

MARINE RADAR EQUIPMENT

JMA-3807/3811

INSTRUCTION MANUAL

JRC *Japan Radio Co., Ltd.*

JMA-3807/3811

MARINE RADAR

INSTRUCTION MANUAL



Precautions During Operation



WARNING

- **To avoid an electrical shock, never touch the inside of antenna, transceiver, and display units.**

The high voltage can cause a severe personal injury by the electrical shock. Call the service for component inspection, adjustment and maintenance inside of these units.

- **Do not enter the rotational area of the antenna unit.**

The antenna can rotate quickly and can cause a personal injury. To avoid an access to the antenna, we recommend to install the antenna unit in the highest place such as the cabin roof, flying bridge, radar mast, and top base frame of your ship. Also, we recommend to cover the antenna unit with a fence if someone can access to it. Before servicing the antenna unit, turn OFF the safety switch of the antenna unit.

- **Install the antenna unit in a place above the human height.**

The radio frequency exposure in a short distance can cause a personal injury.

- **Place the Display Power switch to the STANDBY position before approaching the antenna during inspection or maintenance.**

The radio frequency exposure in a short distance can cause a personal injury.



CAUTION

- **Install and use your radar system by following the Instruction Manuals.**

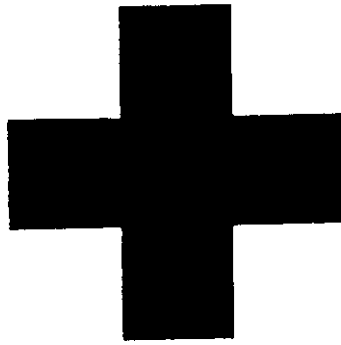
An incorrect installation or operation can drop the optimum system performance.

- **Use your radar system as a navigation aid. You must make the final decision by yourself during navigation.**

- **Use your ARPA as a navigation aid. You must make the final decision by yourself during navigation.**

The ARPA information such as vectors, numerical data, and alarms may have an error. Also, a target that is not detected by the radar system cannot be acquired and tracked.





CAUTIONS FOR HIGH VOLTAGE

High voltages of hundreds upto thousands volt are used in radio and radar devices. Although prudent measures for safety have been adopted, sufficient cares should be taken on operation, maintenance and adjustment of the device.

Electric shock by thousands volt leads to an instantaneous death for certain, and even electric shock by hundreds volt leads to an instantaneous death occasionally. To prevent such an accident, turn off the power source, discharge capacitors by a wire surely earthed at one end, and check that any charge is no longer inside the device, before you put your hand into the inside. It is still better to wear dry wool gloves. It is also necessary caution not to use both hands simultaneously, by putting the one hand into your pocket.

The selection of a stable foothold is essential to prevent more extensive or additional injuries. When injured by electric shock, disinfect the burn perfectly and give first aid as soon as possible.

HEALTH HAZARD

Some person allergic to dust may temporarily be affected in health, if he inspires dust scattered at the time of cleaning the radar inside.

RADIATION HAZARD

If the human body is exposed to a microwave of $10\text{mW}/\text{cm}^2$ in mean power density, it will be affected, in particular, at the eyes.

Do not approach to any antenna during standstill as near as 60cm or less.

If it is unavoidable by any means to disconnect a microwave transmission line upon the maintenance or checks, always connect a microwave dummy load to associated radar transmitter. If it is unavoidable to radiate the microwave without using any microwave dummy load, never peep the active waveguide into its end during transmission, since the end is open.

WHAT TO DO IN CASE OF ELECTRIC SHOCK

When a victim of electric shock is found, turn off the power source and earth the circuit immediately. If this is impossible, move the victim away from it without touching him with bare hands as quick as possible. He can safely be moved if an insulating material such as dry wood plate or cloth is used.

Breathing may stop if current flows through the respiration center of brain due to electric shock. If the electric shock is not large, breathing can be restored by artificial respiration. A victim of electric shock looks pale and his pulse becomes very weak or stops, resulting in unconsciousness and rigidity.

FIRST-AID TREATMENTS

As far as the victim of electric shock is not in dangerous condition, artificial respiration should be started at once at the site. Once started it should be continued rhythmically.

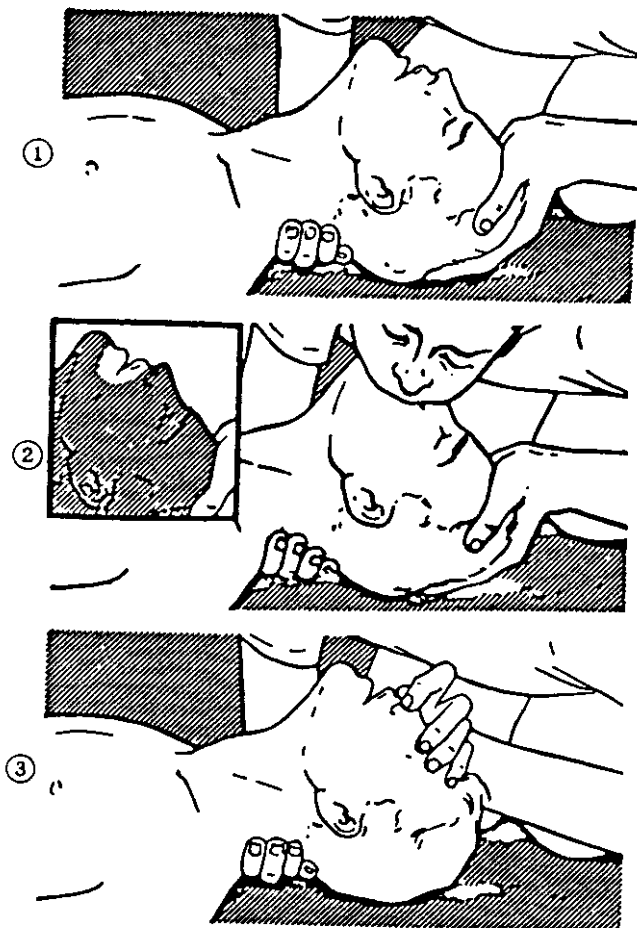
- 1) Do not touch the victim confusedly or rescuer may also receive an electric shock.
- 2) Turn off the power source and move the victim from the electric line calmly.
- 3) Call a physician or ambulance immediately, or instruct someone else to call.
- 4) Place the victim on his back and loose his necktie, clothes, belt, etc.
- 5)
 - a. Examine the victim's pulse.
 - b. Examine the heartbeat by laying your ear on his heart.
 - c. Examine breathing by bringing your face or back of hand close to his face.
 - d. Examine the victim's pupils.
- 6) Open the victim's mouth and remove the artificial teeth, cigarette or chewing gum, if any. Keeping the mouth open, stretch the tongue and insert a towel or the like to prevent the tongue from suffocating. (If it is hard to open the mouth with set teeth, open it by a screwdriver and insert a towel.)
- 7) Wipe the mouth to prevent foamable mucus and saliva from accumulating.

IN CASE PULSE CAN BE DETECTED BUT BREATHING STOPS

(Mouth to mouth artificial respiration)

- a) Tilt the victim's head back as far as his face looks back.
(A pillow may be inserted under the neck.)
- b) Pull the jaw into jutting position to open the throat.
- c) Pinch the victim's nostrils shut and place your mouth tightly over his after drawing your breath long. Then blow into mouth strongly. Continue blowing at a rate of 10-15 breathes a minute.
- d) Watch carefully and continue artificial respiration till natural respiration is restored.
- e) If the opening of mouth is difficult, insert a vinyl pipe or the like into a nostril and blow into it by shutting the other nostril and mouth perfectly.
- f) Victim may stand up suddenly when he becomes aware. He should lie quietly and kept warm and calm.
Serve him with hot coffee or tea (but never alcoholic drinks).

Fig. 1



Method of Mouth to Mouth artificial respiration

Tilting Back of Victim's Head

Put one of your hands on the victim's forehead and the other under the neck ①. In general his mouth opens when the head is tilted back, making easy mouth to mouth artificial respiration.

Place your mouth tightly over his and press your cheek against his nose ② or pinch his nostrils by your fingers ③ to prevent air leakage.

Blowing into Lungs

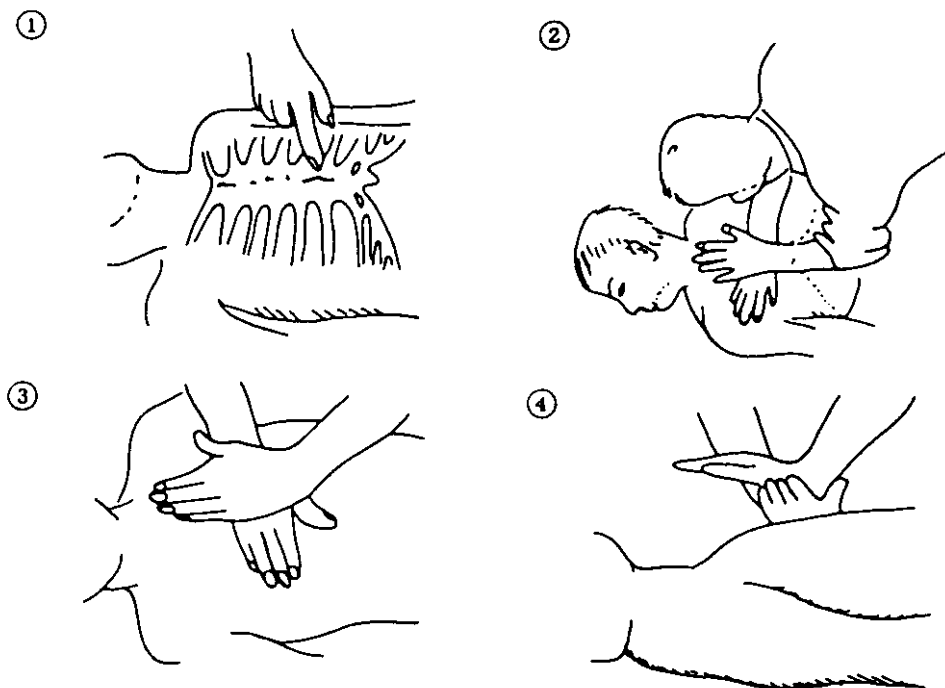
Blow into the mouth till the chest rises. The first 10 breathes should be performed as fast as possible.

IN CASE OF CARDIAC ARREST AND CESSATION OF BREATHING

(Cardiac massage and mouth to mouth artificial respiration)

- a) When no pulse can be detected, the pupils are open and no heartbeat is heard, cardiac arrest is considerable.
Therefore, artificial respiration should be started at once.
- b) Put the heel of one hand over the lower 1/3 of his breastbone and the other hand on the back of the first. Apply your weight so that the braestbone is compressed by about 2cm. (Repeat it at a rate of about 50 times a minute.)
(Cardiac massage)
- c) In case of one rescuer
After about 15 times cardiac massages, give mouth to mouth artificial respiration 2 times, and repeat them in this manner.
- d) In case of two rescuers
While the victim is massaged, another person should give mouth to mouth artificial respiration. A breath is interposed after 5 cardiac massages.
(Cardiac massage and mouth to mouth artificial respiration)
- e) Examine the pupils and pulse often. When they become normal, stop the first aid treatments, serve the victim with coffee or tea and keep him warm and calm, while watching him carefully.
- f) Commit the victim to a medical specialist, according to the situation. For earlier recovery of the victim from the mental shock, the understanding of bystanders is essential.

Fig. 2



JMA-3807/3811

RADAR SYSTEMS

OPERATION MANUAL

This manual contains very important information on the installation, operation and maintenance of your new equipment. In order to get the best results in operation and performance, please take the time to read this manual thoroughly.

IMPORTANT NOTICE

This device is only an aid to navigation. Its accuracy can be affected by many factors including equipment failure or defects, environmental conditions, and improper handling or use. It is the user's responsibility to exercise common prudence and navigational judgement. This device should not be relied upon as a substitute for such prudence and judgment.



WARNING

This radar equipment must be installed and operated in accordance with the instructions contained in this manual. Failure to do so can result in personal injury or navigational inaccuracies. In particular:

HIGH VOLTAGE The radar display unit contains areas of high voltage. Internal adjustments require specialized service procedures and tools only available to qualified service technicians, and there are no user serviceable parts or adjustments. The operator should never remove the display unit covers or attempt to service the equipment.

ANTENNA A mechanical hazard exists from the external rotating antenna. Remain clear of rotating antennas at all times. It is recommended that the radar antenna (whether external or internal) be mounted above objects which interfere with the radar signal such as the flying bridge, large engine stacks, and personnel. This may be difficult on some vessels and in such a case it is recommended that a radar mounting pedestal be used. Always turn the system to "OFF" before servicing the antenna or nearby equipment.

ELECTROMAGNETIC ENERGY The radar antenna transmits electronic energy. It is important that the radar be turned off whenever personnel are required to come in range of the antenna to perform work on the antenna assembly or associated equipment. When properly installed and operated, the use of this radar will conform to the requirements of ANSI/IEEE C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300 GHz.

NAVIGATION AID This radar unit is only an aid to navigation. Its accuracy can be affected by many factors including equipment failure or defects, environmental conditions, and improper handling or use. It is the user's responsibility to exercise common prudence and navigational judgment. This radar unit should not be relied upon as a substitute for such prudence and judgment.



TABLE OF CONTENTS

SECTION		PAGE
1	INTRODUCTION	
1.1	GENERAL	1-1
1.2	EQUIPMENT FEATURES	1-2
1.2.1	JMA-3800 DISPLAY UNIT	1-3
1.2.2	JMA-3800 ANTENNA UNIT MAIN FEATURES	1-4
1.3	ABOUT THIS MANUAL	1-5
1.4	SPECIFICATIONS	1-6
1.4.1	GENERAL	1-6
1.4.2	DISPLAY UNIT	1-7
1.4.3	ANTENNA UNIT	1-9
1.4.4	MARPA	1-9
2	INSTALLATION	
2.1	GENERAL	2-1
2.2	UNPACKING AND INSPECTION	2-1
2.3	EQUIPMENT SUPPLIED	2-1
2.3.1	OPTIONAL ACCESSORIES	2-2
2.4	PLANNING THE INSTALLATION	2-3
2.4.1	MOUNTING THE DISPLAY UNIT	2-4
2.4.1.1	PROCEDURE FOR OVERHEAD MOUNTING	2-5
2.4.2	ASSEMBLING THE OPEN ARRAY ANTENNA	2-8
2.4.3	MOUNTING THE OPEN ARRAY ANTENNA UNIT	2-9
2.4.4	SETTING THE RADIATION PLANE	2-10
2.4.5	CABLING THE ANTENNA PEDESTAL UNIT	2-12
2.5	ELECTRICAL CONNECTIONS	2-14
2.5.1	DC POWER CONNECTIONS	2-14
2.5.2	EXTERNAL SYSTEM INTERFACE	2-15
2.5.2.1	CONNECTION WITH EXTERNAL NAVAIDS	2-16
2.5.2.2	INSTALLING NJZ-1086, NWZ-92 HEADING SENSOR	2-17
2.5.2.3	CONNECTING NJZ-1086, NWZ-92 HEADING SENSOR	2-19
2.5.2.4	SETTING UP THE GYRO/LOG INTERFACE (MDLW10664A)	2-20
2.5.3	BONDING	2-24
2.5.3.1	CONTINUOUS METALLIC DECK OR BULKHEAD PROCEDURE	2-24
2.5.3.2	NON-METALLIC DECKS AND BULKHEADS BONDING PROCEDURE	2-24

SECTION 3 OPERATIONS

3.1	INTRODUCTION.....	3-1
3.2	GENERAL LAYOUT OF THE DISPLAY UNIT CONTROLS AND SCREEN READOUTS.....	3-2
3.2.1	RADAR CONTROLS.....	3-3
3.3	STARTING OPERATION.....	3-7
3.3.1	INITIAL DISPLAY SETUP.....	3-7
3.3.2	TURN-ON/TURN-OFF PROCEDURE.....	3-7
3.3.2.1	TURN-ON PROCEDURE.....	3-7
3.3.2.2	TURN-OFF PROCEDURE.....	3-8
3.3.3	BRILLIANCE CONTROL (15).....	3-8
3.4	FRONT PANEL OPERATION.....	3-9
3.4.1	THE TRACKPAD (23).....	3-9
3.4.2	X-MIT/OFF AND ST-BY/OFF KEYS (1).....	3-10
3.4.3	RANGE KEYS (2).....	3-11
3.4.4	VRM (VARIABLE RANGE MARKER) KEY (7).....	3-12
3.4.5	EBL (ELECTRONIC BEARING LINE) KEY (8).....	3-12
3.4.6	F.EBL (FLOATING EBL) KEY (9).....	3-13
3.4.7	OFF CENTER KEY (10).....	3-13
3.4.8	ZOOM KEY (11).....	3-14
3.4.9	TUNE CONTROL (3).....	3-14
3.4.9.1	AUTO TUNE MODE.....	3-15
3.4.10	RAIN CLUTTER CONTROL (4).....	3-15
3.4.11	SEA CLUTTER CONTROL (5).....	3-16
3.4.12	GAIN CONTROL (6).....	3-17
3.4.13	ENTER KEY (22).....	3-18
3.4.14	MENU KEY (21).....	3-18
3.4.14.1	FEATURES MENU.....	3-20
3.4.14.2	DISPLAY OPTIONS MENU.....	3-24
3.4.14.3	CUSTOM RANGE MENU.....	3-26
3.4.14.4	RADAR SETUP MENU.....	3-27
3.4.14.5	MARPA MENU.....	3-30
3.4.14.6	INITIAL SETTING MENU.....	3-31
3.4.15	GUARD KEY (19).....	3-32
3.4.16	RR/SHM KEY (12).....	3-35
3.4.17	HEADING MODE KEY (14).....	3-35
3.4.18	HEADING/RESET KEY (14).....	3-36
3.4.19	TM/RM (TRUE MOTION/RELATIVE MOTION) KEY (13).....	3-37

3.4.20	WINDOW KEY (18).....	3-38
3.4.21	MAN OVERBOARD KEY (17).....	3-38
3.5	USING MARPA.....	3-40
3.5.1	MARPA OPERATION.....	3-40
3.5.2	MARPA READOUT PANEL.....	3-46
3.5.3	ACQUISITION OF TARGETS.....	3-46
3.5.4	CANCELLING THE TARGET.....	3-47
3.5.5	MARPA DEFINITIONS & SYMBOLS.....	3-48
3.5.6	MARPA ALARMS.....	3-49
3.6	GENERAL RADAR PRINCIPLES.....	3-50
3.6.1	RADAR MAP.....	3-50
3.6.2	MAP ORIENTATION.....	3-50
3.6.3	EFFECT OF SHIP'S MOVEMENT.....	3-51
3.6.4	NAVIGATIONAL ECHOES.....	3-51
3.6.5	SEA RETURN.....	3-52
3.6.6	STORM AND RAIN SQUALL RETURNS.....	3-52
3.6.7	BLIND SECTORS OR SHADOW EFFECT.....	3-52
3.6.8	SIDE LOBES.....	3-53
3.6.9	RADAR INTERFERENCE.....	3-54
3.6.10	FALSE ECHOES.....	3-54
3.6.11	DETERMINING RADAR LINE-OF-SIGHT RANGE.....	3-56

SECTION 4 TECHNICAL DESCRIPTION

4.1	GENERAL.....	4-1
4.2	ANTENNA UNIT.....	4-1
4.2.1	RADIATOR.....	4-1
4.2.2	RADIATOR ROTATING MECHANISM.....	4-2
4.2.3	MOTOR-ENCODER.....	4-2
4.2.4	BEARING RESET CIRCUIT.....	4-2
4.3	TRANSMITTER UNIT.....	4-4
4.4	RECEIVER UNIT.....	4-5
4.5	DISPLAY UNIT.....	4-10
4.5.1	SIMPLIFIED BLOCK DIAGRAM.....	4-10
4.5.2	MAIN CONTROL PCB.....	4-10
4.5.2.1	VIDEO INPUT CIRCUITRY.....	4-10
4.5.2.2	A/D CONVERTER.....	4-10
4.5.2.3	BUFFER MEMORY.....	4-11
4.5.2.4	LSI1 & LSI2/VIDEO MIXER, SAMPLING CLOCK GENERATOR.....	4-11
4.5.2.5	LSI3/VIDEO PROCESSOR.....	4-11

4.5.2.6	VIDEO MEMORY.....	4-12
4.5.2.7	CONTROL PCBS.....	4-12
4.5.2.8	CPU & GCM MEMORY.....	4-12
4.5.2.9	VIDEO OUTPUT.....	4-13
4.5.2.10	DISPLAY MONITOR.....	4-13
4.5.3	OPTIONAL INPUTS.....	4-13
4.5.4	POWER SUPPLY (CBD-1426).....	4-15
4.5.5	MARPA PCB (CDC-826).....	4-15

SECTION 5 MAINTENANCE

5.1	GENERAL.....	5-1
5.1.1	PRODUCT AND CUSTOMER SERVICE.....	5-1
5.2	PREVENTIVE MAINTENANCE.....	5-2
5.2.1	HIGH VOLTAGE ARC PREVENTION.....	5-2
5.2.2	INSPECTION (MONTHLY INTERVALS).....	5-2
5.2.3	CLEANING (MONTHLY INTERVALS).....	5-2
5.2.4	LUBRICATION.....	5-3
5.2.5	CONNECTOR MAINTENANCE (SEMI-ANNUAL).....	5-4
5.2.6	GASKET MAINTENANCE (SEMI-ANNUAL).....	5-4
5.2.7	ANTENNA PEDESTAL BRUSHES REPLACEMENT PROCEDURE (ANNUAL).....	5-5
5.2.8	BATTERY REPL. (CMC-1037)[EVERY 2 YEARS].....	5-7
5.2.9	CRT SURFACE CLEANING.....	5-7
5.2.10	FUSE.....	5-7
5.3	OPERATIONAL CHECKOUT.....	5-8
5.3.1	POST INSTALLATION SETUP ADJUSTMENTS.....	5-9
5.3.2	TROUBLE-SHOOTING GUIDE.....	5-9
5.3.3	MASTER RESET.....	5-9
5.4	ALIGNMENTS AND SERVICE.....	5-10
5.4.1	ANTENNA PEDESTAL RECEIVER ALIGNMENTS.....	5-10
5.4.1.1	TUNE INDICATOR ADJUSTMENT.....	5-11
5.4.1.2	FACTORY ADJUSTMENTS.....	5-11
5.4.2	DISPLAY ALIGNMENTS.....	5-12
5.4.2.1	DISPLAY AVR VOLTAGE ADJUSTMENT.....	5-12
5.4.2.2	CONTRAST ADJUSTMENT.....	5-13
5.4.2.3	FOCUS ADJUSTMENT.....	5-13
5.4.2.4	HORIZONTAL HOLD ADJUSTMENT.....	5-13
5.4.2.5	HORIZONTAL SIZE/VERTICAL SIZE ADJUSTMENT.....	5-13
5.4.2.6	VERTICAL LINEARITY ADJUSTMENT.....	5-13
5.4.2.7	BEAM CENTERING ADJUSTMENT.....	5-13

5.4.2.8	INITIAL SETUP ADJUSTMENTS.....	5-14
5.4.2.9	DISPLAY TIMING ADJUSTMENT (ONM ALIGNMENT).....	5-15
5.4.2.10	RELATIVE BEARING ADJUSTMENT.....	5-16
5.4.2.11	ANTENNA HEIGHT SELECTION.....	5-17
5.4.2.12	INTERLACE (SYNCHRONIZATION) ADJUSTMENT...	5-17
5.4.2.13	BUZZER VOLUME ADJUSTMENT	5-18
5.4.3	FAULT FINDING PROCEDURES.....	5-18
5.6	MAGNETIC SENSOR COMPENSATION.....	5-31

SECTION 6 PARTS LIST AND DRAWINGS

6.1	INTRODUCTION.....	6-1
Fig 6-1	INTERNAL CONNECTION DIAGRAM FOR SCANNER UNIT	
Fig 6-2	CIRCUIT DRAWING OF CCB- SCANNER CONTROL UNIT	
Fig 6-3	CIRCUIT DRAWING OF NMA- MODULATOR UNIT	
Fig 6-4	CIRCUIT DRAWING OF NRG- RECEIVER UNIT	
Fig 6-5	CIRCUIT DRAWING OF CMA- RECEIVER CHASSIS	
Fig 6-6	INTERNAL CONNECTION DIAGRAM FOR NCD- 3860 DISPLAY UNIT	
Fig 6-7	CIRCUIT DIAGRAM OF CMC- 1037 MAIN CONTROL UNIT (1/6 ~ 6/6)	
Fig 6-8	CIRCUIT DIAGRAM OF CMC- 1038 MAIN CONTROL UNIT (1/2 ~ 2/2)	
Fig 6-9	CIRCUIT DIAGRAM OF CCK- 709 CONTROL PANEL (A)	
Fig 6-10	CIRCUIT DIAGRAM OF CCK- 708 CONTROL PANEL (B)	
Fig 6-11	CIRCUIT DIAGRAM OF CCN- 271A/CKJ- 121 CRT DISPLAY UNIT	
Fig 6-12	CIRCUIT DIAGRAM OF CDC- 826 MARPA UNIT	
Fig 6-13	CIRCUIT DIAGRAM OF CBD- 1426 POWER SUPPLY UNIT	
Fig 6-14	CIRCUIT DIAGRAM OF CFR- 166 LINE FILTER UNIT	
Fig 6-15	CIRCUIT DRAWING OF CPC- 200 PICTURE PROCESS UNIT	
Fig 6-16		
Fig 6-17	MECHANICAL PARTS PEDESTAL	
Fig 6-18	MECHANICAL PARTS 12" DISPLAY	
Fig 6-19	PEDESTAL MOUNTING TEMPLATE	

RADAR GLOSSARY OF 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 IN	-	Alarm In, also known as the approach alarm. For targets approaching a preset zone.
ALM OUT	-	Alarm Out, also known as the departure or exit alarm
CPU	-	Central Processing Unit
CRT	-	Cathode Ray Tube
DEL	-	Delete
DISP	-	Display
EBL	-	Electronic Bearing Line
EXP	-	Expansion
FET	-	Field Effect Transistor
FTC	-	Fast Time Constant also known as Rain Clutter
GPS	-	Global Positioning System
IR	-	Interference Rejection
KM	-	Kilometer
KY	-	Kiloyard
MH	-	Modulator High Voltage
NM	-	Nautical Mile
NSK	-	North Stabilization Kit
PCB	-	Printed Circuit Board
PPI	-	Plan Position Indicator
P-S	-	Parallel to Serial Conversion
PW	-	Pulse Width or Pulse Length
PWS	-	Pulse Width Selection
RR	-	Range Rings (Fixed)
MC	-	Motor Control
SHM	-	Ships Heading Marker
ST-BY	-	Standby
STC	-	Sensitivity Time Control also known as Sea Clutter
TB	-	Terminal Board
TD	-	Time Difference
TI	-	Trigger
TP	-	Track Pad
VD	-	Video
VRM	-	Variable Range Marker
WPT	-	Waypoint
W/TP	-	with Track Pad
X-MIT	-	Transmit

RADAR GLOSSARY OF TERMS
(With relation to MARPA)

ACQ	-	Acquisition
BRG	-	Bearing
COG	-	Course Over Ground
CPA	-	Closest Point of Approach
CRS	-	Course
C-UP	-	Course-up
CUR	-	Cursor
DNG	-	Dangerous
F.EBL	-	Floating EBL
HDG	-	Heading
H-UP	-	Head-up
INT	-	Intercept
MARPA	-	Mini Automatic Radar Plotting Aid
MHZ	-	Mega Hertz
MOB	-	Man-Over-Board
NMEA	-	National Marine Electronics Association
PRF	-	Pulse Repetition Frequency
RM	-	Relative Motion
RNG	-	Range
SOG	-	Speed Over Ground
SPD	-	Speed
ST	-	Speed Through Water
TCPA	-	Time to Closest Point of Approach
TM	-	True Motion
V.DNG	-	Very Dangerous

SECTION 1

INTRODUCTION

1.1 GENERAL

Congratulations on selecting the JRC JMA-3800 Series Raster Scan Radar to meet your radar navigation requirements.

Whether you purchased this radar because of its ease of installation or long term reliability, one thing is certain; the moment you turn on your JMA-3800 Series Display you will know you are seeing a revolutionary new concept in radar technology at work. You are the proud owner of a radar system unmatched within the recreational marine industry.

Radar signals are "stored" on a 12-inch diagonal TV-type picture tube with chart-like clarity and details. A single glance at your display will give you a complete and accurate 360° radar picture of other vessels, buoys and landfall surrounding your vessel.

The new 1/8 NM range, together with the Offset mode, makes navigating tight channels, rivers, or waterways at night a pleasure instead of a problem.

The EXP mode provides you a echo to easy visible size enlargement of the radar presentation in the zone you have designated. In "Timed Tx" mode, the radar scans the area around your vessel in operator preselected intervals to conserve power. Set the target alarm zone to alert you if any radar contacts have entered the alarm zone, including any that you might not have noticed.

Dual Electronic Bearing Lines (EBL) and Variable Range Markers (VRM) allow rapid high accuracy target bearing and range measurements. When connected to a Loran-C or GPS Navigator with proper output data format for full function operation, the radar can display your destination waypoint on the screen at the proper bearing and range from your vessel. The Waypoint feature provides steering reference information to the destination, or can be used to help locate specific buoys or waypoint landmarks.

Collision Avoidance and Intercept features commonly associated with costly, high seas radar systems are now efficiently incorporated into the JMA-3800 Series Radar by the MARPA unit.

With all of these electronic features and the compact and efficient design of this radar, it soon becomes apparent that human engineering and operational simplicity have been foremost considerations in the development of the Radar System JMA-3807/3811.

You, the customer, set the standard for development of our products.

We trust you will enjoy many years of excellent performance, reliability, and smooth sailing with your new "cutting edge" JMA-3800 Series Radar system.

1.2 EQUIPMENT FEATURES

The JMA-3800 Series Radar system is designed and manufactured to provide ease of installation and operation combined with excellent reliability. Some of the many important built-in features of the equipment are listed below:

1. Target wakes can be displayed on screen.
2. Trackball for quick information access, any place on the display.
3. Multi-language operation (English, French, Spanish, German, Norwegian and Italian). All six languages are standard within each system and are selectable via menu prompt.

4. Automatic Tuning Feature.
5. MARPA capability (standard).
6. Interface with NAVAIDS.
7. Compass Stabilized presentation, allowing for True Magnetic North display heading changes.
8. Unique Man-Overboard feature allowing for quick activation and instantaneous readouts for a fast return to the point of origin of the event.
9. Operator selectable Custom ranges scales.
10. Basic radar alignments can be performed via menu prompts.

1.2.1 JMA-3800 DISPLAY UNIT

The JMA-3800 display unit uses a 12" green monochrome monitor enclosed in a rugged compact aluminum spray proof cabinet.

The front panel contains all of the operating controls for the radar system organized in a combination of rotary controls for precise setting of the Gain, Tuning, Sea-clutter, Rain-clutter, and 20 switches. The silicone soft rubber keys assure fast and accurate selection of key operating functions. The keys are logically arranged for the operator's convenience and are well backlit for night time use.

The display unit is designed to be tabletop mounted, but can be mounted on a bulkhead or overhead.

All system set-up adjustments are made on the display MENU, negating any requirements to open the display unit during the installation. Screwdriver and adjustment tools are no longer required for display setups.

The compact design of the display unit is made possible by the use of two custom Large Scale Integrated circuit devices. Each of these "chips" contain, in one package, the equivalent of up to 120 integrated circuits. Thus, compact size, power efficiency, and a full line of features all come standard with the JMA-3800 Series radar system at an economical price.

1.2.2 JMA-3800 ANTENNA UNIT MAIN FEATURES

The open array antenna and pedestal unit of the JMA-3800 system house 6KW or 10KW transmitter, a log receiver with a low-noise front end, the array drive motor, and its control circuitry.

The X-band transmitter operates in four different pulse lengths at four different PRF's. The magnetron types are the MSF1422B, rated at 6KW or the MSF1425B, rated at 10KW. Each are driven by a solid state modulator unit.

There are two types of open array antenna. One is a 4.0 foot endfed slotted array producing 2.0° horizontal and 30° vertical beamwidths, and special 4.0 foot endfed slotted array producing 1.9° horizontal and 25° vertical beam widths. The other is a 6 foot array producing 1.2° horizontal and 25° vertical beamwidths for very high resolution, super sensitive target pick up and display.

The open array antenna is driven by a speed-regulated motor at approximately 24RPM.

The receiver section consists of a passive diode limiter, PIN diode attenuator, low noise MIC front end, coupled to a 60MHz triple bandwidth IF amplifier. The bandwidth of the receiver switches between 20, 6 and 3MHz at the designated pulsewidth during range scale selections to provide optimum sensitivity with minimal background noise.

1.3 ABOUT THIS MANUAL

This manual contains important information to help you get the best operation and performance from your new JMA-3800 Radar and its associated optional equipment. Although the unit is simple to master, please take the necessary time to read through each section of the manual.

Section 2 contains very important information on the proper installation of the JMA-3800 Radar. Although the typical installation might seem straight forward and simple, we highly recommend that this section be read thoroughly and the guidelines for installation be closely followed to obtain trouble-free and efficient operation of your new unit.

Section 3 contains a brief discussion of the general principles of radar, along with the operating instructions for the radar which will guide you through the unit's operating controls and display layouts.

To more easily recognize how to enable the various operations, the names of the keys that must be pressed to complete the described operation are enclosed in boxes, such as **MENU**, or **RANGE**. In most cases, pictures showing the correct displays to obtain the desired entry are included next to each function.

The best way to learn about the JMA-3800 is to dive right in. You can't damage the unit by randomly pressing keys. So don't be afraid to experiment. In Menu mode, if at any time the results appear confusing, just push the **MENU** key twice in order to return to the Main menu, and start again.

Sections 4 and 5 contain technical information about the theory of operation and maintenance for your new radar. In the event that the JMA-3800 should ever experience an operational failure, it is recommended that all repair services be provided by an authorized JRC service dealer or performed at the JRC Service Office.

1.4 SPECIFICATIONS

1.4.1 GENERAL

- 1) Maximum range: JMA-3807 : 48NM
JMA-3811 : 72NM
- 2) Minimum range: Less than 25m (27yds) on 0.125NM
- 3) Standard Range Scales:

	“ Range ”	Number of rings	Range ring interval
	0.125 NM	2	0.0625 NM
	0.25 NM	2	0.125 NM
	0.5 NM	2	0.25 NM
	0.75 NM	3	0.25 NM
	1.5 NM	6	0.25 NM
	3 NM	6	0.5 NM
	6 NM	6	1 NM
	12 NM	6	2 NM
	24 NM	6	4 NM
[JMA-3807]	48 NM	6	8 NM
[JMA-3811]	72 NM	6	12 NM

- Plus 25 custom range scales (user selectable)
- 4) Range discrimination: Less than 20m (22yds)
 - 5) Range ring accuracy: $\pm 1\%$ of selected range or 22 m, whichever is greater.
 - 6) Bearing accuracy: ± 1 degree.
 - 7) Environmental Conditions
 - Scanner Unit: Temperature; -25°C to $+55^{\circ}\text{C}$
(under nominal input voltage)
Humidity; Up to 95% at 40°C
 - Display Unit: Temperature; -15°C to $+55^{\circ}\text{C}$
Humidity; Up to 95% at 40°C
 - 8) Input power requirements: 10.8 ~ 42.0VDC
 - 9) Power Consumption: 120W (JMA-3807)
130W (JMA-3811)

1.4.2 DISPLAY UNIT

- 1) Dimensions: Width 319mm (12.6in.)
Depth 466mm (15.7in.)
without sunshield
Height 390mm (15.4in.)
 - 2) Mounting: Table, overhead or bulkhead mounting
 - 3) Weight: Approx. 17kg (Approx.37.5lbs)
 - 4) Cathode-ray tube: Green
 - 5) Video: 8 levels, quantized
 - 6) Display Resolution: 928 Dots × 698 lines
 - 7) Bearing synchronizing system: Motor Encoder
 - 8) Tuning: Manual or Automatic
 - 9) Bearing scale: 360° scale graduated at intervals of 1°
 - 10) Ship's heading marker: Electrical
 - 11) VRM: Dual VRM's with 4 digit readout on CRT.
 - 12) Presentation Modes
 - Display: RM (Relative Motion); TM (True Motion)
 - Bearing: Head Up (H-UP); Course Up (C-UP); North Up (N-UP)
 - 13) EBL
 - Mode: Relative; True; Magnetic
 - Resolution: 0.1°
 - 14) Alarm: Audible alarm (Internal only)
 - 15) Off Center: Up to 2/3 radius (except maximum range)
 - 16) Expand: Echo Expand
 - 17) Timed TX Mode: Transmit period; Select 10, 20, or 30 scans
Sleep period; Select 3,5,10 or 15 minutes
 - 18) Features: Two (2) VRM's, Two (2) EBL's,
Interference Rejection, Target Expansion,
Target Alarms, Lat/Long or TD Readouts,
Waypoint Mode, Off Center, Zoom, Timed
Transmit, Ship's Heading Line with Mo-
mentary Off Key, Cursor, F.EBL, MOB,
Wakes, Window, Custom Range
-

19) Controls:

ST-BY/OFF	Standby Key
XMIT/OFF	Transmit Key
RANGE ▲	Range UP Key
RANGE ▼	Range DOWN Key
VRM	Variable Range Marker key Select or ON/OFF key
EBL	Electronic Bearing Line key Select or ON/OFF Key
BRIL	Screen Brilliance Key
OFF/CENT	Off Center Key
EXP	Expand
ENTER	Enter Key
MENU	Menu Key
ACQ/CNL	Acquisition/Cancel Key
GUARD	Guard Zone Key
RR/SHM	Range Ring or SHM Off Key
HDG/MODE	Heading Mode Select Key
TM/RM	TM or RM selection Key ON/OFF Key
FEBL	Floating EBL ON/OFF Key
DESIG	Designation Key
WINDOW	Multi-screen Select Key
MOB	Man Over board Key

20) Inputs:

LORAN-C/ GPS	NMEA0183, must include GLL, GTD, VTG, BWC, ZTG (or calculate), or RMA & RMB, or RMB & RMC sentences for full function displays and capabilities (or JRC Serial format).
MAGNETIC SENSOR	NMEA0183 HDG, HDM, HDT, VHW, data

21) Rear Panel Connectors

Interunit (Ant)	24 pin
Power (DC)	4 pin
NAVAIDS/Mag.Sensor	6 pin

1.4.3 ANTENNA UNIT

	<u>4FT Scanner</u>	<u>6FT Scanner</u>
1) Dimensions:		
Height:	440mm (17.4in)	440mm (17.4in)
Swing Circle:	1340mm (52.8in)	1910mm (75.2in)
Width:	292mm (11.5in)	292mm (11.5in)
Depth:	500mm (19.7in)	500mm (19.7in)
2) Weight:	Approx. 29kg (64 Lbs) 33kg (73Lbs)	
3) Polarization:	Horizontal	
4) Beamwidth:	Horizontal 1.9° (4ft)	1.2° (6ft)
	Vertical 25°	25°
5) Side lobe level:	-23dB or greater (within ± 10°) -26dB or greater (more than ± 10°)	
6) Rotation:	Approx. 24rpm	
7) Wind velocity:	51.5m/s (100 knots), relative	
8) Transmitter frequency:	9410 ± 30MHz	
9) Peak power:	6kw (JMA-3807) 10kw (JMA-3811)	
10) Transmitter tube:	Magnetron (MSF1422B) 6kw Magnetron (MSF1425B) 10kw	
11) Pulse length/PRF:	0.08 μ s/2000Hz (0.125,0.25,0.5,0.75,1.5NM) 0.4 μ s/1500Hz (3,6NM) 0.8 μ s/750Hz (12,24NM) 1.2 μ s/500Hz (48,72NM)	
12) Modulator:	Solid state modulator	
13) Duplexer:	Circulator and Diode Limiter	
14) Mixer:	MIC Front End	
15) IF Amplifier		
Center frequency:	60MHz	
Bandwidth:	20MHz/6MHz/3MHz	
Characteristic:	Logarithmic	
16) Receiver noise figure:	Less than 6dB	

1.4.4 MARPA

1) Acquisition	
Acquisition Mode:	Manual (6 targets max)
Manual Cancelling of unnecessary Target:	By 1 target each or all targets
2) Tracking	
Tracking Mode:	Automatic
3) Vectors	
Mode:	RELATIVE; TRUE
Length:	1, 3, 6, 12 minutes
Display Time	
Initial:	1 minute
Stable:	3 minutes

4) Dangerous Target Limits:

CPA 0, 0.1, 0.2, 0.5, 1, 2 NM
 TCPA 1, 2, 5, 10, 20, 30 min

Target Conditions:

Safe target ○	<ul style="list-style-type: none"> · $CPA > MIN.CPA$ · $D \geq MIN.CPA, TCPA < 0$, behind own ship · $D > MIN.CPA, TCPA < 0$
Dangerous target △	<ul style="list-style-type: none"> · $CPA \leq MIN.CPA, TCPA > MIN.TCPA$ · $D \leq MIN.CPA, TCPA < 0$, forward own ship
Very Dangerous target ◇	<ul style="list-style-type: none"> · $CPA \leq MIN.CPA,$ $0 < TCPA < MIN.TCPA$

D is distance from own ship to target.

Alarm Conditions:

Target Condition	CRT Symbol	Alarm Characters	Buzzer
Safe	○	OFF	OFF
Dangerous	△	DNG	OFF
Very Dangerous	◇	VDNG	ON
LOST TARGET	Broken line symbol	-	ON

5) Lost Target:

Broken line symbol on CRT, broken line vector Visible/Audible alarms.

6) Numerical Display

Target Data:

Simultaneous and continuous display for 1 target.

Bearing, range, true course, true speed, CPA, TCPA.

Own Ship Data:

Speed

7) Intercept Mode:

Intercept Target is MARPA Information Readout.

Intercept True Course

Intercept True Speed

Intercept Time

This function only in True Vector mode.

SECTION 2

INSTALLATION

2.1 GENERAL

Although your JMA-3800 Series Radar is designed to the highest levels of quality and performance, it can best attain those standards when a proper installation of the equipment has been achieved.

This section provides you with practical guidelines to assist in the planning and installation of the JMA-3807 or JMA-3811 aboard your vessel.

2.2 UNPACKING AND INSPECTION

Use care when unpacking your new JMA-3800 Series Radar from the shipping cartons to prevent damage to the contents. It is also good practice to save the cartons and the interior packing materials until the units have been satisfactorily installed on the vessel so that they may be reused in the unlikely event that it becomes necessary to return any unit for service.

2.3 EQUIPMENT SUPPLIED

Table 2.1 lists the items that are included with your new radar system. If you are missing any items, please notify your dealer immediately to obtain replacements for the missing material.

TABLE 2.1

DESCRIPTION	PART NO.	Q'TY	REMARKS
DISPLAY Unit	NCD-3860	1	
Sunshield	MPOL30078	1	
Instruction Manual	7ZPRD0451	1	
Connector, 4Pin	5JCAA00005	1	Power Plug
Connector, 6Pin	5JWHZ00065	1	NMEA/Flux Sensor
Spare Parts Kit	6ZXRD00184	1	Fuses,Brushes
Label Kit		1	JMA-3807/JMA-3811

TABLE 2.1 Continued

DESCRIPTION	PART NO.	Q'TY	REMARKS
PEDESTAL UNIT, 6KW	NKE-1062	1	for JMA-3807 System
PEDESTAL UNIT, 10KW	NKE-1055	1	for JMA-3811 System
Interunit Cable Assembly, 20M	CFQ-8973-20	1	
ARRAY UNIT, 4FT	NAX-16A-4	1	4' Antenna
ARRAY UNIT, 6FT	NAX-16A-6	1	6' Antenna

The input power voltage requirement for the radar via the Display Unit is 10.8 to 42.0 VDC. If the ship's input power is 24 or 32 VDC, then F401 and F402 should be changed to the 8 amp fuses provided.

TABLE 2.2 STANDARD SPARE PARTS KIT (6ZXRD00184)

Name of Parts	Type	Quantity	Description	Part Number
Fuse	Glass tube 15A (12VDC)	3	F402 Display unit	5ZFAD00173
Fuse	Glass tube 10A (12VDC)	3	F401 Display unit	5ZFAD00018
Fuse	Glass tube 8A (24,32VDC)	3	F402 Display unit	5ZFAD00268
Fuse	Glass tube 6.3A (24,32VDC)	3	F401 Display unit	5ZFAD00363
BRUSH	ANTENNA MOTOR	3		

The total power required by the Model JMA-3807 is about 120 watts.
 The total power required by the Model JMA-3811 is about 130 watts.

2.3.1 OPTIONAL ACCESSORIES

- | | |
|------------------------------|------------------|
| 10M Interunit Cable Assembly | CFQ-8973-10 |
| 30M Interunit Cable Assembly | CFQ-8973-30 |
| **Heading Sensor | NJZ-1086, NWZ-92 |
| GYRO/LOG Interface Kit | MDLW11031 |

****NOTE**

Heading Sensor (NJZ-1086, NWZ-92) or GYRO/LOG Interface Kit (MDLW11031) is required for proper operation of the MARPA functions.

2.4 PLANNING THE INSTALLATION

The layout for installing the JMA-3800 Series Radar should be planned to give the best operation and service aboard your particular vessel. In general, the Antenna Unit should be mounted as high as possible above the waterline. The Display Unit should be installed in a convenient viewing position near the helm.

NOTE

In order to maximize the operation of your radar system, it is recommended that the radar antenna be mounted above objects which would interfere with the path of the radar signal. Installation of the radar antenna above such obstacles as the flying bridge, large engine stacks and out of the range of ships personnel will insure maximum benefit from your radar system.

A 10 meter (33') length of vinyl-covered, shielded, 19 conductor cable is furnished for interconnecting the two main units (Antenna and Display).

This length of cable should be sufficient to complete the cable run required on most small vessels. The maximum length of cable from the Antenna Unit to the Display Unit should not exceed 30 meters (100').

In some instances, you may wish to shorten the cable length to be less than the 33' provided, due to space restrictions. In this instance, it is not recommended that the cable length be shortened to less than 10'. In any case, you should always keep a few extra foot, just in case it is required for service.

A General System diagram for the JMA-3800 Series Radar is shown below.

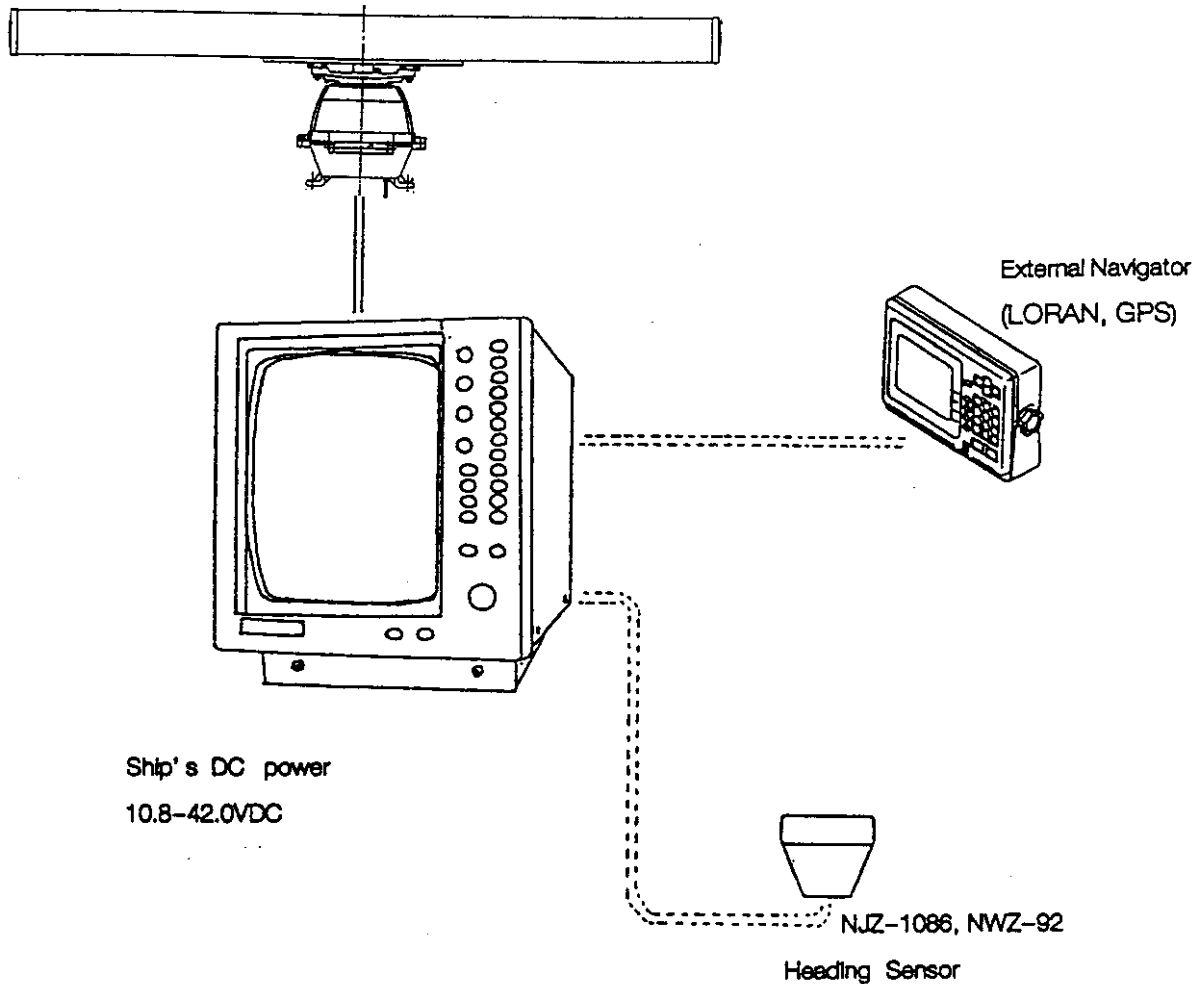


Fig. 2-1 GENERAL SYSTEM DIAGRAM

2.4.1 MOUNTING THE DISPLAY UNIT

When planning the installation for your JMA-3800 Series Display Unit, the following conditions should be considered to insure dependable and troublefree operation.

- 1) The mounting location should be easily accessible to allow operation of the front panel controls.
- 2) There should be adequate ventilation.
- 3) There should be sufficient space behind the display to allow cable connections to the rear panel connectors.
- 4) The Display Unit should be located near a DC power source.
- 5) The selected location should be far enough away from devices that may cause interference, such as motors and generators.
- 6) Generally speaking, the display 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 mounted on a chart table, bulkhead, overhead or console mounted in a desired location. (Refer to Figure 2-2 for typical mounting methods)

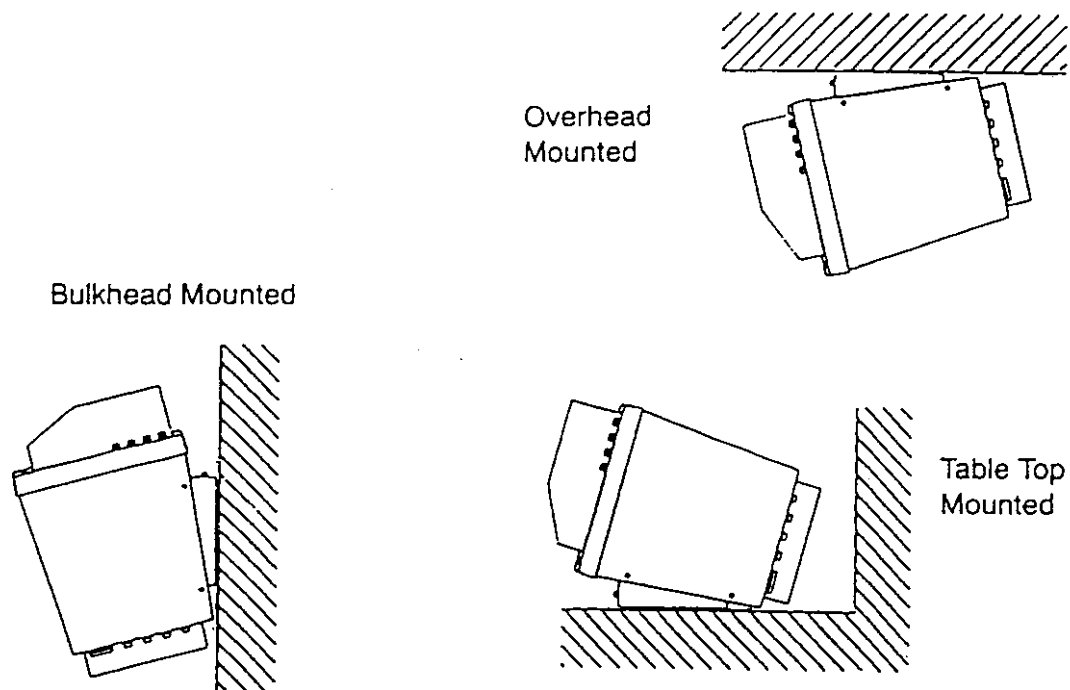


Fig. 2-2 TYPICAL MOUNTING METHODS

2.4.1.1 PROCEDURE FOR OVERHEAD MOUNTING

There may be occasions where overhead mounting of the radar display unit is desired. Keep in mind that the unit weighs over 37 pounds. So take the necessary precautions to assure that the overhead can support this weight and use appropriate mounting hardware to make certain the bracket will remain firmly attached to the mounting surface.

To prepare the unit for overhead mounting, it will be necessary to reverse the bracket mounting plate position on the display unit.

- A. Remove the cover from the display unit (10 Screws).
- B. Remove the Mounting Bracket by removing the two Socket Head Cap screws.
A #5 metric allen wrench may be used to remove the screws.
- C. Remove the 10 machine screws holding the bracket plate. Remove the plate and re-attach the plate to the top of the display chassis using the appropriate screws.
- D. Re-attach the cover onto the display unit.
- E. Attach the Mounting Bracket onto the overhead at the desired position.
- F. Slide the display unit into the bracket latches and secure in position with the Socket Head Cap screws.

UNLESS OTHERWISE SPECIFIED		DIMENSION SPECIFIED TOLERANCE	
0	10	± 1	
OVER 30	TO 120	± 1.5	
OVER 120	TO 400	± 2.5	
OVER 400	TO 1000	± 4	
OVER 1000	TO 2000	± 6	
OVER 2000	TO 3000	± 8	

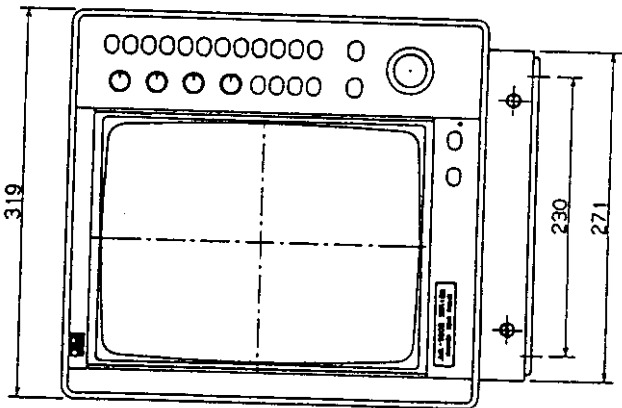
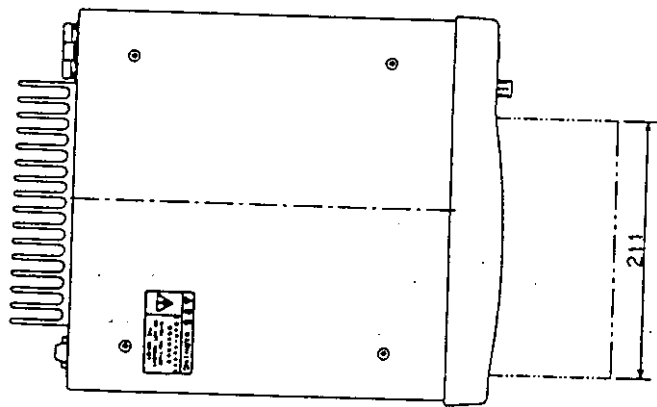
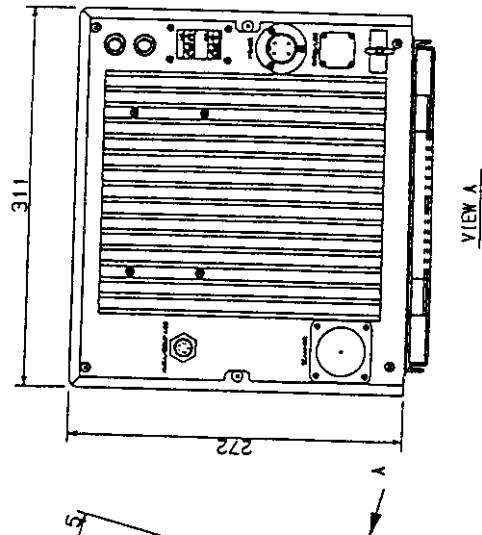
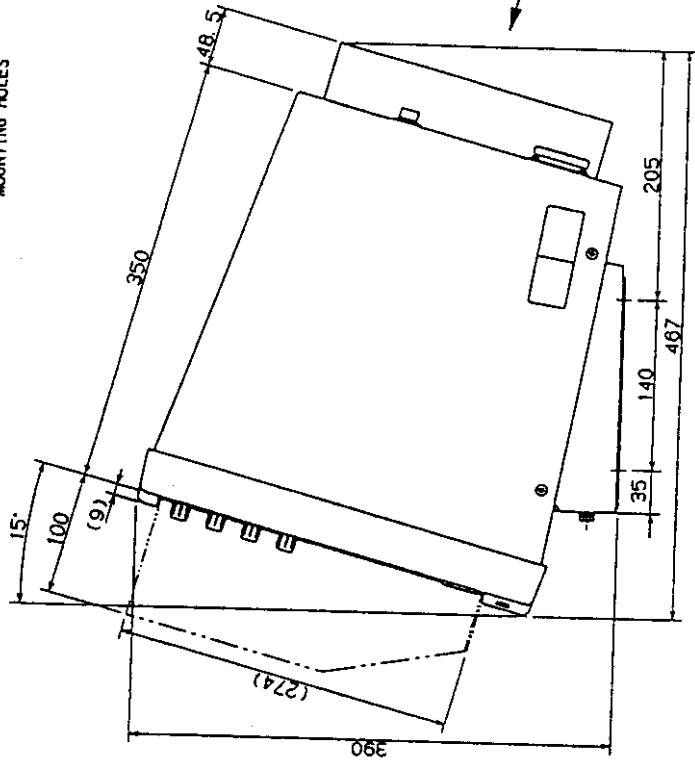
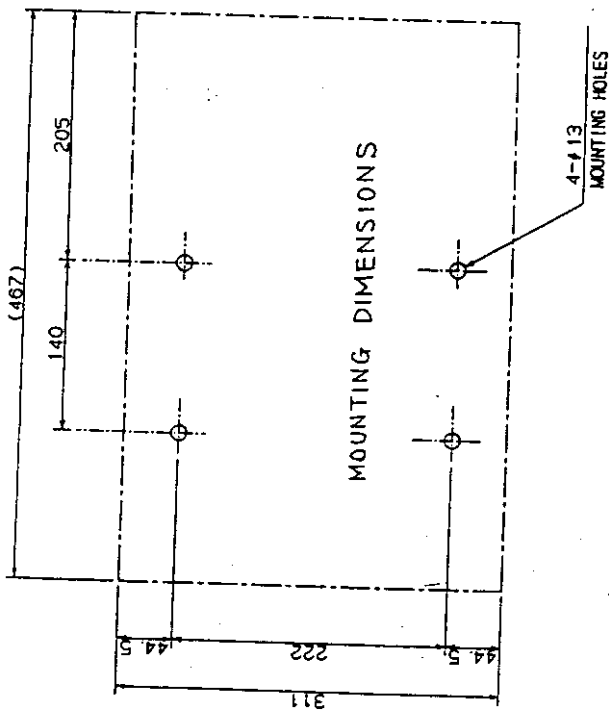


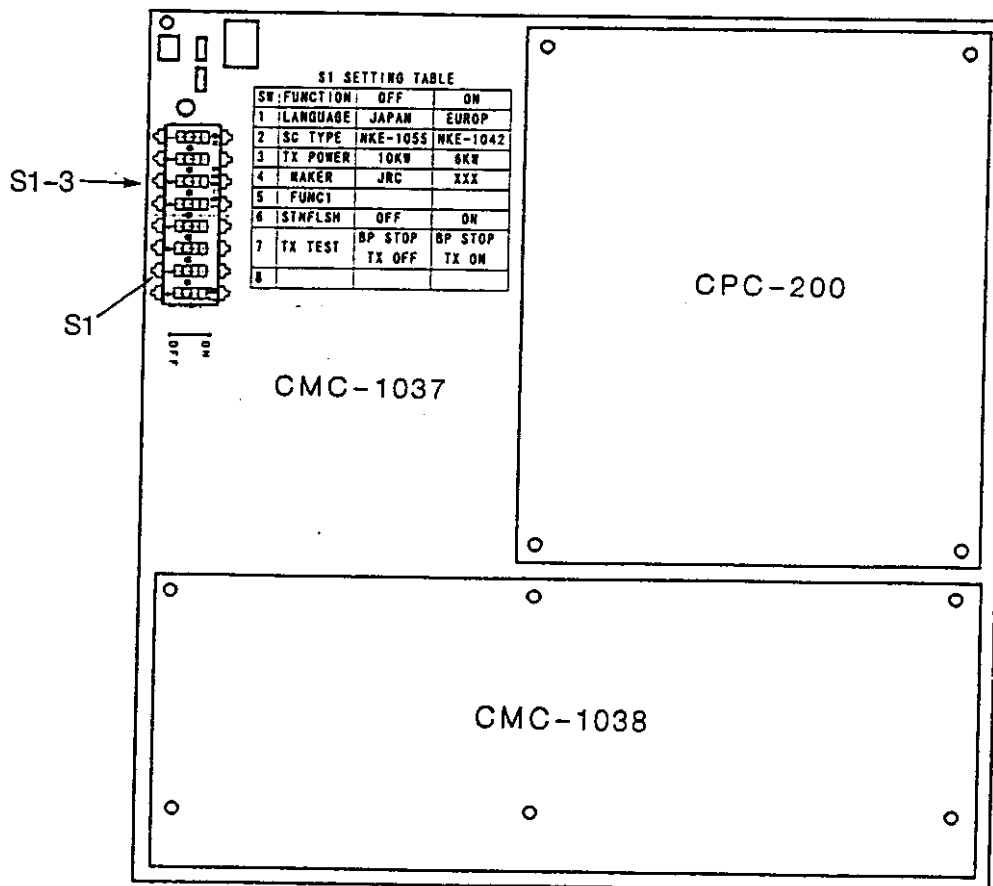
Fig. 2-3 NCD-3860 DISPLAY UNIT OUTLINE DIMENSIONS

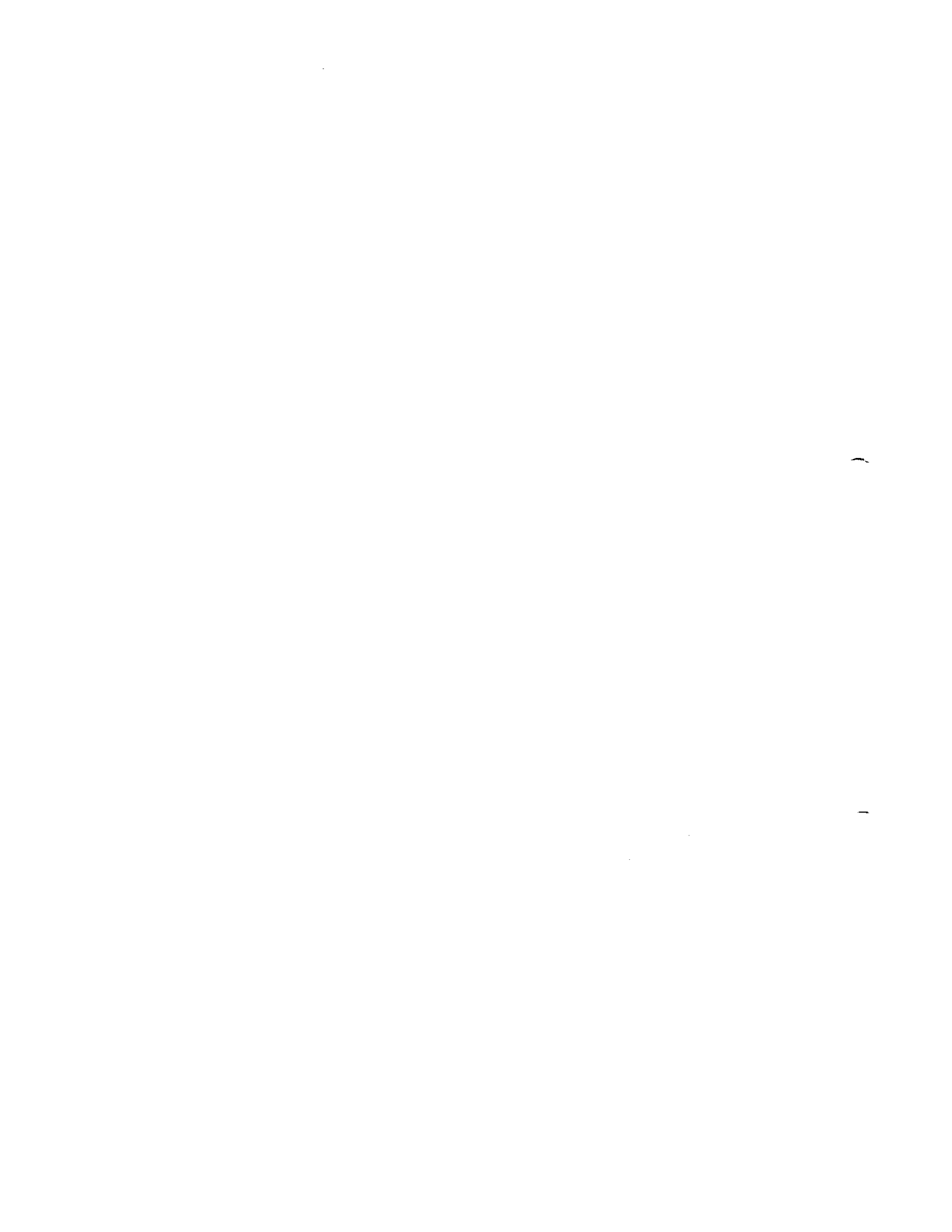
2.4.1.2 DISPLAY SET UP

Depending on whether you have purchased the JMA-3807 or the JMA-3811, S1 on the Main PCB (CMC-1037) will have to be configured to set the maximum range of the radar. Remove the case screws, then the back cover. As you look at the front of the unit, the PCB's are on the right hand side. Locate the S1 on the Main PCB (CMC-1037)(see figure). Set the S1-3 according to the chart below.

	S1-3
JMA-3807	ON
JMA-3811	OFF

Included with your radar is an adhesive backed tag with either "JMA-3807" or "JMA-3811". This label is to be affixed in the recessed rectangle in the lower left hand corner of the front of the display.





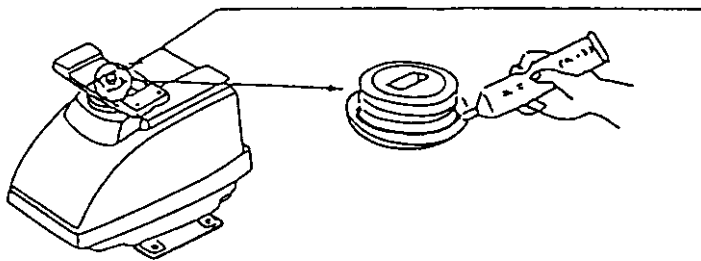
2.4.2 ASSEMBLING THE OPEN ARRAY ANTENNA

Open Array pedestal units are shipped as two separate assemblies, the pedestal and the array. Packaged with the array is the hardware, sealant, and assembly instructions.

MATERIALS SUPPLIED:

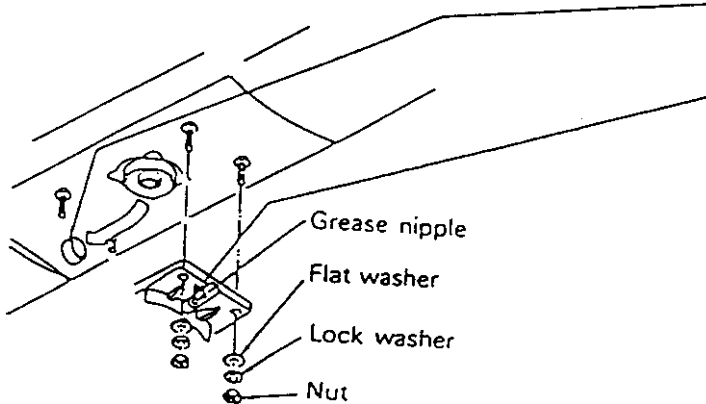
- | | |
|------------------------|--------|
| 1) Seal Material | 1 tube |
| 2) M10 Nuts | 4 each |
| 3) M10 Lock Washers | 4 each |
| 4) M10 Flat Washers | 4 each |
| 5) Assembly Directions | |

The following procedure should be followed in assembling the JMA-3811 Array unit onto the pedestal.



1) Remove the plastic cap from the top of the pedestal.

2) Apply the sealing material around the flange (as illustrated) with a thickness of about 1/8".

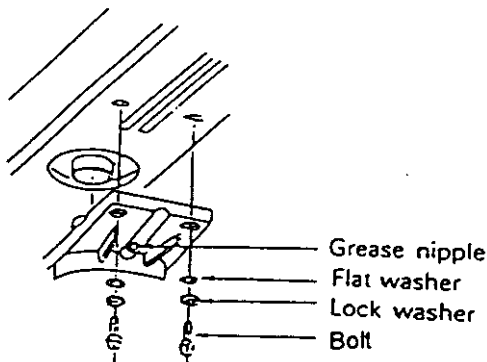


3) Remove the plastic cap from the array.

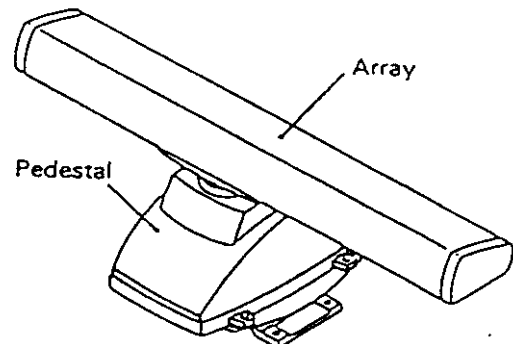
4) Position the array support so the grease fitting is on the right side of the pedestal (looking from the front) place the array on the pedestal with the logo facing forward.

5) Install a flat washer, lock washer, and nut to each stud and tighten with a wrench.

4 Foot Array



4, 6 Foot Array



The Completely Assembled Scanner Unit

2.4.3 MOUNTING THE OPEN ARRAY ANTENNA UNIT

Selecting the best location for the Open Array Antenna Unit requires careful consideration. On many vessels, the unit can be installed on a mast or mast platform, on an arch, or on a bridge structure. Since radar basically transmits at line-of-sight, the unit should be mounted as high as possible on the ship to ensure the best range performance.

NOTE
THE ARRAY SWING CIRCLE IS 48"(4FT), 75.2"(6FT)
ASSURE THAT THERE IS ADEQUATE CLEARANCE
TO ROTATE THE ARRAY

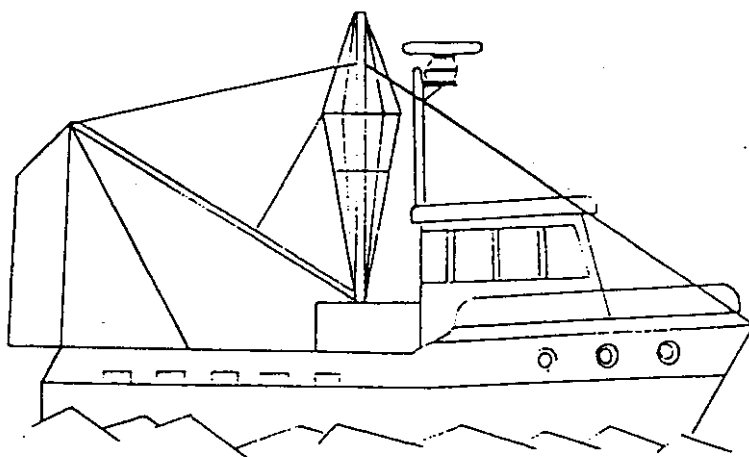


Fig. 2-5 TYPICAL MOUNTING LOCATION

The scanning beam should never be obstructed by surrounding large objects. Try to locate the antenna unit where large objects such as searchlight, horn, mast, or bridge and superstructure are not in the same horizontal plane. Otherwise, blind areas and false targets can appear on the radar screen. Installation near the top of exhaust stacks must be avoided as damage could result due to potentially excessive heat and the corrosive effect of stack gases on the radar antenna.

NOTE

A mechanical hazard exists from the external rotating antenna. Remain clear of rotating antennas at all times. It is recommended that the radar antenna (whether external or internal) be mounted above objects which could interfere with the radar signal such as the flying bridge, large engine stacks, and personnel. This may be difficult on some vessels and, in such a case, it is recommended that a radar mast be used. Always turn off the radar system before servicing the antenna or nearby equipment.

Using the appropriate mounting dimensions shown in Fig. 2-6 as a guide, along with the template provided at the back of the manual, prepare a mounting platform surface for the radar pedestal unit. Assure that the platform has sufficient strength to support the scanner's weight under the most adverse conditions the vessel is likely to encounter. Also ensure that the platform is parallel with the vessel's water line to maintain the proper plane of radiation for the radar antenna.

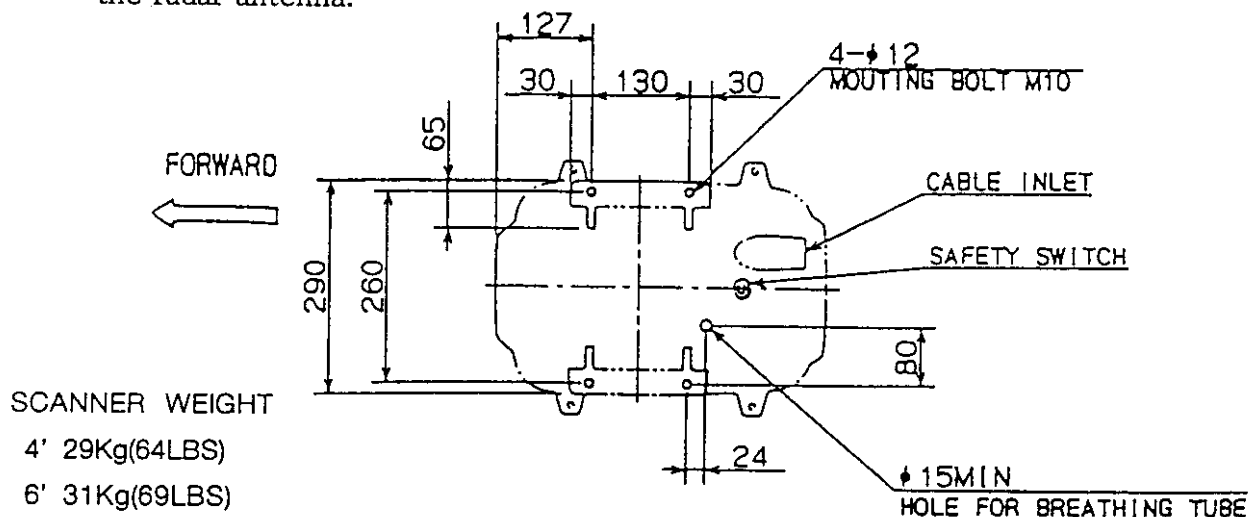


Fig. 2-6 BASE MOUNTING DIMENSIONS

Install the scanner unit onto the mounting platform with the cable entry and safety switch facing "AFT".

The pedestal has a rubber breathing tube extending from the base of the pedestal. Assure the vent has clearance through the platform and is not kinked or blocked. Secure the scanner with stainless steel hardware to the platform.

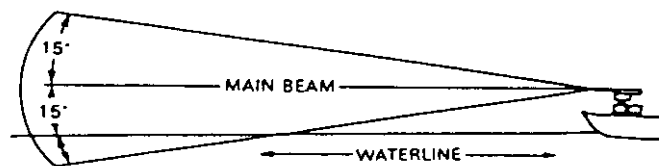
If mounting directly to a deck which does not give the antenna unit sufficient height or clearance, a radar mast or pedestal may be used to elevate the unit.

When choosing the mounting site, be aware that you will need an open area of at least four or six feet in order to rotate the antenna array.

2.4.4 SETTING THE RADIATION PLANE

In the standard antenna installation the scanner/pedestal unit is mounted so the array will rotate parallel to the waterline.

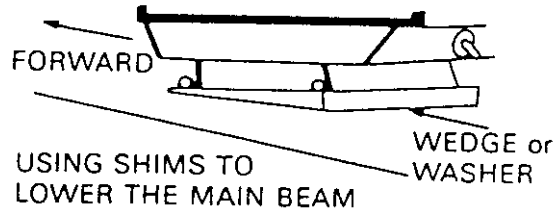
The beam of radar is approximately 30° (4' array) or 25° (6' array) wide in the vertical direction so target detection during the vessel's pitching and rolling will be generally good.



IDEAL RADIATION PLANE

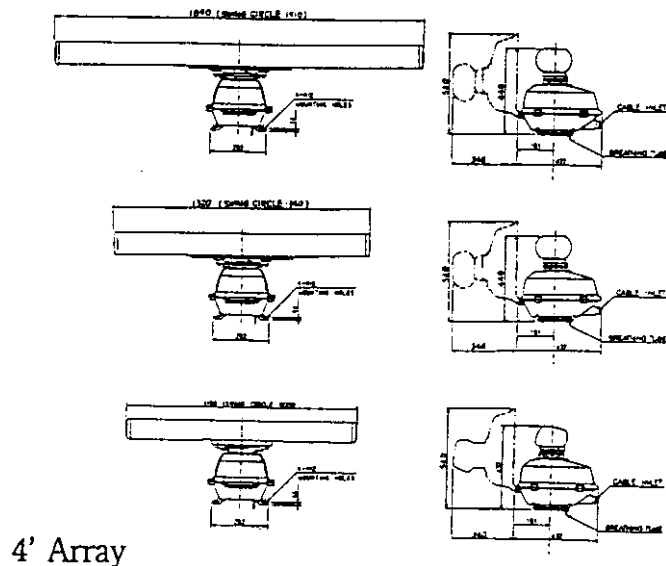
Some vessels however, may adopt a higher bow angle when the vessel is at its cruising speed that substantially alters and raises the radar's main radiation plane. In this case, nearby target detection might be poor. It may be helpful to lower the radar beam to parallel the waterline by shimming the radar pedestal to tilt the beam angle slightly downward with respect to the waterline.

The figure shows one approach, that of using an angled wood block between the pedestal mounting feet and the mast or platform surface to obtain the desired tilt angle. The shims may also be made from aluminum plate wedges or simple flat washers.



WARNING

A mechanical hazard exists from external rotating antenna arrays. Remain clear of rotating antenna arrays at all times.



Dimensions shown in mm.

The length of 6' Array is 1890 mm, and swing circle is 1910 mm.

Fig. 2-7 OUTLINE DRAWING - Open Array Antenna

イラシ-美替?

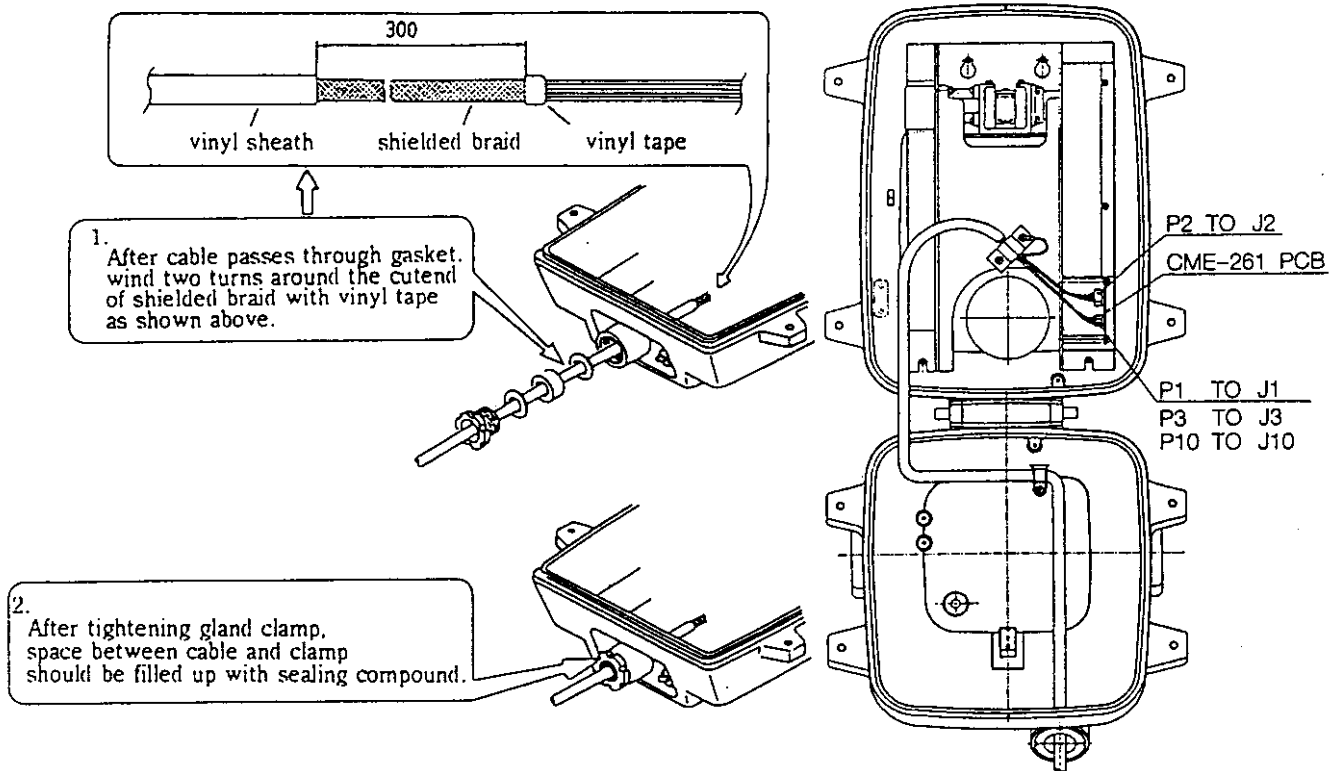


Fig. 2-8 ANTENNA PEDESTAL UNIT CABLE CONNECTION PROCEDURE

2.4.5 CABLING THE ANTENNA PEDESTAL UNIT

The cable inlet of the antenna pedestal unit is located in the right rear corner of the pedestal base assembly (see Fig. 2-8). Verify whether the interunit cable is already connected at the display unit. If connected, disconnect the 24-pin connector before installing the cable at the pedestal to prevent any live voltages on the cable wiring.

- 1) Loosen the 4 Pedestal bolts and lift open the cover.
- 2) Remove the nut, rubber bushing and silver colored blocking plate from the gland assembly. The blocking plate can be discarded.
- 3) Insert the gland nut washers and rubber gasket on the cable as shown in Fig. 2-8. Screw the gland nut loosely into the cable gland.

- 4) Remove the 2 internal screws and remove the cable clamp. Insert the cable into the pedestal until the vinyl sheath contacts the clamp. Reassemble the clamp so that the clamp bar is compressing the shield material.
- 5) Attach the lug from the cable shield to one of the clamp mounting screws and secure the cable into the clamp using care not to pinch any of the conductors.
- 6) Follow the wire colors in Fig. 2-9, attach the wires to TB101 and TB102. While reinstalling the cable clamp, ensure that the cable shield is grounded in the clamp.
- 7) Tie all spare wires to the cable harness.
- 8) Tighten the gland nut.

SCANNER UNIT
NKE-1055/1062

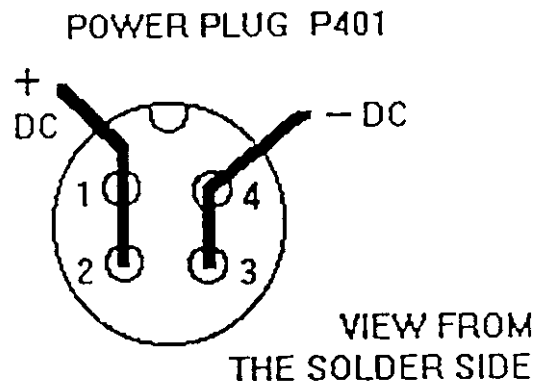
2.5 ELECTRICAL CONNECTIONS

2.5.1 DC POWER CONNECTION

The JMA-3800 Series Radar is intended for use on DC power systems and can operate as long as the DC supply system is maintained from 10.8 to 42.0VDC. The DC system can be "negative" grounded or have both positive and negative supply lines "floating" above ground. This radar is not intended for use on "positive" ground vessels.

A 4 pin Power connector is provided with the radar system and is packaged in the spare parts box in the Display unit carton. To make a connection to the ships DC supply, it will be necessary to determine the wire size to use for the power leads, and then attach the wires to the correct pins of the plug.

The total power required by the JMA-3807 radar system is approximately 120 watts. JMA-3811 system requires about 130 watts. When the power leads are less than 10 feet, # 14 AWG wire should be OK. For power cables up to 30 feet # 12 AWG wires should be used. If longer than 30 feet, use #10 AWG wire.



The wire that will connect to the POSITIVE terminal should connect to both pins 1 and 2 of the connector. The wire that will connect to the NEGATIVE terminal should connect to both pins 3 and 4 of the connector. The metal plug cover can be removed by unscrewing the two small set screws located near the locking ring. Once the cover is OFF, the correct pins can be identified as shown in the drawing above.

Mark the wires as necessary or note the wire color to assure connections at the DC panel will be made with correct polarity. If the power leads are accidentally reversed, the rear panel fuses will open. If this happens, verify the polarity with a meter, change the wire connections if necessary, and replace the fuses.

At the DC distribution panel, connection to a 15 Amp or 20 Amp circuit breaker is recommended. It is important for best noise immunity to keep the radars power leads separated from other electronic equipments. On smaller vessels the connection may be made at the main battery isolation switch or breaker if necessary.

2.5.2 EXTERNAL SYSTEM INTERFACE

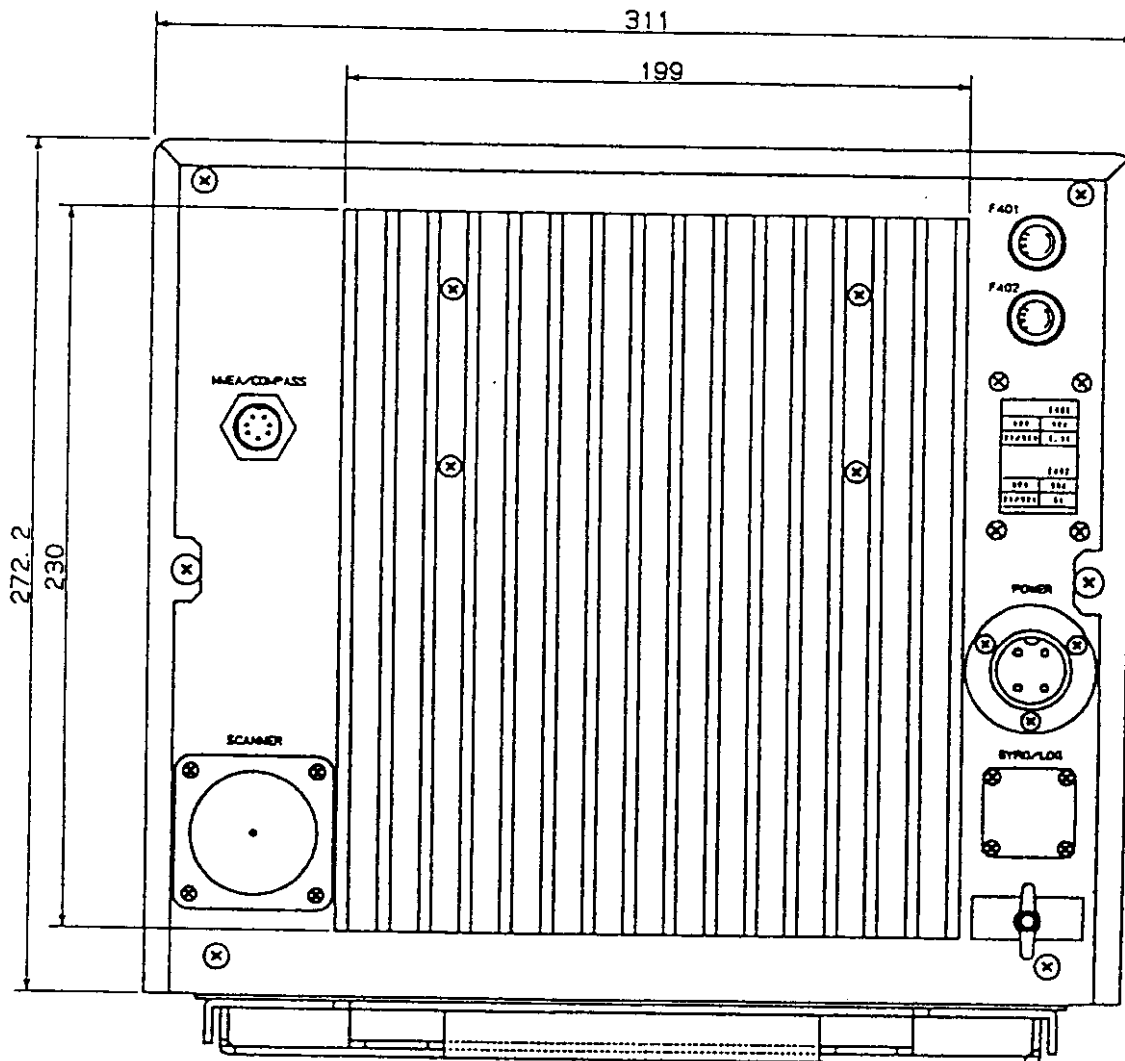


Fig. 2-10 DISPLAY UNIT REAR CHASSIS

Many of the key features of the JMA-3800 series radar require various input signals from Nav aids, and a Gyro Compass or Flux Sensor. Inputs from the Nav aid, and Flux Sensor, will be digital data conforming to the NMEA0183 format, to drive the Waypoint mode and MARPA.

When more than one data type is present, the radar has established a hierarchy or priority system in software to respond to the various data. The priorities are set as follows:

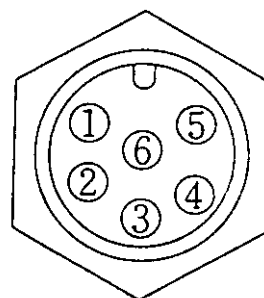
FUNCTION	PRIORITY	INPUT
HEADING:	1.	Gyro Compass Data
	2.	Flux Sensor (NMEA0183 " HDG, HDM, VHW, HDT ")
	3.	Navaid Data (NMEA0183 " RMC, RMA, VTG ")
POSITION:	1.	Navaid Data (NMEA0183 " RMC, RMA, GLL, GTD ")
SPEED:	1.	Gyro Compass Data (NMEA0183 " STW ")
	2.	Navaid Data (NMEA0183 " RMC, RMA, VTG, or JRC format ")
WAYPOINT:	1.	Navaid Data (NMEA0183 " RMB, BWC ")

2.5.2.1 CONNECTION WITH EXTERNAL NAVAIDS

Navaid data is the primary source for position, speed, and waypoint bearing and range input information to the radar. Check the list above and verify that the Navaid that will be used to supply data input to the radar contains the required sentences in it's NMEA0183 output. The Navaid input should be connected at the NMEA connector J403, Pin 1 (NAV+) and Pin 2(NAV-).

If for some reason, NMEA0183 data is not available from Navaid on the vessel, JRC serial format, if available, can be accepted by the radar. The polarity of the JRC data is identical to the NMEA data.

DATA + = J403 PIN 1
DATA - = J403 PIN 2



NMEA CHASSIS CONNECTOR J403 (male)
View from the rear of the display.
Connector*(female)
View from the solder side

- ① NAV+(NMEA, JRC DATA)
- ② NAV-(DATA COMMON)
- ③ COMPASS+(NMEA DATA)
- ④ COMPASS-(DATA COMMON)
- ⑤ COMPASS+(12VDC)
- ⑥ COMPASS-(GROUND)

*ASSEMBLY INSTRUCTIONS
PROVIDED WITH CONNECTOR.

NOTE: For greater accuracy and vector stability, it is recommended that the Heading Sensor be used over the Magnetic Flux Sensor.

The JMA-3800 series radar can accept the NMEA0182 data at the NAV input to show ships L/L position. But Speed, Course, or Waypoint data is NOT available from NMEA0182 and those functions which require this data in the radar will not be enabled.

2.5.2.2 INSTALLING NJZ-1086, NWZ-92 HEADING SENSOR

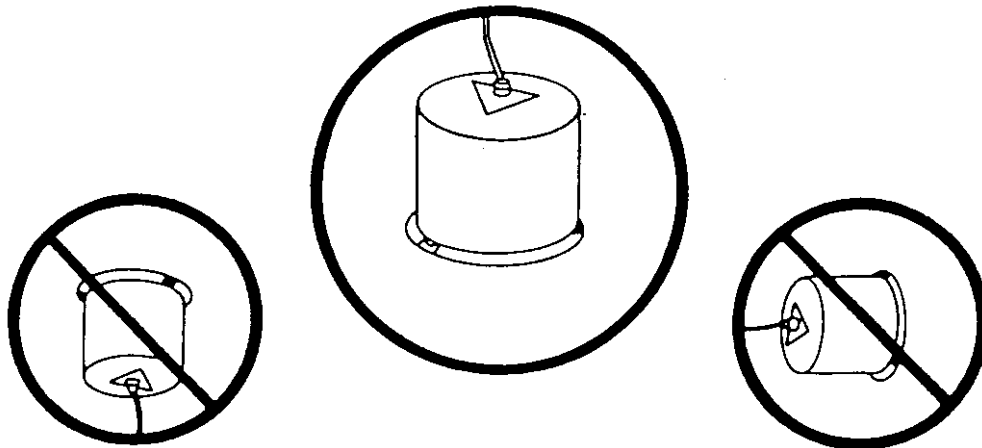
The sensor should be mounted in a location on the vessel where magnetic interference is minimal and where it will remain undisturbed. The optimum sensor mounting location should be close as possible to the vessel's center of gravity and in an area of minimum pitch and roll such as below deck, close to the waterline. Flying bridge installations are not recommended. On steel vessels, the sensor may need to be mounted above the main deck enclosure between one meter to three meters from the main structure in order to minimize magnetic disturbances.

1. Locate a suitable installation area, reasonably free from magnetic interference. Keep away from magnetic devices using coils, transformers or other types of permanent and electrical magnets. Examples: generators, motors, radio or radar receivers and transmitters, loudspeakers and magnetic compasses etc. Minimum mounting distances are shown below.

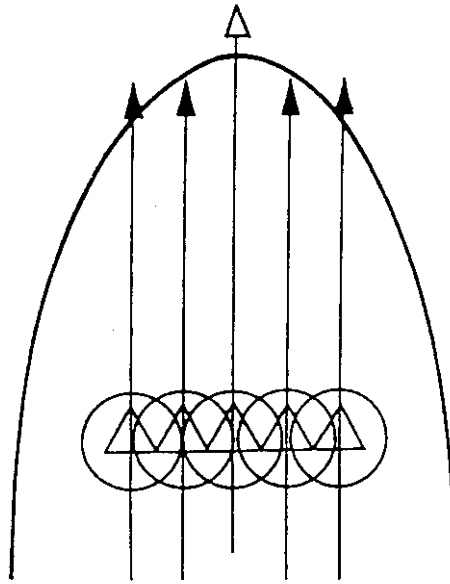
Minimum Mounting Distances

Radio, RDF, Depth Recorders etc.	3ft (1 meter)
Power Cables carrying more than 0.5 Amp	3ft (1 meter)
Radar Magnetrons	9 ft (3 meters)
Ships Engines	3ft (1 meter)

2. Each compass is accurately compensated at the factory, so the more carefully you locate the sensor in nonmagnetic environments, the less compensation will be required for heading errors introduced by the installation. Even though the sensor is gimballed, it should be mounted as close to horizontal as possible. The sensor must never be mounted on its side or upside down; i.e., the cable plate of the sensor should be facing upwards. After selecting the best possible location for the sensor, ensure that there is enough cable provided to complete the installation. 10 feet of cable is supplied with the sensor.



3. When mounting the sensor, carefully align the arrow shown on top of the sensor's housing parallel with the keel line of the boat. The arrow point must be facing forward.



4. Drill a $9/64$ " hole in the center of each of the three slots in the base of the sensor. These slots will allow you to turn the sensor slightly to align it with the center line of the vessel during compensation.
 5. Using the three #10 stainless steel screws provided, or three #10 brass screws, secure the sensor in place.
 6. Install a terminal strip or junction box (not supplied) in any convenient place to allow system interconnection.
-

2.5.2.3 CONNECTING NJZ-1086, NWZ-92 HEADING SENSOR

NOTES

The sensor is designed to output the NMEA0183 "HDM" sentence for the radar. The sensor can supply data for up to two (2) external inputs which conform to the NMEA interface requirements.

To avoid ground loops DO NOT CONNECT the sensor cable shield to ground.

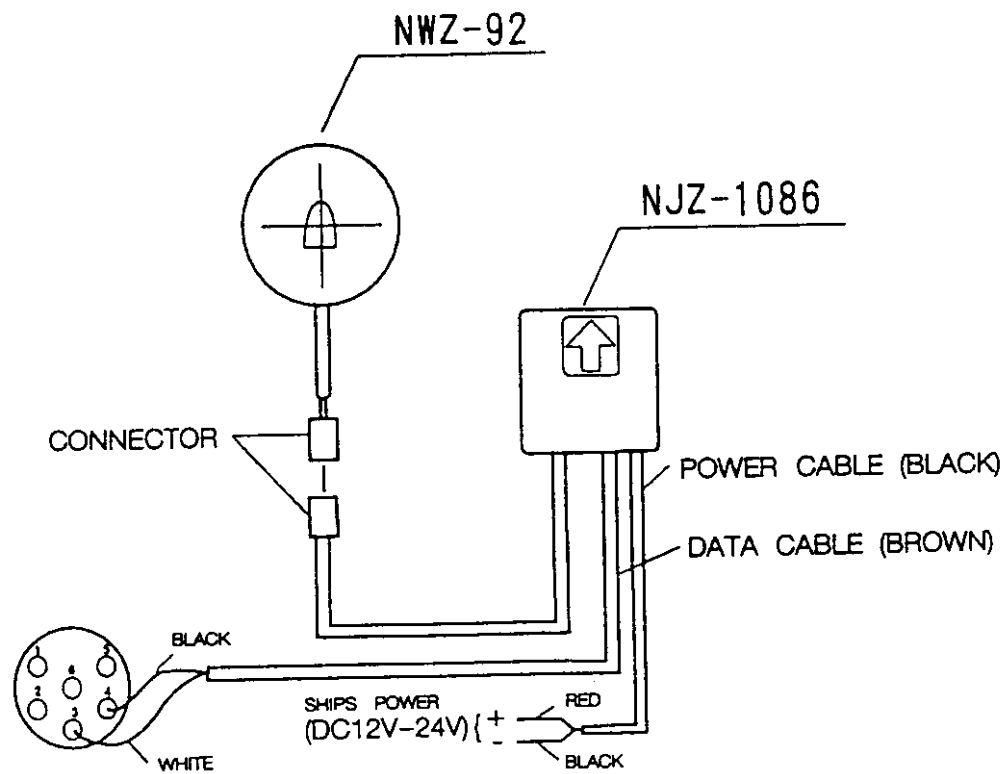


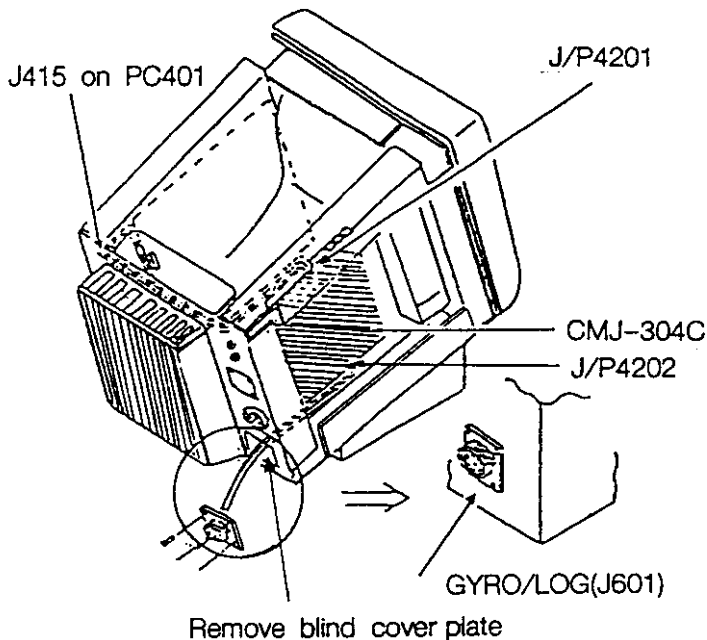
Fig. 2-11 HEADING SENSOR WIRING

2.5.2.4 SETTING UP THE GYRO/LOG INTERFACE (MDLW10664A)

When the radar can receive input from the Ships Gyro or Speed Log, the optional MDLW11031 Interface Kit must be configured to match the input signals.

This section describes the procedure to install for the GYRO/LOG Interface Kit MDLW11031 and set the interface to match the vessels Gyro and Log inputs. This Interface Kit includes the CMJ-304C PCB. The CMJ-304C PCB is powered by the Gyro repeater supply voltage. This kit MDLW11031 is composed of a CMJ-304C interface PCB, 2 cables (H-7ZCRD0416B/H-7ZCRD0627) and mounting hardware.

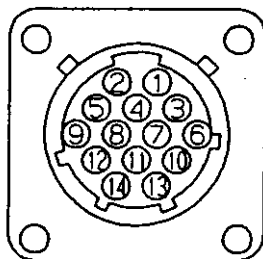
(A) MDLW10664B Mounting and cabling.



- (1) Remove the Display Cover.
- (2) Remove the blind cover plate.
- (3) Attach and Fix the CMJ-304C to the left side of the display unit.
- (4) Connect the cable (H-7ZCRD0416B) between J4201 on CMJ-304C and J415 on CMC-1037 Main control unit.
- (5) Connect the other cable (H-7ZCRD0627) between J4202 on CMJ-304C and the connector J601. Fix the connector J601 by 4 screws after removing the blind cover plate.
- (6) Interconnect the GYRO COMPASS and Ship's LOG to the radar as shown below.

GYRO/LOG CONNECTOR [J601]

This location is the rear side view of display unit.



- | | |
|---------|----------|
| ① 1/R1 | ⑧ SYNC- |
| ② 2/S1 | ⑨ PULSE+ |
| ③ 3/S2 | ⑩ PULSE- |
| ④ S3 | ⑪ NC |
| ⑤ 5/R2 | ⑫ NC |
| ⑥ NC | ⑬ NC |
| ⑦ SYNC+ | ⑭ NC |

After the ship's Gyro signal or Speed Log signal is interconnected, the switch on CMJ-304C interface PCB must be set as follows.

(1) Switch setting (PC4201 NSK Unit)

Before installing the PCB in the display, verify the following switch settings:

S1: OFF

S2: Set S2 according to the type of the gyro signal to be input.

Synchronous signal: SYNC

Step signal: STEP

S5: Set S5 according to be connected.

See the S5 setting table (silk-screened on the PCB).

S5-1 Type OFF Synchronous type

ON Step type

S5-2,3 Revolution ratio

	360X	180X	90X	36X
S5-2	<input type="checkbox"/> OFF	<input type="checkbox"/> OFF	<input type="checkbox"/> ON	<input type="checkbox"/> ON

S5-3 OFF ON OFF ON

S5-4 Rotational direction OFF Normal

ON Reverse

S5-5 Log type OFF Pulse type

ON Synchronous signal type.

S5-6 (Unused) Always set to OFF .

S5-7,8 Log ratio

Pulses/NM (pulse type)	800	400	200	100
Rev./NM (Synchro type)	360X	180X	90X	30X
S5-7	<input type="checkbox"/> OFF	<input type="checkbox"/> OFF	<input type="checkbox"/> ON	<input type="checkbox"/> ON
S5-8	<input type="checkbox"/> OFF	<input type="checkbox"/> ON	<input type="checkbox"/> OFF	<input type="checkbox"/> ON

S6 LOG TEST switch Set to the NORM position.

Item Maker	Gyro Compass	Repeater	Excitation Voltage	Gyro Selector Switch (S5, S2, JP1 ON PC4201)								Setting Condition of JP	
				Setting condition of S5									Setting Condition of S2
				1	2	3	4	5	6	7	8		
(SPERRY)	ES-1, ES-2, ES-11 GLT-100, GLT-101, GLT-102, GLT-103, CLOT-106, KGLT-105, GLT-107, CR-ZA	Synchro motor INMS (TS6:3N7E1:3) (360X)	AC115V 60Hz	OFF	ON	ON					SYNC	SYNC	
		Synchro motor TSAN60E11 (90X)	AC110V 60Hz	OFF	ON	OFF						SYNC	SYNC
TKC	TG-200, ES-11A, PR-221, PR-2022, PR-222, PR-226, PR-237, PR-223, PR-237-L GM-11A, GM-11	Step motor GA-2001G 103590810 600 Ω	DC70V	ON	OFF	ON					STEP	STEP	
		(180X) 103590820 150 Ω	DC35V	ON	OFF	ON	OFF (NOTE)				STEP	STEP	
YOKOKAWA	C-2 C-1A HOKUSHIN PLATH-55 HOKUSHIN PLATH-C, PLATH HKRK-C3 PLATH HKRK-C1	Synchro motor YM-14 TS-19 (360X)	AC60V 60Hz	OFF	OFF	OFF					SYNC	SYNC	
		Synchro motor PY76-N2 (360X)	AC100V 50/60Hz	OFF	OFF	OFF					SYNC	SYNC	
ARMA	MK-10, MKL-1 SERIE 1351 MOD-4, MK-1-7, MK-20 SGB-1000	Step motor BZ-2191 (180X)	DC50V	ON	OFF	ON					STEP	STEP	
BROWN	AN SCHUTU -4, I-39-31, NB23-126 AN SCHUTU -6, I10-301, GH-BH AN SCHUTU -1, 2, 3, 5 AN SCHUTU -Z	Synchro motor NB23-91 (360X)	AC50V 50Hz	OFF	OFF	OFF					SYNC	SYNC	
C.PLATH (JRC)	PLATH NAVIGAT-11 PLATH NAVIGAT-111	Synchro motor YM14A (360X)	AC50V 60Hz	OFF	OFF	OFF					SYNC	SYNC	

NOTE: | COURSE | is reversed, setting should be made | ON |.

SETTING TABLE FOR GYROCOMPASS

2.5.3 BONDING

The purpose of bonding radar equipment to the ship's hull is to minimize radio frequency interference (RFI) and to protect the equipment from lightning damage.

Bonding practices considered acceptable include not only the use of bonding straps but also connection of cable shields and drains to cable entrance clamps and the ground lugs adjacent to these clamps provided in each unit and connection of unused conductors to the ground lugs.

Ship's having combination aluminum and steel superstructures should be bonded in accordance with applicable specifications. If the bonding between aluminum and steel portions of the superstructure is faulty, bonding the equipment to the superstructure will not be as effective in overcoming undesirable interaction and interference.

While copper is the recommended material for bonding straps, its place in the galvanic series presents a corrosion problem if not treated properly. Use of a non-migratory grease compound such as NO-AL-OX[®] will minimize galvanic interaction and ensure a long-lasting low resistance connection.

2.5.3.1 CONTINUOUS METALLIC DECK OR BULKHEAD PROCEDURE

1. Chip off paint in the area where the bonding strap will make contact with the vessel.
2. Sand remaining paint and primer down to bright metal.
3. Clean sanded area.
4. Apply anti-corrosive grease such as NO-AL-OX[®] to copper strap and grounding contact point.
5. For installations using threaded holes in the deck or bulkhead, apply anti-seize compound to screw threads before securing the strap to vessel.
6. For bolt through installations, secure strap to vessel with clamp screws, washers, and self-locking nuts.
7. Paint all exposed metal surfaces with corrosion inhibiting primer (zinc chromate) and a finish coat of paint.

2.5.3.2 NON-METALLIC DECKS AND BULKHEADS BONDING PROCEDURE

The bonding strap should be connected to the vessels grounding system or some other suitable grounding point. The same procedures for prevention of galvanic corrosion apply.

SECTION 3

OPERATIONS

3.1 INTRODUCTION

The JMA-3800 Series Radar combines the operations of Fishfinding and Chart Plotting with those of Radar Navigation. This Section of the manual provides the descriptions and instructions for all of operations and features within this radar system.

For first time users of radar we have included some basic information on the general principles of how radar works. This will provide you with a basic understanding of how the controls affect the radars operation and display. This discussion is located at the end of this section.

Part 3.2 of this section (pg. 3-2) begins the description of the front panel controls by showing the keypad layout and the various display screens of the JMA-3800 Series Radar. The fold-out page 3-57 shows a drawing of the display and locations of all the controls and display data.

As you read through this section of the manual you will also notice that when operations call for keys to be pressed to complete entries, the keys are highlighted in the instructions in key shaped boxes. i.e., RR/SHM

To make the operation of the JMA-3800 Series Radar simple and as automatic as possible, the radar uses many on-screen menus and prompts to help guide you through various operations. You should master the unit very quickly. The approach to take, while becoming familiar with the operations, is one of relaxed confidence.

3.2 GENERAL LAYOUT OF THE DISPLAY UNIT CONTROLS AND SCREEN READOUTS

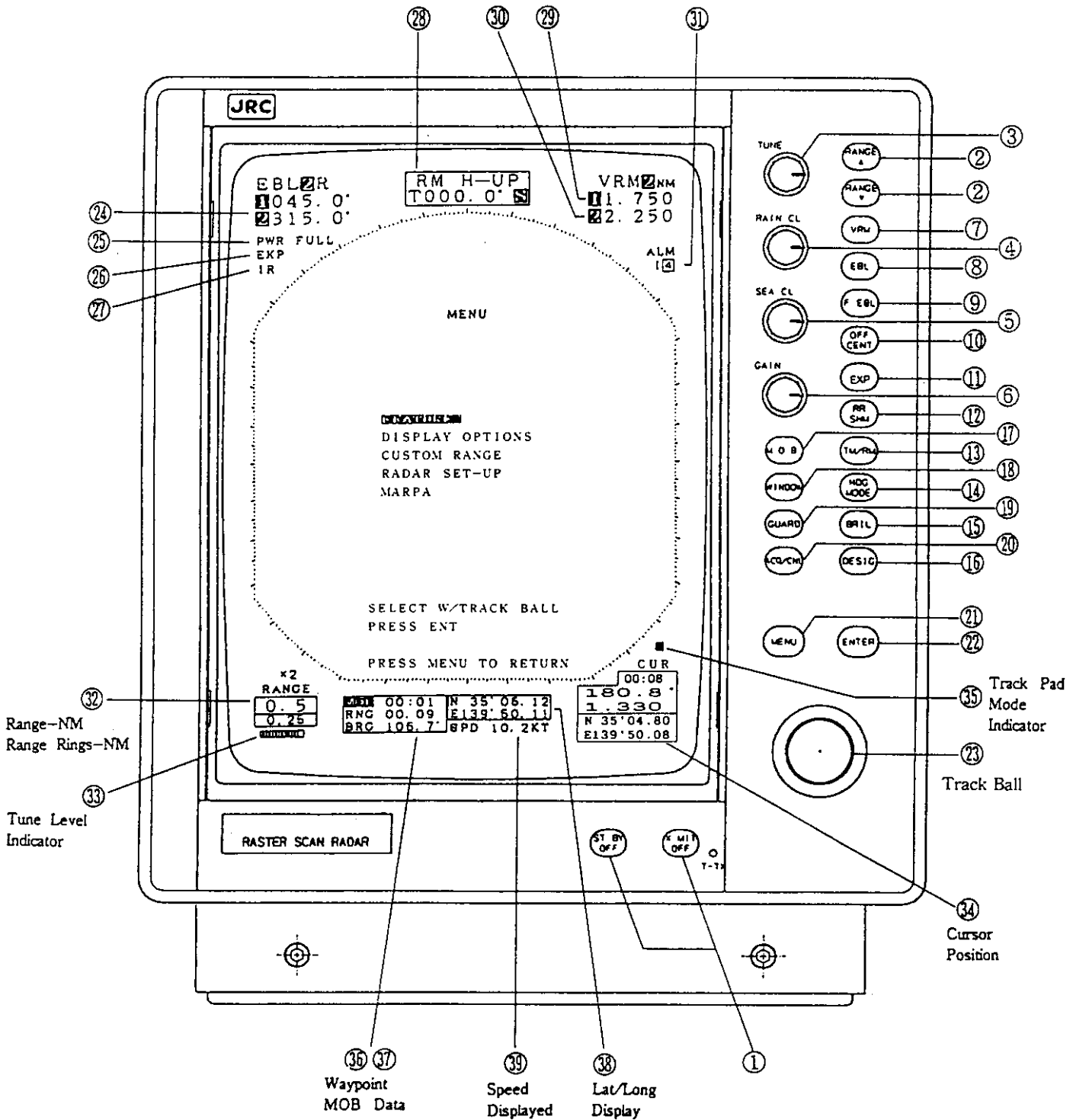








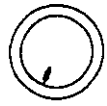



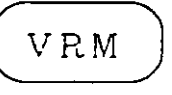
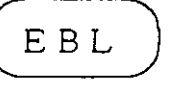







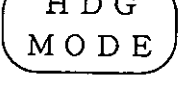


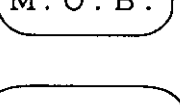
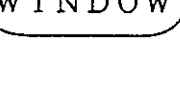

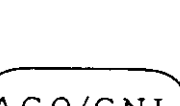



Fig. 3-1 JMA-3807/3811

3.2.1 RADAR CONTROLS

The layout of the controls is shown in Fig. 3-1.

#	Symbol	Description	Function
1		Standby/OFF Switch	Turns ON power to Display and Pedestal and activates 90 second countdown timer. Press  and  simultaneously to SHUT OFF
1		Transmit/OFF Switch	Turns ON transmitter which activates Pedestal Press  and  simultaneously to SHUT OFF
2		Range Scale UP	Increases the range scale
2		Range Scale DOWN	Decreases the range scale
3	TUNE 	Tune Control	Manual fine tunes receiver by peaking bar in lower left corner 'A' appears next to the tuning bar in AUTO TUNE.
4	RAIN CL 	Rain Clutter Control	Reduces the amount of rain or snow returns.
5	Sea CL 	Sea Clutter Control	Manually reduces the amount of sea returns.
6	GAIN 	Gain Control	Controls strength of target returns
7		VRM Enable/Select	Enables a VRM for display/If quickly pressed, selects a VRM for operation. Press and hold to turn off selected VRM.
8		EBL Enable/Select	Enables an EBL for display/If quickly pressed, selects an EBL for operation. Press and hold to turn off selected EBL.
9		Free Floating EBL Enable/Select	Enables EBL #2 as a free Floating EBL to be placed anywhere on the display. VRM #2 automatically appears with EBL #2.

Radar controls(cont.)

#	Symbol	Description	Function
10		Display OFF Center	Places origin at any point on screen up to 66% of radius. No operation on the maximum range scales 48NM(JMA-3806), 72NM(JMA-3810).
11		Echo Expand	Expand the echoes.
12		Range Rings ON/OFF and Ship's Heading Marker OFF	Enables or disables the fixed Range Rings alternately. Momentarily disables the Heading flash while key is held depressed.
13		True Motion/Relative Motion	Selects true or relative motion display.
14		Heading Mode Selection	Selection type of Heading Mode C-UP=Course UP N-UP=North UP H-UP=Head UP
15		Brilliance Level selection	Brilliance level for video, characters, rings, and EBLs
16		MARPA Acquisition	Provides designated target information. Quick press change designations. Press and hold to turn off.
17		Man Over Board	Marks the point where the MOB incident occurred by placing on screen MOB figure. (Need L/L and Heading data with variation to operate MOB mode)
18		Dual Screen	Enables and Selects the display within the dual screen: Radar/MENU Radar/OFF
19		GUARD Zone Select	Enables or disables Guard zone alarm as set with the Track-Pad and I or O operation. I =Inbound Mode O=Outbound Mode Blank = OFF
20		MARPA Aquire/Cancel	Acquires target to be tracked or cancels targets one by one. Press and hold to delete all acquired targets simultaneously.
21		MENU Recall	Recalls MENU for display and selection.
22		ENTER Date	Enters selected data.
23		TRACK BALL	Positions cursor, selects menu items, or makes on screen measurements and selections.

ON Screen Readouts

#	Symbol	Description	Function
24	VRM [2] NM [1] 045.0 [2] 315.0 °	<u>EBL Selected</u> <u>EBL Bearing Mode</u> R=Relative Bearing T=True Bearing M=Magnetic Bearing <u>Bearing of EBL 1 & EBL 2</u>	Display Readout, Upper Left
25	PWR FULL	Shows RX Power level (can be reduced)	In a " busy " congested area Receiver sensitivity can be reduced to clean up the display.
26	EXP	Target Expander Mode On	Display Readout, Upper Left
27	IR	Interference Rejection ON	Display Readout, Upper Left
28	RM H-UP T000.0 ° [N]	<u>Heading Mode</u> H-UP=Head Up C-UP=Course Up N-UP=North Up <u>Bearing Selected</u> T=True Bearing M=Magnetic Bearing Own Ship's Heading <u>Heading Data Source</u> [M]=Magnetic Sensor [L] =Loran or GPS [N] =NSK	Display Readout, Upper Center RM:Own ships position fixed on screen center. TM:Own ships position moves on screen Shows bearing type Selected:Magnetic or true
29	VRM [2] NM [1] 1.750	<u>VRM Selected</u> <u>VRM Range Units</u>	Display Readout, Upper Right
30	[2] 2.250	NM=Nautical Mile KY=Kiloyard KM=Kilometer <u>Range of VRM1 & VRM2</u>	
31	ALM I [4]	<u>Guard Zone Alarm ON</u> <u>Guard Zone Mode</u> I =In Mode. O =Out Mode <u>Sensitivity Level</u> [1] - [7]	Display Readout, Upper Right

On Screen Readouts

#	Symbol	Description	Function
32	<div style="border: 1px solid black; padding: 2px;"> RANGE 0.5 0.25 </div>	Range Scale Range Ring Interval	Display Readout, Lower Left
33	<div style="border: 1px solid black; padding: 2px;"> □ □ □ □ □ □ □ □ </div>	Tuning level indicator	Display Readout, Lower Left
34	<div style="border: 1px solid black; padding: 2px;"> CUR 00:08 1.330 180.8' N 35° 04.80 E 139° 50.08 </div>	Auto tuning Mode Cursor Position Time-To-Go (Min.) Range NM, KY or KM Bearing (Deg.) CURSOR point LL	Display Readout, Lower Right
35	<div style="border: 1px solid black; padding: 2px;"> C </div>	Track Pad Mode Indicator C = Cursor E = EBL V = VRM O = Off Center G = Guard F = Floating EBL M = MARPA Z = Zoom	Display Readout, Lower Right
36	<div style="border: 1px solid black; padding: 2px;"> WPT: 00:07 RNG 01.25 BRG 086.0° </div>	Waypoint Data ON Time-To-Go (Min.) Range (NM) Bearing (Deg.)	Display Readout, Lower Mid Left
37	<div style="border: 1px solid black; padding: 2px;"> MOB 00:01 RNG 00.09 BRG 106.7° </div>	MOB Data ON Time-To-Go (Min.) Range (NM) Bearing (Deg.)	Display Readout, Lower Mid Left
38	<div style="border: 1px solid black; padding: 2px;"> N 41° 90.67 W 70° 06.04 N 42° 37.68 W 70° 05.97 </div>	Own Ship's LL WayPoint LL	Display Readout, Lower Mid Right
	<div style="border: 1px solid black; padding: 2px;"> N 35° 06.12 W 139° 50.11 </div>	MOB Point LL	
	<div style="border: 1px solid black; padding: 2px;"> 1 26231.5 μ s 2 14454.3 μ s </div>	Own ships TD	
39	SPD 10.2KT	Own Ship's Speed	Display Readout, Lower Mid Right

3.3 STARTING OPERATION

The following paragraphs describe the control settings used for initial display setup, turn-on procedure, inclement weather operation and finally the turnoff procedure. Fig. 3-1 (pg.3-2 , 3-57) may be used to find the location of the radar controls described in this section.

3.3.1 INITIAL DISPLAY SETUP

Before turning the power "ON" to the unit for the first time the four variable controls should be checked and be preset to the following positions:

TUNE ③	12 o'clock position (MIDDLE)
GAIN ⑥	CCW
RAIN CL ④	CCW
SEA CL ⑤	CCW

3.3.2 TURN-ON/TURN OFF PROCEDURE

3.3.2.1 TURN-ON PROCEDURE

At TURN-ON the countdown timer in the radar display is activated. After approximately 90 seconds, the radar is warmed up, set to standby, and ready for transmitting. The ST-BY position maintains the radar in a constant state of readiness at minimum power consumption. The display shows the operating time (hours) of the radar during the warm-up period, as well as the software level (i.e. V1.0).

1. Press the key ① to place the radar in standby. After the countdown has expired, the displayed prompt of "ST-BY" should appear. Pressing the key puts the radar in the transmitting mode.
 2. Set the radar range via the keys ② to the 3NM range scale.
 3. Turn the GAIN Control ⑥ clockwise until targets appear and a light speckle of background noise is visible (Usually around 3/4 CW).
 4. Adjust the TUNE Control ③ to obtain maximum (strongest pickup) of targets. When "A" is displayed in the lower left corner and right side of tuning bar, then the tuning is in "Automatic". Manual/Auto tuning is selected in the display options menu.
 5. Reset the key ② down to 0.75NM.
 6. Turn the SEA CL Control ⑤ CW as necessary to reduce (but not eliminate) sea clutter.
-

7. If rain echo returns are present and obscure targets, first reduce the GAIN Control slightly ⑥ to see whether the rain clutter will disappear leaving targets still visible. If not, readjust the GAIN Control for best gain setting.
8. Then turn the RAIN CL Control ④ clockwise to reduce or eliminate the rain, while retaining targets for best viewing.

3.3.2.2 TURN-OFF PROCEDURE

To turn off the Display and radar system, simply press both the **ST-BY/OFF** and the **X-MIT/OFF** keys simultaneously.

3.3.3 BRILLIANCE CONTROL (15)

Once the display unit has been placed in the transmitting mode with the **XMIT/OFF** key, periodically it may be necessary to change the brilliance level of the target presentation for better viewing. Press the **BRIL** key to bring up the Display Brilliance menu. The menu will appear in the bottom center of the screen as follows:

DISPLAY BRILLIANCE 6
SET BRILLIANCE WITH BRIL KEY

HOLD PRESS - NEXT SELECTION

The number following DISPLAY BRILLIANCE shows the current brilliance level. Each press of the **BRIL** key changes the level from level 1 (low) to level 7 (brightest). When the desired level is set, the menu will disappear after approximately 3 - 5 seconds from the last key press.

To change the Range Rings/SHM marker brilliance independently, press and hold down the **BRIL** key until the RING BRILLIANCE menu appears. The level of the rings and SHM can then be changed by pressing the **BRIL** key in steps from 1 to 7. Note that both the fixed range rings and the ships heading line brilliance levels are controlled in this menu.

To change the EBL/VRM brilliance levels independently, press and hold down the **BRIL** key until the EBL/VRM BRILLIANCE menu appears. The level of the VRMs and EBLs can then be changed by pressing the **BRIL** key in steps from 1 to 7.

To change the CHARACTER Readouts brilliance levels on the screen independently, press and hold down the **BRIL** key until the CHARACTER BRILLIANCE menu appears. The readout levels can then be changed by pressing the **BRIL** key in steps from 1 to 7.

In every case, when the desired level has been set, the menu will disappear approximately 3 – 5 seconds after the last key press.

3.4 FRONT PANEL OPERATIONS

3.4.1 THE TRACKBALL (23)

Throughout the operation section of this manual instructions are given which involve using the trackball. The trackball operates similar to computer mouse, while the direction is determined by the rotational direction.

To operate the trackball place your thumb in the center of the trackball.

To move to the right press your thumb toward the right edge; to move to the left, move your thumb toward the left edge of the trackball.

To move up, move your thumb toward the top edge; to move down, move your thumb toward the bottom edge of the trackball.

When using the Trackball to select items from the menus or in determining positions on the screen to actuate particular features, the **ENTER** key is used to enable the selection or feature once it is highlighted or underlined.

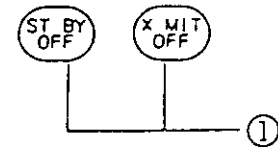
Usually on-screen messages guide you through the correct operations involving the trackball and **ENTER** key.

3.4.2 X-MIT/OFF AND ST-BY/OFF KEYS (1)

In the "OFF" state no power is applied to the radar system. Upon pressing the **ST-BY/OFF** key, power is applied to the scanner and display units. A countdown timer on the radar display shows the time remaining in the warm up period. During the warm up period the antenna does not rotate. After the warm up period (approximately 90 seconds), three beeps will sound and "ST-BY" will be displayed on the screen along with the bearing circle and graphics. The radar is now available for operation. Pressing the **X-MIT/OFF** key will now place the radar into the "transmit" mode. The antenna will begin rotating and targets will be displayed on the screen.

By pressing the ST-BY/OFF key again, the radar will return to the "standby" condition with the transmitter OFF and "ST-BY" again appears on the screen.

By pressing the ST-BY/OFF and the X-MIT/OFF keys simultaneously, the radar will be turned OFF and all alphanumeric information on screen will extinguish.



3.4.3 RANGE KEYS (2)

By pressing the **RANGE ▲** or **RANGE ▼** key, the desired range scale can be selected.

Each time the radar is turned ON, the range displayed will be the last range scale that was previously "in use" when the radar was turned OFF. During range changes, the **RANGE ▲** and **RANGE ▼** keys change not only the range scale, but simultaneously change the number and interval of the fixed range rings, the pulse repetition frequency, the transmitter pulse length, and the bandwidth of the IF amplifier.

Table 3-2 shows this relationship.

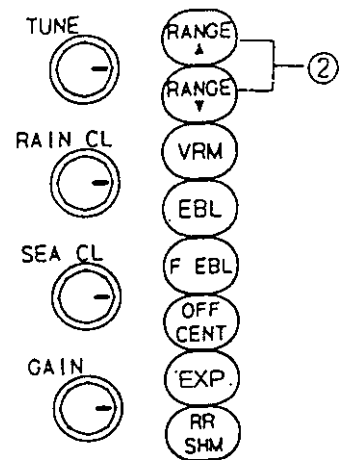


TABLE3-2 RELATION OF RANGE, RINGS AND PULSE LENGTH

Range (nm)	Range Ring Interval (nm)	Number of Rings	Pulse Repetition Frequency (Hz)	Transmitting Pulse Length (μs)	Bandwidth of IF Amplifier (MHz)
0.125	0.0625	2	2000	0.08	20
0.25	0.125	2	2000	0.08	20
0.5	0.25	2	2000	0.08	20
0.75	0.25	3	2000	0.08	20
1.5	0.25	6	2000	0.08	20
3	0.5	6	1500	0.4	6
6	1	6	1500	0.4	6
12	2	6	750	0.8	3
24	4	6	750	0.8	3
48	8	6	500	1.2	3
* 72	12	6	500	1.2	3

Note : * JMA-3811 Rader only

NOTE

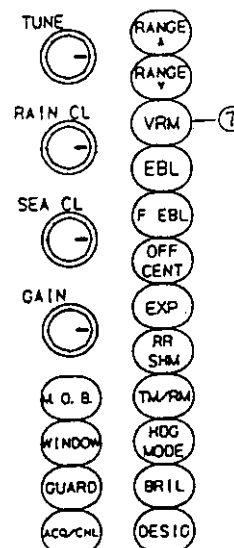
Pressing both **RANGE** keys simultaneously will perform a Soft Master Reset to the unit in the event that a "lock up" condition should occur. A Soft Master Reset will NOT reset the Radar's initial settings (i.e. bearing, STC, tune, timing ...). In order to perform the Soft Master Reset, shut the Radar System OFF. Then simultaneously hold down both the **RANGE ▲** and **RANGE ▼** keys; and press the ST-BY key to place the unit in ST-BY. After applying power to the unit, release the **RANGE** keys. This completes the Master Reset.

A Hard Master Reset can also be performed. This type of reset will also clear the Radar's initial settings. Press **RANGE ▲** and **RANGE ▼** and **EBL** simultaneously while also pressing the ST-BY key. Release the ST-BY and then all other keys in order to Hard Reset the Radar.

3.4.4 VRM (VARIABLE RANGE MARKER) KEY (7)

A VRM is used to obtain accurate range measurements to targets or land masses. There are two VRM's available in this equipment. When the **VRM** key is pressed for a short time (1 beep), VRM 1 will be displayed as a dashed circle on the screen and the VRM 1 indicator will be displayed in the upper right corner. If the **VRM** key is pressed quickly again, VRM 2 will be displayed but as a dotted circle.

If the **VRM** key is depressed for a long time, (until the long beep sounds), the selected VRM ring will be turned OFF. The selection of which VRM will be controlled, is made by depressing the **VRM** key momentarily. The VRM being controlled is displayed with a reversed character 1 or 2 after "VRM" in the upper right corner of the display.



The range and numerical readout of the selected VRM can be changed by the trackball. In order to be sure you're going to move the VRM with the trackball, it is necessary to first press the **VRM** key. A **V** character will appear in the Trackpad Mode Indicator block in the lower right corner and "SET VRM w/TP" will illuminate in the lower portion of the display. The VRM function will remain activated for 15 seconds for further VRM movement after the last VRM ranging is completed. Merely press the **VRM** key again to reactivate the VRM mode and the **V** character will illuminate if the VRM message has disappeared.

After the VRM function is activated, pressing the VRM key a second time, will toggle between VRM 1 and VRM 2.

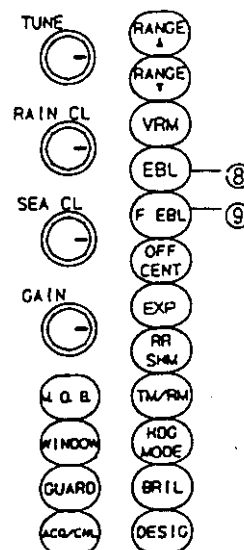
3.4.5 EBL (ELECTRONIC BEARING LINE) KEY (8)

The EBL is used to measure the bearing or angle to radar targets from the vessel's position. There are two EBL's available in this equipment.

When the EBL key is first momentarily pressed "EBL1" appears as a "dashed" line on the radar screen. The EBL line is possible to rotate by the trackball.

The trackball will control the EBL only while the "SET EBL with T/B" message is displayed and the letter **E** is displayed in the trackball mode indicator block in the lower right corner of the screen.

A second EBL can be turned on by pressing the EBL key momentarily again. The second EBL is a dotted line. You will notice that both VRM 1 and EBL 1 use "dashed" characteristics while VRM 2 and EBL 2 use "dotted" characteristics.



3.4.6 F EBL (FLOATING EBL) KEY (9)

The Floating EBL (EBL 2) feature allows the operator to measure bearings and distances from any two points on the display rather than just from the ship's origin.

To use the Floating EBL feature, press the **F EBL** key. The F EBL cursor “+” appears at the F EBL sweep origin and the message “SET ORIGIN W/TP; PRESS ENT” is displayed at the bottom of the screen.

An “F” blocked character appears on the right side of the screen indicating F EBL Mode is in use. Use the Trackpad control to move the cursor, placing the cursor at the desired EBL origin location on the screen.

Press **ENTER** to turn ON the Floating EBL. The EBL appears at the designated point and the Trackball mode changes to Floating EBL bearing control.

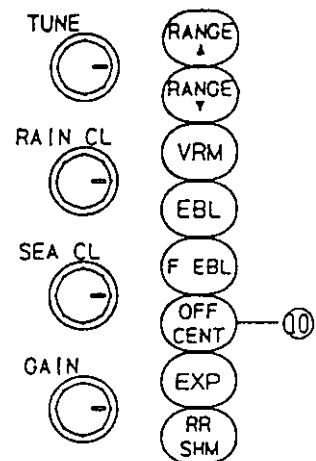
Use the Trackball to change the Floating EBL bearing. Press the VRM key to enable Trackball control for the VRM to make a distance measurement. EBL 2 readout indicates the Floating EBL bearing and VRM2 readout indicates the distance. To turn OFF the Floating EBL press the **F EBL** key. EBL 2 will return to the center of the screen, but the floating origin of EBL 2 will be stored in memory for future use.

3.4.7 OFF CENTER KEY (10)

The OFF Center Mode lets you position the radar origin to any point on the screen within 66% of the radius of the display or in the center 2/3 of the display. This permits the operator to obtain a greater view in the direction of interest.

Press the **OFF CENT** key. Both the cursor and the message “SET ORIGIN W/TB” appear on the screen. Position the cursor to the desired starting location for the sweep line by using the trackball. Note that when the trackball is activated in the Off-Center Mode, a blocked character “O” appears in the lower right corner. Press the **ENTER** key to activate the offset mode placing the ship's origin at the designated cursor location.

To turn OFF the Off-Center Mode and re-center the origin of own ship back to center of the display, press the **OFF CENT** key again. Since off-centering cannot be used on the 72NM scale this mode will automatically cancel and re-center the vessel origin upon increasing to these ranges. If the radar system is turned OFF while Off-Center mode is on, at next power up the offset mode will still be on.



3.4.8 EXP (11)

TGT EXPAND

When ON, this function gives the operator the ability to make small targets appear bigger on the screen in depth for better viewing. This function however enlarges all targets, so use of expansion mode should be limited to only certain circumstances.

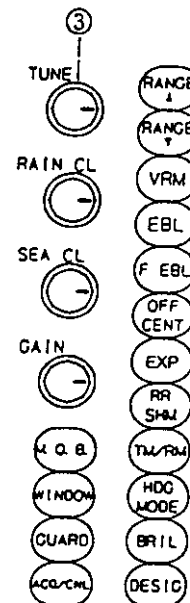
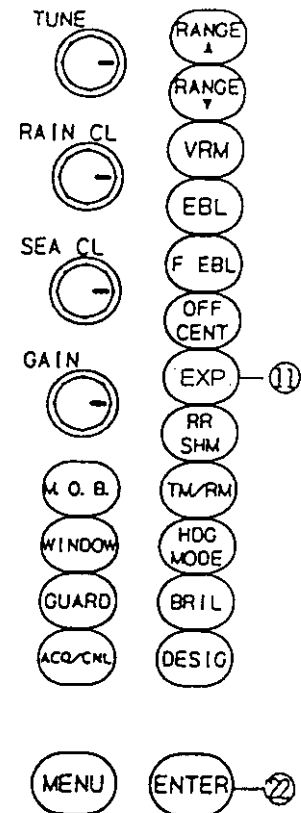
Press **EXP** key, echo size is expanded.

More Press **EXP** key, return to normal echo size.


3.4.9 TUNE CONTROL (3)

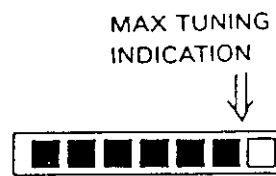
The TUNE Control is a variable control used to tune the receiver in the Pedestal for maximum target returns on the display. If no land or ship targets are available, the operator may tune for maximum sea clutter. The on-screen tuning indicator will show the strength of tuning peak conditions. Tuning is performed on the 3 NM range or higher.

The minimum deflection of the tuning indicator will occur when there are few or no targets. Minor retuning of the radar may be necessary after the radar has warmed up for 10 minutes. The 10 minutes allows time for the magnetron frequency to stabilize.



3.4.9.1 AUTO TUNE MODE

The Radar includes an Automatic TUNE feature. In Auto tune mode, the radar tunes itself on each range scale. Auto Tune is available by pressing the **MENU** key (21). Use the trackpad to select the Display Options Menu. Press **ENTER**. Use the trackpad to Select "TUNE AUTO" with the highlighted cursor. Press **ENTER** to activate Tuning Mode. The Manual mode is indicated by the "Tuning Bar" only, and the Automatic mode is indicated by  A. When Auto tune is selected, you can not control the Manual Tuning with the variable control.

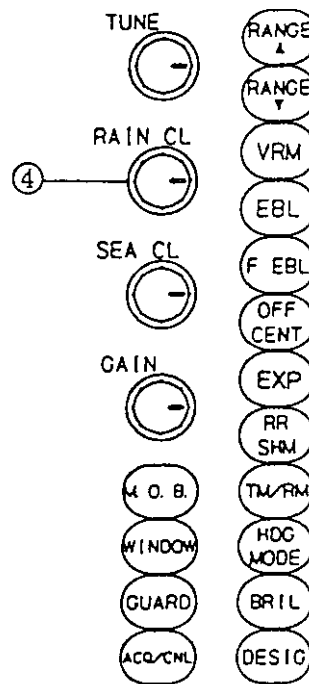


3.4.10 RAIN CLUTTER CONTROL (4)

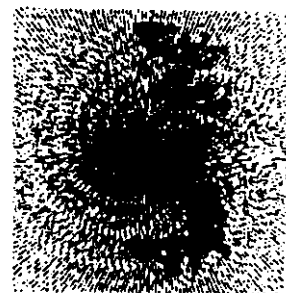
The function of the RAIN CLUTTER control, [also known as Fast Time Constant FTC], is to reduce large clutter masses caused by rain or snow. This control differentiates the multitude of small radar returns from rain, effectively reducing or eliminating the rain clutter and allowing the operator to observe larger vessel traffic within the rain clutter.

The Rain Clutter Control has the effect of only displaying the leading edge of large echoes and will effect the smaller echoes only slightly. This can be of great advantage on shorter ranges to distinguish between two very close echoes on the same bearing which may otherwise merge and appear as one echo.

When turned fully counterclockwise, the RAIN CLUTTER control has no effect (OFF) and will become increasingly effective (ON) as the control is turned clockwise. It should also be noted when operating the RAIN CLUTTER, there will be some reduction of background noise as well as background fill-in returns from land and large targets.



NO EFFECT



EFFECTIVE



3.4.11 SEA CLUTTER CONTROL (5)

The SEA CLUTTER control, also known as the Sensitivity Time Control [STC], is normally used on the shorter ranges to suppress the effects of sea clutter close to own ship by reducing the nearby gain level.

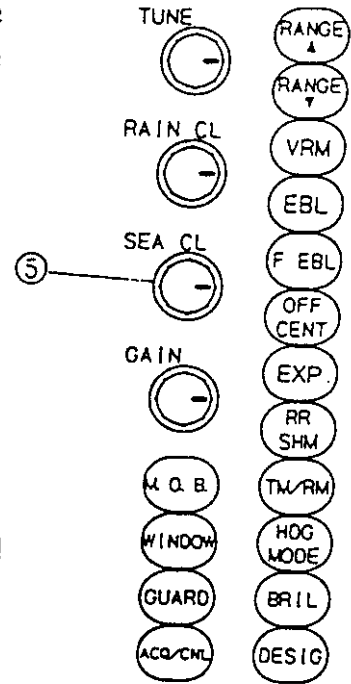
The SEA CLUTTER control can effectively reduce the strength of the mass of random echoes received from nearby sea clutter for up to approximately 3 to 5 miles depending on wave and sea conditions. STC is set to reduce the strength of these echoes such that the clutter appears only as intermittent small dots, yet small targets can still be distinguished.

NOTE

On short range scales, the setting of the SEA CLUTTER control should never be advanced so high as to completely obliterate all clutter, since this setting could prevent the detection of close-in target echoes.

The SEA CLUTTER control setting should always be checked and readjusted as necessary after changing ranges or when ever sea conditions change. It should also be noted that the GAIN Control setting interacts with the SEA CLUTTER control. That is; if you reduce the Gain Control, less Sea Clutter control is needed. If you increase the Gain, the Sea Clutter level may need to be reset. Judicial use of these controls is important to assure that excessive sea clutter or insufficient gain will not cause targets to be overlooked or not displayed.

When the STC Control is adjusted for the optimum setting, a crescent of clutter will probably remain toward the windward direction. Excessive application of STC will create a zone of darkness around and beyond the maximum range to which the clutter extends. This could eliminate some desired echoes, particularly if the GAIN Control is set so that a light speckled background is not clearly visible at longer ranges. In any event, small adjustments of the GAIN Control the STC Control may be necessary to obtain the optimum picture and target detection, in varying conditions.



NO EFFECT



EFFECTIVE

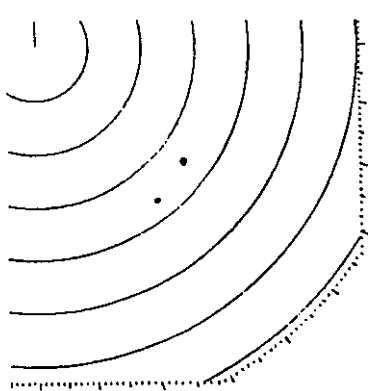
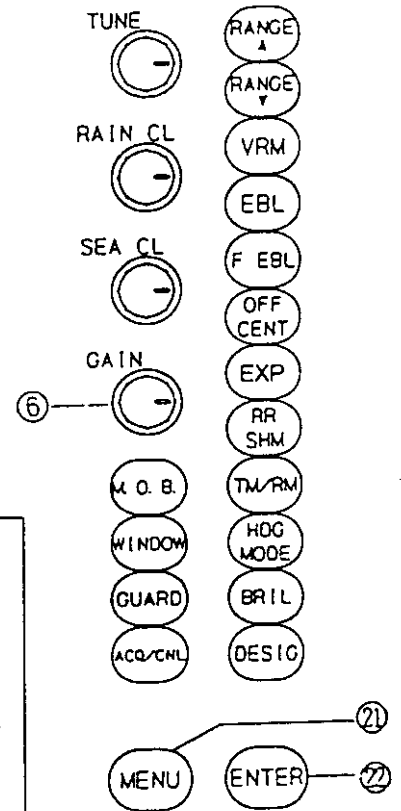
3.4.12 GAIN CONTROL (6)

The GAIN control adjusts the gain level of the radar's receiver. The GAIN Control level is usually set for the best target presentation with a slight noise speckle in the background on the 12 or 24 NM range. The GAIN Control level may be reduced on shorter ranges to improve target definition as necessary, and increased on longer ranges.

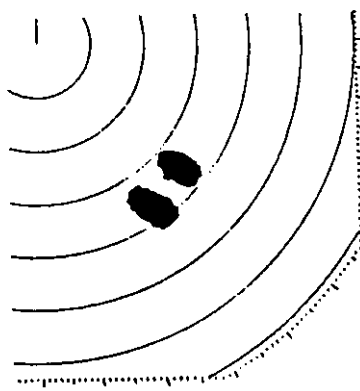
Use some caution when adjusting the GAIN Control. If gain is set too low, small or weak targets may be missed. If the gain is set too high on short ranges, the CRT may become excessively covered with noise speckle making target observation difficult.

NOTE

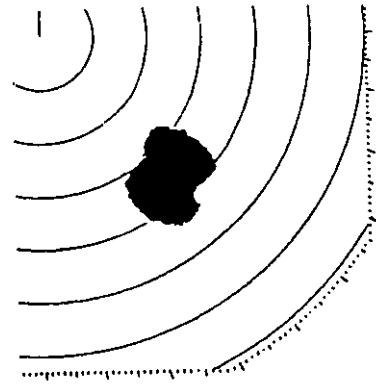
On the longer range scales (24 miles or greater), the STC Control may be advanced to decrease excessive video clutter around own ship's position in the center of the display if necessary.



GAIN TOO LOW



GAIN OK



GAIN TOO HIGH

3.4.13 ENTER KEY (22)

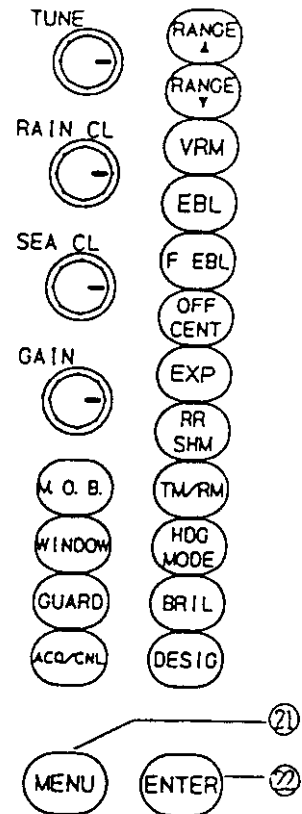
The **ENTER** key activates items set by the cursor position in menus or on-screen.

3.4.14 MENU KEY (21)

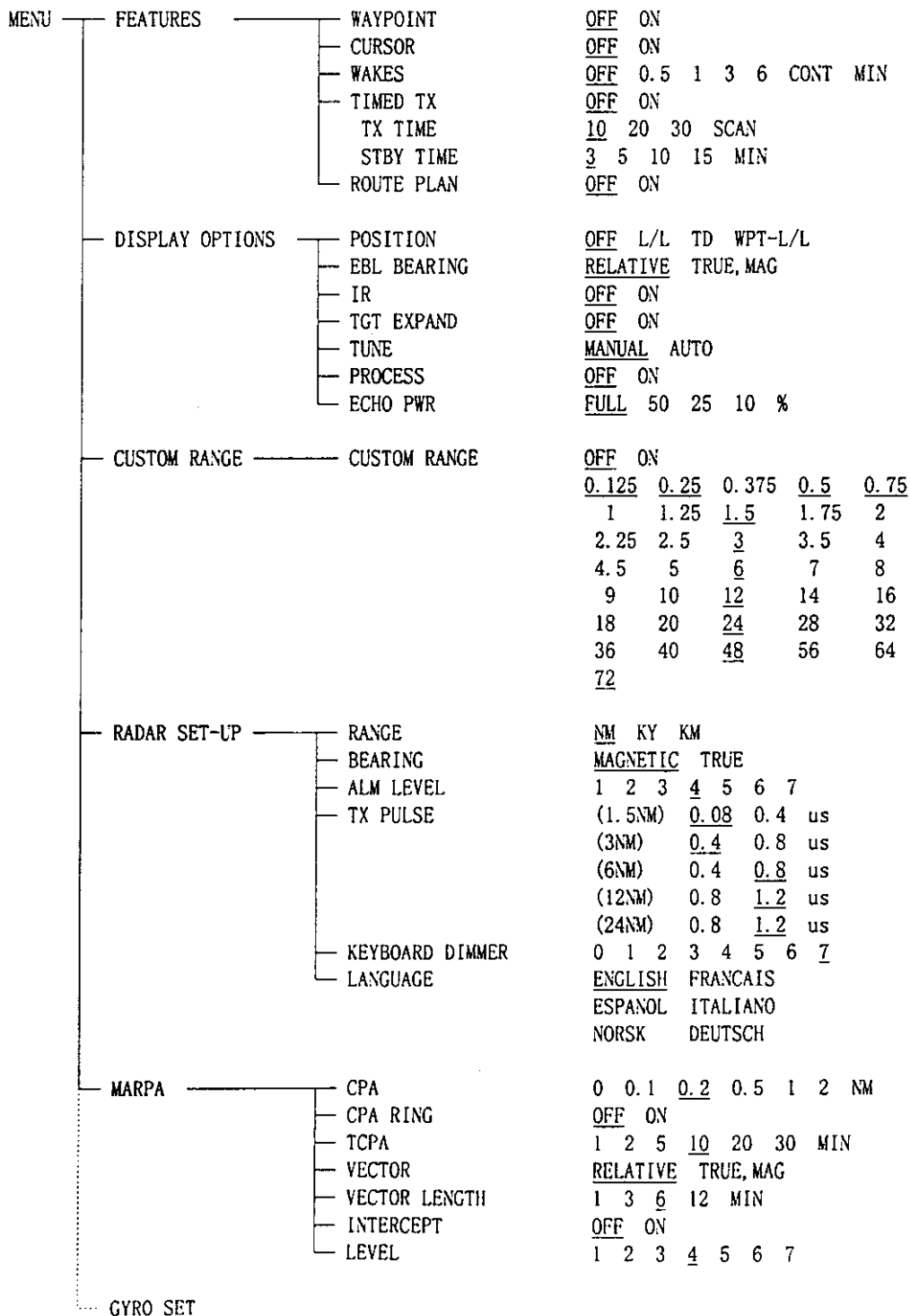
The **MENU** key may be pressed at any time in order to call up the various main menus. A second press of the **MENU** key, cancels the menu pages and returns the display to the normal video presentation.

The following menus may be selected from the main menu display:

- FEATURES – This selects and enables various features such as Waypoint mode, CURSOR ON/OFF, Wakes, Timed-TX, and Route Plan ON/OFF.
- DISPLAY OPTIONS – Selects various items for display on the CRT such as Position data, EBL Bearings, TGT Expand, Auto Tune, IR, Process, and EPWR.
- CUSTOM RANGE – Allows you to program up to 11 ranges of your choice in order to customize the range settings.
- RADAR SET UP – This setup menu enables basic radar set up functions.
Select Range Units, Bearing Type, Alarm Level, TX Pulse Length, Keyboard Dimmer, and Display Language.
- MARPA – This menu selects MARPA criteria for calculation and display of CPA/TCPA, Vectors, Intercept Mode, and Target Level.
- GYRO HEADING SET – This menu will only be displayed when the NSK option is installed.
This function is used to perform the initial setting of the heading when the NSK is used.
- INITIAL SETTING – This menu allows access to setup installation parameters such as Tune Preset, Display Timing, Relative Bearing Adjust etc. The initial setting menu is accessed by pressing the – **MENU**, **ACQ/CNL**, and **GUARD** keys simultaneously. See Maintenance SECTION 5.4.2.8 Initial Setup Adjustment for details.



When the MAIN Menu is selected by pressing the **MENU** key, the below sub menus will be displayed. The TRACK BALL is then used to highlight the desired menu. Press the **ENTER** key, as directed by the menu prompt at the bottom of the display, to the chosen menu screen. The figure below shows a road map of the various menu selections available in the JMA-3800 series radar. The underlined items shown in the menus are the normal default selections of the radar.



The trackpad is used to select the desired menu. Use downward pressure on the trackball to highlight the desired menu item. Once the item is highlighted, press the **ENTER** key to call up the menu. Once again, use the trackball and highlight the desired selection within the menu. Press **ENTER** to confirm the selection. To leave the menu simply press the **MENU** key.

NOTE

All settings, except TX PULSE selection, ECHO POWER & Timed-TX, are memorized when the radar is turned OFF.

3.4.14.1 **FEATURES** MENU

WAYPOINT

When the Waypoint (WPT) mode is turned on the radar will display the Waypoint symbol (the radar must be connected to a LORAN or GPS with appropriate data output for the Waypoint symbol to appear). The Waypoint symbol, a graphic depiction of the Waypoint's bearing and distance, appears a dashed bearing line with a circle at the end. Numeric data, showing the Waypoint's bearing and range, and Time-To-Go, appears at the bottom of the display. "WPT" characters in the upper left corner of the Waypoint data box indicate that the Waypoint mode is ON.

If the radar is receiving course data from a "magnetic" sensor or from a LORAN/GPS with magnetic Waypoint bearing data, the radar mode must be set to Magnetic for the Waypoint mode to operate. If GYRO/LOG Interface Kit (MDLW 10664) is installed or the LORAN/GPS Bearing Data is "True" the radar mode must be set to "True". The Waypoint function will be enabled when the radar True or Magnetic mode matches the LORAN course data input to the radar, and a Waypoint is selected as a destination from the Navaid or Raychart.



NOTE

In order to avoid confusion, when operating with a LORAN or GPS, ensure that the RADAR and LORAN/GPS are both operating in the Magnetic mode or True mode together.

EXT.OPTIONS	LORAN/GPS COURSE DATA	RADAR BEARING MODE
LORAN/GPS	MAGNETIC or TRUE	MAGNETIC or TRUE
LORAN/GPS W/Compass	MAGNETIC or TRUE (compass takes priority)	MAGNETIC or TRUE (compass takes priority)
GYRO/LOG INTERFACE KIT(OPTION)	TRUE	TRUE

If the Waypoint is not within the selected range scale of the radar, only the dashed line indicating the bearing to the Waypoint can be displayed. When the Waypoint distance appears within the range scale in use, the Waypoint is displayed as a , ○ , connected by a dotted line to own ship.

Should data be lost from the heading sensors or from the LORAN C, the Waypoint function will become disabled and the message "NO DATA" will appear in the message area of the lower portion of the display. It should also be noted that the Waypoint symbol can only appear if the operator has programmed the LORAN/GPS or Raychart to proceed to a Waypoint.

In order to enable the Waypoint feature, the external navigator data input must contain either the "BWC" , or "RMB" sentences in addition to the position and course data. This sentence structure is contained within the NMEA0183 data format. The Waypoint information is also available from JRC and Seataalk data input. (Refer to section 2.5.2 External System Interface)

If the Waypoint is turned ON in the menu, but is not visible on the screen, refer to the appropriate navigator technical manual to verify that the proper data sentence structure is outputted.

The radar must calculate the TTG to the Waypoint when using the NMEA format. Therefore, due to the rate of sampling data, the display of TTG sometimes appears to lag the TTG appearing on the external navigator.

CURSOR

The Cursor feature combines the EBL and VRM functions and can be used to quickly determine the range and bearings from your own ship to any point on the radar screen. The cursor appears on the display as a large (+) character.

To turn ON the Cursor mode, just select Cursor ON in the FEATURES Menu. A block character "C" appears above the CUR characters in the lower right corner of the screen to let you know that you are in the "Cursor" mode. The cursor may now be positioned by using the trackball. When the cursor is set to a position on the screen, the range, bearing, and Time-To-Go data will be displayed in the cursor window in the lower right corner of the screen. The latitude/longitude of the cursor will also appear on the screen underneath the bearing information.

WAKES

This feature allows the operator to see the past history of target movement as a "WAKE", or trail behind the moving targets. Selecting OFF inhibits the function. The numerical selections, 0.5, 1, 3, and 6, represent the length of the "trail time" in minutes. For example, if 3 minutes is selected as the interval, the trail represents the last 3 minutes of the targets movement. This provides a visual indication of a targets relative speed and course. "CONT" provides a continuous trail.

If range scales are changed, the wakes will be cleared and new wake histories will be redrawn to the screen.

The wakes are drawn for anything that moves on screen, including sea gulls, sea clutter, buoys, lobsterpots, and shoreline. In general, it is better to use the wake feature away from harbors and the shoreline to avoid a cluttered display and to concentrate on wakes of target vessels.

TIMED-TX

The Timed-TX Menu selection allows the operator to program the radar to automatically transmit for a selected period of time and then enter a "sleep mode" for a selected period of time. This permits the user to maintain limited radar watch yet minimizes power consumption. In Timed-TX Mode the display high voltage and antenna rotation are disabled. To use the Timed-TX Mode, proceed as follows:

1. Press the menu key and select the FEATURES menu.
2. Use the trackpad to select Timed TX function as follows:
 - 1) First: Select the desired number of radar scans for the transmit period using the Trackpad. Then press .
 - 2) Next: Select the STANDBY period with the Trackpad and Press - .
 - 3) Finally: Select "TIMED-TX" ON with the Trackpad, and then press - key to place the Timed Transmit program in operation.

Note: Timed-TX ON is selectable only when in a X-mit condition.

- 4) To turn "TIMED - TX" Mode OFF use the trackpad in the features menu to select timed TX OFF and the press - . The radar returns to its normal operation. Normal operation may also be restored without entering the Menus by pressing the key and then the key.

When Timed - Tx sleep mode is enabled, the Timed Tx lamp (T - TX) on the front panel will be illuminated in red.

3.4.14.2 **DISPLAY OPTIONS** MENU

POSITION
EBL BEARING
IR
ZOOM
TUNE
PROCESS
ECHO PWR

POSITION

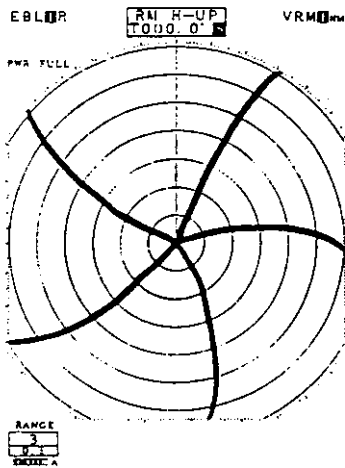
This menu item selects L/L (LAT/LONG), TD (TIME DIFFERENCE) position Displays. In addition you may display Waypoint (WPT) as a LAT/LONG position in place of own ship L/L position. LAT/LONG position is located in the lower portion of the display. The position information is only available if a LORAN C (L/L or TD) or GPS (L/L only) NAVAID (or Seatalk) is connected to the radar.

EBL BEARING

This menu item selects if the EBL bearings should be "Relative" , or "True/Magnetic" bearing types. If Relative is selected, the digits of the EBL bearing are followed by the letter " R " . If True/Magnetic is chosen, the letter following the EBL bearing digits will be a " T " or " M " depending on the selection made in the RADAR SETUP menu for True or Magnetic. Relative bearings are those related to the vessels bow representing 0° and require no other external inputs.

Generally, when planning to plot radar target information from the radar display to a chart, it will be helpful to have the bearing readouts in True or Magnetic for easier plotting. To get True or Magnetic bearings, you must have either Loran C or GPS position data, a Magnetic Flux sensor, or Gyro Compass input to the radar. Then True or Magnetic bearings can be selected in the RADAR SETUP menu as was previously mentioned. When Navaid data from the Loran or GPS is used, the vessel must be underway on a constant heading for several minutes so the COG data will be usable for the radar and the EBL bearings, accurate.

IR(Interference Rejection)



When IR is on. This function reduces or cancels interference on the display caused by other radars operating on the same radar frequency band. This type of interference typically appears as long curled spokes or short repetitive hash marks on the display. The interference is most noticeable on longer ranges. The IR function is also effective in reducing the radars background noise.

If you are operating in an area serviced by a RACON beacon, the IR mode should be turned OFF to see the RACON beacon signals. IR mode can cancel Racon beacon Signals quite effectively.

ZOOM

The Zoom mode is used to enlarge any designated area of the screen. The area between Own Ship and the location designated by the cursor will be magnified by a factor of 2 using the cursor as the centering point. The Zoom mode provides a quick means of getting an enlarged look at a particular portion of the radar image (i.e.; a channel entrance). Effectively the Zoom mode combines switching to the next lower range with automatic offset at the same time.

TUNE

This item selects the receiver tuning method for the radar. If Manual is selected, the Tune Control on the front panel is used to peak the radar tuning and the Tune Bar indicator is present. The AUTO tuning mode will automatically tune the radar for optimum returns whenever the radar is turned on, or ranges changed. Generally, the AUTO tuning mode provides unattended operation and should be selected. "A" appears next to the Tune Bar indicator in Auto Tune Mode.

PROCESS

This selection activates a video plotting mode which provides short term indications of target movement. "Process" is a very useful feature in the North stabilized heading mode.

ECHO PWR

The received echo power can be reduced to improve discrimination on the short range scale. This function is most useful when navigating in narrow channels, rivers, etc. In this menu the power levels can be changed from full to 50%, 25%, 10%.

NOTE: The echo power level defaults to full power when the unit is shut off.

3.4.14.3 **CUSTOM RANGE** MENU

The CUSTOM RANGE feature allows you to choose actual ranges of operation for your display unit. When Custom Range Menu is OFF, the display relies on its standard ranges for range scale operation. The ranges are 0.125, 0.25, 0.5, 0.75, 1.5, 3, 6, 12, 24, 48, and 72NM.

When Custom Range mode is ON, you can select any 10 of the 33 available range scales, for display in accordance with the menu choices. The JMA-3810 allows you to use 11 of 36 available scales.

CUSTOM RANGE				
<u>0.125</u>	<u>0.25</u>	0.375	<u>0.5</u>	<u>0.75</u>
1	1.25	<u>1.5</u>	1.75	2
2.25	2.5	<u>3</u>	3.5	4
4.5	5	<u>6</u>	7	8
9	10	<u>12</u>	14	16
18	20	<u>24</u>	28	32
36	40	<u>48</u>	(56)	(64)
<u>(72)</u>				

() : JMA-3811 only

RANGE UNITS

This menu item provides selection of the VRM range units to be changed between NM (nautical miles), KY (kiloyards), or KM (kilometers). The selection changes only the VRM range units as indicated by the two letter abbreviation to the right of "VRM" in the upper right corner of the display. The Fixed range rings on the display do not change and are always shown in "nautical miles". The CURSOR range units are the same as VRM range units.

BEARING UNITS

This selects Heading Mode to work in either Magnetic or True Bearings.

TRUE-T-

Select the bearing mode to true.

The vessels TRUE Heading is displayed at the top center of the bearing ring

T075.0° L with the LORAN designator just to the right.

(L:LORAN, S:SEATALK, N:NSK)

NOTE

The True mode is available only if the LORAN or GPS navigator installed with the JMA-3807/3811 display is: "PROGRAMMED FOR TRUE HEADING DATA" or contains true heading information within the NMEA0183 data stream. The True mode may also be used if a NSK Gyro Compass interface is connected to the compass input of the radar or MDLW10664B GYRO I/F option is connected.

It should be kept in mind that Loran navigators typically require 1 to 3 minutes to properly calculate the vessels true heading when underway. When the vessel is stationary, the navigator does not determine accurate headings. Therefore it is normal for the waypoint symbol to bounce around if you're sitting in your slip at the dock. A steady compass input to the radar will eliminate this effect.

When "T" is displayed at the top of the screen **T075.0°** and a "T" is displayed just to the right of the EBL 1 & 2 readouts, this indicates that the Heading information is referenced to True North as is the EBL bearing data. EBL bearing is selected in "EBL BEARING", of "DISPLAY OPTION" menu. Waypoint bearings read out will also be provided referenced to True North.

TRUE	HEADING	EBL	WPT
LORAN/GPS(T)	T075° L	T/R	T
LORAN/GPS(T) & COMP.SENS.	T075° L	T/R	T
COMP.SENS.		REL	N/A
GYRO	T075°	T/R	T

NOTE

If no external navigator or compass sensor is connected to the Display Unit, the heading readout box will be empty.

MAG-M-

The magnetic heading mode of operation provides the operator with a magnetic readout M091.0° L, M, S or N.
(L:LORAN, M:MAG COMPASS, N:NSK)

When changing course, the magnetic heading data from a LORAN typically requires 1 to 3 minutes to stabilize to the vessels current heading. This lag in providing accurate magnetic heading is noticeable when using the Waypoint mode on Short Range Scales and maneuvering the vessel in a channel. The symbol sometimes doesn't keep up with the changes. We recommend the optional Heading Sensor be installed whenever the radar is used with a LORAN navigator in order to provide immediate magnetic heading information to the radar display. This is very important if navigating within restricted waters and relying on accurate EBL bearings to confirm one's position. An heading sensor is imperative when using the MARPA feature of the radar since it supplies a rapid update rate of the heading input.

When an "M" is displayed at the top of the screen M091.0° and just to the right of the EBL 1 and EBL 2 readouts, this indicates the heading and EBL information are relative to magnetic north. Waypoint bearings will also be provided as magnetic headings.

Note that with a Compass Sensor installed, the heading as well as other bearing information will be provided by the Compass Sensor M rather than the LORAN or GPS. In this mode heading, EBL and Waypoint information will be updated immediately.

MAGNETIC	HEADING	EBL	WPT
LORAN/GPS(M)	M091 ° L	M/R	M
LORAN/GPS(M) & COMP.SENS.	M091 ° L	M/R	M
COMP.SENS.	M075 ° M	M/R	N/A

NOTE

If no external navigator, compass sensor, or NSK input is connected to the Display Unit, the HEADING readout box will read (BLANK) in True or Relative Modes. When using the NSK data, it will display **N** .

ALM LEVEL

This function sets the Guard Zone Alarm sensitivity where "1" is most sensitive and "7" is least sensitive. The alarm level operates by sensing the target size and the level can be varied to prevent false triggering of the Guard Zone Alarm circuits due to sea clutter or other momentary weaker target echoes. Normally the level is set to "4" .

TX PULSE

This menu item is useful to temporarily change the transmitter operating pulse for stronger echo returns. It will return to the default setting under the following conditions.

1. Radar operating condition to be set at STBY.
2. The radar power goes to OFF.

A. (1.5NM)

This function allows the operator to temporarily change the 0.08 μ s pulse short length to 0.4 μ s for greater power output in the 1.5 NM range. The longer pulse selection accents the size of smaller targets on the 1.5 NM Ranges. After the radar is switched OFF, this selection will return to 0.08 μ s when the radar is reenergized. When operating custom ranges 1.0 - 2.25NM, pulse length is allowed at the 1.5NM selection.

B. (3,6NM)

This function allows the operator to increase the 0.4 μ s pulse length to 0.8 μ s for greater power output on the 3 and 6 NM ranges. After the radar is switched OFF, this function returns to 0.4 μ s when the radar is reenergized.

When operating custom range 2.5 – 4.5NM, pulse length is same as 3NM pulse length. Custom range 5 – 9NM are the same as the 6NM pulse length.

C. (12,24NM)

This function allows the operator to increase the normal 0.8 μ s pulse length to 1.2 μ s for better detection of targets in heavy rain clutter on the 12 or 24 NM range scales. After the radar is switched OFF, this function returns to 0.8 μ s when the radar is reenergized. When operating custom range 10 – 18NM, pulse length is the same as the 12NM selection. Custom range 20–36NM are the same as the 24NM pulse length.

KEYBOARD DIMMER

This selection sets the keyboard illumination intensity from 0 (OFF) to 7 (Maximum) to the desired level.

LANGUAGE

This Menu Selection allows the operator to choose from 6 languages for the radar menus and display prompts. The programmed languages include English, French, Spanish, Italian, Norwegian and German.

3.4.14.5 **MARPA** MENU

This menu provides selection of various MARPA (Mini Automatic Radar Plotting Aid) parameters:

CPA	0	0.1	<u>0.2</u>	0.5	1	2	NM
CPA RING	<u>OFF</u>	ON					
TCPA	1	2	5	<u>10</u>	20	30	MIN
VECTOR	<u>RELATIVE</u>					TRUE,	MAG
VECTOR LENGTH	1	3	<u>6</u>	12	MIN		
INTERCEPT	OFF	ON					
LEVEL	1	2	3	<u>4</u>	5	6	7

See the MARPA Section 3.5 on page 3–40 for details.

3.4.14.6 INITIAL SETTING MENU

The Initial Setting menu permits the Installer to perform initial installation settings generally required at the time of the initial radar installation.

To access the Initial setting menu:

※ : Press “ MENU + ACQ + GUARD ” keys at the same time to turn on the menu for the initial setting mode.

SETUP	SEE SECTION	FUNCTION
TUNE PRESET	5.4.2.8	Sets coarse receiver tuning.
STC MAX LEVEL	5.4.2.8	Sets the maximum STC Range.
GAIN MAX LEVEL	5.4.2.8	Sets the noise level at maximum gain.
COMPARATOR SET	5.4.2.8	Sets the threshold level for video signal.
DISPLAY TIMING	5.4.2.9	Sets timing for minimum range.
RELATIVE BEARING ADJ	5.4.2.10	Aligns the radar picture bearing to the heading line (Relative mode).
ANTENNA HEIGHT	5.4.2.11	Sets the height from the sea level.
INTERLACE ADJ	5.4.2.12	Sets the line interlacing.
BUZZER VOLUME	5.4.2.13	Sets buzzer Volume Level.

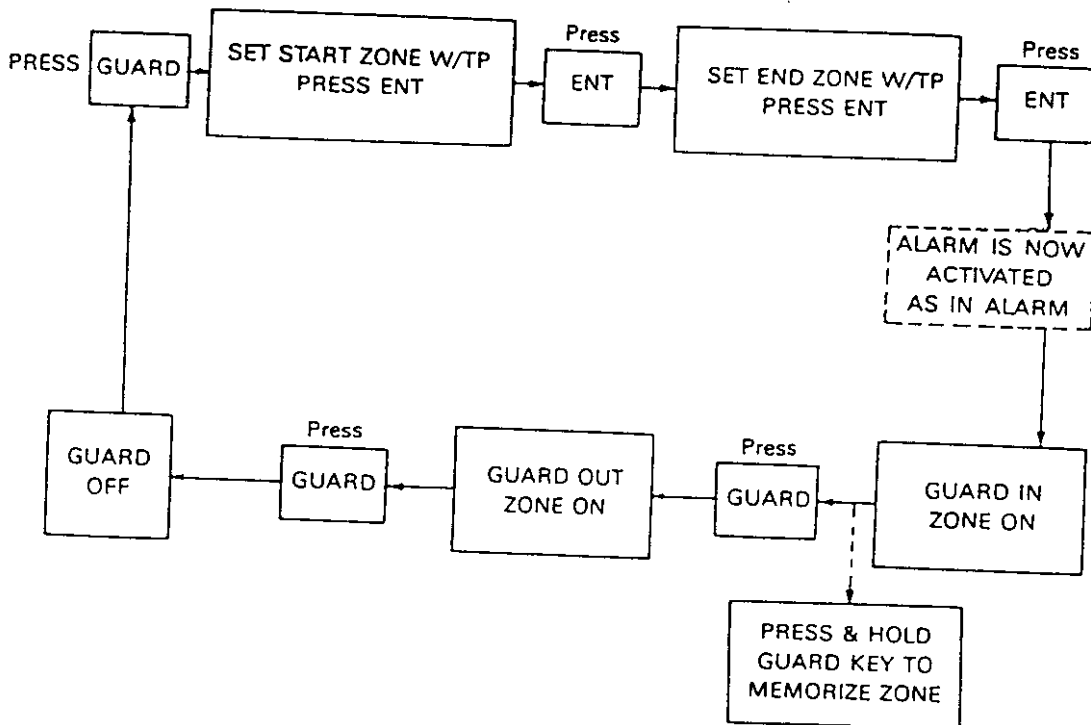
The alignment procedures are described in detail beginning on page 5-16 of this manual.

3.4.15 GUARD KEY (19)

The **GUARD** key turns ON or OFF the radar's Guard Zone feature. The Guard Zone may be a zone completely surrounding the vessel or a partial trapezoidal zone to monitor targets entering or departing the specified area.

Targets entering or leaving the guard zone will sound audible and visual alerts to the operator. In the IN mode, an alarm will sound if a target enters the area. The "IN" alarm is effective for alerting the operator to targets approaching his vessel. In the "OUT" alarm mode, the alarm will sound if a target leaves the prescribed area. This type of Alarm is useful for monitoring during an anchor watch, when cruising with other vessels, pair trawling, or towing operations.

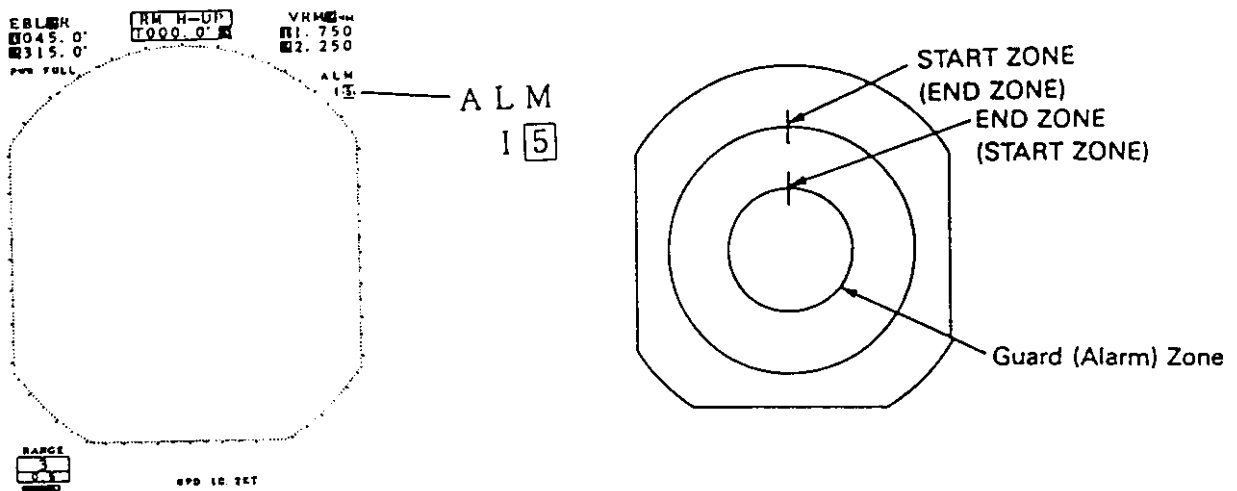
This diagram indicates the sequence of steps used in making a Guard Zone. The paragraphs that follow describe in greater detail each type of Guard Zone.



MAKING A 360 ° GUARD ZONE:

Press the **GUARD** key to make the first guard zone alarm ring. Note that a prompt at the bottom of the screen states "SET START ZONE W / TP PRESS ENTER". With the trackpad, set the cursor to the outer limits of the zone, press **ENTER** and a ring will appear at that range. (NOTE that the "G" in the lower right corner indicates that the trackpad is operating with the GUARD mode.)

Now the cursor may be adjusted again with the trackpad to define the inner boundary of the Guard Zone. Press the **ENTER** key. A complete Guard Zone (360 °) around the vessel has been established within the Guard Rings.



Note that in the upper right corner of the display, the "ALM" indicates that the Guard Zone is activated and below this we have "I 5" which indicates the "IN" alarm mode is in operation and the alarm target sensitivity is set at "5". To change the "IN" alarm to an "OUT" alarm, press the **GUARD** key again and the "I" symbol will change to "0" indicating that the alarm will now sound for targets leaving the guard zone.

Pressing the **GUARD** key again turns off the Guard Zone.

SETTING A SECTOR ZONE

SETTING A GUARD (Alarm) ZONE IN MEMORY

Many operators prefer to use the same alarm zone and occasionally will design special alarm zones as the need arises. This radar has a built-in memory to retain the zone that you use most often so that it is not necessary to always remake that alarm zone.

To memorize an alarm zone, first make the zone following the normal procedure. After selecting the target size (if desired) and the alarm "IN" is displayed, press and hold the **GUARD** key until you hear a long beep and the alarm characters on the screen right side turn into block form. At this time the zone will have been memorized for use at any time.

To activate the "memorized" alarm zone just press and hold the **GUARD** key until the display beeps. Your memorized zone will reappear. The zone will be displayed as an "IN" type zone. If you want to change to an "OUT" zone, press the **GUARD** key one time and "O" will be displayed on-screen showing the "OUT" alarm is "in use".

3.4.16 RR/SHM KEY (12)

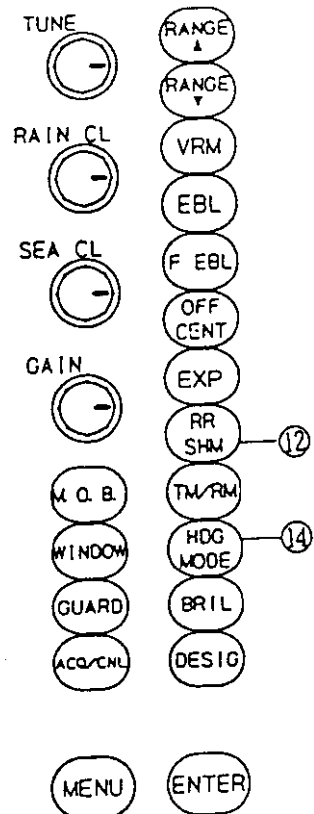
This is a dual function key which turns ON and OFF the Range Rings (RR), and will keep the SHM (Ship's Heading Marker) OFF as long as the button is held pressed.

Each time the **RR/SHM** key is pressed, the range rings will cycle on or off, depending on their present state.

The fixed rings are used to estimate the distances to targets. The interval between range rings is displayed at the lower left of the screen just below the range scale indicator. The ship's heading marker is displayed to show Own Ship's Heading (SHM) on the screen.

If the **RR/SHM** key is held down for about 2-3 seconds, the SHM will disappear until the key is released.

This feature allows the operator to turn OFF the ship's heading marker momentarily, in order to better see small targets which may be located beneath it.



3.4.17 HEADING MODE KEY (14)

Each press of the **HDG MODE** key changes the display mode in the following sequence:

Head-Up → Course-up → North-UP

Most radar operators are familiar with seeing the radar picture aligned with the bow of the vessel. This type of radar display orientation makes it easy to look out the windshield and identify the radar's targets as they are positioned relative to the ship's Heading line. This Heading Mode is known as the HEAD-UP mode and is one of the selections using the **HDG MODE** key. "H-UP" appears at the top of the screen in this mode.

NORTH-UP MODE

One of the key functions of this radar is the capability to plot radar targets and provide warnings if the targets will approach the safety limits of your vessel. In order to plot the targets accurately with radar, the vessel's heading must remain stable. One simple way to do this automatically is to synchronize the radar picture to the ship's Gyro or Magnetic compass. When the picture is synchronized in this manner, the radar will be operating in the NORTH-UP or COURSE-UP modes. In fact, to use the MARPA feature you must select one of these operating modes. NORTH-UP mode means the radar picture is positioned just like your marine chart. 000° on the radar bearing scale is the same as True or Magnetic North. If the vessel is steering 090°, for example, the SHM line on the radar will point to the 090° bearing on the scale. "N-UP" appears on the top of the screen in this mode.

COURSE-UP MODE

If having the radar picture turned around on the screen in the N-UP mode is confusing, you could select the COURSE-UP mode. The COURSE-UP mode lets you rotate the radar picture so the vessel's basic Course Heading (and the SHM line) point at 000° on the bearing scale, similar to the HEAD-UP mode. In C-UP mode you can again reference the targets by looking out the front window. "C-UP" appears on the top of the screen in this mode.

Note however, if the vessel changes direction, the radar picture will shift on the radar display in sync with the ship's Heading changes. This keeps all target plots stable and also provides a clear visual reference to the operator on the impact of the vessel's Heading shifts to the targets around his vessel.

The unit of Magnetic bearing or True bearing is selected by the "RADAR Setup" menu. "C-UP-M" or "C-UP-T" is shown on the display in Course-Up display mode. "N-UP-M" or "N-UP-T" is shown on the display in North-UP display mode. "H-UP" is shown on the display in Head-UP display mode.

3.4.18 HEADING/RESET (14)

After a course change, press and hold the HDG MODE key so that the heading marker is up at the head of the display.

This key functions only when the display mode is in the "Course-UP" display mode.

3.4.19 TM/RM (TRUE MOTION/RELATIVE MOTION) KEY (13)

At any time, the operator can choose between a relative or true motion display. First, however, it is necessary to become familiar with the characteristics of both types of displays.

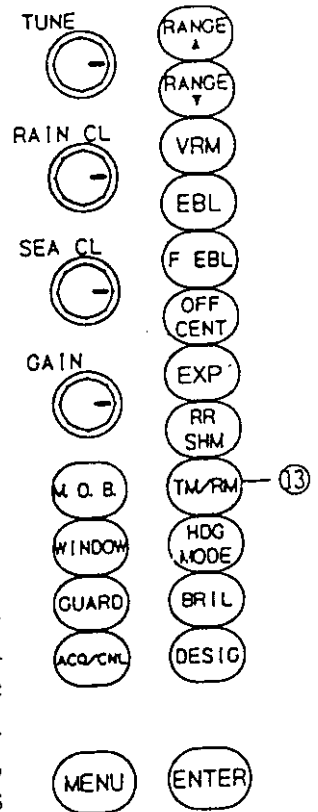
The last mode used (true or relative motion) is selected by the JMA-3807/3811 at the time of system turn on. If relative motion is selected, it is evidenced by the green RM legend at the top of the display in the heading box. In the Relative Motion display mode, the sweep origin (own ship's position) remains fixed and all targets move past own ship in their relative directions (fixed targets move 180° to own ship's heading and moving targets' movements depend on relative speeds and headings).

An alternative to the relative motion display is the true motion display. True motion is selected by pressing the TM/RM pushbutton (13) so that the TM legend appears. A true motion display is one in which the fixed targets and the radar targets maintain a constant position on the CRT screen while the sweep origin, representing own ship's position, moves across the CRT surface in accordance with own ship's speed and course. A map-like picture is thus displayed with all moving vessels shown traveling in true perspective with each other and the fixed land masses.

As own ship approaches the end of the true motion map (edge of CRT) the JMA-3800 series will automatically reset the display. The travel limit of own ship is two-thirds the CRT radius and so the reset action will occur when own ship's position is approximately two inches away from the CRT edge. This action moves own ship's position to two-thirds the CRT radius on its counter heading and will appear as if the true motion map was pulled down, thus revealing the area ahead of the ship. Own ship's position will always reset so that the heading flash passes through CRT center. The OFF CENT feature may be exercised to off-center the display if so desired.

To manually reset the presentation, press the TM/RM key twice. This restarts the TM function. The TM mode cannot operate on the maximum range scale, 48NM(JMA-3807) or 72NM(JMA-3811).

When the Radar is working in the CUSTOM RANGE mode, the TM mode can not be operated beyond the 24NM range (JMA-3807), or 48NM range(JMA-3811).



3.4.20 WINDOW KEY (18)

The JMA-3800 Series Radar includes a PIP (Picture-in-Picture) mode. When the **WINDOW** key is pressed, the PIP image can be toggled in the following sequence:

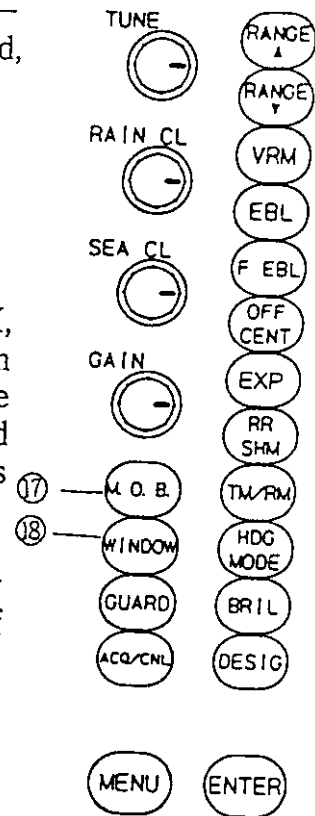
In the radar mode

MENU screen → WINDOW off.

3.4.21 MAN OVERBOARD KEY (17)

Pressing the **MOB** key, the range scale change to 0.5NM, and will locate a man overboard mark () over own ship's present location. A course line from own ship to the MOB mark will be continuously displayed on the screen and the Range, Bearing and TTG to the **MOB** mark is displayed in the lower position of the display.

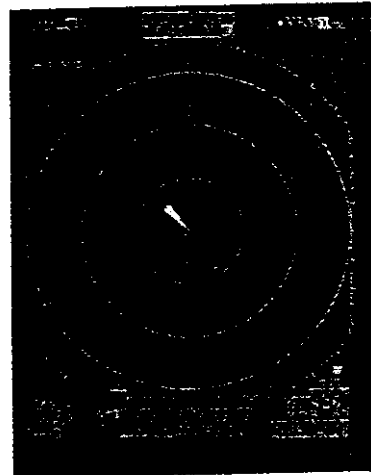
To turn MOB mode to OFF, press and hold the MOB key until a series of beeps are heard. Release the key. If connected to Seatalk, the MOB command is transmitted to the other Seatalk equipments and MOB will be activated or cancelled by operation at the radar for all equipments.



Actual screens showing the PIP mode when the window key is sequenced.



RADAR W/MENU
IN WINDOW



MOB MODE

3.5 USING MARPA

3.5.1 MARPA OPERATION

The MARPA or Mini Automatic Radar Plotting Aid is a computerized system that can track up to 6 targets simultaneously and calculate their Bearing and Range, Speed and Course, CPA (Closest Point of Approach), and TCPA (Time to Closest Point of Approach). Target information calculated by the MARPA can be displayed alphanumerically on the lower portion of the radar screen and graphically by a line called a vector that is superimposed over the target video. The vector depicts approximate target course by the direction in which it is pointing. In so doing, the MARPA provides the radar operator a very quick and precise means to evaluate collision risk and thereby increase vessel safety.

Automatic Radar Plotting Aids have been used by high seas commercial and military vessels for many years. With the JMA-3800 series radar, JRC has successfully reduced the cost of this technology to the point where MARPA services can be economically included in small boat radars.

Proper MARPA operation is dependent on accurate own ship course and speed inputs to the radar. Target calculations are based on position changes of target video, from one antenna revolution to the next, which can only be accurately calculated by subtracting own ship's motion (course and speed) from the radar display. Own ship's course information can be obtained from a gyrocompass, Raytheon's Heading Sensor, or a fluxgate compass. For best results, the gyrocompass option or a Heading Sensor should be used. Speed input could be obtained from a Navaid (GPS, Loran, etc), or from a paddle wheel sensor, if the boat is so equipped. However, first priority is given to a Speed Log (speed through the water) available using the NSK option.

Glossary of MARPA Terms

MARPA	Mini Automatic Radar Plotting Aid
Vector	Line from a target which defines targets speed (length of the vector) and course (direction vector is pointing).
True Vector	Shows True course and True speed of target.
Relative Vector	Shows Relative course and Relative speed of target.
Magnetic Vector	Shows Magnetic course and True Speed of target.
Head-up	Bow of ship fixed at 0° on display.
Course-up	Bow of ship placed at 0° on display but will respond to course changes.
North-up	North fixed at 0° on display and ship's heading flash indicates vessels heading. Correlates directly to Raychart images, when selected.
True Motion	Land buoys and fixed objects remain stationary while targets track across screen.
Relative Motion	Land, buoys and fixed objects move past own ship.
Stabilization	A gyro stabilized picture is generally also referred to as a north stabilized picture.
Acquisition	The process of acquiring a target.
Cancel	The process of deleting a target under track.
Heading Reset	Resets the heading in course-up mode to 000° (HDG Mode key)
MARPA Range Scale	.75NM thru 12NM. (Acquire) 14.8NM (Maximum tracking range.)
Tracking Window Size	Initial tracking window (invisible to the operator) is rather large and will then crop down around the target.
Vector Swap	The process whereby a target is passing a buoy or point of land and the tracking window merges with the buoy. When the target separates, the tracking window stays on the buoy.

The term "MARPA" is an acronym for Mini Automatic Radar Plotting Aid. Its initial function is to watch a specified radar target and determine that target's movement. Once the movement is determined, the MARPA can predict how "close" the target will come to own ship, and when this will occur in terms of "Time". The measurements are called "CPA" (Closest Point of Approach) and "TCPA" (Time to Closest Point of Approach).

In order for the MARPA to calculate CPA and TCPA, it must determine the range and bearing to the target. With this information as well as own ship's course and speed, the MARPA can now determine the true course and true speed of the target. This data as well as CPA and TCPA is displayed in the MARPA data window in the lower portion of the display screen.

The movement of a ship target can be measured by the MARPA in two ways; True or Relative.

A. True Vector - "Targets Motion Over Ground" is defined by the term "TRUE". The MARPA measures the DIRECTION in which the target and own ship are actually moving over the ground. The result is the vessels "TRUE COURSE". The RATE of motion is the vessels "TRUE SPEED". Think of this motion as if you were in a helicopter looking down watching the targets movement across the harbor. In this mode TRUE vectors for the target and own ship are displayed.

B. Relative Vector - Targets Motion Related To Own Ship's Motion. This motion is the most easy to see on the radar screen since the successive target pips are painted on the radar screen at the measured distances from own ship and in bearings "relative" to own ship's heading. The measurements, of course, are "RELATIVE COURSE" and "RELATIVE SPEED". The difference in this type of measurement is that own ship's speed and course are applied to the target speed and course, producing a relative vector that appears on the target only. Own ship does not display a vector in this mode.

The relative vector presentation is easier to understand than True vector because, in Relative Vector operation, the collision threat is determined by whether or not the vector is pointing at the sweep origin (own ship). If it is, the target is on a collision course with own ship. If it is not, the target will pass clear.

To access collision risk in True vector operation it is best to turn-on the "Intercept Function" in the MARPA set-up menu. When the Intercept Function is ON, the target is safe if your heading line does not intersect the intercept point.

The MARPA operation begins when the operator presses the ACQ/CNL (acquisition) key and positions the radar cursor over a target ship and then press the ENTER key. The MARPA places the target into a tracking window and its job for the next several minutes is to determine (plot) the target vessels "motion" to determine direction and speed. If own ship's speed and heading are known and the radar continuously detects the target, the MARPA will track the target and develop a vector within one to three minutes depending on the range scale selected.

As the tracking process continues, the MARPA continues to plot more track history on the target and "fine tunes" its prediction of the target vessel's current course and speed. It also detects if the target vessel makes maneuvering changes of course, speed or both and updates the calculations accordingly.

The MARPA shows the operator the results of its tracking calculations in the MARPA readout panel. True Course and Speed, Bearing and Range to target, CPA, and TCPA are shown.

"All of this is fine", you say, "but how will the MARPA help me determine whether the target is dangerous?" The answer is that the MARPA will classify the target as a "SAFE" target, "DANGEROUS" target, or "VERY DANGEROUS" target according to the "safety limits" selected in the MARPA menu. The safety limits are the CPA distance and the time to CPA.

The operator selected CPA limit sets the "Safe" distance that a target should remain clear from own ship. The MARPA considers that a tracked target whose calculated CPA distance is greater than the CPA Safe limit distance is a "SAFE" target. A target whose calculated CPA distance is equal to or less than the CPA safety limit distance will be classified as a "Dangerous Target"

Setting the TCPA limit in the MARPA menu is similar to setting an alarm clock for a wake up call. When the tracked target time to CPA (TCPA) reaches the TCPA time limit set in the menu, the audible alarm sounds and the target becomes a "Very Dangerous Target"

"Very Dangerous Targets" (V. DANG) are those having a CPA distance less than the preset limit and a TCPA less than the TCPA limit. The classification of the target can easily be identified by its unique on-screen symbol and by the message in the MARPA information panel. "Very Dangerous Targets" also activate the audio beeper warning.

Tracking symbols used to distinguish target classifications include:

“○” for SAFE targets “△” for Dangerous Targets
“◇” for Very Dangerous Targets

The MARPA will also alert you both visually and audibly if the target being tracked becomes a “LOST TARGET”. Targets can be “Lost” for several reasons including being a weak echo or very close to land, buoys, or other large targets, or if in excessively strong sea clutter.

Not all targets tracked by MARPA need be solely for the purpose of collision avoidance. Occasionally, you may want to rendezvous with another vessel. With MARPA, you can acquire and track the vessel and using MARPA's “INTERCEPT” mode with True vectors. The “intercept course” and time-to-intercept” at your present speed is indicated graphically on the display and alphanumerically in the data window. If your vessels speed is too slow or the intercept time is too long, you can change your speed and heading accordingly to change the rendezvous time. If you don't, the warning “CAN NOT INTERCEPT” will appear on the display within the target designation window.



STARTING MARPA

As mentioned earlier, the MARPA operation begins when the operator presses the **ACQ/CNL** (acquisition) key and positions the radar cursor over a target ship and presses the **ENTER** key. The same procedure is used to cancel a target. If the target is moving very fast you may want to place the cursor just in front of the target.

The MARPA uses initial setups in the MARPA menu (determined at the factory) which will provide general MARPA operation. However the pre-set values may not always be those preferred for the navigation of the vessel in all conditions. The initial values are listed here in the table, but can easily be changed in the menu.

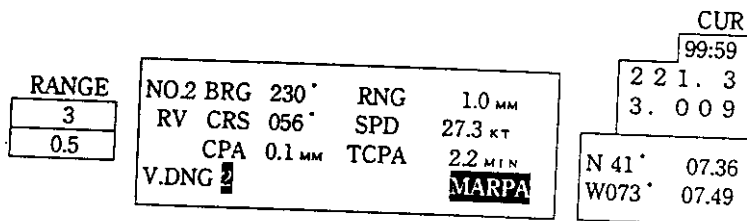
TABLE 2.1 MARPA DEFAULT SETTINGS

MODE	SETTING
CPA	0.2NM
CPA RING	OFF
TCPA	10MIN
VECTOR	RV(Relative Vector)
VECTOR LENGTH	6NM
INTERCEPT	OFF
LEVEL	4
READOUT	OFF

3.5.2 MARPA READOUT PANEL

The MARPA readout panel is turned ON or OFF by using the **DESIG** key. When the MARPA panel is enabled, the characters "TV" or "RV" will be shown to indicate if True Vectors or Relative Vectors are selected in the MARPA menu.

MARPA Panel: Shows relative vectors vessels relative speed Bearing, Range, Course, CPA and TCPA data.



Although Relative Vectors are selected, the readouts of the tracked targets bearing and range, True CRS (course), True SPD (speed), CPA and TCPA, and own ships SPD (speed) are displayed.

If True Vectors are selected, the CRS and SPD readouts are True Course and True Speed. The bearing readouts will be in degrees Magnetic or True depending on the selection in the SETUP menu.

If the MARPA determines that the target has become a Dangerous target, a Very Dangerous target, or a Lost target, a message appears in the panel indicating the current target status.

To turn the MARPA readout panel OFF, press and hold the **DESIG** key for 1-2 seconds. The readout panel will disappear.

3.5.3 ACQUISITION OF TARGETS

The MARPA operation begins when the operator presses the **ACQ/CNL** (acquisition) key and positions the radar cursor over a target ship and presses the **ENTER** key. The same procedure is used to cancel a target. If the target is moving very fast you may want to place the cursor just in front of the target.

The symbol may shift slightly over the target for a few seconds initially while the window size is adjusted to contain the target.

In approximately one to three minutes after acquisition, a vector will appear extending from the tracked target indicating the targets course and speed. (True/Magnetic or Relative vector is selected in the MARPA menu.) If the MARPA designation readout has been enabled using the front panel key, all of the calculations for the target will be displayed in the panel below the PPI area.

As mentioned earlier, there are conditions where tracking a target may become difficult. These same conditions may be a factor in successfully acquiring a target. The symptom is that the symbol may wander away from the target, lock onto another target, or simply disappear after several seconds. Some of these conditions are:

- a. The target echo is weak.
- b. The target is very close to land, buoys, or other large targets.
- c. Sloppy sea state conditions exist and the target is buried in excessive sea clutter or in deep swells.
- d. Sloppy sea state conditions exist yielding poor platform stability; own ships heading and speed is very unstable.

If any of these conditions are present, acquisition and tracking may need to be reinitiated from time to time or, in some cases, be impossible to maintain.

3.5.4 CANCELLING THE TARGET

If you wish to discontinue tracking an acquired target to perhaps select another target of interest, press the **ACQ/CNL** key. When the cursor appears, use the Trackpad to place the cursor over the tracked target. Then press the **ENTER** key. The symbol and vector will disappear.

To instantly cancel ALL tracked targets or, to simply turn MARPA OFF, press and hold the **ACQ/CNL** key until you hear a long beep.

3.5.5 MARPA DEFINITIONS & SYMBOLS

	MARPA DEFINITIONS
CPA	Sets the minimum distance from own ship that the target vessel can approach own ship without concern. The MIN CPA ring appears on the radar screen for your reference. 0, 0.1, 0.2, 0.5, 12 NM
CPA RING	Turns CPA Ring ON or OFF around own ship. Only functions with Relative Vectors selected.
TCPA	Set the time limit where a targets time to CPA to own vessel is reached, thereby actuating the "Very Dangerous" Target alarm.
VECTOR INTERCEPT	Toggles the vectors between Relative or True/Magnetic. Turns the Intercept calculation mode ON or OFF. Only functions in True/Magnetic Mode with True Vectors Selected.
VECTOR LENGTH	Selects a time of travel for the target vector length. The length of the vector will show where the target will be at the selected time (i.e. 3 minutes or 6 minutes, etc.) if the vessel maintains its current speed. 1, 3, 6, 12 min
MARPA RANGE SCALES	Although the MARPA will track on every range scale of the radar it should be noted that the ACQUIRE FUNCTION is only available on the .75NMi to 12 NMi range scales. The maximum range to which targets may be tracked is 14.8NM.

MEANING OF SYMBOLS

Vector	Meaning	Remarks
○	Safe targets	Does not violate CPA and TCPA settings
△	Dangerous targets	Alarm Display
◇	Very Dangerous target	Alarm Display and generation of audible alarm.
∧	Initial acquisition	After acquisition, symbol is displayed until a vector is determined.
∧ △ ○ ◇	Lost target (displayed when tracking becomes impossible)	Alarm Display generation of audible alarm.
⊔	Intercept point	
+	Cursor mark of trackball	Manual acquisition of target, cancellation of target display.

3.5.6 MARPA ALARMS

DANGEROUS TARGET ALARM

Target Condition	Symbol on CRT	Alarm Display	Buzzer	REMARKS
Safe	○	OFF	OFF	· CPA > MIN CPA TCPA > 0 · D < MIN CPA, TCPA < 0, Behind own ships · D > MIN CPA, TCPA < 0
Dangerous	△	DNG	OFF	· CPA ≤ MIN CPA, TCPA > MIN TCPA · D ≤ MIN CPA TCPA < 0, Forward of own ship
Very Dangerous	◇	V DNG	ON	CPA ≤ MIN CPA 0 < TCPA < MIN TCPA

NOTE: D represents range from own ship to target.

2) Lost Target Alarm: LOST

When it becomes impossible to continue the tracking of a target, which was acquired and under track, a "LOST TARGET" alarm will be activated. There are several reasons for a lost target alarm:

- (a) When echo of target is very weak.
- (b) When last echo is due to target being behind land or opposite side of large ship.
- (c) When target is buried in sea clutter or rain clutter.

LOST ALARM

Condition	Symbol on CRT	Alarm	REMARKS
LOST target	Dotted Symbol	ON	For 5 Radar Scans the symbol becomes dotted, the vector becomes dashed and then all symbology on the lost target disappears.

NOTE: Inadequate adjustment of radar tuning, gain, sea clutter suppression may cause the echo to be weak and in such a case the target may be LOST. Therefore, it is important to verify proper adjustments. If there is a possibility of losing a target due to weak echo from a far distant target or even nearby targets which have no special problems, then it is necessary to increase the gain.

3.6 GENERAL RADAR PRINCIPLES

3.6.1 RADAR MAP

The radar display is a map-like representation of the area in which the radar is operating. Typically, the ship's position is at the center of the display or sometimes may be repositioned or offset up to $2/3$ of the radius anywhere on the screen in the OFFCENT MODE. The ship's dead ahead bearing is indicated by the heading line flashing at the 0° relative bearing with every revolution of the sweep trace.

Coastline contours are generally depicted in solid filled green echo areas. Other surface vessels and channel buoys are displayed as smaller single echoes. The radar picture or map can be viewed in many sizes or scales from own ship. These sizes are selected by the range scale controls. Greater detail of radar echoes nearby own ship is shown when using the short range scales. The best technique is to start with using a longer range scale and then switching to shorter ranges when nearby targets appear, or as the ship approaches the coastline, harbor, or other vessels in the area.

Until the operator becomes familiar with interpreting the radar display, every opportunity should be taken to compare the radars display patterns with visual targets, such as other vessels, buoys, coastal structures etc. Harbor and coastal navigation should be practiced during daylight with clear weather conditions.

3.6.2 MAP ORIENTATION

In the RELATIVE mode, the heading line always appears on the Display Unit at 0° relative, and is coincident with the antenna beam passing the ship's bow. Thus the top of the displayed picture represents the direction in which the ship is heading. All targets appearing on the display are "Relative" to own ship's position and heading. As you look outside at targets around you, you will see the targets appear on the Radar display at the same relative bearing.

The EBL's give relative bearing data. When in the TRUE mode, EBL readouts give true bearing to targets. The MAGNETIC mode provides magnetic bearings to targets.

A Compass input is required in order to have magnetic bearings. An NSK, GPS or Loran input is required in order to provide True heading. Some GPS and Loran units allow for the input of magnetic variation into them, which in turn, will provide magnetic course information to the radar.

3.6.3 EFFECT OF SHIP'S MOVEMENT

Radar display can be drawn in two ways to show the ship's motion. The displays are called "Relative Motion" and "True Motion". In Relative Motion, the most common radar display mode, the appearance of the radar display changes according to the ship's speed and course, that is, own ship is permanently fixed at the center of display but radar echoes (targets) move in relation to your vessel. With no movement of the ship, a steady display of fixed radar echoes is shown.

If the ship is moving ahead on a constant course, echoes appearing at the top of the display will move downward across the display. Your position will always remain at the center of the display.

If your vessel alters course to the right, the displayed echoes will be displaced by an equal amount in bearing in a counterclockwise direction, and vice versa. These changes in the display pattern with ship movement is an extremely important factor when plotting the ship's course and the courses of nearby vessels.

The True Motion Display Mode is very much like seeing your vessel moving on a map or chart. In True Motion, the surrounding landmark echoes will remain stationary on the screen. If your ship is moving at a constant course and speed, you will see your position move across the screen towards the edge of the display. Any other targets which are underway will also be moving on the display screen at their True course and True speed. All motion seen on the True Motion display is "TRUE" (meaning motion over the ground).

3.6.4 NAVIGATIONAL ECHOES

Echoes displayed on the radar screen may be large or small, bright or faint, depending on the size of the object. Radar Echo indications are often different than an observer's visual indication in that nearby small objects may appear to be the same size as a distant large object on the radar. With experience, however, the approximate size of different objects can be determined by the relative size and brightness of their radar echoes.

Buoys and small boats are an example of targets that are sometimes difficult to differentiate. Since they bob and toss about in the waves, they do not present a consistent reflecting surface. Consequently, their echoes have a tendency to fade and brighten and at times to disappear momentarily. Very often buoys and small boats resemble each other, but usually the motion of one target to the other identifies the boat from the buoy.

High coastlines and mountainous coastal regions can be observed at the longest range of the radar. However, the first sight of landfall on the radar display may be a mountain several miles inland from the coastline. The actual coastline may not appear on the radar until the vessel has closed the range to the land near the line of sight distance.

3.6.5 SEA RETURN

Not all radar echoes are produced by hard navigation items such as boats, buoys and land. Some Radar echoes may be received from irregularities on the surface of the water, particularly at close range by breaking wavecrests in heavy seas. These echoes appear on the PPI screen usually on the very short range scales as multiple small echoes not in a repetitive or consistent position. Under high winds and extreme conditions the echoes from sea clutter may appear as dense background of clutter forming the shape of an almost solid disc, as far as one to three miles in all directions from the display center.

3.6.6 STORM AND RAIN SQUALL RETURNS

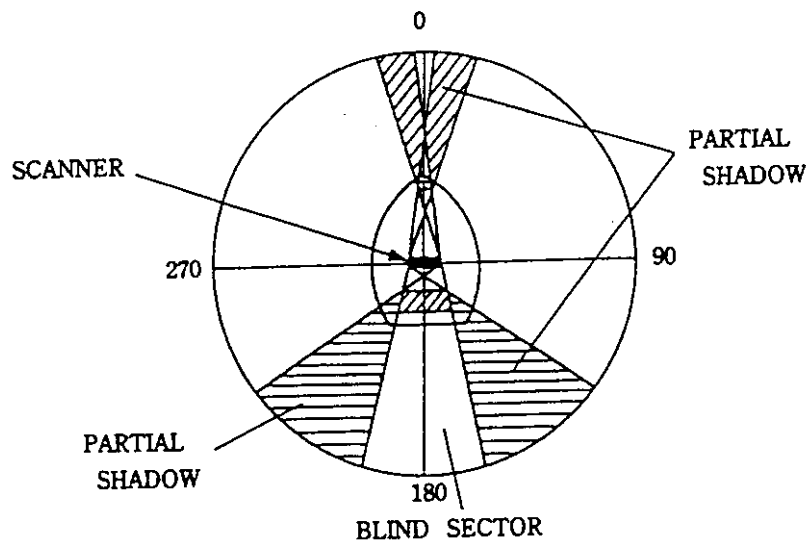
The Radar can also see echoes from rain or snow. Returns from storm areas and rain squalls consist of countless small echoes, continuously changing in size, intensity, and position. These returns sometimes appear as large hazy areas on the display depending on the intensity of the rainfall or snow in the storm cell. The cells usually are visible for long distances due to their extreme altitude and are very helpful for observing bad weather warnings. If the returns from storm areas and rain squalls are not desired, the RAIN CLUTTER control can be adjusted to minimize them.

3.6.7 BLIND SECTORS OR SHADOW EFFECT

Not all echoes on the radar are direct returns to the radar antenna. There are many types of echoes that can appear on the display if certain conditions occur. The sections that follow briefly describe the echo patterns that may be produced by these false echoes and their likely cause. It should be noted that the Radar operator, through observation, practice, and experience can detect these conditions generally very quickly.

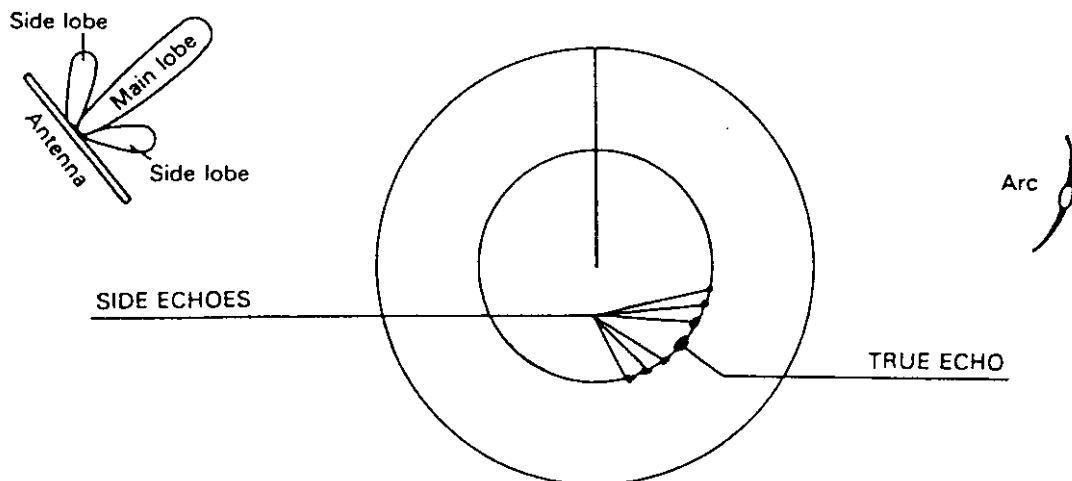
Funnels and masts, (when located near the antenna array) may cause shadows. In the shadow area beyond the obstruction there will be a reduction of the beam intensity, although not necessarily a complete cutoff. However, if the subtended angle is more than a few degrees there will be a blind sector.

In some shadow sectors the beam intensity may not be sufficient to obtain an echo from a very small object even at close range, despite the fact that a large vessel can be detected at a much greater range. For this reason the angular width and relative bearing of any shadow sector must be determined at installation. Sometimes shadowing can be seen by increasing the Radar Gain until noise is present. Dark sectors indicate possible shadowed areas. This information should be posted near the Display Unit, and operators must be alert for objects in these blind sectors.



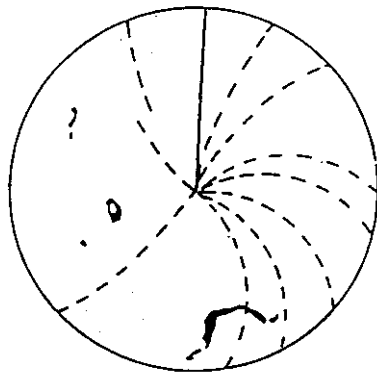
3.6.8 SIDE LOBES

A very small part of the RF energy from each transmitted pulse is radiated outside the single narrow beam, producing side lobe patterns. Side lobes have no effect on distant or small surface objects, but the echo from a large object at short range may produce an arc on the radar screen similar to a range ring, or appears as a series of echoes forming a broken arc. Side-lobe echoes normally occur at a range below 3 miles and can be reduced by adjustment of the SEA CLUTTER control.



3.6.9 RADAR INTERFERENCE

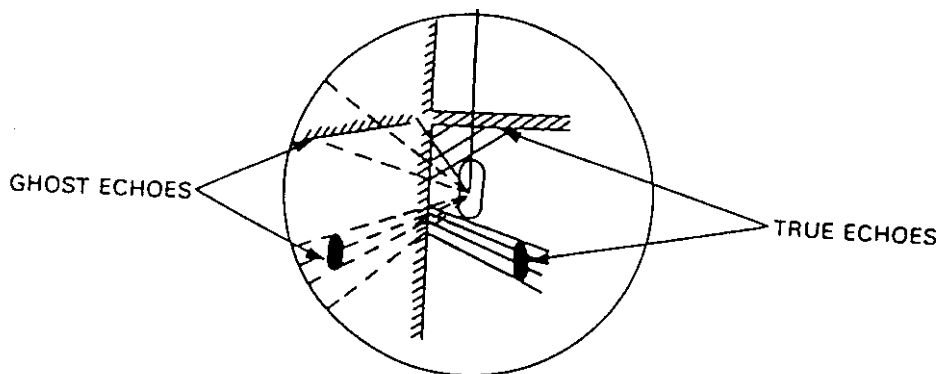
Whenever two or more radar equipped vessels are operating within reception range of each other, mutual interference is likely. This will usually appear on the screen as a series of small dots, which move to and from the PPI center, sometimes in a straight line, but more often in a long, sweeping curve. This type of interference is most noticeable in longer ranges. This should not, as a rule, impair the effectiveness of the radar as a navigational aid. Radar interference can be completely eliminated by turning IR "ON" on the Display Unit function menu. The IR feature is normally left "on".



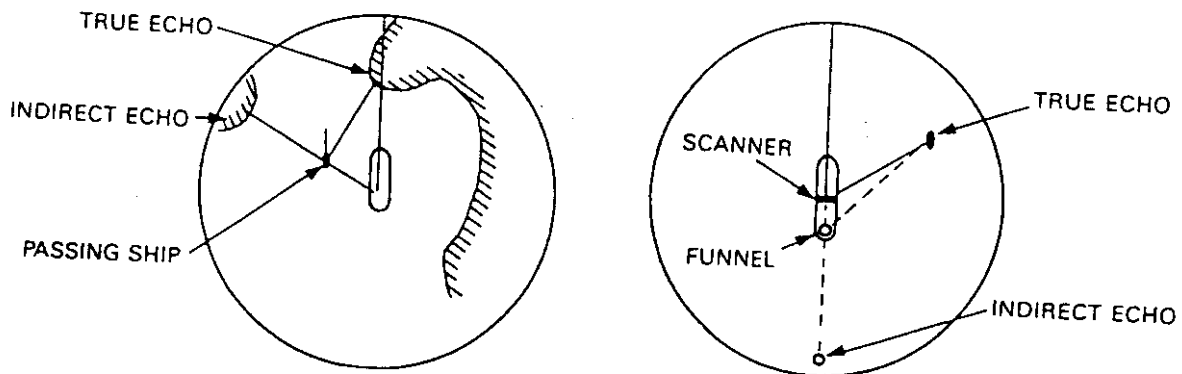
3.6.10 FALSE ECHOES

Occasionally, signals will appear on the screen at positions where there is no actual target. These targets are called "False Echoes" and may be caused by Ghost Images, Indirect Echoes or Multiple Echoes.

There are several types of ghost images. They sometimes have the appearance of true echoes, but in general they are intermittent and poorly defined. A ghost image retains a fixed relationship with respect to the true image and has a more arc-like appearance with a tendency to smear. They are sometimes caused by targets which have a wide, smooth surface near your own ship.

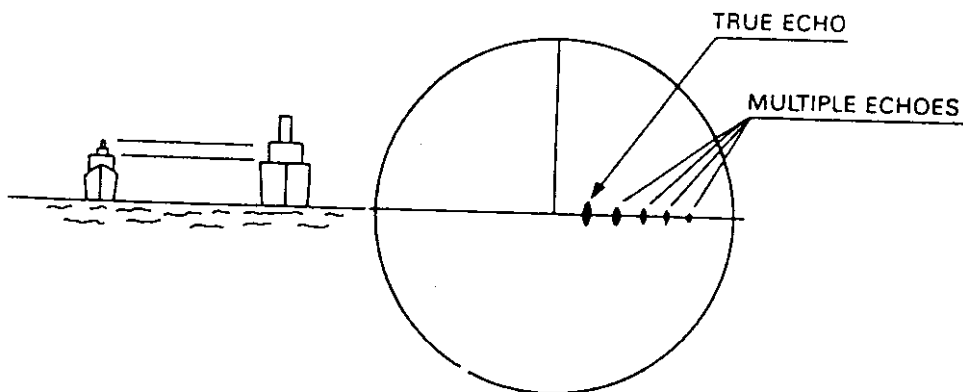


Indirect echoes may appear when there is a large target, such as a passing ship at a short range, or a reflecting surface, such as a funnel on your own ship in line with the antenna. The signal, on first striking the smooth side of the large target, will be reflected, and these subsequent echo returns to the antenna are shown on the display. However, the same reflection hits other masts or obstacles and then gets picked up by the radar antenna with enough strength to appear as a target on the radar screen.



Multiple echoes could appear if there is a large target having a wide vertical surface to your own ship at a comparatively short range. The transmitted signal will be reflected back and forth between the wide vertical surface of the target and your own ship.

Thus, multiple echoes will appear beyond the true target's echo on the same bearing as shown below. This is not a very common phenomena.



3.6.11 DETERMINING RADAR LINE-OF-SIGHT RANGE

When searching for distant echoes, the radar line-of-sight range to the echo can be a limiting factor. Radar waves behave like light waves but are refracted slightly more, increasing the distance to the radar horizon to slightly beyond the optical horizon (displayed range is correct, however). As Fig. 3-2, below, shows, the radar line-of-sight range is a combination of the radar horizon of the ship's radar antenna and the radar horizon of the target. The nomograph shown in Fig. 3-2, below, provides a convenient method of determining any of the three factors involved when the other two factors are known.

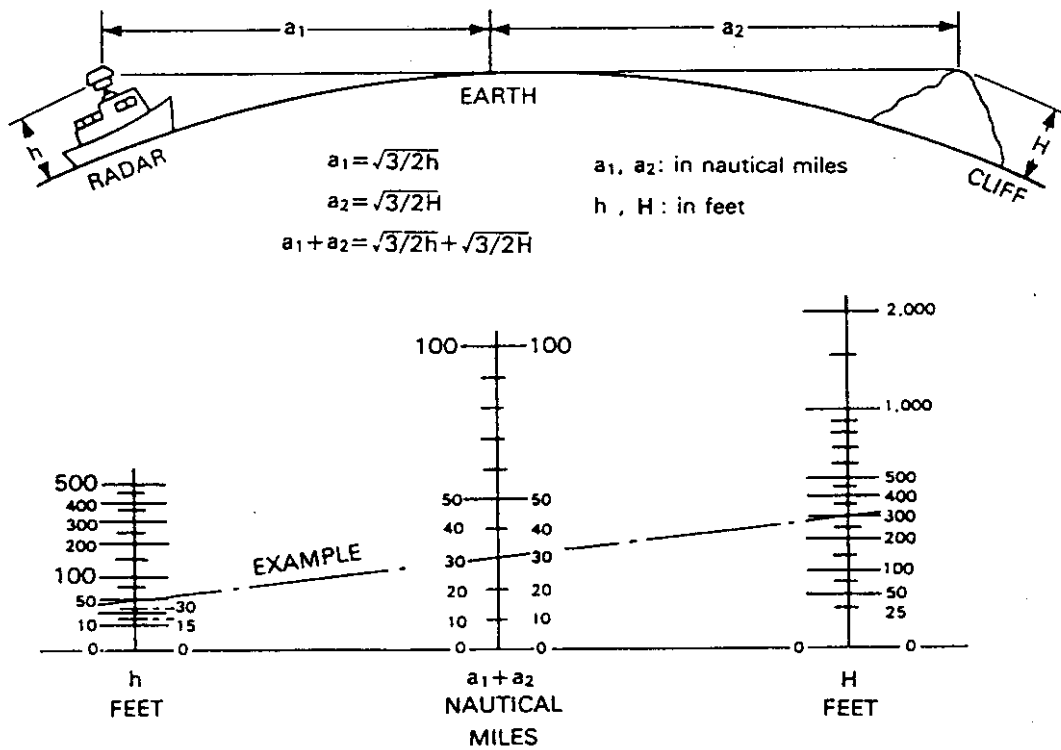


Fig. 3-2 RADAR LINE-OF-SIGHT RANGE NOMOGRAPH

The distance to the radar horizon from the radar antenna of height "h" feet, under standard conditions, may be calculated from the formula.

$$\text{Distance (NM)} = 1.23\sqrt{h}$$

For example, an antenna at a height of 50 feet has a radar horizon of 8.7 NM,

A 300 foot cliff has a radar horizon of 21.3 NM. Therefore, under standard conditions, the cliff should begin to appear on the screen when the ship comes within $8.7 + 21.3 = 30$ NM.

SECTION 4

TECHNICAL DESCRIPTION

4.1 GENERAL

The theory of operation for the Radar Set JMA-3807 and JMA-3811 is presented here with descriptions following the functional block diagram circuits.

The schematic diagrams for each electronic subassembly together with the component parts layout for each assembly and parts list are contained within SECTION 6 of this manual.

4.2 ANTENNA UNIT

The antenna unit consists of the RF radiator housed in a separate array assembly and coupled to a rotary joint assembly on the pedestal housing. The radiator rotating mechanism, antenna motor/encoder assembly, bearing reset circuitry, transmitter and receiver modules are all mounted within the pedestal housing. The Functional Block Diagram for the Antenna unit is shown in Fig. 4-2.

4.2.1 RADIATOR

The purpose of the RF radiator is to shape the main transmitted beam of the radar during the transmission phase of the radar's operating cycle and to receive any incoming echo pulses during the receive portion of the cycle.

The radiator is a horizontally polarized, non-resonant, end fed slotted waveguide array. The radiator either 4 foot or 6 foot in length is coupled to the transmitter and the receiver through a short waveguide section a rotary joint and a circulator assembly.

Electrically, the array produces a horizontal beamwidth either of 2° for the 4' array or 1.2° for the 6' array at the half power points with a vertical beamwidth of 30° or 25° respectively. The direction of the beam (maximum radiated power) is essentially perpendicular to the face of the radiator. Within +/-10° of this main beam, the side lobes are reduced by greater than -23 dB. Outside of this area, the sidelobes are reduced by more than -26 dB.

The array is typically rotated at 24 rpm by the antenna motor-encoder assembly through the gear reduction assembly.

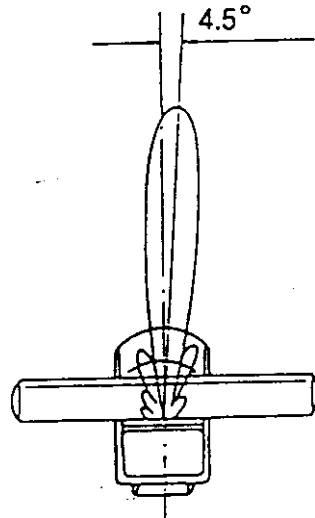


Fig. 4-1 RADIATOR

4.2.2 RADIATOR ROTATING MECHANISM

The antenna drive mechanism consists of a 10 VDC motor and a gear reducer assembly. The DC operating power for the motor is supplied from the ship's DC power via the interunit cable through the antenna motor power supply control circuit. When the Radar is turned to the X-MIT condition, the motor drives the gear reducer assembly through a 5.6:1 ratio to provide the antenna rotation of approximately 24 rpm.

This electrical/mechanical assembly is designed to maintain the antennas rotation in wind speeds up to 100 knots.

4.2.3 MOTOR-ENCODER

The antenna motor also includes a pulse encoder as part of its assembly. The encoder section produces the bearing pulses for display sweep generation, transmitter triggering, and rotation synchronization. A bearing sync pulse is generated every 0.176 degrees of rotation or 2048 pulses per each rotation at 5V amplitude. These pulses (BP) are sent down to the Bearing Pulse circuitry in the display unit via TB102 - BP.

4.2.4 BEARING RESET CIRCUIT

The Bearing Reference Generator circuit, also known as the ship's heading marker circuit, produces a 5V signal each time a directly on the main gearing breaks the magnetic path of S102. This output pulse is used to synchronize the bearing of the display sweep line with the scanner rotation.

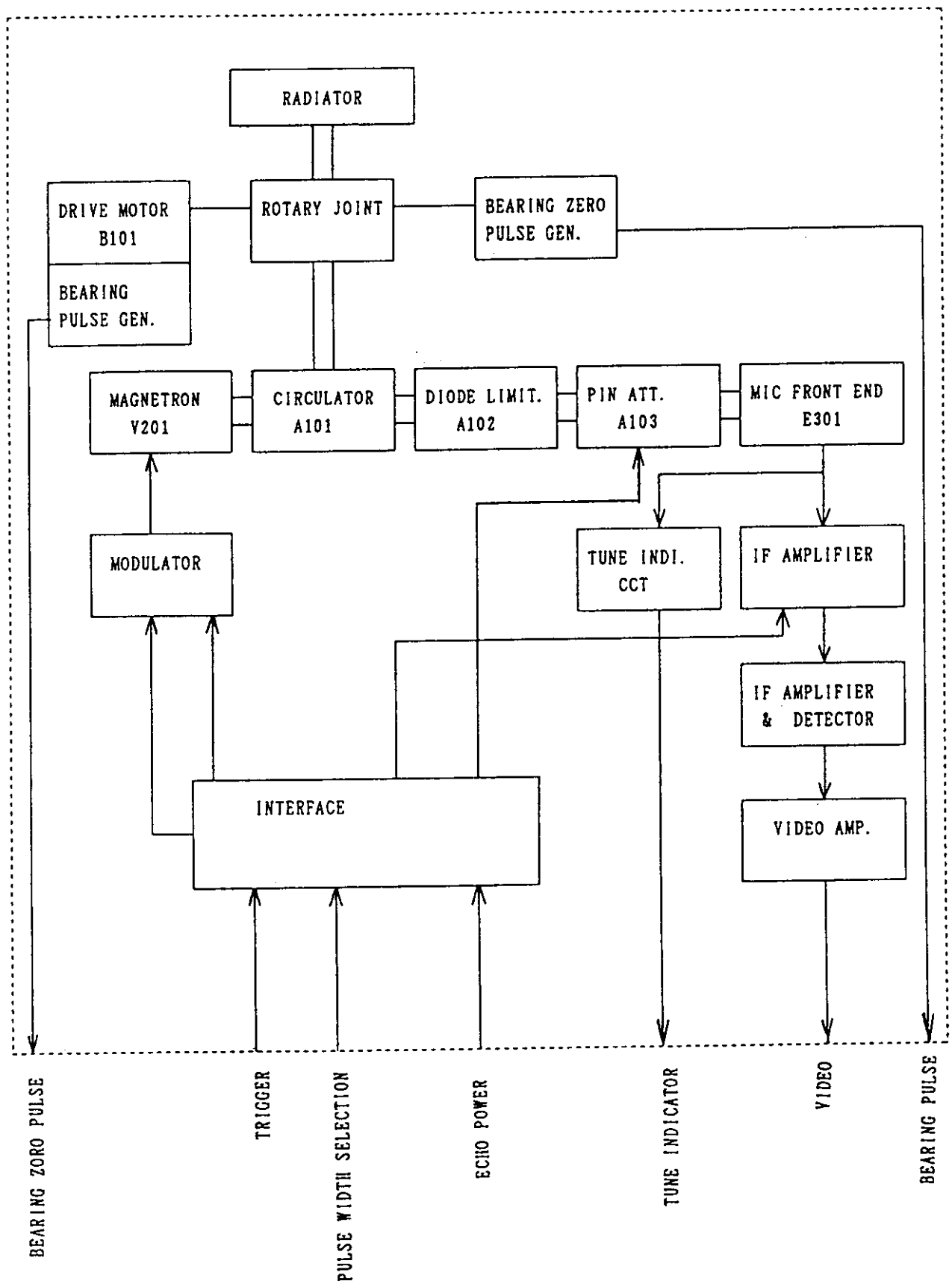


Fig. 4-2 FUNCTIONAL BLOCK DIAGRAM OF OPEN ARRAY ANTENNA UNIT

4.3 TRANSMITTER UNIT

The transmitter consists of the solid state modulator circuits, the 6kW or 10kW magnetron, and the Power Supply.

A solid state type pulse 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/OFF key on the indicator 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 modulator.

Generally the pulse width of the pulse generator circuit is controlled by the range key selections on the indicator front panel. Four different pulse lengths: 0.08 μ sec, 0.4 μ sec, 0.8 μ sec and 1.2 μ sec (in accordance with the range scale or menu selections) are provided. The Pulse Repetition Frequency (PRF) changes automatically to match the selected operating pulse length (See Table 4- 1).

Upon receiving the positive trigger pulse at its gate, TR6 and TR7 conduct and the charged voltage across capacitors C13 and C14, is immediately discharged through TR6, TR7 and the primary winding of the pulse transformer T1. Consequently, the pulse in the primary winding of the pulse transformer T1, is stepped up by more than 10 times by the T1 secondary winding to drive the cathode of the magnetron. The peak pulse voltage on the primary of T1 is -360V, and on the secondary, -5.5kV at 10kW output.

TABLE 4- 1 RANGE, PULSE LENGTH, AND PRF RELATIONSHIPS

Range	Pulse Length	PRF
0.125, 0.25, 0.5, 0.75, 1.5NM	0.08 μ s	2000Hz
3, 6NM	0.4 μ s	1500Hz
12, 24NM	0.8 μ s	750Hz
48, 72NM	1.2 μ s	500Hz

4.4 RECEIVER UNIT

The receiver unit consists of the passive Diode Limiter, the PIN Attenuator, the MIC Front End, and the Receiver IF PCB (CAE-344-2).

The PIN Attenuator includes a PIN diode which limits the RF microwave power in accordance with control current. The current is driven by the modulator circuit PCB (CME-261).

The MIC Front End (E301) device consists of low-noise RF amplifier, a double balanced mixer, and the local oscillator. The received radar echo signals at 9410 MHz are first amplified in the low-noise RF amplifier. The signals are then sent into the double balanced mixer of the MIC. The MIC Local Oscillator is tuned by the adjustment of the operator's Tune control on the display unit front panel to be 60MHz higher than the magnetron's operating frequency for maximum target detection. The output is fed into the double balanced mixer. The balanced mixer output of 60 MHz echo signals is then coupled into the 60MHz IF amplifier.

Receiver PCB (PC301:CAE-344-2)

The Receiver PCB contains the 60MHz IF amplifier, bandwidth control circuits, video detector, tune circuitry and the video output circuitry.

IF Amplifier Circuit

The IF amplifier consists of low noise amplifier TR1, and bandwidth selector circuits CD1 through CD6.

The bandwidth selectors are controlled by voltages supplied from IC4 located on the CME-261 PCB. The voltage enables components to be activated in the amplifier circuit so the receiver has a 20MHz, 6MHz or a 3MHz bandwidth characteristic. The selection of bandwidth depends on the pulse length selector signal (PW) from the Display Unit which will be determined by the range in use.

When no pulse length signal is present at CME-261 PCB, IC2 will be "OFF" and the gates A, B, and C of IC3 will be "H". In this condition, the pulse length in operation is $0.08 \mu s$ and the bandwidth of the receiver is widened to 20MHz. When the pulse length signal is other $0.08 \mu s$, gates of IC2 will be turned "On". When the input A of IC3 is "H", the bandwidth will become 6MHz. When the input B and C of IC3 are "H", the bandwidth will become narrow at 3MHz.

Video Detector Circuit

IC1 through IC9 at CAE-344-2 operate as logarithmic amplifiers and video detector to remove the 60MHz IF component from the incoming signals. The negative going signals appear across R36 where the IF component is removed by filter L13, C41 and C42. The detected signals, now at video frequency rates, are sent to the video output circuit.

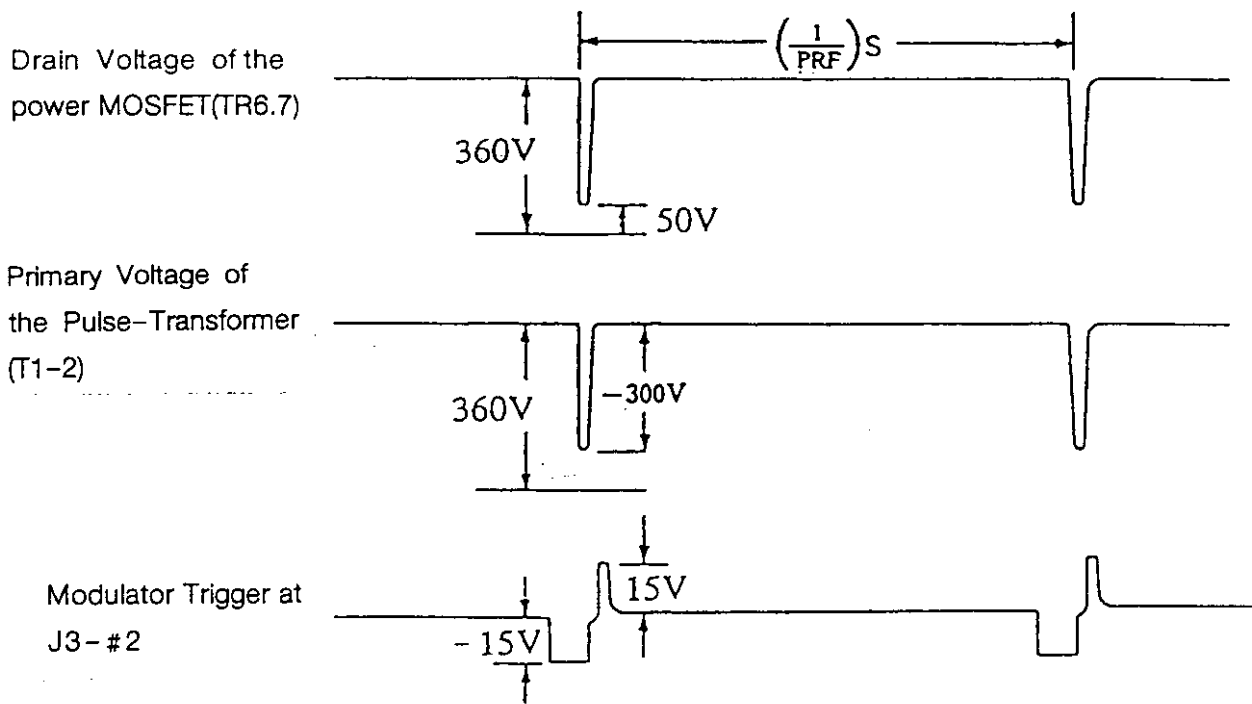


Fig. 4-3 TIME TABLE OF THE TRANSMITTER

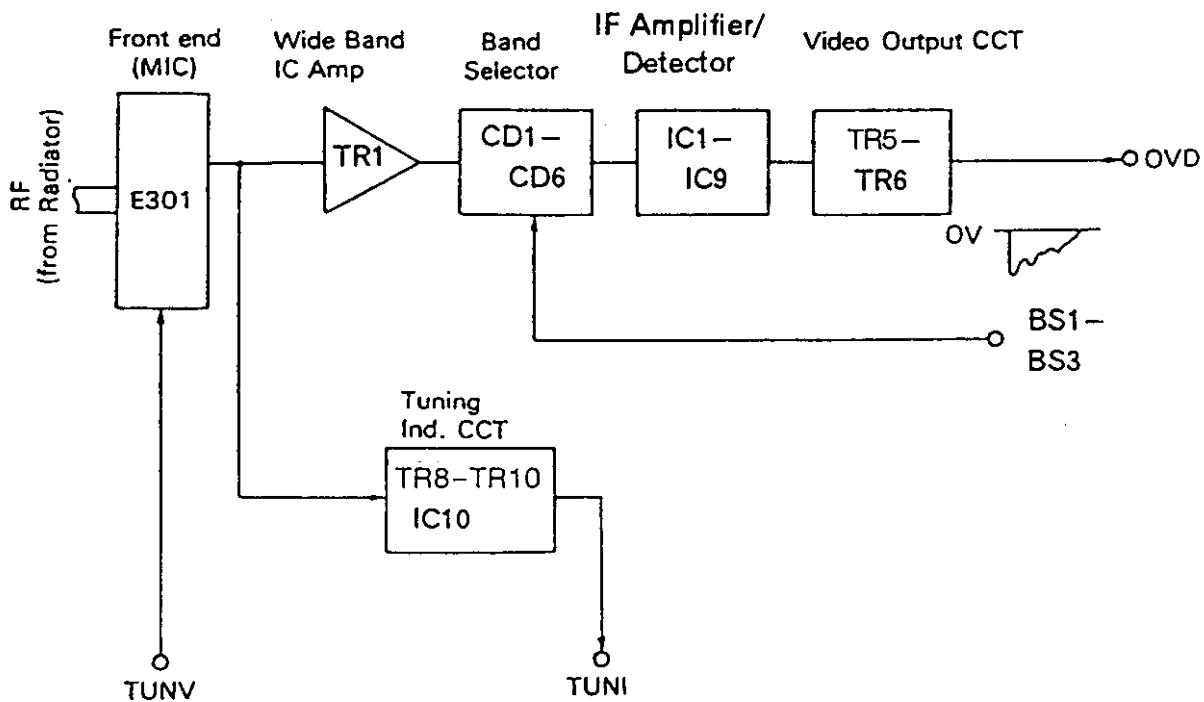


Fig. 4-4 RECEIVER UNIT BLOCK DIAGRAM

Video Output Circuit

The video output circuit at CAE-344-2 consists of emitter follower TR5 and TR6. 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. The video signal is shown in Fig. 4-4.

Tuning Indication Circuit

The tuning indicator circuit at CAE-344-2 consists of amplifier TR8 and TR9, detector TR10, and emitter follower TR10. TR10 discharges C77 to the detected signal voltage. This voltage is sent to the display unit as a tuning indication voltage via buffer amplifier IC10. The range of the tuning indication voltage varies normally between +4V (detuned) and -0.7V (peaked tuning in long pulse).

(CME-261)

ATT Driver Circuit

The PIN Attenuator driver IC6, TR12 is controlled with DC bias (EPWR) and Main Bang Suppression (MBS) trigger, via TR12.

This circuit will drive the PIN Diode to control the microwave power fed to the MIC in the receiver unit (to desired level). These levels are controlled to 1/1, 1/2, 1/4, 1/10 of the peak output power, and MBS will always be applied.

Motor Control Circuit

This circuit will drive the scanner motor for constant rotation of the antenna array. After the TX switch on the display unit is set to "X-MIT", the ship's main, is fed to this circuit. and TR14 ~ 17 will go to ON. The motor will start to rotate.

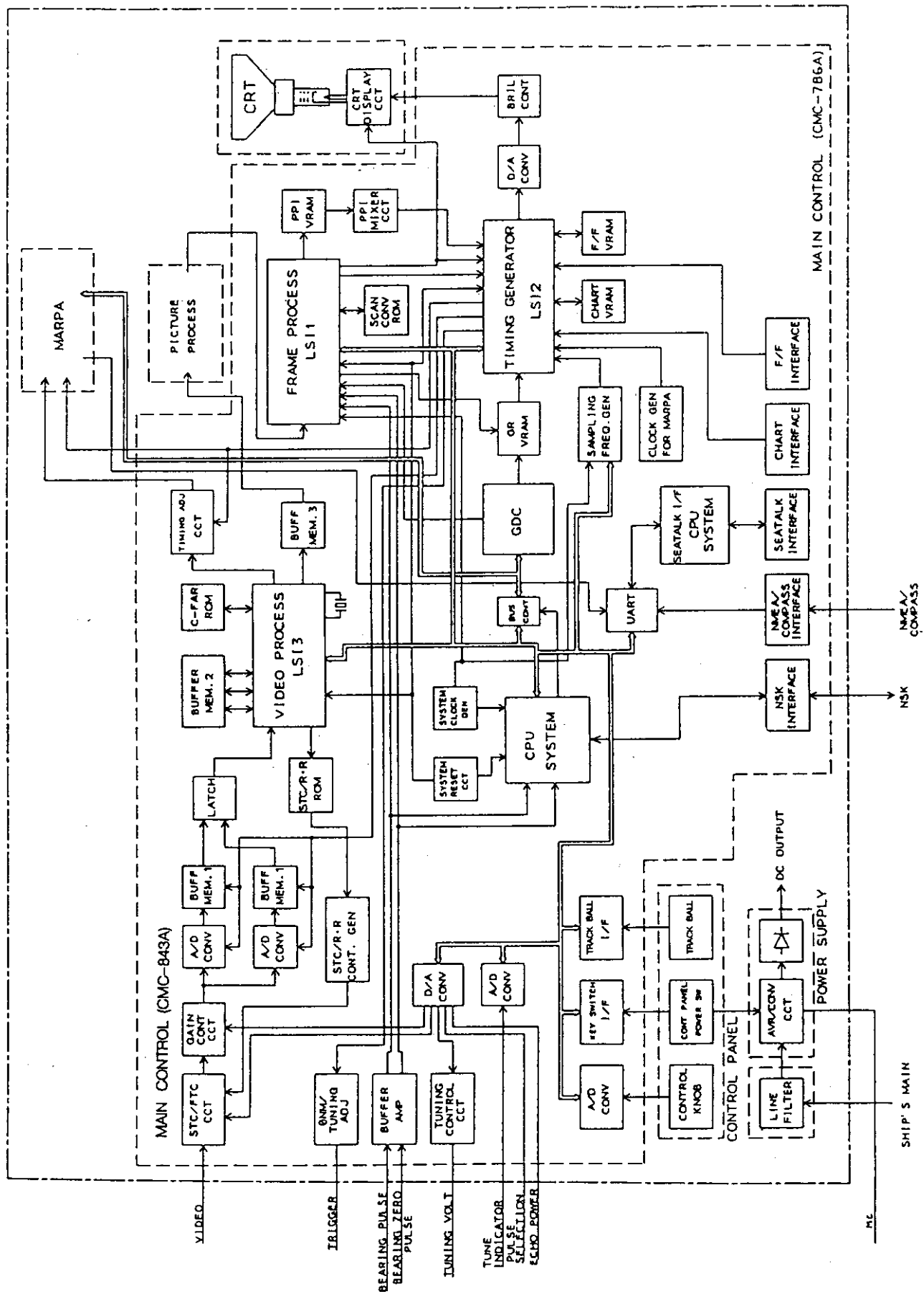


Fig. 4-5 DISPLAY UNIT FUNCTIONAL BLOCK DIAGRAM

4.5 DISPLAY UNIT

The display unit normally contains the Main Control PCB, the Power Supply PCB, the Power Filter PCB, MARPA PCB, the CRT and the CRT Display Control PCB, and the Control Panel PCBs. If separately ordered, the display may also include the optional NSK PCB.

4.5.1 SIMPLIFIED BLOCK DIAGRAM

Fig. 4-5 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 PCBs (CMC-1037, CMC-1038). It is on these PCBs that most of the signal processing takes place. The following is a brief description of the main circuit functions of the display unit.

4.5.2 MAIN CONTROL PCBS

4.5.2.1 VIDEO INPUT CIRCUITRY(CMC- 1038)

The incoming video signals from the receiver in the scanner are first routed through the GAIN and STC circuit components consisting of TR1, TR2 and TR3. The GAIN signal is fed from IC3, the STC signal is fed from IC4, IC5 and IC17 and Rain Rate signal is fed from IC3, IC6 and IC18 generated by IC47 in CMC-1037. The IC17, IC18, R108 and R109 are D/A converters. The data of these ICs are supplied from PROM IC47. Next stage, video signals are passed through the FTC circuit consisting of CD6, CD7, R29 and R30.

The diode CD6 and CD7 are controlled by the voltage supplied from IC7 which is determined by the front panel RAIN CLUTTER control.

4.5.2.2 A/D CONVERTER(CMC- 1038)

The A/D converter changes the incoming video signal from analog video signals into 8 bit digital signals. The A/D converter consists of IC12 - IC13. Since the conversion must occur at high speed, two A/D converter ICs are used. The digitized video output is then sent to IC14 to IC15 the Video buffer memory.

4.5.2.3 BUFFER MEMORY(CMC- 1038)

IC14 and IC15 are buffer memories capable of 2K word x 8 bit dual port input data and output data handling. The buffer memories are used to temporarily store the digitized video input signals according to the clock timing for the range scales in use for the video processor.

4.5.2.4 LSI1(IC60) & LSI2(IC78)/VIDEO MIXER, SAMPLING CLOCK GENERATOR(CMC- 1037)

The LSI1(IC60) receive the Bearing Pulse signal (BP) generated by the antenna motor/encoder assembly to synchronize the timing of the scan converter and to control the various clock inputs and outputs for the video memory and display. When the bearing pulses are received, IC60 generates the system trigger at TIYLOU and is sent over to LSI2 (IC78). IC78 also generates the radar transmit pre-trigger at TIYL2. This trigger signal is sent over to IC11 where the 0 - NM delay timing adjustment is applied. The outputs at IC11 provide complimentary drive signals to TR12 and TR13. These amplifiers boost the output transmit trigger (TRIG) level to +12VDC in amplitude.

The Sampling Clock Generators consist of VCO (Voltage Controlled Oscillator), along with IC83 and IC84. The VCO operates from 23 MHz to 55 MHz. This is the reason the Variable Range Scale is stepped by 1/2, 1/3, 1/6 each range scale. Totally JMA-3810 radar has 0.125, 0.25, 0.375, 0.5, 0.75, 1, 1.25, 1.5, 1.75, 2, 2.25, 2.5, 3, 3.5, 4, 4.5, 5, 6, 7, 8, 9, 10, 12, 14, 16, 18, 20, 24, 28, 32, 36, 40, 48, 56, 64, 72 NM. JMA-3811 has 36 range scales.

The LSI1 can perform additional processing functions on the video signal when activated in menu. They are:Wakes Processing, Zoom Processing, Target Expander Processing, true motion and signal integration.

The Expander Processing is performed by extending by the target digital video pulse length up to 8 additional digital video cells whenever target expansion is enabled in the menu.

4.5.2.5 LSI3/VIDEO PROCESSOR

The interference rejection processing is performed by LSI3 comparing the bit-by-bit content of the digital video stored from each successive radar transmission whenever the IR function is enabled by the operator.

The sampling clock oscillators generate the frequencies necessary to create the various timing signals including those used for controlling the processing of the digital video signals into the memories. The various timing signals are generated by LSI2.

4.5.2.6 VIDEO MEMORY(CMC- 1037)

The start of the data readout of the video buffer memory is triggered on the trailing edge of the Bearing Pulse from the scanner unit. This clock is used for data processing in LSI1. The processed video which has passed through LSI1 is now transferred to the video memory IC61 through IC64.

These ICs are VRAM consisting of $512 \times 512 \times 8$ memory planes which are used to produce the video picture (including wakes) data.

The address signals used to write into and read out of the video memory are generated in LSI1. The output data from the video memory is entered into LSI2(IC78), the video signal mixer/processor.

4.5.2.7 CONTROL PCBs

The JMA-3800 series radar use two separate Keypad Control PCB assemblies to activate the radar system and control its functions. These Keypad Control PCBs interface directly into the Main Control PCBs via connectors J411 and J412 to IC37 and path through the I/O port IC25 - IC26 and the CPU.

Panel B contains 2 of the 20 key switches used by radar. PC403, on the right side of the front panel A, contains the remaining 18 key switches and the four variable controls for the TUNE, GAIN, FTC and STC. Each panel includes LEDs for backlighting the keyboard panels and the LED intensity can be controlled in 8 levels of brightness by the menu selection via the DIM line. The operating voltage for the LEDs originates at IC31 and IC36 on the Main PCB.

4.5.2.8 CPU & GCM (GRAPHIC CONTROL MEMORY)

This radar uses an 16bit CPU (IC1), and a Graphic Display Controller (IC27) to principally control the graphic system of the on-screen display of VRM, EBL, Bearing Scale, Range Markers, and other graphic characters. The CPU receives operating instructions from the 4Mbit EPROM in IC10 and system setting stores data in the 128Kbits of RAM available in IC11. The RAM memory has a battery backup through CD2 so that the settings of Range, EBL, VRM, EXP, and IR will be maintained in memory after each shutdown of power.

The GDC (Graphic Display Controller) paints the various character data, VRM, EBL, Range marker, etc. under direction of the CPU to graphic VRAM memories IC34 - IC40.

4.5.2.9 VIDEO OUTPUT

In IC78, data which has been written into the Video Mixer/Processor by the range and sample clock timing signals will now be read out to the CRT monitor in raster scan timing; that is, the Horizontal frequency of 24KHz and 60Hz Vertical frequency.

The 3 bit digital video signals are reconverted into analog video signals having 8 levels and outputted to the buffer amplifier TR6. The graphic data is also mixed in IC78. When the brilliance control is changed, the brilliance control signal is outputted from D/A converter IC31 at CMC-1038 and applied to IC85. The CRT brilliance will be varied in 8 steps. The combined video signals (radar targets and display graphics) along with the horizontal (HS) and vertical (VS) synchronization signals are sent to the monitor display. When the Power Save mode is operated, the SAVE signal is applied to the monitor display too.

4.5.2.10 DISPLAY MONITOR

The Display monitor receives its operating supply voltage from the +25VDC supplied by the Power Supply PCB. The video signal is sent to TR1 through TR5 amplifiers before coupling to the CRT cathode. RV1 sets the contrast level of the video for the CRT.

The horizontal sync signal operates the horizontal oscillator IC1. The oscillator provides the drive to run the HV flyback transformer and generate the operating voltages for the CRT as well as the horizontal deflection coil.

The vertical sync signal operates the Vertical oscillator IC2. The oscillator output at VOUT drives the vertical deflection coil.

Traditional adjustments are provided to set the focus, CRT brightness, vertical hold, size, and linearity, horizontal hold, and the video contrast.

The CRT is mounted and arranged in the "portrait" mode in the JMA-3800 series radar. Therefore, the horizontal adjustments will effect the vertical picture and vice-versa, the vertical adjustments will effect the horizontal aspects of the picture.

4.5.3 OPTIONAL INPUTS

The JMA-3800 series radar can receive various input signals from Nav aids and Flux Sensors, Fishfinders, Raychart Units, and Seataalk Data networks. The inputs from the JRC JFV-850 and JFV-8010 Fishfinders and from the Raychart Units are digital video and the horizontal/vertical sync signals to drive the JMA-3810 display. The Inputs from the flux sensor and Nav aids will be digital data conforming to the NMEA0183, JRC serial, to drive various radar features such as Waypoint Mode or the MARPA.

If more than one data type is present at the radar inputs (for example; flux sensor 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. GYRO/LOG Data (CMJ- 304B/304C including the kit of MDLW11031)
2. Flux Sensor (NMEA0183 " HDG, HDM, VHW, HDT " sentence)
3. Navaid Data (NMEA0183 " RMC, RMA, VTG " sentences)

POSITION: 1. Navaid Data (NMEA0183 " RMC, RMA, GLL, GTD " sentences)

SPEED: 1. GYRO/LOG Data (CMJ- 304C including the kit of MDLW11031)
2. Navaid Data (NMEA0183 " RMC, RMA, VTG, JRC FORMAT " sentences)

WAYPOINT: 1. Navaid Data (NMEA0183 " RMB, BWC " sentences)

The NAVAID input is connected at J403 pins 1 and 2. The signal is coupled via J409 to IC106 (Optical Isolator), to Inverters IC102, to the UART IC92, and finally to the CPU IC1.

The HEADING data input essentially follows a similar route. The signal is connected at J403 Pins 3 and 4, coupled via J409 to IC107 (Optical Isolator), Invertors IC102, to the UART IC92, and finally to the CPU IC1.

4.5.4 POWER SUPPLY (CBD- 1426)

The Power Supply converts the ship's DC input voltage to the necessary DC voltages to operate the radar system. These output voltages include regulated +25VDC, +15VDC, -15VDC, +5VDC, +30VDC and +360VDC.

The power supply can begin operation when the STBY/OFF switch is pressed on the Control PCB. The STBY signal toggles IC3 - 11 output and TR6 conducts. This enables the Vcc supply to the AVR converter circuit. When the X-MIT/OFF key is pressed, IC4 - 13 operates TR10 and TR15 to enable the OPE output.

The AVR consists of IC1, IC2, as well as TR1 and TR2. IC2 controls the switching of the power FETs TR3 and TR4. Sensing of the AVR output occurs from the output of +5VDC line, sampled via RV1, compared at IC7 and controlled via IC1 - 6 to the AVR. RV1 is normally set by monitoring the +5VDC output at TP2 and adjusting for +5VDC, $\pm 0.1\text{VDC}$.

When both the **STBY/OFF** and **XMIT/OFF** keys are pressed together, IC3 resets IC4 output and shut off the Vcc from the AVR IC1. This will turn the power supply and the radar system to OFF.

4.5.5 MARPA PCB(CDC- 826- 1)

When the MARPA is used in the radar display, acquisition and track calculations of the targets movement are performed and can provide predictions of the targets course, speed and CPA and TCPA to own ship if essential data is input to the MARPA unit.

Necessary inputs to the MARPA include:

- Magnetic or True Heading Data
- Speed of Own Ship data
- Target Video
- Bearing Pulse data
- SHM data

The Heading data and speed of own ship are ordinarily provided by the NSK unit, NMEA or Seataalk inputs to the radar, while the target video, bearing pulse data and SHM signals are available in the display unit.

The MARPA outputs include video symbol and vector data, graphic calculation data, buzzer activate command.

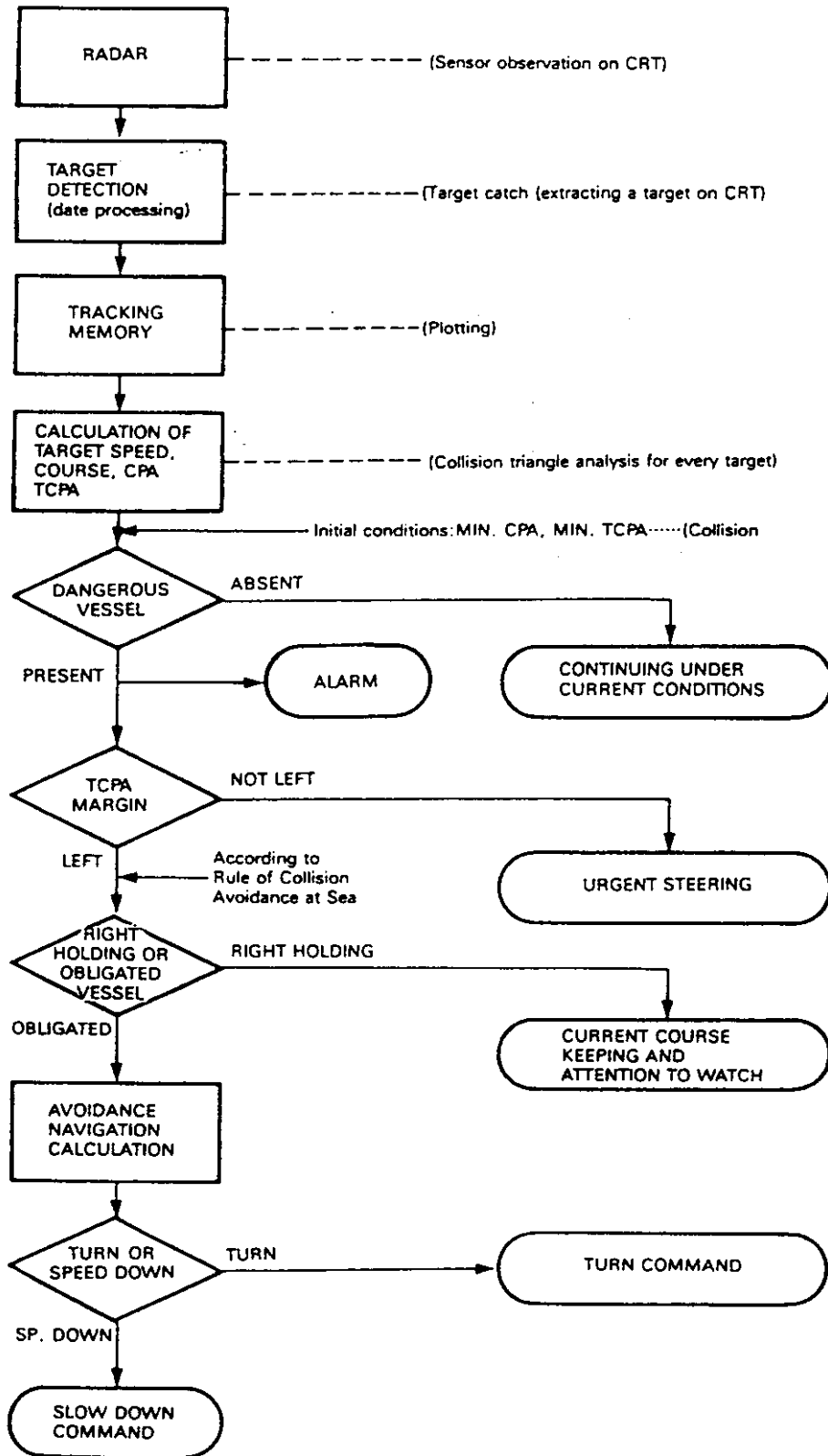


Fig. 4-8 MARPA LOGIC

SECTION 5

MAINTENANCE

5.1 GENERAL

The purpose of this section is to provide servicing instructions to the service technician. The JMA-3800 Series Radar is designed to provide long periods of trouble-free operation, however it is recognized that environmental and other factors may result in a need for occasional service.

WARNING

This radar equipment contains high voltage. Adjustments require specialized service procedures and tools only available to qualified service technicians, and there are no user serviceable parts or adjustments. The operator should never remove the radar unit cover nor attempt to service this equipment. For technicians servicing this equipment, it is important that you comply with all safety precautions set forth in this manual.

5.1.1 PRODUCT AND CUSTOMER SERVICE

In the event that your JMA-3800 Series Radar is in need of service, the dealer from whom the radar was purchased, or an authorized JRC dealer should be contacted for assistance. The authorized JRC dealer is best equipped to handle your inquiries. If, after contacting your dealer, you have further questions and require further assistance, you may contact Japan Radio Company directly.

WARNING

A mechanical hazard exists from the internal rotating gears of these antenna systems. Use extreme caution when working on or around these antenna systems. Always secure the radar power at the main breaker panel before attempting any work on the antenna system.

5.2 PREVENTIVE MAINTENANCE

Continuous satisfactory operation of the radar can depend on how well you take care of your equipment. These simple maintenance tips can save you time and money, and help you avoid premature equipment failure.

1. Always keep the equipment as clean as possible. Remove dirt, dust, or water-spray from the display and antenna during boat clean up.
2. During routine ships maintenance, make a thorough inspection of the radar system including the following points:
 - a. Check all hardware for tightness.
 - b. Check for evidence of any corrosion of the scanner unit, display unit, or its cable and connectors. Clean as required.
 - c. Check the cable connections and terminal strip connections for cleanliness and tightness. Make sure the wiring is free from chafing or abrasions.

5.2.1 HIGH VOLTAGE ARC PREVENTION

High voltage components within the MTR assembly and the display unit must be kept clean and dust free to prevent the possibility of HV arcing. Diesel soot and dirt should be removed with a sash brush and dry cloth.

5.2.2 INSPECTION (MONTHLY INTERVALS)

During routine ships maintenance, make a thorough inspection of the radar system including the following items:

1. Check all hardware for tightness.
2. Check for evidence of any corrosion on the scanner unit/and display unit, or cable and connectors. Clean as required.
3. Check the cable connections and terminal strip connections for cleanliness and tightness. Make sure the wiring is free from chafing or abrasions.

5.2.3 CLEANING (MONTHLY INTERVALS)

Wash the exterior of the pedestal and array with fresh water. Clean the face of the display unit with a clean, soft, lint - free cloth slightly dampened with fresh water.

WARNING

A mechanical hazard exists from the internal rotating gears of these antenna systems. Use extreme caution when working on or around these antenna systems. Always secure the radar power at the main breaker panel before attempting any work on the antenna system.

5.2.4 LUBRICATION

Pedestal should be lubricated every 6 months as follows.

Pedestal Motor Gear Lubrication (Semi-Annual Intervals)

1. De-energize radar equipment at the main breaker panel and place pedestal safety switch to OFF.
2. Remove antenna motor.
3. Apply general bearing grease compound, Mobilux No.2 of the Mobil Oil Company or an equivalent, to motor gear and also internal antenna bull gear through motor mounting hole. Rotate antenna array in order to properly coat entire gear.
4. Reassemble antenna motor.
5. Place Pedestal safety switch to ON.
6. Reapply power to the radar equipment.

5.2.5 CONNECTOR MAINTENANCE

(SEMI-ANNUAL INTERVALS OR AS REQUIRED)

During installation and maintenance, it is recommended that Dow Corning Compound #4 silicone grease or equivalent be inserted inside the power and control cable connectors on the rear of the display unit. This silicone grease is an insulator and may be used to protect RF, power, and control connector pins from the corrosive effects of the marine environment.

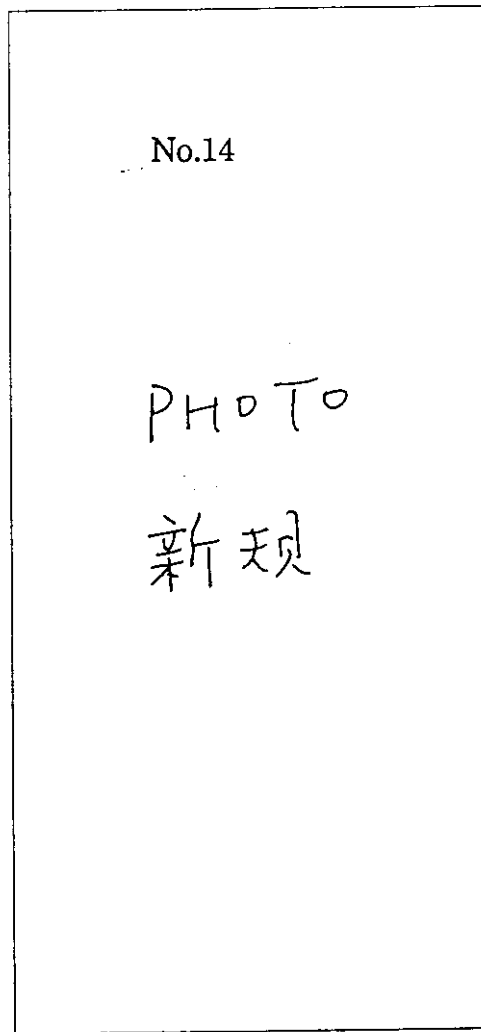
Carefully squeeze a small amount of DC-4 compound inside the connector on the pins. Do not fill the entire connector cavity. When the connector is installed, the DC-4 compound seals out the air preventing any possibility of pin corrosion.

CAUTION

NEVER USE RTV OR SILICONE SEALANT WITHIN ELECTRICAL CONNECTORS. DC-4 COMPOUND IS SPECIFICALLY DESIGNED FOR THIS PURPOSE.

5.2.6 GASKET MAINTENANCE (SEMI-ANNUAL INTERVALS)

Every 6 months Pedestal gaskets should be carefully lubricated, using silicone grease (Dow Corning #4 or equivalent). The primary locations to lubricate with this grease are shown in figure 5-2.



Gasket

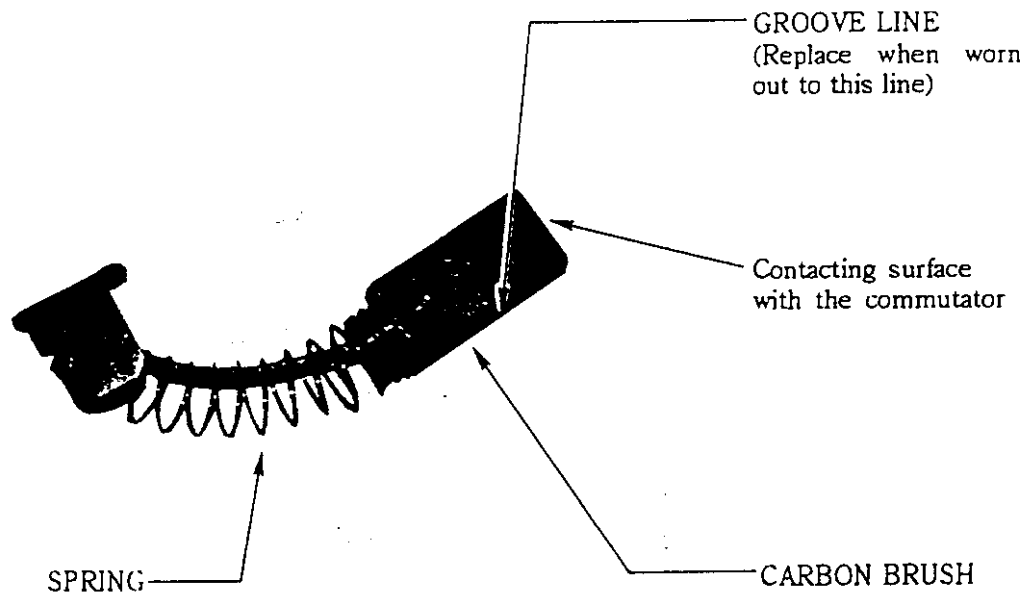
Fig.5-2 GASKET LUBRICATION

5.2.7 ANTENNA PEDESTAL BRUSHES REPLACEMENT PROCEDURE (ANNUAL)

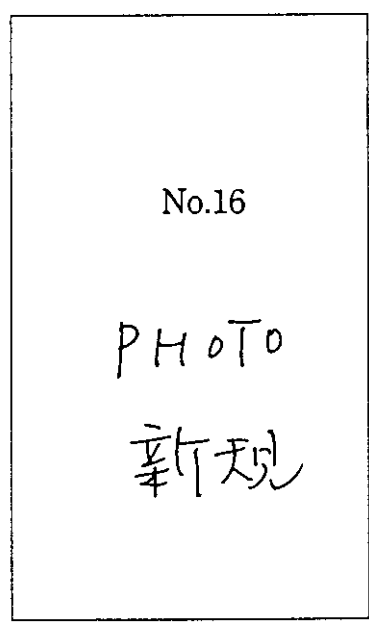
Part of the routine maintenance program should include a periodic inspection of the condition of the motor brushes and commutator segments after every 200 hours of use. The useful life of the brushes is approximately 3000 hours. The brushes should be replaced when they have worn to the groove located at one-half its length.

The commutator of the motor should be inspected for wear and cleaned of excess carbon buildup. To clean and polish the commutator segments, use a common pencil eraser.

In order to access the motor brushes, unscrew the four securing bolts around the pedestal housing and open the unit. Unscrew the two motor brush holders located on either side of the antenna motor and remove the brushes. Inspect for wear as shown, replace with new brushes if worn to line on the body of the brush as shown in the drawing.



Description	Type	Part Number
Motor Brushed	S00152-5C-70	BRXP00918



Motor Brush

To clean the commutator segments, removing the modulator assembly will provide a clear access to the motor assembly. Loosen the four phillips screws holding the chassis. Slide the assembly upward to clear the RF port and lay aside.

NOTE: Before removing the transmitter module, unplug J103 from the Scanner Control PCB (Heading ref. generator).

Fig. 5-3 ANTENNA PEDESTAL BRUSH LOCATIONS

5.2.8 BATTERY REPLACEMENT (CMC – 1037) [EVERY 2 YEARS]

The Lithium Battery (BT1) on the Main Control PCB (CMC – 1037) should be replaced every 2 years or as required when the voltage reaches 2.00 Vdc. The purpose of this onboard battery is to maintain certain memory functions such as the hour meter, last position of Range Rings, EBLs, VRMs, etc., when the radar is switched off. If the Display Unit does not return to the "last used" condition of those functions (i.e., Range, Range Rings, EBLs, VRMs, etc.) when the unit was turned off, then the Lithium Battery (BT1) should be replaced per the following procedure.

1. De – energize the radar equipment by securing the input power to the Display Unit.
2. Remove the Display Unit interconnect cable and power cable.
3. Remove the Display Unit cover (10 screws) and the Main Control PCB (CMC – 1037) from the chassis.
4. With soldering iron and de – soldering tool remove battery BT1 from the Main Control PCB. Use caution not to short out battery leads.
5. Install replacement lithium battery (P/N 5ZBBA00006). Check that battery voltage is greater than $3.00 \pm .2$ Vdc. If less than 2.50 Vdc, the battery may not be used and should be replaced with new battery before voltage drops below 2.00 Vdc (Battery TYPE CR–2032 3V).
6. Replace Main Control PCB and rear cover.

5.2.9 CRT SURFACE CLEANING

The surface of the cathode–ray tube may, in time, accumulate a film of contaminants which tends to dim the picture.

Be sure Radar is "OFF", use glass cleaner and soft cloth or towels to clean CRT glass, key board, and display cabinet.

5.2.10 FUSE

A fuse seldom opens 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 5–1 shows a table of fuses employed in the equipment.

TABLE 5–1 FUSES USED

Location	Part No. Current	Rating circuit	Protective	Type	Remarks
DISPLAY	F401	10A	Scanner motor	Glass tube	10A dc 12V
DISPLAY	F401	6.3A	Scanner motor	Glass tube	6.3A dc 24V,32V
DISPLAY	F402	15A	All circuit	Glass tube	15A dc 12V
DISPLAY	F402	8A	All circuit	Glass tube	8A dc 24V,32V

5.3 OPERATIONAL CHECKOUT

Turn the radar on.

The clock will count down, showing the remaining warm-up time. After approximately 90 seconds, the unit will beep and "ST-BY" will be displayed on the CRT.

If you are unfamiliar with the operating controls of this radar, please take a few moments to familiarize yourself by reviewing the operating instructions found in Chapter 3 – Operation.

Press the **X-MIT** key and look for the presence of radar targets on the screen. Check the operation of the **Range** selection keys for each range scale. Observe that the sweep is the correct length and has the proper number of range rings. Observe that the "ON-SCREEN" characters are positioned and focused properly.

After approximately 10 minutes of operation, check the TUNE control for maximum target returns occurring at the center of the TUNE control rotation.

If any readjustment of the Display Unit is required, check the instructions for alignment in the following sections or refer to the particular 5.4 – Alignment and Service.

TABLE 5-3 OPERATION CHECKLIST

Unit to be checked	Check item	Correct condition	Measuring point
Scanner Unit	a.Ship's main Input voltage	Refer to note	TB 102(M+ ~ M-)
	b.Input voltage	+15VDC -15VDC +360VDC	TB101-(+15) VDC TB101-(-15) VDC TB101-(+360) VDC
	c.Mag.current	12VDC	TB101-(M0)
Display Unit	a.Input voltage	Refer to note	J401-1-3
	b.AVR output voltage	5VDC	TP2-ground(PC501)
	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, 10.8VDC-42VDC

5.3.1 POST INSTALLATION SETUP ADJUSTMENTS

Following the operational checks, two alignments A) and B) are normally required for proper operation. The procedure for performing these adjustments are found in 5.4.2.10 (Bearing) and 5.4.2.9 (Display Timing).

They are:

- | | |
|--------------------------------|----------|
| A) Relative Bearing Adjustment | 5.4.2.10 |
| B) Display Timing Adjustment | 5.4.2.9 |

Other adjustments that may require touchup include:

- | | |
|--------------------------|----------|
| Video Circuit Adjustment | 5.4.2.8 |
| Antenna Height Selection | 5.4.2.11 |
| Interlace Adjustment | 5.4.2.12 |
| Buzzer Volume Adjustment | 5.4.2.13 |

All adjustments are made electronically using operations on the "Initial Setting" menu.

5.3.2 TROUBLE-SHOOTING GUIDE

While the JMA-3810 Radar are 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.

5.3.3 MASTER RESET

The first step in attempting to clear any problem associated with the general operation of this radar is to perform a SOFT MASTER RESET. This is done by starting with the radar turned off. Press and hold the **RANGE ▲** and **RANGE ▼** keys simultaneously. While holding these keys, press the **STBY/OFF** key to turn the radar on. The SOFT MASTER RESET will not reset the radar's initial settings (i.e. Bearing, STC, Tune, Timing, ...).

A HARD MASTER RESET is performed in a similar manner. The **RANGE ▲**, **RANGE ▼**, and the EBL keys are pressed simultaneously as the unit is powered on with the **STBY/OFF** key. This should be performed anytime a component or PCB within the Radar is replaced. This function will clear the radar's RAM and initial settings returning the radar to factory settings.

It should be noted that micro components within the Radar are generally not field replaceable. Therefore, most repairs to the radar typically go to the PC board level only. A replacements parts list for the JMA-3800 Series Radar system can be found in Section 6.

CAUTION

In making any measurements or other checks, be alert to the high voltage points existing throughout the equipment.

5.4 ALIGNMENT AND SERVICE

Although the radar is delivered from the factory adjusted for optimum performance, it may be necessary to make adjustments after a major component has been replaced or if a fault is suspected during operation.

The alignments detailed in paragraphs 5.4.2.9 through 5.4.2.11 should normally be accomplished when the radar is installed and/or when necessary.

REPLACEMENT ITEM	ADJUSTMENT REQUIRED	See Sect.#
Magnetron V201	Tuning	5.4.2.8
MIC Frontend E301	Tuning	5.4.2.8
Cathode-ray tube V501	Adjusting Centering Magnet	5.4.2.7
Display PCB	Adjusting contrast	5.4.2.2
	Adjusting focus	5.4.2.3
SHM Unit	Bearing Alignment	5.4.2.10

5.4.1 ANTENNA PEDESTAL RECEIVER ALIGNMENTS

The Antenna Pedestal Receiver alignments are normally not accomplished in the field due to the complexity and awkwardness of gaining access to the Receiver PCB. For the sake of completeness, however, we have provided the following Receiver alignment procedures.

NOTE

**Do NOT adjust or attempt to adjust L1 thru L8.
These are factory adjustments only.**

5.4.1.1 TUNE INDICATOR ADJUSTMENT

This adjustment matches the maximum tuning peak of Radar Video with the maximum tune bar deflection on the display. If both agree, this adjustment is not required.

1. Select the range scale 3NM above.
2. Adjust RV1 on the Receiver PCB(PC301) for the tuning level indication of 6 or 7 on CRT.

5.4.1.2 FACTORY ADJUSTMENTS

It is important to note that the tuning coils located on the Receiver PCB are primarily used to adjust for proper narrow/medium/wideband operation. These components set the IF Amplifier bandwidth and general receiver sensitivity.

These adjustments require specialized test equipment and are normally set at the factory. No adjustment to the receiver tuned circuits should be performed in the field.

5.4.2 DISPLAY ALIGNMENTS

HIGH VOLTAGE WARNING

Only qualified licensed service technicians should remove the equipment covers and service this equipment. This equipment contains High Voltage and requires specialized service procedures and tools only available to qualified licensed service technicians.

When aligning this equipment, all standard safety precautions must be followed.

The following display alignment procedures are to be performed after corrective maintenance to assure proper operation or at any time system performance is not as specified.

Remove all power to the display unit.
Remove the 8 screws at the rear of the Display Unit and Lower the rear panel to gain access to the Power Supply PCB.

Figure 5-4 details the Power Supply PCB adjustment and Figure 5-5 shows the locations of the CRT monitor PCB adjustments.

5.4.2.1 DISPLAY AVR VOLTAGE ADJUSTMENT

The following adjustment correctly sets the values of the output voltages on the Display Power Supply PCB (CBD-1426). Refer to FIG. 5-5 below while performing these adjustments.

1. Reconnect power to the radar system
2. Place the positive lead of a OVM to TP2 and the negative lead to ground.
3. Adjust RV1 so that reading on DVM is $+5.1 \pm .1$ VDC.

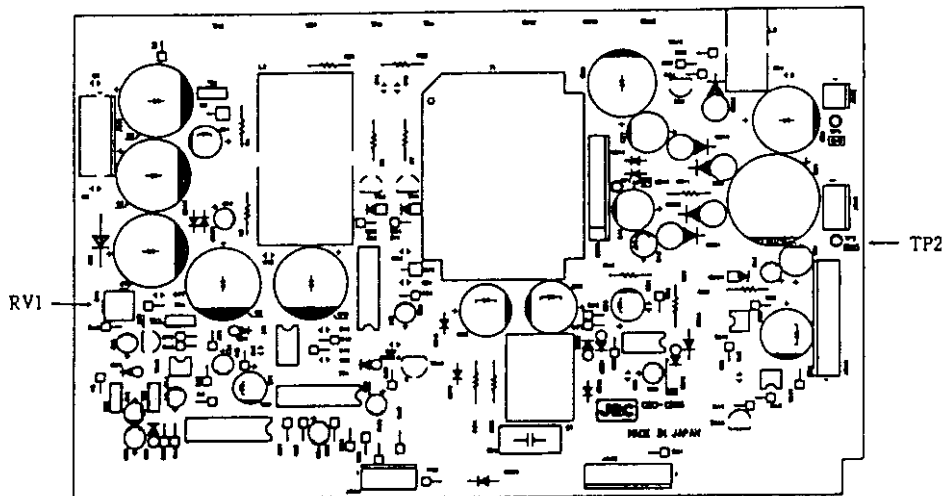


Fig. 5-4

4. Remove power and replace the display rear panel to its correct position.

5.4.2.2 CONTRAST ADJUSTMENT

1. Set front panel BRILLANCE to the maximum level.
2. Adjust RV1 on CRT Monitor PCB(PC405), so that PPI is of suitable brightness without losing sharp focus.

5.4.2.3 FOCUS ADJUSTMENT

Adjust RV7 on CRT Monitor PCB so that the range rings, EBL, and target video are clear and well defined.

5.4.2.4 HORIZONTAL HOLD ADJUSTMENT

Adjust RV2 on CRT Monitor PCB so that horizontal screen is in sync.

5.4.2.5 HORIZONTAL SIZE/VERTICAL SIZE ADJUSTMENT

Adjust LV1 and RV5 on CRT Monitor PCB so that the rings are round.

NOTE

Use a ruler to adjust for equal diameters in the N/S and E/W radius.

5.4.2.6 VERTICAL LINEARITY ADJUSTMENT

Adjust RV3 on CRT Monitor PCB so that the rings are round.

5.4.2.7 BEAM CENTERING ADJUSTMENT

Rotate the two tabs simultaneously or individually so that the beam center coincides with the center of CRT.

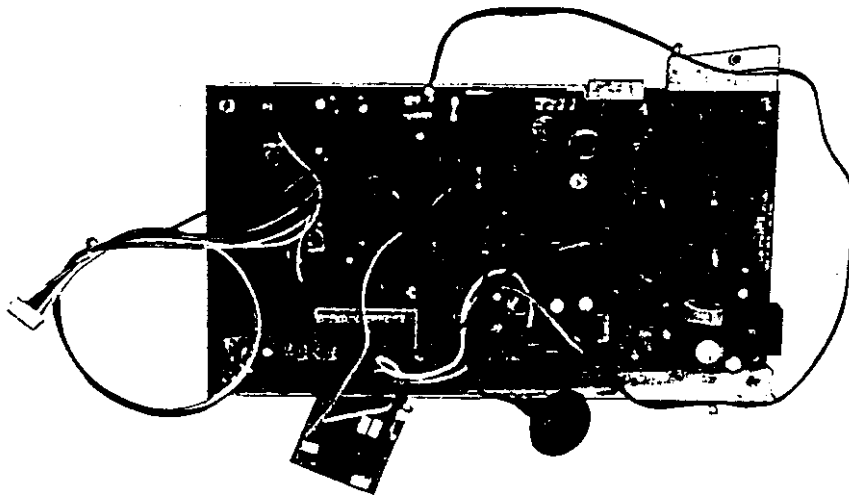


Fig. 5-5 CRT MONITOR ADJUSTMENTS

5.4.2.8 INITIAL SETUP ADJUSTMENTS

Before starting the initial adjustments verify the following control settings are in effect:

--- PANEL ---

Range Scale : 24NM.
[TUNE] knob : Center
[RAIN CL] knob : Full CCW
[SEA CL] knob : Full CCW
[GAIN] knob : Full CW

--- MENU/DISPLAY OPTIONS ---

" TUNE " : MANUAL
" PROCESS " : OFF
" ECHO PWR " : FULL

Press , and keys simultaneously to get " INITIAL SETTING " menu. Use the trackpad to select the desired menu item and press .

1) Preadjustment

Adjust the " Indicator Bar " level on the bottom of the screen as follows using the keys.

" ANTENNA HEIGHT " : 5-10m
" STC MAX LEVEL " : half(indicator bar level)
" GAIN MAX LEVEL " : half(indicator bar level)
" COMPARATOR SET " : quarter(indicator bar level)

2) TUNE PRESET ADJUSTMENT

Normal tuning of the radar should be indicated on the Radar Display by observing maximum target returns with the " TUNE " control at its mid scale position. If the maximum tune point is at the edge of the rotary adjustment, perform the following readjustment.

After about 10 minutes of operation:

- ① Set the radar to the 3NM range scale or above.
- ② Set GAIN for normal noise level on the display.
- ③ Set TUNE control of the front panel at mid scale position.
- ④ Select " TUNE PRESET " from " INITIAL SETTING " .
- ⑤ Adjust the " Indicator Bar " level on the bottom of the screen to get the clearest picture of the targets using and keys.
- ⑥ Press key.

3) COMPARATOR SET ADJUSTMENT

This function determines the threshold voltage for quantizing the received video signal into the digital video signal.

- ① Set **GAIN** and **RAIN CL** knobs fully clockwise.
- ② Select "COMPARATOR SET" from "INITIAL SETTING".
- ③ Adjust the "Indicator Bar" level on the bottom of the screen with the **RANGE ▲** and **RANGE ▼** keys so that the level is three steps down just before the noise base appears.
- ④ Press **ENTER** key.

4) GAIN MAX LEVEL ADJUSTMENT

This function will determine the suitable Receiver Noise Level at maximum gain.

- ① Set **GAIN** knob and **SEA CL** knob fully clockwise.
- ② Select "GAIN MAX LEVEL" from "INITIAL SETTING".
- ③ Check the output voltage of TP7 on main control (B) PCB CMC-843 using an oscilloscope.
- ④ Adjust the "Indicator Bar" level on the bottom of the screen, so that the voltage difference between the noise base level and the suppression level by **SEA CL** control will be about 0.05V, using **RANGE ▲** and **RANGE ▼** keys.
- ⑤ Press **ENTER** key.

5) STC MAX LEVEL ADJUSTMENT

The STC MAX controls how far out in range the STC gain reduction should be effective.

- ① Set **GAIN** and **SEA CL** knobs fully clockwise.
- ② Select "STC MAX LEVEL" from the "INITIAL SETTING" menu.
- ③ Adjust the "Indicator Bar" level on the bottom of the screen, so that the noise on the screen will disappear at 6NM, using **RANGE ▲** and **RANGE ▼** keys.
- ④ Press **ENTER** key.

6) READJUSTMENT

- ① Readjust "COMPARATOR SET".
- ② Readjust "TUNE PRESET".

5.4.2.9 **DISPLAY TIMING ADJUSTMENT (" O " NM ALIGNMENT)**

This is the radar timing adjustment to ensure that targets are at their proper range on the display unit. Display timing is most critical on the 1/8NM range.

- 1) Set the range at 0.125 NM.
-

- 2) Locate a dock, seawall or bridge on the display. Observe whether the radar target is straight on the display. If not, adjustment is indicated.
- 3) Press **MENU** + **ACQ/CNL** + **GUARD** for the initial setting menu. Then select "DISPLAY TIMING" with the Trackpad and press the **ENTER** key.
- 4) Adjust the "Indicator Bar" shown in the lower part on the display using the **RANGE ▲** / **RANGE ▼** keys so that the object appears to be straight on the display. Press the **ENTER** key when setting is correct.

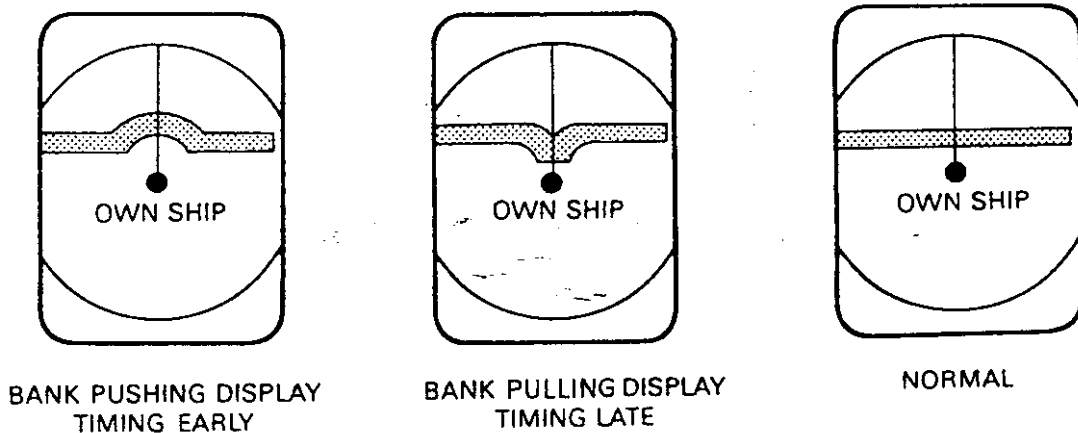


Fig. 5-6 0 NM ALIGNMENT

5.4.2.10 RELATIVE BEARING ADJUSTMENT

This alignment should be performed when the installation is complete to ensure that target returns on your display appear at their proper bearing with respect to the ship's bow.

Proceed as follows:

- 1) Identify a suitable target (e.g., ship or buoy, etc.), preferably between 1.5 and 3 NM in range on the screen.
- 2) Using an accurate means other than the radar (visual means) establish the relative bearing of the target.
- 3) Press the **MENU** + **ACQ/CNL** + **GUARD** key for the Initial Settings menu. Then select "RELATIVE BEARING ADJ".
- 4) Put the EBL 1 marker on the selected target using the trackball.
- 5) Press **ENTER** key.
- 6) Now move the EBL 1 marker to the desired bearing for the target measured in Step 2 using the trackball again.
- 7) Press **ENTER**. The targets will now be repositioned as desired on screen.

5.4.2.11 ANTENNA HEIGHT SELECTION

This selection chooses a proper STC curve according to the vessels radar antenna height. Select the antenna height nearest to the value matching your antenna location above sea level.

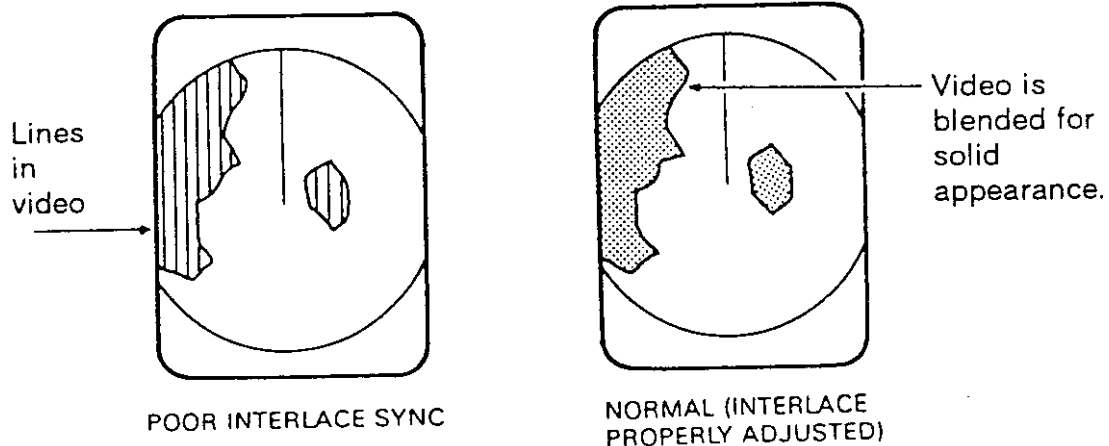
The values are 0–5m, 5–10m, 10–20m, over 20m.

1. Press **MENU** + **ACQ/CNL** + **GUARD** for the initial setting menu.
2. Select “ANTENNA HEIGHT” with the trackpad.
3. Select the desired value using the **RANGE ▲** **RANGE ▼** keys.
4. Press the **ENTER** key.

5.4.2.12 INTERLACE (SYNCHRONIZATION) ADJUSTMENT

This adjustment synchronizes the scanning line positions so that they are adjacent to each other. The ideal interlace adjustment occurs when there are no visible lines appearing in the video pattern. This is normally set at the factory and should not require field adjustment.

1. Select **MENU** + **ACQ/CNL** + **GUARD** for the initial setting menu and select “INTERLACE ADJ” with the trackpad. Press **ENTER**.
2. Adjust the “Indicator bar” shown in the lower part on the screen using the **RANGE ▲** **RANGE ▼** keys so that no separation between the lines (Blends) can be seen. Press **ENTER** to end.



5.4.2.13 BUZZER VOLUME ADJUSTMENT

At the time of shipment, the Buzzer sound has been adjusted to the maximum position. To lower the volume, perform the following .

- 1) Select **MENU** **ACQ/CNL** + **GUARD** for the initial setting menu with the trackball and press **ENTER** . Select BUZZER VOLUME.
- 2) Adjust the “ Indicator Bar ” shown in the lower part of the display using the down key for suitable buzzer sound level.
- 3) Press **ENTER** when finished.

5.4.3 FAULT FINDING PROCEDURES

Often the display on the CRT 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 5-4).

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

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 5-4 is the trouble shooting guide and check-out procedure. TABLE 5-5 shows typical voltages and resistances at significant points throughout the equipment. The internal resistance of the voltmeter used in these measurements was $20\text{k } \Omega / \text{V dc}$, $8\text{ k } \Omega / \text{V ac}$.

TABLE 5-4 TROUBLE SHOOTING GUIDE

	Trouble	Remedy
1.	Does not POWER-UP.	Check: Blown fuse F402. Check input power circuits. Faults of contact on PC404. Faults of power supply circuit on PC501. Faults of contact on connector of PC501. Faults of rectifier diodes on PC501.
2.	Scanner fails to rotate.	Check: Fault of S101. (Safety Switch OFF) Fault on contact on terminal boards. Fault of B101 CBP-136. Fault of drive mechanism.
3.	Scanner rotates but rotation of sweep is abnormal.	Fault of connection between CBP-136 Check: Fault of encoder (BP/BZ). Fault of main circuit for the Display Unit.
4.	No picture on the screen.	Fault of CRT display unit or its supply voltages. Check: Open heater of CRT. Fault of contact on CRT socket. Fault of contact on CRT cap. Fault of video circuit, and power save circuit.
5.	Only horizontal line screen.	There may be fault in vertical sweep generator, amplifier circuits and deflection coil. Check: Fault in vertical sweep generator, amplifier circuit.
6.	Incorrect sweep - Start of sweep is not centered on the screen. - Markers are oval.	Adjust CENTERING MAGNET. Adjust horizontal or vertical hold. Adjust vertical length and linearity. Adjust height as necessary.
7.	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: Fault of GAIN, STC control settings. Fault of receiver unit. Fault of contact on terminal boards and connector.

	Trouble	Remedy
8.	Noise and range on the screen but no echoes.	<p>If no transmission is present, check the modulator and magnetron.</p> <p>Check: If transmission appears to be present as indicated by the correct MAG.I reading on Tester. TB1, MO = Failure of Local Oscillator tuning If transmission appears to be present, carry out the Local Oscillator tuning procedures and check the MIC. Fault of the MIC Mixer. If no transmission is present, ensure the lead wire to magnetron is grounded to chassis. Fault of magnetron.</p>
9.	Poor sensitivity. Dim Echoes.	<p>Check: Reduction of transmitting output power. Fault of magnetron. ⇒ Check of MAG.I reading on</p> <p>Fault of MIC Frontend. Fault of CRT. Failure of Local Oscillator tuning. Failure of FOCUS adjustment. Failure of INTENSITY ADJ. Fault of video amplifier circuit on PC402. Fault of receiver unit.</p>
10.	No VRM or VRM cannot be controlled.	<p>Check: Fault of PC403. Fault of main circuit (PC401).</p>
11.	No EBL or EBL cannot be controlled.	<p>Check: Fault of PC403. Fault of main circuit (PC401).</p>
12.	No alarm zone marker, cannot be controlled or no alarm sound.	<p>Check: Fault of PC403. Fault of main circuit (PC401). Fault of Buzzer BZ1.</p>

TABLE 5-5

SCANNER UNIT JMA-3800 series (with Interunit Cable connected)

Measuring Point	Resistance (Ω)	Voltage(v)			FUNCTION
		0.125.1.5 (NM)	3.6 (NM)	12 (NM)	
+360	44K	360	355	360	+360V
TRIG	100	-0.09	-0.06	-0.05	Trigger
PW	12K	0	4.4	6.6	Pulse Width
+15	950	15.4	15.4	15.5	+15V
-15	11.5K	-16.7	-16.7	-16.7	-15V
EPWR	10K	0.4m	0.4m	0.4m	Reduce Power
MO	234	65m	0.2m	0.2m	TX Monitor
X1	7.2	8.06	8.06	8.06	MAG. Heater
VD	300	-0.13	-0.13	-0.13	Video
TNC	4.7K	15.7	15.7	15.7	Tuning Volt
TNI	∞	5.3	5.3	5.3	Tune Indicator
BP	0/ ∞	2.1	2.1	2.1	Bearing Pulse
BZ	0/ ∞	5.1	5.1	5.1	Zero Pulse
MC	∞	6.0	6.0	6.0	} Motor Control
M-	∞	} 24.0	} 24.0	} 24.0	
M+	∞				} Ship's Power

SCANNER UNIT(Interunit Cable disconnected)

Measuring Point	Resistance (Ω)	FUNCTION
+360	44k	+360V
TRIG	100	TRIGGER
PW	12k	Pulse Width
+15	950	+15V
-15	28k	-15V
MO	234	TX Monitor
$\times 1$	7.2	MAG. Heater
E	∞	Video
VD	4.7k	Tuning Voltage
TNC	∞	Tuning Indicator
TUI	∞	Bearing Pulse
BP	0/ ∞	Zero Pulse
BZ	0/ ∞	Motor Control
MC	∞	} Ship's Power
M-	∞	
M+	∞	

DISPLAY UNIT(Interunit Cable disconnected)

Measuring Point	Resistance (Ω)
L402 1	0.1
2	80×10
3	0.1
4	80×10
5	0.1
6	5.6×10
7	77×10
8	0.1
9	21.6×10
10	2×10
11	2×10
12	10×10^3
13	12×10^6
14	98×10^3
15	16×10^3
16	0.1
17	28×10^4
18	∞
19	42×10^5
20	35×10^3
21	12×10^2
22	30×10^6
23	0.1
24	∞

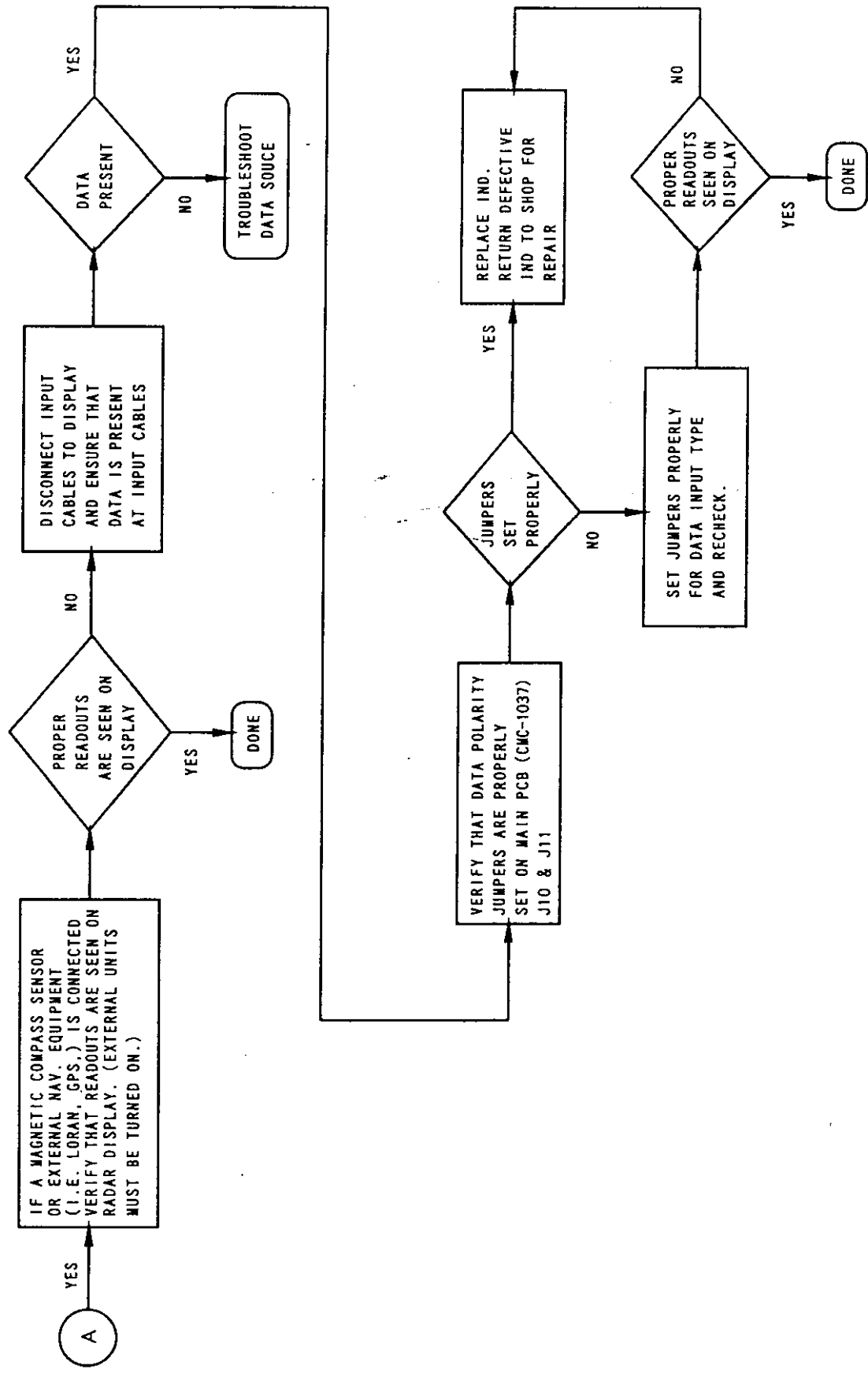


Fig. 5-7 RADAR SYSTEM TROUBLESHOOTING CHART (2 of 2)

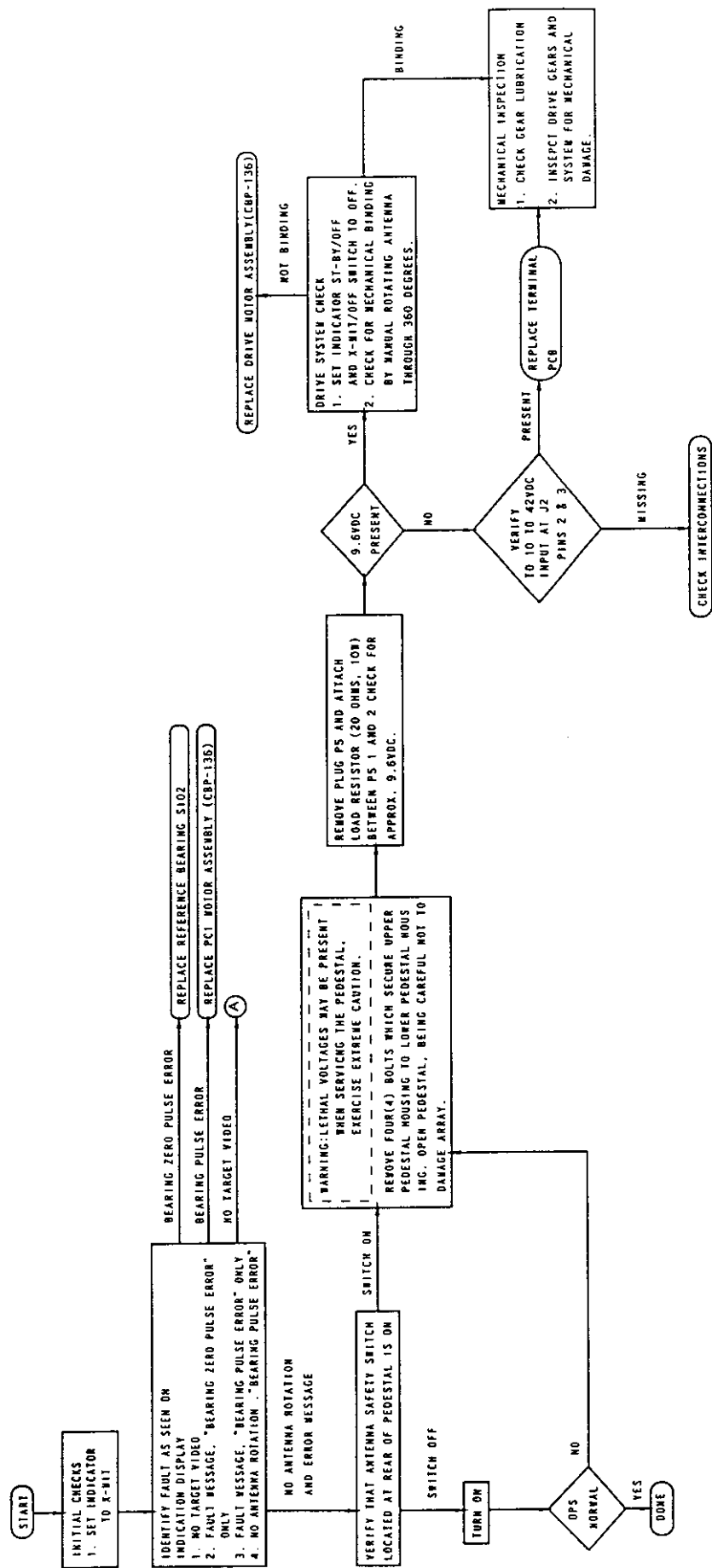


Fig. 5-8 ANTENNA UNIT TROUBLESHOOTING CHART (1 of 2)

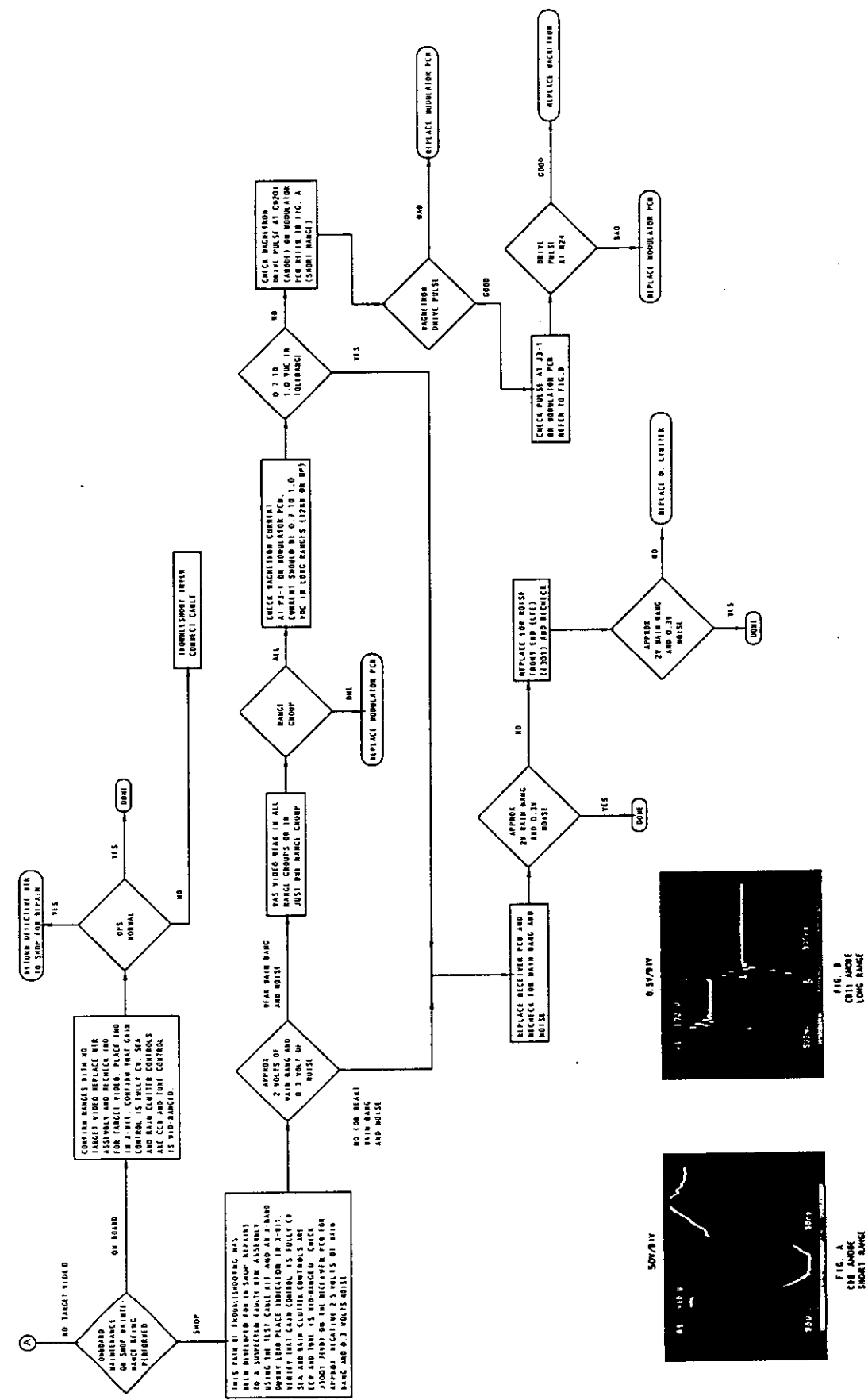


Fig. 5-8 ANTENNA UNIT TROUBLESHOOTING CHART (2 of 2)

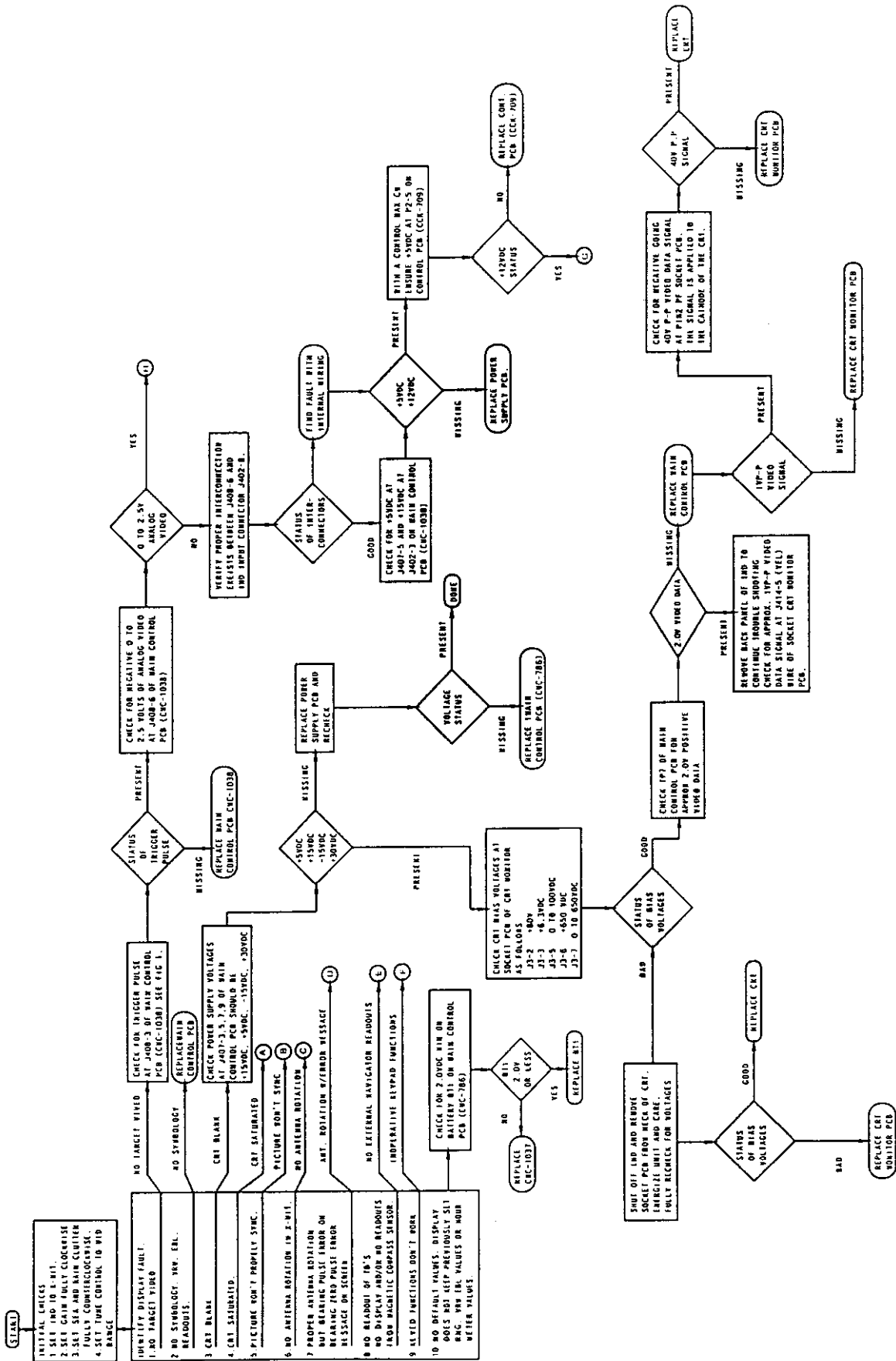


Fig. 5-9 SYSTEM TROUBLESHOOTING CHART (1 of 4)

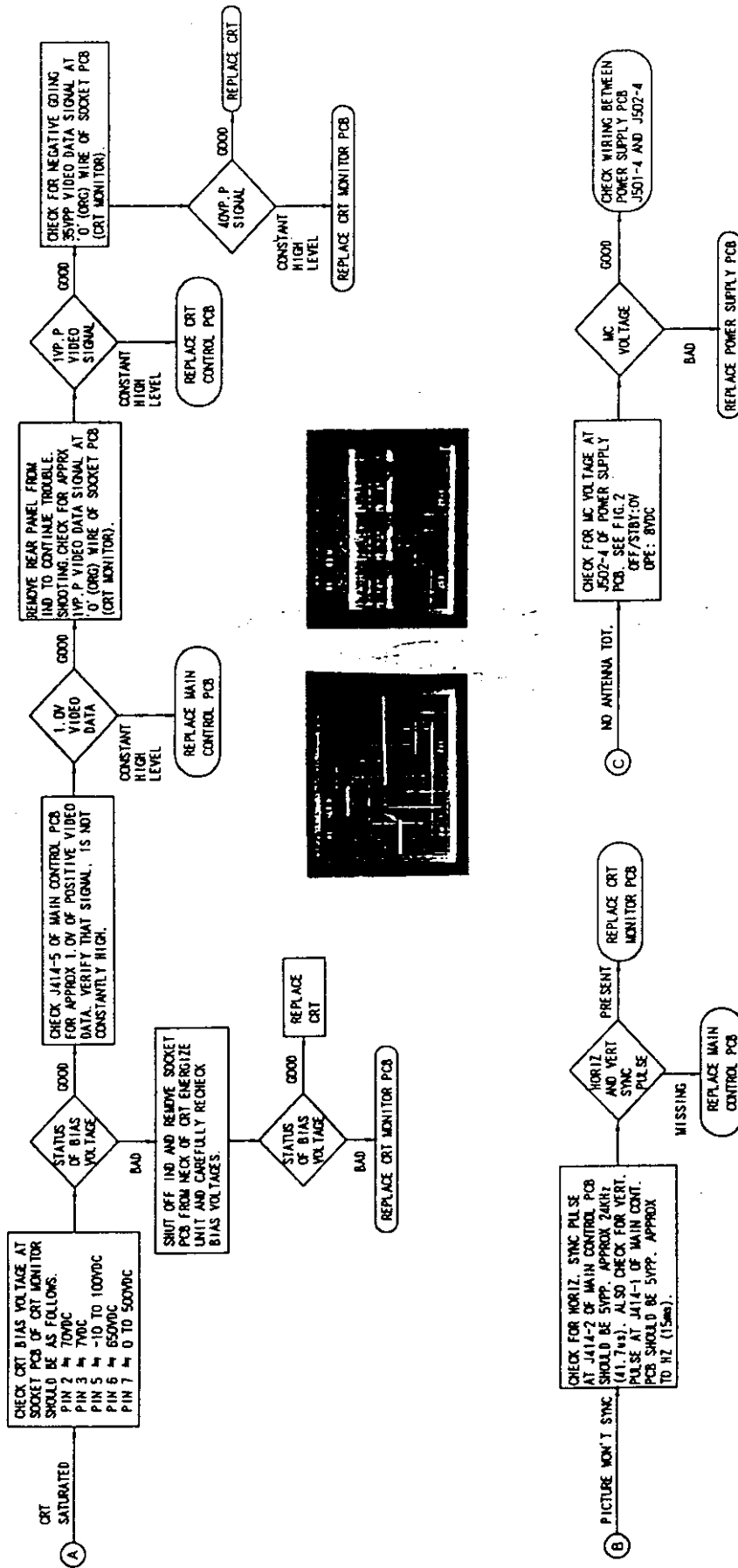


Fig. 5-9 SYSTEM TROUBLESHOOTING CHART (2 of 4)

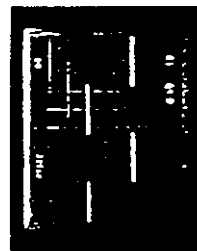
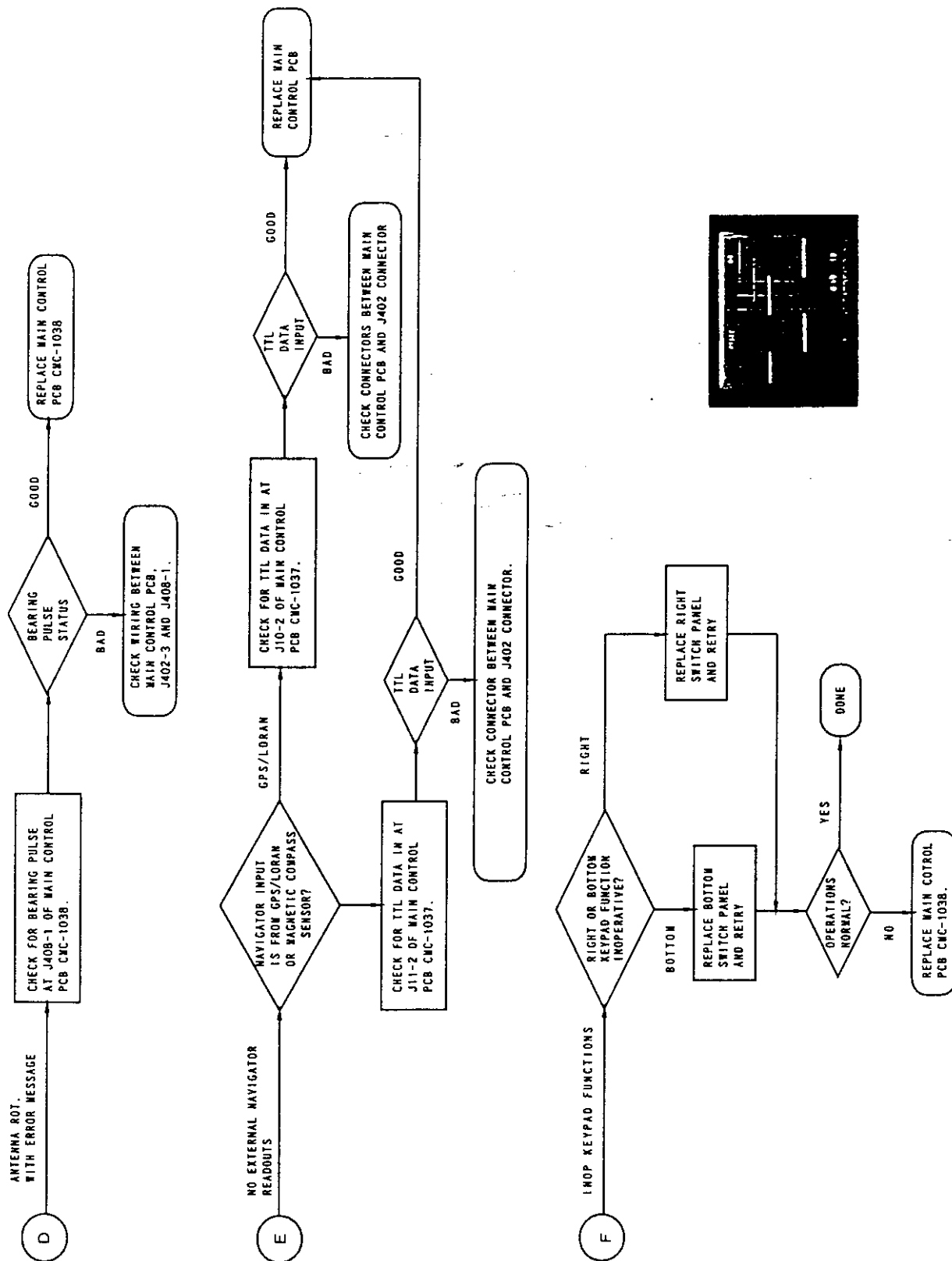


Fig. 5-9 SYSTEM TROUBLESHOOTING CHART (3 of 4)

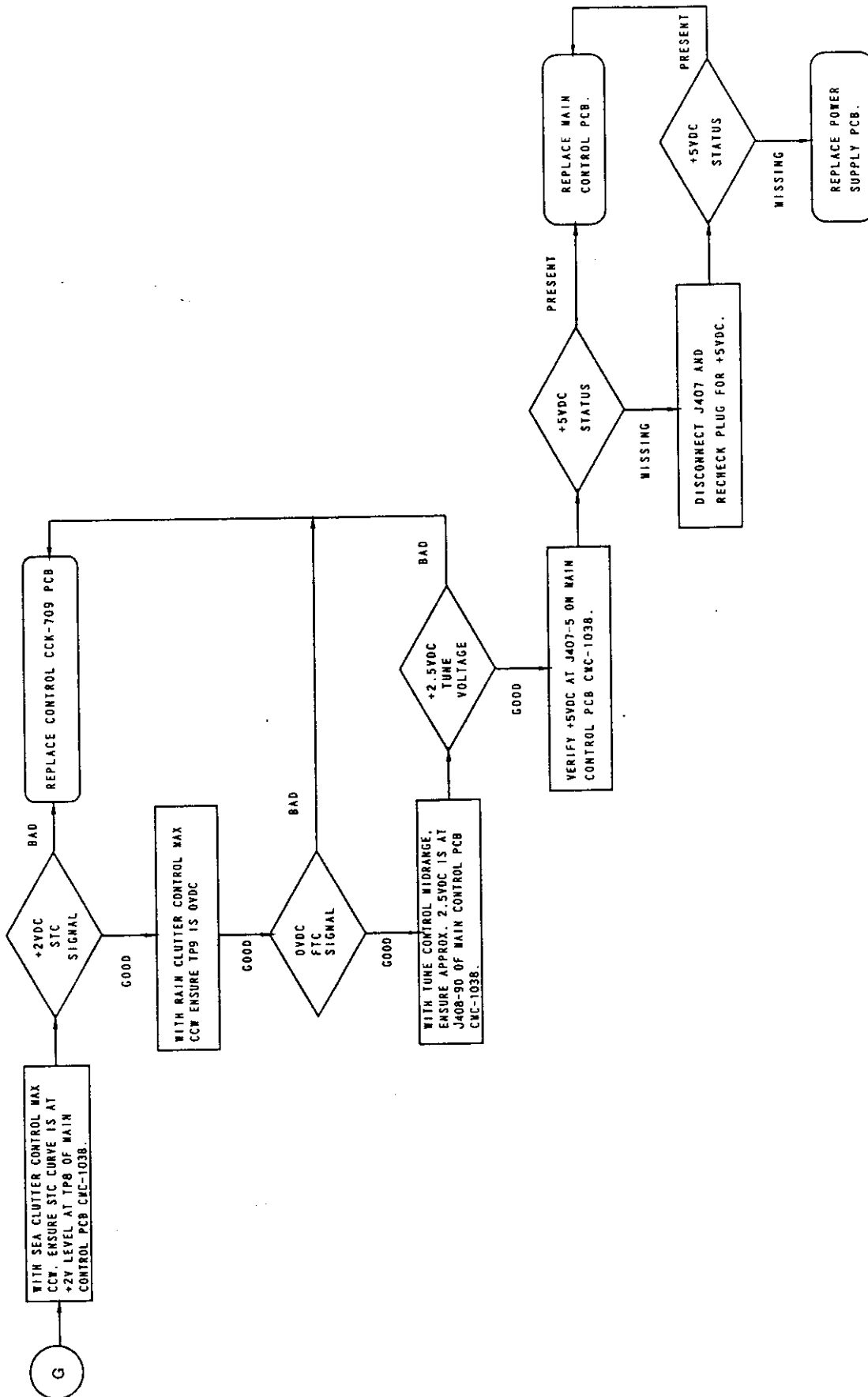


Fig. 5-9 SYSTEM TROUBLESHOOTING CHART (4 of 4)

5.6 MAGNETIC SENSOR COMPENSATION

CAUTION

ALL COMPASSES MUST BE CAREFULLY CHECKED AGAINST KNOWN HEADING REFERENCES BEFORE BEING USED FOR NAVIGATION.

Heading Sensor Compensation Adjustment

Although each Heading Sensor is calibrated at the factory, magnetic field distortions on the vessel can introduce errors in the reported heading. These errors can be minimized by proper sensor placement and then removed by compensating the compass after it has been mounted. The Heading Sensor is equipped with an auto-compensation capability in which it automatically measures the surrounding magnetic field distortion and compensates for it, thereby, removing the resulting heading errors.

Nevertheless, one should carefully locate the sensor and carefully align the sensor parallel with the keel line of the boat, as previously outlined in the Installation section of this manual.

Automatic compensation removes the need to manually adjust N/S and E/W compensation potentiometers because the system performs this continually and with greater accuracy.

The Heading Sensor is always in "compensation mode" so there is no special procedure required to begin auto-compensation. Every time the vessel completes a 360° turn within the time constraints of the system, the sensor will check its accuracy and recompensate itself if required.

Both "hard" (magnetic) and "soft" (iron) errors are automatically compensated by this procedure. This procedure will produce excellent accuracies ($\pm 1^\circ$) even on vessels with steel hulls. This procedure may happen during the normal use of your boat. When it does, the sensor will check the calibration and adjust itself if anything has changed.

Heading Sensor – Compensation Procedure (Part 1)

Compensating the Heading Sensor following installation is very important to ensure its accuracy. The procedure involves turning the boat continuously through two large, lazy circles at a slow speed (the circles may be slightly out of round or elliptical if necessary). During this procedure, it is critical that the boat

remains level and slow enough so that the 2 circles take approximately 4 minutes to complete (2 minutes per circle). The vessel cannot go too slowly, but if it goes too quickly at any point while doing the circles, the sensor is programmed to ignore the data to ensure a perfect compensation. Figure out how big a circle the vessel must make to keep at a slow, steady speed through 360°. Once the conditions for a 2 minute circle are calculated, keep on circling 2 more times in exactly the same manner. The Heading Sensor will latch on to the first good data it gets and won't replace it unless it gets a better set of data.

1. Select a calm day and a clear area without too much current or tide. Watch out for excessive pitching and rolling, as this can make the boat turn in surges faster than the Sensor will accept.
2. Turn the boat continuously through 720° (2 large, lazy circles) in a slow, smooth, and steady turn. Make each full circle take 2 minutes to complete. (Try to time the turn so that it takes about 30 seconds or more to turn 90 degrees.)
3. After completing two full circles according to the above parameters, the auto-compensation procedure is now complete.

Heading Sensor – Compensation Procedure (part 2)

Following Auto compensation, one should check the sensor's alignment by comparing the sensor readings on the radar display with the ship's recently calibrated magnetic compass readings for several headings or by navigation between known reference points chosen from a chart. The magnetic readout on the radar should then be compared to the correct chart courses.

Should the sensor's readings vary by a small but constant amount in one direction or the other, the heading sensor housing may be rotated slightly clockwise or counterclockwise to eliminate this error.

1. Slightly loosen the mounting screws securing the sensor to the mounting surface to permit rotation of the housing.
 2. If the sensor reads "less", rotate the housing clockwise.
 3. If the sensor reads "more", rotate the housing counterclockwise.
 4. When the headings match correctly, tighten the mounting screws to secure the sensor housing in place.
 5. This completes the alignment procedures for the heading sensor.
-

SECTION 6

PARTS LIST AND DRAWINGS

6.1 INTRODUCTION

This chapter contains schematic diagrams, assembly drawings and parts lists for Radar Set JMA-3800 series. Assembly drawings will assist in identifying and locating components. You will find numbers on the drawings are the same as location numbers in the parts list tables.

On PCB assembly drawings, components are identified by circuit symbol designations which are listed and described in the appropriate parts list.

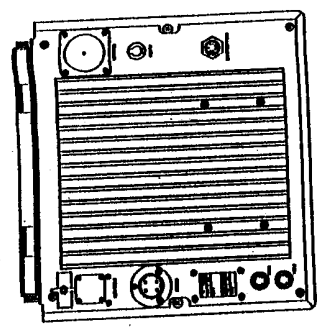
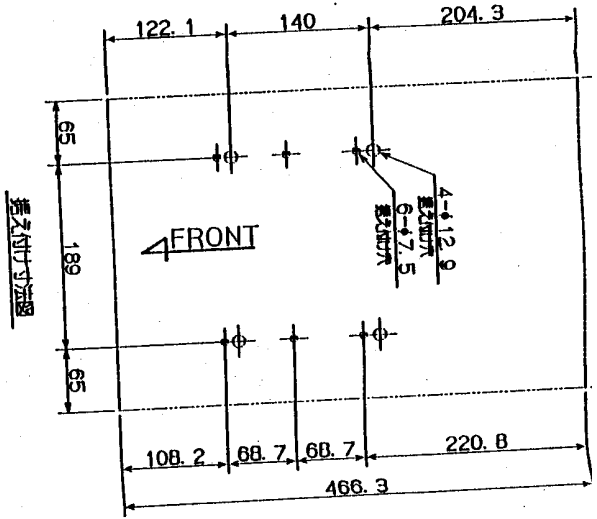
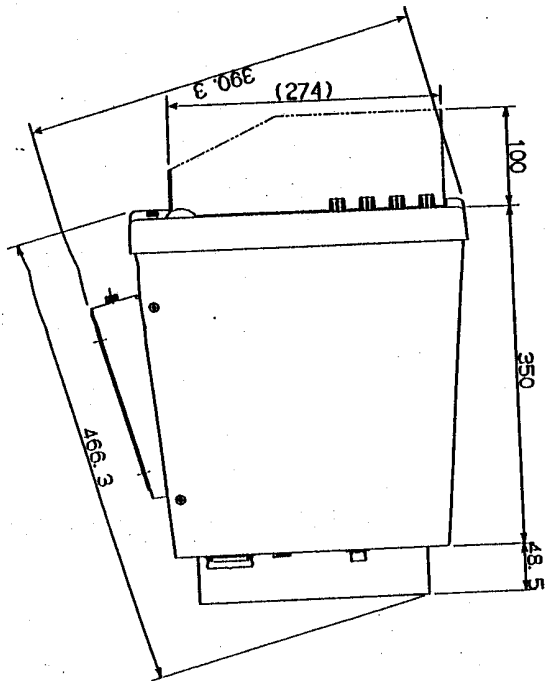
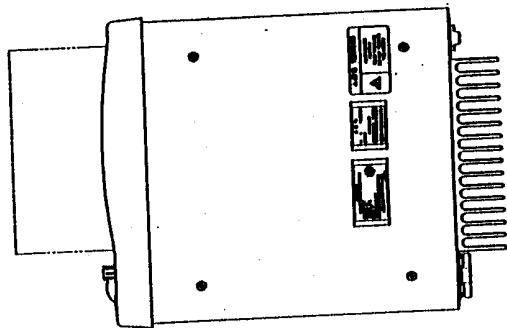
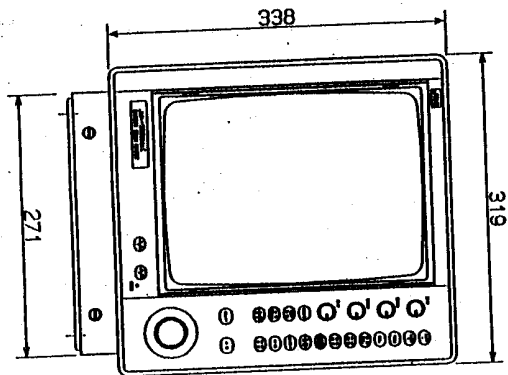
The generation breakdown Table 6-1 provides an index of the parts lists and drawings for assemblies and subassemblies of significant importance associated with the Model JMA-3807/3811. The schematic diagram, assembly drawing, and parts list format is repeated for each assembly and subassembly.

WARNING

This radar equipment contains high voltage. Adjustments require specialized service procedures and tools only available to qualified service technicians, and there are no user serviceable parts or adjustments. The operator should never remove the radar unit covers nor attempt to service this equipment.

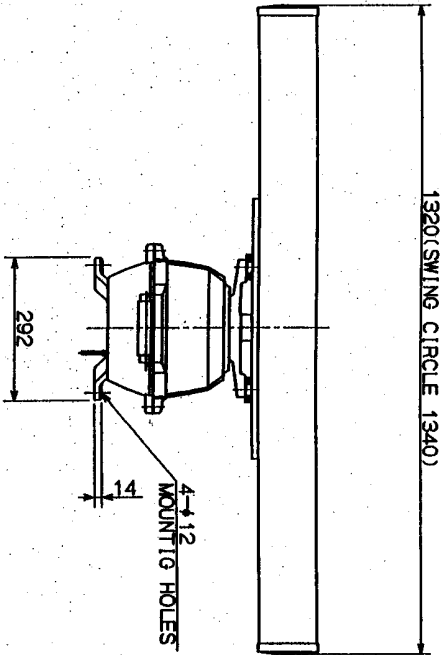
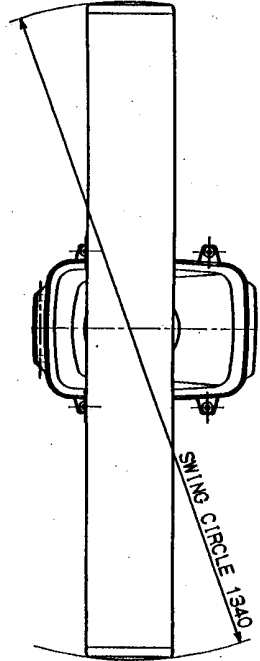
TABLE 6-1
Model JMA-3800 Generation Breakdown

Description	Part No.	Assembly Dwg. (Fig.)	Parts List (TBL)
MTR Unit			
Modulator Assembly (6KW)	NMA-473		
Modulator Assembly (10KW)	NMA-469		
Modulator PCB (6KW)	CME-261		
Modulator PCB (10KW)	CME-261		
Magnetron (6KW)	5VMAA00068		
Magnetron (10KW)	5VMAA00051		
Receiver Assy	NRG-210		
Receiver PCB	CAE-344-2		
Low Noise Front End	5EZAA00021		
PIN Attenuator	NJS6926		
Diode Limiter	NJS6930		
Circulator Assy	6AJRD00001		
Motor Assembly	CBP-136		
SHM			
Antenna Safety Switch	5SAAB00680		
Display Unit	NCD-3860		
PS.Heat Sink Assy	MTC300106		
Power Supply PCB	CBD-1426		
Line Filter PCB	CFR-166		
Chassis Assy	CML-561		
Main Control PCB (PC401)	CMC-1037		
Main Control PCB (PC402)	CMC-1038		
Control Panel(A)	CCK-709		
Control Panel(B)	CCK-708		
MARPA PCB	CDC-826		
CRT Assembly			
Consisting of:			
CRT Monitor	CKJ-121		
Video PCB	CCN-271A		
Deflection Yoke	7LGRD0042		
CRT	5VBAB00067		
Track Ball	EUAFTF814B		
Picture Process	CPC-200		
Option			
NSK	MDLW11031 (CMJ-304C)		



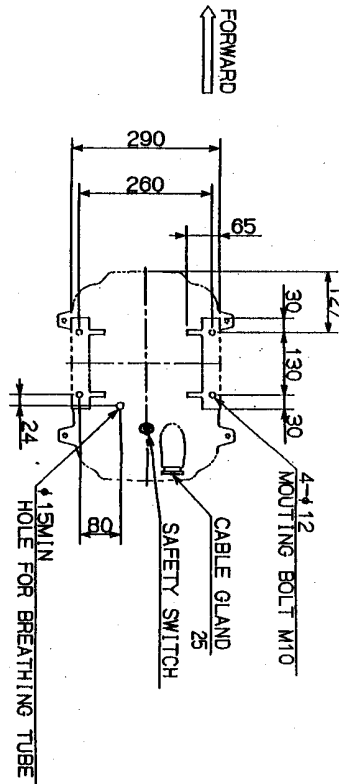
NCD-3860 DISPLAY UNIT OUTLINE DIMENSIONS

UNLESS OTHERWISE SPECIFIED	
DIMENSION SPECIFIED	TOLERANCE
0 TO 30	+/- 1
30 TO 120	+/- 1.5
120 TO 400	+/- 2.5
400 TO 1000	+/- 4
1000 TO 2000	+/- 6
2000 TO 3000	+/- 8

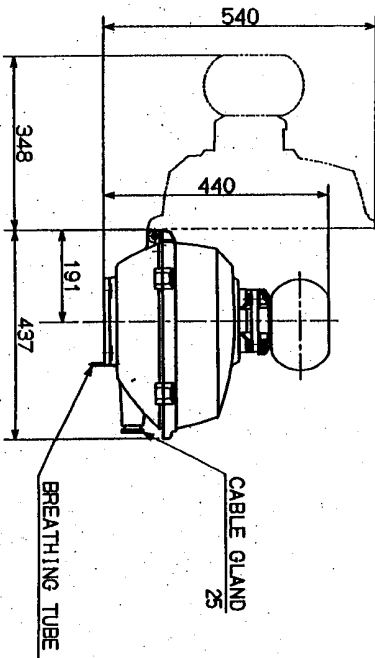


UNLESS OTHERWISE SPECIFIED

DIMENSION SPECIFIED	TOLERANCE	TOLERANCE
0 TO 30	± 1	40.5
OVER 30 TO 120	± 1.5	
OVER 120 TO 400	± 2.5	± 1
OVER 400 TO 1000	± 4	± 2
OVER 1000 TO 2000	± 6	
OVER 2000 TO 3000	± 8	43



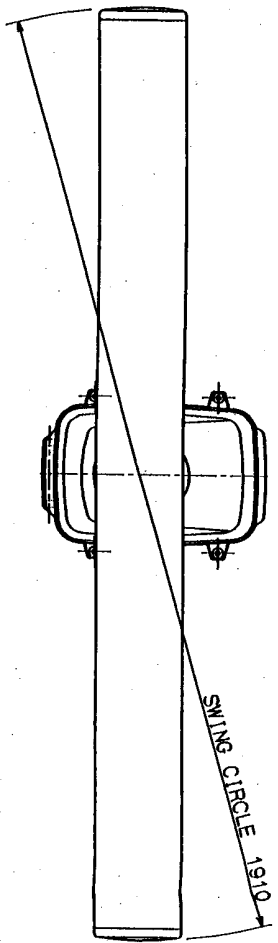
MOUNTING DIMENSIONS



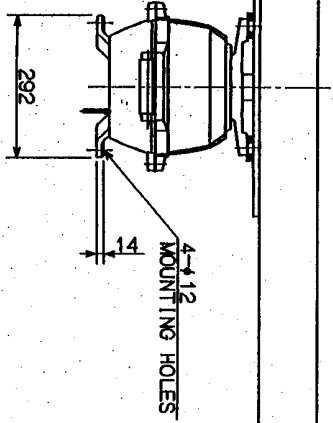
Dimension mm

WEIGHT APPROX. 29 Kg

NKE-1055-4 SCANNER UNIT
OUTLINE DRAWING

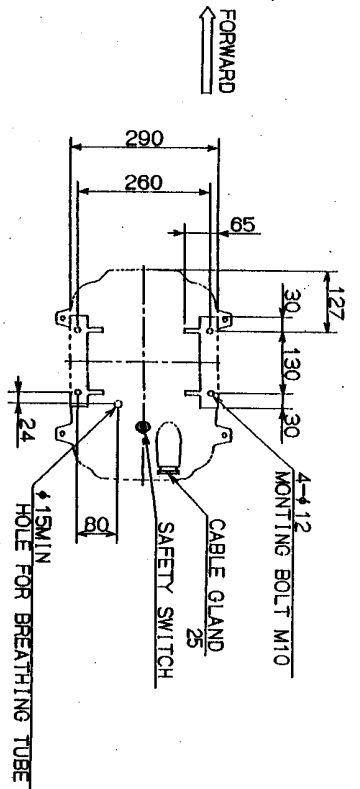


1890 (SWING CIRCLE 1910)

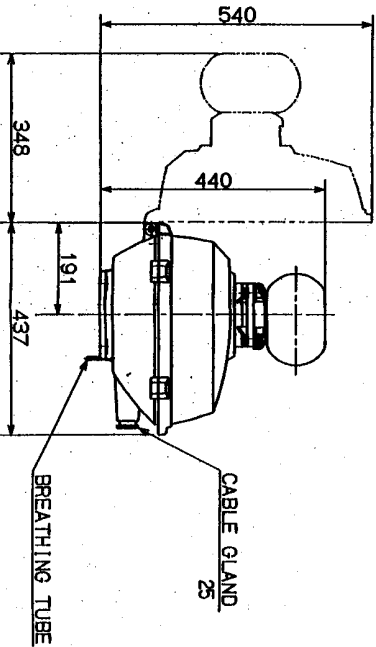


UNLESS OTHERWISE SPECIFIED		DIMENSION SPECIFIED		TOLERANCE		TOLERANCE	
0	TO	30	± 1	40.5			
OVER	30	TO	120	± 1.5			
OVER	120	TO	400	± 2.5	± 1		
OVER	400	TO	1000	± 4	± 2		
OVER	1000	TO	2000	± 8			
OVER	2000	TO	3000	± 8	± 3		

Dimension mm



MOUNTING DIMENSIONS



WEIGHT APPROX. 31 Kg

NKE-1055-6 SCANNER UNIT
OUTLINE DRAWING