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. Insure 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 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 the symbols and take the 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 in the left prohibits disassembly.)

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

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

RA53/RA54
Marine Radar
Instruction Manual

1st Jun. 2001 (1st Edition)

Document: E-A53/54-1

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/m^2: 2 m
   Distance at which RF power density level to become 10 W/m^2: 6 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 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.

Installation

Only qualified personnel should install the radar system in order to make sure proper radar performance and operation.

To Customers

* To always use this equipment at its best condition, we recommend observing the operation and maintenance procedures in this manual from time to time. Further, try to operate the radar in good visibility condition to make comparison between visual impression and the radar picture presentation of the situation you are in. By doing this, you will be able to gain practical knowledge in interpreting the radar picture as well as the false echoes and blind sectors caused by the masts or funnel of the ship. Note that this equipment should only be used as a navigational aid and ship's crew must make final decision on ship's maneuvering.

* In case of functional failure, immediately turn off the radar and switch off the ship's main power supply at the distribution switchboard. Inform your local service agent of the faulty situation to detail, where possible.

* This instrument uses crystal oscillators and a LCD backlight lamp, which are vulnerable to mechanical shock. Take utmost care when handling these items

* The mercury (Hg) is used in the LCD backlight lamp. When you attempt to discard your radar, observe the local code of practice for deposit.

Contents

APPENDIX

CHAPTER 1 OVERVIEW

1.1 Introduction

The RA53/54 represents a compact, high-performance color marine radar that delivers a peak power output of 6 kW(RA53) or 12 kW(RA54) from the antenna and uses a 15-inch color liquid crystal display.

In addition to a microcomputer, it incorporates a video signal processing LSI and a newly developed LSI chip exclusively designed for radars, thus providing versatile functionality and high performance.

Features

1. A thin display unit incorporating a liquid crystal display.
2. Easy operation using only a few keys and menu screens.
3. A position of key and its function can be set in position (Selectable soft function key).
4. Easy operation by the rotary knob.
   Gain, STC, FTC, EBLs, VRMs etc. can be controlled by the rotary knob.
5. A short and a long range echo can be seen at the same time (Dual range radar).
6. Semi-3D screen display for easy identification of targets in noise.
7. Capable of continuous distance range changes (Continual variable range).
8. Waterproof construction of display allows installation at any desired location.

1.2 Organization of This Manual

This manual provides a wide range of information necessary to operate the RA53/54 radar ranging from the basic knowledge on radars to the methods of operating, installing, and maintaining the radar. The manual also provides rather detailed technical information on how to adjust video display to obtain clear images. You are requested to read this manual thoroughly from beginning to end in order to understand the various functions of the radar so you can take full advantage of its advanced functions. If you are using a radar for the first time, refer to the basic data on radars in CHAPTER 2.

This manual consists of the following chapters:

If you are an experienced user of radars, skip CHAPTER 2 and begin from CHAPTER 3.

CHAPTER 2. USING RADAR FOR THE FIRST TIME

This chapter describes basic information on radars and explains technical terms used in radar operation for those who are using a radar for the first time.

2.1 What is a radar ?

A marine radar is one of the navigation equipment installed on a ship. It emits a radio wave in very high frequency called a microwave from its antenna and receives the reflected radio wave from objects on the sea (e.g., other ships, buoys, and lands). The received radio wave is converted into an electric signal which is displayed on a display screen to indicate the presence of such objects. Although it is very difficult to find other ships or the destination coast with human eyes at night or in thick fog, a radar can detect objects on the sea helping you avoid danger when sailing. The antenna turns 360 degrees as it radiates waves, allowing you to grasp ambient conditions around your ship at a glance.

The radio wave radiated from the antenna is called a pulse wave and the radar performs transmission and reception alternately. Several hundred to several thousand pulse waves generally are transmitted while the antenna rotates one turn.

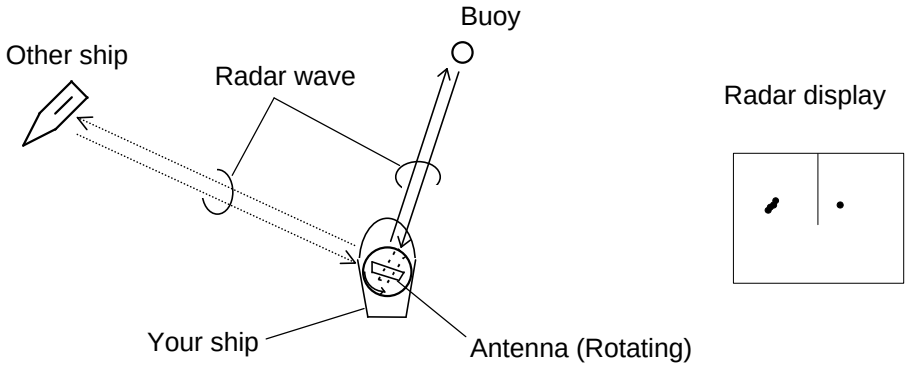


Fig.2-1 What is a radar?

Antenna

There are many types of antennas generally used for a radar. For example, these include a parabolic antenna and a slotted-array antenna. The performance of the antenna determines that of the radar. The dominant factors are the antenna's beam width and side lobe level. The narrower the beam width, the higher the resolution of the angle direction. The lower the side lobe level, the fewer the effect of a false echo.

Side lobe

A beam in one direction in which the strongest radio wave is radiated from the antenna is called the main lobe and beams in other directions are called "side lobes". The side lobe level refers to the difference in level between the largest side lobe and the main lobe.

Beam width

A beam width is defined as the width of the main lobe at an angle where the radiated power is halved as measured from the position from which the strongest radio wave is radiated.

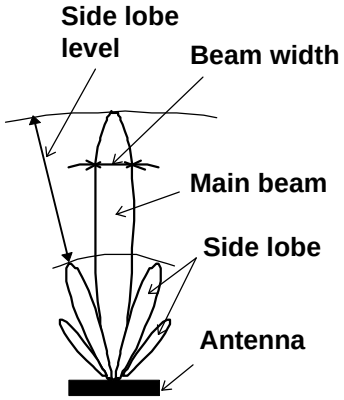


Fig.2-2 Antenna pattern

2.2 Characteristics of Radar Wave

Radio waves from the radar propagate while bending slightly along the terrestrial surface. This characteristic varies dependent on the density of the atmospheric air. The sight distance D of a radar generally is said to be approximately 6% longer than the optical sight distance and is calculated using the equation below :

$D\ (NM) = 2.22\ (\sqrt{h1} + \sqrt{h2})$ where, h1= antenna height in meters
h2= target height in meters

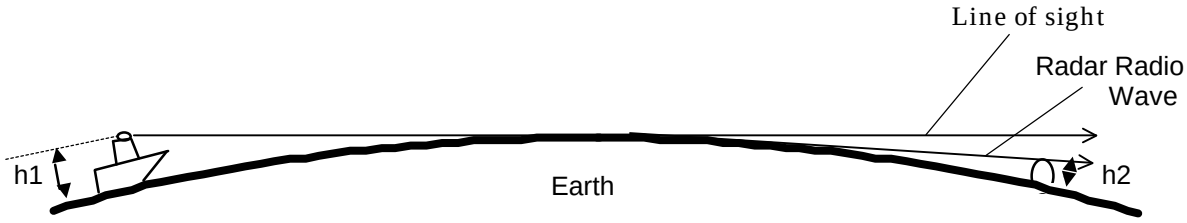


Fig.2-3 Radar wave

Targets difficult to display on screen

The intensity of the reflected wave from a target depends on the distance, height, and size of the target, as well as its material and shape. Targets constructed with FRP, wood, or other low-reflectance materials or those that have a small incident angle are difficult to display on a screen. Therefore, FRP and wooden ships, sandy beaches, and sandy or muddy shallows all are difficult to catch and require attention when monitoring on the screen. Especially, coast lines on the radar image appear to be present further from the ship than they are actually located. Therefore, it is important not to misinterpret the available data.

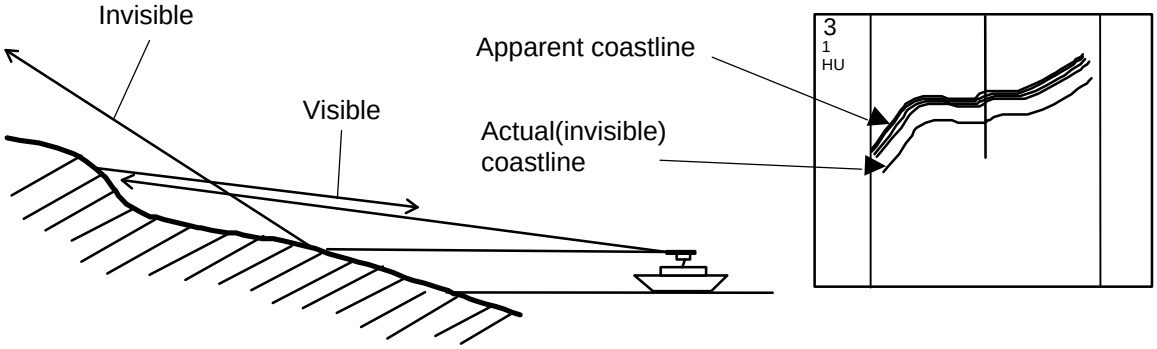


Fig.2-4 Targets difficult to display on screen

Shadow zones of radar

Radar waves are characteristic in that they propagate straight ahead. Therefore, if the ship's smokestack or mast is located near the antenna or there is a tall ship or mountain at the side of the ship, such an object generates a shadow behind it. In this case, some objects produce a complete shadow and some produce a partial shadow. In an extreme case, the shadow of an object may extend to a position far away and cannot be displayed on the screen at all. Since these shadows can be discovered when installing an antenna, the problem can be avoided by changing the place of antenna installation to minimize the shadow. Targets in shadow zones are difficult to display on the screen.

False echoes

A false echo of an actually nonexistent object may sometimes appear on the screen when sailing. The following explains the cause of each such phenomena.

A. Ghost echoes

It sometimes happens that one large object near the ship appears at two different bearings. One is the actual echo and other is a ghost echo generated as the wave is re-reflected from the ship's own smokestack or mast. The former appears at the correct distance and bearing on the screen and the latter appears behind the smokestack or mast. This type of false echo is also generated by re-reflection of waves from bridges and quay walls other than the ship itself.

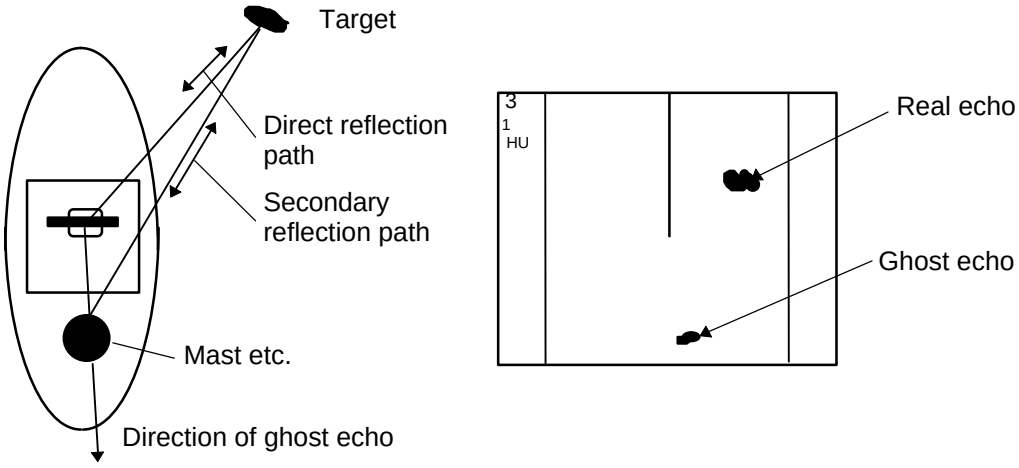


Fig.2-5 False echoes of radar (Ghost echoes)

B. Multiple echoes

If there is a large vertical reflecting plane near the ship as in the case when your ship passes alongside a large ship, the wave is repeatedly reflected back and forth between your ship and the other object. For this reason, two to four images appear on the screen at equal intervals in the same bearing. A false echo that is generated by such multiple reflections is called multiple echoes. In this case, an image appearing at the nearest position is the real echo. Multiple echoes disappear as the ship moves away from the reflecting object or its bearing changes. Therefore, it is not difficult to determine the correct image.

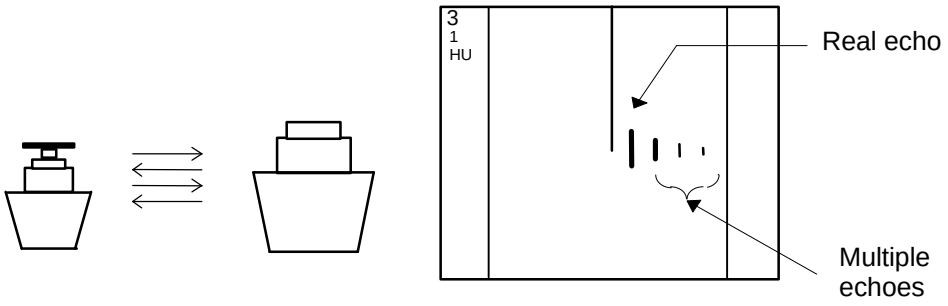


Fig.2-6 False echoes of radar (Multiple echoes)

C. False echoes caused by side lobe

The radiant beam emitted from an antenna contains side lobes in directions other than that of the main beam. Since the side lobe level is low, it in no way affects distant targets. However, if there is a strong reflecting target near the ship, it sometimes appears as a circular-arc false echo on the screen.

⚠ CAUTION

When located near large targets such as land, the ship's mast, etc. sometimes appears as a false echo of circular-arc shape.

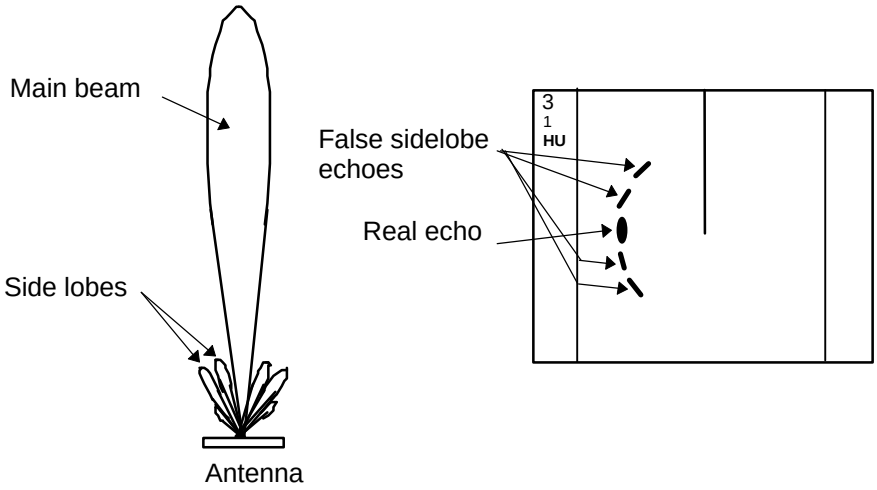


Fig.2-7 False echoes of radar (Caused by side lobe)

D. Distant false echoes caused by duct phenomenon

Depending on meteorological conditions, duct phenomenon sometimes occurs in temperature inverting layers of air. In such a case, the wave propagates erratically reaching a location surprisingly far away from the ship. In this case, a target present at a distant location more than the radar's maximum distance range appears on the screen presenting a false echo that can be misunderstood to be present nearer than the actual position. This phenomenon is attributed to the fact that since echo from the distant target arrives late, it gets out of the pulse repetition frequency and is displayed on the screen as an echo in the next frequency. If the target distance changes as you switch over the distance range, you can determine that it is a false echo.

Radar interference

If a radar operating in the same frequency exists near your ship, interference noise may appear on the screen that is caused by transmitted waves from that radar. This interference appears in various ways. In most cases, however, it appears as spiral or radial patterns.

The RA53/54 radar has a function to eliminate interference. Use of this function helps you minimize interference.

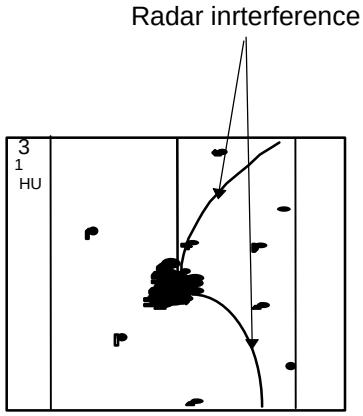


Fig.2-8 Radar interference

2.3 Terms Specific to Radar

HM (Heading Marker)

This is a line-shaped marker used to indicate the advancing direction of your ship.

North Mark

This marker indicates the north direction. It is a short line approximately 1/6 of the screen size.

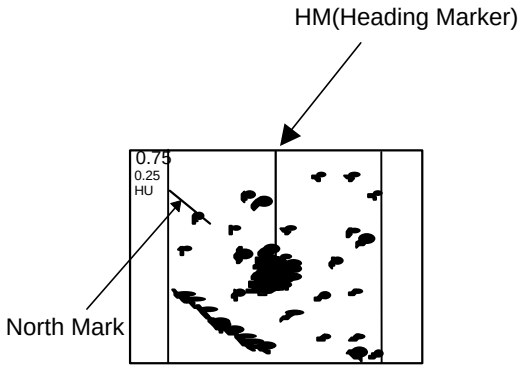


Fig.2-9 Heading Marker and North Mark

Display modes

This refers to a radar's display modes. There are four display modes depending on the direction in which the top of the screen faces with respect to the ship.

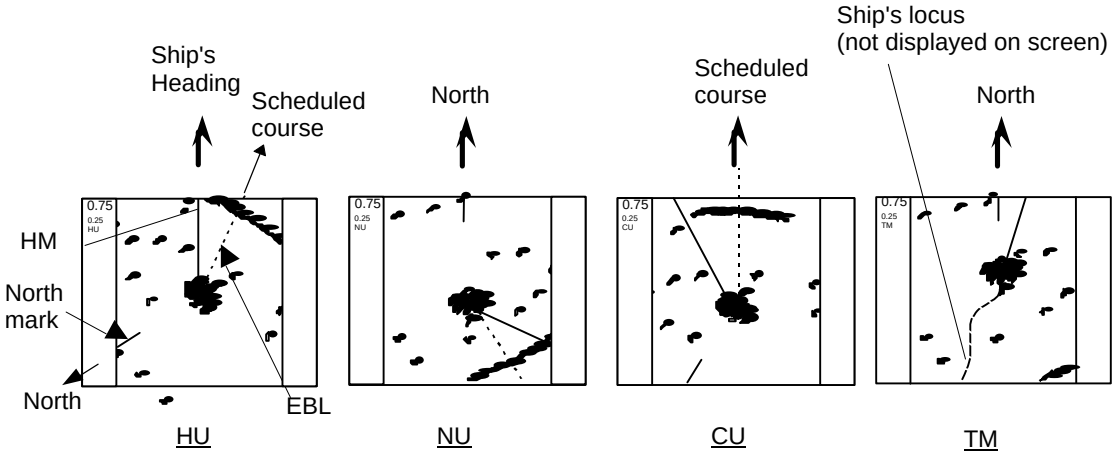


Fig.2-10 Display modes

Head Up (HU)

In this mode, the ship's heading always indicates the upward direction of the screen. This mode lets you know the relative positions of your ship and other ships or land.

North Up (NU)

In this mode, the north direction always indicates the upward direction of the screen, allowing you to compare your ship's position with a marine chart as you navigate.

Course Up (CU)

The ship's heading in a course-up mode always indicates the upward direction of the screen as the bearing toward the destination. In this mode, the ship can be maneuvered to sail the shortest distance to the destination by steering it in such a way that its heading marker always directs to the upward direction of the screen. If the ship drifts due to tidal current, care must be taken because the fixed targets move to other positions.

True Motion (TM)

In this mode, the ship is displayed as if it is moving on a marine chart while the fixed targets such as islands and seashores are fixed in position. When the ship reaches a certain position on the screen (approx. 2/3 of screen size), the ship is placed back to the opposite side on the screen. (The top of the screen faces north.)

Note: Navigation equipment such as a gyrocompass or magnet compass must be connected to your radar system before it can be operated in NU, CU, and TM modes. (Refer to Section 3.9 for details on how to connect your radar to navigation equipment.)

VRM (Variable Range Marker)

This is a circular-shaped marker whose size can be changed as desired. You can use this marker when you want to examine the distance of an echo from your ship.

When measuring the distance of an echo from your ship, be sure to measure at a point close to the center of the echo image on the screen.

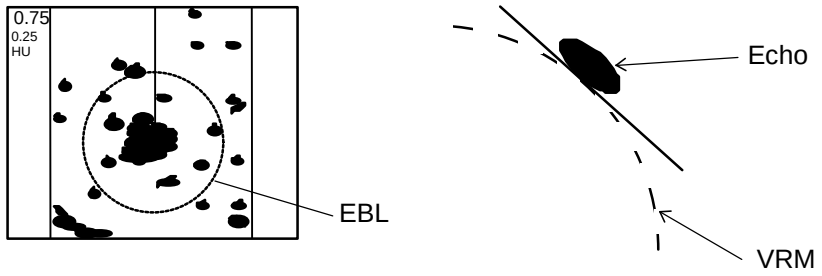


Fig.2-11 VRM

EBL (Electronic Bearing Line)

This is a marker shaped like a straight line segment that can be changed to any direction centering around the ship's position. Use this marker to examine the advancing direction of your ship and its relative angle with an echo. When measuring the angle of an echo, position the marker at the center of the echo.

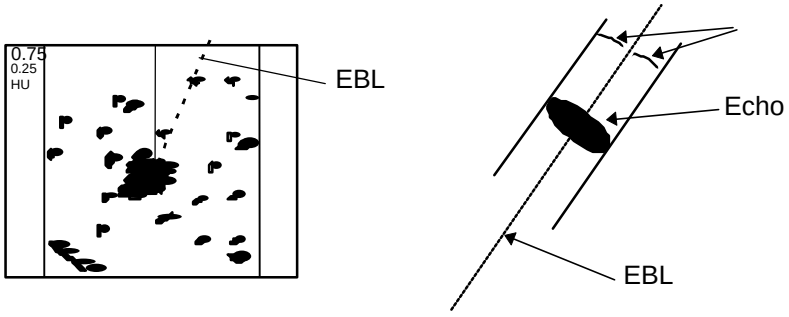


Fig.2-12 EBL

STC (Sensitivity Time Control)

Since echo signals received by the radar are strong when they are coming from a short distance, it is difficult to compare signal strength between each reflected signal. To overcome this difficulty, signal strength is adjusted in such a way that the received signal levels coming from a short distance are lowered and those from a long distance are raised. This function should prove useful when there are large reflected waves from sea surfaces during rough weather.

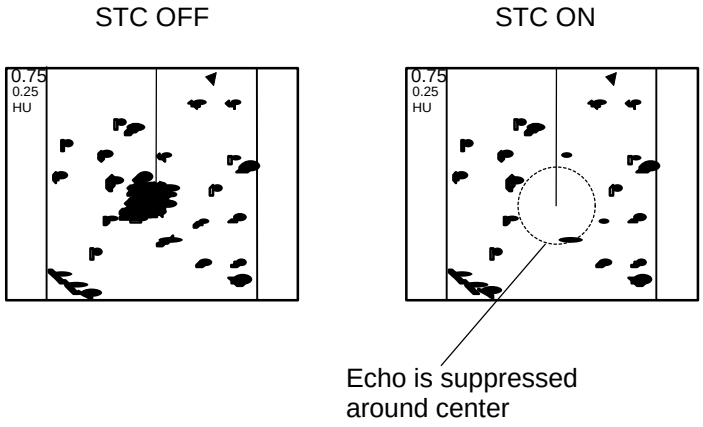


Fig.2-13 STC

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.

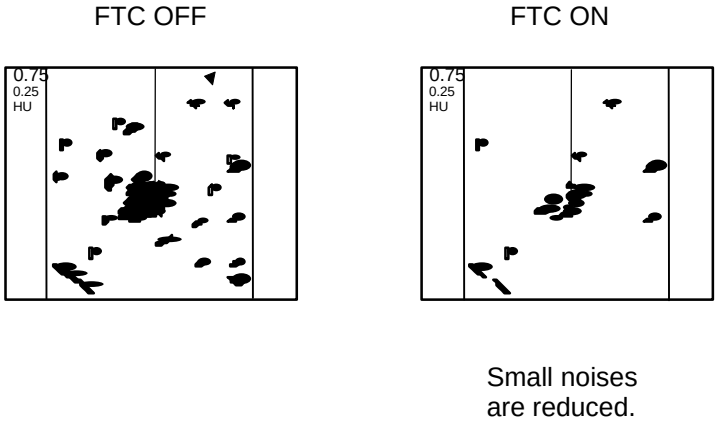
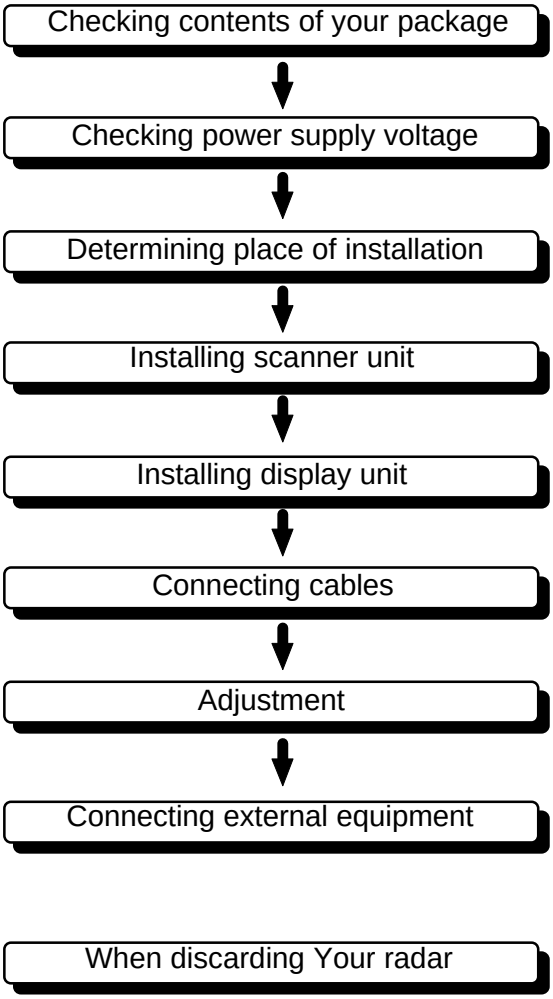


Fig.2-14 FTC

CHAPTER 3. INSTALLATION

This chapter describes procedures for installing the RA53/54 radar in your ship and precautions to be observed during installation. Follow the procedure below to install the radar.



3.1 Checking Contents of Your Package

First, unpack your package and see if all of the following items are included.

	RA53	**RA54**
Item	**Q'TY**	**Q'TY**
Display unit	1 (RF720A)	1 (RF720A)
Scanner unit	1 (RB717A)	1 (RB718A)
Display cover	1	1
Fuse	2	2
Interconnecting cable	1 (10 m)	1 (10 m)
Power supply cable	1 (2 m)	1 (2 m)
M12 hexagonal bolt	4 sets	4 sets
Carbon brush	2	2

The package contains a 10m interconnecting cable as an accessory. Longer cable is also available as an option as listed in Tab.3-1.

Tab.3-1 Optional Interconnecting Cable

	RA53/RA54
Cable length	**Product No.**
15m	242J159098B
20m	242J159098C
30m	242J159098D

In addition to the above components included with your package, the following items are also required. Please prepare them separately.

Item	QTY	Remarks
Tapping screw or M5 bolt and nut	6 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

For the RA53/54 radar to be operated normally, the power supply (battery) detailed in Tab.3-2 is required. Note also that if the battery is discharged, its voltage may fluctuate greatly, causing the radar to malfunction. When to starting up the radar system or starting transmitting, an additional rush current is required on the power supply line. Carefully check the power supply system including wiring by using a circuit tester.

Tab.3-2 Power Supply Requirements

Supply voltage used	Maximum current	Allowable range of voltage
DC12V	14A	10.2-41.6V
DC24V	6A	10.2-41.6V

*A.C. power cannot be used

3.2.2 Fuse Replacement

For the RA53/54 radar to be operated safely, proper rated fuses must always be used. Tab.3.3 is fuse rating table. All these fuses are provided as spares.

Tab.3-3 Supply Voltage vs Fuse Ratings

Main Fuse	Motor Fuse
15A/250V or 125V * (6.3 dia. x 32mm)	T3.15A/250V or 125V (5 dia. x 20mm)

3.3 Determining Place of Installation

3.3.1 Scanner unit

A radar's target detection capacity varies greatly depending on the position of the scanner. An ideal position is a location high above the ship's keel line where there is no obstacle all around the scanner. In an actual ship, such an ideal location is limited by various factors. To comply with FCC RF exposure requirements, the radar antenna for this scanner must be installed to provide a separation distance of 80 cm or more from all persons. Therefore, consider the following suggestions when you determine the place to install the scanner:

(a) Install scanner at a position as high as possible.
The higher the installation position, the longer the radio ranging distance. Install the scanner at a position as high as possible after considering the ship's hull structure and radar maintainability.

(b) Install scanner away from smoke-stack and mast
If the scanner is installed at the same height as the smoke-stack or mast, radar waves may be blocked, creating shadow zones or generating false echoes. Therefore, do not install the scanner at such a position.

(c) Install scanner forward away from obstacle.
To avoid creating shadow zones or generating false echoes, install the scanner at a position nearer to the ship's bow away from obstacles. When installing the scanner on a mast, position it in front of the mast. (If obstacles cannot be avoided for the ship's structural reasons, refer to "Shifting away from obstacles" described Page 13.)

(d) Do not install the scanner near hot or heat-generating items.
Do not install the scanner at a position where it may be subjected to smoke or hot air from smokestacks or heat from lamps.

(e) Install the scanner away from antennas of other equipment.
Install the scanner as much away from the antennas of a direction finder, radio transceiver, etc. as possible.

> ⚠ **CAUTION**
>
> **To eliminate the interference, install the scanner away from the antenna of radio transceivers.**

(f) Make 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 use longer cable for unavoidable reasons, limit the cable length to a maximum of 100 m for RA53/54.

3.3.2 Display unit

The display unit can be installed on desktop, wall surface, or ceiling. Determine the place to install the display unit that is convenient for navigation and radar operation after considering the following suggestions:

(a) A place where you can see the ship's bow when you raise your face from the radar screen.
(b) A place where there is no direct sun-light to avoid display temperature up.
(c) A place where there is good ventilation and minimum vibration.
(d) A place where the display unit is further away than the minimum safe distance from a magnet compass as listed in Tab.3-4 below.

Tab.3-4 Minimum Safe Distance from Magnetic Compass

	Master 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 ship, it is possible to move shadow zones to the port side which makes it possible to keep vision clear in the bow direction. The distance to be shifted can be obtained by calculation depending on the distance from the scanner to obstacles using the following equation:

Ls=0.4R+D/2 [m] (when R<15m)
Ls=0.025R+D/2 [m] (when R>=15m)
where Ls = distance to be shifted from keel line
D = diameter of obstacle on keel line
R = distance from scanner to obstacle

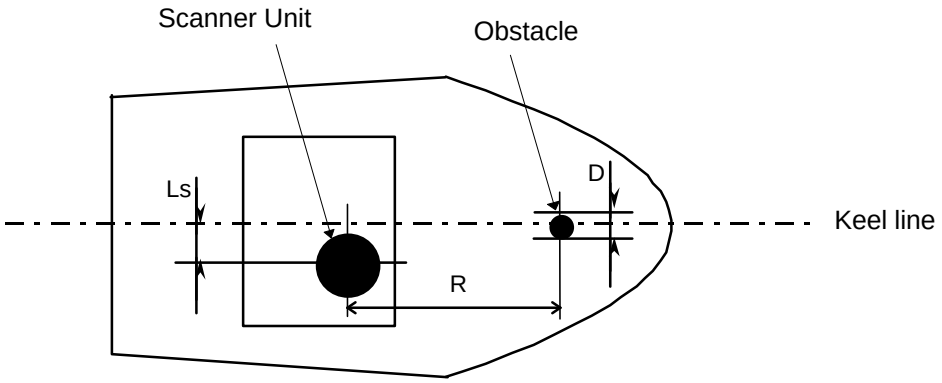


Fig.3-1 Shifting from keel line

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.

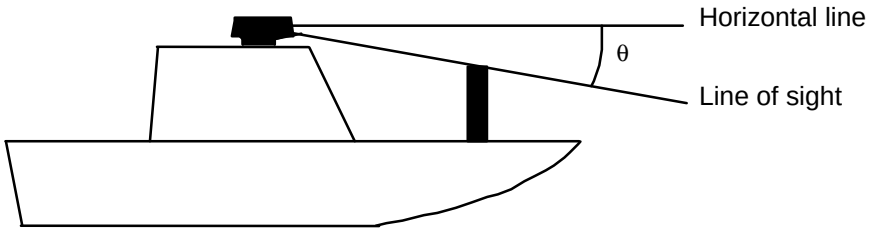


Fig.3-2 Obtaining sufficient dip angle

3.4 Installing Scanner Unit

When you have decided the place of installation, install the scanner unit. If a mount base like the one shown below is available, it may be easier to install the scanner. If such a mount base is not available in your ship, you may install the scanner directly to the roof, etc. In such a case, pay attention to the water drain tube located at the bottom of the scanner unit during installation.

Note : When the radar mast or mounting bracket has a curvature of more than 2mm, repair it or use spacers.

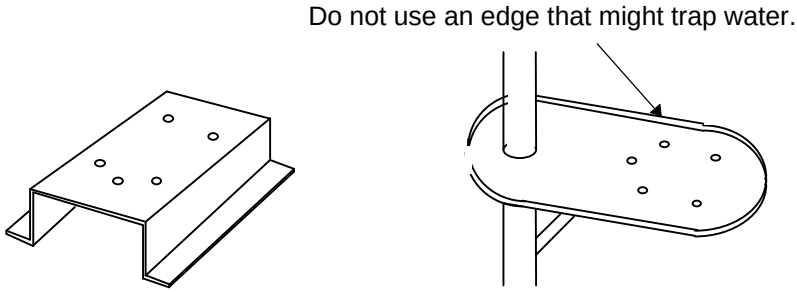


Fig.3-3 Mount base

Referring to Fig.3-4, open holes in diameter of 12 mm (0.47 in.) at five locations in the mount base and use these holes to fix the scanner unit to the mount base with hexagonal bolts. (Use the template included with this manual.) The bolts included with your radar equipment 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 than this, prepare bolts listed in Tab.3-6.

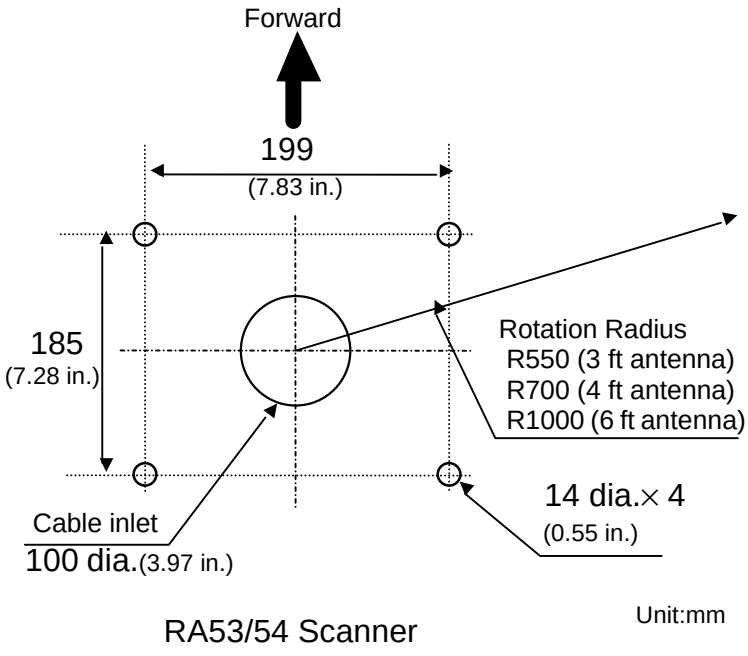


Fig.3-4 Hole positions for mounting scanner

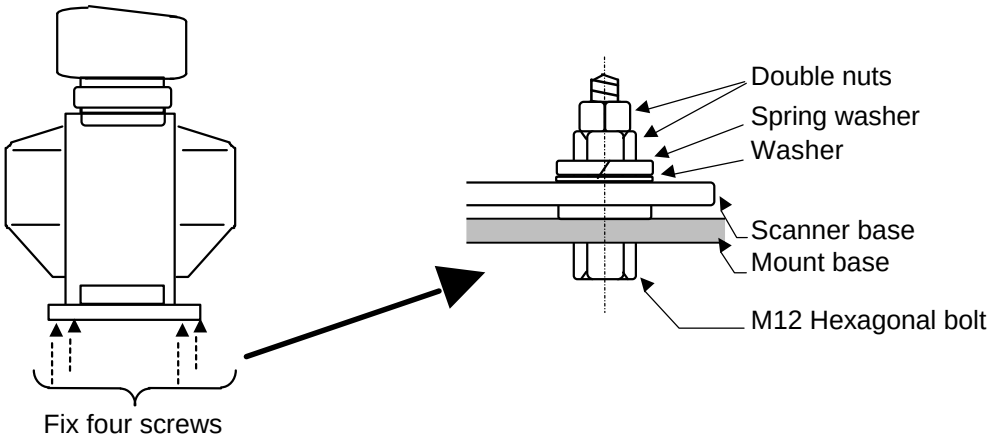


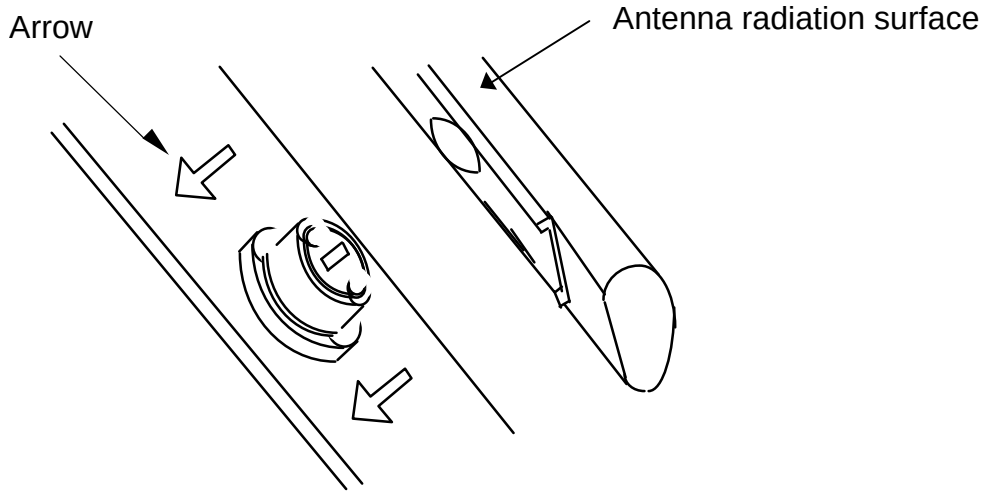
Fig.3-5 Fixing Scanner Unit

Tab.3-5 Bolts for Mounting Scanner Unit

Thickness of mount base	Bolts necessary to fix scanner	Material	Remarks
1-4mm(0.04-0.16 in.)	M12 x 45 (1.5mm pitch)	Stainless	
4-9mm(0.16-0.35 in.)	M12 x 50 (1.5mm pitch)	Stainless	
9-14mm(0.35-0.55 in.)	M12 x 55 (1.5mm pitch)	Stainless	Included with radar
14-19mm(0.55-0.75 in.)	M12 x 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 fix the antenna in position using the four M8 accessory bolts.



3.6 Installing Display Unit

After you have finished installing the scanner unit, install the display unit in the same way. Choose the proper bolt length according to the thickness of the surface on which you are going to install the display unit. Hole diameter is different using bolts from using tapping screw. When using tapping screw, open holes in adequate holes. When using bolts and nuts, open holes in diameter of 6 mm (0.24 in.). When you have opened holes, install the pedestal part first and then the display unit.

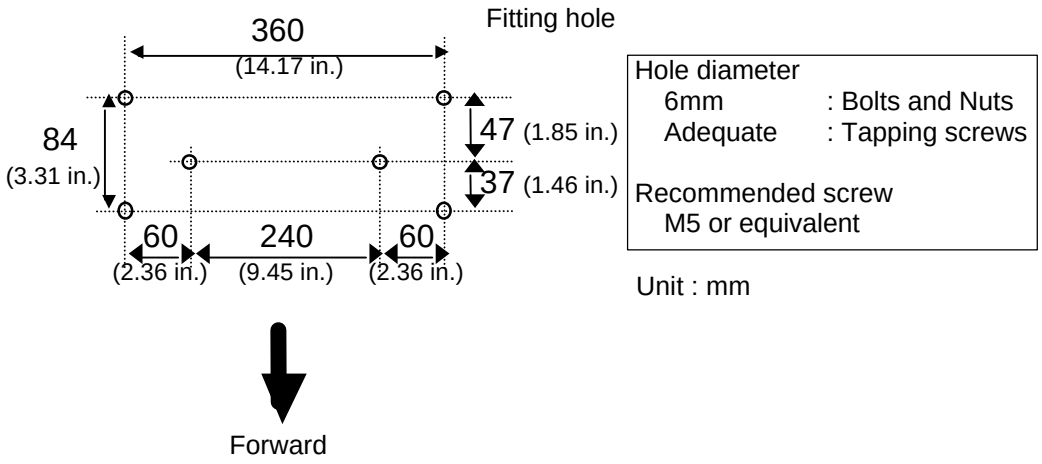


Fig.3-6 Hole positions for display unit

Note : When you install the display by flush mount, refer to appendix "OUTLINE DRAWING".
Slide off four triangle corner covers, and fix the display unit to the panel with screws. After fixing the display unit, put on corner covers to the corner of the display unit. See APPENDIX.

⚠ WARNING

Avoid operating display in direct sunlight. The temperature inside becomes high and display may be broken.

3.7 Connecting Cables

Lay cables firmly in place by following the instructions below.

Note1: Do not bind the cable for the radar collectively with cables of other equipment (especially power supply cable).

Note2: Leave clearance near the inlet of the display so you can remove the display unit easily. This facilitates installation and maintenance of the display unit. (Refer to Appendix.)

Note3: Because the cable has a connector fitted on the display and scanner side, if it is necessary to pass cable through a narrow path, fix the scanner-side connector vertically using vinyl tape before passing cable through the path.

Note4: Lay cable along the ship's hull or wall surface and attach it in place at intervals of about 40 cm.

3.7.1 Interconnecting cable (See Fig.3-9)

① Ensure that the radar is off. Connect the cable to the socket labeled "SCANNER" on the rear panel of the display unit.

② Use a T-wrench to remove the back covers of scanner unit.

③ Remove the two bolts securing the transceiver; pull out the transceiver after removing two connectors.(to Motor(J5), to Heading switch (J3))
④ Remove the four bolts securing the fixing plate at the cable entrance.
⑤ 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.
⑥ Return the transceiver to its original position and secure it with the removed bolts.
⑦ Connect 7-pin connector to J2 and 9-pin connector to J1 of PCB. And connect two connectors that were removed at ③.
⑧ Refit the scanner covers.
Take care not to pinch the cable when refitting the cover.

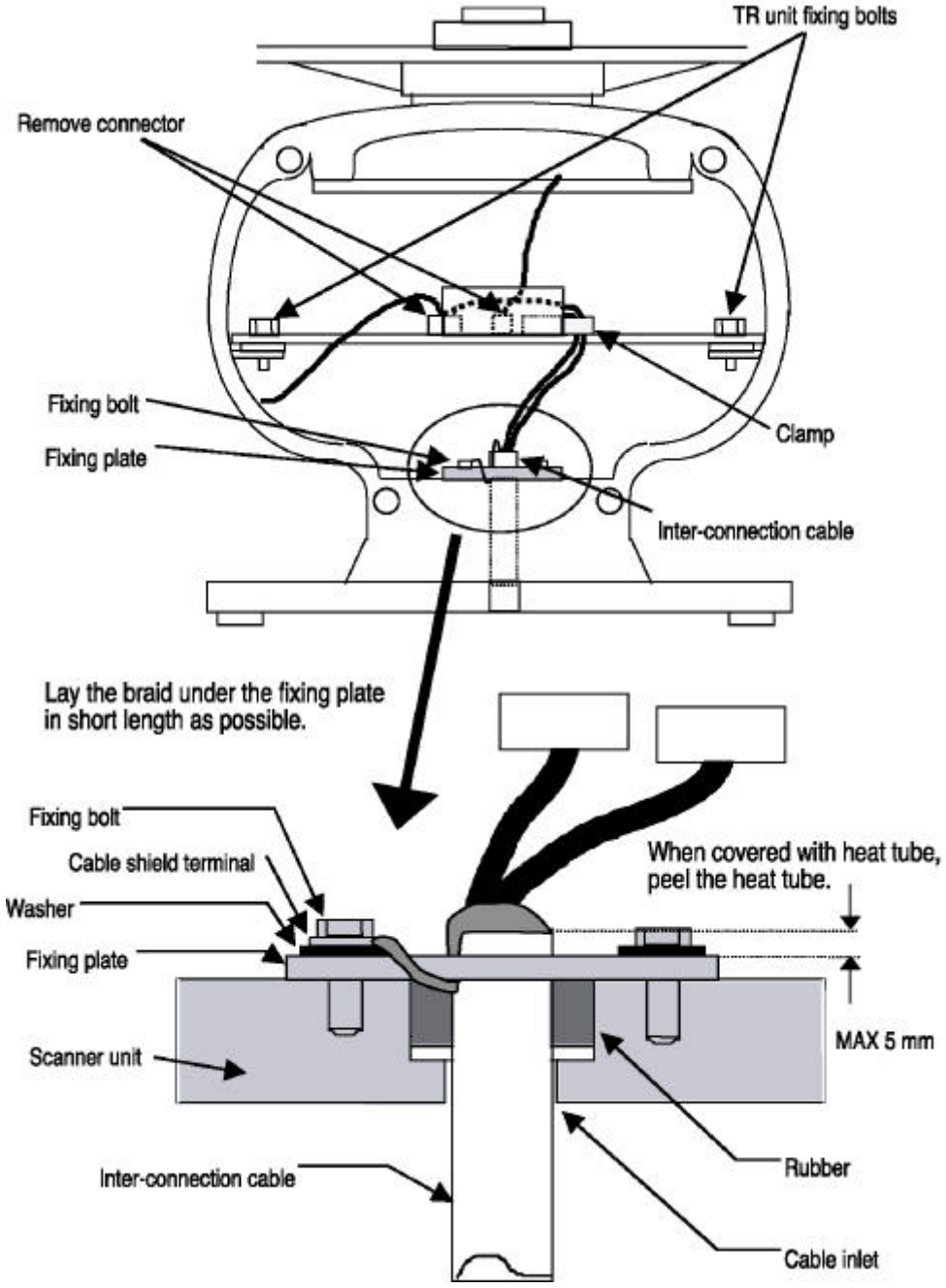


Fig.3-9 Interconnecting cable

3.7.2 Grounding wire

> **⚠ WARNING**
>
> **Connect grounding wire before connecting power supply cable. Leakage current is too high.**

Connect grounding wire from the grounding terminal on the rear panel of the display unit to the ship's hull as shown below.

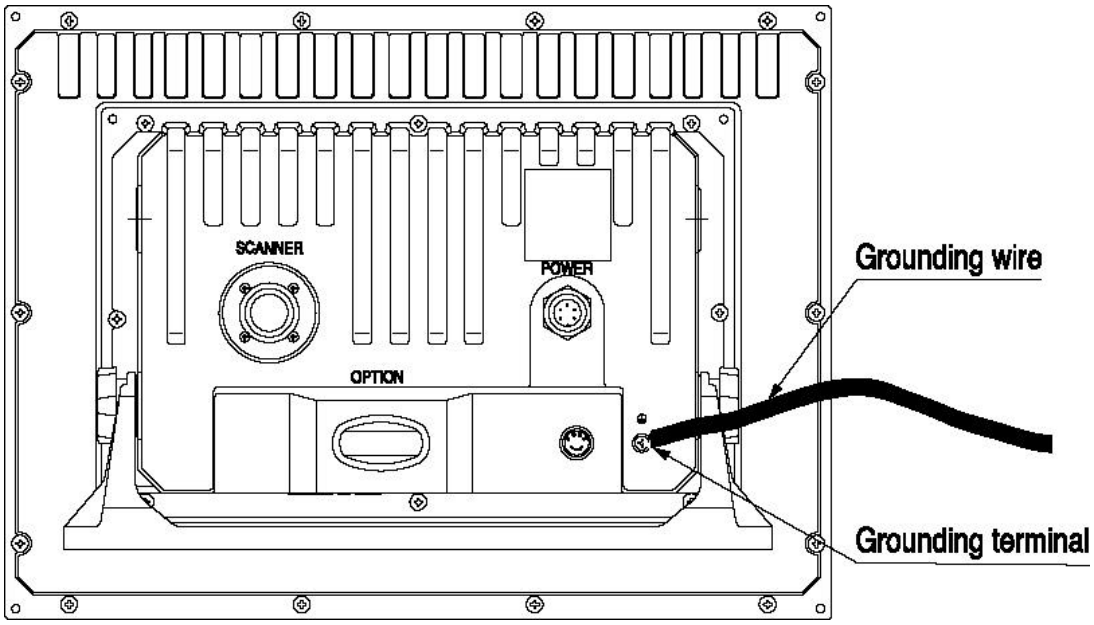


Fig.3-10 Grounding display unit to earth

Connect grounding wire from one of the bolts you have attached when installing the scanner unit to the ship's hull as shown in Fig.3-11. (The crimp terminal and grounding wire are not included with the radar equipment.)

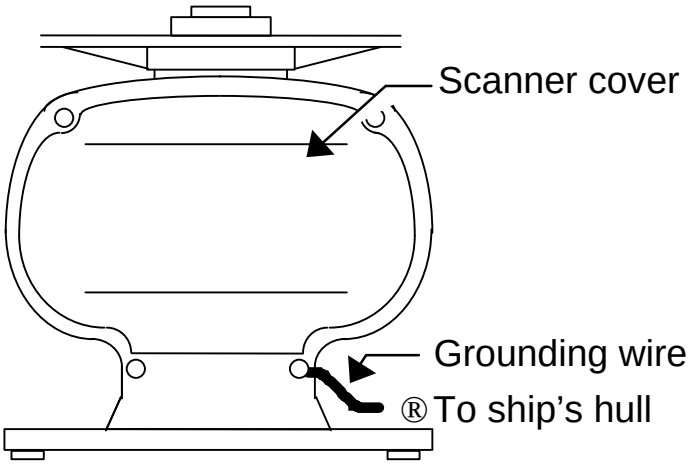
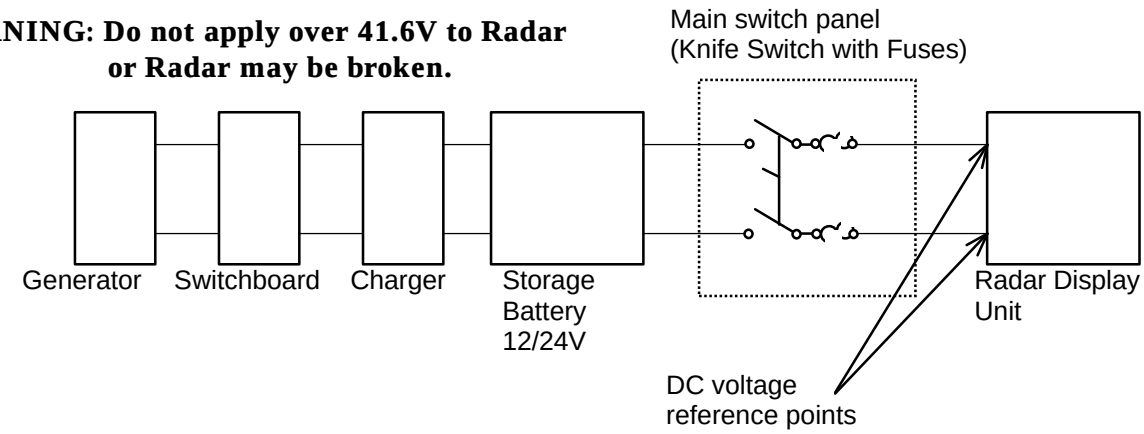


Fig.3-11 Grounding scanner unit to earth

3.7.3 Power supply cable

Power is fed through a knife switch (or circuit breaker) and protective fuses, as shown in below.

WARNING: Do not apply over 41.6V to Radar or Radar may be broken.



Fit the power supply cable (included with your radar) to the receptacle labeled "POWER" on the rear panel of the display unit. And connect to power supply as follows. (When you do not connect external equipment, put tape on red and green wire.)

Place the Fuse and connection part where there is no water splashes and the area is dry.

If you extend the power supply cable, use a suitable cable as below.

Ship's Power Voltage	Cable conductor cross section	Cable max. length
12Vdc	3.5 mm²	3 m
	6.0 mm²	5 m
24Vdc	2.0 mm²	6 m
	3.5 mm²	10 m

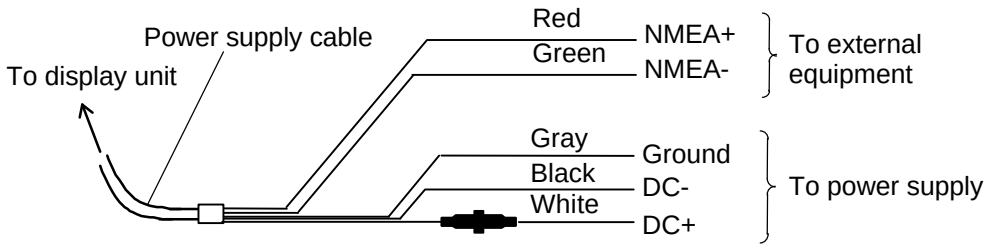


Fig.3-12 Power supply cable

3.8 Adjustment

⚠ CAUTION

Be sure to operate the following adjustment. If this is not adjusted properly, the radar picture does not display true image.

When you have finished installing the scanner and display units and connecting cables, turn on the power to the display and scanner units and check to see if they operate normally without problem. Then make adjustments as detailed below and check to see if the units operate normally again.

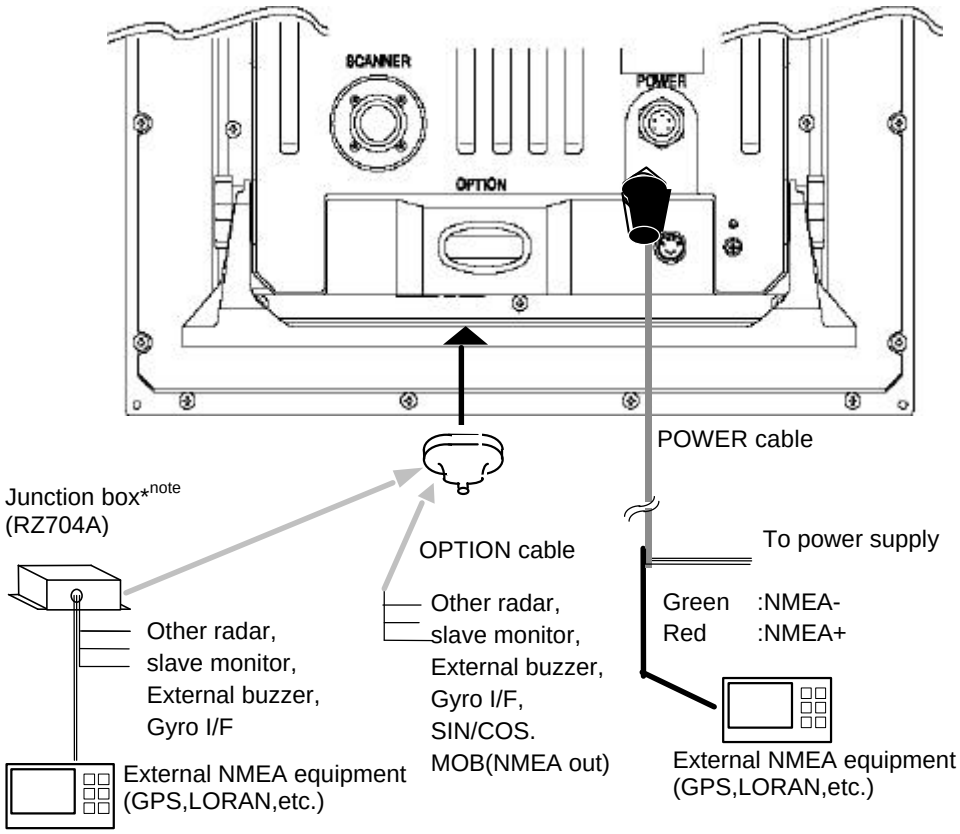
1. TUNING	Refer to Adjusting tuning circuit in 5.5.4.5.5
2. HEADING DIRECTION	Refer to Adjusting angle in 5.5.4.5.5
3. DISTANCE	Refer to Adjusting distance in 5.5.4.5.5

3.9 Connecting External Equipment to Display Unit

The display unit has two channels of NMEA input. One is standard in power cable. The other is necessary to connect optional parts (Junction box with OPTION cable).

OPTION connector is located at display's rear panel for connecting external equipment such as a GPS, LORAN, or gyro compass. You must have a Junction box with OPTION cable. (Refer to CHAPTER 8 (4) External interface.)

Note: SIN/COS and MOB signals cannot be used on Junction Box.



* Junction box with OPTION cable (Order No. RZ704A)

Fig.3-13 Connecting external equipment to display unit

3.10 Countermeasure for Electromagnetic Interference

RA53/54 radar provides shields in the units and the inter-unit connection cable. When the radar, however, is closely installed to radio equipment such as VHF transceiver, UHF transceiver, etc., or the radar and/or radio equipment are not sufficiently grounded to the hull or ship's earth, the radar may happen to cause EMI trouble.

Followings are general procedures for reducing EMI due to radars. When installing radars, refer to them, and also check the radio equipment EMI trouble with operating the radar and radio equipment.

(1) Installation Place of Radar

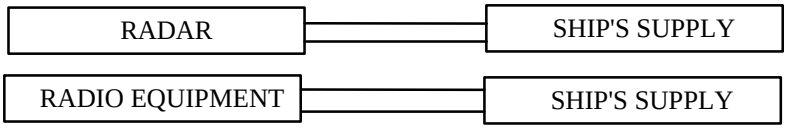
The display unit, scanner unit and inter-unit connection cable should be located apart from the main unit, feeder, antenna coupler and antenna of radio equipment as far as possible.

Especially, proper installation of the feeder, antenna coupler and antenna of radio equipment is very important to improve EMI trouble.

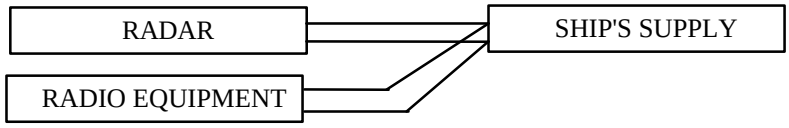
(2) Laying Power Supply Cables

Following connections A and B are recommended to reduce conduction noise generated from radar. Connection C should not be used.

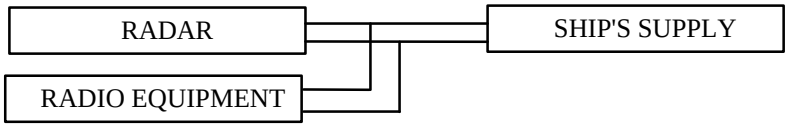
Connection A (Very Good)



Connection B (Good)



Connection C (Bad)



(3) Grounding

All equipment should be firmly grounded at the earth nearest hull with copper plates or braided wires.

Improvement Procedure for EMI

(1) Confirm grounding on the radar and radio equipment. However, some equipment, on which grounding is not always necessary, have a possibility of EMI improving when taking off their grounding. Try to take off grounding.

(2) Confirm power supply cable connections and modify to the connection A or B above.

(3) Try to shift the display unit and inter-unit connection cable of radar to be apart from radio equipment.

(4) Try to shift the feeder of radio equipment to be apart from each units and the inter-unit connection cable of radar.

(5) Try to shift the antenna coupler and antenna of radio equipment to be apart from the scanner unit and inter-unit connection cable of radar.

3.11 When Discarding Your Radar

When discarding your RA53/54 radar, consult the distributor to get information on precautions to be followed. Tab.3-6 below lists the primary component materials of the RA53/54 radar for your reference.

Tab.3-6 Component Materials

Scanner unit	Material	Display unit	Material
Radome	AES	**Front panel**	ABS
Chassis	A5052P	**Rear panel**	ADC12
Base	ADC12	**Pedestal**	ABS+PC
Antenna	A5052P		