JMA-609

RIVER RADAR EQUIPMENT

INSTRUCTION MANUAL

JRC Japan Radio Co., Ltd.

PREFACE

Thank you very much for purchasing the JRC marine radar equipment, JMA-609 series.
This equipment is a river radar equipment designed to obtain safe operation of ships.
This equipment consists of a radar signal processing unit, a LCD display unit and a scanner unit as its main units.

- Before operating the equipment, be sure to read this instruction manual carefully for correct operation.
- Maintain this instruction manual so that operators can refer to it at anytime.

Refer to this manual when any inconvenience or defect occurs..

●Before Operation●

Pictorial Indication

Various pictorial indications are included in this manual and are shown on these equipment so that you can operate them safety and correctly and prevent any danger to you and/or to other persons and any damage to your property during operation. Such indications and their meanings are as follows.
Please understand them before you read this manual:

DANGER	This indication is shown where incorrect equipment operation due to negligence may cause death or serious injuries.
WARNING	This indication is shown where any person is supposed to be in danger of being killed or seriously injured if this indication is neglected and these equipment are not operated correctly.
CAUTION	This indication is shown where any person is supposed to be injured or any property damage is supposed to occur if this indication is neglected and these equipment are not operated correctly.

Examples of Pictorial Indication

Electric Shock

The △ mark represents CAUTION (including DANGER and WARNING).
Detailed contents of CAUTION (“Electric Shock” in the example on the left.) is shown in the mark.

Disassembling Prohibited

Prohibited

The ⃠ mark represents prohibition.
Detailed contents of the prohibited action (“Disassembling Prohibited” in the example on the left.) is shown in the mark.

Disconnect the power plug

Instruction

The ● mark represents instruction.
Detailed contents of the instruction (“Disconnect the power plug “ in the example on the left.) is shown in the mark.

Warning Label

There is a warning label on the top cover of the equipment.
Do not try to remove, break or modify the label.

●PRECAUTIONS●

⚠DANGER

Never conduct inspection or repair work of equipment components.
Inspection or repair work by uncertified personnel may result in fire hazard or electrocution.
For inspection and repair work of equipment components, consult with our branch office, branch shop, sales office, or our distributor in your district.

When conducting maintenance, make sure to turn the main power off.
Failure to comply may result in electrocution.

Turn off the main power before cleaning the equipment. Especially when a rectifier is used, make sure to turn it off since voltage is still outputted from the rectifier even after the indicator and the radar are turned off. Failure to comply may result in equipment failure, or death or serious injury due to electric shock.

When conducting maintenance work on the antenna, make sure to turn its main power off.
Failure to comply may result in electrocution or injuries.

DANGER

Make sure to turn off the antenna operation switch. Failure to comply may result in injuries caused by physical contact with the rotating antenna.

WARNING

When conducting maintenance work, make sure to turn off the power and unplug the power line of the processor so that the power supply to the equipment is completely cut off.
Some equipment components can carry electrical current even after the power switch is turned off, and conducting maintenance work without unplugging the power connector may result in electrocution, equipment failure, or accidents.

Never carry out internal inspection or repair work of the equipment by users.
Inspection or repair work by unauthorized personnel may result in fire hazard or electric shock.
Ask the nearest branch, business office or a dealer for inspection and repair.

Turn off the main power before maintenance work. Otherwise, an electric shock may result.

Turn off the main power before cleaning the equipment. Especially, make sure to turn off the indicator if a rectifier is used. Otherwise, equipment failure, or death or serious injury due to electric shock may result, because voltage is outputted from the rectifier even when the radar is not operating.

⚠WARNING

Turn off the main power source before starting maintenance.
Otherwise, an electric shock or injury may be caused.

Turn off the main power if you need to be near the scanner unit for maintenance or inspection purposes.
Direct exposure to electromagnetic waves at close range in death or serious injury.

Set the safety switch for stopping the scanner unit to the OFF position.
Otherwise, an accidental contact with the rotating scanner unit may cause injury.

When cleaning the screen, do not wipe it too strongly with a dry cloth. Also, do not use gasoline or thinner to clean the screen. Otherwise the screen surface may be damaged.

Never carry out internal inspection or repair work of the equipment by users.
Inspection or repair work by unauthorized personnel may result in fire hazard or electric shock.
Ask the nearest branch, business office or a dealer for inspection and repair.

Turn off the main power before maintenance work.
Otherwise, an electric shock may result.

Turn off the main power before cleaning the equipment.
Especially, make sure to turn off the indicator if a rectifier is used. Otherwise, equipment failure, or death or serious injury due to electric shock may result, because voltage is outputted from the rectifier even when the radar is not operating.

WARNING

Turn off the main power source before starting maintenance.
Otherwise, an electric shock or injury may be caused.

Turn off the main power if you need to be near the scanner unit for maintenance or inspection purposes.
Direct exposure to electromagnetic waves at close range in death or serious injury.

Set the safety switch for stopping the scanner unit to the OFF position.
Otherwise, an accidental contact with the rotating scanner unit may cause injury.

When disposing of used lithium batteries, be sure to insulate the batteries by taping ⊕ and ⊖ terminals.
Otherwise, heat generation, explosion or a fire may occur.

Caution

A malfunction may occur if the power in the ship is instantaneously interrupted during operation of the radar.
In this case, the power should be turned on again.

When using the [SEA] function, never set the suppression level too high canceling out all image noises from the sea surface at close range.
Detection of not only echoes from waves but also targets such as other ships or dangerous objects will become inhibited.
When using the [SEA] function, make sure to choose the most appropriate image noise suppression level.

CAUTION

When using the [RAIN] function, never set the suppression level too high canceling out all image noises from the rain or snow at the close range.
Detection of not only echoes from the rain or snow but also targets such as other ships or dangerous objects will become inhibited.
When using the [RAIN] function, make sure to choose the most appropriate image noise suppression level.

Do not put watches, clocks, or magnetic cards close to the modulator unit since this unit holds magnetrons having strong magnetic force. Failure or data destruction of the above devices may result.

Turn off the main power source before replacing parts. Otherwise, an electric shock or trouble may be caused.

Before replacing the magnetron, turn off the main power source and wait for 5 minutes or more until the high voltage circuits are discharged.
Otherwise, an electric shock may be caused.

Take off your wrist watch when bringing your hands close to the magnetron.
Otherwise, your watch may be damaged because the magnetron is a strong magnet.

Two or more persons shall replace the liquid crystal monitor.
If only one person does this work, he may drop the LCD, resulting in injury.

Even after the main power source is turned off, some high voltages remain for a while.
Do not contact the inverter circuit in the LCD with bare hands. Otherwise, an electric shock may be caused.

◆◆◆PRECAUTIONS BEFORE OPERATION◆◆◆

■Cautions for high voltage

High voltages from hundreds volts to tens of thousands volts are to be applied to the electronic equipment such radio and radar devices. You do not face any danger during normal operation, but sufficient cares are required for maintenance, inspection and adjustment of their internal components. (Maintenance, check-up and adjustment of the inside of the equipment are prohibited except by maintenance specialists.)

High voltages of tens of thousands volts are so dangerous as to bring an instantaneous death from electric shock, but even voltages of hundred volts may sometimes lead to a death from electric shock. To prevent such an accident, make it a rule to turn off the power switch, discharge capacitors with a wire surely earthed on an end make sure that internal parts are no longer charged before you touch any parts inside these devices. At the time, wearing dry cotton gloves ensures you further to prevent such danger. It is also a necessary caution to put one of your hands in the pocket and not to use your both hands at the same time.

It is also important to select a stable foothold always to prevent additional injuries once you were shocked by electricity. If you were injured from electric shock, disinfect the burn sufficiently and get it taken care of promptly.

■What to do in case of electric shock

When finding a victim of electric shock, turn off the power source and earth the circuit immediately.

If it is impossible to turn off the circuit, move the victim away promptly using insulators such as dry wood plate and cloth without touching the victim directly.

In case of electric shock, breathing may stop suddenly if current flows to the respiration center in the brain. If the shock is not so strong, artificial respiration may recover breathing. When shocked by electricity, the victim will come to look very bad with weak pulse or without beating, resulting in unconsciousness and rigidity. In this case, it is necessary to perform an emergency measure immediately.

◆◆◆FIRST-AID TREATMENTS◆◆◆

☆First-aid treatments

As far as the victim of electric shock is not in dangerous condition, do not move him and practice artificial respiration on him immediately. Once started, it should be continued rhythmically.

(1) Do not touch the victim confusedly as a result of the accident, but the rescuer may also get an electric shock.

(2) Turn off the power source calmly and move the victim away quietly from the electric line.

(3) Call a physician or ambulance immediately or ask someone to call a doctor.

(4) Lay the victim on this back and loosen his necktie, clothes, belt, etc.

(5) a. Examine the victim's pulse.
b. Examine his heartbeat bringing your ear close to his heart.
c. Examine his breathing bringing the back of your hand or your face close to his face.
d. Check the size of the pupils of his eyes.

(6) Open the victim's mouth and take out artificial teeth, cigarette or chewing gum if any. Keep his mouth open, stretch his tongue and insert a towel or the like in his mouth to prevent the tongue from suffocating. (If it is hard to open his mouth due to set teeth, open it with a screwdriver and insert a towel in this mouth.)

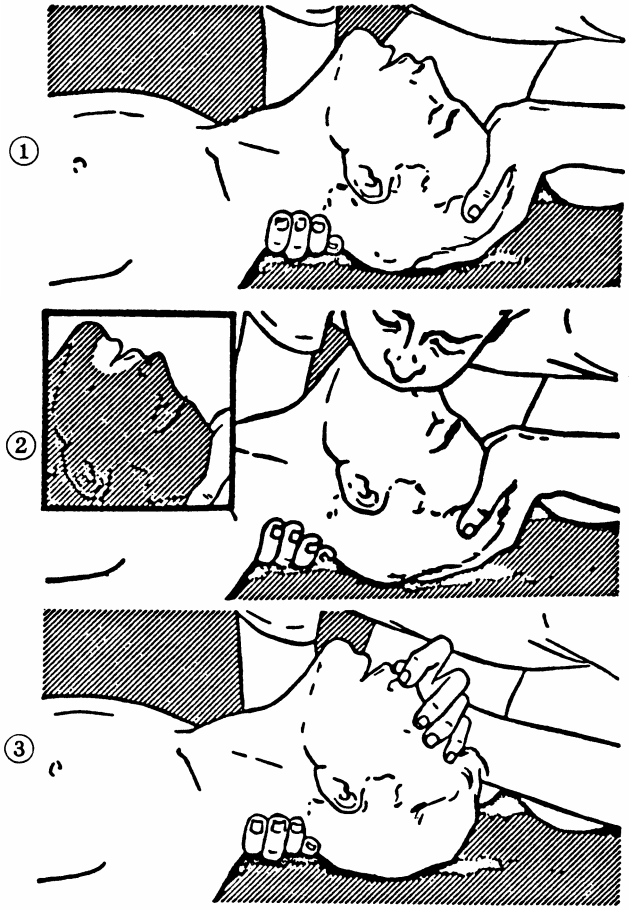
(7) Then, wipe his mouth so that foaming mucus does not accumulate inside.

☆When pulse is beating but breathing has stopped

(Mouth-to-mouth respiration) Fig. 1

(1) Tilt the victim's head back as far as this face looks back. (A pillow may be inserted his neck.)
(2) Push his jaw upward to open his throat wide (to spread his airway).
(3) Pinch the victim's nostrils and take a deep breath, block his mouth completely with yours and blow into his mouth strongly. Take a deep breath again and blow into his mouth. Continue this 10 to 15 times a minutes (blocking his nostrils).
(4) Carefully watch that he has recovered his natural breathing and atop practicing artificial respiration.
(5) If it is difficult to open the victim's mouth, insert a rubber or vinyl tube into one of his nostrils and blow into it blocking the other nostril and his mouth completely.
(6) When the victim recovers consciousness, he may try to stand up suddenly, but let him lie calmly and serve him with a cup of hot coffee or tea and keep him warm and quiet. (Never give him alcoholic drinks.)

Method of mouth-to-mouth respiration by raising head



(1) Raise the victim's head. Support his forehead with one of your hand and his neck with the other hand. →①

When you tilt his head backward, the victim, in most cases, opens his mouth to the air. This makes mouth-to mouth respiration easy.

(2) Cover his mouth as widely as possible with yours and press your cheek against his nose →②

or, pinch his nostrils with your fingers to prevent air from leaking. →③

(3) Blow into his lungs. Continue blowing into his mouth until his breast swells. Blow into his mouth as quickly as possible for the first 10 times.

Fig. 1 Mouth-to mouth respiration

☆When both pulse and breathing have stopped

Perform the (Cardiac massage) Fig. 2 and (Mouth-to-mouth respiration) Fig. 1

When no pulse has come not to be felt, his pupils are open and no heartbeat is heard, cardiac arrest is supposed to have occurred and artificial respiration must be performed.

(1) Place your both hands, one hand on the other, on the lower one third area of his breastbone and compress his breast with your elbows applying your weight on his breast so that it is dented about 2cm (Repeat compressing his breast 50 times or so a minutes). (Cardiac massage)

(2) In case of one rescuer,
Repeat cardiac massages about 15 times and blow into his mouth 2 times quickly, and repeat this combination.
In case of two rescuers,
One person repeats cardiac massages 15 times while the other person blow into his mouth twice, and they shall repeat this combination. (Perform the cardiac massage and mouth-to-mouth respiration)

(3) Examine his pupils and his pulse sometimes. When the both have returned to normal, stop the artificial respiration, serve him with a cup of hot coffee or tea and keep him warm and calm while watching him carefully. Commit the victim to a medical specialist depending on his condition. (Never give him alcoholic drinks.) To let him recover from the mental shock, it is necessary for persons concerned to understand his situations and the necessary treatment.

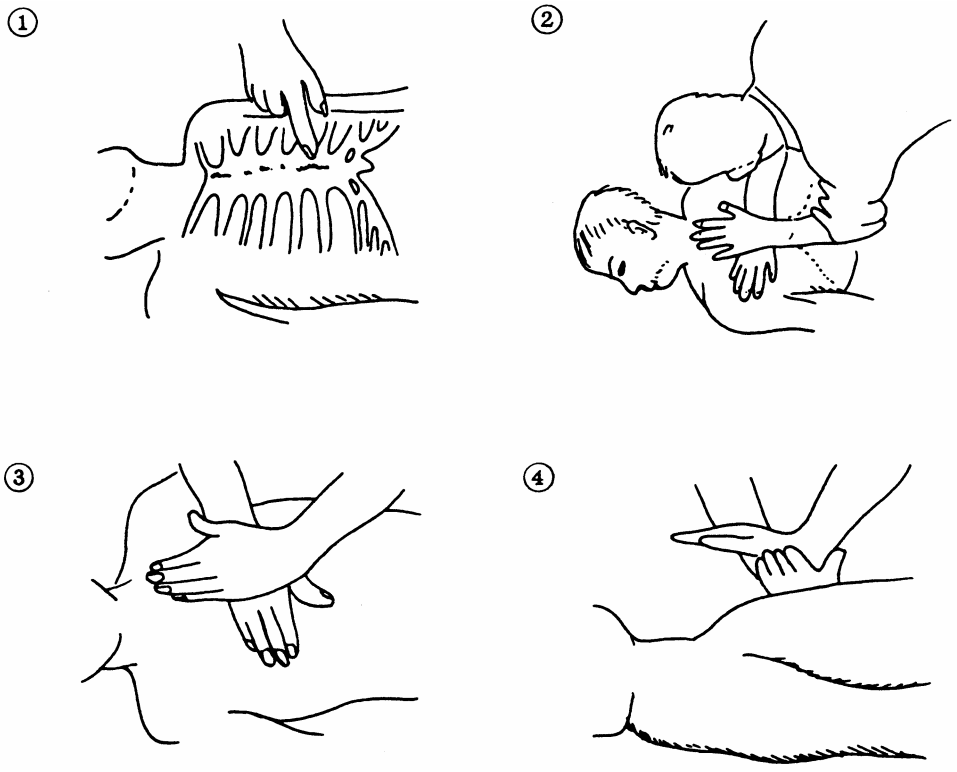


Fig. 2 Cardiac massage

GLOSSARY

This section describes the main terms used for this equipment and general related maritime terms.

ARPA:
Automatic Radar Plotting Aid.

AZI MODE (Azimuth Stabilization MODE):
Bearing display mode

Anti-clutter rain (FTC):
Rain/snow clutter suppression

Anti-clutter sea (STC):
Sea clutter suppression

ATA:
Automatic Tracking Aid

BCR:
Bow Crossing Range

BCT:
Bow Crossing Time

BRG:
Bearing

CPA (Closest Point of Approach):
The closest point of approach from own ship, which can be set by the observer.

COG (Course Over Ground):
Course relative to the ground.

CUP (Course-Up):
Own ship's course is pointed to the top center of the radar display.

DRIFT:
The current velocity for manual correction or the current speed on the horizontal axis of the 2-axis log is displayed.

EBL (Electronic Bearing Line):
An electronic bearing line originated from own ship's position.

ENH (Enhance):
A target can be enlarged.

Floating EBL (Floating Electronic Bearing Line):
Floating electronic bearing line originated from an arbitrary point.

GND:
Stabilization relative to the ground.

GPS (Global Positioning System):
The position of a GPS receiver can be determined by the signals from GPS satellites.

Guard Zone:
Alarm ring against intrusion

HDG (Heading):
Own ship's heading bearing.
The display ranges from 000 to 360 degrees as scanned clockwise.

HL (Heading Line):
Ship's heading line

HUP (Head-Up):
Own ship's heading line is always pointed to the top center of the radar display.

IMO:
International Maritime Organization

Interswitch:
A device to switch over two or more radar display units and two or more antennas.

IR (Interference Rejector):
Radar interference rejector

MRK (Mark):
Reflection plot

NM (Nautical Mile):
1NM=1852m

NSK (North Stabilization Kit):
True bearing unit

NUP (North-Up):
The north is always pointed to the top center of the radar display.

OWN TRACK:
Display function of own ship's track

PI:
Parallel index line

PIN:
Information set by the user (personal code)

PM (Performance Monitor):
An additional unit to monitor the transmitted power and the receiving sensitivity of radar equipment.

PROC (Process):
Target processing function

PPI:
Plan Position Indicator

Relative Vector:
A target's movement predicted relative to own ship.

RR (Range Rings):
Fixed range ring

RM (Relative Motion):
Relative motion presentation
Own ship's position is fixed and other targets move relative to own ship.

S/X Band:
Radio frequency bands
S: 3GHz band, X: 9 GHz band

SCANNER:
Antenna

SEA:
Sea clutter suppression

SET:
The current direction for manual correction or the current speed on the horizontal axis of the 2-axis log is displayed.

SOG (Speed Over Ground):
Speed relative to the ground.

STAB (Stabilization):
Stabilization

TCPA (Time to Closest Point of Approach):
The time to approach the closest point from own ship.

TM (True Motion):
True motion presentation
A presentation in which own ship and any other target move depending on their individual movements.

TRAILS:
Function of displaying tracks of other ships.

TRIAL:
Trial maneuvering

True Vector:
A target's true movement predicted as the result of entering own ship's direction and speed.

VRM:
Variable Range Marker

WATER:
Stabilization relative to the water

CONTENTS

4. MEASUREMENT OF RANGE AND BEARING

5. TRUE AND FALSE ECHOES ON DISPLAY

6. MAINTENANCE

7. TROUBLE SHOOTING

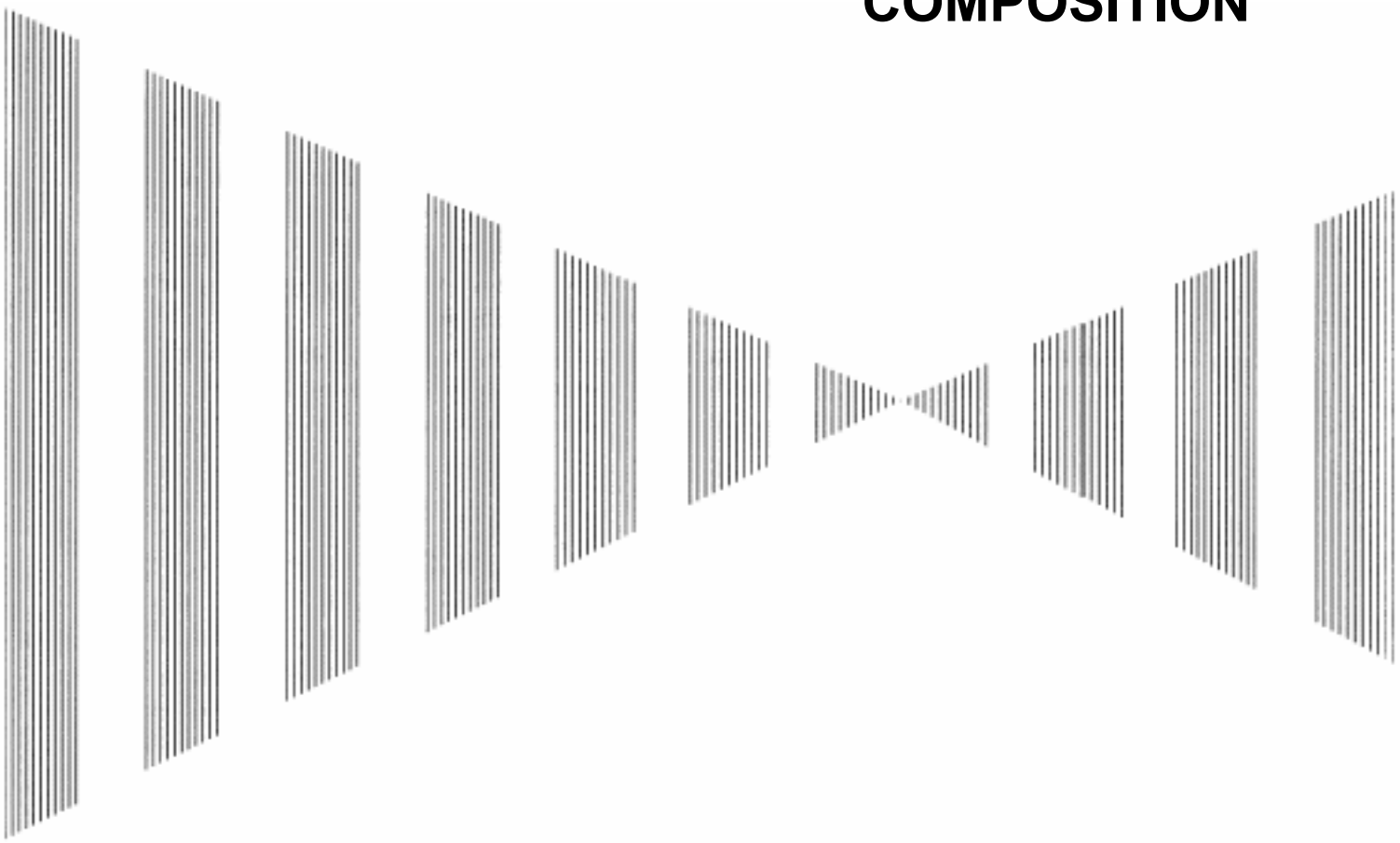
8. AFTER-SALES SERVICE

9. DISPOSAL

10. SPECIFICATIONS

APPENDIX

SECTION 1
GENERAL AND EQUIPMENT COMPOSITION



1.1 FUNCTIONS

This equipment is a high-performance radar equipment consisting of a scanner unit, a transmitter-receiver unit and a high resolution color LCD display unit.

1.1.1 Function of This System

The JMA-609 series is a color radar system.
The main functions include:

- sensitivity adjustment
- sea clutter and rain/snow clutter suppression
- interference reflector
- bearing and range measurement using a cursor, fixed/variable range markers, and electronic bearing line
- own track display

1.2 FEATURES

Realization of Large, Easy-to-see Screen with High Resolution

The 18.1-inch color LCD with high resolution of 1280 × 1024 pixels can display radar images of 250 mm or more in diameter. Even short-range targets can also be displayed as high-resolution images.

Target Detection by Latest Signal Processing Technology

The system employs the latest digital signal processing technology to eliminate undesired clutter from the radar video signals that are obtained from the receiver with a wide dynamic range, thus improving the target detection.

Easy Operation with GUI

All the radar functions can be easily controlled by simply using the trackball and two switches to operate the buttons shown on the radar display.

Improved Day/Night Mode

Two types of background colors are available in each Day/Night mode (total 4 background colors).
Each background color can be reproduced to be suited for the user's operating environment by simple key operation. The radar echoes and a variety of graphics can also be represented in different colors, ensuring easy-to-see displays.

Compact Design and Low Power Consumption

Since an LCD has been implemented as the display device, the weight of the display is greatly reduced and the power consumption is lowered in comparison with the conventional radar equipment.

1.3 CONFIGURATION

Scanners and Transmitted Output Powers

SCANNER TYPE		TRANSMITTED OUTPUT POWER	BAND
JMA-609-7	7 FT SLOT ANTENNA	6 KW	X

Radar Configuration and Ship's Mains

RADAR MODEL	SCANNER UNIT	CONTROL UNIT	SHIP'S MAINS
JMA-609-7	NKE-283	NCM-825	24 VDC

Notes:

1. An optional rectifier is necessary for using Ship's Mains 100/110/115/200/220/230 VAC.
2. The control unit NCM-825 has a separate structure consisting of the following:
   Processor NDC-1337
   Operation panel NCE-7882

1.4 EXTERIOR DRAWINGS

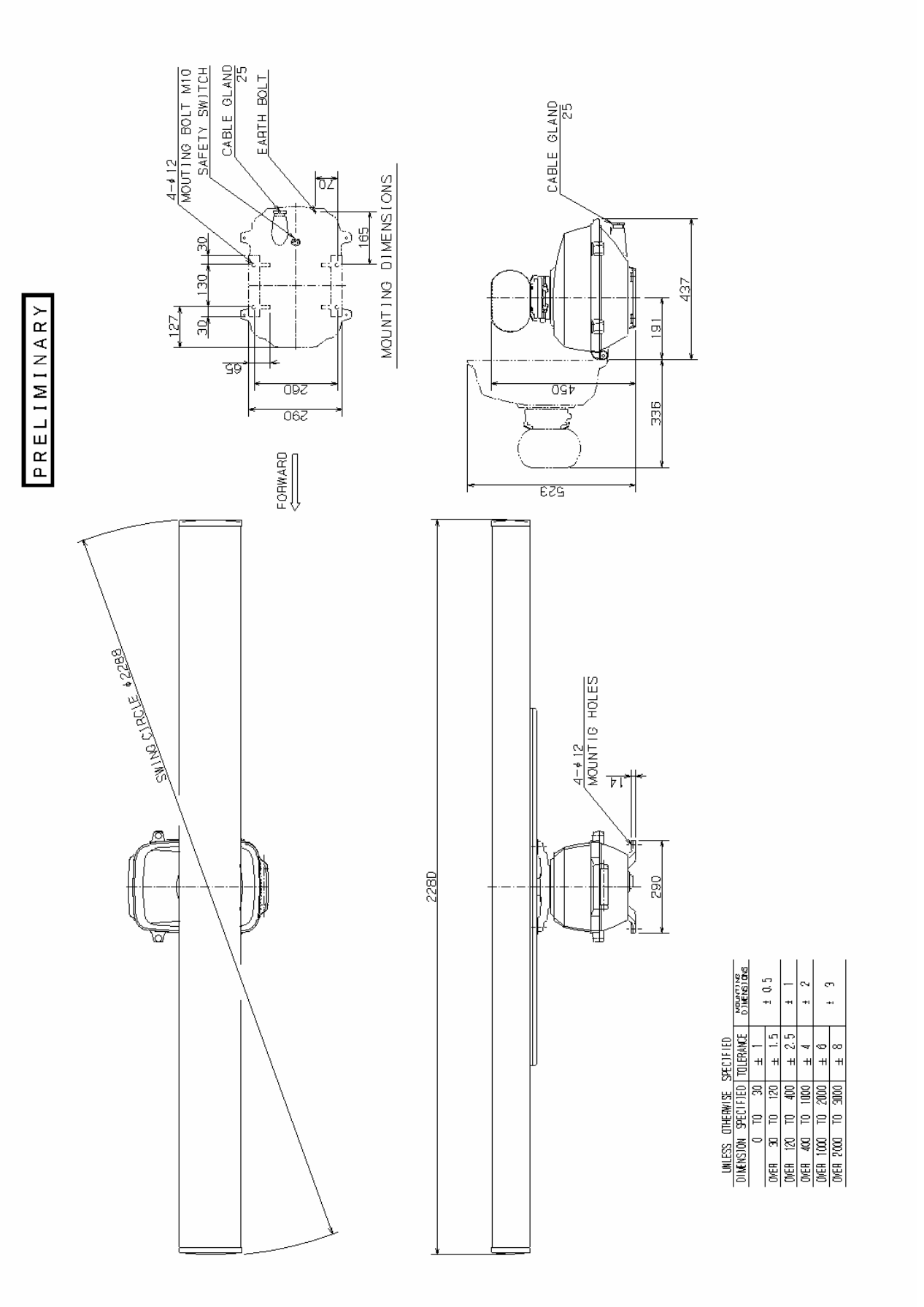


Fig. 1.1 Exterior Drawing of Scanner Unit, Type NKE-283

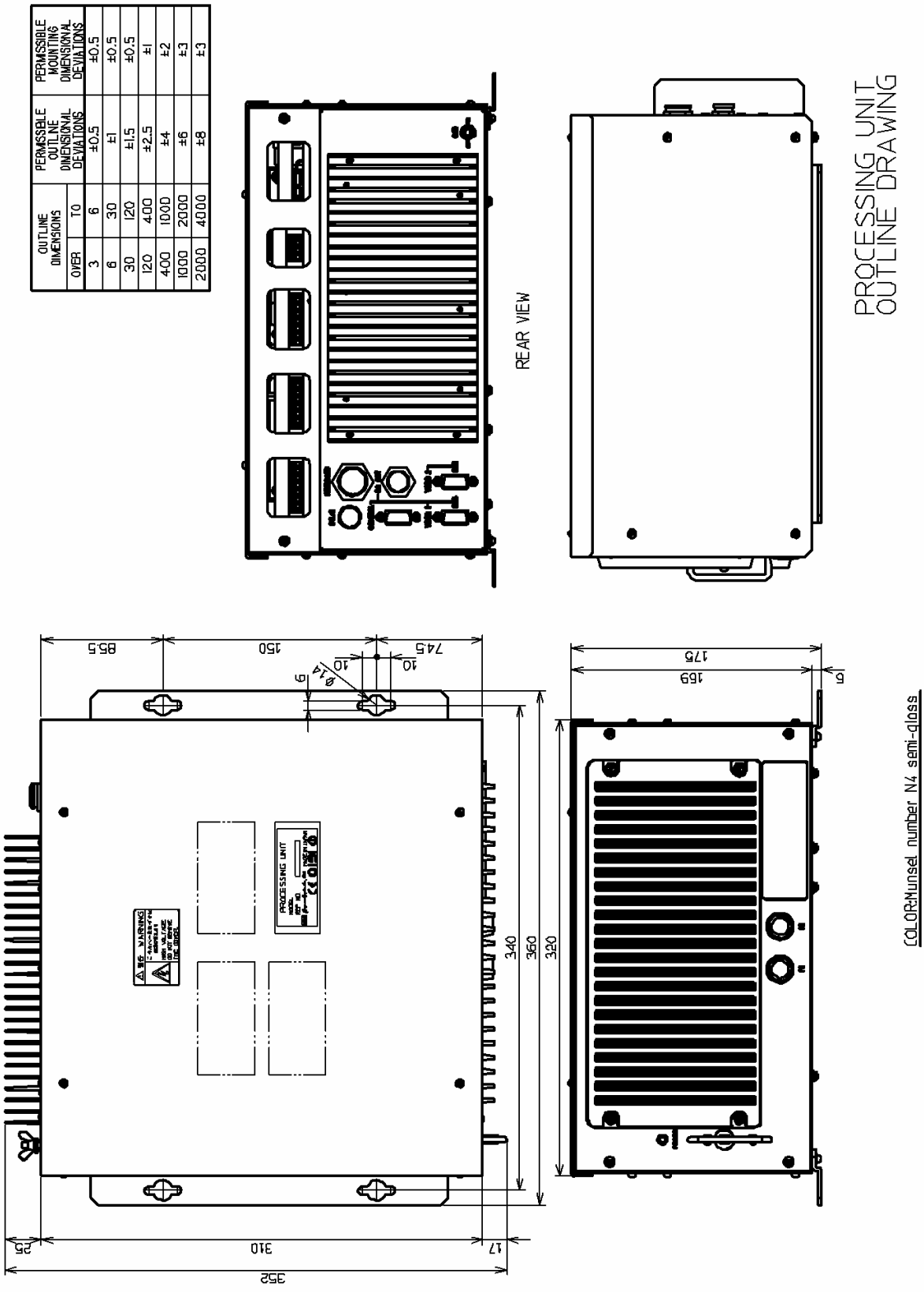
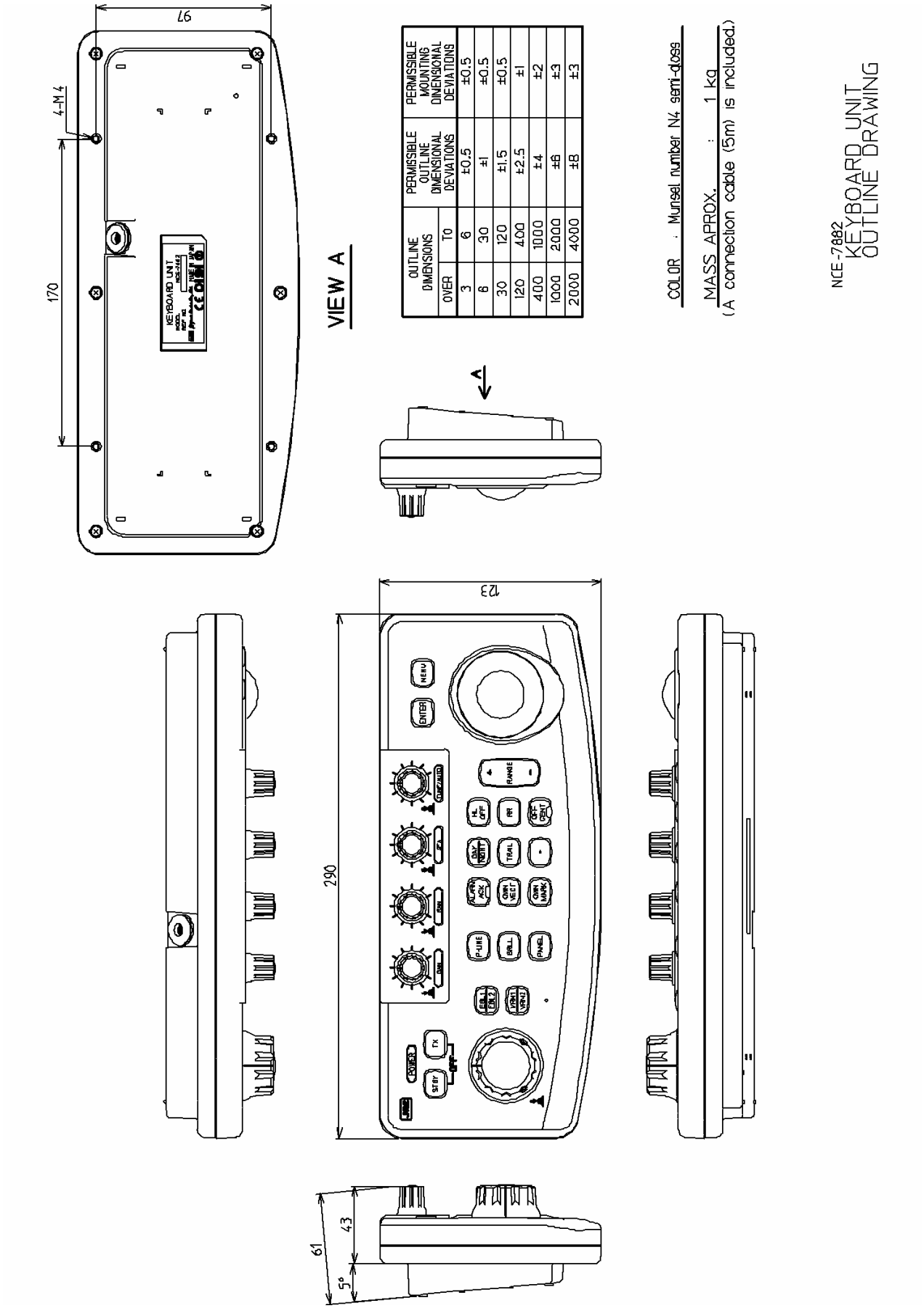


Fig. 1.2 Exterior Drawing of Processing Unit, Type NDC-1337



OUTLINE DIMENSIONS		PERMISSIBLE OUTLINE DIMENSIONAL DEVIATIONS	PERMISSIBLE MOUNTING DIMENSIONAL DEVIATIONS
OVER	TO		
3	6	±0.5	±0.5
6	30	±1	±0.5
30	120	±1.5	±0.5
120	400	±2.5	±1
400	1000	±4	±2
1000	2000	±6	±3
2000	4000	±8	±3

Fig. 1.3 Exterior Drawing of Operating Unit, Type NCE-7882

1.5 GENERAL SYSTEM DIAGRAMS

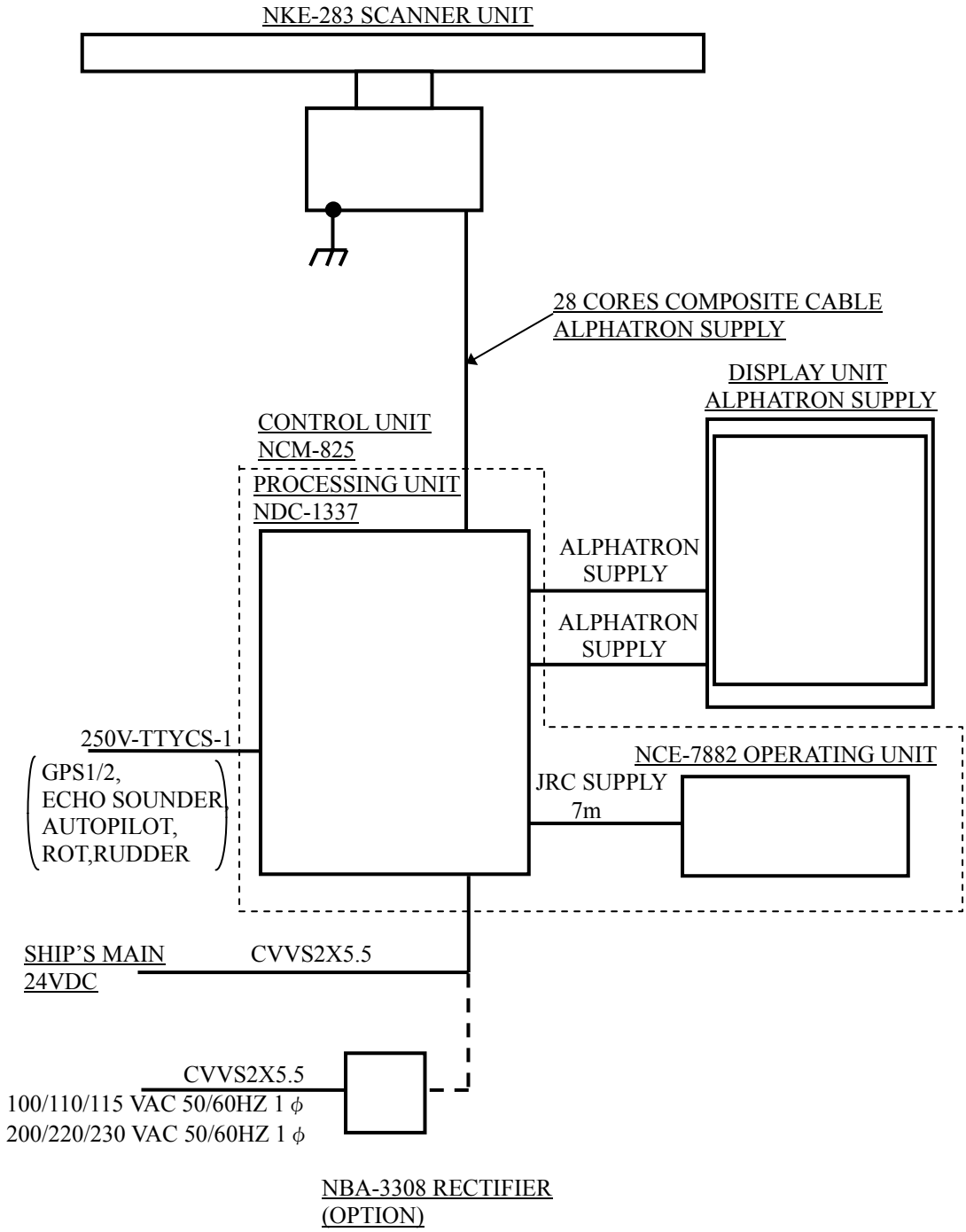
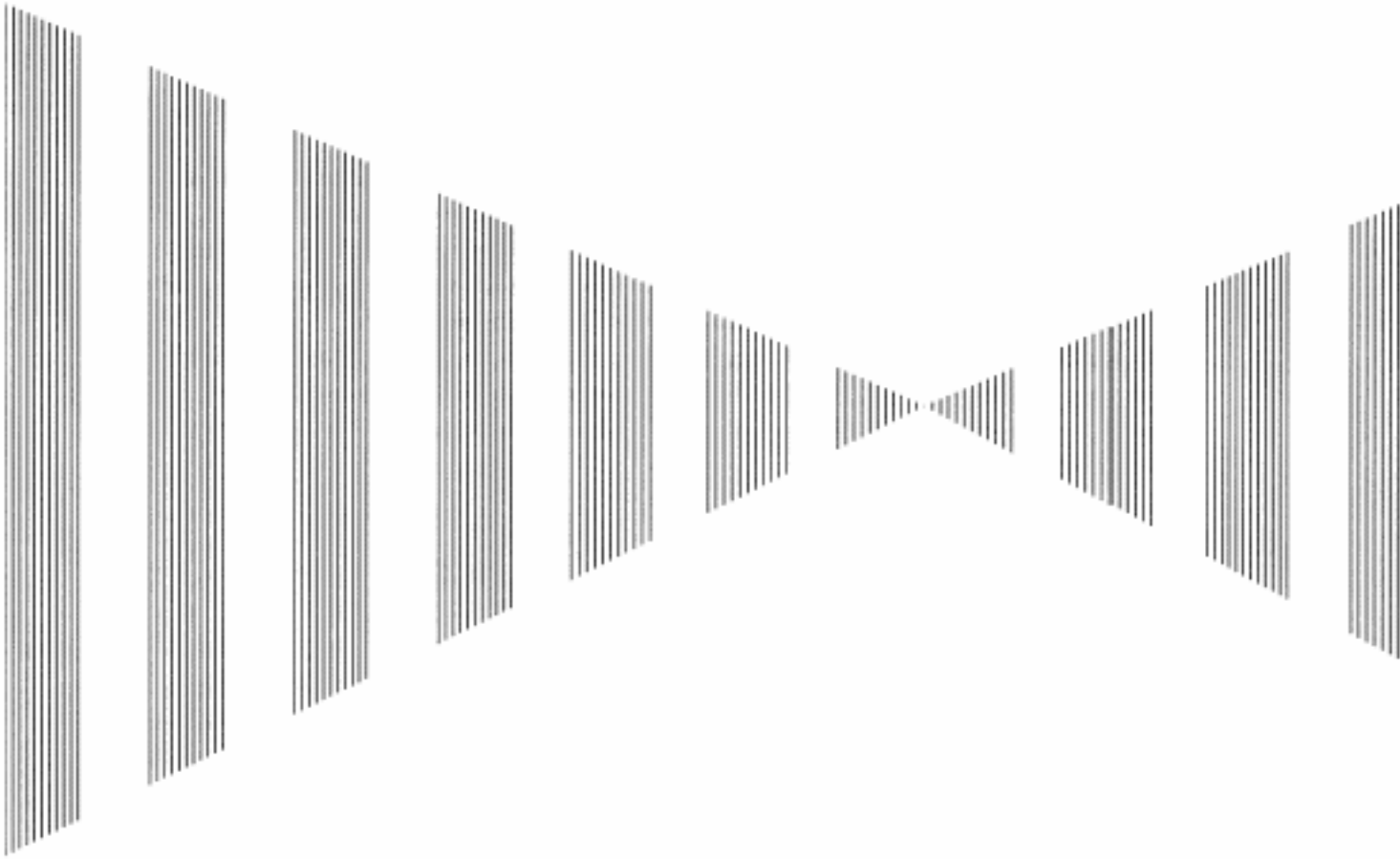
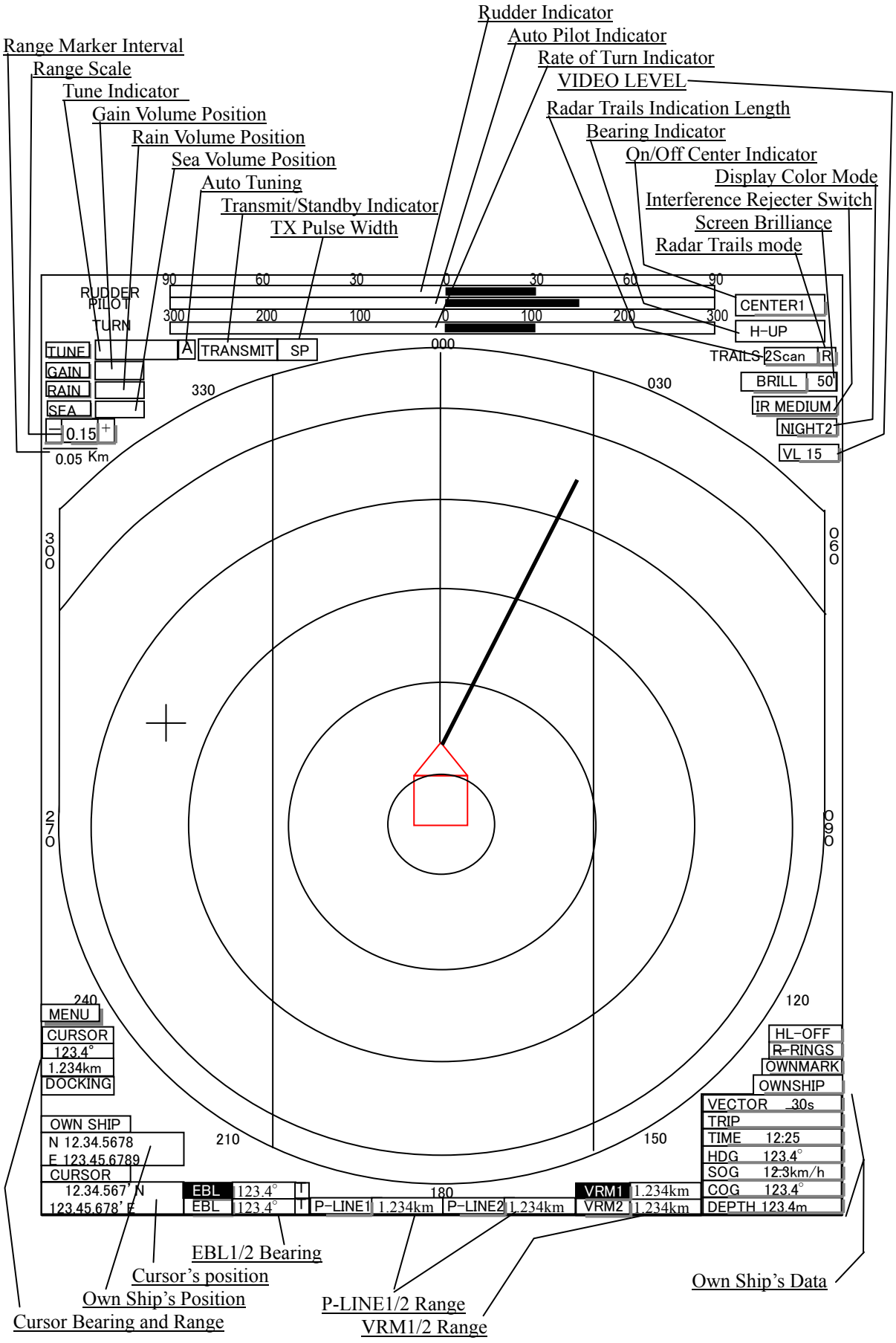


FIG. 1.4 GENERAL SYSTEM DIAGRAM OF RADAR, TYPE JMA-609-7

Note: Eliminating the interference on frequencies used for marine communications and navigation due to operation of the radar.
All cables of the radar are to be run away from the cables of radio equipment.
(Ex. Radiotelephone. Communications receiver and direction finder, etc.)
Especially inter-wiring cables between scanner unit and display unit of the radar should not be run parallel with the cables of radio equipment.

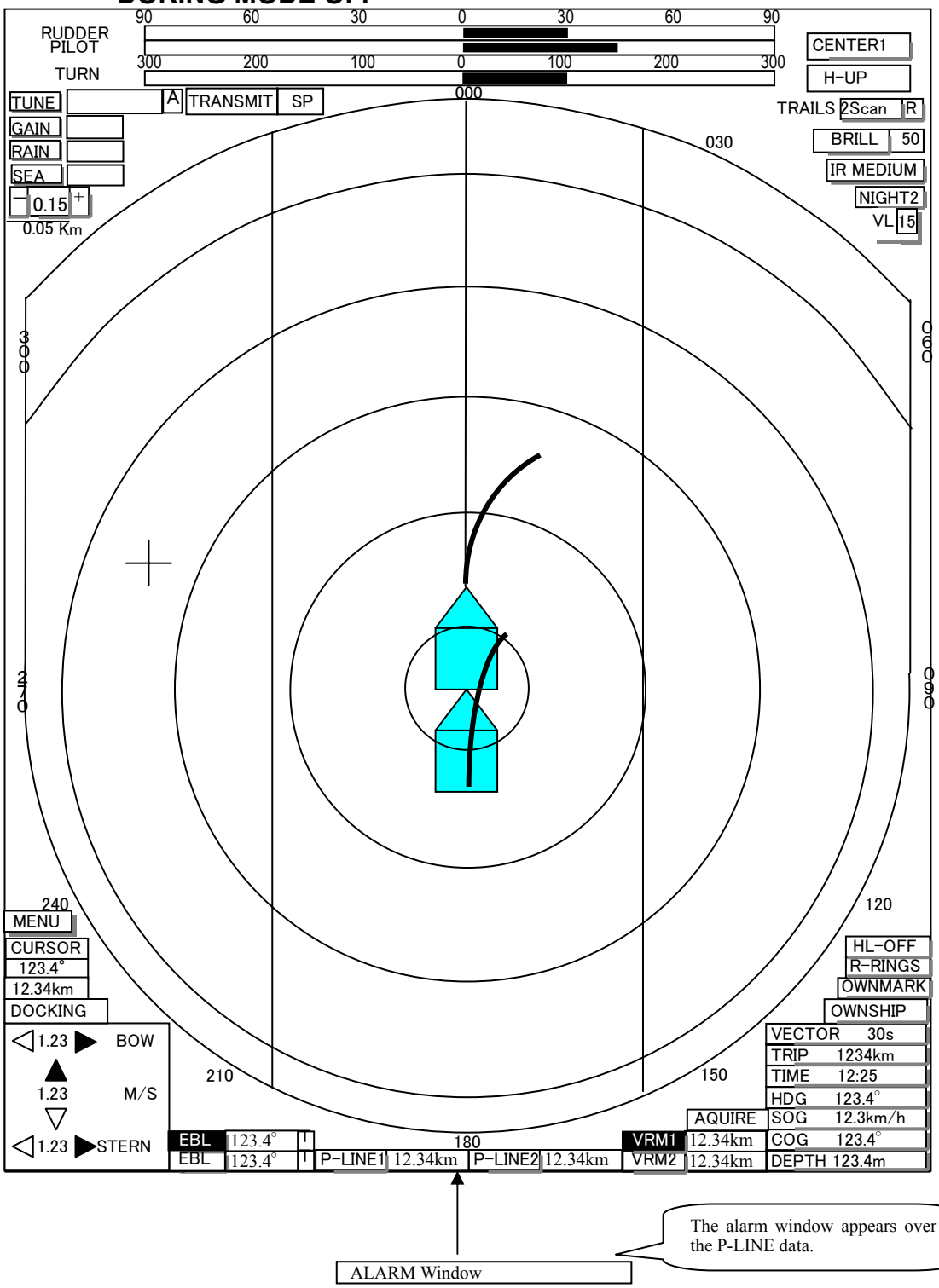
SECTION 2
NAMES AND FUNCTIONS OF CONTROL PANEL SWITCHES AND FUNCTIONS OF SOFTWARE BUTTONS




Range Marker Interval
Range Scale
Tune Indicator
Gain Volume Position
Rain Volume Position
Sea Volume Position
Auto Tuning
Transmit/Standby Indicator
TX Pulse Width
Rudder Indicator
Auto Pilot Indicator
Rate of Turn Indicator
VIDEO LEVEL
Radar Trails Indication Length
Bearing Indicator
On/Off Center Indicator
Display Color Mode
Interference Rejecter Switch
Screen Brilliance
Radar Trails mode
RUDDER
PILOT
TURN
TUNE
GAIN
RAIN
SEA
A
TRANSMIT
SP
0.15
0.05 Km
CENTER1
H-UP
TRAILS 2Scan
R
BRILL 50
IR MEDIUM
NIGHT2
VL 15
MENU
CURSOR
123.4°
1.234km
DOCKING
OWN SHIP
N 12.34.5678
E 123.45.6789
CURSOR
12.34.567' N
123.45.678' E
EBL 123.4°
EBL 123.4°
P-LINE1 1.234km
P-LINE2 1.234km
VRM1 1.234km
VRM2 1.234km
HL-OFF
R-RINGS
OWNMARK
OWNSHIP
VECTOR 30s
TRIP
TIME 12:25
HDG 123.4°
SOG 12.3km/h
COG 123.4°
DEPTH 123.4m
EBL1/2 Bearing
Cursor's position
Own Ship's Position
Cursor Bearing and Range
P-LINE1/2 Range
VRM1/2 Range
Own Ship's Data

2

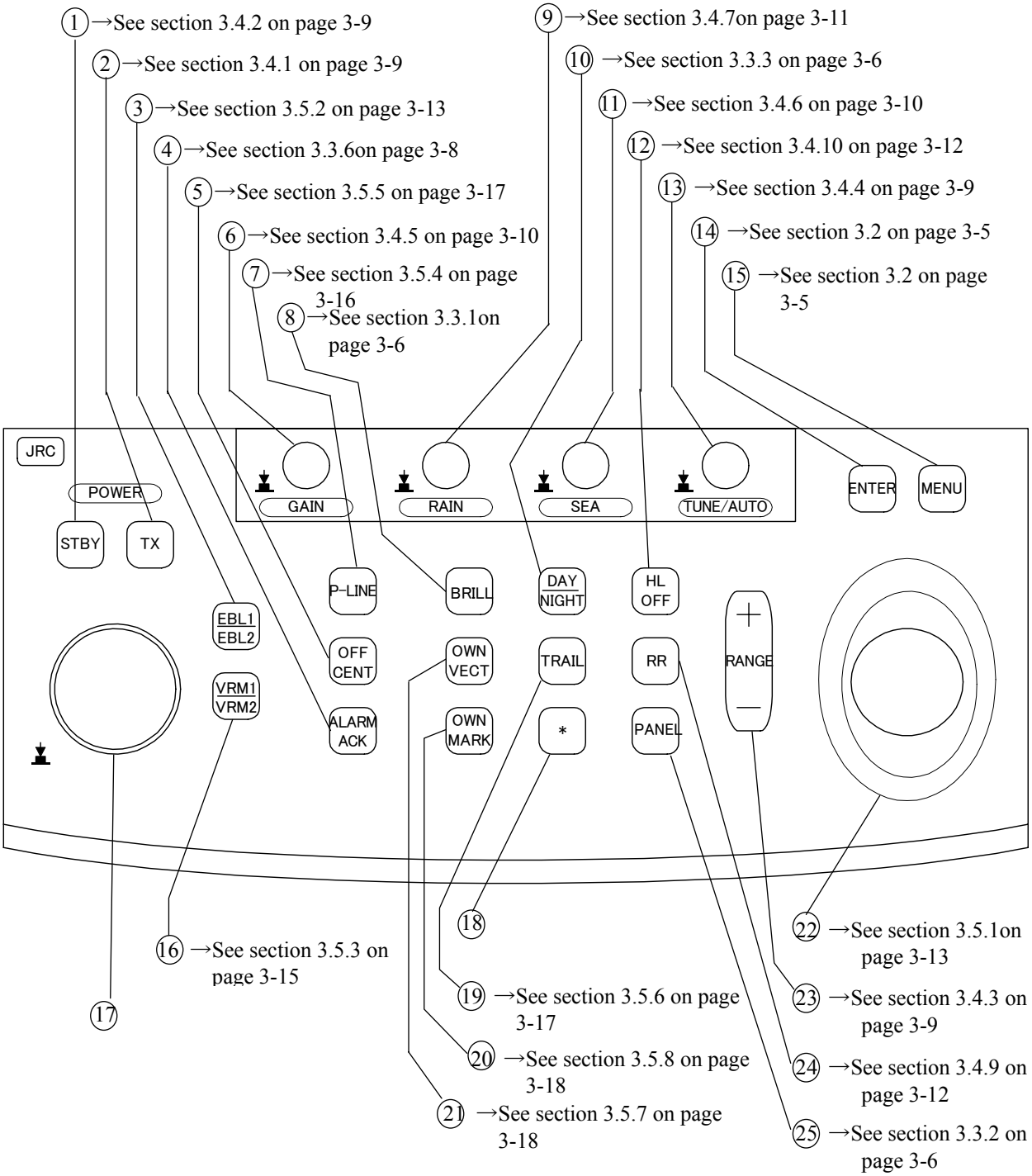
DOKING MODE OFF



DOCKING MODE ON

2.1 NAMES AND FUNCTIONS OF CONTROL PANEL SWITCHES

Names and Functions of Control Panel Switches



The following page describe name of buttons. The Sections and page numbers on the above indicate pages where operation procedures and detailed descriptions are provided.

① [STBY](standby) Switch

Use this switch to change the power-off state to the power-on state, or the transmission state to the standby state.
To turn off the power, press the **[STBY]** switch and **[TX]** switch together.
-> See section 3.4.2 on page 3-9.

② [TX](Transmit) Switch

PREHEAT at the upper left of the radar display changes to STANDBY about 90 seconds after the power is turned on.
Then, press this switch to start transmission.
-> See section 3.4.1 on page 3-9.

③ [EBL1/EBL2] (Electric Bearing Line 1/2) Switch

Use this switch to display and select EBL1/2.
-> See section 3.5.2 on page 3-13.

④ [ALARM ACK] (Alarm Acknowledgement) Switch

Use this switch to acknowledge a failure, target's approach, or collision alarm.
Press the switch to stop an audible alarm.
If more than one alarm has occurred, the switch needs to be pressed the number of times equivalent to the number of alarms.
-> See section 3.3.6 on page 3-8.

⑤ [OFF CENT] (Off Center) Switch

Shifts the own ship's position .
-> See section 3.5.5 on page 3-17.

⑥ [GAIN] (Receiving Sensitivity) Control

Controls the radar's receiving sensitivity.
To get higher sensitivity, turn the control clockwise.
Suppresses the clutter echo from the sea surface.
To heighten a suppressing effect, turn the control clockwise.
The clutter suppression mode switches back and forth between MANUAL and AUTO each time the control is pressed.
-> See section 3.4.5 on page 3-10.

⑦ [P-LINE] (Parallel Index Line) Switch

Use this switch to display and select EBL1/2.
-> See section 3.5.4 on page 3-16.

⑧ [BRILL] (Operation LCD Brilliance) Switch

Controls the brilliance of the special LCD monitor.
-> See section 3.3.1 on page 3-6.

⑨ [RAIN] (RAIN/SNOW Clutter Suppression) Control

Suppresses the clutter echo from rain or snow.
To heighten a suppressing effect, turn the control clockwise.
To control this suppressing effect using Trackball, press the control.
-> See section 3.4.7 on page 3-11.

⑩ [DAY/NIGHT] (DAY/NIGHT MODE) Switch

Switches the screen color and brilliance according to each setting.
-> See section 3.3.3 on page 3-6.

⑪ [SEA] (Sea clutter Suppression) Control

Suppresses the clutter echo from the sea surface.
To heighten a suppressing effect, turn the control clockwise.
To control this suppressing effect using Trackball, press the control.
-> See section 3.4.6 on page 3-10.

⑫ [HL OFF] (Heading Line Off) Switch

Clears the Ship's heading line while this key is being pressed.
-> See section 3.4.10 on page 3-12.

⑬ [TUNE/AUTO] (Tune Control/Automatic) Control

Tunes the receiver of the radar.
Controls the target on the screen to be seen most clearly.
To change to automatic mode, press the control.
-> See section 3.4.4 on page 3-9.

⑭ [ENT] (Enter) Switch

Use this switch to determine menu selection or value input.
Pressing the switch has the same effect as left-clicking the trackball.
-> See section 3.2 on page 3-5.

⑮ [MENU] (Menu) Switch

Opens the menu.
-> See section 3.2 on page 3-5.

⑯ [VRM1/VRM2] (Variable Range Marker 1/2) Switch

Use this switch to display and select EBL1/2.
-> See section 3.5.3 on page 3-15.

⑰ Jog Dial

Use this dial to change the bearing of EBL1/2, the range of VRM1/2 and P-Line 1/2 .

⑱ [＊] (ATA Function) Switch

This switch has no function.

⑲ [TRAIL] (Other Ship's Trails) Switch

Use this switch to display other ship's trail.
-> See section 3.5.6 on page 3-17.

⑳ [OWN MARK] (Own Ship's Mark) Switch

Use this switch to display the own ship's mark according to setting.
-> See section 3.5.8 on page 3-18.

㉑ [OWN VECT] (Own Ship's Vector) Switch

Use this switch to display the own ship's vector.
-> See section 3.5.7 on page 3-18.

㉒ Trackball

Use this trackball to move the cursor mark to an arbitrary point. The trackball can be used for setting in each mode.
-> For setting cursor, see section 3.5.1 on page 3-13.

㉓ [+RANGE-] (Range Scale) Switch

Expands or shrinks the observation range scale.
-> See section 3.4.3 on page 3-9.

㉔ [RR] (Fixed Range Marker) Switch

Use this switch to display the fixed range marker.
-> See section 3.4.9 on page 3-12.

㉕ [PANEL] (Operation Panel Brilliance) Switch

Controls the brilliance for the controls and switches on the operation panel.
The brilliance changes cyclically each time the switch is pressed.
→See section 3.3.2 on page 3-6.

2.2 MENU LIST

This radar has 2 kinds of main menu as following.

MAIN MENU1 : This menu is displayed by pressing **[MENU]** switch when radar is transmitted.

MAIN MENU2 : This menu is displayed by pressing **[MENU]** switch when radar is standby mode.

Turning the trackball, select the item and press the ENTER key.

MAIN MENU1

1.BRILLIANCE	0.PREVIOUS	
	1.RADAR VIDEO/TRAILS	1/2/3/4
	2.FIX RANGE RING	1/2/3/4
	3.VRM	1/2/3/4
	4.EBL／P-LINE	1/2/3/4
	5.BEARING SCALE	0/1/2/3/4
	6CHARACTER	1/2/3/4
	7.ATA/AIS	1/2/3/4
	8.OWN SHIP/2nd SHIP	1/2/3/4

2.COLOR	0.PREVIOUS	
	1.ECHO	YELLOW/GREEN/AMBER/WHITE
	2.TRAILS	GREEN/WHITE/BR BLUE/YELLOW/AMBER
	3.ECHO BACK GROUND	BLACK/BLUE/DARK GREY
	4.DATA BACK GROUND	BLACK/GREY/DARK GREY/BR BLUE
	5.OTHERS	GREEN/AMBER/WHITE/YELLOW
	6.OWN SHIP/2nd SHIP	CYAN/GREY/MAGENTA/GREEN/WHITE

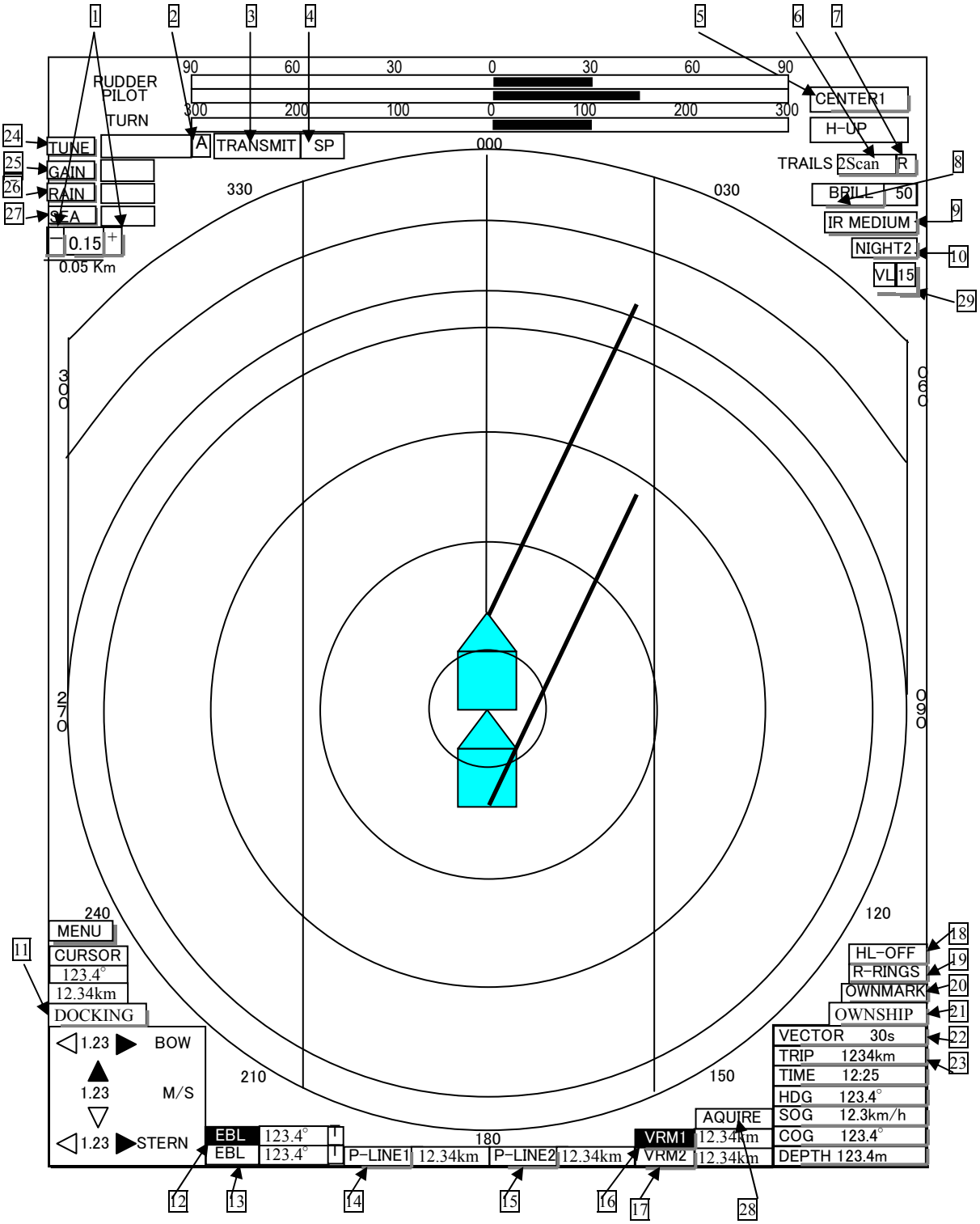
3.SETTING	0.PREVIOUS	
	1.BUZZER LEVEL	OFF/1/2/3
	2.RATE OF TURN	30-0-30/90-0-90/300-0-300
	3.EXPANSION	OFF/FAIR/STRONG

MAIN MENU2

1.SETTING	0.PREVIOUS	
	1.TIME ZONE SETTING	
	2.LOCAL TIME	

2.OWN MARK	0.PREVIOUS	
	1.FILLED	OFF/ON
	2.RADAR TARGETS ON TOP	OFF/ON
	3.OWN SHIP DIMENSION	
	4.OWN SHIP PROFILE	RECTANGLE/PENTAGON
	5. 2nd SHIPS DIMENSION	
	6. 2nd SHIPS PROFILE	RECTANGLE/PENTAGON/OFF

2.3 NAMES AND FUNCTIONS OF ON-SCREEN CONTROLS



Layout on On-screen controls

1 【RANGE】
A click on "+" will increment the RANGE SCALE.
A click on "-" will decrement the RANGE SCALE.

2 【AUTO TUNE】
A click on the box will select either Manual tune, "M" or Auto tune, "A".

3 【TX/STBY】
A click on the box will select either TRANSMIT or STANDBY.

4 【PULSE LENGTH】
A click on the box will cycle trough the available pulse lengths.

5 【OFF-CENTER】
A click on the box will cycle the center mode as follows.
CENTER1⇒CENTER2⇒CENTER3⇒OFF

6 【LENGTH ON THE TRAILS】
A click on the box will cycle the length of trails as follows.
2Scan⇒15sec⇒30sec⇒1min⇒2min⇒3min⇒4min⇒5min
⇒6min⇒OFF
Clicking and holding down the box over 2 seconds will set the trails to OFF.

7 【MODE OF THE TRAILS】
A click on the box will select TRUE TRAILS,"T", or RELATIVE TRAILS,"R".

8 【BRILLIANCE】
A click on the box will enable brilliance adjustment.
The brilliance can be change by [JOG DIAL] or [TRACK-BALL] and [ENTER] key.

9 【INTERFERENCE REJECTION】
A click on the box will cycle IR mode as follows.
IR OFF⇒IR LOW⇒IR MEDIUM⇒IR HIGH

10 【DAY/NIGHT】
A click on the box will cycle the display mode as follows.
DAY1⇒DAY2⇒DAY3⇒DAY4
⇒NIGHT1⇒NIGHT2⇒NIGHT3⇒NIGHT4

11 【DOCKING】
A click on the box will open or close DOCKING display.

12 13 【EBL】
Refer to Section 3.5.2.

16 17 【VRM】
Refer to Section 3.5.3.

18 【HL OFF】
With the cursor positioned on the box, pressing and holding the [ENTER] key will remove the HEADING LINE from the display. When the key is released, the line is showed again.

19 【RANGE RINGS】
A click on the box selects between RANGE RINGS ON and OFF.

20 【OWN SHIP MARK】
A click on the box selects between OWN SHIP MARK ON and OFF.

21 【OWN SHIP INFORMATION】
A click on the box selects between ON and OFF of the OWN SHIP IFORMATION.

22 【VECTORS】
A click on the box will cycle the vector time as follows.
VECTOR OFF⇒VECTOR 5S⇒VECTOR 10S⇒VECTOR 20S⇒
⇒VECTOR 30S⇒VECTOR 60S⇒VECTOR 120S
Pressing and holding down the [ENTER] key on the box over 2 seconds will set the VECTOR OFF.

23 【TRIP COUNTER】
Pressing and holding down the [ENTR] key on the box will clear the TRIP COUNTER.

24 【TUNE】
Pressing the [ENTER] key on the box, you can adjust TUNE with [TRACK BALL]. If you want to adjust TUNE with [TUNE] knob, press [TUNE] knob on keyboard.

25 【GAIN LEVEL】
Pressing the [ENTER] key on the box, you can adjust GAIN with [TRACK BALL]. If you want to adjust GAIN with [GAIN] knob, press [GAIN] knob on keyboard.

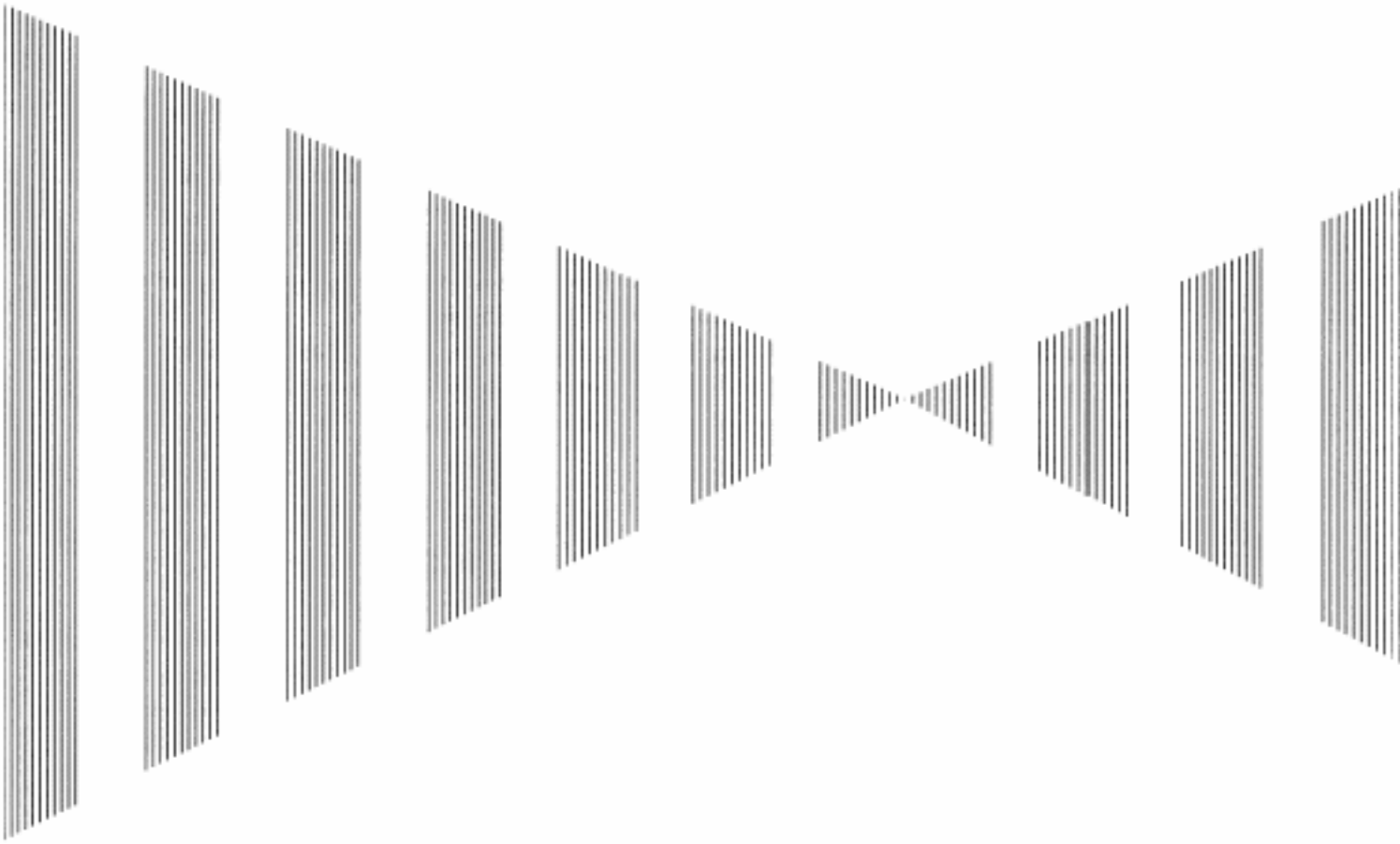
26 【RAIN CLUTTER SUPPRESSION LVEL】
Pressing the [ENTER] key on the box, you can adjust RAIN with [TRACK BALL]. If you want to adjust RAIN with [RAIN] knob, press [RAIN] knob on keyboard.

27 【SEA CLUTTER SUPPRESION LVEL】
Pressing the [ENTER] key on the box, you can adjust SEA CLUTTER SUPPRESION LEVEL with [TRACK BALL]. If you want to adjust SEA CLUTTER SUPPRESION LEVEL with [SEA] knob, press [SEA] knob on keyboard.

28 **【ARPA】**
The box is disabled.

29 **【VIDEO LVEL】**
A click on the box will cycle the VIDEO LEVEL.

SECTION 3
BASIC OPERATION

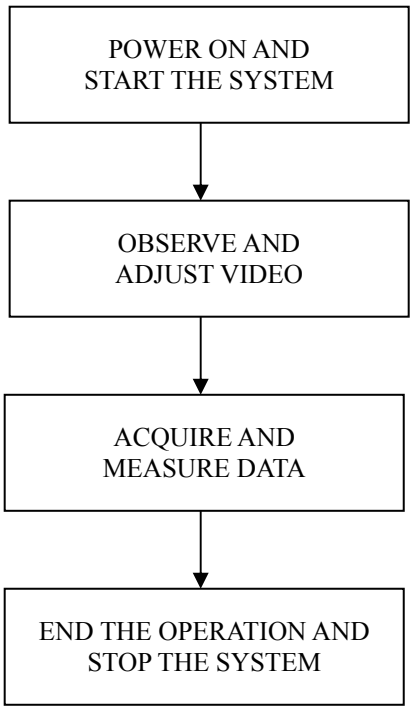


3.1 FLOW OPERATION

Attention

- **Do not put anything on the operation panel.**
  If you put anything hot on it, it may be deformed.

- **Do not give any impact to the operation panel, trackball, or controls.**
  Otherwise, any failure or damage may result.



Each operation is described in detail below.

3.1.1 Power ON and Start the System

Caution

A malfunction may occur if the power in the ship is instantaneously interrupted during operation of the radar. In this case, the power should be turned on again.

Attention

- **Wait for about 2 seconds before turning on the power again.**
- **Immediately after the radar is installed, at start of the system after it has not been used for a long time, or after the magnetron is replaced, preheat the equipment in the standby state for 20 to 30 minutes before setting it into the transmit state.**
- **If the preheating time is short, the magnetron causes sparks, resulting in its unstable oscillation. Start transmission on a short-pulse range and change the range to the longer pulse ranges in turn. If the transmission is unstable in the meantime, immediately place the system back into the standby state and maintain it in the standby state for 5 to 10 minutes before restarting the operation. Repeat these steps until the operation is stabilized.**

Procedures

1 Check that the ship's mains are turned on.

2 Press [STBY] key.

The system is turned on, and the preheating time is displayed.
PREHEAT is indicated at the upper left of the radar display.

3 Wait until the preheating time is over.

When the preheating time is over, the preheating time screen disappears, and PREHEAT at the upper left of the radar display changes to STANDBY.

4 Press [TX] key.

The radar will start transmission and the antenna will start rotating.
STANDBY at the upper left of the radar display changes to TRANSMIT.

Note: The radar does not start transmission if you press [TX] key while PREHEAT is indicated.

3.1.2 Observe and Adjust Video

Procedures

1 Press [+RANGE-] key to set the range to the scale required for target observation.

2 Turn the controls [GAIN], [SEA], and [RAIN] to obtain the clearest targets.

3.1.3 Acquire and Measure Data

For details on data acquisition and measurement, refer to Section 3.4 "BASIC OPERATIONS" and Section 4 "MEASUREMENT OF RANGE AND BEARING."

3.1.4 End the Operation and Stop the System

Exit

1 Press [STBY] key.

The radar will stop transmission and the antenna will stop rotating.
TRANSMIT at the upper left of the radar display changes to STANDBY.

(Maintain the standby state if radar observation is restarted in a relatively short time.
Only pressing the **[TX]** key starts observation.)

2 Press the [STBY] key and the [TX] key together.

The system will be turned off.

Warning

When conducting maintenance work, make sure to turn off the power and unplug the power line of the processor so that the power supply to the equipment is completely cut off.
Some equipment components can carry electrical current even after the power switch is turned off, and conducting maintenance work without unplugging the power connector may result in electrocution, equipment failure, or accidents.

3.2 MENU COMPOSITION

The Menu system of this radar equipment consists of the main menu and the submenus up to the lower 2 levels. This radar has 2 kinds of main menu as following.

MAIN MENU1 : This menu is displayed at the lower left by pressing **[MENU]** switch while the transmission mode.

MAIN MENU2 : This menu is displayed at the lower left by pressing **[[MENU]** switch while the standby mode.

Press [MENU] key while the transmission mode.

↓

MAIN MENU1	
0. EXIT	
1. BRILLIANCE	>
2. COLOUR	>
3. SETTING	>

↓

Select item with trackball and Press [ENT] key.

↓

BRILLIANCE	
0.PREVIOUS	4
1.RADAR VIDEO/TRAILS	4
2.FIX RANGE RING	4
3.VRM	4
4.EBL/P-LINE	4
5.BEARING SCALE	4
6.CHARACTER	4
7.ATA/AIS	4
8.OWN SHIP/2nd SHIP	4

↓

Select item with trackball and Press [ENT] key.

↓

1
2
3
4

↓

Select item with trackball and Press [ENT] key.

To open the menu:

Press **[MENU]** key.

To close the menu:

Press key **[MENU]** again.

To determine the selected item:

Place the cursor over the selected item with trackball and then press **[ENT]** key.

3.3 PREPARATION

3.3.1 Adjust Display Brilliance [BRILL]

NOTE : This [BRILL] key is only for the special display (is not for NWZ-147). In the case of NWZ-147, turn the knob on NWZ-147.

Procedures

1 Press [BRILL] key .

2 Set the brilliance value with the [JOG DIAL] or [TRACKBALL] and [ENTER] key.

3.3.2 Adjust Operation Panel Brilliance [PANEL]

Procedures

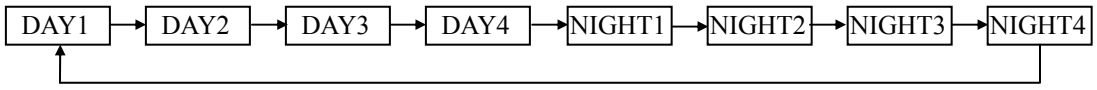
1 Press [PANEL] key to adjust the brilliance of the operation panel light.

There are five brilliance levels (include off) , and brilliance increases by one level each time the **[PANEL]** key is pressed. When it reaches the highest level, it is resumed to the lowest level (off).

In consideration of the ambient brightness, adjust panel brilliance that is high enough to read the characters on the operation panel but does not glare.

3.3.3 Switch Day/Night Mode [DAY/NIGHT]

The day/night mode changes in the following sequence each time the **[DAY/NIGHT]** key is pressed:



The current mode is indicated at the upper right of the radar display.
The brilliance level and the display color in accordance with the selected mode is saved.

3.3.4 Adjust Brilliance of Information on Radar Display (Brilliance Setting)

Brilliance can be adjusted for each item of information (shown below) on the radar display by operating the menu.
RADAR VIDEO & TRAILS, FIX RANGE RING, VRM, EBL & P-LINE, BEARING SCALE, CHARACTER, ATA/AIS, PANEL

Procedures

1 Press [MENU] key while the transmission mode.

Place the cursor over [1.BRILLIANCE] with trackball and then press [ENT] key.

The Brilliance Setting menu will appear.

2 Select the item with trackball for which brilliance is to be adjusted, pressing [ENT] key.

The brilliance levels menu will appear.

3 Select the brilliance level number to be set with trackball, pressing the [ENT] key.

The selected brilliance level will be set.

Exit

1 Press [MENU] key.

The menu will be closed.

Note: The brilliance levels set here are saved in accordance with the day/night mode.

3.3.5 Adjust Sound Volume (Buzzer Volume)

Procedures

1 Press [MENU] key while the transmission mode.
Place the cursor over [3.SETTING] with trackball and then press [ENT] key.

The setting menu will appear.

2 Place the cursor over [1.BUZZER LEVEL] with trackball and then press [ENT] key.

The buzzer levels menu will appear.

3 Select the volume number to be set with trackball, and press the [ENT] key.
The selected volume level will be set.

Exit

1 Press [MENU] key.

The menu will be closed.

3.3.6 Reset Alarm Buzzer [ALARM ACK]

When an audible alarm is issued, use ALARM ACK to acknowledge the alarm information, stop the alarm buzzing, and stop the alarm lamp flashing. (If more than one alarm has occurred, press the switch for each alarm indication.) The alarm stops buzzing, but the alarm indication does not disappear.

Procedures

1 Press [ALARM ACK] key.

The alarm will stop buzzing.

3.3.7 Set Display Color

Color can be adjusted for each item of information (shown below) on the radar display by operating the menu.

1.ECHO	Adjusts the colors of radar echoes.
2.TRAILS	Adjusts the colors of radar trails.
3.ECHO BACK GROUND	Adjusts the background color inside the bearing scale.
4.DATA BACK GROUND	Adjusts the background color outside the bearing scale.
5.OTHERS	Adjusts the colors of characters and etc.
6.OWN SHIP	Adjusts the colors of own mark.

Procedures

1 Press [MENU] key while the transmission mode.

Place the cursor over [2.COLOR] with trackball and then press [ENT] key.

The color-setting menu will appear.

2 Select the item with trackball for which color is to be adjusted, press the [ENT] key.

The kinds of color menu will appear.

Select the color to be set with trackball, pressing the [ENT] key.

The selected color will be set.

Exit

1 Press [MENU] key.

The menu will be closed.

Note: The display color set here are saved in accordance with the day/night mode.

3.4 BASIC OPERATIONS

3.4.1 Start Transmission [TX]

Procedures **1 Press [TX] key.**

The radar will start transmission and the antenna will start rotating.
The indication STANDBY at the upper left of the radar display changes to TRANSMIT.

Note: The radar does not start transmission if you press **[TX]** key while PREHEAT is indicated.

3.4.2 Stop Transmission [STBY]

Procedures **1 Press [STBY] key.**

The radar will stop transmission and the antenna will stop rotating.
The indication TRANSMIT at the upper left of the radar display changes to STANDBY.

3.4.3 Change Range (Observation Range Scale) [+RANGE-]

Procedures **1 Press [+RANGE-] key or [RANGE-] key to set the range to the scale required for target observation.**

To observe long-range targets, press upper side of this key.
To zoom and observe a short-range target near the own ship, press lower side of this key.

3.4.4 Tune

This control is used to tune the receiver.
When the tuning does not match, the receiver sensitivity decreases and the operator may miss weak or distant target.

Procedures **1 Press [+RANGE-] key to select 16km or 32 m.**

2 Turn [TUNE] control.

Adjust the video for best presentation.
If radar display does not show a weak target, adjust the control until the tuning bar on the upper left of the screen indicates the maximum.

To use Auto tuning mode

Procedures

1 Continue pressing [TUNE] control until the character on the right of the tuning bar changes to "A".
Select auto tuning mode.

2 Continue pressing [TUNE] control again.

"A" on the right of tuning bar changes to "M", changes to manual mode.

Note: After tune adjustment with software button once, push the **[TUNE]** knob for tune adjustment with **[TUNE]** knob.

3.4.5 Control Sensitivity [GAIN]

Procedures

1 Control noise on the radar display by turning the [GAIN] control until targets can be easily observed.

Turning **[GAIN]** control clockwise increases sensitivity.
Turning **[GAIN]** control counterclockwise decreases sensitivity.

Turning the **[GAIN]** control clockwise increases receiving sensitivity and extends the radar observation range. If the sensitivity is too high, the receiver noise increases reducing the contrast between the targets and the background video. As a result, the targets become obscure on the radar display.
To observe densely crowded targets or short-range targets, turn the **[GAIN]** control counterclockwise to reduce the sensitivity so that the targets are easy to observe. However, be careful not to overlook important small targets.
Note: After gain adjustment with software button once, push the **[GAIN]** knob for gain adjustment with **[GAIN]** knob.

3.4.6 Suppress Sea Clutter [SEA]

⚠ Caution

When using the [SEA] function, never set the suppression level too high canceling out all image noises from the sea surface at close range.
Detection of not only echoes from waves but also targets such as other ships or dangerous objects will become inhibited.
When using the [SEA] function, make sure to choose the most appropriate image noise suppression level.

Procedures

1 Control the sea clutter returns on the radar display by turning the [SEA] control until targets can be easily observed.

Turning **[SEA]** control clockwise suppresses sea clutter returns.
Turning **[SEA]** control counterclockwise intensifies sea clutter returns.

The sea clutter suppression function suppresses sea clutter returns by decreasing the receiving sensitivity on a short range.
Turning the **[SEA]** control clockwise heightens the effect of sea clutter suppression.
However, be careful that excessive suppression causes low signal-strength targets such as buoys and boats to disappear from the radar display.

Note: After STC adjustments with software button once, push the **[SEA]** knob for STC adjustment with **[SEA]** knob.

3.4.7 Suppress Rain/Snow Clutter [RAIN]

Caution

When using the [RAIN] function, never set the suppression level too high canceling out all image noises from the rain or snow at the close range.
Detection of not only echoes from the rain or snow but also targets such as other ships or dangerous objects will become inhibited.
When using the [RAIN] function, make sure to choose the most appropriate image noise suppression level.

Procedures

1 Control the rain/snow clutter returns on the radar display by turning the [RAIN] control until targets can be easily observed.

Turning **[RAIN]** control clockwise suppresses rain/snow clutter returns.
Turning **[RAIN]** control counterclockwise intensifies rain/snow clutter returns.

When the **[RAIN]** control is turned clockwise, the rain/snow clutter suppression function suppresses rain/snow clutter returns and gets targets hidden by rain/snow clutter returns to appear on the radar display. However, be careful that excessive suppression may cause small targets to be overlooked. Since the rain/snow clutter suppression function also has the effect of suppressing sea clutter, the suppression efficiency improves when the **[RAIN]** control is used with the **[SEA]** control. In general, turn the **[RAIN]** control fully to the left.

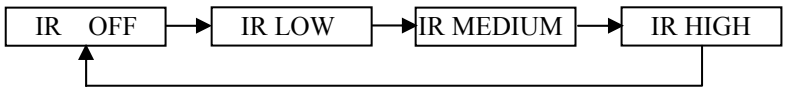
Note: After rain adjustment with software button once, push the **[RAIN]** knob for rain adjustment with **[RAIN]** knob.

3.4.8 Reject Radar Interference [IR]

Procedures

1 Place the cursor over [IR]icon at the upper right of the radar display with trackball and then press [ENT] key.

Changes in the following sequence each time the **[ENT]** key is pressed.



Rejection levels of the interference rejecter
IR OFF: Interference rejecter off
IR LOW: Interference rejection level - low
IR MEDIUM: Interference rejection level - moderate
IR HIGH: Interference rejection level - high

When a high interference rejection level is selected, the radar's ability of detecting small targets such as buoys and small boats lowers.
In general, **[IR LOW]** should be selected.

Attention

- **When viewing a radar beacon or SART signal, select IR OFF (Interference Rejector OFF) because IR processing suppresses the video.**

3.4.9 Hide/Display Range Rings (RINGS)

Procedures

1 Press [RR] key.

The range rings display switches back and forth between display and non-display each time **[RR]** key is pressed.

3.4.10 Hide Ship's Heading Line (HL OFF)

Procedures

1 Hold down [HL OFF] key.

The ship's heading line is hidden while **[HL OFF]** key is held down.

The ship's heading line (HL) that presents the course of own ship is always shown on the radar display. The heading line is hidden while **[HL OFF]** key is held down, so the targets on the heading line can be easily observed.

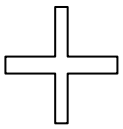
3.5 GENERAL OPERATIONS

3.5.1 Move Cross Cursor Mark by Trackball

The cross cursor mark [+] is used for position designation and other purposes in various operating procedures. The cross cursor mark [+] moves in coupling with the trackball. If the trackball is rotated up and down or right and left, the cross cursor mark follows the move of the trackball.
Operators must be familiar with trackball operation before running the system.

Operation inside Radar Video PPI

The cross cursor mark as shown at right is displayed inside the radar video PPI.



1) The distance and bearing between own ship and the cross cursor mark [+] , and the degrees of latitude and longitude are digitally indicated at the lower left of the radar display.
   NOTE : The display of degrees of latitude and longitude needs the connection of GPS and heading sensor.

Operation outside Radar Video PPI

As shown at right, the cursor mark changes into the pointer outside the radar video PPI.

1) Use the pointer to operate software buttons.
2) Use the pointer to select menu items.

3.5.2 Use EBLs (Electronic Bearing Lines) [EBL1/EBL2]

EBLs (Electronic Bearing Lines) are indispensable to the measurement of bearings.
Operators must be familiar with the operation of EBLs beforehand.

EBL1 Operation

If EBL2 is selected or EBL1 is not displayed, press **[EBL1/EBL2]** key to select EBL1 before starting operation.
(The currently selected EBL is shown in reverse video at the lower left of the radar display.)

Procedures

1 Press [EBL1/EBL2] key to select EBL1.

EBL1 at the lower left of the radar display will be shown in reverse video, and EBL1 becomes operable.

2 Adjust the bearing of EBL1 with [JOG DIAL] or [TRACKBALL].

3 Press [ENT] key.

The bearing of EBL1 is fixed .

EBL2 Operation

If EBL1 is selected or EBL2 is not displayed, press **[EBL1/EBL2]** key to select EBL2 before starting operation.
(The currently selected EBL is shown in reverse video at the lower right of the radar display.)

Procedures

1 Press [EBL1/EBL2] key to select EBL2.

EBL2 at the lower left of the radar display will be shown in reverse video, and EBL2 becomes operable.

2 Adjust the bearing of EBL2 with [JOG DIAL] or [TRACKBALL].

3 Press [ENT] key.

The bearing of EBL2 is fixed.

CLEARING EBL

Procedures

1 Hold down [EBL1/EBL2] key.

The EBL (current selected EBL) display will disappear.

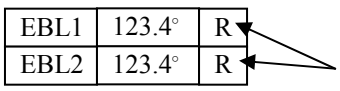
SETTING EBL DISPLAY

Select EBL true and relative bearing display.

Procedures

1 Place the cursor over the position at the bottom left as following figure. Press [ENT] key.

The bearing mode is switched back and forth between true and relative.



3.5.3 Use VRMs (Variable Range Markers) [VRM1/VRM2]

This function is to display and select variable range markers (VRMs). Two VRMs are available: VRM1 is represented as a broken line, and VRM2 as a dotted line. When EBL1 is displayed, VRM1 marker appears on the EBL1. When EBL2 is displayed, VRM2 marker appears on the EBL2.

VRM markers displayed on EBL1/EBL2
○ mark: VRM1
● mark: VRM2

VRM1 Operation

If VRM2 is selected or VRM1 is not displayed, press **[VRM1/VRM2]** key to select VRM1 before starting operation.
(The currently selected VRM is shown in reverse video at the lower right of the radar display.)

Procedures

1 Press [VRM1/VRM2] key to select VRM1.

VRM1 at the lower right of the radar display will be shown in reverse video, and VRM1 becomes operable.

2 Adjust the range of VRM1 with [JOG DIAL] or [TRACKBALL].

3 Press [ENT] key .

The range of VRM1 is fixed .

VRM2 Operation

If VRM1 is selected or VRM2 is not displayed, press **[VRM1/VRM2]** key to select VRM2 before starting operation.
(The currently selected VRM is shown in reverse video at the lower right of the radar display.)

Procedures

1 Press [VRM1/VRM2] key to select VRM2.

VRM2 at the lower right of the radar display will be shown in reverse video, and VRM2 becomes operable.

2 Adjust the range of VRM2 with [JOG DIAL] or [TRACKBALL].

3 Press [ENT] key .

The range of VRM2 is fixed.

CLEARING VRM

Procedures

1 Hold down [VRM1/VRM2] key.

The VRM (current selected VRM) display will disappear.

3.5.4 Use P-LINEs (Parallel Index Lines) [P-LINE]

P-LINE1 Operation

If P-LINE2 is selected or P-LINE1 is not displayed, press **[P-LINE]** key to select P-LINE1 before starting operation.
(The currently selected P-LINE is shown in reverse video at the lower left of the radar display.)

Procedures

1 Press [P-LINE] key to select P-LINE1.

P-LINE1 at the lower left of the radar display will be shown in reverse video, and P-LINE1 becomes operable.

2 Adjust the range from own ship's position of P-LINE1 with [JOG DIAL] or [TRACKBALL].

3 Press [ENT] key.

The range of P-LINE1 is fixed.

P-LINE2 Operation

If P-LINE1 is selected or P-LINE2 is not displayed, press **[P-LINE]** key to select P-LINE2 before starting operation.
(The currently selected EBL is shown in reverse video at the lower right of the radar display.)

Procedures

1 Press [P-LINE] key to select P-LINE2.

P-LINE2 at the lower left of the radar display will be shown in reverse video, and P-LINE2 becomes operable.

2 Adjust the bearing of EBL1 with [JOG DIAL] or [TRACKBALL].

3 Press [P-LINE] key.

The range of P-LINE2 is fixed.

CLEARING P-LINE

Procedures

1 Hold down [P-LINE] key.

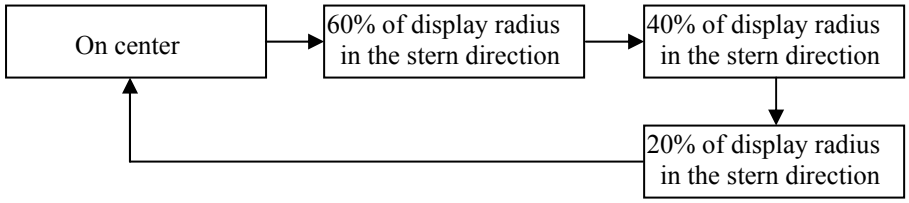
The P-LINE (current selected P-LINE) display will disappear.

3.5.5 Move Own Ship's Display Position [OFF CENT]

The own ship's position can be moved from the display center to stern or bow direction.

Procedures **1 Press [OFF CENT] key.**

The own ship's position will be moved from the display center as following sequence each time the **[OFF CENT]** key is pressed:

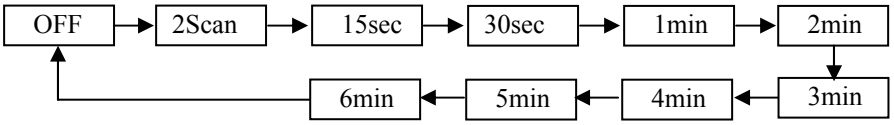


3.5.6 Display Other Ships' Trails [TRAILS]

Other ships' movements and speeds can be monitored from the lengths and directions of their trails, serving for collision avoidance.

Procedures **1 Press [TRAIL] key.**

Trails length will be changed as following sequence each time the **[TRAIL]** key is pressed.



Erasing Trails Data

Procedures **1 Continue Pressing [TRAIL] key .**

All the stored trails data will be erased.

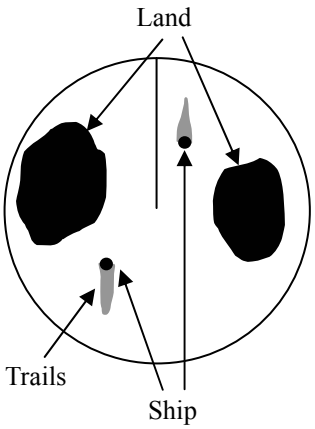
Trails Motion Mode

There are two types of trails: relative motion trails and true motion trails.

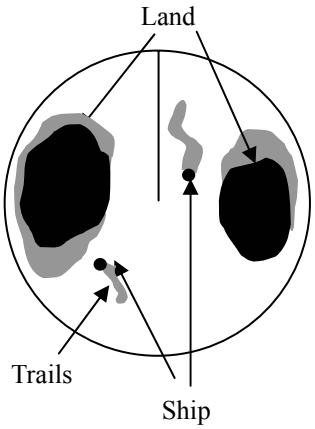
Relative motion trails: The system plots the trails of a target at a position relative to the own ship. The operator can easily judge whether the target is approaching the own ship. While the own ship is moving, the system also plots the trails of land and other fixed targets.

True motion trails: The system plots the absolute motion trails of a target, irrespective of the own ship's position. The operator can easily judge the course and speed of the target. The system does not plot the trails of land and other fixed targets.

NOTE : The display of true motion trail needs the connection of the speed sensor and heading sensor.



True Motion Trails

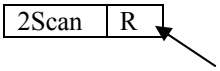


Relative Motion Trails

Changing Motion Mode of Trails (Trails mode)

Procedures **1 Place the cursor over the position at the upper right as following figure. Press [ENT] key.**

The motion mode of trails is switched back and forth between true and relative.

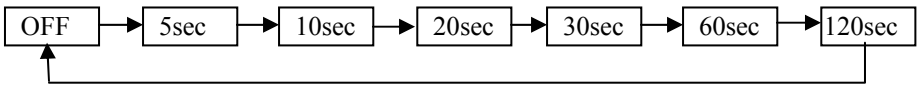


3.5.7 Display Own Vector [OWN VECT]

NOTE : The display of own vector need the connection of the speed sensor and the Heading sensor.

Procedures **1 Press [OWN VECT] switch.**

Own vector is switched each time ,the vector length is changed as following.



3.5.8 DISPLAY OWN MARK

Procedures **1 Press [OWN MARK] key.**

The own mark display switches back and forth between display and non-display each time **[OWN MARK]** key is pressed.

Editing own mark dimension

Procedures

1 Press [MENU] key when radar is standby mode.

MAIN MENU2 will appear.

2 Place the cursor over [2.OWN MARK] with trackball and then press [ENTER] key.

OWN MARK menu will appear.

3 Place the cursor over [3.OWN SHIPS DIMENSION] with trackball and then press [ENTER] key.

DIMENSION menu will appear.

4 Place the cursor over the item to change the dimension with trackball And then press [ENTER] key.

5 Decide the value with [JOG DIAL] or trackball and then press [ENTER] key.

Paint own mark

Procedures

1 Press [MENU] key when radar is standby mode.

MAIN MENU2 will appear.

2 Place the cursor over [2.OWN MARK] with trackball and then press [ENTER] key.

OWN MARK menu will appear.

3 Place the cursor over [1.FILLED] with trackball and then press [ENTER] key.

ON/OFF menu will appear.

4 Place the cursor over [ON] with trackball and then press [ENTER] key.

"OFF" will changes to “ON”.

Change own mark’s figure

Procedures

1 Press [MENU] key when radar is standby mode.

MAIN MENU2 will appear.

2 Place the cursor over [2.OWN MARK] with trackball and then press [ENTER] key.

OWN MARK menu will appear.

3 Place the cursor over [4.OWN SHIP PROFILE] with trackball and then press [ENTER] key.

Own ship profile menu will appear.

4 Place the cursor over [RECTANGLE] with trackball and then press [ENTER] key.

Own mark's figure will change from "PENTAGON" to "RECTANGLE".

Change the priority of ECHO and OWN MARK

Procedures

1 Press [MENU] key when radar is standby mode.

MAIN MENU2 will appear.

2 Place the cursor over [2.OWN MARK] with trackball and then press [ENTER] key.

OWN MARK menu will appear.

3 Place the cursor over [1.RADAR TARGETS ON TOP] with trackball and then press [ENTER] key.

ON/OFF menu will appear.

4 Select "ON" or "OFF" with trackball and then press [ENTER] key.

Editing 2nd ship dimension

Procedures

1 Press [MENU] key when radar is standby mode.

MAIN MENU2 will appear.

2 Place the cursor over [2.OWN MARK] with trackball and then press [ENTER] key.

OWN MARK menu will appear.

3 Place the cursor over [5.2nd SHIP DIMENSION] with trackball and then press [ENTER] key.

DIMENSION menu will appear.

4 Place the cursor over the item to change the dimension with trackball And then press [ENTER] key.

5 Decide the value with [JOG DIAL] or trackball and then press [ENTER] key.

Change 2nd ship figure

Procedures

1 Press [MENU] key when radar is standby mode.

MAIN MENU2 will appear.

2 Place the cursor over [2.OWN MARK] with trackball and then press [ENTER] key.

OWN MARK menu will appear.

3 Place the cursor over [6. 2nd SHIP PROFILE] with trackball and then press [ENTER] key.

2nd ship profile menu will appear.

4 Place the cursor over [RECTANGLE] with trackball and then press [ENTER] key.

Own mark's figure will change from "PENTAGON" to "RECTANGLE".

3.5.9 TIME ZONE SETTING

Local time is displayed at the bottom right. Adjust the time as following.

Procedures

1 Press [MENU] key when radar is standby mode.

MAIN MENU2 will appear.

2 Place the cursor over [1.SETTING] with trackball and then press [ENTER] key.

SETTING menu will appear.

3 Place the cursor over [1.TIME ZONE SETTING] with trackball and then press [ENTER] key.

TIME ZONE SETTING menu will appear.

4 Adjust the time with [JOG DIAL] or trackball and then press [ENTER] key.

3.5.10 LOCAL TIME SETTING

Procedures

1 Press [MENU] key when radar is standby mode.

MAIN MENU2 will appear.

2 Place the cursor over [1.SETTING] with trackball and then press [ENTER] key.

SETTING menu will appear.

3 Place the cursor over [2.LOCAL TIME] with trackball and then press [ENTER] key.

LOCAL TIME SETTING menu will appear.

4 Adjust the time with [JOG DIAL] or trackball and then press [ENTER] key.

3.5.11 CHANGE THE UNIT OF RATE OF TURN

Procedures

1 Press [MENU] key when radar is transmitted.

MAIN MENU1 will appear.

2 Place the cursor over [3.SETTING] with trackball and then press [ENTER] key.

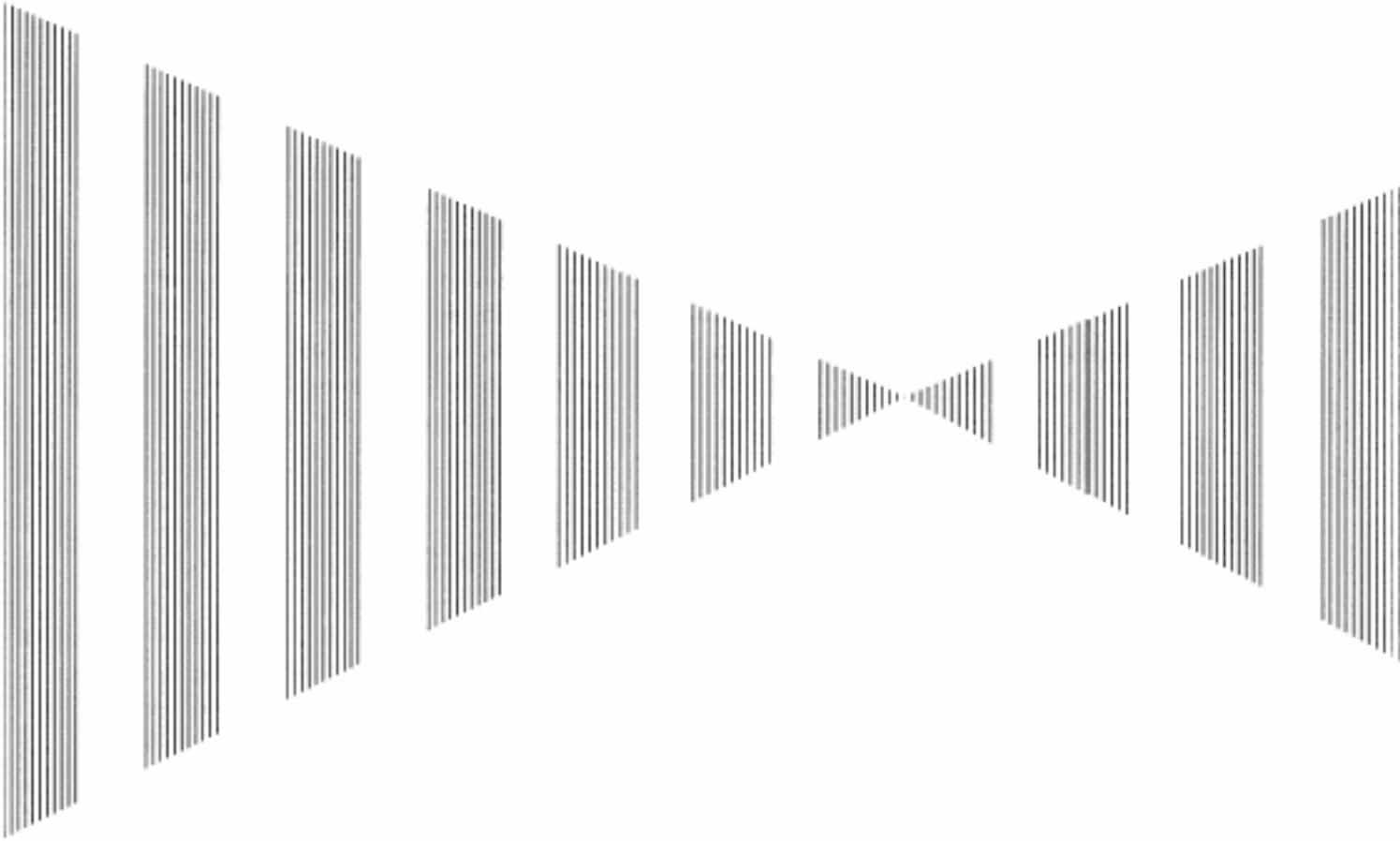
SETTING menu will appear.

3 Place the cursor over [2.RATE OF TURN] with trackball and then press [ENTER] key.

The unit of RATE OF TURN will appeare.

4 Select the unit with trackball and then press [ENTER] key.

SECTION 4
MEASUREMENT OF RANGE AND BEARING



4.1 MEASUREMENT BY TRACKBALL

Procedures

1 Check the target echoes on the radar display.

2 Move the cursor mark to a target by the trackball.

The CURSOR on the radar display indicates the bearing and range of the target. The range is a distance from own ship's position.

CURSOR
45.0°: True bearing of the cursor relative to own ship
3km: Range between the cursor and own ship

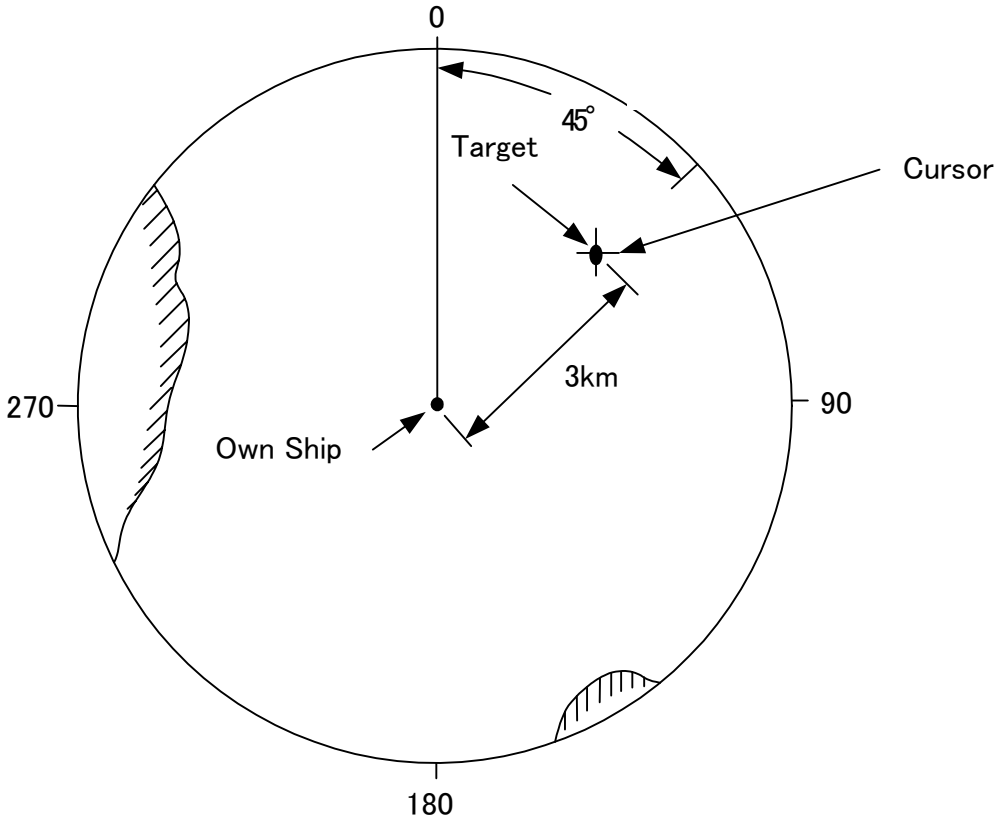


Figure 4.1

4.2 MEASUREMENT BY RANGE RINGS

Procedures **1 Press [RR] key.**

The Range Rings will appear on the radar display.
The range between the target and own ships can be determined by visually measuring the target's position that lies between two range rings.

4.3 MEASUREMENT BY EBLS AND VRMS····

Procedures

1 Press [EBL1/EBL2] key to select EBL1 display and operation.

The EBL1 indication at the lower left of the radar display will be selected and the EBL1 will appear as a broken-line on the PPI display.

2 Turn the [JOG DIAL] to put EBL1 on a target.

The bearing of the EBL1 will appear at the lower left of the radar display. The EBL1 bearing represents the target's bearing.

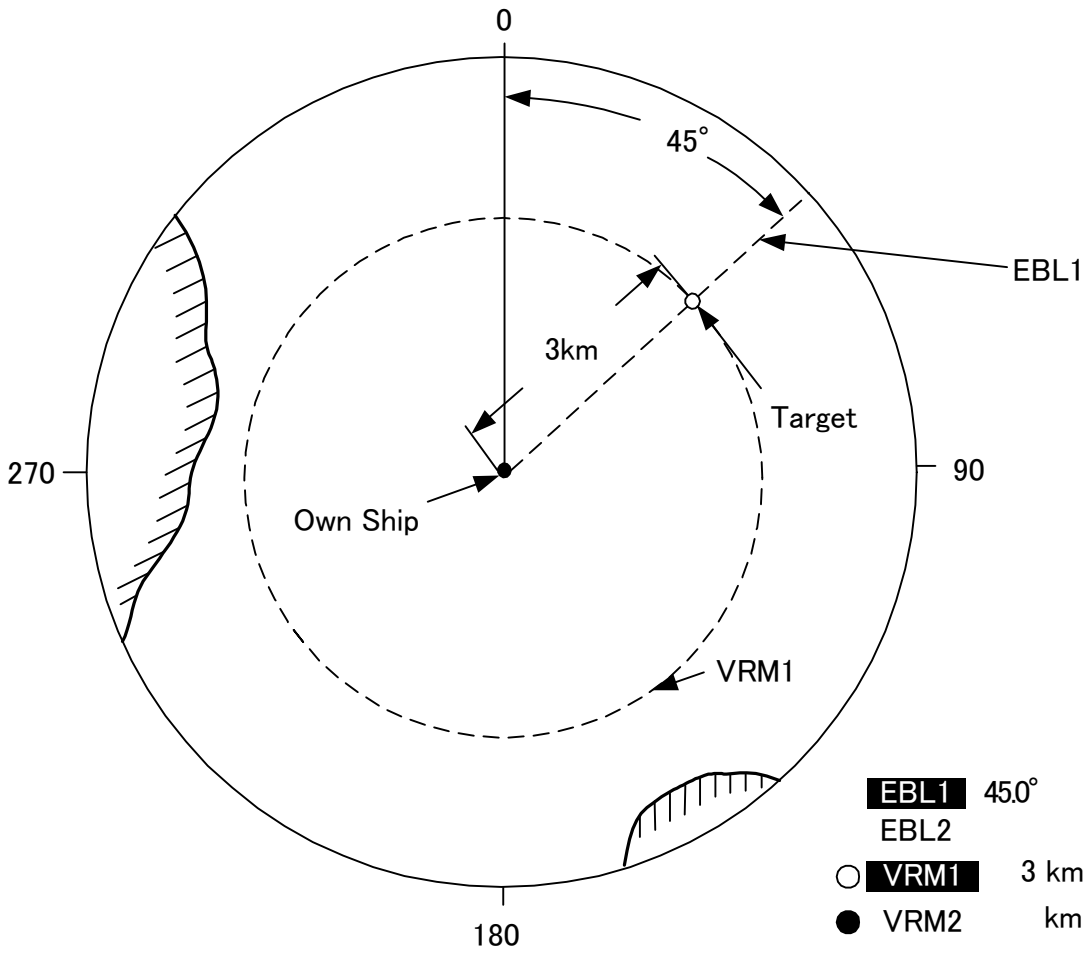
3 Press [VRM1/VRM2] key to select VRM1 display and operation.

The VRM1 indication at the lower right of the radar display will be selected and the VRM1 will appear as a broken-line circle on the PPI display.

4 Move the broken-line VRM1 to the target by using the [JOG DIAL] control.

The range of the VRM1 from own ship will appear at the lower right of the radar display. The range of VRM1 signifies a distance between the target and own ship.

Refer to **Figure 4.2** in the next page.
In this **Figure 4.2**, the range and bearing are;
Range: 3km
Bearing: 45.0°


0
45°
EBL1
3km
Target
270
90
Own Ship
VRM1
180
EBL1 45.0°
EBL2
VRM1 3 km
VRM2 km

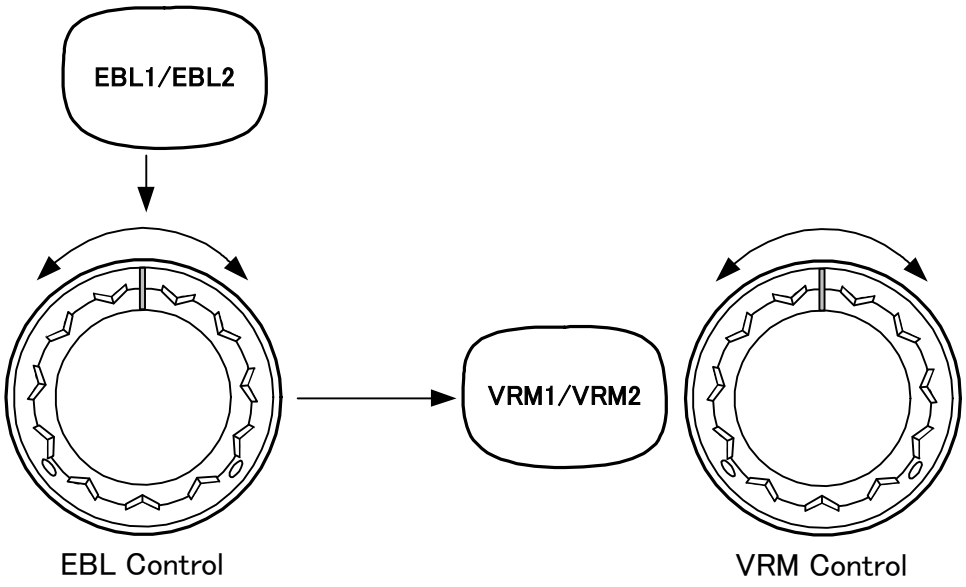
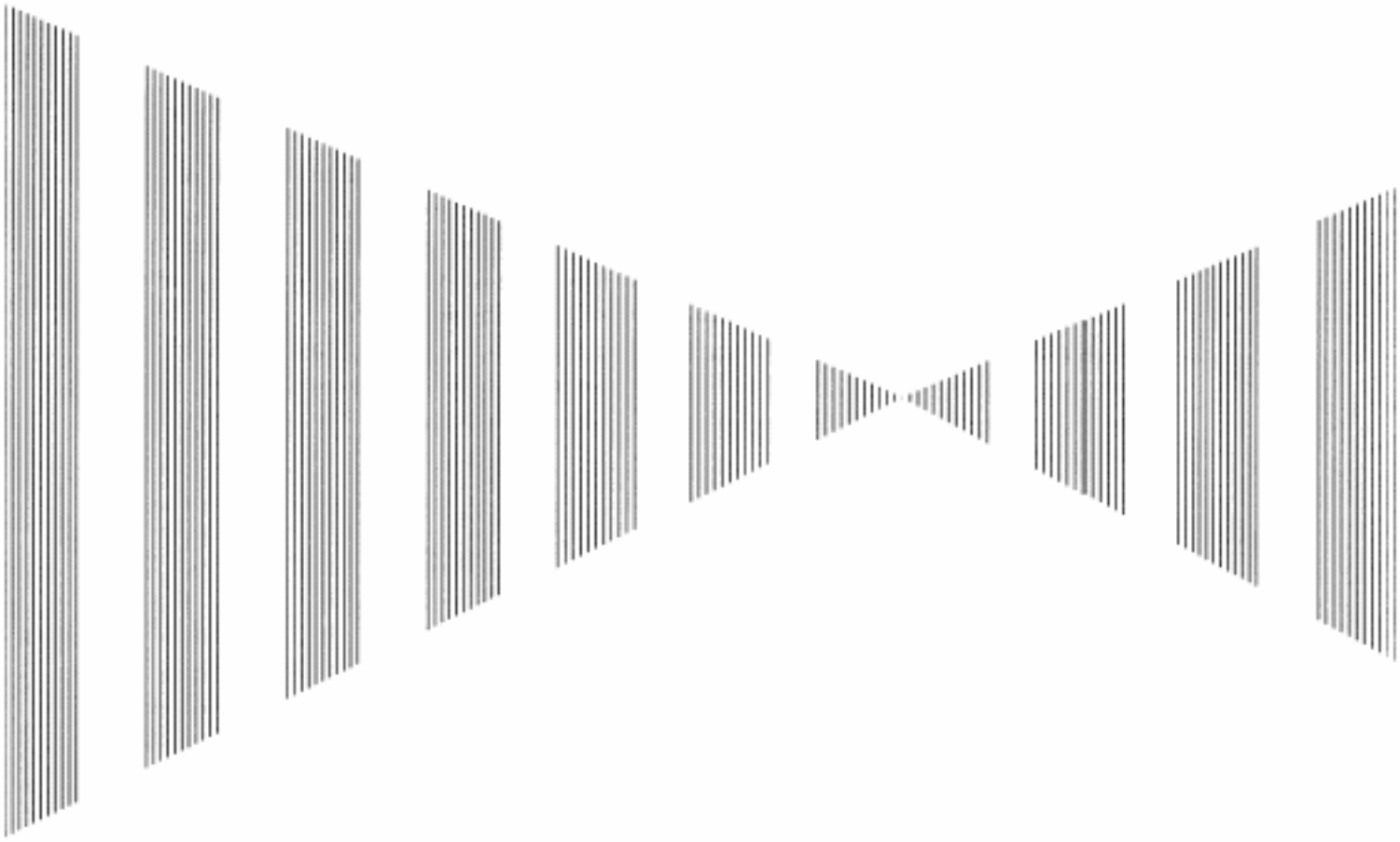

EBL1/EBL2
VRM1/VRM2
EBL Control
VRM Control

Figure 4.2

SECTION 5
TRUE AND FALSE ECHOES ON DISPLAY



The radar operator has a role of interpreting the radar displays to provide his best aid in maneuvering the ship. For this purpose, the operator has to observe the radar displays after fully understanding the advantages and disadvantages that the radar has. For better interpretation of radar display, it is important to gain more experiences by operating the radar equipment in fair weathers and comparing the target ships watched with the naked eyes and their echoes on the radar display.

The radar is mainly used to monitor the courses of own ship and other ships in open seas, to check buoys and other nautical marks when entering a port, to measure own ship's position in the coastal waters relative to the bearings and ranges of the shore or islands using a chart, and to monitor the position and movement of a heavy rain if it appears on the radar display.

Various types of radar display will be explained below.

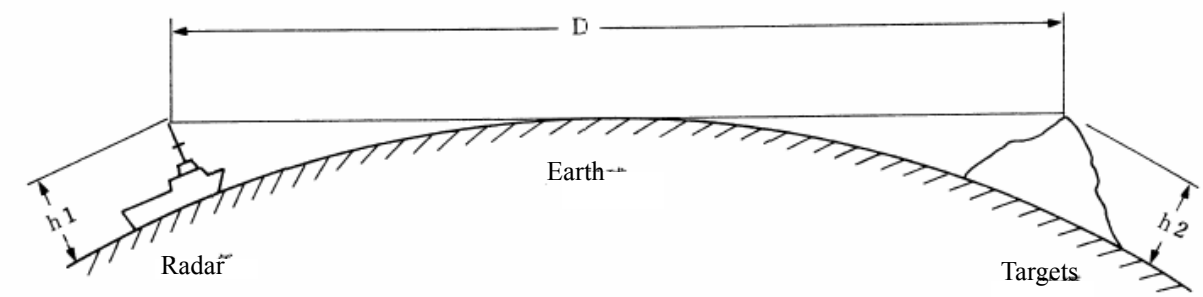
5.1 RADAR WAVE WITH THE HORIZON

Radar beam radiation has the nature of propagating nearly along the curved surface of the earth.
The propagation varies with the property of the air layer through which the radar beam propagates.
In the normal propagation, the distance (D) of the radar wave to the horizon is approximately 10% longer than the distance to the optical horizon. The distance (D) is given by the following formula:

$D=2.23(\sqrt{h1}+\sqrt{h2})$(nm)

h1: Height (m) of radar scanner above sea level
h2: Height (m) of a target above sea level

Figure 5.1 is a diagram for determining the maximum detection range of a target that is limited by the curve of the earth surface in the normal propagation.



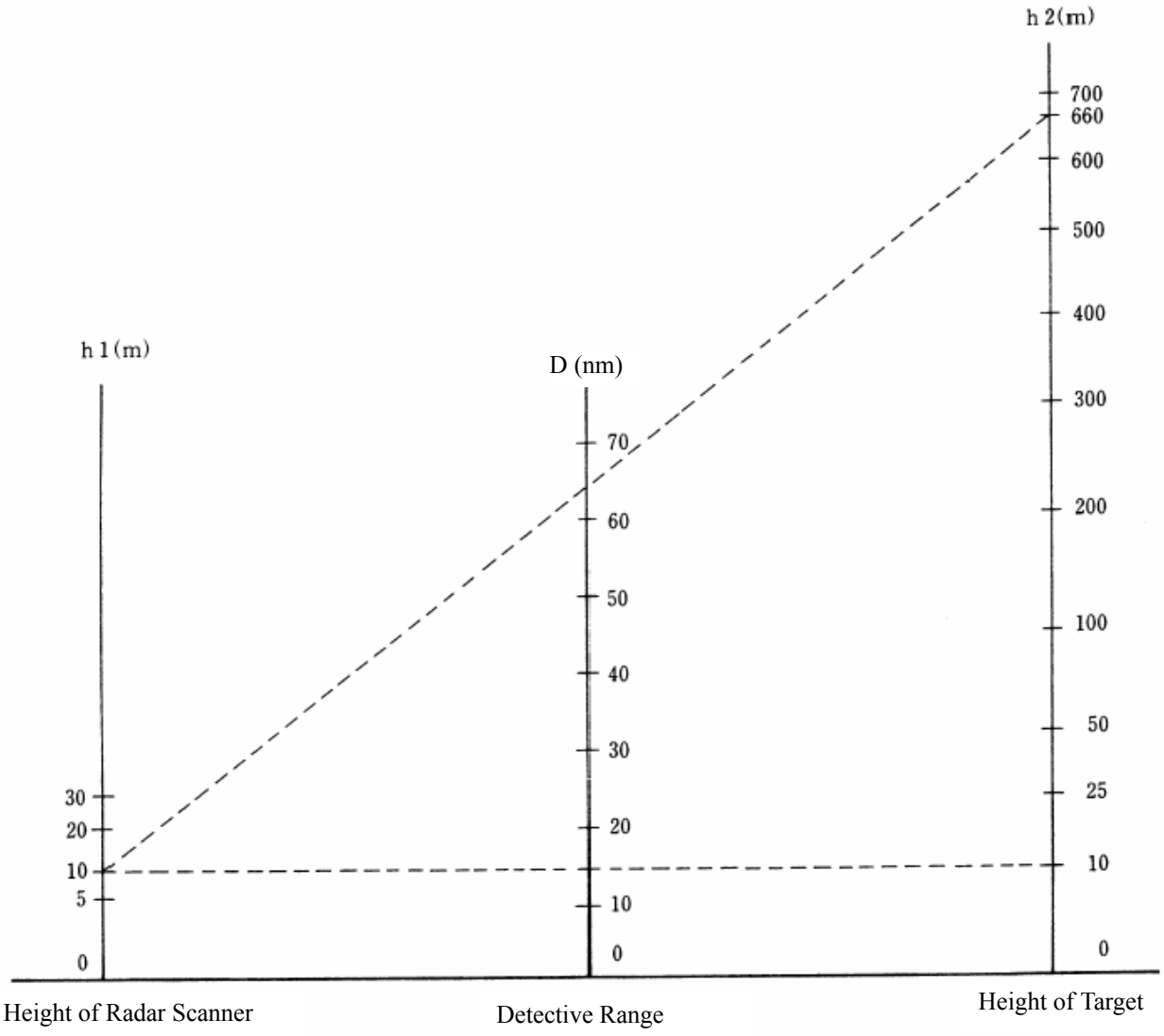


Figure 5.1

When the height of own ship's scanner is 10 m for instance,

(a) A target that can be detected at the radar range of 64 nm on the radar display is required to have a height of 660 m or more.

(b) If the height of a target is 10 m, the radar range has to be approx. 15 nm. However, the maximum radar range at which a target can be detected on the radar display depends upon the size of the target and the weather conditions, that is, the radar range may increase or decrease depending upon those conditions.

5.2 STRENGTH OF REFLECTION FROM THE TARGET

The signal intensity reflected from a target depends not only on the height and size of the target but also on its material and shape. The echo intensity from a higher and larger target is not always higher in general.
In particular, the echo from a coast line is affected by the geographic conditions of the coast.
If the coast has a very gentle slop, the echo from a mountain of the inland appears on the radar display.
Therefore, the distance to the coast line should be measured carefully.

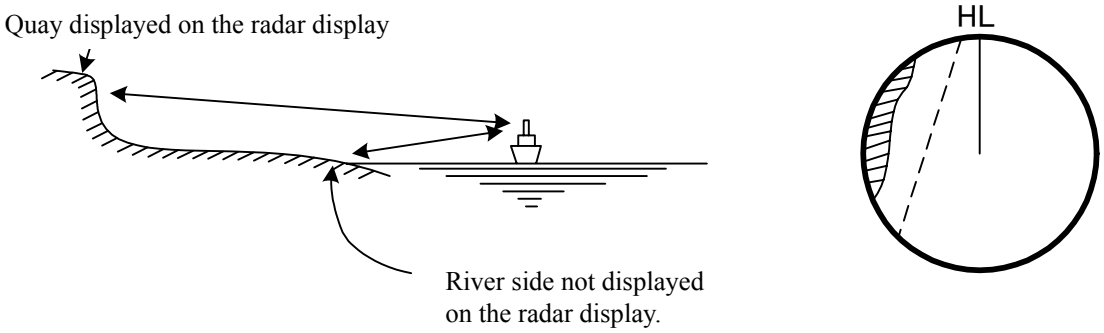


Figure 5.2

5.3 SEA CLUTTERS

When the sea surface ruffles, bright echo returns spread around the center of the radar display.
The higher the waves are, the echo returns are larger.
Swirling currents may appear as a smooth line like a coastal line.

5.4 FALSE ECHOES

The radar observer may be embarrassed with some echoes that do not exist actually. These false echoes appear by the following causes that are well known:

[I] Shadow

When the radar scanner is installed near a funnel or mast, the echo of a target that exists in the direction of the funnel or mast cannot appear on the radar display because the radar beam is reflected on the funnel or mast. Whether there are some false echoes due to shadows can be checked monitoring the sea clutter returns, in which there may be a part of weak or no returns.
Such shadows appear always in the same directions, which the operator should have in mind in radar operation.

[II] Side Lobe Effect

A broken-line circular arc may appear at the same range as the main lobe of the radar beam on the radar display. This type of false echo can easily be discriminated when a target echo appears isolated. (See Figure 5.3)

Figure 5.3

[III] False Echo by Secondary Reflection

When a target exists near own ship, two echoes from the single target may appear on the radar display.
One of those echoes is the direct echo return from the target and the other is the secondary reflection return from a mast or funnel that stands in the same direction as shown in Figure 5.4.

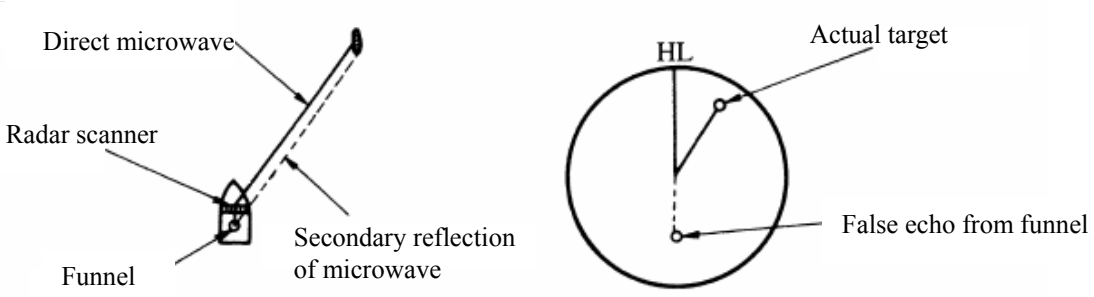


Figure 5.4

[IV] False Echo by Multiple Reflection

When there is a large structure or ship with a high vertical surface near own ship as shown in Figure 5.5, multiple refection returns may appear on the radar display. These echoes appear in the same intervals, of which the nearest echo is the true echo of the target.

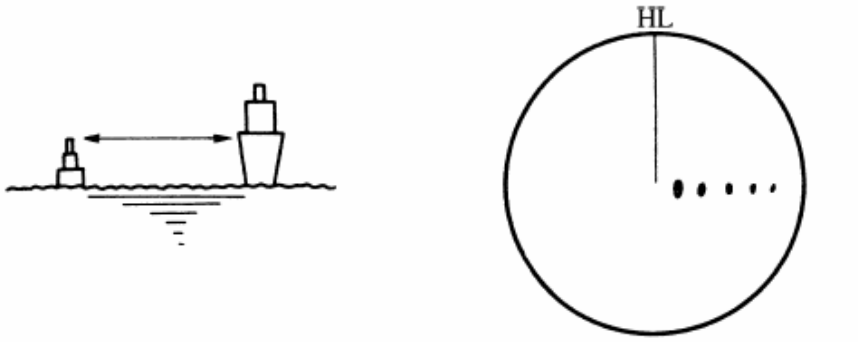


Figure 5.5

[V] Abnormal Propagation

The maximum radar detection range depends upon the height of the scanner and the height of a target as described in the section of "The Horizon for Radar Beam Radiation". If a so-called "duct" occurs on the sea surface due to a certain weather condition, however, the radar beam may propagate to a abnormally long distance, at which a target may be detected by the radar.

For instance, assuming that the radar range is 4 km (on the repetition frequency of 4000 Hz), the first pulse is reflected from a target at about 37.5 km or more and received during the next pulse repetition time. In this case, a false echo appears at a position that is about 37.5 km shorter than the actual distance.

If the false echo appears at 5 NM on the radar display, the true distance of the target is 2+37.5=39.5 km.

This type of false echo can be discriminated by changing over the range scale (the repetition frequency), because the distance of the target changes accordingly.

[VI] Radar Interference

When another radar equipment using the same frequency band as that on own ship is near own ship, a radar interference pattern may appear on the radar display. This interference pattern consists of a number of spots which appear in various forms. In many cases, these spots do not always appear at the same places, so that they can be discriminated from the target echoes. (See Figure 5.6)

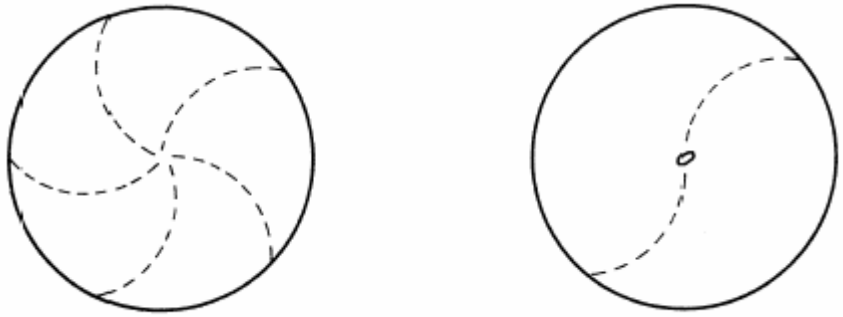


Figure 5.6

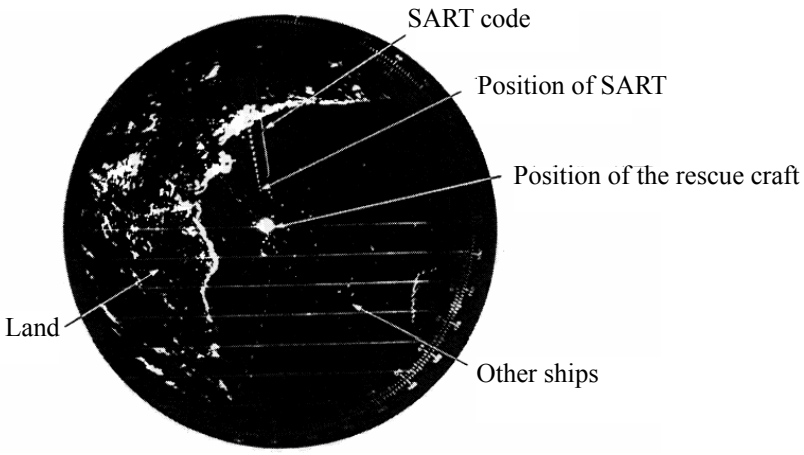
If radar equipment causing an interference pattern and this radar are of the same model, their transmitting repetition frequency is nearly the same. As a result, interference patterns may be displayed concentrically.
In this case, the interference patterns cannot be eliminated by using only the interference reflector function, so press **[TX/PRF]** several times to fine-tune the transmitting repetition frequency.
An interference suppressing effect can be heightened by applying a different transmitting repetition frequency to the interference pattern source radar and this radar.

5.5 DISPLAY OF RADAR TRANSPONDER (SART)

The SART (Search and rescue Radar Transponder) is a survival device authorized by the GMDSS (Global Maritime Distress and Safety System), which is used for locating survivors in case that a distress accident occurs at sea. The SART is designed to operate in the 9 GHz frequency band.
When receiving the 9 GHz radar signal (interrogating signal) transmitted from the radar equipment on a rescue ship or search aircraft, the SART transmit a series of response signals to inform the distress position to the rescue and search party.

The setting for SART signal reception

(1)	Sea clutter control:	Minimum (Most counterclockwise)
(2)	AUTO SEA function:	OFF
(3)	Rain and Snow Clutter Control (RAIN):	minimum
(4)	Auto Rain and Snow Clutter Yesterday (AUTO RAIN):	minimum
(5)	TUNE control:	No tuning (to weaken clutter echoes)
(6)	Interference rejector (IR):	OFF

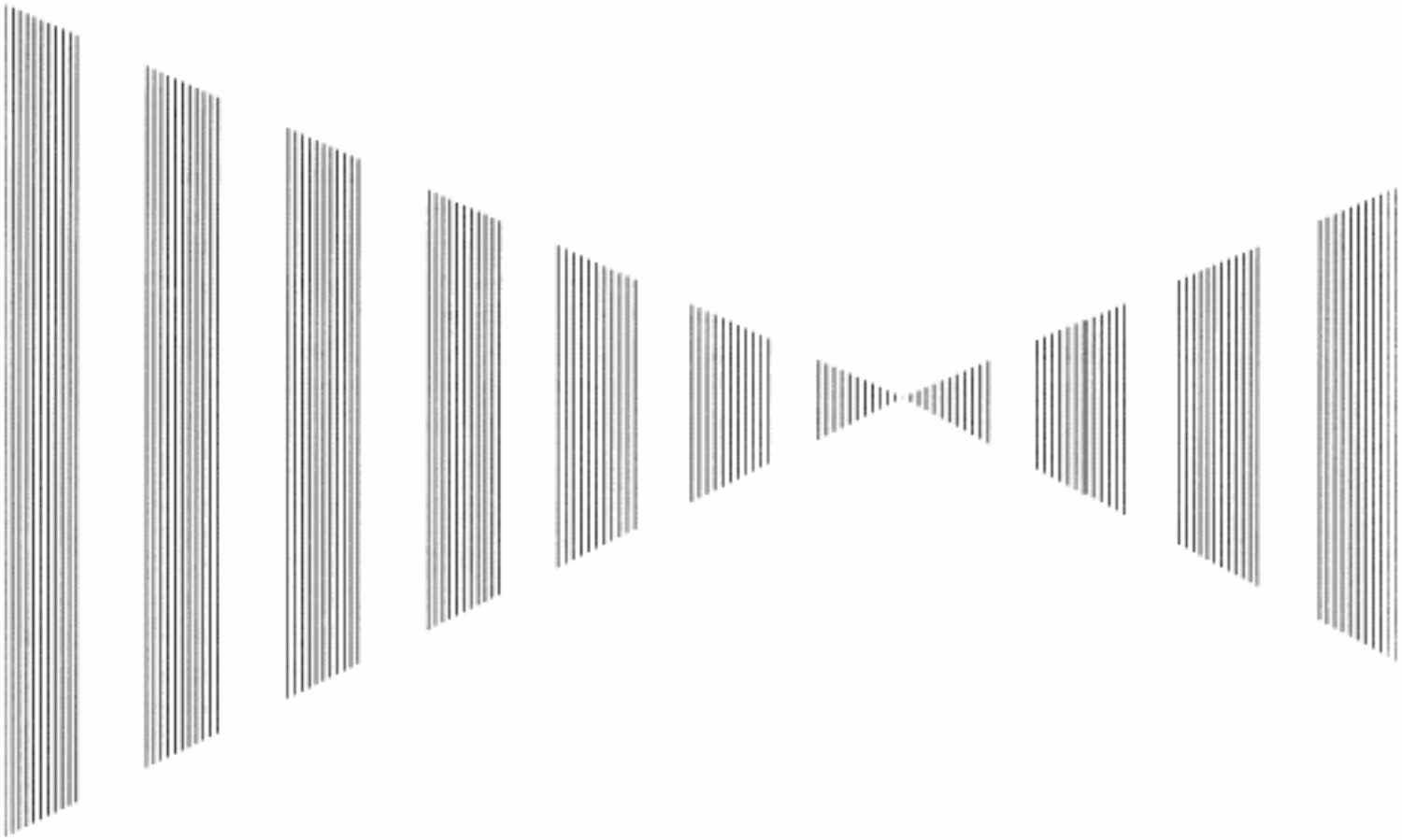


[Example of Display]

Attention

- **When you set the radar to detect the SART signal, small targets around own ship will disappear from the radar display. So it is necessary to exercise full surveillance over the conditions around own ship by visual watch in order to avoid any collision or stranding.**
  If two or more sets of radar equipment are installed on own ship, use one set of 9 GHz band radar for detection of the SART signal and operate others as normal radars for avoiding collision, monitoring targets around own ship, and checking on own ship's position and avoidance of stranding.
  After end of detecting the START signal, adjust the radar normally again. Then the radar returns normally to the nautical mode.

SECTION 6
MAINTEMANCE



6.1 ROUTINE MAINTENANCE

WARNING

Never carry out internal inspection or repair work of the equipment by users.

Inspection or repair work by unauthorized personnel may result in fire hazard or electric shock.

Ask the nearest branch, business office or a dealer for inspection and repair.

Turn off the main power before maintenance work. Otherwise, an electric shock may result.

Turn off the main power before cleaning the equipment. Especially, make sure to turn off the indicator if a rectifier is used. Otherwise, equipment failure, or death or serious injury due to electric shock may result, because voltage is outputted from the rectifier even when the radar is not operating.

For operating the radar equipment in the good conditions, it is necessary to make the maintenance work as described below. If maintenance is made properly, troubles will reduce. It is recommended to make regular maintenance work.
Common points of maintenance for each unit are as follow:

Clean the equipment.

Remove the dust, dirt, and sea water rest on the equipment cabinet with a piece of dry cloth.
Especially, clean the air vents with a brush for good ventilation.

6.2 MAINTENANCE ON EACH UNIT

Scanner Unit NKE-283

⚠ WARNING

Turn off the main power source before starting maintenance.

Otherwise, an electric shock or injury may be caused.

Turn off the main power if you need to be near the scanner unit for maintenance or inspection purposes. Direct exposure to electromagnetic waves at close range in death or serious injury.

Set the safety switch for stopping the scanner unit to the OFF position.

Otherwise, an accidental contact with the rotating scanner unit may cause injury.

⚠ CAUTION

Do not put watches, clocks, or magnetic cards close to the modulator unit since this unit holds magnetrons having strong magnetic force. Failure or data destruction of the above devices may result.

After finishing the maintenance work, reset the safety switch to the ON position.

Precautions in Mounting the Cover

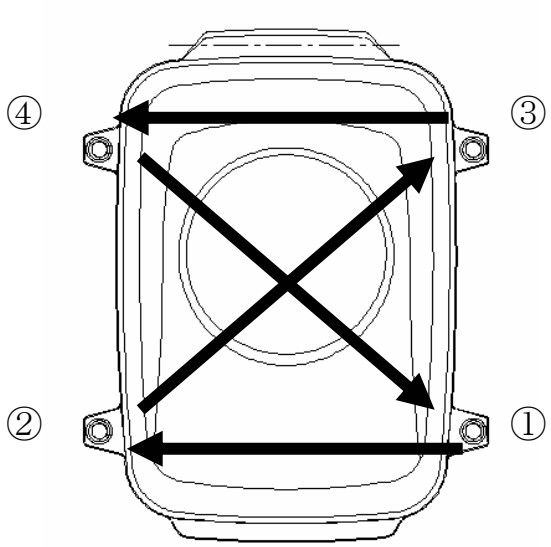
When the cover is removed for regular checkup and replacement of parts and refitted after such work, the procedures of fastening bolts shall be taken with the following precautions:

(a) The proper fastening torque of the fitting bolts (M8) is 1176 to 1470 N•cm (120 to 150kgf•cm) (which makes the inside water-tight and protects the packings against permanent compressive strain).
The packings start producing from the cover at a torque of approximately 1470N•cm (150kgf•cm).
Do not fasten the bolts with a torque exceeding the specified value. Otherwise, the screws may be broken.

(b) Use an offset wrench of 11 mm × 13 mm or a double-ended wrench of 13 mm × 17 mm (not longer than 200 mm).

(c) Screw all the bolts by hand first to prevent them playing, then fasten them evenly in order not to cause one-sided fastening. (Fasten the bolts with 25% of the required torque at the first step.)

*: Fasten the bolts in the diagonal order.



Top View of NKE-283
Bolt Tightening Procedure of NKE-283 Cover

(1) Radiator

Attention

- **If the radiator front face (radiation plane) is soiled with smoke, salt, dust, paint or birds' droppings, wipe it with a piece of soft cloth wetted with alcohol or water and try to keep it clean at all times. Otherwise, radar beam radiation may attenuate or reflect on it, resulting in deterioration of radar performance.**
- **Never use solvents of gasoline, benzine, trichloroethylene and ketone for cleaning. Otherwise, the radiation plane may deteriorate.**

Check up and clean the radiator.

(2) Rotating section

(a) Supply Oil Seal
When there is not a grease nipple, the replenishment of grease oil is unnecessary.
Remove the cap on the grease nipple located on the side of the X band radar or on the front of S band radar at which the radiator is supported, and grease with a grease gun.
Make the oiling every six months. The oil quantity shall be approximately 100 g, which is as much as the grease comes out of the oil seal. Use the grease of Mobilux 2 of Mobil Oil.

(b) Oiling gears
Apply grease evenly to the tooth surfaces of the main shaft drive gear and the encoder drive gear with a spreader or brush. Oiling in short intervals is more effective to prevent the gears from wear and tear and extend their service life, but oil at least every six months.
Use Mobilux2 of Mobile Oil.

(c) Mounting legs
Check the mounting legs and mounting bolts of the scanner unit case for corrosion at intervals and maintain them to prevent danger. Apply paint to them once a half year because painting is the best measure against corrosion.

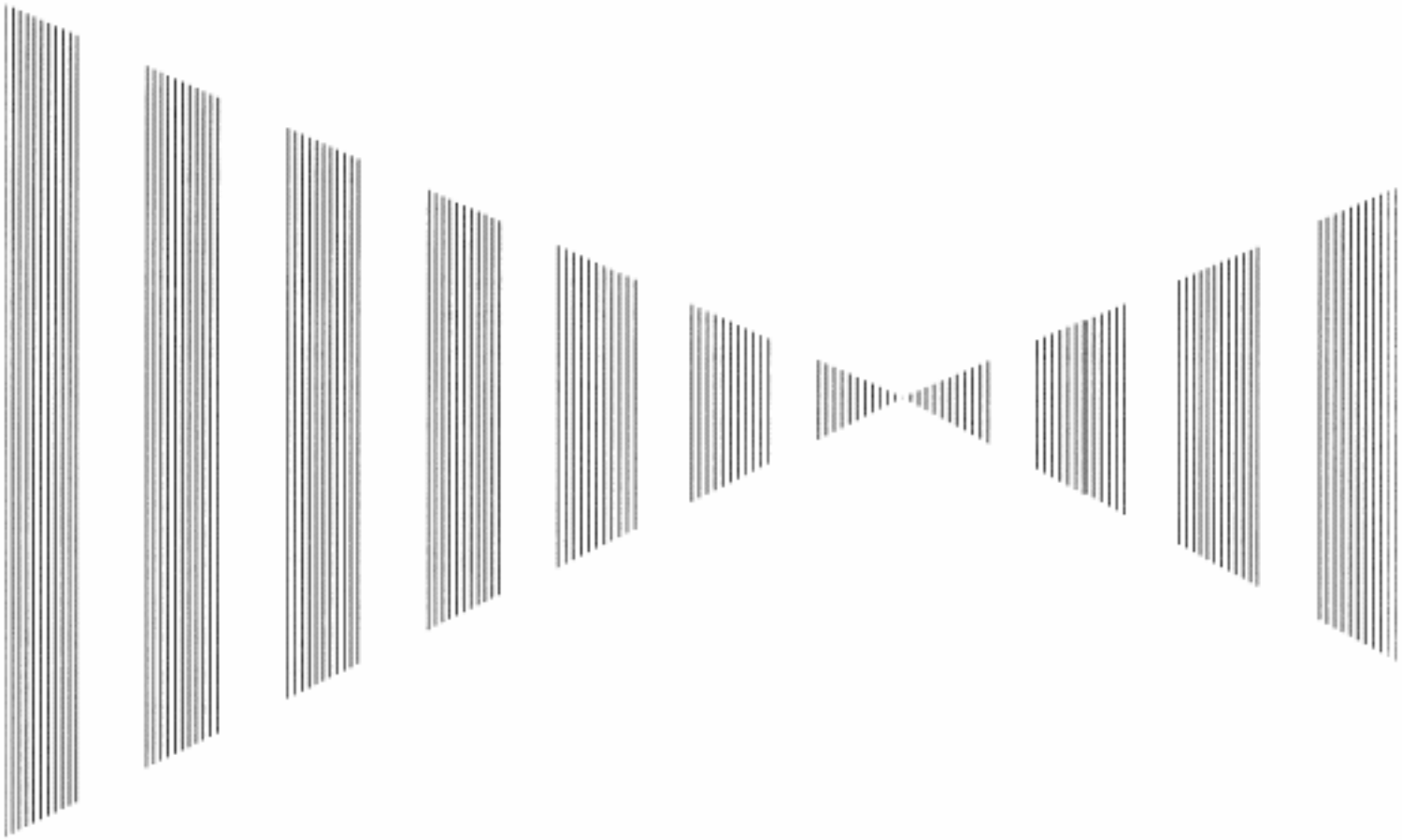
Display Unit NCD-4336

WARNING

When cleaning the screen, do not wipe it too strongly with a dry cloth. Also, do not use gasoline or thinner to clean the screen. Otherwise the screen surface may be damaged.

Dust accumulated on the screen will reduce clarity and darken the video. For cleaning it, wipe it with a piece of soft cloth (flannel or cotton). Do not wipe it strongly with a piece of dry cloth nor use gasoline or thinner.

SECTION 7
TROUBLE SHOOTING



WARNING

Never carry out internal inspection or repair work of the equipment by users.

Inspection or repair work by unauthorized personnel may result in fire hazard or electric shock.

Ask the nearest branch, business office or a dealer for inspection and repair.

Turn off the main power before maintenance work. Otherwise, an electric shock may result.

Turn off the main power before cleaning the equipment. Especially, make sure to turn off the indicator if a rectifier is used. Otherwise, equipment failure, or death or serious injury due to electric shock may result, because voltage is outputted from the rectifier even when the radar is not operating.

For operating the radar equipment in the good conditions, it is necessary to make the maintenance work as described below. If maintenance is made properly, troubles will reduce. It is recommended to make regular maintenance work.
Common points of maintenance for each unit are as follow:

Clean the equipment.

Remove the dust, dirt, and sea water rest on the equipment cabinet with a piece of dry cloth.
Especially, clean the air vents with a brush for good ventilation.

WARNING

Turn off the main power source before starting maintenance.

Otherwise, an electric shock or injury may be caused.

Turn off the main power if you need to be near the scanner unit for maintenance or inspection purposes. Direct exposure to electromagnetic waves at close range in death or serious injury.

Set the safety switch for stopping the scanner unit to the OFF position.

Otherwise, an accidental contact with the rotating scanner unit may cause injury.

7.1 FAULT FINDING

In case of semiconductor circuits, it is deemed that there are few cases in which the used semiconductor devices have inferior quality or performance deterioration except due to insufficient design or inspection or by other external and artificial causes. In general, the relatively many causes are disconnection in a high-value resistor due to moisture, a defective variable resistor and poor contact of a switch or relay.
Some troubles are caused by defective parts, imperfect adjustment (such as tuning adjustment) or insufficient service (such as poor cable contact). It will also be effective to check and readjust these points.
Melted fuses are caused by any clear cause. When a fuse is replaced, it is necessary to check the related circuits even if there is no trouble. In checking, note that there is some dispersion in the fusing characteristics.
Table 7-1 shows a list of fuses used in the equipment.

Table 7-1 Fuse List

Location	Parts No.	Current Rating	Protection Circuit	Type
Transmitter-receiver Unit	F401	5A	Scanner unit without motor	ST4-5AN1
Motor Unit	F402	8A	Motor (CBP-169)	ST6-8AN1

7.2 TROUBLE SHOOTING

As this radar equipment includes complicated circuits, it is necessary to request a specialist engineer for repair or instructions for remedy if any circuit is defective.
There are also troubles by the following causes, which should be referred to in checking or repair work.

1 Poor Contact in Terminal Board of Inter-Unit Cables

a) Poor contact in terminal board
b) The cable end is not fully connected, that it, contacted with earthed another terminal.
c) Disconnected cable wire

2 Poor Contact of Connector within Unit

Reference: This radar equipment is provided with 7-2 standard spares.

Table 7-2 Spares (7ZXRD0020, JMA-609)

7ZXRD0020

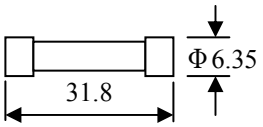
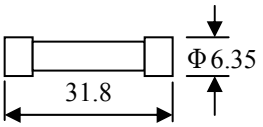
Name	Type/Code	Shape (mm)	In use	Spare	Parts No.	Location
Fuse	ST4-5AN1 (5ZFCA00050)		1	3	F401	Inside processing unit
Fuse	ST6-8AN1 (5ZFCA00052)		1	3	F402	Inside processing unit

Table 7-3 Special Parts

[I] JMA-609-7

Parts No.	Name	Type	Manufacturer	Location	Code
V101	Magnetron	MSF1422B	NJRC	Scanner	5VMAA00068
A101	Circulator	FCX68	Toshiba	Scanner	6AJRD00001
A102	Diode Limiter	NJS6930	NJRC	Scanner	5EZAA00024

Table 7-4 Circuit Block to be Repaired (JMA-609)

Location	Circuit Block	Type	Remarks
Scanner	Motor with gear	CBP-169	DC brush less motor (ordinary)
Scanner	Modulator	CPA-248-1	Excluding Magnetron
Scanner	Receiver	NRG-214	Including CAE-406
Scanner	Power supply circuit	CBD-1645	
Scanner	Terminal board circuit	CQD-2011	
Scanner	Revolwtior coutrol circuit	CSA-282	
Scanner	Filter circuit	CFR-193	
Processor	Radar processing circuit	CDC-1198Y	
Processor	Terminal board circuit	CQD-2010	
Processor	I/F circuit	CQC-1130	
Processor	Power circuit	CBD-1655	
Processor	DC-DC convertor	CBD-1701	
Operation panel unit	Operation circuit	CCK-892	
Operation panel unit	Track ball	CHG-198	

7.3 REPLACEMENT OF MAJOR PARTS

⚠ CAUTION

Turn off the main power source before replacing parts. Otherwise, an electric shock or trouble may be caused.

Before replacing the magnetron, turn off the main power source and wait for 5 minutes or more until the high voltage circuits are discharged.

Otherwise, an electric shock may be caused.

Take off your wrist watch when bringing your hands close to the magnetron.

Otherwise, your watch may be damaged because the magnetron is a strong magnet.

Two or more persons shall replace the liquid crystal monitor.

If only one person does this work, he may drop the LCD, resulting in injury.

Even after the main power source is turned off, some high voltages remain for a while.

Do not contact the inverter circuit in the LCD with bare hands. Otherwise, an electric shock may be caused.

Parts Required for Periodic Replacement

Here are parts required for periodic replacement

Part name	Interval
1. Magnetron	4000 hours
2. Motor	10000 hours
3. Fan motor	20000 hours
4. Backup battery	3 years

Replacement of magnetron (V101)

Remove the shield cover of the modulator and check that no charge remains in the high-voltage modulator circuit. Then, remove the socket of the magnetron. The magnetron can be demounted by removing the screws fixing it. When mounting a new magnetron, do not touch the magnet with a screwdriver or put it on an iron plate. After replacement, connect the lead wire correctly.

Handling of Magnetron under Long-Time Storage

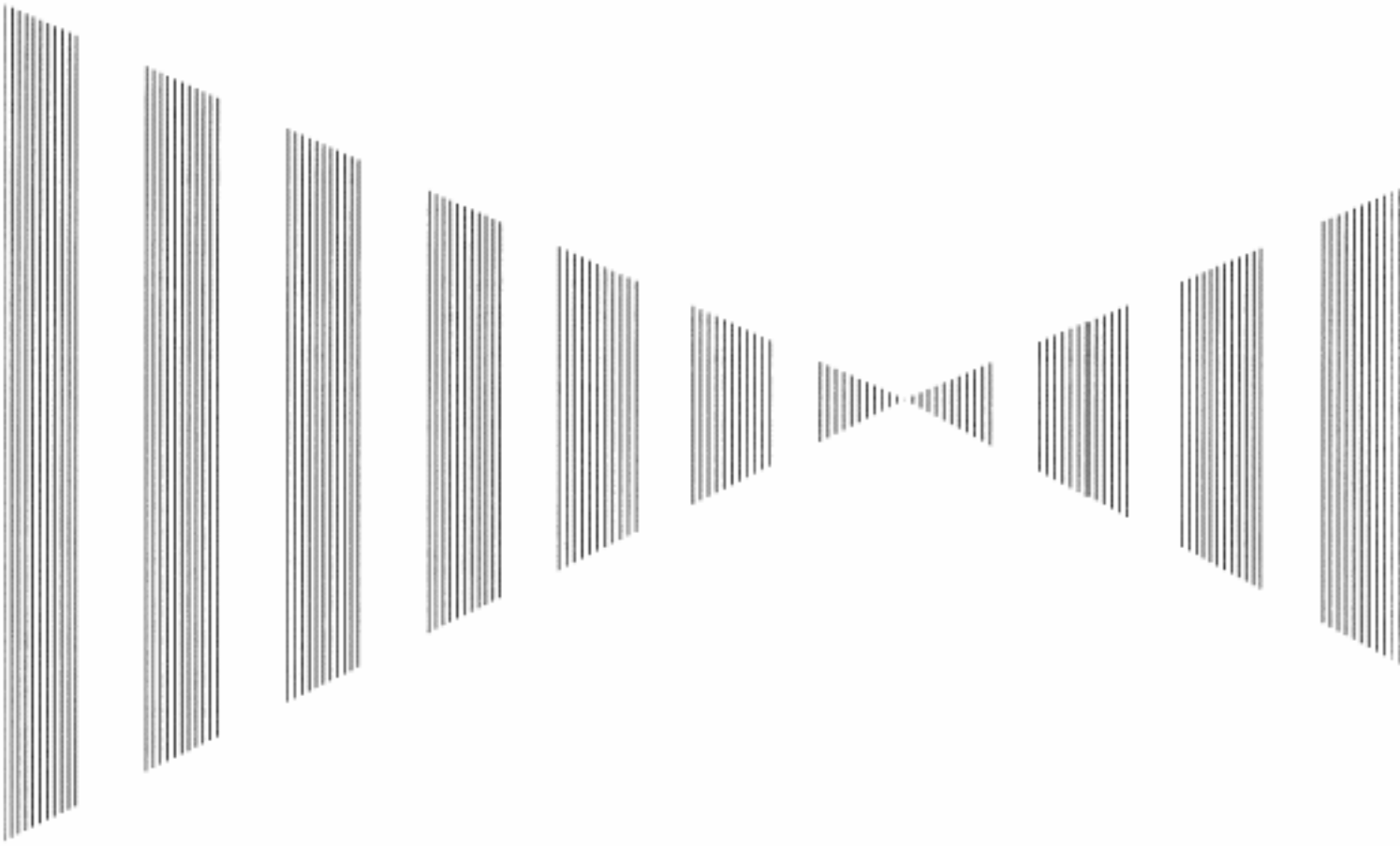
The magnetron that has been kept in storage for a long time may cause sparks and operate unstably when its operation is started. Perform the aging in the following procedures:

(1) Warm up the cathode for a longer time than usually. (20 to 30 minutes in the STBY state.)
(2) Start the operation from the short pulse range and shift it gradually to the longer pulse ranges. If the operation becomes unstable during this process, return it to the standby mode immediately. Keep the state for 5 to 10 minutes until the operation is restarted.

Replacement of Diode Limiter (A102)(JMA-609-7)

Remove the 4 screws fixing the receiver. Remove the 4 screws fixing the diode and the limiter, and remove diode limiter. When mounting the diode limiter, take care of the mounting direction and mount it in the arrow direction facing it the receiver front end.
Connect the wiring in the same way as before the replacement.

SECTION 8
AFTER-SALES SERVICE



When you Request for Repair

If you suppose the product may be out of order, read the description in Section 8 carefully and check the suspected point again.
If it is still out of order, you are recommended to stop operation of the equipment and consult with the dealer from whom you purchased the product, or our branch office in your country or district, the sales department in our main office in Tokyo.

- Repair within the Warranty Period

  If any failure occurs in the product during its normal operation in accordance with the instruction manual, the dealer or JRC will repair free of charge. In case that any failure is caused due to misuse, faulty operation, negligence or force major such as natural disaster and fire, the product will be repaired with charges.

- Repair after the Warranty Period

  If any defective function of the product is recoverable by repair, the repair of it will be made at your own charge upon your request.

- Necessary Information for Repair

  ☆ Product name, model, manufacturing date and serial number
  ☆ Trouble conditions (as detailed as possible. Refer to "Radar Failure Check List" in page 8-2.)
  ☆ Name of company/organization, address and telephone number

Recommended Maintenance

The performance of the product may deteriorate due to the secular change of the parts used in it, though such deterioration depends upon the conditions of operation.
So checkup and maintenance is recommendable for the product in addition to your daily care.
For maintenance, consult with the near-by dealer or our sales department.
Such maintenance will be made with charges.

For further details of after-sale service, contact the JRC Offices in the list at the end of this manual.

Radar Failure Check List

When placing an order for repair of the product, it is requested that you could confirm the check items and fill the results and sent the sheet to our contact.
If there is any unclear items, contact the ship on which the product is installed, and give the correct information on the product.

Ship name:_____Phone:_____Fax:_____
Radar general model name: JMA-_____Serial No. :_____
(Write the full model name correctly)

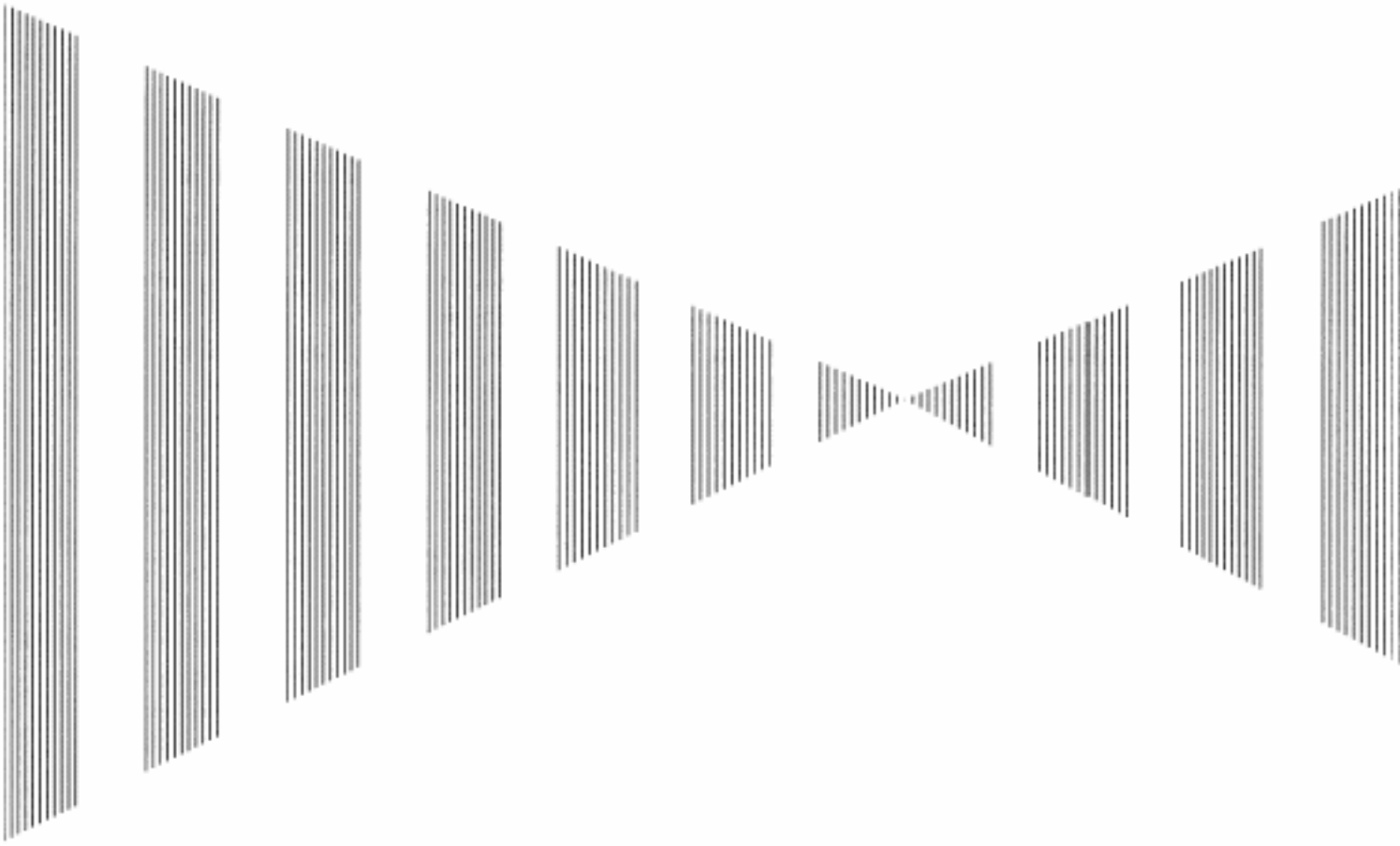
(1) Check the following items in the order of the number, and circle the applicable answer between YES or NO. If the item cannot be determined as YES or NO, explain in detail in the item (18), others.
(2) If any of the items (1) to (5) is marked as NO, check the fuse of the product (refer to Section 8.2 and 8.3).
(3) Check the items (4) to (17) while the transmission (TX) is ON.

* Functions mentioned in the items (14), (15) and (17) may be optional, answer is not necessary.

No.	Check Item	Result	
(1)	Power can be turned on. (The lamp on the operation panel is lit)	YES	NO
(2)	A few minutes after powering-on, it will become standby status (TX Ready).	YES	NO
(3)	When powering-on (or TX ON), CRT displays something (CRT is lit).	YES	NO
(4)	The scanner rotates at the transmission (TX) ON. (Check the following items while transmission is ON)	YES	NO
(5)	Current is supplied to the magnetron. (Refer to the instruction manual)	YES	NO
(6)	Turning is enabled. (Check with the range of 6 NM or more)	YES	NO
(7)	Fixed marker is displayed.	YES	NO
(8)	VRM is displayed.	YES	NO
(9)	While noise is displayed while set at STC and FTC minimum, GAIN maximum, IR-OFF and range 48 NM.	YES	NO
(10)	Target reflection echo is displayed.	YES	NO
(11)	Sensitivity of reflection echo is normal.	YES	NO
(12)	EBL is displayed.	YES	NO
(13)	Cursor mark moves.	YES	NO
*(14)	GYRO course can be set and normally displayed.	YES	NO
*(15)	LOG speed can be normally displayed.	YES	NO
(16)	ARPA works normally.	YES	NO
*(17)	If equipped with an interswitch, when switching from the straight mode (II) to (X), the failures (items marked NO) in the above (1) to (16), are switched over to the other unit.	YES	NO

(18) Others (Error message, etc.)_____

SECTION 9
DISPOSAL



DISPOSAL

9.1 DISPOSAL OF THE UNIT

When disposing of this unit, be sure to follow the local laws and regulations for the place of disposal.

9.2 DISPOSAL OF USED BATTERIES

WARNING

When disposing of used lithium batteries, be sure to insulate the batteries by taping the ⊕ and ⊖ terminals.
Otherwise, heat generation, explosion or a fire may occur.

In this unit, Lithium batteries are used for the following parts:
Radar Processing circuit (CDC-1198Y): BT1 (Maxell: CR2450)

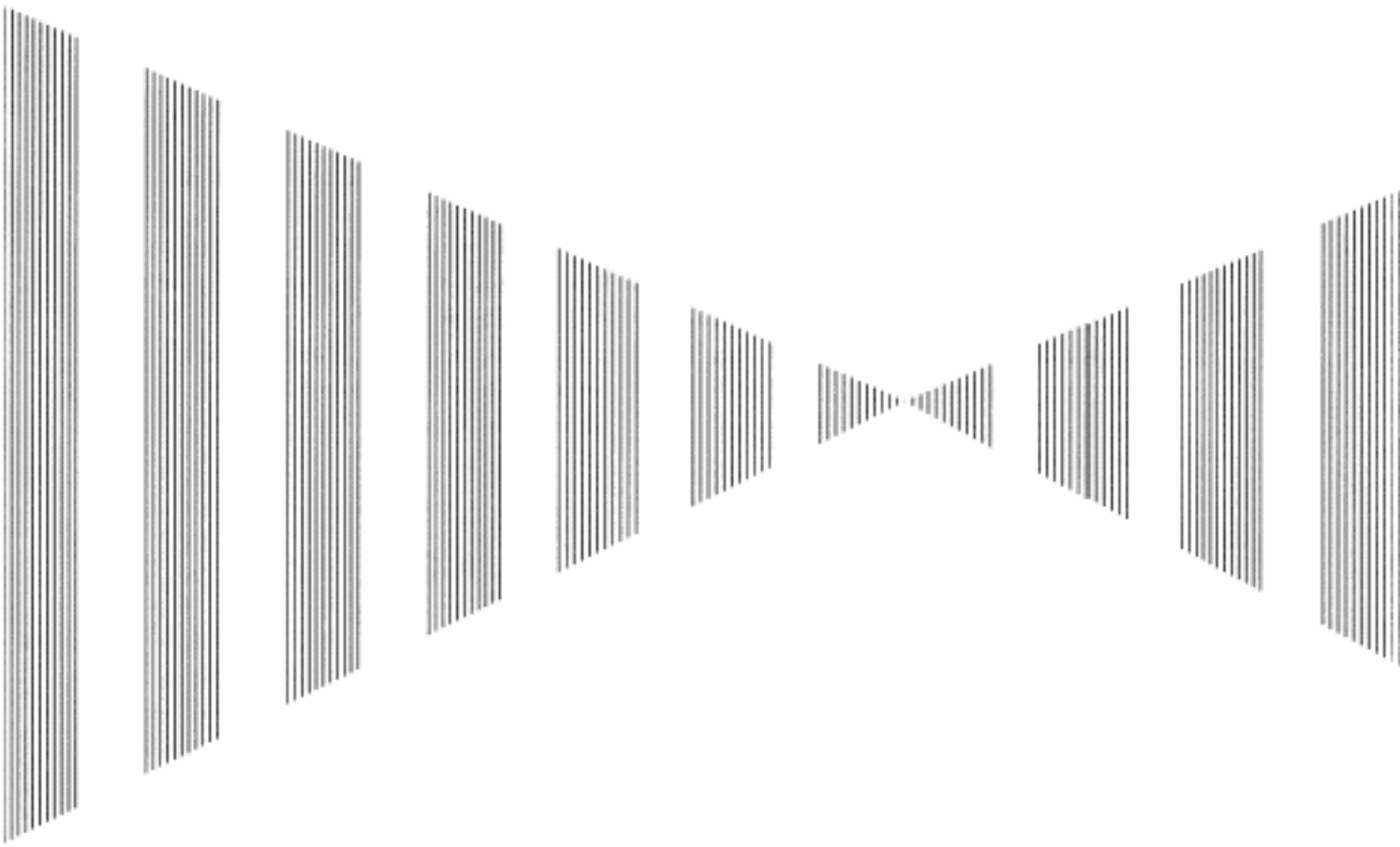
- Do not store used lithium batteries. Dispose of them in accordance with regulations of local government.
- When disposing of used lithium batteries be sure to insulate the batteries by taping the ⊕ and ⊖ terminals. For disposal of batteries, be sure to follow the local laws and regulations.
  For detail, consult with the dealer you purchased the product our business office, or local government.

9.3 DISPOSAL OF USED MAGNETRON

Magnetron is used in the Scanner （NKE－283）

- When the magnetron is replaced with a new one, return the used magnetron to our dealer or business office.
  For detail, consult with our dealer or business office.

SECTION 10
SPECIFICATIONS



10.1 JMA-609 TYPE RADAR

(1)	Type of Emission	P0N
(2)	Display type	PPI method, vertically long display
(3)	Display panel	Radar video effective diameter of 270mm (min)
(4)	Range Scale	0.15, 0.3, 0.5, 0.8, 1.2, 1.6, 2, 4, 8, 16 and 32km
(5)	Range Resolution	Less than 15m
(6)	Minimum Detective Range	Less than 15m
(7)	Range Accuracy	Within ±1.5% of range in use or ±5m
(8)	Bearing Accuracy	Less than 1°
(9)	Bearing Indication	Relative Motion mode: Head-up/Course-up/North-up True Motion mode: Course-up/North-up
(10)	Ambient Condition	According to IEC60945-4 Temperature Scanner: -25 to +55℃ (Storage Temperature: -25 to +70℃) Other Unit except Scanner: -15 to +55℃ Relative Humidity 93% at +40℃ Vibration 2 to 13.2Hz, amplitude ±1mm ±10% 13.2 to 100Hz, Gravity acceleration 0.7m/s^2 Velocity of the wind 27.8m/s(54kt)
(11)	Power Supply Input	+24VDC (Display Unit) +24VDC (Scanner) * Display Unit and Scanner correspond to 100VAC/220VAC when use NBA-3308.
(12)	Power Consumption	Approx. 400W (In maximum wind velocity)
(13)	Power Supply Voltage Fluctuation	+24VDC –10/+30% (Display Unit) +24VDC –10/+30% (Scanner Unit)
(14)	Pre-heating Time	Approx. Within 1min30sec

10.2 SCANNER (NKE-283)

(1)	Dimensions	Height 448mm×Swing Circle 2270mm	
(2)	Mass	Approx. 33kg	
(3)	Polarization	Horizontal Polarization	
(4)	Directional Characteristic	Horizontal Beam Width:	1.0° (-3dB width)
		Vertical Beam Width:	25° (-3dB width)
		Sidelobe Level:	Below –26dB (within ±10°)
			Below –30dB (outside ±10°)
(5)	Revolution	Approx. 26/48/AUTO rpm	
(6)	Peak Power	6kW	
(7)	Transmitting Frequency	9410 ±30MHz	
(8)	Transmitting Tube	MSF	
(9)	Pulse width/Repetition Frequency		

0.15km	0.04μS/4000Hz	
0.3km	0.04μS/4000Hz	
0.5km	0.04μS/4000Hz	
0.8km	0.04μS/4000Hz	
1.2km	0.04μS/4000Hz	
1.6km	0.04μS/4000Hz	
2km	0.04μS/4000Hz	0.1μS/4000Hz
4km	0.1μS/4000Hz	0.3μS/2000Hz
8km	0.3μS/2000Hz	0.6μS/1000Hz
16km	0.6μS/1000Hz	
32km	0.6μS/1000Hz	

(10)	Duplexer	Circulator + Diode Limiter
(11)	Mixer	MIC Front End
(12)	Intermediate Frequency Amplifier	Intermediate Frequency: 60MHz Receiver characteristic = Logarithmic receiver
(13)	Overall Noise Figure	6dB(Average)

10.3 CONTROL UNIT(NDC-4336)

(1)	Mounting	Table mounting
(2)	Video Output	RGB, H-sync and V-sync (SXGA)
(3)	Range Scale	0.15, 0.3, 0.5, 0.8, 1.2, 1.6, 2, 4, 8, 16 and 32km (0.125, 0.25, 0.5, 0.75, 1.5, 3, 6, 12, 24 and 48nm)
(4)	Range Ring	0.05, 0.1, 0.1, 0.2, 0.2, 0.4, 0.4, 1, 2, 4 and 8km (0.025, 0.05, 0.1, 0.25, 0.25, 0.5, 1, 2, 4, 8nm
(5)	Variable range marker	Digital read-out on the screen (4 characters) 2 kinds of VRM
(6)	EBL	Digital read-out on the screen (4 characters) 2 kinds of EBL
(7)	Cursor	Range, Bearing, and Lat./Lon’
(8)	Dimension	Processing / Keyboard Height: approx. 170mm / 45mm Width: approx. 360mm / 290mm Depth: approx. 340mm / 123mm
(9)	Mass	Processing: approx. 21kg Keyboard: 1.0kg
(10)	Tune mode	Auto/manual mode
(11)	STC	only manual mode
(12)	FTC	only manual mode
(13)	IR	3 kinds of IR mode
(14)	Scan correlation	OFF/1/2/3/peak hold processing
(15)	Bearing scale	360° scale graduate at intervals of 1°
(16)	Ship’s heading marker	Electric flash line suppressible while pushing key Ship’s stern marker can be displayed.
(17)	P-Line	2 Parallel line
(18)	Off center	5steps from +40% to –60%
(19)	Trails	Relative trails / True trails Trails length: OFF//2 scans/15/30sec/1/2/3/4/5/6min
(20)	Pulse length	short/long (2, 4, 8km)
(21)	Expansion	OFF/FAIR/STRONG
(22)	display color	Radar echo: 16 level (yellow, green, amber, white) Background (PPI): black, blue, dark gray Background (outside of PPI): black, blue, dark gray, bright blue Trails: 16 level (white, bright blue, green) Fix marker: white VRM1/VRM2/EBL1/EBL2: cyan

Character/ Bearing scale: white
Own ship wakes/ other ship wakes: seven colors

10.4 ARPA FUNCTION (OPTION)

Manual / automatic tracking by two guard rings
30 targets
maximum tracking range: 24nm
data read: 1 ship
vector: relative/ true
dangerous target warning by CPA/TCPA

10.5 INPUT SIGNAL

(1)	Navigation equipment	NMEA0183 The sentence which JMA609 can receive Lat./lon: GGA>RMC>RMA>GNS>GLL Waypoint: RMB>BWC(BWR) COG/SOG: VTG SPEED: VBW Time: ZDA
(2)	signal for bearing	JRC-NSK format (JLR-10) IEC61162-2 38400bps: HDT IEC61162-1: HDT>HDG>HDM>VHW (ATA can't use these sentence.)
(3)	signal for speed	LOG-SYNC: 360x, 180x, 90x, 36x (NSK Option) LOG-PULSE: 360x, 180x, 90x, 36x (NSK Option)
(4)	Depth	DRT>DBT
(5)	Rate of turn	ROT 20mV/degrees: 30-0-30, 90-0-90. 300-0-300
(6)	Rudder	RSA 20mV/degrees: 90-0-90
(7)	Auto pilot	APB 20mV/degrees: 90-0-90
(8)	Transmit Trigger	low impedance
(9)	RADAR video	50 ohm matching
(10)	Bearing pulse	Open collector
(11)	Ship's heading signal	Open collector
(12)	Tune indicator	0-5 (V)

10.6 OUTPUT SIGNAL

(1) The signal for Slave Display TIY, VD, BP (2048 pulse), BZ,TUNI

(2) Navigation information
NMEA0183
RADAR system data: RSD
Own ship data: OSD
ATA DATA: TTM
Target lat. /lon. Data: TLL

(3) External alarm — Point-of-contact signal

(4) 2ND monitor — Analog RGB HD 15pin connector 1pcs
(DVI connector 1pcs.)

10.7 STANDARD EQUIPMENT COMPOSITION

Scanner: 1
Processor unit: 1
Keyboard: 1
Spare parts: 1
Instruction manual:1

10.8 DISTANCE BETWEEN UNITS

	Maximum	Standard
Monitor-processor unit	5m	5m
Keyboard-processor unit	7m	7m
Scanner-processor unit	300m	
Power supply unit-processor	30m	

10.9 OTHERS (OPTION)

ATA circuit (built-in)
AIS interface circuit

For further information contact:

JRC Japan Radio Co., Ltd.
Since1915

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SALES DEPT.

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