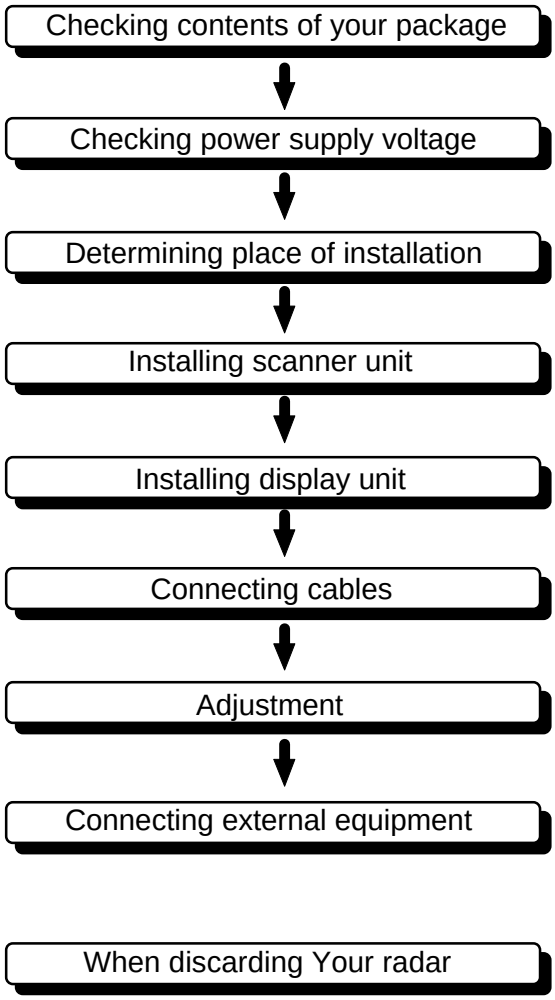
CHAPTER 3. INSTALLATION

This chapter shows how to install the RA51/52/53/54/55 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	RA51 Q'TY	RA52 Q'TY	RA53 Q'TY	RA54 Q'TY	R55 Q'TY
Display unit	1 (RF720A)	1 (RF720A)	1 (RF720A)	1 (RF720A)	1 (RF720B)
Scanner unit	1 (RB715A)	1 (RB716A)	1 (RB717A)	1 (RB718A)	1 (RF719A)
Display cover	1	1	1	1	1
Fuse	2	2	2	2	2
Interconnecting cable	1 (10 m)	1 (10 m)	1 (10 m)	1 (10 m)	1 (15 m)
Power supply cable	1 (2 m)	1 (2 m)	1 (2 m)	1 (2 m)	1 (2 m)
M10 hexagonal bolt	4 sets	0	0	0	0
M12 hexagonal bolt	0	4 sets	4 sets	4 sets	4 sets
Motor brush	0	2	2	2	2

Your unit was shipped with a 10m(or 15m) interconnecting cable. Longer or shorter cable is also available as an option, as listed in Tab.3-1.

Tab.3-1 Optional Interconnecting Cable

	RA51	RA52/53/54	RA55
Cable length	**Product No.**	**Product No.**	**Product No.**
10m(If you need)			242J158055A
15m	242J158055B	242J159098B	
20m	242J158055C	242J159098C	242J159098C
30m	242J158055D	242J159098D	242J159098D

You'll need to supply the following hardware:

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

Tab.3-2 shows the power requirements for the RA51/52/53/54/55 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	14A	10.2-41.6V
DC24V	6A	10.2-41.6V
DC24V (for RA55)	15A	18.0-41.6V

*A.C. power cannot be used

3.2.2 Fuse Replacement

CAUTION: Use only exact replacements.

Tab.3-3 Supply Voltage vs. Fuse Ratings

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

3.3 Where to Install the Scanner

3.3.1 Scanner unit

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 1.3 m or more from all persons.

(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.

> **⚠ CAUTION**
>
> **Radar scanners will cause interference with radio transceivers. Keep them as far apart as possible**

(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 (or 15m). If you need a longer cable, limit the length to a maximum of 100 m.

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 calculated 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

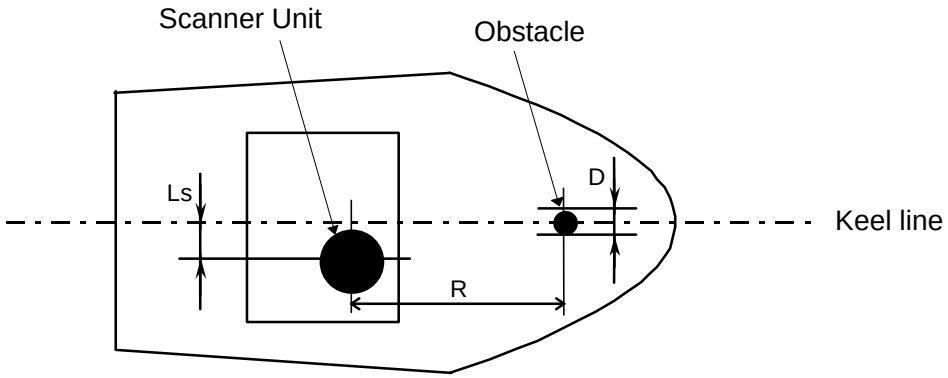


Fig.3-1 Shifting from keel line

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.

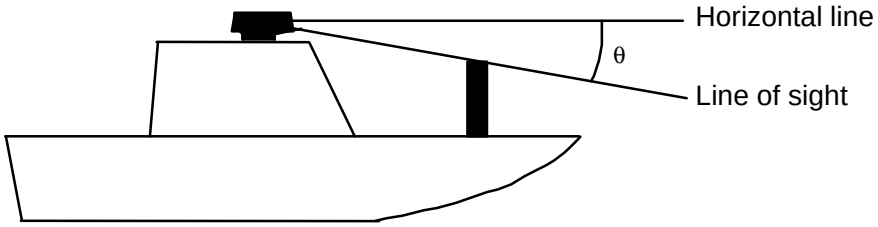


Fig.3-2 Obtaining sufficient dip angle

3.4 Installing Scanner Unit

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.

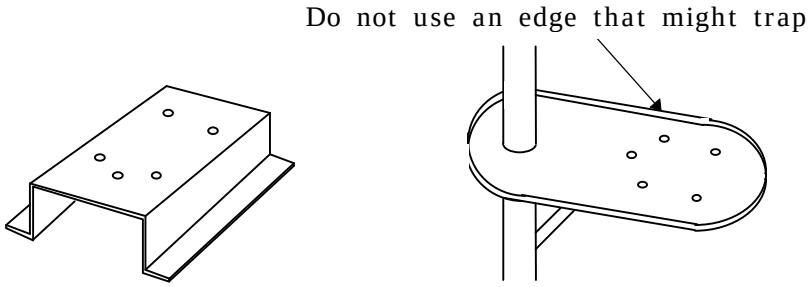


Fig.3-3 Mount base

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 housing may be damaged if you use a thread-locking compound.

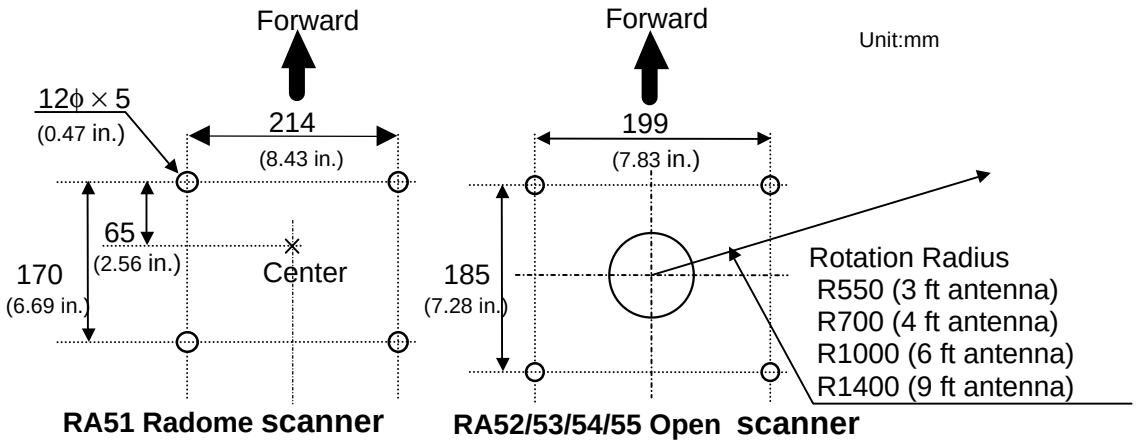
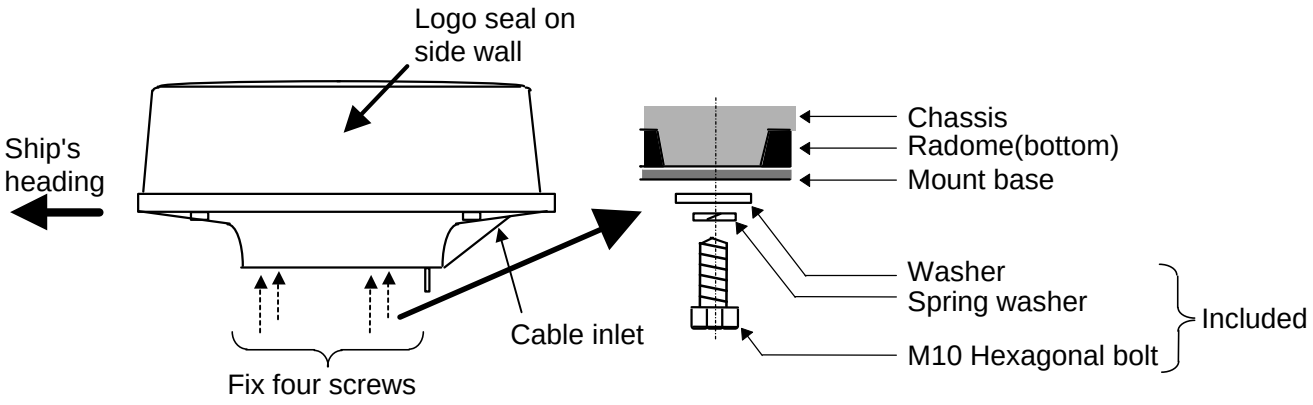
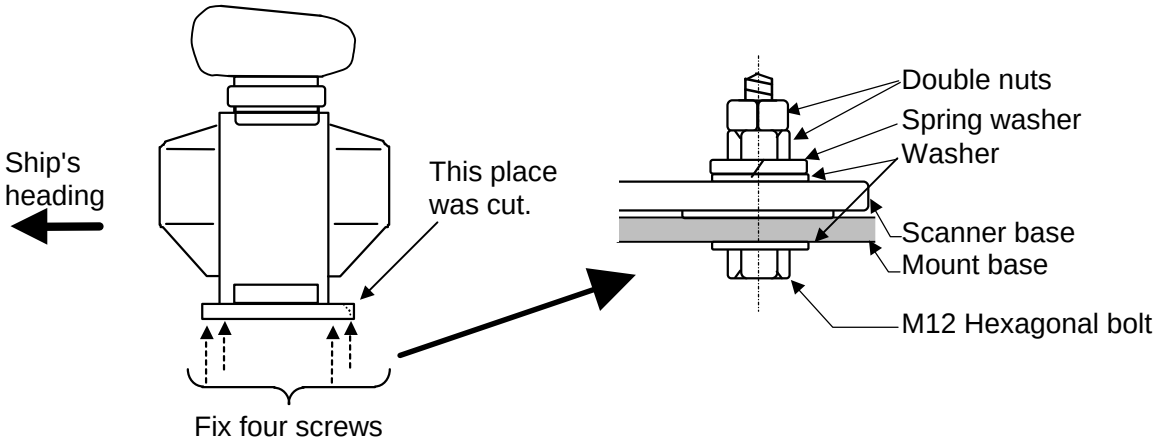


Fig.3-4 Hole positions for mounting scanner



RA51 Radome scanner

Note: See Fig.3-11



RA52/53/54/55 Open scanner

Fig.3-5 Mounting the Scanner

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

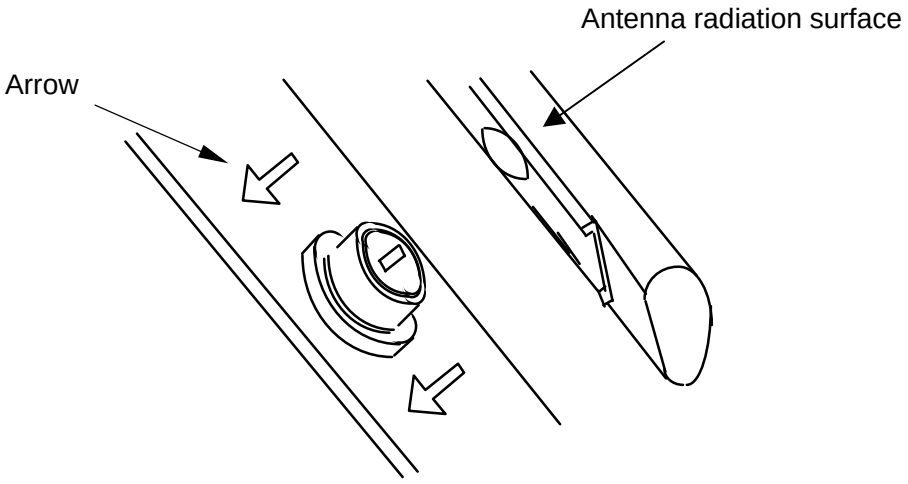
Thickness of mount base	Bolts necessary to fix radome scanner	Material	Remarks
1-4mm(0.04-0.16 in.)	M10 × 15 (1.5mm pitch)	Stainless	
4-9mm(0.16-0.35 in.)	M10 × 20 (1.5mm pitch)	Stainless	
9-14mm(0.35-0.55 in.)	M10 × 25 (1.5mm pitch)	Stainless	Included with radar
14-19mm(0.55-0.75 in.)	M10 × 30 (1.5mm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

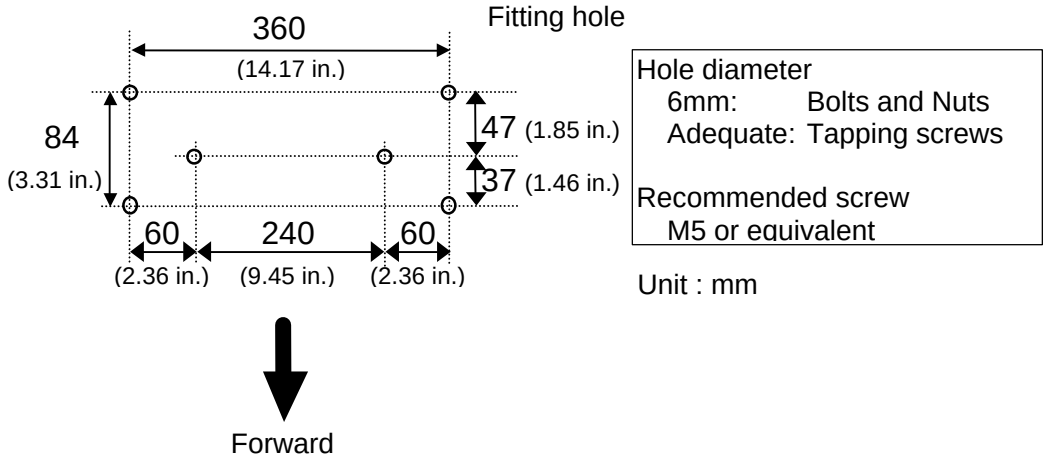


Fig.3-6 Hole positions for display unit

⚠ 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").

3.7.1 Interconnecting cable (RA51 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 up 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. The upper and lower parts of the radome each have four alignment markings indicating screw positions.
8) 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.

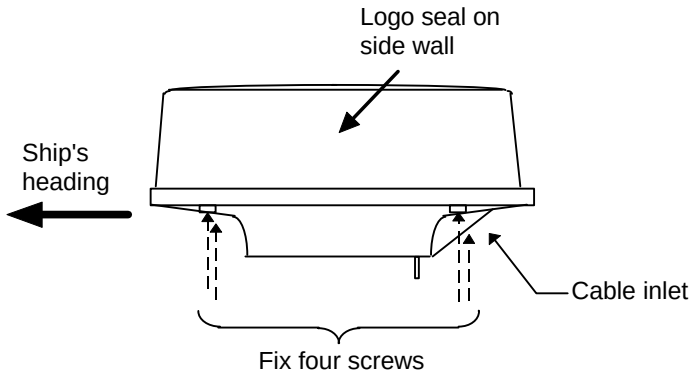


Fig.3-7 Fitting cover (RA51)

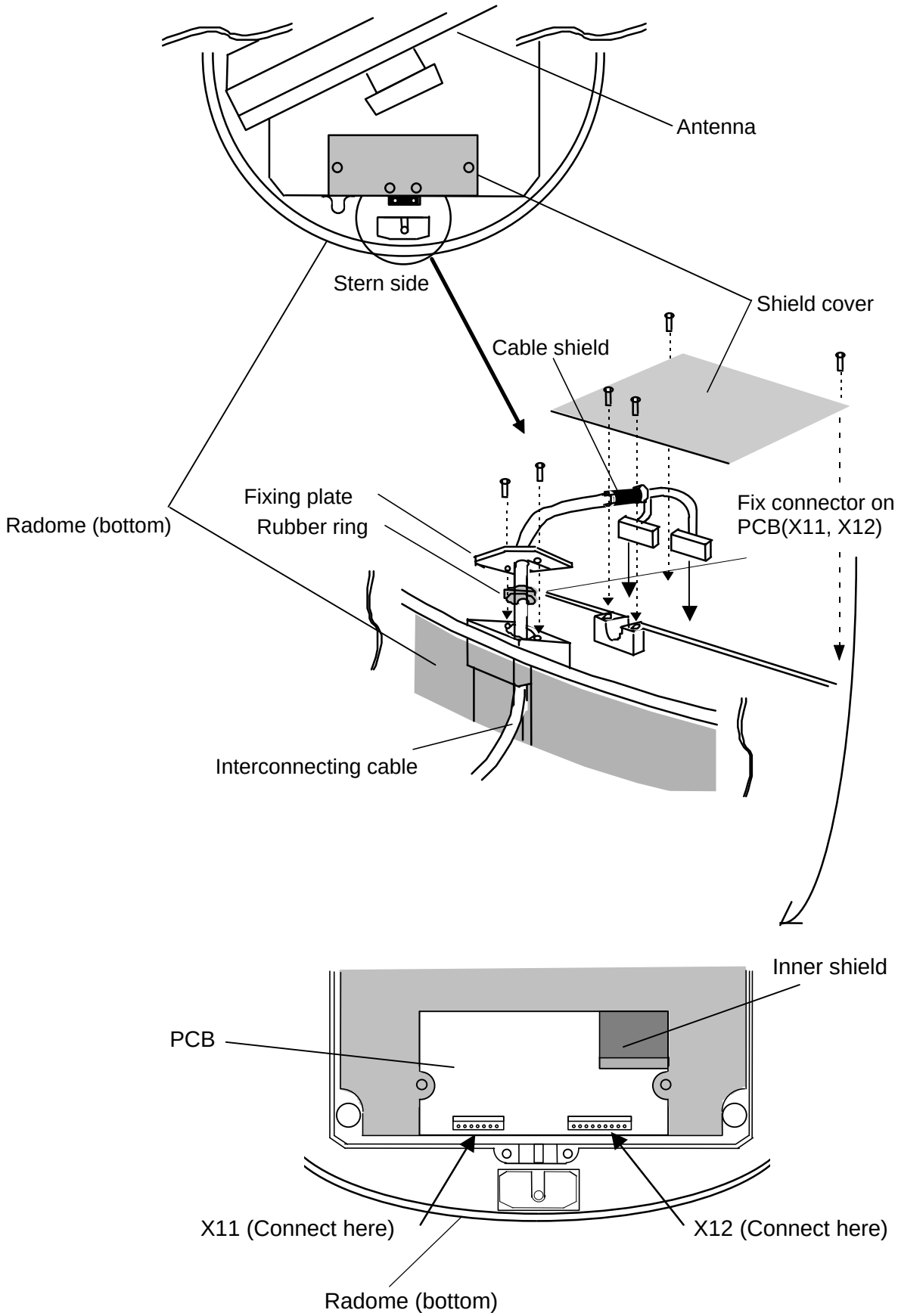


Fig.3-8 Fitting interconnecting cable (RA51)

3.7.2 Interconnecting cable (RA52/53/54/55 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. Be 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:RA52, J5:RA53/54/55) and to the heading switch (X2:RA52, J3:RA53/54/55). 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 (RA52)/J1 (RA53/54/55) and the 9-pin connector to X12 (RA52)/J2 (RA53/54/55) 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.
10) 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.

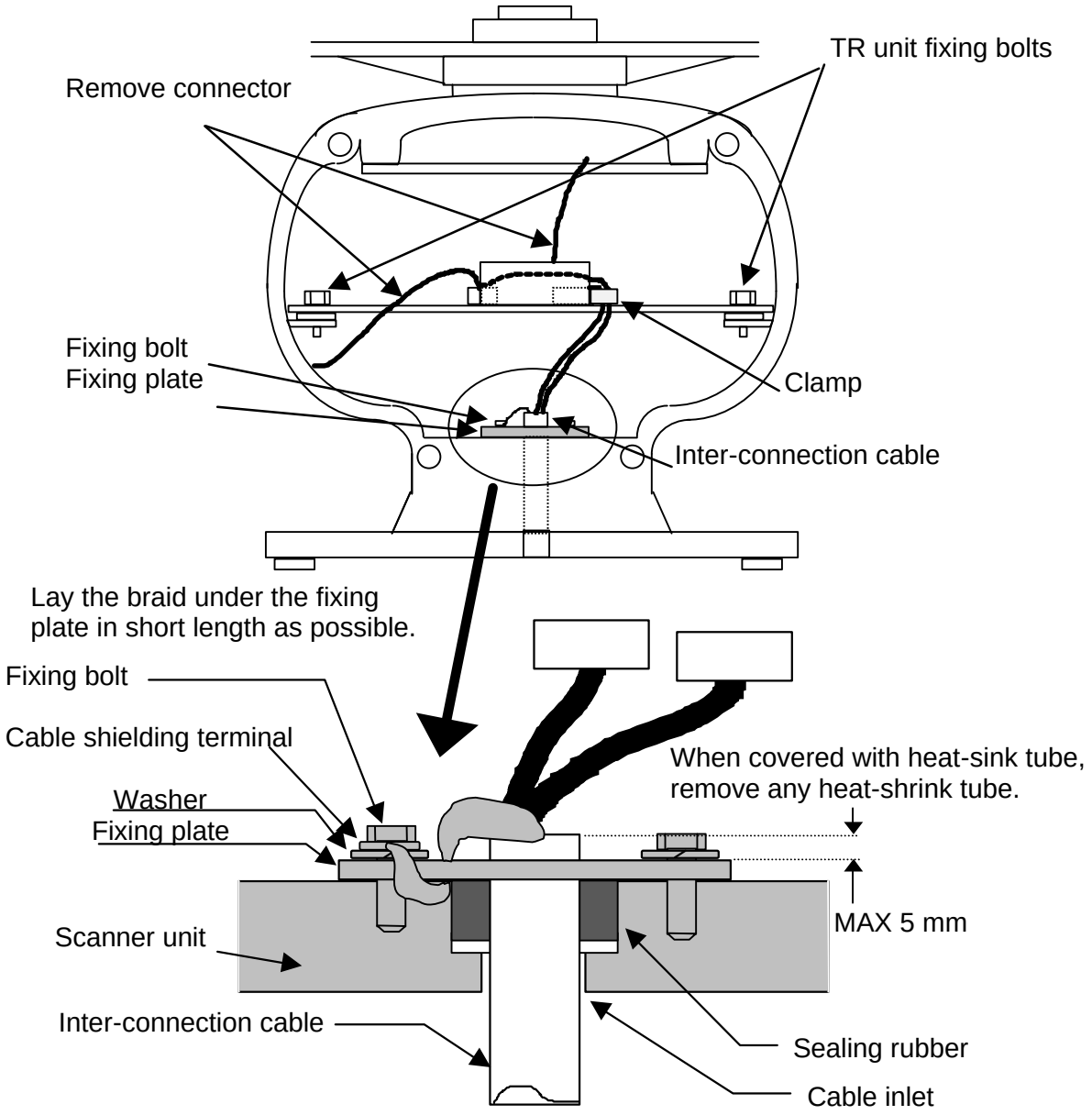


Fig.3-9 Fitting interconnecting cable

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.

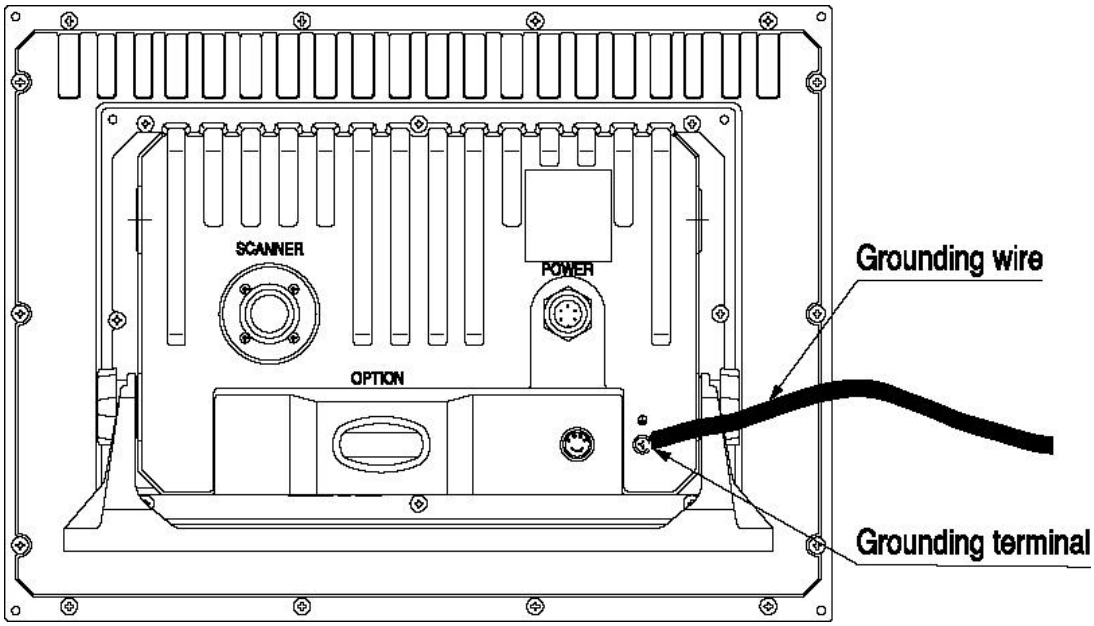


Fig.3-10 Grounding display unit to earth

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 is user supplied.)

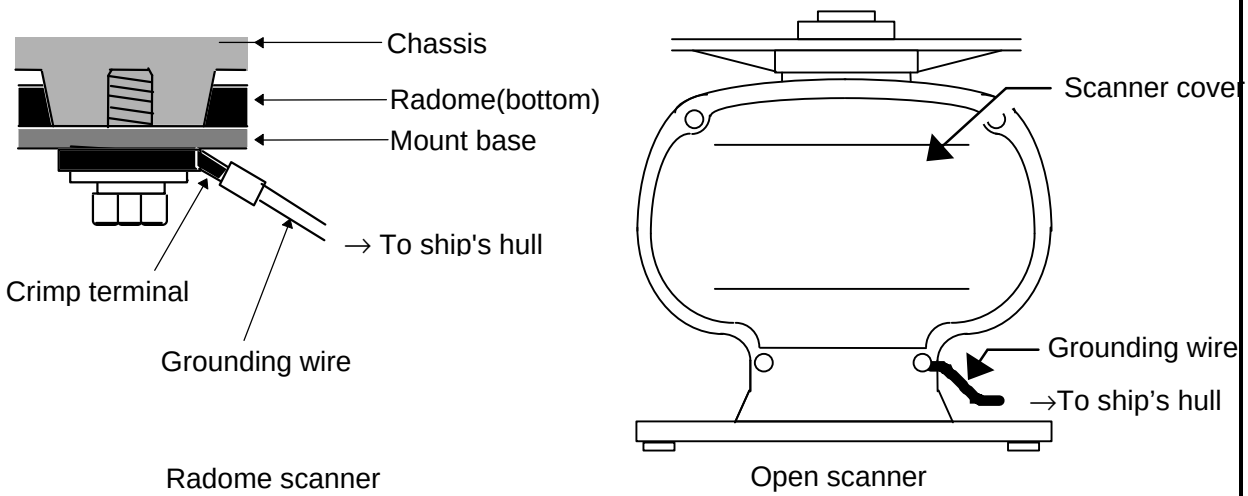
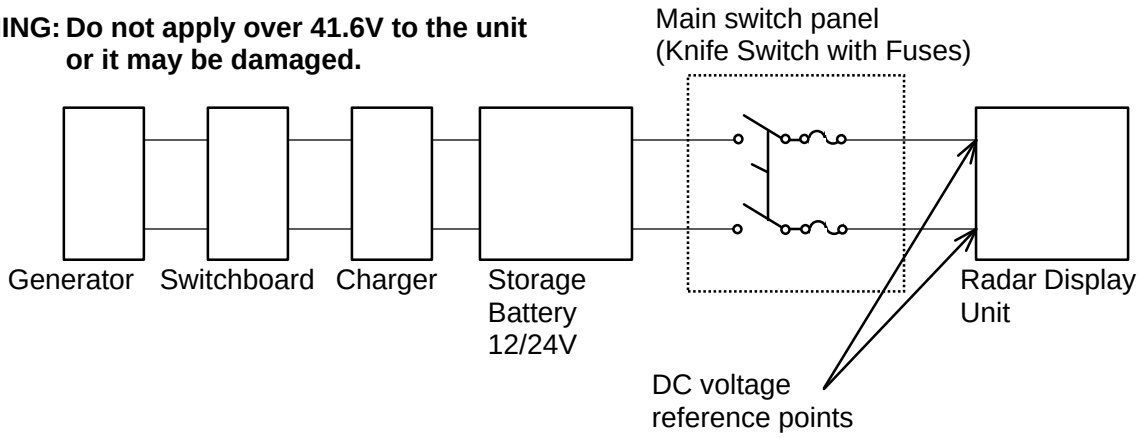


Fig.3-11 Grounding scanner unit to earth

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 don 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 mm²)	3 m
	8 AWG (6.0 mm²)	5 m
24Vdc	12 AWG (2.0 mm²)	6 m
	10 AWG (3.5 mm²)	10 m

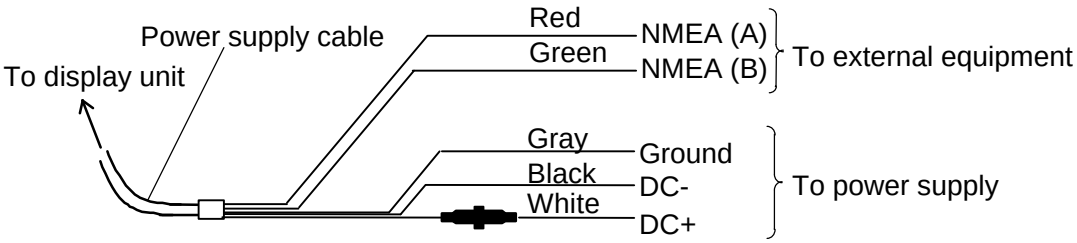


Fig.3-12 Power supply cable

3.8 Adjustment

⚠ CAUTION

Be sure to make 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:

① TUNING	Refer to Adjusting tuning circuit in 5.5.4.6.5
② HEADING DIRECTION	Refer to Adjusting angle in 5.5.4.6.5
③ DISTANCE	Refer to adjusting distance in 5.5.4.6.5

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 MOB/TARGET signals cannot be accessed through the junction box interface.

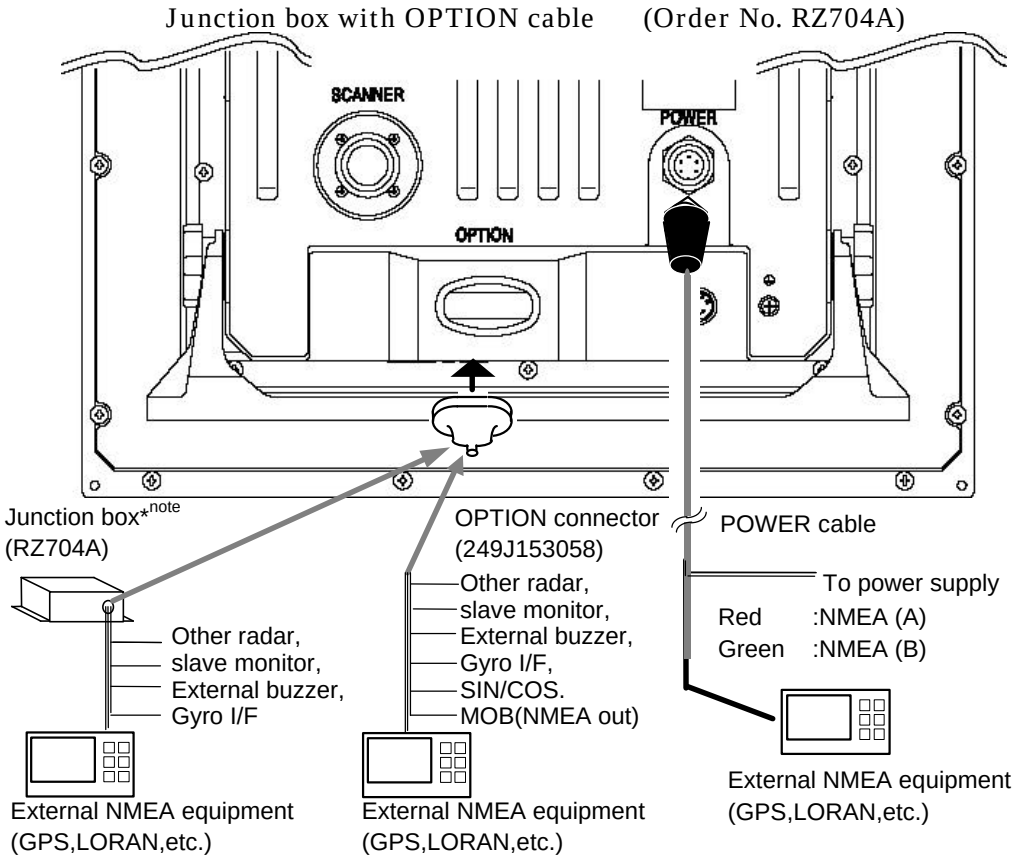


Fig.3-13 Connecting external equipment to display unit

3.10 Countermeasure for Electromagnetic Interference

The RA51/52/53/54/55 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 interference.

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

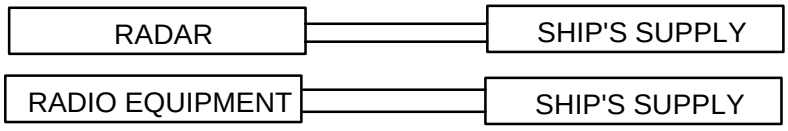
(1) Installation Location

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. Experiment with various positions of both to see if it improves the condition.

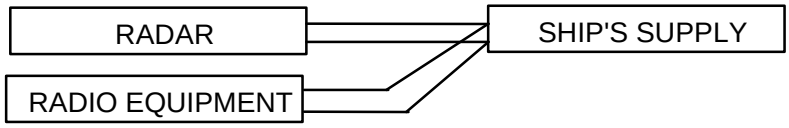
(2) Laying Power Supply Cables

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 breaker panel or as close to the generator or battery as possible. Connection A and B are recommended. Connection C should not be used.

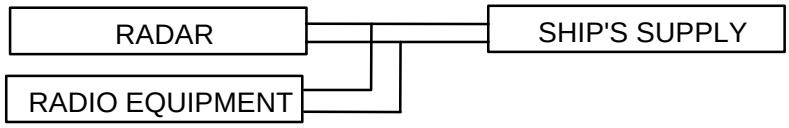
Connection A
(Very Good)



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 RA51/52/53/54 radar. Dispose of them according to local environmental and recycling regulations.

Tab.3-7 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		