

CE 0191 ⓘ

KODEN

OPERATION MANUAL

COLOR RADAR

MDC-721/741/740

This product is specifically designed to be installed on boats and other means of maritime transport. If your country forms part to the EU, please contact your dealer for advice before attempting to install elsewhere.

Declaration of Conformity

(As required by Article 6.3 of Directive 1999/5/EC-RTTE Directive)

Declares under his sole responsibility that the produced Marine Radar System manufactured by

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Intended for Worldwide use as a Marine Radar for use aboard non-SOLAS vessels and identified by the type number MDC-721 / MDC-741 / MDC-740 to which this declaration refers has been tested to the essential radio test suites required by the notified body and is in conformity with the standards

EN 60945 : 2002 (Clauses 9,10 & 12)

EN 62252 : 2004 (Clauses 4.8, 4.33, 5.8, 5.33 and Annex D)

ITU-R Recommendation RM.1177

and complies with the essential requirements of Directive 1999/5/EC

Conformity procedure under Annex IV of 1999/5/EC (Technical Construction file) has been undertaken by

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Notified Body : QinetiQ

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Koden Electronics Co., Ltd.

07 Jul. 2005

Safety Symbols

To prevent the risk of personal injury or damage to the equipment, the following safety symbols are used to indicate safety-related information. Be sure that you clearly understand the meanings of the symbols BEFORE using the equipment.

Symbols Used in Manual



DANGER

This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.



WARNING

This indicates a hazardous procedure that could result in serious injury or death if not performed properly.



CAUTION

This indicates a hazardous procedure or danger that could result in a light-to-severe injury, or that might damage the equipment, if proper precautions are not taken.

Safety Symbols Used on Equipment

The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of each symbol and take necessary precautions BEFORE using the equipment.



This indicates high voltages with a risk of serious electric shock if the part is touched. NEVER touch the part with bare hands, etc.



The symbol prohibits the operation shown inside the symbol. (The example on the left prohibits disassembly.)



The symbol indicates that the operation inside the symbol is potentially hazardous. (The example on the left indicates that a power plug should be held when disconnecting it from an AC outlet.)



This indicates the ground (earth) terminal. If the equipment cannot be grounded via a power cord, connect this terminal to ground. There is a risk of serious electric shock if the equipment is not grounded.

MDC-721/741/740
Marine Radar
Operation Manual

22nd October 2001 (1st Edition)
25th March 2002 (6th Edition)

For Safety

WARNING and CAUTION for Scanner Unit and Antenna;

- ① Do not approach the antenna while it is transmitting.
 In addition, at inspection never look into the wave-guide during transmission.
 Distance at which RF power density level to become 100 W/m²: 0.8 m
 Distance at which RF power density level to become 10 W/m²: 8 m
- ② There is a risk of receiving electric shock if these parts are touched by accident.
 Only qualified personnel should remove covers on these parts.

 WARNING/警告		
	RF Radiation in process ! Keep away from the antenna.	電波発射中 近寄らないでください!
	Lethal High Voltage Inside ! Do NOT open the cover.	高圧危険 開けないでください!

WARNING for Display Unit;

There is a risk of receiving electric shock if these parts are touched by accident.
 Only qualified personnel should remove covers on these parts.

 **WARNING**

"HIGH VOLTAGE inside"

Only qualified person should work inside display unit.
 Consult MANUAL before opening.

 **警告**

内部に高電圧があり危険です。
 サービスマン以外は開けないで下さい。
 サービスマンは取扱説明書を熟読してから開けて下さい。

Installation

Read and understand the manual thoroughly before installing this unit.

To The User

- * Read and follow the operation and maintenance procedures in this manual. Note that this equipment is only a navigational aid. There is *no warranty for navigational safety*. It is no substitute for prudent navigational procedure and should not be relied on solely for passage.
- * If this equipment does not operate properly, immediately turn off the power switch and disconnect the main power supply. Notify your authorized Simrad dealer or technical service center as soon as possible.
- * The liquid crystal display as well as some of the internal components of this radar can be damaged by dropping or excessive force due to impact. Mount the unit so that it will not be subject to these forces.
- * Mercury (Hg) is used in the LCD backlight. When the unit is taken out of service, it should be disposed according to local regulations regarding hazardous materials.

DISCLAIMER

KODEN assumes no liability for any errors, omissions, damages, or accidents resulting from the interpretation of the supplied documentations.

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CHAPTER 1 OVERVIEW

1.1 Introduction

The MDC-721/741/740 is a compact marine radar that delivers a peak antenna power output of either 2 kW (MDC-721) or 4 kW (MDC-741/740) and has a 7-inch color 640 x 480 liquid crystal display. It uses a microcomputer and a video signal processing LSI chip specifically designed for the radar equipment to deliver high performance and a wide range of features.

Features

1. The LCD allows for a thin case, permitting the installation in tight quarters.
2. Minimal keys and menu screens mean you can easily learn how to use the radar.
3. On screen soft key functions are user assignable.
4. Continuously variable adjustments are done with a rotary control.
5. The Semi-3D display allows for easy identification of targets in noise.
6. A variable range function allows for smooth range changes, not in steps.
7. Waterproof construction (IPX-5) of the display allows the open deck installation.

1.2 Organization of This Manual

This manual provides information for both the novice and experienced users to install, operate and maintain the MDC-721/741/740 radar. Please read it thoroughly so you can take full advantage of its advanced functions. If you are using a radar for the first time, begin with the background information on how the radar works in CHAPTER 2.

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CHAPTER 2. USING RADAR FOR THE FIRST TIME

This chapter covers basic information and technical terms about radar for those who are using one for the first time.

2.1 What is a radar ?

The word "radar" is an acronym for "RAdio Detecting And Ranging." In very simple terms, this is how it works. A radio transmitter sends out a very short microwave pulse, and then a receiver listens for that signal's echo when it is bounced back from something in its path. The returning signal is processed by a computer to determine its relative distance, position and bearing. This information is graphically displayed on a screen for you to see. Other boats or ships, navigational markers, landmasses and such are referred to as targets.

By knowing how long it takes for a signal to return, the distance to a target can be determined. As the radar antenna scans through a 360-degree rotation, it can show where the target is relative to your position. By repeated scans, you can see which direction another vessel is moving.

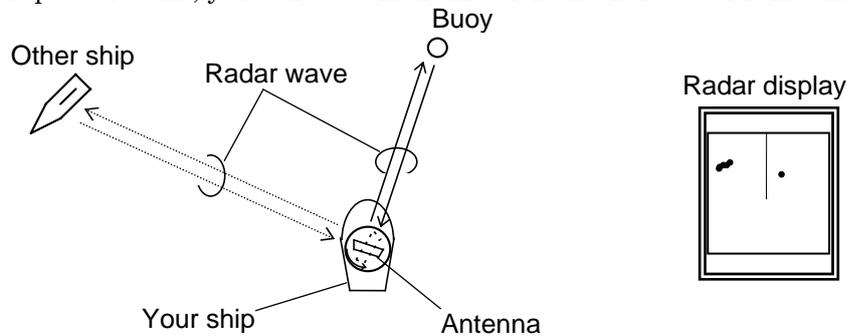


Fig.2-1 What is a radar?

Antenna

How a radar will perform is largely determined by its antenna or scanner. Increasing the size of the antenna improves long-range performance and target discrimination, or the ability to distinguish two separate targets at a distance. The critical factors are the antenna's beam width and side lobe level. Typically, a radar antenna will radiate a tightly focused beam from the front of the array. The longer the antenna array is, the narrower the beam width will be. Additionally, it will also emit smaller amounts of energy to each side. The lower the side lobe level, the less the effect of a false echo. The MDC-721/741 radars are equipped with a closed dome scanner, the MDC-740 has a larger, open array.

Side lobe

The beam in which the strongest radio signal is radiated from the antenna is called the "main lobe". Those beams that are radiated in other directions are referred to as the "side lobes". The side lobe level refers to the difference in level (signal strength) between the largest side lobe and the main lobe.

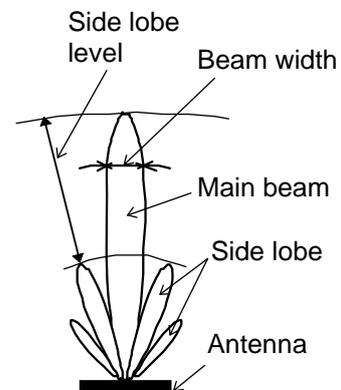


Fig.2-2 Antenna pattern

2.2 Characteristics of Radar Wave

Radio waves travel out from the antenna while bending slightly along the earth's surface. The amount they bend depends on atmospheric conditions. The sight distance of a radar generally is about 6% longer than the optical sight distance and is calculated using this equation :

$$\text{Radar sight distance (NM)} = 2.22 \left(\sqrt{\text{antenna height(m)}} + \sqrt{\text{target height(m)}} \right)$$

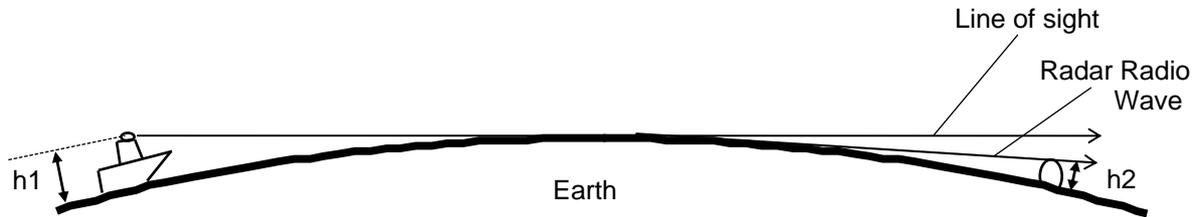


Fig.2-3 Radar wave

Targets difficult to display on screen

The intensity of the reflected radio signal from a target depends on the distance, height, and size of the target, as well as its material and shape, along with the radar's transmitter power output and antenna size. Targets made of fiberglass, wood, or other low-reflectance materials or those that have a small incident angle are difficult to display on a screen. Sandy beaches, and sandy or muddy shallows can be difficult to catch. Because there's not much to reflect a signal back to you, a coastline can actually be closer to your boat than it appears on the screen.

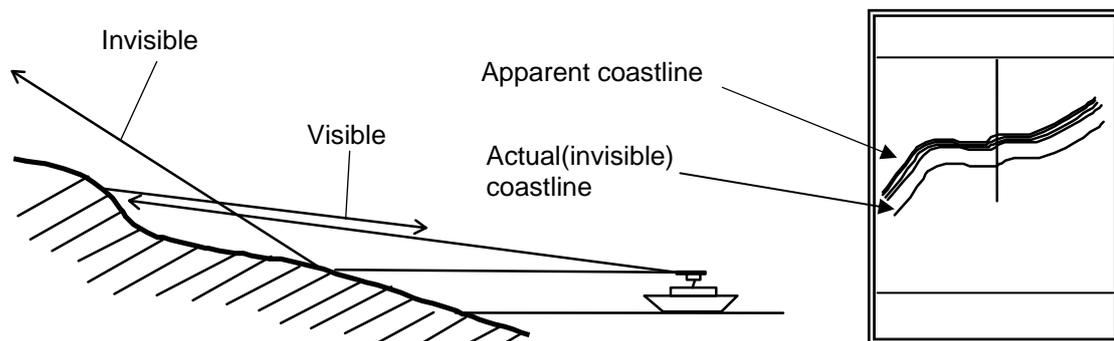


Fig.2-4 Targets difficult to display on screen

Shadow zones of radar

Radar waves propagate in a straight line. A high outcropping of land or a large ship will create a shadow zone behind it and prevent you from seeing targets on the other side. More importantly, if a mast or some part of the boat's superstructure is in the path of the antenna's sweep, this will also create a shadow zone. No targets will be recognized behind it and it could create a dangerous situation.

False echoes

Sometimes a radar will display targets on screen that do not exist in the real world. You should be aware of how and why this happens.

A. Ghost echoes

Sometimes one large object very near your boat will appear as two different targets on-screen. One is the actual radar echo. The other is a ghost echo generated by a re-reflection of the original signal. It comes back to your own boat, bounces back to the target, then is picked up by the an-

tenna on the second bounce. The actual echo appears at the correct distance and bearing on the screen. The ghost echo appears somewhere behind your boat. This type of false echo is also generated by re-reflection of waves from bridges, quay walls or building along shore.

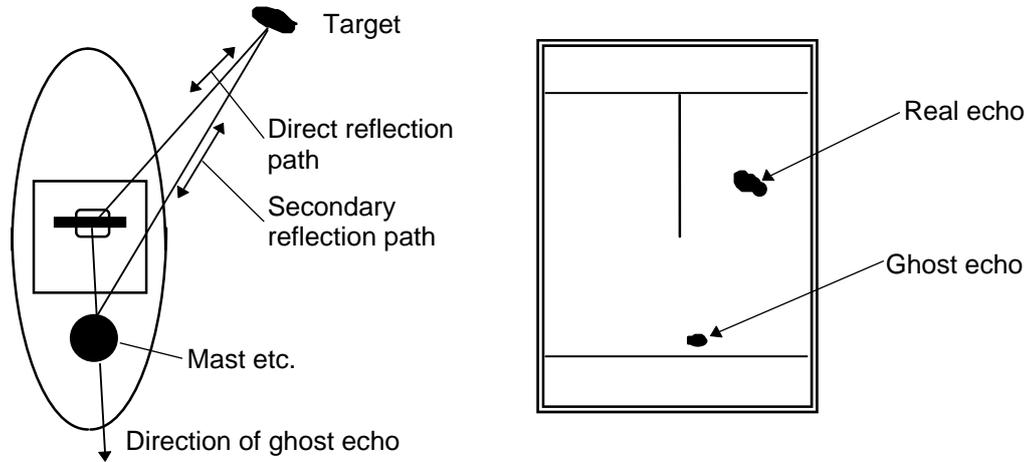


Fig.2-5 False echoes of radar (Ghost echoes)

B. Multiple echoes

If there is a large vertical reflecting surface near your boat, as in the case when you pass alongside a large ship, radar signals are repeatedly bounced back and forth between your boat and the other object. Two to four images appear on the screen at equal intervals in the same bearing. This is called a multiple echo. The image appearing closest to you is the real echo. Multiple echoes will disappear as you move away from the reflecting object or its bearing changes.

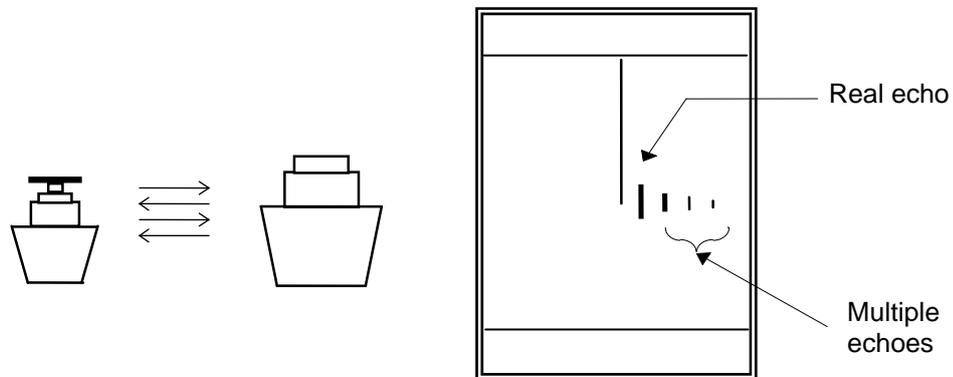


Fig.2-6 False echoes of radar (Multiple echoes)

C. False echoes caused by side lobe

An antenna's side lobe emissions are low power, and will not register distant targets. However, if there is a strong reflecting target near your boat, it sometimes may appear as a circular-arc false echo on the screen.

⚠ CAUTION

When near large targets or land, these echoes may sometimes appear as a circular-arc shaped false echo.

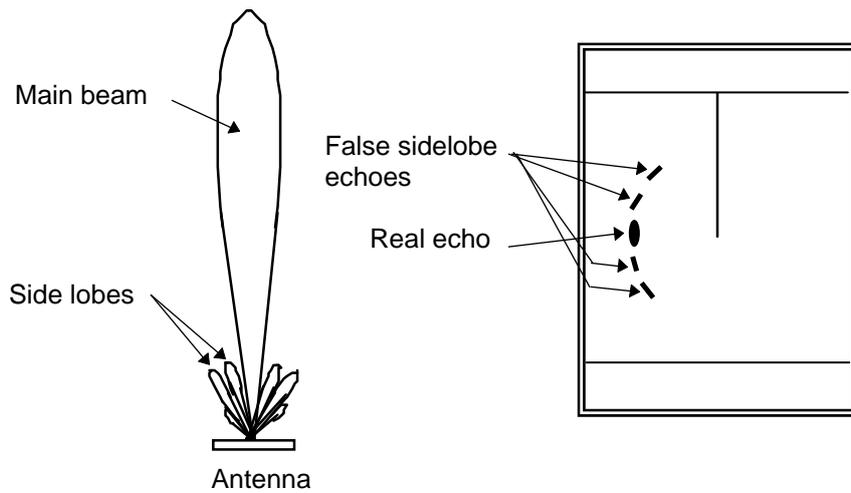


Fig.2-7 False echoes of radar (Caused by side lobe)

D. Distant false echoes caused by duct phenomenon

The duct phenomenon sometimes occurs when meteorological conditions create a temperature inversion between layers of the air. When this happens, radar waves propagate erratically and can reach a location considerably farther away from your boat than the radar's maximum distance range. What appears onscreen is a false echo that looks to be nearer than the actual target. Since the true echo from the distant target is outside the measurement capabilities of the radar, its apparent distance will change when you change ranges, and you can conclude that it's a false echo.

Radar interference

If another boat's radar is operating on the same frequency as yours, it can create interference on your display. The interference usually appears as spiral or radial patterns. The MDC-721/741/740 radar has two levels of interference rejection control to eliminate interference. Turn it on to reduce or eliminate the interference.

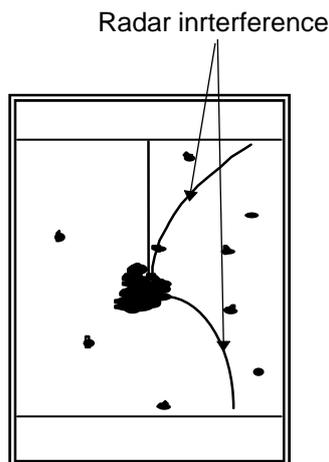


Fig.2-8 Radar interference

2.3 Terms Specific to Radar

HM (Heading Marker)

This is a line-shaped marker used to indicate the forward direction of your boat.

North Mark

The marker to indicate the direction North is a short line approximately 1/6 of the screen radius. It only appears when the radar is connected to a suitable heading source provided through NMEA, 10/12 bit serial or sin/cos.

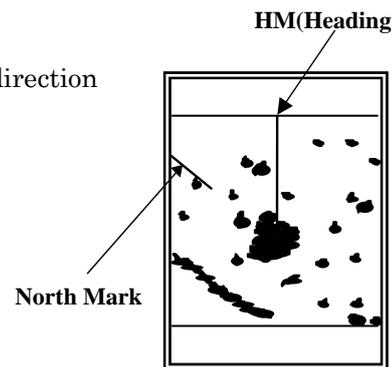


Fig.2-9 Heading Marker and North Mark

Display modes

The MDC-721/741/740 has four display modes. Each refers to the top of the screen as it relates to the direction of your boat's travel.

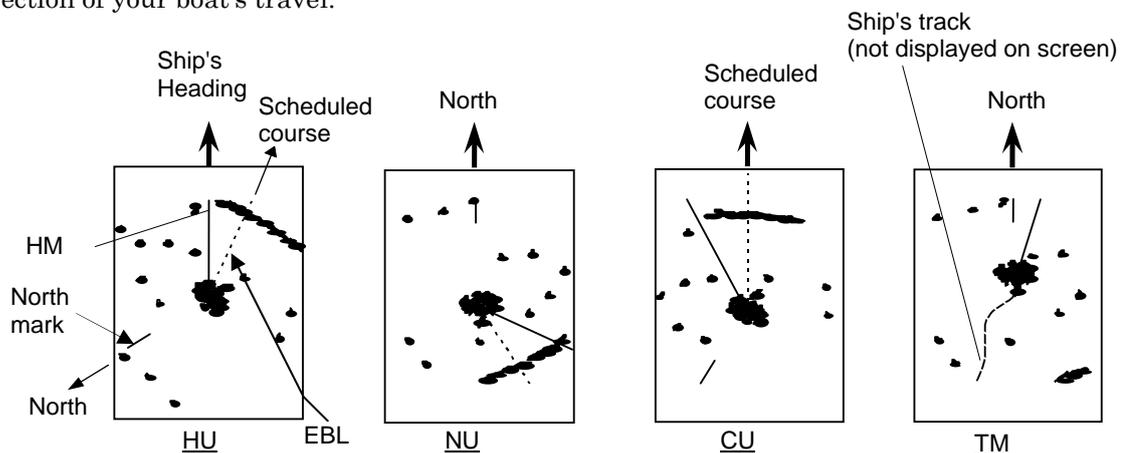


Fig.2-10 Display modes

Head Up (HU)

The heading line is fixed on top of the screen. The movements and bearings of other targets around you are shown relative to your boat.

North Up (NU)

In this mode, True North is fixed at the top of the screen. This allows you to compare your position with a chart as you navigate. Bearing data input is required for this mode to function.

Course Up (CU)

This is similar to North up except that your boat's destination is at the top of the screen. A straight line (imaginary) from the center to top of the screen is your scheduled course bearing.

True Motion (TM)

In this mode, your boat is displayed as if it is moving on a marine chart while targets such as islands and the seashores are fixed in position. When the boat reaches a certain position on the screen (approx. 2/3 of screen radius), it is put back on the opposite side on the screen. North is at the top of the screen. External heading and speed data are needed for this mode.

VRM (Variable Range Marker)

This adjustable circular-shaped marker can be used to determine the distance of a target from your boat. When measuring be certain to move the VRM to a point close to the center of the echo image on the screen.

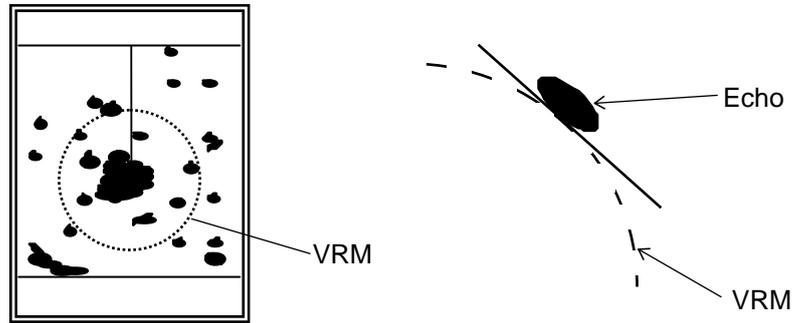


Fig.2-11 VRM

EBL (Electronic Bearing Line)

This straight-line marker can be rotated in any direction centered on your boat's position. Use the EBL to indicate the advancing direction of your boat and its relative angle with a target.

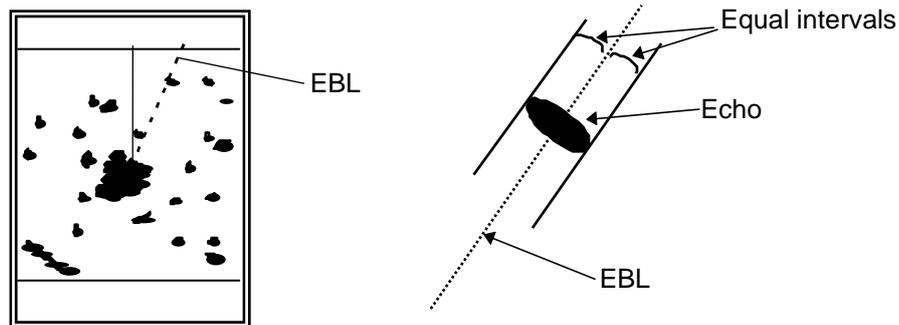


Fig.2-12 EBL

STC (Sensitivity Time Control)

Since echo signals received by the radar are stronger when they are coming from a short distance, it's difficult to compare signal strength between each reflected signal. To overcome this, signal strength is adjusted in such a way that the received signal levels coming from a short distance are lowered. This is helpful when there are large reflected waves from sea surfaces during rough weather.

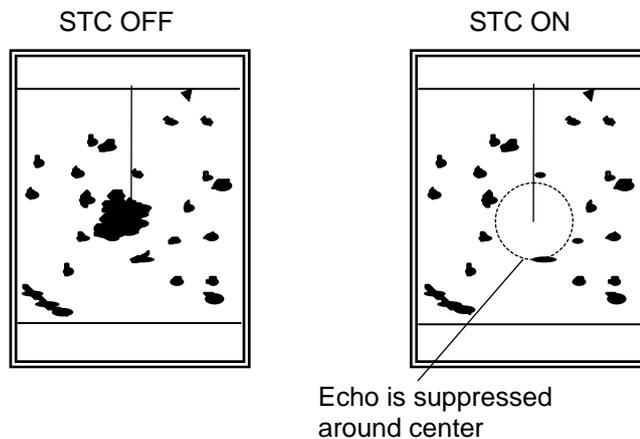


Fig.2-13 STC

FTC (Fast Time Constant)

When it rains or snows, fine noise may appear over the entire screen, making it difficult to identify echoes. In such a case, echo images on the screen can be made easily distinguishable by adjusting FTC.

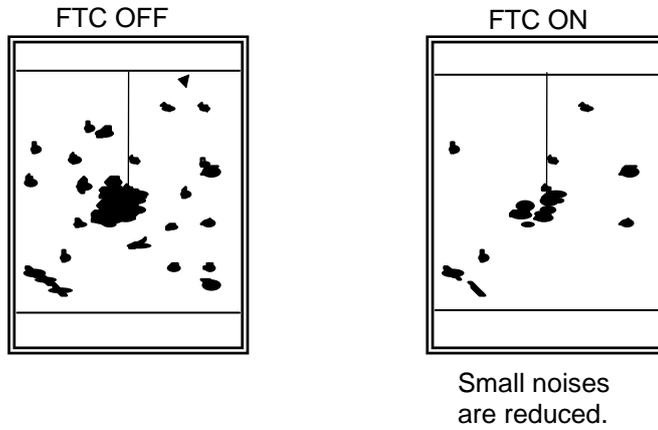


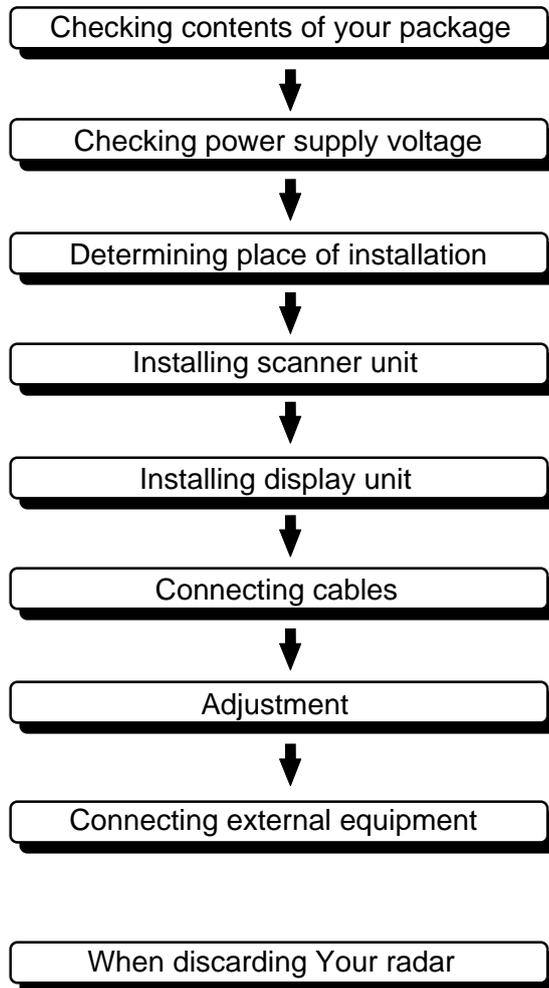
Fig.2-14 FTC

PPI (Plan Position Indicator)

A display system of radar. Reflected radar signal is displayed in plan.

CHAPTER 3. INSTALLATION

This chapter shows how to install the MDC-721/741/740 radar on your boat and the precautions you'll need to observe.



3.1 Checking Inventory

Carefully unpack the box and check to see that all components are present.

Item	MDC-721 Q'TY	MDC-741 Q'TY	MDC-740 Q'TY
Display unit	1 (MRD-99)	1 (MRD-99)	1 (MRD-99)
Scanner unit	1 (RB714A)	1 (RB715A)	1 (RB716A)
Display cover	1	1	1
Fuse	2	2	4
Interconnecting cable	1 (10 m)	1 (10 m)	1 (10 m)
Power supply cable	1 (2 m)	1 (2 m)	1 (2 m)
M10 hexagonal bolt	4 sets	4 sets	0
M12 hexagonal bolt	0	0	4 sets
Carbon brush	0	0	2

Your unit was shipped with a 10m interconnecting cable. Longer cable is also available as an option, as listed in Tab.3-1.

Tab.3-1 Optional Interconnecting Cable

	MDC-721	MDC-741	MDC-740
Cable length	Product No.	Product No.	Product No.
15m	242J160680B	242J158055B	242J159098B
20m	242J160680C	242J158055C	242J159098C
30m	242J160680D	242J158055D	242J159098D

You'll need to supply the following hardware:

Item	QTY	Remarks
Tapping screw or M5 bolt and nut	4 sets	To install display unit
Grounding wire	1	Earth line for display unit
Grounding wire and crimp terminal	1 set	Earth line for scanner unit

3.2 Checking Power Supply Voltage

3.2.1 Power Supply Requirements

Tab.3-2 shows the power requirements for the MDC-721/741/740 radar. If the unit is supplied with less than the specified voltage, it won't operate properly. Keep in mind that when the unit is initially powered on there will be a peak current surge. Check all circuits back to the power source for correct wire gauge and tight connections.

Tab.3-2 Power Supply Requirements

Supply voltage used	Maximum current	Allowable range of voltage
DC12V	5A	10.2-41.6V
DC24V/32V	2.5A	10.2-41.6V

*A.C. power cannot be used

3.2.2 Fuse Replacement

CAUTION: Use only exact replacements.

Tab.3-3 Supply Voltage vs Main Fuse Ratings

Supply voltage used	MDC-721/741	MDC-740
DC12V	8A/250V or 125V* (6.3 Φ x 32mm)	10A/250V or 125V (6.3 Φ x 32mm)
DC24V/32V		8A/250V or 125V* (6.3 Φ x 32mm)

Tab.3-4 Supply Voltage vs Motor Fuse Ratings

Supply voltage used	MDC-721/741	MDC-740
DC12V	Not used	5A/250V or 125V (5 Φ x 20mm)
DC24V/32V		T3.15A/250V or 125V* (5 Φ x 20mm)

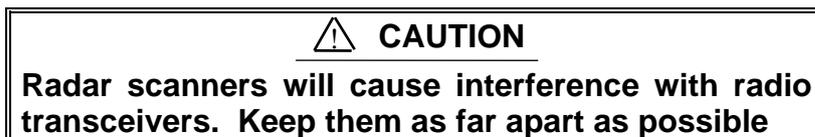
Note: A fuse with an asterisk (*) is fitted as standard.

3.3 Where to Install the Scanner

3.3.1 Scanner unit

A radar's target detection ability increases with the height of the scanner. The ideal location is as high as possible along the boat's keel line and clear of any obstructions.

- (a) Install the scanner as high as possible.
Consider the structural support of the location. Will it hold the weight of the scanner?
How difficult will it be to get to the scanner for maintenance?
- (b) Install the scanner away from masts.
If the scanner is installed at the same height as a mast, radar waves may be blocked, creating shadow zones or generating false echoes.
- (c) Install the scanner forward of obstacles.
If you can't avoid an obstacle, place the scanner on the bow side of it. When installing the scanner on a mast, position it in front of the mast. (If obstacles cannot be avoided for structural reasons, refer to "Shifting away from obstacles" in Section 3.3.3.)
- (d) Do not install the scanner near hot or heat-generating items.
Do not install the scanner where it may be subjected to smoke or hot air from exhausts or heat from lights.
- (e) Install the scanner away from other antennas.
Keep it as far as possible from the antennas of other electronic equipment.



- (f) Keep the cable length as short as possible.
Keep the distance from the scanner to the display unit within the standard cable length of 10 m. If you need a longer cable, limit the length to a maximum of 30 m for MDC-721 and 100 m for MDC-741/740.

3.3.2 Display unit

The display unit can be installed in a helm console, bulkhead, or electronics box. Consider these suggestions:

- (a) A place where you can see the boat's bow when looking straight up from the radar screen.
- (b) A place where there is no direct sunlight to avoid display temperature buildup.
- (c) A place where there is good ventilation and minimum vibration.
- (d) A place where the display unit is more than the minimum safe distance from a magnetic compass as listed in Tab.3-5 below.

Tab.3-5 Minimum Safe Distance from Magnetic Compass

	Standard compass	Steering compass
Scanner unit	2.0m	1.4m
Display unit	2.0m	1.4m

3.3.3 Shifting away from obstacles

① Shifting from keel line

By shifting the scanner position from the keel line to the starboard side of the boat, it is possible to move shadow zones to the port side. This makes it possible to keep a clear view to the bow. The distance to be shifted can be calculated using the following equation:

$$L_s = 0.4R + D/2 \text{ [m]} \quad (\text{when } R < 15\text{m})$$
$$L_s = 0.025R + D/2 \text{ [m]} \quad (\text{when } R \geq 15\text{m})$$

where L_s = distance to be shifted from keel line
 D = diameter of obstacle on keel line
 R = distance from scanner to obstacle

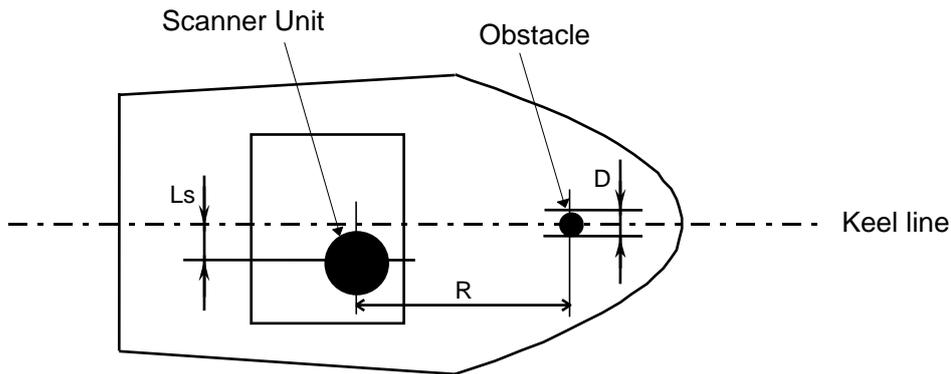


Fig.3-1 Shifting from keel line

② Obtaining sufficient dip angle

Raise the scanner position so that there is a sufficient dip angle θ available between the line of sight from the scanner to the obstacle and the horizontal line. By raising the dip angle above 5° , it is possible to prevent mid- and long-distance shadow zones. The radar cannot detect objects below the line of sight.

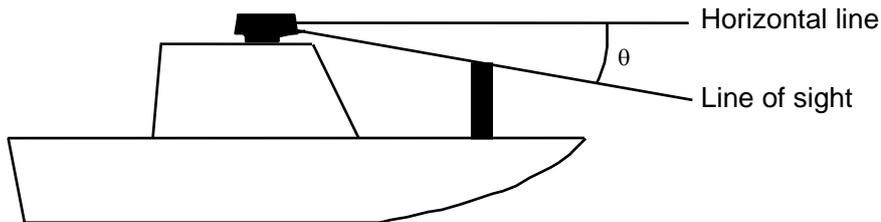


Fig.3-2 Obtaining sufficient dip angle

3.4 Installing Scanner Unit

Use a mounting base such as the ones shown in Fig. 3.3, or you can install the scanner directly to a roof or other flat surface. Be certain you keep the water drain tube clear. It's located at the bottom of the scanner unit.

Note : If the mounting bracket or surface has a curvature of more than 2mm, use spacers with the mounting bolts to prevent stress on the scanner housing.

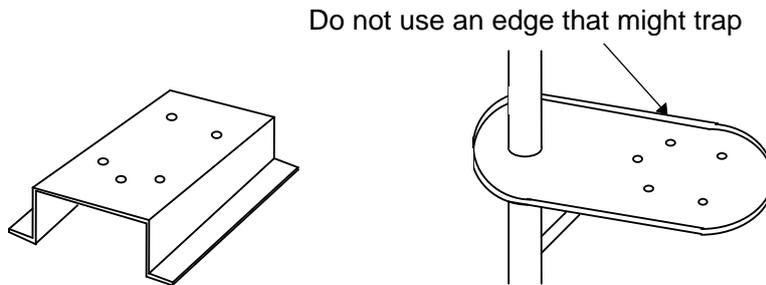


Fig.3-3 Mount base

Use the template provided with this manual to drill five holes for mounting the scanner. Attach the four bolts and feed the drain tube through the fifth hole. The bolts included with your unit will suffice for mount base thickness of 9 to 14 mm (0.35 to 0.55 in.). If the mount base is thicker or thinner, refer to Tab.3-6. Use a silicone sealant to prevent the bolts from working loose. The radome plastic housing may be damaged if you use a thread locking compound.

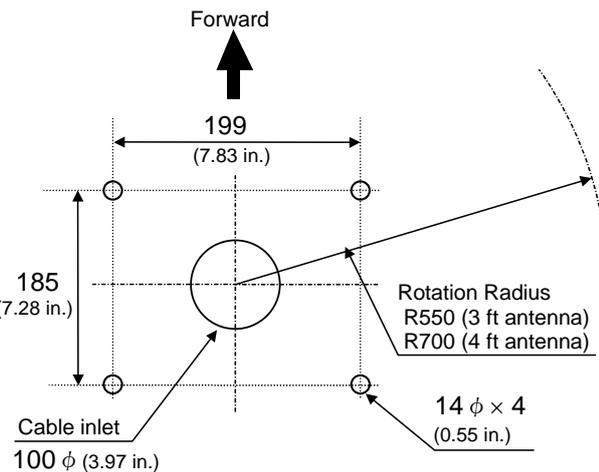
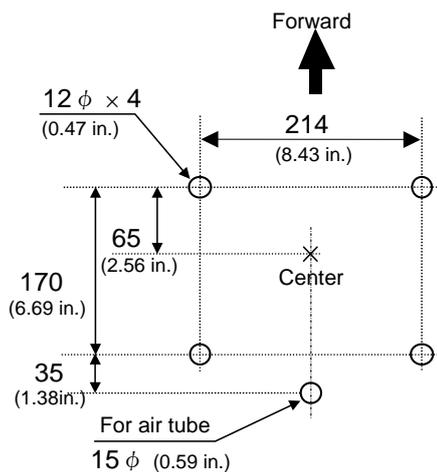
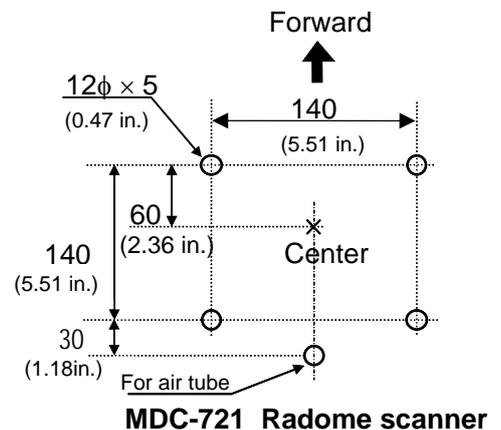
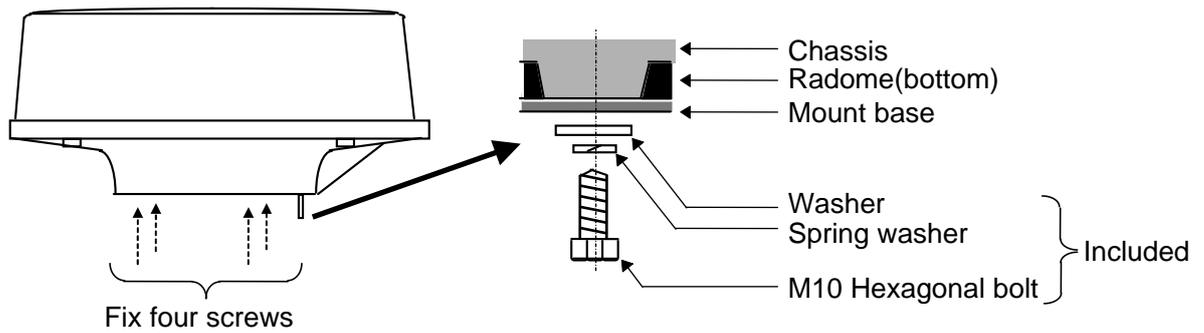
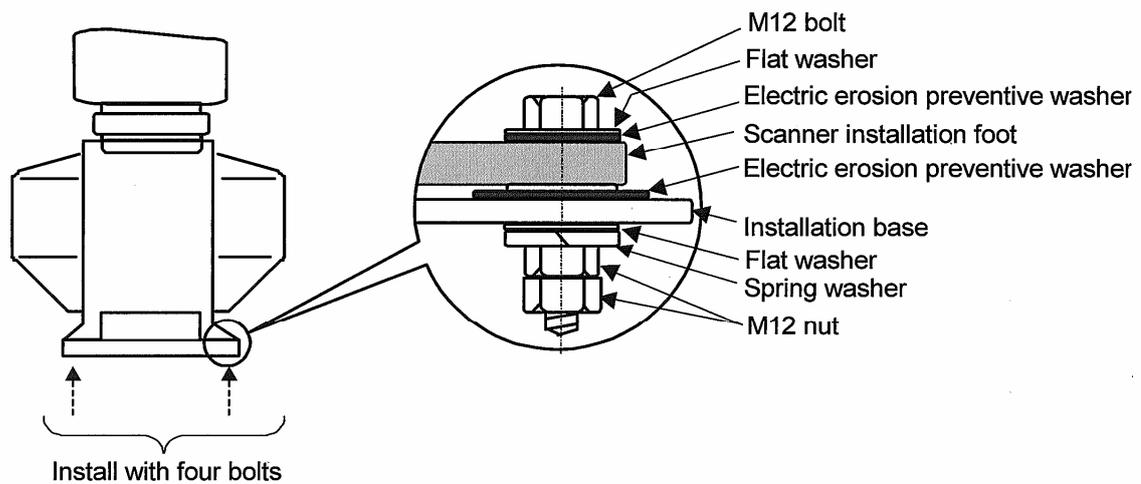


Fig.3-4 Hole positions for mounting scanner



MDC-721/741 Radome scanner



MDC-740 Open scanner

Fig.3-5 Mounting the Scanner

Tab.3-6 Bolts for Mounting Scanner Unit (Radome scanner)

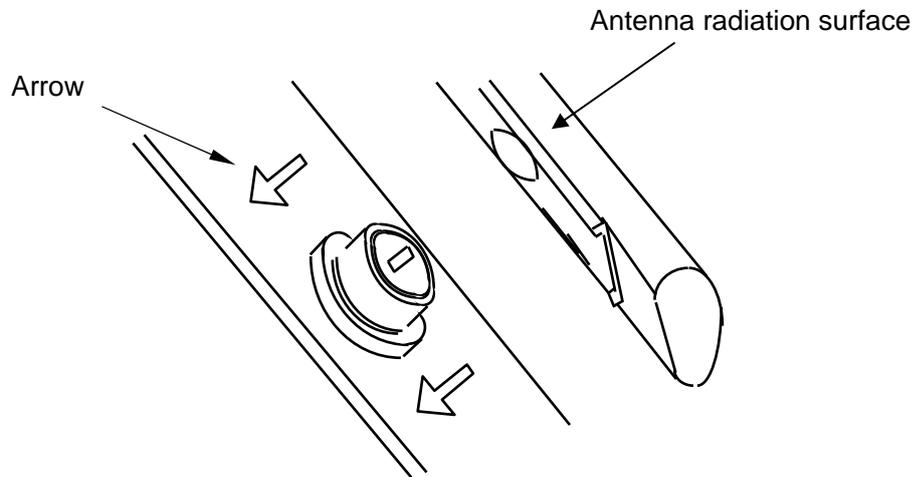
Thickness of mount base	Bolts necessary to fix radome scanner	Material	Remarks
1-4mm(0.04-0.16 in.)	M10 × 15 (1.5mm pitch)	Stainless	
4-9mm(0.16-0.35 in.)	M10 × 20 (1.5mm pitch)	Stainless	
9-14mm(0.35-0.55 in.)	M10 × 25 (1.5mm pitch)	Stainless	Included with radar
14-19mm(0.55-0.75 in.)	M10 × 30 (1.5mm pitch)	Stainless	

Tab.3-6-1 Bolts for Mounting Scanner Unit (Open scanner)

Thickness of mount base	Bolts necessary to fix radome scanner	Material	Remarks
1-4mm(0.04-0.16 in.)	M12 × 45 (1.5mm pitch)	Stainless	
4-9mm(0.16-0.35 in.)	M12 × 50 (1.5mm pitch)	Stainless	
9-14mm(0.35-0.55 in.)	M12 × 55 (1.5mm pitch)	Stainless	Included with radar
14-19mm(0.55-0.75 in.)	M12 × 60 (1.5mm pitch)	Stainless	

3.5 Installing Antenna Unit

Remove the protective cap covering the rotary coupler on the top of the scanner. Match the antenna radiation direction to direction of the arrow markings on the rotation base and secure the antenna in position using four M8 bolts.



3.6 Installing Display Unit

Choose the proper bolt length according to the thickness of the surface on which you are going to install the display. Hole size depends on whether you are using self-tapping screws or bolts.

Note : When you install the display by flush mounting to a panel, refer to appendix "OUTLINE DRAWING". Slide off the four triangular-shaped corner covers, and attach the display unit to the panel with screws. Replace the corner covers. See APPENDIX.

Note: FLUSH MOUNT KIT (COM7/MRD99.FM.KIT) is extra-cost option.

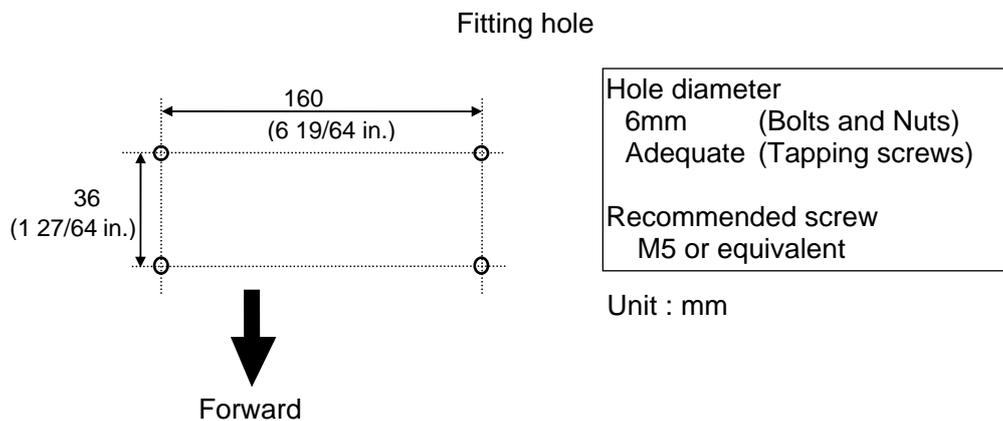


Fig.3-6 Hole positions for display unit

⚠ WARNING
Do not mount the display where it will be operating in direct sunlight. The excessive internal heat buildup may damage the unit.

3.7 Connecting Cables

Keep the following tips in mind when laying cables:

- Do not tie the cables for the radar together with cables of other equipment, especially the power supply cable.
- If you need to pass the cable through a wire chase or conduit, tape the scanner side connector to the wire so it doesn't pull off or get hung up.
- Secure cables in place at intervals of about 40 cm (16").

3.7.0 Interconnecting cable (MDC-721 Radome scanner) (See Fig.3-8-1)

- 1) Be sure that the power is off. Connect the cable to the plug labeled "SCANNER" on the rear panel of the display unit. Be sure to secure the rubber boot around the cable connector rim.
- 2) Remove the upper part of the radome from the scanner unit. Lift it vertically to avoid bumping it against the antenna. (There are three screws holding it in place.)
- 3) Remove the tape securing the antenna.
- 4) Remove the shield cover located on the backside. (There are three screws.)
- 5) Remove the cable clamping plate and rubber ring, pass the cable through the opening, replace the rubber ring, and clamp the cable to the scanner unit with screws on the fixing plate. Attach the cable connector to the X1 connector on the printed circuit board.
- 6) Replace the aluminum cover. Lay the cable shield into the channel machined into the aluminum housing. Be careful that the cable will not get caught between the main unit and cover.
- 7) Replace the upper part of the radome, being careful not to bump it against the antenna. Make sure that the cover is positioned in the correct direction as shown in Fig.3-7-1. The upper and lower parts of the radome each have three alignment markings indicating screw positions.

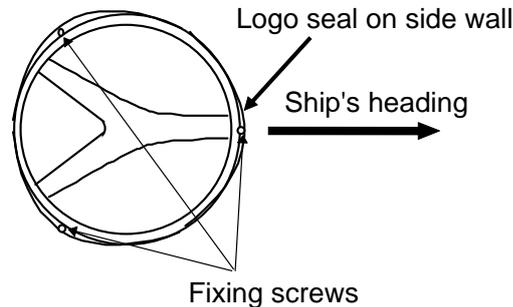


Fig.3-7-1 Fitting Cover (MDC-721)

3.7.1 Interconnecting cable (MDC-741 Radome scanner) (See Fig.3-8-2)

- 1) Be sure that the power is off. Connect the cable to the plug labeled "SCANNER" on the rear panel of the display unit. Be sure to secure the rubber boot around the cable connector rim.
- 2) Remove the upper part of the radome from the scanner unit. Lift it vertically to avoid bumping it against the antenna. (There are four fixing screws.)
- 3) Remove the tape securing the antenna.
- 4) Remove the shield cover located on the backside. (There are four screws.)
- 5) Remove the cable clamping plate and rubber ring, pass the cable through the opening, replace the rubber ring, and clamp the cable to the scanner unit with screws on the fixing plate. Attach the 7-pin connector to X11 and 9-pin connector to X12 of the printed circuit board.
- 6) Replace the aluminum cover. Lay the cable shield into the channel machined into the aluminum housing. Be careful that the cable will not get caught between the main unit and cover.

- 7) Replace the upper part of the radome, taking care not to bump it against the antenna. Make sure that the cover is positioned in the correct direction as shown in Fig.3-7-2. The upper and lower parts of the radome each have four alignment markings indicating screw positions.

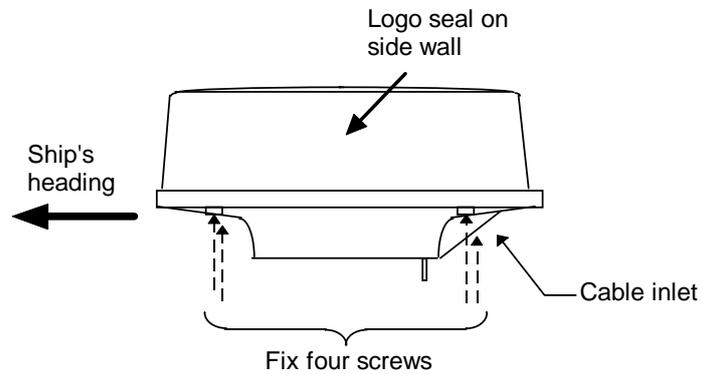


Fig.3-7-2 Fitting cover (MDC-741)

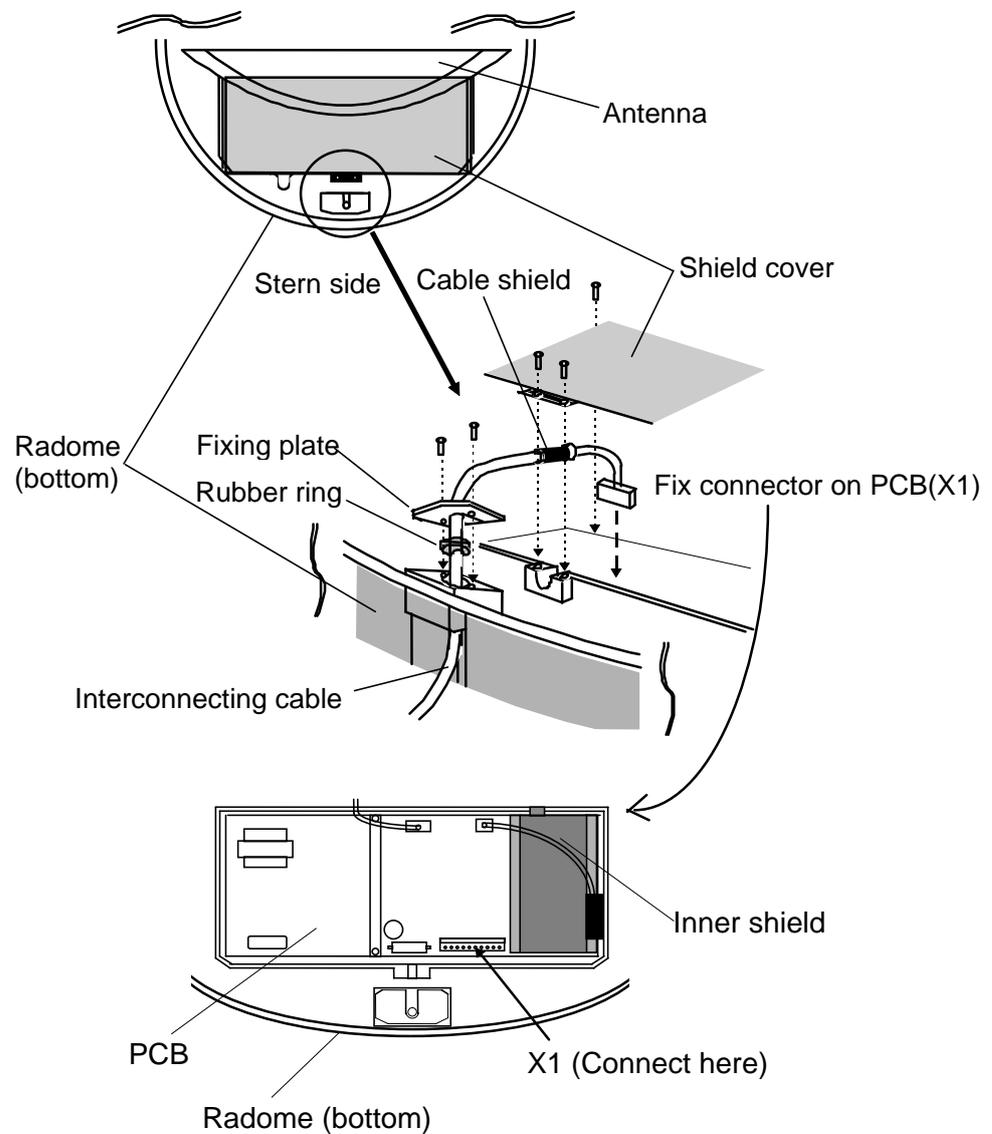


Fig.3-8-1 Fitting interconnecting cable (MDC-721)

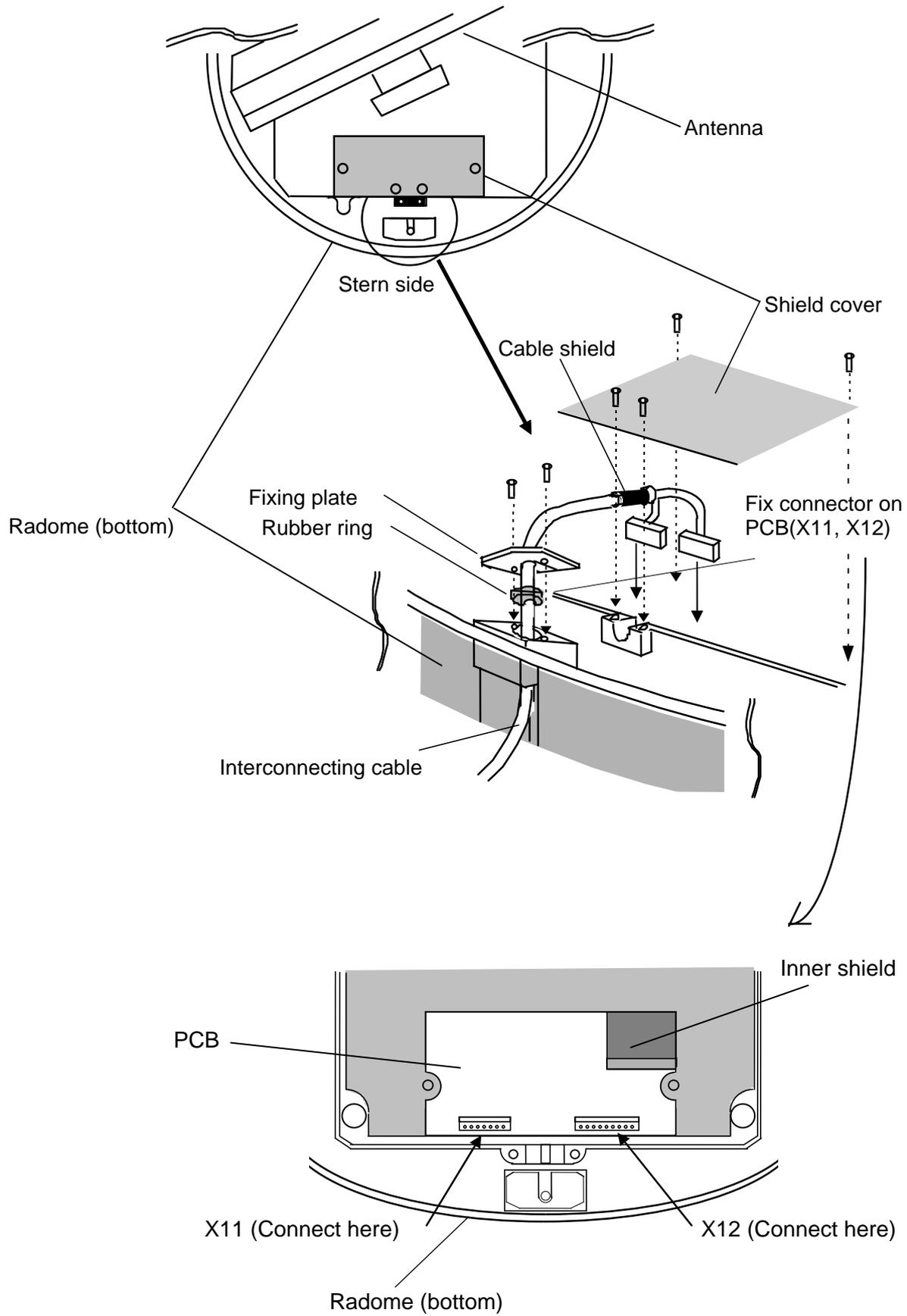


Fig.3-8-2 Fitting interconnecting cable (MDC-741)

3.7.2 Interconnecting cable (MDC-740 Open scanner) (See Fig.3-9)

- 1) Be sure that the power is off. Connect the cable to the plug labeled "SCANNER" on the rear panel of the display unit. Make sure to secure the rubber boot around the cable connector rim.
- 2) Use a socket wrench to remove the back cover of scanner unit.
- 3) Remove the two bolts securing the transceiver.
- 4) Remove the connectors to the motor X1 and to the heading switch X2. Pull out the transceiver.
- 5) Remove the four bolts securing the fixing plate at the cable entrance.
- 6) Remove the metal fixing plate, rubber seal and washer that secure the cable. Pass the cable through as shown in the diagram below; replace the above items and tighten the bolts.
- 7) Return the transceiver to its original position and secure it with the bolts you removed.
- 8) Connect the 7-pin connector to X11 and the 9-pin connector to X12 of the printed circuit board and connect the two connectors that you removed in Step 3).
- 9) Reattach the scanner cover. Take care not to pinch the cable when reattaching the cover.

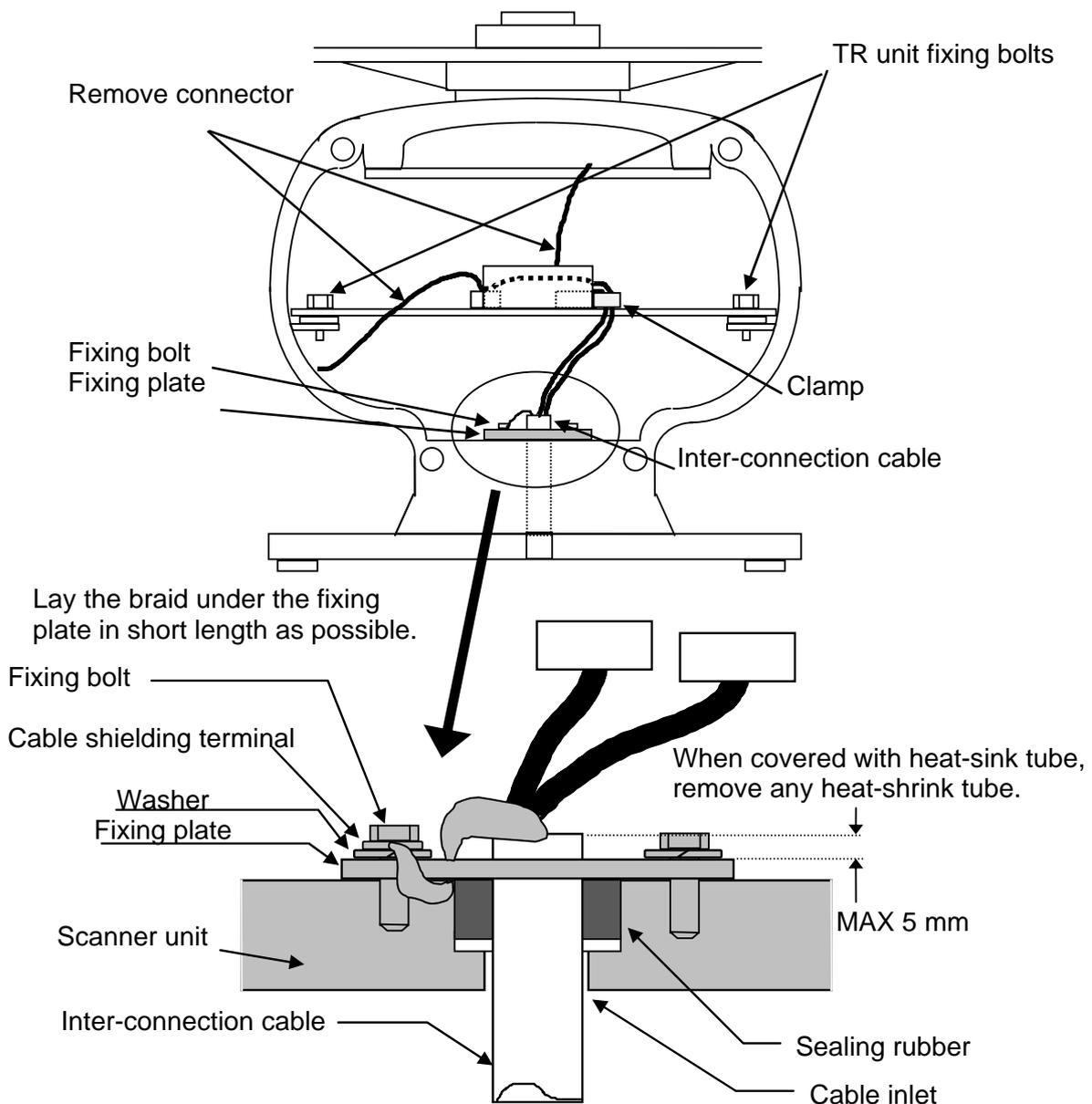


Fig.3-9 Fitting interconnecting cable

3.7.3 Grounding wire

⚠ WARNING
Connect all grounding wires before connecting the power supply cable to prevent a shock hazard from leakage current.

Connect a wire from the grounding terminal on the rear panel of the display unit to your boat's bonding system or electrical ground bus.

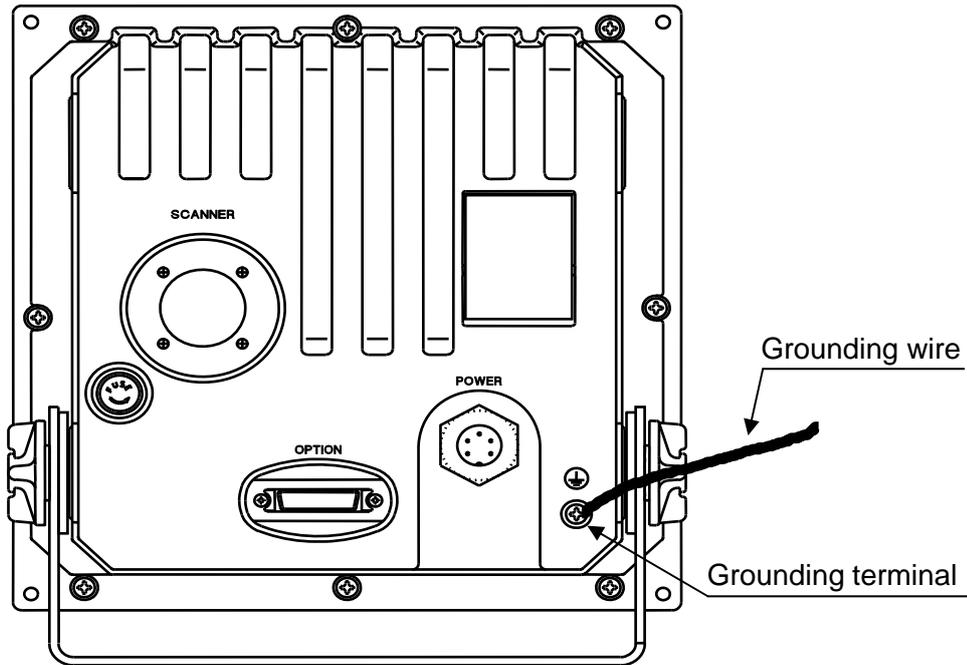


Fig.3-10 Grounding display unit to earth

Connect a grounding wire from one of the bolts on the scanner base as shown in Fig.3-11. (The crimp terminal and grounding wire are user supplied items.)

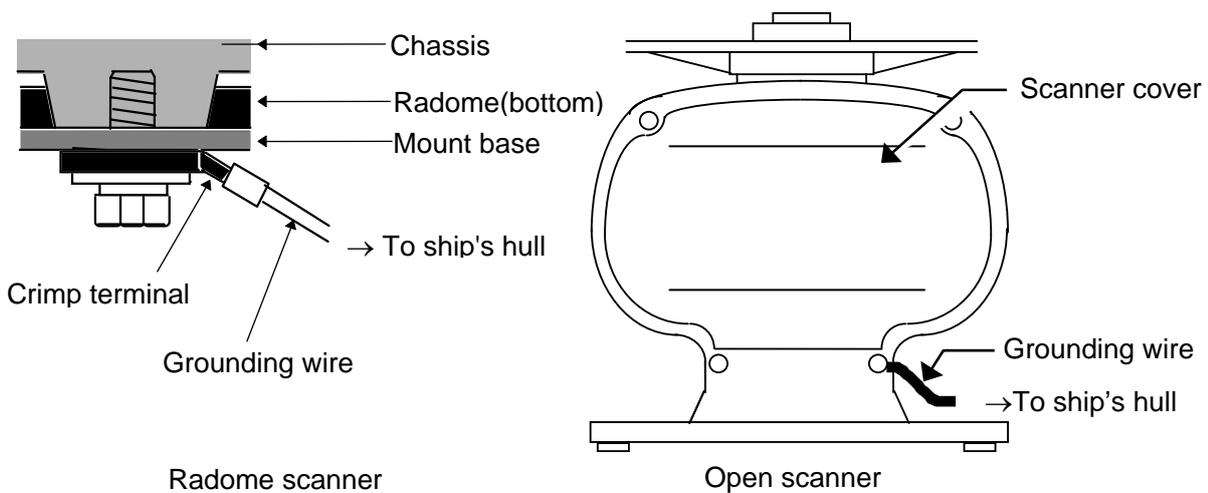
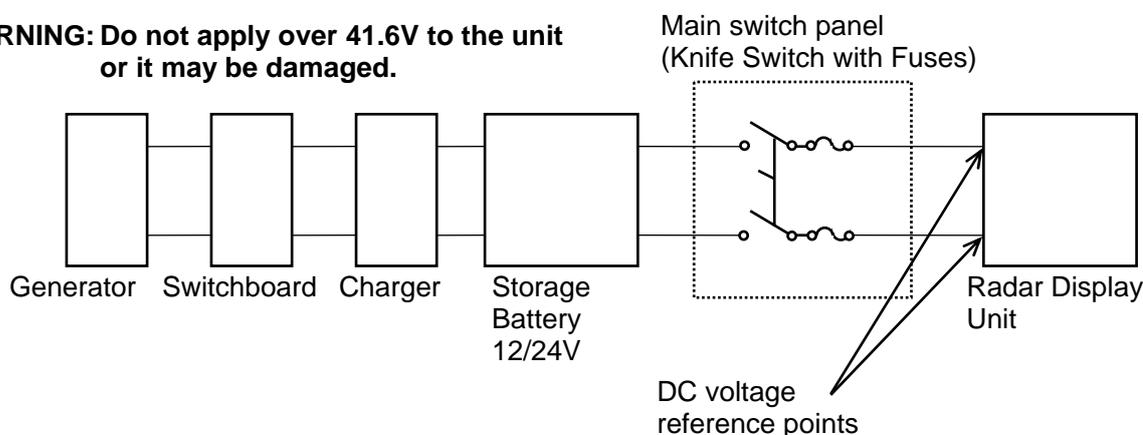


Fig.3-11 Grounding scanner unit to earth

3.7.4 Power supply cable

Power should be fed through a switch and protective fuses (or circuit breakers), as shown below.

WARNING: Do not apply over 41.6V to the unit or it may be damaged.



Plug the power supply cable into the connector labeled "POWER" on the rear panel of the display unit. If you do not connect your radar to external equipment, tape the ends of the red and green wires. Be certain to locate the fuse where it will be kept dry. When extending the power supply cable, size the wire as follows:

Boat Power Voltage	Cable conductor cross section	Cable max. length
12Vdc	10 AWG (3.5 mm ²)	3 m
	8 AWG (6.0 mm ²)	5 m
24Vdc	12 AWG (2.0 mm ²)	6 m
	10 AWG (3.5 mm ²)	10 m

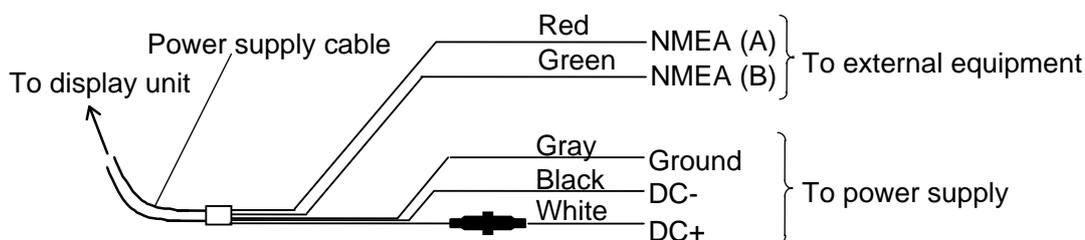


Fig.3-12 Power supply cable

3.8 Adjustment

⚠ CAUTION

**Make sure to carry out the following adjustments.
If not the radar will not display a true image.**

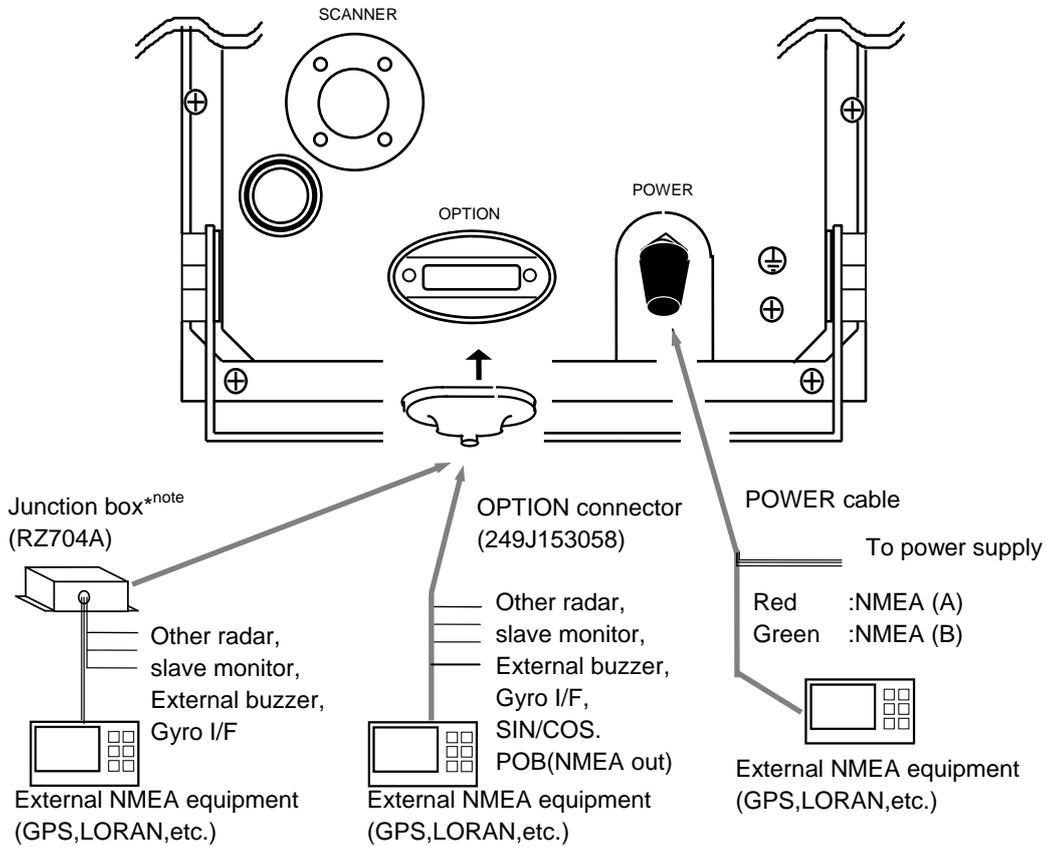
When you have finished installing the scanner and display units, turn on the power to see if they operate. Then make adjustments as detailed below:

- | | |
|---|---|
| <ul style="list-style-type: none"> ① TUNING ② HEADING DIRECTION ③ DISTANCE | <ul style="list-style-type: none"> Refer to Adjusting tuning circuit in 5.5.4.5.5 Refer to Adjusting angle in 5.5.4.5.5 Refer to Adjusting distance in 5.5.4.5.5 |
|---|---|

3.9 Connecting External Equipment to Display Unit

The display unit has connections for two NMEA interface ports. One is made through the power cable. The other is accessed through the OPTION connector on the display's rear panel. A separate cable and optional junction box are needed to use this interface. (Refer to CHAPTER 8 (4) External interface.)

Note: SIN/COS and POB/TARGET signals cannot be accessed through the junction box interface.



Note: Junction box with OPTION cable(Order No. RZ704A)

Fig.3-13 Connecting external equipment to display unit

3.10 Countermeasure for Electromagnetic Interference

The MDC-721/741/740 radar uses internal shields and shielded cable to minimize electro-magnetic interference (EMI). However, when the unit is placed close to a radio transceiver and either piece of equipment is not properly grounded, the radar will cause the radio interference or EMI (Electro Magnetic Interface).

Here are some hints on how to reduce EMI due to radar.

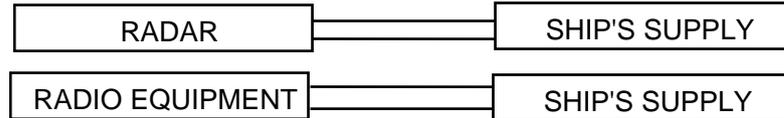
(1) Installation Location

The display unit, scanner unit and interconnecting cable should be located as far as possible from the transceiver, antenna cable and antenna of the radio. Some trials may be needed to find out the best position for installation.

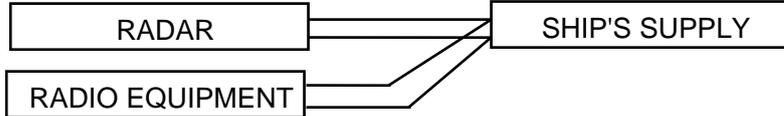
(2) Laying Power Supply Cables

The best solution is to run separate power wires from each unit directly to the boat's electrical supply source. A connection should be made at the main distribution board or as close to the generator or battery as possible. In the connection plan shown, we recommended the connection A and B. Connection C should not be used.

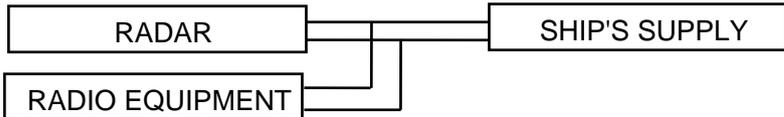
Connection A
(Very Good)



Connection B
(Good)



Connection C
(Bad)



(3) Grounding

Both the display unit and the scanner should be securely grounded to the closest point of the boat's bonding system or electrical ground bus using braided copper wire or copper strap.

3.11 When Discarding Your Radar

Tab.3-7 lists the primary component materials of the MDC-721/741/740 radar. Dispose them according to local environmental and recycling regulations.

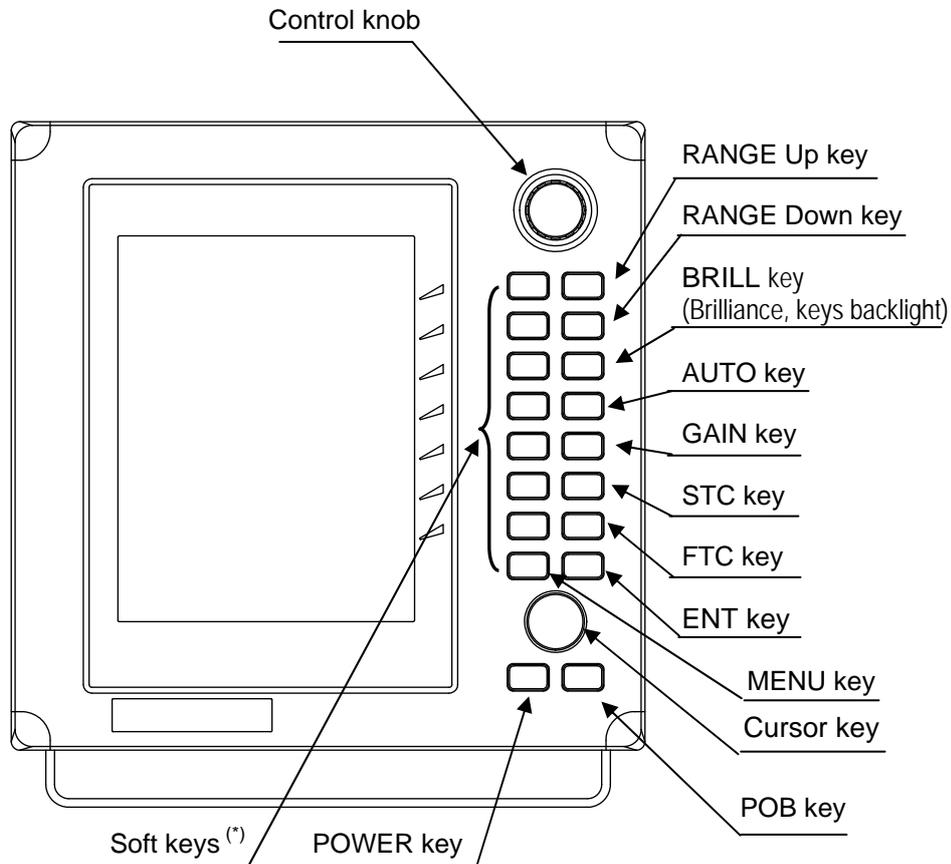
Tab.3-7 Component Materials

Scanner unit	Material	Display unit	Material
Radome	AES	Front panel	AAS
Chassis	A5052P	Rear panel	ADC12
Base	ADC12	Pedestal	A5052P
Antenna	A5052P		

CHAPTER 4. FUNCTIONS AND NAMES

The MDC-721/741/740 radar consists of a display and a scanner. The display unit has on its front panel eighteen push-button keys, one rotary control knob and one cursor control touch pad.

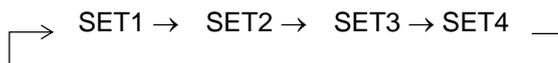
4.1 Key layout



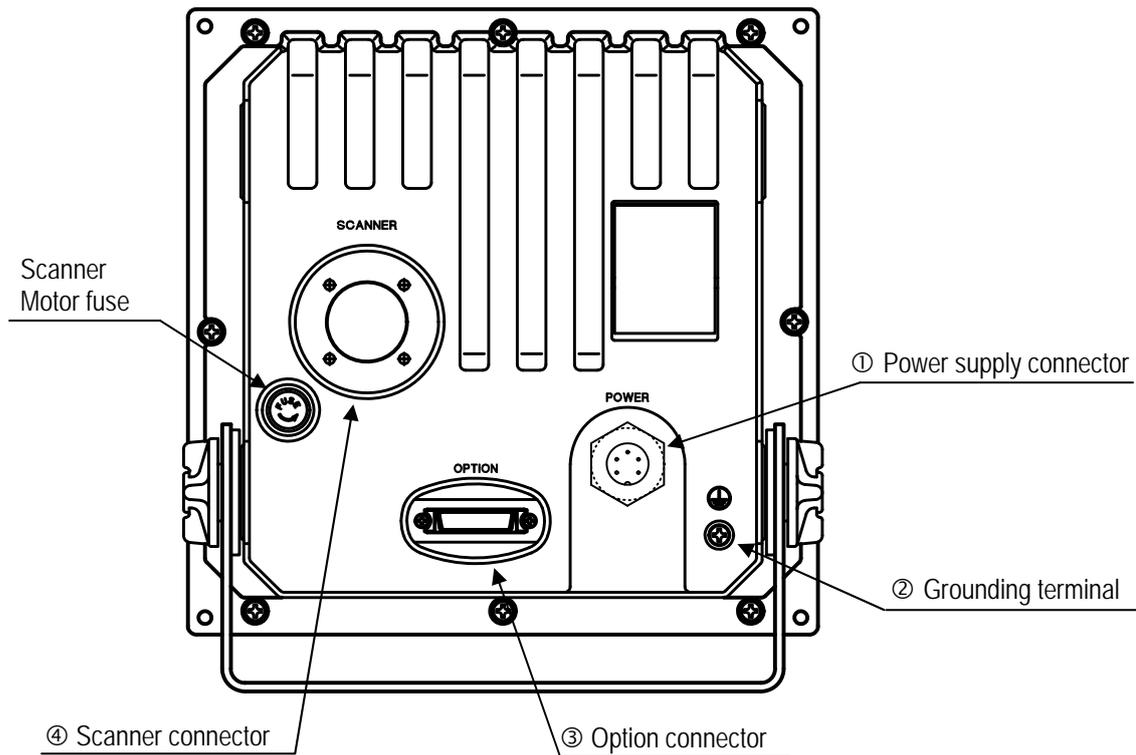
Tab. 4 Function of soft key

Key No.	SET1	SET2	SET3	SET4
1	EBL1	EBL2	RINGS	PPI
2	VRM1	VRM2	TUNE	PPI/3D
3	VAR RNG	FL EBL2	ST	ALLPPI
4	TRACK	FL VRM2	ZOOM	///CSR
5	TARGET	GZ	SLEEP	+MK LINE
6	MODE	OFF-C	PICTURE	S/L
7	NEXT	NEXT	NEXT	NEXT

*Every time the "NEXT" soft key is pressed, the soft key group changes as follows:



4.2 Rear panel



① Power supply connector

The wires in the cable that attaches to this connector supply both power and NMEA interface data. Refer to Section 3.7 “Connecting Cables” and Section 3.9 “Connecting External Equipment to Display Unit”.

② Grounding terminal

Use this terminal to connect grounding wire. Refer to Section 3.7 (3) “Grounding wire”.

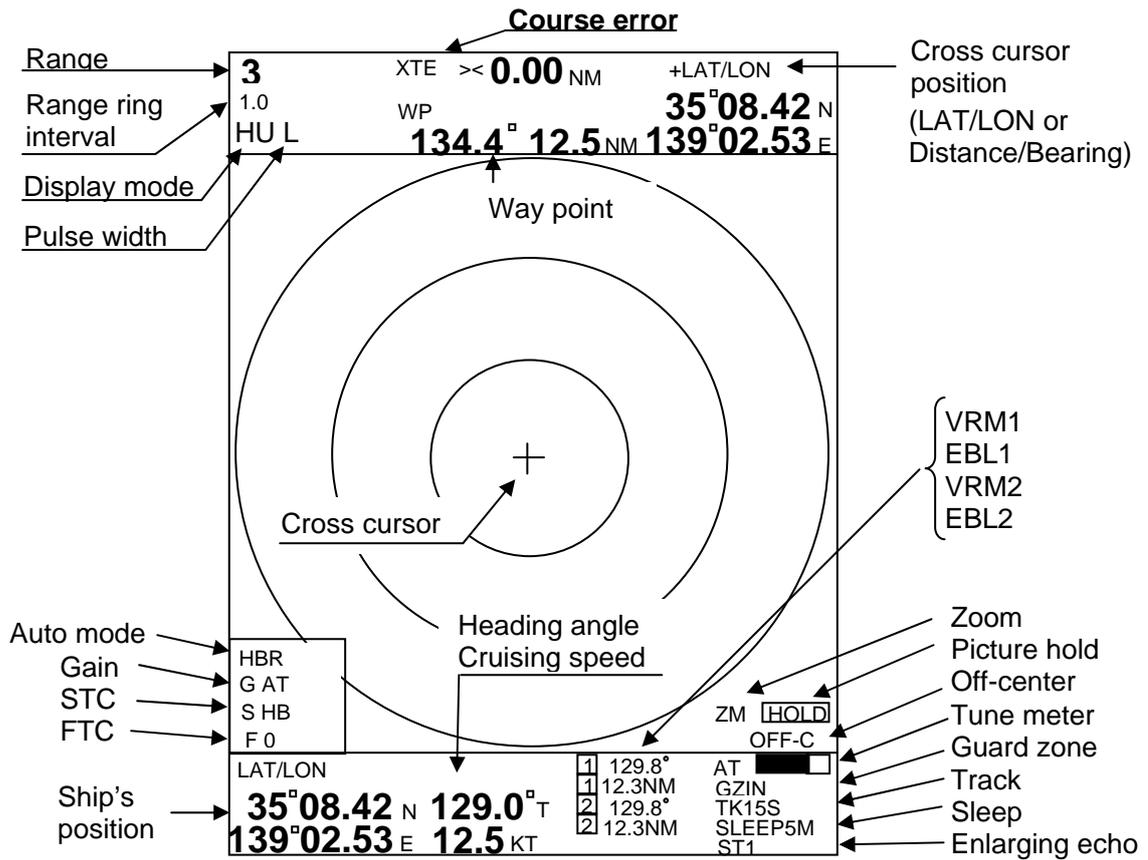
③ Option connector

Connect an NMEA data source, an external monitor, external buzzer or GYRO I/F here through an optional dedicated cable or using a dedicated module box. Refer to Section 3.9 “Connecting External Equipment to Display Unit”.

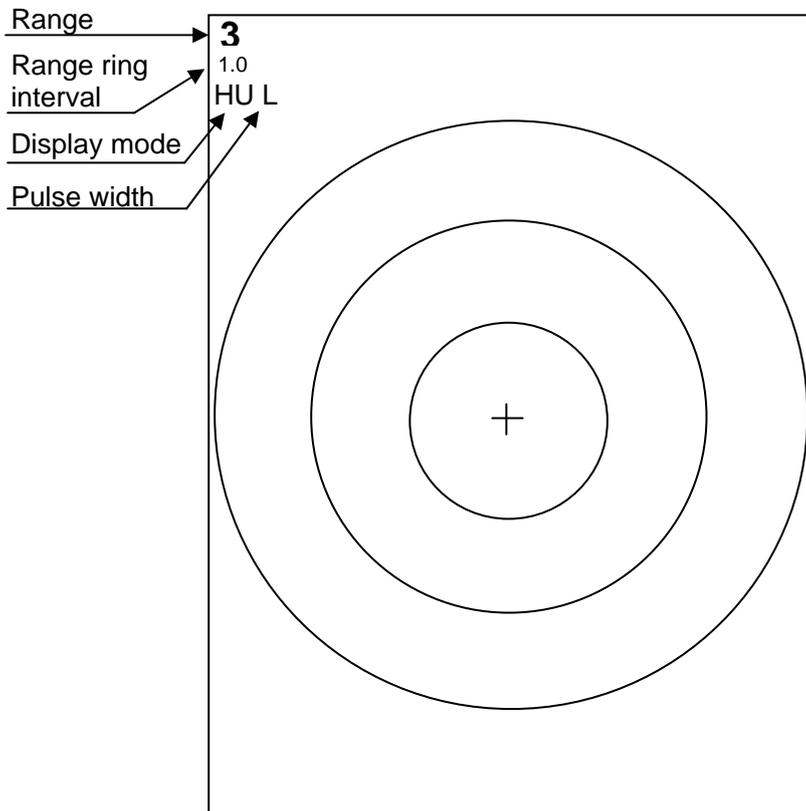
④ Scanner connector

This connector is for the cable that runs between the display and the scanner. Refer to 3.7 “Connecting cable”.

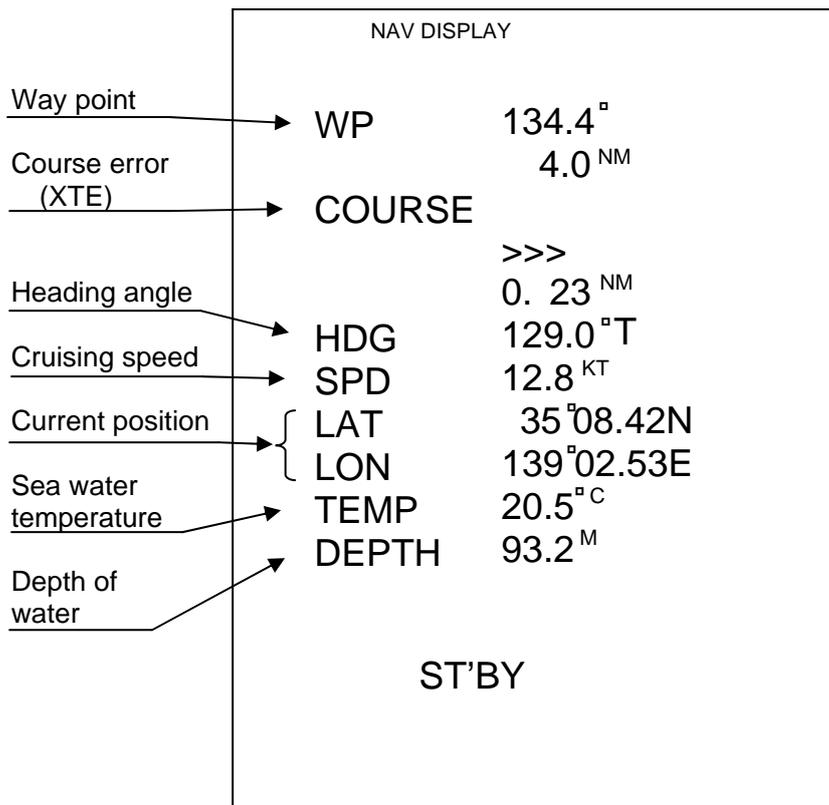
4.3 Radar screen (PPI)



4.4 Radar screen (ALL PPI)



4.5 Navigation screen



To show the NAV display, you need to connect a GPS receiver to your radar. The NAV Display shows the position and cruising speed of your ship, seawater temperature, and other Navigation information.

Note: Heading angle will be displayed "COG" when Course Over Ground data is used.

Note: Cruising speed will be displayed "SOG" when Speed Over Ground data is used

Deviation from course	Indication mark
0.00--	><
0.02--	>or<
0.04--	>>or<<
0.08--	>>>or<<<
0.16--	>>>>or<<<<

> Indicates star boarding the helm (right)

< Indicates porting the helm (left)

CHAPTER 5. OPERATION

Basic operation of the radar

The front panel of the MDC-721/741/740 radar has both fixed-function keys as well as programmable soft keys.

5.1 Powering On and Off

(1) Powering On

Press the "POWER" key. A beep sounds and the unit is powered.

Screen contrast and brilliance is set to the same level as when the unit was last turned off.

(2) Powering Off

Press and hold the "POWER" key for more than 3 seconds to turn the unit off.

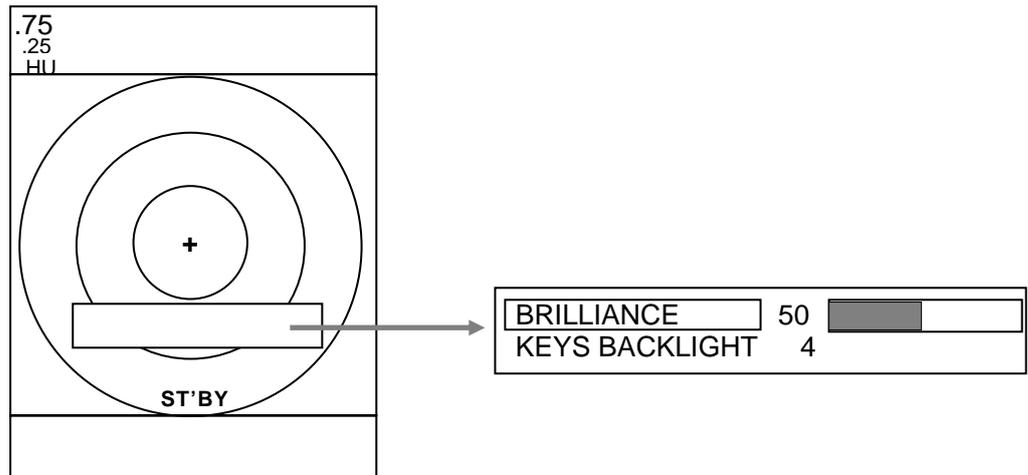
5.2 Adjusting contrast and brilliance of the screen and key-backlight

(1) Press the "BRILL" key. A bar indicating contrast, brilliance, and key-backlight appears on the screen.

(2) Select the item to adjust with the up-down cursor, then adjust it with the control knob.

(3) When through adjusting, press either the "BRILL" key or the "ENT" key to exit the adjustment screen. (Pressing any other key afterwards will access the function of that key.)

BRILL → **Control knob** (Adjustment of contrast) → **BRILL** or **ENT**
|→ **Up/Down** (Selection of brilliance, key-backlight) |→ **Other function key**
Move to other functions



5.3.4 Changing the range scale (RANGE UP, RANGE DOWN)



RANGE UP or Pressing "RANGE UP" key increases the distance the unit

RANGE DOWN the "RANGE DOWN" key decreases it.

RADOME SCANNER (MDC-721)

RANGE	0.125	0.25	0.5	0.75	1.5	3	6	12	24
Number of rings	2	2	2	3	3	3	3	3	3
Range ring interval	0.0625	0.125	0.25	0.25	0.5	1	2	4	8

RADOME SCANNER (MDC-741)

RANGE	0.125	0.25	0.5	0.75	1.5	3	6	12	24	36
Number of rings	2	2	2	3	3	3	3	3	3	3
Range ring interval	0.0625	0.125	0.25	0.25	0.5	1	2	4	8	12

OPEN SCANNER (MDC-740)

RANGE	0.125	0.25	0.5	0.75	1.5	3	6	12	24	48
Number of rings	2	2	2	3	3	3	3	3	3	4
Range ring interval	0.0625	0.125	0.25	0.25	0.5	1	2	4	8	12

5.3.5 Automatic adjustment (AUTO)

"AUTO" adjusts the GAIN, STC and FTC automatically. If the "AUTO" key is pressed after you've adjusted GAIN, STC, or FTC manually, they will all be switched to "AUTO" or harbor mode (HBR). By pressing the "AUTO" key repeatedly, you alternate among the AT1, AT2 and HBR modes. By pressing "STC" key, all controls return to manual state.

AT1 Use when navigating in a harbor area, narrow channel, or area with small islands where there is a high level of echo. The control condition is similar to turning down GAIN slightly.*

AT2 Use on open sea to suppress sea clutter. The control condition is similar to high GAIN.*

HBR Also for use when navigating in a harbor area, narrow channel, or area with small islands. The FTC is switched to manual mode. The STC is set to a predetermined value that you can select. See section 5.5.4.5.5 (7) "Setting Harbor STC circuit".

* Manual FTC may be used in these modes to reduce the appearance of noise on the screen.

You can make manual adjustments to GAIN and FTC during AUTO operation.

If the "GAIN" key is pressed, only GAIN enters the manual state.

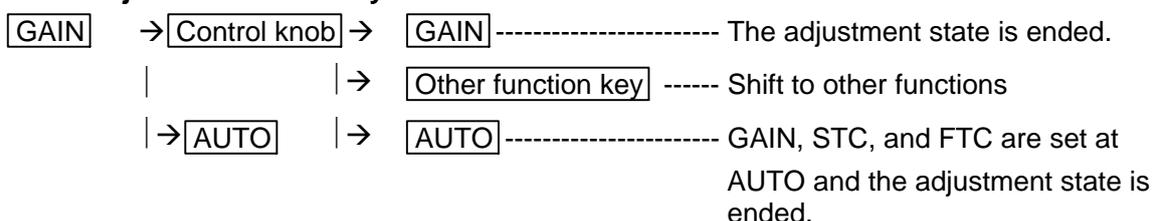
If the "FTC" key is pressed, only FTC enters the manual state.

However, if the "STC" key is pressed, STC, GAIN, and FTC all enter the manual state.

5.3.6 Sensitivity adjustment (GAIN)

- (1) When the "GAIN" key is pressed, the GAIN display characters on the left side of the screen will be highlighted.
- (2) Turn the control knob to select an acceptable level. The numbers will move in a range of 0 to 99.
- (3) Press the "GAIN" key to exit from the adjustment state. You can also press any other key and continue with that function.

To make adjustments manually:



To switch from the MANUAL state

AUTO ----- Set GAIN, STC and FTC at AUTO

5.3.7 Reducing the sea clutter (STC)

- (1) When the "STC" key is pressed, the STC display characters on the left side of the screen will be highlighted.
- (2) Turn the control knob to select an acceptable level. The numbers will move in a range of 0 to 99.
- (3) Press the "STC" key to exit from the adjustment state. You can also press any other key and continue with that function.

To make adjustments manually:

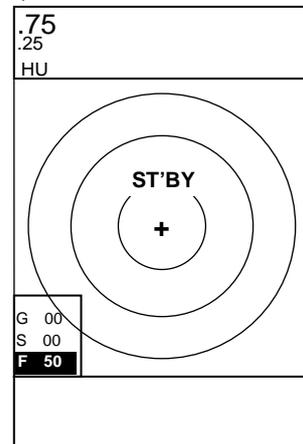
--- **STC** --> **Control knob** --> **STC** ----- The adjustment state is ended.
 | | -> **Other function key** --- Shift to other functions
 | -> **AUTO** | -> **AUTO** ----- STC, GAIN, and FTC are set at
 AUTO and the adjustment state is ended.

To switch from the MANUAL state

AUTO ----- Set STC, GAIN and FTC at AUTO

5.3.8 Removing rain and snow clutter (FTC)

- (1) When the "FTC" key is pressed, the FTC display characters on the left side of the screen will be highlighted.
- (2) Turn the control knob to adjust to an acceptable level. The numbers move in a range of 0 to 99.
- (3) After you've made an adjustment, press the "FTC" key again to exit. You can also exit by pressing any other function key and continuing with that function.



To make adjustments manually:

FTC --> **Control knob** --> **FTC** ----- The adjustment becomes ineffective.
 | | -> **Other function key** - Shift to other functions
 | -> **AUTO** | -> **AUTO** ----- GAIN, STC, and FTC are set at AUTO
 and these functions will become ineffective.

To switch from the MANUAL state

AUTO ----- Set GAIN, STC and FTC at AUTO

5.3.9 Person Over Board (POB)

To activate the Person Overboard function, press the "POB" button at the lower right of the display panel. This will send your boat's position to an external plotter through the NMEA port using the "WPL" format. It will only work if you are connected to an external navigation receiver and compass. You can then use the plotter to navigate a return to that position. To check position data, select "POB" from the "WINDOW" menu in the "SETUP". The position of POB and current position will be displayed on the screen. If you press the "POB" key while watching the POB screen, POB data will be cleared and you will return to previous screen. If you press any other key, the POB data will remain and you will return to the previous screen you had been viewing.

5.4 Functions of Soft Keys

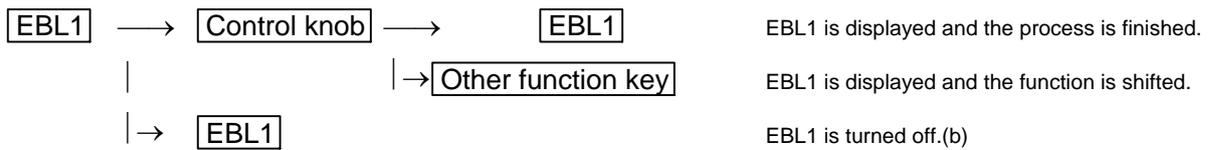
note: xxx = keys to press

Various functions are assigned to keys numbered "1" through "7". There can be a total of 4 sets of functions assigned to them. Switching among the sets is done by pressing the "NEXT" soft key. Soft keys can be assigned any function you like by accessing the "KEY ASSIGNMENT" function in the "CUSTOM" menu of the "SETUP".

5.4.1 Bearing measurement (EBL1)

When the "EBL1" key is pressed, a dotted electronic bearing line (EBL1) appears from the center to the top of the screen. Initially it overlays the boat's heading line. By rotating the control knob, you can change the bearing of this line. The angle from the boat's heading will appear in a highlighted display at the lower right of the screen. Press the "EBL1" key again to make the line disappear.

note: 1 xxx.x ° indicates EBL1.



5.4.2 Bearing measurement (EBL2)

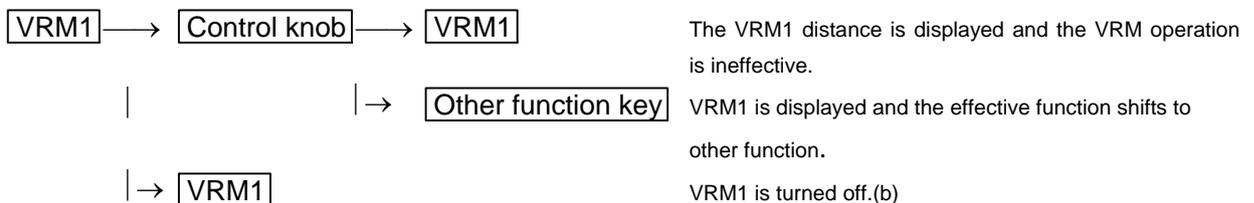
Your radar is equipped with two electronic bearing lines. Press the "EBL2" soft key to display the second one. The EBL2 angle will appear in a highlighted display at the lower right of the screen.

5.4.3 Distance measurement (VRM1)

When the "VRM1" key is pressed, a variable range marker (VRM1) appears as a dotted-line circle.

You can adjust the distance of this line from your boat's position by rotating the control knob. This distance is displayed in reverse characters at the lower right of the screen.

note: 1 xxx.x NM indicates VRM1.



5.4.4 Distance measurement (VRM2)

A second variable range marker is also available when you press the "VRM2" soft key. The VRM2 distance will appear in a reverse display at the lower right of the screen.

5.4.5 Measuring the angle between two points (FL EBL2)

The angle relative to your boat's heading between two points anywhere on the screen can be measured using the floating electronic bearing line or "FL EBL2" soft key. When you press the key, "SET START POINT" is displayed at the bottom of the screen and a small cross mark appears. Use the cursor pad to position the cross mark on one of the echoes, then press "ENT". Press "EBL2", then rotate the control knob until the electronic bearing line is centered on the second echo. The angle of a line between the two objects relative to your boat's heading will be displayed in the lower right corner of the screen. If you want to keep the floating electronic bearing line you have just created, press "ENT", otherwise, press "EBL2" and it will disappear.

5.4.6 Measuring the distance between two points (FL VRM2)

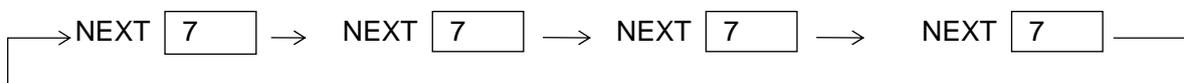
You can measure the distance between any two points on the screen by using the floating variable range marker or "FL VRM2" soft key. When you press the key, "SET START POINT" is displayed at the bottom of the screen and a small cross mark appears. Use the cursor pad to position the cross mark on one of the echoes, then press "ENT". Press "VRM2", then rotate the control knob until the electronic bearing line is centered on the second echo. The distance between the two objects will be displayed in the lower right corner of the screen. If you want to keep the floating variable range marker you have just created, press "ENT", otherwise, press "VRM2" and it will disappear.

5.4.7 Changing the group of Soft Keys (NEXT)

The soft key functions are pre-assigned to default values in four groups, as indicated below. These groups can be accessed by pressing the "NEXT" soft key. The "NEXT" key will always be assigned to the bottom, or #7, soft key.

The soft keys may be re-assigned functions as per the requirements of the operator, thus allowing quick access to functions not provided in the default setup. This is accomplished through the "SETUP" menu, by selecting "CUSTOM" and then "KEY ASSIGN".

Operation



Soft Key Setting Example

	SET1		SET2		SET3		SET4
	EBL1 [1]		EBL2 [1]		RINGS [1]		PPI [1]
	VRM1 [2]		VRM2 [2]		TUNE [2]		PPI/3D [2]
	VAR RNG [3]	→	FL EBL2 [3]	→	ST [3]	→	ALLPPI [3]
→	TRACK [4]		FL VRM2 [4]		ZOOM [4]		///CSR [4]
	TARGET [5]		GZ [5]		SLEEP [5]		+MK LINE [5]
	MODE [6]		OFF-C [6]		PICTURE [6]		S/L [6]
	NEXT [7]						

The function can be changed at the "KEY ASSIGNMENT" function in the "CUSTOM" menu of the "SETUP".

5.4.8 Erasing the Heading Marker temporarily (HDG OFF)

The heading marker is temporarily removed from the screen by holding down the "HDG OFF" key.

5.4.9 Using parallel cursors (///CSR)

Press the "///CSR" key and parallel cursors will appear on the screen. As you move the EBL, the parallel cursors also move. To cancel the function, press "///CSR" key once more.

5.4.10 Establishment of the indication of the RANGE RINGS (RINGS)

Press the "RINGS" key to make range rings appear on the screen. Press again to remove them.

5.4.11 ON/OFF of variable range function (VAR RNG)

The "RANGE UP" and "RANGE DOWN" keys change the range of the radar in steps, but this can be done in a continuously variable mode by using "VAR RNG". When you press the key, **VAR** will be displayed at the upper left of the screen (beside MODE). Pressing the up and down cursor arrows changes the display. To exit this function, press "VAR RNG" again.

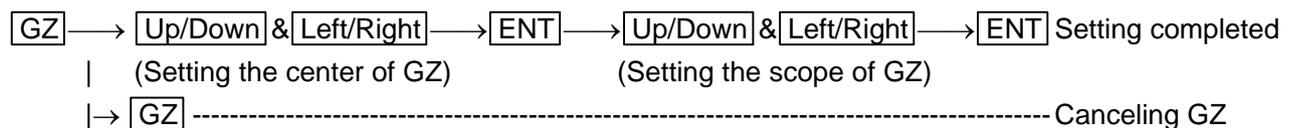
5.4.12 Changing display modes (MODE)

Pressing the "MODE" key will step you through the various screen display modes: heads up (HU), heading to steer (HS), North up (NU), course up (CU), and true motion (TM). Position data from a GPS is needed for NU, CU and TM to function. TM is only displayed on a PPI screen. The mode will automatically change to NU on other screens.

5.4.13 Guard Zone (GZ)

A guard zone can be created around your boat at any distance and any angle range. Whenever another vessel enters the zone, an alarm sounds. This is called the IN MODE. You can also set an OUT MODE that monitors when a target leaves the guard zone. The guard zone IN MODE is set using the "GZ" soft key. OUT MODE must be set via the "MENU" key under the "NAV" heading. To set a guard zone, press the "GZ" soft key. Set a center point for the zone by moving the cross with the cursor pad, then press "ENT". Next set the area with the cursor pad and press "ENT" again. The guard zone will remain in effect until you press the "GZ" key twice. While a guard zone is on, the text "GZ IN" will appear at the lower right of the screen.

When the alarm sounds, press either the "MENU" or "ENT" key to turn it off. Select between the IN MODE and OUT MODE by pressing "MENU", and then select SETUP>CUSTOM>PRESET2. The volume level of the alarm can also be set in the same place.



5.4.14 Off Center (OFF-C)

You can set the screen display so that it just shows what's directly in front of your boat while underway, or it only displays a portion of the entire scanner sweep in any direction. Press the "OFF-C" soft key and use the cursor pad to set an off-center point on the screen for the boat's location. Press "ENT" and your boat's location will now be moved to the new cursor position. The text "OFF-C" will be displayed at the lower right of the screen. To cancel the off-center function, press "OFF-C" again.

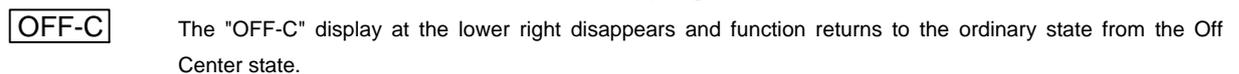
Note: VRM2 and EBL2 functions do not work in the OFF-C mode. OFF-C operates only on the PPI screen.

To set off-centering point, press relevant keys as follows:



**Note: VRM2 and EBL2 do not follow the off-centered picture while they are floated.
The function operates on PPI screen only.**

To cancel the OFF-C function, press the OFF-C key again.

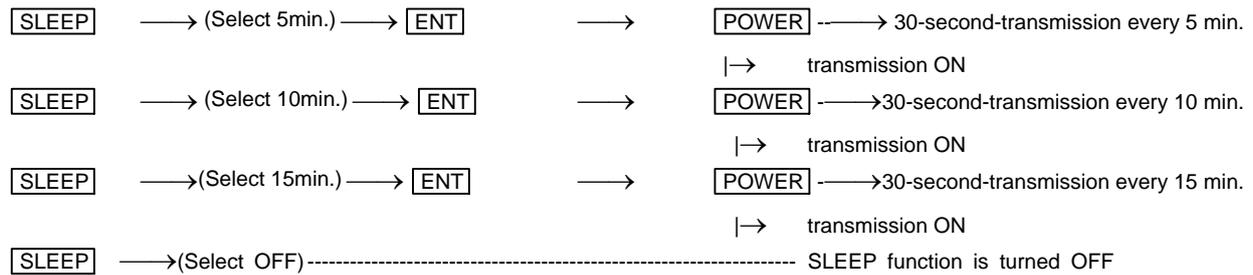


5.4.15 Setting of the SLEEP function (SLEEP)

The SLEEP mode allows you to initiate a 30-second transmission at predetermined intervals, then allow the radar to go into standby mode and the display will go dark to conserve power. Press the "SLEEP" soft key once for a 5-minute interval, twice for a 10-minute interval, or three times for a 15-minute interval. Pressing the key a fourth time will exit the sleep mode. Two

minutes before a specified transmission time, the screen backlighting turns on and the warm-up timer starts. The transmitter will then run for 30 seconds and shut down. The sequence repeats continually until you override it by pressing any key on the keypad.

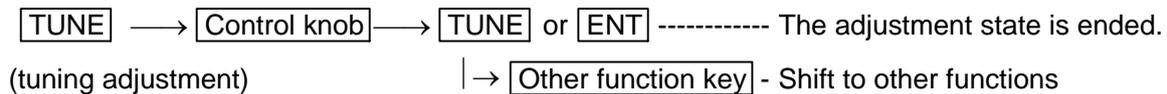
Setting procedure



Setting completed

5.4.16 Tuning adjustment (TUNE)

- (1) When the "TUNE" soft key is pressed, the TUNE display on the lower right side of the screen will be highlighted.
- (2) Turn the control knob to adjust the tuning to the desired level. The display will move in a range of 0 and 99.
- (3) When you are through, press the "ENT" key to exit. Pressing any other key will also exit and move you to that function.

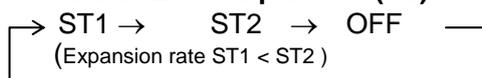


Note: Use the "MENU" to return auto-tuning state.

5.4.17 Echo expansion (ST)

When the "ST" key is pressed, "ST1" is displayed in the lower right side of the screen and the echo expansion function is turned on. This changes the target image by showing echoes expanding in the direction away from the boat, thereby making smaller ones easier to see. Two levels of echo expansion are available. Press the "ST" key repeatedly to alternate between them and to turn off the function.

Note: Refer to "5.5.3.5 Echo expansion (ST)".

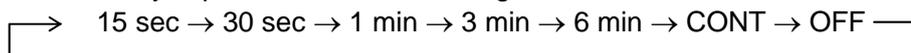


5.4.18 Displaying the track of a target (TRACK)

When the "TRACK" key is pressed, "TK 15SEC" is displayed on the lower right side of the screen and track mode is entered. Use this function to determine the direction another boat or ship is moving relative to your boat's course. The display characters indicate the length of the track, in this case, where the other boat has been during the past 15 seconds.

Note: Refer to "5.5.3.6 Displaying track of target (TRACK)".

Every time this key is pressed, the course length increases as follows:



Note: The "OFF" state will not be displayed on the screen and the "TK xx" display will disappear.

5.4.19 Enlarging selected areas (ZOOM)

This function lets you double the video image centering around an adjustable point on the screen. Press the "ZOOM" key. A small cross cursor for setting appears the center of the screen and "SET ZOOM POINT" is displayed at the bottom. Use the cursor pad to move the cross cursor to the point to be magnified, and press the "ENT" key. The area around the cross cursor is displayed in 2x magnification, and a blinking "ZM" is displayed at the lower right of the screen. To cancel the ZOOM function, press the "ZOOM" key again or change the range scale.

Note: Refer to "5.5.3.7 Enlarging selected areas (ZOOM)".



Note 1: VRM2 and EBL2 do not follow the ZOOM function during a floating state.

2: Normal screen returns when you change the range scale.

3: ZOOM function is unusable in 3D/PPI screen.

4: ZOOM function is unusable in OFF-C.

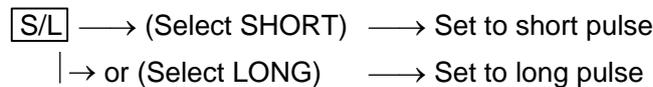
5: Center of ZOOM can be set to any desired position within the set range.

5.4.20 Increasing transmitter average power (S/L)

The pulse width is automatically changed as you change the range. However, if you want to increase sensitivity, you can choose sensitivity from two pulse lengths. The short pulse (SHORT) gives you sharp images with high distance resolution. The long pulse (LONG) provides higher average transmit power and shows targets in large size for easy identification, although bearing resolution is reduced.

Press the "S/L" key to select the Pulse length (LONG or SHORT). The pulse length changes L(Long) and S(Short) alternately.

Note: Refer to "5.5.3.8 Increasing average transmitter power(S/L)".



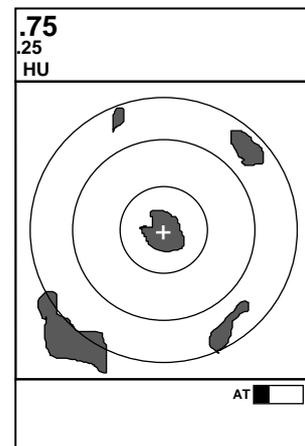
5.4.21 Reversing the screen (PICTURE)

The LCD display readability is affected by ambient light conditions. In some cases, specifically at night, you may find the display is easier to view when the entire screen is reversed. Press the "PICTURE" key to change it.

Note: Refer to "5.5.4.2 Reversing the screen (PICTURE)".

5.4.22 Change to PPI screen (PPI)

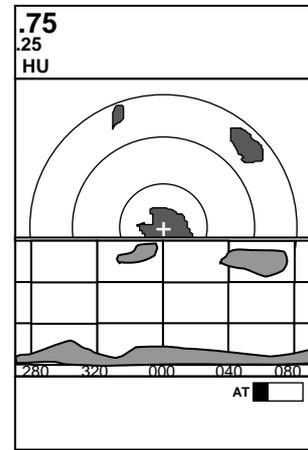
Press the "PPI" soft key, and the screen will change to a single PPI screen. All of the radar's functions will work normally in this mode.



PPI screen

5.4.23 Change to SEMI3D/PPI screen (SEMI3D)

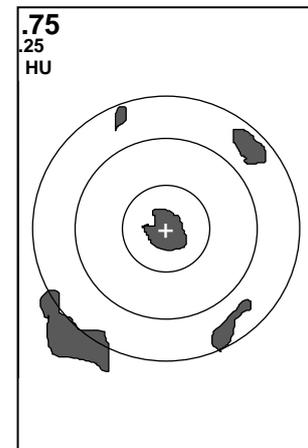
Press the "SEMI3D" soft key. The screen will split between the SEMI3D view and a PPI screen. All controls, such as EBLs, VRMs, affect both screens. The ZOOM, OFF-C, FL EBL2, and FL VRM2 cannot be used in this mode. The SEMI3D screen always displays the boat's heading at its center.



SEMI3D/PPI screen

5.4.24 Change to ALL PPI screen (ALL PPI)

Press the "ALL PPI" key and all data elements and soft keys will disappear from the screen, displaying a full-frame radar image. The range, ring interval and display mode are shown in the upper left corner. The only controls that have any effect in this mode are the "RANGE UP", "RANGE DOWN", "MENU" and POWER buttons, along with the cursor pad. Pressing any other keys will exit ALL PPI and return the display to the normal PPI screen mode.



ALL PPI screen

5.4.25 Activating Automatic Target Acquisition (ATA) : Option

The Automatic Target Acquisition function allows you to automatically track up to ten targets simultaneously and determine their distance and bearing. ATA calculates the CPA (Closest Point of Approach) and the TCPA (Time to reach Closest Point of Approach) from the movement of the target towards your boat. These numbers, along with the target's course vector are shown on the screen. You can also set an alarm to sound if any target is on a collision course with your boat. Before using ATA, you must preset its operational parameters. Refer to Section 5.5.2.5 for this procedure and to learn how to use the ATA function.

ATA can only be used in the PPI or ALL PPI mode. If ATA is turned on and you switch to another mode, target tracking will continue, but you will not see the ATA symbols or data on screen.

5.5 MENU Operation

List of MENU

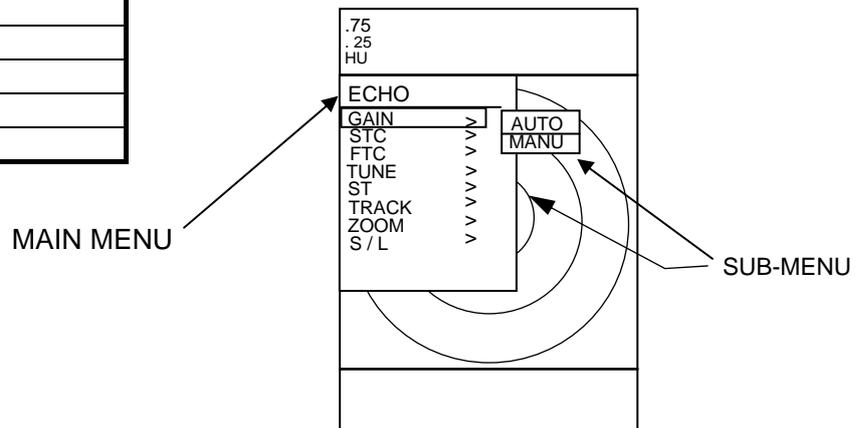
List of Main Menu

MARK (MAIN-MENU)		NAVIGATION (MAIN-MENU)		ECHO (MAIN-MENU)		SETUP (MAIN-MENU)	
EBL1	ON/OFF	MODE	HU/HS/NU/CU/TM (MANU/NMEA)	GAIN	AUTO/MAN	WINDOW	PPI SEMI 3D+PPI ALL PPI POB
VRM1	ON/OFF			STC	AUTO/MAN/HARBOR		
EBL2	ON/OFF	GZ	ON/OFF	FTC	AUTO/MAN		
VRM2	ON/OFF	OFF-C	ON/OFF	TUNE	AUTO/MAN		
FL EBL2	ON/OFF	SLEEP	OFF/5min/10min/ 15min	ST	OFF/ST1/ST2	PICTURE	DAY/NIGHT
FL VRM2	ON/OFF			TRACK	OFF/15SEC/30SEC/ 1MIN/3MIN/6MIN/ CONT	SYSTEM CHECK	
HDG OFF	OFF			ZOOM	ON/OFF	CUSTOM	KEY ASSIGNMENT PRESET1 (SUB-MENU) PRESET2 (SUB-MENU) NMEA PRESET ADJUST (SUB-MENU)
///CSR	ON/OFF			S / L	SHORT/LONG		
RINGS	ON/OFF						
VAR RNG	ON/OFF						
TARGET							
+MK LINE	ON/OFF						

List of Custom Menu

PRESET1 (SUB-MENU)		PRESET2 (SUB-MENU)	
HM FLSH	ON/OFF	GZ LEVEL	1-7
STERN M	ON/OFF	GZ MODE	IN/OUT
NORTH M	ON/OFF	HOLD	ON/OFF
ST'BY	NAVI/NOR	DISPLAY	RDR/MONI/NAV
BUZ VOL	OFF/LOW/HIGH	EXT BUZ	OFF / CONT / INT
RM UNIT	NM / KM / SM	IN P/R	1080/1024/2048/4096/360
TEMP	°C / F	OUT P/R	1080/1024/2048/4096/360
DEPTH	M / FT / FM	DEMO	ON / OFF
EBL BRG	REL / TRUE / MAG	IR	OFF / IR1 / IR2
WP BRG	TRUE / MAG	SPD SET	NMEA / MANU x.x KT
HEAD INPUT	NMEA / SIN/COS /12BIT / 10BIT	LANGUAGE	15 languages
HEAD	TRUE / MAG	SCAN SPEED	STD / HIGH
+MK MODE	DIST/BRG / LAT/LON	COLOR	MONO / MULTI
P TABLE	0 / 1 / 2		
WP SEL	EXT / INT		

ADJUST (SUB-MENU)	
TIMING ADJ	
HEAD ADJ	
TUNING CAL.	
ANTENNA	1-9
GAIN	1-30
STC	1-16

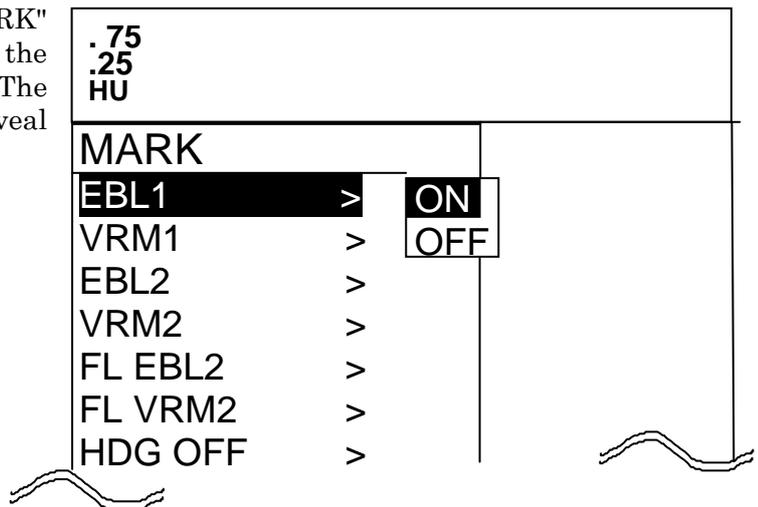


5.5.1 Mark Menu

[xxx] = keys to press

Press the "MENU" key and select "MARK" from the four displayed menus by using the left or right arrows on the cursor pad. The contents of the selected MENU will reveal beneath its name when it's highlighted.

[MENU] → [Left/Right]
(Select MARK)



5.5.1.1 Bearing measurement (EBL1)

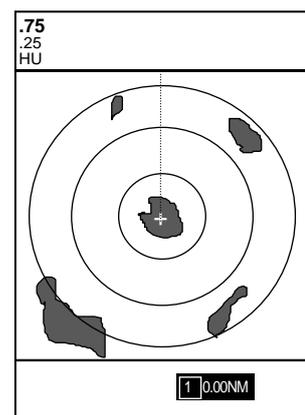
- (1) Select EBL1 from the pull-down display items using the up-down cursor key, and press the "ENT" key.
- (2) When the ON/OFF box is displayed beside the EBL1 item, select ON with the up-down cursor keys and press the "ENT" key.
- (3) When the "ENT" key is pressed, electronic bearing line (EBL1) appears and the angle from the direction of the boat's heading will appear in a highlighted display at the lower right of the screen. The displayed EBL angle is either relative to your heading, true or magnetic north, depending on the setting of "EBL BRG" in the "SETUP>CUSTOM>PRESET1" menu.
- (4) Rotate the control knob until the line is at the center of the target and read the bearing. Press "ENT" or another function key and the EBL will remain on-screen. To remove it, either use the menu or press the EBL1 soft key.

Note: [1] xxx.x indicates the relative bearing measured by EBL1.

[Up/Down] → [ENT] → [Up/Down] → [ENT] → [Control knob] → [ENT] (a)
 (Select EBL1) (Select ON) (EBL1 operation) |→ [MENU] (b)
 |→ [Other function key] (c)

5.5.1.2 Determining the distance (VRM1)

- (1) Select VRM1 from the pull-down display items using the up-down cursor key and press "ENT" key.
- (2) When the ON/OFF box is displayed beside the VRM1 item, select ON with the up-down cursor keys and press the "ENT" key.
- (3) When the "ENT" key is pressed, the variable range marker1 (VRM1) appears and the distance from it to the boat will appear in highlighted characters at the lower right of the screen.
- (4) Using the control knob, change the size of the ring until you place the marker on the front edge of the target. Read the distance. Press "ENT" or another function key and the VRM will remain onscreen. To remove it, either use the menu or press the VRM1 soft key.



[Up/Down] → [ENT] → [Up/Down] → [ENT] → [Control knob] → [ENT]
 (Select VRM1) (Select ON) (VRM1 operation) |→ [MENU]
 |→ [Other function key]

Note: [1] xx.xx NM indicates VRM1.

5.5.1.3 Bearing measurement (EBL2)

Use the same procedure for placing EBL1. The angle measurement will appear in highlighted characters at the lower right of the screen.

Note: 2 xxx.x indicates EBL2.

5.5.1.4 Determining the distance (VRM2)

Use the same procedure for placing VRM1. The distance measurement will appear in highlighted characters at the lower right of the screen.

Note: 2 xx.xx NM indicates VRM2.

5.5.1.5 Measuring the distance or angle between two points (FL EBL2, FL VRM2)

- (1) Select FL VRM2 on the MARK menu and press the "ENT" key.
- (2) Select ON from the ON/OFF box and press "ENT". "SET START POINT" is displayed and a small cross mark appears.

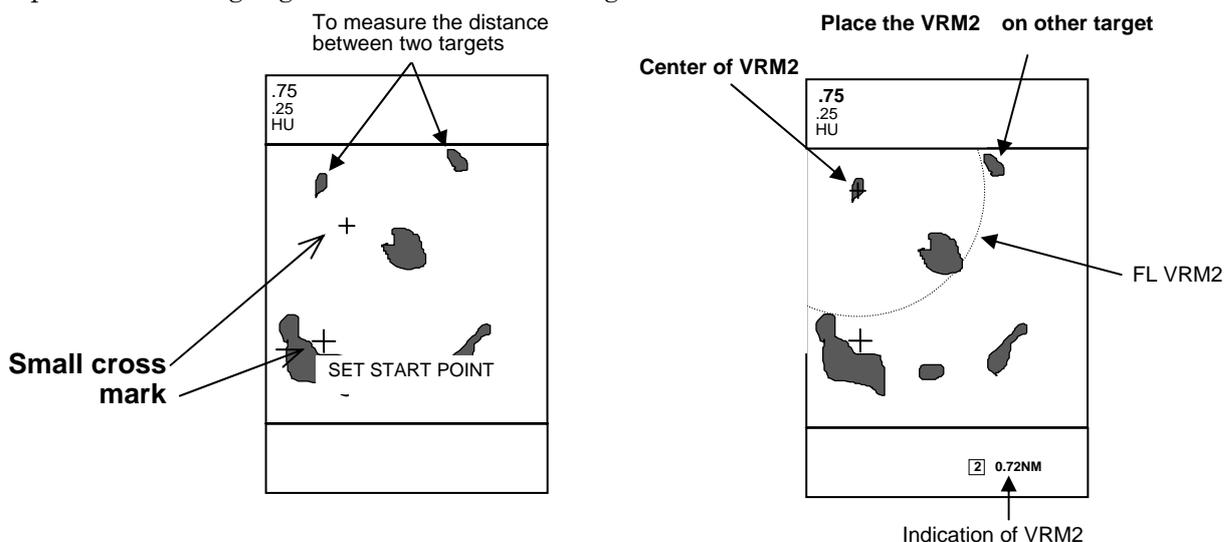
Up/Down → ENT → Up/Down → ENT -----FL VRM2 is turned ON and the small cross mark appears.
 (Select FL VRM2) (Select ON)

- (3) Use the left-right and up-down cursor keys to place the cross mark on one of the two echoes whose distance will be measured, and press the "ENT" key.

Up/Down & Left/Right → ENT -----Criterion of the reference point is set.

(Place the cross cursor on an echo)

- (4) Select VRM2 from the menu as described previously or press the "EBL2" soft key. Rotate the control knob until it is on the second echo, then read the distance between the two echoes or points in the highlighted text at the lower right of the screen.



Note: EBL2 and VRM2 do not work in the "ZOOM" and "OFF-C" modes.

5.5.1.6 Measuring the angle between two points (FL EBL2)

- (1) Select FL EBL2 on the MARK menu and press the "ENT" key.
- (2) Select ON from the ON/OFF box and press "ENT". "SET START POINT" is displayed and a small cross mark appears.

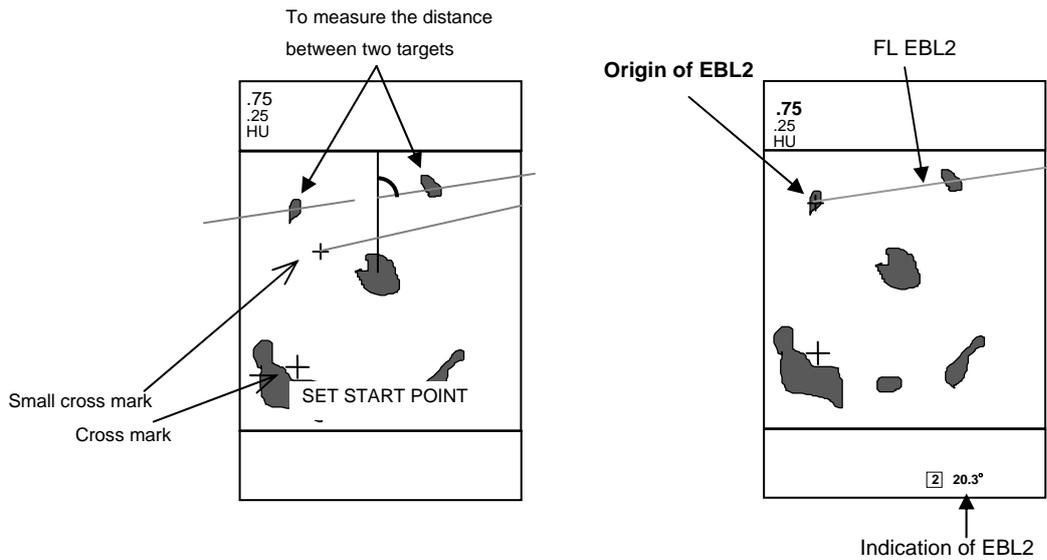
Up/Down → ENT → Up/Down → ENT ----- FL EBL2 is turned ON and the small cross mark appears.
 (Select FL EBL2) (Select ON)

- (3) Use the left-right and up-down cursor keys to place the small cross mark on one of the two echoes whose angle will be measured, and press the "ENT" key.

Up/Down & Left/Right → ----- ENT Criterion of the reference point is set.

(Place the cross cursor on an echo)

- (4) Select EBL2 from the menu as described previously or press the "EBL2" soft key. Rotate the control knob until it is on the second echo, then read the angle in the highlighted text at the lower right of the screen. The angle is relative to either the boat's heading, true or magnetic north, depending on the setting of "EBL BRG" in the "SETUP>CUSTOM>PRESET1" menu.

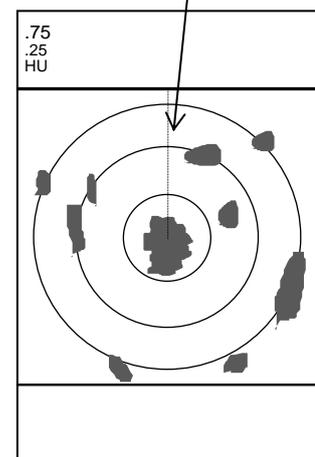


5.5.1.7 Erasing heading marker temporarily (HDG OFF)

- (1) Use the up-down cursor key to select HDG OFF from among the pulled down and displayed items.
- (2) Press the "ENT" key. The heading marker is not displayed as long as you hold down the "ENT" key.

→ The heading marker is off as long as you press and hold the "ENT" key down.
(Select HDG OFF)

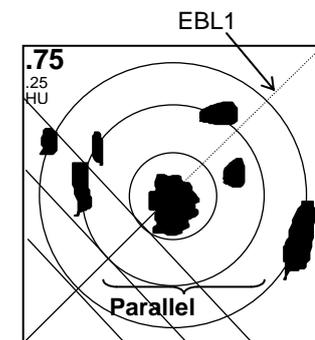
Not displayed while ENT key is pressed and held down.



5.5.1.8 Using parallel cursor (///CSR)

Normally the EBL is used to measure the exact bearing from the position of your boat to a target. However, you can also use parallel cursors.

- (1) Select ///CSR from the MARK menu, press "ENT" and select ON.
- (2) Press the "ENT" key. Parallel cursors will appear on the screen. As you move the EBL, the parallel cursors will also rotate.
- (3) To cancel the ///CSR function, either select OFF in the menu or press the ///CSR soft key.



→ → (Select ON) → Parallel cursor appears.

(Select ///CSR) | → (Select OFF) → Parallel cursor disappears.

Note: Interval of ///CSR same as fixed range marker. ///CSR moves with EBL1.

5.5.1.9 Establishment of the indication of the RANGE RINGS (RINGS)

- (1) Select RINGS from MARK menu and press the "ENT" key.
- (2) Use the up-down key to select ON or OFF and press the "ENT" key

Up/Down → ENT → Up/Down (Select ON) → ENT ----- Range rings appear.
 (Select RINGS) | → Up/Down (Select OFF) → ENT ----- Range rings disappear.

Number of range rings and range interval

Radome antenna (MDC-721)

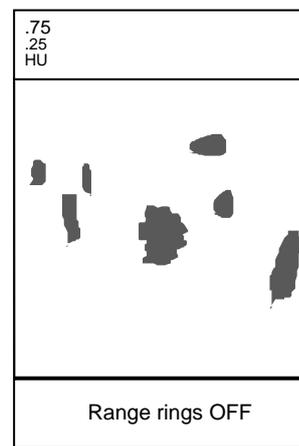
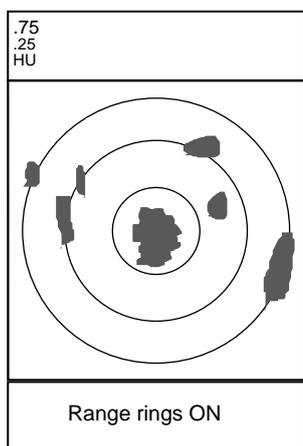
Range	0.125	0.25	0.5	0.75	1.5	3	6	12	24
Number of Rings	2	2	2	3	3	3	3	3	3
Interval	0.0625	0.125	0.25	0.25	0.5	1	2	4	8

Radome antenna (MDC-741)

Range	0.125	0.25	0.5	0.75	1.5	3	6	12	24	36
Number of Rings	2	2	2	3	3	1	3	3	3	3
Interval	0.0625	0.125	0.25	0.25	0.5	1	2	4	8	12

Open antenna (MDC-740)

Range	0.125	0.25	0.5	0.75	1.5	3	6	12	24	48
Number of Rings	2	2	2	3	3	3	3	3	3	4
Interval	0.0625	0.125	0.25	0.25	0.5	1	2	4	8	12



5.5.1.10 Variable range function (VAR RNG)

Using the "RANGE UP" and "RANGE DOWN" buttons changes the displayed range in predetermined increments for whatever you've set the distance measurement (NM, KM, SM). The VAR RNG function allows you to make the change in 0.1 unit increments using the up and down arrows on the cursor pad.

- (1) Select VAR RNG from the MARK menu press "ENT", then turn on the function.
- (2) **VAR** will be displayed at the upper left of the screen beside MODE.

Setting procedure

Up/Down → ENT → Up/Down (Select ON) → ENT -----VAR RNG function is turned ON
 (Select VAR RNG) | → Up/Down (Select OFF) → ENT -----VAR RNG function is turned OFF

Method of use

Up/Down ----- Range changes continuously
RANGE UP & RANGE DOWN ----- Range changes in step

- (3) To cancel the VAR RNG function, turn it off using the menu or press the "VAR RNG" soft key.

5.5.1.11 Output the position of the cursor location to another NMEA device (TARGET).

- (1) Turn on the TARGET function in the MARK menu
- (2) Using the cursor pad, move the cursor cross so it is directly over the position you would like to send to another navigation unit.
- (3) When you press "ENT" the latitude and longitude data of the position will be output to the NMEA port in TLL format.

[Up/Down] → [ENT] ----- output the L/L position of the cursor
 (Select TARGET)

Note: When you activate this function, nothing happens onscreen.

5.5.1.12 Determine the distance and bearing to the mark position (+MK LINE).

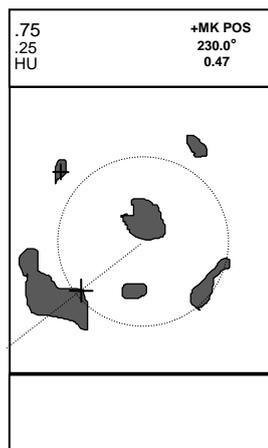
- (1) Select +MK LINE from the MARK menu and turn it on.
- (2) A variable range marker and an electronic bearing line will appear on the screen. A cross marker will be shown at their intersection. This is the mark position.
- (3) The up and down cursor pad arrows move the VRM in and out. The left and right arrows change the position of the EBL. Use them to place the cross marker over the position to which you want to determine range and bearing.
- (4) The data will be displayed in the upper right corner of the screen.
- (5) Turn off the function using the menu or press the "+MK LINE" soft key.

Setting procedure

[Up/Down] → [ENT] → [Up/Down] (Select ON) → [ENT] -----+MK LINE function is turned ON
 (Select +MK LINE) | → [Up/Down] (Select OFF) → [ENT] -----+MK LINE function is turned OFF



+MK LINE OFF



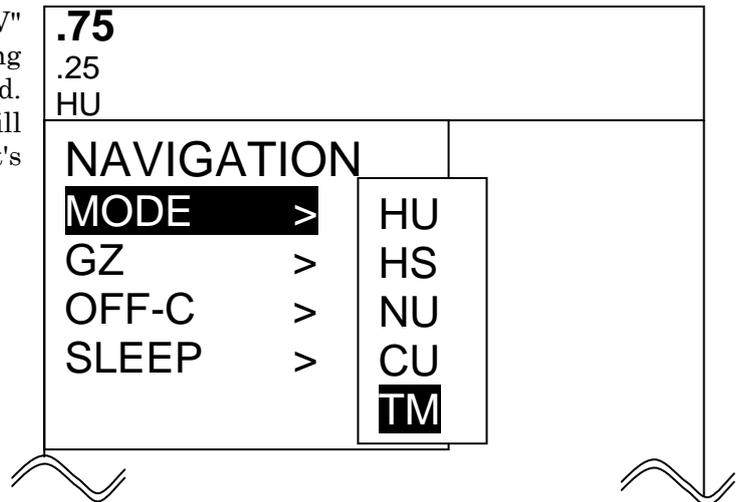
+MK LINE ON

The distance/bearing marker follows to cross cursor. EBLs and VRMs can be used separately.

5.5.2 Nav (Navigation) Menu

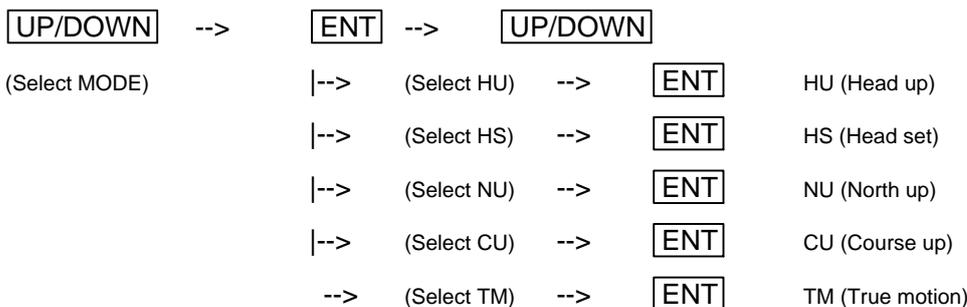
[xxx] = keys to press

Press the "MENU" key and select "NAV" from the four displayed menus by using the left or right arrows on the cursor pad. The contents of the selected MENU will be shown beneath its name when it's highlighted.



5.5.2.1 Changing display mode (MODE)

- (1) Select MODE from the pull-down display items using the up-down cursor key, and press the "ENT" key.
- (2) When the selection box is displayed beside the MODE item, select the appropriate mode with the up-down cursor keys and press the "ENT" key.
- (3) The display mode you selected will be shown at the upper-left of the screen.



Note 1: Your radar must be connected to an NMEA data source in order to use the NU, CU and TM modes.

2: In the TM mode you will either need NMEA speed data input present or you will have to manually input your boat's speed.

3: TM works only on PPI screen, NU is used automatically for the other screens.

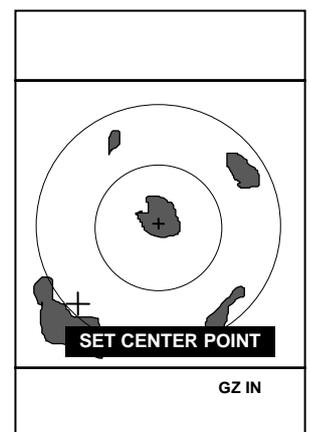
5.5.2.2 Setting the Guard Zone (GZ)

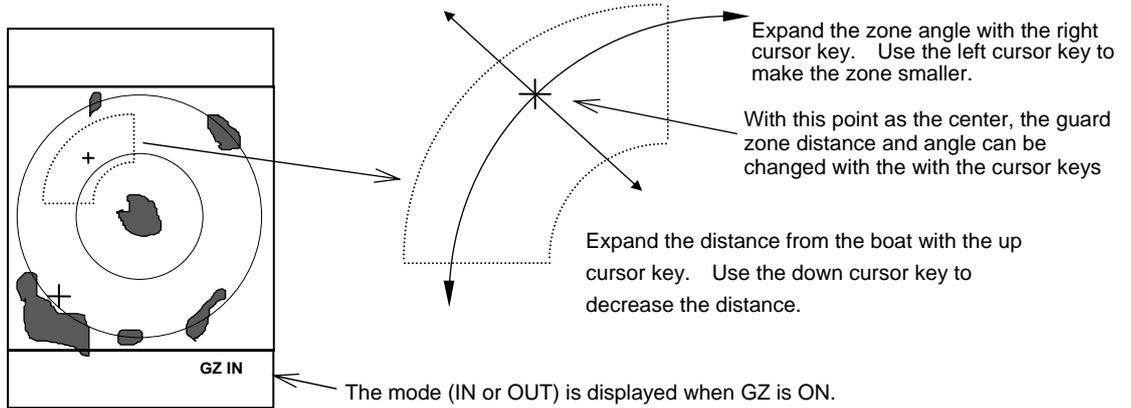
This function sets a guard zone around your boat of any distance and any angle range, and sounds an alarm when either echoes enter it or (IN MODE) leave it (OUT MODE). You can also select the sensitivity level to detect echoes entering or leaving the zone.

Setting the guard zone

[Up/Down] --> [ENT] -----ON/OFF sign is displayed.

- (1) Select GZ from the NAV menu and turn it on.
- (2) The mode setting will be displayed on the lower right side of the screen as GZ IN. A small cross cursor for setting the guard zone will show at the screen center, and "SET CENTER POINT" is displayed at the bottom.
- (3) Use the up-down and left-right cursor keys to move the cross cursor to the center of the warning zone to be set, and press the "ENT" key.
- (4) From the cross cursor position you set as the center, expand the guard zone as follows:





(5) After the setting the guard zone, press "ENT". To turn off the GZ function, use the menu or press the "GZ" soft key.

[ENT] --> [Up/Down] & [Left/Right] --> [ENT] --> [Up/Down] & [Left/Right] --> [ENT] ----- Setting completed
 (Setting the center of GZ) (Setting the scope of GZ)

To turn off the alarm when it sounds, press any key except the "GZ" soft key to stop it. The guard zone function will remain on. To select between the IN or OUT mode, Go to the Menu and select SETUP>CUSTOM>PRESET2>GZ MODE. To adjust the level of detection, select a GZ LVL or 1 through 7 on the same menu screen.

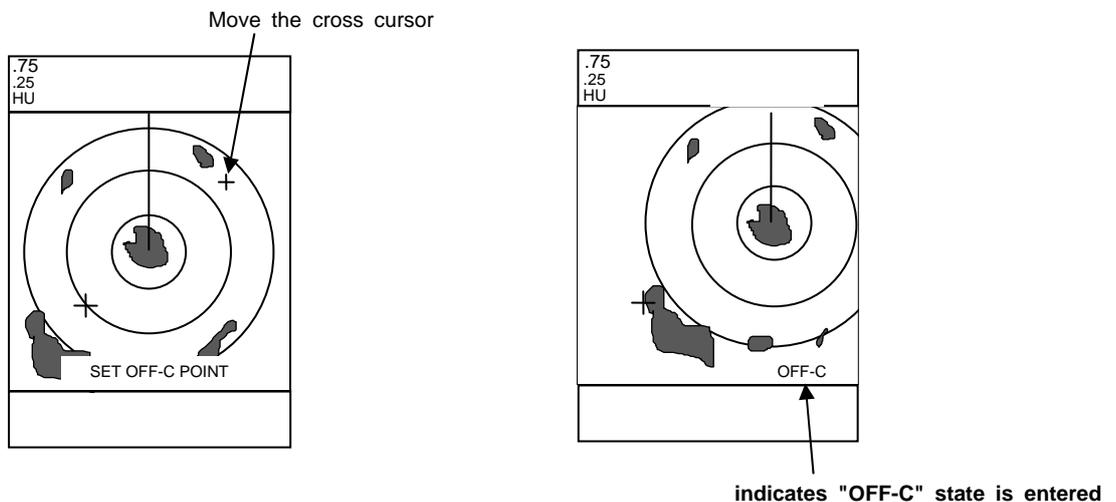
5.5.2.3 Offsetting the screen display (OFF-C)

This function allows you to position the cross cursor at the boat's location off center to any point on the screen.

- (1) Select OFF-C from the NAV menu and turn it on.
- (2) OFF-C is displayed in the lower right corner and "SET OFF CENTER POINT" appears at the bottom of the screen. Move the cross cursor with the cursor pad to the intended location, and press the "ENT" key. Your boat's location will now be displayed at the cursor's location.
- (3) To cancel the OFF-C function, use the menu or press the "OFF-C" soft key.

[Up/Down] --> [ENT] --> [Up/Down]
 (Select OFF-C) |-->(Select ON) [ENT] --> [Left/Right] & [Up/Down] --> [ENT] ----- Set OFF-C
 -->(Select OFF) [ENT] ----- Cancel OFF-C

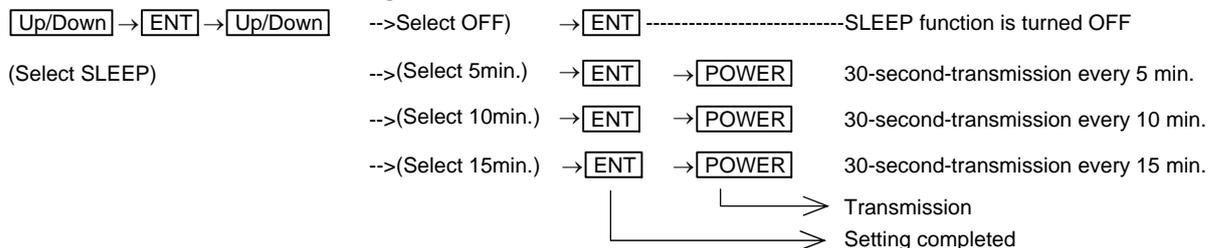
Note : FL VRM2 and FL EBL2 do not work while the OFF-C function is on. It can only be used on the PPI screen.



5.5.2.4 Setting of the SLEEP function(SLEEP)

The SLEEP function allows you to initiate a 30-second transmission at predetermined intervals, then allow the radar to go into standby mode and make the display go dark to conserve power. You can set the "SLEEP" function for a 5-, 10- or 15-minute interval. Two minutes before a specified transmission time, the screen backlighting turns on and the warm-up timer starts. The transmitter will then run for 30 seconds and shut down. The sequence repeats continually until you override it by pressing any key on the keypad.

To turn on the SLEEP function go to the NAV menu, select SLEEP, then select the time interval.



Action after setting

SLEEP setting(5min.)						(Operation)
↓	(Under power-saving mode)				↑(Under Tx)	↑(Under power-saving mode)
↑(Under Tx)	↑		↑	↑(Under Tx)	↑	
0 sec.	30 sec.		3 min.	5min.	5and a half min.	(Time used)
TX Start	TX OFF		Backlight ON	Tx Start	TxOFF	(Action)
			Countdown start			

What happens if a key is pressed after a SLEEP mode setting?

- If a key is pressed during the power-saving mode, the SLEEP function is canceled and the 2-minute timer starts.
- If a key is pressed while the 2-minute timer is in use, or during transmission, the SLEEP function is canceled.

What happens if a key is pressed during the SLEEP mode?

- If you press a key during the power-saving mode, the SLEEP function will be canceled and the 2-minute timer starts.
- If you press a key while the 2-minute timer is in active, or during transmission, the SLEEP function will be canceled.

5.5.2.5 Activating Automatic Target Acquisition (ATA) : Option

This function allows you to automatically track up to ten targets and determine their distance and bearing. You can also set an alarm to sound if any are on a collision course with your boat. It can only be used in the PPI or ALL PPI mode. If ATA is turned on and you switch to another mode, target tracking will continue, but you will not see ATA symbols or data on screen.

Setting	Initial Value
CPA SET	0.0 NM
TCPA SET	0 MIN
VECT SET	6 MIN
VECT MODE	REL
ATA	ON

Before using ATA, you must set its parameters. They are found in the MENU under SETUP>CUSTOM>ATA PRESET.

- Set the CPA to the closest point of approach you want to be before the alarm sounds.
- Set the TCPA to the minimum time to collision you want before the alarm sounds.
- Set the time length of the vector showing the target's bearing.
- Select between a relative or true vector.
- Turn the ATA function on or off.

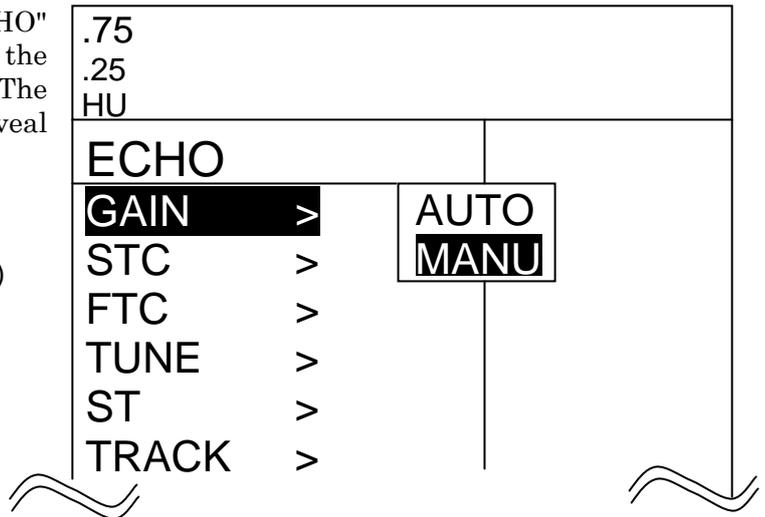
To activate the ATA function, once parameters are set:

- Select a target to track by placing the cursor directly on it.
- Under the NAV menu, select ACQ and press "ENT". The target will be identified by a number from 0 through 9 and a vector showing its bearing will appear on screen.
- If you want CPA and TCPA data displayed on screen, select "ON" from the "DATA" menu item.
- If you have several targets displayed and you would like to change the number of one of the targets, place the cursor over it. Select "TGT NUM" from the Menu, pick a new number, then press "ENT".
- To discontinue tracking a target, place the cursor over it, then select "DEL" from the menu. To discontinue tracking all targets, select "ALL DEL".

5.5.3 Echo Menu

[xxx] = keys to press

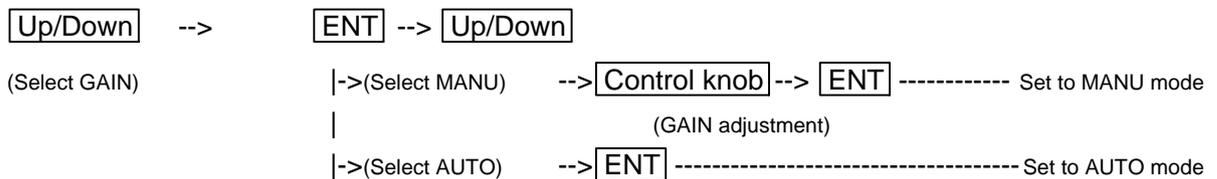
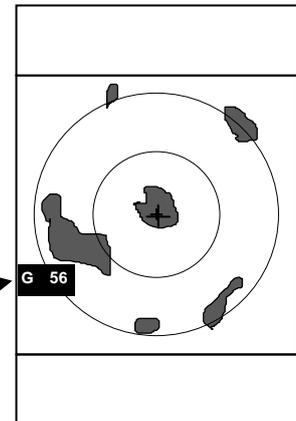
Press the "MENU" key and select "ECHO" from the four displayed menus by using the left or right arrows on the cursor pad. The contents of the selected MENU will reveal beneath its name when it's highlighted.



5.5.3.1 Sensibility adjustment (GAIN)

- (1) Select GAIN from the menu and press "ENT".
- (2) Select MANU from the MANU/AUTO box and press "ENT".
- (3) The current GAIN setting is highlighted in the middle of the left side of the screen. Use the control knob to adjust the gain setting through a range of 0 to 99.
- (4) Press "ENT" to exit the gain setting mode.
To set the radar to automatic sensitivity adjustment, select AUTO in (2) and press "ENT".

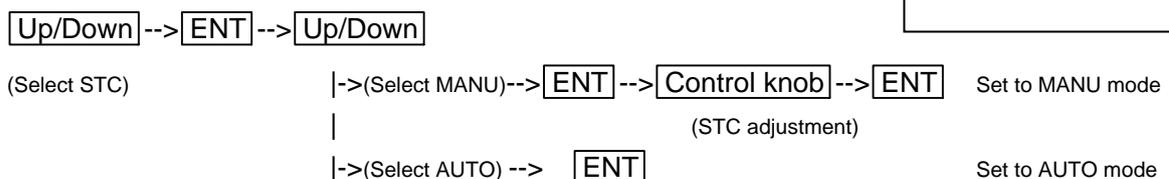
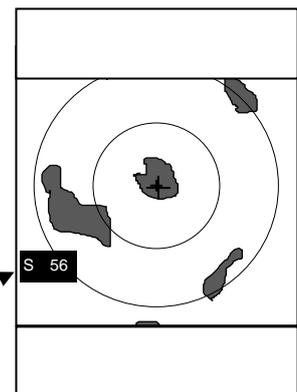
The setting value is displayed during MANUAL operation.
AT is displayed during AUTO operation.
(The same applies to STC, and FTC.)



5.5.3.2 Removing sea clutter (STC)

- (1) Select STC from the menu and press "ENT".
- (2) Select MANU from the MANU/AUTO box and press "ENT".
- (3) The current STC setting is highlighted in the middle of the left side of the screen. Use the control knob to adjust the STC setting through a range of 0 to 99.
- (4) Press "ENT" to exit the STC setting mode.

The setting value is displayed during MANUAL operation.
AT is displayed during AUTO operation.

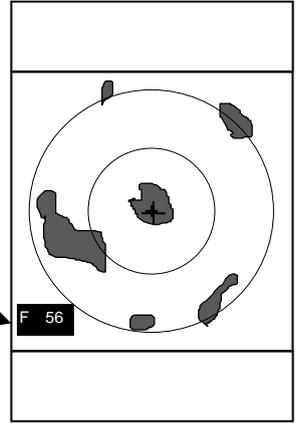


Note 1: When you select the MANU mode, GAIN and FTC will be switched to MANU mode, also.
2: When you select the HARBOR mode, only FTC will be switched to MANU mode

5.5.3.3 Removing rain and snow clutter (FTC)

- (1) Select FTC from the menu and press "ENT".
- (2) Select MANU from the MANU/AUTO box and press "ENT".
- (3) The current FTC setting is highlighted in the middle of the left side of the screen. Use the control knob to adjust the FTC setting through a range of 0 to 99.
- (4) Press "ENT" to exit the FTC setting mode.

The setting value is displayed during MANUAL operation.
AT is displayed during AUTO operation.



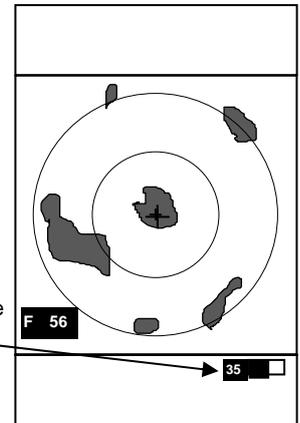
Up/Down --> **ENT** --> **Up/Down**

(Select FTC) |->(Select MANU) --> **ENT** --> **Control knob** --> **ENT** ----- Set to MANU mode
 | (FTC adjustment)
 |->(Select AUTO) --> **ENT** ----- Set to AUTO mode

5.5.3.4 Adjusting the receiver tuning (TUNE)

- (1) Select TUNE from the menu and press "ENT".
- (2) Select MANU from the MANU/AUTO box and press "ENT".
- (3) The current TUNE setting is highlighted in the lower right corner of the screen. Use the control knob to adjust the setting through a range of 0 to 99.
- (4) Press "ENT" to exit the TUNE setting mode.

Indicated setting value on manual mode, AT on auto mode



Up/Down --> **ENT** --> **Up/Down**

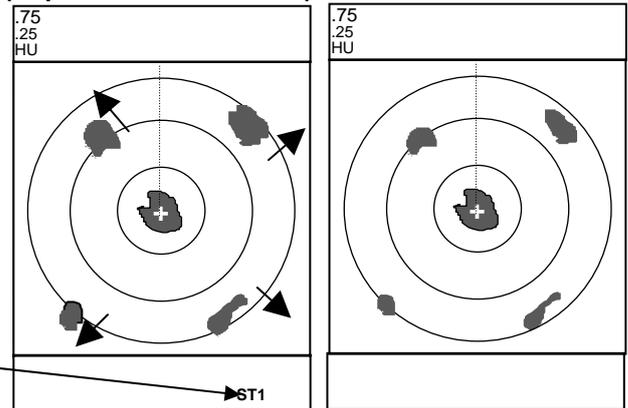
(Select TUNE) |->(Select MANU) --> **ENT** --> **Control knob** --> **ENT** ----- Set to MANU mode
 | (TUNE adjustment)
 |->(Select AUTO) --> **ENT** ----- Set to AUTO mode

5.5.3.5 Echo expansion (ST)

This function expands or stretches the echo in a direction away from your boat. It is used to better define smaller targets. There are two levels of echo expansion, ST1 and ST2.

- (1) Select ST1 from the ECHO menu and press "ENT".
- (2) Select ST1 or ST2 from the box and press "ENT".

(expansion rate ST1<ST2)



ST1, or ST2 display, no display on OFF state

The picture to display echoes expanded in the direction of the distance

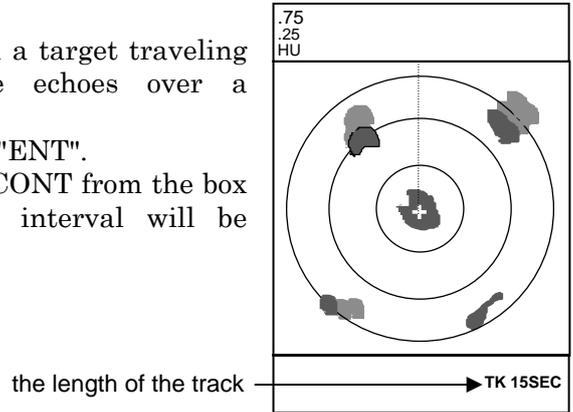
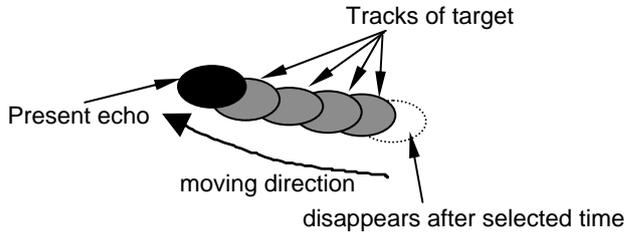
ST function is OFF

Up/Down --> **ENT** --> **Up/Down** --> (select ST1) --> **ENT** set ST1
 |-> (select ST2) |-> **ENT** set ST2
 |-> (select OFF) |-> **ENT** ST OFF

5.5.3.6 Displaying track of targets (TRACK)

This function allows you to determine the direction a target traveling relative to your boat by displaying multiple echoes over a pre-determined length of time.

- (1) Select TRACK from the ECHO menu and press "ENT".
- (2) Select 15SEC, 30SEC, 1MIN, 3MIN, 6MIN, or CONT from the box and press "ENT". The selected track time interval will be displayed on the lower right of the screen.



The key sequence for setting up the ship's track

[up/down]	-->	[ENT]	-->	[up/down]	->	(select OFF)	->	[ENT]	TRACK OFF
				----	->	(select 15SEC)	->	[ENT]	set 15sec. track
				----	->	(select 30SEC)	->	[ENT]	set 30sec. track
				----	->	(select 1MIN)	->	[ENT]	set 1 min. track
				----	->	(select 3MIN)	->	[ENT]	set 3 min. track
				----	->	(select 6MIN)	->	[ENT]	set 6 min. track
				----	->	(select CONT)	->	[ENT]	set continue track

5.5.3.7 Enlarging the selected areas (ZOOM)

The image centered on the cross cursor is doubled in size on the screen.

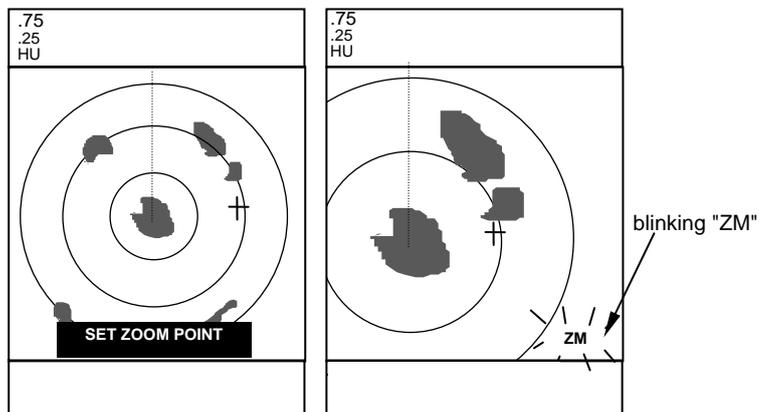
- (1) Select ZOOM from the ECHO menu and press "ENT".
- (2) Select ON and press "ENT".
- (3) A small cross cursor appears in the middle of the screen and "SET ZOOM POINT" are displayed at the bottom. Use cursor pad to move the cross cursor to the point to be magnified and press "ENT". The area around the cross cursor is displayed in 2x magnification. The word ZOOM will blink at the lower right of the screen.

To cancel the ZOOM function, either select OFF in the menu or press "RANGE UP" or "RANGE DOWN".

[Up/Down]	->	[ENT]	->	[Up/Down]	(Select ON)-->	[ENT]	->	[Up/Down] & [Left/Right]	->	[ENT]	ZOOM Setting
(Select ZOOM)								(Move cross cursor)			
				----	->	(Select OFF)	->	[ENT]			ZOOM canceled

Note 1: VRM2 and EBL2 do not follow the ZOOM function during the floating (FL) state.

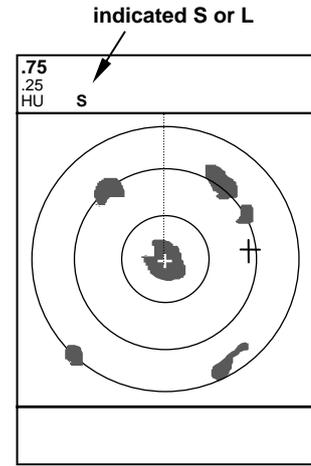
- 2: A normal screen returns when you change the range scale.
- 3: You can only use the ZOOM function on a PPI screen.
- 4: ZOOM function cannot be used in conjunction with OFF-C.
- 5: Center of ZOOM can be set anywhere on the screen and in any range.



5.5.3.8 Increasing average transmitter power (S/L)

The pulse length is automatically changed as you change the range. However, if you want to increase average transmitter power, you can choose from two pulse lengths for each range. The short pulse (SHORT) gives you sharp images with high bearing resolution. The long pulse (LONG) provides higher average transmit power and shows targets in large size for easy identification although bearing resolution is reduced.

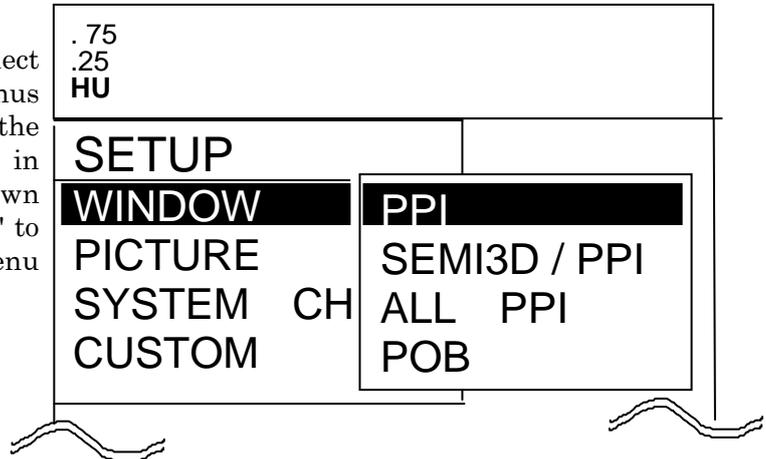
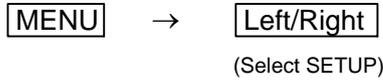
- (1) Select S/L from the ECHO menu and press "ENT".
- (2) Select either SHORT or LONG from the box and press "ENT".



--> -->(Select SHORT) --> ----- Set to short pulse
 --> -->(Select LONG) --> ----- Set to long pulse

5.5.4 SETUP Menu

Press the "MENU" key and select "SETUP" from the four displayed menus by using the left or right arrows on the cursor pad. Highlight a specific item in the SETUP menu using the up-down cursor pad keys, and then press "ENT" to reveal the box containing further menu choices.



5.5.4.1 Selecting the screen display (WINDOW)

There are eight selectable screen configurations on the MDC-721/741/740:

- 1) PPI screen with navigation data and soft keys
- 2) PPI screen & SEMI3D screen with navigation data and soft keys
- 3) Full-screen PPI display without nav data or soft keys
- 4) POB position data screen



Available functions on each screen mode

ITEM	SCREEN	PPI	PPI/SEMI3D	ALL PPI	POB
RANGE		○	○	○	X
VRM1, EBL1		○	○	X	X
VRM2, EBL2		○	○	X	X
FL VRM2/EBL2		○	X	X	X
RINGS ON/OFF		○	○	○	X
ZOOM, OFF CENT		○	X	X	X
///CSR		○	○	○	X
HDG OFF		○	○	X	X
STERN M		○	○	○	X
NORTH M		○	○	○	X
GAIN, STC, FTC		○	○	X	X
TUNE		○	○	X	X
ST		○	○	X	X
GZ		○	○	X	X
TXON/OFF		○	○	○	X

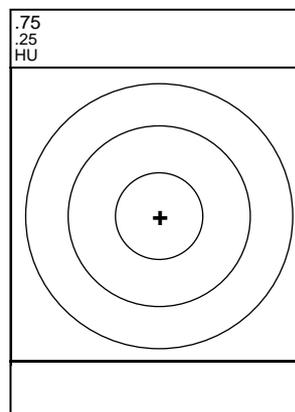
◎ : Independent control on both screens using SEL WIN
 □ : Can only be used on a PPI screens

○ : Simultaneous control on both screen
 X : Cannot be used

Screen modes and Operations

(a) PPI Screen

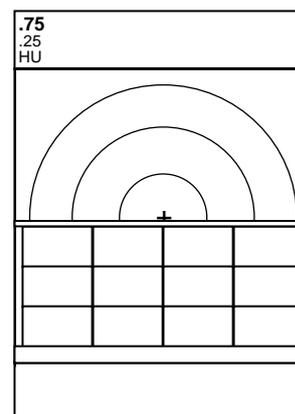
All functions can be used on this screen.



PPI Screen

(b) PPI/SEMI3D Screen

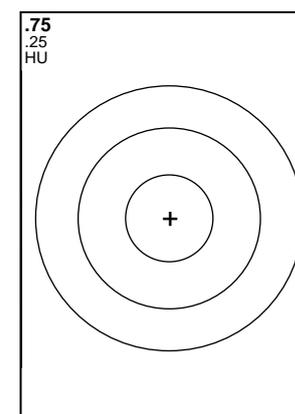
Simultaneous control of both screens at one time with controls, such as EBLs and VRMs. ZOOM, OFF-C, FL EBL2, and FL VRM2 cannot be used on this mode. The "SEMI3D" screen always displays the boat's heading at its center.



PPI/SEMI3D Screen

(c) ALL PPI Screen

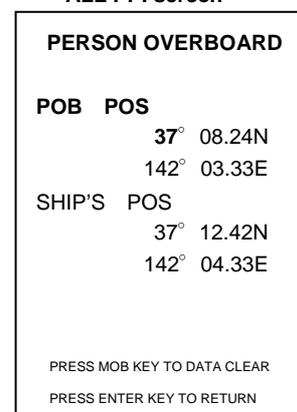
The range, range ring interval and display mode are displayed in the upper-left corner of the screen. To return to a normal PPI screen, press any key except "MENU", "RANGE UP", "RANGE DOWN", "BRILL", or "POWER".



ALL PPI screen

(d) POB Screen

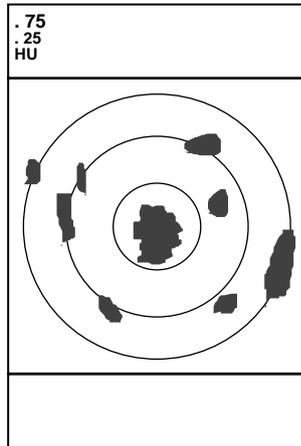
When you press the "POB" key, the POB screen appears. It displays both your present position and the position of your boat when you push the button. Press the "POB" key to clear the POB position and return to the previous screen. Press "ENT" to return previous screen but keep the POB position data.



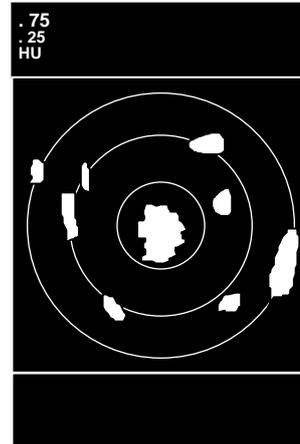
5.5.4.2 Reversing the screen (PICTURE)

You can reverse the screen display for better viewing at night or to suit ambient lighting conditions. Select PICTURE from the SETUP menu and press "ENT". Select either DAY or NIGHT.

Up/Down → ENT → Up/Down → (select DAY) → ENT → day display
(select PICTURE) → (select NIGHT) → ENT → night display



DAY display



NIGHT display

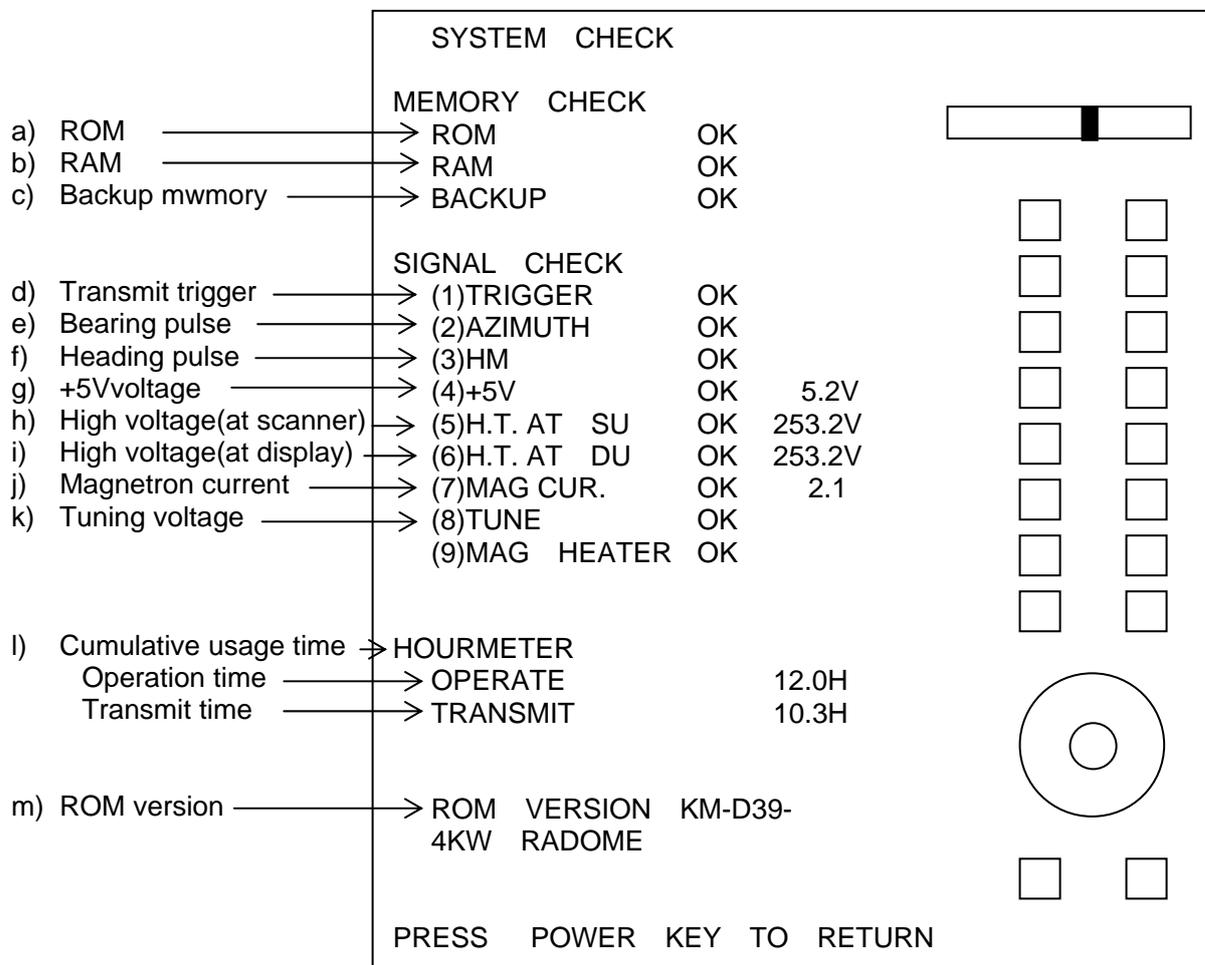
5.5.4.3 Slave Display Operation

It is possible to utilize a slave radar display as a repeater for the MDL-114x, MDC-104X radars. However, there are limitations to this configuration. The master display unit must be set to the single PPI mode only, in order for the slave to operate properly. Additionally, the slave display will have reduced target performance if operated outside the range setting of the master. The slave radar display must be set to "MONI" in the "SETUP", "CUSTOM" and "PRESET 2" menu. See 5.5.4.5.3.

5.5.4.4 Fault Diagnosis by Self Check (SYSTEM CHECK)

SYSTEM CHECK helps you identify a problem with your system.

- (1) Select SYSTEM CHECK the SETUP menu and press "ENT".
- (2) The self check will take a few seconds to run. OK indicates the item is operating properly. NG means it is faulty.
- (3) You can test the functioning of the front panel buttons by pushing them. If they are working properly, their corresponding icons will be highlighted. Rotating the control knob will make a line move inside the box on screen.
- (4) Press the "POWER" key to return to the previous screen.



SYSTEM CHECK screen

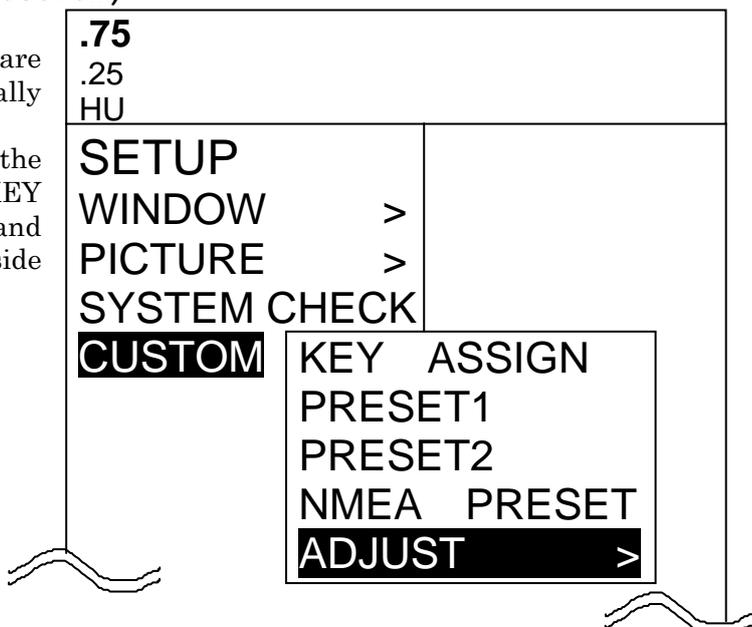
- a) ROM** Indicates the ROM status.
- b) RAM** Indicates the RAM status.
- c) Backup memory** Indicates the backup memory status.
- d) Transmit trigger** Indicates the signal line status for the trigger signal sent from the scanner unit.
- e) Bearing pulse** Indicates the signal line status for the bearing signal sent from the scanner unit.
- f) Heading pulse** Indicates the signal line status for the bow signal sent from the scanner unit.
- g) +5V voltage** Indicates the reference voltage status of the video circuit and its voltage value.
(at video circuit) (normally about 5 V)
- h) High voltage(at SU)** Indicates the status of the high voltage supplied from the display unit to the scanner unit and its voltage value (normally about 250 V) at scanner unit.

- i) High voltage(at DU)** Indicates the status of the high voltage supplied from the display unit to the scanner unit and its voltage value (normally about 250 V) at display unit.
- j) Magnetron current** Indicates the status of the anode current flowing in the magnetron and its current value.
- k) Tuning voltage** Indicates the status of the voltage used for tuning and its voltage value.
- l) Cumulative usage time** Indicates the cumulative time your radar is used.
 - OPERATE** : Duration of time during which the power supply is turned on.
 - TRANSMIT** : Duration of time transmitting.
- m) ROM version** Indicates the ROM software version.
- n) Front-panel keys** As you press any front-panel key when the SYSTEM CHECK screen is on, the corresponding key is highlighted on the screen by displaying it in reverse video.

5.5.4.5 Changing the content of the setting (CUSTOM)

Most items in the CUSTOM menu are normally set when the radar is initially installed or are changed infrequently.

Press "MENU", select CUSTOM from the SETUP menu, and then press "ENT". "KEY ASSIGN", "PRESET1", "PRESET2" and "ADJUST", are displayed in the box beside CUSTOM.



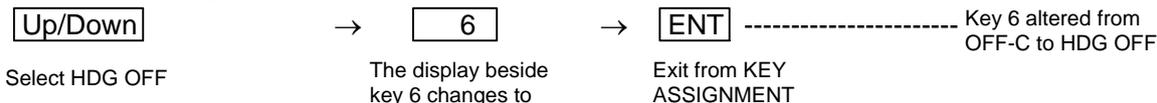
KEY ASSIGNMENT				
MARK				
<input checked="" type="checkbox"/> EBL1		EBL1	EBL2	RINGS
<input checked="" type="checkbox"/> VRM1	EBL1		VRM2	TUNE
<input checked="" type="checkbox"/> EBL2		VRM1	FL EBL2	ST
<input checked="" type="checkbox"/> VRM2	VRM1		FL VRM2	ZOOM
<input checked="" type="checkbox"/> FL EBL2		VAR RNG	GZ	SLEEP
<input checked="" type="checkbox"/> FL VRM2	VAR RNG		OFF-C	PICTURE
<input type="checkbox"/> HDG OFF		TRACK	NEXT	NEXT
<input checked="" type="checkbox"/> ///CSR	TRACK			
<input checked="" type="checkbox"/> RINGS		TARGET		
<input checked="" type="checkbox"/> VAR RNG	TARGET			
<input checked="" type="checkbox"/> TARGET		MODE		
<input checked="" type="checkbox"/> +MK LINE	MODE			
NAV	NEXT			
<input checked="" type="checkbox"/> MODE		SET1	SET2	SET3
<input checked="" type="checkbox"/> GZ				SET4
<input checked="" type="checkbox"/> OFF-C				
<input checked="" type="checkbox"/> SLEEP				

KEY ASSIGNMENT	
ECHO	
<input checked="" type="checkbox"/> TUNE	
<input checked="" type="checkbox"/> ST	EBL1
<input checked="" type="checkbox"/> TRACK	
<input checked="" type="checkbox"/> ZOOM	VRM1
<input checked="" type="checkbox"/> S/L	
	VAR RNG
NAV	
<input checked="" type="checkbox"/> MODE	TRACK
<input checked="" type="checkbox"/> GZ	
<input checked="" type="checkbox"/> OFF-C	TARGET
<input checked="" type="checkbox"/> SLEEP	
	MODE
	NEXT
	SET1

5.5.4.5.1 Changing the settings of the soft keys (KEY ASSIGN)

- (1) Press the "MENU" key, select SETUP>CUSTOM>KEY ASSIGN, and press "ENT". This will open a screen for setting the key assignments for the soft keys.
- (2) Select a soft key set by moving the left-right cursor pad arrows. It will be enclosed in a frame.
- (3) Select functions by moving the up-down cursor pad arrows to highlight the item. If an item has a check mark in the box in front of it, that item is currently assigned to a soft key set.
- (4) Highlight the function you'd like to assign, then press the numbered button you want to assign it to. The key name on the screen diagram will change to the new assignment.
- (5) Continue to make other changes in the same way. When you have completed all settings, press "ENT" and all the changes you've made will be stored.

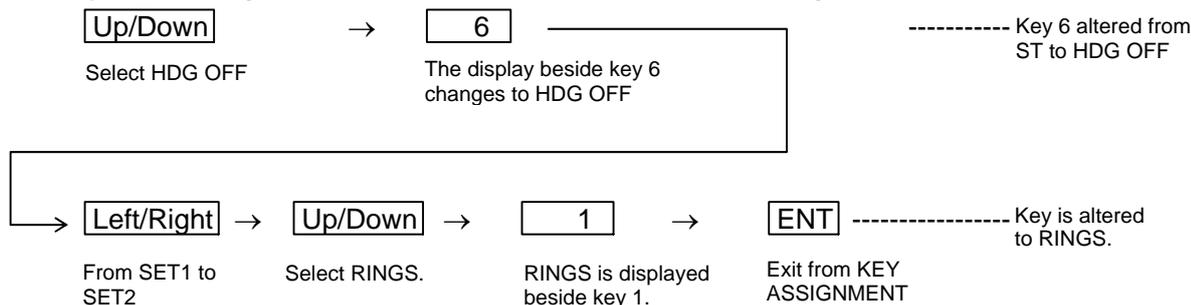
Example 1) Altering OFF-C allocated to key 6 in Set 2 to HDG OFF.



Example 2) Re-allocate RINGS to key 1 in Set 2.



Example 3) Alter key 1 in Set 1 from ST to HDG OFF and then reset key 1 in Set 2 as RINGS.



5.5.4.5.2 Changing the settings in PRESET1 screen

- (1) Press the "MENU" key, select SETUP>CUSTOM>PRESET1, and press "ENT". This will open a screen for setting various preset parameters that control the operation of your radar.
- (2) Select items with the up-down cursor pad keys and options with the left-right keys. The selected item will be enclosed in a frame and the current option setting will be highlighted.
- (3) After you've completed making settings, exit from the PRESET1 screen by pressing "ENT".

a) Heading Flash	→	PRESET1	1 / 3
		HM FLSH	
		ON	OFF
b) Stern Mark	→	STERN M	
		ON	OFF
c) North Mark	→	NORTH M	
		ON	OFF
d) ST'BY screen	→	ST'BY	
		NAVI	NOR
e) Buzzer Volume	→	BUZ VOL	
		OFF	LOW HIGH
f) VRM Unit	→	RM UNIT	
		NM	KM SM
g) Water temperature	→	TEMP	
		°C	°F
		PRESS ENTER KEY TO RETURN	

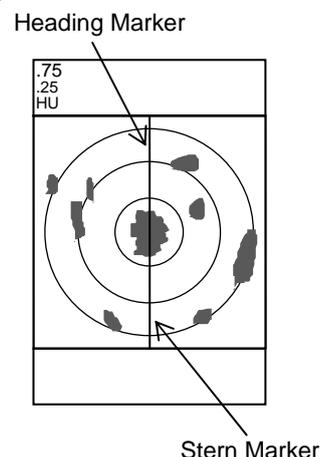
h) Depth Unit	→	PRESET1	2 / 3
		DEPTH	
		M	FT FM
i) EBL Mode	→	EBL BRG	
		REL	TRUE MAG
j) Way Point Mode	→	WP BRG	
		TRUE	MAG
k) Heading Input	→	HEAD INPUT	
		NMEA	SIN / COS
		12BIT	10BIT
l) Heading Type	→	HEAD	
		TRUE	MAG
m) Cursor position	→	+MK MODE	
		DIST / BRG	LAT / LON
n) TX Pulse	→	P TABLE	
		0 1 2	
		.5 .75 1.5 3 6	
		SHORT 0 0 0 1 1	
		LONG 0 1 1 2 2	
		PRESS ENTER KEY TO RETURN	

o) Way Point select	→	PRESET1	3 / 3
		WP SEL	
		EXT	INT
		PRESS ENTER KEY TO RETURN	

Pulse Table configuration will be displayed when you select a number in the P TABLE entry (n).

Descriptions of glossary used in the menu.

- a) Heading Flash Each revolution of the antenna turns the heading marker off then on.
- b) Stern Mark Turn a stern line on or off
- c) North Mark Display the direction of North (requires Heading input).
- d) ST^BY screen Selecting which screen is displayed when the radar goes into standby mode.
NAVI: -----Navigation Data screen.
NOR:-----Normal radar display screen.
- e) Buzzer Volume Set the volume of the internal warning buzzer.
- f) VRM Unit Set the VRM unit
NM:-----Nautical mile
KM:-----Kilometer
SM:-----Statute mile
- g) Water temperature Set the water temperature unit
°C:-----Celsius
°F:-----Fahrenheit
- h) Depth Unit Set the Depth unit
M:-----Meter
FT:-----Feet
FM:-----Fathom
- i) EBL Mode Set the Mode of EBL
REL:-----Relative bearing from HM
TRUE: -----True bearing
MAG:-----Magnetic bearing
- j) WayPoint Mode Set the Waypoint bearing mode
TRUE: -----True bearing
MAG:-----Magnetic bearing
- k) Heading Source Set the Heading source;
NMEA
SIN/COS: ---Compass Data with SIN/COS signal
12BIT: -----Compass Data with 12bits serial signal
10BIT: -----Compass Data with 10bits serial signal
- l) Heading Type Heading Information Type setting
MAG:-----Magnetic bearing
TRUE: -----True bearing
- m) Cross cursor position display mode
DIST/BRG: -Range and Bearing indication
LAT/LON: ---Latitude and Longitude indication (requires GPS input)
- n) Transmitting pulse width
Select pulse setting for various ranges



P TABLE

	PULSE TYPE	<0.25 NM	0.5 NM	0.75 NM	1.5 NM	3 NM	6 NM	>12 NM
P TABLE 0	SHORT	0	0	0	0	0	1	2
	LONG	0	0	0	1	1	2	2
P TABLE 1	SHORT	0	0	0	0	1	1	2
	LONG	0	0	1	1	2	2	2
P TABLE 2	SHORT	0	0	0	1	1	1	2
	LONG	0	1	1	2	2	2	2

5.5.4.5.3 Changing the settings in PRESET2 screen

- (1) Press the "MENU" key, select SETUP>CUSTOM>PRESET2, and press "ENT". This will open a screen for setting various preset parameters that control the operation of your radar.
- (2) Select items with the up-down cursor pad keys and options with the left-right keys. The selected item will be enclosed in a frame and the current option setting will be highlighted.
- (3) After you've completed making settings, exit from the PRESET2 screen by pressing "ENT".

a) Guard Zone LEVEL	→	PRESET2 1/2 GZLVL 1 2 3 4 5 6 7
b) Guard Zone Mode	→	GZ MODE IN OUT
c) Hold	→	HOLD ON OFF
d) Display Unit Mode	→	DISPLAY RDR MONI NAV
e) External Buzzer	→	EXT BUZ OFF CONT INT
f) Bearing pulse/rot(in)	→	IN P/R 1080 1024 2048 4096 360
g) Bearing pulse/rot(out)	→	OUT P/R 1080 1024 2048 4096 360
PRESS ENTER KEY TO RETURN		
h) Built-in Simulator	→	PRESET2 2/2 DEMO ON OFF
i) Interference Rejection	→	IR OFF IR1 IR2
j) Ship's Speed	→	SPD SET NMEA MANU x.xKT
k) Indication Language	→	LANGUAGE CHI DAN ENG FRE GER GRE ITA JPN KOR NOR POR RUS SPA SWE TUR
l) Scan speed	→	SCAN SPEED STD HIGH
m) Color	→	COLOR MONO MULTI
PRESS ENTER KEY TO RETURN		

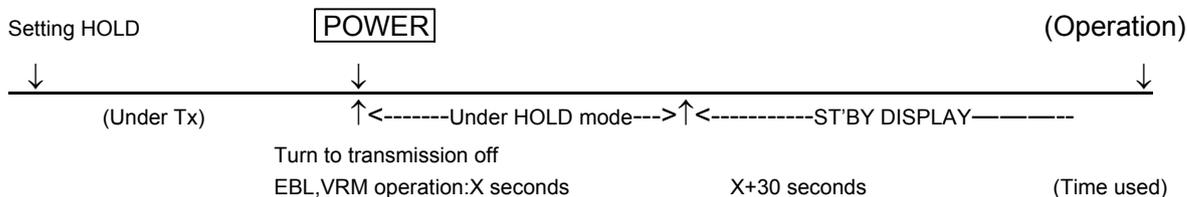
- | | |
|----------------------|---|
| a) Guard Zone Level | Guard zone detection level setting. 1: High sensitivity for smaller targets through 7: to sense large targets only |
| b) Guard Zone Mode | Guard zone detection mode setting
IN:----- Detect target when it moves inside the zone
OUT: -- Detect target when it leaves the target zone |
| c) Hold | Hold the radar image for 30 seconds after you switch to ST'BY. The EBL and VRM can be used in HOLD state. |
| d) Display Unit Mode | Display unit operation mode setting
RDR: -- <u>R</u> adar mode(normal) |

- e) External Buzzer
 MONI:- Monitor mode (for slave display use)
 NAV: -- Navigation mode (for DATA indicator use)
 External buzzer control setting
 OFF: -- Buzzer off
 CONT: Continuous tone
 INT:---- Intermittent tone
- f) Bearing pulse/rot.(IN) To change the setting when connected to another type of rada transceiver
- g) Bearing pulse/rot.(OUT) To change the setting when connected to another type of radar transceiver
- h) Built-in simulator Demonstration mode
- i) Interference Rejection Reject interference from other radars nearby
 OFF: -- IR OFF
 IR1:---- ON level 1
 IR2:---- ON level 2
- j) Boat Speed How the radar will determine and display your boat's speed
 NMEA: Data input from NMEA port
 MANU: Set speed manually with the control knob
- k) Display Language
 CHI: Chinese KOR: Korean DAN: Danish NOR: Norwegian
 ENG: English POR: Portuguese FRE: French RUS: Russian
 GER: German SPA: Spanish GRE: Greek SWE: Swedish
 ITA: Italian TUR: Turkish JPN: Japanese
- l) Scan Speed Scanning speed setting
 STD: - Standard
 HIGH: High
 (This setting can be changed only in the stand-by mode.)
 (No high speed rotation in RA30)

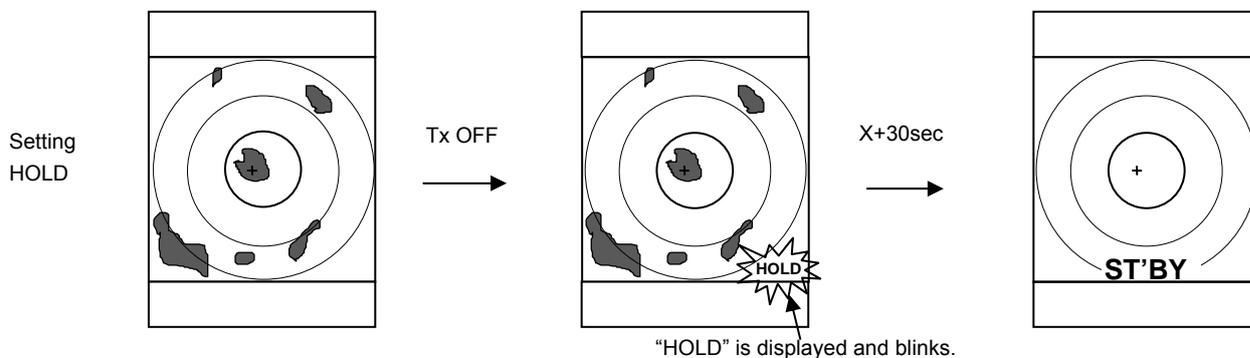
HOLD function

POWER = POWER key to press

The HOLD function is only available in standby mode that momentarily freezes the radar picture. In this mode, you can use VRMs and EBLs and, as far as the operation continues the picture stays frozen. If you leave these controls, the timer starts to count and after 30 seconds the screen will be put back automatically to normal transmitting mode.



NOTE: EBL and VRM function is usable in HOLD state.

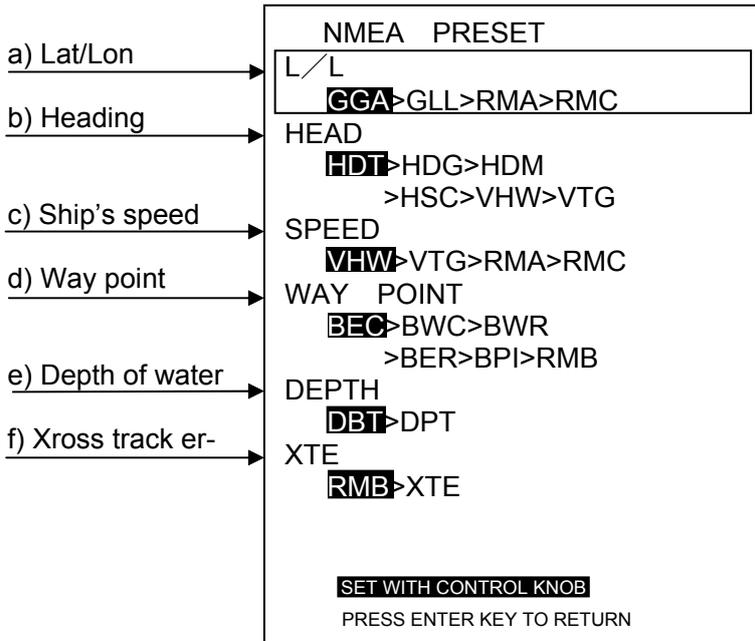


EBLs and VRMs can be used to locate a target.

5.5.4.5.4 NMEA Preset

This preset allows you to change the priority of the NMEA data being read by the radar. Lat/Long, Heading, Speed, Waypoint, Depth, Cross track error, and Magnetic compass deviation can be adjusted so as to read the various NMEA sentences available for each in a prioritized format.

The highlighted NMEA sentence ID will become the priority sentence. To highlight a sentence ID, scroll the cursor touch pad to required data (up or down) to bring border to that function. Then scroll the cursor touch pad to right until the required sentence ID is selected. Then, rotate control knob counter-clockwise until highlighted sentence ID is at the beginning of the list.



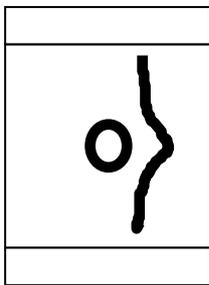
5.5.4.5.5 Initial adjustment settings (ADJUST)

The items in the ADJUST menu are done immediately after installation. This adjustment does not need during normal operation.

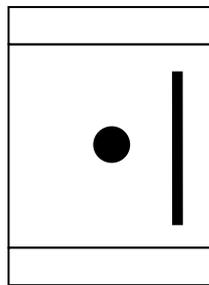
(1) Adjusting distance (TIMING ADJ)

This adjustment calibrates the distance displayed on the radar screen to the actual distance.

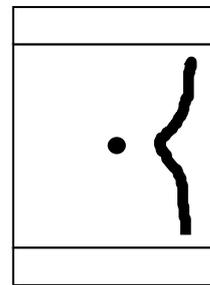
- (1) First, set the radar range to 0.25 NM, FTC to minimum, and GAIN to optimum. Then adjust STC until the pulse generated by the radar at the center of the screen is a round dot.
- (2) Adjusting the transmission timing (TX timing).
 - (2-1) Press the "MENU" key and select SETUP>CUSTOM>ADJUST>TIMING ADJUST. Press "ENT".
 - (2-2) "TIMING ADJUSTMENT" will be displayed at the bottom of the screen. Using the control knob, adjust the timing until the center dot appears as shown in (b). If there is a linear target such as a bridge or breakwater, adjust timing until the target appears straight on the screen.
 - (2-3) When the adjustment is finished, press the "ENT" key to exit from the distance adjustment screen.



a) TX timing too delayed



b) TX timing correct



c) TX timing too early

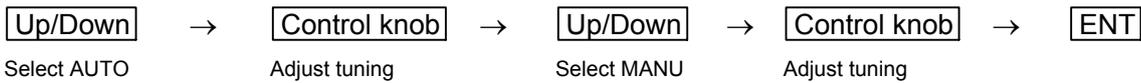
(2) Adjusting angle (HEAD ADJ)

This adjustment calibrates the heading direction displayed on the screen to the actual direction of the ship.

Note: Heading offset value for open antenna is different from that for a radome antenna.

- (1) Find one small target within a 0.5 to 1.5 NM range off your bow and is both within visible range and is clearly displayed on the radar screen.

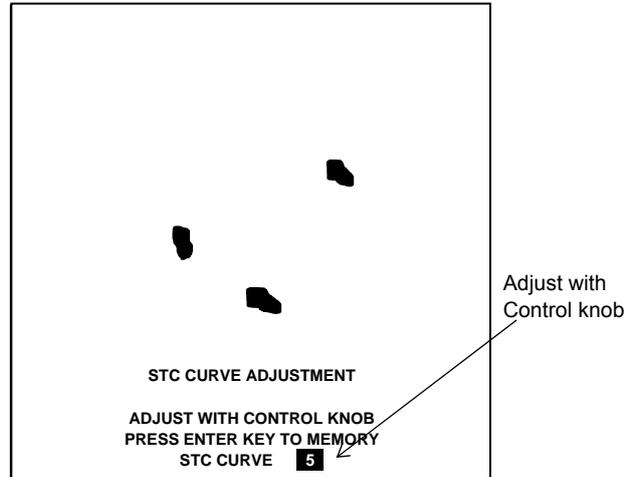
- (5) Select MANUAL with the down cursor key.
- (6) Adjust the control knob until echoes are clearly visible. This sets the middle value of manual tuning.
- (7) When the adjustment is finished, press the "ENT" key to exit from the TUNING CALIBRATION screen.



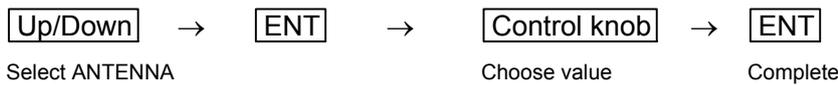
(4) Adjusting antenna height (ANTENNA)

Depending on the height at which the antenna is installed, it may be necessary to make the following correction.

- (1) Press the "MENU" key and select SETUP>CUSTOM>ADJUST>ANTENNA. Press "ENT".
- (2) "STC CURVE ADJUSTMENT" will be displayed at the bottom of the screen. Using the control knob, choose a desired value from 1 to 9.
- (3) Press the "ENT" key to exit from the adjusting antenna height screen



ANTENNA Adjustment



Echoes in short range are varied in accordance with the antenna height. Use 9 for the lowest antenna and 1 for the highest antenna. Actual adjustment of the ANTENNA HEIGHT is done by obtaining a continuous echo return of sea clutter out to maximum selected range. Note that erasing sea clutter in short range functions will erase small targets as well.

(5) Setting the receiver GAIN (GAIN)

- (1) Press the "MENU" key and select SETUP>CUSTOM>ADJUST>GAIN ADJ. Press "ENT". "MANUAL GAIN ADJUSTMENT" will be displayed at the bottom of the screen. Using the control knob, choose a desired value from 1 to 30.
- (2) Press the "ENT" key to exit from the adjusting antenna height screen.

Set the radar to the 1.5 NM range. Press the "GAIN" button until AT2 appears at the left of the screen. The G, S, and F readings below it should all have AT next to them, meaning they are all set to the auto mode. This adjustment must be done after adjusting the Auto STC. Relative sizes of targets that are processed remain at a constant level. The target signal of the auto gain circuit is adjusted constantly, even if actual returns are varied due to a change of sea conditions. This adjustment is made on a long range scale, and should be adjusted to obtain a small amount of noise on the display.

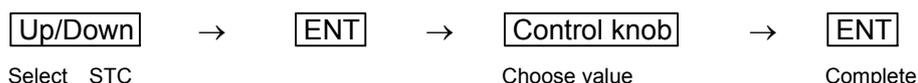


(6) Setting the STC level (STC)

Set the radar to the 1.5 NM range. Press the "GAIN" button until AT2 appears at the left of the screen. The G, S, and F readings below it should all have AT next to them, meaning they are all set to the auto mode. AUTO STC will automatically delete echoes within 0.1 NM around your boat. Because the 0.1 N.M. detection zone provides the data for the STC circuit outside the 0.1 N.M. range, it's not recommended to make this adjustment close to shore or in a harbor area.

- (1) Press the "MENU" key and select SETUP>CUSTOM>ADJUST> STC ADJ. Press "ENT".
- (2) "AUTO STC ADJUSTMENT" will be displayed at the bottom of the screen. Using the control knob, choose a desired value from 1 to 16.

(3) Press the "ENT" key to exit from the adjusting antenna height screen.



(7) Setting HARBOR STC circuit (HARBOR)

Set 1.5N.M range, HBR, G AT (Gain Auto), S HB (STC harbor), F 0 (FTC 0) first.

This adjustment must be carried out after adjustment of auto gain. Harbor mode means that a fixed STC depth is applied when the ship is going into a harbor or close to shore. This adjustment will provide good short-range target detection.

- (1) Press the "MENU" key and select SETUP>CUSTOM>ADJUST>STC ADJ. Press "ENT".
- (2) "AUTO STC ADJUSTMENT" will be displayed at the bottom of the screen. Using the control knob, choose a desired value from 1 to 16.
- (3) Press the "ENT" key to exit from the adjusting antenna height screen.



CHAPTER 6. MAINTENANCE AND INSPECTION

WARNING

There are high voltage circuits inside this radar. Do not attempt to open the rear cover of display unit or disassemble internal parts. Leave this to qualified service personnel. When you open the radome, power must be off. Never work on or near the radome while it is operating. Even if the power switch is OFF, this radar still has electrically charged components inside.

Tab. 6-1 Owner Inspection and Maintenance Items

Interval	Item	Procedure
3-6 months	Scanner hardware	Check if the scanner's mounting bolts are corroded or loose.
	LCD display	Clean filter and LCD screen surfaces with a soft moist cloth.
6-12 months	Antenna drive	Apply an even coating of grease to the entire surface of the antenna drive gear. Be certain to use grease that will not harm plastic surfaces.
	Electrical connectors	Check electrical connectors on the back panel of display unit for proper contact by unscrewing them and examining the contacts. Remove any corrosion by polishing or using a contact cleaning agent.
	Antenna motor brushes (open array antennas)	Check length of brushes and replace if under 6mm.

Replaceable items:

(1) Magnetron

This component is located in the scanner. If distant echo images have become less visible, the magnetron probably is degraded. Contact your dealer or authorized repair center for this service

Period of the replacement : 3,000 hours (typical) (500 hour guarantee)

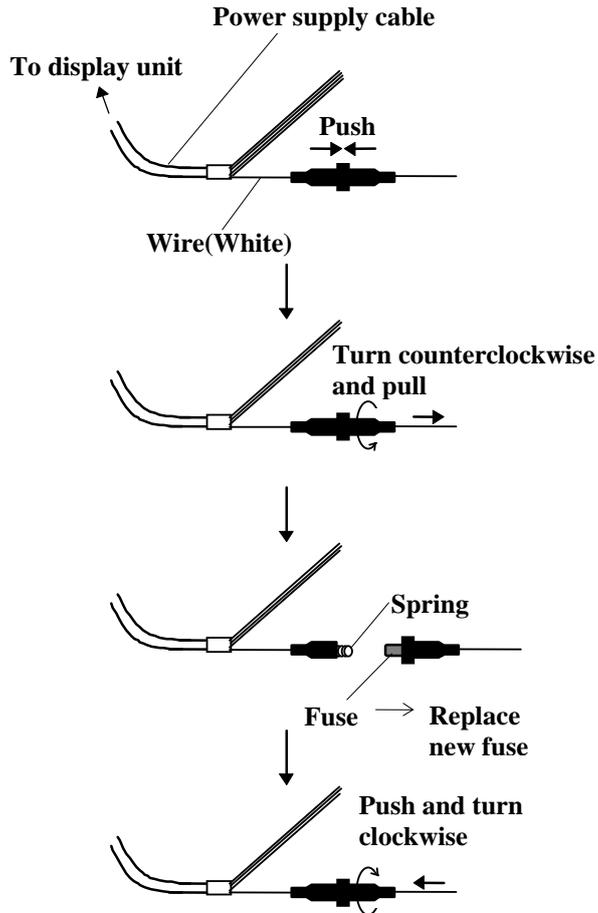
(2) LCD back-light

If the display screen becomes extremely dark and its illumination cannot be increased by adjusting the Brilliance control, the LCD backlight may be faulty. Contact your dealer or authorized repair center for this service

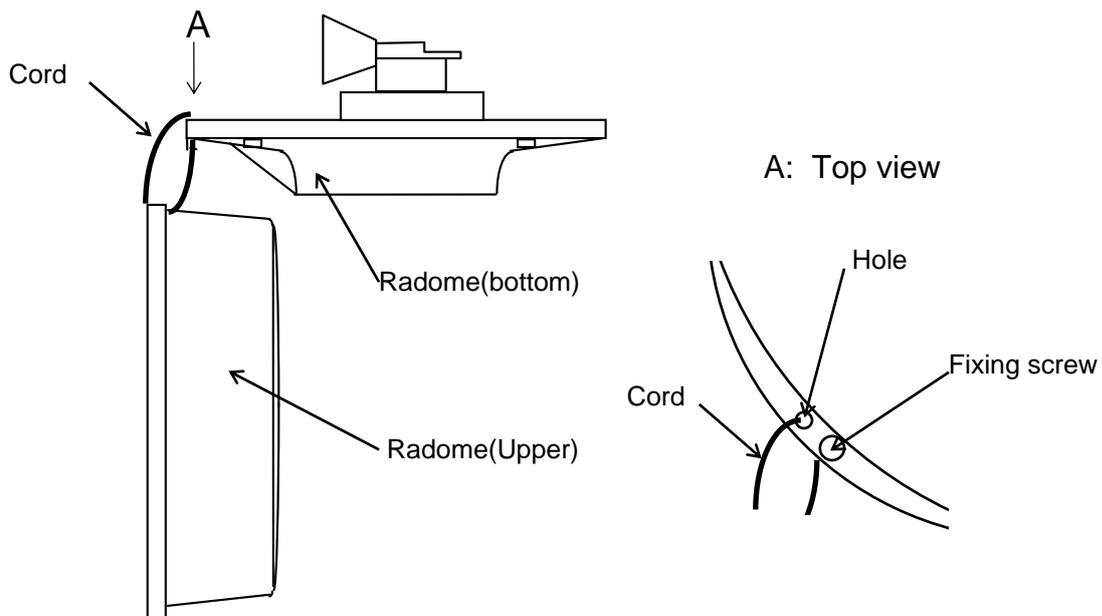
Period of the replacement: 15,000 hours (typical) (1,000 hour at 0 °C)

(3) Fuse

The fuse is installed in a in-line fuse holder provided in the power supply cable.



When working on the scanner, you can hang the upper half of the radome using a piece of wire or cord through holes to either side of the mounting screws.



CHAPTER 7. TROUBLESHOOTING

The first step to take when your radar is not operating properly is to **reboot the software**. Press and hold the POWER key for three seconds to turn the unit off. Wait for 15 seconds, and then power on again. If this does not correct the fault, then try a master reset. With the unit turned off, press and hold the FTC and RANGE UP buttons, and then press POWER. When the screen lights up, release all three buttons. If the fault persists at this point, continue with the troubleshooting steps.

WARNING

There are high voltage circuits inside of this radar. Do not attempt to open the rear cover of display unit or disassemble internal parts. When you open the radome for installation, power must be off. Even if power switch is OFF, this radar is still supplied with power inside.

7.1 Fault Diagnosis by Self-check

This radar has a self-check to diagnose equipment faults. If the unit is operable so that you can access the MENU function, select SETUP>SYSTEM CHECK and press "ENT". Refer to section 5.5.4.4 - Fault Diagnosis by Self Check (SYSTEM CHECK).

7.2 Troubleshooting System Components

Tab. 7-1 Troubleshooting

Symptom	Cause	Corrective action
(1) Radar cannot be powered on.	The unit is not receiving power	Use a voltmeter to check for power where the cable is connected to your boat's power source.
	Power supply voltage is deviated from specified value.	Correct voltage to within specified power range. (See Section 3.2)
	Fuse in power cable is blown.	Replace fuse. (See Chapter 6)
(2) Nothing is displayed although radar is powered on.	Brightness or contrast are improperly adjusted.	Use BRIL key to adjust. (See Section 5.3.)
	LCD is faulty.	Contact your dealer.
(3) Screen is dark.	Brightness is improperly adjusted.	Use BRIL key to adjust. (See Section 5.3.
	Backlight is faulty.	Contact your dealer.
(4) Radar images do not appear although screen display is present.	Scanner interconnecting cable connector is not seated properly	Go to system check menu to determine missing signals. Make sure display set to radar mode (not monitor mode)
	Cable connectors inside radome are not seated properly	Unplug and reattach cable connectors inside scanner
(5) Echo image on screen differs from actual image.	Boat heading is incorrectly set.	Set boat heading correctly. (See Section 5.5.4.5.4)
	Timing adjustment is incorrectly set.	Set timing adjustment correctly. (See Section 5.5.4.5.4)
(6) Echo images	GAIN, STC, or FTC is improperly set.	Adjust. (See Section 5.3.6 to

are blurred.		5.3.8.)
	Magnetron has degraded.	Contact your dealer.
(7) Too much noise.	Radar is not tuned correctly	Adjust TUNE. (See Section 5.5.3.4)
	Radar is not properly grounded.	Connect grounding wire to boat's bonding or grounding system. (See Section 3.4 to 3.7.)
(8) No response when a key is pressed.	Panel key is not contacting.	Use SYSTEM CHECK to confirm. (See Section 5.5.4.4) Contact your dealer.
	Power supply circuit is faulty.	Contact your dealer.
(9) No NMEA data present	Incorrect data being transmitted by talker device.	With radar powered off, press and hold POB and RANGE UP keys, then press POWER. When screen lights up, release all three buttons. Unit will display actual NMEA data being transmitted. Correct talker as necessary.

CHAPTER 8. PRODUCT SPECIFICATIONS

8.1 General

Type:	MDC-721, MDC-741 and MDC-740
Power supply voltage and power consumption	
Power supply voltage:	24Vdc (nominal)(10.2 to 41.6 Vdc)
Power consumption:	45 W or less (MDC-721) 55 W or less (MDC-741) 70 W or less (MDC-740)
Range scale:	0.125 to 24 NM, 9 ranges (MDC-721) 0.125 to 36 NM, 10 ranges(MDC-741) 0.125 to 48 NM, 10 ranges(MDC-740) (Continual variable range also possible)
Range resolution:	Within 30 m (MDC-721) Within 25 m (MDC-741/740)
Range accuracy:	Better than 0.9% of maximum range of the scale in use, or 8m, whichever is the greater
Minimum detecting distance:	Within 30 m (MDC-721) Within 25 m (MDC-741/740)
Bearing resolution:	Within 7.5°(MDC-721) Within 4.5° (MDC-741) Within 3.0° (MDC-740)
Bearing accuracy:	1° or less
Warm-up time:	2 minutes
Environment conditions	
Ambient temperature range	(S/U): -25 to 55°C (D/U): 0 to 55°C
Humidity:	93% RH at +40°C
Vibration:	(S/U): 3 mm(300 to 500 rpm) 1.2 mm(500 to 1500 rpm) 0.3 mm(1500 to 3000 rpm) 14.7m/s ² (1.5G) Resonance test (D/U): 3 mm(300 to 500 rpm) 0.75 mm(500 to 1500 rpm) 0.2 mm(1500 to 3000 rpm)
Wind resistance:	100 knots (max.)
Waterproof standard:	(D/U): IPX-5 (S/U): CER-46 (MDC-721), IPX-6 (MDC-741/740)
Interconnecting cable:	30 m in max. (MDC-721) 100 m in max. (MDC-741/740)

Noise:

(D/U): 65 dB or less

(S/U): 65 dB or less (MDC-721/741)

(S/U): 70 dB or less (MDC-740)

8.2 Scanner Unit

Type:	RB714A (MDC-721) RB715A (MDC-741) RB716A (MDC-740)
Antenna type:	Parabolic (MDC-721) Slotted-array (MDC-741/740)
Antenna characteristics	
Beam width (horizontal):	6.0° ± 1.0° (MDC-721) 3.9° (MDC-741) 2.5° ± 0.3° (MDC-740 with 3ft antenna) 1.8° ± 0.2° (MDC-740 with 4ft antenna)
Beam width (vertical):	25° (typ.) (MDC-721/741) 22° (typ.) (MDC-740 with 3/4ft antenna)

Pulse width and peak power output:

MDC-721		MDC-741/740	
Pulse width (μsec)	Peak Power (kW)	Pulse width (μsec)	Peak Power (kW)
0.12 ± 0.02	1.5 (±50%)	0.08	4 (-50% to +20%)
0.3 ± 0.05	2.0 (±50%)	0.25	4 (-50% to +20%)
0.8 ± 0.1	2.0 (±50%)	0.8	4 (-50% to +20%)

Radio wave type and frequency:	P0N, 9445 ± 30 MHz (MDC-721) P0N, 9410 ± 30 MHz(MDC-741/740)
Antenna revolution:	24 rpm ± 20% (MDC-721) 24 rpm or 48rpm* (MDC-741) 24 rpm or 48rpm* (24Vdc or more)(MDC-740) * 24 rpm only: SEMI 3D screen display.
Transmit/receive switching:	Magic T and limiter type(MDC-721) Circulator and limiter type(MDC-741/740)
Intermediate frequency:	60 MHz (logarithmic amplifier)
Noise figure:	6.5 dB or less

8.3 Display Unit

Type:	MRD-99
Indication system:	PPI, PPI+semi-3D
Indicator:	7-inch monochrome LCD (TFT) 640 x 480 dots Monochrome four (4) levels
Cursor Control:	Analog cursor key and rotary encoder

VRM:	2 lines (One line can be offset.) Unit of distance can be selected from NM, KM, and SM.
EBL:	2 lines (One line can be offset.)
Display modes:	HU, HS, NU, CU, and TM
Off-center:	Can be 100% off-centered over the full range.
Guard zone:	Can be set at any desired distance and angle in any desired width. IN and OUT modes are available.
Stretch:	2 modes
Echo track:	15, 30 sec, 1, 3, 6 min. and continuous.
Other functions:	Interference rejection, Zoom, Sleep mode, Hold mode, Course error display, Parallel cursors, Stern marker, and Navigation data display mode
Panel brightness:	4 levels
Language support:	Chinese, Danish, English, French, German, Greek, Italian, Japanese, Korean, Norwegian, Portuguese, Russian, Spanish, Swedish, and Turkish

8.4 External Interface

NMEA0183:	2 channels (One standard channel; Optional cable is required for 2nd-channel connections)
L / L	GGA, GLL, RMA, RMC
Heading	HDT, HDG, HDM, HSC, VHW, VTG
Speed	VHW, VTG, RMA, RMC
Way point	RMB, BEC, BWC, BWR, BER, BPI
Depth	DBT, DPT
Course error	RMB, XTE
Seawater temperature	MTW

Others (using optional cable):

External buzzer control output, Auxiliary indicator connecting signal output and input, Bow direction signal input(SIN/COS signals), and compass interface (10/12 bits serial)

8.5 Standard set

Display unit	1	
Scanner unit	1	
Display cover	1	
Fuse	1 set	
Interconnecting cable	1	(10m)
Power supply cable	1	(2m)
M10 hexagonal bolt	4 sets	(for MDC-721/741)
M12 hexagonal bolt	4 sets	(for MDC-740)

8.6 Options

Interconnecting cable	(15, 20, and 30 m)
Flush-mount installation kit	
Junction box for external connection	(with cable 1.5m)
Option connector kit	249J153058

8.7 External dimensions and weight

See APPENDIX

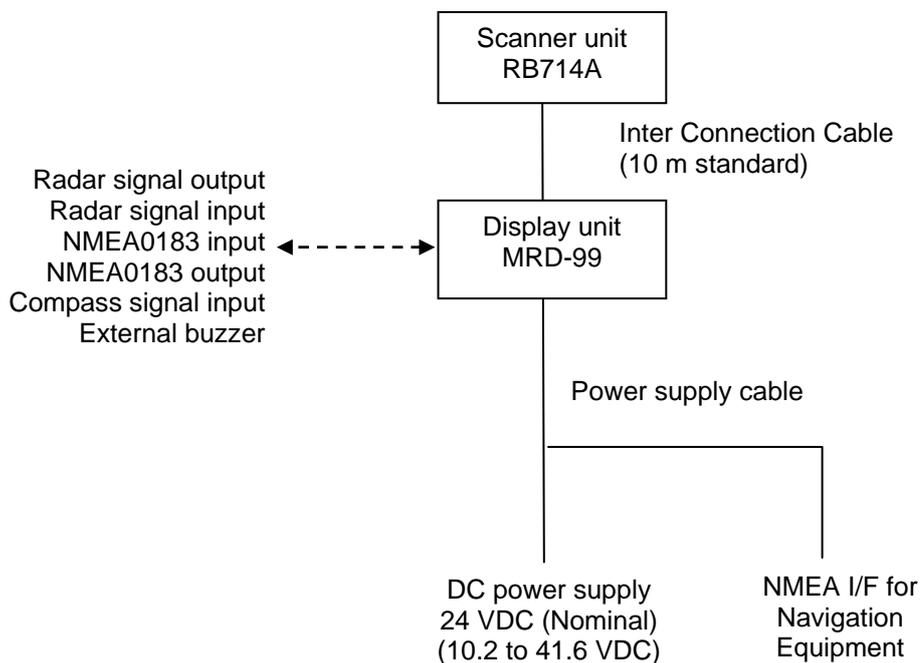
8.8 External Connection and function

X1 Connector for Option

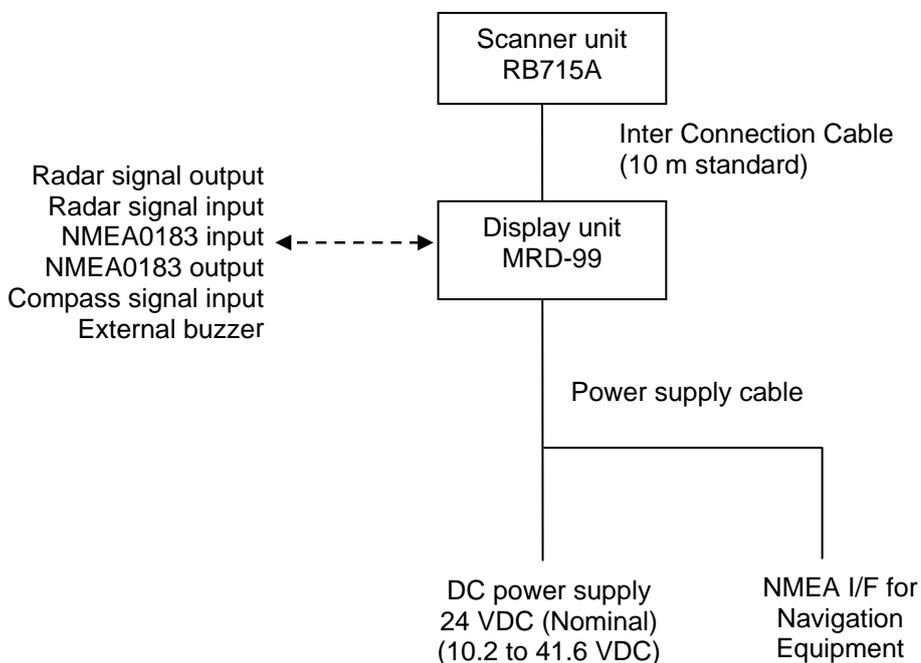
pin No.	Name	function
1	NMEA2-A	NMEA ch2 data input(A)
19	NMEA2-B	NMEA ch2 data input(B)
2	GND	
20	EXBUZ+	Output for External Buzzer
3	EXBUZ-	Output for External Buzzer controlled ship's power output
21	VIDEO_IN	Video input for Monitor operation 0 to -1V negative video, Zi = 50ohm
4	VIDEO_OUT	Video output for External Monitor 0 to -1V negative video, Zo = 50ohm
22	GND	
5	TRIG_IN	Trigger signal input for Monitor operation 0 to 5V positive pulse, rising edge
23	TRIG_OUT	Trigger output for External Monitor 0 to 5V positive pulse, rising edge
6	SHF_IN	Heading signal input for Monitor operation 0 to 5V negative pulse, falling edge
24	SHF_OUT	Heading signal output for External Monitor 0 to 5V negative pulse, falling edge
7	AZI_IN	Bearing Pulse input for Monitor operation 0 to 5V positive pulse, rising edge
25	AZI_OUT	Bearing Pulse output for External Monitor 0 to 5V positive pulse, rising edge
8	GND	
26	GYRCK+	Gyro Interface clock(+) input
9	GYRCK-	Gyro Interface clock(-) input apply 5V pulse between (+) and (-), isolated
27	GYRDT+	Gyro Interface data(+) input
10	GYRDT-	Gyro Interface data(-) input apply 5V pulse between (+) and (-), isolated
28	GND	
11	MARK_I	External Marker signal input, ex) Radar Buoy negative video, 0 to -1V Zi = 50ohm
29	+12V	External interface power, 100mA max.
12	SIN	Compass Interface for SIN/COS type
30	COS	Compass Interface for SIN/COS type
13	REF	Compass Interface for SIN/COS type SIN/COS signal: SIN = REF±1V, COS = REF±1V
31	--	not used
14	GND	
32	NMEA_OUT	NMEA data output, ex) MOB data, TARGET data

Appendix

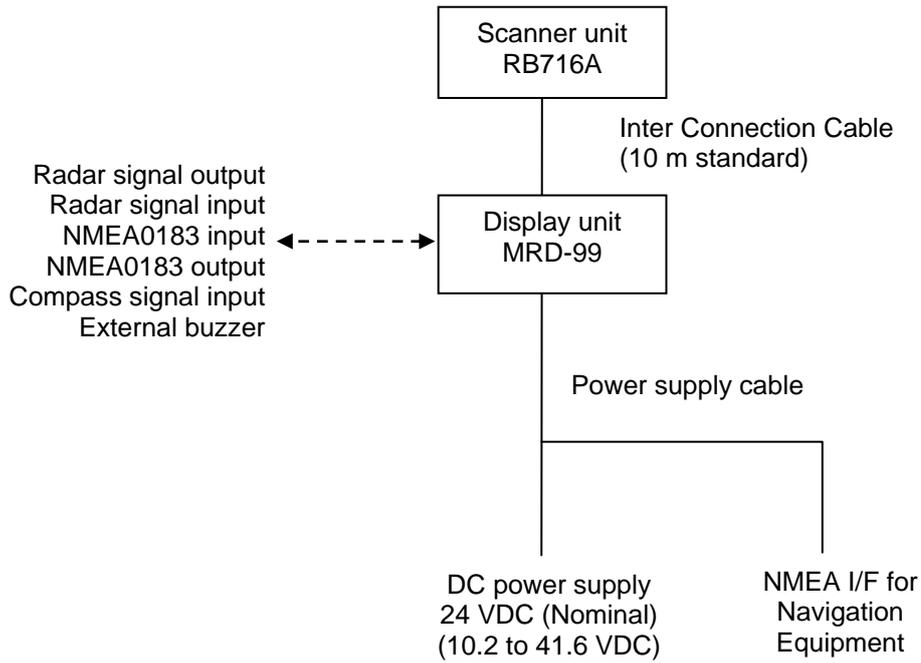
1. MDC-721 General System Diagram



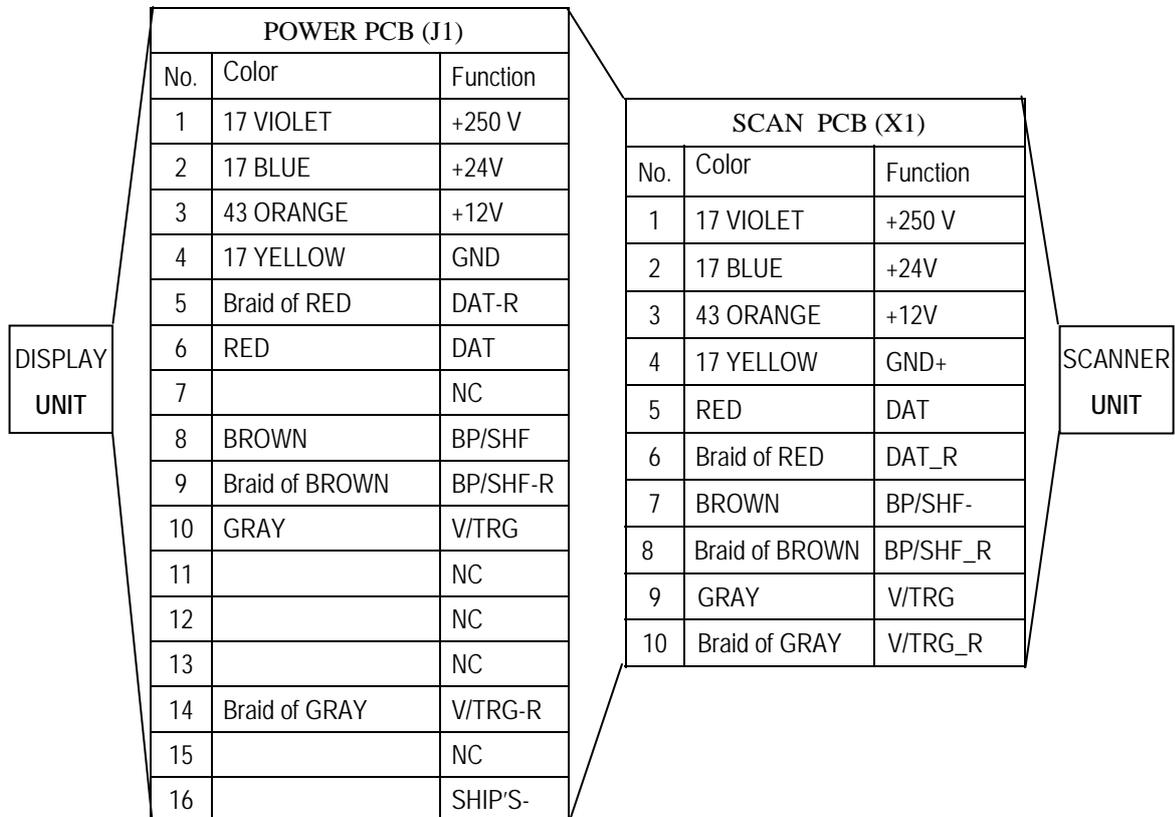
2. MDC-741 General System Diagram



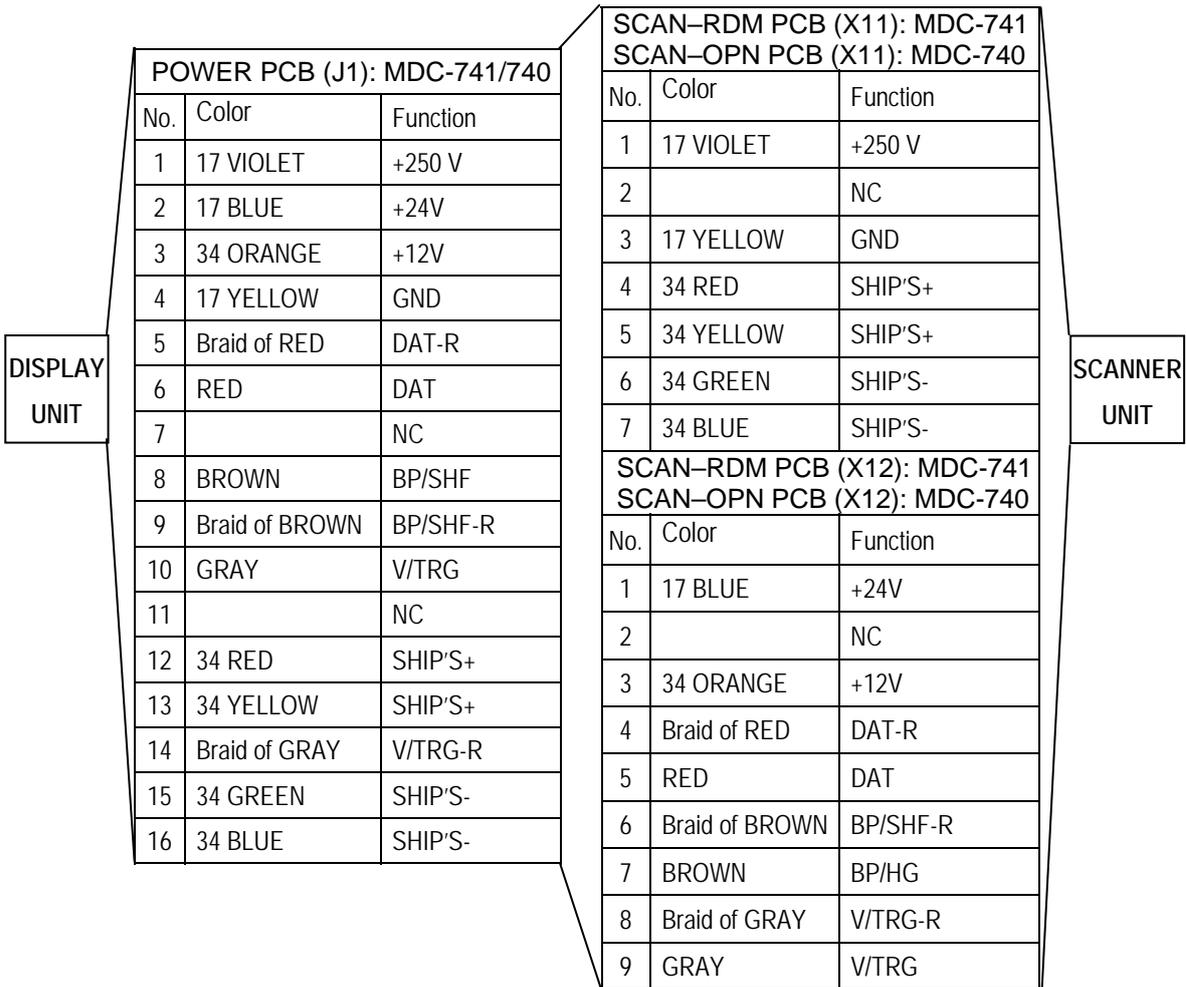
3. MDC-740 General System Diagram



4. MDC-721 Interconnection Diagram

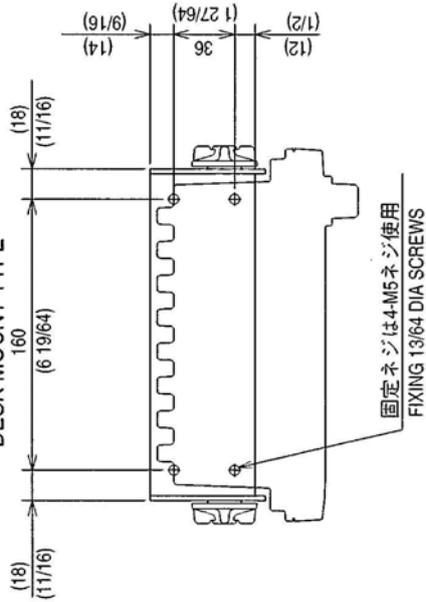


5. MDC-741/740 Interconnection Diagram

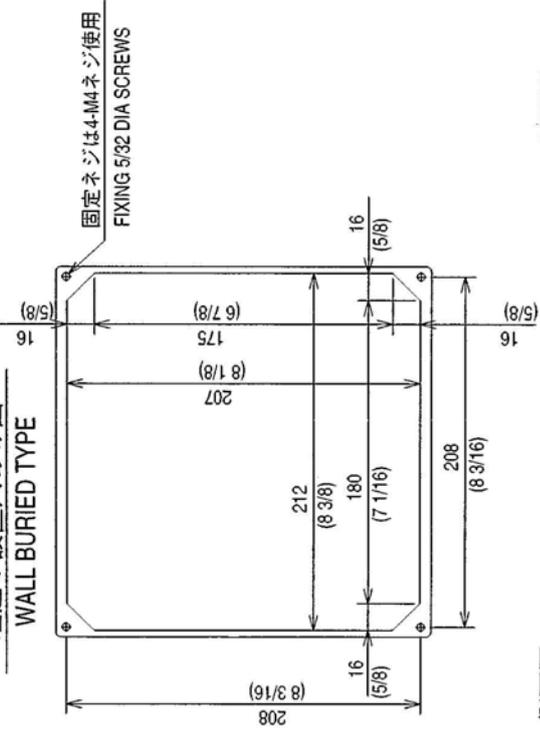


OUTLINE DRAWING MRD-99

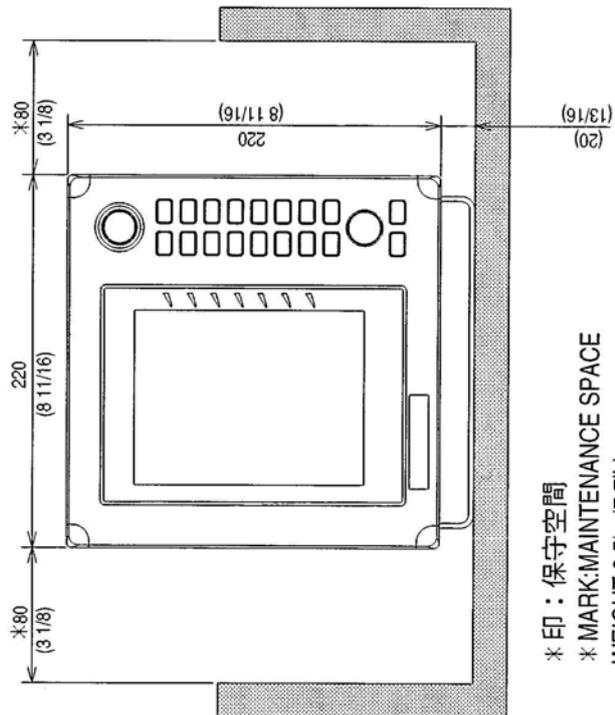
卓上設置穴あけ図
DESK MOUNT TYPE



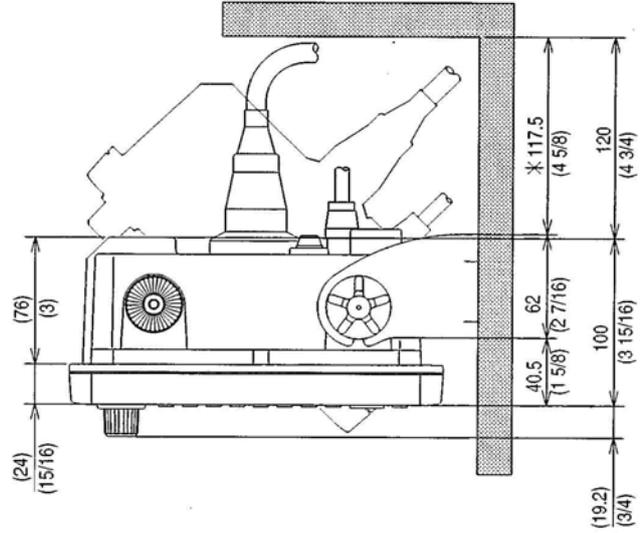
埋込み設置穴あけ図
WALL BURIED TYPE



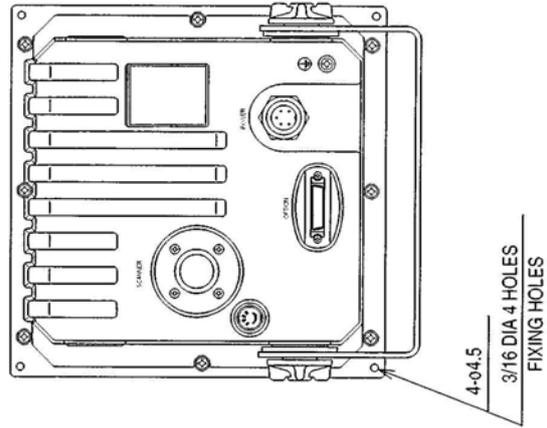
正面図
FRONT VIEW



右側面図
RIGHT VIEW

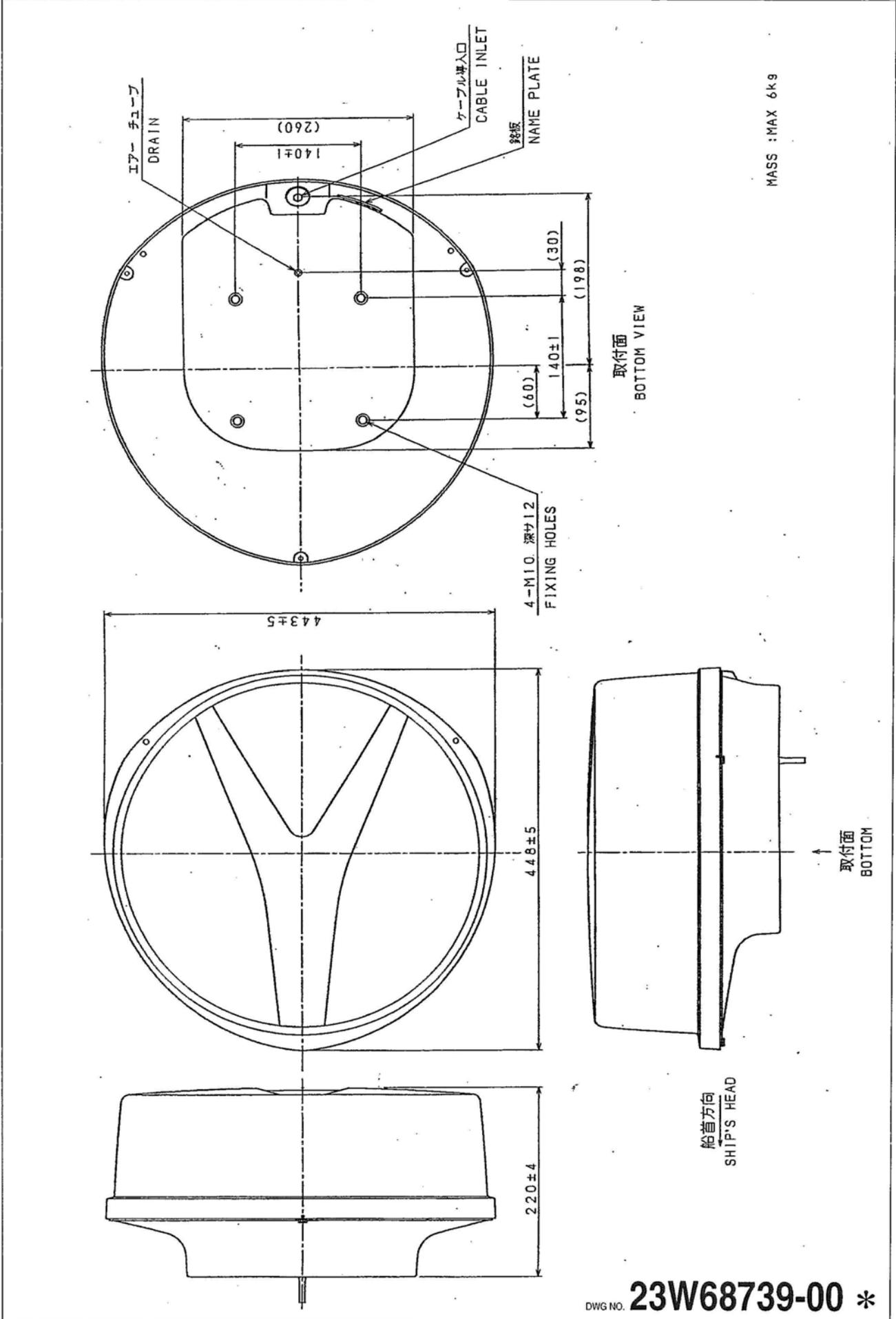


背面図
REAR VIEW



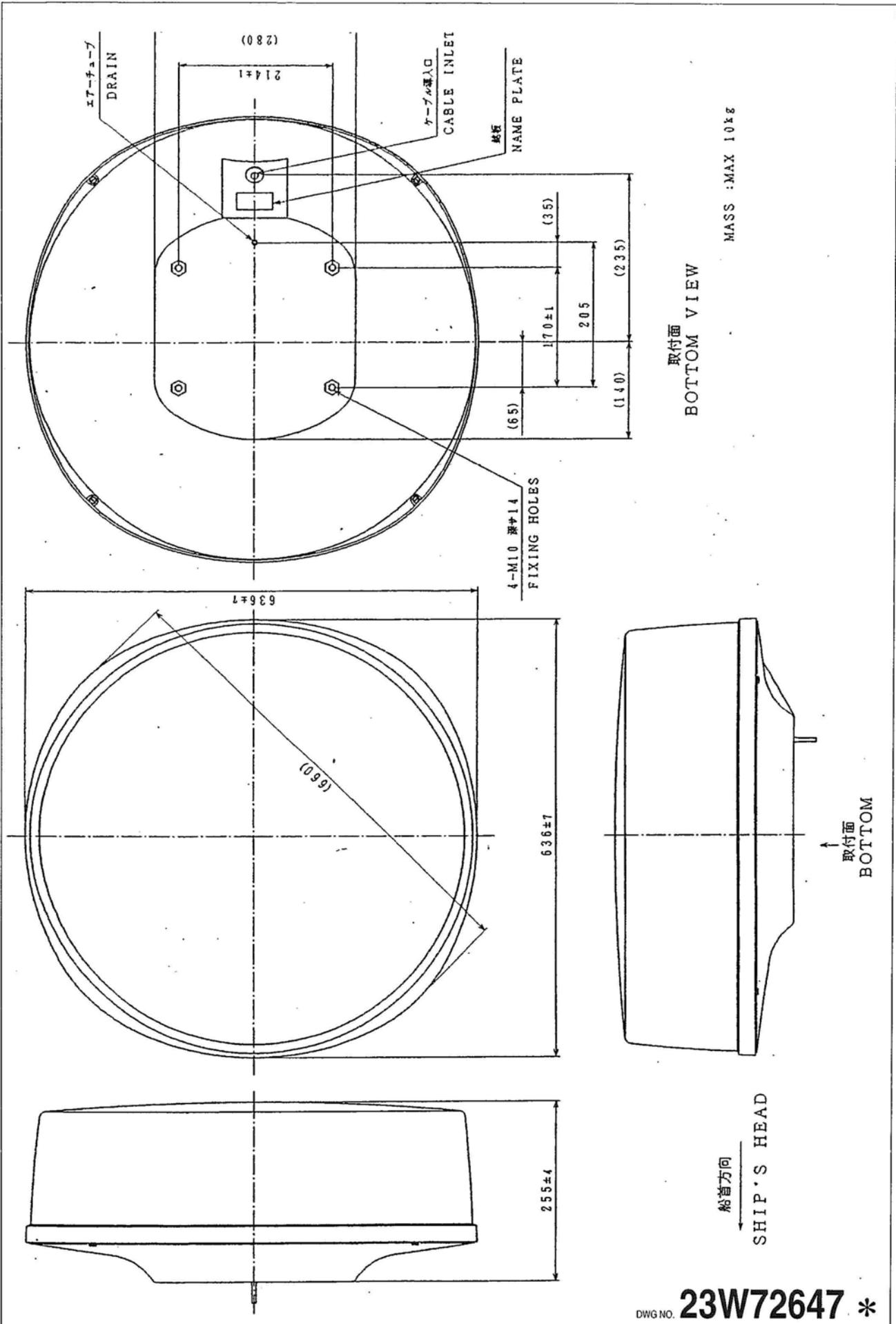
DWG NO. **E45BG12000 ***

OUTLINE DRAWING RB714A



DWG NO. **23W68739-00** *

OUTLINE DRAWING RB715A



MASS : MAX 10kg

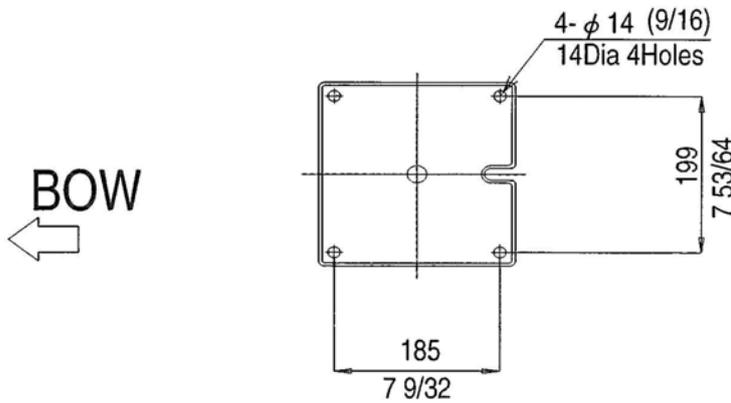
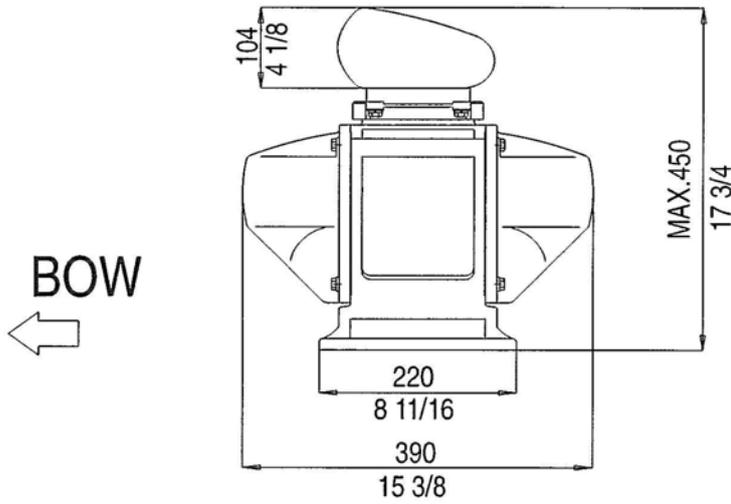
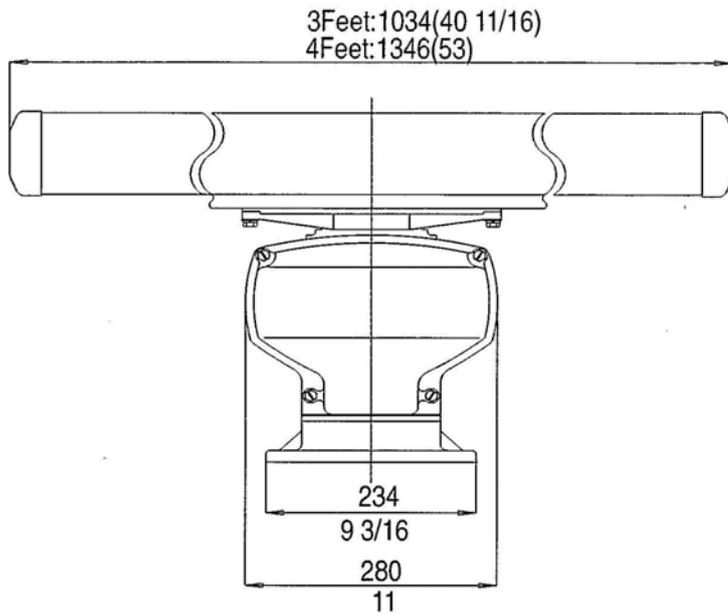
取付面
BOTTOM VIEW

取付面
BOTTOM

船首方向
SHIP'S HEAD

DWG NO. **23W72647** *

OUTLINE DRAWING RB716A



重量 : 21 kg (3ft)

22 kg (4ft)

Weight : 46 lb (3ft)

49 lb (4ft)

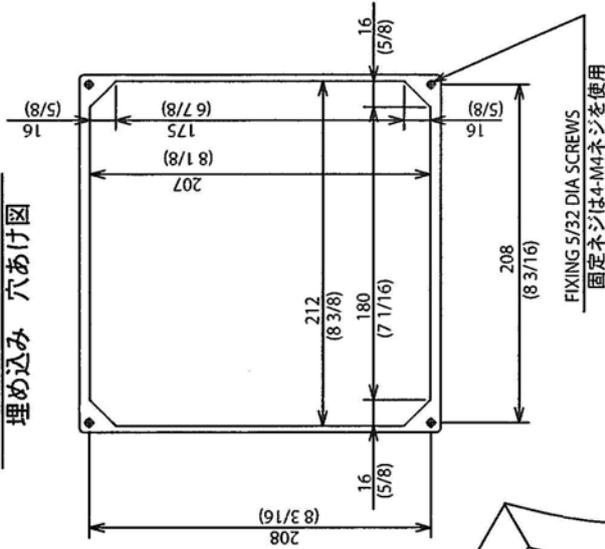
DWG NO. **E38BG52000 ***

FLUSH MOUNT PROCEDURE

FLUSH MOUNT KIT (COM7/MRD99.FM.KIT)

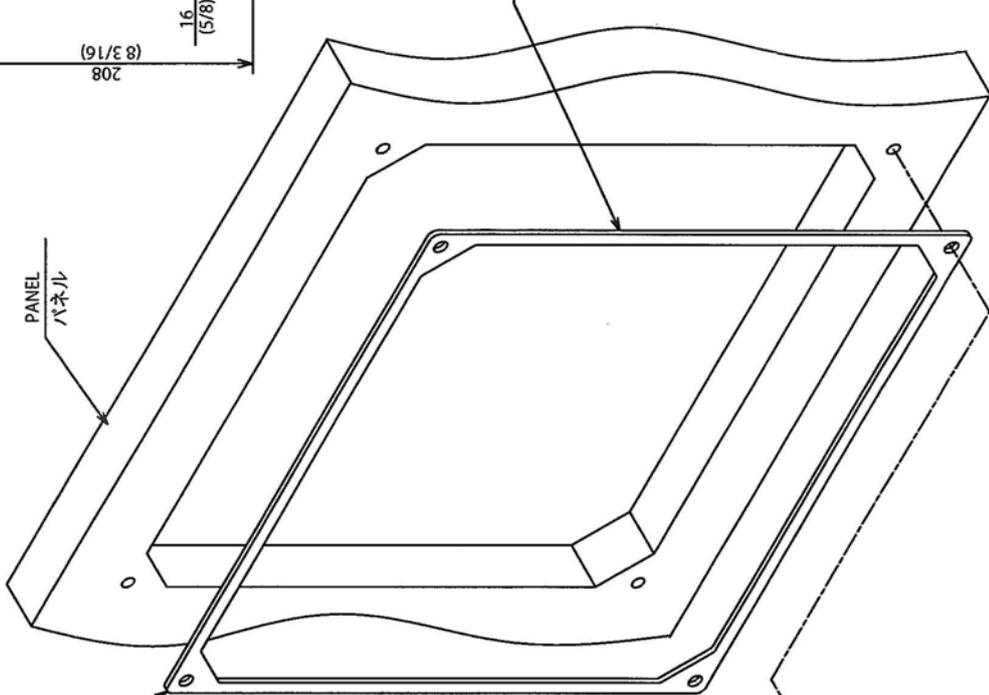
PACKING (Option) E45MB11090

WALL BURIED TYPE
埋め込み 穴あけ図



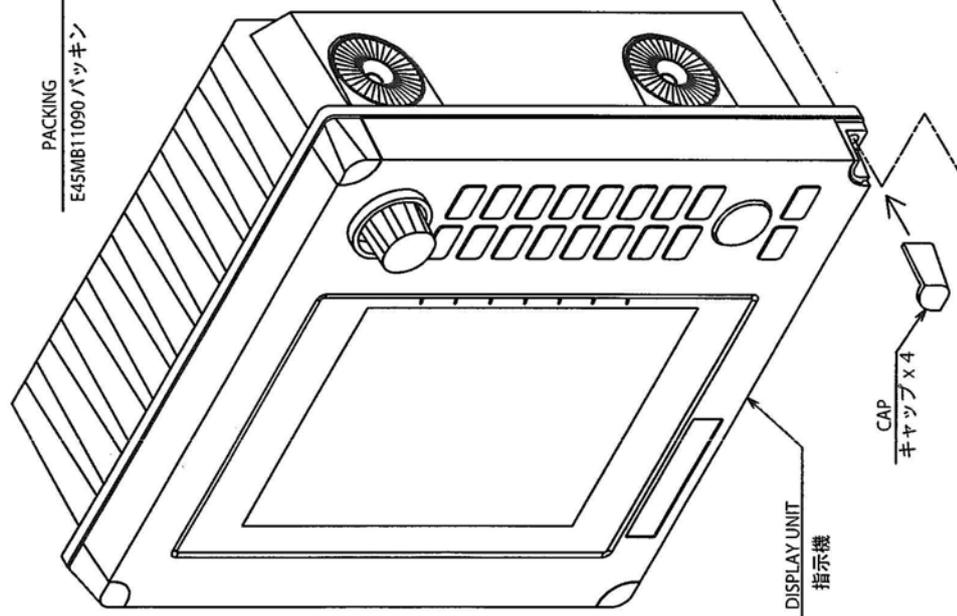
FIXING 5/32 DIA SCREWS
固定ネジは4-M4ネジを使用

ADHESIVE TAPE
両面テープ



PANEL
パネル

PACKING
E45MB11090 パッキン



DISPLAY UNIT
指示機

SCREWS
ネジ x 4

CAP
キャップ x 4

DWG NO. **E45BG12041** *

RB714A

TEMPLATE OF SCANNER MOUNTING HOLES (FULL SIZE)

スキャナー取り付け穴 テンプレート

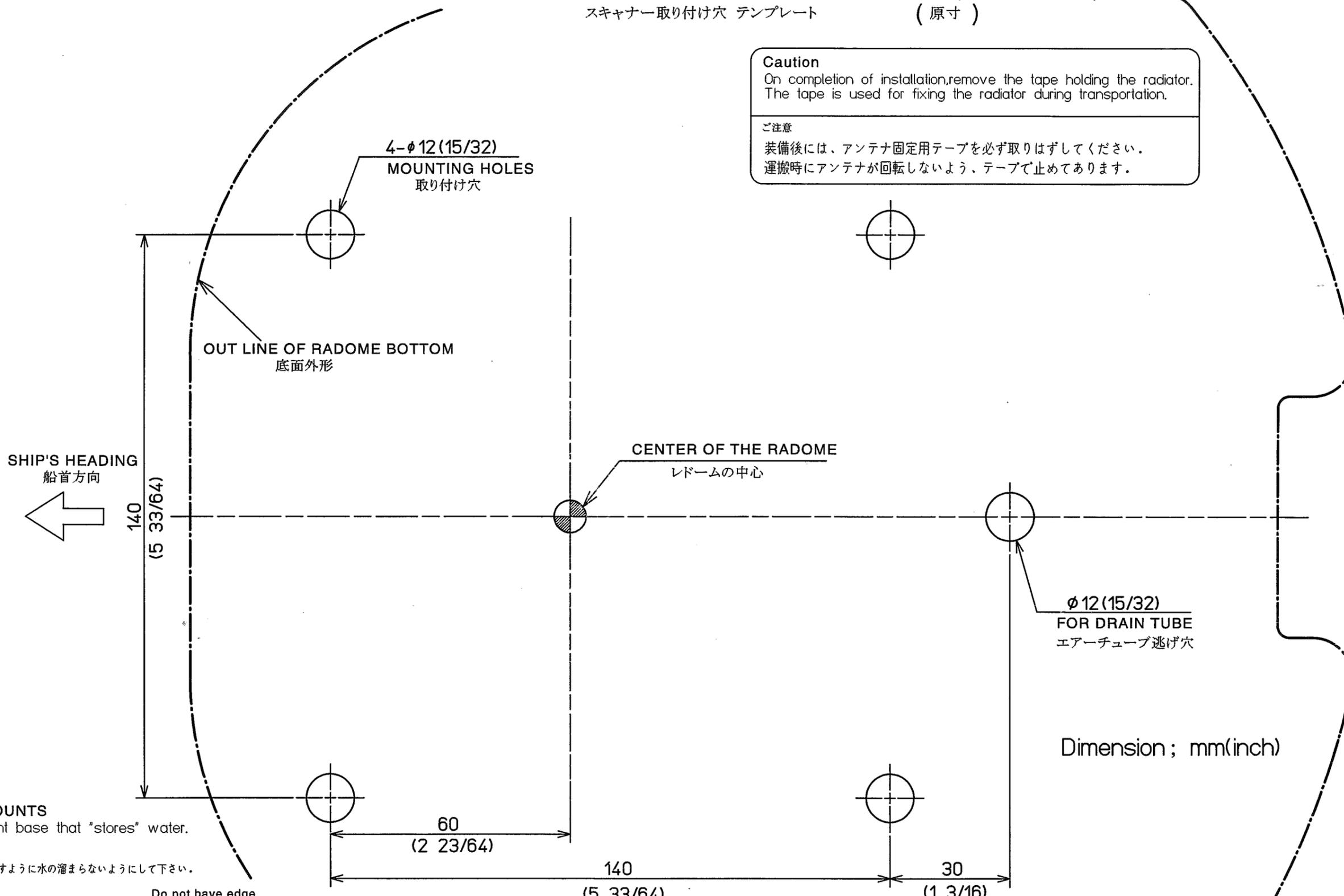
(原寸)

Caution

On completion of installation, remove the tape holding the radiator. The tape is used for fixing the radiator during transportation.

ご注意

装備後は、アンテナ固定用テープを必ず取りはずしてください。運搬時にアンテナが回転しないよう、テープで止めてあります。



Dimension; mm(inch)

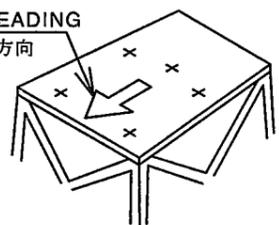
SCANNER UNIT MOUNTS

Do not use a mount base that "stores" water.

スキャナの取付け

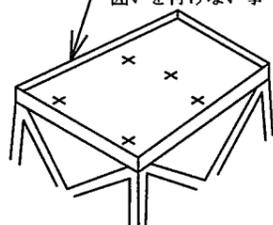
架台の注意: 架台は下図に示すように水の溜まらないようにして下さい。

SHIP'S HEADING
船首方向



Good Example
良い例

Do not have edge around mount base.
囲いを付けない事



Bad Example
悪い例

NOTE

1. In case a platform plate is warped more than 2mm, you need to level off the surface. If not possible, use appropriate spacers to allow the scanner unit mounted on the level.
2. Thickness of the platform plate should be 5mm to 12mm.
3. The scanner must be installed to allow the cable gland oriented towards ship's stern.

注)

1. レーダーマスト又は架台の取付面ソリが2mm以上の場合は修正するか又はスペーサを用意して下さい。
2. 架台の厚さは5mm~12mm以内で使用して下さい。
3. 取付方向はケーブル導入口を船尾側にして下さい。

RB715A TEMPLATE OF SCANNER MOUNTING HOLES (FULL SIZE)

スキャナー取り付け穴 テンプレート (原寸)

OUT LINE OF RADOME BOTTOM
底面外形

4- $\phi 12$ (15/32)
MOUNTING HOLES
取り付け穴

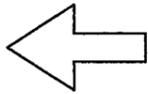
Caution

On completion of installation, remove the tape holding the radiator. The tape is used for fixing the radiator during transportation.

ご注意

装備後には、アンテナ固定用テープを必ず取りはずしてください。
運搬時にアンテナが回転しないよう、テープで止めてあります。

SHIP'S HEADING
船首方向



SCANNER UNIT MOUNTS

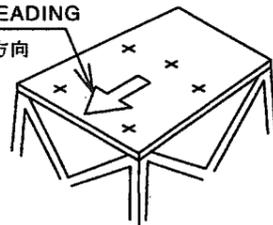
Do not use a mount base that "stores" water.

スキャナの取付け

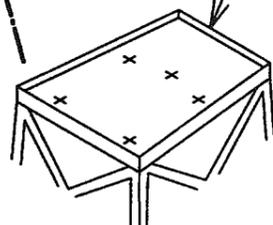
架台の注意：架台は下図に示すように水の溜まらないようにして下さい。

Do not have edge
around mount base.
囲いを付けない事

SHIP'S HEADING
船首方向



Good Example
良い例



Bad Example
悪い例

CENTER OF THE RADOME
レドームの中心

$\phi 15$ (19/32)
FOR AIR TUBE
エアチューブ逃げ穴

Dimension; mm(inch)

NOTE

1. In case a platform plate is warped more than 2mm, you need to level off the surface. If not possible, use appropriate spacers to allow the scanner unit mounted on the level.
2. Thickness of the platform plate should be 5mm to 12mm.
3. The scanner must be installed to allow the cable gland oriented towards ship's stern.

注)

1. レーダーマスト又は架台の取付面ソリが2mm以上の場合は修正するか又はスペーサを用意して下さい。
2. 架台の厚さは5mm~12mm以内で使用して下さい。
3. 取付方向はケーブル導入口を船尾側にして下さい。

214
(8 27/64)

65
(2 9/16)

170
(6 11/16)

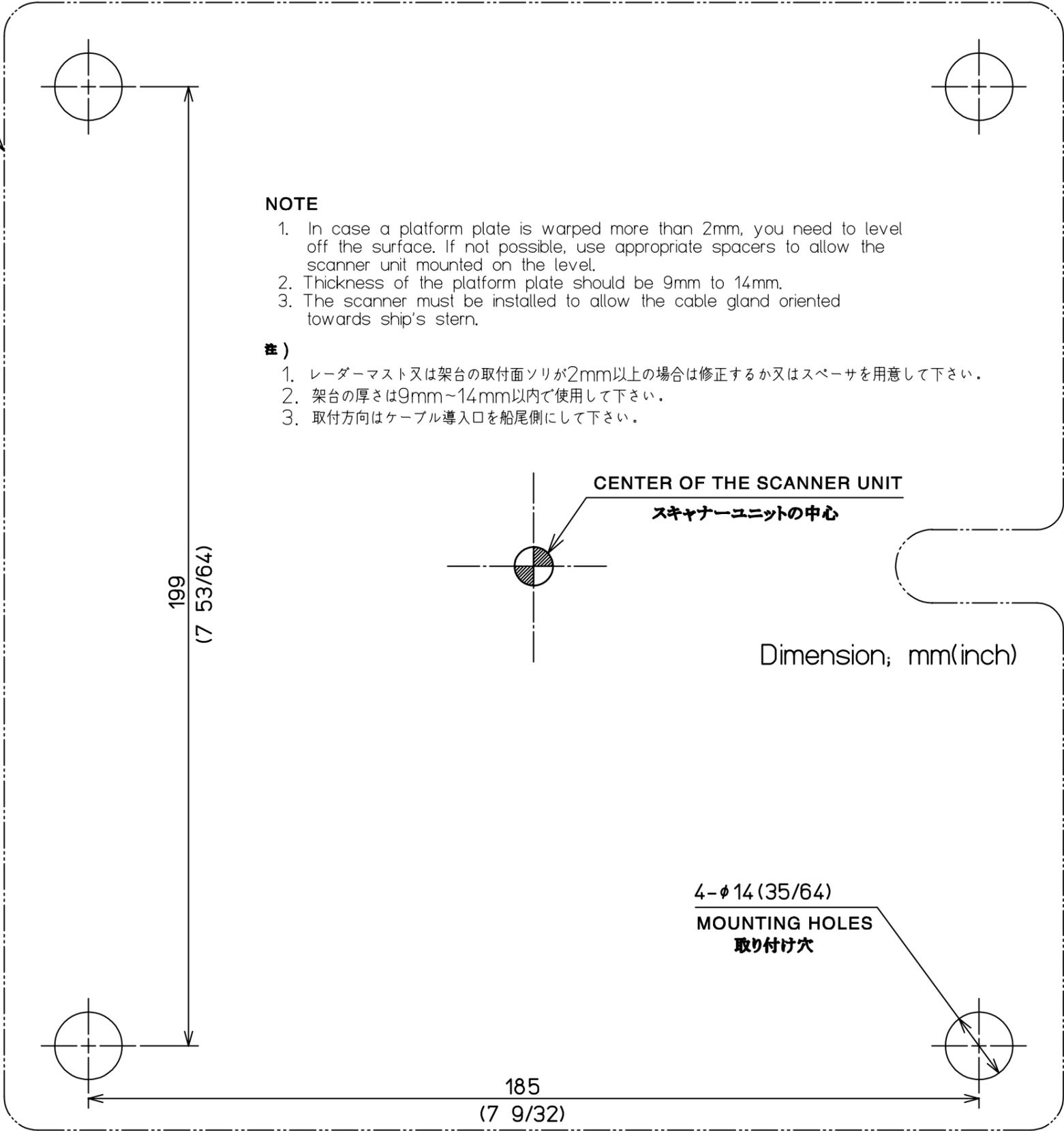
35
(1 3/8)

RB716A/717A/718A/719A
 TEMPLATE OF SCANNER MOUNTING HOLES (FULL SIZE)

スキャナー取り付け穴 テンプレート (原寸)

OUTLINE OF SCANNER UNIT BOTTOM

底面外形



NOTE

1. In case a platform plate is warped more than 2mm, you need to level off the surface. If not possible, use appropriate spacers to allow the scanner unit mounted on the level.
2. Thickness of the platform plate should be 9mm to 14mm.
3. The scanner must be installed to allow the cable gland oriented towards ship's stern.

注)

1. レーダーマスト又は架台の取付面ソリが2mm以上の場合は修正するか又はスペーサを用意して下さい。
2. 架台の厚さは9mm~14mm以内で使用して下さい。
3. 取付方向はケーブル導入口を船尾側にして下さい。

CENTER OF THE SCANNER UNIT

スキャナーユニットの中心

Dimension; mm(inch)

SCANNER UNIT MOUNT

Do not use a mount base that "stores" water.

スキャナーユニットの取付け

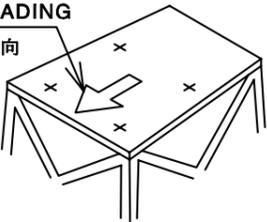
架台の注意：架台は下図に示すように水の溜まらないようにして下さい。

Do not have edge around mount base.

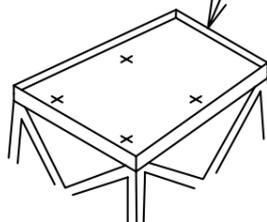
囲いを付けない事

SHIP'S HEADING

船首方向



Good Example
 良い例



Bad Example
 悪い例



Koden Electronics Co., Ltd.

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2-13-24 Tamagawa, Ota-ku, Tokyo, 146-0095 Japan

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