

OPERATOR'S MANUAL

RIVER RADAR

MODEL RHRS-2005RCTFT

SAIT-RADIO HOLLAND MARINE B.V.

Eekhoutstraat 2, 3087 AB Rotterdam - P.O. Box 5068, 3008 AB Rotterdam, Holland
Tel: +31 (0)10-4283344, Fax: +31 (0)10-4281498

All rights reserved. Printed in Japan

FIRST EDITION : AUG. 2001

(HIMA)

PUB. No. OME-34881
RHRS-2005RCTFT



SAFETY INSTRUCTIONS

WARNING

Radio Frequency Radiation Hazard

The radar antenna emits electromagnetic radio frequency (RF) energy which can be harmful, particularly to your eyes. Never look directly into the antenna aperture from a close distance while the radar is in operation or expose yourself to the transmitting antenna at a close distance.

Distances at which RF radiation levels of 100 and 10 W/m² exist are given in the table below.

Note: If the antenna unit is installed at a close distance in front of the wheel house, your administration may require halt of transmission within a certain sector of antenna revolution. This is possible. Ask your dealer to provide this feature.

Radiator type	Distance to 100 W/m ² point	Distance to 10 W/m ² point	RF power density on antenna aperture
XN-14A	Nill	0.9 m	78 W/m ²
XN-22AF		1.0 m	83 W/m ²
XN-20AR	0.1 m	1.4 m	118 W/m ²

 **WARNING**



ELECTRICAL SHOCK HAZARD
Do not open the equipment.

Only qualified personnel should work inside the equipment.



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 being struck by the rotating antenna and exposure to RF radiation hazard.



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.

Before turning on the radar, make sure that there is no one near the antenna unit.

Serious injury or even death may result if a rotating antenna strikes someone standing nearby.

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.

 **WARNING**

Use the proper fuse.

Fuse rating is shown on the equipment. Use of a wrong fuse can result in equipment damage.

Keep heater away from equipment.

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

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

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

Do not operate the equipment with wet hands.

Electrical shock can result.

 **CAUTION**

A warning label is attached to the display unit and processor unit.

Do not remove the label.

If the label is missing or illegible, contact place of purchase about replacement.



To avoid electrical shock, do not remove cover. No user-serviceable parts inside.

TABLE OF CONTENTS

FOREWORD	iv
SYSTEM CONFIGURATION	v
SPECIFICATIONS	SP-1
1. OPERATION	1-1
1.1 Turning on the Power	1-1
1.2 Transmitter ON	1-2
1.3 Control Head	1-3
1.4 Screen Brilliance	1-4
1.5 Icon-based Operation Overview.....	1-4
1.6 Tuning the Receiver	1-4
1.7 On-screen Legends and Markers.....	1-6
1.8 Selecting the Range Scale	1-7
1.9 Selecting the Pulselength	1-7
1.10 Adjusting the Sensitivity	1-7
1.11 Suppressing Sea Clutter	1-8
1.12 Suppressing Precipitation Clutter	1-8
1.13 FTC (Fast Time Constant).....	1-8
1.14 Interference Rejector	1-9
1.15 Echo Stretch	1-9
1.16 Noise Rejector	1-9
1.17 Echo Averaging	1-10
1.18 Contrast	1-10
1.19 Measuring the Range	1-10
1.20 Measuring the Bearing	1-11
1.21 Off-Centering	1-12
1.22 Menu Operation.....	1-12
1.23 Cursor Data Format.....	1-13
1.24 Target Trails.....	1-13
1.25 Markers.....	1-14
1.26 Background Color.....	1-15
1.27 Echo Color.....	1-15
1.28 Panel Dimmer.....	1-15
1.29 Adjusting Brilliance of Screen Data	1-15
1.30 Programming Sets of Brilliance and Echo	1-16
1.31 Turning On/Off Heading, Speed, Position, Depth, Time.....	1-17
1.32 ROT, Rudder, Autopilot Graphs	1-18
1.33 Nav Lines	1-21
1.34 Radar Map	1-22
1.35 Alarms, Error Messages	1-24
2. RADAR OBSERVATION	2-1
2.1 General	2-1
2.2 False Echoes	2-2
3. MAINTENANCE	3-1
3.1 Replacement of Fuse.....	3-1
3.2 Periodic Maintenance Schedule	3-2
3.3 Life Expectancy of Major Parts	3-2
4. TROUBLESHOOTING	4-1
4.1 Easy Troubleshooting	4-1
4.2 Advanced-level Troubleshooting	4-2
4.3 Diagnostic Test.....	4-4
5. PARTS LIST	5-1
5.1 Processor Unit RPU-012	5-1
5.2 Display Unit RDP-140.....	5-2
5.3 Control Unit RCU-013.....	5-4
5.4 RF Unit RTR-071	5-4
6. DIGITAL INTERFACE (IEC-61162-1)	6-1
MENU TREE	MN-1
INDEX	Index-1

FOREWORD

A Word to the Owner of the RHRS-20005RCTFT Radar

Thank you for purchasing the RHRS-20005RCTFT. It has been developed with the latest electronics and microcomputer technologies.

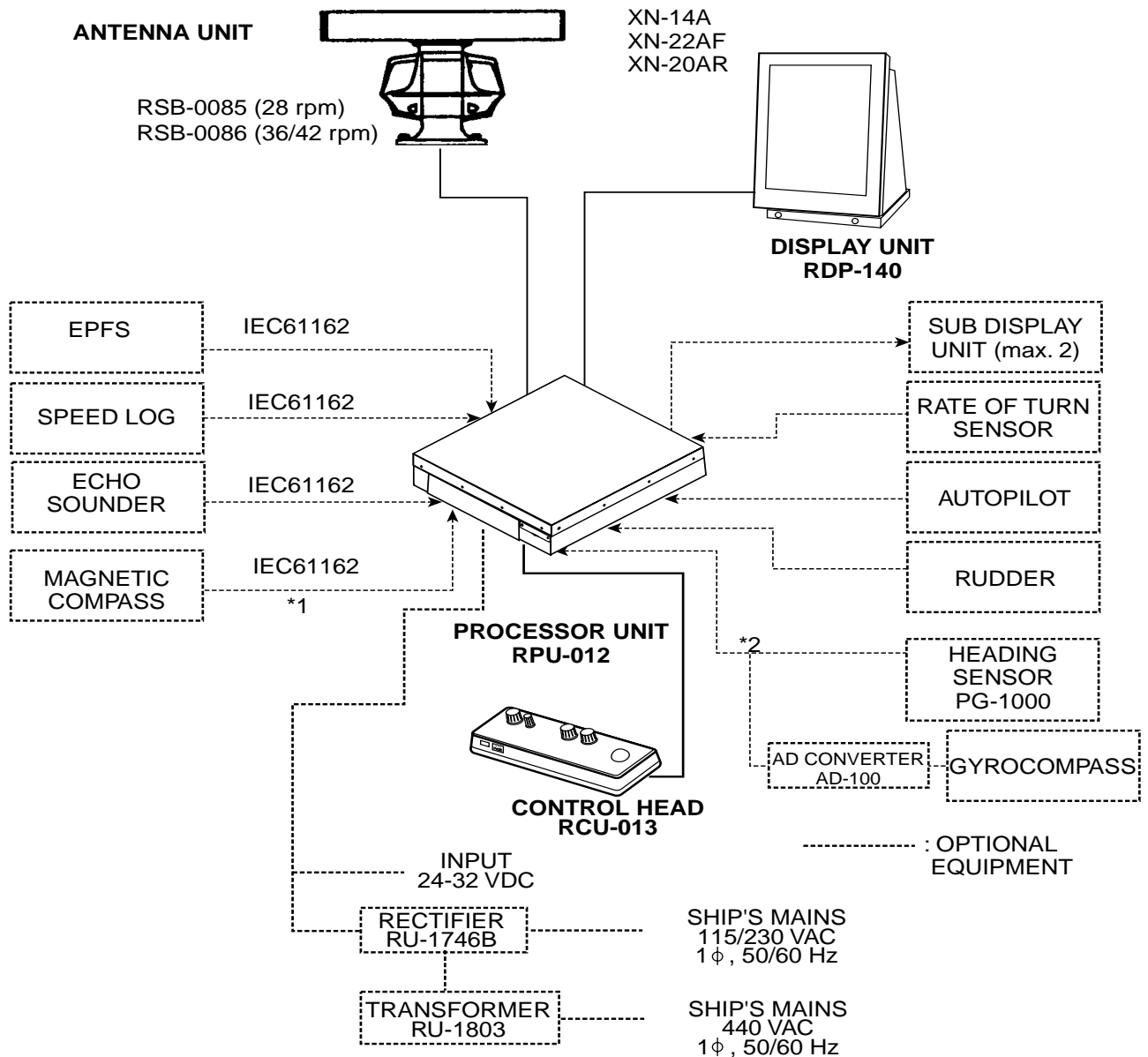
Utilizing the 18.1-inch high resolution LCD screen, the RHRS-2005RCTFT has been designed to meet the Rhine River Radar requirements.

Please carefully read the safety information and operating instructions set forth in this manual before attempting to operate the equipment and conduct any maintenance. Your radar set will perform to the utmost of its ability only if it is operated and maintained in accordance with the correct procedures.

Features

- Daylight-bright rasterscan 18.1-inch multi-color, high-resolution display.
- New microprocessing technology with high-speed high-density gate array and software expertise.
- Easy operation by combination of discrete keys, rotary controls, and menu operation, all logically arranged and configured.
- Unique “icon-based” operation provides for quick adjustment of brilliance and echo-related functions.
- Radar map function

SYSTEM CONFIGURATION



Compass input is available either *1 or *2.
When both are connected, the priority is *2>*1.

Unit	Category
Antenna unit	Exposed to the weather
Processor unit	Protected from the weather
Display unit	Protected from the weather
Control unit	Protected from the weather

Program Number

SPU: 0359163-01.08
(See page 4-4 to confirm this on the screen.)

This page is intentionally left blank.

1. OPERATION

The example screens shown in this manual may not match the screens you see on your display. The screen you see depends on your system configuration and equipment settings.

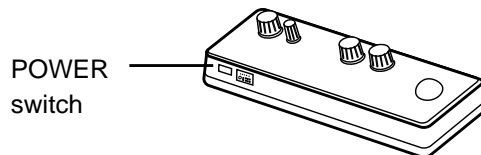
WARNING

Before turning on the radar, make sure that there is no one near the antenna unit.

Serious injury or even death may result if a rotating antenna strikes someone standing nearby.

1.1 Turning on the Power

The [POWER] switch is located on the control unit. Push it to switch on the radar system. Bearing scale and digital appears in approximately 15 seconds. The timer counts down one minute of warm-up time. During this period the magnetron, transmitter tube, is warmed for transmission. When the timer has reached 0:00, the indication ST-BY appears, indicating that the radar is ready to transmit pulses.



Control head

HOURS IN USE and TX HOURS values shown at middle of the screen are the time counts in hours and tenths of hours the radar has been powered and transmitted, respectively.

To turn off the radar, push it again.

NOTICE

The brilliance of the LCD is adjustable to match a wide variety of lighting conditions. However, its maximum setting may not be sufficiently bright to permit viewing of the display with polarized sunglasses.

1.2 Transmitter ON

When the indication ST-BY appears on the screen, press the [STBY/XMIT] switch on the control head.

The radar is initially set to previously used range and pulselength. Data brilliance and echo settings are as shown at the left bottom and right bottom on the display, respectively.

The STBY/XMIT switch toggles the radar between standby and transmit status. The antenna stops in standby status and rotates in transmit status.

Note 1: The magnetron ages with time resulting in a reduction of output power. It is highly recommended that the radar be set to standby status when not used for an extended period of time.

Note 2: If the antenna does not rotate in the transmit mode, suspect that the Service Switch on the antenna housing is set in the OFF position.

Quick Start

Provided that the radar was once in use with the transmitter tube (magnetron) still warm, you can turn the radar into Transmit condition without standby. If the [POWER] switch has been turned off by mistake or the like and you wish to restart the radar promptly, turn on the [POWER] switch not later than 10 seconds after power-off.

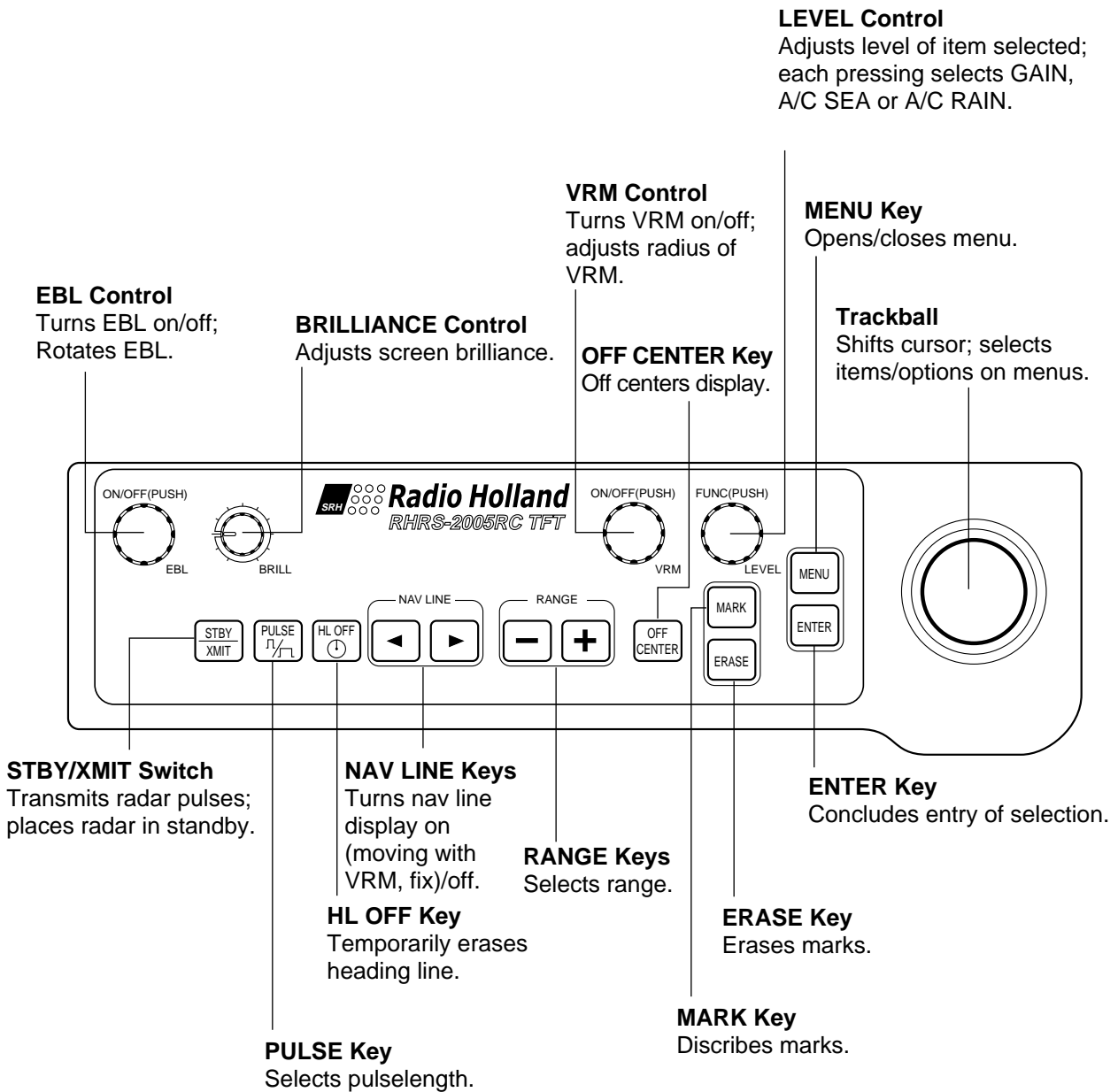


Freeze-up Recovery

Picture freeze-up and keyboard lock-up can occur unexpectedly on any digital rasterscan radars. This is mainly caused by heavy spike noise in the power line and can be noticed by carefully watching the nearly visible sweep line. If you suspect that the picture is not updated every scan of the antenna or no key entry is accepted notwithstanding the apparently normal pictures, do Quick Start below to restore normal operation.

1. Turn off the Power Switch and within 10 seconds turn it on again.
2. Press the STBY/XMIT switch STBY/XMIT for transmit condition.

1.3 Control Head



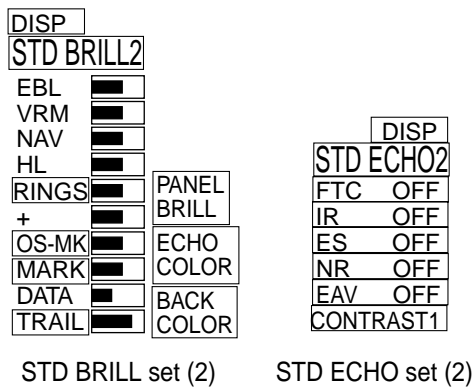
1.4 Screen Brilliance

The [BRILL] control adjusts the entire screen brightness. Note that the optimum point of adjustment varies with ambient light conditions, especially between daytime and nighttime

Note: The LCD brilliance should be adjusted before adjusting the brilliance of individual functions such as Gain and Modes.

1.5 Icon-based Operation Overview

A unique feature of this radar is its icon-based operation. Using the trackball you select on-screen item to adjust and set desired option with the [ENTER] key and [LEVEL] control. Icon-based items are circumscribed and they appear at the bottom left and bottom right corners of the screen, as below.



For example, to set the interference rejector do the following:

1. Use the trackball to select IR (Interference Rejector) at the bottom right corner of the screen. The cursor changes to an arrow outside of the display area. IR and its frame appear in a different color (color depends on color assignment) to indicate the selection.

2. Press the [ENTER] key to set option. Each pressing of the key changes the indication cyclically. For IR, the display shows IR1, IR2, IR3 or OFF with each pressing of the [ENTER] key.

1.6 Tuning the Receiver

1.6.1 Initializing tuning

Do the following to find the best tuning point:

1. Press the [MENU] key to open the menu. The menu appears at the bottom-left side of the display as below.

OTHERS >	
DATA >	MARK
GRAPH>	MAP
INITIALIZE	

2. Use the trackball to select INITIALIZE. The display changes as below.

OTHERS >	
DATA >	MARK
GRAPH>	MAP
INITIALIZE	
TUNE INITIALIZE	TEST

3. Use the trackball to select TUNE INITIALIZE and press the [ENTER] key. The menu is erased and tuning initialization starts; you can monitor the initialization by watching the tuning indicator at the bottom right corner.

AUTO TUNE 

1.6.2 Tuning method

Tuning method can be selected for automatic or manual with the icon-based item TUNE. The default method is “automatic.”

1. Use the trackball to select AUTO TUNE at the bottom-right hand corner of the screen.
2. Press the [ENTER] key to display AUTO TUNE or MANUAL TUNE as appropriate.

1.6.3 Automatic tuning

The radar receiver is tuned automatically each time the power is turned on. The tuning indicator and the label AUTO TUNE appear at the bottom right corner of the screen.

1.6.4 Manual tuning

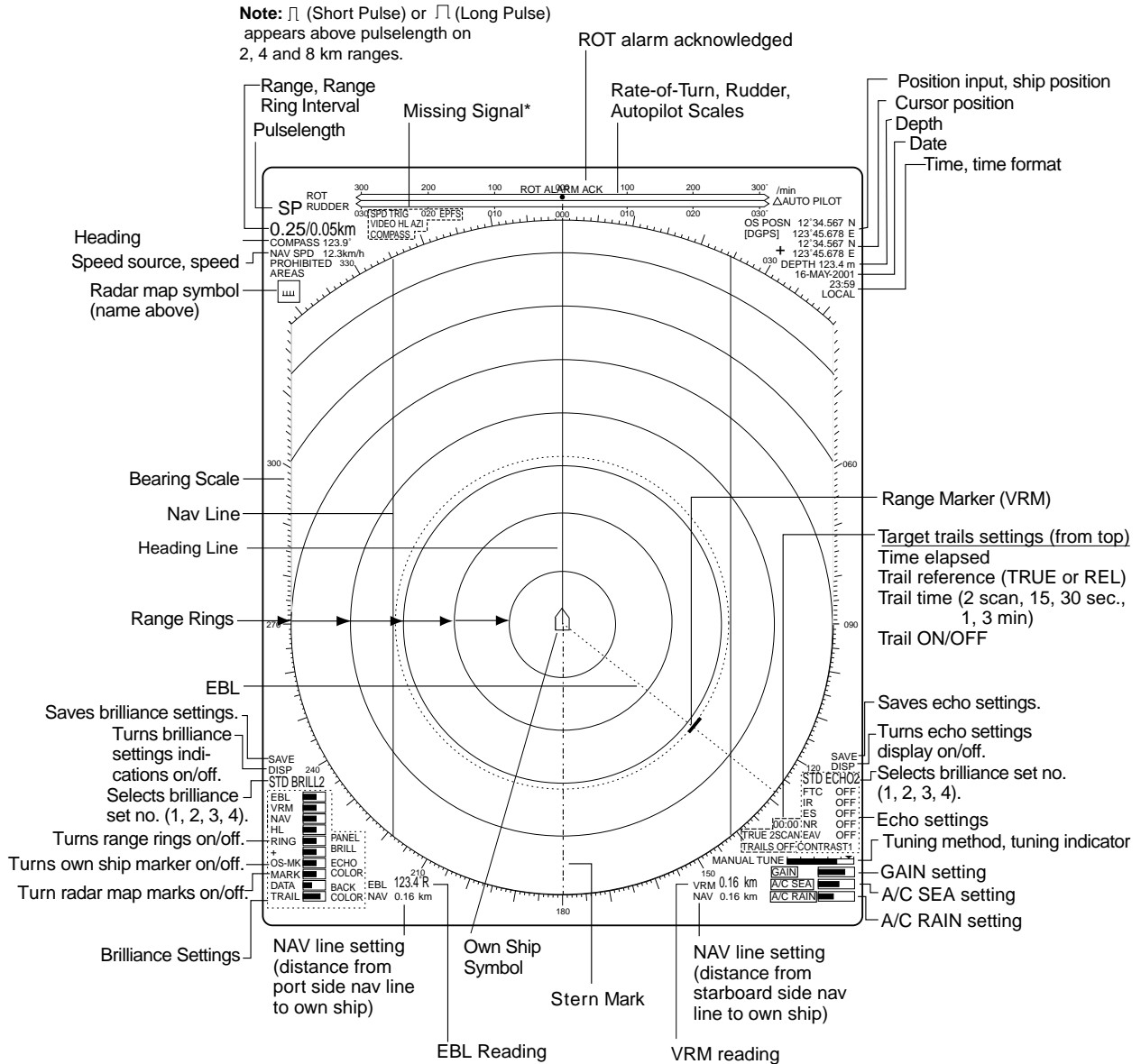
If you are not satisfied with the current tune setting, follow these steps to fine-tune the receiver:

1. Set the tuning method to manual as described in paragraph 1.6.2.
2. Use the trackball to place the arrow anywhere on the tuning indicator.
3. Slowly adjust the [LEVEL] control on the control head and find the best tuning point, monitoring the display.

MANUAL TUNE 

4. Make sure that the radar has been set to the best tuning point. This condition is where the tuning indicator lights to about 80% of its total length. Note that the tuning indicator will never extend to full length.

1.7 On-screen Legends and Markers



* - Indication appears in red and alarm sounds when corresponding signal is lost.

1.8 Selecting the Range Scale

The display range scale is changed by pressing the [+] and [-] keys. The selected range scale and range ring interval are shown at the upper left corner of the screen. When a target of interest comes closer, reduce the range scale so that it appears in 50-90% of the display radius. The range scales are;

0.25 - 0.5 - 0.8 - 1.2 - 1.6 – 2 – 4 – 8 – 16 – 32 – 64 (km)

1.9 Selecting the Pulselength

The pulselength may be selected for short, medium or long pulse on the ranges shown in table below. The pulselength in use appears at the top left-hand corner of the screen as SP (Short Pulse)/MP (Middle Pulse)/LP (Long Pulse) with the pulse symbol (\sqcap/\sqcup). To change the pulselength, press the [PULSE] key.

Range	Available pulselength
2 km	SP, MP
4 km	MP, LP
8 km	MP, LP

1.10 Adjusting the Sensitivity

The GAIN control (icon) is used to adjust the sensitivity of the receiver, and thus the intensity of echoes as they appear on the screen. It should be adjusted so that speckled background noise is just visible on the screen.

Higher gain increases the echo intensity but reduces the detections. Lower gain setting results in the loss of weak echoes and reduces detection range.

1. Press the [FUNC] switch several times to select the GAIN indicator at the bottom right of the screen. Each pressing of the [FUNC] switch selects GAIN, A/C SEA or A/C RAIN.

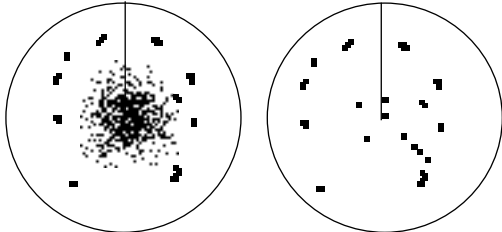
GAIN 

2. Use the [LEVEL] control to set the gain.

Note: The gain indicator may also be selected with the trackball.

1.11 Suppressing Sea Clutter

In rough weather conditions returns from the water surface are received over several kilometers around own ship and mask close targets. This situation can be improved by properly adjusting the A/C SEA (Anti-Clutter Sea) control.



A/C SEA control off A/C SEA control adjusted

A common mistake is to over adjust the A/C SEA control so that the surface clutter is completely removed. By using maximum A/C SEA, you will see how dangerous this can be; a dark zone shown above is created near the center of the screen and close-in targets can be lost. This dark zone is even more dangerous if the gain has not been properly adjusted. Always leave a little surface clutter visible on the screen. If no surface clutter is observed (on a very calm water), turn off the A/C SEA.

To adjust the A/C SEA;

1. Press the [FUNC] switch several times to select the A/C SEA indicator. (The A/C SEA indicator may also be selected with the trackball.)

A/C SEA

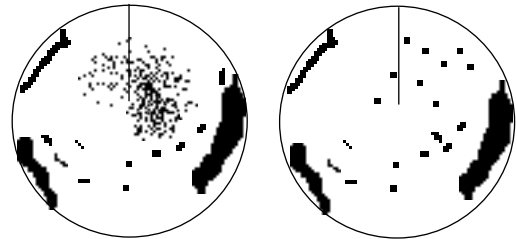
2. Use the [LEVEL] control to set level.

For optimum target detection, you should leave speckles of the surface return slightly visible.

The anti-clutter sea control is often referred to as STC (Sensitivity Time Control) which decreases the amplification of the receiver immediately after a radar pulse is transmitted, and progressively increases the sensitivity as the range increases. A/C SEA is effective up to about 4 km.

1.12 Suppressing Precipitation Clutter

In adverse weather conditions, clouds, rain or snow produce a lot of spray-like spurious echoes and impairs target detection on close range targets. This situation can be improved by adjusting the A/C RAIN (Ant-Clutter Rain) control.



A/C RAIN control
OFF

A/C RAIN control
adjusted

The A/C RAIN control adjusts the receiver sensitivity as the A/C SEA control does but rather in a longer time period (longer range).


To adjust the A/C RAIN;

1. Press the [FUNC] switch several times to select the A/C RAIN indicator. (The A/C RAIN indicator may also be selected with the trackball.)

A/C RAIN

2. Use the [LEVEL] control to set level.

1.13 FTC (Fast Time Constant)

 CAUTION
Switch off FTC if objective is to receive radar beacon.

If you fail to effectively suppress rain clutter with the A/C RAIN, use the FTC function. In adverse weather, clouds, rain or snow produce spray-like spurious echoes which impair target detection over a long distance. These echoes can be suppressed by turning on the FTC circuit. There are two FTC settings, FTC1 and FTC2, FTC2 provides increased rain clutter suppression effectively.

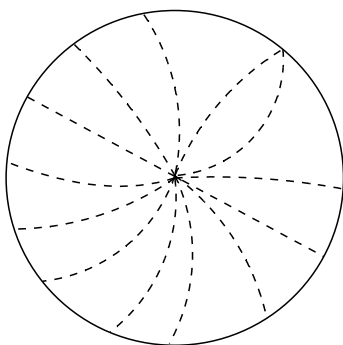
1. Use the trackball to select FTC at the bottom right of the screen.
2. Press the [ENTER] key to select the FTC setting 1, 2 or OFF as appropriate.

Note: FTC2 may only be enabled with medium or long pulselength. FTC1 is for short pulselength.

1.14 Interference Rejector

Mutual radar interference may occur in the vicinity of another shipborne radar operating in the same frequency band (9 GHz for X-band). It is seen on the screen as a number of bright spikes either in irregular patterns or in the form of usually curved spoke-like dotted lines extending from the center to the edge of the picture. This type of interference can be reduced by activating the interference rejector circuit.

The interference rejector is a kind of signal correlation circuit. It compares the received signals over successive transmissions and suppresses randomly occurring signals. There are three levels of interference rejection IR1, IR2 and IR3 depending on the number of correlations.



To activate the interference rejector;

1. Use the trackball to select IR at the bottom right of the screen.
2. Press the [ENTER] key to select level of interference rejection desired. Switch off the interference rejector when no interference exists; otherwise weak targets may be lost.

1.15 Echo Stretch

On short and medium ranges such as 2, 4 and 8 km scales, the same size targets get smaller on screen as they approach the own ship. This is due to the radiation pattern of the antenna. To enhance target video, use the echo stretch function.

ES1: Enlarges close-range echoes in bearing directions.

ES2: Like ES1 but further enlarges close-range echoes.

To activate the echo stretch do the following:

1. Use the trackball to select ES at the bottom right of the screen.
2. Press the [ENTER] key to display Echo Stretch option 1, 2 or OFF as desired.

1.16 Noise Rejector

The noise rejector suppresses white noise, which appears on the screen as many dots scattered randomly over the display.

1. Select NR at the bottom right of the screen.
2. Press the [ENTER] key to turn the noise rejector on or off as appropriate.

Note: Noise rejector is effective on ranges of 4 km and higher.

1.17 Echo Averaging

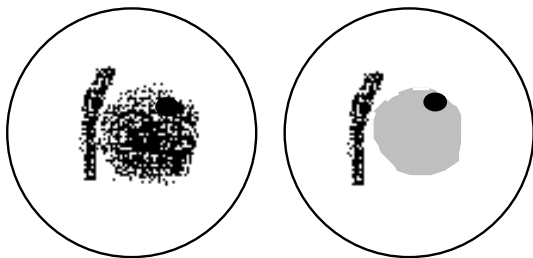
Note: This function requires a compass signal and selecting of LOG or NAV on DATA on the HEADING, SPEED menu.

The echo average feature effectively suppresses sea clutter. Echoes received from stable targets such as ships appear on the screen at almost the same position every rotation of the antenna. On the other hand, unstable echoes such as sea clutter or false echoes appear at random positions.

To distinguish real target echoes from sea clutter, this radar performs scan-to-scan correlation. Correlation is made by storing and averaging echo signals over successive picture frames. If an echo is solid and stable, it is presented in its normal intensity. Sea clutter is averaged over successive scans resulting in the reduced brilliance, making it easier to discriminate real targets from sea clutter (false echoes).

To properly use the echo average function, it is recommended to first suppress sea clutter with the A/C SEA control and then do the following:

1. Use the trackball to select EAV at the bottom right-hand corner of the screen.
2. Press the [ENTER] key until echo average option 1, 2, 3 or OFF as desired is highlighted. The larger the figure the greater the suppression of unstable echoes. Note however that echoes moving at high speed may be lost in the highest setting.



(a) Echo average OFF (b) Echo average ON

Echo averaging uses scan-to-scan signal correlation technique based on the true motion over the ground of each target. Thus, small stationary targets such as buoys will be shown while suppressing random echoes such as sea clutter. Echo average is not effective for picking up small targets running at high speeds.



CAUTION

Do not use the Echo Average feature under heavy pitching and rolling; loss of true targets can result.

1.18 Contrast

Contrast is adjustable in three levels according to the radar video sampling level. Select the level so the picture shows up most clearly from the background.

1. Select CONTRAST at the bottom right of the screen.
2. Press the [ENTER] key to select contrast level desired; 1, 2 or 3.

1.19 Measuring the Range

1.19.1 Measuring range by the range rings

Use the fixed range rings to obtain a rough estimate of the range to a target. They are the concentric circles about own ship, or the sweep origin. The number of rings is automatically determined by the selected range scale and their interval is displayed at the upper-left position on the screen.

To turn the range rings on/off;

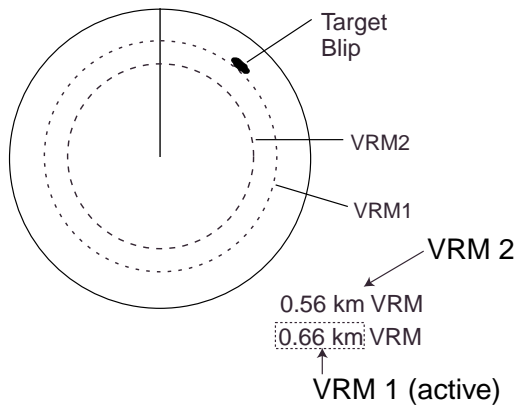
1. Select RINGS at the bottom left of the screen.
2. Press the [ENTER] key to turn the rings on or off as appropriate.

1.19.2 Measuring range by the variable range marker

Use the Variable Range Marker (VRM) for more accurate measurement of the range to a target. Two VRM are available, one is short dashed ring and the other is long dashed. You can control one at a time.

1. Press the [VRM] control to turn the VRM on.
2. Turning the [VRM] control, align the active variable range marker with the inner edge of the target of interest and read its distance at the bottom right of the screen.

Note: This radar can display two VRMs by turning on 2EBL•VRM on the MARK menu. In this case successive presses of the VRM control toggles the active VRM between No. 1 and No. 2 and activated VRM readout is identified by >.....<. The two VRMs can be distinguished from each other by different lengths of dashes. To erase both VRMs, press and hold down the [VRM] control.



1.20 Measuring the Bearing

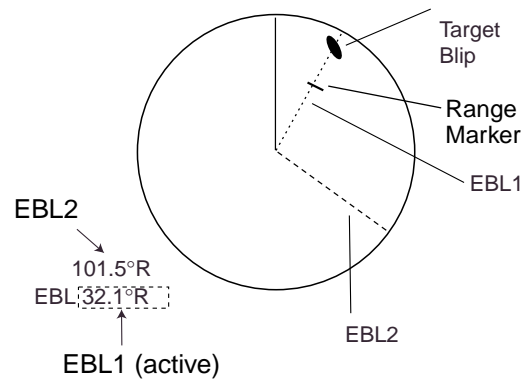
Use the Electronic Bearing Lines (EBL) to determine the bearing of a target.

1. Press the [EBL] control to display either of the EBLs.
2. Rotate the [EBL] control clockwise or counterclockwise until the active EBL bisects the target of interest, and read its bearing at the bottom left of the screen.

The EBL readout is affixed by "R" (relative) if it is relative to own ship's heading, "T" (true) if it is referenced to the north, as determined by the setting on the MARK menu.

The EBL carries a range marker, or a short line crossing the EBL at right angles and its distance from the EBL origin is indicated at the VRM readout whether or not the VRM is displayed. The range marker changes position on the EBL with rotation of the [VRM] control.

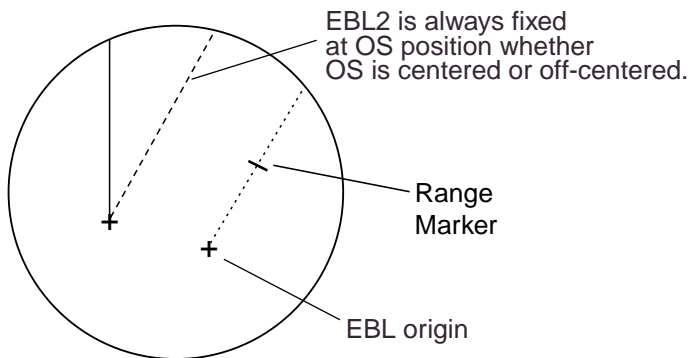
Note: This radar can display two EBLs by turning on 2EBL•VRM on the MARK menu. In this case successive presses of the [EBL] control toggles the active EBL between No. 1 and No. 2 and the currently active EBL. EBLs can be distinguished from each other by different lengths of dashes. To erase both EBLs, press and hold down the [EBL] control.



1.20.1 Offsetting the origin of the EBL1

The origin of the EBL1 can be placed anywhere with the trackball to enable measurement of range and bearing between any targets. This function is also useful for assessment of the potential risk of collision.

1. Press the [EBL] control to display the EBL1.
2. Use the trackball to place the cursor where desired.
3. Press the [EBL] control while holding the [HL OFF] key down, and the origin of the EBL1 shifts to the cursor position.
4. See the range and bearing indications for range and bearing to the target.



To cancel the offset EBL, press the [EBL] control while pressing and holding down the [HL OFF] key.

1.21 Off-Centering

Own ship position, or sweep origin, can be displaced to expand the view field without switching to a larger range scale. The sweep origin is off-centered 33% in the stern direction (fixed), on any range.

The number of range rings increases keeping the original range intervals unchanged.

To off-center the radar picture do the following:

1. Press the [OFF CENTER] key.
2. To cancel off-centering, press the [OFF CENTER] key again.

1.22 Menu Operation

Less-often used functions are contained in the menu. This section shows you how to select items and options from the menu.

1. Press the [MENU] key to open the menu. The menu appears at the bottom left-hand corner of the display as below. ">" indicates a menu has sub menus.

OTHERS >	
DATA >	MARK
GRAPH>	MAP
INITIALIZE	

2. Use the trackball to select a menu. For example, select MARK. Selected menu's options appear.

OTHERS >		
DATA >	MARK	
GRAPH>	MAP	
INITIALIZE		
CURSOR&EBL REF MODE	2EBL-VRM	STERN MARK
TRUE /REL	OFF ON	OFF /ON


Menu items (current settings are highlighted)

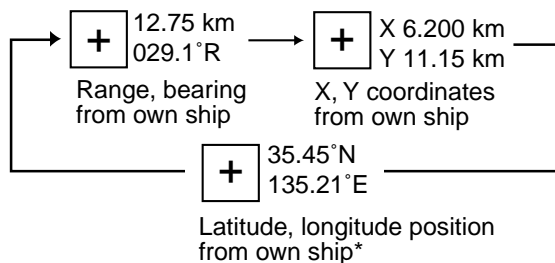
3. Use the trackball to select menu item.
4. Press the [ENTER] key to select option desired. Current selection is highlighted.
5. Press the [MENU] key to close the menu.

Note: A selected menu will close automatically after 30 seconds.

1.23 Cursor Data Format

Cursor position can be displayed in range and bearing from own ship, X and Y coordinates from own ship and position in latitude and longitude from own ship.

1. Use the trackball to place the arrow inside the  mark at the upper right of the screen.
2. Press the [ENTER] key to select cursor data format. Each pressing of the key changes the cursor data format in the sequence shown below. Position data and compass data are required to display latitude and longitude position.



*L/L data and compass data are required.
(If no compass data, L/L position display is skipped.)

1.24 Target Trails

It is possible to display the trails of targets in the form of synthetic afterglow. This is useful for monitoring targets' movements.

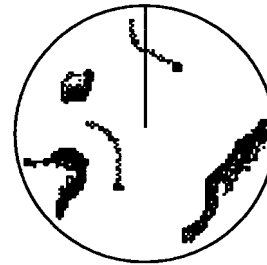
Note: Whenever turning the radar on, the echo trail settings are as follows;

- Presentation: Relative
- Trail time: 2 SCAN
- Trail OFF

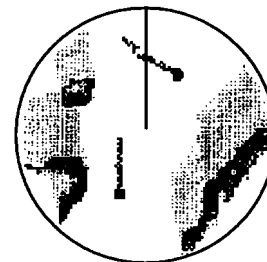
1.24.1 True or relative trails

You may display target trails in true or relative motion. Relative trails are shown relative to own ship; stationary targets will also have trails as OS moves. True motion trails require a compass signal, and speed. The spec may be LOG or NAV on the HEADING, SPEED menu. True motion trails present target ship movements in accordance with their

over-the-ground speeds and courses.



(a) True target trails - no smearing of stationary targets



(b) Relative target trails - all targets moving relative to own ship

1. Use the trackball to select TRUE (or REL, whichever is displayed) at the bottom right of the screen.
2. Press the [ENTER] key to select TRUE or REL as appropriate.

1.24.2 Starting and erasing target trails

1. Use the trackball to select TRAILS OFF at the right of the screen.
2. Press the [ENTER] key to display TRAILS ON.
3. Use the trackball to select the trail time icon 2 SCAN, 15 SEC, 30 SEC, 1 MIN or 3 MIN option.
4. Press the [ENTER] key to select desired trail time.

1.24.3 Selecting trail colors

Operate the trackball to place the arrow on TRAIL at the bottom left and press the [ENTER] key to change the trail colors. Each pressing the [ENTER] key changes the color sequence as shown below.

Echo color	Trail color	
	Background color is black	Background color is blue
Yellow	Blue ↔ yellow	Green ↔ yellow
Green	Yellow ↔ green	White ↔ green
White	Blue ↔ white	Blue ↔ white

1.25 Markers

1.25.1 Heading line

The heading line indicates the ship's heading. It is a line from the own ship position to the outer edge of the radar display area and appears at zero degrees on the bearing scale.

Temporarily erasing heading line

If a target is mashed by the heading line, press and hold the [HL OFF] key to erase the line. The stern mark and own ship marker are also erased. The heading line reappears when the key is released.

1.25.2 Stern mark

The stern mark (a dot-and-dash line) appears opposite to the heading line. This mark can be turned on/off with STERN MK on the OTHERS menu.

1.25.3 Own ship marker

When the appropriate data is input, the own ship marker, which requires input of own ship data, is shown on the screen as (△) by selecting OS-MK indicator at bottom left. The symbol is scaled to indicate the length and width of the vessel. If the largest dimension of the symbol gets smaller than 3 mm, the symbol will disappear. The own ship marker's dimensions are set during installation. For details, contact your dealer.

If the own ship marker is turned on, it can be erased from the screen as follows:

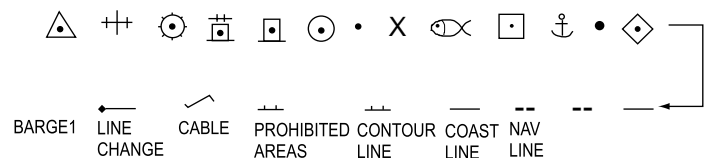
1. Select OS-MK at the bottom.
2. Press the [ENTER] key to turn the mark off.
3. To turn it on again, repeat this procedure.

Note: You can temporarily erase this marker by pressing the [HL OFF] key.

1.25.4 Barge symbol

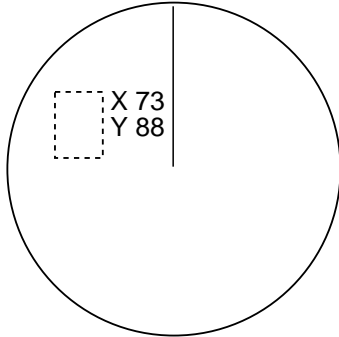
You can define the shapes of barges (max. 10) which are transported by own ship as below:

1. Operate the trackball to place the arrow on the OS-MK at the bottom left of the screen.
2. Press the [ENTER] key to turn on the own ship mark, and the OS-MK level indicator appears.
3. Operate the trackball to place the arrow on MARK at the bottom left of the screen. A (circumscribed) radar map symbol appears at the top left corner.
4. Use the trackball to select the radar map symbol at the top left corner.



Note: The triangle mark appears with the [LEVEL] control in the fully counterclockwise position.

5. Turn the [LEVEL] control clockwise to select a desired barge number.
6. Draw the barge shape as below:
 - a) Using the trackball, select a barge and press the [MARK] key. The X·Y coordinates appear.



- b) Drag the arrow to bottom right corner of barge and press the [MARK] key.
7. Repeat steps 5 to 7 to enter other barges.
8. Selecting the barge by turning [LEVEL] control as in step 5 and press the [ENTER] to retain the barge symbols.

1.26 Background Color

You may select the color for the background, display area and alphanumeric as follows:

1. Use the trackball to select BACK COLOR at the bottom left.
2. Press the [ENTER] key to select a desired color group. Each pressing of the [ENTER] key selects the color group as below:

Item	1	2	3	4	5
Back-ground	BLK	BLK	BLK	BLU	L-BLU
Display Area	BLK	BLK	BLU	BLU	L-BLU
Char. Markers	GRN	RED	GRN	WHT	WHT

1.27 Echo Color

Echoes may be displayed in yellow, green or white as follows:

1. Select ECHO COLOR at the bottom left of the display.
2. Press the [ENTER] key.

1.28 Panel Dimmer

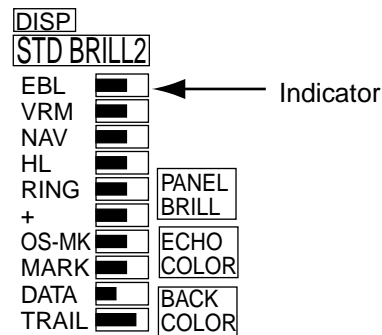
To adjust illumination of the control head, do as follows:

1. Select PANEL BRILL at the bottom left of the display.
2. Press the [ENTER] key several times until a required intensity is reached within four levels.

1.29 Adjusting Brilliance of Screen Data

You can adjust the brilliance of marks and text on the screen. Items which can be adjusted are displayed at the bottom left as below:

1. Using the trackball, place the arrow on the indicator of the item you want to adjust.



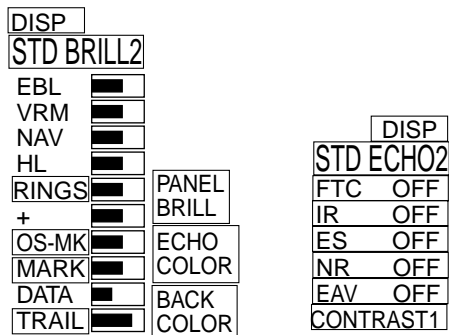
2. Adjust the [LEVEL] control to set brilliance.

Note: To save the brilliance adjustment, see section 1.31.

1.30 Programming Sets of Brilliance and Echo

Suppose you have been navigating along a bank for hours and now you are approaching a harbor, your final destination. You will have to adjust your radar to change from the settings for bank navigation to those for harbor approach. Every time your navigating environment or task changes, you must adjust the radar, which can be a nuisance in a busy situation. Instead of changing radar settings case by case, it is possible to preset optimum settings for often encountered situations.

1. Select STD BRILL or STD ECHO at the left and right corners of the screen, respectively.



STD BRILL set (2)

STD ECHO set (2)

2. Press the [ENTER] key to display STD BRILL(STD ECHO) 2, 3 or 4, whichever set you want to adjust.

Note: STD BRILL1 and STD ECHO1 can be adjusted but their settings are restored once the power is turned off. Whenever the power is turned on the radar starts up with STD BRILL1 and STD ECHO1 settings.

3. Select and adjust an item and adjust brilliance levels with the [LEVEL] control; select echo settings with the [ENTER] key. Note that brilliance items OS-MK, MARK (radar map) and RINGS color can be turned on or off, TRAIL can be selected as desired by placing the arrow on the option name.
4. The indication SAVE appears above DISP. Select SAVE and press the [ENTER] key.
5. Repeat steps 1 and 4 to set other items.

If you do not need STD BRILL or STD ECHO settings you may delete one or both by selecting DISP and pressing the [ENTER] key. Repeat the procedure in above to redisplay.

1.31 Turning On/Off Heading, Speed, Position, Depth, Time

The DATA menu allows you to turn heading, speed, position, depth, date and time on or off. Appropriate sensors are required to display data.

1. Press the [MENU] key to display the menu.
2. Select DATA> with trackball.
3. Select appropriate sub-menu with trackball.
4. Press the [ENTER] key to set option.
5. Press the [MENU] key to close the menu.

Note: The figure in the adjacent column shows all data of sub menus and their options.

1.31.1 Speed input

Speed is input through a speed log or EPFS (GPS or Loran C). "SPD" appears in red at the upper left to warn speed data is absent for 90. Be sure to select SPEED DATA OFF on the HEADING, SPEED menu when neither speed log nor EPFS is connected. Otherwise, the speed reading will be "***" and an error message appears (in red).

1.31.2 Using local time

With GPS input UTC time is displayed (provided it is turned on in the DATE, TIME menu). If you prefer the local time to UTC, do the following:

1. Select the DATE TIME menu following the procedure above in this column.
2. Select LOCAL TIME ADJ.
3. Adjust the [LEVEL] control to display the time difference between local time and UTC. The setting range is -13:30 to +13:30.
4. Select LOCAL TIME ADJ.

OTHERS		
DATA >	HEADING SPEED	
GRAPH>	OS POSN DEPTH	
INITIALIZE	DATE TIME	
HEADING DATA OFF /ON	SPEED DATA OFF/km/h/ kt	SPEED MODE NAV/LOG

HEADING SPEED sub menu

OTHERS		
DATA >	HEADING SPEED	
GRAPH>	OS POSN DEPTH	
INITIALIZE	DATE TIME	
OWN SHIP POSN DATA OFF /ON	DEPTH DATA OFF/m/ft/ FA	

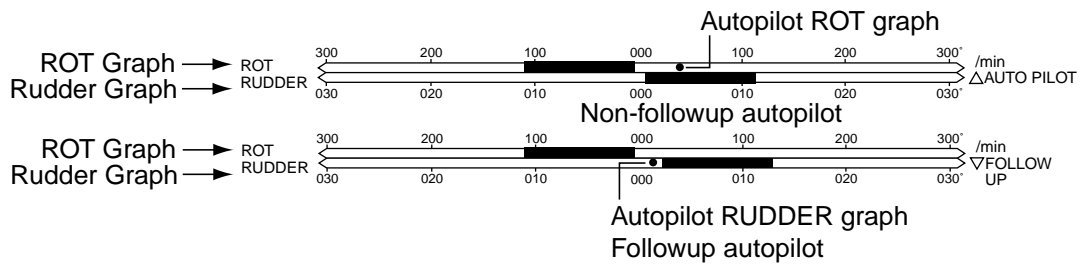
OS POSN sub menu

OTHERS		
DATA >	HEADING SPEED	
GRAPH>	OS POSN DEPTH	
INITIALIZE	DATE TIME	
DATE TIME OFF/UTC/ LOCAL	LOCAL TIME ADJ +00:00	

DATE TIME sub menu

1.32 ROT, Rudder, Autopilot Graphs

The ROT (Rate of Turn), RUDDER and AUTOPILOT graphs appear at the top of the display, and they may be turned on or off and adjusted on the GRAPH menu.



1.32.1 Graph Description

ROT graph

The ROT graph displays ship's rate of turn (degrees/min), with a ROT signal from a ROT sensor. If the rate-of-turn indicator fails, the indication ROT ALARM appears at the top of the screen and the radar beeps intermittently.

To acknowledge loss of ROT signal do the following:

1. Use the trackball to select the indication ROT ALARM.
2. Press the [ENTER] key to silence the alarm. The indication ROT ALARM ACK replaces ROT ALARM.

Rudder graph

The rudder graph shows the rudders angle as sensed by the rudder angle indication.

Autopilot graph

The autopilot graph shows ROT command set on the autopilot when a ROT signal is available from the autopilot. The actual ROT command set on the autopilot is represented by a small circle on the ROT scale.

When the autopilot is in the follow-up mode the follow-up rudder command is indicated on the RUDDER scale. Further, ▽FOLLOW UP replaces the indication ΔAUTOPILOT at the top of the screen.

1.32.2 Turning on/off graph

1. Press the [MENU] to open the menu.
2. Select GRAPH> and press the [ENTER] key.
3. Select ROT, RUDDER or AUTOPILOT and press the [ENTER] key. The figure below shows all GRAPH sub menus and their options.

OTHERS		
DATA >	ROT	
GRAPH>	RUDDER	
INITIALIZE	AUTO PILOT	
ROT GRAPH OFF /ON	ROT OFFSET ADJ	ROT GAIN ADJ

ROT menu

OTHERS		
DATA >	ROT	
GRAPH>	RUDDER	
INITIALIZE	AUTO PILOT	
RUDDER GRAPH OFF /ON	RUDDER OFFSET ADJ	RUDDER GAIN ADJ

RUDDER menu

OTHERS		
DATA >	ROT	
GRAPH>	RUDDER	
INITIALIZE	AUTO PILOT	
AUTO PILOT GRAPH OFF /ON	AUTO PILOT OFFSET ADJ	AUTO PILOT GAIN ADJ

AUTOPILOT menu

4. Use the trackball to select ROT GRAPH, RUDDER GRAPH or AUTOPILOT GRAPH depending on which sub menu you selected at step 3.
5. Press the [ENTER] key to select ON or OFF as appropriate.
6. Press the [MENU] key to close the menu.

1.32.3 Changing the graph scale

Select the ROT or RUDDER label at the side of the graphs and press the [ENTER] key. Each pressing of the [ENTER] key changes the selected graph scale.

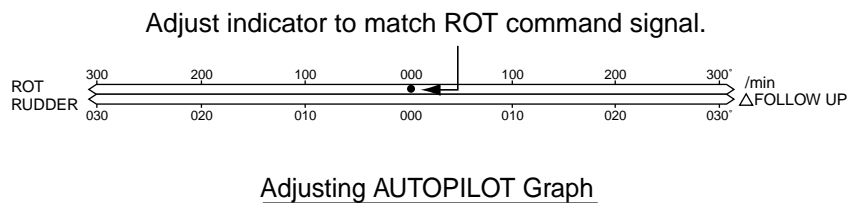
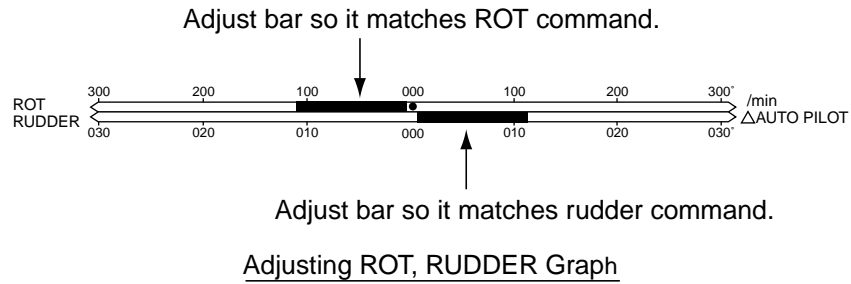
1.32.4 Adjusting the graphs

ROT graph, Rudder graph

1. Press the [MENU] key to open the menu.
2. Select GRAPH from the menu.
3. Select ROT or RUDDER from the menu as appropriate.
4. Set external ROT device to zero. (Set rudder to 0°.)
5. Select ROT OFFSET ADJ (or RUDDER OFFSET ADJ) from the menu.
6. Press the [ENTER] key.
7. Set external ROT device to “test position”.
8. Select ROT GAIN ADJ (or RUDDER GAIN ADJ) from the menu.
9. Adjust the [LEVEL] control so the same ROT (of RUDDER) indication as shown on the external ROT indicator (external RUDDER indicator) is shown on the radar.
10. Press the [ENTER] key.

Autopilot graph

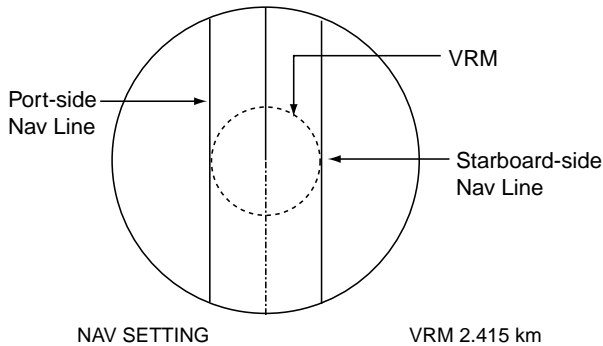
1. Set external autopilot to "Follow-up."
2. Press the [MENU] key to open the menu.
3. Select GRAPH from the menu.
4. Select AUTOPILOT from the menu.
5. Set autopilot to 0°.
6. Select AUTOPILOT OFFSET ADJ from the menu.
7. Press the [ENTER] key.
8. Set autopilot to max PS or SB.
9. Select AUTOPILOT GAIN ADJ from the menu.
10. Adjust the [LEVEL] control so that the autopilot indicator (small dot) on the radar display shows the same heading indication as the external autopilot.



1.33 Nav Lines

You can display nav lines as follows:

1. Press [NAV LINE◀] key or [NAV LINE▶] key to display a nav line on the port side or starboard side, respectively.



Nav lines are set on both sides of own ship by using the VRM control. The distance to port or starboard is individually determined.

1. Press the [VRM] control to turn on the VRM.
2. Press [NAV LINE◀] key or [NAV LINE▶] key to display a nav line on the port side or starboard side, respectively. Make sure that NAV SETTING appears below the VRM range.
3. Adjust the [VRM] control to place the nav line(s) where desired. Watch the VRM indication to know the distance between own ship and the nav line(s).
4. Press the [NAV LINE] key as pressed at step 2 again to fix the nav line and detach it from the VRM. The indication NAV and the distance from own ship to the nav line replace the indication NAV SETTING.

To turn off a nav line, press its corresponding NAV LINE key.

The nav lines are stored in the memory until you change them, even when the radar is switched off.

1.34 Radar Map

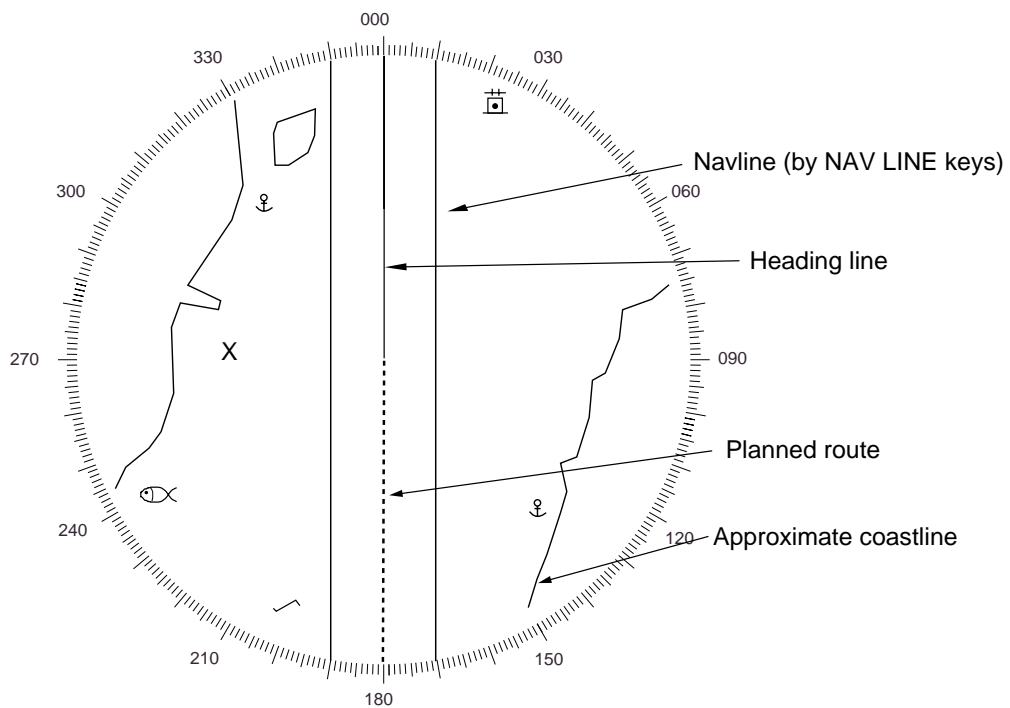
1.34.1 Radar map description

A radar map is a combination of map lines and symbols whereby the user can define and input the navigation, route planning and monitoring data on the radar equipment. Map lines are a navigational facility whereby the observer can define lines to indicate channels or traffic separation schemes.

In this radar a radar map may contain 1500 points of mark and line data on map.

The user can create a radar map on real-time base while using the radar for navigation or at leisure time at anchor. The map data is stored on the EEROM memory which is mounted on the main processor board.

Note: Radar map function requires an input from heading device and positioning equipment.

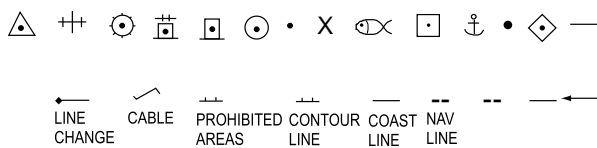


1.34.2 Turning the radar map on/off

1. Use the trackball to select MARK at the bottom left of the display.
2. Press the [ENTER] key to turn the map on or off as appropriate.

1.34.3 Entering marks, lines

1. Use the trackball to place the arrow inside the square with symbol at the upper left-hand corner of the screen.
2. Use the [LEVEL] control to select mark to enter. Rotating the control clockwise selects marks in the following order.



Note: The triangle mark appears with the [LEVEL] control in the fully CCW position.

3. Use the trackball to select the location for the mark with the cursor.
4. Press the [MARK] key to inscribe the mark.

To erase a mark, use the trackball to place the cursor on it and press the [ERASE] key.

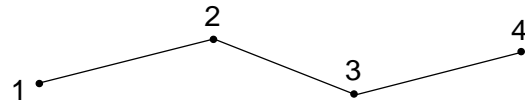
Example: How to draw a coastline

1. Select the mark "Coast Line" following steps 1 and 2 above.
2. Place the cursor on a required position and press the [MARK] key.
3. Place the cursor at a next position and press the [MARK] key. One line appears connecting designated two points.
4. Repeat step 3 to establish the coastline.

The map is stored on the main processor board.

To enter more than one line, after entering one line, select LINE CHANGE and press the [MARK] key. Then, repeat the procedure for entering marks and lines above.

To erase a line segment entered, place the cursor to a point and then press the [ERASE] key. For example, if point 4 is to be erased in the illustration below, line segment 3-4 is erased. If point 3 is erased, line segments 2-3 and 3-4 are erased and new line segment 2-4 is generated.



1.34.4 Aligning the radar map

There may be some instances where the map is not overlaid on the radar picture correctly. You can align the map as follows:

1. Press the [MENU] key to open the menu.

OTHERS >	
DATA >	MARK
GRAPH>	MAP
INITIALIZE	

2. Use the trackball to select OTHERS and press the [ENTER] key to open the OTHERS menu.
3. Use the trackball to select MAP.

OTHERS	
DATA >	MARK
GRAPH>	MAP
INITIALIZE	
MAP ALIGN	
OFF/SET/ON	

4. Use the trackball to select MAP ALIGN.
5. Press the [ENTER] key to select SET.
6. Use the trackball to correct the position.
7. Press the [ENTER] key to select MAP ALIGN ON.

1.35 Alarms, Error Messages

The table below summarizes the various audio and visual alarms and error messages which may appear on the display.

Warning	Audible alarm	Visual alarm	Remedy
Compass failure*	Two beeps	COMPASS label reads “*. *” COMPASS in red.	Check compass.
Own ship lat/lon* Cursor lat/lon*	Two beeps	“*o** . **” in own ship position and cursor latitude and longitude position. EPSF appears in red.	Make sure that own ship position data is fed from external EPFS.
Log failure*	Two beeps	** . * and SPD appear in red if speed log is connected. If no log signal is input for 30 sec.	Check log connection.
ROT signal	Continuous beeps	ROT ALARM appears at the top of the screen when the ROT error signal is received.	Acknowledge the ROT alarm as follows: 1. Use the trackball to select the indication ROT ALARM. The indication ROT ALARM ACK replaces ROT ALARM. 2. Press the [ENTER] key to silence the alarm.
Trigger signal	Two beeps	TRIG appears in red at the screen top when the trigger signal is lost.	Check SPU Board.
Heading signal	Two beeps	HL appears in red at the screen top when the heading line signal is lost.	Check the cable connector between the display unit and the antenna unit.
Azimuth (bearing) signal	Two beeps	AZI appears in red at the screen top when the azimuth signal is lost.	Check the cable connector between the display unit and the antenna unit.
Video signal	Two beeps	VIDEO appears in red at the screen top when the video signal is lost.	Check the cable connector between the display unit and the antenna unit.
Incorrect keystroke	Two beeps	None	Correct keystroke is responded by a single beep provided that KEY BEEP ON is selected during installation.

*: Error message appears in red when the NAV ON is selected on the HEADING, SPEED menu.

2. RADAR OBSERVATION

2.1 General

2.1.1 Minimum range

The minimum range is defined by the shortest distance at which, using a scale of 1.2 km, a target having an echoing area of 10 m² is still shown separate from the point representing the antenna position.

It is mainly dependent on the pulselength, antenna height, and signal processing such as main bang suppression and digital quantization. It is a good practice to use a shorter range scale as far as it gives favorable definition or clarity of picture.

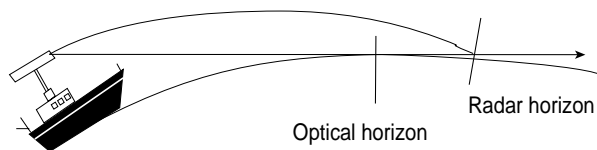
2.1.2 Maximum range

The maximum detecting range of the radar, R_{max}, varies considerably depending on several factors such as the height of the antenna above the waterline, the height of the target above the water, the size, shape and material of the target, and the atmospheric conditions.

Under normal atmospheric conditions, the maximum range is equal to the radar horizon or a little shorter. The radar horizon is longer than the optical one by about 6% because of the diffraction property of the radar signal. The R_{max} is given in the following equation.

$$R_{\max} = 2.2 \times (\sqrt{h_1}) + (\sqrt{h_2})$$

Where R_{max}: radar horizon (nautical miles)
h₁: antenna height (m)
h₂: target height (m)



It should be noted that the detection range is reduced by precipitation (which absorbs the radar signal).

2.1.3 Radar resolution

There are two important factors in radar resolution (discrimination): bearing resolution and range resolution.

2.1.4 Bearing resolution

Bearing resolution is the ability of the radar to display as separate pips the echoes received from two targets which are at the same range and close together. It is proportional to the antenna length and reciprocally proportional to the wavelength.

2.1.5 Range resolution

Range resolution is the ability to display as separate pips the echoes received from two targets which are on the same bearing and close to each other. Major contributor to determine this is a pulselength. Test targets for determining the range and bearing resolution are radar reflectors having an echoing area of 10 m².

2.1.6 Range measurement

Measurement of the range to a target is a very important function of the radar. Generally, there are two means of measuring range: the fixed range rings and the variable range marker (VRM). The fixed range rings appear on the screen with a predetermined interval and provide a rough estimate of the range to a target. The variable range marker's diameter is increased or decreased so that the marker touches the inner edge of the target, allowing the operator to obtain more accurate range measurements.

2.1.7 Bearing accuracy

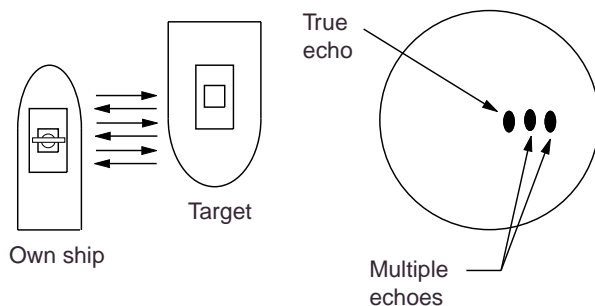
One of the most important features of the radar is how accurately the bearing of a target can be measured. The accuracy of bearing measurement basically depends on the narrowness of the radar beam. However, the bearing is usually taken relative to the ship's heading, and thus, proper adjustment of the heading line at installation is an important factor in ensuring bearing accuracy. To minimize error when measuring the bearing of a target, put the target echo at the extreme position on the screen by selecting a suitable range.

2.2 False Echoes

Occasionally echoes appear on the screen at positions where there is no target or disappear even if there are targets. They are, however, recognized if you understand the reason why they are displayed. Typical false echoes are shown below.

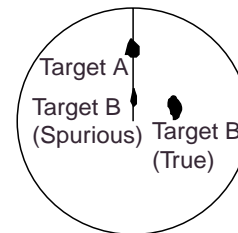
2.2.1 Multiple echoes

Multiple echoes occur when a transmitted pulse returns from a solid object like a large ship, bridge, or breakwater. A second, a third or more echoes may be observed on the display at double, triple or other multiples of the actual range of the target as shown below. Multiple reflection echoes can be reduced and often removed by decreasing the gain (sensitivity) or properly adjusting the A/C SEA control.



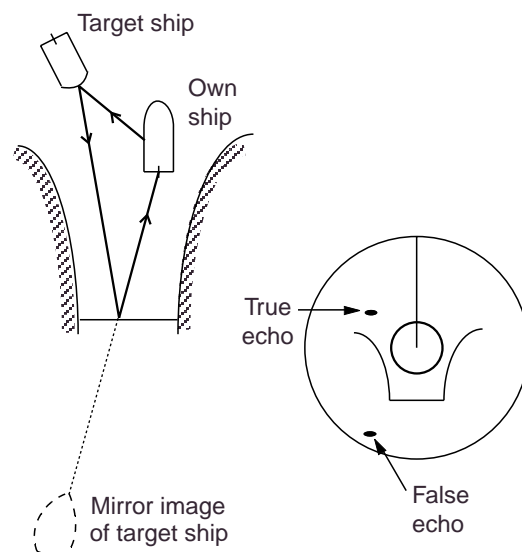
2.2.2 Sidelobe echoes

Every time the radar pulse is transmitted, some radiation escapes on each side of the major axis. This is called "sidelobe." If a target exists where it can be detected by the sidelobes as well as the main lobe, the sidelobe echoes may be represented on both sides of the true echo at the same range. Sidelobes show usually only on short ranges and from strong targets. They can be reduced through careful reduction of the gain or proper adjustment of the A/C SEA control.



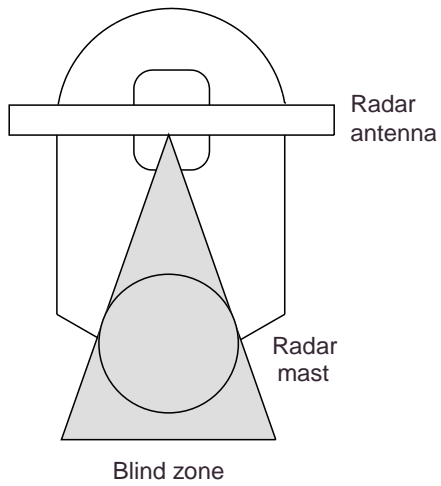
2.2.3 Virtual image

A relatively large target close to your ship may be represented at two positions on the screen. One of them is the true echo directly reflected by the target and the other is a false echo which is caused by the mirror effect of a large object on or close to your ship as shown in the figure below. If your ship comes close to a large metal bridge, for example, such a false echo may temporarily be seen on the screen.







2.2.4 Shadow sectors

Funnels, stacks, masts, or derricks in the path of the antenna block the radar beam. If the angle subtended at the scanner is more than a few degrees, a non-detecting sector may be produced. Within this sector targets cannot be detected.




This page is intentionally left blank.

3. MAINTENANCE

 WARNING	
	<p>Do not open the equipment.</p> <p>Hazardous voltage which can cause electrical shock exists inside the equipment. Only qualified personnel should work inside the equipment.</p>
	<p>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.</p> <p>Prevent the potential risk of being struck by the rotating antenna and exposure to RF radiation hazard.</p>
	<p>Wear a safety belt and hard hat when working on the antenna unit.</p> <p>Serious injury or death can result if someone falls from the radar antenna mast.</p>

3.1 Replacement of Fuse

The TX fuse on the rear panel of the display unit protects the equipment from overcurrent. If the fuse blows find the cause before replacing it. Use only a specified fuse; use of a wrong fuse may not protect the equipment and void the warranty.

 CAUTION
<p>Use the proper fuse.</p> <p>Use of a wrong fuse can cause fire or equipment damage.</p>

3.2 Periodic Maintenance Schedule





Periodic checks and maintenance are important for proper operation of any electronic systems. This chapter contains maintenance instructions to be followed by the technician to obtain optimum performance and the longest possible life of the equipment.

Interval	Check point	Check and measures	Remarks
Daily	LCD screen	The LCD screen will, in time, accumulate a coating of dust which tends to dim the picture. Wipe LCD lightly with soft cloth to remove dust.	Do not use chemical cleaners to clean any part of the display unit; they can remove paint and markings.
3 to 6 months	Exposed nuts and bolts on antenna unit	Check for corroded or loosened nuts and bolts. If necessary, clean and repaint them thickly. Replace them if heavily corroded.	Sealing compound may be used instead of paint. Apply a small amount of grease between nuts and bolts for easy removal in future.
	Antenna radiator	Check for dirt and cracks on radiator surface. Thick dirt should be wiped off with soft cloth dampened with fresh water. If a crack is found, apply a slight amount of sealing compound or adhesive as a temporary remedy, then call for repair.	Do not use plastic solvent (acetone) for cleaning. If you need to remove ice from antenna unit, use a wooden hammer or plastic head hammer. Crack on the unit may cause water ingress, causing serious damages to internal circuits.
	Terminal strips and plugs in antenna unit	Open antenna cover to check terminal strip and plug connections inside. Also check the rubber gasket of antenna covers for deterioration.	When closing antenna covers in position, be careful not to catch loose wires between covers and unit.
6 months to one year	Terminal strips, sockets, earth terminal	Check for loose connections. Check contacts and plugs for proper seating, etc.	

3.3 Life Expectancy of Major Parts

Parts	Type	Life expectancy	Remarks
Carbon Brush	MG120-5X6X11 D8G	10,000 hours	
Magnetron	MG-5248, X-band, 4 kW	2,000 - 3,000 hours	

4. TROUBLESHOOTING

 WARNING	
	<p>Do not open the equipment.</p> <p>Hazardous voltage which can cause electrical shock exists inside the equipment. Only qualified personnel should work inside the equipment.</p>
	<p>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.</p> <p>Prevent the potential risk of being struck by the rotating antenna and exposure to RF radiation hazard.</p>
	<p>Wear a safety belt and hard hat when working on the antenna unit.</p> <p>Serious injury or death can result if someone falls from the radar antenna mast.</p>

4.1 Easy Troubleshooting

This paragraph describes how to cure operational problems, which can be made by observing the radar picture and using operator controls and keys without opening the display unit or antenna unit.

Problem	Remedy
Cannot turn on the power.	Check fuse.
Power is on but nothing appears on the screen.	Adjust the BRILL control.
Key beep inaudible.	Key beep (on or off) is set during installation. (default setting: OFF) Consult your dealer.
Own ship marker not shown.	OFF is selected on OWN SHIP POSN DATA menu.

4.2 Advanced-level Troubleshooting

This paragraph describes how to cure hardware and software troubles which should be carried out by qualified service personnel.

Note: This radar equipment contains complex modules in which fault diagnosis and repair down to component level are not practicable by users. .

4.2.1 Serviceman qualification

All adjustments of radio transmitter during or coinciding with the installation, servicing, or maintenance which may affect the proper operation must be performed by or under the immediate supervision and responsibility of a person holding an operator certificate containing a ship radar endorsement.

As such, every administration sets forth its own rule; service personnel must be aware of this kind of competency requirements.

4.2.2 Service call

When making a service call to your service agent, check S/N and symptom beforehand following the table on the next page.

Advanced troubleshooting

Problem	Probable causes or check points	Remedy
Power turned on but radar does not operate at all. Control panel is not illuminated.	1) Blown fuse F1351. 2) Mains voltage/polarity 3) Power supply board 4) Cable connection error	1) Replace blown fuse. 2) Correct wiring and input voltage. 3) Replace power supply board. 4) Check the connection.
LCD brilliance adjusted but no picture.	1) Brilliance settings 2) SPU board	1) Check setting of BRILL control. 2) Replace SPU board.
Antenna not rotating.	Antenna drive mechanism	Check connection of the SPU Board, service switch on the antenna unit or service menu setting.
Adjust GAIN control with A/C SEA control set at minimum. Marks and legends appear but no noise or echo.	1) IF amplifier 2) Signal cable between antenna and display 3) SPU board	1) Replace IF amplifier. 2) Check continuously and isolation of coaxial cable. Note: Disconnect the plug and lugs at both ends of coaxial cable before checking it by ohmmeter. 3) Check video coax line for secure connection. If connection is good, replace SPU board.
Marks, legends and noise appear but no echo. (Transmission leak representing own ship position is absent.)	1) HV board 2) Magnetron 3) Modulator board 4) SPU board	1) Check the connection of HV Board. 2) Check magnetron current with the check meter on the test display. If current is out of $2.5\text{ V} \pm 0.2\text{ V}$ (in long pulse), replace magnetron. 3) Replace modulator board. 4) Replace SPU board.
TUNE control adjusted but poor sensitivity.	1) Deteriorated magnetron 2) Dirt on radiator face 3) Water ingress to the waveguide or other feeder line.	1) With radar transmitting on 64 km range, check magnetron current. If current is below normal, magnetron may be defective. Call service engineer. 2) Clean the radiator surface. 3) Remove water from the feeder line. 4) Initializes the tune at menu.
Range changed but radar picture not changing.	1) Defective range key 2) SPU board 3) Keyboard freeze-up	1) Try to hit [+] and [-] range keys several times. If unsuccessful, replacement of keypad may be required. 2) Replace SPU board. 3) Turn off and on radar.
Range rings are not displayed.	1) Adjust the ON/OFF of range rings at left side of display with RINGS. 2) SPU board	1) Call service engineer. 2) Replace SPU board.
Picture not updated or picture freeze-up.	1) Bearing signal generator board (in antenna unit) 2) SPU board 3) Video freeze-up	1) Check the connection of signal cables. 2) Replace SPU board. 3) Turn off and on the radar.

4.3 Diagnostic Test

A diagnostic test program is provided to enable testing of major circuit boards in the radar display unit. Note that the normal radar picture is lost during this test.

Proceed as follows to execute the diagnostic test:

1. Press the [MENU] key to open the menu. The menu appears at the bottom-left corner of the screen as below.

OTHERS >	
DATA >	MARK
GRAPH>	MAP
INITIALIZE	

2. Use the trackball to select INITIALIZE. The display now looks as below.

OTHERS >	
DATA >	MARK
GRAPH>	MAP
INITIALIZE	
TUNE INITIALIZE	TEST

3. Use the trackball to select TEST and press the [ENTER] key to start the test.
 - a) Program number appears. The diagnostic test is executed and the screen shows test results as shown below. OKs appear for normal operation. If NG (No good) appears, consult your dealer.
 - b) Small squares and circles displayed at the bottom of the test result screen are for testing the keys and controls on the control head. As you operate these keys and controls, corresponding squares are highlighted (key operated) and digits increment upward or downward (control operated), indicating that your key/control operations are properly recognized.
 - c) The inputted serial data is read out at the bottom of the display. Each pressing the [HL OFF] key changes the sentence. ALL shows all serial data inputted.

RHRS2005RC TEST

PROGRAM NO ROM RAM EEROM
 MAIN 0359163-01.** OK OK OK

ANTENNA SPEED 28 RPM
 TRIG FREQ. 1000 Hz
 MAG CURRENT 2.5 V
 TUNE IND. 1.5 V

○	○	○	○
000	000	000	000
□	□	□	□
□	□	□	□

To quit press [STBY/XMIT] key twice
 ALL CH1.....
 CH2.....
 GA.....

** Program Version No.

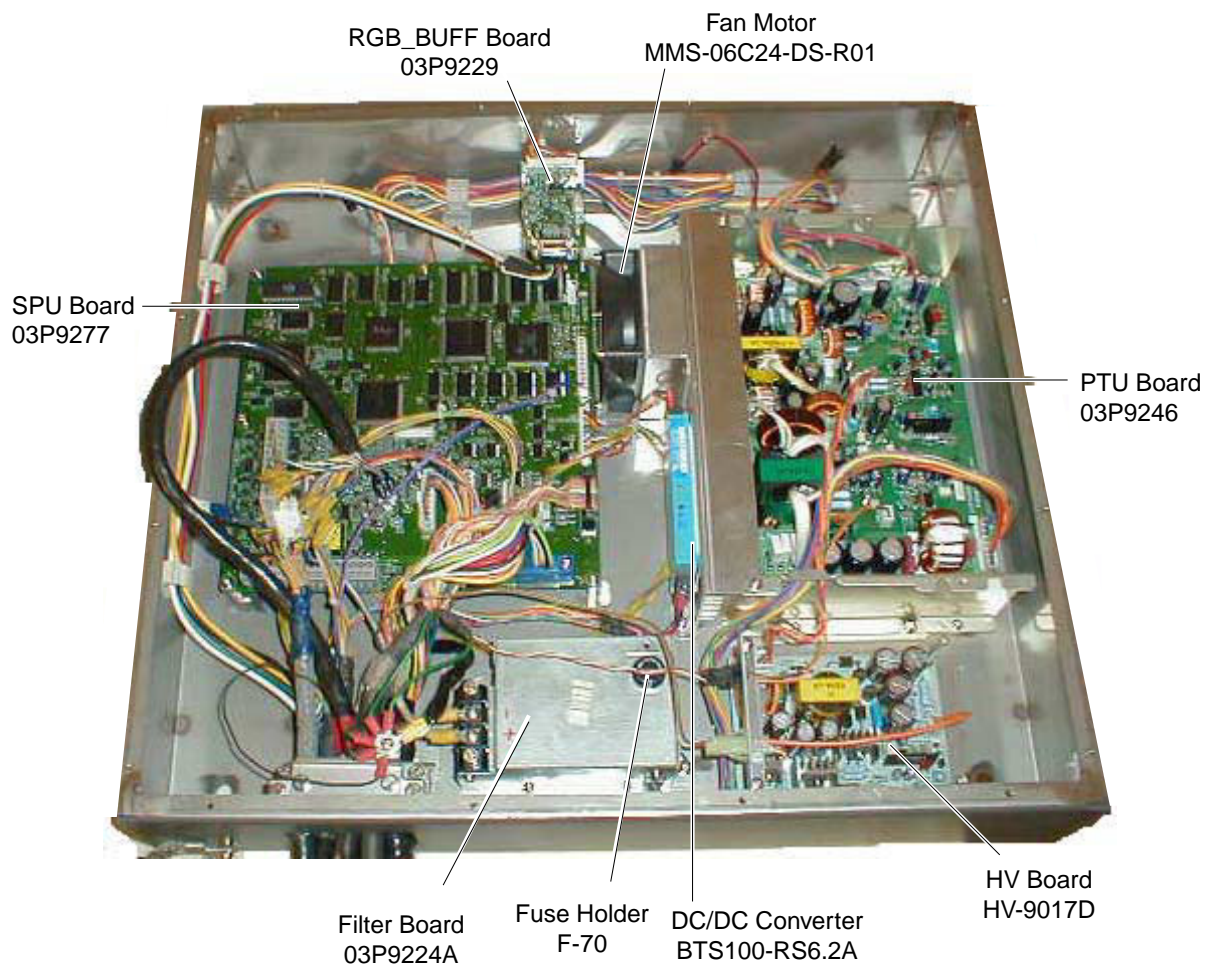
4. To show a test pattern press the [STBY/XMIT] key.
5. To quit the self test, press the [STBY/XMIT] key again.

5. PARTS LIST

This equipment contains one complex module in which fault diagnosis and repair down to component level is practicable; therefore, parts list is omitted in this manual (IMO A.694(17)/8.3.1). Only discrete components that may be checked or replaced by the ship personnel are power jack and a fuse (20 A).

5.1 Processor Unit RPU-012

SYMBOL	TYPE	CODE NO.	REMARKS
PTU Board	03P9246C	008-493-700	
HV Board	HV-9017D	008-481-660	
SPU Board	03P9277	008-506-040	
Fan Motor	MMS-06C24-DS-R01	000-128-409	
Fuse	FGBO 20A AC125V	005-490-015	
Fuse Holder	F-70	000-123-436	
Filter Board	03P9224A	008-492-440	
RGB_BUFF Board	03P9229	006-551-050	



Processor unit, cover removed

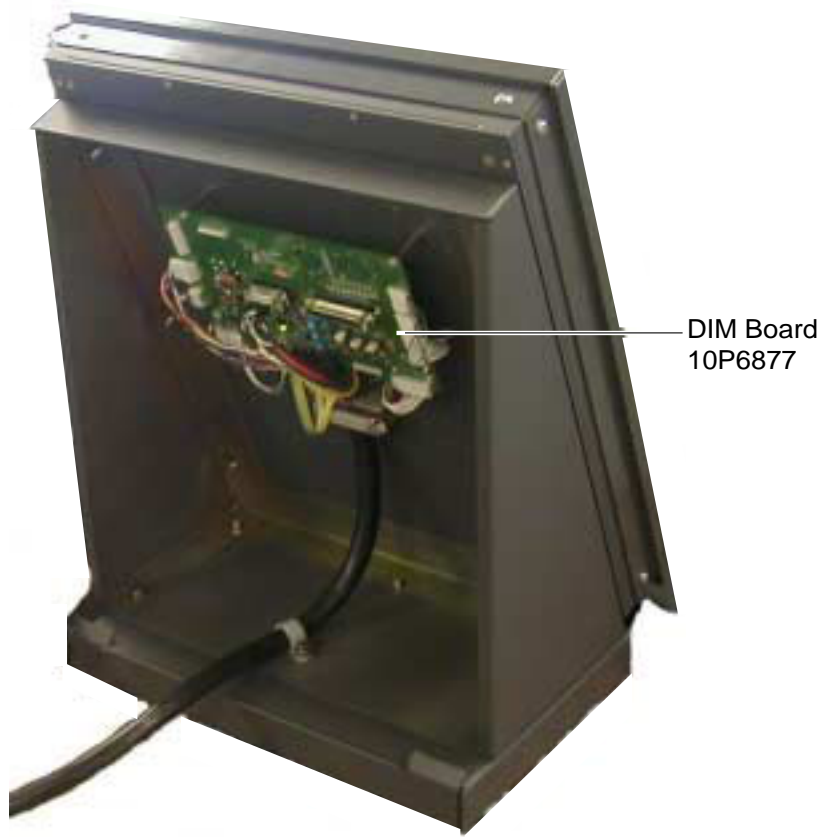
5.2 Display Unit RDP-140

SYMBOL	TYPE	CODE NO.	REMARKS
TFT Color LCD Module	NL128102AC-01F		
DIM Board	10P6877		

TFT Color LCD Module
NL128102AC28-01F



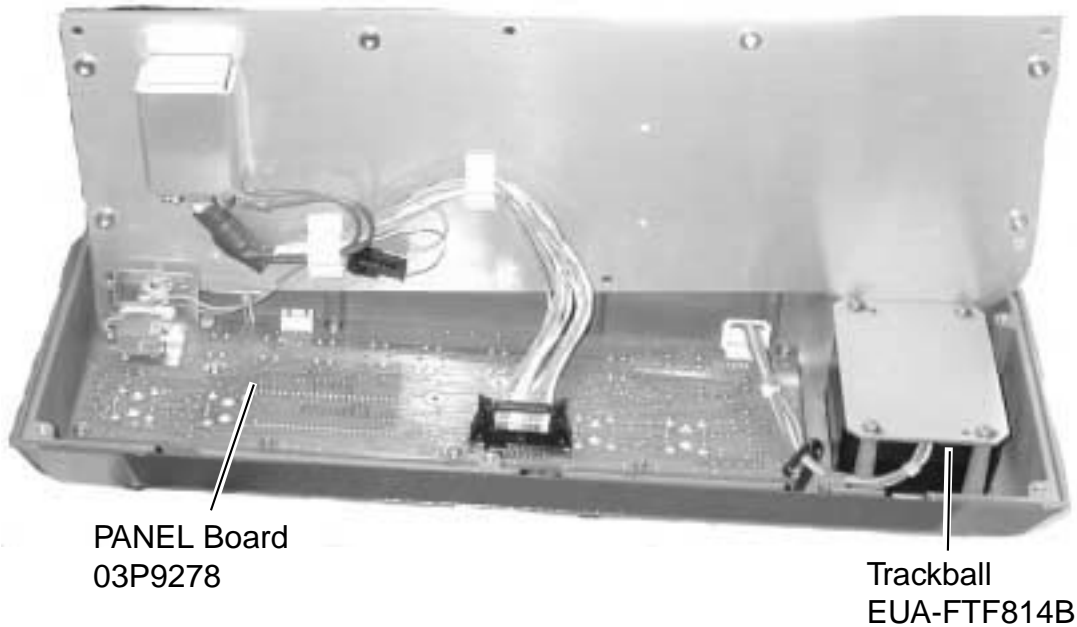
Display unit, front view



Display unit, rear view

5.3 Control Unit RCU-013

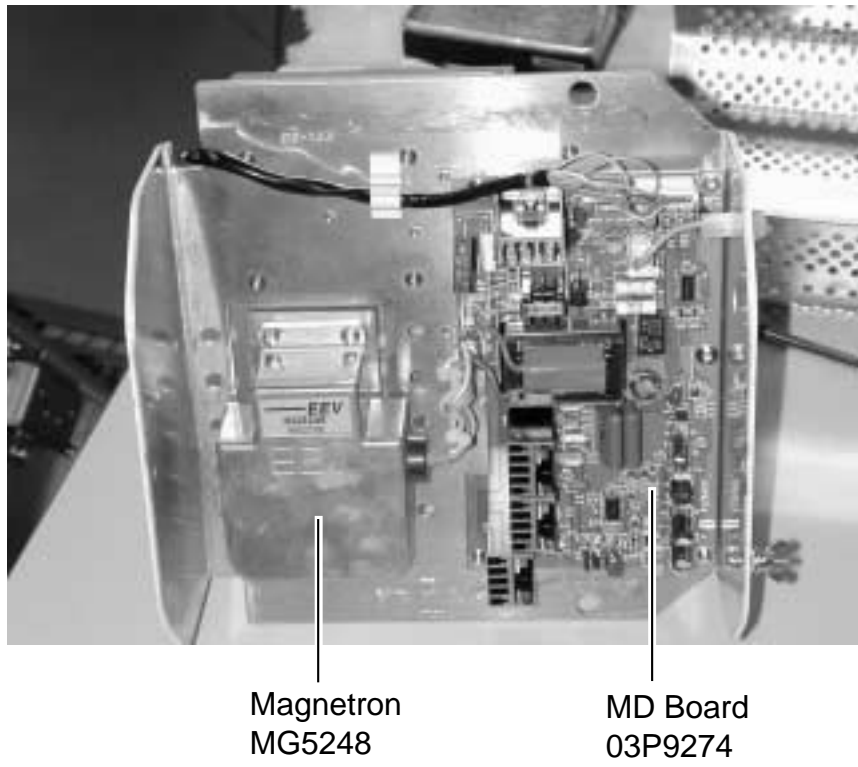
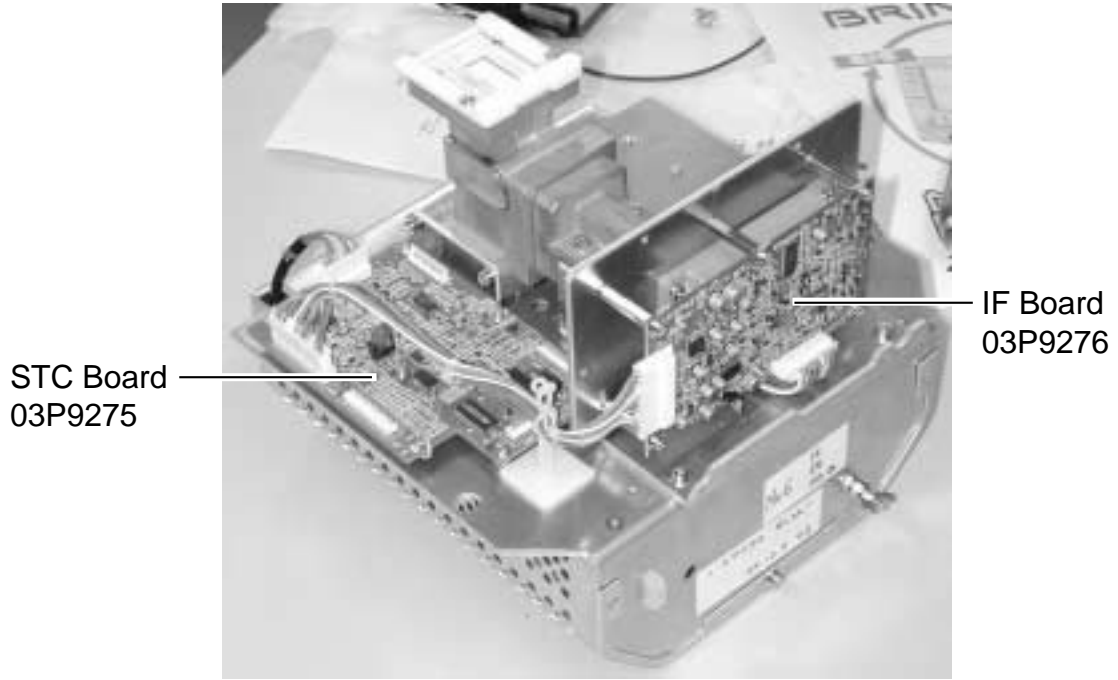
SYMBOL	TYPE	CODE NO.	REMARKS
Trackball	EUA-FTF814B	000-115-533	
PANEL Board	03P9278	008-506-060	



Control unit, bottom cover removed

5.4 RF Unit RTR-071

NAME	TYPE	CODE NO.	REMARKS
STC Board	03P9275	008-504-770	
MD Board	03P9274	008-504-790	
IF Board	03P9276	008-504-750	
TB Board	03P9279	008-504-720	
MP Board	MP-3795	008-312-370	
Magnetron	MG5248	000-116-121	
MIC	RU-9360	000-138-979	
Motor	D8G-516 30W DC24V	000-631-715	for RSB-0085
	D8G-571	000-136-566	for RSB-0086
Reed SW	RS-1. NO.	000-478-301	
Toggle SW	ATK21-W	000-479-243	
Circulator	RC-3686	000-106-850	



RF Unit

This page is intentionally left blank.

6. DIGITAL INTERFACE (IEC61162-1)

6.1 I/O Sentences for Channel 1

Input

GGA, RMC, RMA, GLL, ZDA, RMC, RMA, VTG

Output

RSD

6.2 I/O Sentences of Channel 2

Input

HDT, HDG, HDM, VHW, RMC, RMA

Output

None

6.3 I/O Sentences of Channel 3

Input

VBW, VTG, VBW, VHW

Output

None

6.4 I/O Sentences of Channel 4

Input

DPT, DBK, DBS, DBT

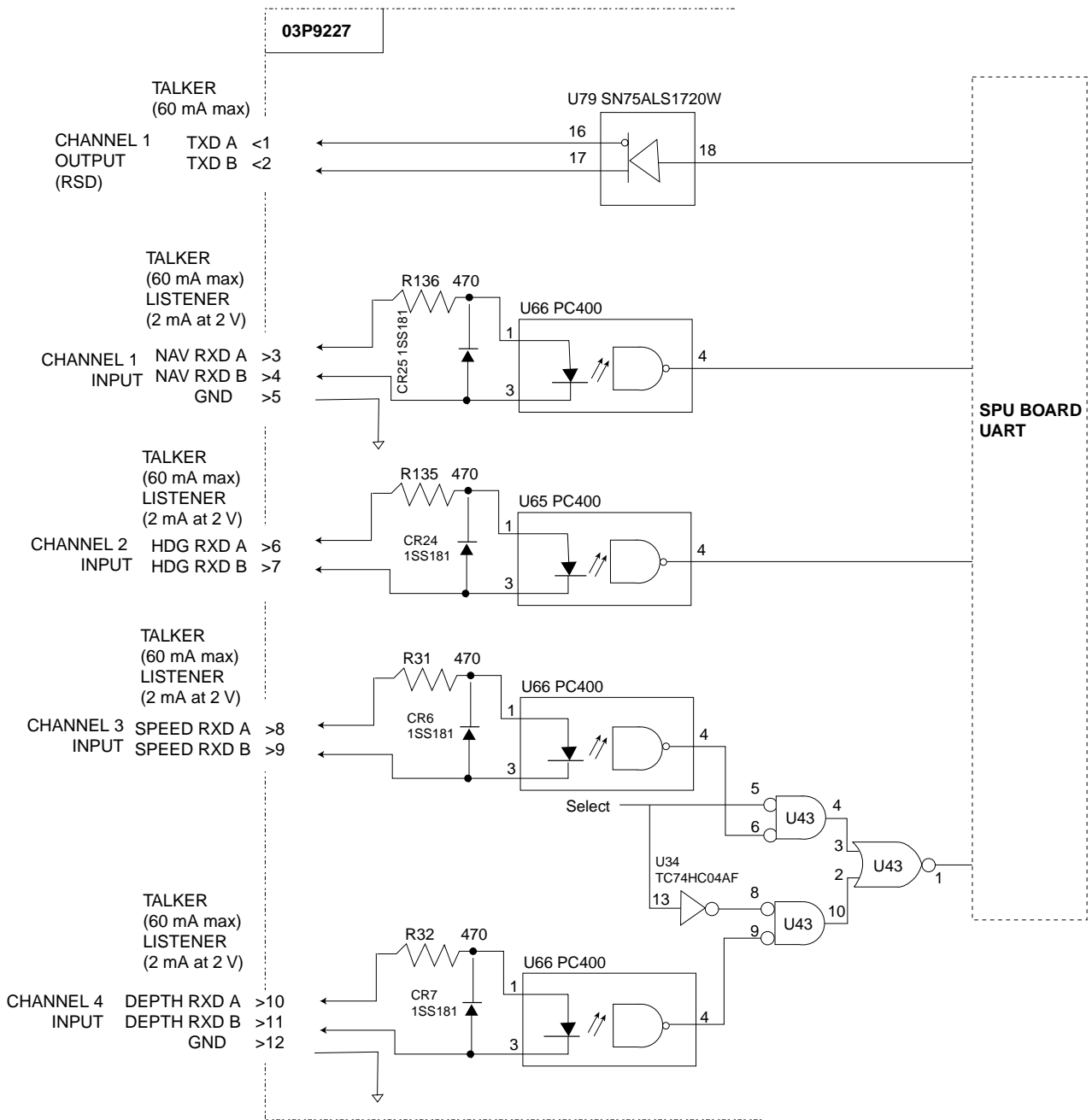
Output

None

6.5 Sentence Description

See pages which follow.

6.6 RHRS-2005RCTFT SERIAL INTERFACE I/O CIRCUIT

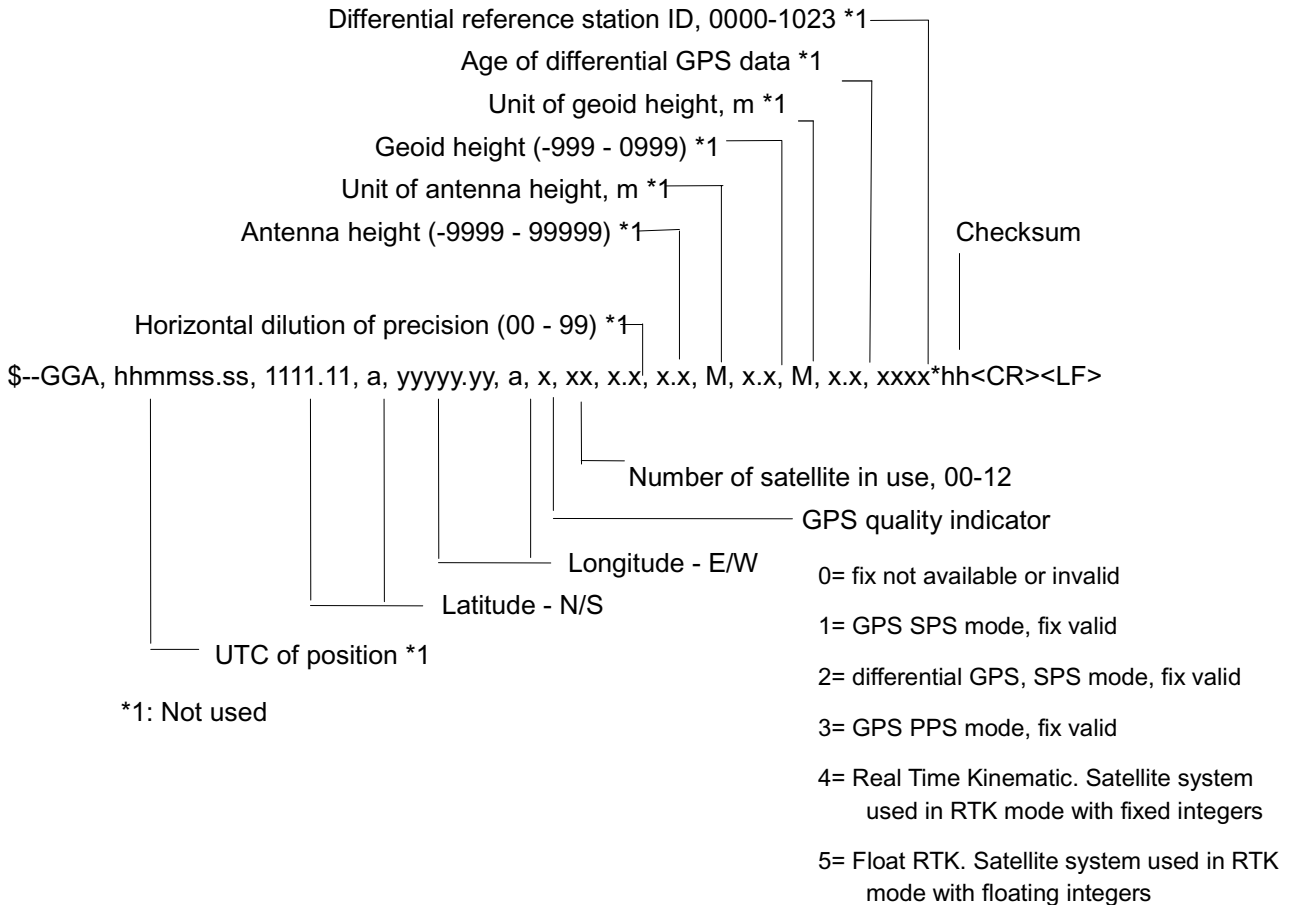


Description of Sentence

Channel 1 Input

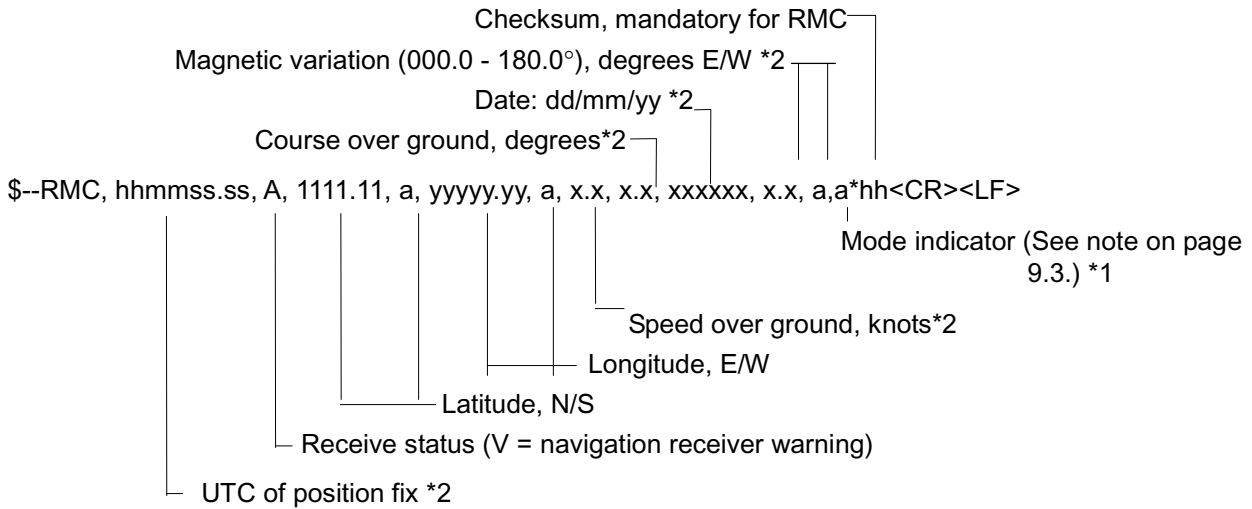
GGA - Global positioning system (GPS) fix data

Time, position and fix related data for a GPS receiver.



RMC - Recommended specific GPS/TRANSIT data

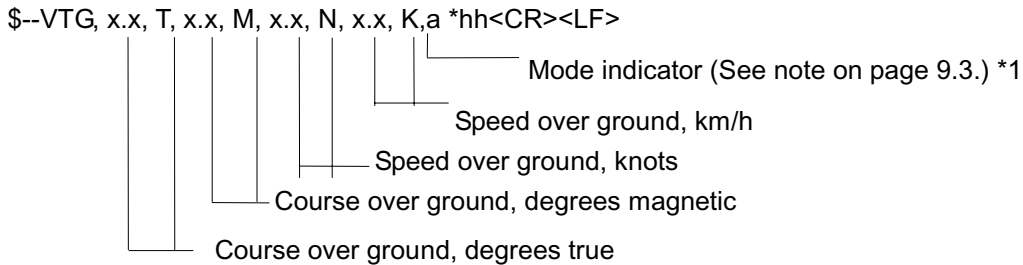
Time, date, position, course and speed data provided by a GPS or TRANSIT navigation receiver. Checksum is mandatory in this sentence. This sentence is transmitted at intervals not exceeding 2 s and is always accompanied by RMB when a destination waypoint is active. RMC and RMB are the recommended minimum data to be provided by a GPS or TRANSIT receiver. All data fields must be provided, null fields used only when data is temporarily unavailable.



*1: Edition 2 only, *2: Not used

VTG – Course over ground and ground speed

The actual course and speed relative to the ground.

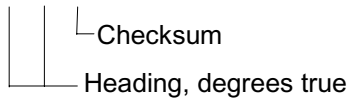


*1: Edition 2 only

Channel 2 input

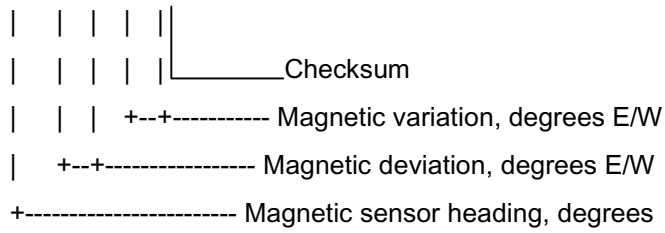
HDT-Heading true

\$HDT,x.x,T*hh<CR><LF>



HDG-Heading, deviation and variation

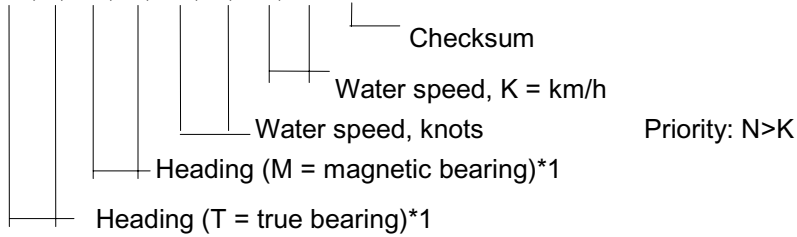
\$--HDG,x.x,x.x,a,x.x,a*hh<CR><LF>



VHW - Water speed and heading

The heading to which the vessel points and the speed of the vessel relative to the water.

\$--VHW, x.x, T, x.x, M, x.x, N, x.x, K *hh<CR><LF>

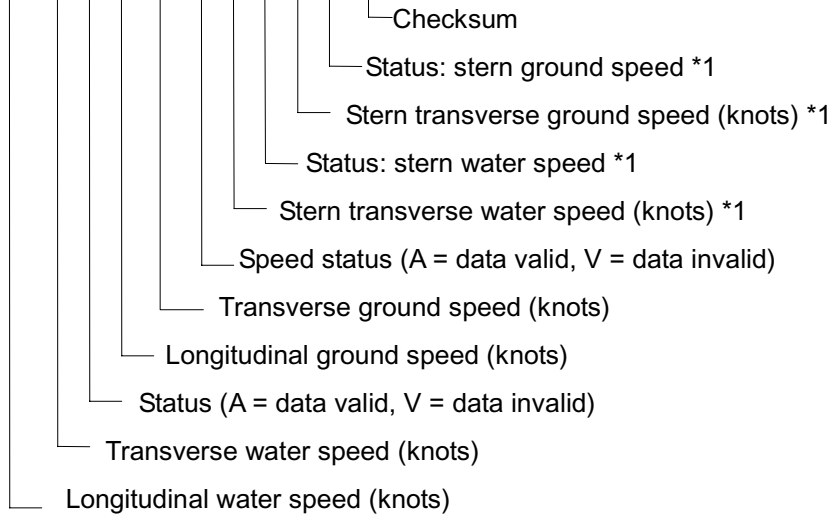


*1: Not used

Channel 3 input

VBW - Dual ground/water speed

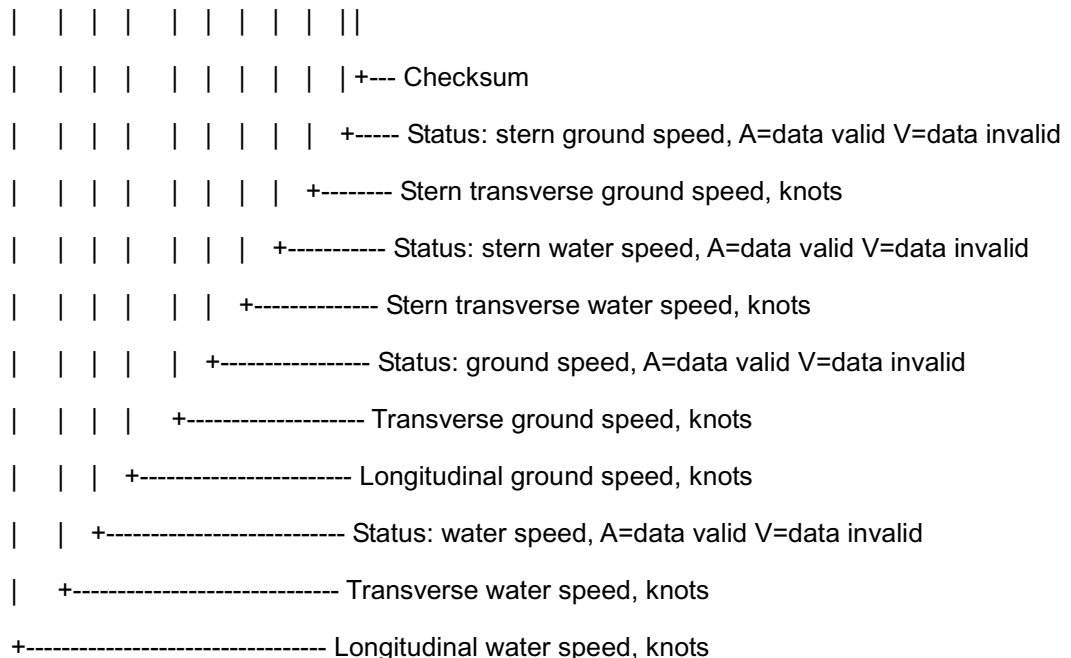
\$--VBW,x,x,x,x,A,x,x,x,x,A,x,x,A,x,x,A*hh<CR><LF>



*1: Edition 2 only

V B W - Dual ground/water speed

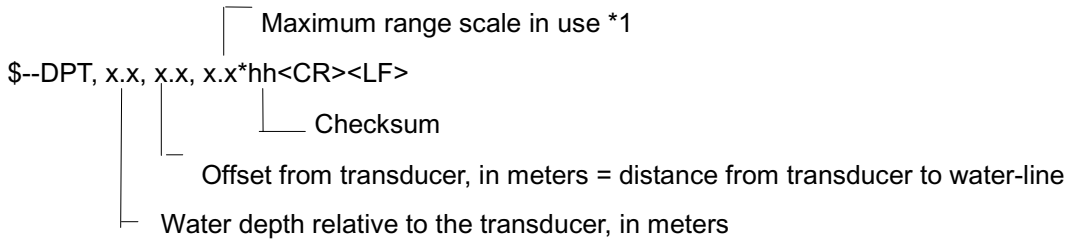
\$--VBW,x,x,x,x,A,x,x,x,x,A,x,x,A,x,x,A*hh<CR><LF>



Channel 4 input

DPT - Depth

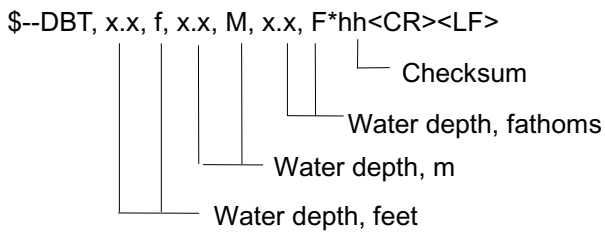
Water depth relative to the transducer and offset of the measuring transducer. Positive offset numbers provide the distance from the transducer to the waterline. Negative offset numbers provide the distance from the transducer to the part of the keel of interest.



*1: Edition 2 only, however not used

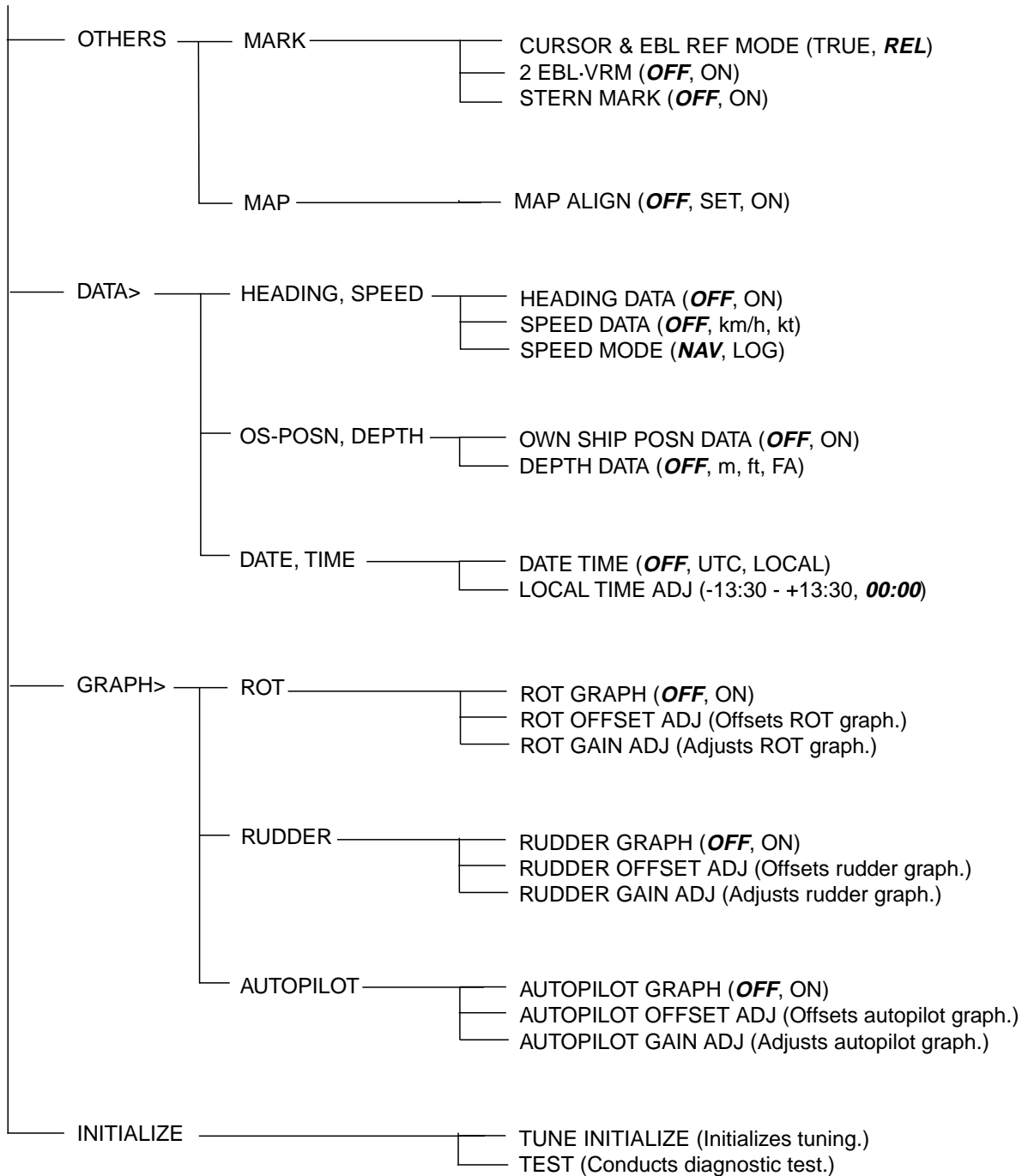
DBT - Depth below transducer

Water depth referenced to the transducer.



MENU TREE

[MENU] key



Default settings shown in bold italics.

- 2.10 Duplexer Ferrite Circulator with diode limiter
- 2.11 Noise Figure 9 dB nominal

3 DISPLAY UNIT

3

- 3.1 Display 46 cm (18.1-inch) diagonal display (359 x 287 mm) TFT color LCD, effective display area: 270 mm

- 3.2 Presentation Mode Relative motion head-up

3.3 Range, Range Interval, Number of Rings

Range (km)	0.25	0.5	0.8	1.2	1.6	2	4	8	16	32	64
Ring Interval (km)	0.05	0.1	0.2	0.2	0.4	0.4	1	2	4	8	16
Number of Rings	5	5	4	6	4	5	4	4	4	4	4

- 3.4 Radar Display Area Continuous forward range extension to 150% with full 100% range aft.
- 3.5 Off-centering Forward range extension to 183% of range in use
- 3.6 Minimum Range 15 m (0.25-1.2 km range)
- 3.7 Range Discrimination 15 m (0.25-1.2 km range)
- 3.8 Bearing Readout By EBL, 0.1° resolution
- 3.9 Range Accuracy ±1 % of range or 10 m, whichever is the greater
- 3.10 Bearing Accuracy ±1°
- 3.11 Echo Trails 2 scan: 15 sec/ 30 sec/ 1 min/ 3 min (relative trail / true trail*)
- 3.12 Radar Map** 1500 point
- 3.13 Echo Average* Scan to scan correlation
- 3.14 Nav lines Two independently adjustable lines parallel to ship's heading
- 3.15 ROT/Autopilot indicator OFF, 30 , 90, 300°/min
- 3.16 Rudder Angle/Follow-up Indicator
OFF, 30, 90, 120, 180°

*: Heading information and L/L (or speed) data are required.

** : Radar map requires L/L data.

4 INTERFACES

- 4.1 Inputs L/L, speed, compass and depth (IEC 61162-1), rate-of -turn, autopilot (ROT/follow-up), rudder angle,
- 4.2 Outputs Repeater display outputs (2 ports: radar video, trigger, heading, bearing pulses)
- 4.3 Repeater radar inputs Radar video, trigger, heading, bearing pulses

5 POWER SUPPLY

- 5.1 Input Voltage 24-32 VDC: 7.5-5.6 A (28 rpm)
 24-32 VDC: 8.1-6.1 A (42 rpm)
- 5.2 Power Consumption 180 W (28 rpm), 200 W (42 rpm)
- 5.3 For AC supply (optional rectifier/transformer required)
- RU-1746B-2 (rectifier) Input: 115/230 VAC, 50-60 Hz, 1 phase
 Output: 24VDC, 13 A max.
- RU-1803 (transformer) Input: 440 VAC, 50-60 Hz, 1 phase
 Output: 115 VAC, 7 A max.

6 ENVIRONMENTAL CONDITIONS

- 6.1 Ambient Temperature Antenna Unit: -25°C to +70°C
 Display Unit: -15°C to +55°C
- 6.2 Relative Humidity 93 % (±3%) at +40°C
- 6.3 Water Protection
- Antenna Unit IPX6 (IEC 60529)
- Display Unit For use in protected area
- Processor Unit For use in protected area
- 6.4 Vibration IEC 60945

7 COATING COLOR

- 7.1 Display Unit Dark gray (N3.0)
- 7.2 Processor Unit Dark gray (N3.0)
- 7.3 Scanner Unit White (N9.5)

8 X-RADIATION

No components are used executing a dose rate > 5 µJ/kg h (0.5 mrem/h) at 50 mm.

INDEX

A

- A/C RAIN control 1-8
- A/C SEA control 1-8
- Alarms 1-24
- Autopilot graph 1-18
 - adjusting 1-20
 - description 1-18
 - on/off 1-19
- AUTOPILOT menu 1-19

B

- Background color 1-15
- Barge 1-14
- Bearing measurement 1-11
- BRILL control 1-4
- Brilliance
 - CRT 1-4
 - data 1-15
 - markers 1-15
 - panel 1-15
 - programming sets 1-16

C

- Contrast 1-10
- Control description 1-3
- Cursor data 1-13
- Cursor data format 1-13

D

- Data
 - brilliance 1-15
- DATE, TIME menu 1-17
- Diagnostic test 4-4

E

- EBL control 1-11
- Echo averaging 1-10
- Echo color 1-15
- Echo programming 1-16
- Echo stretch 1-9
- Error messages 1-24

F

- False echoes
 - multiple echoes 2-2
 - shadow sectors 2-3
 - sidelobe echoes 2-3
 - virtual image 2-2
- FTC (Fast Time Constant) 1-8
- Fuse replacement 3-1

G

- GAIN control 1-7
- Graphs
 - adjusting 1-19
 - description 1-18
 - on/off 1-18
 - scale 1-19

H

- Heading input 1-17
- Heading line 1-14
- HEADING, SPEED menu 1-17
- HL OFF key 1-14

I

- Interference rejector 1-9

L

- Legends 1-6

M

- Maintenance 3-2
- Mark entry 1-23
- MARK key 1-23
- Markers 1-6
- MENU key 1-12
- MENU operation 1-12
- Menu tree 1
- Multiple echoes 2-2

N

Nav lines 1-21
Noise rejector 1-9

O

OFF CENTER key 1-12
Offset EBL 1-12
OS POSN menu 1-17
Own ship marker 1-14

P

Parts list 5-1
POWER switch 1-1
Programming brilliance, echo 1-16
PULSE key 1-7

Q

Quick start 1-2

R

Radar map 1-22
RANGE control 1-7
Range measurement
 range rings 1-10
 VRM 1-11
ROT graph
 adjusting 1-19
 description 1-18
 on/off 1-19
ROT menu 1-19
Rudder graph 1-18

 adjusting 1-19
 description 1-18
 on/off 1-19
RUDDER menu 1-19

S

Shadow sectors 2-3
Sidelobe echoes 2-2
Speed input 1-17
STBY/XMIT switch 1-2
Stern mark 1-14
System configuration v

T

Target trails
 color 1-14
 erasing 1-13
 reference (true or relative) 1-13
 starting 1-13
Time input 1-17
Troubleshooting
 technician 4-2
 user 4-1
Tuning
 automatic 1-5
 initialization 1-4
 manual 1-5

V

Virtual image 2-2
VRM control 1-11