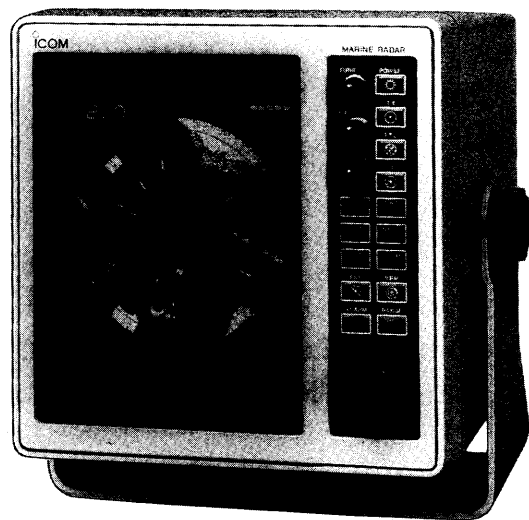MARINE RADAR
MR-40

Icom Inc.

DANGER! HIGH VOLTAGE

■ NEVER OPEN THE UNIT

This product contains high voltages that could be FATAL. This product has no user-serviceable parts inside. All repairs and adjustments MUST be made by a qualified electronics repair person.

■ HIGH VOLTAGES

High voltages of up to 5,000 volts are used in radar equipment. Although prudent measures for safety have been adopted, sufficient care must be taken in the operation, maintenance and adjustment of the equipment.

Electric shock by 1,000 volts or more may cause electrocution and death; and, even an electric shock of 100 volts may be fatal.

■ PREVENTION AGAINST ELECTRIC SHOCK
(FOR QUALIFIED ELECTRONICS REPAIR PERSONS ONLY)

To prevent such accidents, turn OFF the power source and do not reach inside the unit until you have: ① discharged capacitors by a wire securely grounded at one end; and ② checked that no charges remain inside the device.

Also, it is safest to wear dry wool insulated rubber gloves. NEVER use both hands simultaneously; keep one hand in your pocket.

RADIATION HAZARD

Radiation emitted from the scanner can be harmful, particularly to the eyes. To avoid harmful radiation, ensure the radar power is in the OFF position before beginning work on the radome.

Under no circumstances should you look directly into the radome from a distance of less than 2 feet (0.61 meters) when the radar is in operation.

IMPORTANT

- **READ THIS INSTRUCTION MANUAL CAREFULLY** before attempting operation. If you have any questions regarding the operation of the MR-40, feel free to contact your nearest authorized Icom Dealer or Service Center.

- **SAVE THIS INSTRUCTION MANUAL**
  This instruction manual contains important safety and operating instructions for the MR-40.

EXPLICIT DEFINITIONS

The following explicit definitions apply to this instruction manual.

WORD	DEFINITIONS
WARNING	Personal injury, fire hazard or electric shock may occur.
CAUTION	Equipment damage may occur.
NOTE	If disregarded, inconvenience only. No personal injury, risk of fire or electric shock.

INTRODUCTION

Thank you for choosing this Icom product for your radar navigation needs.

The **MR-40** is designed especially for pleasure boats and yachts. It has powerful 3 kW transmission power, a 9 inch CRT display and many advanced features with long term reliability.

PRECAUTIONS

- **NEVER** connect the MR-40 to an AC outlet. This will ruin the unit.

- **NEVER** let metal, wire or other objects touch any internal components in the unit. Electric shock could occur.

- **NEVER** place the unit within the reach of babies or children at any time.
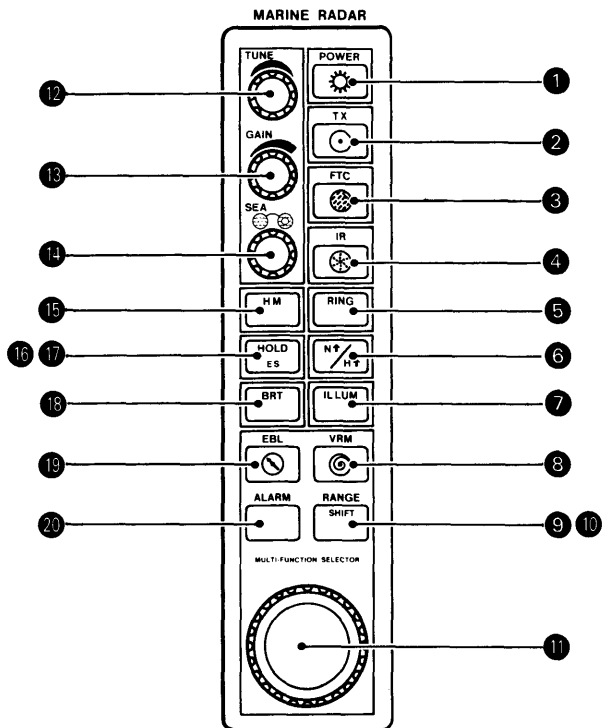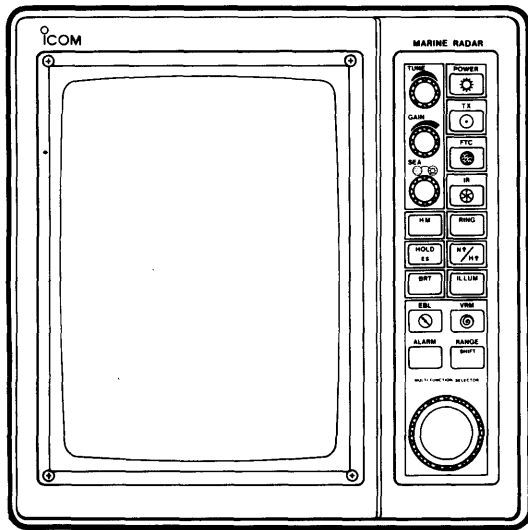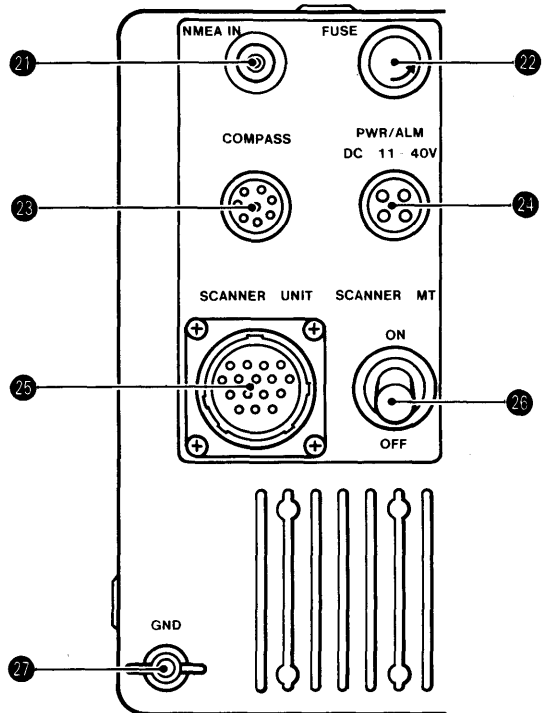
- **NEVER** expose the unit to rain, or any liquid.

UNPACKING

Accessories included with the MR-40:	Qty.
① System cable	1
② Installation nuts (M10)	4
③ Flat washers (M10)	4
④ Spring washers (M10)	4
⑤ Installation screws (M10 x 25)	4
⑥ Installation screws (M10 x 50)	4
⑦ Connector cover	1
⑧ BNC connector cover	1
⑨ Cable lug	1
⑩ Sponge	1
⑪ DC power cable	1
⑫ Viewing hood	1
⑬ Mounting bracket	1
⑭ Self-tapping screws (M6 x 30)	5
⑮ Spring washers (M6)	5
⑯ Flat washers(M6)	5
⑰ Mounting screw knobs	2
⑱ Mounting screw rubbers	2
⑲ Spare fuse (10A)	1
⑳ Spare fuse (5A)	1

# TABLE OF CONTENTS

1 CONTROL FUNCTIONS

FRONT PANEL

REAR PANEL
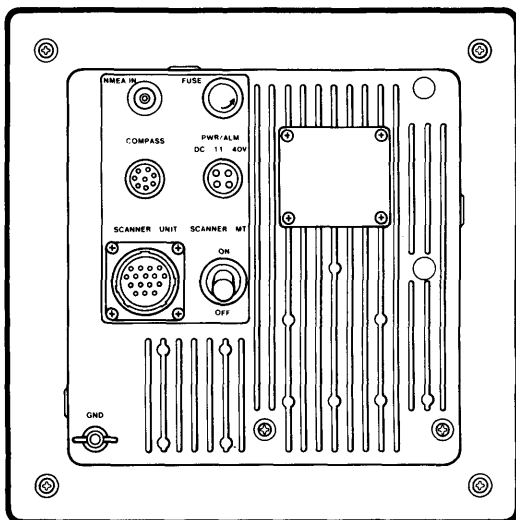
❶ **POWER SWITCH [POWER]** (p. 5)
Turns the power ON and OFF.
- The Initial screen appears for 2 min. after power has been turned ON.
- To turn OFF the power, push and hold the switch for 2 sec.

❷ **TX SWITCH [TX]** (pgs. 4, 5)
Selects PPI (Plan Position Indicator) or stand-by screen.

❸ **FTC SWITCH [FTC]** (pgs. 4, 10)
Suppresses some precipitation clutter.
- Small pips may be suppressed when [FTC] is ON.

❹ **INTERFERENCE REDUCTION SWITCH [IR]** (pgs. 4, 10)
Reduces or eliminates interference from other radar devices.

❺ **RING SWITCH [RING]** (pgs. 4, 7)
Turns the fixed range ring ON and OFF.

❻ **NORTH-UP/HEAD-UP SWITCH [N↑/H↑]** (p. 4)
Selects the Head-up and North-up screens.
- A compass interface with an "N+1" data format is necessary to indicate the North-up screen.

❼ **ILLUMINATION SWITCH [ILLUM]** (p. 6)
Turns ON and OFF the control panel illumination.

❽ **VRM SWITCH [VRM]** (pgs. 4, 7~8)
Displays the variable range marker and acts as the multi-function selector for the range marker selector.

❾ **RANGE SWITCH [RANGE]** (p. 6)
Acts as the multi-function selector for the range selector.

❿ **SHIFT SWITCH [SHIFT]** (p. 4)
Turns ON and OFF the shift function when the switch is pushed and held.
- When the shift function is ON, the displayed area is shifted forward.

⓫ **MULTI-FUNCTION SELECTOR** (pgs. 7~9)
Selects the displayed range, EBL, VRM and alarm area according to the pushed switch.

⓬ **TUNE CONTROL [TUNE]** (p. 6)
Adjusts the clarity of the display.
- Adjust the control to increase the "LEVEL" indication in the upper right corner.

⓭ **GAIN CONTROL [GAIN]** (p. 6)
Adjusts the receiver amplifier gain.
- Clockwise rotation increases the gain.
- Greater gain may increase noises on the screen.

⓮ **SEA CLUTTER CONTROL [SEA]** (pgs. 6, 10, 12)
Reduces sea clutter such as echoes. Display can be adjusted on ranges up to 4 miles.
- Set the control in the counterclockwise position in the normal condition.
- Use the control when the sea is rough.

⓯ **HEADING MARKER SWITCH [HM]** (p. 6)
Removes the heading marker temporarily from the screen when pushed and held.

⓰ **HOLD SWITCH [HOLD]** (p. 6)
Freezes the displayed screen.

⓱ **ECHO STRETCH SWITCH [ES]**
Turns ON and OFF the echo stretch function when the switch is pushed and held for 2 sec.
- When the function is activated, pips are magnified.

⓲ **BRIGHT SWITCH [BRT]** (p. 6)
Selects the screen brightness.

⓳ **EBL SWITCH [EBL]** (p. 8)
Displays the electronic bearing line and acts as the multi-function selector for the bearing line selector.

⓴ **ALARM SWITCH [ALARM]** (p. 9)
Activates the alarm function and acts as the multi-function selector for the alarm area selector.

㉑ **NMEA INTERFACE CONNECTOR [NMEA IN]** (p. 5)
Accepts the connection of a navigation receiver with NMEA 182 or 183 data format such as Loran-C or GPS to indicate Lat/Lon information on the screen.

㉒ **FUSE HOLDER [FUSE]** (p. 21)
Holds the specified 10 A fuse for internal DC power supply protection.

㉓ **COMPASS SOCKET [COMPASS]**
Connects the compass interface to display the North up screen.

㉔ **DC POWER SOCKET AND ALARM TERMINAL [PWR/ALM DC 11~40V]** (p. 19)
Accepts 11~40 V DC. Also accepts an external buzzer, if desired.

㉕ **SCANNER SOCKET [SCANNER UNIT]** (p. 15)
Connects the supplied scanner unit.

㉖ **SCANNER MOTOR SWITCH [SCANNER MT]** (p. 5)
Switches the scanner rotation.

㉗ **GROUND TERMINAL [GND]** (p. 15)
To prevent electrical shock and other problems, connect this terminal to a ground.

PPI SCREEN

INITIAL SCREEN

SHIFTED SCREEN
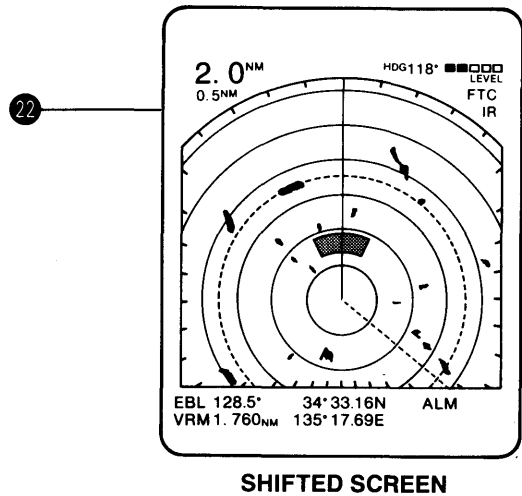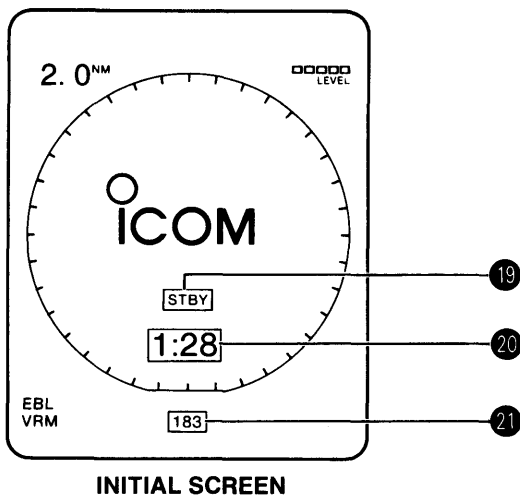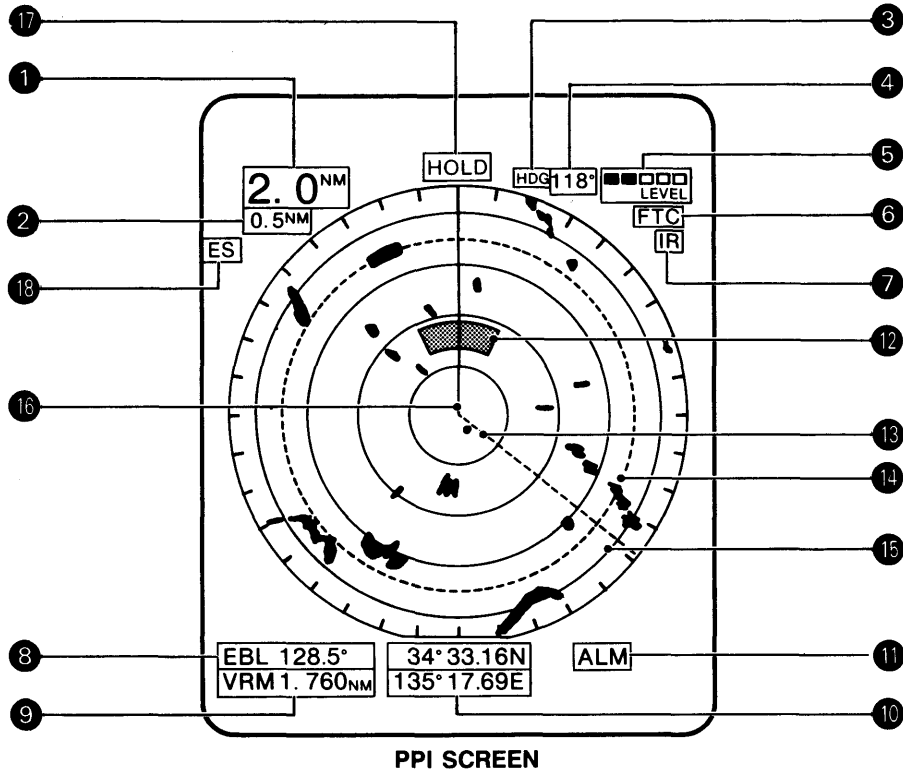
❶ SCREEN RANGE READOUT (pgs. 2, 6)
Shows the maximum range of the displayed screen.
• The multi-function selector selects ranges from 0.25 NM to 24 NM.

❷ RING RANGE READOUT (pgs. 2, 7)
Shows the interval range of the fixed ring.
• Appears when [RING] is pushed.
• This range varies with the screen range from 0.125 NM to 6.0 NM.

❸ NORTH-UP/HEAD-UP INDICATOR (p. 2)
"HDG" appears when selecting the head-up screen and "N↑" appears when selecting the north-up screen.
• The north-up can be used only when a compass interface with "N + 1" data format is connected.
• The screen is selected when [N↑/H↑] is pushed.

❹ COMPASS BEARING READOUT (p. 15)
Shows the ship's progress direction with north as 0°.
• This readout only appears when a compass interface is connected.

❺ TUNING LEVEL INDICATOR (pgs. 2, 6)
Shows the receiver tuning condition.
• Adjust [TUNE] to the maximum level.

❻ FTC INDICATOR (pgs. 2, 10)
Appears when the FTC (Fast Time Control) function is activated.
• The [FTC] switch turns ON and OFF this indicator.

❼ IR INDICATOR (pgs. 2, 10)
Appears when the IR (Interference Reduction) function is activated.
• The [IR] switch turns ON and OFF this indicator.

❽ EBL READOUT (pgs. 2, 8)
Shows the bearing of the displayed line with 0° ~ 360° when the EBL (Electronic Bearing Line) function is activated.
• The [EBL] switch turns ON and OFF the readout.
• The multi-function selector sets the bearing.

❾ VRM READOUT (pgs. 2, 7, 8)
Shows the range of the displayed marker when the VRM (Variable Range Marker) function is activated.
• The [VRM] switch turns ON and OFF the readout.
• The multi-function selector sets the range.

❿ LAT/LON READOUT (pgs. 5, 15)
Shows the latitude and longitude of the ship position.
• The readout appears only when a navigation receiver with the NMEA 182 or 183 format is connected.
• Acceptance of NMEA data can be selected during the waiting period after power has been turned ON.

⓫ ALM INDICATOR AND READOUT (pgs. 2, 9)
The indicator appears when the alarm function is activated.

The readout shows alarm range or bearing while programming the alarm zone.
• "UP RANGE" appears when the zone setting is incorrect.

⓬ ALARM ZONE (p. 9)
Shows pre-programmed alarm area.
• Appears when the alarm function is activated.

⓭ EBL LINE (pgs. 2, 8)
Used for bearing measurement. When selecting a target, the EBL readout shows the bearing.
• The line appears when the [EBL] is pushed.
• The multi-function selector sets the line position.

⓮ VRM MARKER (pgs. 2, 7, 8)
Used for distance measurement. When selecting a target, the VRM readout shows the distance.
• The marker appears when [VRM] is pushed.
• The multi-function selector sets the marker range.

⓯ FIXED RANGE RING (pgs. 2, 7)
Divides the screen range for easy distance reading. The interval of the rings is shown in the ring range readout.
• The [RING] switch turns ON and OFF the ring.

⓰ HEADING MARKER (pgs. 5, 6)
Shows ship heading.
• Appears in the center of the screen when the head-up screen is selected.
• The marker can be hidden while pushing [HM].

⓱ HOLD INDICATOR (pgs. 2, 6)
Appears when the screen is frozen.
• The [HOLD] switch displays the "HOLD" indicator.

⓲ ECHO STRETCH INDICATOR (p. 2)
Appears when the echo stretches for better distinction.

⓳ STBY INDICATOR (p. 5)
Appears when the unit does not transmit and has just been turned ON (during the 2 min. of the stand-by screen).
• The [TX] switch selects the Stand-by and PPI screens.

⓴ WARM UP TIMER READOUT (p. 5)
Appears when turning power ON. Counts down for 2 min. while the magnetron is being heated up.

㉑ NMEA DATA READOUT (p. 5)
Shows the format for the acceptance of NMEA data.
• When no navigation receiver is connected, "OFF" must be selected.

㉒ SHIFTED SCREEN
Shifts the forward screen area.

■ 3 BASIC OPERATION

3-1 Checking the installation

Before turning power ON, be sure all the connections are complete. The following check list may be helpful for confirmations.

> **CAUTION:** Connecting the scanner unit after the PPI screen appears may damage the magnetron inside the scanner unit.

• Check list

1) The vent tube on the radome base must be correctly set on the stern side.

2) The 4 fixing bolts of the radome base must be fully tightened.

3) A waterproof cable must be used for radome base connection.

4) The cable must be securely attached to a mast or mounting material and must be free of interference from the rigging.

5) Be sure waterproof is completed on the cable gland, if provided.

6) The power connections to the battery must be of the correct polarity.

7) Be sure that the plugs at the rear of the unit have been connected correctly and securely.
See p. 15 for "INSTALLATION AND CONNECTION."

3-2 Power ON/OFF

1) On the rear panel, turn ON the [SCANNER MT] switch.

2) Push [POWER] to turn ON the unit.
   • The initial screen appears and waiting time is counted on the screen.
   • The magnetron is heated up for 2 min.

3) When a navigation receiver such as a Loran-C receiver is connected, rotate the multi-function selector to set the NMEA data format.
   • The unit accepts NMEA 182 or NMEA 183.
   • When a navigation receiver is not connected, select the "OFF" position.

4) When the countdown is completed, the stand-by screen appears.
   • The scanner is rotated, yet the screen does not scan.

5) Push [TX] to select the PPI screen.
   • Targets and heading marker appear.

6) To turn OFF the unit, push and hold [POWER] for 2 sec.
   • The scanner stops once the [POWER] switch is OFF, even when the [SCANNER MT] switch remains ON.
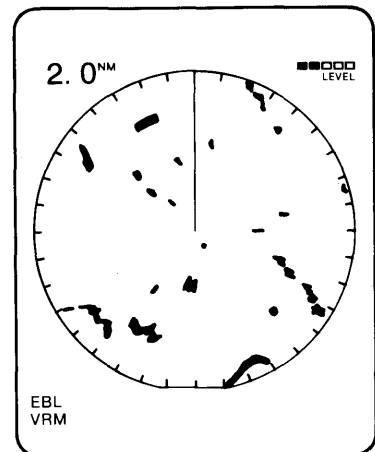
Power ON
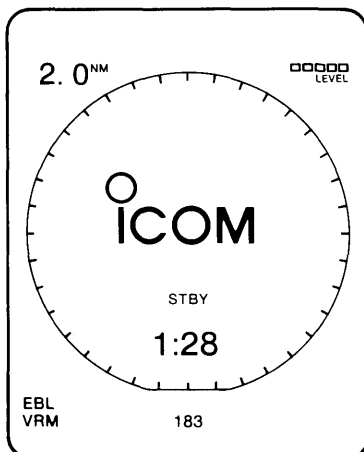
After 2 min.

Push [TX]

Initial screen
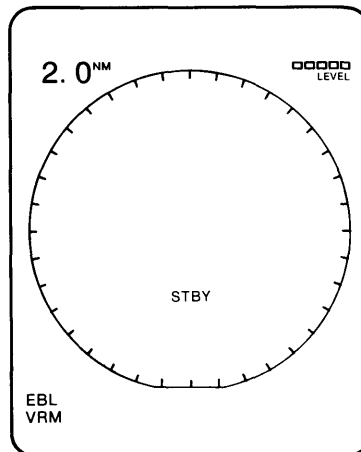
Stand-by

PPI screen

3-3 Operating procedure

1) Turn power ON to start scanning on the screen.
   • See Section 3-2 for details.

2) Push [RANGE] and rotate the multi-function selec-
   tor to select the display range.
   • 8 different distances are available.

3) Set [GAIN] to the 2 o'clock position.
   Set [SEA] to the fully counterclockwise position.

4) Adjust [TUNE] to set the "LEVEL" indicator to the
   maximum level.
   • Level indicates clarity.
   • After the unit has warmed up (approx. 30 min. after turn-
     ing power ON), adjust [TUNE] again.

CAUTION:
When setting the [SEA] control for the clockwise position, closed targets are blanked.
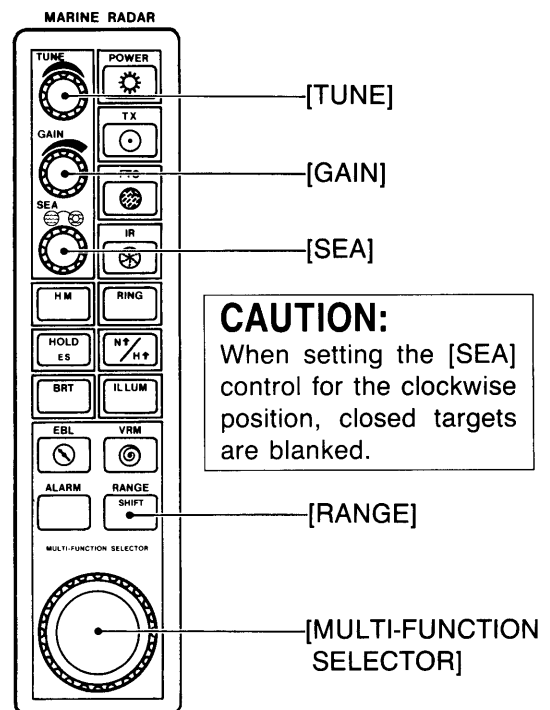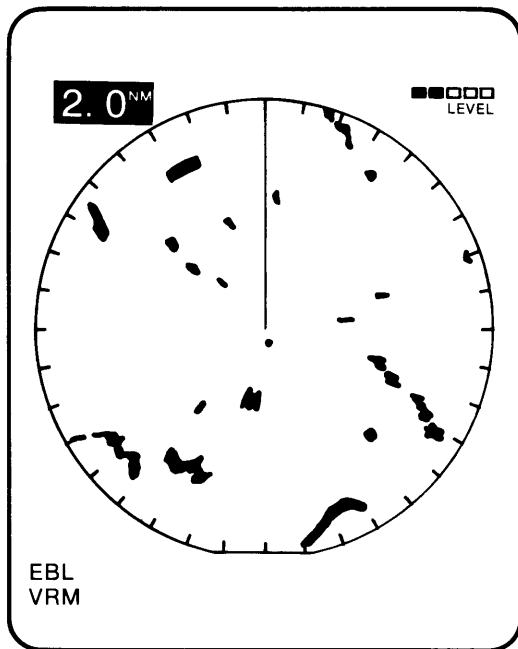
BRIGHTNESS NOTES

The intensity of the screen can be changed in 4 steps. When you require continuous operation, but not constant viewing, the lowest intensity setting can increase the life of the CRT display.

Push [BRT] to select the intensity.

NOTE: High intensity will shorten the life of the CRT display.

CONTROL PANEL ILLUMINATION

The back lighting of the control panel can be turned ON and OFF for night operation.

Push [ILLUM] to turn ON and OFF.

HEADING MARKER

The heading marker is a line that shows your ship bow direction. (This marker will appear in the center of the screen when the head-up screen is selected.) The heading marker can be hidden, if you desire as such when the desired target is located under the heading marker, etc.

While pushing [HM], the heading marker is hidden.

SCREEN HOLD

Screen scanning can be frozen to see the target in detail.

Push [HOLD] to freeze and scan the screen.
• "HOLD" appears.

4-1 Distance measurement

Two measurement procedures are available on the unit.
Operating them separately or jointly is possible.

SWITCH	DESCRIPTION
RING	Displays fixed ring. Suitable for rough estimation of any targets.
VRM	Displays a variable range marker and uses the multi-function selector as a range selector. Suitable for accurate measurement of a target.

• Using [RING]

Push [RING] to display or clear the fixed ring.
• The distance of the ring scale appears in the upper-left corner of the screen.
• The ring range is fixed depending on the screen range as follows.

Range (nm)	0.25	0.5	1	2	4	8	16	24
Ring (nm)	0.125	0.25	0.25	0.5	1	2	4	6

Ring readout
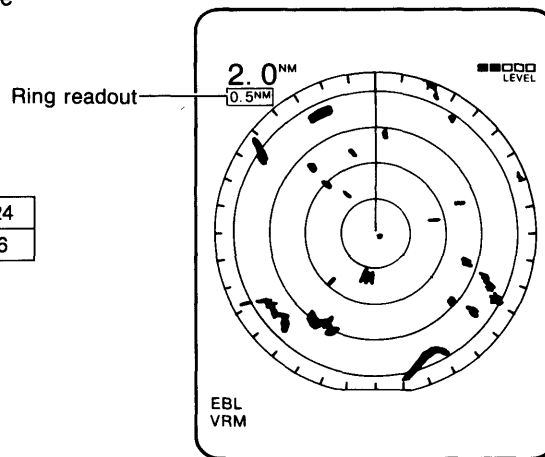
• Using [VRM]

1) Push [VRM] to use the multi-function selector as a range selector.

2) Rotate the selector to adjust the range marker to the desired target.
   • The distance between the ship and the target is indicated in the lower-left corner of the screen.

Range readout
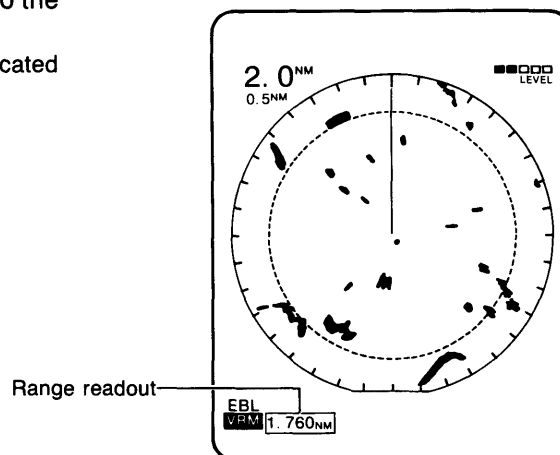
4-2 Direction measurement

The unit has an Electronic Bearing Line to indicate the target's direction from your ship.

• Using [EBL]

1) Push [EBL] to use the multi-function selector as a direction selector.

2) Rotate the selector to adjust the bearing line to the desired target.
   • The bearing of the target in relation to your ship is indicated in the lower left corner of the screen.

Bearing readout

2.0ᴺᴹ
0.5ᴺᴹ
LEVEL

EBL 128.5°
VRM
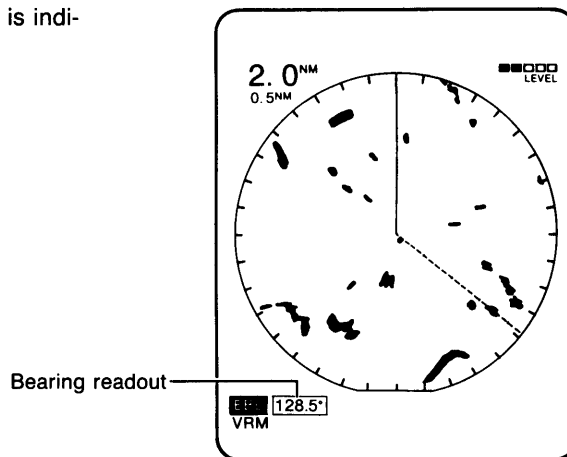
• Combined use of [EBL] and [VRM]

The range marker and bearing line can be simultaneously indicated on the display. Therefore, the direction and distance of the desired target can easily be measured.

2.0ᴺᴹ
0.5ᴺᴹ
LEVEL

EBL 128.5°
VRM 1.760ᴺᴹ

5 ALARM SETTING
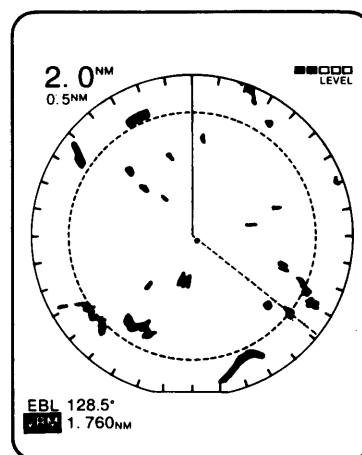
The unit has an alarm function to protect your ship from collisions. If ships, islands, etc. come into the pre-programmed alarm zone, the function alerts you with an alarm. The unit can set the desired range and bearing for an alarm zone.

• Using [ALARM]

1) Push [ALARM].
   • "ALM" and the alarm readout appear.

2) Rotate the multi-function selector clockwise to set the outside edge of the alarm zone.
   • A zone marker appears.
   • The alarm readout shows the distance of the marker.

3) Push [ALARM], then rotate the multi-function selector to set the inside edge of the alarm zone. (Fig. 1)
   • Another zone marker appears.
   • The readout shows the distance of the marker.

4) Push [ALARM], then rotate the multi-function selector counterclockwise to set the left side of the alarm zone.
   • A zone line appears.
   • The readout shows the direction of the zone line.

5) Push [ALARM], then rotate the multi-function selector clockwise to set the right side of the alarm zone. (Fig. 2)
   • Another zone line appears.
   • The readout shows the direction of the line.

6) Push [ALARM] to activate the alarm function. (Fig. 3)
   • Zone markers and zone lines disappear and only the selected zone remains.
   • The readout disappears and only "ALM" remains.

> **NOTE:** When "UP RANGE" appears on the alarm range readout, the programmed range is too small or too wide according to the selected screen range. At this time, select again the alarm range or screen range.

7) To deactivate the alarm function, push [ALARM] again.
   • "ALM" and the selected zone disappear from the screen.

8) To activate the alarm function again with the same programmed range, push [ALARM] 5 times.
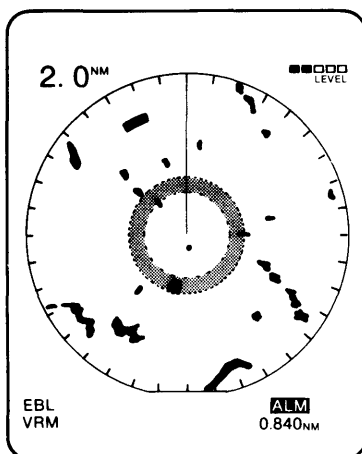   • "ALM" and the alarm zone appear.

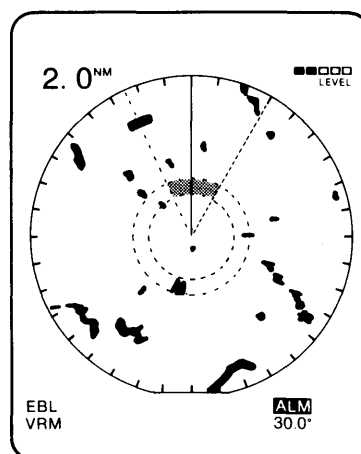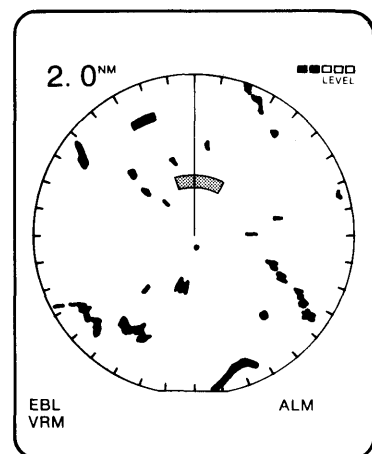| 2. 0ᴺᴹ	2. 0ᴺᴹ	2. 0ᴺᴹ
Fig. 1	Fig. 2	Fig. 3
EBL VRM ALM 0.840ɴᴍ	EBL VRM ALM 30.0°	EBL VRM ALM

Basically there are 3 types of interference which may hinder radar reception (sea clutter, echoes of waves and precipitation interference).

6-1 Sea clutter interference

Sea clutter appears in the center of the screen as a large number of small echoes. You may use the [SEA] control to reduce this type of interference.

CAUTION: The [SEA] control reduces the receiver sensitivity of objects within 4 miles. Therefore, caution and careful adjustment are necessary when using the [SEA] control.
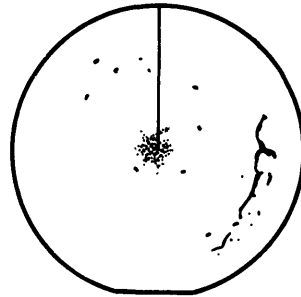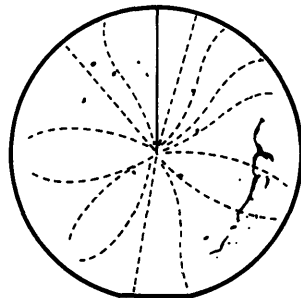
6-2 Radar interference

Radar interference may appear when another ship's radar is operating nearby on the same frequency band. You may use the [IR] switch to eliminate this type of interference.
• "IR" appears when the function is activated.

**NOTE:** Turn OFF the [IR] switch during normal operation.

6-3 Precipitation interference

Precipitation clutter is easily recognizable by its wool-like appearance on the screen. When this type of interference appears over a large area of the screen, you may use the [FTC] switch to reduce the interference.
• "FTC" appears when the function is activated.

NOTE: Turn OFF the [FTC] switch during normal operation.
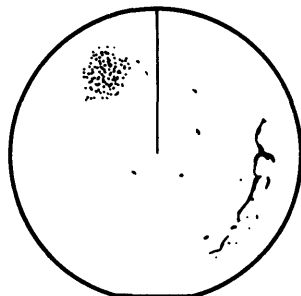
■ 7 FALSE ECHOES

False echoes may appear on the screen at positions where there is no target. These echoes may appear if a large vessel, bridge, or tank is in proximity. Operators should be familiar with the effects of these phenomena. In some cases, echoes can be reduced.

7-1 Side-lobe echoes

Radiation can escape on each side of the beam inside the lobes. If a target refracts this radiation, it will be displayed on the screen as an echo.

Side lobes show usually only on short ranges and from strong targets. They can be reduced by proper adjustment of the [SEA] control.

Main beam
Side lobes

Side echoes
True echo
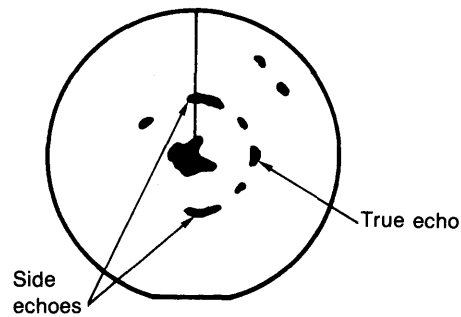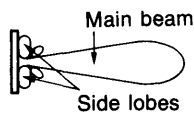
7-2 Indirect echoes

Indirect echoes may be returned from either a passing ship or returned from a reflecting surface on your own ship.

An indirect echo will appear on the same bearing as the reflected surface, but at the same range as a direct echo.

Target
Scanner
Mast or Funel

Target
Own ship
Bridge

True echo
Indirect echo

True echo
Indirect echo
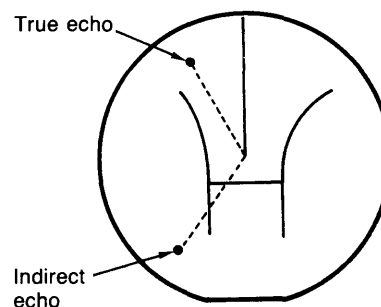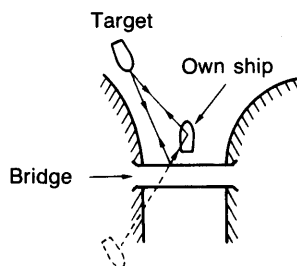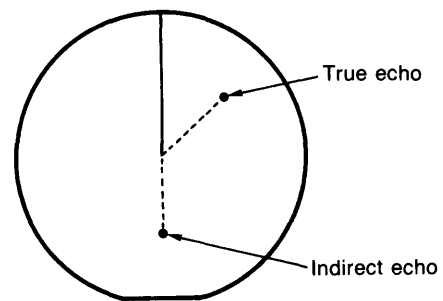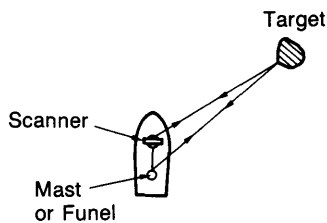
7-3 Multiple echoes
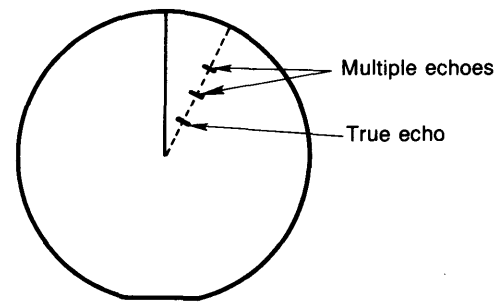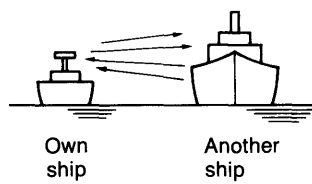
Multiple echoes may appear when a short-range and strong echo is received from a ship, bridge, or breakwater.

The multiple echoes will appear beyond the target's true echo point on the same bearing as the large target. Multiple echoes can be reduced by proper adjustment of the [SEA] control.

Own ship
Another ship

Multiple echoes
True echo

7-4 Ghost echoes

Ghost echoes may appear if there is a target having a wide smooth surface near your own ship. The appearance of ghost echoes is similar to that of indirect echoes.

The ghost echoes will appear on the screen as if the targets had been reflected in a mirror.

Ghost echoes
True echoes

8 NAVIGATION USING THE RADAR
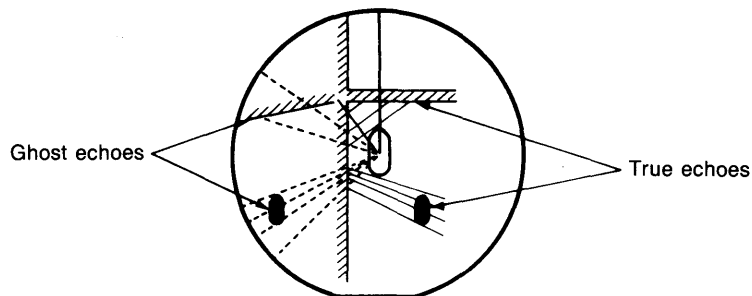
8-1 Determining your position

The MR-40 is an accurate and reliable navigation aid for determining your position. The following diagrams show examples to determine your position using radar and a nautical chart.
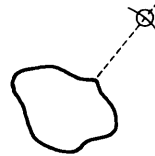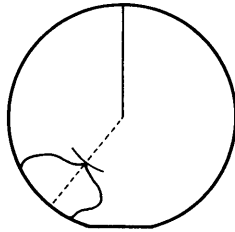
When 1 range and 1 bearing can be plotted on the chart.

When 3 ranges can be plotted on the chart.
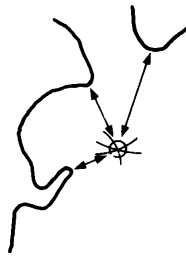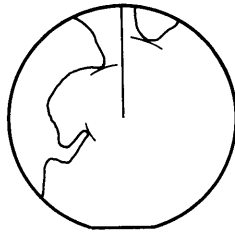
When 3 bearings can be plotted on the chart.
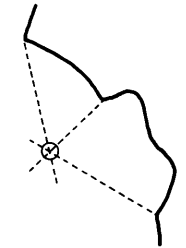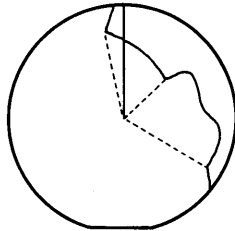
8-2 Avoiding collisions

At the moment that a target appears on the screen, its range and relative bearing should be noted. When a target is in visual observation, a constant bearing shows a collision course.
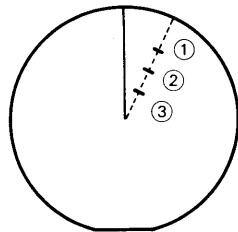
When a series of plots shows a closing range and no significant change in successive bearings, corrective action is mandatory, and "The Regulations for Preventing Collisions at Sea" should be observed.

① ② ③ Another ship

Own ship
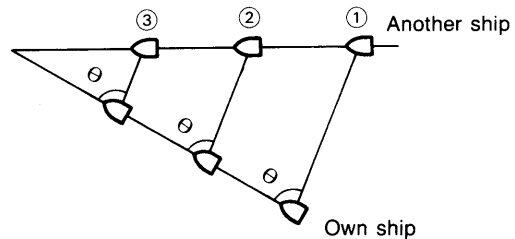
8-3 Line-of-sight range

A line-of-sight range limits distant target searching. Radar waves behave like light waves, yet they are refracted slightly more than the optical horizon. The range limit can be calculated with the following formula.

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

h1: Scanner height (m)
h2: Target height (m)
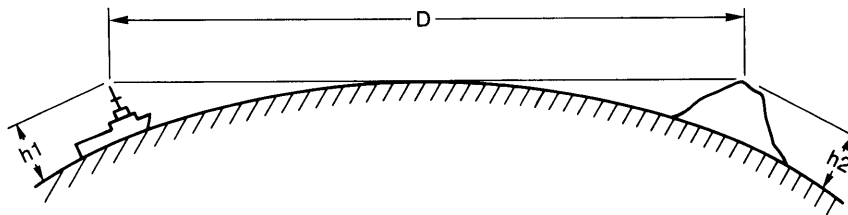
The following graph shows the relationship among the antenna, target heights, and distance.

[EXAMPLE]

Scanner height is 5 m; Target height is 5 m.
Thus, the range limit is less than 10 nm. (marked ①)

Scanner height is 5 m; Target height is 25 m.
Thus, the range limit is less than 16 nm. (marked ②)

9 INSTALLATION AND CONNECTION
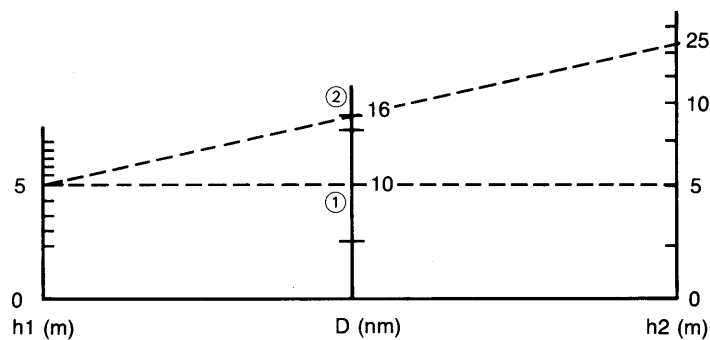
9-1 Installing the display unit

• Installation location

Select a place for installation which meets these important conditions:

1) The unit must be placed near the wheel in the cabin so that an operator may easily view the radar screen while facing in the direction of the bow.

2) To minimize interference, **KEEP** the unit **AT LEAST** 1 m (3.3 ft.) away from the compass and any navigation receiver.

3) Select a position where there is no danger of salt or fresh water spray or immersion.

4) Select a location where it is easy to perform maintenance or adjustment after installation.

5) Select a location which can support the weight of the unit.

6) **DO NOT** select areas subject to extreme heat, cold, vibrations or direct sunlight.

9-2 Installing the scanner unit

• Installation location

**WARNING: BE SURE [POWER] is OFF whenever you are working with the scanner unit.**

The scanner unit is designed to be weatherproof and completely watertight. Select a place for installation which meets these important conditions:

1) The unit must be near the boat's center line and have a good view in every direction. Be sure there are no objects in the surrounding area which will intercept the scanning beam.

2) Keep the scanner unit away from any smokestacks. Smoke can damage the unit.

3) When the boat is equipped with a radio directional finder (RDF) system, keep the scanner unit at least 2 m (approx. 7 ft.) away from its antenna.
   • Radiation from the scanner unit can affect the measurement data of RDF equipment.

4) The unit should be placed as high as possible on the boat to obtain best performance with maximum range.

9-3 Connecting the units

Compass interface "N+1" data format

NMEA data interface Accepts NMEA 0182 or 0183.

External buzzer or lamp

Scanner unit

Red Black

Ground terminal

Power supply 11~40 V DC
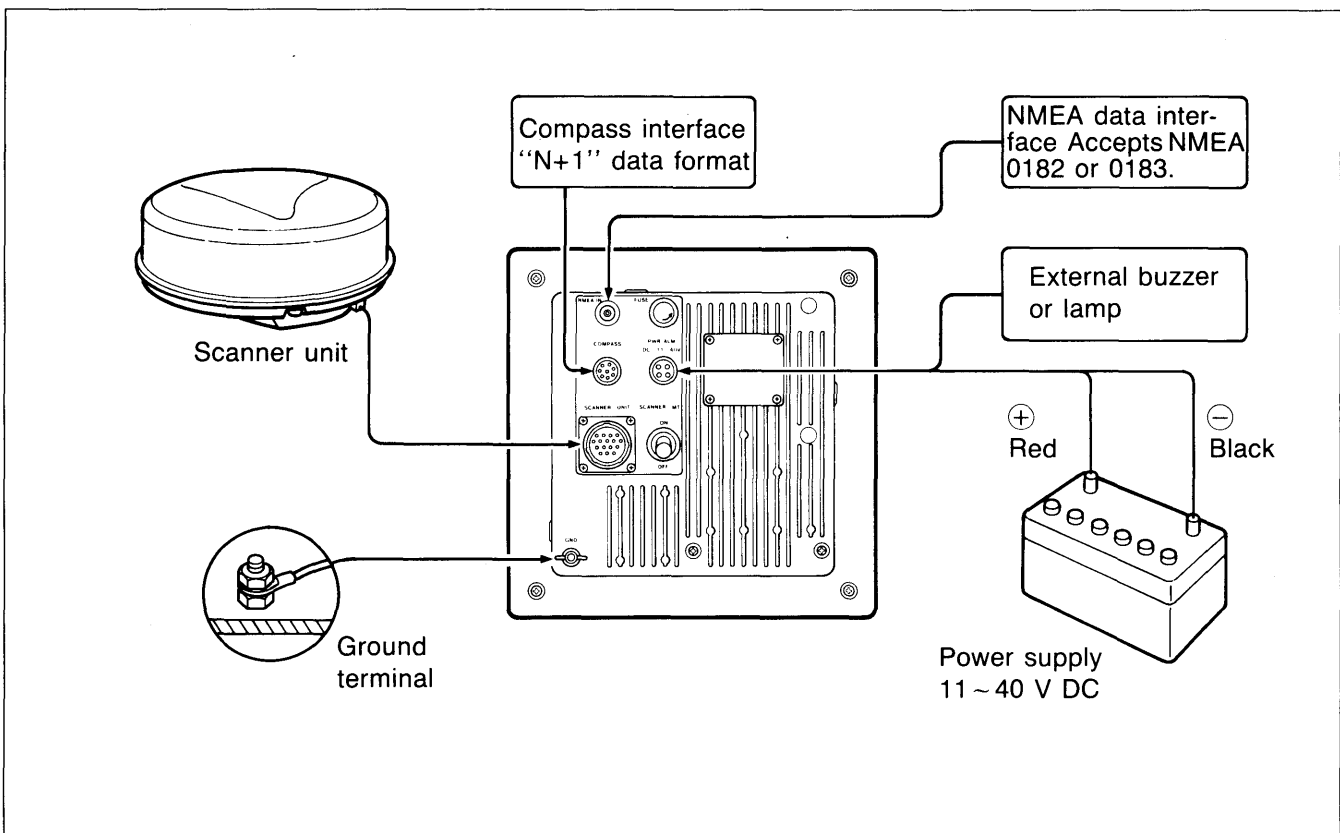
9-4 Mounting the display unit

The universal bracket supplied with the display unit allows "dashboard," "overhead" or "screen-up" mounting.

1) Hold the universal bracket up to the selected location and mark pilot holes for 5 installation holes.

2) Drill 5 holes with a diameter of 3 mm (1/8 in.) as shown in the diagram.

3) Install the bracket using the screws, nuts, bolts or washers and the supplied accessories.

4) Adjust the display unit to the adequate view angle and attach the supplied sponge to protect the radar from vibrations.

5) After installing the display unit, install the suplied viewing hood.

Bracket installation
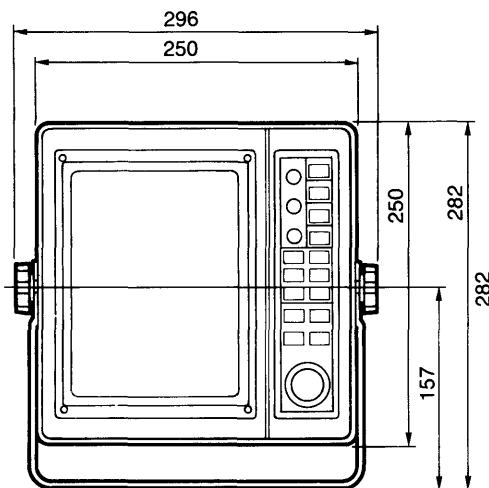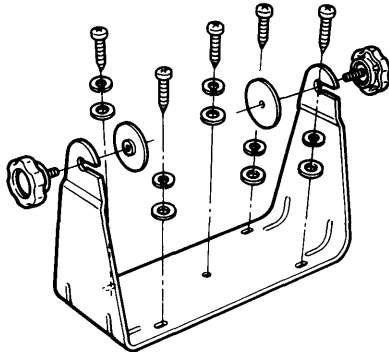
Sponge attachment
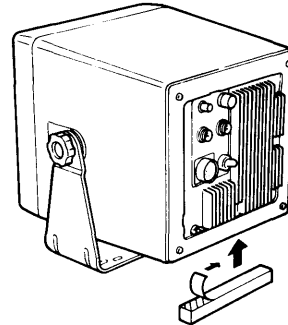
Viewing hood attachment
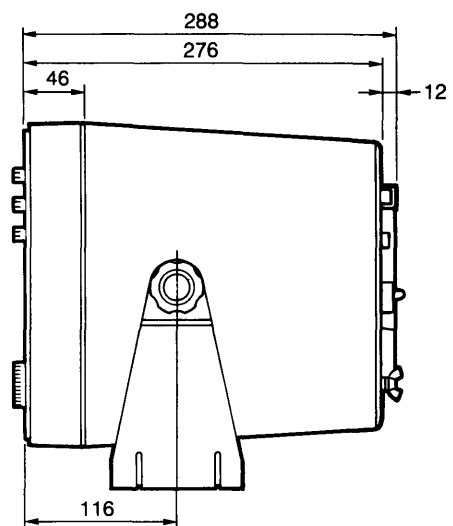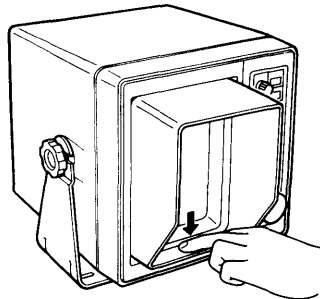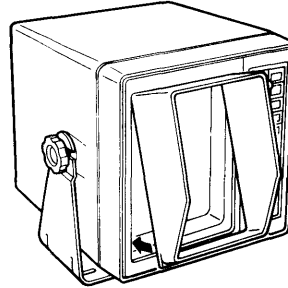
Unit : mm

9-5 Mounting the scanner unit

After selecting the mounting location for the scanner unit, follow this mounting procedure:

1) Choose a location for the radome base which meets the following important conditions:
   • The radome base should be adjusted so that a target echo returned from the bow direction will be shown on the 0° (Heading marker) position on the screen.
   • The mounting surface must be parallel with the boat's waterline.
   • If the height is insufficient to install the unit, build a special frame for installation.

2) Unscrew the 4 screws from the bottom side of the radome base and remove the radome cover.

3) Hold the radome base up to the location and drill 4 holes of 12 mm (1/2 in.) in diameter as shown in the diagram.

4) If the mounting surface or platform for the radome base is metal, apply sealing compound around the holes to prevent corrosion and to waterproof the unit.

5) Fix the radome base to the selected position with bolts of 10 mm (3/8 in.) in diameter, and flat and spring washers. The supplied bolts are of 2 lengths 25 mm (1 in.) or 50 mm (2 in.).

Bow direction

ICOM

Bow direction

243

607

Bow direction

90.5
90.5

45.5   150.5

Unit : mm
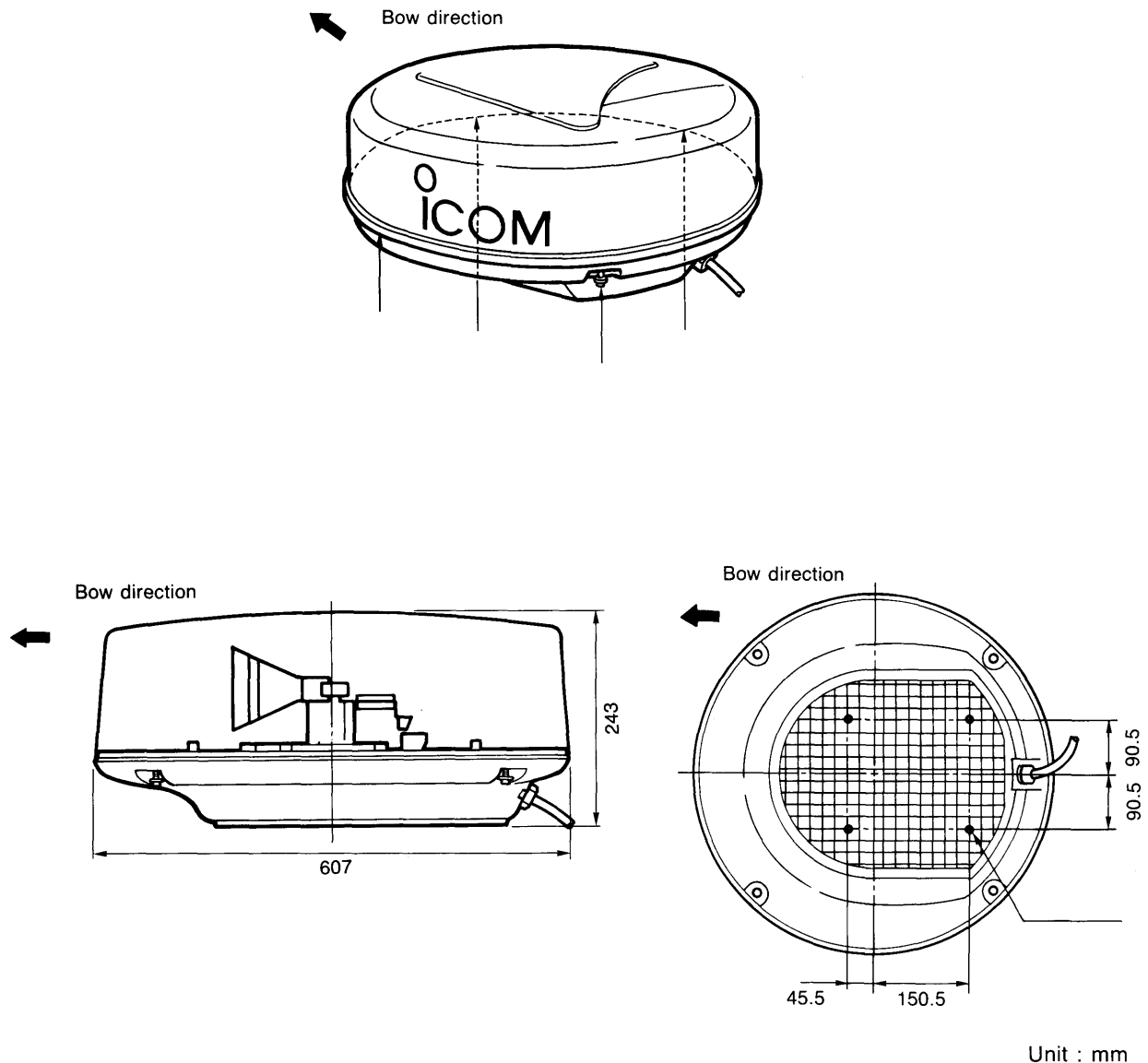
9-6 Wiring a system cable

CAUTION: DO NOT cut the supplied system cable. If cut, readjustment of the internal display unit is necessary.
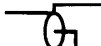
1) Strip each wire end of the system cable as shown in the diagram.

2) Loosen the nut on the scanner unit and pass the system cable (the end without a connector) through the nut.

3) After the cable has been passed through the nut, place the sealing union over the cable as shown in the diagram.

4) Connect each wire end to the proper terminal. Be sure to follow the connection diagram carefully.

CAUTION: The shield wire must be connected to the ground plate with the screw as shown in the diagram.

5) Tighten the nut and replace the radome cover over the radome base with 4 screws.

6) Connect the cable connector securely to the rear panel of the display unit.

6 mm

Shield wire
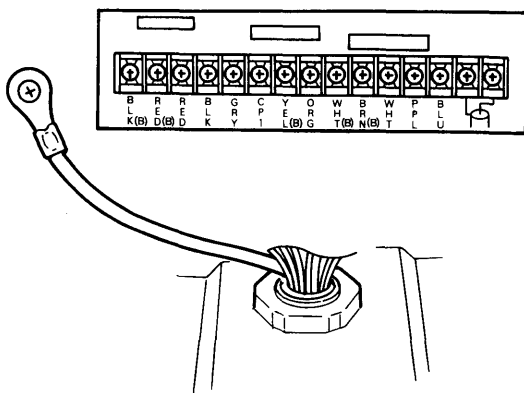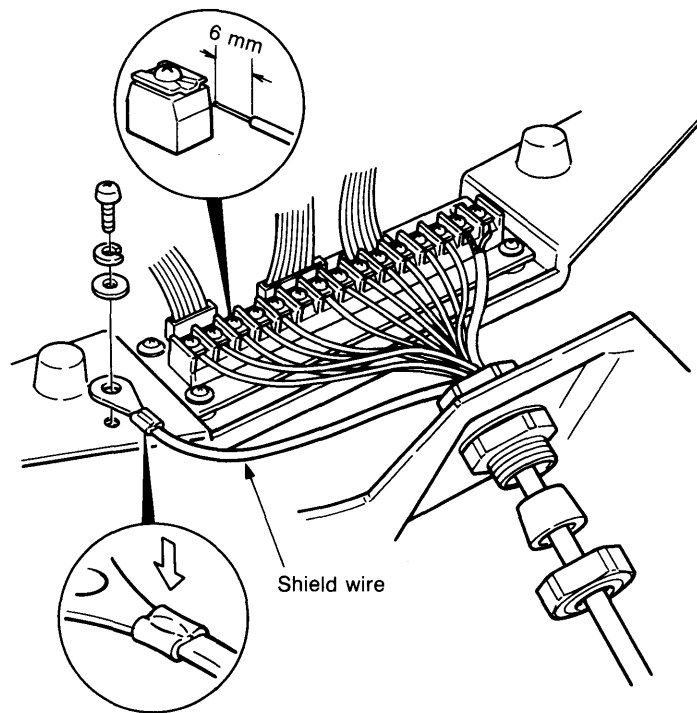
BLK (B)	:	Black	BIG
RED (B)	:	Red	BIG
RED	:	Red	REG.
BLK	:	Black	REG.
GRY	:	Gray	REG.
CP1	:	No connection	
YEL (B)	:	Yellow	BIG
ORG	:	Orange	REG.
WHT (B)	:	White	BIG
BRN (B)	:	Brown	BIG
WHT	:	White	REG.
PPL	:	Purple	REG.
BLU	:	Blue	REG.
	:	Shield wire ground	
	:	Shield wire center conductor	

9-7 Power source requirement

• DC power source

The MR-40 is designed for connection to any power source voltage of 11~40 V DC so that a 12, 24, or 36 V DC battery can be used without any internal modifications.

• DC power cable connection

Connect the supplied DC power cable as shown in the diagram.

CAUTION: Incorrect cable connection will damage the MR-40.

Gray

External buzzer

Power supply

Black ⊖

Power supply

Red ⊕

Power supply

Black ⊖
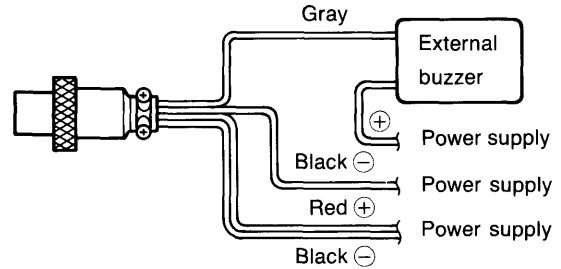
9-8 Ground connection

To prevent electrical shocks and other problems, ground the display unit through the [GND] terminal on the rear panel.

For best results, connect a heavy gauge wire or strap to the nearest grounding point on the boat. The distance between the [GND] terminal and ground point should be as short as possible.

9-9 Bow correction

If the heading marker line differs from the exact bow direction, correct the heading marker line as follows. The function may be helpful when the radome has not been mounted exactly in the direction of the bow.

1) Push and hold [EBL] until "EBL" changes to "ADJ" on the screen.

2) Rotate the multi-function selector to adjust the heading marker line to the desired direction with $-20° \sim +20°$. (Fig. 1)

3) Push [EBL] to set the heading marker. (Fig. 2)

2. 0ᴺᴹ   ■■□□□ LEVEL

"ADJ" appears

ADJ
VRM

Fig. 1

Push [EBL]

2. 0ᴺᴹ   ■■□□□ LEVEL

EBL
VRM

Fig. 2
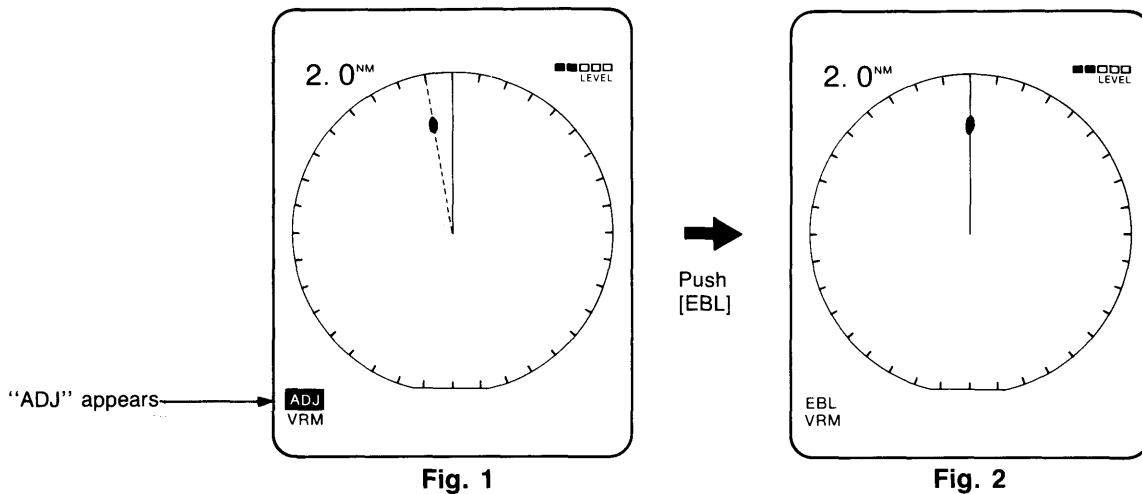
Continuing satisfactory operation of the radar depends on how you care for your equipment. The simple maintenance tips that follow can help you save time, save money, and avoid premature equipment failures.

10-1 Periodic maintenance

WARNING: BE SURE the [POWER] switch is OFF before performing any maintenance.

1) Keep the equipment as clean as possible.
   • Use a soft cloth to remove dirt, dust and water.

2) Check all hardware for tightness.

3) Check cables and terminal connections.

10-2 Scanner unit maintenance

WARNING: BE SURE the [POWER] switch is OFF before working on the radar.

• Radome

1) Wipe the surface of the radome with a clean soft cloth.
   • Do not use any chemical cleaners such as benzine or alcohol.

2) Check that there is no paint, dirt or caked salt.
   • A heavy deposit of dirt or caked salt on a painted surface of the upper radome will cause a considerable drop in radar performance.

3) Check for cracks or deterioration of the rubber packing and replace it if necessary.

4) Clean away only lubrication residue and dirt accumlated in the main drive gear.
   • Using a spatula, apply a light coating of grease on the gear of the main shaft and the drive motor.

• Mounting

Check the mounting bolts of the scanner unit and tighten if necessary.

10-3 Display unit maintenance

WARNING: BE SURE the [POWER] switch is OFF before working on the radar.

• Cleaning the screen

Dirt on the screen filter or the CRT will, in time, leave a film of contaminants which tend to dim the picture.

1) Wipe the surface of the screen filter with a clean soft cloth.
   • Do not use chemical cleaners such as benzine or alcohol.

2) If the picture is still dim, wipe the CRT.
   • To wipe the CRT, unscrew 4 screws from the screen filter and remove the filter.

3) Replace the screen filter, after cleaning.

10-4 Fuse replacement

WARNING: Fuse replacement can be performed ONLY BY A QUALIFIED ELECTRONICS REPAIR PERSON. DISCONNECT the DC power cable before replacing the fuses and never touch other parts.

If the fuse blows or the radar stops functioning, find the source of the problem if possible, and replace the damaged fuse with a new rated fuse.

2 fuses are installed in the display unit:

• Rear panel DC line fuse holder : 10 A

• Internal DC line fuse holder : 5 A

Internal DC line fuse
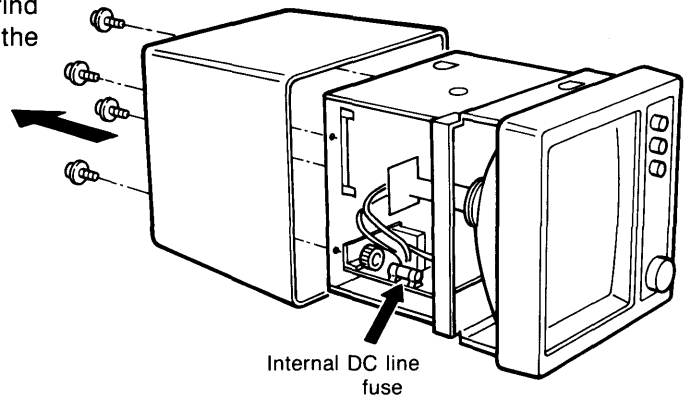
10-5 Option

• OPC-286 SYSTEM CABLE

Allows you to install the display unit and scanner unit up to 30 m (98.4 ft.) apart.

■ General

•Minimum range	:	25 m (when measurement range is 0.25 nm)
•Maximum range	:	24 nm (when measurement range is 24 nm)
•Measurement range	:	

Range (nm)	0.25	0.5	1	2	4	8	16	24
Ring (nm)	0.125	0.25	0.25	0.5	1	2	4	6

•Preheat time   :   2 min.

■ Scanner unit

•Type	:	Center-feed slot array
•Revolution speed	:	Approx. 24 r.p.m.
•Beam width	:	Horizontal beam approx. 4° at −3 dB point
		Vertical beam approx. 22° at −3 dB point
•Side lobe	:	−25 dB
•Polarization	:	Horizontal
•Transmission frequency	:	9410 MHz ±30 MHz (X band)
•Peak output power	:	3 kW
•Pulse width	:	For 0.25, 0.5, 1.0 nm range 0.065 μsec./1400 Hz
		For 2, 4, 8, 16, 24 nm range 0.65 μsec./700 Hz
•Transmit/receive switching	:	Circulator
•Intermediate frequency	:	60 MHz
•IF passband width	:	3 or 8 MHz
•IF circuit characteristics	:	Linear
•Antenna length	:	554 mm; 21.8 in
		(Projections not included)
•Dimensions (radome)	:	607(φ) x 243(H) mm; 23.9(φ) x 9.6(H) in
		(Projections not included)
•Usable temperature range	:	−10°C ~ +60°C (+14°F ~ +140°F)
•Weight	:	8 kg ; 17.6 lb (without cable)

■ Display unit

•System	:	Raster scan method
•CRT display	:	9-inch green display
•Pixels	:	512 x 512 dots (262144 pixels)
•CRT mounting	:	Vertical
•Input	:	NMEA0182 or NMEA0183 format (for navigation receiver)
		N+1 Data format (flux gate compass sensor)
•Output	:	Alarm zone output (relay)
•Power supply requirement	:	11~40 V DC
•Power consumption	:	Approx. 50 W
•External alarm current	:	Less than 1A (240 V DC) 0.5 A (120 V DC)
•Usable temperature range	:	−10°C ~ +60°C (+14°F ~ +140°F)
•Relative humidity	:	Less than 95% at 35°C
•Weight	:	6.7 kg; 14.8 lb

All stated specifications are subject to change without notice or obligation.

Count on us!

Icom Inc.
6-9-16, Kamihigashi, Hirano-ku, Osaka 547, Japan
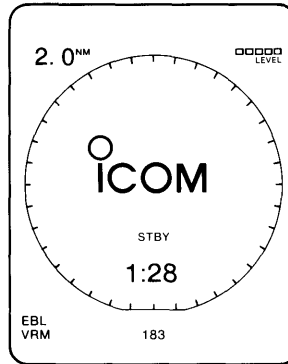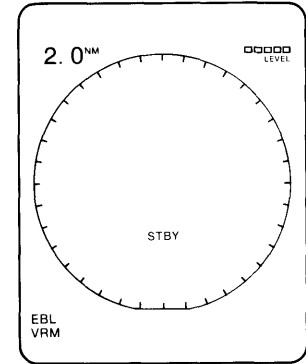
$\overset{\circ}{\text{I}}$COM | MR-40 | OPERATING GUIDE
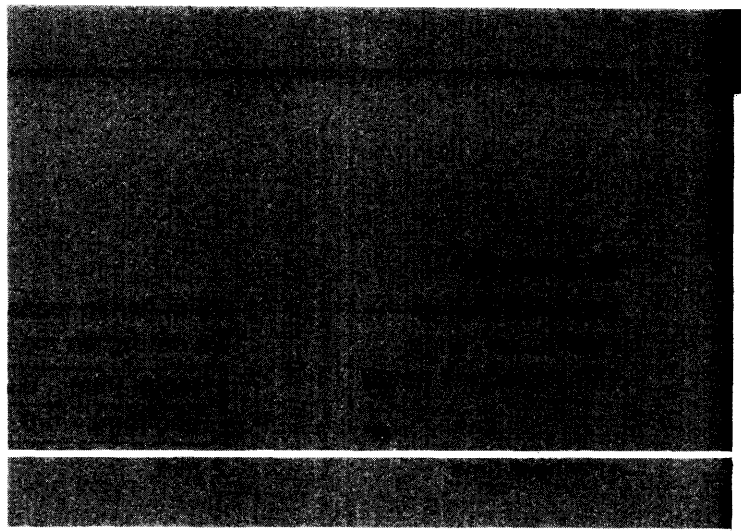
■ Basic operation

① Turn ON the [SCANNER MT] switch on the rear panel.

② Push [POWER] to turn ON the unit and wait 2 minutes.

③ Push [TX] to select the PPI screen.

④ Push [RANGE] and rotate the multi-function selector to select the display range.

⑤ Set [GAIN] to the 2 o'clock position.

⑥ Set [SEA] to the fully counterclockwise position.

⑦ Adjust [TUNE] to set the "LEVEL" indicator to its maximum level.

INITIAL SCREEN   **STAND-BY SCREEN**

■ Screen description

HOLD INDICATOR

SCREEN RANGE READOUT

RING RANGE READOUT

ECHO STRETCH INDICATOR

ALARM ZONE

VRM MARKER

EBL READOUT

VRM READOUT

HEAD-UP/NORTH-UP INDICATOR*1

COMPASS BEARING READOUT

TUNING LEVEL INDICATOR

FTC INDICATOR

IR INDICATOR

FIXED RANGE RINGS

EBL LINE

ALM INDICATOR AND READOUT

LAT/LON READOUT*2

HDG118° LEVEL FTC IR

2. 0NM
0.5NM
ES
HOLD

EBL 128.5°   34°33.16N   ALM
VRM1.760NM 135°17.69E

PPI SCREEN

*1 North-up can be used only when a compass interface with "N+1" data format is connected.

*2 The readout appears only when a navigation receiver with the NEMA 0182 or 0183 is connected.

■ Control functions

[TUNE]
Adjusts the clarity of the display.

[GAIN]
Adjusts the receiver amplifier gain.

[SEA]
Reduces sea clutter such as echoes.   Display can be adjusted on ranges up to 4 miles.

[HM]
Removes the heading marker temporarily from the screen when the switch is pushed and held.

[HOLD]
Freezes the displayed screen.

[ES]
Turns ON and OFF the echo stretch function when the switch is pushed and held for 2 sec.

[BRT]
Selects the screen brightness.

[EBL]
Displays the electronic bearing line and acts as the multi-function selector for the bearing line selector.

[ALARM]
Activates the alarm function and acts as the multi-function selector for the alarm area selector.

MARINE RADAR

TUNE — POWER
GAIN — TX
SEA — FTC
— IR
HM — RING
HOLD ES — N↑/H↑
BRT — ILLUM
EBL — VRM
ALARM — RANGE SHIFT
MULTI-FUNCTION SELECTOR

[MULTI-FUNCTION SELECTOR]
Selects the displayed range, EBL, VRM and alarm area according to the pushed switch.

[POWER]
Turns the power ON and OFF.
To turn power OFF, push and hold the switch for 2 sec.

[TX]
Selects the PPI or stand-by screen.

[FTC]
Suppresses some precipitation clutter.

[IR]
Reduces or eliminates interference from other radar devices.
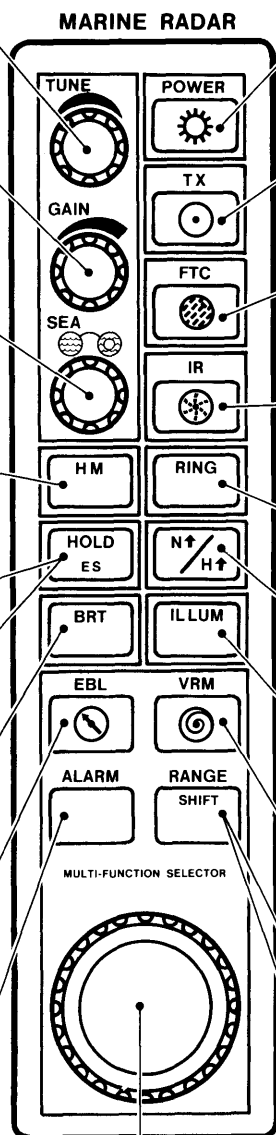
[RING]
Turns ON and OFF the fixed range ring.

[N ↑ /H ↑]
Selects the Head-up or North-up screens*1 .

[ILLUM]
Turns ON and OFF the control panel illumination.

[VRM]
Displays the variable range marker and acts as the multi-function selector for the range marker selector.

[RANGE]
Acts as the multi-function selector for the range selector.

[SHIFT]
Turns ON and OFF the shift function when the switch is pushed and held for 2 sec.

*1 North-up can be used only when a compass interface with "N + 1" data format is connected.