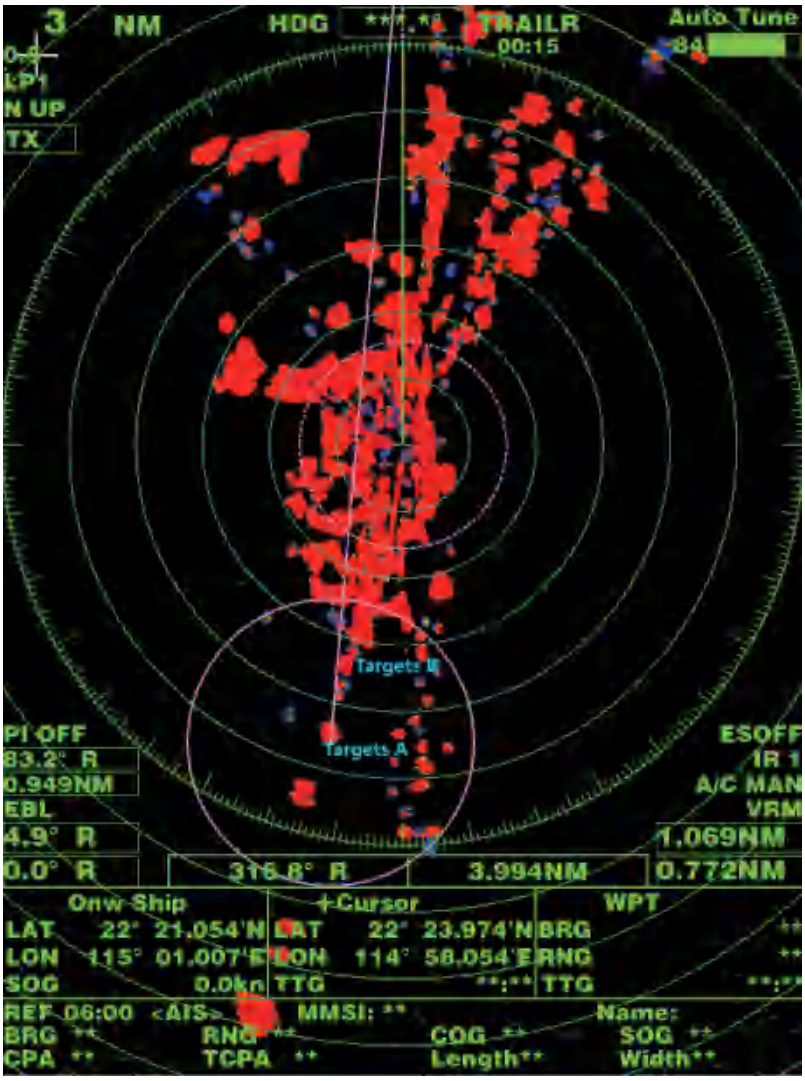


4. Use ▲ or ▼ to select [Rel] or [True], then press the [ENT/ACQ] key.
5. Press the Menu Key to close the menu

2.16 Measuring range and bearing between two targets

The following procedure shows how to measure the range and bearing between target "A" and target "B".

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



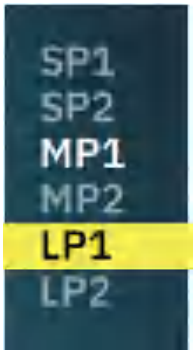
2.17 Select The Pulse Width

This project is used to select the pulse width of the transmitted pulse i. e. , the transmission time. When using a wider pulse width, the echo from distant targets increases, while the range resolution decreases. Corresponding pulse width settings are available across different measurement ranges.

1. Press the menu Key
2. Use ▲ or ▼ to select [Echo], then press the [ENT/ACQ] key



3. Use ▲ or ▼ to select [Pulse Length], then press the [ENT/ACQ] key



4. Use ▲ or ▼ to select different Pulse Length, then press the [ENT/ACQ] key.
5. Press the Menu Key to close the menu

2.18 Target Alert

The target alert function is used to search for targets (e. g. , vessels, land objects) within a predefined area. When a target enters or exits the alert zone, it triggers visual and audio alerts.

> **△ TAKE CARE**
>
> - One must not rely solely on alerts to detect potential collision risks.
> - Correctly adjust the anti-wave interference, anti-rain/snow interference, and gain control knobs to prevent the alert system from missing target echoes

2.18.1 How to configure the target Alert Zone

Follow the steps below to configure the target alert zone.

1. Press the ″ALARM″ button to enable Alert 1 or Alert 2. Pressing the ″ALARM″ button also allows you to switch between the currently active alerts, 1 and 2. The indicator of the currently active alert is displayed within the rectangular area in the upper-right corner of the screen.
2. Use the direction key to move the cursor to position A, then press the [ENT/ACQ] key.
3. Move the cursor to position B, then press the [ENT/ACQ] key. The rectangular alert status indicator in the upper-right corner of the screen will disappear. (Refer to the figure below.)

Note 1) A 360° warning zone shall be set; ensure that the same orientation is applied to Position B and Position A.

Note 2) When the target warning zone is outside the current range, the indicator ″ALARM1 (or 2) Range″ in the alarm status area will be replaced by ″ALARM1 (or 2) Entry (or Exit)″. (If the target warning zone is within the full offset range, the indicator remains unchanged.) Select the range to display for the target warning zone.

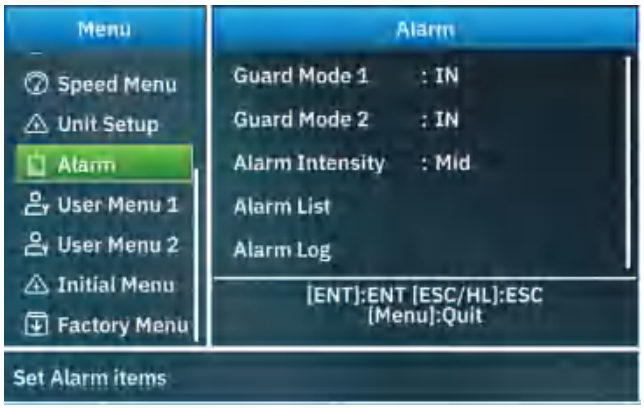
2.18.2 How to disable the audible alarm

When the target enters (or exits) the target alert zone, the target will flash and an alarm sound will be triggered. An alert message will appear at the bottom of the screen. To silence the alarm, press any key. When the target re-enters (or re-exits) the target alert zone, the target will flash again and the alarm sound will be triggered once more.

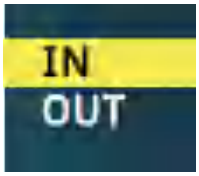
2.18.3 How to choose alarm types

You can configure target alerts to be activated when a target enters or exits the alert zone.

1. Press the Menu Key
2. Use ▲ or ▼ to select [Alarm], then press the [ENT/ACQ] key



3. Use ▲ or ▼ to select [Guard Mode 1 or 2], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to navigate in or out, then press the [ENT/ACQ] key.
5. Press the Menu Key to close the menu

2.18.4 How to disable target alerts

1. Press the [ALARM] button to select the Alert 1 or Alert 2 indicator located in the upper-right corner of the screen. The selected indicator is enclosed within a rectangle.
2. Press the [ALARM] button. The alarm indicator "ALARM1 (or 2) Confirmed" appears within a dashed rectangle.
3. Press and hold the [ALARM]button. The target alert area and the alert indicator will then disappear from the screen

2.18.5 How to Select the Target Intensity for Triggering Target Alerts

1.You can select the target intensity for triggering the target alert by following these steps:
2. Press the Menu button to open the menu.
3. Use ▲ or ▼ to select [Alarm], then press the [ENT/ACQ] key.
4. Use ▲ or ▼ to select [Alarm Intensity], then press the [ENT/ACQ]key



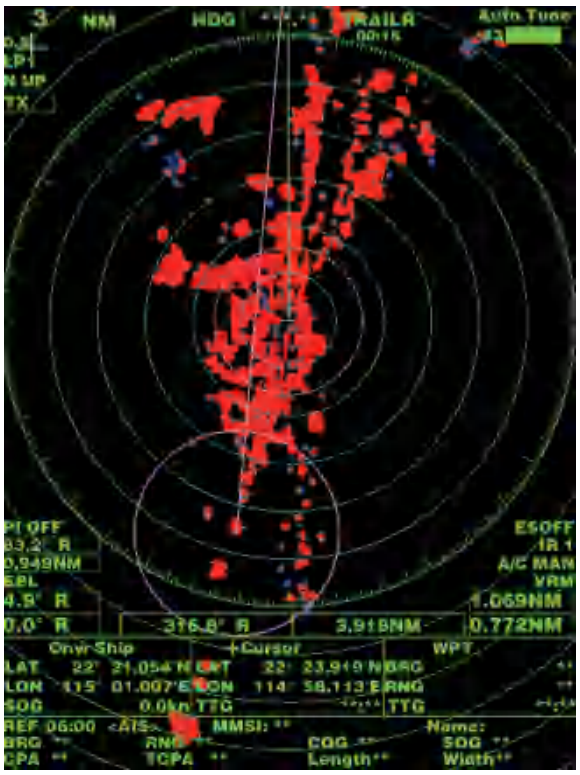
5. Use ▲ or the ▼ arrow to select the echo intensity level, then press the [ENT/ACQ] key to select.
6. Exit using the menu button

2.19 How to offset the display

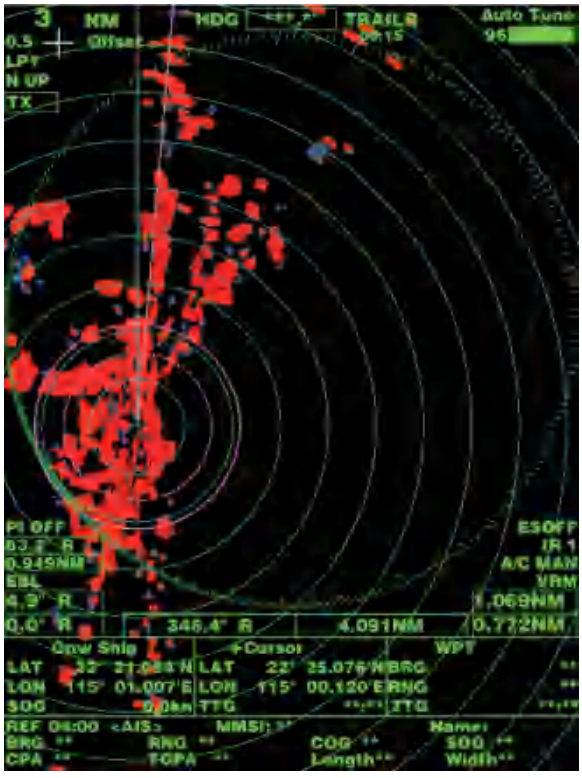
The vessel's position can be offset to expand the field of view without the need to select a larger range. This offset can be set manually or automatically based on the vessel's speed.

Note: Offset (eccentric) display is unavailable in True Motion mode or when using a range of 64 nautical miles or greater.

Press the offset key to enable offset display; the resulting effect is shown in the figure below



No offset effect



The effect after offsetting

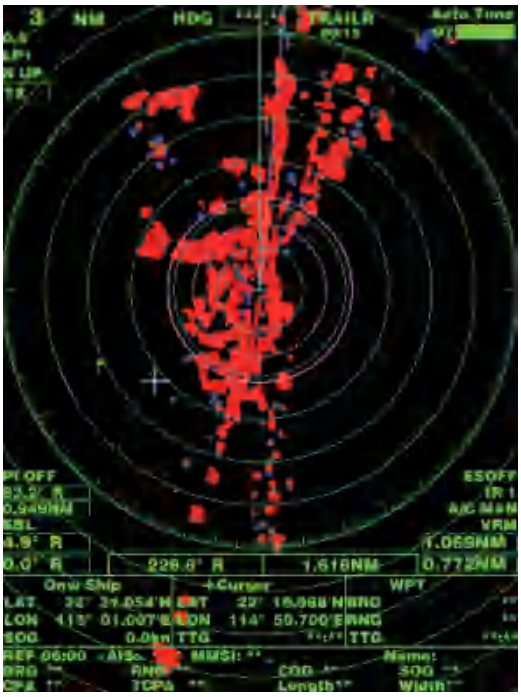
2.20 Target amplification

This feature allows you to zoom in by a factor of two from any point on the currently displayed image to the vessel's position, facilitating detailed inspection of areas of interest.

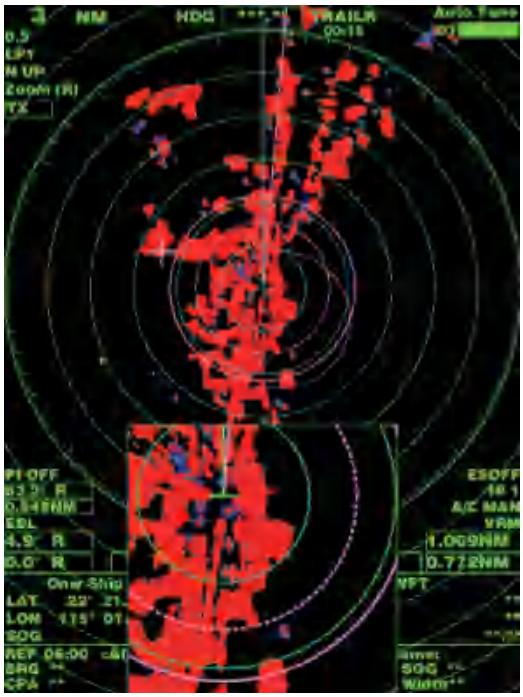
Use the cursor to select the area to be magnified.

Select "Zoom In" from the menu. The label "Zoom" will then appear in the upper-right corner of the screen, and the distance from the center point to the cursor will be doubled.

To disable the zoom feature, go to Menu> Display Settings, then select "Zoom" and press the OK/Enter key to turn it off



No zoomed in

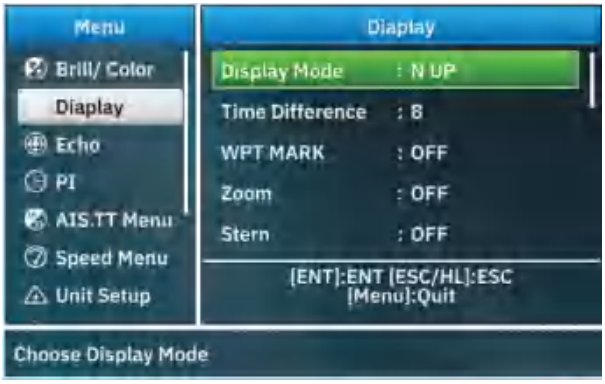


magnified view

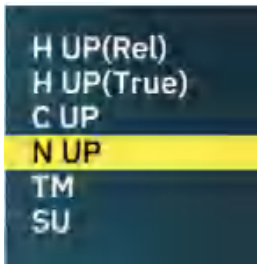
2.21 Select display mode

This radar offers six display modes for user selection: HU P(rel), HU P (True), CU P, NU P, and TM. SU is also available.

1. Press the Menu Key to open the menu.
2. Use ▲ or ▼ to select [Display], then press the [ENT/ACQ] key



3. Use ▲ or ▼ to select [Display Mode], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select the display mode, then press the [ENT/ACQ] key.
5. Press the Menu button to close the menu.
Note: When powered off, this radar records and displays the mode settings; however, it cannot record when the course is pointing upward it instead reverts to the bow-up mode.

HU P (Rel): The scale ring on the display screen always remains at 0°;
HU P(True): The scale ring on the display screen rotates in accordance with the HDG setting and is displayed at the center of the upper portion of the screen.

CU P

First, align the vessel with the intended course direction, then switch to ″CU″ mode. At this point, the bow of the vessel will align with the course direction; however, if the vessel deviates from this course, the previously set course will still remain centered on the display. The bow line will then swing to either side of the course, corresponding to the angle of deviation, to indicate the deviation status.

NU P

The north mark is displayed at the top center of the screen, while the bow line moves to the actual direction relative to the north axis; this mode is primarily employed as a navigation monitor on nautical charts once the vessel's position has been established. This display is relatively stable, thereby enabling more accurate reproduction of the target echo.

TM

This mode displays the true motion directions of both this vessel and the moving target.

SU

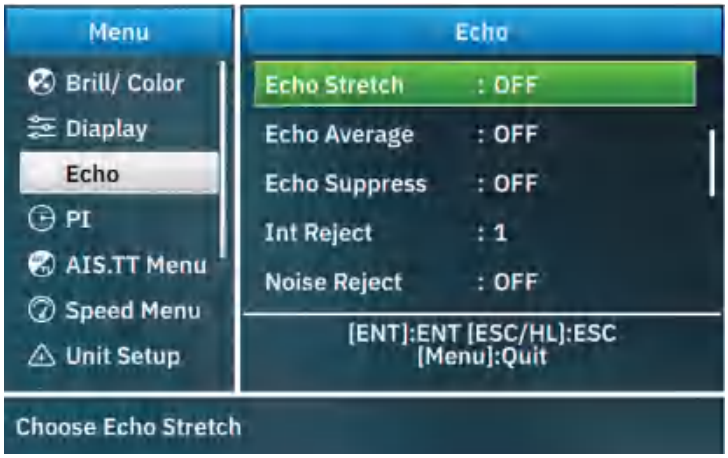
The image displayed on the screen consistently keeps the stern line directly above the center of the screen.

2.22 Use a wide range of echoes(echo spread)

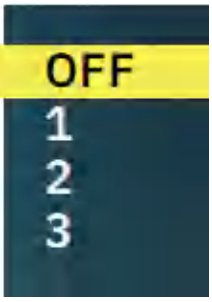
Under normal operating conditions, targets at the far end of the range appear smaller and weaker on the display screen, even though they have already undergone compensation by the radar's internal circuitry. This feature can extend the visibility of such small targets across the entire range. This feature offers two levels: ES1 expands the echo in the axial direction, while ES2 expands the echo in both the axial and radial directions.

Enable or disable echo spread

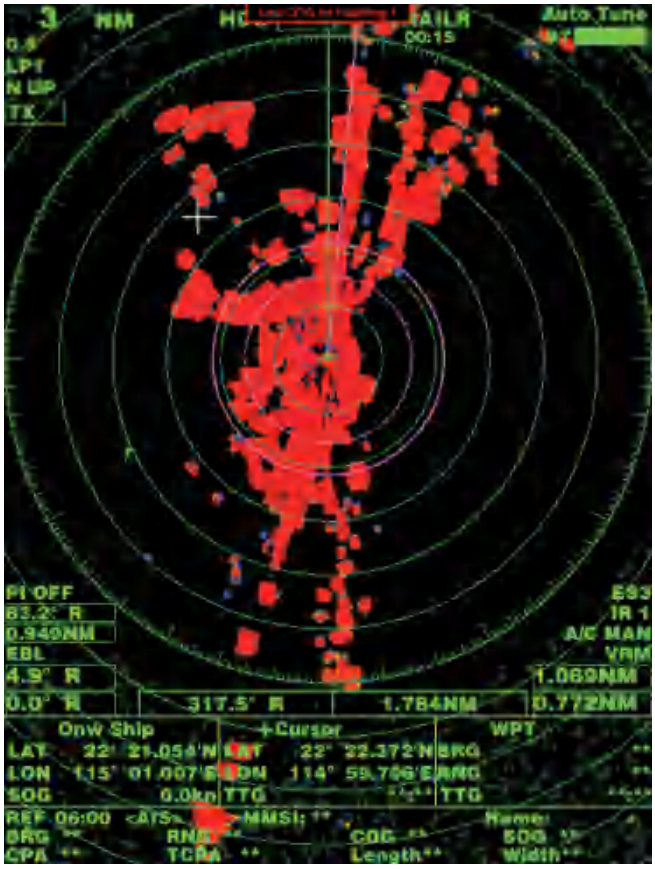
1. Press the [Menu] button to open the menu.
2. Use ▲ or ▼ to select [Echo], then press the [ENT/ACQ] key.



3. Use ▲ or ▼ to select [Echo Stretch], then press the [ENT/ACQ] key to select.



4. Use ▲ or ▼ to select echo spread [Off, 1, 2, 3], then press the [ENT/ACQ] key.
5. Press the Menu button to close the menu.



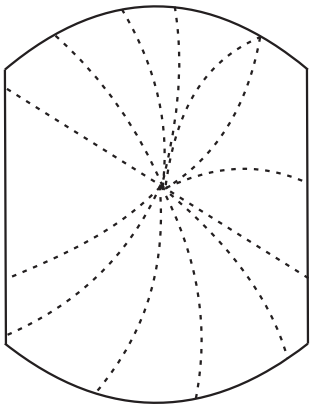
Expansion effect

Note 1: This function not only amplifies the target but also amplifies sea wave noise and radar interference. Therefore, when using this function, appropriate adjustments for sea wave suppression and interference rejection should be performed.

Note 2: The echo width expansion factor of 2 cannot be activated in the near-range mode.

2.23 Radar jamming suppression

Radar interference, also known as co-frequency interference, is a mutual interference phenomenon caused by nearby vessels operating radars within the same frequency band as the vessel itself. It manifests as a series of fan-shaped bright spots appearing on the radar screen, with the center of each "fan" corresponding to the position of the vessel. Figure 3-5 illustrates the approximate appearance of co-frequency interference; this radar features an interference suppression function that restores normal echo display, as the continuous rotation of the antenna prevents these spots from appearing at the same location.



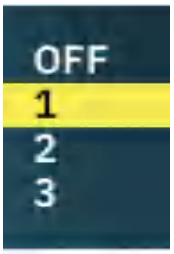
Radar jamming

The interference suppression feature offers four selectable levels: Off; Interference Suppression Level 1; Interference Suppression Level 2; Interference Suppression Level 3; and Off. Interference Suppression Level 3 represents the highest level of this feature. 。

1. Press the menu button.
2. Use ▲ or ▼ to select [Echo], then press the [ENT/ACQ] key.



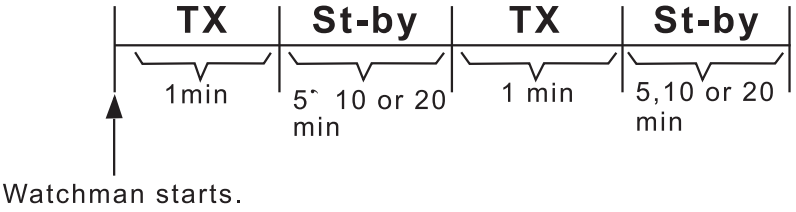
3. Use ▲ or ▼ to select [Int Reject], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select "Off, 1, 2, 3" for anti-interference, then press the [ENT/ACQ] key.
5. Press the Menu button to close the menu.

2.24 Watchman

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



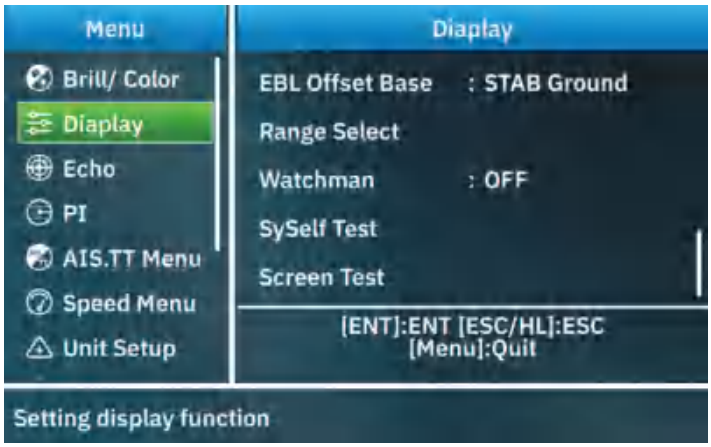
How watchman works

How watchman works

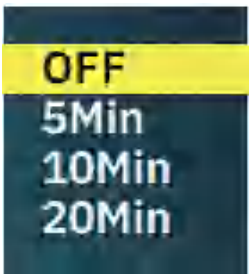
When the time selected for the watchman rest period has elapsed, the radar automatically transmits for one minute to check the condition inside the guard zone. If there is no change, the radar goes into stand-by ("WATCHMAN"appears during stand-by.) If there is change, the radar sounds the audible alarm,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

Turning on watchman

1. Create a guard zone (usually 360 degrees) with the guard alarm function.
2. Press the [MENU] key.
3. Use ▲ or ▼ to select [Display], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select [Watchman], then press the [ENT/ACQ] key to select.



5. Use ▲ or ▼ to select [OFF, 5, 10, 20], then press the [ENT/ACQ] key.
6. Press the Menu button to close the menu.

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

Cancelling watchman

Go into the "OTHERS"menu, and set"17.Watchman" to off.

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

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

2.25 Display navigation data

When this radar receives navigation data compliant with the IEC 1162 standard, it may display the navigation data at the bottom of the screen; the navigation data includes

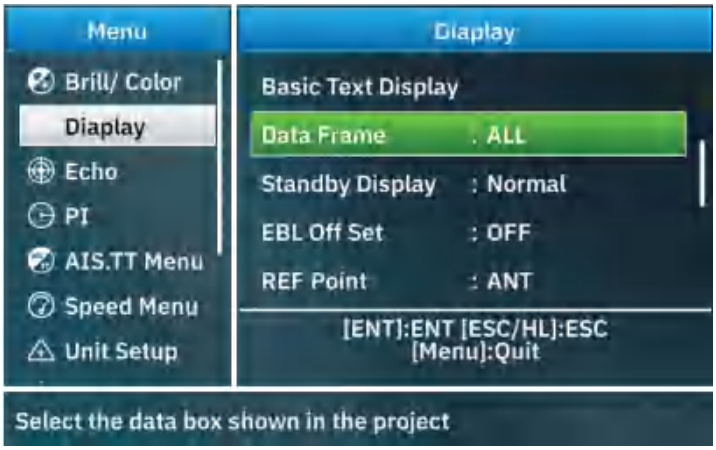
Location, latitude and longitude information

Distance, bearing, and estimated arrival time and course between two route points selected on the navigation device. Speed; (if the navigation data input includes destination data, the route point locations will be indicated on the display screen by dashed circular outlines.)

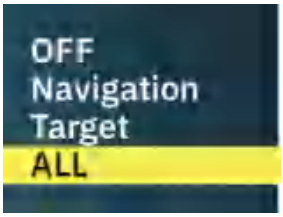
AIS information: AIS vessel data already received

How to enable or disable navigation data

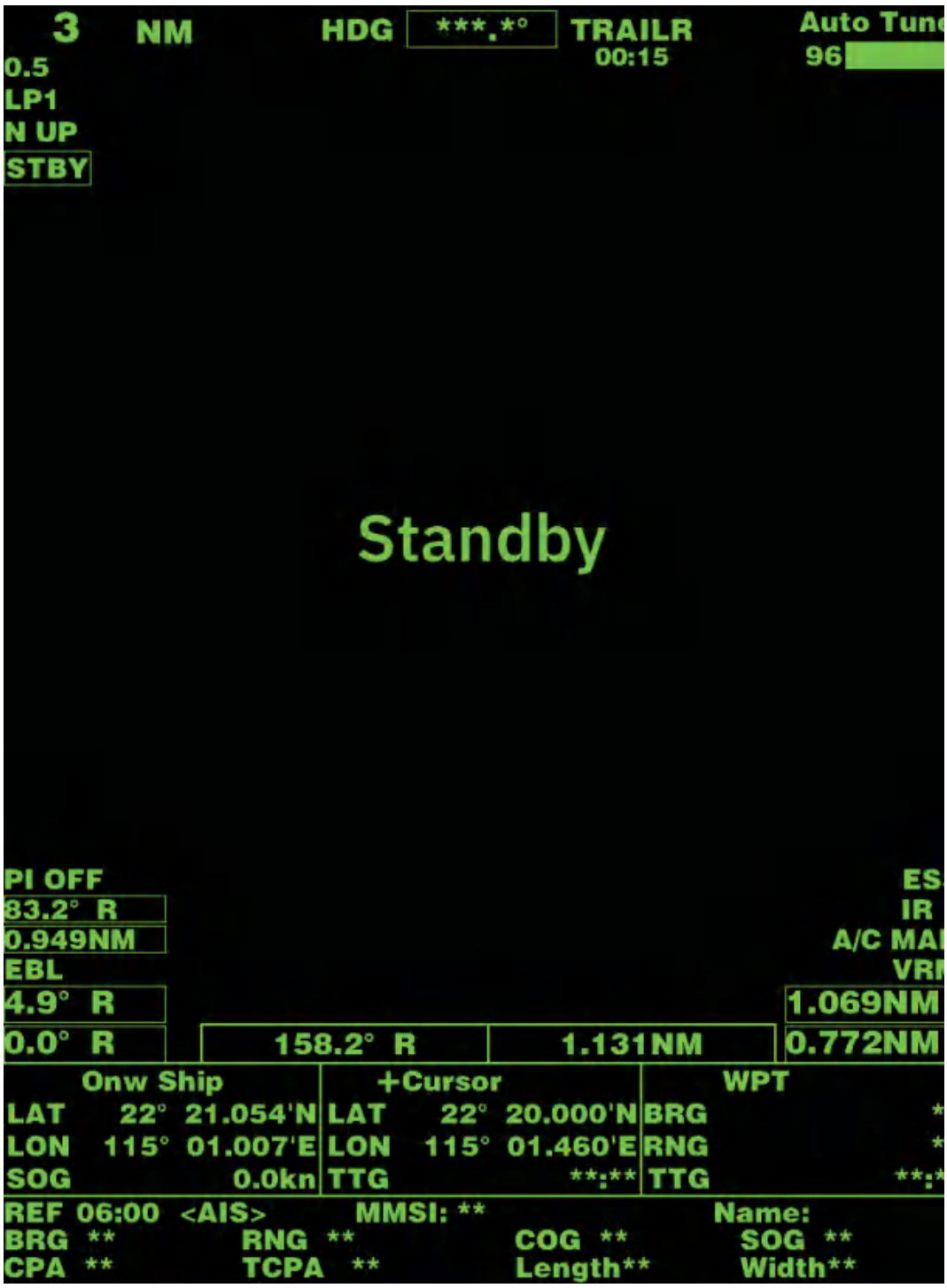
1. Press the menu button.
2. Use ▲ or ▼ to select [Display], then press the [ENT/ACQ] key.



3. Use ▲ or ▼ to select [Data Frame], then press the [ENT/ACQ] key to select.



4. Use ▲ or ▼ to select [OFF, Navigation, Target, All], then press the [ENT/ACQ] key.
5. Press the Menu button to close the menu.



Typical navigation data

2.26 Function key

The functions of the three function buttons (Function 1, Function 2, and Function 3) can be configured.

Default Setting:

F1: Background color

F2: Echo color

F3: Character color

How to record new key settings

1. Press the menu button
2. Access the function menu by selecting [Gain] (Function 1), [Wave Suppression] (Function 2), or [Rain/Snow Suppression] (Function 3).



Function Menu

3. Select the desired features.
4. Press the [ENT/ACQ] key.
5. Exit using the menu button.

2.27 Noise reject

White noise may appear on the screen as random ″noise marks.″ These noise marks can be suppressed by following these steps:

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [Echo], then press the [ENT/ACQ] key.



3. Use ▲ or ▼ to select [Noise Reject], then press the [ENT/ACQ] key to select it.



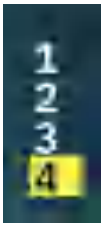
4. Use ▲ or ▼ to select [Close] or [Open], then press the [ENT/ACQ] key.
5. Press the Menu button to close the menu.

2.28 Adjusting marker brightness

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [Brill/Color], then press the [ENT/ACQ] key.



3. Use ▲ or ▼ to select [Symbol Bright], then press the [ENT/ACQ] key to select.



4. Use ▲ or ▼ to select a different level, then press the [ENT/ACQ] key.
5. Press the Menu button to close the menu.

2.29 Echo trail

You can view the relative motion of all radar targets relative to your vessel via the image display. This feature is primarily used in situations where it is critical to monitor the risk of collisions.

Activate the echo trail

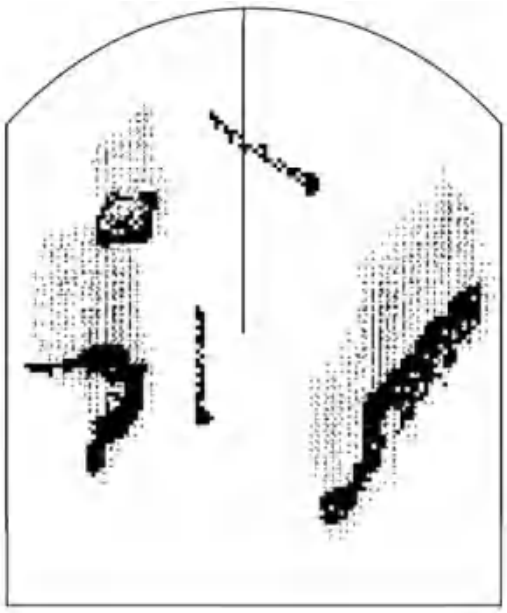
1. Press the [Menu] button to open the menu.
2. Use ▲ or ▼ to select [Echo], then press the [ENT/ACQ] key.



3. Use ▲ or ▼ to select [Trail Switch], then press the [ENT/ACQ] key to select.



4. Use ▲ or ▼ to select ″Trail Off″, ″Rel, or ″True″, then press the ″[ENT/ACQ]″ key. 。
5. Press the Menu button to close the menu.



Echo Tracking Operation

The echo trail time selection (in the ″Echo Menu″) and the elapsed time display appear in the upper-right corner of the screen.
Subsequently, the trails of all moving targets begin to extend.
Note:The trail will be redrawn when the range display mode is changed, or when the magnification and eccentricity functions are activated.

Fixed tracking duration

1. When the measurement time reaches the preset tracking duration, the measurement time display freezes.
2. At this point, the earliest recorded navigation trail is removed, while trails recorded during the measurement period are retained.
3. Tracking continues. For example, if the tracking duration is set to one minute, when the measurement time reaches 60 seconds, the measurement time display stops at ″60″, and the earliest tracking trail begins to be removed; however, tracking continues. Continuous Tracking: The maximum continuous tracking duration is 99 minutes and 59 seconds. When this limit is reached, the display resets to ″0″, and tracking resumes.

Exit echo trail

In the menu, select the Trail Switch [Off] and press the [ENT/ACQ] key.

Modify tracking properties

The time tracking and the color scale for trail display can be selected in the ″Echo Menu″.

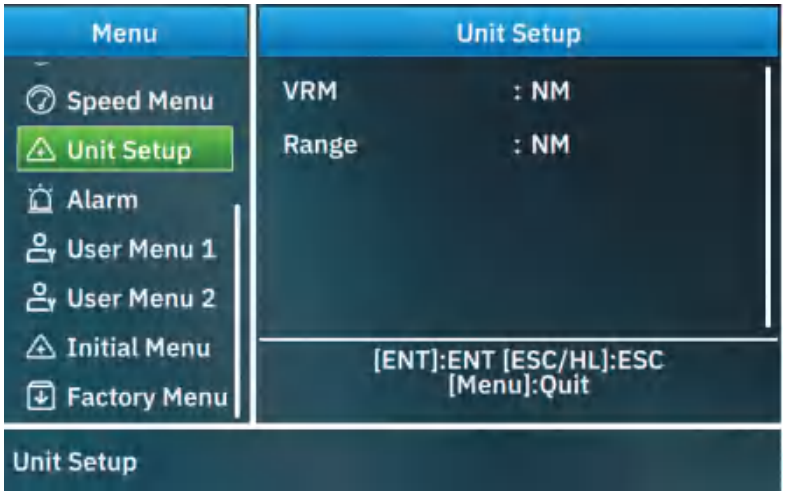
The tracking characteristics are as shown in the table below:

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

Trailing attributes

2.30 Unit setup

You can select the measurement range, variable-range scale, temperature, and depth measurement units via the [Unit Setup] sub-menu in the menu.

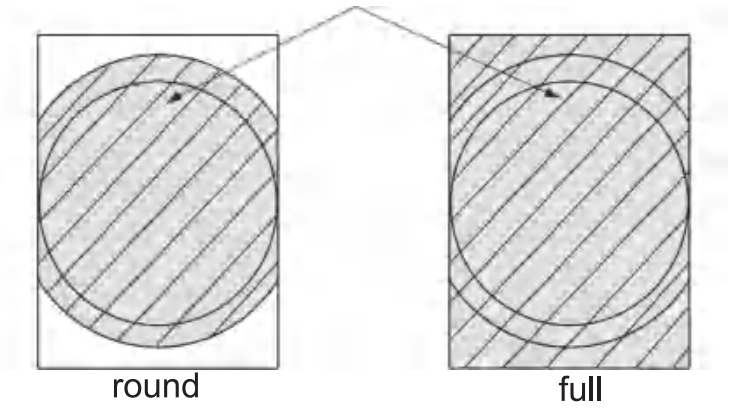


[Range]: NM 、KM

[VRM]: NM 、KM 、SM

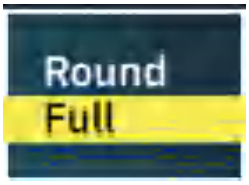
2.31 Echo area

You can select the display area from [Normal] or [Full-screen] to examine the surrounding area in greater detail. Echo display area.



Echo area

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [Display], then press the [ENT/ACQ] key.
3. Use ▲ or ▼ to select [Echo Area], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select [Round] or [Full], then press the [ENT/ACQ] key.
5. Press the Menu button to close the menu.

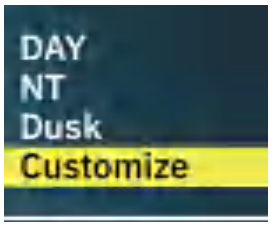
2.32 Color selection

The radar preset utilizes color schemes optimized for observation during daytime, nighttime, and twilight hours. The following are the default color settings for each display item.

Display items, color schemes, and colors

Display Items	Day	Night	Dusk	Custom
Character	Black	Red	Green	Green
Circle marker	Green	Red	Green	Green
Echo	Yellow	Green	Green	Yellow
Background	White	Black	Blue	Black

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select[Brightness/Color], then press the [ENT/ACQ] key.
3. Use ▲ or ▼ to select[Theme], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select a color, then press the [ENT/ACQ] key.
5. Press the Menu button to close the menu.

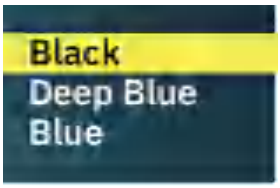
2.32.1 Custom colors

You can use the custom color feature to select your preferred echo, background, character, distance ring, and marker colors. Select the "Show Colors" menu item to apply the echo, background, character, distance ring, and marker colors you have chosen.

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [Brightness/Color], then press the [ENT/ACQ] key.
3. Use ▲ or ▼ to select [Echo Color], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select an echo color, then press the [ENT/ACQ] key. [Multi-color] displays echoes in red, yellow, and green based on echo intensity; however, [Multi-color] is unavailable in [IEC] or [Russian Rivers] modes.
5. Use ▲ or ▼ to select [Background Color], then press the [ENT/ACQ] key.



6. Use ▲ or ▼ to select a background color, then press the [ENT/ACQ] key.
7. Use ▲ or ▼ to select [Character Color], then press the [ENT/ACQ] key.



8. Use ▲ or ▼ to select a character color (including the distance ring and marker), then press the [ENT/ACQ] key.
9. Press the Menu button to close the menu.

2.33 Display brightness

Use the [Brightness/Color] menu to adjust the brightness of the following menu items:
[Fixed Distance Scale]: brightness of the distance ring (setting range: Off, 1–4);
[Symbol Brightness]: brightness of markers such as EBL and VRM (setting range: 1–4);
[Bow Marker]: brightness of the bow line (setting range: 1–4);
[Character Brightness]: brightness of characters (setting range: 1–4);
[Menu Transparency]: adjust the menu transparency (setting range: Off, 1–4).

2.34 How to temporarily hide the bow line

The bow line indicates the bow direction of the vessel under all display modes. It is defined as a straight line extending from the vessel's position to the outer edge of the radar display area. When the bow is oriented upward and in real-observation mode, the bow direction line aligns with the 0° mark on the bearing scale. In true north-up mode and true-motion mode, the bow line adjusts according to the vessel's heading; it also changes direction when the course is adjusted in course-up mode. To hide the bow line (along with all river and ocean navigation markers) while displaying only targets, hold down the Cancel / Bow Line key. To re-display the bow line, release this key.

2.35 PI

2.35.1 PI Display

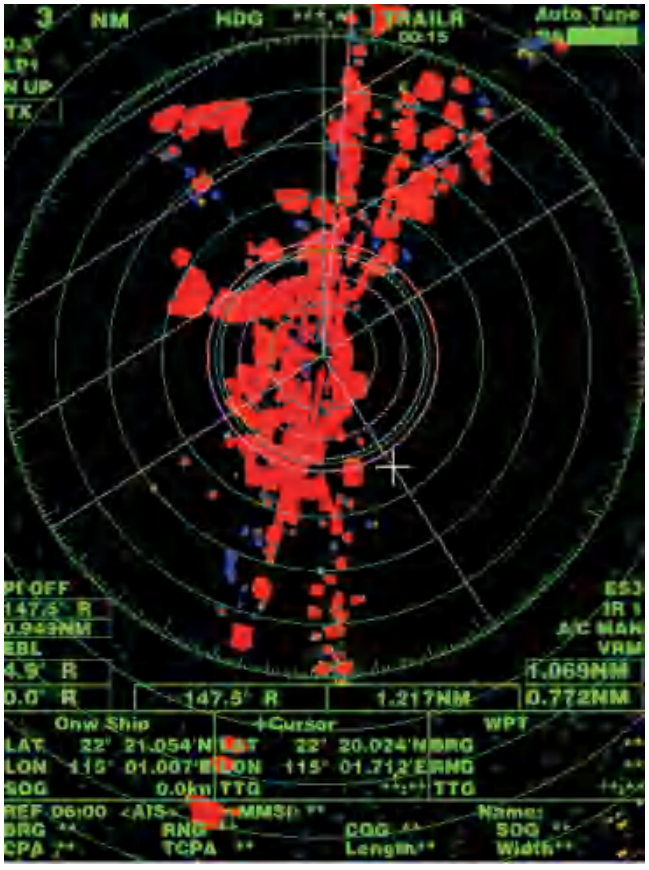
Configure the parallel index line display switch
1. Press the Menu button to open the menu.。
2. Use ▲ or ▼ to select [PI], then press the [ENT/ACQ] key.
3. Use ▲ or ▼ to select [Display], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to toggle off or on, then press the [ENT/ACQ] key.
5. Press the Menu button to close the menu.

2.35.2 Adjustment of parallel index lines

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [PI], then press the [ENT/ACQ] key.
3. Use ▲ or ▼ to select [Adjust], then press the [ENT/ACQ] key.
4. Adjust the parallel index line, move the cursor to fine-tune the orientation, press the [ENT/ACQ] key to set the spacing, and finally press the [ENT/ACQ] key to complete the adjustment.



PI

2.35.3 Truncation

For selecting the display length of parallel index lines

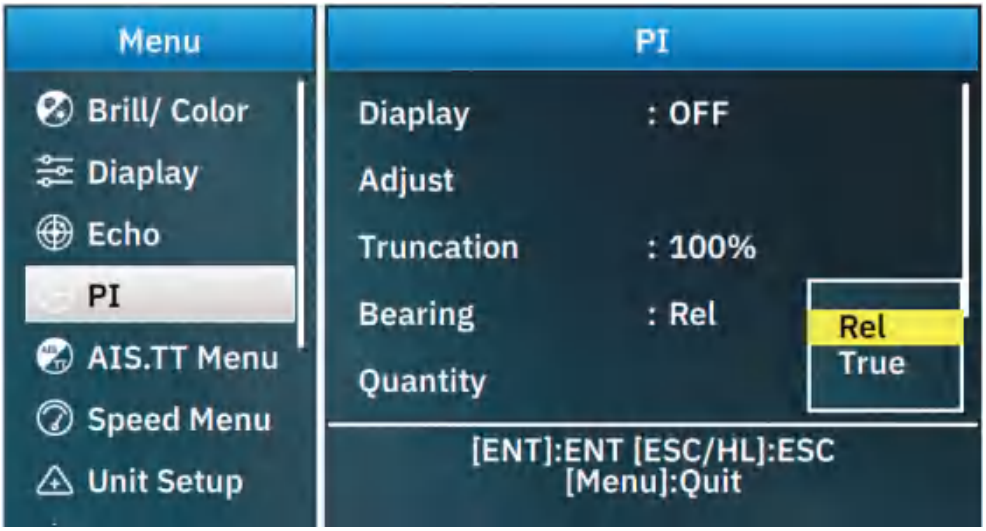
1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [PI], then press the [ENT/ACQ] key.
3. Use ▲ or ▼ to select [Truncate], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select different scales, then press the [ENT/ACQ] key.
5. Press the Menu button to close the menu.

2.35.4 Bearing

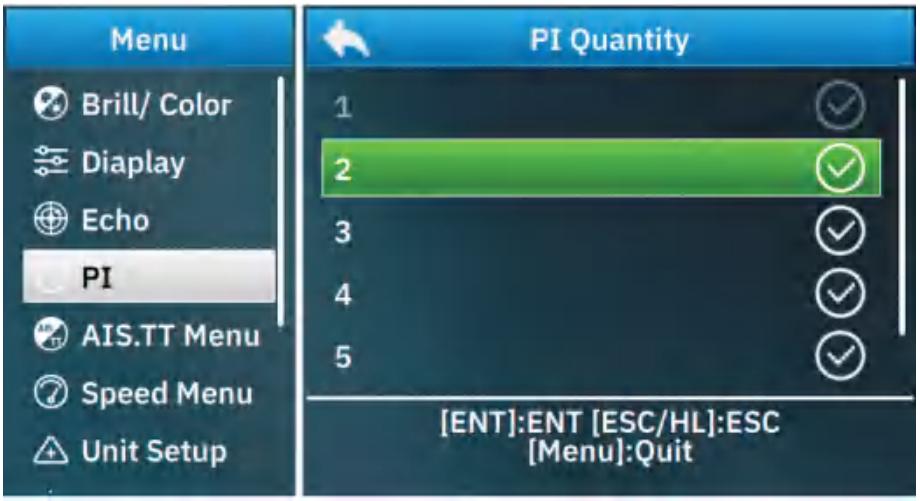
1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [PI], then press the [ENT/ACQ] key.
3. Use ▲ or ▼ to select [Bearing], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select Rel or True, then press the [ENT/ACQ] key.
5. Press the Menu button to close the menu.

2.35.5 Quantity

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [PI], then press the [ENT/ACQ] key.
3. Use ▲ or ▼ to select [Quantity], then press the [ENT/ACQ] key.

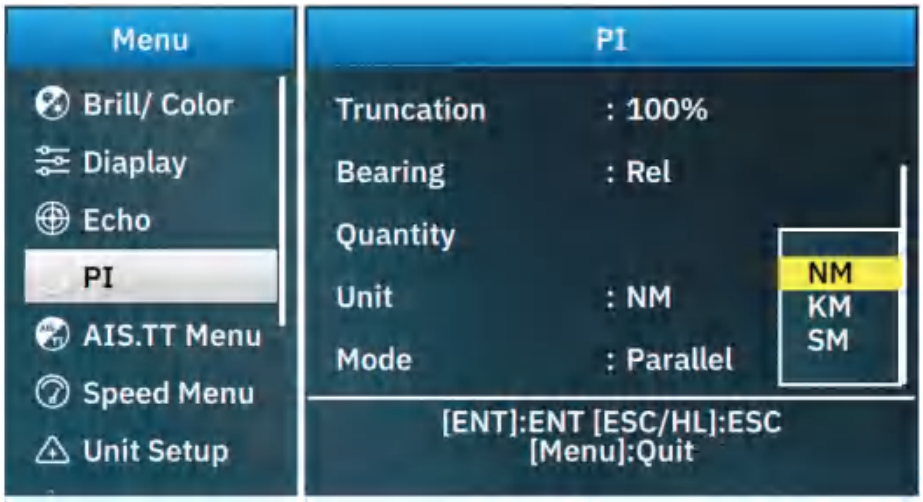


4. To use this feature, select it using ▲ or ▼, then press the [ENT/ACQ] key.
5. Press the menu button to return to the parent menu.
6. Press the Menu key to close the menu.

2.35.6 Unit

Used to modify the unit of parallel index line spacing

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [PI], then press the [ENT/ACQ] key.
3. Use ▲ or ▼ to select [Unit], then press the [ENT/ACQ] key.

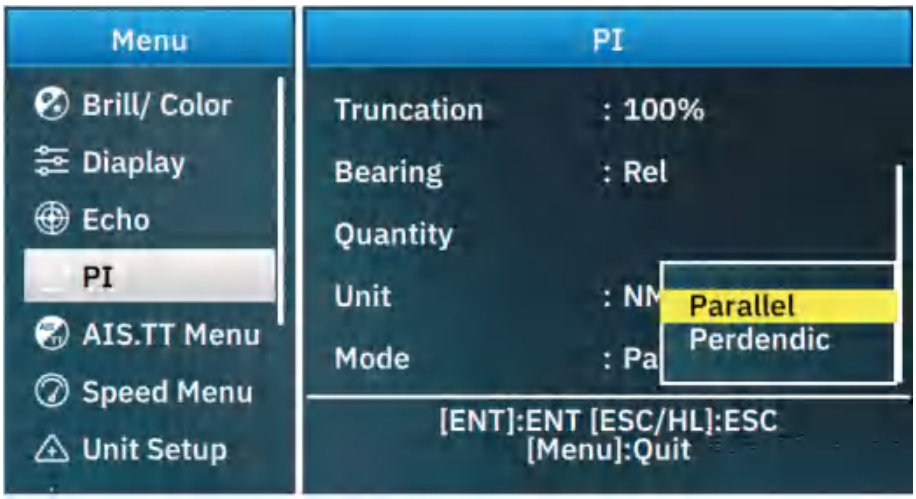


4. Use ▲ or ▼ to select the corresponding unit to display, then press the [ENT/ACQ] key.
5. Press the Menu button to close the menu.

2.35.7 Mode

Used to reset the display position of parallel index lines

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [PI], then press the [ENT/ACQ] key.
3. Use ▲ or ▼ to select [Mode], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select the corresponding display mode, then press the [ENT/ACQ] key.
5. Press the Menu button to close the menu.

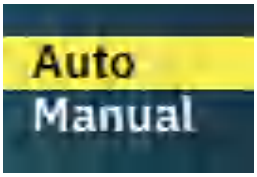
2.36 Tuning

In the default settings, once the radar is set to transmission mode, the radar receiver will be automatically tuned. If you need to perform manual fine-tuning, follow these steps:

1. Turn on the radar, then use the range selector to choose the maximum range.
2. Press the Menu button to open the menu.
3. Use ▲ or ▼ to select [Tuning Mode], then press the [ENT/ACQ] key.



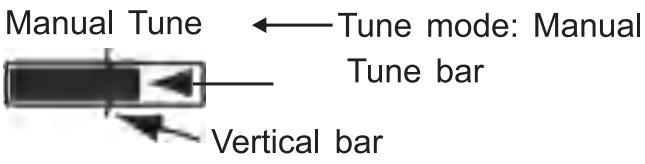
4. Use ▲ or ▼ to select [Tune Mode], then press the [ENT/ACQ]key.



5. Use ▲ or ▼ to select [Manual], then press the[ENT/ACQ]key.
6. Use ▲ or ▼ to select [Manual Tune], then press the[ENT/ACQ]key.



7. Use ▲ or ▼ to adjust the tuning while monitoring the tuning bar in the upper-right corner of the display screen. The optimal tuning point is when the tuning bar reaches its maximum value. The vertical bar on the tuning indicator displays the tuning voltage.



8. Press the [ENT/ACQ] key.
9. Press the Menu button to close the menu.

3. Introduction To Radar

3.1 Summary

3.1.1 Minimum and maximum range

Minimum range

The minimum range refers to the shortest detection distance at which, using a scale of 0.0625 or 0.125nm, a target with an echo area of $10m^2$ is displayed as an independent point, independent of the antenna's position. The minimum range depends on the pulse width, antenna height, and signal processing techniques—such as main pulse suppression and digital quantization. Whenever ideal image resolution can be achieved, it is advisable to employ the shortest possible range.

Maximum range

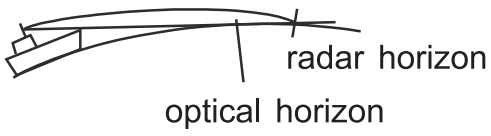
The maximum detection range (Rmax) varies depending on the elevation of the radar antenna, the altitude of the target above sea level, the size, shape, and material of the target, as well as climatic conditions. Under normal climatic conditions, the maximum detection range is equal to or slightly less than the optical horizon. Due to the diffractive nature of radar signals, the radar horizon is approximately 6% longer than the optical horizon. The maximum detection range (Rmax) is calculated using the following formula:

Rmax = 2.2 x (h1 + h2)

Inside Rmax: Radar horizon in nautical miles

h1: Antenna height(m)

h2: Target height: meters



If the antenna height is 9 meters and the target height is 16 meters, the maximum radar range is:

Rmax = 2.2 x (9 +16) = 2.2 x (3 +4) = 15.4 nm

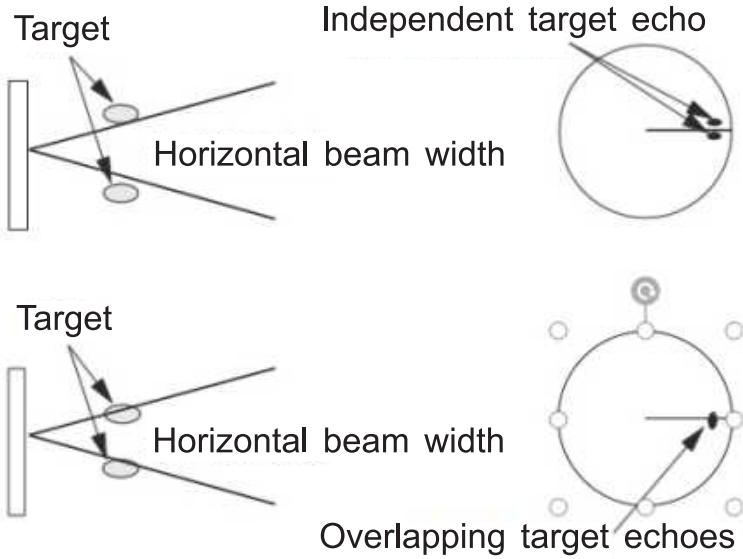
Note: Since raindrops can absorb radar signals, the detection range will be shortened

3.1.2 Radar resolution

Azimuth resolution and range resolution are critical factors that influence the overall resolution of a radar system.

Azimuth resolution

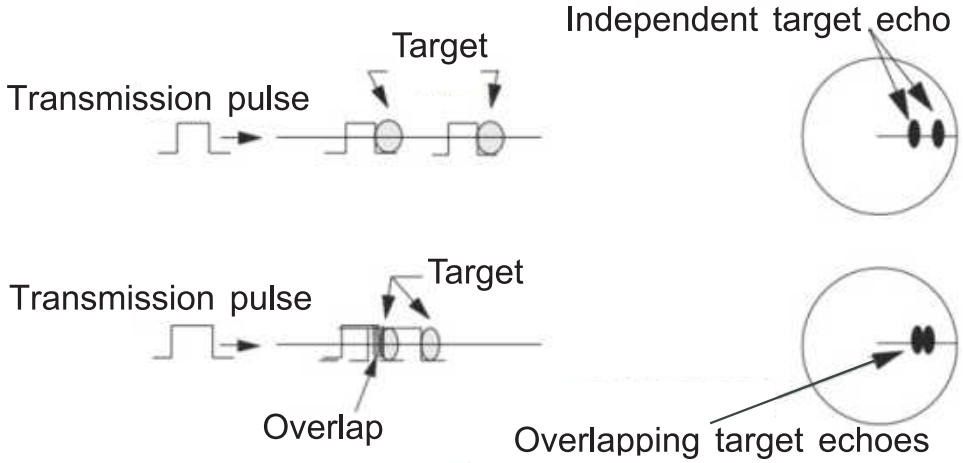
Azimuth resolution refers to a radar's ability to independently display the echoes of two targets within the same range. Azimuth resolution is proportional to both the antenna height and the wavelength.



Bearing resolution

Range Resolution:

Range resolution refers to the capability of an independent echo display system to distinguish echoes from two targets located at the same azimuth angle. Pulse length is the sole parameter used to calculate range resolution. The test target employed to evaluate range and azimuth resolution is a radar reflector with a radar cross-section of $10m^2$.



Range resolution

3.1.3 Positional accuracy

One of the most critical functions of a radar system is to measure the azimuth accuracy of a target. The accuracy of azimuth measurement depends on the beam width of the radar pulse. Azimuth is determined relative to the bow direction of the vessel. Proper adjustment of the bow line during installation is therefore a crucial factor in ensuring azimuth accuracy. When measuring target azimuth, to minimize measurement errors, select an appropriate measurement range and position the target echo at the extreme edge of the display screen.

3.1.4 Range measurement

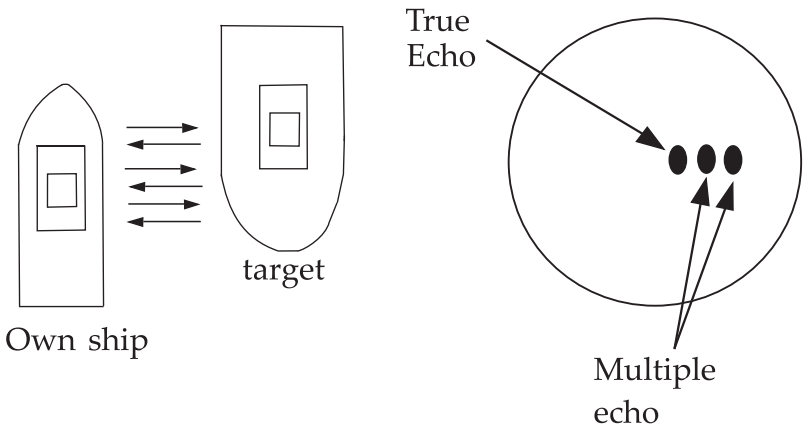
The measurable range to a target is one of the key functions of a radar system. There are three methods for determining this range: fixed-range rings, Variable Range Markers (VRM), and cursors (when configured for both range and azimuth measurement). The display will show fixed-range rings spaced at predetermined intervals, allowing for a rough estimation of the range to the target. The diameter of the VRM can then be increased or decreased.

3.2 Artificial echo

Echo signals may appear in areas of the screen where no target is present, or they may disappear when a target is present. The following section describes some types of false echoes.

3.2.1 Multiple echoes

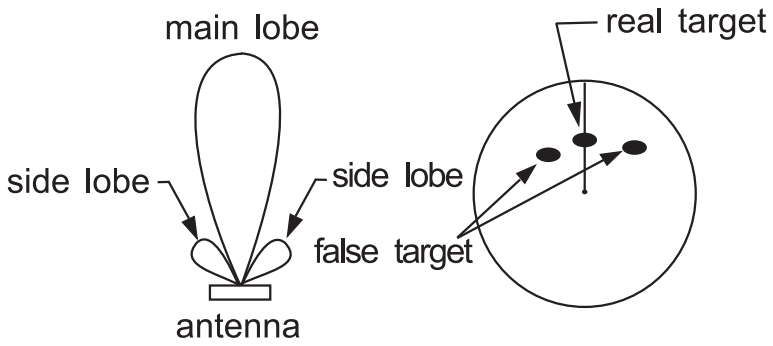
Multiple echoes may occur when the transmit pulse returns from stable targets such as large vessels, bridges, or breakwaters. As illustrated below, the display may show secondary, tertiary, or additional echoes, with their range spanning twice, three times, or more than the actual range. A sea-state interference suppression control knob can be used to reduce or eliminate multiple reflected echoes.



Multiple echoes

3.2.2 Parabolic lobe echo

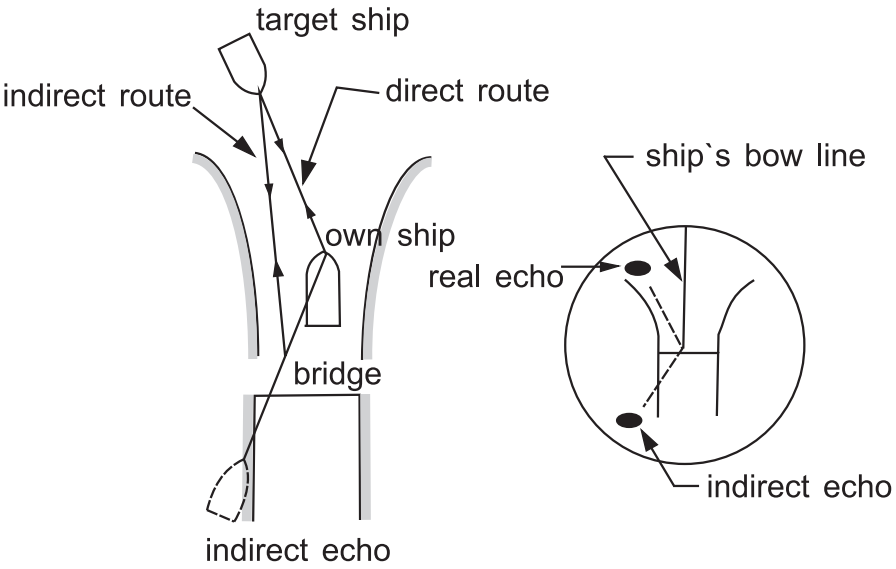
When transmitting radar pulses, some radiation may leak out from the sides of the beam; this radiation is referred to as a side lobe. If both the side lobe and the main lobe can detect a target simultaneously, then the true echo will be flanked by side lobe echoes of identical range. Side lobes typically only exhibit echoes from short-range targets and large targets. A sea-state rejection control knob can be used to reduce the effects of side lobes.



echo of the side lobe

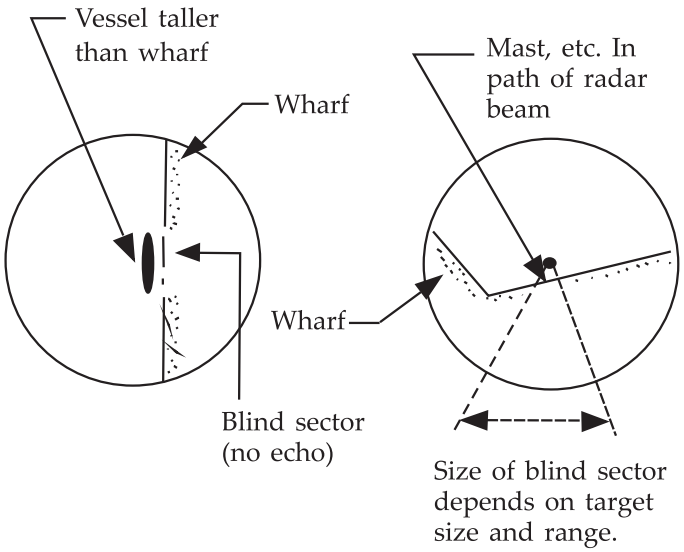
3.2.3 Virtual image

Large targets approaching the vessel may appear in two locations on the screen: one is the true echo reflected by the target, and the other is a false echo. As illustrated below, due to the mirroring effect, large targets on or near the vessel can generate false echoes. For example, if the vessel approaches a large metal bridge, a false echo may temporarily appear on the screen.



3.2.4 Shadow region

Ventilation shafts, chimneys, masts, or lifting frames near the antenna can block the radar beam, thereby creating zones where detection is impossible. In such sectors, the radar cannot detect any targets.



Blind and shadow sectors

4. MAINTENANCE & TROUBLESHOOTING

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

DANGER



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

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

RF RADIATION HAZARD



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

Period	Item	Check point	Remarks
3 to 6 months	Exposed nuts and bolts on antenna unit	Check for corroded or loosened nuts and bolts. If necessary, clean and repaint them thickly. Replace them if heavily corroded.	Sealing compound may be used instead of paint. Apply a small amount of grease between nuts and bolts for easy removal in the future.
	Radome cover (KR-1008)	Check for wear. Permanent damage to the antenna's internal circuitry will result if water leaks into the radome.	If a crack is found it should be temporarily repaired by using a small amount of sealing compound or adhesive. You should then contact your dealer for service.
6 months to 1 year	Display unit connectors	Check for tight connection and corrosion.	If corroded, contact your dealer for replacement.

Recommended maintenance program

4.1 Preventative Maintenance

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

4.2 Replacing the Fuse

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

12 V : 10 A fuse

24/32 V : 5 A fuse

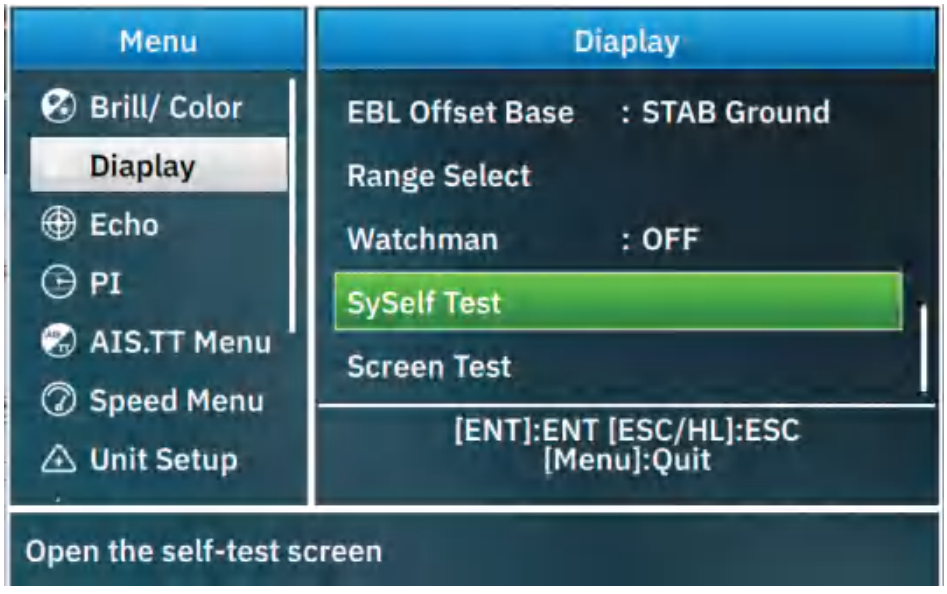
4.3 Troubleshooting

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

4.4 Self Test

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

1. Press the [MENU] key.
2. Use ▲ or ▼ to select [Display], then press the [ENT/ACQ] key.



3. Use ▲ or ▼ to select [Syself Tes], then press the [ENT/ACQ] key.

4. Memory and RAM are automatically detected. If “Bad”appears to the right of the detected item, please contact your supplier.
5. When testing the buttons, do not press the[Menu] or power buttons; instead, press any other button. If the button is functioning correctly, the corresponding indicator light will illuminate.
6. Press the [Menu] button to return to the menu page.

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

Troubleshooting table

4.5 Expected service life of the magnetron

The table below shows the expected service life of the pipe.

Expected service life of the magnetron

Model	Type	Code no.	Life expectancy
KRA-1011	MSF1421B	V801	2，000 - 3,000 hours (Including stand-by)
	MAF1421B		
KRA-4003	MAF1433B		
	MSF1422		

5. ARPA Explain

⚠ WARNING

This device features a basic ARPA function; please observe the following points when using it:
This automatic plotting instrument is not designed to replace the human eye, nor is it intended to assist navigators in making decisions; it merely provides auxiliary support for navigation. Therefore, navigators should continue to maintain their course, and should regularly compare the data obtained by this plotting instrument with data from other sources to verify its accuracy.
This instrument can automatically or manually track detected radar targets, calculate their bearing and velocity, and represent these parameters via a vector. Since this set of data determines which radar targets are selected, it is essential to ensure that the radar operates at its optimal tuning state. This guarantees that no targets are missed, and that unwanted targets—such as sea surface reflections and noise—are neither detected nor tracked.
Target echoes are not necessarily generated solely by the surfaces of landmasses, reefs, vessels, or other objects; they may also arise from sea surface reflections or from precipitation such as rain or snow. To eliminate these unwanted echoes, it is necessary to apply suppression against sea waves, suppression against rain/snow, and appropriate gain adjustments.
During normal radar operation and mapping, these settings may vary slightly; therefore, it is recommended to readjust them to achieve optimal performance.
Note: Keep the device away from magnets and magnetic fields.
Magnetic fields can cause display distortion and may lead to device malfunctions; therefore, the device should be kept as far as possible from objects that generate magnetic fields. Devices that may generate magnetic fields include speakers, solenoid valves, electrical cabinets, etc.

The following items may affect the accuracy of the calculations.

- ●Echo Intensity
- ●Radar Pulse Width
- ●Radar Bearing Error
- ●Compass Deviation
- ●Change of course of this vessel or another vessel
- ●CPA Data such as the nearest point and TCPA (time to the nearest point) are approximations; please use these data with caution.

5.1 ARPA Operation Declaration

Summarize

This automatic plotting feature enables manual or automatic capture and automatic tracking of up to 80 radar targets. The onboard microprocessor of the radar calculates target data—such as velocity and bearing—and presents the results via digital and vector displays. To obtain accurate target data, the radar must be tuned to a state where sea surface reflection and noise are minimized.

Main Specifications

Capture and Tracking:

●It can capture up to 80 targets within a range of 0.2 to 16 nautical miles.

●It can track up to 80 captured targets within a range of 0.1 to 16 nautical miles.

Vector:

Vector Length: 30 seconds, 1, 3, 6, 15, 30 minutes

Vector reference: true velocity or relative velocity

Historical Location: Retain five previous positions, specifically at 15 and 30 seconds, and at 1, 2, 3, 6, and 12 minutes.

Alarm : CPA/TCPA Audio-visual alert; audio-visual alert upon target loss;

Target resolution: When a target reaches or exceeds 800 m in the radial or circumferential direction, it will be treated as a ground target and will not be acquired or tracked; conversely, if the echo height is less than 800 m, the target will be treated as an effective target.

This feature still utilizes standard keys; the following section provides a description of these keyboard keys. :

[Menu]: Show/Hide Main Menu。

[Elimination/HL]: Cancel target capture

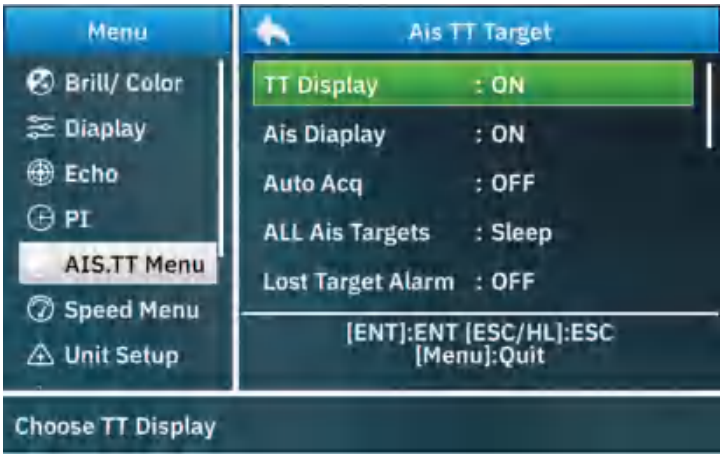
[Capture/Input]: Capture the target selected by the cursor

5.2 Turn on/off ARPA display

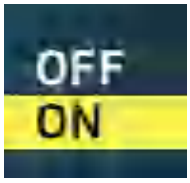
The ARPA display can be enabled or disabled. Regardless of whether this setting is enabled, the system will continuously track the ARPA target.

1.Press the Menu button to open the menu

2.Use ▲ or ▼ to select [AIS.TT Target], then press the [ENT/ACQ]key.



3.Use ▲ or ▼ to select [TT Display], then press the [**ENTER/ACQ**] key.



4.Use ▲ or ▼ to select [Off] or [On], then press the [**ENTER/ACQ**] key.
5.Press the menu button to return to the parent menu.
6.Press the Menu key to close the menu.

5.3 Acquiring targets

Manual Acquisition

Follow the steps below to manually acquire a target. Up to 80 targets can be manually acquired.

1. Place the cursor(+) on a target of interest by operating the omnipad.
2. Press the [**ENTER/ACQ**] key.

The plot symbol changes its shape according to the status as shown below. A vector appears in about one minute after acquisition indicating the target's motion trend. If the target is consistently detected for three minutes, the plot symbol changes to a solid mark. If acquisition fails, the target symbol blinks and disappears shortly.

CIRCLE (dotted)

Immediately after acquisition - Plot symbol shown in broken lines.

CIRCLE (dotted with a vector)

One minute after acquisition - Vector still unreliable.

CIRCLE(Solid with a vector)

3 minutes after acquisition - Plot symbol changes to a solid circle indicating the stable tracking condition.

FRAME CIRCLE

The plot symbol of a target under tracking becomes a circle with a discontinuous outline when the target is selected for data reading.

Note 1: The target to be acquired should be within 0.2 to 16 nm from own ship and not obscured by sea or rain clutter for successful acquisition.

Note 2: When you want to acquire the 31st target, cancel tracking one of the less important target.

Note 3: When auto acquisition mode (Auto ACQ) is on, up to 10 targets can be acquired. For details, see next section titled Automatic Acquisition.

⚠ WARNING

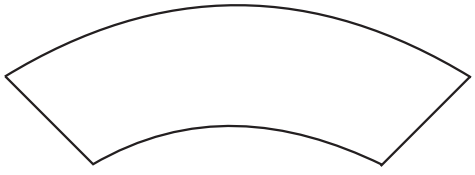
When a tracked target nears another tracked target the targets may be "swapped."When two targets come close to each other, one of the two can become a lost target. Should this happen, reacquisition of the lost target is required after the two targets have separated.

Automatic Acquisition

The Auto plotter ARPA can acquire up to 80 targets automatically by setting the Auto Acquisition area predefined in the system. If Auto ACQ is selected after more than 10 targets have been manually acquired, only the remaining capacity of targets can be automatically acquired. Example; when 25 targets are acquired manually, then the Auto ACQ is switched on, only 5 targets can be acquired automatically. When ten targets have been automatically acquired, "AUTO TARGET FULL" message appears at the top left corner of the display.

Setting Auto Acquisition Area

Auto acquisition area is predefined between 2.0 and 2.5 nm in range and 45° on either side of the heading line in the bearing. If a target comes into this area, it is acquired automatically.



Auto acquisition area

You can also redefine the automatic capture area in the AIS. TT menu by following these steps:

1.Press the Menu button to open the menu.

2.Select the AIS. TT menu, then press the [Capture/Confirm]key to enter.

3.Use ▲ or ▼ to select [AZ Polygon], then press the [ENT/ACQ]key.

4. Select the desired capture area shape, then press the [ENT/ACQ]key.



5.Use ▲ or ▼ to select [Draw AZ], then press the [ENT/ACQ]key to enter the draw capture area mode.

6.Use the arrow keys to control the drawing operation, and the capture/confirm keys to define the capture area.

7.Press the menu button to exit the drawing capture area operation.

Note: The capture area shape can only be modified when TT display is enabled and automatic capture is turned on; the full-screen capture area shape cannot be customized via drawing.

Sector: After moving the cursor with the direction keys and pressing the Capture/Confirm key to define the starting point and drawing position, move the cursor to another location using the direction keys and then press the Capture/Confirm key to display a dashed sector; finally, press the Menu key to save and complete the drawing operation.

Polygon: Move the cursor using the arrow keys, then press the Capture/Confirm key to set the starting point. To draw, move the cursor to other positions using the arrow keys and press the Capture/Confirm key; this will connect the two points with a line. At least three points must be drawn, and then press the Menu key to save and complete the drawing operation.

Circle: Move the cursor using the arrow keys, then press the Capture/Confirm key to set the starting point of the drawing. After that, move the cursor to another position using the arrow keys and press the Capture/Confirm key to display a dashed circle; finally, press the Menu key to save and complete the drawing operation.

Stop tracking the target

Once the plotter has captured 80 targets, no further captures can be performed unless targets are lost. The following methods can be used to cancel tracking of individual or all targets:

Single target

Use the arrow keys to move the cursor to the target you wish to stop tracking, then hold down the [Cancel/Line] key until tracking stops.

All Objectives

You can clear all targets at once via the AIS. TT menu.

1. Open the AIS. TT target menu;
2. Select Erase All TT Target;
3. Press the [Capture/Confirm] key

Display target data

The automatic plotting instrument can calculate the motion trends of all tracked targets (distance, bearing, course, speed, CPA, and TCPA) and display them in the ARP data area.

⚠ CAUTION

At the speed under 5 kts the target data is displayed with a delay because of the filtration

Place the cursor (+) over the target object from which you wish to read data, then press the [ENT/ACQ] key; the data of the selected target will appear at the bottom of the display screen, and the plotting marker of the selected target will expand to twice its normal size.

The displayed data includes the following information:

Distance/Angle: The distance and bearing from the last captured or selected target to this vessel; the "True" or "Magnetic" indicator at the rear indicates the basis for the directional data, where "True" denotes the use of true north as the reference standard, and "Magnetic" denotes the use of magnetic north as the reference standard.

Course/Speed: Displays the course and speed of the last captured or selected target; the stern also features displays for "True" and "Magnetic".

CPA (Closest Point): refers to the point closest to the target that the vessel can potentially reach; if you do not wish to use this feature, the operator should reset the CPA alarm settings.

TCPA (Time to Closest Point): TCPA refers to the time required to reach the closest point, calculated based on the speeds of this vessel and the target vessel. Both CPA and TCPA are automatically computed; when the target vessel has clearly passed the route of this vessel, CPA and TCPA are displayed as "**.**". In such cases, TCPA is displayed as "**.**" because the calculated value exceeds 99.9 minutes, indicating that TCPA is greater than 99.9 minutes.

5.4 Vector mode and length

Real or relative vector

The target vector can be displayed in either relative or absolute mode, whereas the vessel's own vector does not support relative mode.

Vector length

In the AIS.TT target menu, the vector duration can be set to 30 seconds, 1, 3, 6, 15, or 30 minutes, and the selected vector duration will be displayed on the screen.

The tip of the vector indicator displays the predicted position of the target within the specified vector time window. Extending the vector time window is valuable for assessing the collision risk between any target and the vessel.

Show past locations

This automatic plotting feature can display position markers for any tracked target within the same time interval.

If the target speed changes, the distances between the marker points will become uneven; if its heading changes, its plotted heading in TM mode will no longer be a straight line.

Operation Alert

The automatic plotter will trigger visual and audible warnings under the following two conditions:

- CPA/TCPA alarm
- Lost Target Alert

CPA/TCPA alarm

When the CPA and TCPA values for any target fall within the preset alarm thresholds, an audio-visual alarm is triggered, and the audio alarm will persist for 10 seconds.

The automatic plotting system automatically predicts the Closest Point of Approach (CPA) and the Time to Closest Point of Approach (TCPA) for each tracked target relative to the vessel.
When the predicted CPA value of any target falls below the preset alarm threshold and its predicted TCPA value falls below the preset TCPA threshold, the ARPA system triggers an audible alarm. Simultaneously, the target's marker changes to a triangle, and its vector indicator begins to flash.
When used correctly, this feature will indicate targets posing a collision risk, helping vessels avoid such hazards. Of course, to achieve optimal results, it is crucial to properly adjust the radar enhancement, wave suppression, rain/snow suppression, and other control parameters, as well as configure the automatic plotting system to ensure effective target tracking.
CPA/TCPA The setting of the alarm range must take into account the vessel's size, tonnage, speed, steering performance, and other characteristics.

⚠ WARNING

The CPA/TCPA alarm feature should never be relied upon as a sole means for detecting the risk of collision. The navigator is not relieved of the responsibility to keep visual lookout for avoiding collisions, whether or not the radar or other plotting aid is in use.

Configure the CPA/TCPA alert thresholds according to the following steps:
1. Open AIS. TT Target Menu;
2. In the "CPA Limit Settings" section, use the left and right arrow keys to select the appropriate CPA limit (Off, 0. 5, 1, 2, 3, 5, 6NM).
3. In the "TCPA Limit Settings" section, use the left and right arrow keys to select the appropriate TCPA limit (30 seconds, 1, 2, 3, 4, 5, 6, or 1 2 minutes).
4. Press the [Cancel/Forward] key to exit.
The flashing triangular symbols and vector markers will remain displayed on the screen until the hazardous condition is cleared or the tracking target is stopped using the [Cancel/Forward] key.

Target Loss Alert

When a tracked target is lost, the target symbol changes to a diamond shape and flashes.

When the predicted CPA value of any target falls below the preset alarm threshold and its predicted TCPA value falls below the preset TCPA threshold, the ARPA system triggers an audible alarm. Simultaneously, the target's marker changes to a triangle, and its vector indicator begins to flash.

When used correctly, this feature will indicate targets posing a collision risk, helping vessels avoid such hazards. Of course, to achieve optimal results, it is crucial to properly adjust the radar enhancement, wave suppression, rain/snow suppression, and other control parameters, as well as configure the automatic plotting system to ensure effective target tracking.

The setting of the CPA/TCPA alert range must take into account the vessel's size, tonnage, speed, turning performance, and other characteristics.

5.5 History shows(target past position)

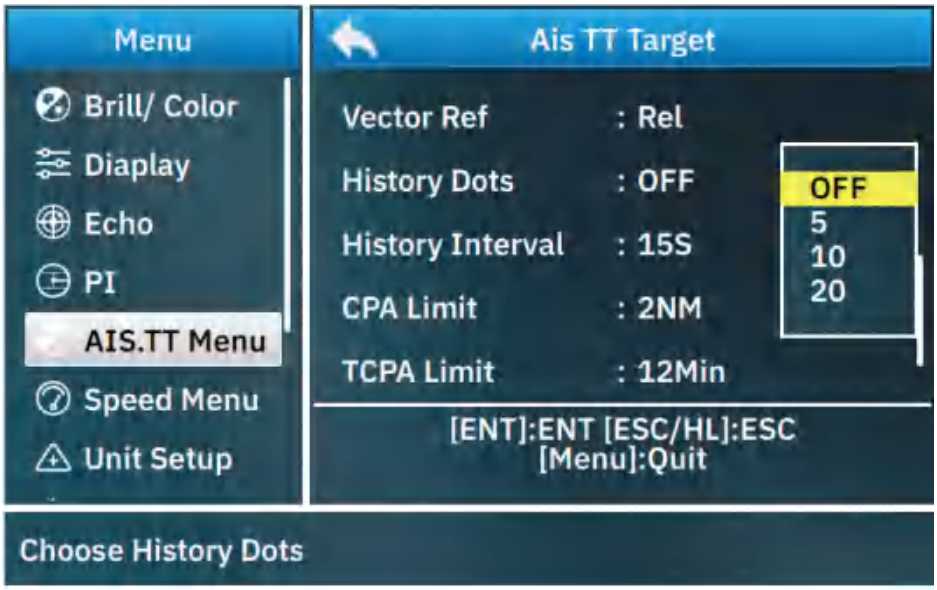
This radar can display time interval points (up to 20 points) to mark the historical positions of any tracked ARPA target. The target's motion can be inferred from the spacing between these points. Examples of point spacing and target motion are provided below.



(a)The ship turned around (b)The ship go straight (c)The ship slowed down (d)The ship accelerated

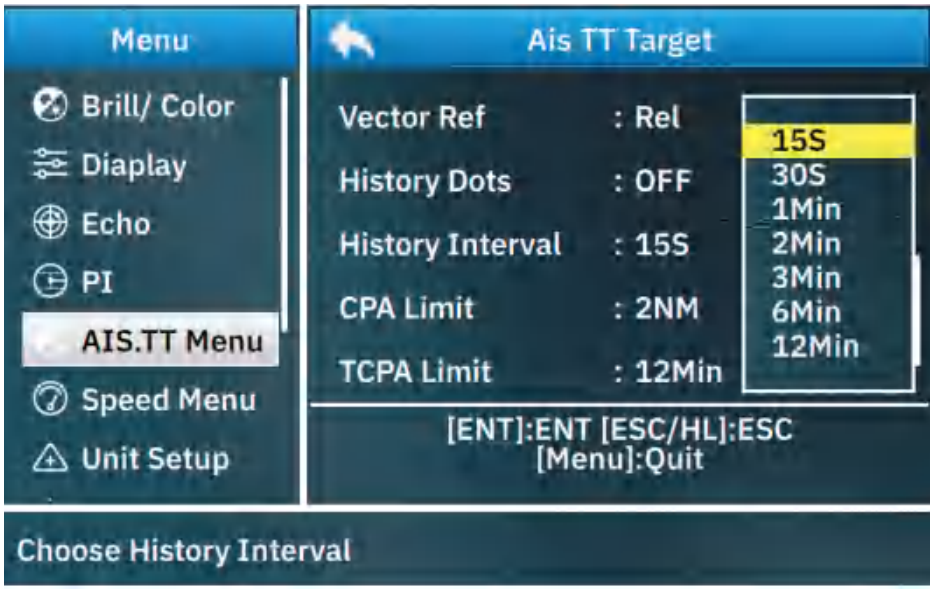
You can choose the number of historical points to display and the time interval between these points.

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [AIS. TT Target], then press the [ENT/ACQ]key.
3. Use ▲ or ▼ to select [Historical Dots], then press the [ENT/ACQ]key.



4. Use ▲ or ▼ to select the number of historical points to display (5, 10, or 20), or select [Off] to disable historical display; then press the [ENT/ACQ] key to confirm the selection.

5. Use ▲ or ▼ to select [Historical Interval], then press the [ENT/ACQ] key.



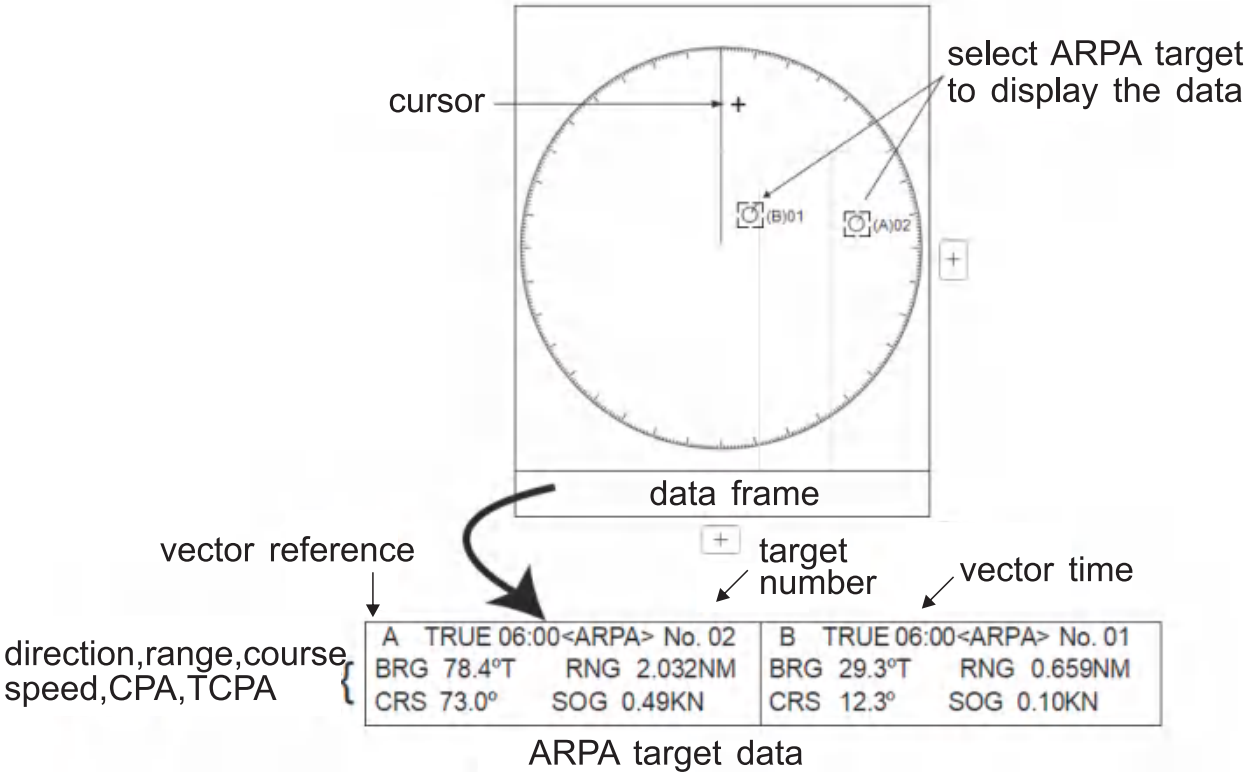
6. Use ▲ or ▼ to select the time interval, then press the [ENT/ACQ] key.

7. Press the Menu button to close the menu.

5.6 ARPA target data

You can display data for tracked ARPA targets in the data box at the bottom of the screen. To select ARPA target data, the [TT Display] menu item in the [AIS. TT Targets] menu must be set to [On], and the [Data Box] menu item in the [Display] menu must be set to [Targets] or [All].

1. Use the cursor keyboard to place the cursor over the ARPA target.
2. Press the [ENT/ACQ] key to display target data.



ARPA target data

The symbols of the selected ARPA targets are magnified two times to distinguish them from other symbols. To remove target data from the data frame, place the cursor over the target symbol and then press the Cancel/Backspace key.

5.7 Lost target

When the system detects that a target has gone missing, an audio alert sounds and a "Lost" alert message appears. The target icon then changes to the flashing square shown in the figure below. Once the system re-acquires the target, the target icon reverts to its normal appearance.

To remove a lost target symbol, place your cursor over the symbol and then press the Cancel/Escape key. If you allow the target symbol to flash, it will disappear after one minute.


Lost target symbol

5.8 Symbol color

You can choose the color of the ARPA symbol from green, red, blue, white, or black.

1.Press the Menu button to open the menu.

2.Use ▲ or ▼ to select[AIS.TT symbol], then press the [ENT/ACQ] key.

3.Use ▲ or ▼ to select[TT symbol color], then press the [ENT/ACQ] key.



4.Use ▲ or ▼ to select a color, then press the [ENT/ACQ] key.

5.Press the Menu button to close the menu.

Note: Do not use a symbol color that matches the background color.

6.AIS Explain

6.1 What is AIS?

AIS stands for Automatic Identification System, which translates to ″Automatic Identification System″ in Chinese. AIS is used to enhance maritime navigation safety; vessels equipped with AIS transmit their own vessel identification information and receive information from other vessels also equipped with AIS, thereby reducing the risk of collisions due to factors such as nighttime conditions and radar blind spots. This identification information includes vessel call sign, position, course, speed, and other navigation data.

6.2 What is the radar AIS function?

The radar AIS functionality does not mean that the radar itself possesses all the capabilities of an AIS system—such as VHF transceiver functions-rather, it involves transmitting AIS data received by the AIS system via the radar's serial interface (NMEA) to the radar host, and then displaying this information in real time on the radar display screen.

6.3 AIS use the control knob

[ENT/ACQ]: Enable the target selected by the cursor. Display data related to the selected target activity (in the data box at the bottom of the screen).

Cancel/Headline: Removes the selected AIS target data from the data frame. Pauses the selected target (when its data is no longer displayed in the data frame).

Menu: Access the [Display] and [AIS. TT] menus to perform AIS operations.

6.4 AIS symbol

As shown below, when AIS is enabled, the AIS target is displayed using the AIS symbol.

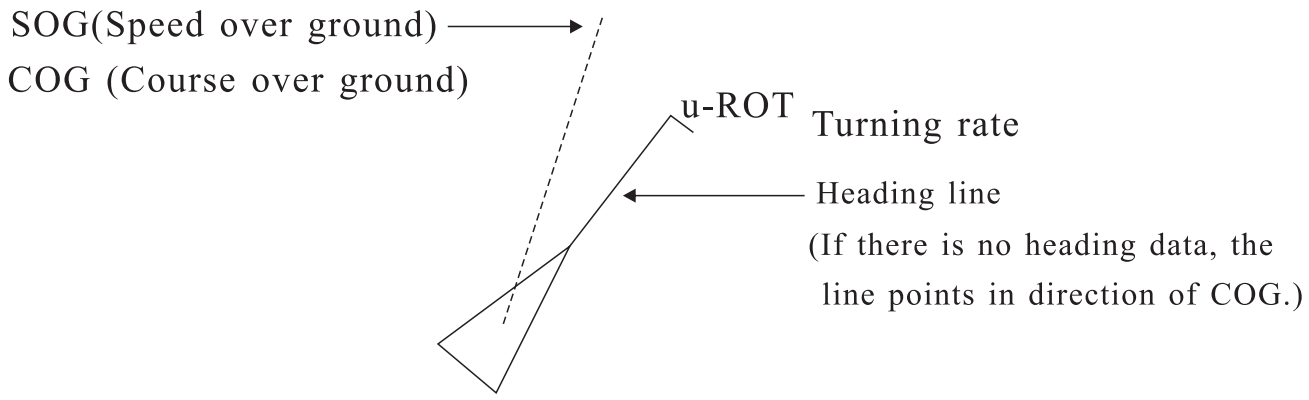


AIS symbol

Note: When changing the bow direction in the ″bow-up″ mode, the AIS symbol will be temporarily cleared after the screen changes.

6.5 Enable/Disable target

When a target is converted from a suspension target to an activity target, a vector is displayed to show the target's trajectory and velocity. The target's motion can then be easily assessed using this vector.



Activated target

When multiple active targets are displayed on the screen, you may find it difficult to distinguish active targets from the radar imagery or ARPA targets. You can pause active targets to better observe the radar imagery.



Target discontinuation

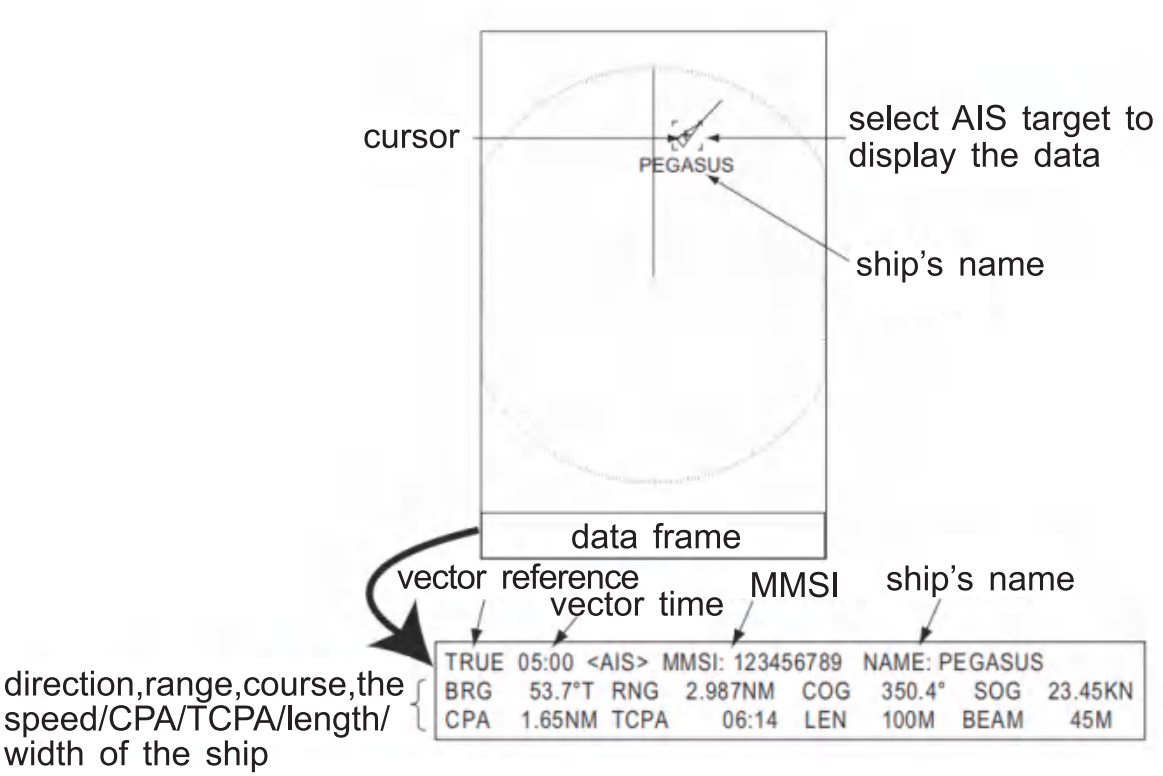
To activate a target: place the cursor over the target, then press the [ENT/ACQ] key.

To deactivate a target: place the cursor over the target, then press the Cancel/Line key.

6.6 AIS target data

AIS target data can be displayed in the data box at the bottom of the screen. To select AIS target data, the [Display] menu item in the AIS menu must be set to [On], and the [Data Box] menu item within the [Display] menu must be set to [Target] or [All].

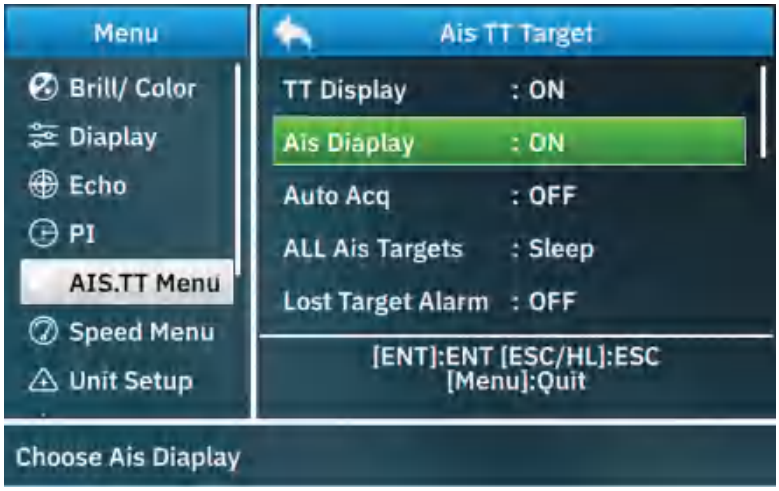
1. Use the cursor keyboard to place the cursor over the target activity.
2. Press the [ENT/ACQ] key to display target data.



To delete target data from a data frame, place the cursor over the target symbol, then press the Cancel/Backspace key.

6.7 How to enable the radar AIS function?

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [AIS. TT Target], then press the [ENT/ACQ] key.



3. Use ▲ or ▼ to select [AIS Display], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select [Close] or [Open], [Filter], then press the [ENT/ACQ] key.

5. Press the menu button to return to the parent menu.

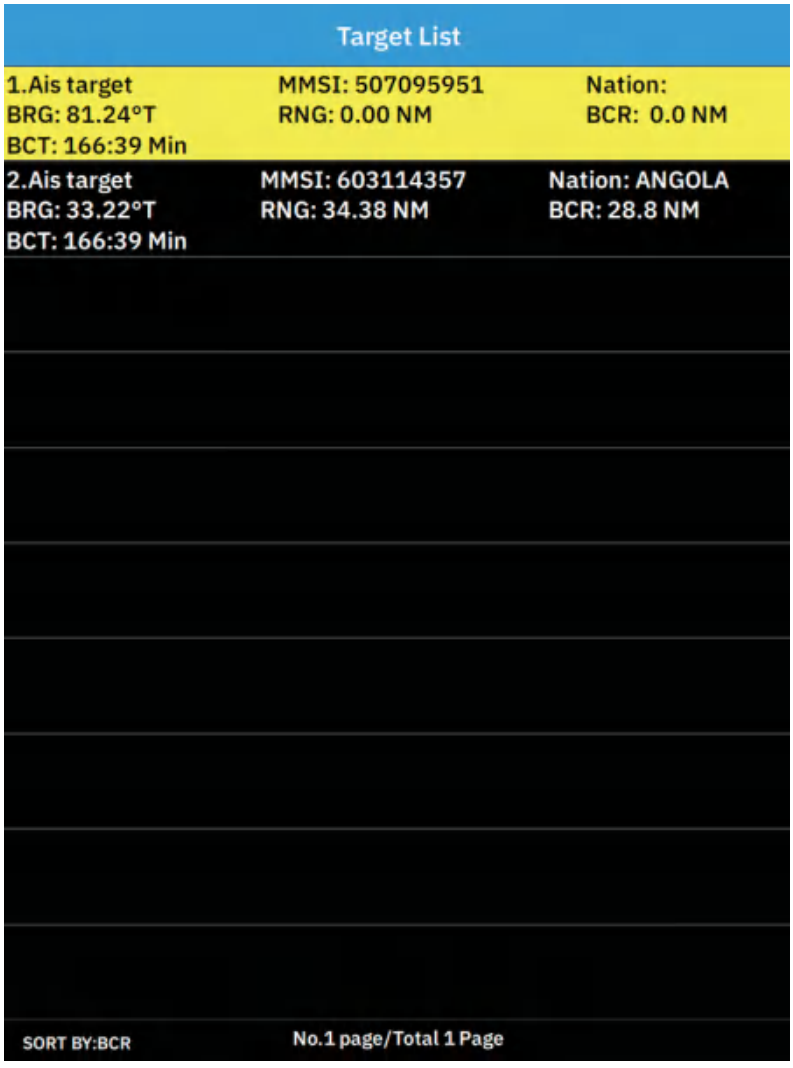
6. Press the Menu key to close the menu.

Note: The AIS function remains continuously active. If an AIS signal is received, target tracking will persist even when the AIS display is not active, ensuring that the corresponding target will be displayed immediately upon enabling the AIS display when required. Alternatively, you may configure a custom radar function key to the AIS function, allowing you to activate the AIS feature with a single keystroke when needed.

6.8 AIS labeling instructions

How to view the current AIS vessel information received?

Follow the aforementioned procedure to access the AIS. TT menu, select the "Target List" menu item, then press the [ENT/ACQ] key to confirm. This will then bring up the following target list dialog box, which displays basic vessel information.



To view detailed AIS vessel information for a selected target, press the [ENT/ACQ] key to enter the AIS vessel details window, as shown in the figure below:



Exit the dialog box using the Cancel/Forward key.

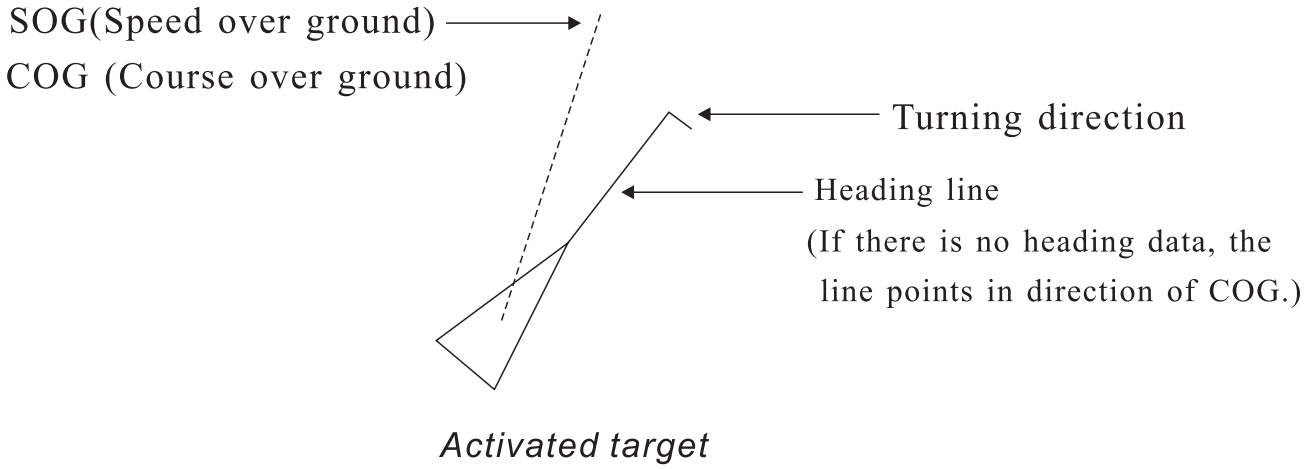
6.9 View the vessel's AIS information

Enter the AIS. TT menu, select the "Ship's AIS Information" option, and press the [ENT/ACQ] key to confirm. Once in the Ship's AIS Information menu, press the menu key to return to the parent menu.



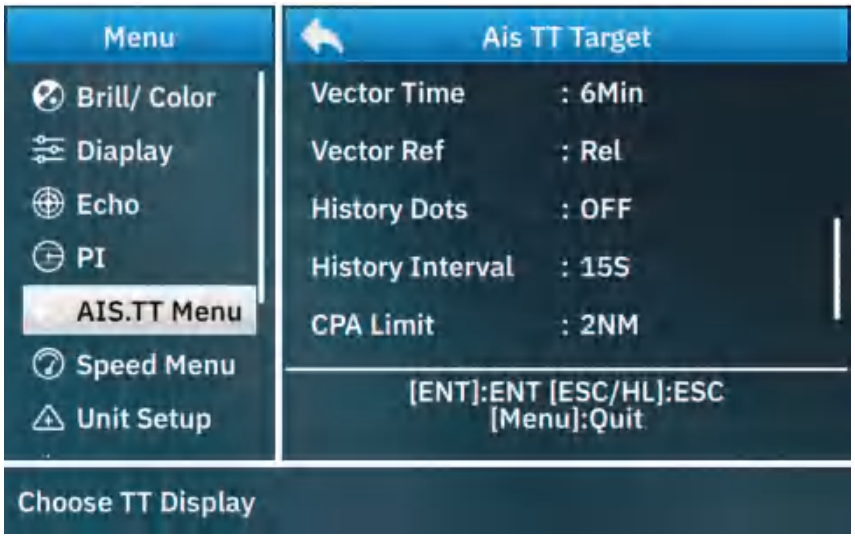
6.10 Set the vector display interval

This setting is used to define the vector display duration between this vessel and the target vessel. The vector indicator indicates the estimated position the vessel should reach after a specified duration of travel under its current course; this is an estimated value that continuously updates in response to the vessel's motion, thereby enabling radar operators to more easily and intuitively assess the vessel's current navigation status.

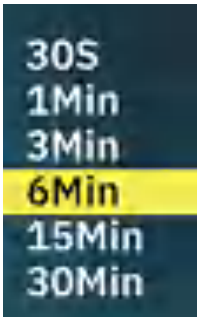


Operating steps:

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [AIS. TT Target], then press the [ENT/ACQ] key.



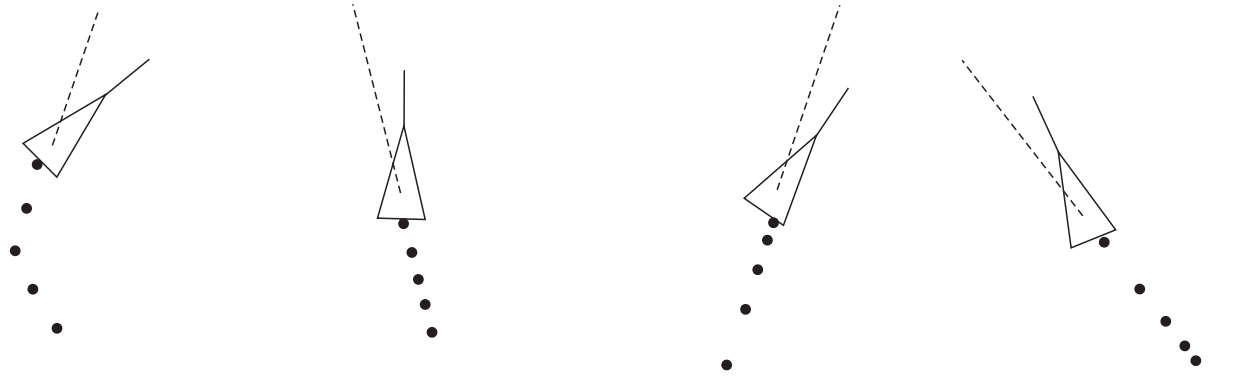
3. Use ▲ or ▼ to select [Vector Time], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select the dispaly Time, then press the [ENT/ACQ] key.
5. Press the menu button to return to the parent menu.
6. Press the Menu key to close the menu

6.11 Historical position settings

This function allows you to set the recording interval for the positions where this vessel and the target vessel pass by. It enables the recording of the vessels' passage positions at fixed time intervals, with a maximum of 20 data points per target vessel. When set to one data point per interval—for example, selecting 6 minutes—the system records the position every 6 minutes and displays it on the screen; when a new data point is recorded, the earliest recorded point is discarded. Under these conditions, up to 30 minutes of passage positions can be recorded.



(a) Ship turning

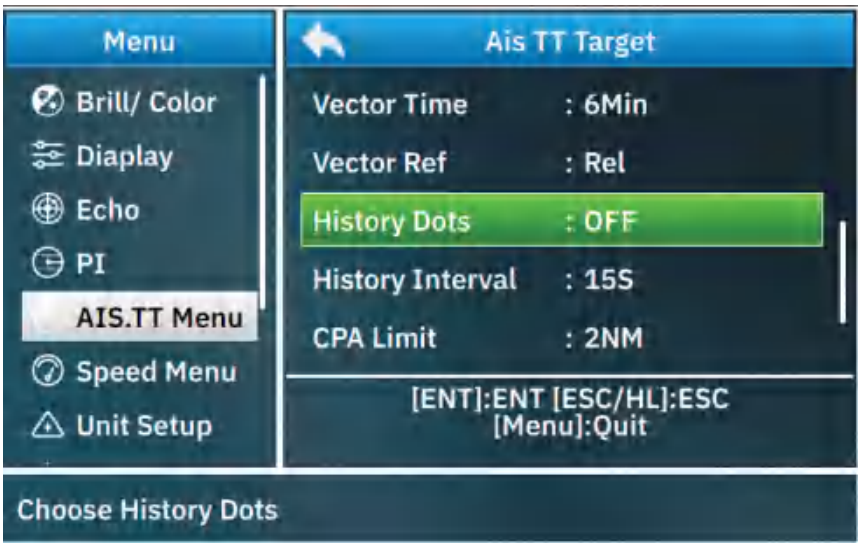
(B) Ship turning straight

(c) Ship reduced speed

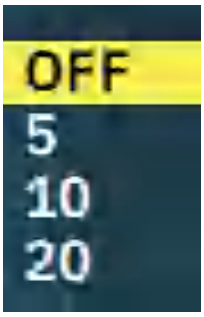
(d) Ship increased speed

Sample past position displays

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [AIS.TT Target], then press the [ENT/ACQ] key.



3. Use ▲ or ▼ to select [Historical Dots], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select the number of items to display, then press the [ENT/ACQ] key.
5. Press the menu button to return to the parent menu.
6. Press the Menu key to close the menu.

6.12 Alarm Setting for CPA Limit and TCPA Limit Values

When the CPA and TCPA values for any target fall within the preset alarm thresholds, an audio-visual alarm is triggered: the audible alarm persists for 10 seconds, while the visual alarm remains displayed until the alarm is cleared.

The AIS function automatically calculates the Closest Point of Approach (CPA) of each detected target vessel to this vessel, as well as the Time to Closest Point of Approach (TCPA). If the calculated CPA of a target vessel falls within a predefined range, the target vessel's identifier will change to the alert color corresponding to the currently displayed color scheme; however, no audible or visual alert will be triggered. The audible and visual alert will only be activated once the TCPA also reaches the preset threshold. The target vessel that triggers the alert will be displayed in bold, will flash, and will emit an audible alert.

CPA Setting Method:

Follow the aforementioned procedure to access the AIS menu, select "CPA limit settings" press the [ENT/ACQ] key to bring up a dialog window, then use the ▲ or ▼ keys to select the desired setting, and finally press the [ENT/ACQ] key to confirm the selection.

TCPA Setting Method:

In the AIS. TT target menu, select "TCPA limit settings" Press the [ENT /ACQ] key to open the pop-up window, then use the ▲ or ▼ keys to select the desired setting, and finally press the [ENT/ACQ] key to confirm the selection

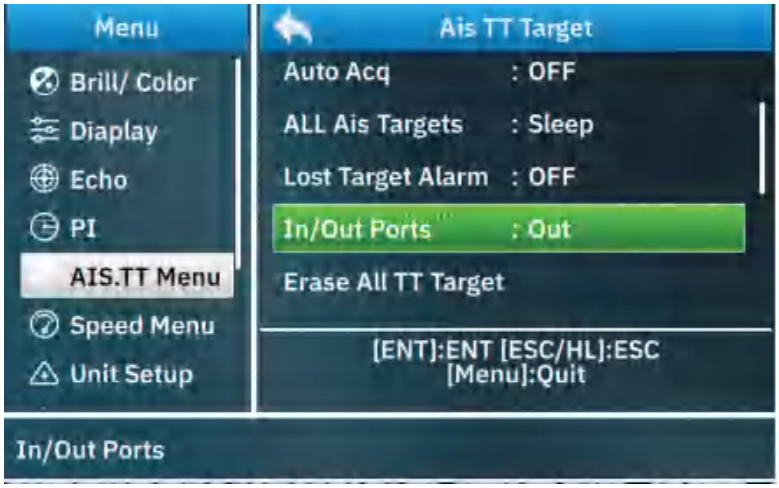
Note: These two settings should be configured based on a comprehensive consideration of vessel type, turning rate, and other relevant factors; otherwise, the collision avoidance requirements may not be met.

Entry and Exit Facilities

This feature is designed to prevent continuous alarm triggering caused by an excessive number of AIS vessels when a vessel enters a port. When this setting is configured to ″Port Entry,″ both CPA and TCPA alarms will be completely disabled.

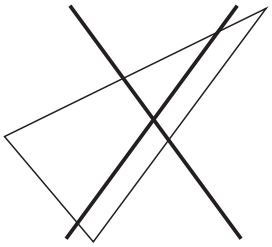
The setup procedure is as follows:

Enter the AIS. TT target menu, select ″IN/OUT Ports″ press the [ENT/ACQ] key to open a dialog window, then use the ▲ or ▼ keys to select the desired settings, and finally press the [ENT/ACQ] key to apply the selected settings.



6.13 Missing target alert function

If information on an AIS target within the current measurement range is not received after its maximum update interval, the target loss alarm function will be triggered. In this case, the symbol of the target will change to the following target loss indicator—displayed in red and flashing —while the radar will emit an audible alert to alert the ship operator. To manually disable the audible alert, press the [Alarm] button once.



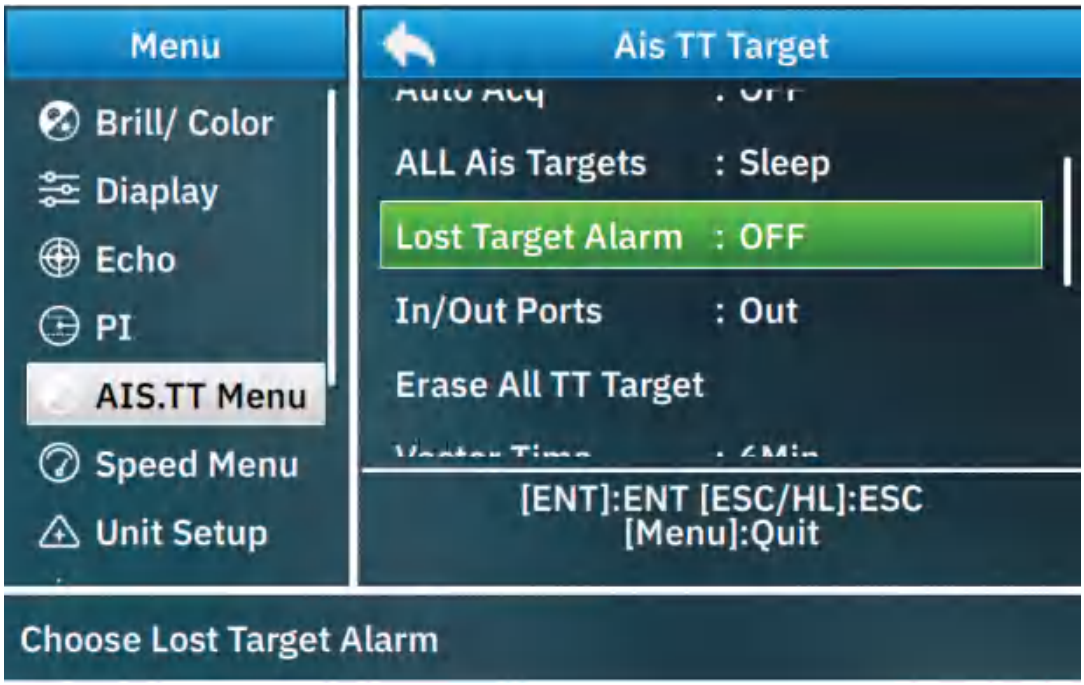
loss target display symbol

6.13.1 How to enable the lost target alert feature

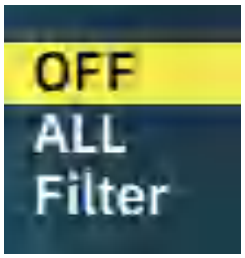
When this feature is disabled, the lost target will still be displayed, but no alert will be triggered. The activation procedure is as follows:

operating steps:

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [AIS. TT Target], then press the [ENT/ACQ] key.



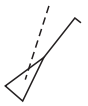
3. Use ▲ or ▼ to select [Lost Target Alarm], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select the desired setting, then press the [ENT/ACQ] key.
5. Press the menu button to return to the parent menu.
6. Press the Menu key to close the menu.

6.14 Processing of various data indicators

This radar system can integrate various NMEA data sources, including AIS/GPS, bearing, and water depth data. Upon startup, if AIS is not enabled, the radar will display a prompt on the screen such as: ″No AIS device connected.″ Other prompts may appear, including ″AIS signal lost″ or ″No bearing data connected″; to disable these prompts, press the [[ENT/ACQ]] key. Description of target display marker status.

Symbol	Status	Remark
	Sleep target	An acute-angled isosceles triangle whose centroid represents the reference position of the target. The acute angle of the triangle is used to indicate heading or COG if there is no heading
	Activated target	Dotted line represents COG, solid line represents HDG
	Turning target	Show ships that are turning
	Selected target	Marked with a square discontinuous frame
	Danger target	Use bold to display , and at the same time display red and flash until the status is eliminated
	Lost target	Cross the mark with a thick solid line crossed, and the direction of the solid line is perpendicular to the last direction of the target

AIS ship symbol description

Other symbol description

Other AIS symbols that may appear are shown in the table below.

SYMBOL	Meaning
	Real AIS AtoN
	Virtual AIS AtoN
	Base Station
	Airborne SAR aircraft
	AIS SARTS

NO.	TYPE	COLOR	REMARK
1	Military	Gray	
2	Yacht/Fishing/Class B	Pink	
3	Tanker/Cargo	Orange	
4	Cruise ship	Violet	
5	Tug/Pilot	White	
6	Unknows	Blue	When blue background is Black
7	ATON	Red	
8	SART	Red	
9	Selected target frame	With the selected target color	
10	Loss Target	Red	
11	Danger Target	Red	

AIS Icon Color Description

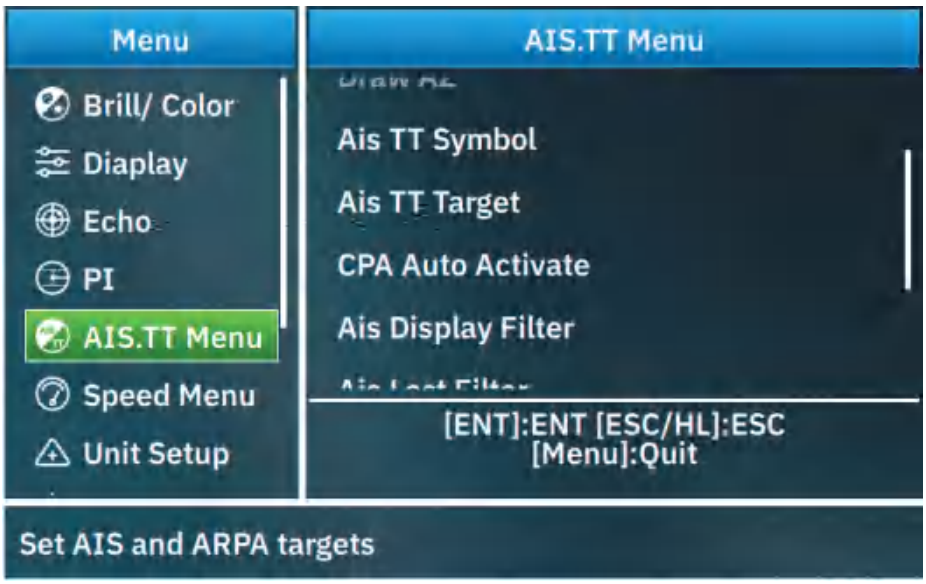
6.15 CPA activation

Used to activate AIS target vessels that comply with the CPA activation menu configuration parameters.

Note: The CPA activation parameters only apply to the AIS targets during sleep.

operating steps:

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [AIS. TT menu], then press the [ENT/ACQ] key.



3. Use ▲ or ▼ to select [CPA Auto Activation], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select the setting parameters, then press the [ENT/ACQ] key.
5. Press the menu button to return to the parent menu.
6. Press the Menu key to close the menu.

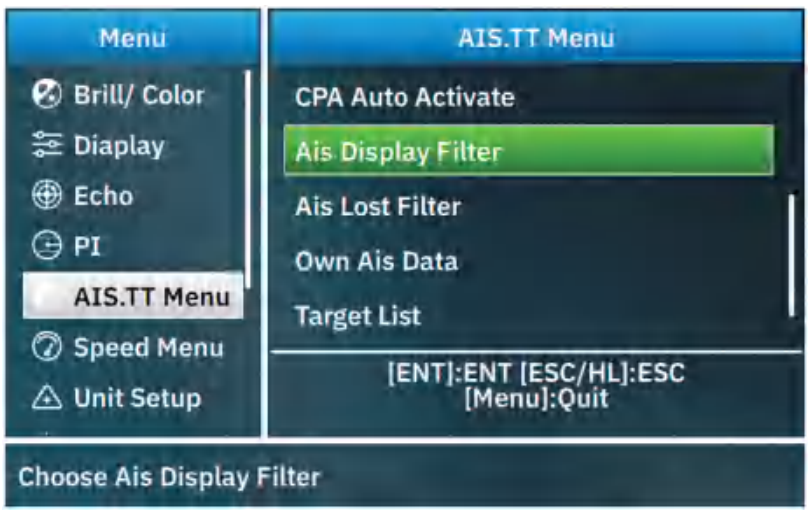
Max Range	AIS targets that exceed this setting will not be activated.
Min ship Speed	AIS targets that exceed this setting will not be activated.
Except class B	Class B vessels will not be activated.
Min ship Length	AIS targets that exceed this setting will not be activated.

6.16 AIS display filter

Used to filter AIS target vessel displays that comply with the parameters set in the AIS display filtering menu.

Note: The current AIS targets displayed are not affected by filter settings. operating steps:

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [AIS. TT menu], then press the [ENT/ACQ] key.



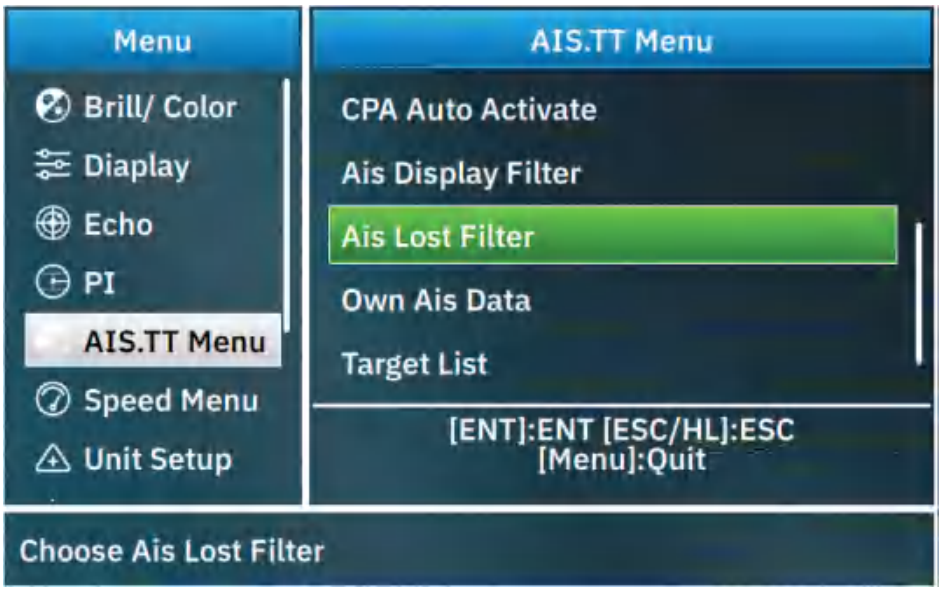
3. Use ▲ or ▼ to select [AIS Display Filter], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select the setting parameters, then press the [ENT/ACQ] key.
5. Press the menu button to return to the parent menu.
6. Press the Menu key to close the menu.

6.17 AIS lost filter

Display of AIS loss targets that meet the AIS loss filtering criteria.
Note: This feature is triggered only when the filtering option in the "Lost Target Alert" section of the AIS. TT target menu is selected.
operating steps:
1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [AIS. TT menu], then press the [ENT/ACQ] key.



3. Use ▲ or ▼ to select [AIS Lost Filter], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select the setting parameters, then press the [ENT/ACQ] key.
5. Press the menu button to return to the parent menu.
6. Press the Menu key to close the menu.

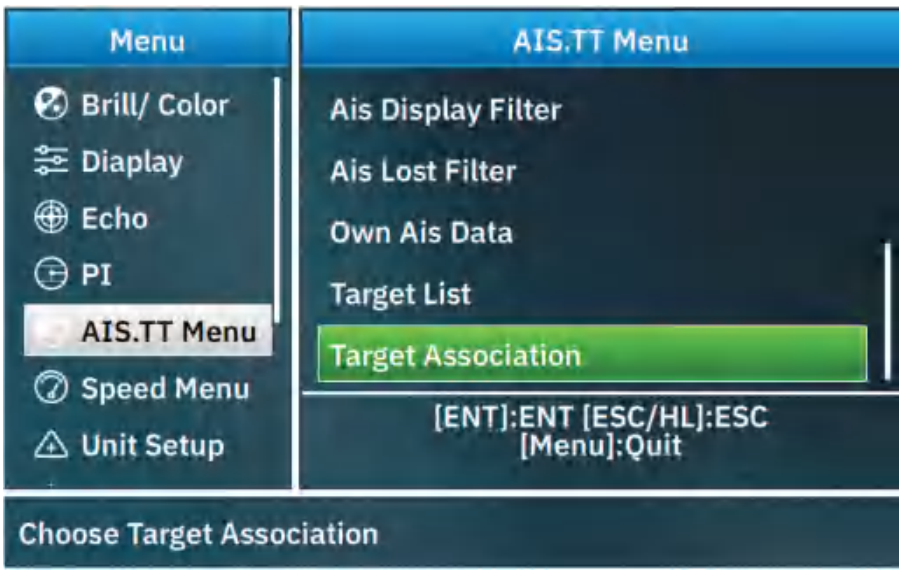
6.18 Target association

On radar vessels equipped with AIS, both an AIS target and a TT target will be displayed; to avoid using two symbols to represent the same physical target, targets for which the parameters in the target association menu have been configured will be displayed in a fused manner.

Note: If the associated AIS target falls asleep or loses consciousness, fusion will not be performed.

operating steps:

1. Press the Menu button to open the menu.
2. Use ▲ or ▼ to select [AIS. TT menu], then press the [ENT/ACQ] key.



3. Use ▲ or ▼ to select [Target Association], then press the [ENT/ACQ] key.



4. Use ▲ or ▼ to select the setting parameters, then press the [ENT/ACQ] key.
5. Press the menu button to return to the parent menu.
6. Press the Menu key to close the menu.

Target Association	Switches for controlling target association and display criteria: Off — target association function disabled; AIS — display based on AIS compliance and AIS data; TT — display based on TT compliance and TT data.
Target Spacing	The target spacing defines the maximum allowable distance between associated targets; targets exceeding this distance will not be paired.
Target Range	The target distance is used to set the maximum distance difference between this vessel and the AIS target and the tracking target.
Target Nearing	The target bearing is used to set the maximum angular difference between this vessel and the AIS target or the tracking target.
Speed Poor	The speed difference is used to set the maximum speed difference between the AIS target and the tracking target.
COG Poor	The course difference is used to define the maximum course difference between the AIS target and the tracking target.

7. RADAR INSTALLATION

This chapter provides the procedures necessary for installation.

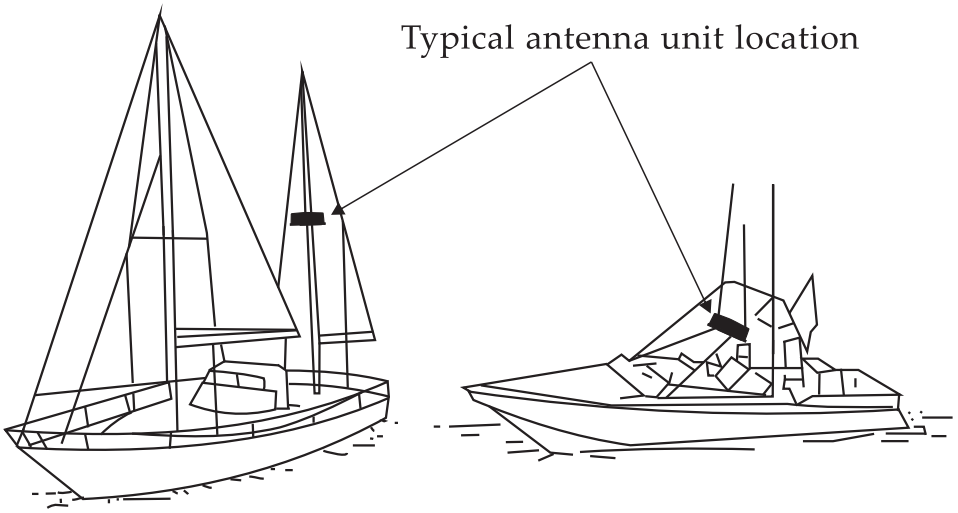
Installation mainly consists of the following:

- sitting and mounting the display unit and antenna unit
- connection of the signal cable and the power cable
- establishing the ground
- checking the installation, and
- adjustments.

7.1 Antenna Unit Installation Sitting, handling considerations

- The antenna unit is generally installed either on top of the wheelhouse or on the radar mast on a suitable platform. Locate the antenna unit where there is a good all-round view as far as possible, no part of the ship`s superstructure or rigging intercepting the scanning beam. Any obstruction will cause shadow and blind sectors. A mast for instance, with a diameter considerably less than the width of the radiator, will cause only a small blind sector, but a horizontal spreader or crosstrees in the same horizontal plane as the antenna unit would be a much more serious obstruction; you would need to place the antenna unit well above or below it.
- It is rarely possible to place the antenna unit where a completely clear view in all direction is available. Thus, you should determine the angular width and relative bearing of any shadow sectors for their influence on the radar at the first opportunity after fitting. (The method of determining blind and shadow sectors appears later in this chapter.)
- If you have a radio direction finder on your boat, locate its antenna. Clear the antenna unit, to prevent interference to the direction finder. A separation of more than two meters is recommended.
- To lessen the chance of picking up electrical interference, avoid routing the signal cable near other onboard electrical equipment. Also avoid running the cable in parallel with power cables.
- The compass safe distance should be observed to prevent deviation of the magnetic compass.

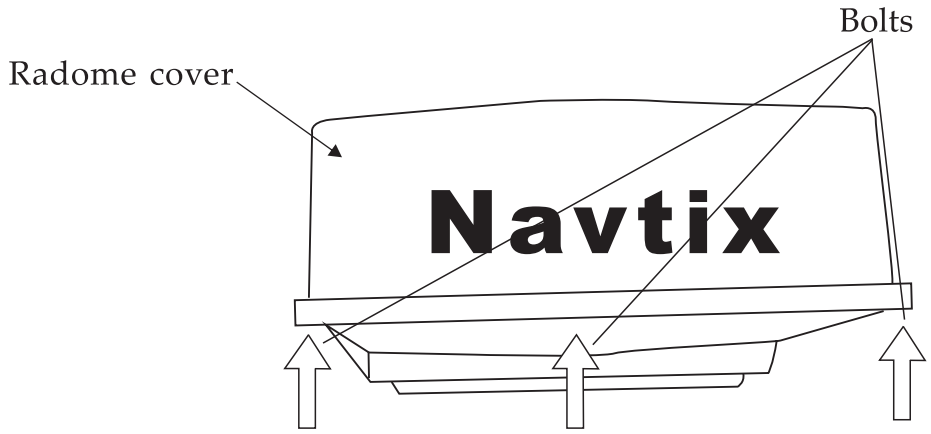
Model	Standard compass	Steering compass
KNR-1X0	1.3m	0.7m



Typical antenna unit location

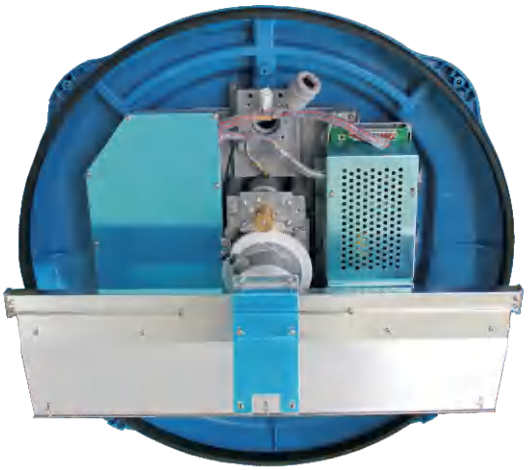
Unpacking the antenna unit

1. Open the antenna unit packing box carefully.
2. Unbolt the bolts at the base of the radome to remove the radome cover.

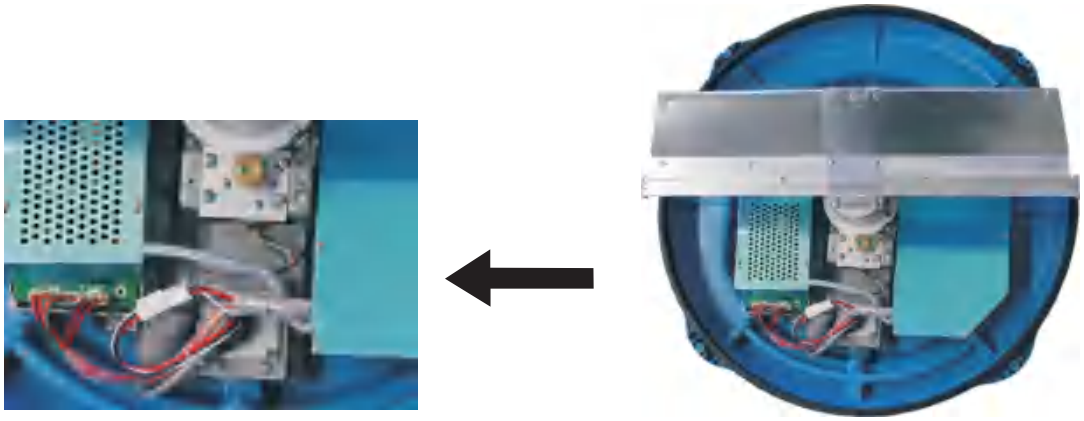


Antenna unit

3. Drill holes in the antenna mounting platform in accordance with the previous removal of the base mounting map.
   Note: the hole is arranged in parallel with the center line of the ship.
4. Loosen the antenna cover and the base of the 4 screws, carefully remove the cover.
5. Remove the cable clamping plate by unfastening four screws and removing a gasket.
6. Pass the cable through the hole at the bottom of the radome base.
7. Secure the cable with the cable clamping plate and gasket. Ground the shield and vinyl wire by one of the screws of the cable clamping plate.
8. Connect the wire to the Video Processing unit.

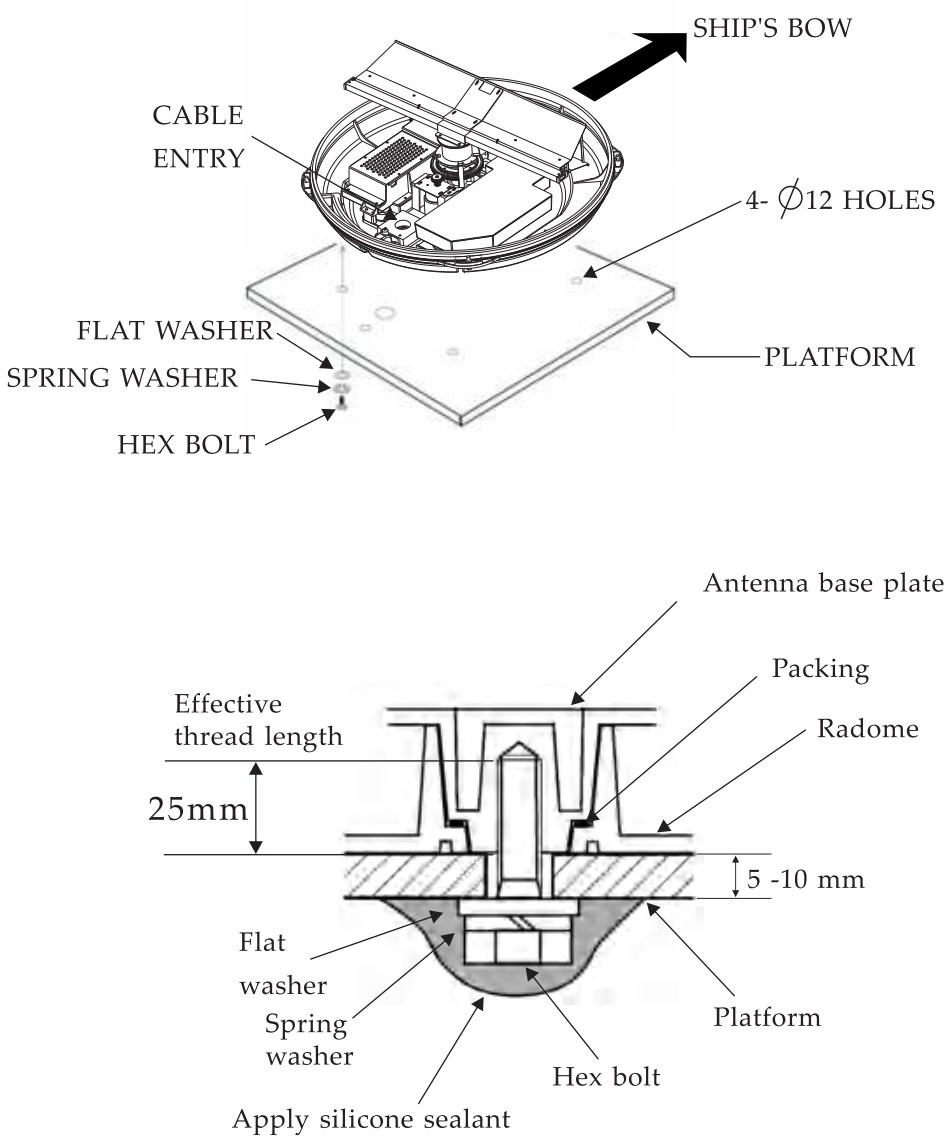


10. Fix the shield cover. Do not pinch the cable.



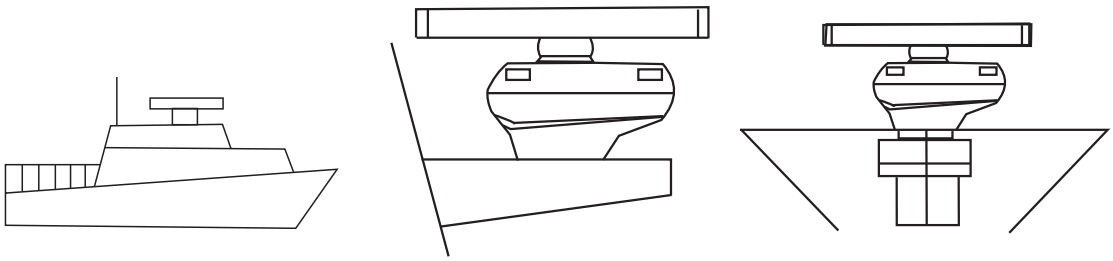
Antenna Cable Wiring

11. Loosely fasten the radome fixing bolts. You will tighten them after confirming the unit is working normally.



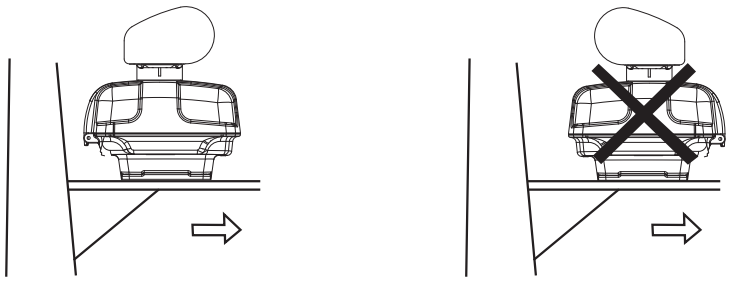
How to fasten the radome base to the mounting platform

Mounting of KRA-4003



Typical antenna unit mounting locations

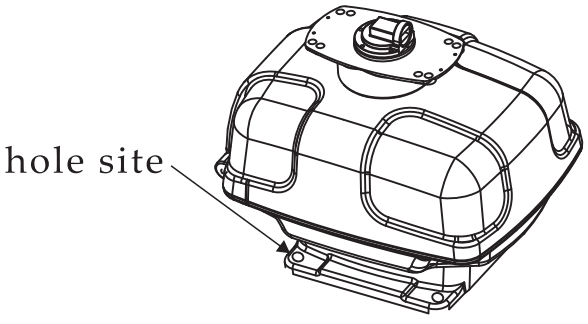
1. Drill four fixing bolt holes (13 millimeters dia.), In the mounting platform. See the outline drawing.
2. Detach the antenna housing cover from the antenna housing by loosening four fixing blots. The antenna housing cover fitted with the transceiver module can be stored in a convenient place until the wiring to the antenna unit is done.
3. Place the antenna housing on the mounting platform and orient it as shown in.



How to orient the antenna unit

4. Insert four M12×60 hex head bolts with the seal washers from inside the antenna housing, to prevent the bolts from contacting the transceiver module. Install the seal washer with the larger diameter next to the head of the bolt.

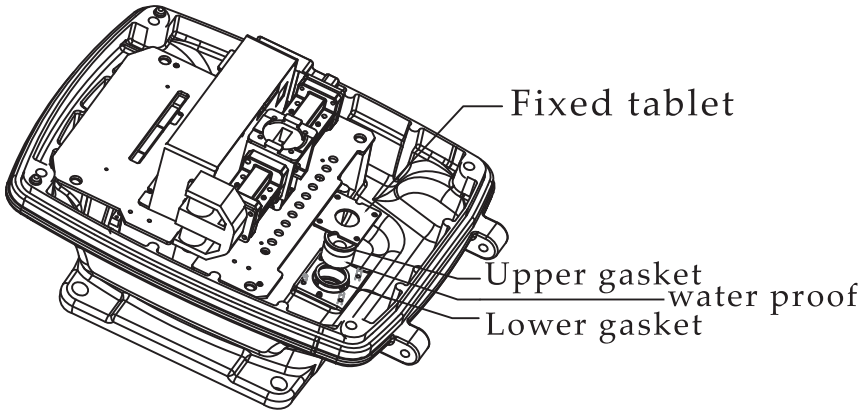
Coat flat and spring washers and nuts and then use them to fasten the antenna housing to the mounting platform.



Linkage

Only the signal cables need to be connected from the display unit to the antenna unit; the minimum diameter of the through-hole through which these signal cables can pass normally shall be 20 mm, and waterproofsealant shall be applied after the wiring in allthrough-holes has been completed.The procedure for connecting the signal cable to the antenna section is as follows:

1. Route the signal cable to the top of the cab or other installation locations via conduits or waterproof cables;
2. Loosen the fastening bolts of the cable interface, then remove the waterproof gasket and the washer.
3. Pass the signal cable sequentially through the output ports of the base, then through the lower gasket, the waterproof rubber ring, the upper gasket, and the fixing pressure plate, before entering theinterior of the antenna, as shown in the figure below:

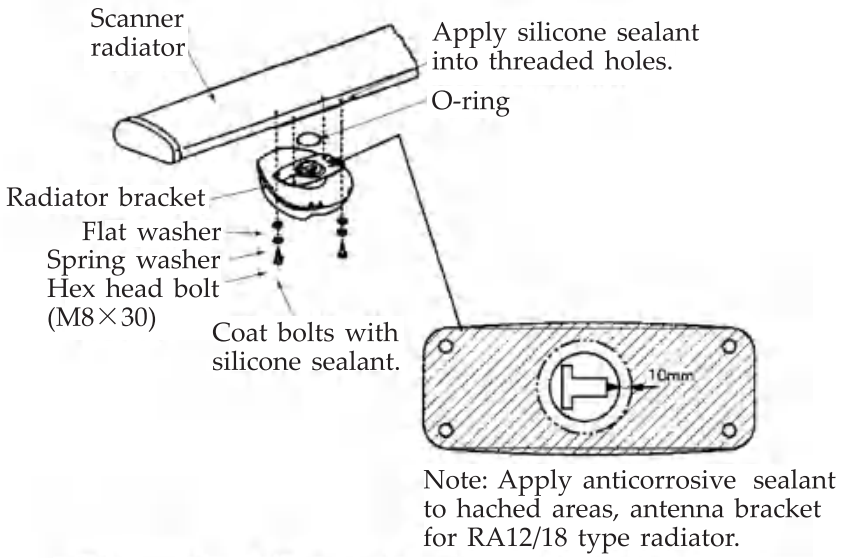


Pass the signal cable through the interior of the antenna

4. Tighten the fixing screw;
5. Connect the RJ45 network plug of the signal cable to the corresponding RJ45 socket J12 on the antenna unit;
6. Connect the 4-core plug of the signal cable to the corresponding 4-core socket J18 inside the antenna;
7. Secure the antenna cover, inspect the waterproof gasket, and tighten the fastening bolts.

Installation of Waveguide:

8. The antenna is placed in the arm, and the packing of the antenna is opened;
9. Take out the antenna base waveguide filler;
10. Install the waterproof rubber ring.
11. To check the position of the antenna base guide, and to load the antenna waveguide port with the alignment.As shown below:



Fastening the radiator to the radiator bracket

12. Open antenna cover;
13. Check the internal connection of signal cable is correct;
14. The grounding of the earth wire in the signal cable to the chassis;
15. Loosely fasten the cover screws.You will tighten them after confirming the unit is working normally.

7.2 Display Unit Installation Mounting considerations

When selecting a mounting location for the display unit keep in mind the following points.

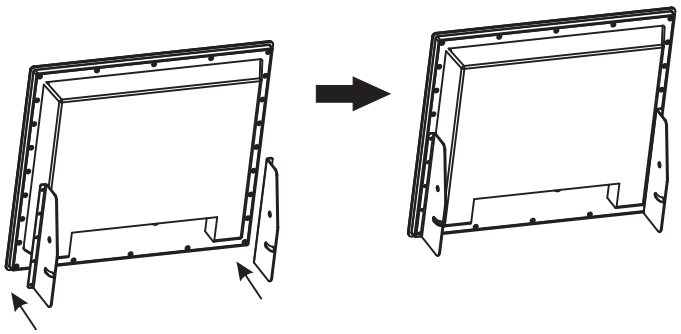
- Even though the display unit is waterproof, it is recommended that the display unit must be mounted inside an enclosed cabinet.
- Provide adequate space behind and around the unit to permit circulation of air and to provide convenient access to the rear connectors.
- Even though the picture is quite legible even in bright sunlight, keep the display unit out of direct sunlight or at least shaded because of heat that can build up inside the cabinet.
- Locate the display unit in a position where you can view and operate it conveniently but where there is no danger of salt or fresh water spray or immersion.
- The orientation of the display unit should be so the radar screen is viewed while the operator is facing the direction of the bow. This makes determination of your position much easier.
- Make sure you allow enough clearance both to get to the connectors behind the unit and to allow you to get your hands on both sides to loosen or tighten the mounting knobs. Make sure you leave at least a foot or so of "service loop" of cables behind the unit so it can be pulled forward for servicing or easy removal of the connectors.
- The compass safe distance of 0.8 meters (standard compass) and 0.6 meters (steering compass) should be observed to prevent deviation of the magnetic compass.

Mounting

The display unit is designed to be mounted on a tabletop or bulkhead.

Display unit tabletop installation

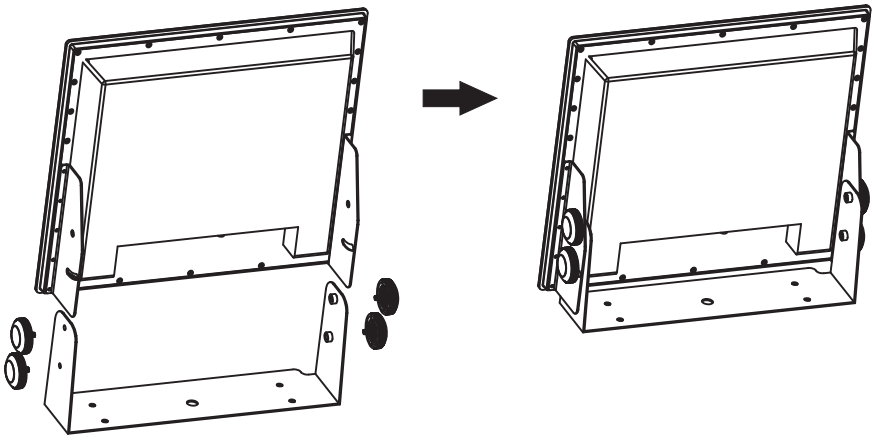
1 . Secure the bracket mounting accessories(one piece on each side) to the left and right sides of the monitors rear housing using screws, as shown in the figure below:



2. Using a fixed bracket, mark the selected fixed position and drill a small hole.

3. Secure the bracket to the worktable using four M6 screws.

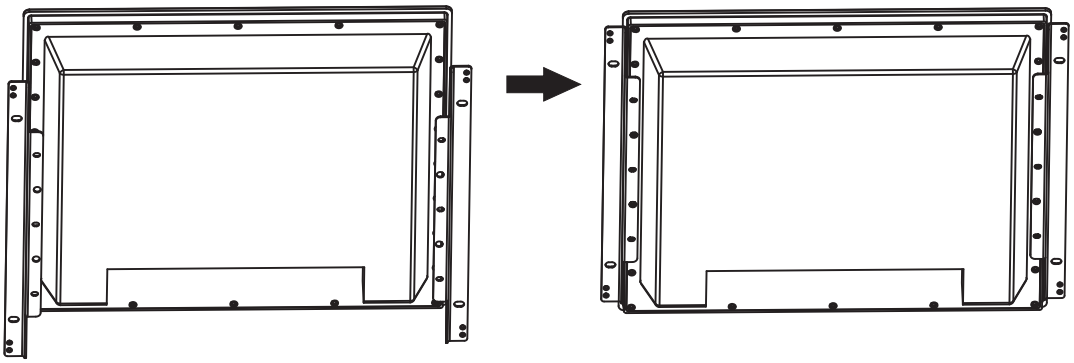
4. First, screw each fixed knob into the corresponding fixing screw holes of the left and right support brackets following the initial installation; then, adjust the display unit to the desired tilt angle, and finally screw each fixed knob into its corresponding hole and tighten it.



Embedded installation

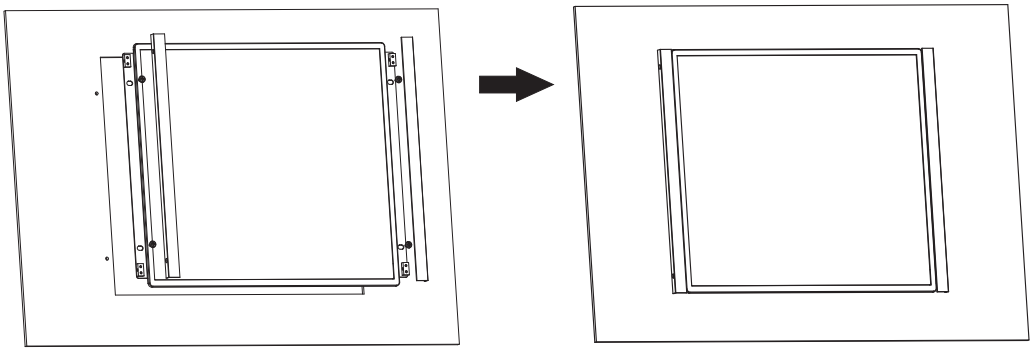
1. Perform cutting at the installation location, referring to the embedded installation contour drawing.

2. Secure the embedded components to the rearhousing of the monitor using screws, as shown in the figure below.



3. Place the monitor into the hole and secure it with four screws.

4. Press the edge cover of the embedded component onto both sides, then secure it with screws along the edges.



7.3 Exchanging the Fuse for 24/32V Power Supply

The power cable comes with a 10A fuse in the fuse holder. This fuse is used with a 12V DC power supply. For 24V/32V DC power supply, replace the fuse with the 5A fuse (supplied) to the fuse holder.

7.4 Checking the Installation

After completing the installation, it is a good idea to recheck it to be sure all steps were correctly done. Use the table 8-1 to check the installation.

Tick box

- The signal cable is securely retained against the mast or mounting platform and is free of interference from running rigging
- The cable gland or entry on the deck, if provided, is waterproofed
- The power connections to the battery are of correct polarity
- The plugs at the rear of the display unit are tightly fastened
- The fuse in the power cable is 10A (12V) or 5A (24V/32V DC)

7.5 Adjustments

This section covers adjustment of the radar after installation.
You will need to do:

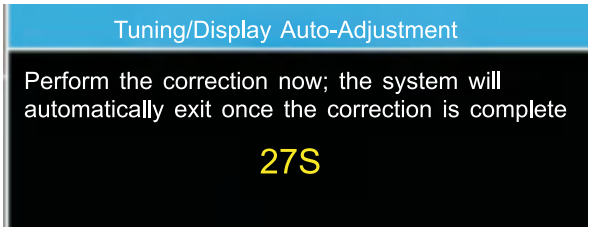
- Tune/video adjustment
- enter antenna height
- Heading alignment
- adjust sweep timing
- adjust main bang suppression
- setting a blanking area

These adjustment are done through the radar installation Menu.

Adjust tuning level

The adjustment here allows you to modify theinput level of the tuner and video signal amplifier to make the echo clearer.

1. Press the [Standby/Transmit] button to activate the radar;
2. In the installation menu, select "Tune/Show Automatic Adjustment" and press the [Confirm/Capture] key;
3. At this point, the radar will automatically adjust and display the following information:



Automatic tuning information

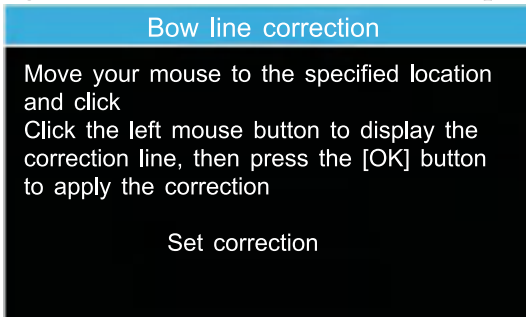
4. Once the adjustment is complete, the information disappears.

Crown line correction (adjustable range: 0–359.9°)

Once the antenna has been installed, the bow line accuracy should be verified. Rotate the vessel so that the bow aligns with a small, distinct target, and observe whether the bow line displayed on the radar passes through the center of the target.

If any deviation is detected, the bow line must be corrected; otherwise, it may compromise the proper operation of the instrument and jeopardize navigation safety.

1. Identify a clear target (e.g., a ship or a reef) that is within 0 distance from your vessel. 125 to 0. Within a range of 25 nautical miles, adjust the range so that the target echo appears at approximately half of the display range, while disabling the zoom and offset functions.
2. Turn the vessel so that its bow aligns with the selected target;
3. In the "Installation Menu," select "Bow Line Correction," then press the [Confirm/Capture] key; the following information will then be displayed on thescreen:



Bow line correction information

4. Use the direction keys to adjust the electronic bearing line 1 so that it passes through the bow of the vessel and aligns with the center of the target;
5. Press the [Confirm/Capture] key;
6. Using the aforementioned method, reconfirm whether the bow line is accurate.

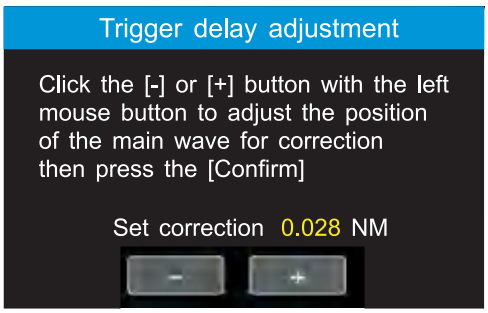
Wave suppression range settings

The wave suppression curve varies depending onthe height between the antenna and the waterline;selecting an appropriate wave suppression rangetailored to vessels of different heights can optimize wave suppression performance.

1. In the installation menu, select "Wave Suppression Range";
2. Use the arrow keys to select the appropriate wave suppression range for the current antenna height: calm, light waves, moderate waves, and heavy waves.

Adjusting sweep timing(Adjustment range:0.000~4.266nm)

1. Set the transmitter to the near-range setting and appropriately adjust [Gain] and [Wave Suppression].
2. Select a visible linear target (e.g., a breakwater, a bridge, etc.).
3. In the "Installation Menu," select " Trigger Delay Adjustment" and press the [Confirm/Capture] key; the following information will then be displayed.



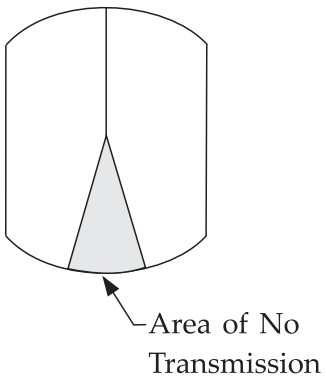
Trigger delay correction information

4. Use the left and right arrow keys to adjust the second selected target echo until it appears as a straight line, then press the [Confirm/Capture] key.

Setting a blanking area

When the antenna is installed at a close distance in front of the wheelhouse, the radar should be set not to transmit within that area. No echoes appear in the blanking areas.

1. Select "DEAD SECTOR".
2. Use the left and right buttons to select the starting point of the region.
3. Press the [ENT/ACQ] key.
4. Operate the omnipad to enter ending point of the area (in figures).
5. Press the [ENT/ACQ] key.



Blank areas where transmission is suspended

This area can be turned on/off on the OTHER MENU.

Note: This setting should be done after other adjustment are finished.

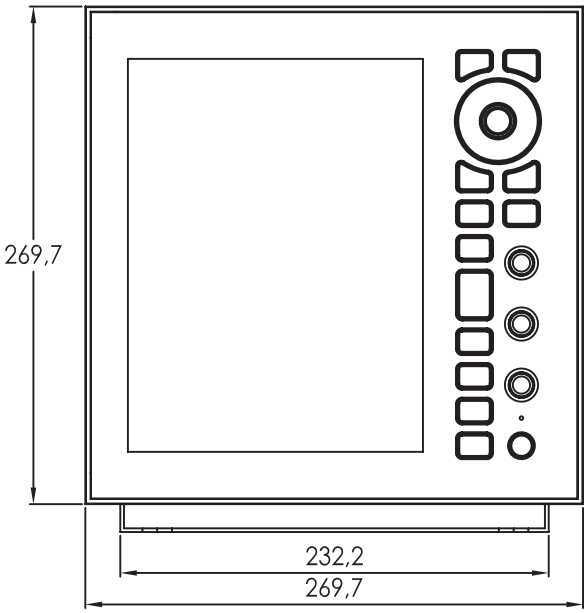
Things to do after all adjustments are finished:

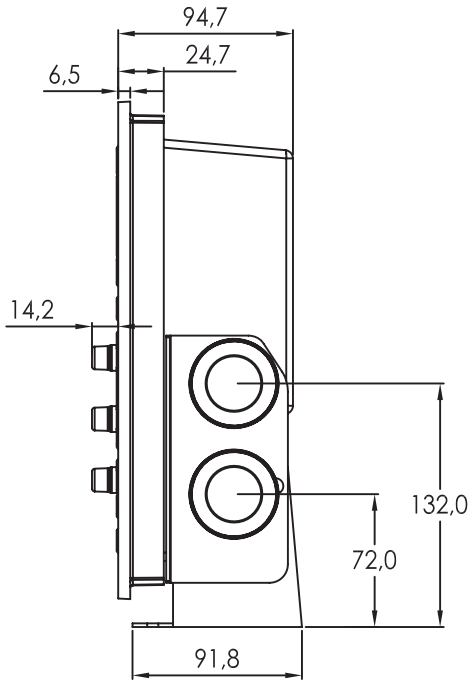
1.Make sure all antenna screws are fastened

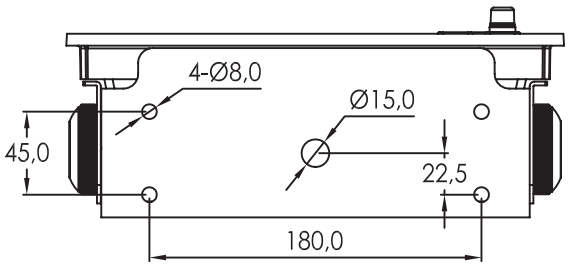
2.Make sure waterproof sealing component is applied to antenna screws

3.Make sure all cables are fixed securely

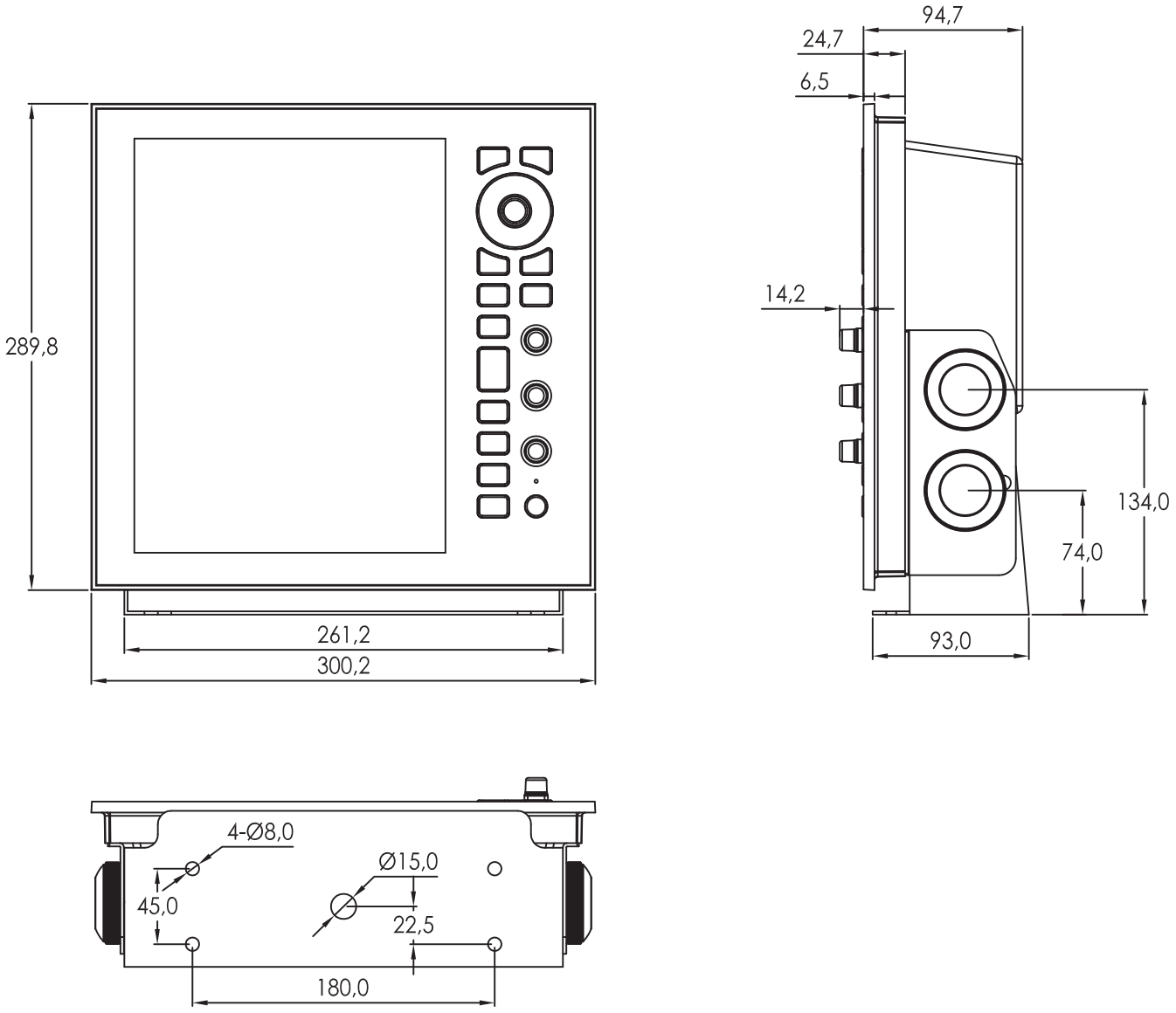
8. DISPLAY UNIT AND ANTENNA UNIT SIZE



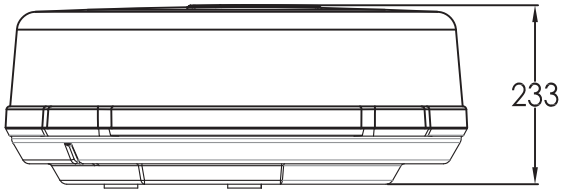


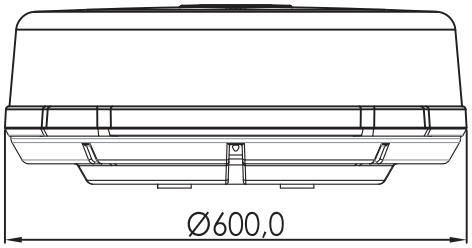


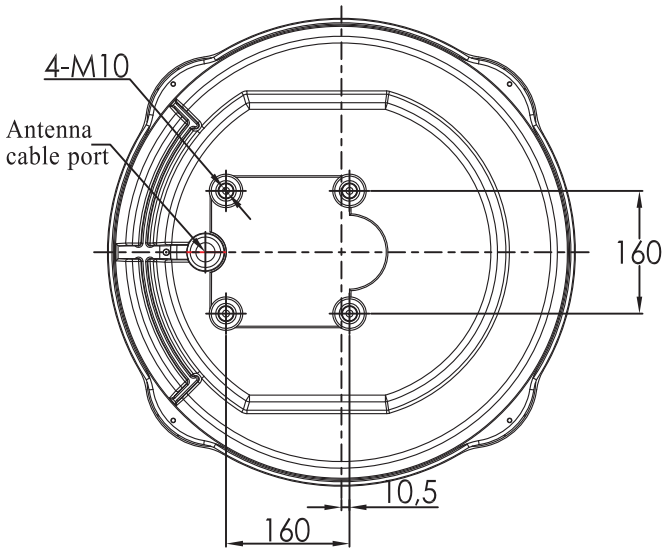
Model:	KNR-100
Name:	Display and Control Unit



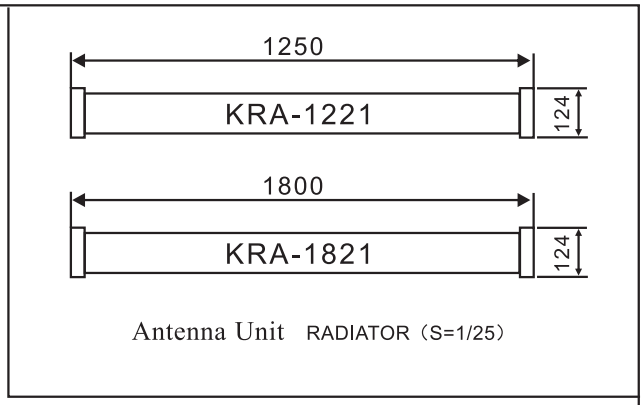
Model:	KNR-120
Name:	Display and Control Unit



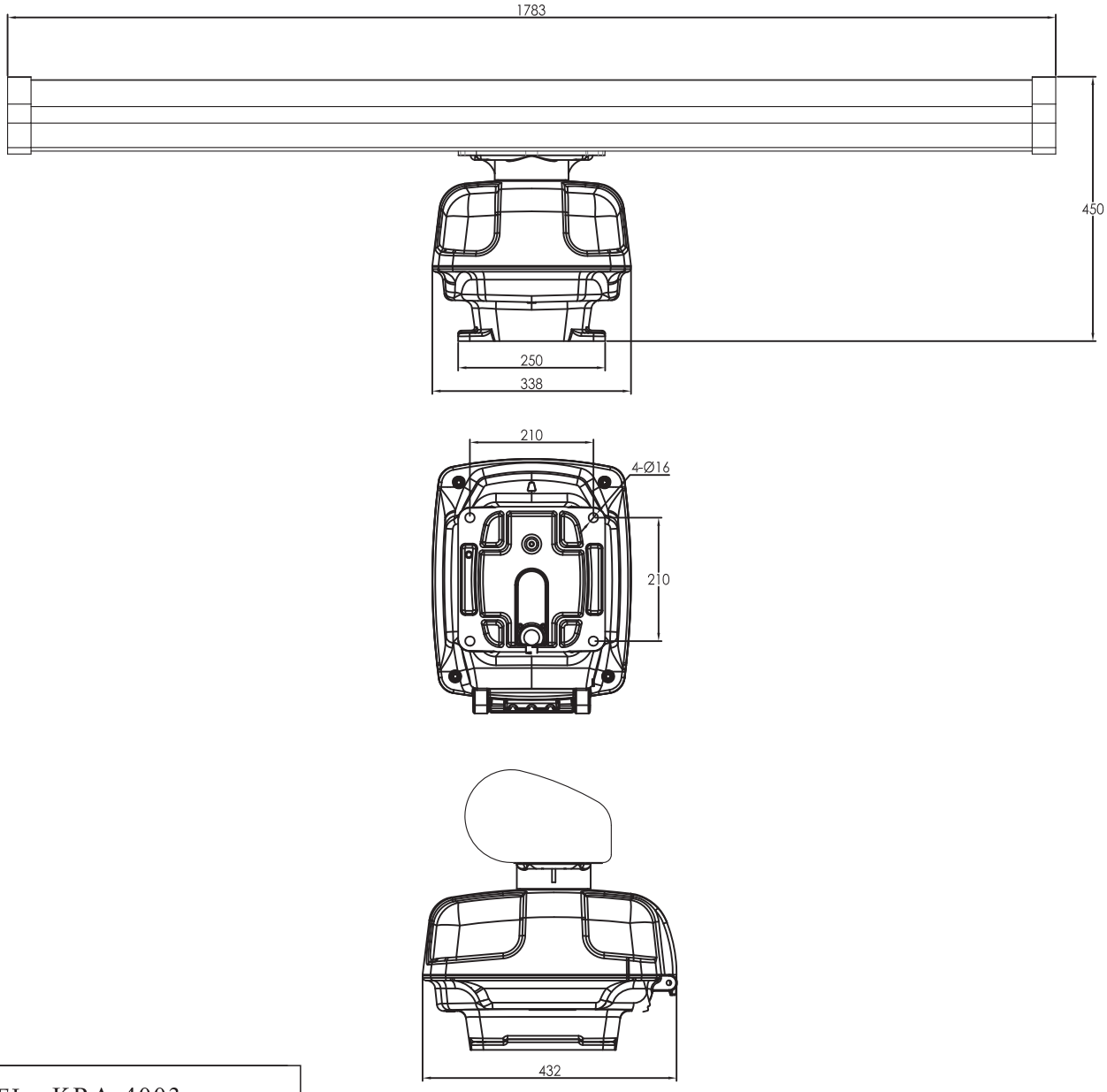




Model: KRA-1011
NAME: Antenna and Transceiver Unit



Antenna Unit RADIATOR（S=1/25）



MODEL：KRA-4003
NAME: Antenna and Transceiver Unit

9. ABBREVIATIONS

Word	Abbreviations	Word	Abbreviations
Acknowledge	ACK	Maximum	MAX
Acquire, Acquisition	ACQ	Medium Pulse	MP
Adjust, Adjustment	ADJ	Menu	MENU
Alarm	ALARM	Minimum	MIN
Anchor Watch	ANCH	Minute(s)	Min
Antenna	ANT	Nautical Mile(s)	NM
Anti Clutter Rain	RAIN	Navigation	NAV
Anti Clutter sea	SEA	Normal	NORM
Automatic	AUTO	Normal	NORMAL
Automatic Identification System	AIS	North	N
Bearing	BRG	North	NORTH
Bow Crossing Range	BCR	North Up	N UP
Bow Crossing Time	BCT	Off	OFF
Brilliance	BRILL	Offset	OFFSET
Clear	CLR	On	ON
Closest Point of Approach	CPA	Out/Output	OUT
Consistent Common Reference Point	CCRP	Own Ship	OS
Contrast	CONT	Panel Illumination	PANEL
Course	CRS	Parallel Index Line	PI
Course Up	CUP	Past Positions	PAST POSN
Course Over Ground	COG	Performance Monitor	PM
Course Through Water	CTW	Port/Portside	PORT
Cursor	CURS	Position	POSN
Delete	DEL	Power	PWR
Depth	DEPTH	Rain	RAIN
Depth	DPTH	Range Rings	RR
Differential GPS	DGPS	Rate Of Turn	ROT
Drift	DRIFT	Reference	REF
East	E	Relative	REL
Echo Reference	REF	Map(s)	MAP
Electronic Bearing Line	EBL	Maritime Mobile Service Identity number	MMSI
Enter	ENT	Relative Motion	RM
Enter	ENTER	Revolutions Per Minute	RPM

Word	Abbreviations	Word	Abbreviations
Error	ERR	Route	ROUTE
Error	ERROR	S-Band	S-BAND
Estimated Time of Arrival	ETA	Search And Rescue Transponder	SART
Fathom(s)	Fm	Second(s)	SEC
Feet/Foot	ft	Select	SEL
Full	FUL	Short Pulse	SP
Full	FULL	Speed	SPD
Gain	GAIN	Speed Over Ground	SOG
Global Positioning System	GPS	Speed Through Water	STW
Ground	GND	Stabilized	STAB
Guard Zone	GUARD	Standby	STBY
Gyro	GYRO	Starboard/Starboard Side	STBD
Head Up	H UP	Symbol(s)	SYM
Head Up	HEAD UP	Symbol(s)	SYMBOL
Heading	HDG	Target	TGT
Heading Line	HL	Target Tracking	TT
Indication	IND	Test	TEST
Interference Rejection	IR	Time	TIME
Interval	INT	Time to CPA	TCPA
Interval	INTERVAL	Time To Go	TTG
Kilometre	Km	Track	TRK
Knot(s)	Kn	Tracking	TRKG
Latitude	LAT	Trail(s)	TRAIL
Latitude/Longitude	L/L	Transmit	TX
Log	LOG	Trigger Pulse	TRIGGER
Long Pulse	LP	Tune	TUNE
Longitude	LON	True	T
Lost Target	LOST TGT	True Motion	TM
Magenta	MAG	Variable Range Marker	VRM
Man Overboard	MOB	Vector	VECT
Manual	MAN	Voyage Data Recorder	VDR
Manual	MANUAL	Warning	WARNING
Marker	MKR	Waypoint	WPT
Marker	MARK	X-Band	X-BAND
Master	MASTER		

10. GLOSSARY

ACA	(AIS) Regional Assignment Channel Assignment Message
ACK	Acknowledgement
ACS	(AIS) Channel management information source messages
AFSK	Audio frequency-shift keying
ALR	(AIS) Alarm Message
A to N	Aid to Navigation
AIS	Automatic Identification System
BIIT	Built In Integrity Test
BNC	Bayonet Neill-Concelman connector
COG	Course over Ground
CR	Carriage Return
CS	Carrier Sense
CSTDMA	Carrier Sense Time Division Multiple Access
DC	Direct Current
DGNSS	Differential Global Navigation Satellite System
DSC	Digital Selective Calling
GLONASS	Global Navigation Satellite System
GNSS	Global Navigation Satellite System
GMSK	Gaussian Minimum Shift Keying
GPS	Global Positioning Satellite / System
HF	High Frequency
IMO	International Maritime Organization
IEC	International Electrotechnical Commission
LED	Light Emitting Diode
LF	Line Feed
LNA	Low-noise Amplifier
MF	Medium Frequency
MKD	Minimum Keypad and Display

MMSI	Maritime Mobile Service ldentity
MPE	Maximum Permissible Exposure
NMEA	National Marine Electronics Association
PC	Personal Computer
PI	Presentation Interface
RF	Radio Frequency
RTCM	Radio Technical Commission for Maritime Services
RX	Receive or Receiver
RFI	Radio Frequency Interference
SAR	Specific Absorption Rate
SELV	Separated Extra Low Voltage
SMS	Short Message System
SOG	Speed over Ground
SRM	Safety Related Message
TDMA	Time-division Multiple Access
TNC	Threaded type RF connector
TX	Transmit or Transmitter
UTC	Coordinated Universal Time
VDM	(AIS) VHF Data Link Messages
VDO	(AIS) VHF Data link own vessel messages
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio

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