RA725UA/RA726UA
Marine Radar
Instruction Manual

4th Edition

Communications Systems Division
Anritsu Corporation

Simrad Part **Number** 855-106537

RA725UA/RA726UA Marine Radar
Instruction Manual
May 21, 1993 (First Edition)
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WHAT TO DO
IF AN ACCIDENTAL ELECTRIC SHOCK OCCURS

First, immediately switch OFF the power to the equipment causing the shock. If the power cannot be cut, get the victim away from the equipment causing the shock by pushing or pulling them with an insulated board or cloth, etc.

If the shock victim has lost consciousness, or if they are not breathing or have no pulse, call a physician immediately. If a physician is not close at hand, give artificial respiration and cardiac massage as first aid to the shock victim until medical help arrives.

Artificial Respiration and Cardiac Massage

1. Do not move the victim unless they are in danger. Proceed immediately as described below.

2. Put the victim on his/her back on a firm surface like a desk or floor. Quickly loosen any tight clothing around the neck and chest.

3. Pull up the chin so that the top of the head rotates back and put your fingers into the mouth to clear the throat and windpipe of any obstruction like the tongue or vomit.

4. If there is no chest or abdomen movement, start artificial respiration; if there is no pulse, start cardiac massage immediately as well.

   If there are two people rescuers, one should give artificial respiration while the other gives cardiac massage. Cardiac massage should be given five times for each time the victim's lungs are artificially inflated.

   If there is only one rescuer, cardiac massage should be given 15 times for each two lung inflations.

Notes

1. Continue giving emergency artificial respiration and cardiac massage even while moving the victim on a stretcher or in an ambulance to medical help. Move the victim gently.

2. When the victim starts breathing normally and the hands and feet get warm and the pulse returns, cover them with a blanket to conserve body heat.

3. If the victim is breathing normally but has not recovered consciousness, turn them on their side (coma position) so that breathing is not stopped again by an obstruction (vomit or tongue) of the windpipe or throat.

WARNINGS

HIGH VOLTAGES

Although this radar presents no dangers in normal usage, dangerous high voltages are used inside the equipment. Observe the following safety precautions when repairing or inspecting the radar.

1. Always set the display POWER switch, and the main switch for the radar on the distribution board to OFF.
2. Even after setting these switches to OFF, there may be high residual voltage at the anode cap of the CRT, at the 300-volt line of the scanner connection cable, at the scanner 300-volt circuit, and at the PFN (pulse adjustment circuit) of the MOD PC board Ground these points using a conductor such as a wire lead or screwdriver whose one end is grounded and check that there is no residual voltage with a tester.

REPAIRING AND INSPECTING SCANNER UNIT

Usually the scanner unit is installed in a high place. Consequently, a slight mishap can result in a serious accident. Note the following precautions when repairing and inspecting the scanner unit.

1. Set the display POWER switch and the main switch for distributing power to the radar to OFF so that there is no danger of the antenna rotating during repair and inspection In addition, before starting any repairs or inspection, post a sign on the display unit indicating that maintenance is in progress so that there is no danger of a third party accidentally setting these switches to on.
2. When repairing or inspecting the scanner unit wear a safety harness and provide a secure platform so that there is no danger of falling even when the vessel lists or when there is an unexpected incident such as an earthquake.

ELECTROMAGNETIC RADIATION

DO NOT approach the antenna while it is transmitting. NEVER get within 15 meters of the antenna radiating surface while the antenna is transmitting. In addition, at inspection, NEVER look into the waveguide during transmission.

CRT MAINTENANCE

The CRT used in this radar has a high vacuum and it is extremely dangerous if it is damaged. Observe the following precautions.

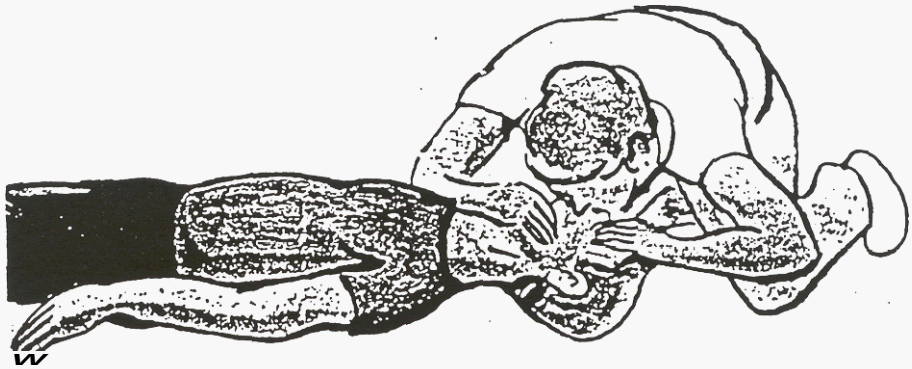
1. Never rest anything on the CRT.
2. Never press on the front display surface of the CRT.
3. Never drop the display unit.

Artificial Respiration Method

As shown in the diagram on the right, pinch the victim's nose with one hand so that air is not expelled from the nose and lift the back of the neck with the other hand,

Place your mouth over the victim's mouth and breath into the victim's mouth for 1 to 1.5 seconds until your lungs become empty. The volume of exhaled is about half that of deep breathing. Check that the victim's chest rises when you exhale. If it does not, check that there is no blockage in the victim's mouth or throat

Do this quickly at first and then proceed at about 12 inflations per minute. Do not stop until medical help arrives.

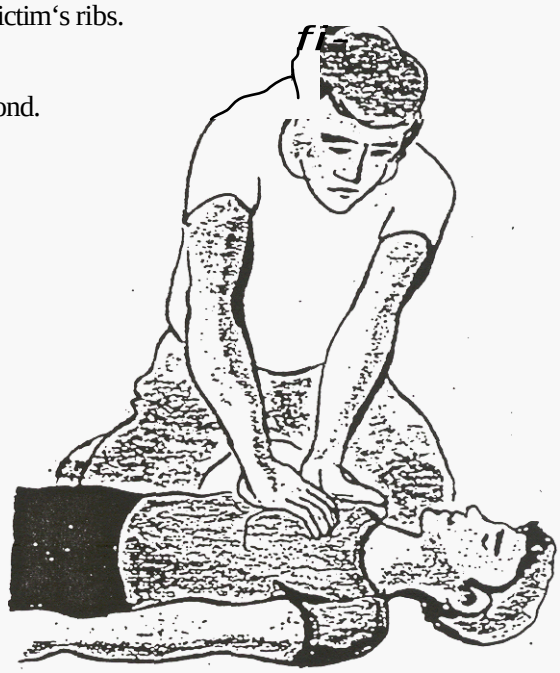


Cardiac Massage Method

As shown in the on the right, place the base of the palm of one hand over the chest about 1/ 3rd of the way up from the bottom, of the rib cage. Put the other hand on top of that hand.

Press the victim's chest firmly by applying your weight without bending your elbows so that the victim's chest depressed about 3 or 4 cm then release the pressure immediately date. Be careful not to press too hard or you may break the victim's ribs.

Repeat this operation about once per second.



ABOUT THIS MANUAL

This manual describes how to operate and maintain the RA725UA/RA726UA marine radar. The range of the radar functions are explained in this operation manual but the basic operations can be performed after reading paragraphs 2.1 and 2.2. To better understand how the radar functions, read APPENDIX C (INTERPRETING RADAR IMAGES).

For installation of this radar or for connection of the related equipment, refer to the APPENDIX B INSTALLATION.

CONTENTS

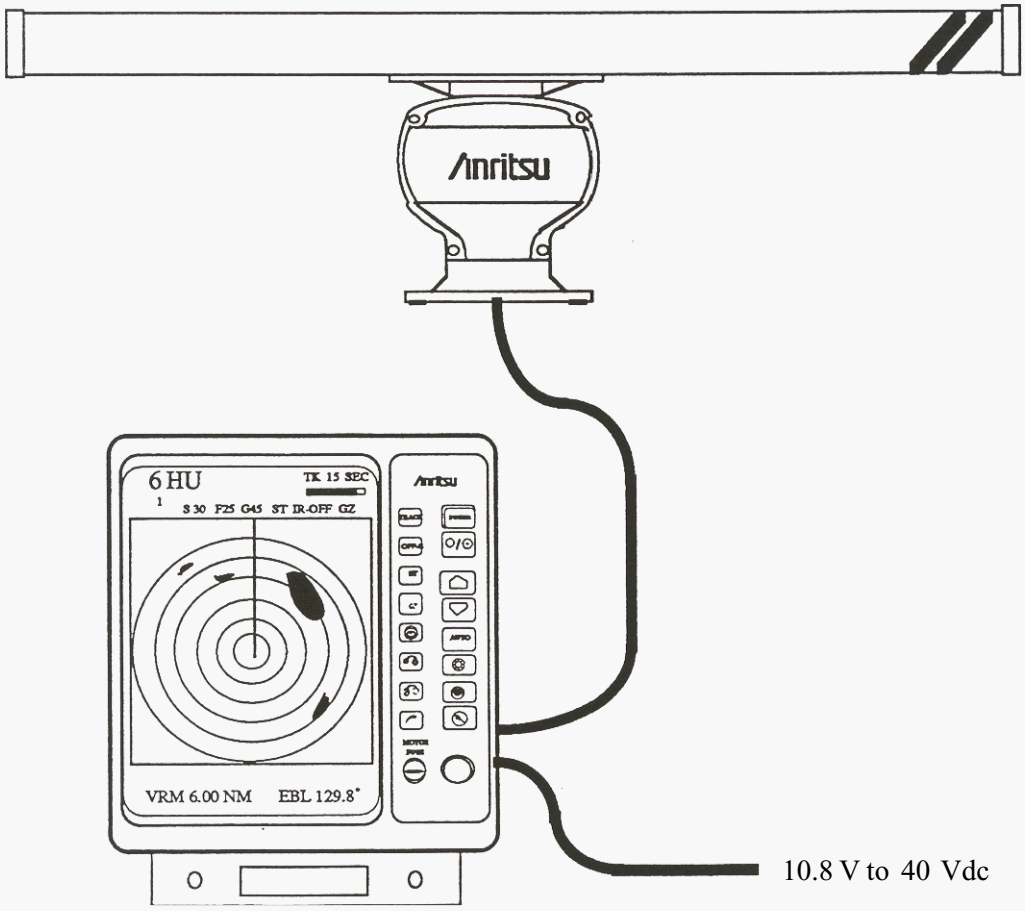
SECTION 1
INTRODUCTION

The RA725UA/RA726UA is a compact marine radarwhich uses a 12-inch orange CRT as the display and has an output of 5/10 kW.The radar achieves high performance through useof a microcomputer, and image processing LSI, and several newlydeveloped signal-processing LSIs.Referto APPENDIX A for detailed specifications.

This radar is composed of the following Standard and Optional components.

Standard Components:

Main unit	RA725UA	5 kW output	10.8 V to 40Vdc of input voltage
	RA726UA	10 kW output	10.8 V to 40 Vdc of input voltage
Antenna		3 ft, 4ft, 6ft	



Optional Components:

- Rectifires

  RP113A Input voltage: lOO/ll0/220 Vac

  69-1E-A Input voltage: 1OO/110/115/120/125/200/220/230/240/250Vac

* Gyro-Interface Unit

  NZ2OA

- Magnifier lense

  RZ702A

The following equipment can be connected to the radar. For the interface information, see Appendix B, INSTALLATION.

Related Equipment:

*LORAN

- GPS

* Buzzer

- Magnetic Compass

* Gyro Compass Interface Unit

* Radar Buoy

Setup Mode

This radar can be set to the Setup mode where the front panel key configuration can be changed or the diagnostics can be activated. It is also used during installation for setup of the radar. refer to Section 3 for details.

SECTION 2
OPERATION

This Section describes basic operations and advnaced functions of this radar. YOU will have basic knowledge of how to operate this radar by just reading paragraphs 2.1 and 2.2. TO better understand how the radar functions, read APPENDIX C (INTERPRETING RADAR IMAGES).

There are sixteen keys and one control knob on the front panel. The keys are aligned on the two lines vertically. The left side keys can be chosen from out of 14 key functions. The figures in this manual shows the key configuration set at factory shipment To change the key configuration, refer to Section 3 and use a key cap in the accessories to show the new function. The functions of the eight right side keys are explained in paragraph 2.2 and other 14-key functions for the left line are explained in paragraph 2.4.

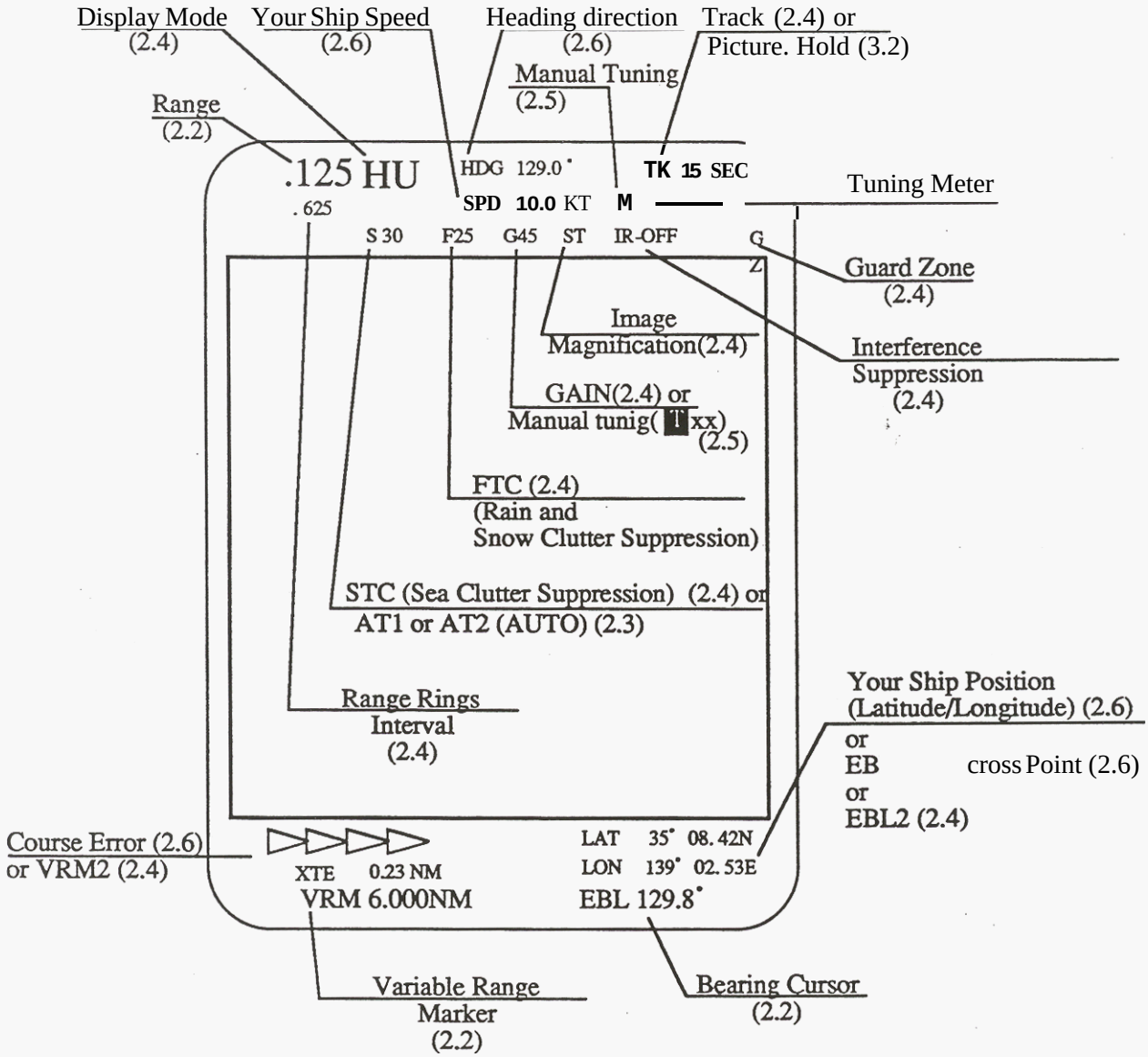
The internal buzzer makes a short 'Pi' sound when a key is pressed and the operation is accepted. If misoperation is attempted, the previous setting is not changed and the internal buzzer makes a long 'Piii' sound.

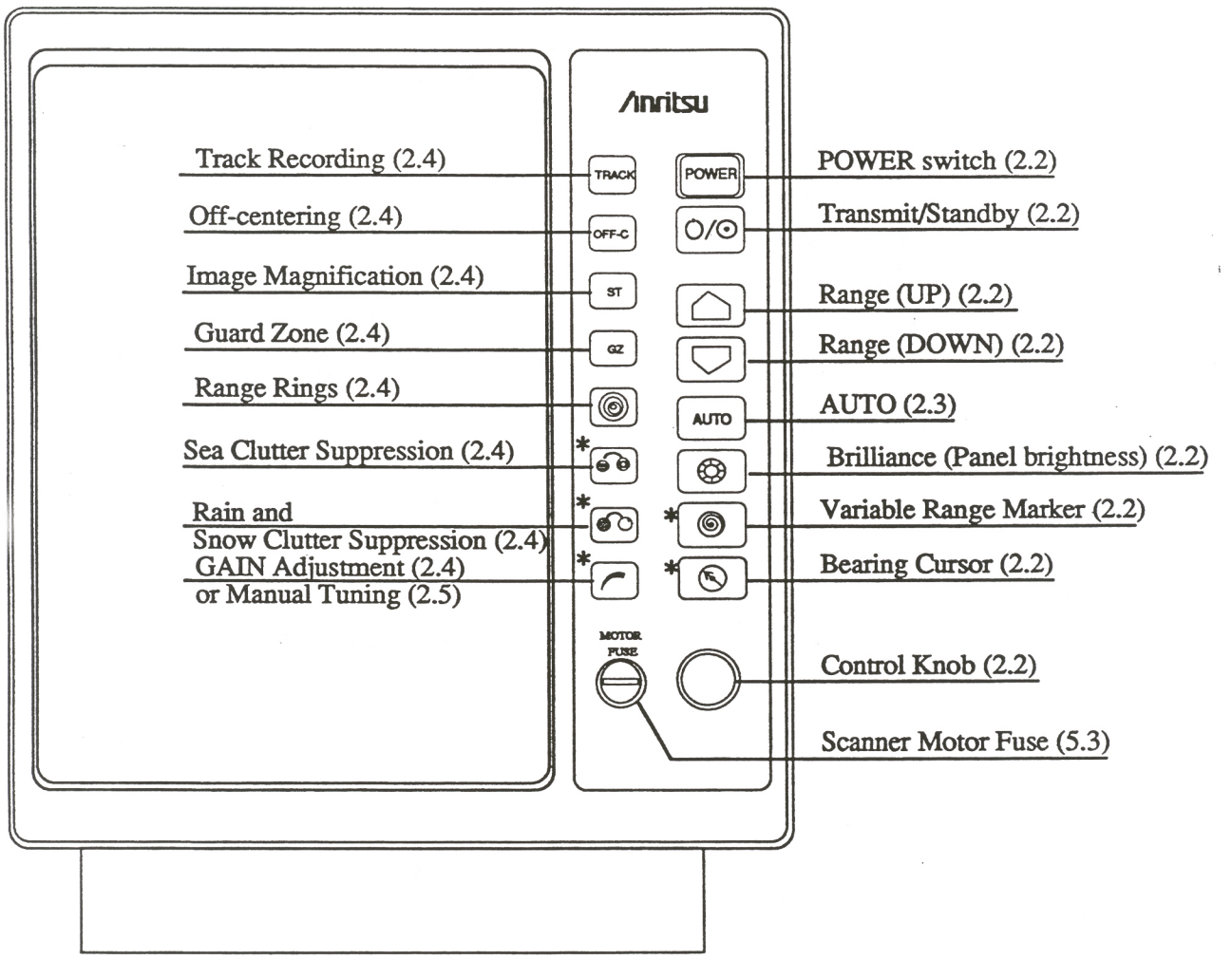
This radar always monitors its operational conditions. If an abnormality has been found, "SYSTEM ERROR is displayed at the bottom right of the screen. To locate. the faulty part, use the internal diagnostics activated in the setup mode (refer to Section 3).

It also monitors the internal +5V voltage. If the power failure has been found, it displays "POWER FAIL" at the center of the screen, or displays the time display, according to the type of the power failure. Refer to Section 5 for details. In both cases, the radar transmission is stopped and the radar returns to standby.

SECTION 2 OPERATION

Check the name and functions of each part. (X.X) indicates the relevant paragraph in this manual.





Notes:

1 (X.X) indicates the relevant paragraph in this manual.

2 Keys marked with * operate in conjunction with the control knob for fine adjustment.

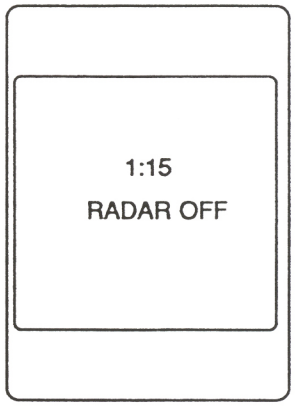
3 The underline on the displayed value shows that the value can be adjusted with the control knob. When the VRM key is pressed for example, the adjustable function is displayed with an underline as VRM.

2.2 Basic Operations

Power-on

Press POWER key.

The time indication appears along with the RADAR OFF display.
To turn OFF, press the POWER key for 3 or more seconds.



2 Minutes Elapsed

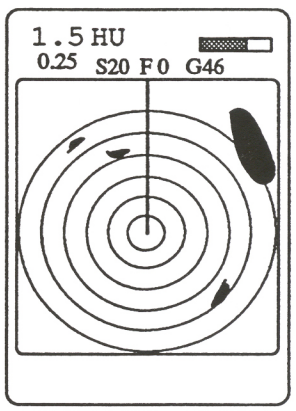
The time indication disappears after 2 minutes have elapsed to indicate that the radar warm up has been completed. This state is called standby state.

Starting Transmission

Press the TX key.

The radar starts transmitting, and the radar image can be observed on the display. The Standby mode is returned when this key is pressed once more.

Note:
If this key is pressed before 2 minutes have elapsed after power-on, the antenna rotates but the radar does not transmit.



Adjusting Display Brilliance

Press the BRIL key.

The screen gets brighter in 5 steps each time the key is pressed. The second step from the darkest is the default setting.

Selecting Range

Press or key.

Press to increase the range each time the key is pressed. Press to decrease the range each time the key is pressed.

Minimum Range: 0.125 NM
Maximum Range: 60 NM (RA725UA)
96 NM (RA726UA)

To next page

From the previous page

AUTO Selection

Press AUTO key.

The radar enters into the auto mode where the GAIN adjustment and sea clutter suppression (STC) are performed automatically.

AT1 or AT2 is displayed and they are switched every time this key is pressed.

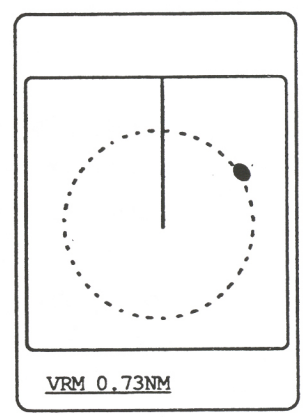
Refer to paragraph 2.3 for the auto/manual modes.

The AUTO operation is released when the STC key is pressed and the manual mode is returned.

Measuring Range

VRM key and knob

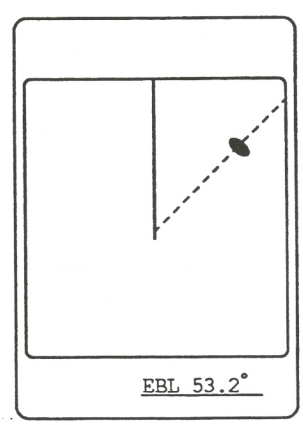
Use the variable range marker (VRM) to measure the distance to the target; the range is displayed at the bottom left of the display. When measuring the range, move the marker to the target using the control knob and read the range. The marker is erased when this key is pressed once more.



Measuring Bearing

EBL key and knob

Use the electronic bearing line (EBL) to measure the bearing to the target from your ship's heading; the bearing is displayed in degrees at the bottom right of the display.
When measuring the bearing, move the EBL marker to the target using the control knob and read the bearing. The EBL marker is erased when this key is pressed once more.



SECTION 2 OPERATION

2.3 Auto/Manual Modes

The AUTO key switches the auto and manual modes.

2.3.1 Auto Mode

The GAIN adjustment, sea clutter suppression (STC), and frequency tuning are automatically performed.The GAIN and rain and snow clutter suppression (FTC) can be adjusted manually even when the AUTO function is used. If you want to make very fine adjustments, use these keys during the AUTO mode. Adjustment can also be made manually using the STC key.

The AUTO mode is divided into AT1 and AT2 submodes. AT1 and AT2 are switched each time the AUTO key is pressed. To return to the manual mode press the STC key.

Select the one to use according to the situation as described below.

AT1

Use this mode when confirming the course in areas where strong radar echoes are returned such as: when leaving or entering port, or when navigating in bays and narrow channels, or near small islands. The effect is the similar to reducing the STC manually and setting relatively-low GAIN.

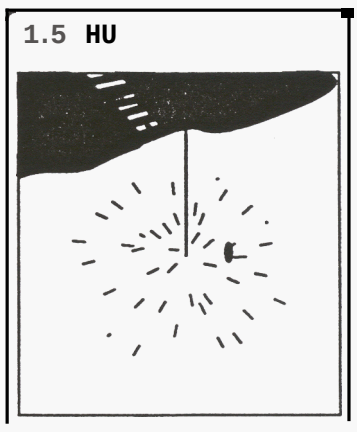
AT2

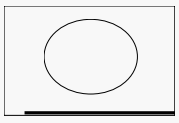
Use this mode when navigating in areas where there are no objects returning very strong radar echoes such as in the open sea, sea clutter is also suppressed automatically. The effect is similar to ling sea clutter manually using the STC key and setting high GAIN.

The constants (image observation degree) for the AT1 and AT2 operation levels can be changed if necessary using the following procedure.

1

Press AUTO key to select either AT! or AT@ to change the operation level of the mode you select. In the case of AT1, set a range of 1.5 NM or more.



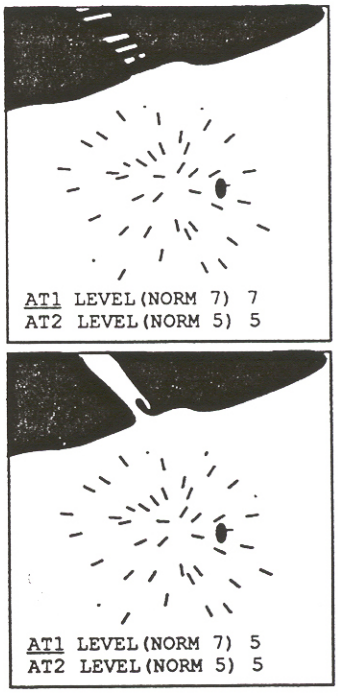
2 Press the BRIL  key continuously to display the SETUP MENU.

3 Press and hold the AUTO key and quickly press the range up key to display the radar image and AT setting as shown in the diagram on the right.

4 To change AT1, change the value 7 by turning the control knob. This will change the strength of the perimeter radar echoes. For AT1, the echoes around the center of the screen will not be changed (the area where STC has its affect).
(The GAIN changes even though STC is not changed.)

5 To change AT2, press the range down key to move the underline to AT2 and then turn the control knob. In the case of AT2, the STC depth is changed so that the echoes of the sea clutter can be controlled.

6 The normal screen is returned when the TX key is pressed.



The perimeter GAIN is decreased so the river mouth can be identified.

2.3.2 Manual Mode

The GAIN adjustment, sea clutter suppression (STC), rain and snow clutter suppression (FTC), and frequency tuning are controlled manually.

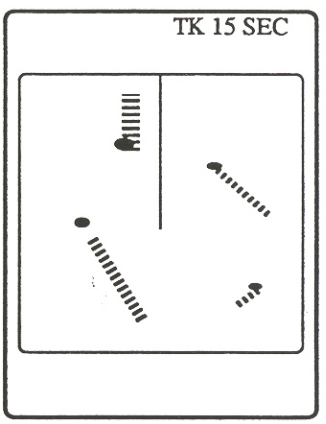
2.4 Key Functions

In this paragraph, 14-key functions for the left side keys on the front panel are explained; see paragraph 2.2 for right side key functions. The key functions described in paragraphs 2.4.1 to 2.4.8 are set at the factory. If you want to use other key functions explained in paragraphs 2.4.9 to 2.4.14, change the key assignment by using the Setup mode (paragraph 3.2 (3)).

2.4.1 Track Recording

TRACK

Press this key to display TK 15 SEC at the top right of the screen and record the tracks of targets around your ship. 15 SEC indicates the tracking duration; the target movement is recorded for 15 seconds maximum. However, weak (faint) echoes are not recorded.



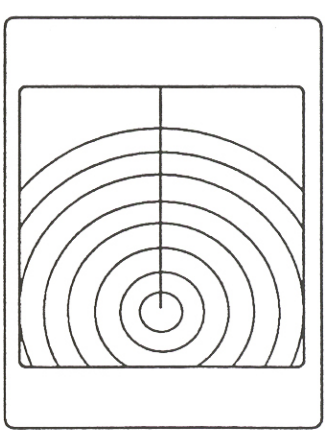
The tracking duration is switched in sequence from 15 SEC (seconds), 30 SEC, 1 MIN (minute), 3 MIN, 6 MIN, and continuously each time the key is pressed.

To release the track recording, press this key for 3 or more seconds.
If the key is pressed for a short time, the tracking duration changes; when it is pressed continuously, the track is erased.

2.4.2 Setting Off-Centering

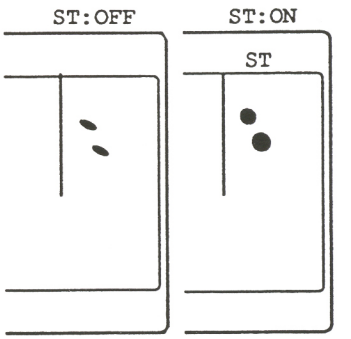
OFF-C

Press this key to change your ship position to the front, back or center of the display. This function is useful for viewing an extended range ahead or astern of your ship. The display can be placed off-center 60%.



2.4.3 Setting Image Magnification

Press this key to magnify the target image and ST will be displayed at the top right of the screen. Use this function to increase the size of the displayed target.

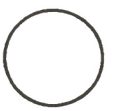


Notes:

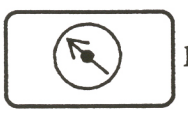
1. The transmission pulse width is changed in the 0.5 NM to 6 NM range. Refer to APPENDIX A for details.
2. Note that the range resolution decreases.
3. The image magnification cannot be used at ranges below 0.25 NM.

2.4.4 Setting Guard Zone

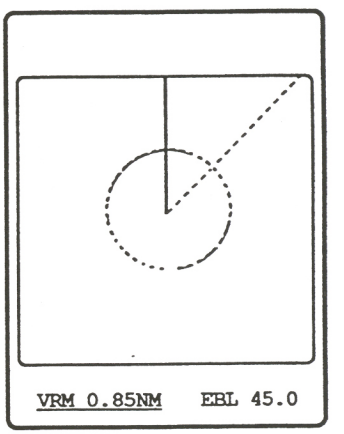
The guard zone is a function that generates a warning alarm when a target enters a preset range. Use it to prevent accidents. However, do not use this function as a substitute for a lookout.

1 Use VRM  key and 

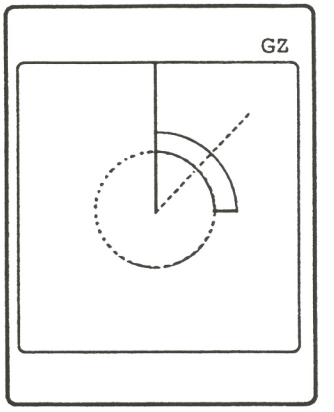
Set the range with the variable range marker (VRM).

2 Use EBL  key and 

Set the bearing with the EBL marker. However, the actual bearing angle is set in increments of about 6°.



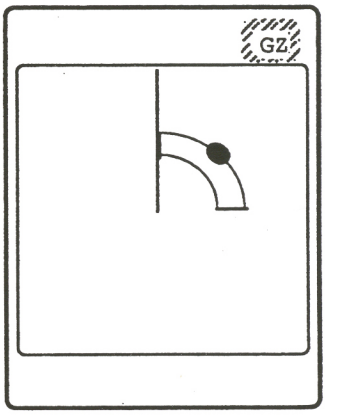
3 Setting Sector [G Z]



Press this key so that GZ is displayed at the top right of the screen. The angle of the guard zone sector changes in sequence from 45° to 90° to 180° to 360° (entire circumference) and flashes each time the key is pressed. The flashing stops when required sector is displayed for about 5 seconds continuously and the setting is completed. It does matter if the VRM and EBL are erased after setting the guard zone.

Note:
The alarm range width is fixed to about 0.4 NM.

4 Alarm



When a target trespasses in the set range, the internal alarm sounds and the GZ display flashes.

Notes:
1. To prevent misoperation, this function does not work when the echo is weak.
2. The alarm is limited to the area displayed on the screen. Note that no alarm is issued when the set range is off-screen as a result of range switching or off-centering.

5 Setting Alarm OFF [G Z]

Press this key to stop the alarm when the target trespassing in the guard zone has been checked but the GZ display does not stop flashing. The alarm will stop when the trespassing target leaves the guard zone.
If the target angle is changed, or if another target trespasses in the guard zone, the alarm will sound again .

6 Changing Position [G Z]

To change Guard Zone position, use VRM and EBL to specify new position and press this key and the new position will be set.

7 Releasing Guard Zone [G Z]

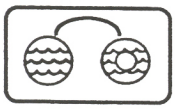
The guard zone is turn off when this key is pressed for 3 or more seconds continuously. The GZ display is then erased. When the alarm is sounding, press this key to stop the alarm and then press it again for 3 or more seconds continuously after the alarm stops.

Although an error alarm sounds for a short period when there is no EBL or VRM, the guard zone is released after 3 seconds.

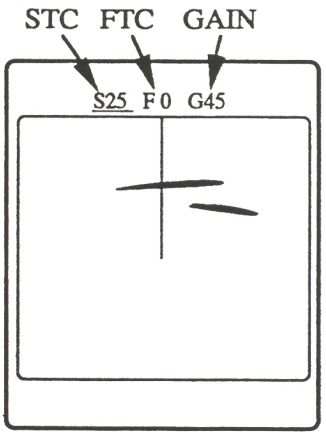
2.4.5 Setting Range Rings

The range rings are erased when this key is pressed. They are returned when the key is pressed again.

2.4.6 Adjusting Sea Clutter Suppression (STC)



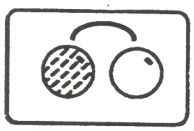
The AUTO mode is released when this key is pressed and the AT display at the top of the screen changes to S25, F0, G25 for example, to indicate the set sea clutter suppression. Turn the control knob in this condition to adjust the sea clutter suppression level from 0 to 50.



Notes:

1. Normally the sea clutter suppression level is kept so that a little sea clutter can be observed. Take care that targets do not disappear when the sea clutter suppression is set to a high level.
2. The GAIN, STC and FTC values are kept in memory even when the power is turned off.
3. Refer to paragraph 3.2 (2) G to change the STC curve.

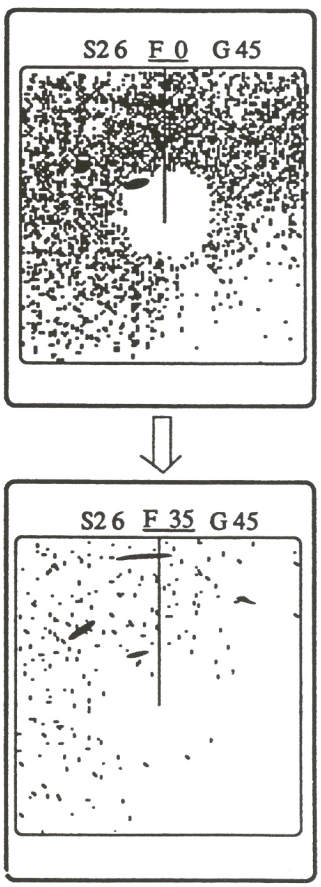
2.4.7 Adjusting Rain and Snow Clutter Suppression (FTC)



Press this key to set the rain and snow clutter suppression mode; the underlined display (F 0) at the top of the screen indicates the set suppression level. Turn the control knob at the bottom right of the display to adjust the suppression level from 0 to 50.

Rain and snow clutter suppression level adjustment can be performed manually even when the radar is in the AUTO mode.

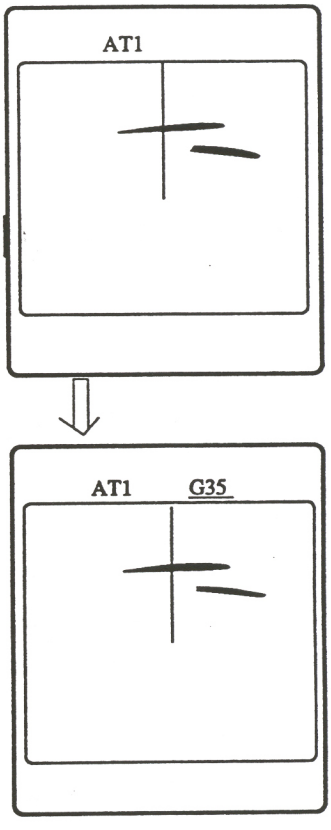
To return the rain and snow clutter suppression level adjustment to the AUTO operation, press this key once more. However, when there is no underlined Fxx display, this key must be pressed twice.



Notes:
1. Normally, the level of the rain and snow clutter suppression is kept so that a little rain and snow clutter can be observed. Take care that targets do not disappear when the rain and snow clutter suppression is set too high.
2. There may be a case where using the GAIN or STC is effective rather than using the FTC.

2.4.8 Adjusting GAIN

Press this key to set the GAIN adjustment mode; the underlined display (G35) at the top of the screen indicates the set GAIN. Turn the control knob at the bottom right of the display to adjust the GAIN from 0 to 50.

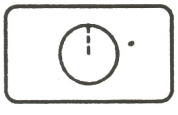


GAIN adjustment can be performed manually even when the AUTO function is being used.

To return the GAIN adjustment to the AUTO operation, press this key once more. However, when there is no underlined Gxx display, this key must be pressed twice.

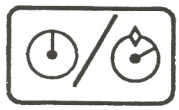
Notes:
1. Note that the GAIN for long-range observation should be set so you have a small amount of background noise.
2. Refer to paragraph 3.2 (2) H to set the manual tuning function.

2.4.9 Erasing Head Marker



The head marker is erased while this key is pressed. This makes it easy to see targets on the head course.

2.4.10 Setting Display Mode



The display mode is changed in sequence from HU, HS, NU, and CU each time this key is pressed. The NU and CU display modes can be used when a bearing signal is received from navigational equipment or aids such as a gyro compass, magnetic compass, or GPS. The display mode is indicated at the top left of the screen.

•HU (Head Up)

In HU (Head Up) mode, the heading is displayed as true up (Fig. 1).

• HS (Head Set)

The heading is moved to the bearing specified by the EBL (Fig. 2).

• NU (North Up)

North is displayed as true up (Fig. 3).

• CU (Course Up)

The course destination is displayed as true up. The display mode is set to CU when the ship's head is pointed toward the course destination (Fig. 4), and then the course destination is always subsequently displayed as true up (Fig. 5). When a bearing signal is input, the display changes to HU, HS, NU and CU in sequence each time this key is pressed.

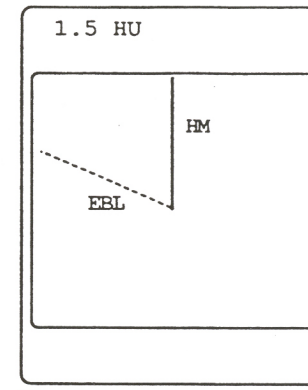


Fig. 1

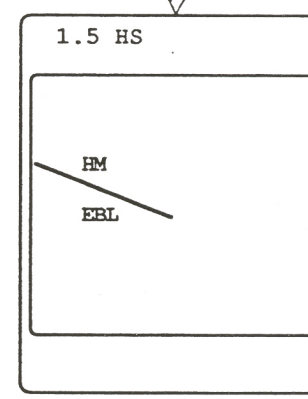


Fig. 2

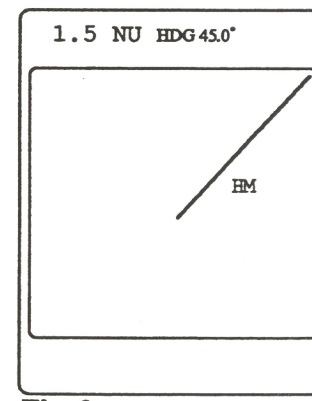


Fig. 3

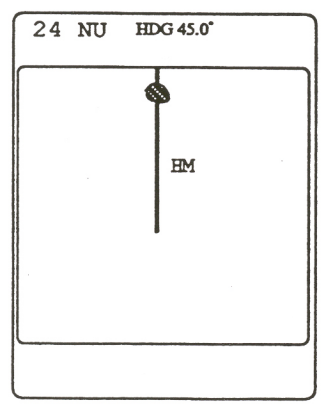


Fig. 4

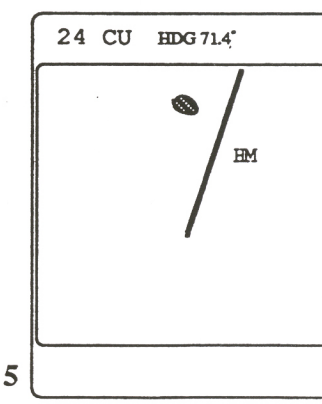
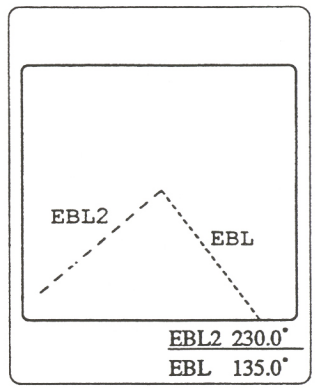


Fig. 5

2.4.11 Setting Second EBL

A second EBL is displayed when this key is pressed. The bearing is displayed at the bottom right of the screen.



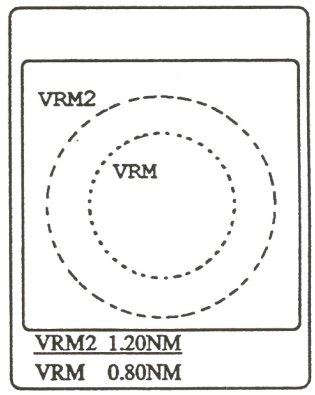
When both EBL and EBL2 markers are used, the control knob works for the underlined marker. To set the underline press the corresponding EBL or EBL2 key.

When the key corresponding to the underlined display is pressed again, the corresponding EBL is erased.

Note that the VRM/EBL cross point function is disabled when EBL2 is used.

2.4.12 Setting Second VRM

A second VRM is displayed when this key is pressed. The range is displayed at the bottom left of the screen.



When both VRM and VRM2 markers are used, the control knob works for the underlined marker. To set the underline press the corresponding VRM or VRM2 key.

When the key corresponding to the underlined display is pressed again, the corresponding VRM is erased.

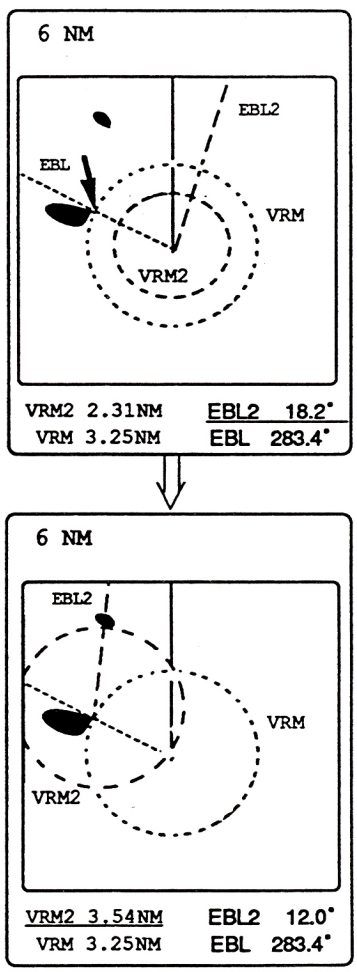
However, the cross track error (XTE) is erased when VRM2 is displayed.

2.4.13 Setting Floating EBL/VRM

F L T

The origin of EBL2 and VRM2 markers can be changed to any position specified by the cross point made by EBL and VRM. Moving the origin is called floating. After floating the origin, the bearing and/or range between any points can be measured by using EBL2 or VRM2. Follow the following steps to move the origin.

1 To specify the position of the new origin move EBL and VRM so that their cross points indicate the point where you want to move the origin of EBL2 and VRM2.



2 Press the floating F L T key.

When this key is pressed, the underlined EBL2 or VRM2 is moved to the new origin. If you want to move both EBL2 and VRM2, mark the underline to the other marker, and then repeat this step.

You can measure the bearing at the new origin and the range between the new origin and any point specified by EBR2/VRM2 cross point.

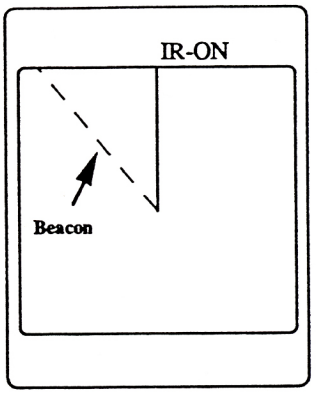
3 Returning to Your Ship's Position

When F L T key is pressed for 3 or more seconds, the origin is returned to your ship's position.

2.4.14 Suppressing Radar Interference

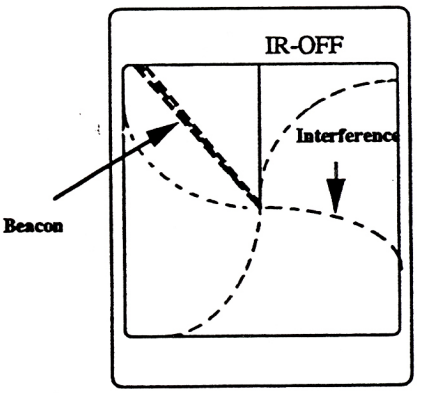
I R

This function sets suppression of interference from other radars ON and OFF. Set it to OFF to observe radar beacons more clearly. At ON, IR-ON is displayed at the top right of the screen. (IR-OFF is displayed at OFF.)



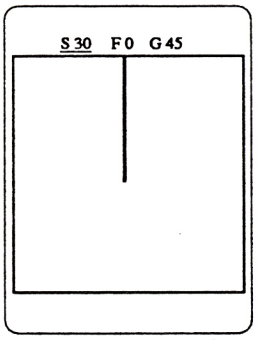
Note:

Interference from other radars is always suppressed but IR is not displayed when this key function is not assigned to one of the left-side keys.



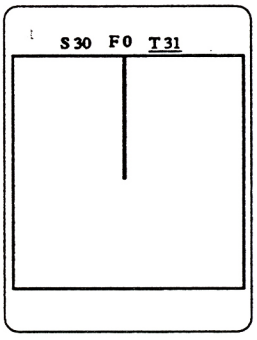
2.5 Manual Frequency Tuning

When MANU is set to TUNE MODE of (2) DISPLAY PRESET of the Setup mode (paragraph 3.2 (2) H), the receiving frequency can be tuned manually if the radar is set to the manual mode. This makes it possible to fine-tune when you want to observe targets in sea clutter. To fine tune, follow the steps below:



1 Check that Sxx, Fxx and Gxx are displayed, which indicates that the manual mode is set. If ATx is displayed, press the STC key to return to the manual mode.

2 Press the GAIN key. (Gxx is underlined and GAIN can be adjusted by using the control knob.)



3 Press the GAIN key once more to change the Gxx display to Txx and the receiving frequency can be manually adjusted. The final value of Txx set at this step is memorized and it will be recalled when the manual tuning is started next time.

4 Press the GAIN key to change Txx to Gxx to set the mode in which the GAIN can be adjusted. Gxx and Txx are switched alternately each time this key is pressed.

Note:

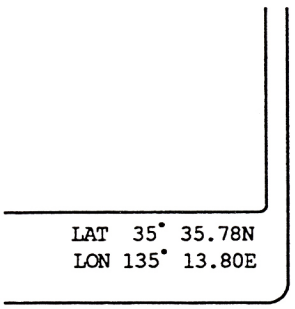
Manual tuning cannot be performed in the auto mode, even when the GAIN is controlled manually.

2.6 Information from Navigation Equipment

Refer to APPENDIX B for connecting other navigation equipment.

(1) Your Ship's Position

When other navigation equipment such as LORAN or GPS is connected to the radar, the latitude and longitude of your ship's position is broadcast from these other navigation aids and is displayed at the bottom right of the screen.



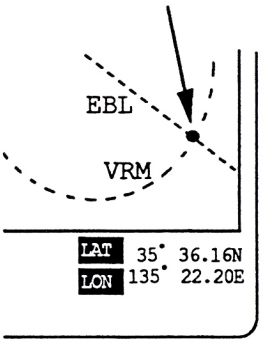
LAT: Latitude	N: North	S: South
LON: Longitude	E: East	W: West

Note:

When you are using both VRM and EBL and are inputting their positioning data, the display is for the cross point of VRM and EBL instead of your ship's position.

(2) Position of VRM and EBL Cross Point (LAT • LON)

When your ship's position and the positioning data are being input, while both VRM and EBL are being displayed, the LAT and LON display at the bottom right of the screen become reverse displayed and the latitude and longitude at the intersection of the VRM and EBL are displayed.

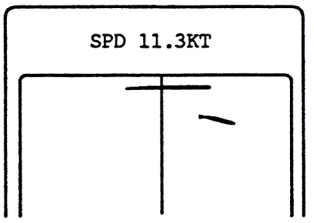


Notes:

1. This data is calculated on the above data broadcast from the navigational aids, therefor the long-range error becomes relatively large.
2. This function is disabled when EBL2 is used.

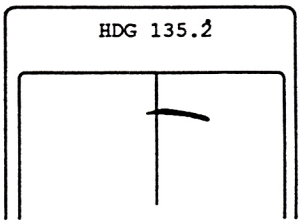
(3) Speed (SPD)

When speed is broadcast from navigational aids such as LORAN and GPS, it is displayed in knots at the center top of the screen.



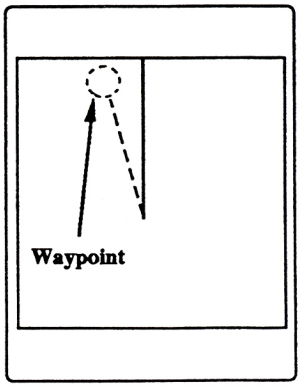
(4) Heading (HDG)

When a magnetic compass or gyroscope is connected to the radar, or when course data indicating the heading is received from navigational aids, the data is displayed with North as 0°.



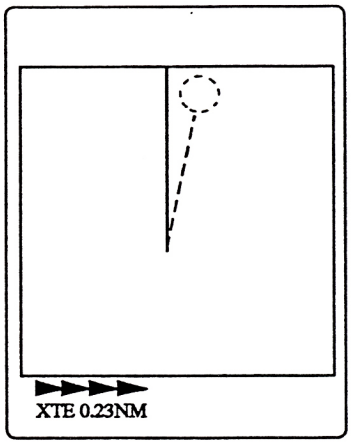
(5) Waypoints

When waypoint data is received from navigational aids such as GPS, a waypoint is displayed with a dashed circle and a dashed line from your ship's position to the waypoint. When used with a LORAN only a dashed circle is displayed to indicate waypoint (dashed line is not displayed).



(6) Cross Track Error (XTE)

When cross track data is received from navigational aids such as LORAN or GPS, the deviation from the course to the waypoint and the course correction are displayed on the screen.



Cross Track Error (NM)	Indication
0.00~0.01	
0.02~0.03	or
0.04~0.07	or
0.08~0.15	or
0.16~	or

◀ Course correction deirection

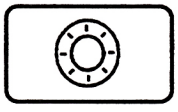
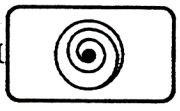
Note:

This function is disabled when VRM2 is assigned to the front panel and used.

2.7 Changing Display Language

Some of the radar functions can be displayed in English or Japanese using the following operation.

(1) Set the POWER switch to OFF.

(2) The display language can be changed from English to Japanese, or vice versa when the POWER switch is set ON while both the BRIL  key and the VRM  key are being pressed simultaneously.

Note:

After the display language is set, it is held even when the POWER switch is set to OFF.

SECTION 3
SETUP MODE

This radar has a setup mode for changing functions, diagnosing faults, and adjusting the installation.

3.1 Basic Operations

(1) To display the Menu:

Press the BRIL key for 3 or more seconds.

(2) To select the menu options use or key:

Move the underline to the number of the option.

(3) To display a selected menu:

Press the BRIL key.

(4) To change the settings:

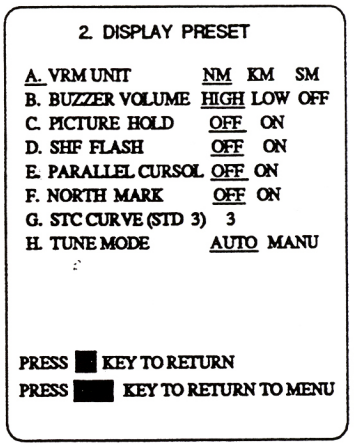
Select an option by using or key and change the value by using the control knob .

(5) To return to the menu screen:

Press the BRIL key.

(6) To return to the radar screen:

Press the TX key.

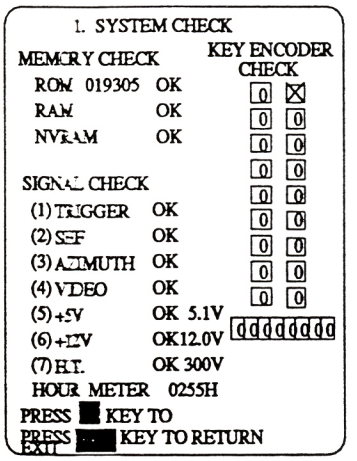


3.2 Setup Menu

(1) SYSTEM CHECK

• MEMORY CHECK and SIGNAL CHECK

These are test modes for checking the internal memory and the signals and voltages. OK is displayed when the test results are normal and NG is displayed when the results are abnormal. The numeric value displayed to the right of ROM is the software version.



• KEY and ENCODER (Control Knob) CHECK

This is the test mode for checking the keys and the control knob, which are aligned on the front panel. The key operation is normal if the display changes from 0 to 1 when the corresponding key is pressed. The control knob operation is normal if the numeric values displayed in the boxes at the bottom right of the screen change when the knob is turned. The numbers are in 8-bit binary code, they increase when the knob is turned clockwise and decrease when it is turned counterclockwise.

• HOUR METER

This displays the radar operating hours in hour units.

(2) DISPLAY PRESET

The display preference can be set in this menu; the underlines indicate the factory-set defaults.

A. VRM UNIT

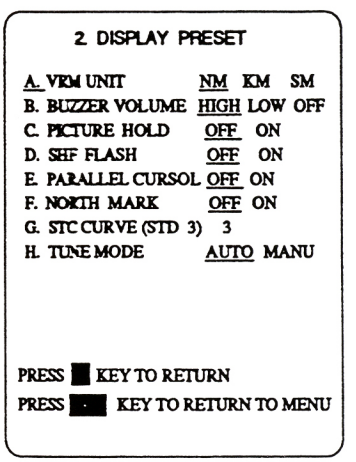
The range units of variable range marker is specified.

NM (Nautical Miles)
KM (Kilometers)
SM (Statute Miles)

B. BUZZER VOLUME

The volume of internal Buzzer sound is specified.

HIGH (Loud)
LOW (Quiet)
OFF (Off)



C. PICTURE HOLD

This specifies whether or not the radar image is held after entering the standby state.

OFF (Image not held)
ON (Image held)

When ON is set, the image remains for 1 minute after entering the Standby state.

D. SHF FLASH

This specifies whether or not the ship's heading is flashing.

OFF (Does not flash)
ON (Flash)

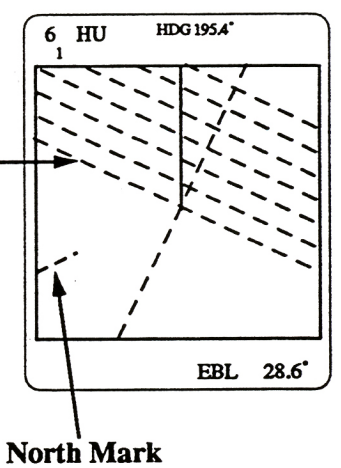
When ON is set, it is easy to see a small target on the heading line.

E. PARALLEL CURSOR

This specifies whether or not the EBL parallel line cursor is displayed.

OFF (Normal heading cursor)
ON (Parallel line cursor)

The distance between the cursor lines is the same as those of the range ring.



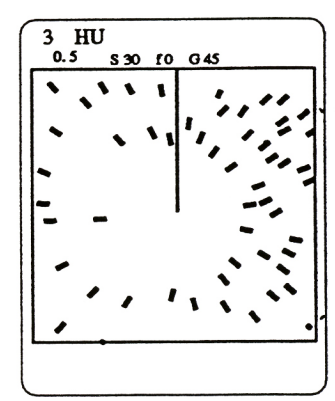
F. NORTH MARK

This specifies whether or not the north mark is displayed.

OFF (North mark not displayed)
ON (North mark displayed)

G. STC CURVE

The short-range sea clutter can be adjusted by using this menu. Set a small value when it is difficult to suppress short-range sea clutter by adjusting STC. Conversely, set a large value when short-range sea clutter is suppressed too much. The value 3 is set as the factory default. The diagram on the right shows an example of excessive suppression of short-range sea clutter.



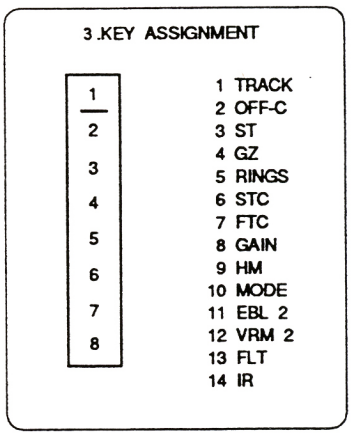
H. TUNE MODE (Sets tuning method)

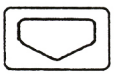
AUTO (AUTO tuning)
MANU (Manual tuning possible)

When MANU is set, manual tuning and adjustment can be performed only if the radar is in the manual mode. This makes it possible to fine-tune if you want to observe targets in sea clutter. Refer to paragraph 2.5 for the frequency tuning operation.

(3) KEY ASSIGNMENT (Changing key functions)

The values indicating the 8 keys in the boxes on the left side of the KEY ASSIGNMENT menu show the current presettings of the functions on the right side of the menu. Change the key functions using the following procedure.



1 Move the underline to the key function to be changed using the  or  keys.

2 Turn the control knob to match the value of the new function.

3 Return to the radar screen and check the new function.

4 Remove the old key cap and replace it with the new key cap in the accessory pack corresponding to the new function. Remove the old key cap gently with a small screwdriver as shown in the diagram on the right.

CAUTION

- **7. FTC and 8. GAIN must be selected when 6. STC is selected.**
- **If 13. FLT is selected, select either one of 11. EBL2 or 12. VRM2, or both.**
- **Do not change the key functions when installing the radar; use it for awhile first to confirm that there really are functions that are not required. In particular, do not change the GAIN, STC, and FTC to other functions until you make sure that satisfactory operation is performed in the AUTO mode.**

(4) AUTO TUNE CALIBRATION

This is the menu for adjusting the auto-tuning to the point that gives the best operation.
Refer to paragraph B.8 for details.

(5) TIMING ADJUSTMENT

This is the menu for adjusting the range when the radar is installed.
Refer to paragraph B.8 for details.

(6) HEAD DIRECTION ADJUSTMENT

This is the menu for adjusting the heading when the radar is installed.
Refer to paragraph B.8 for details.

SECTION 4
MAINTENANCE AND INSPECTION

Maintenance will ensure that this radar gives the best possible performanceover a long operating life. Perform the following preventive maintenance at the correct intervals.

WARNING

NEVER inspect this radar with the POWER switch set to ON. In addition, there is a chance of high residual voltage remaining in the equipment even after the power is turned off. These voltages MUST be grounded or discharged before starting work on the equipment. When inspecting the scanner unit, set both the **POWER** switch and the main switch on the distribution board to **OFF** and remove the motor fuse. Post a sign on the radar display unit informing other people that the radar is under inspection so that there is no chance of a third party the radar on accidentally.

SECTION 4 MAINTENANCE INSPECTION

Period	Inspection Location	Procedure
3 to 6 months	Scanner mountings	Check that the scanner mounting bolts are tight and that there is no corrosion.
	Inside scanner unit	Open the scanner cover and check the tightness of the bolts and the mounting condition of each part. Check the tightness of any packing and thai there is no corrosion on any metal parts.
	. Display surface	Clean the filter and CRTwith a damp soft cloth.
6 to 12 months	Antenna drive gear lubrication	Check that the antenna drive gear is properly greased.
	CRT *HV* parts	Clean the anode cap and its vicinity as well as HV lead with a *dry* cloth. The CRThas voltage of more than 1kV, cut the power to display unit and discharge any residual voltages in the display beforecleaning the HV parts.
	PC boards	Problemsmay *occur* if dirt *or* dust accumulate on the densely-mounted components on the PC boards. Clean off any dust with an electric vacuum cleaner, etc., or a soft cloth,
		Check the tightness of all PC board connectors. If there is any dirt on the connectors or any poor contact, brush it with a piece of plastic or wood material or replace the connector. Polishing with metal materials causes Do not use liquid contact reviver because it attracts dirt.
	Bolts and scanner motor brushes	Check that all fabrication and mounting screws in the equipment are tight. If the scanner motor brushes are worn to less than 6mm long, replace them (14 mm long when new).

SECTION 5
REPAIR

This section describes how to locate faults and make repairs. If the radar malfunctions, inspect it as described below. If the inspection results indicate a difficult repair that cannot be made by the ship's engineer, contact Anritsu or your sales agent and request repair. When contacting Anritsu or your sales agent, provide the following information.

(1) Vessel name, port, repair period (hours)
(2) Radar model
(3) Serial No.
(4) Details of fault **and** inspection results if available.

WARNING

Insure that you have read and understood the warnings in this instruction manual before inspecting and repairing this radar.

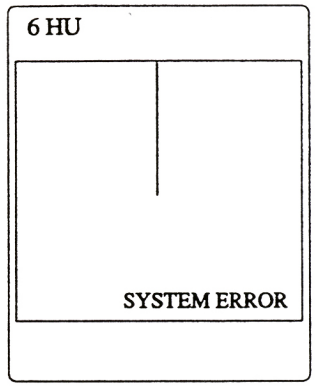
5.1 Abnormal Microcomputer, etc.

(A) When POWER FAIL is displayed on the screen
This warning indicates that the radar internal +5 V power supply has momentarily fallen below 4.8 V. If this happens, the radar enters the Standby status and the Transmit key must be pressed to continue operation. If this warning is displayed repeatedly, consider the possibility that the power supply contacts may be bad or that the battery is faulty.

(B) When time display appears on screen
When the radar internal +5 V voltage falls below 4.8 V for more than several seconds, the time display appears on the screen. This indicates that the CPU has been reset and that the radar is in the Power on status. Although operation can be continued by pressing the Transmit key after the display disappears, the power supply may be faulty.

5.2 Self Diagnostic Inspection (SYSTEM ERROR)

When SYSTEM ERROR is displayed on the screen as shown on the right, inspect the radar using 1. SYSTEM CHECK of the setup menu described in paragraph 3.2. If NG is displayed at any of the SIGNAL CHECK items, inspect the related locations.



SYSTEM ERROR Display

```
1. SYSTEM CHECK
MEMORY CHECK
  ROM   019111   OK
  RAM            OK
  NVRAM          OK

SIGNAL CHECK
(1) TRIGGER      NG
(2) SHF          OK
(3) AZIMUTH      OK
(4) VIDEO        OK
(5) +5V          OK   5.1V
(6) +12V         OK  12.0V
(7) H.T.         OK  285V
```

TRIGGER: Transmit trigger signal
SHF: Ship's head signal
AZIMUTH: Rotation angle signal
VIDEO: Radar video signal
+5 V: +5 V power supply
+12 V: +12 V power supply
HT: Transformer high-voltage power supply

5.3 Checking Voltages and Fuses

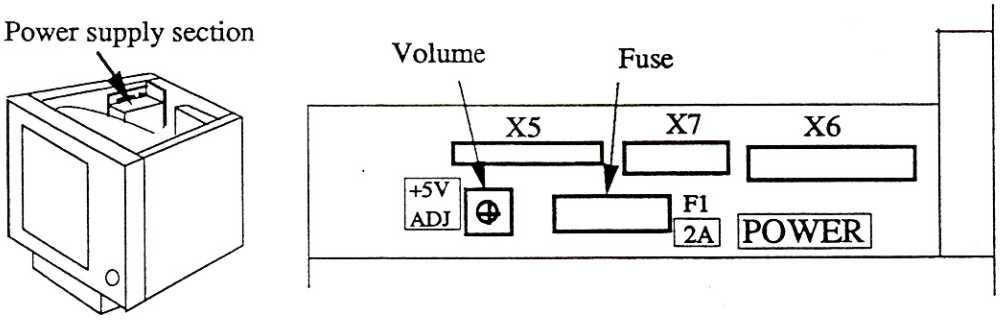
If a fuse blows, it indicates that there is a malfunction in the radar such as a short circuit.

(1) Fuses and output voltages

Location	Marking	Specification	Use	Test point	Voltage range
Display rear panel D CON board	F1: 15A MAIN	15 A	Main power	D CON board X3, X4	PC input voltage 10.8 ~ 40.0 V
Display rear panel	F3 HT	0.3 A	Transformer power supply	D CON board X11-10	+270 ~ 330 V at transmit
Display front panel	MOTOR (F2)	3.15 A	Scanner motor	D CON board between X11-5, - 6	22 ~ 26 V at transmit
Power supply section	F1 2A	2 A	+5 output	Power supply F1	5.0 ~ 5.2 V
PBG 500 board (CRT monitor)	F901	2 A	+12 V output	PBG 500 board F901	11.3 ~ 12.2 V

(2) Adjusting power supply output voltage

If the result of inspecting the +5 V power supply described in paragraph 5.2 is not in the range of 5.0 V to 5.2 V, adjust the power supply level shown below so that the value shown in the voltage table of paragraph 5.2 becomes 5.1 V.



Note: The adjustment also changes the +300 V and motor 24V ratio.

(3) Inspecting other voltages

Location	Voltage name	Use	Test point	Voltage range	Remarks
Display rear panel D CON board	HEATER	Magnetron heater	X7-2	5.7 ~ 6.9 V	0.55 A fixed current Heater burn out 10 V approx
	+12 V	CRT monitor Scanner IF, MOD	X7-3	+11.3 ~ 12.2 V	Different from +12 V inspected at (1)
	TUNE. O	Tuning voltage	X6-3	10 ~ 16 V	Supplied to front end via IF
	TUNE. M	Tuning meter	X6-4	3.5 ~ 4.5 V	From IF
	TUNE. R	Autotuning	X7-9	4.5 ~ 5.5 V	Supplied to IF
POWER (Power supply section)	+24 V	Tuning	Power supply X5-8	23.5 ~ 24.5 V	
	+12 VB	MAIN board	Power supply X5-2	11.5 ~ 12.5 V	+12 V of SYSTEM CHECK (para. 5.2)

APPENDIX A
SPECIFICATIONS

(1) General

Range	0.125 to 60 NM (RA725UA) 11 ranges
	0.125 to 96 NM (RA726UA) 11 ranges
Range resolution	Within 20 m
Minimum detection range	Within 20 m
Bearing accuracy	Within ± 1°
Bearing discrimination	3.0° 3-ftantenna
	2.5° 4-ftantenna
	1.8° 6-ftantenna
Range accuracy	Within larger of ±O.8% or 8 m
Warm up time	2 minutes
Environmental conditions	
Temperatlrre	scanner -25° to +55° C
	Display -15° to +55° C
Humidity	+35°C 95% RHmax.
Vibration	Within lG(Oto3000rpm)
Wmd speed	100 knots (51.4 d s)
DC power supply	
Voltage	10.8 to 40.0 Vdc
Power consumption	l20 W
AC power supply	Voltage AC power supply (option)
Voltage	100/110T220 Vac switchable
Power consumption	200 VA mm.

(2) Scanner unit

Antenna revolutions	24rpm ±20%
Antenna directivity	
3 ft:	Horizontalbeamwidth 2.5° Verticalbeamwidth 22°
	Sidelobes < ±10° : -22dBmax
	>=10° :-28dBmax
4ft.	Horizontal beam width 1.8±° Vertical beam width 22°
	Sidelobes < ±10° : -25dBmax
	>=10° :-3OdB max
6ft:	Horizontal beam width 1.2° Vertical beam width 22°
	Sidelobes <±10° : 25 dB max.
	>=10° :30 dB max.

APPENDIX A SPECIFICATIONS

Waveform and frequency	PON 9410±30 MHz
Peak output power	5 kW ±50% (RA725UA)
	10 kW ±50% (RA726UA)
Pulse width and	0.08 μs/2000 Hz
Repetition frequency	0.3 μs/1300 Hz
	0.6 μs/800 Hz
	1.2 μs/450 or 380 Hz (96 NM)

Range (NM)	0.125	0.25	0.5	0.75	1.5	3	6	12	24	48	60*1	96*2
ST OFF (μs)	0.08	0.08	0.08	0.08	0.08	0.3	0.3	1.2	1.2	1.2	1.2	1.2
ST ON (μs)	0.08	0.08	0.3	0.3	0.3	0.6	1.2	1.2	1.2	1.2	1.2	1.2

Notes:

*1 RA725UA

*2 RA726UA

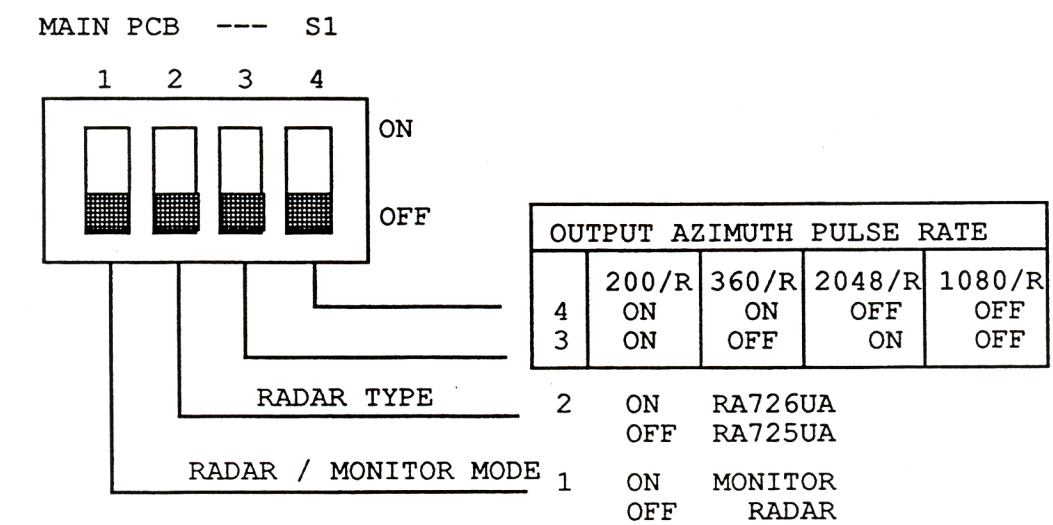
TR switching method	circulator + diode limiter
Noise factor	5.5 dB (MIC)
Center **frequency**	60 MHz (LOG amp)
IF bandwidth	15 MHz (0.08/0.3 μs/pulse)
	5 MHz (0.6/1.2 μs pulse)
Tuning method	Autotuning by CPU control and manual tuning
Interconnection cable	9CD-3292 10 m standard, 100 m max., 16-mm diameter, white

Range	0.125-0.5NM	0.75NM	1.5-60/96NM
No.	2	3	6

Variable range markers	One (VRM2 settable)
Range units	NM/KM/SM selectable
Floating	VRM2 movable from center

EBL	One (EBL2 settable)
Step	0.2°
Floating	EBL 2 movable from center
Display modes	HU (HS, NU, CU settable)
Off-centering (OFF-C)	60% forward and back all ranges
Guard zone	
Range setting	All ranges
Range width setting	0.4 NM fixed
Bearing setting	Any but in 6° steps
Alarm	Internal buzzer
External alarm	Radar input power supply voltage, 1 A max. current
Track recording	15, 30 seconds, 1, 3, 6 minutes and continuous
Setup functions	Operation check and each preset
External interfaces	
Radar signal outputs	
VIDEO	-0.3 V (noise) to -3 V (max.)/50 Ω
Bearing	1080 (200/360/2048) pulses/rev., TTL level
Heading	TTL level, negative edge
NMEA	2 ch internal
Compass interface	SIN/COS (±1 V), 10/12-bit serial

Dip switch selection



OUTPUT AZIMUTH PULSE RATE				
	200/R	360/R	2048/R	1080/R
4	ON	ON	OFF	OFF
3	ON	OFF	ON	OFF

2	ON	RA726UA
	OFF	RA725UA
1	ON	MONITOR
	OFF	RADAR

APPENDIX A SPECIFICATIONS

(4) External dimensions and weight

	WXDXH (mm)	(kg)
Display	326X474X372	16
scanner unit		
3-ft antenna	280X390X450 (revolution radius 517)	22
4-ft antenna	280 x 390 X 450 (revolution radius 673)	23
6-ft antenna	280 X 390 X 450 (revolution radius 985)	25

(5) Magnetic compass safe distances

	Master compass	Steering compass
scanner unit	2 m	1.4 m
Display unit	2 m	1.4 m

(6) Standard composition

Scanner unit	RB704A (RA725UA) or RB705A (RA726UA)	1
Interconnection cable	9CD-3292 (10 m)	1
Display unit	RF713A	1
Accessories	Scanner bolts	1 set
	Power cable (2.5 m)	1 pc.
	Key cap	6 pcs.
	Instruction manual	1
Spares	Fuses 15A	1 pc.
	0.3 A	3 pcs.
	3.15 A	3 pcs.
	2.0 A	2 pcs.
	Motor brushes	2pcs.

(7) options

Rectifier	RP113A (100/110/220 Vac input)
Rectifier	69-1E-A (100/110/115/120/125/200/ 220/230/240/250 VAC input)
Gyro interface unit	NZ2OA
Magnifier lense	RZ702A

APPENDIX B
INSTALLATION

This appendix describes how to install the radarand how to connect other equipment to the radar.

APPENDIX B INSTALLATION

B.1 Installation Materials

All the required installation materials are listed in the following table. Materials other than accessories should be supplied on-site.

Name	Qty.	Use	Remarks
9CD-3292 cable	1 pc.	10 m standard	Accessory
Power cord	1 pc.	2.5 m standard	Accessory
M12 nuts and bolts	4 sets	For mounting scanner	Accessory
M8 nuts and bolts	4 sets	For mounting display	
Grounding cable	1 pc.	For scanner	
Copper ground plate and cable	1 pc.	For display	
Main switch board	1 pc.	For ship power supply	
Shipboard power distribution materials	1 set		

B.2 Power Supply

To insure that the radar operates correctly, check the following items. Provide a stable power supply.

(1) Voltages and current consumption

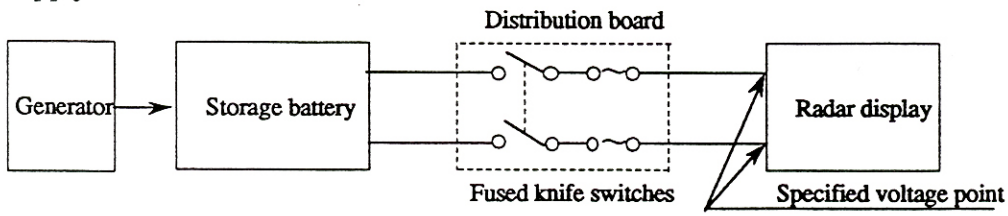
Type of power supply	Normal current	Max. surge current	Permissible voltage variation
12 Vdc	8.5 A max	20 A	10.8 ~ 40 V
24 Vdc	5.0 A max	10 A	
32 Vdc	3.5 A max	7 A	
		(Maximum instantaneous value)	

Note: When operating on an AC power supply, an optional rectifier is required.

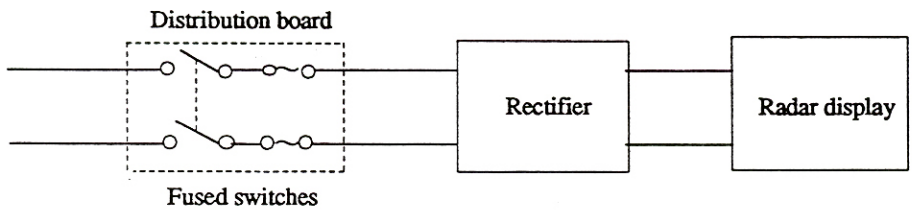
(2) Routing Power Supply

Route the cables via switches and fuses as shown below.

DC power supply



AC power supply



(3) Selecting cables

Although a 2.5-meter power cord is supplied as an accessory, if a 12-Vdc power supply is used, or an even longer cable is required, select the correct cable from the following table.

	Voltage	Cable conductor cross section	Cable max. length	Cable diameter
Connection to display	12 Vdc	3.5 mm²	3 m	ø15
		6.0	5	
	24 Vdc	2.0	6	
		3.5	10	
	32 Vdc	2.0	8	
		3.5	15	
Connection to rectifier	AC	2.0	30	ø20

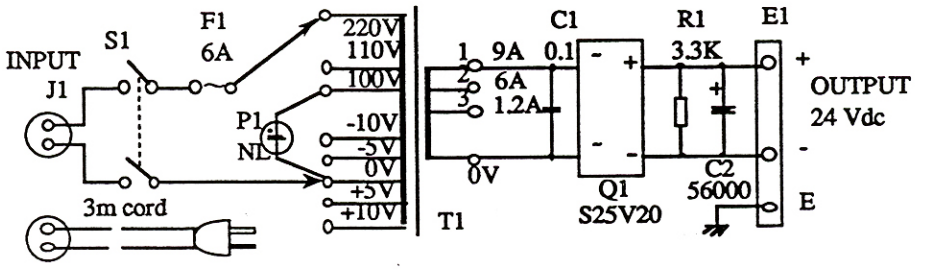
(4) Checking battery

When operating on direct current, a faulty battery or large voltage fluctuation may cause a malfunction. In addition, check the distribution wiring carefully.

(5) Changing rectifier voltage input

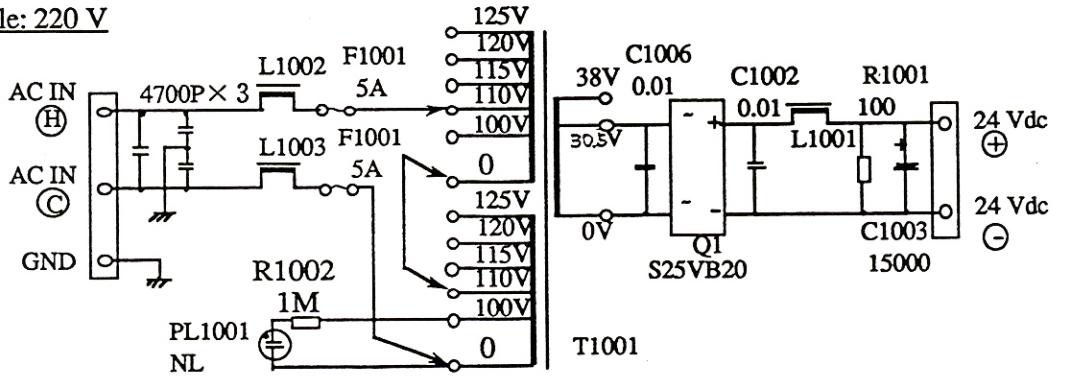
(A) When changing the voltage input of the RP113A Rectifier, change the connections to the transformer primary winding as shown in the diagram below. The input voltage plate has 100 V marked on the front side and 220 V marked on the reverse side. When the voltage is changed to 220 V, remove the plate screws and reverse the plate.

Example: 220 V



(B) When changing the voltage input of the 69-1E-A Rectifier, change the connections to the transformer primary winding as shown in the diagram below. The primary windings must be parallel for 125 Vac or below, and must be serial for 200 Vac or above.

Example: 220 V



APPENDIX B INSTALLATION

B.3 Installation Site

(1) Scanner

The detection ability of shipborne radar changes greatly with the scanner location. The perfect mounting location is as high above the keel line as possible with no obstructions in all azimuthal directions. In practice, all ships are subject to various limitations, and the items listed below must be considered before selecting the mounting location.

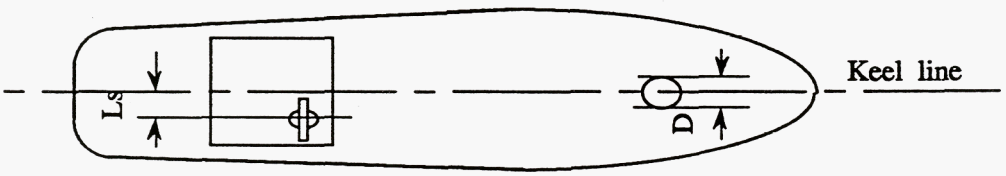
(A) The maximum detection distance increases with the height of the scanner installation location. Install the scanner as high as possible after considering the ship construction and scanner maintainability.

(B) If the scanner is installed at the same height as part of a funnel or mast, the radar pulse will be blocked resulting in a blind spot or ghosting; avoid this type of installation location if at all possible.

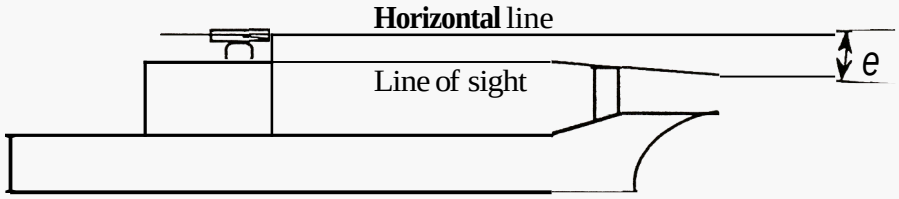
(C) To avoid formation of blind spots or ghosting, install scanner closer to the ship's bow than any other obstacle like a mast or funnel.
If it is impossible to avoid obstacles in the bow direction because of the ship construction, install the scanner off the keel line or elevate the position so that a dip angle can be taken.

(D) • **Method for installing scanner off keel line**
Displacing the scanner to the starboard side of the ship moves the blind spot to the port side on the radar display and gives a clear view in the bow direction. The displacement can be found from the following equations.

Ls = 0.4 R + D/2 [m] .....R < 15 m
Ls = 0.025 R + D/2 [m] .....R ≧ 15 m
where,
Ls = displacement from keel line
D = diameter of obstacle on keel line
R = distance from scanner to obstacle



• **Method calculating dip angle**
Install the scanner as high as possible so that a sufficient dip angle (θ) can be obtained between the line of sight between the scanner and obstacle, and a horizontal line. To prevent blind spots in the medium to long range, the dip angle should be greater than 5° . Objects below the line of sight from the scanner to the obstacle cannot be detected.



(E) Install the scanner where it will not be affected by smoke of hot gas from the funnel or by heat from spot lights, etc.

(F) Keep the antenna as far away as possible from direction-finding equipment and VHF antennas.

(G) Install the scanner within the 10-meter length of the standard connection cable. If this is not possible, the maximum length is 100 m.

(2) Display

The display unit can be mounted on a desk, a bulkhead or from the ceiling. Determine the best location by taking the navigational and shipboard operations into account as follows:

(1) When the operator looks up from the radar, she/he must be able to see the bow.
(2) Water must not splash on the display when a nearby window or door is open.
(3) The installation location must be well ventilated and fiee from vibration.
(4) There must be sufficient clearance for servicing and inspection.
(5) The location must be the minimum safe distance from the magnetic compass to avoid disturbing the compass.

Compass safe distance	Master compass	Steering compass
Scanner	2.0 m	1.4 m
Display	2.0 m	1.4 m

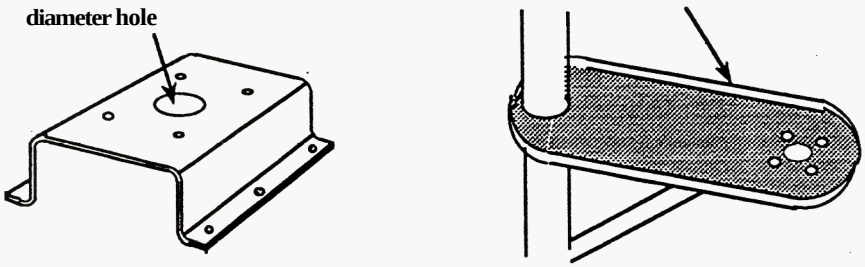
(3)Rectifier (option)

Install the rectifier in a drywell-ventilated location close to the display.

B.4 Mounting Scanner

(1)Bracket

Use a bracket like the two designs shown below in which water cannot accumulate.

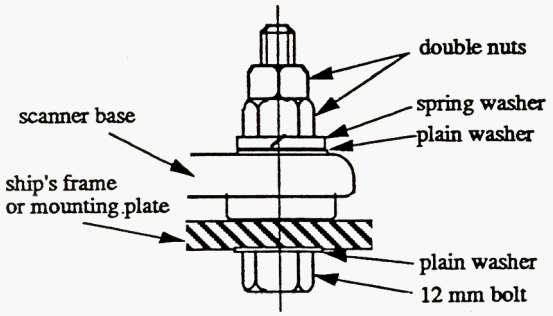


Notes:

1. When the radar mast amounting bracket has a curvature of more than 2mm, repair it or use spacers.
2. The mounting position should besuch that the cable entrance faces the ship's stern.
3. The bracket thickness should be 5 to 12 mm.
4. Refer to the diagram of the external appearance in the supplied diagrams for the mounting dimensions.

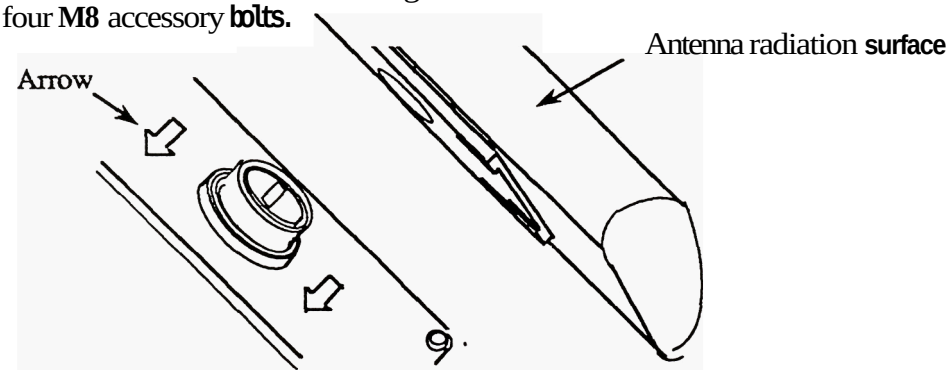
(2) Scanner fixings

Use the accessory nuts and bolts to mount the scanner as shown in the diagram below.



(3) Antenna

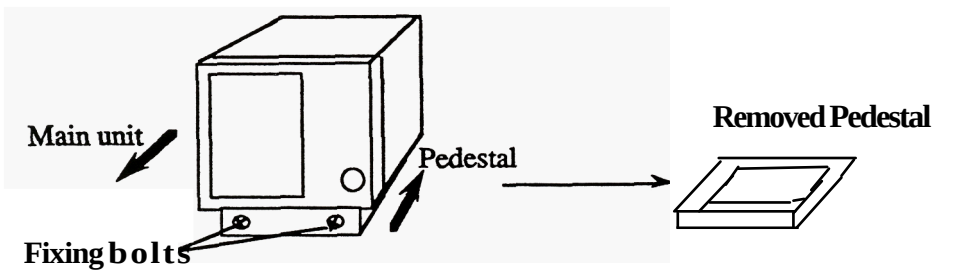
Remove the protective cap covering the rotary coupler on the top of the scanner. Match the antenna radiation direction to direction of the **arrow** markings on the rotation base and fix the antenna in position **using** the four **M8** accessory **bolts.**



B.5 Mounting Display

(1) Desktop

1 Remove the two fixingbolts that secure the pedestal from the display.



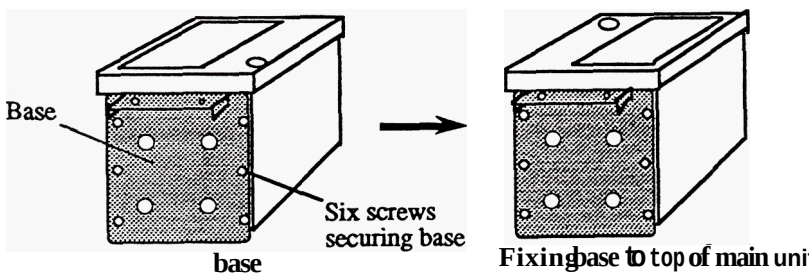
2 Fix the pedestalto the desktop using fourM8 bolts or eight 5-mm self-tapping screws.
3 Fit the main unit into the pedestal and secureit with the two fixing bolts.

Notes:

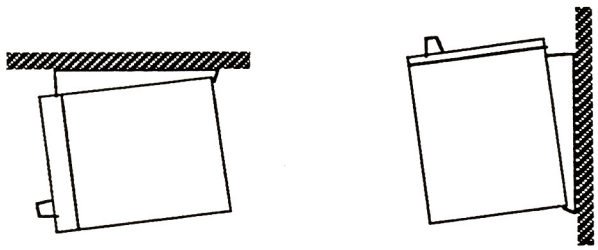
1. Refer to the diagramshowingthe externalappearance for the installation method.
2. The pedestalhas height-adjustment nuts; select the best angle.

(2) Overhead or Wall

1 Remove the pedestal andthe three covers of the main unit.
2 Remove the six screws fixing the base to the bottom of the main unit and remove the base.
3 Install the removed base onthe top of the main Unit



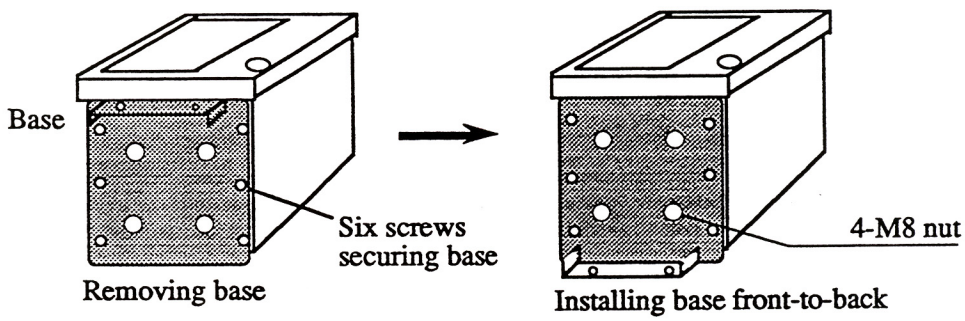
4 Reverse-install the three removed covers (top cover on bottom).
5 Secure the pedestal to the ceiling or wall. Fit the main unit into the pedestal and secure it with the two removed bolts.



Ceiling mount Wall mount

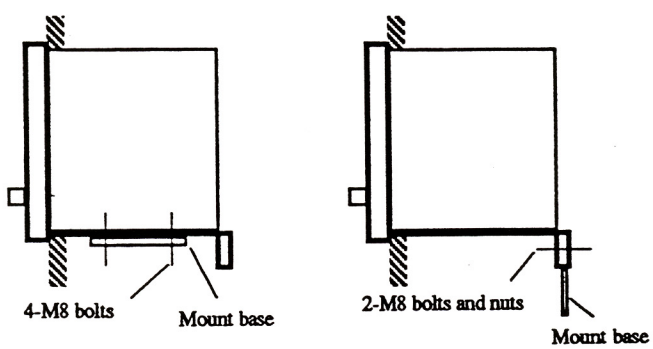
(3) Flush

1 Remove the base in the same way as for the ceiling or wall mount; it is not necessary to remove the covers.
2 Reverse the base plate (back-to-front).



Removing base Installing base front-to-back

3 Cut a 321×313-mm opening in the flush-mount surface; use the four M8 bolts for fixing the base to fix a mount base to the ship bulkhead.
4 Insert the main unit through the opening in the flush-mount surface and secure it to the mount base.



Note: Refer to the diagram of the external appearance for the mount base installation dimensions.

B.6 Installing Scanner Cable

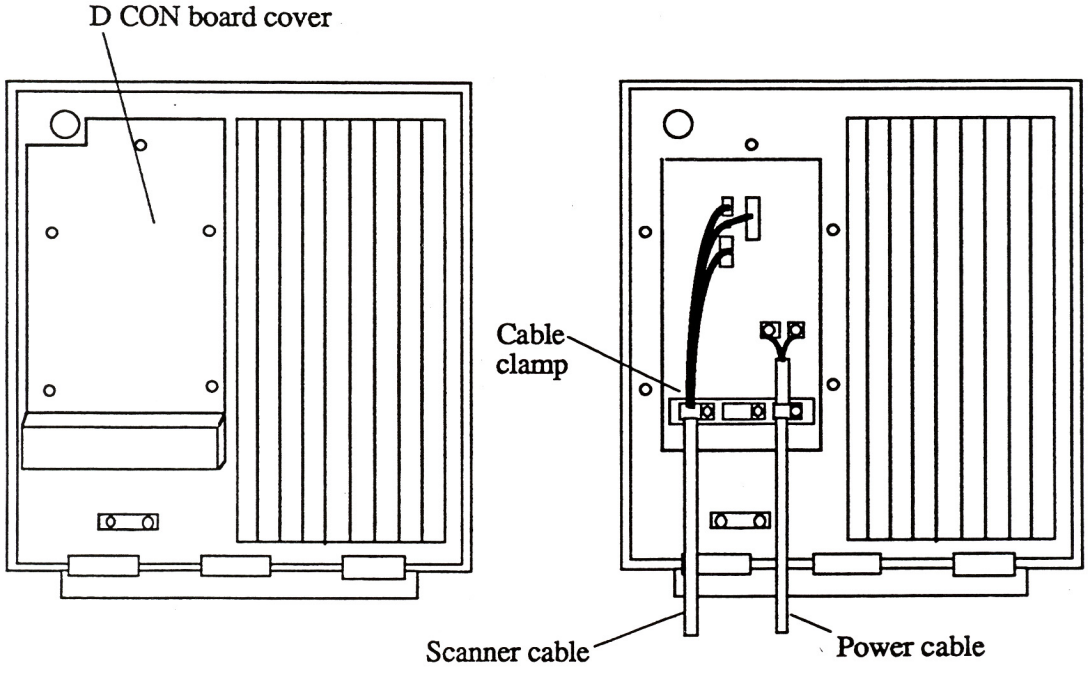
(1) Routing

Note the following points when routing cables.

(A) Avoid laying cables near cables to other electrical equipment, particularly, power cables and coaxial cables.
(B) Leave an extra loop of cable near the entrance of the cable to the display unit so the display unit can be lifted out for easy installation and maintenance.
(C) There are connectors at the display unit end of the cable. If the cable must be passed through a narrow hole, run the cable from the display unit side, not from the scanner side. If the cable must be run from the scanner to the display for unavoidable reasons, wrap the connector in vinyl tape, or remove the cable from the connector and cut the connectors from the cable and fix a new connector after laying the cable. (If you have to cut the cable, use the connector set. Tool YC-16 is required for reattaching the connector to the cable.)
(D) When running the cable over bulkheads or walls, secure it with cable bands about every 40 cm.

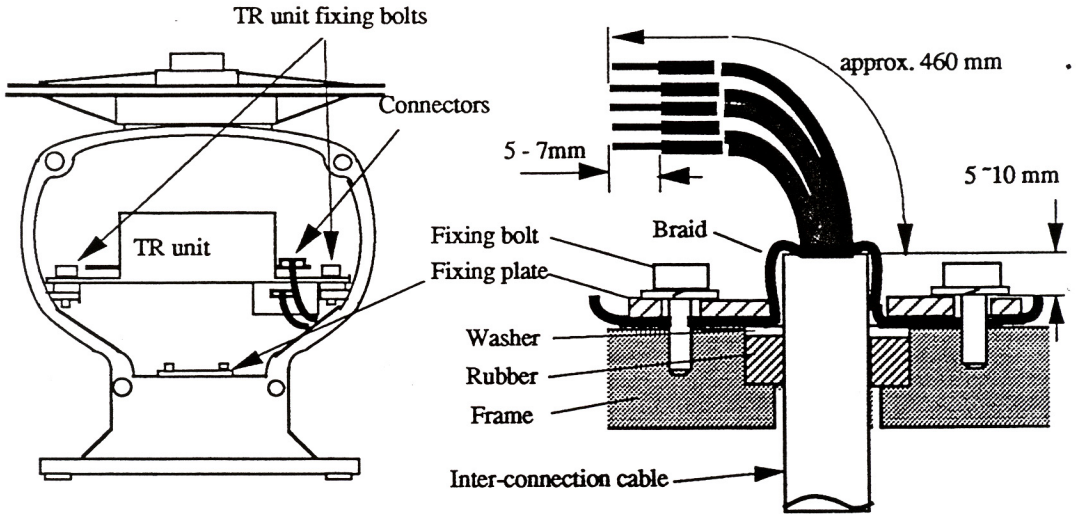
(2) Connecting to display

1 Remove the cover of the D CON board (interconnection board) on the rear panel of the display unit and connect the cable to connectors X5, X6, and X7.
2 Secure the cable with the cable clamp and reinstall the cover.

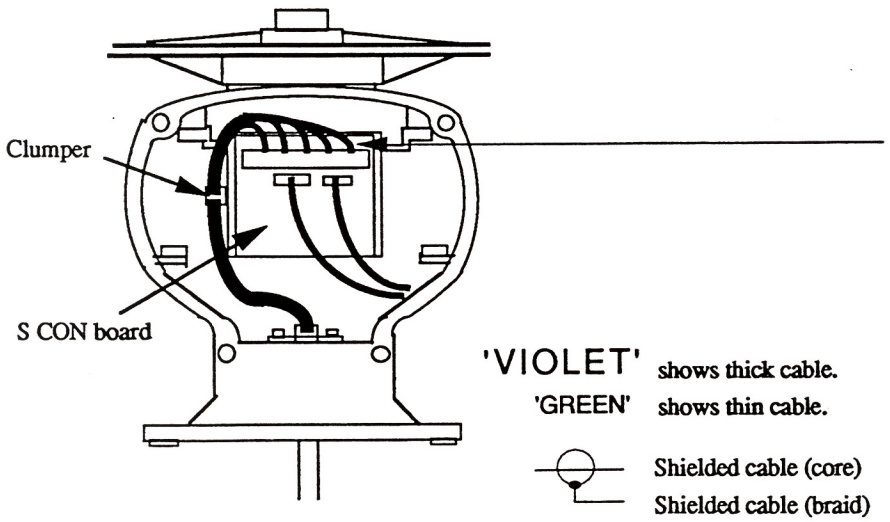


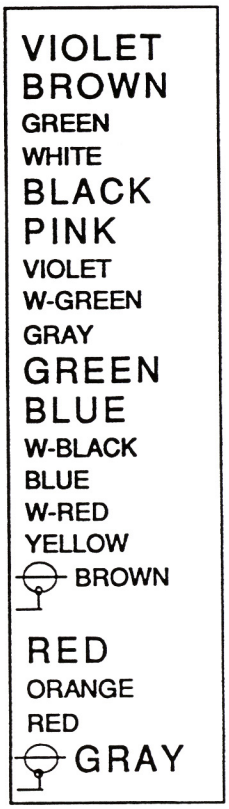
(3) Connecting to Scanner

1 Use a T-wrench to remove the front and back covers of the scanner unit.
2 Remove the two bolts securing the transceiver; pull out the transceiver after removing the two connectors.
3 Remove the four bolts securing the fixing plate at the cable entrance.
4 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.



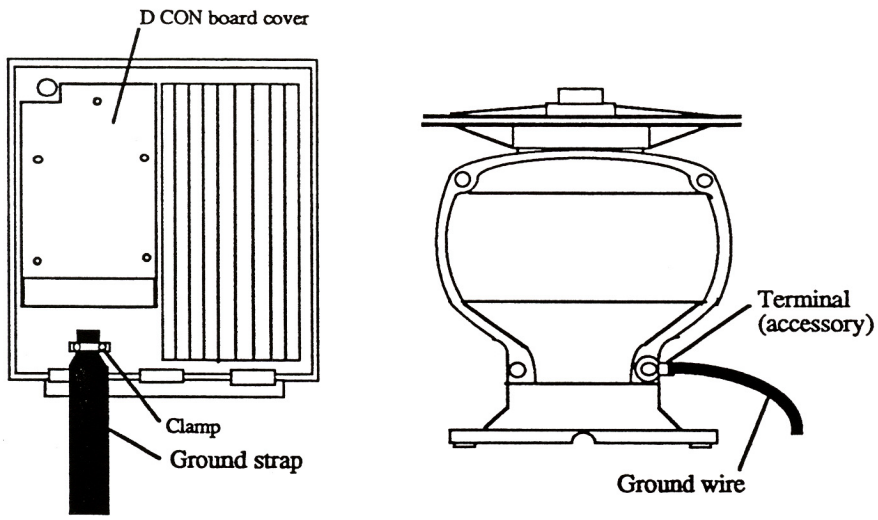
5 Return the transceiver to its original position and secure it with the removed bolts.
6 Use a small flat-bladed screwdriver to connect the cable to the terminal block.
7 Secure the cable clamp as shown in the following diagram.
8 Refit the scanner covers.
Take care not to pinch the cable when refitting the covers.





B.7 Grounding

To prevent the possibility of an accidental electric shock and the presence of unwanted RF radiation, the display unit must be grounded. The scanner unit must also be grounded if it causes interference with radio equipment.

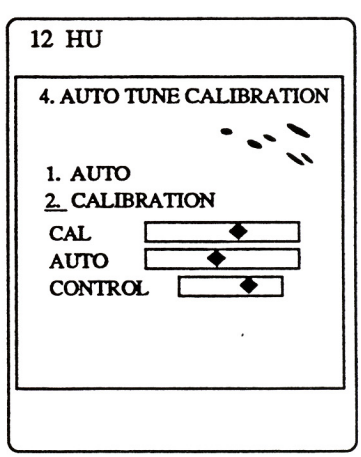


B.8 Adjustment

After completing the installation and adjustments, turn the power on, perform the basic operations described in paragraph 2.2 and check that there is no abnormality. Finally, make the following adjustments.

(1) Adjusting autotuning circuit

This adjusts the autotuning circuit to make the radar operation the best position.Although the adjustment is not normally necessary, it should be performed as follows if the sensitivity gets bad or the tuning slips.

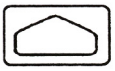


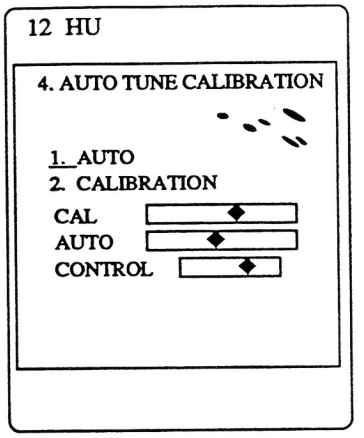
1 Select several images that are weak but stable at the 6 ST range or the range above 12 NM.

2 Select (4) AUTO TUNE CALIBRATION in the setup menu as described in paragraph 3.2.

3 Press  key and underline the numeric value 2.

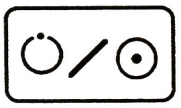
4 Turn the control knob while watching the screen so that the display becomes the best possible. The diamond (◆) mark in the CAL field moves during the process.

5 Press  key and move the underline to the numeric value 1.



6 The diamond (◆) mark in the AUTO field starts moving and automatic calibration starts so that the tuning point becomes the CAL value set in (step 4) above.

7 When the diamond marks in the AUTO field, stops at about the same position as that in CAL field, CALIBRATION COMPLETED is displayed on the bottom of the screen and calibration is completed. In addition, the diamond mark in the CONTROL field will have moved slightly while performing the step 6; this indicates the calibration value.

8 Press TX  to return to the radar screen.

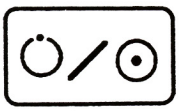
(2) Adjusting range

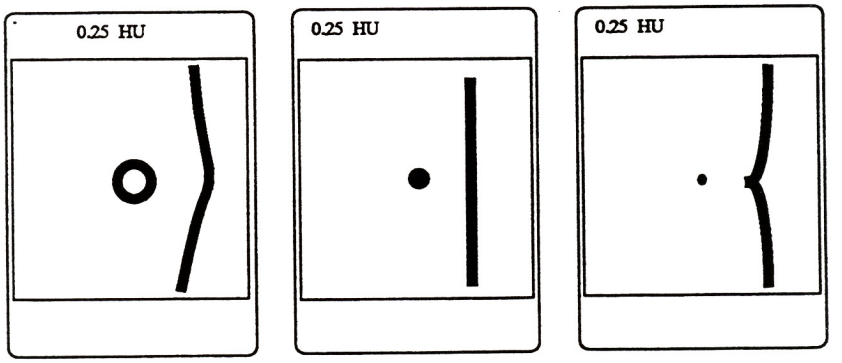
This adjustment matches the range on the radar screen to the true range.

1 At the 0.25 NM range, set STC and FTC to 0 and adjust GAIN to about 10 so that a circular auto-pulse can be observed clearly.

2 Start the Setup mode and select (5) TIMING ADJUSTMENT.

3 Turn the control knob to the point where the black part around the center of the auto-pulse just disappears. In addition, if there is a straight target like a bridge or flood embankment, turn the control knob so that the target becomes a straight line on the screen.

4 Press TX  to return to the radar screen.



(a) Too far (b) Correct (c) Too shrunk

(3) Adjusting heading

This adjustment matches the heading on the radar screen to the true heading.

• Measuring error

When the ship's head can be swung, find a clearly-observable small target in the head direction and measure the bearing with the ship's compass. Measure the bearing on the radar screen and find the error against the compass bearing. If the ship's head cannot be swung, proceed as follows:

1 Find a target that can be measured against the ship's head.

2 Measure the bearing of the target from the ship's head using the magnetic compass. This bearing is θ_c.

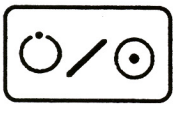
3 In the HU mode, measure the bearing to the same target using the EBL. This bearing is θ_R.

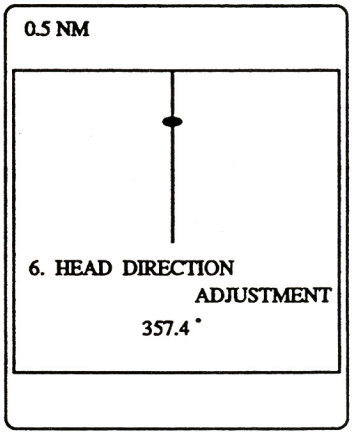
4 Find the bearing error from the following equation.
When $\theta_c > \theta_R$: $\theta_c - \theta_R$
When $\theta_R > \theta_c$: $360 - (\theta_R - \theta_c)$

• Adjusting

1 Select (6) HEAD DIRECTION ADJUSTMENT in the setup menu described in paragraph 3.2.

2 Turn the control knob and match the value displayed on the screen to the value of the bearing error calculated above.

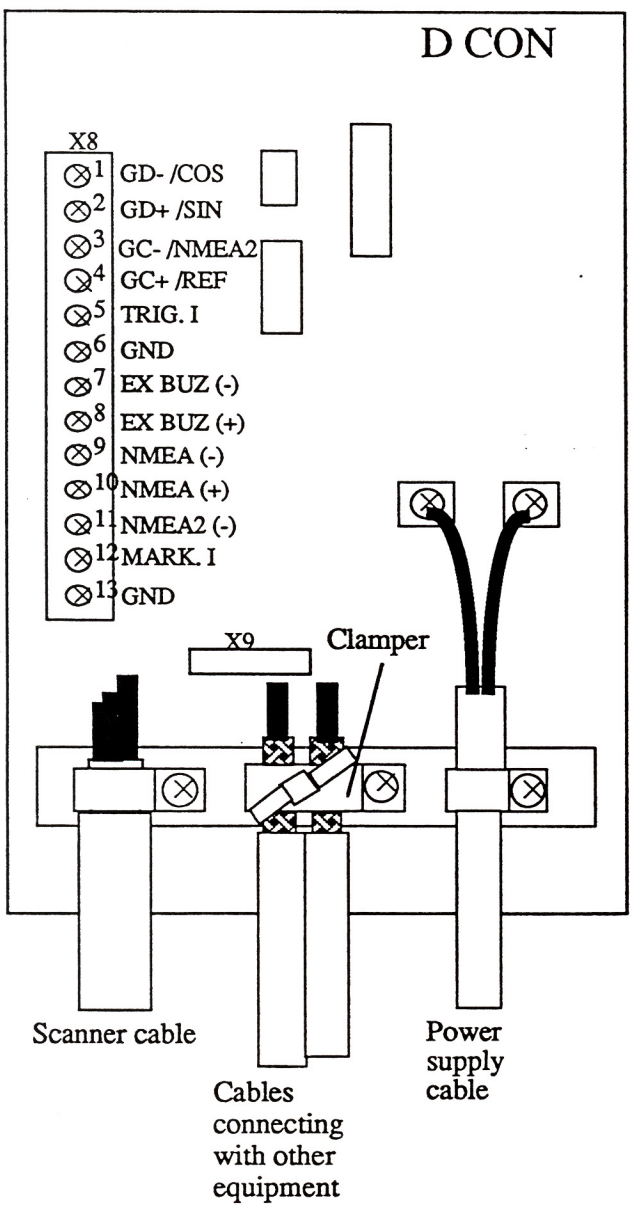
3 Press the TX  key to return to the radar screen.

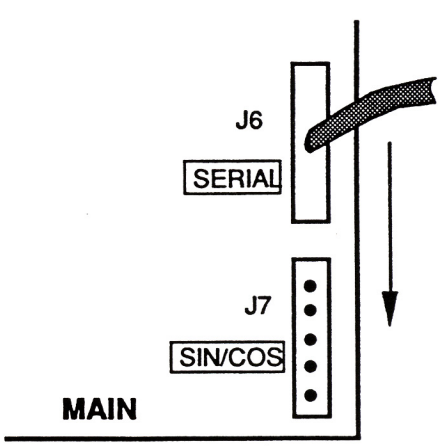


B.9 Interfacing Other Equipment

B.9.1 Cable Clamping

The cables from equipment such as GPS are connected to the D CON pcb board. Please use a shielded cable for the connection and fix the shield conductor to the chassis with a clamper. If the clamper is too loose to fix the cables, use a cable band to fix them as shown in the left figure, or insert a spacer between cable and clamper.





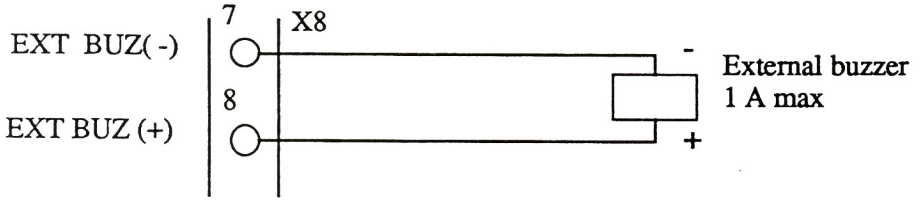
B.9.2 Magnet Compass Connection

When the magnet compass with SIN/COS signals is connected, disconnect the cable connected to J6 of the MAIN board and connect it to J7 of the MAIN board. It is connected to J6 at factory shipment as shown in the above right figure.

B.9.3 Connection of Other equipment

(1) External guard zone alarm

The ship's power supply is fed to an external alarm and the power supply is controlled intermittenly. Use an alarm with the same voltage specification as the voltage input to the radar. The maximum permissible current is 1A.
Make the connection at X8 of the DC CON board on the rear of the radar.



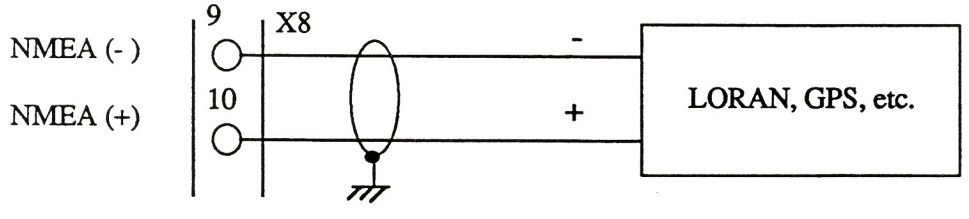
Note: If the current exceeds 1 A, the protective circuit will operate and the power is not supplied.

(2) NMEA interface

This radar has an NMEA interface as standard, so latitude, longitude, and waypoint information, etc. from navigational aids like GPS and LORAN can be input.
The receive format is shown below.

Latitude and longitude:	GLL, GGA
Speed:	VTG
Course:	VTG, HDM, and HDT
Waypoints:	BPI, BWC, BER and BEC
Cross track error:	XTE

Make the connection to the X8 terminal on the D CON board on the rear of the radar.



Notes:

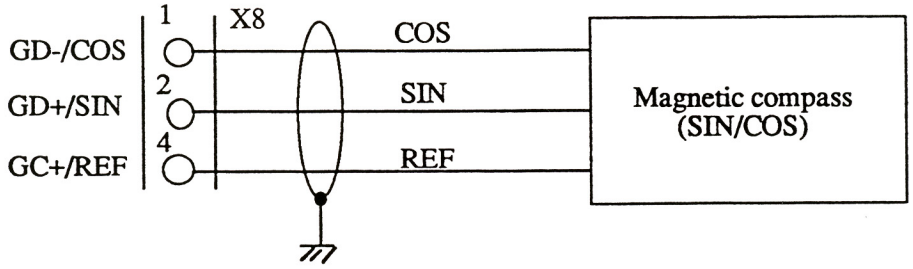
1. Shielded cable must be used for the connection; insure that the shield is clamped so that it is connected to the frame of the display.

2. NMEA is provided with one more channel but note the following conditions.

Format:	HDM and HDT bearing data only
Signal status:	For no parity and 1 stop bit; not received if not interval of 1 or more bits between characters
Connection location:	X8-3 of terminal block (GC-/NMEA 2(+)) and X8-11 (NMEA 2(-))

(3) Magnetic compass (SIN/COS)

A magnetic compass that outputs a SIN/COS signal can be connected.
Make the connection to the X8 terminal on the D CON board on the rear of the radar.

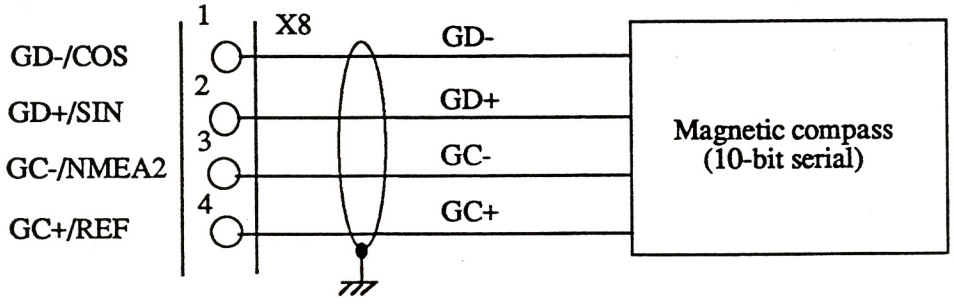


Notes:

1. Shielded cable must be used for the connection; insure that the shield is clamped so that it is connected to the frame of the display.
2. The input signal voltage is ±1 V as standard.
3. Remove the plug (X14) connected to connector J6 (SERIAL) of theMAIN board and connect to J7 (SIN/COS).
4. There is no magnetic error calibration function.

(4) Magnetic Compass (10-bit serial)

A magnetic compass that outputs a 10-bit serial signal can be connected.
Make the connection to the X8 terminal on the D CON board on the rear of the radar.



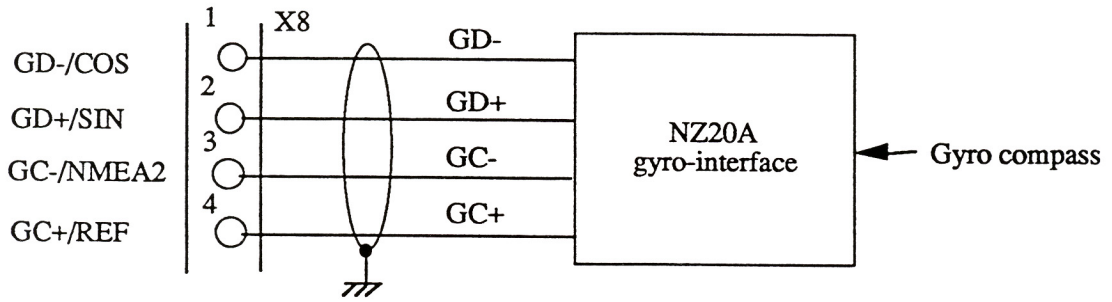
GD: 10-bit serial bearing data
GC: Clock

Notes:

1. Shielded cable must be used for the connection; insure that the shield is clamped so that it is connected to the frame of the display.
2. Check the connection of the plug (X14) connected to connector J6 (SERIAL) of the MAIN board.

(5) NZ20 gyro-interface

An NZ20 that outputs a 12-bit serial signal can be connected. Make the connection to the X8 terminal on the D CON board on the rear of the radar.



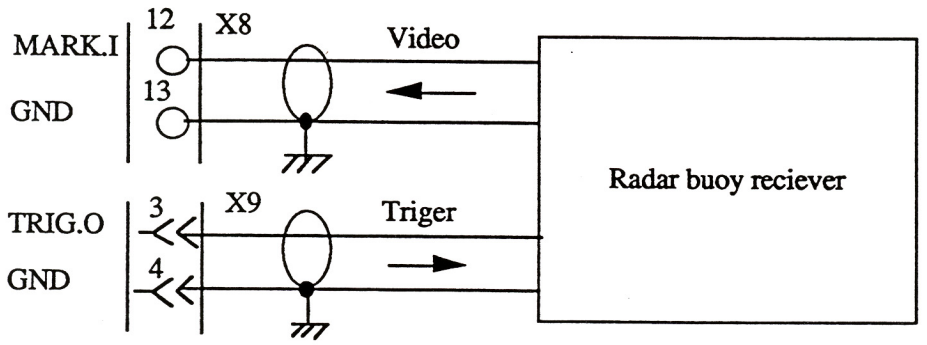
GD: 12-bit serial bearing data
GC: Clock

Notes:

1. Shielded cable must be used for the connection; insure that the shield is clamped so that it is connected to the frame of the display.
2. Check the connnection of the plug (X14) connected to connector J6 (SERIAL) of the MAIN board.

(6) Radar buoy

It is possible to send a transmit trigger signal to a radar buoy and to display the received signal on the radar screen. Make the connection to the X8 terminal on the D CON board on the rear of the radar.



B.10 EMI Countermeasures

(1) At radar installation

Although each unit of the radar as well as the interconnection cables are shielded, if the radar is installed too close to other equipment, there is a possibility of interference with radio equipment like LORAN, OMEGA, DSB and SSB that have high-sensitivity receivers if the equipment is not grounded properly. Take the following countermeasures when installing the radar to prevent this interference.
In addition, if the above radio equipment is in operation, while the radar is being installed, check that the radio equipment is not affected by interference.

(A) The radar display unit, scanner unit, and interconnection cables should be located as far as possible from the radio main unit, power supply, antenna coupler, and antenna. In particular, it is very important to maximize the distance of each unit of the radar and interconnection cables from the radio power supply, antenna coupler, and antenna.

(B) Routing power cables
The power supplies for the radar and the radio should be separate and as close to the battery as possible.

(C) Grounding
All equipment should be securely grounded to the nearest hull plate with a copper plate or braided strap.

(2) Countermeasures if EMI occurs

(A) Check the grounding of each piece of equipment. The EMI can sometimes be reduced by not grounding equipment that does not require grounding like radar and the LORAN main unit.

(B) Check possible interconnection between equipment and power supplies.
- Separate the radar display and radio.
- Separate the radio power supply and the radar display unit as well as interconnection cables and scanner unit.
- Separate the radio antenna coupler and antenna from the radar interconnection cables and scanner unit.

(C) Radio frequencies (Reference)

Radio	Frequency	Remarks
LORAN A	1850 kHz, 1950 kHz	
LORAN C	100 kHz	
OMEGA	10.2 kHz, 11.33 kHz, 13.6 kHz	
DECCA	70 kHz ~ 130 kHz	
NNSS	149.88 MHz, 399.968 MHz	
SSB, DSB	1 MHz ~ 150 MHz max, depends on type	27/40 MHz small ships
Receivers	10 kHz ~ 1 GHz max, depends on type	
FAX	2 MHz ~ 25 MHz	

APPENDIX B INSTALLATION

APPENDIX C
INTERPRETING RADAR IMAGES

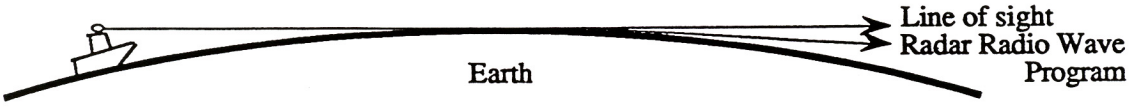
Radar images displayed on a radar screen vary greatly with the target configuration, weather, and operation method. You must train yourself to understand the characteristics of radar and the correct operating methods as well as to interpret the images on the screen correctly.

C.1 Propagation of Radar Radio Waves

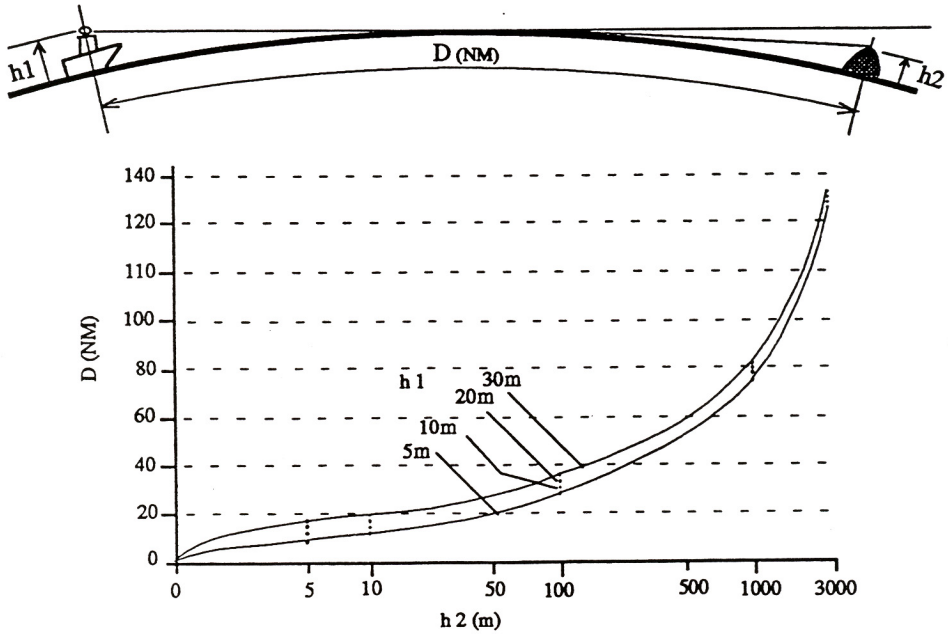
Radar radio waves are bent slightly during their propagation along the curvature of the earth. The bending depends on the density of the air, etc. Under normal propagation, the radar horizon, D, is about 6% longer than the visual horizon. It is expressed by the following formula.

$$D\ (NM) = 2.22\ (\sqrt{h1} + \sqrt{h2})$$

where,
h1 = antenna height in meters
h2 = target height in meters

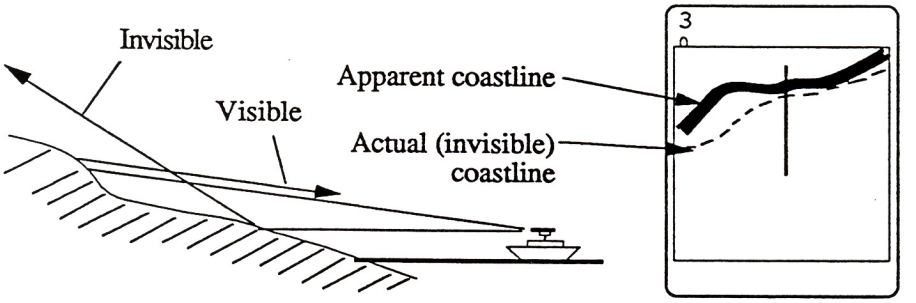


The diagram below shows the calculation when the antenna height, h1, is 5, 10, 20 and 30 m. The possible detection distance for target height can be found from this diagram. However, neither the above formula nor the calculation diagram show the maximum detection distance directly. In addition to the above considerations, the maximum detection distance is greatly affected by the transmission output power, the antenna gain, the target cross-sectional area, the interference between the direct wave, and reflected wave from sea, etc. In particular, the maximum detection distance is greatly reduced when the target is an FRP vessel.



C.2 Echo Strength and Incident Angle of Target

The strength of a returning radar echo from a target is not only greatly affected by the target distance and height above sea level, but is also dependent on its material and shape. Objects like FRP and wood vessels as well as objects with a low incident angle are very difficult to detect. Consequently, it is necessary to exercise caution when interpreting radar images from objects with a low radar reflectivity such as FRP and wood vessels, or with a low angle of incidence such as sandy beaches, river mouths and shoals, or with a low cross-sectional area like lighthouses. In particular, images from objects inland from the coastline may seem like the coastline and you must take great care not to make a mistake in interpreting such images.



C.3 Shadow Zones

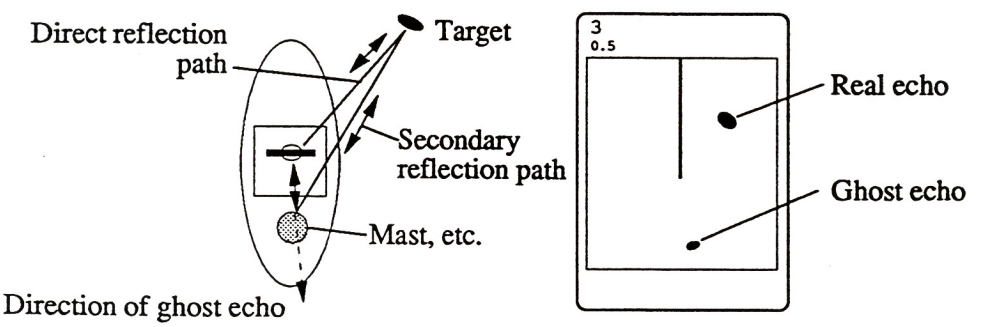
Radar radio waves propagate almost linearly in much the same way as light waves. Close objects like a funnel, mast, or derrick post, or a near-range high target or mountain can cause a radar shadow. The shadow may be total or partial, and in extreme cases can have an effect over long distances so that no radar image is displayed in their presence. Shadows caused by funnels and masts, etc. can be discovered when the antenna is installed and the effect can be minimized by changing the antenna location. Targets in shadow zones can be hard to see so exercise caution.

C.4 False Echoes

False images may appear on a radar screen from objects that are not really present in the apparent direction or location. There are several types of false images and the types and causes are explained below.

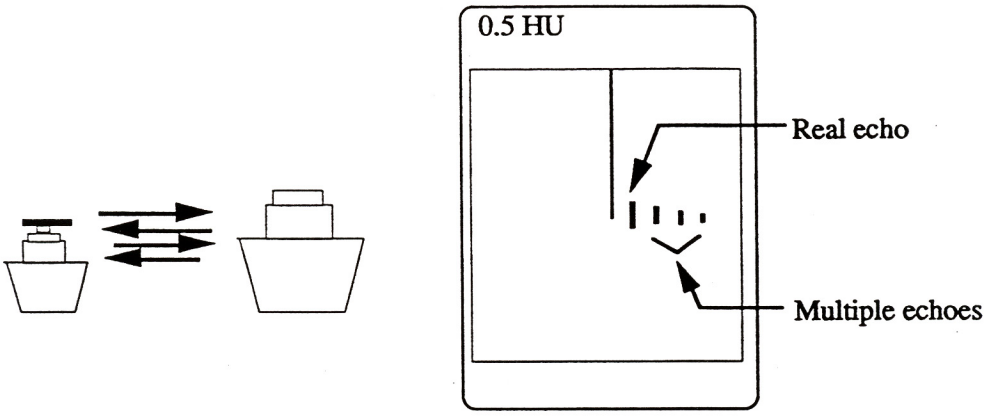
(A) Ghost echoes

A large target at close range may sometimes appear as two images in separate directions on the screen. One image is a real echo and the other is a ghost echo caused by secondary reflection of radar pulses by funnels and masts, etc. The real image appears at the true range and bearing while the ghost image appears at a false range and bearing. Care is needed in interpreting these images.



(B) Multiple echoes

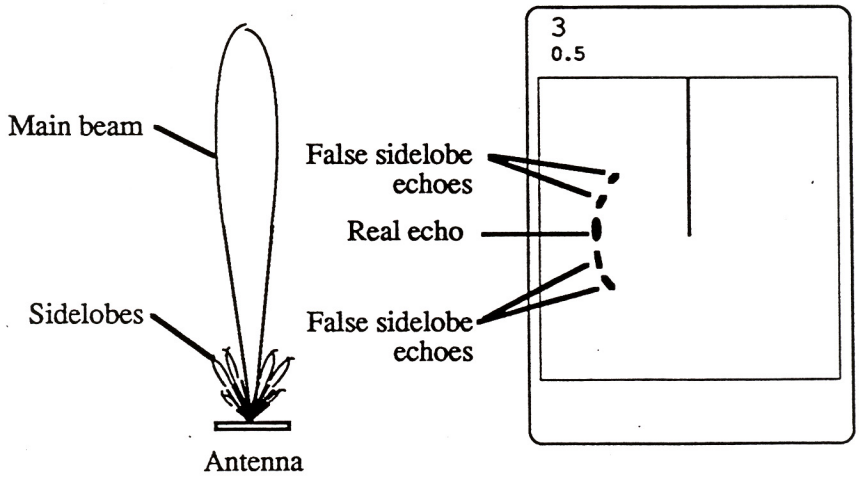
When there are vertical reflective surfaces at close range, for example, when your ship passes a large ship, your radar pulses will bounce back and forth repeatedly between the two vessels resulting in a number of equidistant images appearing on the radar screen. These are called multiple echoes. In this case, the true image is the one at the closest range. Multiple echoes are easily recognized because they disappear as the ships move apart or change bearing.



(C) Sidelobe echoes

The beam radiated from a radar antenna consists of a main beam and a number of side lobes. The energy of the side lobes is low, so they are not affected by long-range targets, but highly-reflective targets at close range can cause a number of multiple images lying on a broken arc at the same range.

Note: With a large close-range target, ghost echoes may also be formed in a similar broken arc by masts, etc.

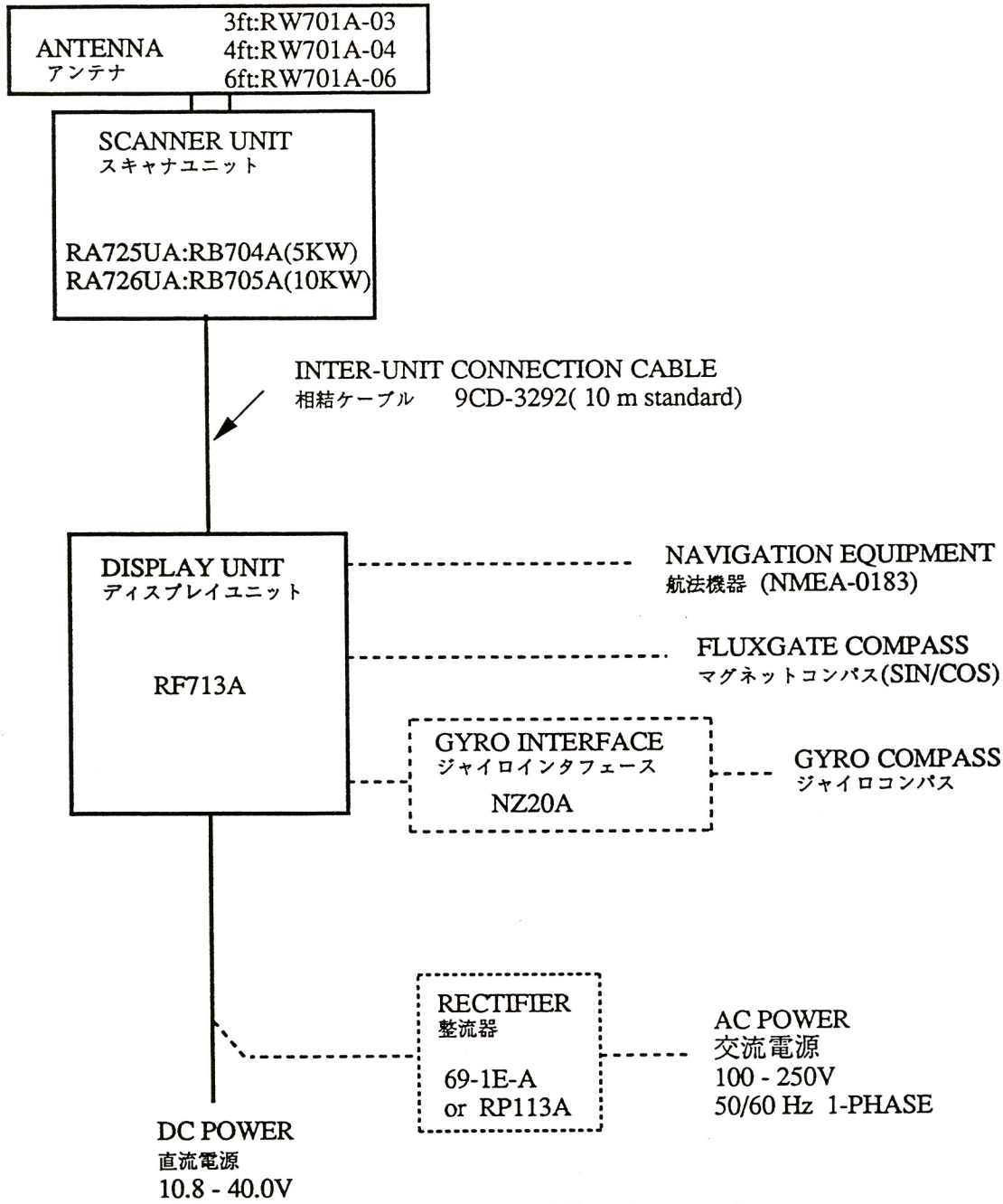


(D) Ducted echoes from long-range targets

An atmospheric phenomenon known as a radio-wave duct can be caused by air at high temperature and humidity. Radar waves can propagate over abnormally-long distances in such a duct. In such a case, long-range targets may appear as if they are at close range. This is attributable to the fact that the echo from a long-distance target is delayed beyond the transmission repetition cycle so the echo appears in the next cycle. These ducted echoes disappear when the range is switched so they can be recognized easily.

C.5 Radar Interference

When another radar is operating nearby at the same frequency, the transmitted radar pulses from the other radar may appear on your screen as interference. The form of the interference is not constant but usually it takes the form of curves or random interference. When the radar interference suppression ON/OFF key of this radar is not preset, the radar interference suppression function continuously.



Note : Dotted lines denote options.
点線の部分はオプション

RA725UA/RA726UA
GENERAL SYSTEM DIAGRAM
総合系統図

24W140914

9CD-3292 CABLE			
SCANNER UNIT S CON PCB	CORE CONDUCTOR COLOR		FUNCTION
E1-1	CX	BRAID	GND
2	CX	GRY	VIDEO
3	12/0.18	RED	T.METER
4	12/0.18	ORG	TUNE
5	37/0.26	RED	+12V
6	SHIELD	BRAID	GND
7	SHIELD	BRN	TRIG
8	12/0.18	YLW	P/S(M2)
9	12/0.18	WHT/RED	TUNE R.
10	12/0.18	BLU	Spare
11	12/0.18	WHT/BLK	Spare
12	37/0.26	BLU	GND
13	37/0.26	GRN	MAG(H)
14	12/0.18	GRY	P/S(L)
15	12/0.18	WHT/GRN	P/S(M1)
16	12/0.18	VLT	GND
17	19/0.18	PNK	MOD.S
18	37/0.26	BLK	GND
19	12/0.18	WHT	SHF
20	12/0.18	GRN	AZIMUTH
21	37/0.26	BRN	MOTOR (+)
22	37/0.26	VLT	MOTOR (-)
CABLE BRAID MUST BE GROUNDED			

CORE CONDUCTOR COLOR		FUNCYION	WHEN CONNECTOR:DOOR
CX	BRAID	GND	X5-1
CX	GRY	VIDEO	2
12/0.18	WHT/GRN	P/S(M1)	3
12/0.18	GRY	P/S(L)	4
SHIELD	BRAID	GND	5
SHIELD	BRN	TRIG	6
12/0.18	YELLOW	P/S(M2)	7
			8
12/0.18	GRN	AZIMUTH	9
12/0.18	VLT	GND	X6-1
12/0.18	WHT	SHF	2
12/0.18	ORG	TUNE	3
12/0.18	RED	T.METER	4
37/0.26	BLU	GND	X7-1
37/0.26	GRN	MAG (H)	2
37/0.26	RED	+12V	3
37/0.26	BLK	GND	4
37/0.26	BRN	MOTOR (+)	5
		MOTOR (+)	6
37/0.26	VLT	MOTOR (-)	7
		MOTOR (-)	8
12/0.18	WHT/RED	TUNE R.	9
19/0.18	PNK	MOD.S	10
BRAID MUST BE GROUNDED			

SCANNER UNIT

DISPLAY UNIT

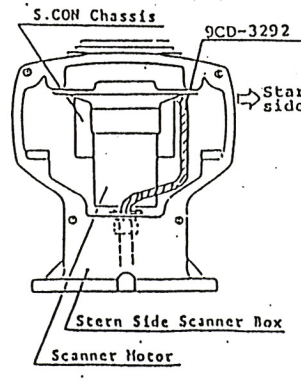
DISPLAY UNIT E201	LINE COLOR	FUNCTION	RECTIFIER UNIT TB1001
+	RED	DC(+)	5
-	WHT	DC(-)	6
GND	BLK	GND	3

WHEN DC SHIP'S SUPPLY

RECTIFIER UNIT

WHEN AC SHIP'S SUPPLY

Laying Cable in Scanner Box



Caution : The cable must be laid starboard side in the box, otherwize the cable may touch to a high voltage of magnetron.

QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH	NOTE

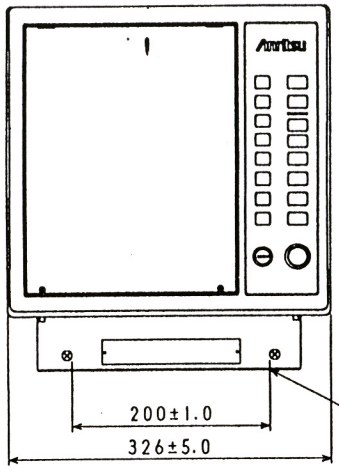
CHECKED BY 22 Apr '93 H. Oda
APPROVED BY 27 APR '93 T. Hidai
TRACED BY
DRAWN BY Jan. 22 '93 K. Nikiyaki
SCALE :

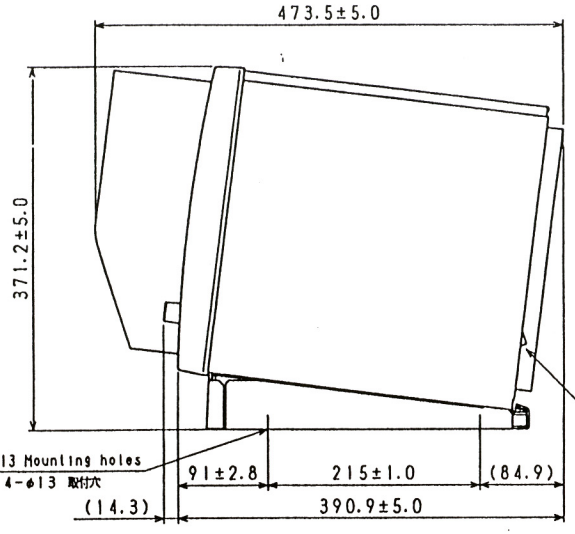
TITLE: INTER-CONNECTION DIAGRAM
RA725UA/RA726UA

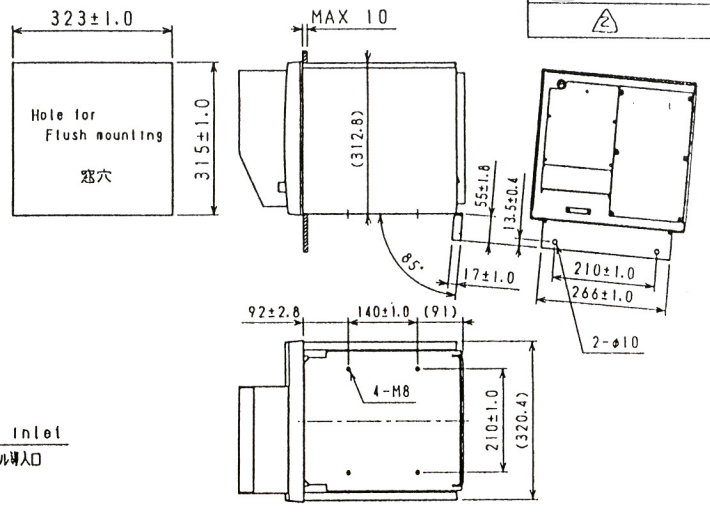
DRAWING No. 24W140789!

APPL ON

VISIONS

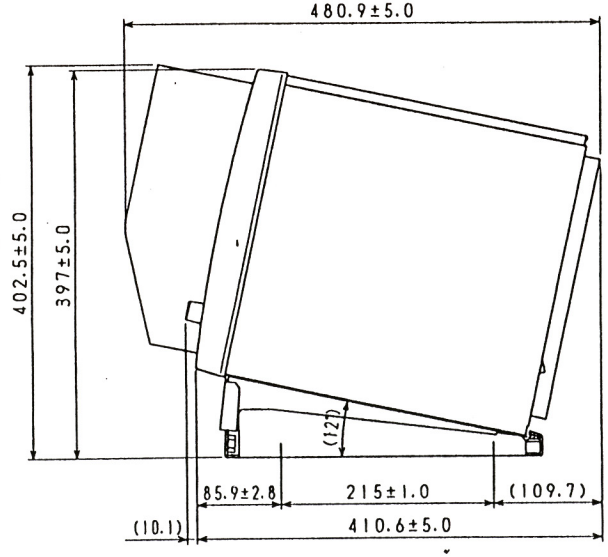






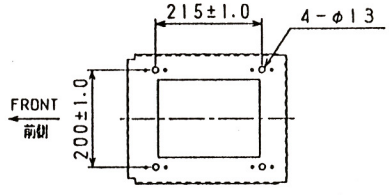
Flush mounting

フラッシュマウント時 寸法図



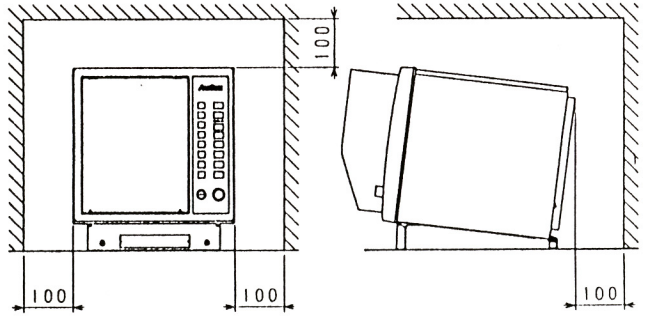
Angle adjustmennt

角度調整時



Pedestal (Bottom view)

ペデスタル形状図（下面より見る）



Service clearance

サービスクリアランス寸法図

Mass : 16 kg approx

質量 : 約 16 kg

QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH	NOTE

CHECKED BY Apr 16 '93 M. Kitayama	TRACED BY	SCALE	
APPROVED BY Apr 16 '93 H. Takahashi	DRAWN BY Apr 16, 93 Y. Saito	1:5	
TITLE OUTLINE DRAWING DISPLAY UNIT 指示機外観図		DRAWING No. 23W62985-02	①/1

ANRITSU CORP.

W_01_3-2

RF713A

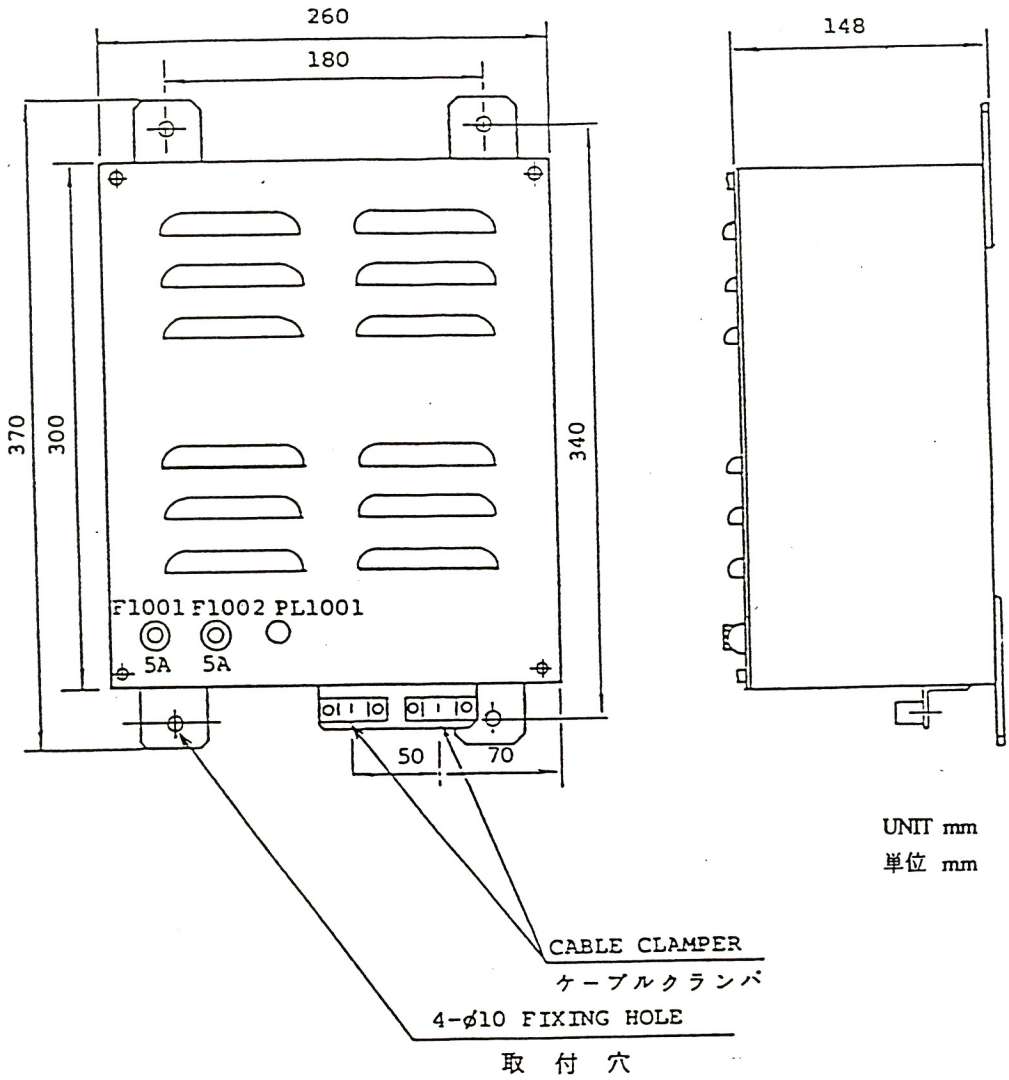
原紙

DEP 大 5.7.6 木

アンテナ長 Antenna length	L	回転半径 Rotation radius	スキャナーユニット重量 Scanner unit weight
3 呎 ft.	1034mm	Max. 522mm	Approx. 22 Kg
4 呎 ft.	1346mm	Max. 673mm	Approx. 23 Kg
6 呎 ft.	1970mm	Max. 990mm	Approx. 25 Kg

図 スキャナー部外観寸法図

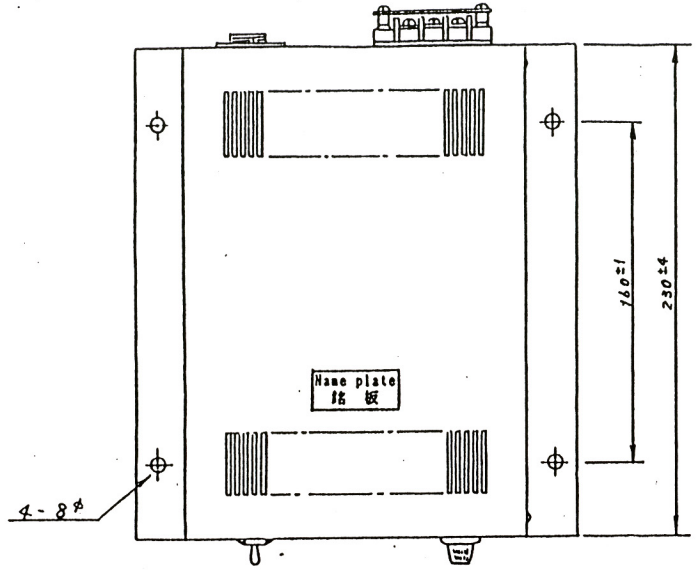
SCANNER UNIT EXTERNAL VIEW

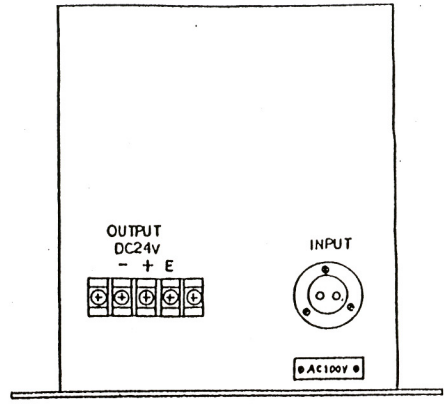


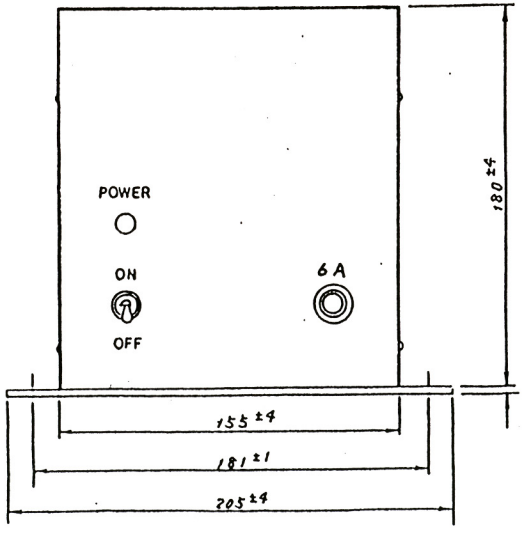
WEIGHT 15kg APPROX
重量 15kg

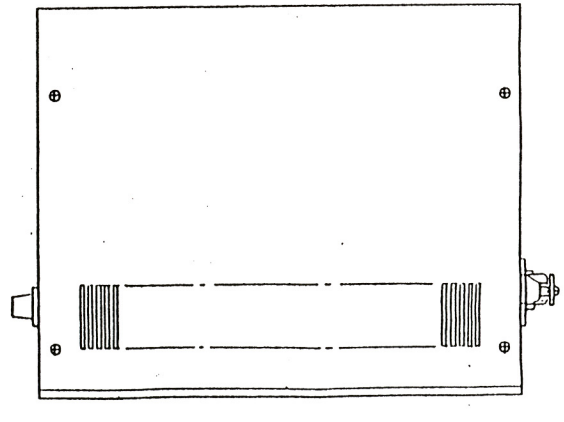
69-1E-A
RECTIFIER UNIT EXTERNAL VIEW
整 流 器 外 観 図

24W140790









Weight : 11kg Approx.
重量 : 約11kg
Unit : mm
単位 : mm

QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH	NOTE

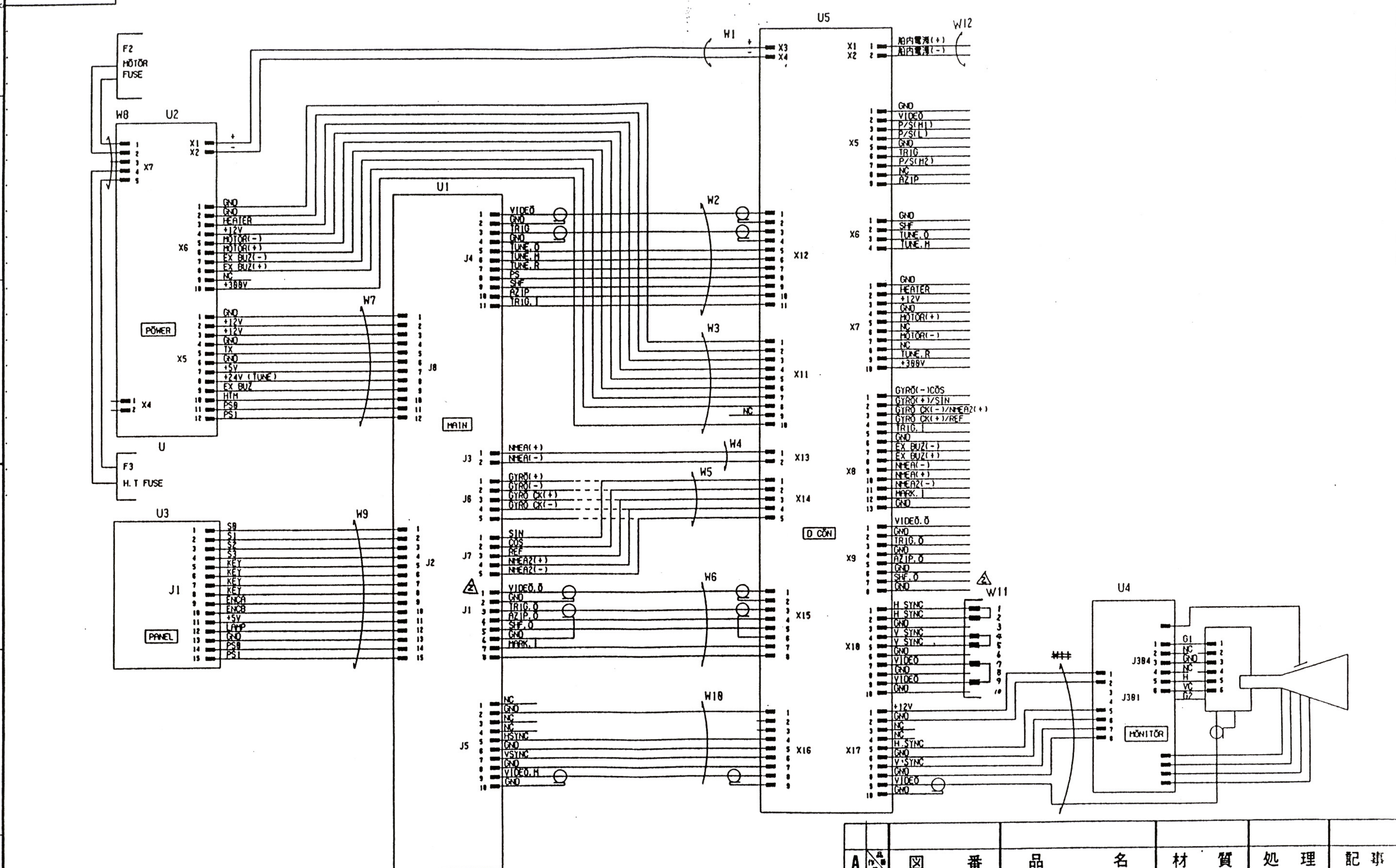
CHECKED BY 13 Jan '92 H. Aida
APPROVED BY T. Hidai
TRACED BY
DRAWN BY 13 Jan. '92 T. Imadou
SCALE :

TITLE RP113A 交流電源 外観図
OUTLINE DRAWING RECTIFIER UNIT RP113A

DRAWING No. 23W56729

ANRITSU CORP

記号	来歴	年月日	氏名	承認
△2	字図. J1端子番号追記 W11追記 版02	93.5.26	犬童	比田井



A	図番	品名	材質	処理	記事

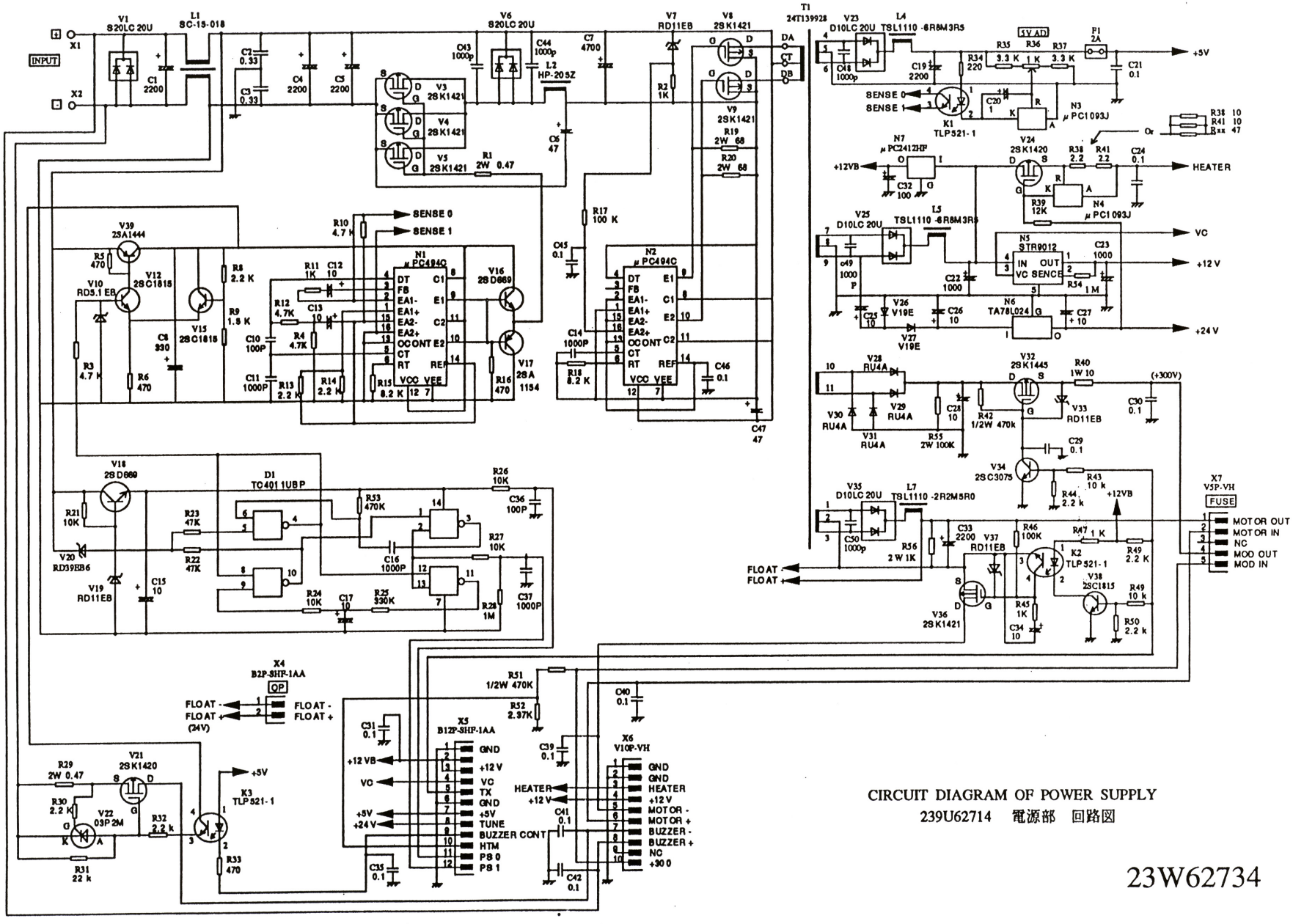
検図	飯田	93.5.26	製図	二見	
承認	比田井	93.5.26	設計	犬童	93.5.26

尺度 :

1993-5-13:14:53 (Ver.14)

名称 指示機回路図(RF713A)
DISPLAY UNIT CIRCUIT DIAGRAM

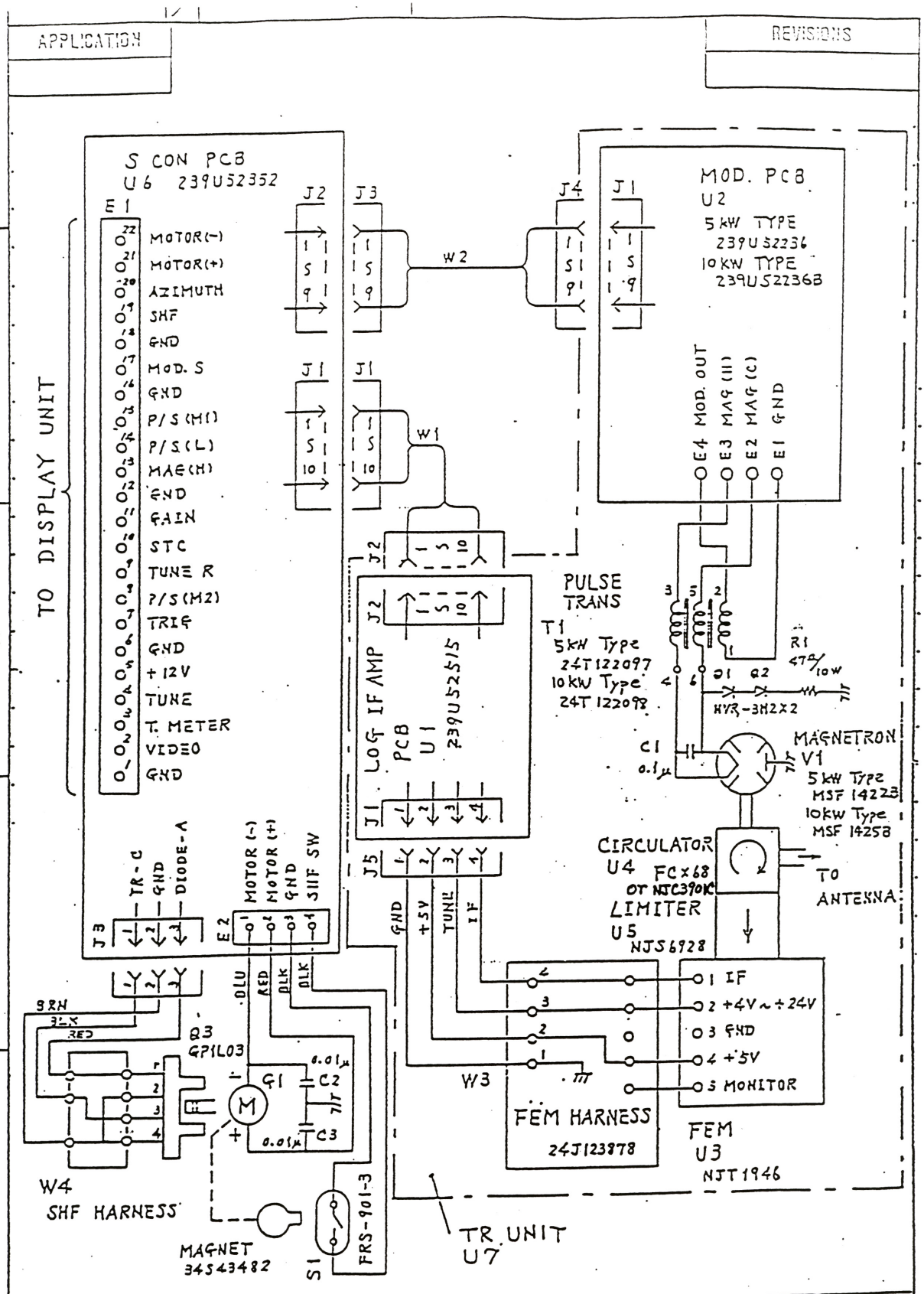
図番 23W62571-02 1/1



CIRCUIT DIAGRAM OF POWER SUPPLY

239U62714 電源部 回路図

23W62734



QTY	ITEM	PART No.	DESCRIPTION	MATERIAL	FINISH	NOTE

CHECKED BY 2. Dec. '92 H. Ojio	TRACED BY	SCALE :
APPROVED BY 2. Dec. '92 T. Hidai	DRAWN BY 2. Dec. '92 J. Imadell	
TITLE CIRCUIT DIAGRAM FOR SCANNER UNIT		DRAWING No. 24W140809