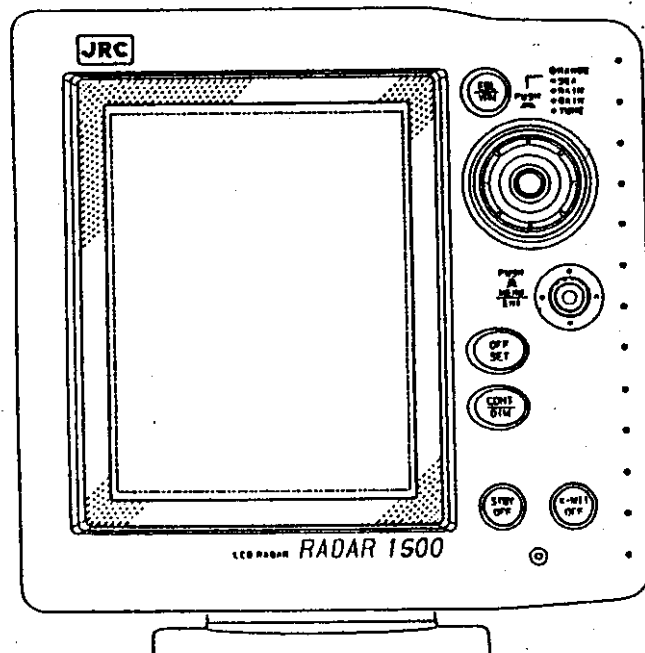




RADAR1500

INSTRUCTION MANUAL



Thank you for purchasing the RADAR 1500 LCD radar. This product will provide many years of trouble free use when operated properly, so it is important that you read and observe the precautions below.

- Read this manual thoroughly to gain a good understanding of the capabilities and the requirements of this equipment.
- Store the manual in a safe location so, that it does not become lost or damaged.
- Observe standard storage and handling procedures for electronic equipment.
- If, after proper installation, RADAR 1500 appears to be defective, please contact your JRC sales or service representative for assistance.

Symbols Used In This Manual

The following symbols are used in this instruction manual and on the product itself to ensure correct handling and proper use. Their meanings are explained below. Please observe the advice and precautions emphasised by the symbols as you read the manual and as you install and use the equipment.



WARNING

A safety warning to alert you of possible physical harm to yourself, or to the equipment.



CAUTION

An alert to possible harm to, or failure of the equipment



Electric shocks

This symbol warns of the possibility of electrical and/or other related dangers. The accompanying instructions should be meticulously followed



Prohibition

This sign alerts the reader to actions which must NEVER be performed



Prohibits disassembly

This sign prohibits disassembly, or otherwise tampering with the indicated components



Instruction

This draws the reader's attention to instructions which must be very exactly followed.

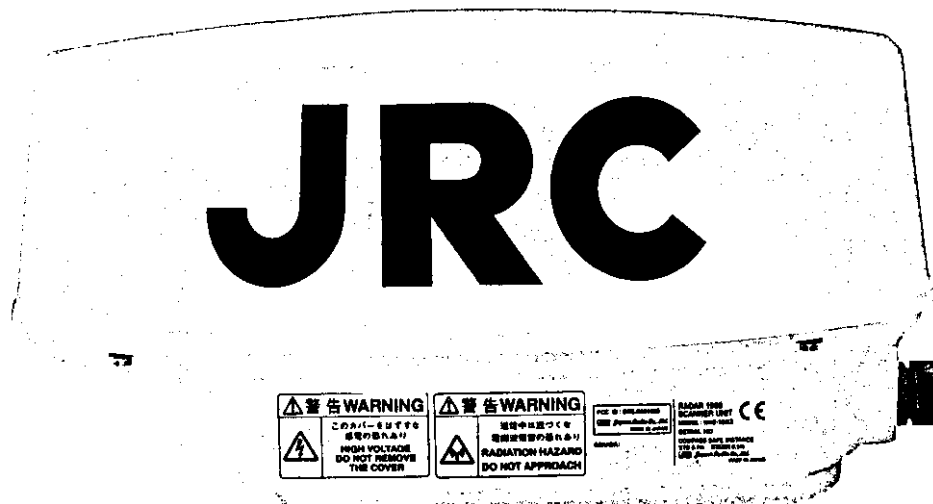
Operating Precautions

WARNING

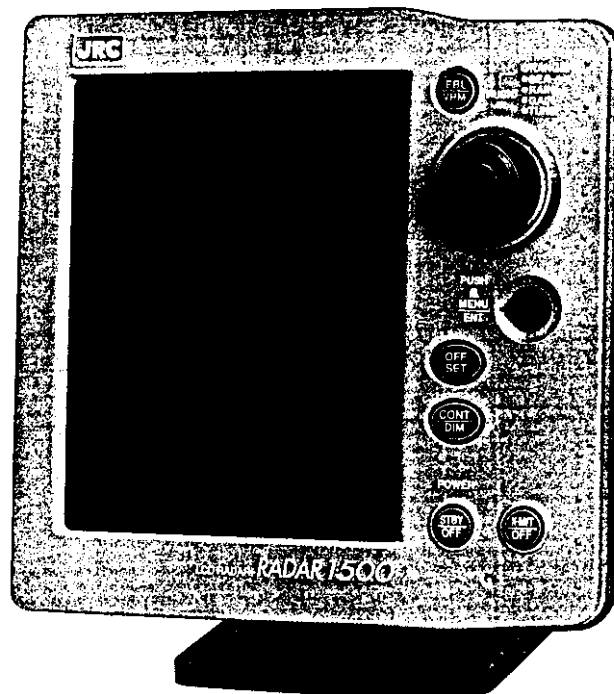
-  To avoid electrical shock, never touch the inside of the scanner when it is connected to an electrical supply.
Always keep the protective cover on the scanner when it is connected to an electrical supply. High internal voltages can cause serious personal injury. The equipment should be routinely serviced, only by JRC authorised personnel.
-  Avoid passing close to the scanner when the radar is in use.
The scanner unit rotates quickly and can cause personal injury. Both this and the enclosed radome should be installed at a high place, such as a cabin roof, or a specially constructed arch, or radar mast. If the radiating units cannot be installed above all possible, standing head height, they should be guarded by a strong, protective, enclosing frame.
Prolonged, close range exposure to radar signals is not recommended.
-  Before approaching close to the scanner, or dismounting it, ensure that the STBY/OFF and the X-MIT/OFF keys on the display unit have both been turned off. The cable connector P1 at the rear of the display unit should be disconnected before removing the scanner unit from its installed position.
-  Never sit on the scanner, nor otherwise subject them to weight. They are not intended to bear loads and ignoring this advice could cause damage to important internal components.

CAUTION

-  You will only get optimum performance from your RADAR 1500 by carefully following this manual's instructions. Incorrect operation reduces the performance level and could cause damage to the equipment.
-  Remember that radar is only an aid to navigation and can be affected by many physical, environmental and operational factors. Radar does not diminish the user's responsibility to keep a good look out at all times and to exercise all other navigational prudence and human judgement. Radar is not a substitute for human faculties.



SCANNER UNIT NKE-1063



DISPLAY UNIT NCD-3970

Table of Contents

Symbols Used In This Manual	I
Operating Precautions	II
Equipment Photographs	III
Glossary of radar terms	IV

SECTION 1 INTRODUCTION

1.1 FUNCTION	1
1.2 FEATURES	1
1.3 COMPONENTS	2
1.4 DIMENSIONS	3

SECTION 2 OPERATING CONTROLS AND FUNCTIONS

2.1 CONTROL PANEL	4
-------------------------	---

SECTION 3 INSTALLATION

3.1 UNPACKING AND INSPECTION	7
3.2 PLANNING THE INSTALLATION	7
3.3 MOUNTING THE DISPLAY UNIT	9
3.4 MOUNTING THE SCANNER UNIT	12
3.5 CONNECTING THE SCANNER UNIT CABLE	13
3.6 ELECTRICAL CONNECTION	14
3.7 INITIAL OPERATION AND CHECKOUT	17

SECTION 4 OPERATION

4.1 LAYOUT OF CONTROLS	21
4.2 TURNING THE RADAR ON AND OFF	22
4.3 SELECTING A RANGE	24
4.4 ADJUSTING RECEIVER SENSITIVITY	24
4.5 ADJUSTING TUNING	24
4.6 REDUCING SEA CLUTTER	25
4.7 ADJUSTING RAIN CLUTTER	25

4.8	SETTING LCD CONTRAST -----	25
4.9	SETTING DIMMER -----	25
4.10	SETTING 1/4 OFFSET -----	26
4.11	RANGE MEASUREMENT -----	26
4.12	BEARING MEASUREMENT -----	27
4.13	OPERATING MENU -----	28
4.14	SETTING GUARD -----	29
4.15	RINGS -----	30
4.16	POSITION -----	30
4.17	WAYPOINT -----	30
4.18	SELECTION OF DATA FORMATS -----	30
4.19	TRAIL -----	30
4.20	TARGET EXPANSION -----	31
4.21	INTERFERENCE REJECTION -----	31
4.22	DISPLAY MODE -----	31
4.23	PLANNED-TX MODE -----	31
4.24	SETTING AUTO/MANUAL TUNING -----	31
4.25	IN CASE AN UNUSUAL CONDITION OCCURS DURING OPERATION -----	32

SECTION 5 MAINTENANCE

5.1	PREVENTIVE MAINTENANCE -----	33
5.2	CLEANING -----	34
5.3	LCD FILTER SURFACE CLEANING -----	34
5.4	FUSE -----	34

SECTION 6 AFTER-SALES SERVICE

-----	35
-------	----

SECTION 7 SPECIFICATIONS

7.1	GENERAL -----	36
7.2	SCANNER UNIT -----	37
7.3	DISPLAY UNIT -----	37

APPENDIX

Fig. 1 RADAR1500 DISPLAY UNIT (NCD-3970) FLUSH MOUNT TEMPLATE

Fig. 2 RADAR1500 SCANNER UNIT (NKE-1063) RADOME TEMPLATE

GLOSSARY OF RADAR TERMS

The following is a list of abbreviations and acronyms which may be used in the text of the manual.

A/D	Analog to Digital Conversion
ALM	Alarm In, also known as the approach alarm. Used to warn of approach to a preset zone or to a zoned target.
CPU	Central Processing Unit
EBL	Electronic Bearing Line
EXP	Expansion
FTC	Fast Time Constant, also known as Rain Clutter
GPS	Global Positioning System
IR	Interference Rejection
KM	Kilometer
LCD	Liquid crystal display
LL	Latitude/Longitude
MH	Modulator High voltage
NM	Nautical Mile
PCB	Printed Circuit Board
PPI	Plan Position Indicator (ship's position/center screen)
PW	Pulse Width
RR	Range Rings (Fixed)
SHM	Ship's Heading Marker
STBY	Standby
STC	Sensitivity Time Control, also known as Sea Clutter
TD	Time Difference
TI	Trigger
VD	Video
VOM	Volt-ohm Meter
VRM	Variable Range Marker
WPT	WAY POINT
X-MIT	Transmit

SECTION 1

INTRODUCTION

1.1 FUNCTION

Congratulations on selecting the JRC RADAR 1500 LCD system to assist with your navigation.

Whether you purchased this radar because of its compactness, power economy, ease of installation, or long term reliability, one thing is certain, the moment you turn on your RADAR 1500 Display you will know that you are seeing a revolutionary new concept in radar technology. You are the proud owner of a radar system unmatched in the marine recreational industry.

Radar signals are stored on an LCD display with excellent graphic clarity and detail. A single glance at your Display will give you a complete and accurate 3600 radar picture of other vessels, buoys and land surrounding your vessel.

1.2 FEATURES

- Easy operation using J-DIAL and JOYSTICK
- High speed rotation antenna
- Easy to understand, cursor-originated target information of range, bearing and Lat/Long.
- Compact, lightweight scanner and display
- Intermittent transmission for power saving
- 1/4 radius offset
- 6 languages (English, French, Spanish, German, Norwegian and Italian) built-in
- Automatic tuning features
- Relative, Magnetic, and True bearing readout for EBL, WAYPOINT and cursor
- Dual IF bandwidth for high sensitivity
- On-screen trail function to see the relative course of displayed targets
- Variable on-screen data including own ship's position, cursor position with Lat/Long, ship's course and range/bearing to waypoint with LL.

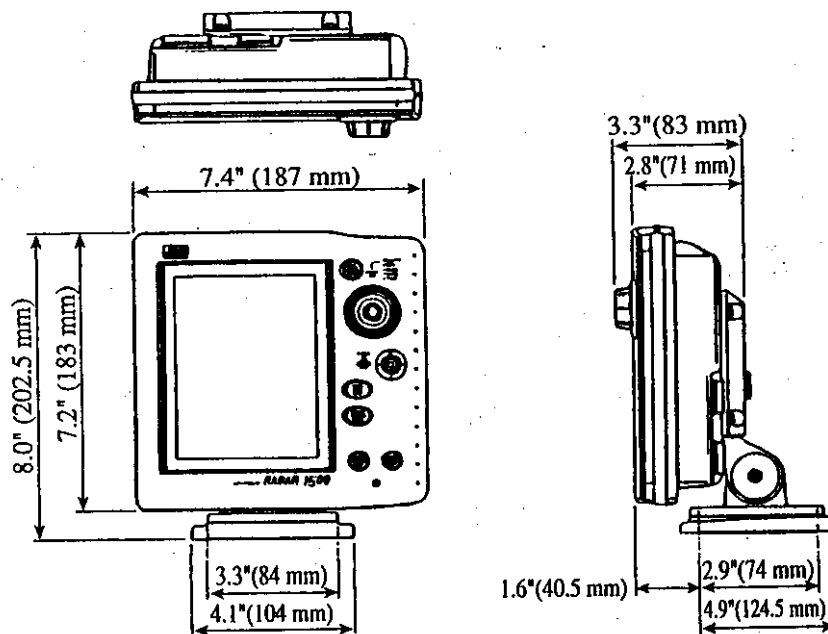
1.3 COMPONENTS

The table below lists the components which are included with your new radar system.

Description	Model No. or Code No.
Radar 1500 system	JMA-1020
Scanner Unit	NKE-1063
Display Unit	NCD-3970
Bracket	MPBX34692
Inter-unit Cable (15m)	CFQ8768-15
Power Cable (2m) with Fuse	CFQ8572
Instruction Manual	7ZPRD0407A
Standard Spares	6ZXRD00190
Sun Cover	MTV301800
Scanner Mounting Hardware	MPXP 31088
Display Mounting Hardware	MPTG30 149

Table 1-1 EQUIPMENT SUPPLIED

1.4 DIMENSIONS



COLOR GRAY
WEIGHT APPROX. 1.2 kg

FIG. 1-1 DISPLAY MOUNTING DIMENSIONS

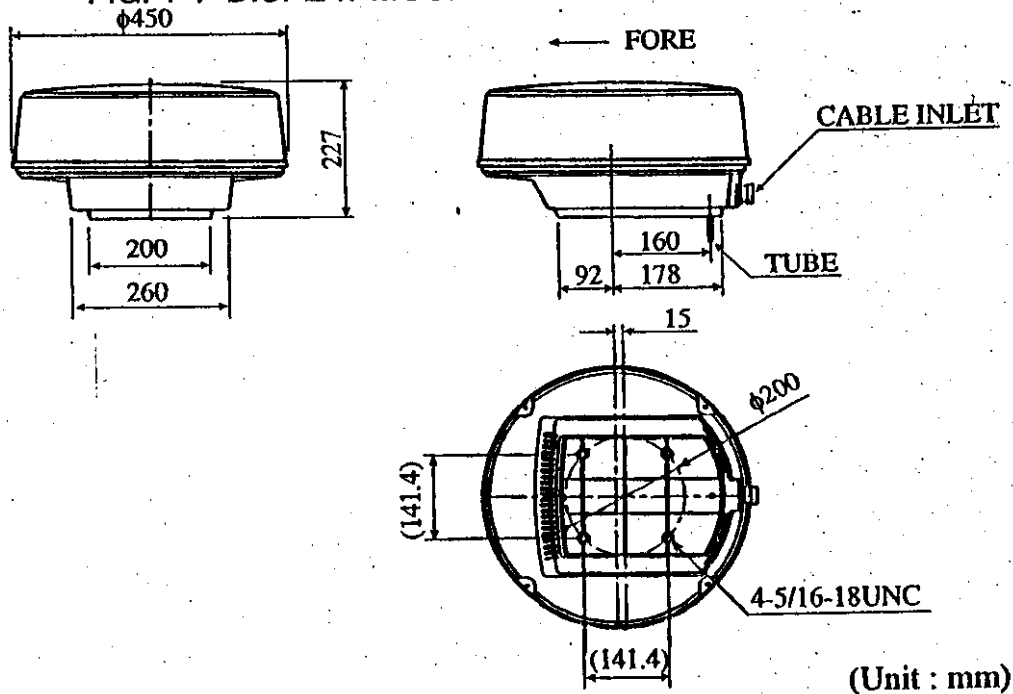


FIG. 1-2 SCANNER MOUNTING DIMENSIONS

SECTION 2

OPERATING CONTROLS AND FUNCTIONS

2.1 CONTROL PANEL

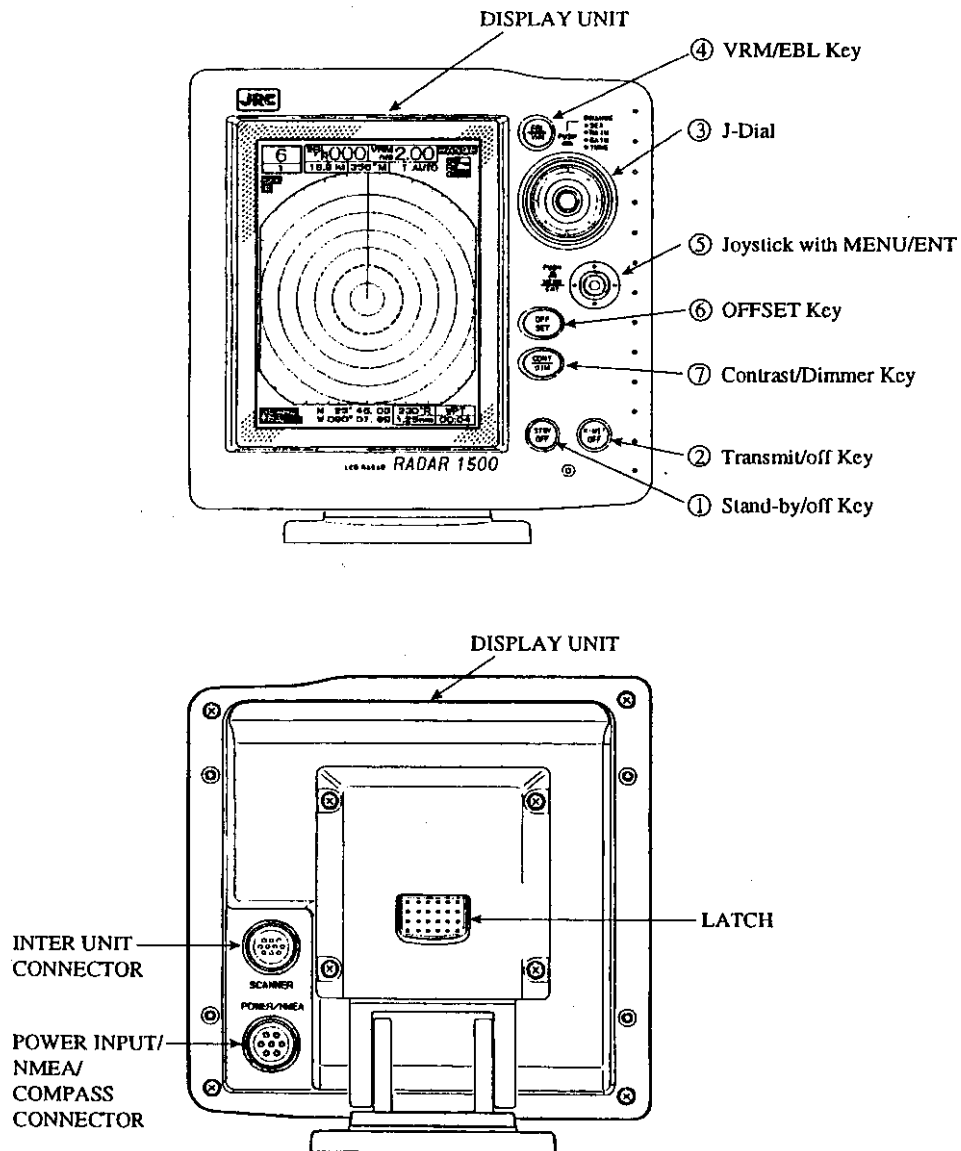


FIG. 2-1 DISPLAY UNIT

① STAND-BY/OFF Key

- Turns ON power to Display and Scanner and activates 90 second count-down timer.
- Press STBY/OFF key to go into Stand-by mode while in the Transmit mode.
- Press STBY/OFF and X-MIT/OFF keys simultaneously to turn radar off.

② TRANSMIT/OFF Key

- Turns transmitter ON and activates Radome.
- Press STBY/OFF and X-MIT/OFF keys simultaneously to switch off the radar.

③ J-DIAL

- Push repeatedly to select RANGE, SEA, RAIN, GAIN, TUNE controls.
RANGE increases or decrease the range scale in use
SEA reduces sea clutter
RAIN reduces rain or snow clutter
GAIN controls strength of returned echoes.
TUNE manually fine tunes receiver by peaking tuning bar (No tuning bar in AUTO tune).
 - SEA, RAIN, GAIN, TUNE, VRM, EBL, CONTRAST can be user-set for best efficiency.
- ④ EBL/VRM Key
- Activates EBL or VRM on the display. A short press will turn on/off selected EBL/VRM. Press and hold, to select and control the desired EBL or VRM by rotating the J-DIAL.

⑤ JOYSTICK

- Position cursor setting.
- Enables MENU for setup and selections

OPERATING MENU

GUARD	OFF	ON		
RINGS	ON	OFF		
POSITION	OFF	L/L	TD	WPT
WAYPOINT	OFF	ON		
BEARING	REL	MAG.	TRUE	

TRAIL	OFF	SHORT	LONG
EXP	OFF	ON	
IR	OFF	ON	
DISPLAY	DAY	NIGHT	

TX-PLAN

TX PERIOD ALL 10 20 30 SCANS

STBY PERIOD 3 5 10 15 MINS

TUNE AUTO MANUAL

INITIAL SETTING MENU

RELATIVE BEARING ALIGNMENT

DISPLAY TIMING

TUNE PRESET

STC PRESET

BUZZER VOLUME ON OR OFF

OPER. PROMPTS

LANGUAGE

⑥ OFFSET Key

- To shift own ship on screen.

⑦ CONTRAST/DIMMER Key

- Sets LCD contrast.
- Sets back light for LCD and panel illumination.

SECTION 3

INSTALLATION

This section provides practical guidelines to assist in the planning and installation of the RADAR1500.

3.1 UNPACKING AND INSPECTION

Use care when unpacking the RADAR1500 from the shipping carton to prevent damage to the contents. It is also good practice to save the carton and the interior packing material until the radar has been satisfactorily installed. The original packing material should be used in the unlikely event that it is necessary to return the unit for service.

3.2 PLANNING THE INSTALLATION

The layout for installing the RADAR 1500 should be planned to give the best operation and service aboard your particular vessel. In general, the scanner unit should be mounted as high as possible above the waterline and the display unit should be installed in a convenient viewing position near the helm. Keep in mind the optimum viewing angle when installing the display. You may wish to apply power before finally installing the unit so that you can determine a satisfactory viewing angle.

A 10 meter length of inter-unit cable is supplied for connecting the two main units (scanner and display). This length should be sufficient to complete the cable run required on most small vessels. It is, however, recommended that the maximum length of inter-unit cable does not exceed 20 meters.

A general system diagram for the RADAR 1500 is shown on the following page.

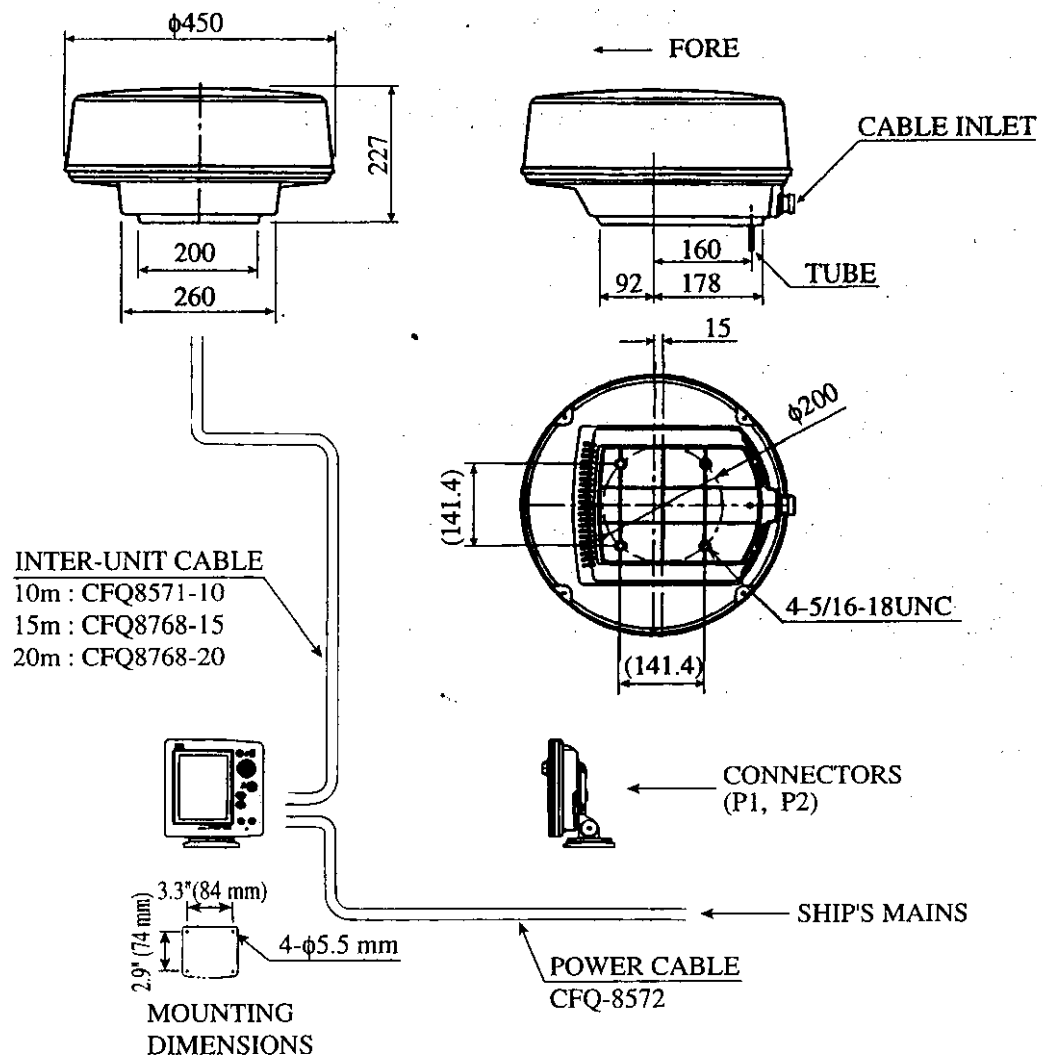


FIG. 3-1 GENERAL SYSTEM DIAGRAM

3.3 MOUNTING THE DISPLAY UNIT

When planning the installation for your display unit, the following conditions should be considered to ensure dependable and trouble-free operation.

- 1) The mounting location should be accessible enough to allow easy operation of all the front panel controls.
- 2) There should be adequate ventilation.
- 3) There should be sufficient space behind the display unit to allow for cable connections to its rear.
- 4) The display unit should be located near a DC power source.
- 5) The selected location should be far enough away from any device which might cause interference, such as motors, generators and echo sounders.
- 6) Generally, the display unit should be located in a protected area, away from prolonged direct exposure to rain and salt spray. It is good practice to protect your valuable electronic equipment as much as possible.

The display unit can be conveniently bracket-mounted on a chart table, or flush mounted in a bulkhead or other convenient panel. Using the outline of FIG 3-1 and 3-3 as a guide, install the display unit and secure it firmly to the mounting surface.

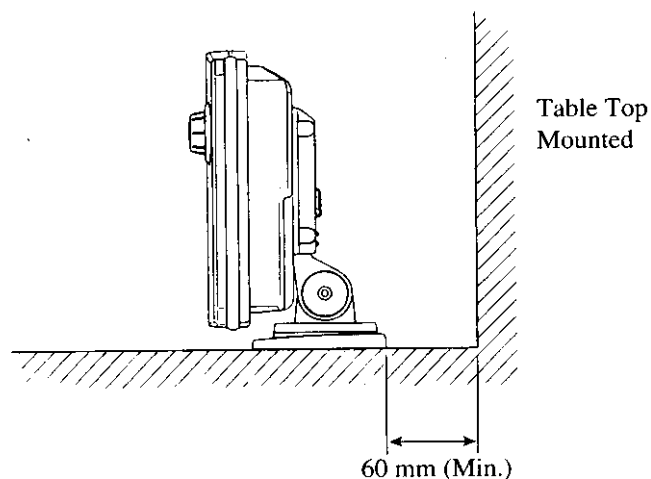
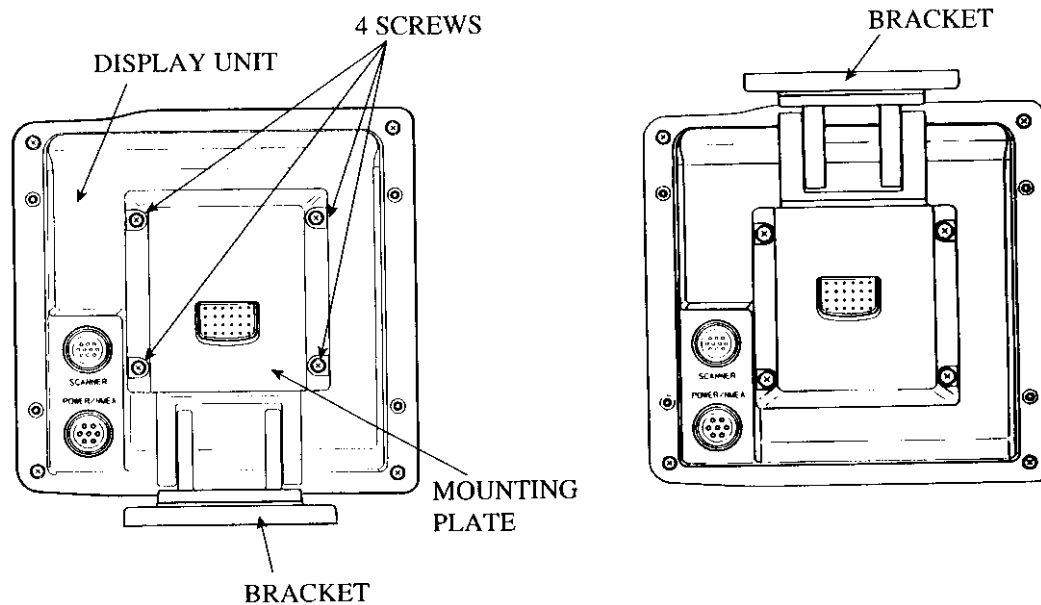


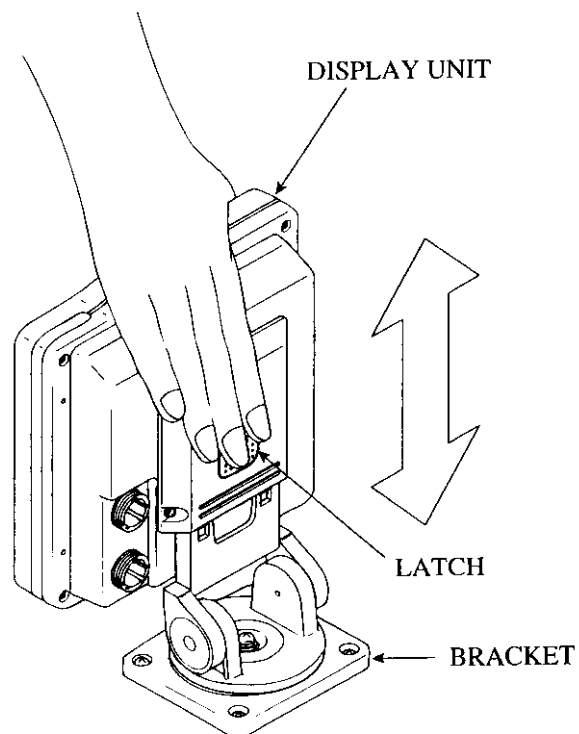
FIG. 3-2 TYPICAL MOUNTING METHOD

When the display unit is mounted overhead, remove the mounting plate, which is secured by four screws and rotate it through 180 degrees for re-assembly on the other side of the unit.



The display unit is separated from the bracket in the shipping carton. Install the display unit by sliding it onto the bracket until it is fully seated.

To remove the unit simply depress the latch on the rear of the display unit and lift.



3.4 MOUNTING THE SCANNER UNIT

Selecting an adequate location for the scanner unit requires careful consideration. On many small vessels, the unit can be installed on a mast platform, on an arch, or on a bridge structure near the ship's center line.

The radiator beam should not be obstructed by nearby large objects. Locate the unit where large structures such as superstructures, searchlight, horns, or masts are not in the same horizontal plane, otherwise, blind areas and false targets can appear on the radar screen.

Using the template provided in the front of manual as a guide, prepare the mounting surface with the four mounting holes as required. Install the Radome and secure it to the mounting surface. The correct mounting hardware is stainless steel hexhead bolts $\frac{5}{16}$ ", $1\frac{1}{4}$ " long with 18 UNC thread. A flat and lock washers should be used. The Radome should be parallel to the ship's waterline and oriented so the cable inlet is pointed AFT.

When mounting the Radome to a platform attached to a fly bridge, or superstructure, avoid placing the Radome Unit at eye level. Although the radar transmits a 2.0kW peak power the average power radiated is less than 0.5 watts. Therefore, the hazard from RF radiation levels is virtually nonexistent beyond 2 feet from the Radome Unit.

However, due to the sensitivity of the human eye, it is recommended and prudent to install the Radome in a plane above or below the passengers line-of-sight.

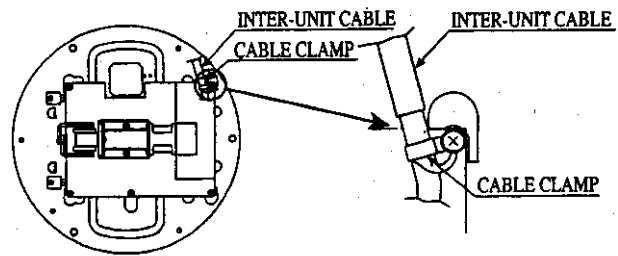
When the sickness of the mounting base is more than 0.4 inches, the longer bolts are required. In this case, the bolts length is as follows;

$$\text{Bolt length (inch)} \leq 1.25 + \text{sickness of mounting base (inch)}$$

If the longer bolts are used, the modulator PCB could potentially damaged.

3.5 CONNECTING THE SCANNER UNIT CABLE

The scanner unit is supplied with an inter-unit cable, which includes a plug (P1) for connection to the display unit. If your installation does not allow you to run the cable with the plug (P1) attached, the wire cable can be disconnected and reconnected inside the scanner unit. When reconnected, be sure to include the cable clamp.



3.6 ELECTRICAL CONNECTION

3.6.1 DC POWER CABLE

The RADAR 1500 will work with any electrical supply within the 10.2 to 16 volt range, since it contains a power regulator circuit. Connect the power cable to a DC source capable of supplying at least 3 amperes. The power cable should normally be wired through a circuit breaker. The red lead wire of the power cable must be connected to the positive source terminal and the black lead to the source negative terminal. The shielded wire is be connected to Boat Main ground. Should the power connections be inadvertently reversed, a protective fuse will blow. In this event, check the input power leads for correct polarity with a VOM and reconnect the leads in their correct polarity. Replace the fuse. The fuse is located in the power cable. ***[NORMAL-BROW FUSE(5A) SHOULD BE SPECIFIED]***

3.6.2 EXTERNAL SYSTEM INTERFACE

The RADAR 1500 will interface with any NAV-AID (GPS or LORAN) and compass with the standard NMEA0182 or NMEA0183 output. The inputs from the NAV-AID must be digital data conforming to the NMEA0183 formats to drive various radar features such as waypoint mode. If more than one data type is present at the radar input (for example; compass and NAV-AID) a priority system has been established in the radar's software to respond to the inputs in driving the features. The assigned priorities are set in this manner:

- | | |
|-----------|---|
| HEADING: | 1. Compass (NMEA0183 "HDM,HDT,HSC") |
| | 2. NAV-AID (NMEA0183 "RMC,RMA,VTG") |
| POSITION: | 1. NAV-AID (NMEA0183 "RMC,RMA,GLL,GTG") |
| SPEED: | 1. NAV-AID (NMEA0183 "RMC,RMA,VTG,VHW") |
| WAYPOINT: | 1. NAV-AID (NMEA0183 "RMB,RMC") |

Using the outline of FIG 3-7 as a guide, connect the RADAR 1500 to your NAV-AID and compass.

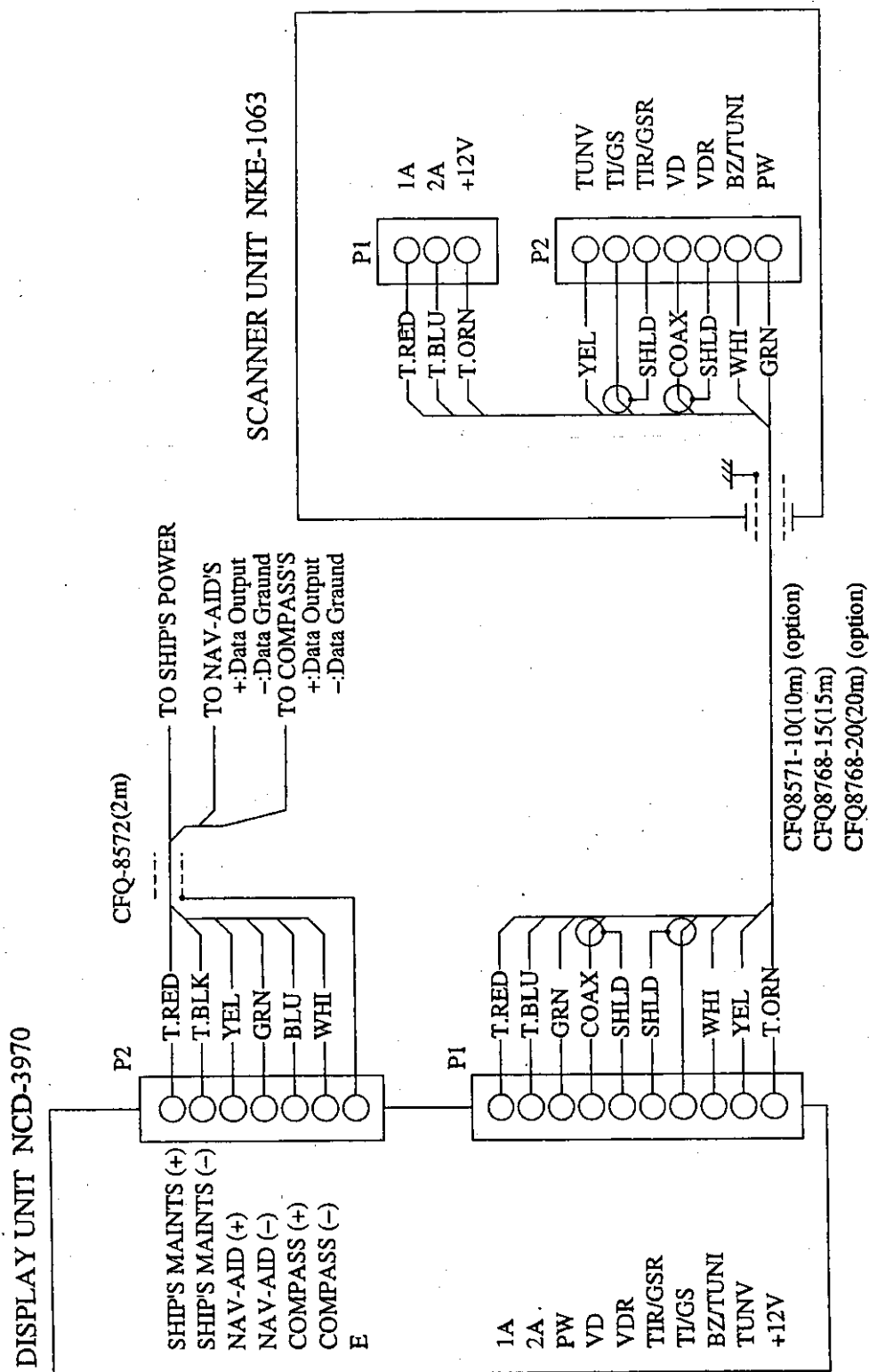


FIG. 3-6 INTERCONNECTION DIAGRAM

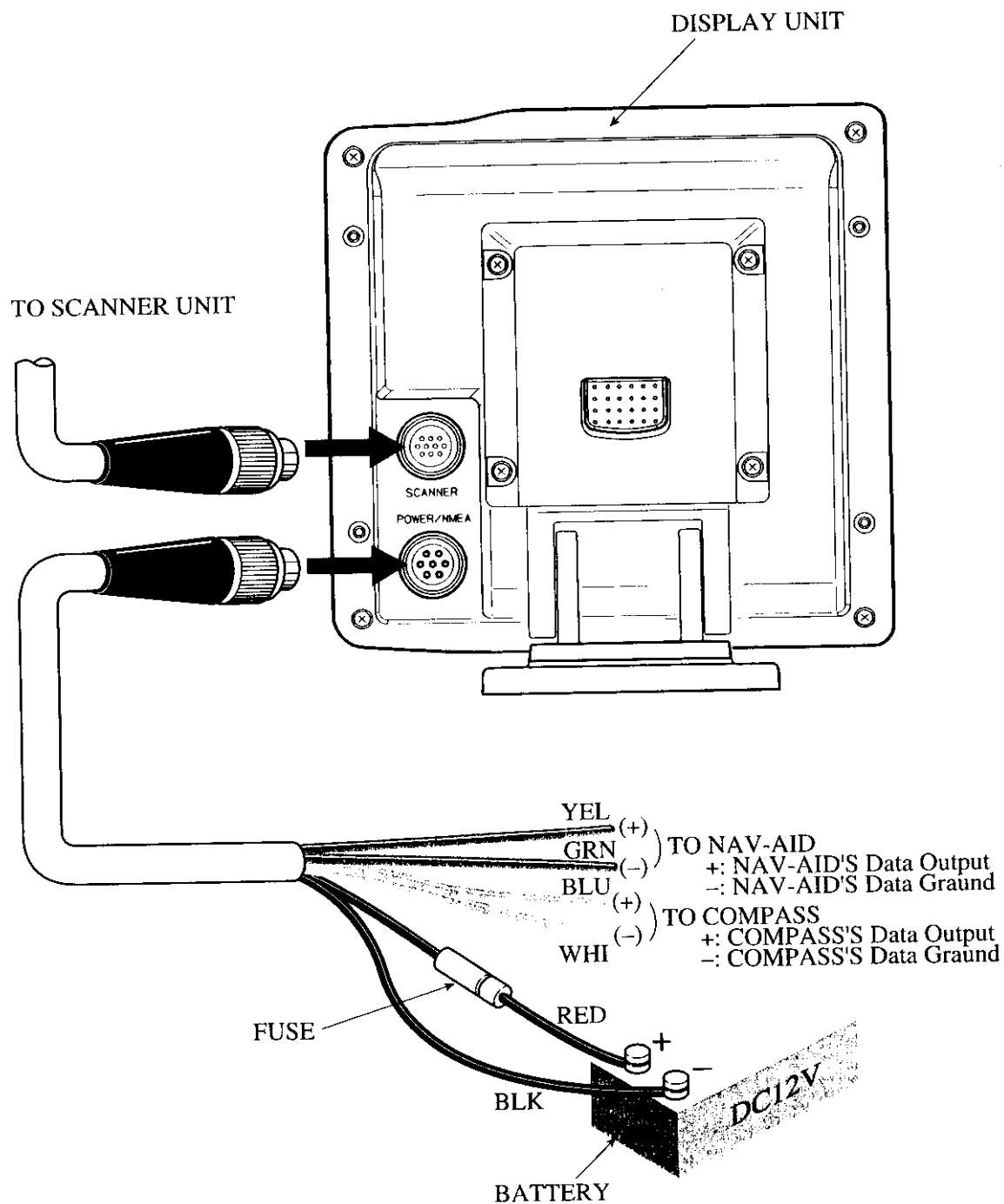


FIG. 3-7 NAV-AID INTERCONNECTION

3.7 INITIAL OPERATION AND CHECKOUT

3.7.1 INSPECTION AFTER INSTALLATION

After completing the installation and prior to energizing the equipment, it is necessary to ensure that all the steps of the installation were accomplished in accordance with the instructions. Especially check that:

- (1) The cables are not crimped or damaged.
- (2) The allowed input voltage has been connected with correct polarity.
- (3) All securing bolts have been tightened.
- (4) The power cable shield has been properly connected to Boat Main ground.

3.7.2 OPERATING INITIAL SETTING MENU

To access this menu, hold JOYSTICK depressed for a few seconds until the Initial Set Up menu appears on the screen. The JOYSTICK is then used to select a particular item and the on-screen prompts appropriate to each process.

INSTALLATION ADJUSTMENTS

BEARING
DISPLAY TIMING
TUNE PRESET
STC PRESET

BUZZER

OPER PROMPTS
LANGUAGE

INSTALLATION ADJUSTMENTS MENU

3.7.3 RELATIVE BEARING ALIGNMENT

This alignment should be made after the radar has been installed. Failure to perform this procedure will result in incorrect target bearing readings.

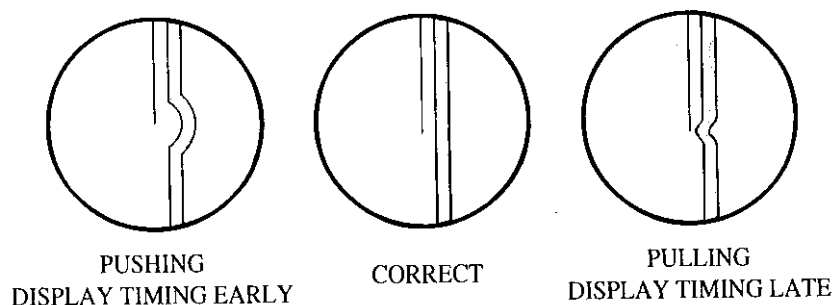
Proceed as follows:

- ① Identify a suitable targets (eg buoy or anchored vessel) preferably between 0.5 and 1 NM in range on the screen.
- ② Visually locate the target and line the bow of the vessel up with it.
- ③ Align the SHM with the target and also rotate #1EBL to the vertical setting.
- ④ Press and hold the JOYSTICK to display the initial setting menu.
- ⑤ Using the JOYSTICK, select BEARING ADJUST and rotate J-DIAL to read zero. You now have both SHM and #1EBL correctly set.
- ⑥ Press the JOYSTICK again to save the settings and exit this menu.

3.7.4 DISPLAY TIMING (ZERO NM ADJUSTMENT)

This alignment must be made when the radar unit is installed. Failure to perform this procedure will result in incorrect target distance readings. Set the range at 0.25 NM and locate a solid target at an approximately known distance.

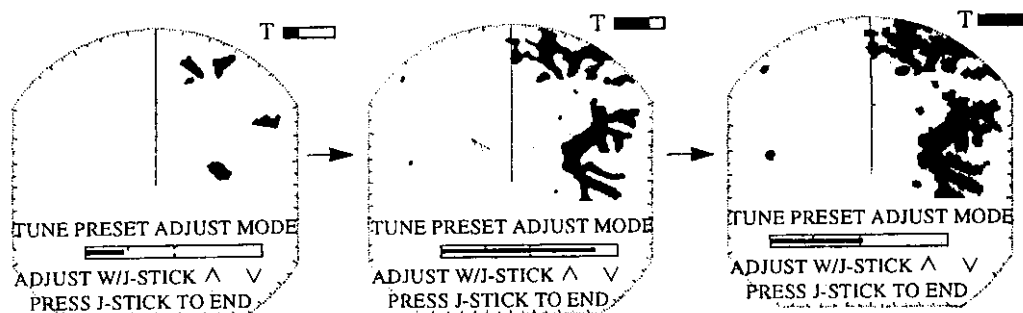
- ① Your target can be a straight dock, sea wall or bridge etc.
Press and hold the JOYSTICK to display the initial setting menu again.
- ② Use the JOYSTICK to select DISPLAY TIMING and press the JOYSTICK once more.
- ③ Using the JOYSTICK, adjust distance so that the object appears to be straight on the display, as per the illustration below.
- ④ Press the JOYSTICK to end the display timing adjustment mode.



3.7.5 TUNE PRESET

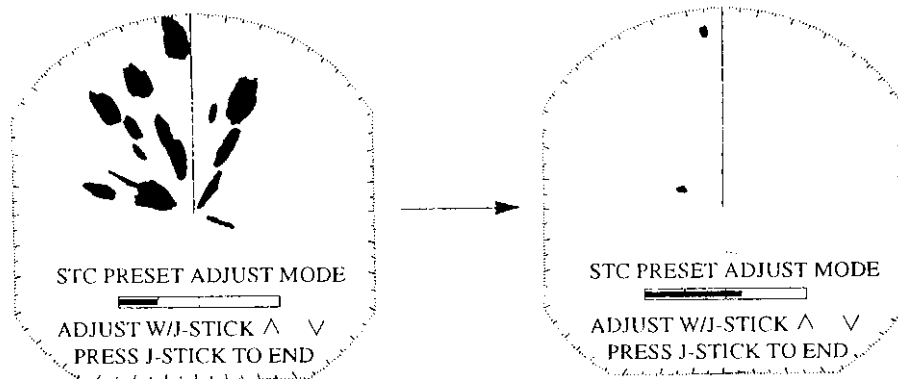
Follow the instructions given below to make coarse tuning of the receiver : if after about 10 minutes of transmit, the tune bar is oriented towards one end of its range for video peak, perform the following steps:

- ① Set the range scale to 3NM.
- ② Set the gain control to desired level.
- ③ Set the SEA, RAIN and IR to Off.
- ④ Press and hold the JOYSTICK for the initial setting menu.
- ⑤ Select TUNE PRESET by using the JOYSTICK, and press the JOYSTICK.
- ⑥ Using the J-DIAL, adjust the image for maximum target brightness.
- ⑦ Press the JOYSTICK to exit the adjustment mode.



3.7.6 STC PRESET

- ① Set range to 6NM.
- ② Set Gain to maximum (refer to Section 3.5)
- ③ Press and hold JOYSTICK to display initial setting menu.
- ④ Select STC PRESET by using the JOYSTICK as before.
- ⑤ Using the J-DIAL, adjust the distance so that no background noise (speckles) in the 0 - 2nm range.



- ⑥ Press JOYSTICK to exit the menu and return to normal navigation mode.

3.7.7 BUZZER VOLUME

At the time of shipment the buzzer volume is set to 'On'.

- ① Select the initial setting menu BUZZER
- ② Select ON or OFF
- ③ Press JOYSTICK to exit the menu.

3.7.8 OPER.PROMPTS

The operation prompt are helpful for the radar operation. At the time of shipment, the operator prompt has been set to On.

- ① Select the initial setting menu ~OPER.PROMPT.
- ② Select ON or OFF.
- ③ Press the JOYSTICK to return to normal navigation mode.

3.7.9 LANGUAGE

The radar menu can be displayed in one of six languages. They are English, Spanish, French, German, Norwegian and Italian. After selecting any language, the menu and the oper. prompts will also change to that language. A master reset will return the display setting to English.

- ① Select the initial setting menu →LANGUAGE.
- ② Select desired language.
- ③ Press the JOYSTICK to exit the language setting mode.

SECTION 4

OPERATION

In normal operation the RADAR1500 is very easy to use and several of its functions are totally automatic. However, the prudent navigator spends time in good visibility to learn the layout of the controls and to become proficient in their use, so that he/she will obtain the best performance from the equipment when the visibility is poor, or the sea area is crowded.

This section takes you through the controls step-by-step.

4.1 LAYOUT OF CONTROLS

The layout of front panel controls is as shown in the diagram below

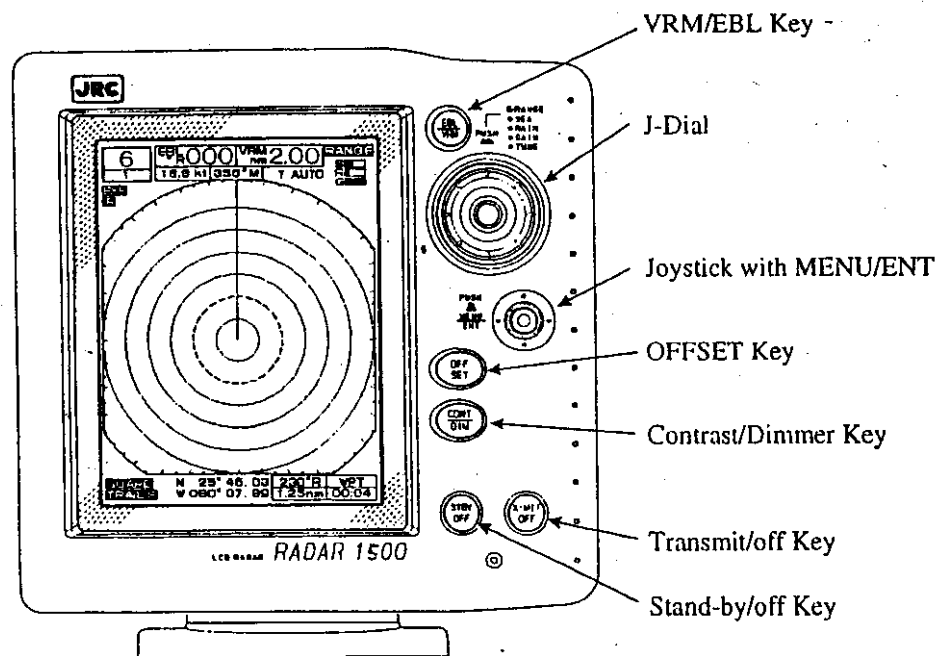


FIG. 4-1 OPERATING CONTROLS

4.2 TURNING THE RADAR ON AND OFF

TO TURN ON	Press the STBY/OFF key
TO TRANSMIT	Press the X-MIT key
TO STAND-BY	Press the STBY/OFF key
TO TURN OFF	Press the STBY-OFF key and the X-MIT/OFF key simultaneously

When you

Press the **STBY/OFF** key a 90 second warm-up count down timer is activated and displayed together with the total (display unit) usage to date.

Press the **X-MIT/OFF** key the radar transmits, the scanner begins to rotate and echoes will appear on the screen

Press the **STBY/OFF** key the radar returns to stand-by mode to reduce battery drain. The rotator stops.

Press the **X-MIT/OFF** key again, the radar reverts to full transmitting function

These sequences are also guided by on-screen prompts

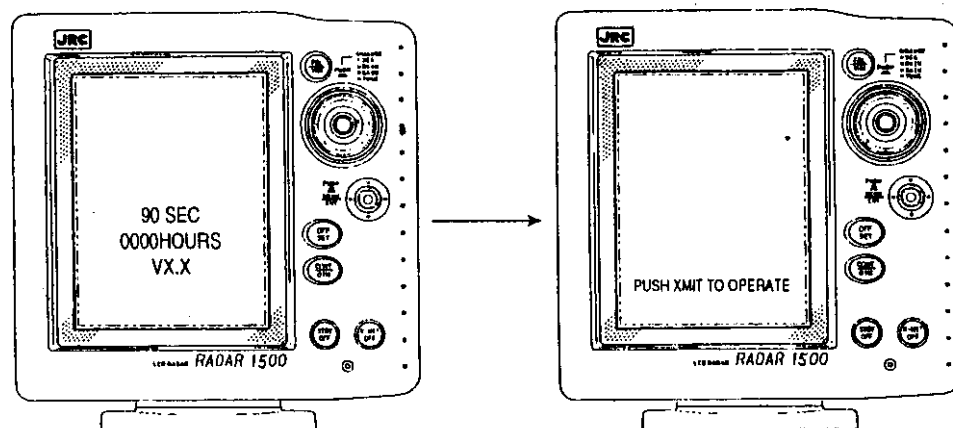


FIG. 4-2 TURNING THE RADAR ON/OFF

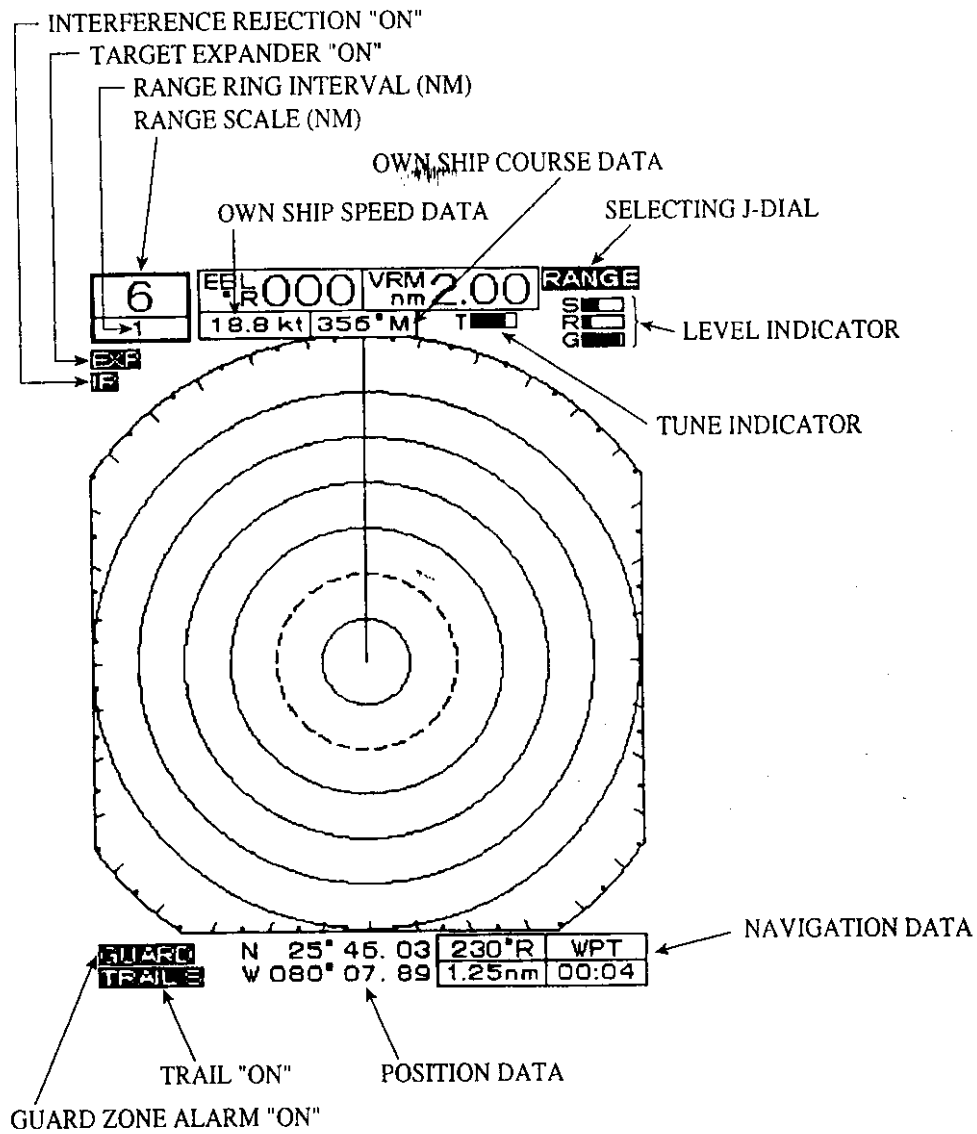


FIG. 4-3 LAYOUT OF THE SCREEN

4.3 SELECTING A RANGE

Press the J-DIAL until RANGE is highlighted in the upper right corner of the display. The range scale and range rings setting in use is shown in the upper left corner. Rotate the J-DIAL clockwise to increase the range and anti-clockwise to decrease it. The range rings are automatically set to correspond with this selection.

4.4 ADJUSTING RECEIVER SENSITIVITY

Press the J-DIAL until GAIN appears highlighted in the upper right corner of the display. Rotate the J-DIAL clockwise or counter clockwise, to vary the gain and thus control the strength of echo returns on the radar screen. An on-screen bar indicates the gain level selected. The proper setting is when the background noise is just visible on the screen. (ie a light speckled effect)

4.5 ADJUSTING TUNING

Press the J-DIAL until the TUNE appears highlighted at the upper right corner of the display. Rotate the J-DIAL clockwise or counter clockwise, to maximize the target echo. If there is no large, identifiable target (eg big ship or land) within range, select SEA CLUTTER and turn the control to maximum. Use these echoes from wave crests to adjust the tuning bar for fullest attainable deflection. This is best done with the range set to 3nm or 6nm.

When the radar has warmed up, it may be necessary to make a further fine tune adjustment.

AUTO TUNE

The RADAR 1500 has an automatic tuning feature. In this mode, the radar automatically tunes itself for best efficiency at all ranges (refer to 3.24)

4.6 REDUCING SEA CLUTTER

CAUTION



Increasing the SEA CLUTTER control effectively diminishes the radar's sensitivity. SEA CLUTTER should never be advanced to the point where it obliterates all returns from waves, since this setting could prevent the detection of nearby targets, especially small wood/grp boats and yachts approaching head-on.

The SEA CLUTTER control is normally only used on the shorter ranges to suppress the effect of sea clutter formed by breaking wave crests which the radar 'sees' as solid objects.

Press the J-DIAL until the SEA appears highlighted in the upper right corner of the display. Rotate the J-DIAL clockwise, or counterclockwise to vary the sea clutter control and thus control the strength of echo returns from the sea surface. The on-screen bar indicates the selected level.

4.7 ADJUSTING RAIN CLUTTER

Press the J-DIAL until the RAIN appears highlighted at the upper right corner of the display. Rotate the J-DIAL clockwise or counterclockwise, to vary the level and thus control the strength of echoes returned from rain or snow. As you rotate clockwise, the returned echoes will become narrower and the returns from rain or snow will be reduced.

4.8 SETTING LCD CONTRAST

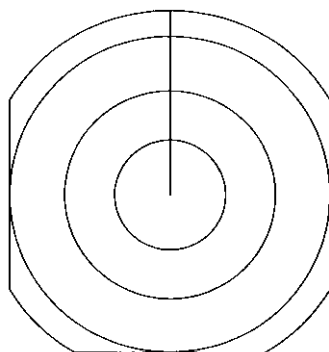
Press the CONT/DIM key, and then rotate the J-DIAL clockwise or counterclockwise to change the display contrast.

4.9 SETTING DIMMER

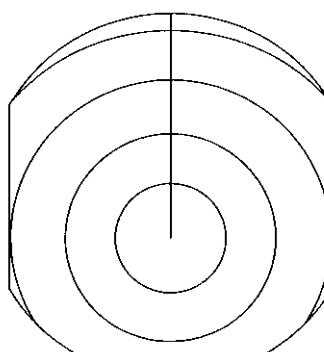
-By pressing the CONT/DIM key, the back light for the LCD and the panel illumination can be varied in intensity. This function has only the two settings 'ON' and 'OFF.'

4.10 SETTING 1/4 OFFSET

By pressing the OFFSET key, the display is offset downwards by 1/4 radius, expanding the display area in front of the vessel. Press the key a second time to return the display to normal.



OFFSET MODE OFF



OFFSET MODE ON

4.11 RANGE MEASUREMENT

(1) Count the number of range scale rings in use between the center of the screen and the ring preceding the target. Add to this distance an estimate of the distance between this nearest ring and the inner edge of the target.

(2) Using VRM

Press the EBL/VRM key

If EBL is highlighted, Press and hold the EBL/VRM key to change to VRM mode and activate the split-line VRM ring

Rotate the J-DIAL clockwise to expand the VRM ring and increase its range.

To lessen the indicated range, rotate the dial in an anti-clockwise direction. The actual target distance, in nautical miles, from the ship appears on the center top of the screen in. (See menu 4.25)

To turn off the VRM, press the EBL/VRM key while VRM is highlighted.

(3) Using cursor

Press the JOYSTICK to make the cross cursor appear on the screen. The cross mark can be moved any direction by using the JOYSTICK. The range and bearing will be displayed at the lower right corner on the display

4.12 BEARING MEASUREMENT

(1) Using the bearing scale

Using the bearing scale on the screen, visually estimate a line from the center of the display (ship's position) projected through the center of the target, to reach the bearing scale around the perimeter of the display. The bearing which you obtain is the target's relative bearing in degrees.

(2) Using EBL

Press the EBL/VRM key

If VRM is highlighted, press and hold the EBL/VRM key to change to EBL mode.

Rotate the J-DIAL clockwise or counterclockwise to move the electronic bearing line to cut the center of the target. The target bearing (in degrees relative to the ship) then appears at the top center of the screen. The bearing may be displayed in relative "R", true or magnetic "M" depending on the menu selection and what other equipment is interfaced to the radar.

To turn off the EBL, Press the EBL/VRM key while EBL is highlighted.

4.13 OPERATING MENU

Press the JOYSTICK to access the first menu sheet.

The JOYSTICK is then used to select a particular menu. Press again to open up the sub menu, which will be displayed to the right side of the selected menu with the "■" mark. The DISPLAY can be scrolled for the second menu sheet which is below IR selection. GUARD on the first menu sheet is below TUNE on the second menu and so on.

Pressing the JOYSTICK again will return the display to the normal video presentation.

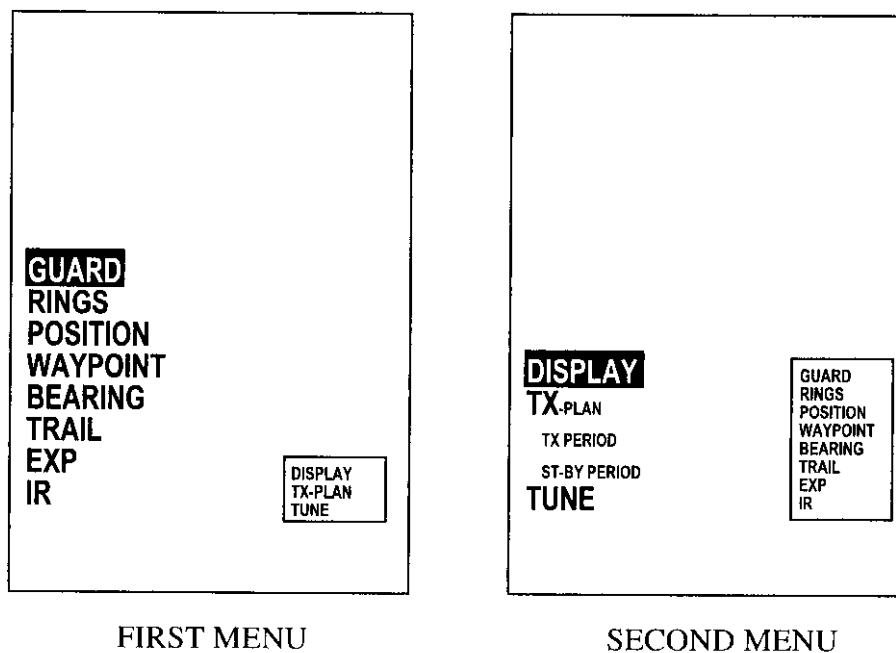


FIG. 4-3 FIRST/SECOND MENU SHEET

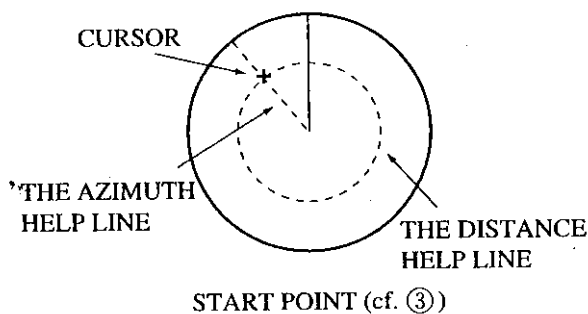
4.14 SETTING GUARD

The guard zone alarm is effective for alerting the operator to targets approaching his own ship. An alarm is sounded when any (apparent) target returning an echo above the noise threshold is detected. If sea clutter, or other incidental echoes trip the alarm, adjust the gain control and/or the sea clutter to avoid this false alarming.

- ① Press the JOYSTICK to display the menu sheet.
- ② Select GUARD-ON and press the JOYSTICK. The radar display returns to the normal video presentation.

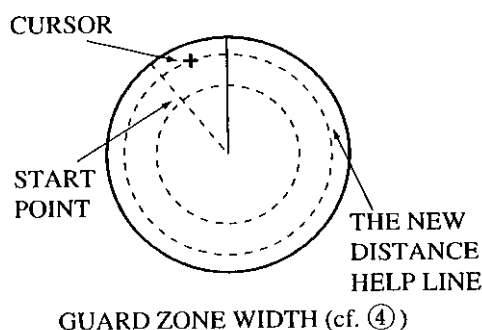
Cursor appears on the PPI screen and shows the distance and the azimuth of the Maker. It displays the distance help line and the azimuth help line of the dotted line.

- ③ Move the cursor to the desired guard zone start point using the JOYSTICK and then press the JOYSTICK again. The distance help line and the azimuth help line of the dotted line are displayed in the fixation in the start point position at this time.

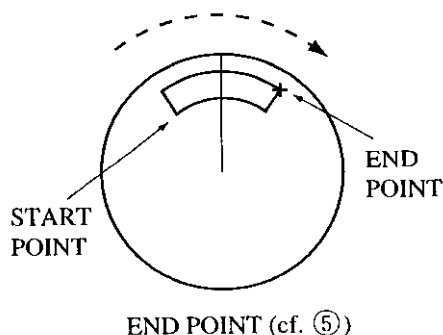


- ④ Next, move the cursor to the desired guard zone Width point of your Guards zone then press the JOYSTICK control.

It displays the distance help line of the dotted line which is new at this time.



- ⑤ Next, move the cursor to the desired end point of your guard zone then press the JOYSTICK control. A ring in the distance range is displayed by the solid line at this time.



- ⑥ To turn the GUARD function Off, select the GUARD-OFF on the Menu sheet.

4.15 RINGS

The range rings can be turned to on or off via this menu.

4.16 POSITION

Select this option to display the ship's position (derived from a navaid input). This function allows selection of ship's position in latitude/longitude (LL), time difference (TD) position, you may also display waypoint(WPT) as a LL position in place of your own position data. This menu also removes this data from display. To highlight the required sub-function, move the cursor to it with the JOYSTICK, then press JOYSTICK to activate it.

4.17 WAYPOINT

If the radar is interfaced with a LORAN or GPS with the necessary data output, a waypoint symbol can be made to appear on the radar screen by activating the WAYPOINT function in the DISPLAY menu. Numeric data, showing the waypoint's bearing, range, and time-to-go appear at the bottom right corner on the screen.

4.18 SELECTION OF DATA FORMATS

This function selects the units and formats for the SHM, EBL, CURSOR and WAYPOINT data.

It can be displayed in degrees True (T) or magnetic (M) and is indicated by these letters on screen. The Ship's Head Marker is always displayed as zero degrees.

4.19 TRAIL

This feature allows the operator to see the past history of target movement as an after-glow, or trail behind moving targets. The 'glow-time' of these 'trails' and - hence - the amount of display time which they occupy, can be set to 'short' or 'long'.

4.20 TARGET EXPANSION

Target expand mode can be set to 'on' or 'off'. When 'on', this function increases the size of the displayed images to make small targets appear larger and easier to view on screen. When active, "EXP" is highlighted in the upper left area of the screen.

4.21 INTERFERENCE REJECTION

Interference Rejection (IR) mode can be set to 'on' or 'off'. The IR reduces 'noise' on the display caused by other radars. When active, the "IR" is highlighted at the upper left of the screen. If you are navigating in a port area serviced by a RACON, you should turn off the IR mode in order to see the RACON signals clearly.

4.22 DISPLAY MODE

Targets can be displayed in black on a white background, or vice versa.

4.23 PLANNED-TX MODE

The PLANNED -TX mode allows the operator to program the radar automatically to transmit for a pre-determined length of time, followed by a stand-by period.

This maintains a radar watch whilst reducing the power consumption experienced during full transmit operation. In PLANNED-TX mode press the STBY/OFF key and the radar will return to its normal operating mode.

4.24 SETTING AUTO/MANUAL TUNING

The Radar 1500 can be tuned either automatically or manually. If MANUAL TUNING is selected, a tuning bar indicator is displayed. AUTO TUNE mode will automatically tune the radar for optimum reception whenever the radar is turned on, even if ranges are changed.

4.25 In Case an Unusual Condition Occurs during Operation

If the operator encounters unusual conditions, such as:--

- The screen is disturbed.
- The machine accepts no key input.

While manipulating, initialize RADAR 1500 by following the steps given below.

- (a) Press the **STBY/OFF** and **X-MIT OFF** keys simultaneously.

The RADAR 1500 is turned off.

- (b) Press the **EBL/VRM** and **STBY/OFF** keys simultaneously.

All settings except the initial settings established through the "INITIAL SETTING" menu are reset to their factory-set values.

SECTION 5

MAINTENANCE

The purpose of this section is to provide instructions for the service technician. The RADAR 1500 is designed to provide long periods of trouble free operation. However, environmental and other factors may require this equipment to be periodically serviced.

WARNING



This radar equipment contains high voltage. Adjustments require specialized service procedures and tools only available to qualified service technicians. The layman should never remove the radar unit cover, nor attempt to service this equipment. When servicing this equipment, it is important that the technician complies with all safety precautions set forth in this manual. The high voltage can cause severe personal injury.

5.1 PREVENTIVE MAINTENANCE

Continuous satisfactory operation of the radar depends on how well it is treated. The following maintenance tips will save you time and money and will help to avoid equipment failure.

1. Always keep the equipment as clean as possible. Remove immediately dirt, dust, or spray from the display and from the scanner from time to time. These units are 'water resistant', "but not 'water proof'". Do not immerse.
2. During routine ship's maintenance, inspect the radar system for the following points:
 - (1) Check all hardware for tightness.

- (2) Check for any evidence of corrosion in the scanner unit and display unit, or their cables and connectors. Clean as needed.
- (3) Check that the cable connector is secure.

5.2 CLEANING (MONTHLY INTERVALS)

Wash the exterior of the scanner with fresh water, but do not immerse the unit. A heavy deposit of dirt, or caked salt on the surface of the scanner may cause a considerable drop in the radar performance. Clean the face of the display unit with a clean, soft, lint-free cloth, slightly dampened with fresh water.

5.3 LCD FILTER SURFACE CLEANING

In time, the surface of the LCD FILTER (screen) may accumulate a film of contaminants, which tend to dim the picture. A good glass cleaner and a soft cloth or towel can be used to clean the LCD display, the keyboard and the display cabinet.

5.4 FUSE

A fuse seldom blows without some cause. Even if a fuse is replaced and it does not immediately blow again, it may still be necessary to make further checks on its associated circuits. If necessary, replace the 5A fuse (Normal-blow type) in the power cable.

SECTION 6

AFTER-SALES SERVICE

To verify ownership and warranty registration, you should take a few minutes to fill out your warranty registration card in the front of the manual. It is very important that you take time to fill out this card.

The warranty registration card should be returned to the nearest JRC service center immediately after your purchase, in order to receive full warranty benefits.

Read the attached the warranty card. It contains important information on warranty limitations.

SECTION 7

SPECIFICATIONS

7.1 GENERAL

1. Maximum range: 16 Nautical Miles
2. Minimum range: Less than 25 m on the 0.125 NM range
3. Range scales:

Range (NM)	Number of Rings	Range ring Interval(NM)
0.125	2	0.0625
0.25	2	0.125
0.5	2	0.25
0.75	3	0.25
1.0	4	0.25
1.5	6	0.25
3.0	6	0.5
6.0	6	1.0
12.0	6	2.0
16.0	4	4.0
4. Range discriminations: Less than 25 m
5. Range ring accuracy: Better than $\pm 0.9\%$ of maximum
maximum range of the scale in use,
or 8 m, whichever is the greater.
6. Bearing accuracy: ± 1 degree
7. Display device: LCD: 115×86.4 mm (320×240 dots)
8. Environmental conditions:

Scanner unit	Temperature	−15℃ to +55℃
	Humidity	Up to 95% at 35℃
Display unit	Temperature	−10℃ to +50℃ (Except LCD) 0℃ to +50℃ (LCD)
	Humidity	Up to 95% at 35℃

Note LCD performance will be slightly deteriorated in response speed and brightness during extreme low temperatures.

9. Input power: 10.2 V to 16 V
10. Power consumption: Approx. 30 W
11. AVR: Floating AVR system

7.2 SCANNER UNIT

1. Dimensions:

Diameter	450mm
Height	227mm
2. Weight: Approx. 5 Kg
3. Polarization: Horizontal
4. Beam width:

Horizontal	5.2 ° nominal
Vertical	30°
5. Sidelobes: Less than -20 dB
6. Rotation: Approx. 32 rpm
7. Transmitter frequency: 9445 MHz
8. Peak power output: 2KW
9. Pulse length/PRF:

0.08μs/ 2250Hz
(0.125,0.25,0.5,0.75 NM)
0.3μs/ 1200Hz (1,1.5 NM)
0.8μs/ 600Hz (3,6,12,16 NM)
10. Duplexer: T-junction with diode Limiter
11. Mixer: MIC front end
12. IF amplifier:

Center frequency	60 MHz
Bandwidth	3/10 MHz
13. Noise figure: Less than 10 dB
14. Characteristic: Linear

7.3 DISPLAY UNIT

1. Dimensions:

Width	187 mm
Depth	83 mm
Height	183 mm
2. Weight: Approx. 1.2 Kg

3. Mounting:	Table, Overhead, or Flush mount
4. Video:	4 levels quantitized
5. Tuning:	Auto/ Manual
6. Bearing scale:	360° scale graduated at intervals of 5°
7. VRM:	3 digit readout
8. EBL:	3 digit readout
9. Alarm:	Audible alarm with zone mark
10. Offset:	1/4 radius below
11. Timed TX:	Rotation period 10,20 or 30 scans Repetition period 3,5,10,15 min.
12. LANGUAGE:	English, French, Spanish, Italian, Norwegian, German
13. Features:	VRM, EBL, Cursor with LL, Interference rejection, Target expansion, Target alarm, LL or TD readout, Waypoint with LL, Offset, Timed TX, Target trail, Auto tune
14. External input:	
NAV-AID	NMEA0183 (RMA, RMB, RMC, GLL, GTD, VTG, BWC sentence) NMEA0182
Compass	NMEA0183 (HDM,HDT,VWH, or HSC sentence)

Main Office & Plants

●Main Office
Akasaka Twin Tower(Main)
17-22,Akasaka 2-chome,
Minato-ku,Tokyo 107
Maritime Sales Department I
Phone : 03-3584-8791
Fax : 03-3584-8795
Maritime Sales Department II
Phone : 03-3584-8834
Fax : 03-3584-8796
International Business Department
Phone : 03-3584-8836
Fax : 03-3584-8878
International Marketing Department
Phone : 03-3584-8845
Fax : 03-3584-8859

●Mitaka Plant
1-1,Shimorenjaku 5-chome,Mitaka
Tokyo 181
Phone : 0422-45-9111
Fax : 0422-45-9110

Overseas Subsidiaries

●JRC (UK) Limited
Suite 100, Temple Chambers
Temple Avenue, London EC4Y 0DT
Phone : 44-171-353-7960,583-7440
Fax : 44-171-353-3321

●c/o JRC do Brasil Empreendimentos
Electronicos Ltda.
Av.Almirante Barroso,63-Gr.S/2707,
20031 Rio de Janeiro,RJ
Phone : 55-21-220-8121,262-9281
Fax : 55-21-240-6324

Overseas Branch Offices

●U.S.A
Japan Radio Co.,Ltd./New York Branch
430 Park Avenue, New York,
N.Y. 10022
Phone : 1-212-355-1180
Fax : 1-212-319-5227

Overseas Liaison & Service Offices

●Indonesia
Japan Radio Co.,Ltd.
Mulia Tower 15th Floor
Jalan Jenderal Gatot Subroto Kav.9-11,
Jakarta 12930
Phone : 62-21-5204053 • 5204056
Fax : 62-21-5204059

●U.S.A.
Japan Radio Co.,Ltd.
c/o Raytheon Marine Company 676 Island
Pond Road Manchester,NH 03109
Phone : 1-603-634-4840
Fax : 1-603-634-4841

●Philippines
Japan Radio Co.,Ltd.
2320 Taft Avenue
Malate,Manila
Phone : 63-2-50-8565 • 57-1490
Fax : 63-2-521-5049

●United Kingdom
Japan Radio Co.,Ltd.
c/o Raytheon Marine Europe,
Anchorage Park Portsmouth,
Hampshire,P03 5TD
Phone : 44-1705-663-239
Fax : 44-1705-663-241

●Thailand
Japan Radio Co.,Ltd.
Charturong Arphon Building
457 Phra Sumaru Street
Bangkok 10200
Phone/Fax : 66-2-280-0401

●Netherlands
Japan Radio Co.,Ltd.
c/o Radio-Holland B.V.
Eekhoutstraat 2,
3087 AB Rotterdam
Phone : 31-10-429-4581 • 31-10-429-1088
Fax : 31-10-428-2259

●India
Japan Radio Co.,Ltd.
5 A,Sagar Apartments
6 Tilak Marg, New Delhi-110001
Phone : 91-11-338-5751 • 1914
Fax : 91-11-338-4571

●Spain
Japan Radio Co.,Ltd.
c/o TOSA CANARIAS S.L.Doctor
Juan Dominguez Perez 44 urbanizacion
EL CEBADAL Las Palmas Gran Canaria
Phone : 34-28-46-5191 • 34-28-46-5291
Fax : 34-28-46-2398

●Taiwan
Japan Radio Co.,Ltd.
10 F-4, No.110, Santou 4th Road,
Kaohsiung
Phone : 886-7-3307151
Fax : 886-7-3307151

For further information contact :



Since 1915

Japan Radio Co., Ltd.

**HEAD OFFICE &
SALES DEPT.**

Akasaka Twin Tower(Main),
17-22,Akasaka 2-chome,Minato-ku,Tokyo.
Phone : 03-3584-8711
Fax : 03-3584-8715
Telex : 0242-5420 JRCTOK J

MAIN PLANT

1-1,Shimorenjaku 5-chome,Mitaka-shi,Tokyo.
Phone : 0422-45-9111
Fax : 0422-45-9110
Telex : 02822-351 JRCMTK J

MODEL 1500

TECHNICAL DESCRIPTION

1 GENERAL

The theory of operation for the Radar RADAR1500 is presented here with descriptions following the functional block diagram circuits.

2 SCANNER UNIT

The scanner unit consists of the RF PCB radiator, the motor, radiator rotating mechanism, bearing reset assembly, and the transmitter/receiver unit. These components are all housed within the 12.2' radome. The functional Block Diagram appears in Figure 2.

2.1 RADIATOR

The RF PCB radiator forms the main RF transmitting beam for the radar transmitter and becomes the receiving antenna during the receive cycle. The beam formed by the patched array styled PCB at half power points is 5.2° horizontally and 30° vertically.

The direction of the beam (maximum radiated power) is essentially perpendicular to the radiator surface.

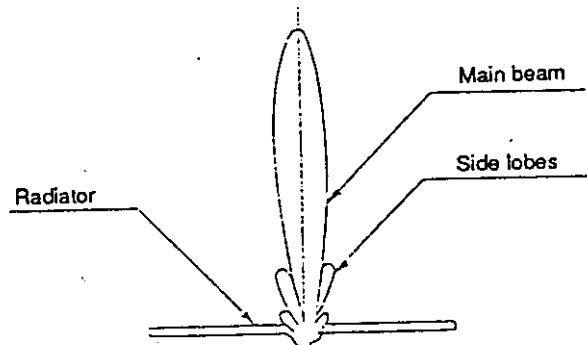


Fig. 1 RADIATOR PATTERN

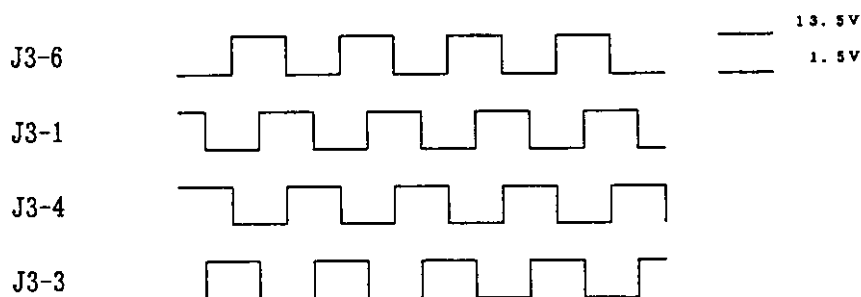
2.2 RADIATOR ROTATING MECHANISM

The mechanical coupling between the PCB radiator assembly and the motor is effected by a reduction drive gear. The antenna motor normally rotates the radiator at approximately 32 rpm.

2.3 MOTOR

The antenna drive motor is used stepping motor. When radar is stand-by mode ,J3-1, 3,4,6 are +12V. When Transmitter mode, output of IC6-12 is changed 136.5 Hz to 256 Hz at first 7 step.After 7 steps, output of IC6-12 is stable at 250 Hz.

The waveform of J3-1,3,4,6 are as follows:



2.4 BEARING RESET SWITCH

The bearing reset switch, or otherwise referred to as the "heading reference switch", produces the signal to reset the scanconverter circuitry to "0" when the permanent magnet fitted on the main gear passes across the reed switch S101. The reset signal (BZ) is sent down to the bearing reset circuitry in the display unit and synchronizes the scanner position to the display sweep. The BZ signal is sent down to the display together with the Tune indication signal at J2-6.

2.5 TRANSMITTER

The transmitter consists of the solid state modulator circuits, the power supply, and the 2KW magnetron.

A.Modulator

A solid state type pulsar design is used by the modulator and primarily consists of a pulse generator circuit, power MOSFET switch, and pulse transformer.

When setting the X-MIT/STBY key on the control panel at the display unit to "ON", the transmitter trigger pulse is sent via the interunit cable from the transmit trigger generator circuit in the display unit to the J2-2 in the modulator.

The switching regulator power supply provides +250Vdc to charge the capacitor (C39). In addition to the high voltage for the modulator, the power supply also provides the magnetron heater voltage (6Vdc)and the operating 12Vdc for the trigger circuits and display unit.

Generally the pulse width of the pulse generator circuit is controlled by the range key selections on the front panel at the display unit. Three different pulse lengths: $0.08\mu\text{sec}$, $0.3\mu\text{sec}$ and $0.8\mu\text{sec}$ (in accordance with the range scale) can be

provided. The pulse repetition frequency (PRF) always changes automatically to match the selected operating pulse length(See TABLE 1).

Upon receiving the positive trigger pulse, TR5 generate a differential waveform at C35, R39-R44 setup the discharge period of this waveform to generate a short(80ns), medium(300ns), or long(800ns) gate to IC1-6. The pulse is amplified and applied to the gate of TR14 which will conduct for the selected pulse length drawing current through the primary of the Pulse Transformer(T2) generating a 1.85kV pulse to the magnetron cathode.

TABLE 1 RANGE, PULSE LENGTH, AND PRF RELATIONSHIPS

Range	Pulse Length	PRF
0.125, 0.25, 0.5, 0.75 nm	0.08 μ S	2250 Hz
1, 1.5. nm	0.3 μ S	1200 Hz
3, 6, 12, 16 nm	0.8 μ S	600 Hz

RECEIVER

The receiver circuit consists of the passive diode limiter, the MIC Front End and the Receiver IF circuit.

The MIC Front End(E101, NJT1967) device consists of ,a single balanced mixer, and the local oscillator. The received radar echo signals at 9445 Mhz are then sent into the single balanced mixer of the MIC. The MIC Local Oscillator, tuned by the adjustment of the operator's Tune control on the display unit front panel to be 60 Mhz higher than the magnetron's operating frequency for maximum target detection, is also fed into the single balanced mixer. The single balanced mixer output of 60 Mhz echo signals is then coupled into the 60 Mhz IF amplifier.

RECEIVER CIRCUIT

The Receiver circuit includes the 60 Mhz IF amplifier, bandwidth control circuits, video detector, tune indicator circuitry, the MBS amplifiers and the video output circuit.

IF Amplifier Circuit: The IF amplifier consists of low-noise gain controlled transistor amplifier TR15 and gain controlled IC amplifiers IC9 with bandwidth selector and IC10 .

TR15, IC9 and IC10 are controlled by the gain and STC control signals generated by the display unit. Maximum gain is obtained when the voltage level at IC9-5 and IC10-5 reaches 4 volts.

The bandwidth selector IC1 and TR15 enables to change load resistor so the receiver has either a 10 Mhz or a 3 Mhz bandwidth characteristic. The selection depends on the

pulse length selector signal (PW).

When +6V at J2-7 is present, the base voltage of TR16 and TR25 will be +12V volts. In this condition, the pulse length in operation is $0.08\mu\text{S}$ and the bandwidth of the receiver is widened to 10 Mhz. When pulse length are other than $0.08\mu\text{S}$, the base of TR16 and TR25 will be 0V, the bandwidth will become narrow at 3 Mhz.

Video Detector Circuit .

The video detector circuit IC11 operate as a video detector to remove the 60MHz IF component from the incoming signals. The output signals on IC11-12 are inverted to negative going pulses and fed to the video output circuit.

Video Output circuit

The video output circuit consists of emitter follower TR18. The emitter follower operates strictly as an impedance transformer to drive the 50 ohms coaxial cable which carries the video signal to the display unit.

TUNING Indication Circuit

The tuning indicator circuit consists of amplifier TR19, detector TR20, and emitter follower TR21,22. TR21 charges C110 to the detected signal voltage. This voltage is sent to the display unit as a tuning indication voltage via buffer amplifier TR22. with bearing reset pulse. The range of the tuning indication voltage varies normally between +5V(detuned)and 1V(tuned in long pulse).

POWER SUPPLY

The power supply converts the ship's mains to necessary DC voltages to operate the radar system. These output voltages include regulated +12VDC, +6VDC, and +250VDC.

The AVR converter consists of IC2 and IC3 as well as TR1 and TR2. The RV1 is normally set by monitoring the +12VDC output at TP1 and adjusting for $+12\text{VDC} \pm 0.1\text{VDC}$ with a volt-ohm meter.

3 DISPLAY UNIT

The display unit normally contains the Main Control PCB, the Power Supply PCB, the LCD module and the Control Panel PCBs.

3.1 SIMPLIFIED BLOCK DIAGRAM

FIG.2 shows the fundamental circuits of the display unit in a simplified functional block diagram. Most system operations within the display unit occur primarily on the Main Control PCB. It is on this PCB that most of the signal processing takes place. The following is a brief description of the main circuit functions of the display unit.

3.2 MAIN CONTROL PCB

3.2.1 VIDEO INPUT CIRCUITRY

The incoming video signals from the receiver in the scanner are first routed through the FTC circuit components consisting of CD2 and C14. The diode CD2

controlled by the voltage supplied from IC10-11 which is determined by the front panel RAIN CLUTTER Control.

3.2.2 A/D CONVERTER

The video signals from CD2 and C14 are fed to an amplifier TR1 and TR1 output video signals are converted to digital pulses by 3 comparator ICs IC12,13,14. The digital video output is then sent to the system control LSI IC6.

3.2.3 SYSTEM CONTROL LSI

The system control LSI IC6 contains video processor, video buffer memory, scan converter, PPI video memory control circuit, various clock input and output circuit, LCD drive signal generator, and system control signal generator circuit.

3.2.4 PPI MEMORY AND GRAPHIC MEMORY

The processed video signals are stored in the buffer memory of the system control LSI, and then read out on the bearing pulse timing. The buffer memory output is fed to PPI memory IC9 followed by the scan converter data onto its address pins. And also graphic data from main CPU and GDC are stored in the graphic memory IC7 and IC8. IC7, IC8 and IC9 are 64K x 4 bit DRAM. The output data from DRAM are fed to the LCD drive signal timing are controlled by GDC and LCD drive signal are fed to the LCD unit via output buffer IC21.

3.2.5 MAIN CPU CIRCUIT

The main CPU circuit consists of CPU IC4, RAM IC2, and ROM IC3. The main CPU controls all of the radar system with GDC and system control LSI according to the front panel key output and the data from the other nav-aid unit. The tuning voltage and gain STC signals are generated by the D/A converter IC10 outputs which are controlled from CPU.

3.2.6 OPTIONAL INPUTS

The Modell500 radar can receive various input signals from Nav-aids and compass.

If more than one data type is present at the radar inputs (for examples; compass and NMEA) a system priority has been established in the radar's software to respond to the inputs in driving the features. The assigned priorities are set in this manner:

HEADING: 1. Flux Sensor(NMEA 0183 "HDM, HDT, HSC" sentences)
2. Navaid Data (NMEA 0183 "RMC, RMA, VTG" sentences)

POSITION: 1. Navaid Data(NMEA 0183 "RMC, RMA, GLL, GTD"
sentences)

SPEED: 1. Navaid Data(NMEA 0183 "RMC, RMA, VTG, VHW"
sentences)

WAYPOINT: 1. Navaid Data(NMEA 0183 "RMB, BWC" sentences)

3.2.7 POWER SUPPLY

The Power Supply converts the +12V to the necessary DC voltages to operate the

radar display unit. These output voltages include regulated , +5VDC, +24VDC, -22VDC, -8VDC, and 300VAC.

The power switch circuit(TR21) can begin operation when the STBY/OFF switch is pressed on the Control PCB. The STBY signal toggles IC31-1 output and TR21 and TR22 conducts. Then ship's main Voltage fed to the AVR converter circuit on the scanner unit. When the XMIT/OFF key is pressed, IC31-12 operates and TR24 and IC33 to enable the OPE output.

4 TROUBLE-SHOOTING GUIDE

While the MODEL1500 radar is highly reliable systems, early signs and detection of component fatigue can sometimes be spotted during regular operational checks.

When a problem is observed, corrective service should be arranged to avoid failure at critical times at sea. In some cases, problems may be cleared by a system master reset.

4.1 MASTER RESET

The first step in attempting to clear a problem associated with the general operation of this Radar is to perform a MASTER RESET. This function will clear the Radar's memory and will return it to its factory settings. It may then be necessary to make the INITIAL SETTING and to re-enter the parameters previously established by the operator.

CAUTION

In making checks, be alert to the high voltage points existing throughout the equipment.

4.2 RESET

This reset will clear the radar's memory except INITIAL SETTING. This can be done by pressing the EBL/VRM key and while holding, then turning the power on. This should be performed anytime a component or PCB within the radar is replaced.

4.3 FUSE

A fuse seldom blows out without some cause. Even if a fuse is merely replaced and does not blow again, it still may be necessary to make further checks of the circuits associated with the fuse.

TABLE 2 shows a table of fuses employed in the equipment.

TABLE 2 FUSES USED

Location	Part No.	Rating Current	Protective circuit	Type	Remarks
DISPLAY	F401	3A	All circuit	Glass tube	

2.7.3 FAULT FINDING PROCEDURE

Often the display on the LCD can help indicate which major circuit is at fault. It may be quicker to check-out the equipment according to the trouble shooting guide that follows (TABLE 3).

In general, the common causes of trouble frequently encountered include abnormal resistances, intermittent variable resistors, switches .

In the following fault finding procedure, it is assumed that only a VOM is available; the use of an oscilloscope simplifies the procedures and may prove necessary in some cases.

TABLE 3 is the trouble shooting guide and check-out procedure, TABLE 4 shows typical voltages and resistances at significant points throughout the equipment. The internal resistance of the tester used in measurements was $20k\Omega/Vdc$, $8k\Omega/Vac$.

TABLE 2 OPERATION CHECKLIST

Unit to be checked	Check item	Correct condition	Remarks	Measuring point
Scanner Unit	a. Input voltage			CMN-457 J1-1-2
	b. AVR output voltage	12V		CMN-457 TP1
	c. Mag. current	12V~20V		CMN-457 TP2
Display Unit	a. Input voltage	Refer to Note		J2-1-2
	b. AVR output voltage	5V		TP1-ground
	c. Observation of Screen sensitivity, Sweep length, sweep linearity, sweep center, ring and illumination.			
	d. Check of the operating controls			

NOTE

Allowable variation of input voltage, DC10.2V-16V

TABLE 3 TROUBLE SHOOTING GUIDE

	Trouble	Remedy
1.	Does not start at OPERATE switch to STBY.	Check:[DISPLAY] Blown fuse F401. Check input power circuits. Check modulator circuits in scanner. Faults of contact on CCK-773. Faults of power supply circuit on CMN-457. Faults of switch cct. on CMC-970.
2.	Scanner fails to rotate.	Check:[SCANNER] Fault on contact on terminal boards. Fault of M101 Fault of drive mechanism. Faults of motor control cct. on CMN-457.
3.	Scanner rotates but rotation of sweep is abnormal.	Fault of connection between M101. Check:[DISPLAY,SCANNER] Fault of main circuit for the Display Unit.
4.	No picture on the screen.	Fault of LCD display unit or its drive cct. Check:[DISPLAY] Fault of LCD drive cct. Fault of video circuit.

	Trouble	Remedy
5.	Range rings on the screen but no noise and no echoes:	Fault circuit between IF amplifier of receiver unit and input circuit of display unit video amplifier. Check: [DISPLAY] Fault of GAIN, STC control cct.. Fault of receiver unit. Fault of MIC.
6.	Noise and range the screen but no echoes.	If no transmission is present, check the modulator and magnetron. Check:[SCANNER] If transmission appears to be present as indicated by the correct MAG. I reading on Tester. CMN-457 TP1=12VDC~20VDC Failure of Local Oscillator tuning. If transmission appears to be present, carry out the Local Oscillator tuning procedures and check the MIC. Fault of MIC Mixer. If no transmission is present, Whether the lead wire to magnetron is grounded to chassis. Fault of magnetron.
7.	Poor sensitivity. Dim echoes.	Check:[SCANNER,DISPLAY] Reduction of transmitting output power. Fault of magnetron. → Check of MAG. I reading on CMN-457-TP1. Fault of MIC Frontend. Failure of Local Oscillator tuning. Failure of INTENSITY ADJ. Fault of video amplifier circuit on CMC-970 Fault of receiver unit.
8.	NO VRM or VRM cannot be controlled.	Check:[DISPLAY] Fault of CCK-773. Fault of main circuit(CMC-970).
9.	NO EBL or EBL cannot be controlled	Check:[DISPLAY] Fault of CCK-773. Fault of main circuit(CMC-970).
10.	No alarm zone marker, cannot be controlled or no alarm sound.	Check:[DISPLAY] Fault of CCK-773. Fault of main circuit(CMC-970). Fault of Buzzer BZ1.

TABLE 4 show typical voltages and resistances at significant points throughout the equipment.

(A) Inter-unit terminal board

Resistance Measurements shall be made under the following conditions:
 POWER switch-off S101-on.
 Resistance values shall be measured between measuring point and J2-7 (E) or metal chassis, and negative terminal of the tester is grounded as a rule.
 The tester used for this measurement is 20k Ω /V DC, 8k Ω /V AC.
 Voltage measurements shall be made with the following display control conditions:
 POWER switch-on, ST-BY or TX, RAIN CLUTTER-min, GAIN-max, SEA CLUTTER-min.
 Ship's power supply is DC 12V.

STC.....MIN TUNE.....CENTER
 FTC.....MIN GAIN.....MAX
 P. S. = 12V (D. C.)

TABLE 4 TYPICAL VOLTAGES AND RESISTANCES
 RADOME RADAR[RADAR1500] (with inter-unit cable connected)

Measuring Point	Resistance (OFF)	Voltage[V]				Remarks
		ST-BY	TX			
			0.125[nm]	1.5[nm]	16[nm]	
J1-1	∞	11.0	10.5	11.0	11.5	1A
-2	∞	0	0	0	0	2A
-3	521.8Ω	12.0	12.0	12.0	12.0	+12V
J2-1	52.12kΩ	14.2	15.5	15.6	15.8	TUNV
-2	4.773kΩ	2.4	2.0	2.0	2.0	TI/GS
-3	0.03Ω	0	0	0	0	TIR
-4	57.05Ω	0	0	0	0	VD
-5	0.02Ω	0	0	0	0	VDR
-6	31.94kΩ	0.01	3.0~4.6	0.8~2.0	0.75~2.0	BZ/TUNI
-7	4.208MΩ	0	4.2	7.6	11.2	PW

(B) Resistance at inter-unit connector without connection of cables.

NOTE
Refer to Note given in item(A).

SCANNER UNIT(Without Inter-unit Cable connected)

Measuring Point	Resistance[Ω]	FUNCTION
J1-1	∞	1A
-2	∞	2A
-3	543.4 Ω	+12V
J2-1	7.349M Ω	TUNV
-2	1.570M Ω	TI/GS
-3	0.03 Ω	TIR
-4	∞	VD
-5	0.03 Ω	VDR
-6	∞	BZ/TUNI
-7	4.193M Ω	PW

DISPLAY UNIT(Without Inter-unit Cable connected)

Measuring Point	Resistance[Ω]	FUNCTION
J1-1	19.859M Ω	1A
-2	16.583M Ω	2A
-3	∞	PW
-4	56.16 Ω	VD
-5	0.03 Ω	VDR
-6	0.03 Ω	TIR/GSR
-7	4.776k Ω	TI/GS
-8	31.94k Ω	BZ/TUNI
-9	50.68k Ω	TUNV
-10	1.143k Ω	+12V
J2-1	17.729M Ω	SHIPS'MAINS(+)
-2	17.182M Ω	SHIPS'MAINS(-)
-3	∞	NAV(+)
-4	∞	NAV(-)
-5	∞	COMPASS(+)
-6	∞	COMPASS(-)
-7	0.04 Ω	E