JRC INSTRUCTION MANUAL

JRC

LCD RADAR *RADAR 1500 MKII*

LCD RADAR
RADAR 1500 MKII

Thank you for purchasing the RADAR 1500 MK II 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 MK II 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.

I

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 MK Ⅱ 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.

II

Equipment Photographs

SCANNER UNIT NKE-1063

DISPLAY UNIT NCD-3970A

Table of Contents

APPENDIX

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 and snow clutter suppression
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 surface clutter suppression
TD	Time Difference
TI	Trigger
VD	Video
VOM	Volt-ohm Meter
VRM	Variable Range Marker
WPT	Waypoint
X-MIT	Transmit

SECTION 1

EQUIPMENT OVERVIEW

1.1 FUNCTION

Congratulations on selecting the JRC RADAR 1500 MK Ⅱ 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 MK Ⅱ 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 360° 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.	Remarks
Radar 1500 MKⅡ system	JMA-1020	
Scanner Unit	NKE-1063	
Display Unit	NCD-3970A	
Bracket	MPBX39815	
Interunit Cable	CFQ8768-15	8-cores composite cables (15 m)
Power Cable	CFQ-8572	with Fuse (2 m)
Instrution Manual	7ZPRD0593	This Manual
Standard Spares	6ZXRD00190	5 A Fuse $\times$ 1
Sun Cover	MTV303726	
Scanner Mounting Hardware	MPXP31681A	
Display Mounting Hardware	MPTG30149	Screw $\times$ 4
Console Mounting Screw	MPTG30380	Screw $\times$ 4

Table 1-1　EQUIPMENT SUPPLIED

1.4 DIMENSIONS

COLOR   GRAY

MASS   APPROX.   1.2kg

(UNIT:mm)
(1mm=1/25.4inch)
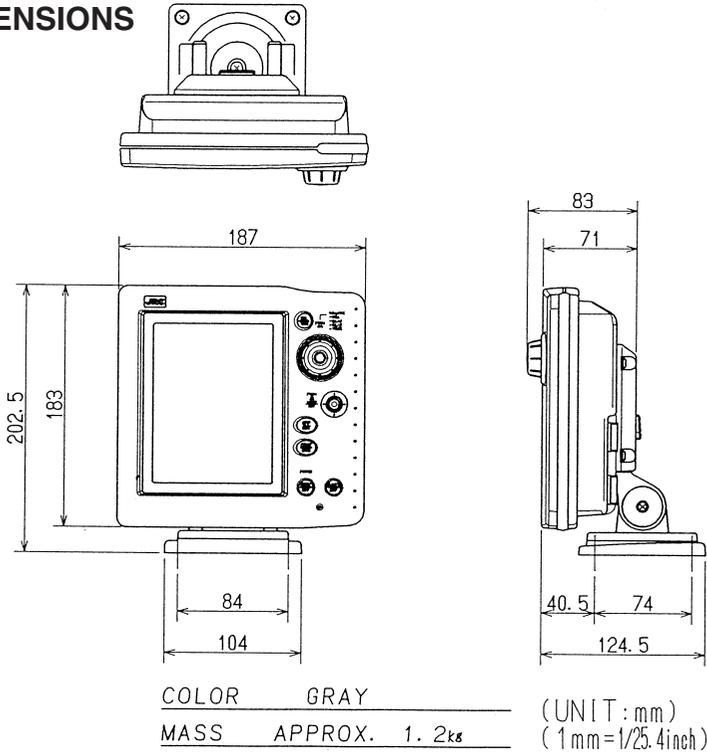
FIG. 1-1 DISPLAY MOUNTING DIMENSIONS
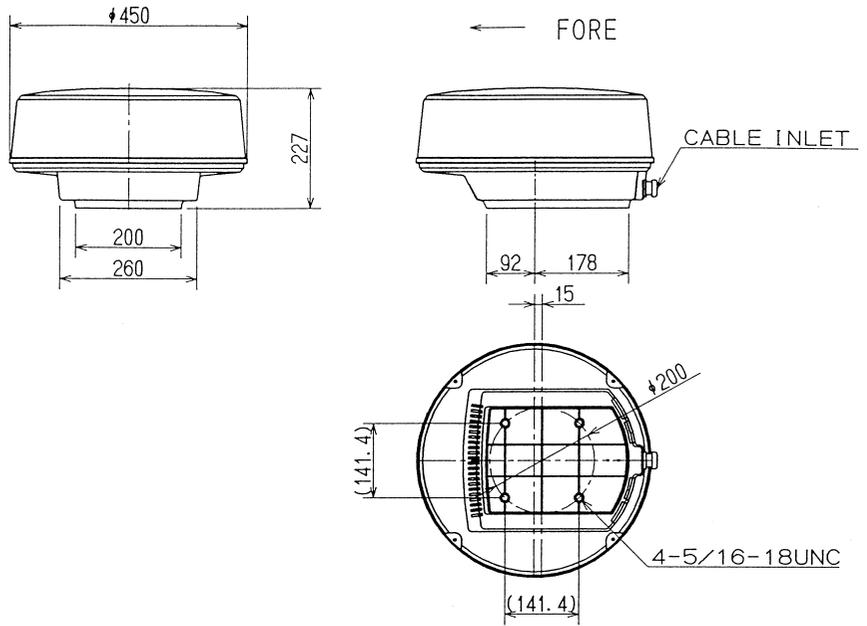
COLOR   WHITE

MASS   APPROX. 5.0kg

(UNIT:mm)
(1mm=1/25.4inch)

FIG. 1-2 SCANNER MOUNTING DIMENSIONS

SECTION 2

NAMES AND FUNCTIONS OF THE COMPONENTS

DISPLAY UNIT

④ VRM/EBL Key

③ J-Dial

⑤ Joystick with MENU/ENT

⑥ OFFSET Key

⑦ Contrast/Dimmer Key

② Transmit/off Key

① Stand-by/off Key

DISPLAY UNIT

LATCH

INTER UNIT CONNECTOR

POWER INPUT/ NMEA/ COMPASS CONNECTOR
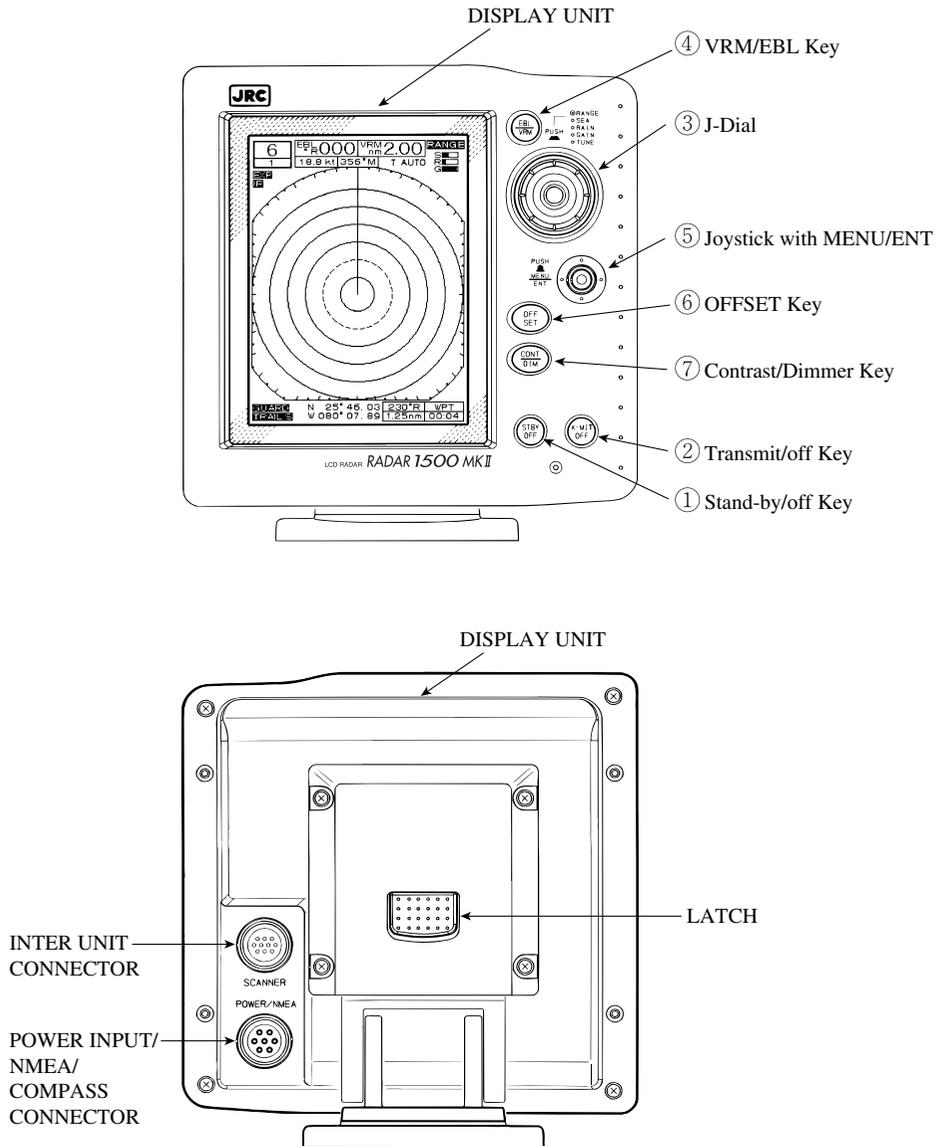
FIG. 2-1 DISPLAY UNIT

2.1 CONTROL PANEL

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 SET UP 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

・ Setts 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 RADAR 1500 MK Ⅱ.

3.1   UNPACKING AND INSPECTION

Use care when unpacking the RADAR 1500 MK Ⅱ 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 MK Ⅱ 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 15 meter length of interunit 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 interunit cable does not exceed 20 meters.

A general system diagram for the RADAR 1500 MK Ⅱ is shown on the following page. (See FIG. 3-1)

SCANNER UNIT
NKE-1063

φ450

FORE

CABLE INLET

227

200
260

92   178

15

φ200

(141.4)

4-5/16-18UNC

(141.4)

MAX φ9.8

8-CORES
COMPOSITE CABLE
15m:CFQ8768-15
10m:CFQ8571-10
(option)
20m:CFQ8768-20
(option)

DISPLAY UNIT
NCD-3970A

187

183

71

202.5

CONNECTORS

104

84

MAX φ9.3

124.5

74

4-φ5.5

SHIP'S MAINS

MOUNTING
DIMENSIONS

POWER CABLE
CFQ-8572
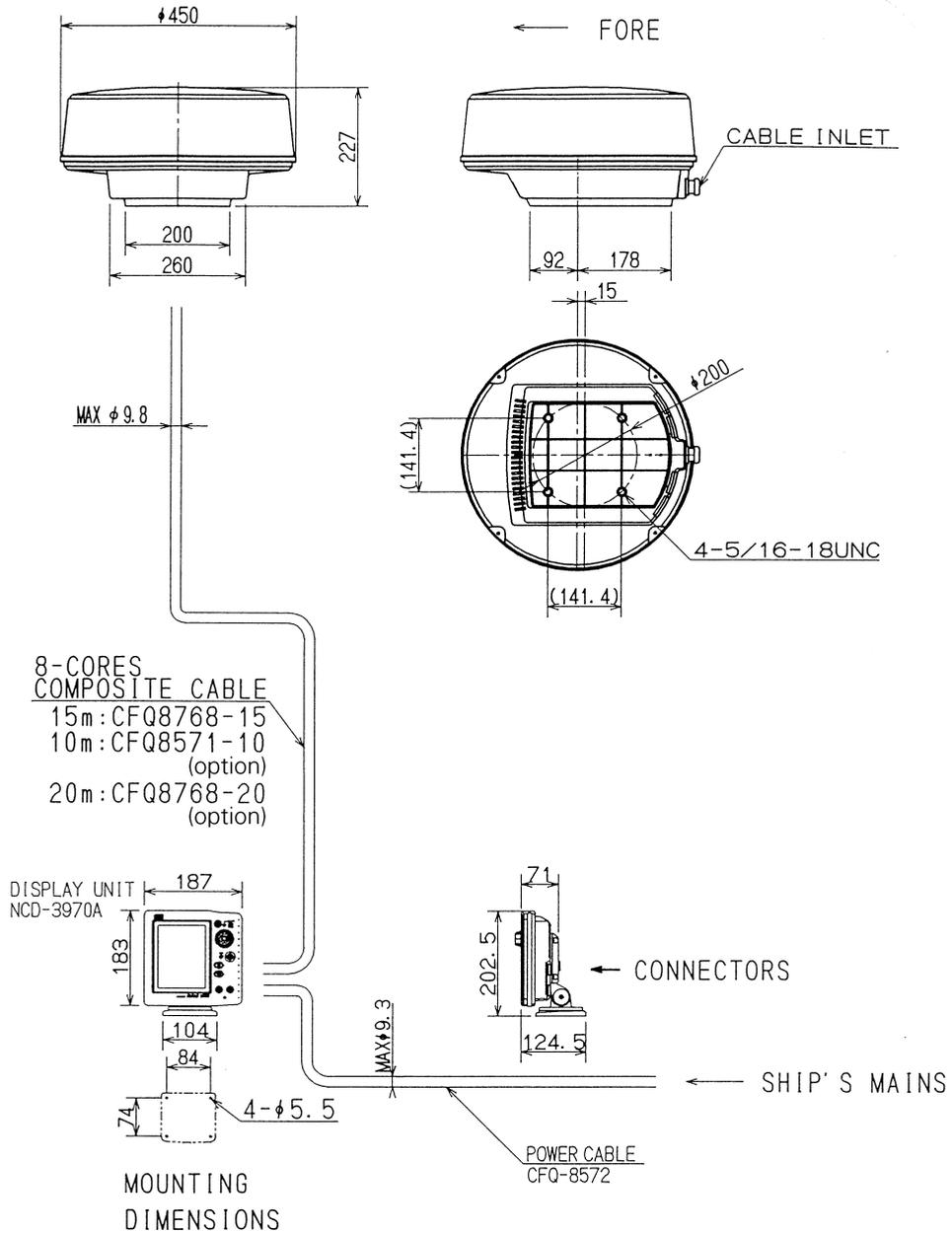
(UNIT:mm)
(1 mm = 1/25.4inch)

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 FIG. 3-3 as a guide, install the display unit and secure it firmly to the mounting surface.


Table Top Mounted

60 mm (Min.)
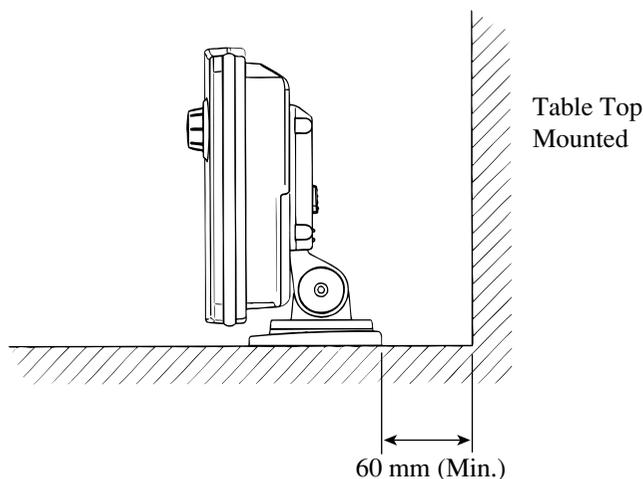
FIG. 3-2 TYPICAL MOUNTING METHOD

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.

4 SCREWS

BRACKET

DISPLAY UNIT

SCANNER

POWER/NMEA

MOUNTING PLATE

BRACKET

SCANNER

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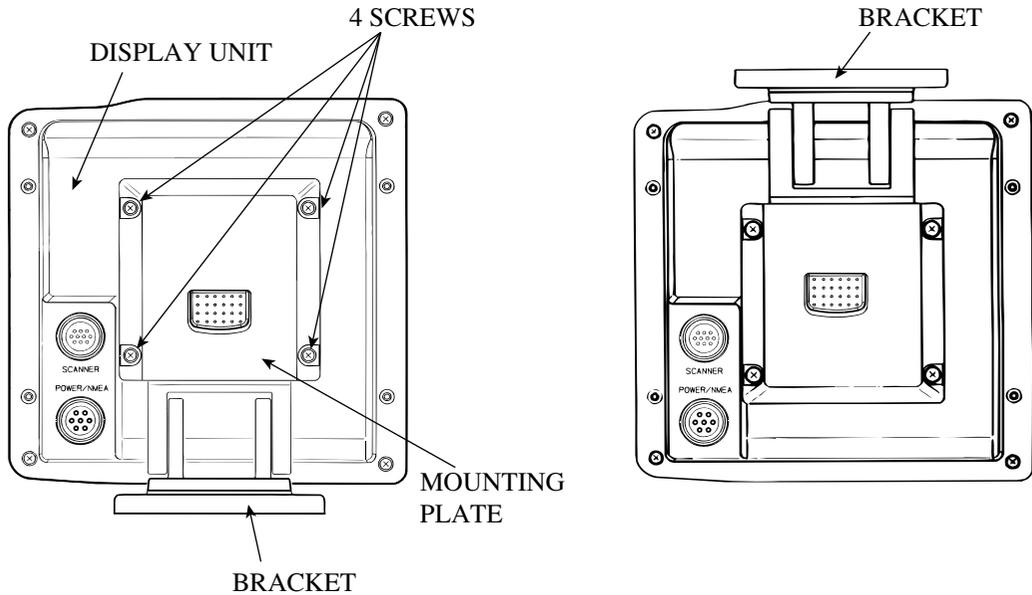
The display unit is separated from the bracket in the shipping carton. Install the display unit by sliding it onto the bracket until it is fully seated.

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

DISPLAY UNIT

LATCH

BRACKET
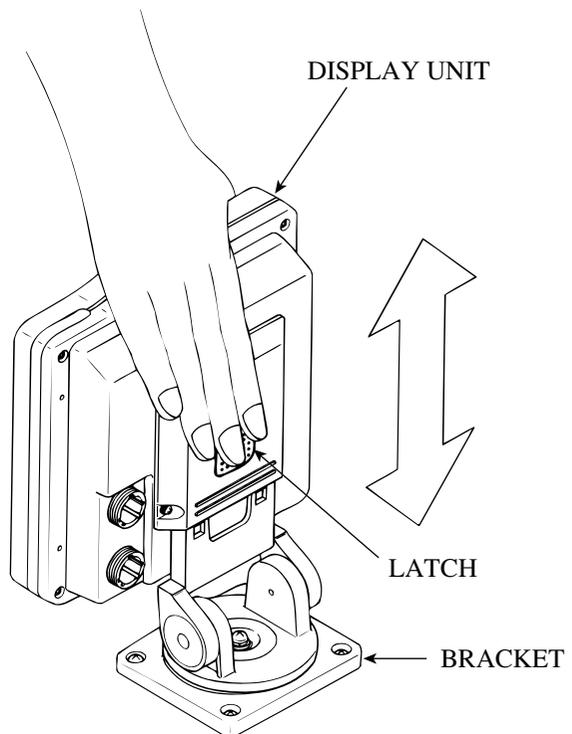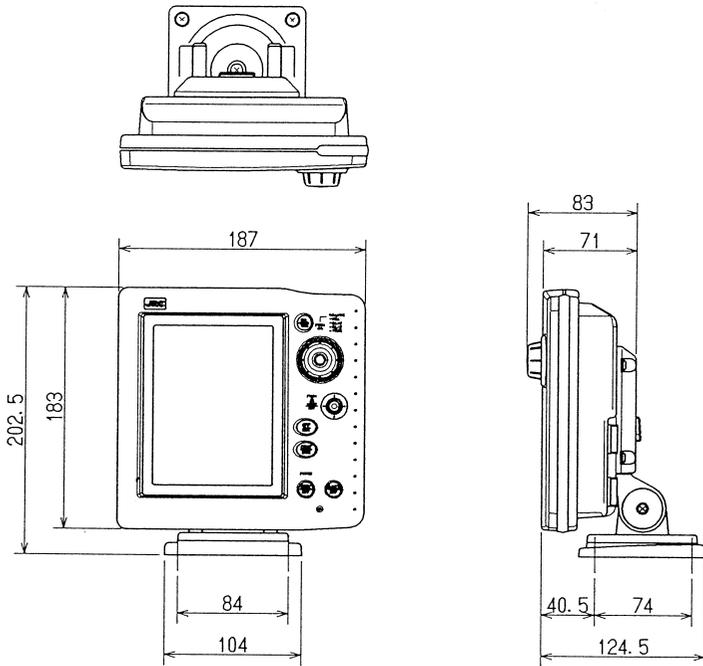
COLOR   GRAY
MASS   APPROX. 1. 2kg

(UNIT:mm)
(1mm=1/25. 4inch)

FIG. 3-3 DISPLAY MOUNTING DIMENSIONS
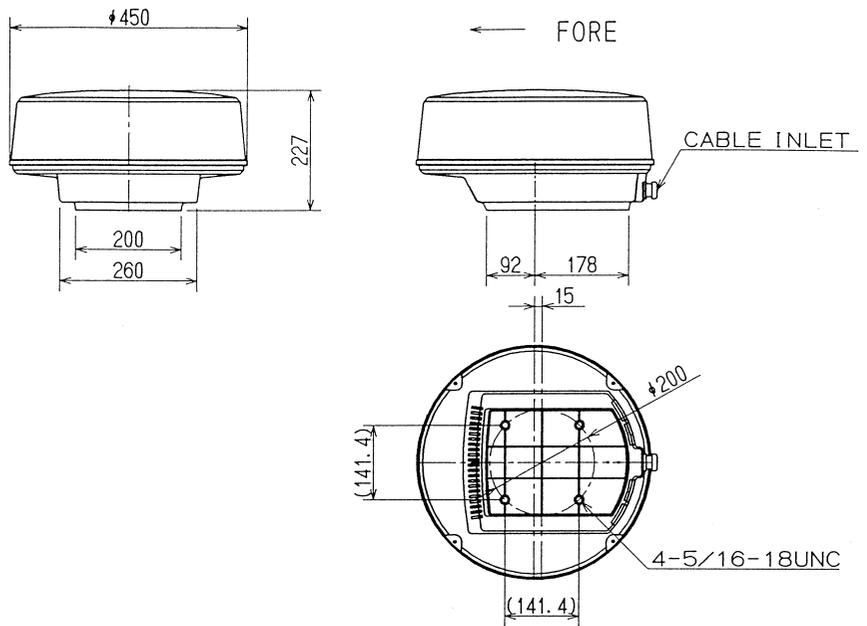
COLOR   WHITE
MASS   APPROX. 5. 0kg

(UNIT:mm)
(1 mm = 1/25. 4inch)

FIG. 3-4 SCANNER MOUNTING DIMENSIONS

3.4 MOUNTING THE SCANNER UNIT

<div style="border:1px solid black">

⚠CAUTION

❗ The scanner unit requires a minimum mounting surface thickness of 3 mm (0.12 inches). If the thickness of the mounting base is less than this, additional flat washers are required. If the thickness is more than 15 mm (0.6 inches), longer hexhead bolts are required.

</div>

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, searchlights, horns or masts are not in the same horizontal plane, otherwise blind areas and false targets will appear on the radar screen.

Using the outline drawing of FIG. 3-4 or the template in the front of the manual as a guide, install the scanner unit by securing it to a solid mounting surface. The attachment bolts are stainless steel hexhead bolts M6, 31.75 mm (1.25") long. Both flat and lock washers should be used. (See FIG. 3-5)

Note: Do not apply excessive torque to fix the bolts. Use a 11 cm-long wrench (Fixing torque: 87 kgf-cm).
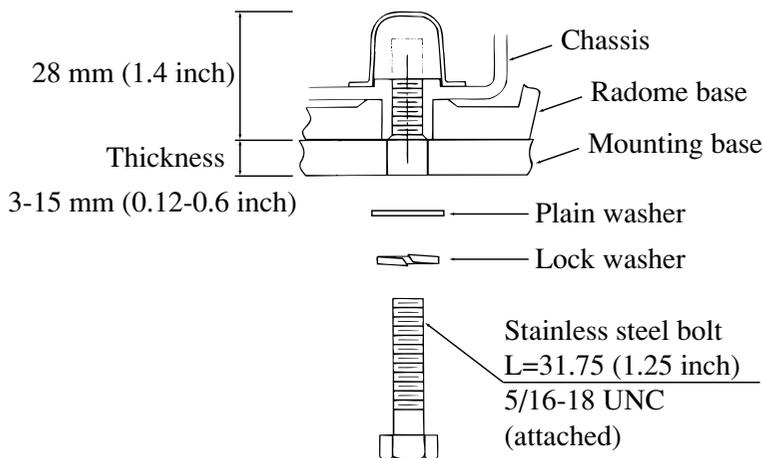

FIG. 3-5 MOUNTING BOLTS for SCANNER UNIT

Usually, the mounting surface for the scanner unit should be parallel with the ship's waterline. Some vessels, however, may adopt a higher bow angle at some cruising speeds. This substantially alters and raises the radar's radiation plane. In this case nearby target detection might be poor. It may be helpful to lower the radar beam towards the FORWARD parallel by shimming the radar pedestal in order to tilt the beam angle slightly downward with respect to the waterline.

15°
MAIN BEAM
15°
WATERLINE

IDEAL RADIATION PLANE

FORWARD

JRC

USING SHIMS TO
TOWER THE MAIN BEAM

WEDEGE or
WASHERS
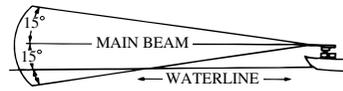
3.5   CONNECTING THE SCANNER UNIT CABLE

The scanner unit is supplied with an interunit 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, the rubber grommet, and the clamping plate. (See FIG. 3-6)
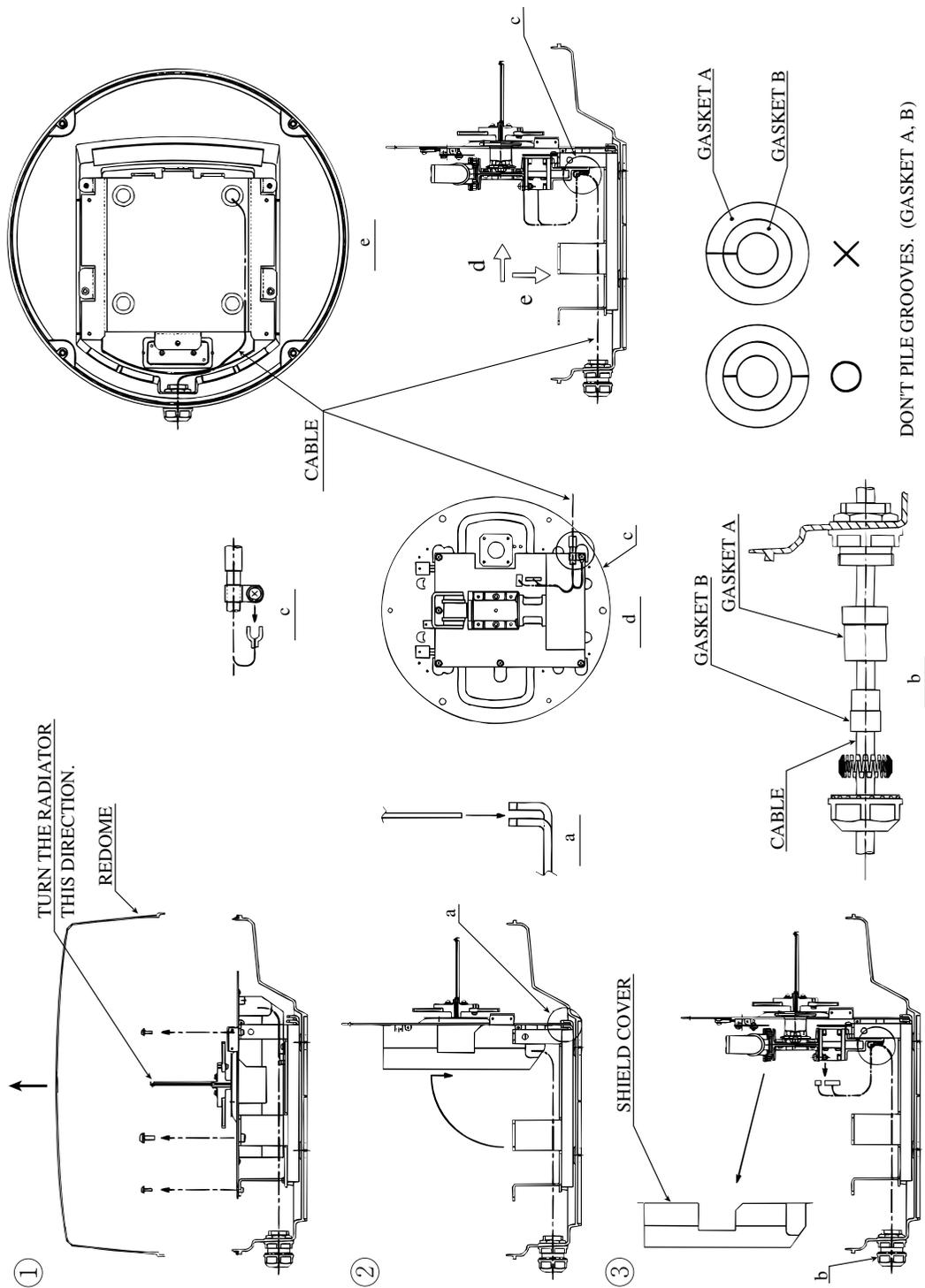
FIG. 3-6   ASSEMBLING PROCEDURE FOR CABLE

3.6   ELECTRICAL CONNECTION
3.6.1   DC POWER CABLE

The RADAR 1500 MKⅡ will work with any electrical supply within the 10.2 to 16 V range, since it contains a power regulator circuit. Connect the power cable to a DC source capable of supplying at least 3.5 A. 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 (5 A) SHOULD BE SPECIFIED]*

3.6.2   EXTERNAL SYSTEM INTERFACE

The RADAR 1500 MKⅡ 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 "HDG,HDM,HDT,VHW")
                    2.   NAV-AID (NMEA0183 "RMC,RMA,VTG")
POSITION: 1.   NAV-AID (NMEA0l83 "RMC,RMA,GLL,GTD")
SPEED: 1.   NAV-AID (NMEA0183 "RMC,RMA,VTG")
                    2.   Compass (NMEA0183 "VHW")
WAYPOINT: 1.   NAV-AID (NMEA0183 "RMB,BWC")

Using the outline of FIG. 3-7, FIG. 3-8 as a guide, connect the RADAR 1500 MKⅡ to your NAV-AID and compass.
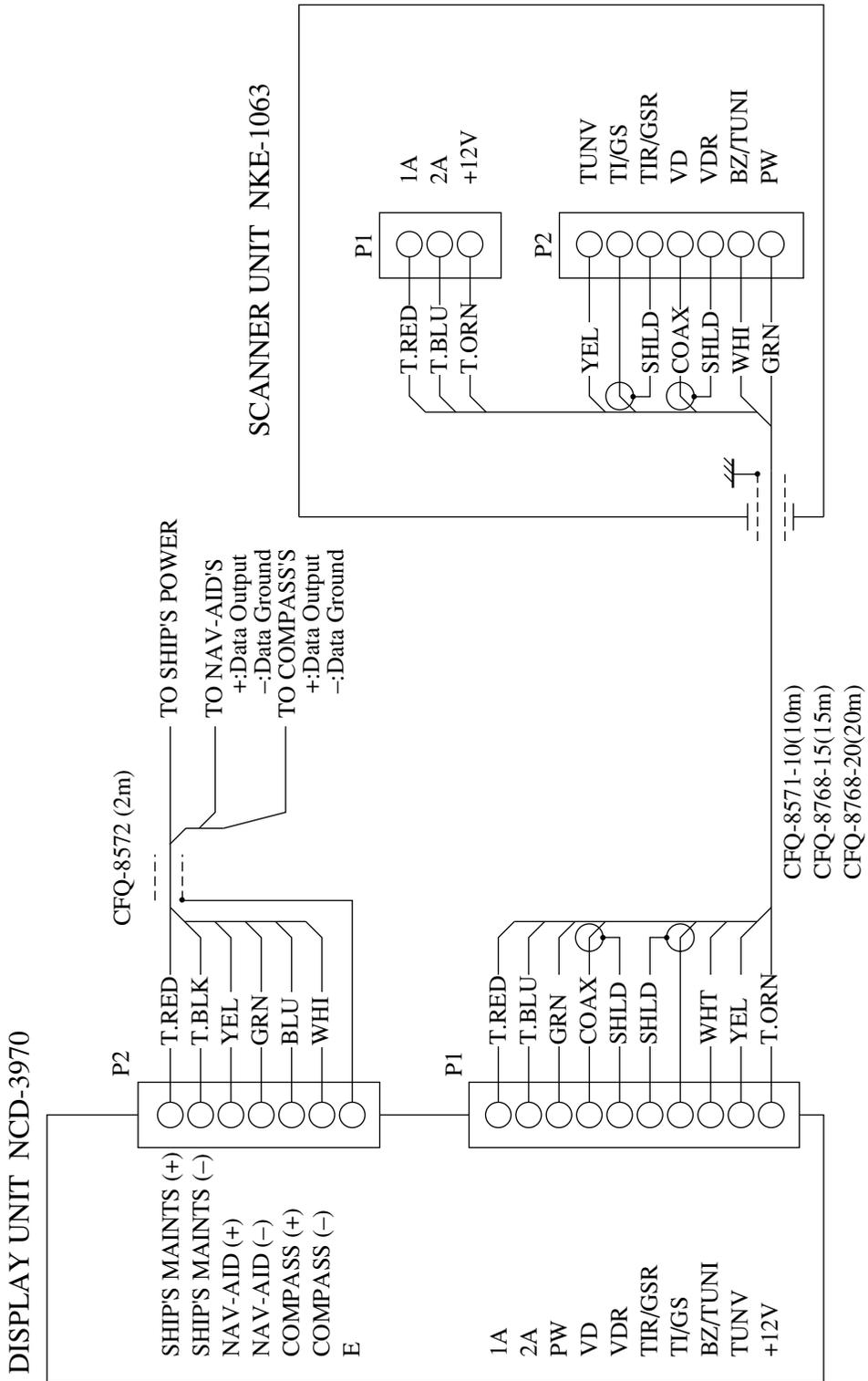
FIG. 3-7 INTERCONNECTION DIAGRAM

DISPLAY UNIT

TO SCANNER UNIT

SCANNER

POWER/NMEA

YEL
(+)
GRN
(−)) TO NAV-AID
+: NAV-AID'S Data Output
BLU   −: NAV-AID'S Data Ground
(+)
(−)) TO COMPASS
+: COMPASS'S Data Output
WHI   −: COMPASS'S Data Ground

FUSE

RED

+

−

BLK

DC12V

BATTERY
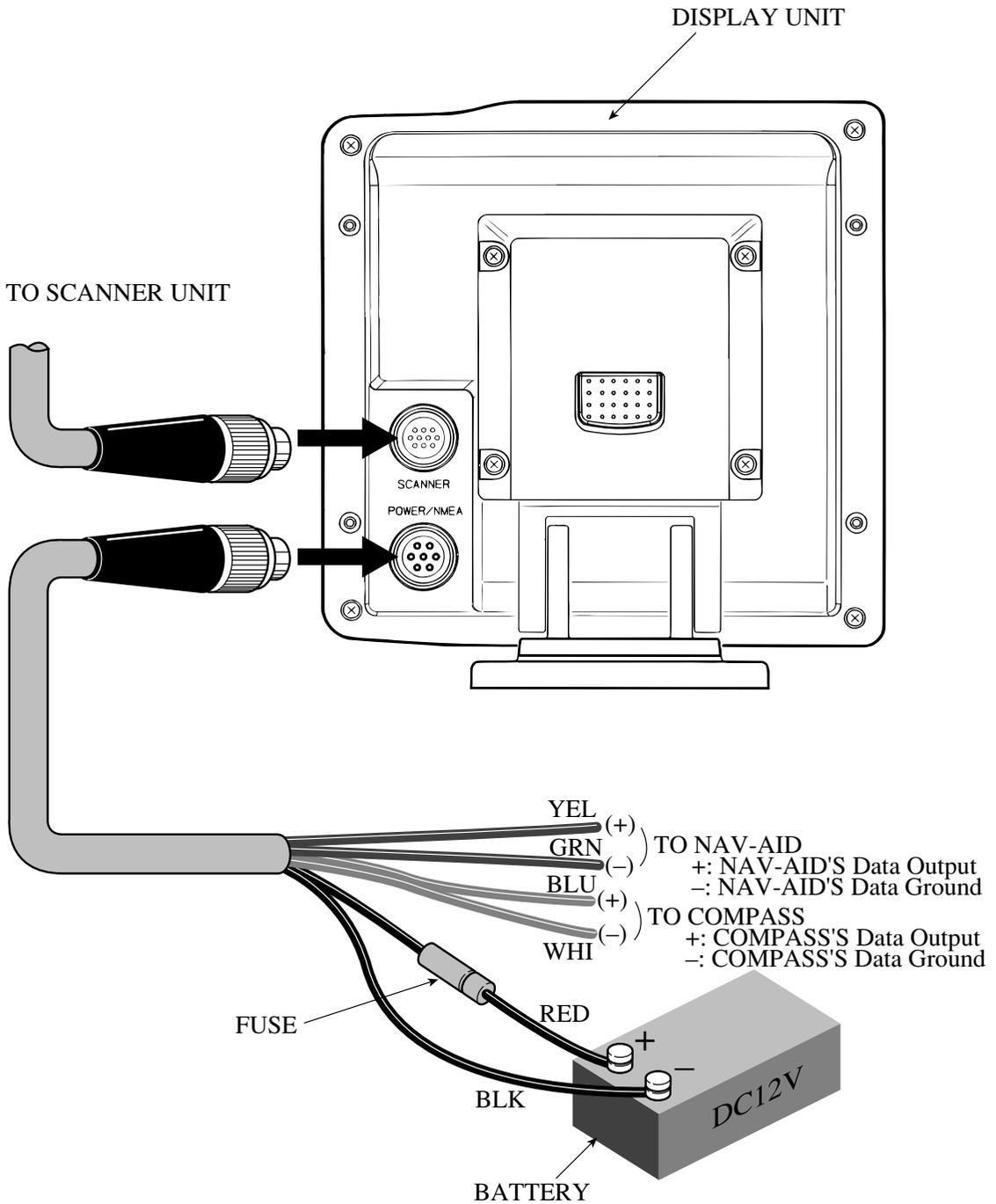
FIG. 3-8 NAV-AID INTERCONNECTION

3.7   INITIAL OPERATION AND SET UP

3.7.1   INSPECTION AFTER INSTALLATION

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

(1) The cables are not pinched or damaged.

(2) The allowed voltage is not exceeded and the polarity is correct.

(3) All bolts are tight.

(4) The power cable shields has been properly connected to Boat Main ground.

3.7.2   OPERATING THE INITIAL SET UP MENU

To access this menu, push in the JOYSTICK until the INITIAL SET UP menu appears. The JOYSTICK is then used to select a particular item on the menu by depressing it.

INSTALLATION ADJUSTMENTS

BEARING
DISPLAY TIMING
TUNE PRESET
STC PRESET

BUZZER

OPER PROMPTS
LANGUAGE
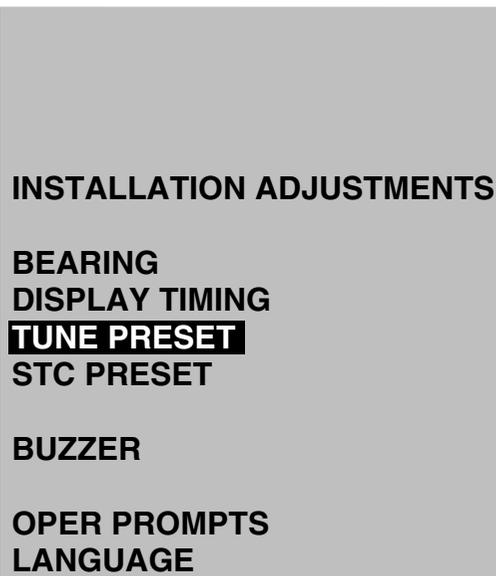
INSTLLATION ADJUSTMENTS MENU

3.7.3   TUNE PRESET

Perform this step after the radar has been X-MITTING for 10 minutes.

① Set the range to 3 NM.

② Set gain to desired level.

③ Turn SEA and RAIN all the way down.

④ Turn IR off.

⑤ In the INITIAL SET UP MENU select Tune preset.

⑥ Move the bar to using the J-DIAL to get the strongest signal back.

Note: There may be 2 positions where the targets are strong. Pick the strongest of the 2.

⑦ Press the JOYSTICK to save and exit.
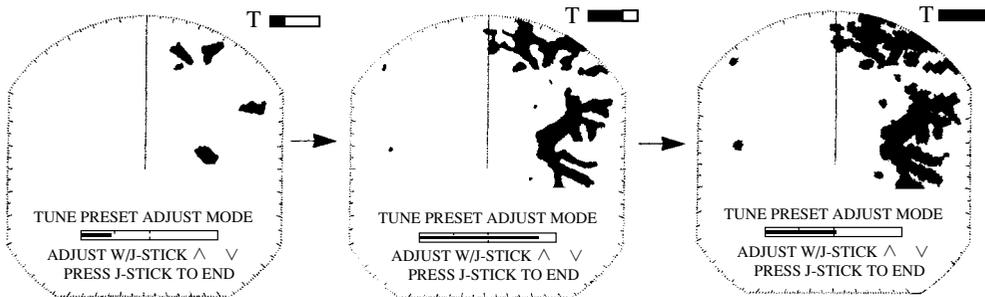
3.7.4 STC PRESET

① Set range to 6 NM.

② Set Gain to maximum.

③ In the INITIAL SET UP MENU select STC PRESET.

④ Use the J-DIAL to remove all background noise from $0-2$ NM.

⑤ Press the JOYSTICK when done.
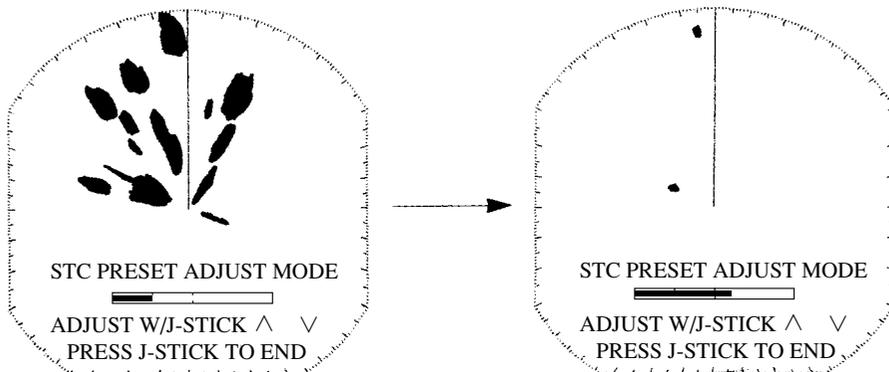
3.7.5   RELATIVE BEARING ALIGNMENT

This step must be performed. Failure to do so may result in incorrect bearing readings.

① Set the range to 1.5 NM.
② Identify a suitable target such as a buoy and position the boat between 0.5 NM and 1 NM.
③ Point the bow at the target.
④ In the INITIAL SET UP MENU select BEARING.
⑤ Locate the target on the display.
⑥ Move the marker over the target.
⑦ Press the JOYSTICK once.
⑧ Move cursor back to the SHM (Ships Heading Marker is the solid vertical line on the display).
⑨ Press JOYSTICK in when done.

3.7.6   DISPLAY TIMING

This step must be performed. Failure to perform this step may result in incorrect target distance reading.

① Set the range to 0.25 NM.
② Locate a pier, a jetty, a bridge (close to water line) or any other straight object. Position the vessel so that it appears on the display. It does not matter which way you are facing.
③ In the INITIAL SET UP MENU select DISPLAY TIMING.
④ If the bridges, pier or jetty does not appear to be in a straight line on the display, then the DISPLAY TIMING needs to be adjusted.
⑤ Use the JOYSTICK to adjust the timing and make the object appear straight on the display.
⑥ Press JOYSTICK when done.

PUSHING
DISPLAY TIMING EARLY

CORRECT

PULLING
DISPLAY TIMING LATE
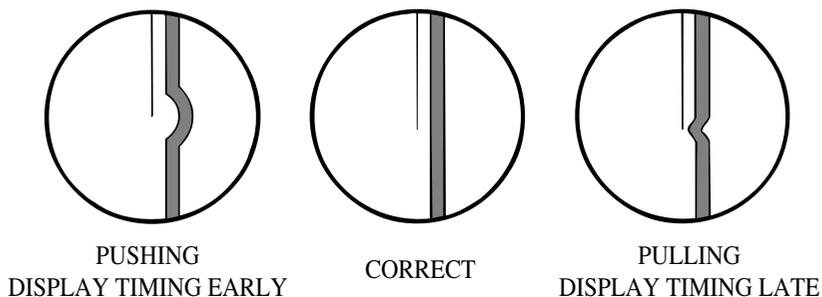
3.7.7   Buzzer ON or OFF

① In the INITIAL SET UP MENU select BUZZER.

② Select ON or OFF.

③ Press JOYSTICK when done.

3.7.8   OPERATOR PROMPTS

Operation prompts can be helpful to new users operating the radar. The default setting is ON.

① In the INITIAL SET UP MENU select OPER.PROMPT.

② Select ON or OFF.

③ Press JOYSTICK when done.

3.7.9   LANGUAGE

English is the default language. It can be changed to Spanish, French, German, Norwegian, and Italian.

① In the INITIAL SET UP MENU select LANGUAGE.

② Select the desired Language.

③ Press JOYSTICK when done.

SECTION 4

OPERATION

In normal operation the RADAR 1500 MK Ⅱ 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 FIG. 4-1.
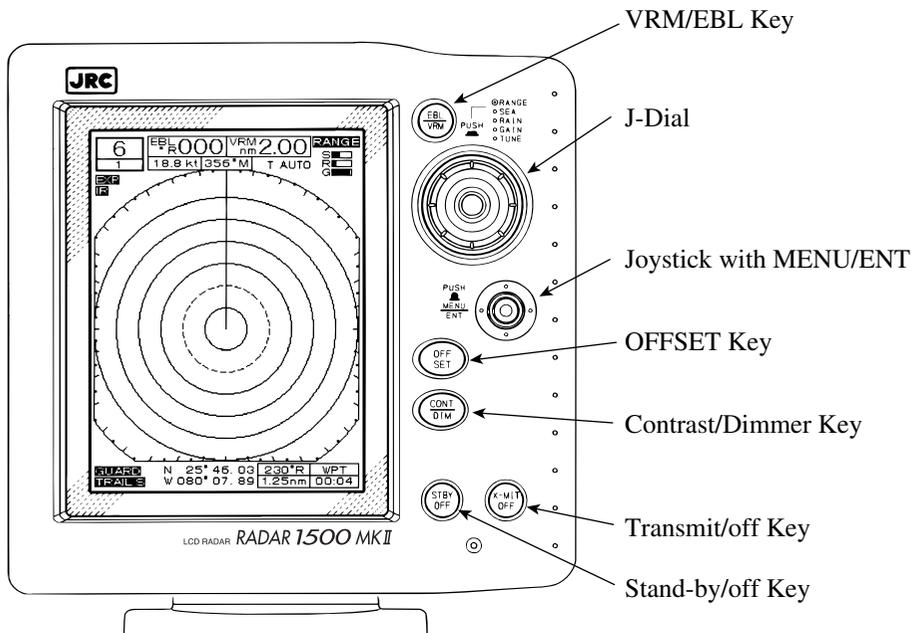
FIG. 4-1 OPERATING CONTROLS

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 si-
                    multaneously.

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.
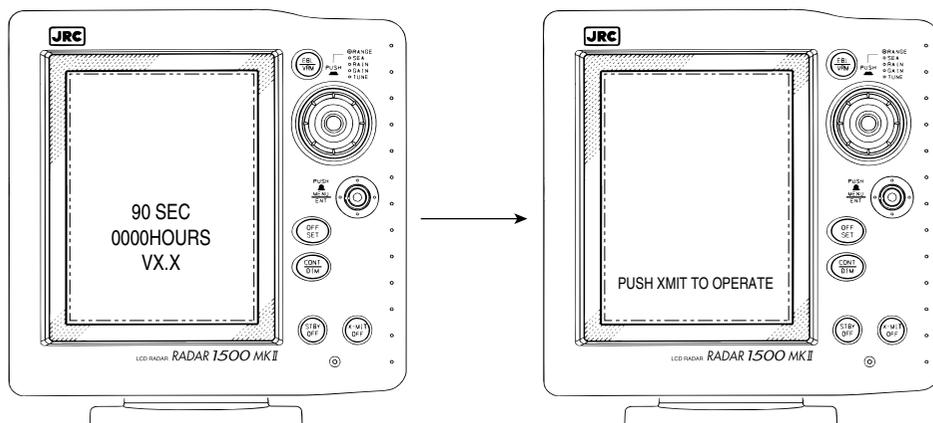
FIG. 4-2 TURNING THE RADAR ON/OFF
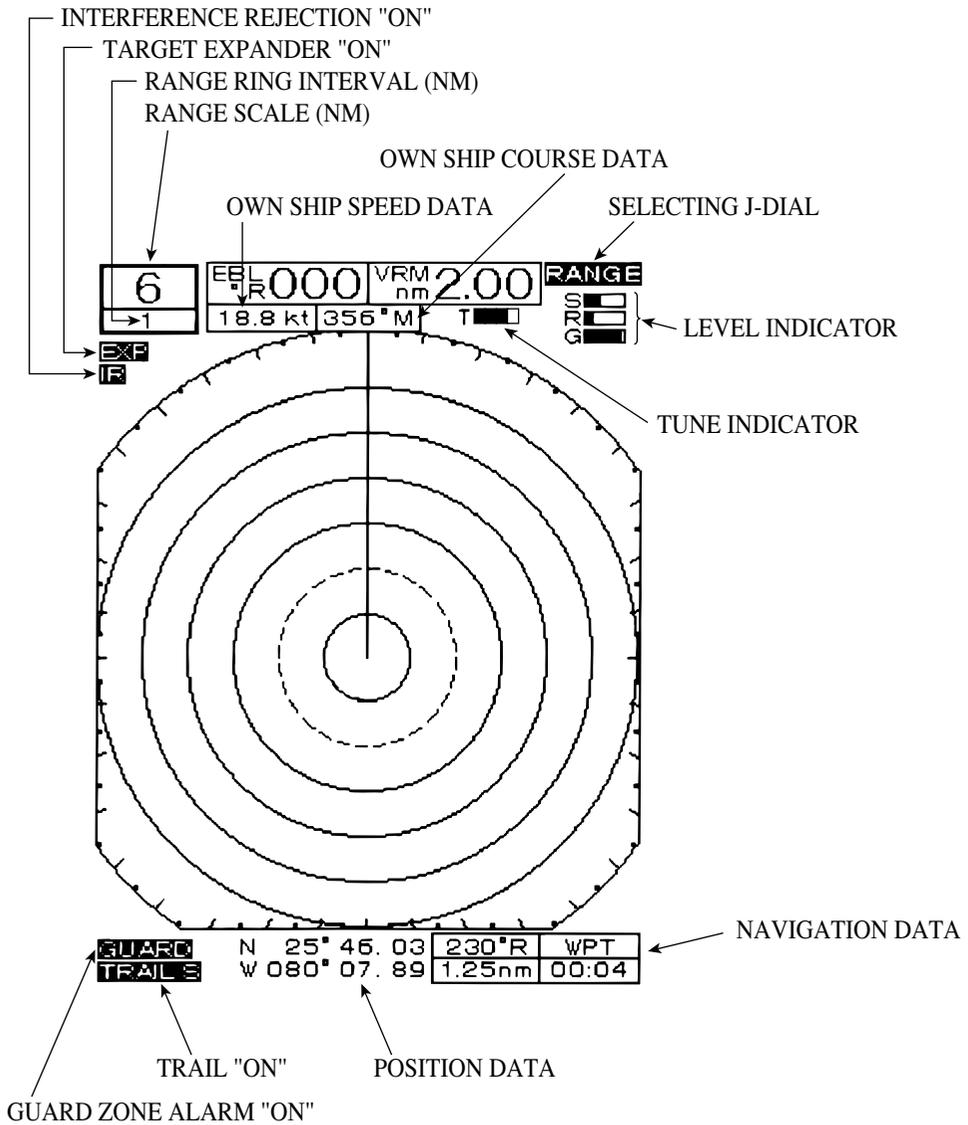
FIG. 4-3 LAYOUT OF THE SCREEN

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 counterclockwise, 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. (i.e. 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 counterclockwise, to maximize the target echo. If there is no large, identifiable target (e.g. 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 3 nm or 6 nm.

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

AUTO TUNE

The RADAR 1500 MK II has an automatic tuning feature. In this mode, the radar automatically tunes itself for best efficiency at all ranges. (refer to 4.24)

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 counter-clockwise 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.
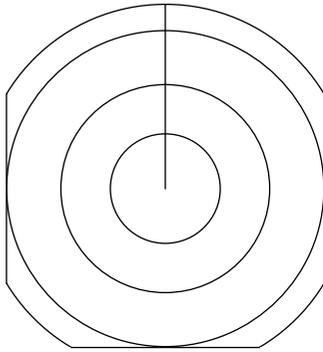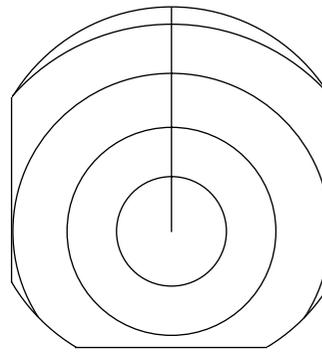
OFFSET MODE OFF   OFFSET MODE ON

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.

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 terget'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 rader.

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.

FIRST MENU

GUARD
RINGS
POSITION
WAYPOINT
BEARING
TRAIL
EXP
IR

DISPLAY
TX-PLAN
TUNE

SECOND MENU

DISPLAY
TX-PLAN
TX PERIOD
ST-BY PERIOD
TUNE

GUARD
RINGS
POSITION
WAYPOINT
BEARING
TRAIL
EXP
IR
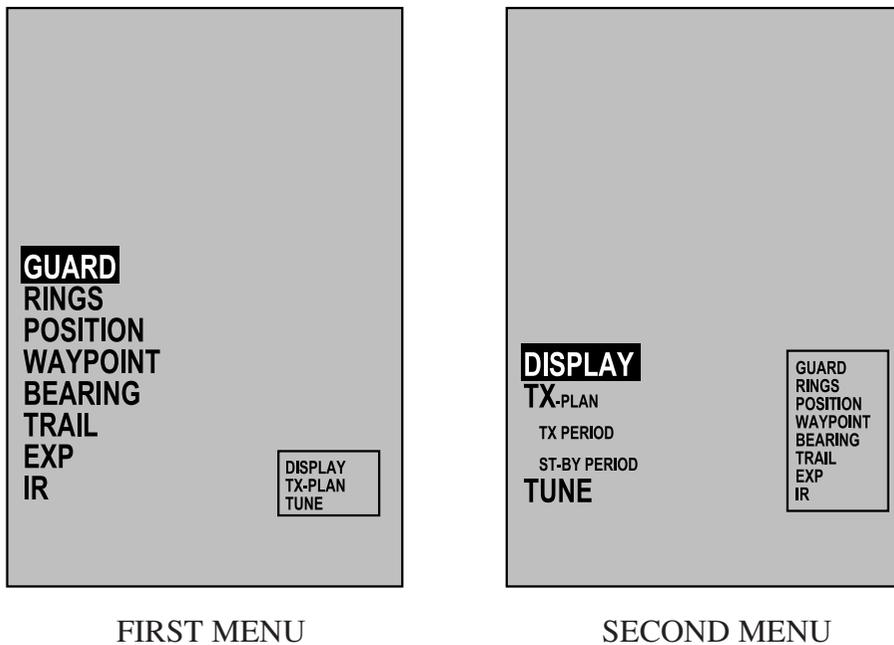
*FIG. 4-4   FIRST/SECOND MENU SHEET*

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.

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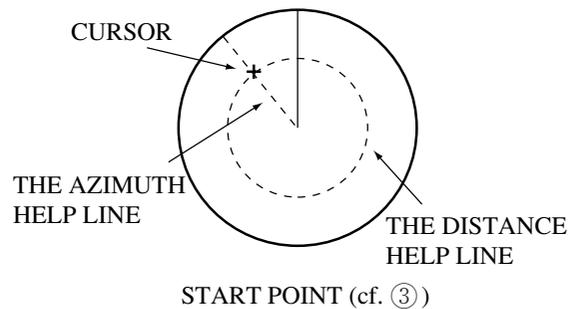
④ Next, move the cursor to the desired guard zone Width point of your Guards zone then press the JOYSTICK control.

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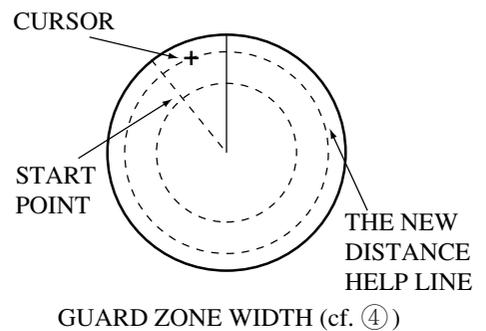
⑤ Next, move the cursor to the desired end point of your guard zone then press the JOYSTICK control. A ring in the distance range is displayed by the solid line at this time.

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

CURSOR

THE AZIMUTH HELP LINE

THE DISTANCE HELP LINE

START POINT (cf. ③)

CURSOR

START POINT

THE NEW DISTANCE HELP LINE

GUARD ZONE WIDTH (cf. ④)

END POINT

START POINT

END POINT (cf. ⑤)
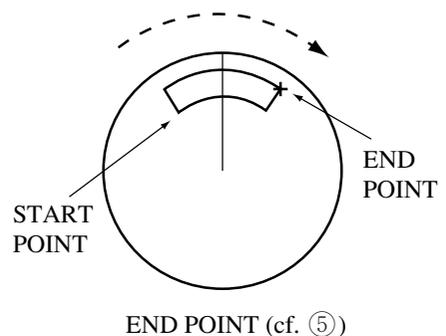
4.15 RINGS

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

⚠**CAUTION**

If you'll watch the RADAR BEACON and the SART, set the process as follows.

IR   OFF

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 MKⅡ 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 MKⅡ by following the steps given below.

(a) Press the **STBY/OFF** and **X-MIT/OFF** keys simultaneously.
The RADAR 1500 MKⅡ is turned off.

(b) Press the **EBL/VRM** and **STBY/OFF** keys simultaneously.
All settings except the initial settings established through the "INITIAL SET UP" menu are reset to their factory-set values.

4.26 DISPLAY OF RADAR TRANSPONDER

SART (Search and Rescur Radar Transponder) is life preserving device approved by GMDSS which is used for locating survivors in the event of a disaster or distress. SART operates in the 9 GHz frequency band. When it receives a radar signal (interrogating radio wave) of 9 GHz transmitted by a rescue ship or aircraft radar, SART transmits a series of respouse signals to the searchers to indicate the distress position.

In order to see the SART or radar beacon mark on the radar screen.

① RANGE SCALE : Select 6 or 12 nm.
② SEA : Set to minimum.
③ TUNE : DETUNED to reduce the clutter.
④ IR : Set IR OFF.

SART Code
Position of SART
Position of the Rescue Craft
Land
Other Ships
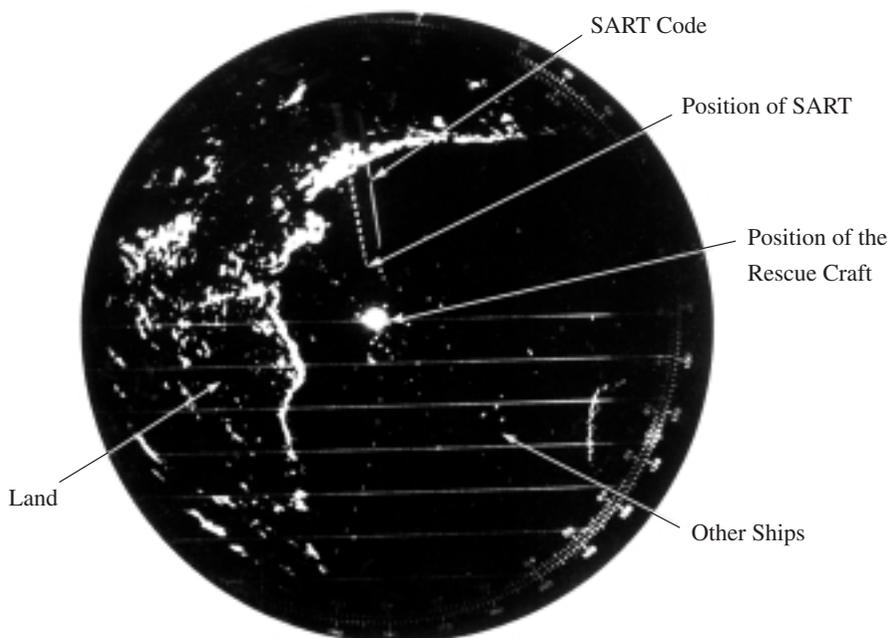
[EXAMPLE]

Attention

When above settings ① to ④ are made to display SART signals, objects around the own ship will not appear on the radar screen, so perform thorough visual monitoring of the sea area around the own ship to avoid any collision or stranding.

Further, when more than one radar systems are mounted, while using a 9 GHz band radar for searching SART signals, be sure to use another radar as an ordinary radar to perform monitoring of objects around the own ship to avoid any collision, check of the position of the own ship to avoid any stranding, and so on.

Need to retune the set for normal operation on completeion.

SECTION 5

MAINTENANCE

The purpose of this section is to provide instructions for the service technician. The RADAR 1500 MKⅡ 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 connecotrs. Clean as reuired.

(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 5 A fuse (Normal-brow 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 $\pm0.9\%$ of maximum range of the scale in use, or 8 m, whichever is the greater.

6. Bearing accuracy: $\pm$ 1 degree

7. Display device: LCD: 115 $\times$ 86.4 mm (320 $\times$ 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   450 mm
                           Height   227 mm

2. Mass: Approx. 5 kg
3. Polarization: Horizontal
4. Beam width: Horizontal 5.2° nominal
                           Vertical 30°

5. Sidelobes: Less than -21 dB
6. Rotation: Approx. 32 rpm
7. Transmitter frequency: 9445 ± 30 MHz
8. Peak power output: 2 kW
9. Pulse length/PRF: 0.08 μs/ 2250 Hz
                           (0.125, 0.25, 0.5, 0.75 NM)
                           0.3 μs/ 1200 Hz (1, 1.5 NM)
                           0.8 μs/ 600 Hz (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. Mass: 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, Norweigian, 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 (HDG, HDM, HDT or VHW
		sentence)

7.36"
187mm

6.65"
169mm

6.49"
165mm

3.93"
100mm

7.20"
183mm

CUT OUT HATCHED AREA

4-HOLES DRILL
4.5mm (.177") DIA

6.33"
161mm
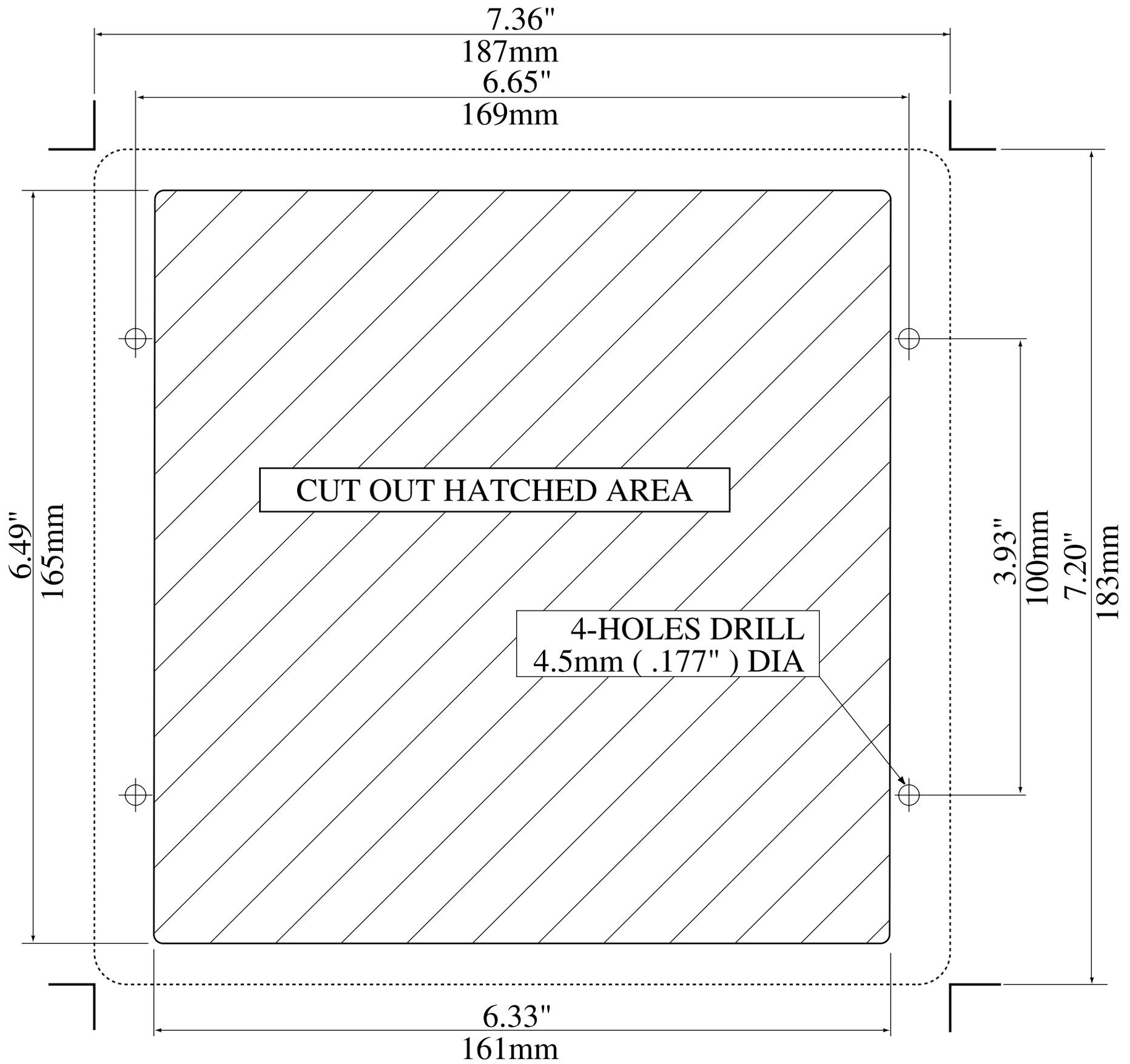
Fig.1   RADAR 1500 MK Ⅱ DISPLAY UNIT (NCD-3970A) FLUSH MOUNT TEMPLATE
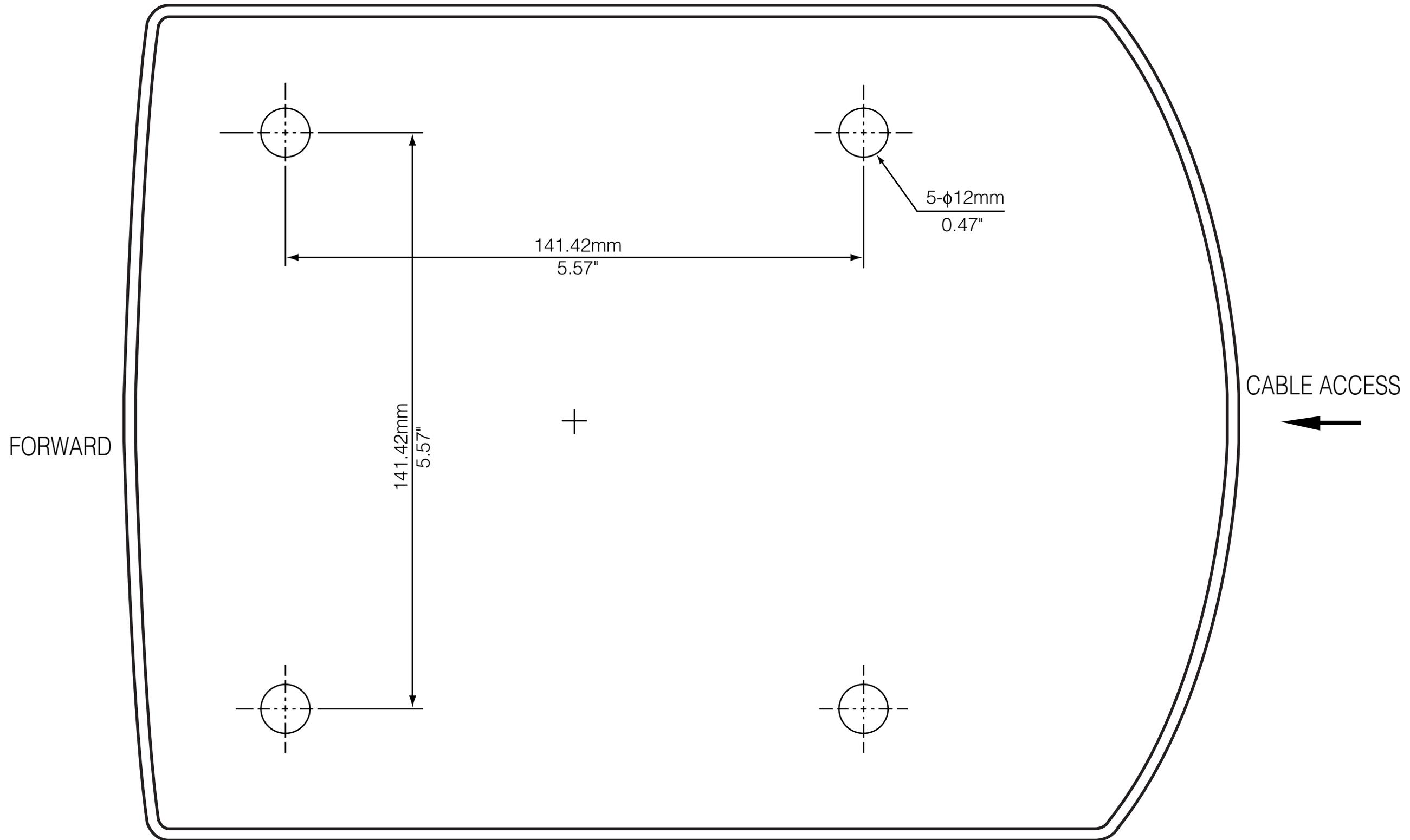
Fig.2   RADAR 1500 MK Ⅱ SCANNER UNIT (NKE-1063) RADOME TEMPLATE