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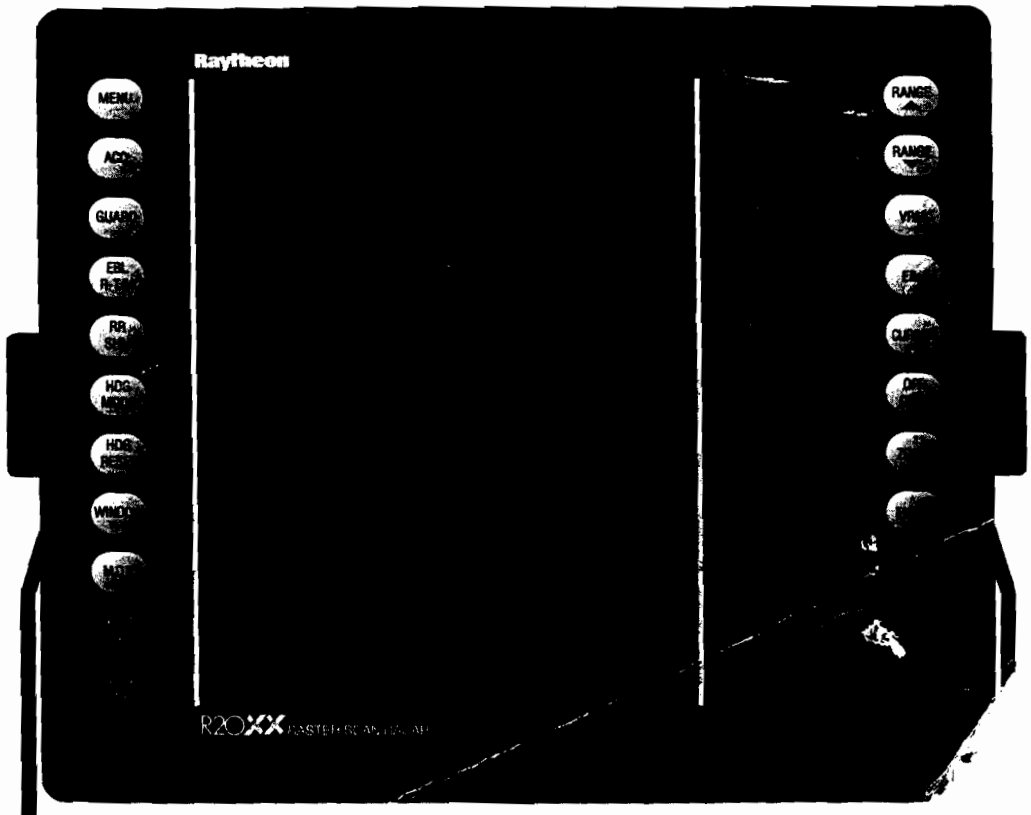
R20/21XX

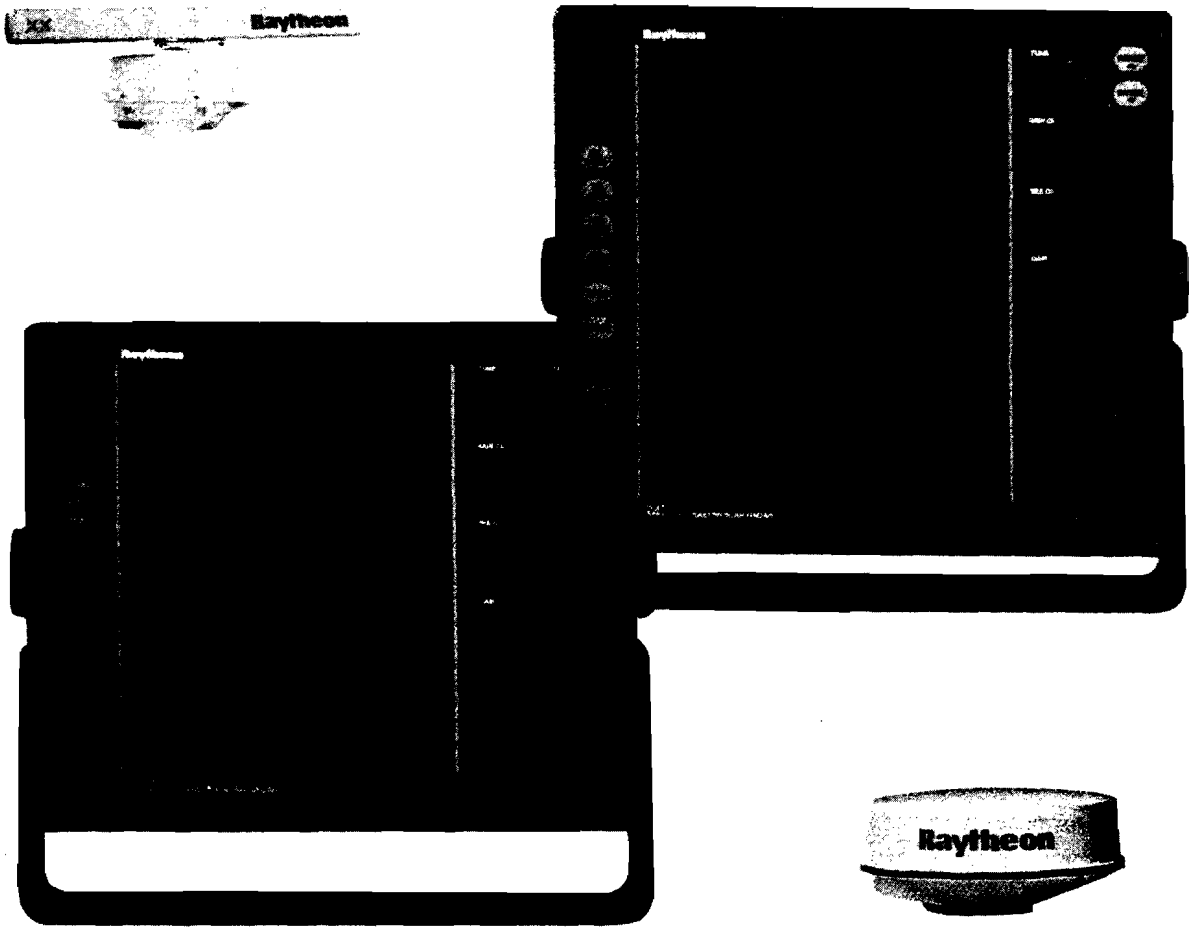
- RASTER SCAN RADAR
- OPERATION MANUAL



SEC

R20XX - R21XX SERIES

RADAR SYSTEM OPERATION MANUAL



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

SECOND EDITION
FEBRUARY 1994

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WARRANTY DATA

To verify your ownership and warranty registration, you should take a few minutes to fill out your warranty registration card found just inside the front cover of this manual. It is very important that you take the time to fill this card out. The warranty registration card should be returned to the factory immediately after your purchase in order to receive full warranty benefits.

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 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 never should 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 off the system 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.

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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 & Nmi	-	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	-	Trackpad
VD	-	Video
VRM	-	Variable Range Marker
WPT	-	Waypoint
W/TP	-	with Trackpad
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 Assocation
PRF	-	Pulse Repetition Frequency
RM	-	Relative Motion
RNG	-	Range
SOG	-	Speed Over Ground
SPD	-	Speed
STW	-	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 Raytheon XX Series Raster Scan Radar to meet your radar navigation requirements.

Whether you purchased this radar because of its compactness or power economy, ease of installation or long term reliability, one thing is certain; the moment you turn on your R20XX or R21XX 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 10-inch diagonal TV-type picture tube with chart-like clarity and detail. A single glance at your display will give you a 360° radar picture of other vessels, buoys and landfall surrounding your vessel.

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

The Zoom mode provides you a fast times 2 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.

When interfaced with the Raytheon Raychart 600A/XX, the revolutionary new ability to display chart information alternately, or in conjunction with the radar picture, adds simplicity and convenience. The industry standard, C-MAP chart cartography, is used to provide you with highly detailed chart information, making navigation both informative and exciting. The unique Multi Screen Mode allows simultaneous viewing of Radar and Raychart, Video Sounder, or SeaTalk ™ Data. Collision Avoidance and Intercept features commonly associated with costly, high seas radar systems are now efficiently incorporated into the R20/R21XX Series Radar with the MARPA Option.

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 Systems R20XX/R21XX.

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" XX Series Radar system.

To verify your ownership and warranty registration, you should take a few minutes and fill out your warranty registration card found just inside the front cover of this manual. It is **very important** that you take time to fill this card out. The warranty registration card should be returned to the factory immediately after your purchase in order to receive full warranty benefits.

1.2 EQUIPMENT FEATURES

The 20XX/21XX 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:

- Multi-screen capability allowing for Raychart with Radar, Sounder or SeaTalk window. Alternately the Radar Screen can be displayed with Raychart, Video Sounder or SeaTalk window
- Target wakes can be displayed on screen
- Pressure sensitive Trackpad for quick information access, anyplace on the display
- Waterproof to U.S.C.G. standards, allowing for flexibility of installation
- Rugged aluminum housing

- The ability to display up to 5 waypoints in a route sequence
- Multi-language operation (English, French, Spanish, German, Norwegian and Italian.) All six languages are standard within each system and are selectable via menu prompt
- Automatic Tuning Feature
- MARPA capability (Optional)
- Interfaces with Autohelm SeaTalk instruments, Raytheon (V850/8010) Video Fishfinder, Raychart 600A/XX, and Navaids
- Compass Stabilized presentation, allowing for True Magnetic North display heading changes
- Unique Man-Overboard feature allowing for quick activation and instantaneous readouts for a fast return to the point of origin of the event
- Basic radar alignments can be performed via menu prompts

1.2.1 R20XX/R21XX DISPLAY UNIT

The R20XX and R21XX display units use a 10" green monochrome monitor enclosed in a compact aluminum, rugged, waterproof cabinet.

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

The display unit is designed to be tabletop mounted, but can be mounted on a bulkhead or overhead. An optional console mounting kit is available to provide a professional look to custom mount the display into consoles or panels.

All system set-up adjustments are made on the display MENU, negating any requirements to open the display units 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 20 integrated circuits. Thus, compact size, power efficiency, and a full line of features all come standard with the XX series radar systems at an economical price.

1.2.2 R20XX RADOME ANTENNA UNIT MAIN FEATURES

The antenna and transceiver are combined within the 24½ inch radome of the R20XX which is made of AES plastic and has a single-flange mounting. A small, flexible interunit cable connects the Radome Unit to the Display Unit.

The radome cover is secured to the pan base by four clamping bolts and is provided with a rubber gasket to completely seal the unit from the weather and salt spray.

Inside, the radome features a printed circuit card array. This technically innovative antenna provides a narrow 4° beam width for excellent short range resolution and high gain in a very compact antenna package.

The internal X-band transmitter operates at a powerful 4kW peak power with a sensitive micro-integrated circuit (MIC) front end receiver.

The construction of the antenna unit is modularized, so repairs, should they be required, can be made quickly and cost-effectively.

1.2.3 R21XX OPEN ARRAY ANTENNA UNIT MAIN FEATURES

The open array antenna and pedestal unit of the R21XX system houses a 4 kW transmitter, a semilog receiver with a low-noise front end, the array drive motor and its control circuitry.

The X-band transmitter, which is common in all of these systems, operates in three different pulse lengths at three different PRF's. The magnetron type is an MSF1421B, rated at 4 kW and is driven by a solid state modulator unit.

The open array antenna is a 3.9 foot end-fed slotted array producing a 2.0° horizontal and 30° vertical beam for very high resolution, super sensitive target pickup and display. The open array is driven by a speed-regulated motor at approximately 27 RPM.

The receiver section consists of a passive diode limiter, low noise MIC front end (NJT 1946), coupled to a 60 MHz dual bandwidth IF amplifier. The bandwidth of the receiver switches between 10 and 3 MHz 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 R20XX/R21XX and its associated optional equipment. Although the unit is actually pretty simple to master, please take the necessary time to read through each section.

Section 2 contains very important information on the proper installation of your new R20XX/R21XX 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 R20XX/R21XX 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, show the correct key entries and displays for each function.

The best way to learn about your R20XX/R21XX 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 contains technical information about the theory of operation and maintenance for your new radar. In the event that your R20XX/R21XX should ever experience an operational failure, it is recommended that all repair services be provided by an authorized Raytheon service dealer or by the Raytheon Factory Service Center.

1.4 SPECIFICATIONS

1.4.1 GENERAL

1) Maximum range:
   R20XX: 24 Nmi
   R21XX: 32 Nmi
2) Minimum range: Less than 25 yds on 0.125 Nmi
3) Range Scales:

Range	Number of Rings	Range Ring Interval
0.125 Nmi	2	0.0625 Nmi
0.25 Nmi	2	0.125 Nmi
0.5 Nmi	2	0.25 Nmi
0.75 Nmi	3	0.25 Nmi
1.5 Nmi	6	0.25 Nmi
3 Nmi	6	0.5 Nmi
6 Nmi	6	1 Nmi
12 Nmi	6	2 Nmi
24 Nmi	6	4 Nmi
(R21XX) 32 Nmi	4	8 Nmi

4) Range discrimination: Less than 35 yds.
5) Range ring accuracy: ± 1% of selected range or 22 m, whichever is greater.
6) Bearing accuracy: ±1 degree.
7) Environmental Conditions
   Radome/Pedestal: Temperature -15°C to +50°C (under nominal input voltage)
   Humidity Up to 95% at 40°C
   Display Units: Temperature -10°C to 50°C
   Humidity Up to 95% at 40°C
8) Input power requirements: 10.8-42Vdc
9) Power Consumption:
   R20XX 55W
   R21XX 60W

1.4.2 DISPLAY UNIT

1) Dimensions: Width 245mm (9.65 in.) - without mounting yoke
   Depth 263mm (10.35 in.) - without sunshield
   Height 203mm (8.00 in)
2) Mounting: Table, overhead, bulkhead or flush mounting
3) Weight: Approx. 6.1 kg (Approx. 13.5 lbs)

4)	Cathode-ray tube:	Green
5)	Video:	8 levels quantized
6)	Display Resolution:	640 x 480 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 3 digit readout on CRT.
12)	Presentation Modes	Relative Motion (RM), True Motion (TM)
	Heading Modes:	Head Up (H-UP); Course Up (C-UP); North Up (N-UP)
13)	EBL	Dual EBL's with 3 digit readout on CRT.
	Bearing Mode:	Relative; True; Magnetic
	Resolution:	1°
14)	Alarm:	Audible alarm (Internal only)
15)		
16)	Off Center Mode:	Up to 66% radius (except maximum range)
17)	Zoom Mode:	X2 (Enlargement) not available on 1/8nm scale)
18)	Timed TX Mode:	Transmit period: - Select 10, 20, or 30 Select 3, 5, 10 or 15 minutes
19)	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 Momentary Off Key, Cursor, F. EBL, MOB, Ext. Route, Wakes, Window.
20)	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
	CURSOR	Cursor Mark & Data ON/OFF Key
	OFF/CENT	Off Center Key
	ZOOM	Zoom Key
	ENTER	Enter Key
	MENU	Menu Key
	ACQ	Acquisition Key
	GUARD	Guard Zone Key
	EBL R-T/M	Bearing Mode Select Key, EBL R-T/M
	RR/SHM	Range Ring or SHM Off Key

HDG/MODE	Heading Mode Select Key
HDG/RESET	C-UP Reset Key
WINDOW	Multi-screen Select Key
MOB	Man Overboard Key

21) Inputs:

Loran C/GPS	NMEA 0183, must include GLL, GTD, VTG, BWC, or RMA & RMB, or RMB & RMC sentences for full function displays and capabilities. NMEA 0182 or JRC Serial format
Magnetic sensor	NMEA 0183 HDM, HDT, VHW or HSC, data sentences.
SeaTalk	Wind Direction, Wind Velocity, Depth, SOG/STW, Position, Cursor Data, Route Data.

22) Outputs — SeaTalk Data, External Monitor Video (with sync)

23) Rear Panel Connectors

Interunit (Antenna)	16 pin
DC Power	3 pin
Navaids/Mag. Sensor	6 pin
SeaTalk	3 pin
Raychart	7 pin
Fishfinder	7 pin

1.4.3 R20XX RADOME ANTENNA UNIT

1) Dimensions:

Diameter of radome:	620 mm (24.4 in.)
Height:	275 mm (10.8 in.)
Base diameter:	250 mm (9.84 in.)

2) Weight: 9.5 kg (20.9 lbs)
3) Polarization: Horizontal
4) Beamwidth: Horizontal 4°, Vertical 25°
5) Sidelobes: -21dB or greater (within ±10°)
6) Rotation: Approx. 27 RPM
7) Drive motor input voltage: 10 Vdc
8) Transmitter frequency: 9410±30 MHz
9) Peak power output: 4 kW
10) Transmitter tube: Magnetron (MSF1421B)
11) Pulse Length/PRF: 0.08µs/2250 Hz (0.125. 0.25, 0.5, 0.75, 1.5 Nmi)
0.35µs/1500 Hz (3, 6 Nmi)
0.7µs/750 Hz (12, 24 Nmi)
12) Modulator: Solid state modulator driving magnetron
13) Duplexer: Circulator and Diode Limiter
14) Mixer: MIC Front End
15) IF amplifier:

Center frequency:	60 MHz
Bandwidth:	10/3 MHz
Characteristic:	Semi-Log
Noise Figure:	Less than 6dB

1.4.4 R21XX OPEN ARRAY ANTENNA UNIT

1)	Dimensions:		
	Height:	411 mm	(16.2 in)
	Swing Circle:	1190 mm	(46.8 in)
	Width:	292 mm	(11.5 in)
	Depth:	500 mm	(19.7 in)
2)	Weight:	Approx. 24 kg (52 lbs)	
3)	Polarization:	Horizontal	
4)	Beamwidth:	Horizontal 2.0°, Vertical 30°	
5)	Side lobe level:	-23 dB or greater (within ±10°)	
		-26 dB or greater (more than ±10°)	
6)	Rotation:	Approx. 27 RPM	
7)	Wind velocity:	41 m/s (80 knots), relative	
8)	Transmitter frequency:	9410±30 MHz	
9)	Peak power:	4 kW	
10)	Transmitter tube:	Magnetron (MSF1421B)	
11)	Pulse length/RPF:	0.08μs/2250 Hz (0.125, 0.25, 0.5, 0.75, 1.5 Nmi)	
		0.35μs/1500 Hz (3, 6 Nmi)	
		0.7μs/750 Hz (12, 24, 32 Nmi)	
12)	Modulator:	Solid state modulator	
13)	Duplexer:	Circulator and Diode Limiter	
14)	Mixer:	MIC Front End	
15)	IF Amplifier:		
	Center frequency:	60 MHz	
	Bandwidth:	10 MHz/3 MHz	
	Characteristic:	Semi-Log	
	Noise figure:	Less than 6 dB	

1.4.5 MARPA (OPTIONAL)

1)	Acquisition:	
	Acquisition Mode:	Manual (1 target max) [.75 Nmi - 12 Nmi]
2)	Tracking:	
	Tracking Mode:	Automatic
3)	Vectors:	
	Bearing Mode:	Relative; True
	Vector Length:	1, 3, 6, 12 minutes
	Display Time:	
	Initial:	1 minute
	Stable:	3 minutes
4)	Guard Zone:	
	Guard Ring:	2 (1 fixed and 1 variable)
	Range Limits:	Variable ring (trackpad setting) max. 40 Nmi
	Alarm Display:	Π mark on CRT and visible/audible alarms

5) Dangerous Target Limits:

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

Target Conditions:

Designation & Symbol	Conditions
Safe target "O"	• CPA>MIN. CPA • D≥MIN CPA, TCPA <0, (behind own ship) • D>MIN.CPA, TCPA<0
Dangerous target "▲"	• CPA≤MIN.CPA, TCPA>MIN.TCPA • D≤MIN.CPA, TCPA<0, (forward own ship)
Very Dangerous target "◆"	• CPA<MIN.CPA, 0 x TCPA<MIN.TCPA

D is distance from own ship to target.

Alarm Conditions

Target Condition	CRT Symbol	Alarm Characters	Buzzer
Safe	O	OFF	OFF
Dangerous	▲	DNG	OFF
Very Dangerous	◆	V DNG	ON
Lost Target	O-------	-----	ON

6) Lost Target: Broken line symbol on CRT, broken line vector Visible/Audible alarms.

7) Numerical Display
Target Data: Simultaneous and continuous display for 1 target.
Bearing, range, course, true speed, CPA, TCPA.
Own Ship Data: Speed

8) Intercept Mode: Intercept Target is MARPA Information Read-out.
Intercept True Course
Intercept True Speed
Intercept Time
This function only in True Vector mode.

SECTION 2

INSTALLATION

2.1 GENERAL

Congratulations on selecting the Raytheon XX Series Raster Scan Radar to meet all of your radar navigation requirements.

Although your XX 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 R20XX or R21XX aboard your vessel.

2.2 UNPACKING AND INSPECTION

Use care when unpacking your new XX Series Radar from the shipping cartons to prevent damage to the contents. It is also good practice to save the carton and the interior packing material until the unit has been satisfactorily installed on the vessel. The original packing material should be saved so that it may be reused in the unlikely event that it becomes necessary in the future to return the unit for service.

2.3 EQUIPMENT SUPPLIED

Table 2-1 indicates a listing of items that are included with your new radar system.

TABLE 2-1 Equipment Supplied

Model R20XX	*M92501*
Description	**Part No.**
Display, 10"	M92538
Radome Antenna	M92539
Interunit Cable, 49' (15m)	M92549
Power Cable Assembly, 6' (1.8m)	CFQ-2646
Sunshield	MTV300344
Instruction Manual	G263600-5
Bridge Card	G263600-10
Standard Spares	(see table 2-2)
Sun Cover	MTV300523
Display Mounting Hdwr.	---
3 pin connector - SeaTalk	G263129-49K
7 pin connector - Fishfinder	G263129-8K
6 pin connector - NMEA	G263129-17K

Model R21XX	*M92503*
Description	**Part No.**
Display, 10"	M92540
Ped/MTR	M92542
Array 4'	M92543
Interunit Cable, 49' (15m)	M92549
Power Cable Assembly, 6' (1.8m)	CFQ-2646
Sunshield	MTV300344
Instruction Manual	G263600-5
Bridge Card	G263600-10
Standard Spares	(see table2-2)
Sun Cover	MTV300523
Display Mounting Hdwr.	---
3 pin connector - SeaTalk	G263129-49K
7 pin connector - Fishfinder	G263129-8K
6 pin connector - NMEA	G263129-17K

TABLE 2-2 STANDARD SPARE PARTS KIT

Name of Parts	Type	Quantity	Description	Part Number
Fuse	Glass tube 6.3A (12 Vdc)	2	F401 Display unit	5ZFAD00336
Fuse	Glass tube 5A (12 Vdc)	2	F402 Display unit	5ZFAD00045
Fuse	Glass tube 3.15A (24, 32 Vdc)	4	F401, F402 Display unit	5ZFAD00382

The input power voltage requirement for the radar via the Display Uni is 10.8 to 42 Vdc. If the ship's input power is 24 or 32 Vdc, then F401 and F402 should be changed to the 3.15 amp fuses provided.
The total power required by the Model R20XX is 55 watts.
The total power required by the Model R21XX is 60 watts.

2.3.1 OPTIONAL ACCESSORIES

XX Fluxgate Heading Sensor	M92580 **
Universal Mast Mount (R20XX)	M88374
Console Mounting Kit (R20XX/R21XX)	M92550
MARPA Kit	M92509
Magnifier Lens Kit	M89962
Rectifier Unit (115/220VAC)	M88074
NCT-27 Gyro Interface	50017 **
Moving Target Radar Simulator (4 targets)	M92556
Dual Station Junction Box	M89367X
OPTIONAL CABLES	
15m Interunit Cable (Standard)	M92549
20 meter Interunit Cable	M92544
Interunit Cable (Raw - no connectors)	G263739-1
20' DC Power Cable (#14 AWG)	G263449-1
Fishfinder to Radar Interconnect Cable (15')	M92577
Raychart 600A to Radar Interconnect Cable (15')	G262166-1*
Raychart 600XX to Radar Interconnect Cable (15')	G622964-1*

*The Raychart to Radar interconnect cable is typically supplied with the Raychart 600A/XX.

**** NOTE**
The XX Fluxgate Heading Sensor (M92580) or the NCT-27 Gyro Interface (50017) is required for proper operation of the MARPA functions.

2.4 PLANNING THE INSTALLATION

The layout for installing the R20XX/R21XX Radars should be planned give the best operation and service aboard your particular vessel. In g eral, the Radome/Pedestal Unit should be mounted as high as possible ab the waterline. The Display Unit should be installed in a convenient viewi position near the helm.

NOTE
In order to maximize the operation of your radar system, it is recommended th the radar antenna be mounted above objects which would interfere with t radar signal. Installation of the radar antenna above such obstacles as the flyi bridge, large engine stacks and out of the range of personnel will insure ma mum benefit from your radar system.

A 15 meter (49 Ft) length of vinyl-covered, shielded, 15 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 (98 Ft.).

In some instances, you may wish to shorten the cable length to be less than the 49 Ft provided, due to space restrictions. In this instance, it is not recommended that the cable length be shortened less than 10 Ft. In any case, you should always keep a few extra feet, just in case it is required for service.

A. General System diagram for the XX Radars is shown below.

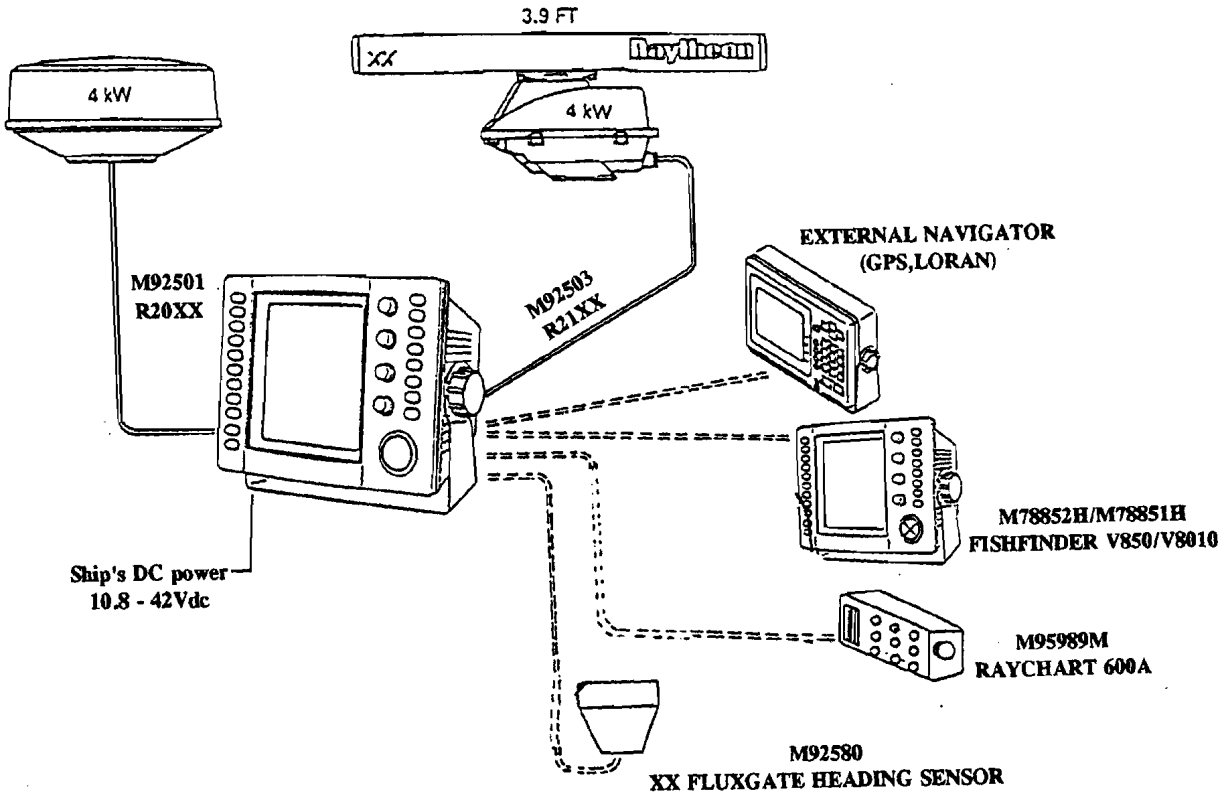


Fig. 2-1 GENERAL SYSTEM DIAGRAM

2.4.1 MOUNTING THE DISPLAY UNIT

When planning the installation for your XX Series Display Unit, the following conditions should be considered to insure dependable and trouble-free 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 Fig. 2-2 for typical mounting methods).

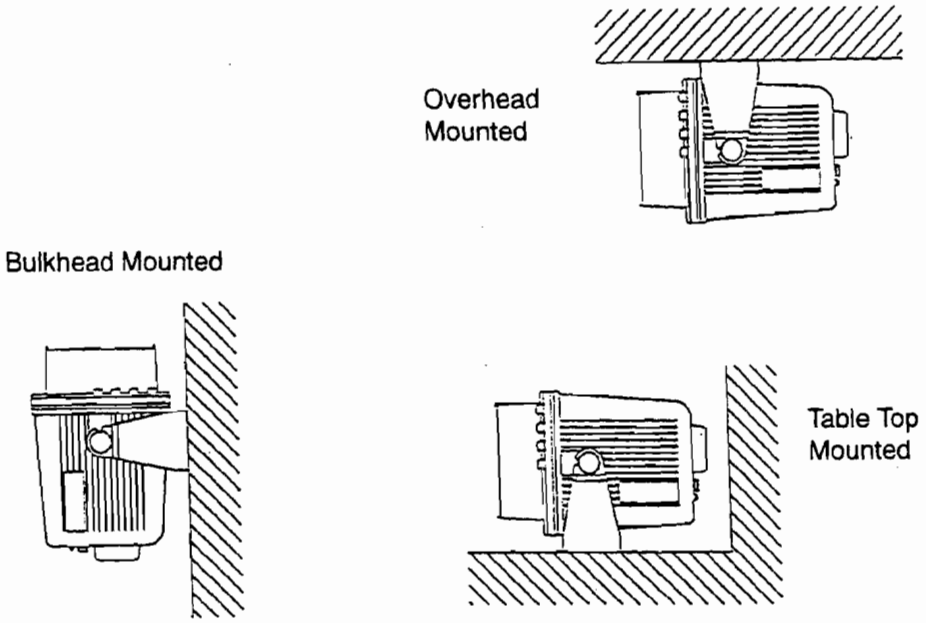
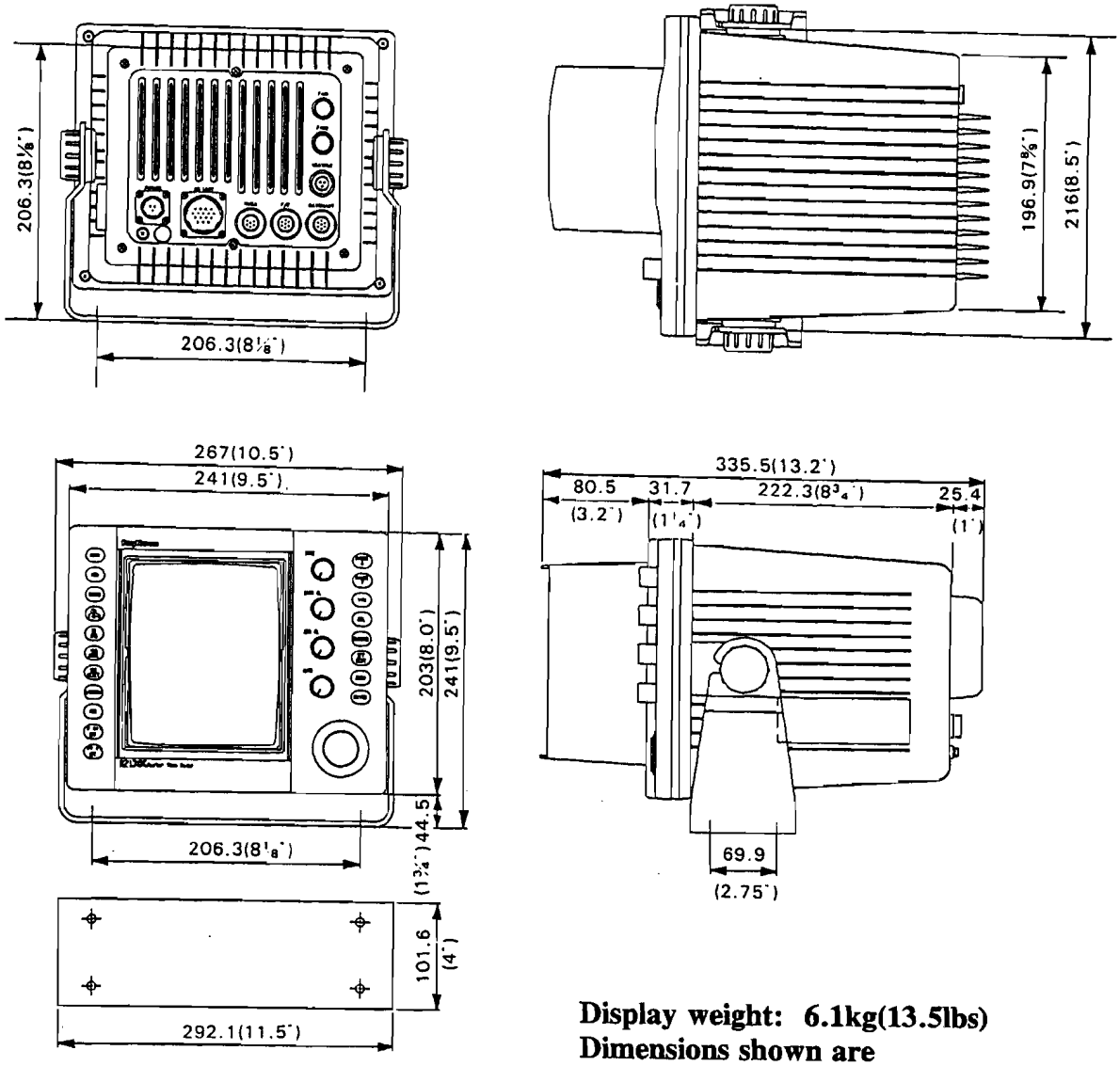


Fig. 2-2 TYPICAL MOUNTING METHODS

Telel



Display weight: 6.1kg(13.5lbs)
Dimensions shown are in millimeters and (inches).

Fig 2-3 DISPLAY MOUNTING DIMENSIONS

2.4.1.1 Console Mounting Instructions

WARNING

This radar display unit contains HIGH VOLTAGE. Adjustments require spec service procedures and tools only available to qualified service technicians, and are no user servicable parts or adjustments. The operator never should remo radar unit covers nor attempt to service this equipment.

The procedure below can be used to console mount the R20XX/R2 Refer to the console mounting figure to see how the various hardware are arranged during assembly.

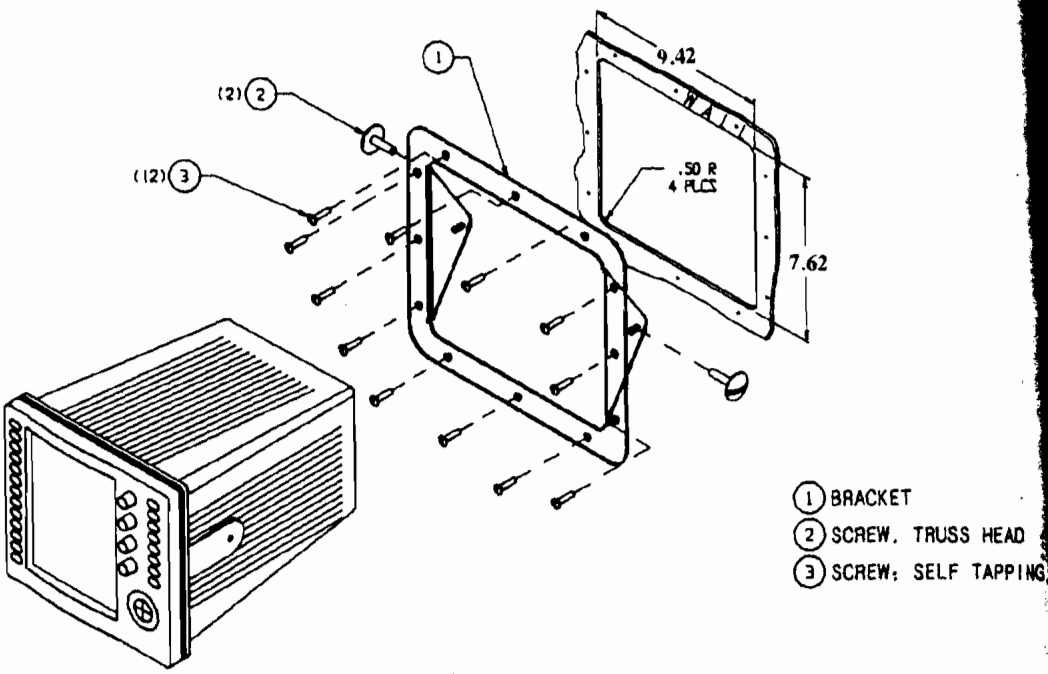


Fig. 2-4 CONSOLE MOUNTING THE DISPLAY

1. Select the location for the unit. A clear, flat area of at least 11.5" wide by 10.5" high having at least 15" of clearance depth behind the panel is required.

CAUTION

Make sure there are no hidden electrical wires or other items behind the desired locati before proceeding. Check that free access for mounting and cabling is available.

2. Unpack the console mounting kit and confirm that all hardware is present.

3. Using the instruction template supplied with the kit, trace out the 9.42" wide x 7.62" high opening.

Tele

4. Drill a ½" pilot hole in each opposing corners of the cut-out area.

5. Using an appropriate saw, cut the outside edge of the cut-out line.

6. Remove the yoke knobs, and the rubber spacers from the display cabinet. Check that the unit will fit into the cut-out area.

7. Complete the installation of the DC power cabling, antenna cable, data input, ground, and any other accessory cables, into the console.

8. Slip the trim ring over the cabinet from the rear. Make sure the rounded tabs on each side face the rear of the cabinet. Slide the unit into the cut-out of the panel. A suitable sealant may be used between the trim ring and console to prevent moisture entry.

9. Use the clamps and hardware supplied in the kit to secure the unit in the trim ring bracket. The trim ring should be then secured onto the console with the countersunk flathead screws. Connect all cables to the unit rear panel.

2.4.2 Radome Antenna Mounting (R20XX)

Selecting the best location for the Scanner Unit requires careful con ation. On many small vessels, the unit can be installed onto a mast p form on an arch or bridge structure, or onto a mast. Since radar basic operates at line of sight, the unit should be mounted as high as possi on the vessel to obtain the best long range performance.

The scanning beam should not be obstructed by surrounding large objects. Try to locate the unit where large structures such as searchligh horns, masts, or other superstructures are not in the same horizontal plane. Otherwise, blind areas and false targets can appear on the radar screen due to these items. Installation near the top of exhaust stacks m be avoided as damage could result due to excessive heat and the corros effects of stack gases.

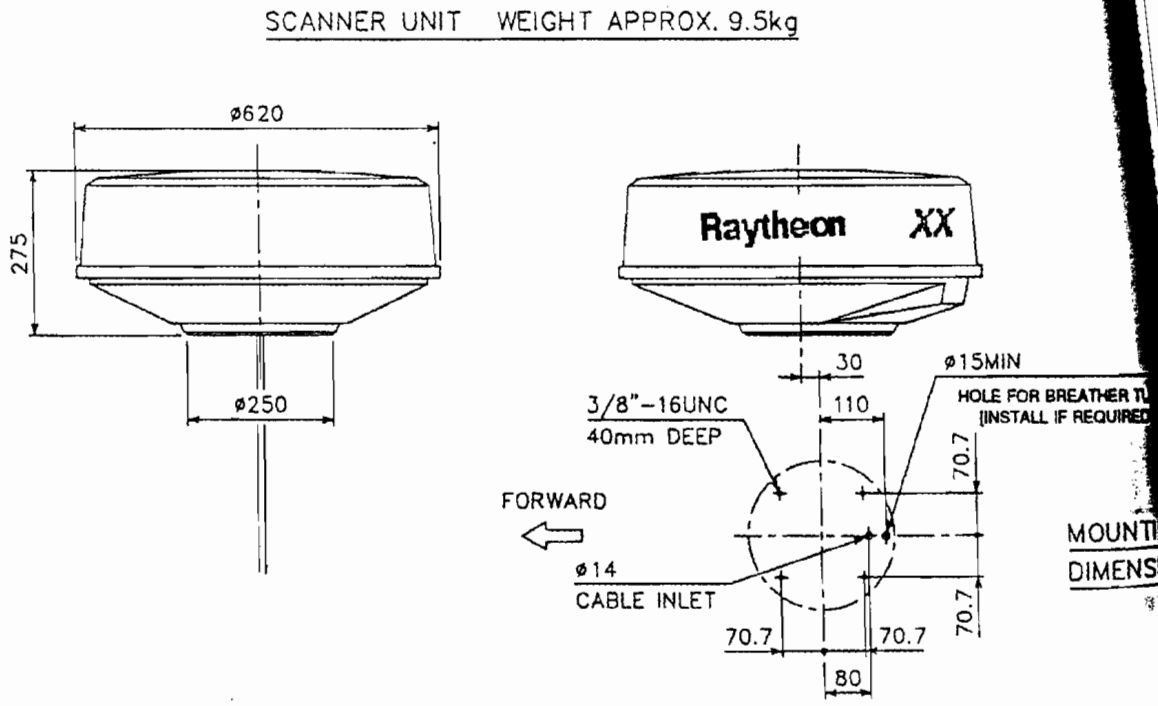
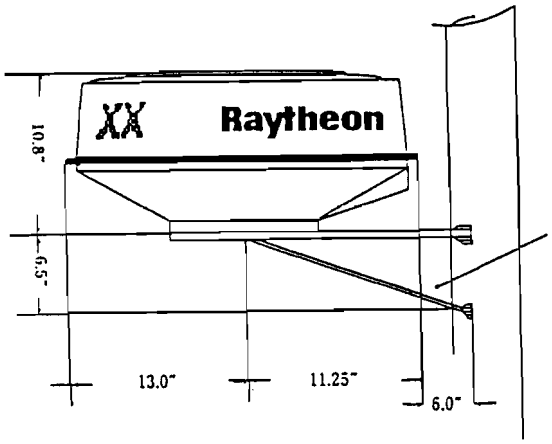


Fig. 2-5 OUTLINE DRAWING OF RADOME ANTENNA UNIT



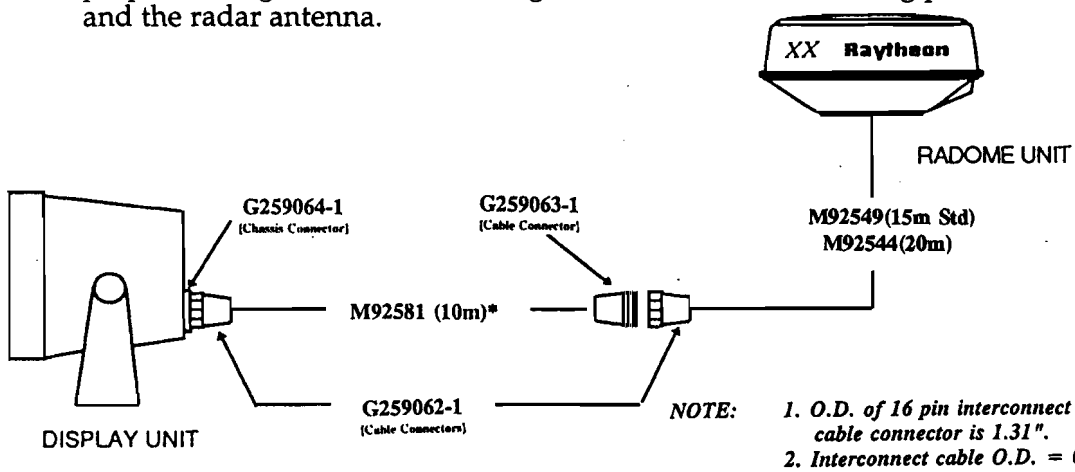
UNIVERSAL MAST MOUNT:
POLYESTER GLOSS WHITE FINISH
DIE CAST ALUMINUM CONSTRUCTION
STAINLESS HARDWARE
WEIGHT 4.5 lbs.
FITS MASTS FROM 2¼" DIA. AND UP

Fig. 2-6 UNIVERSAL MAST MOUNT (M89374)

For sailboat installations, Raytheon offers a universal mast mount kit (Product Code M89374) for use with Raydome Antennas. This optional mount fits masts with diameters from 2¼" and larger. When using the mast mount kit, appropriate hardware should be used for the style and structure of the mast aboard the vessel.

If there is doubt concerning the appropriate type of hardware to use, consult with the boat dealer or manufacturer for their recommendations.

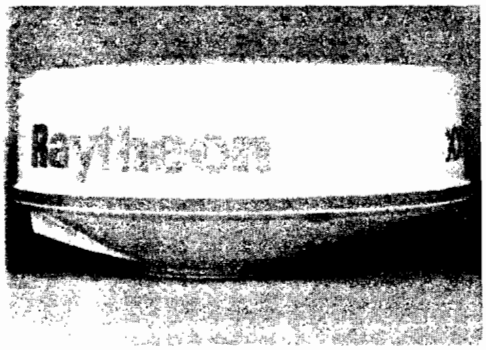
Depending on the type of sailboat, a radar antenna guard should be installed if the sails tend to contact the antenna platform. Without a proper radar guard, serious damage can result to the mounting platform and the radar antenna.



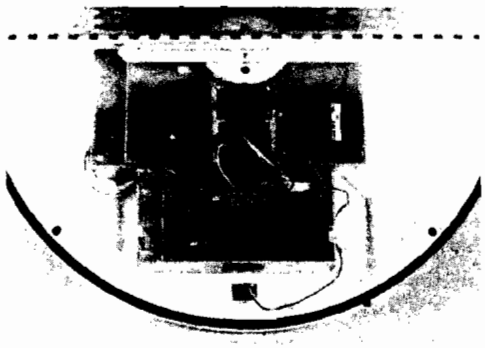
***M92581 is a 10 meter (30') extension cable**
Raw Interconnect Cable P.N. G263739-1

Fig. 2-7 TYPICAL INSTALLATION FOR SAILBOAT SHOWING IN-LINE CONNECTION AT MAST BASE

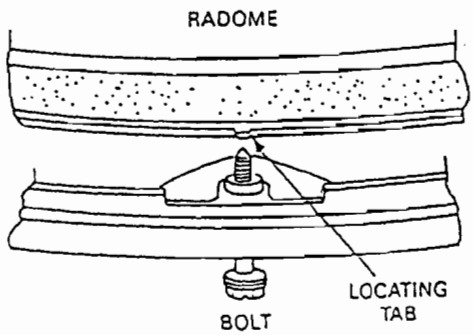
LOOSEN FOUR CLAMPING BOLTS



REMOVE THE RADOME FROM THE BAS
REMOVE THE CLAMPING PLATE, SCRE
AND RUBBER GROMMET, FROM THE
CABLE GLAND.
INSERT RAW END OF THE INTERCONNE
ING CABLE INTO THE CABLE INLET.
ADD THE RUBBER GROMMET, AND THE
CLAMPING PLATE. SECURE THE PLATE
WITH THE TWO SCREWS AFTER ASSURI
THE CABLE LENGTH IS SUFFICENT.



CONNECT THE CABLE LEADS ONTO TH
TERMINAL BOARD TB101 AND CONNEC
THE 9 PIN PLUG TO J101.
GROUND THE SHIELD LUG TO ONE OF T
SCREWS ON THE CLAMPING PLATE.
DRESS THE WIRE HARNESS WITH CABLE
CLAMPS OR TY-RAPS, AS NECESSARY, TO
PREVENT STRAY LEADS FROM CONTACT
ING THE ROTATING ARRAY.



WHEN REASSEMBLING THE RADOME
COVER, NOTE THAT THE TAB ON THE
RADOME COVER MATCH THE BOLT HOL
POSITIONS TO ASSIST YOU IN POSITION-
ING THE RADOME FOR REINSTALLATION

Fig. 2-8 CONNECTING PROCEDURE FOR RADOME ANTENNA UNIT

The cable entrance is provided through the base of the scanner unit. If the unit is mounted on a hollow mast, the cable may be run inside the mast and then fed up through the center entrance hole.

Before wiring the scanner unit, confirm that the interunit cable is not connected and power is not applied to the display unit. Connect the cable leads onto terminal board TB101 and connector J101, as shown below.

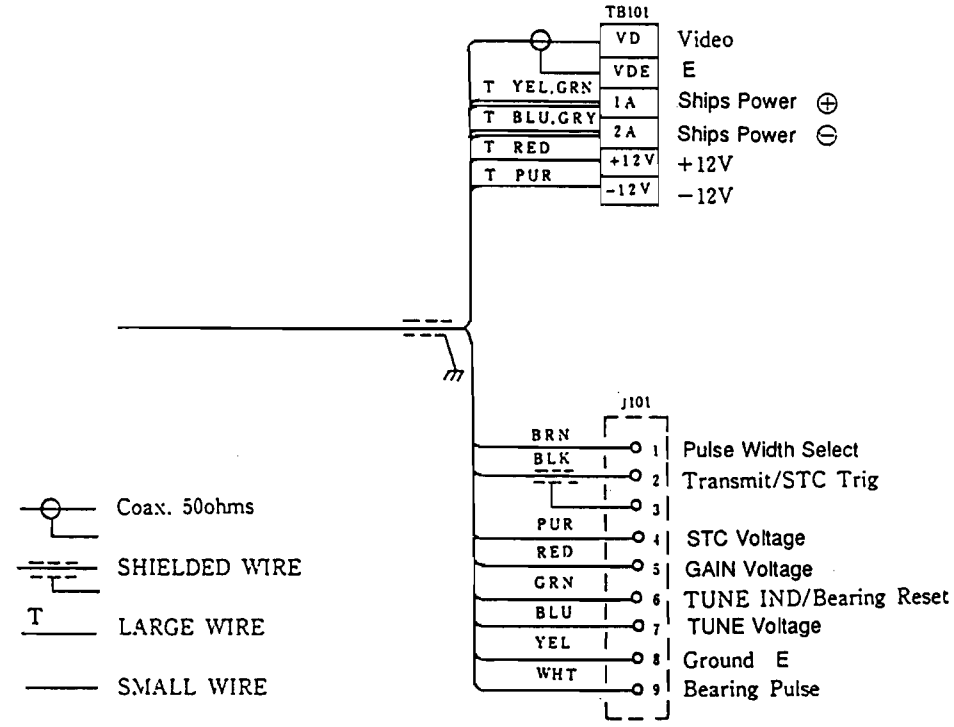


Fig. 2-9 WIRING DIAGRAM FOR XX SERIES RADOME ANTENNA UNIT

NOTE: J101 Connector Kit, P/N G263434-1 is available from the parts department if cutting the radar cable becomes necessary. The kit contains the following items:

J101 Connector Kit (G263434-1)

Quantity	Item
1 ea.	9-pin connector J101 consisting of the plug shell and pins
7 ea.	Lugs for TB101 connectors
1 ea.	Grounding lug for the cable shield

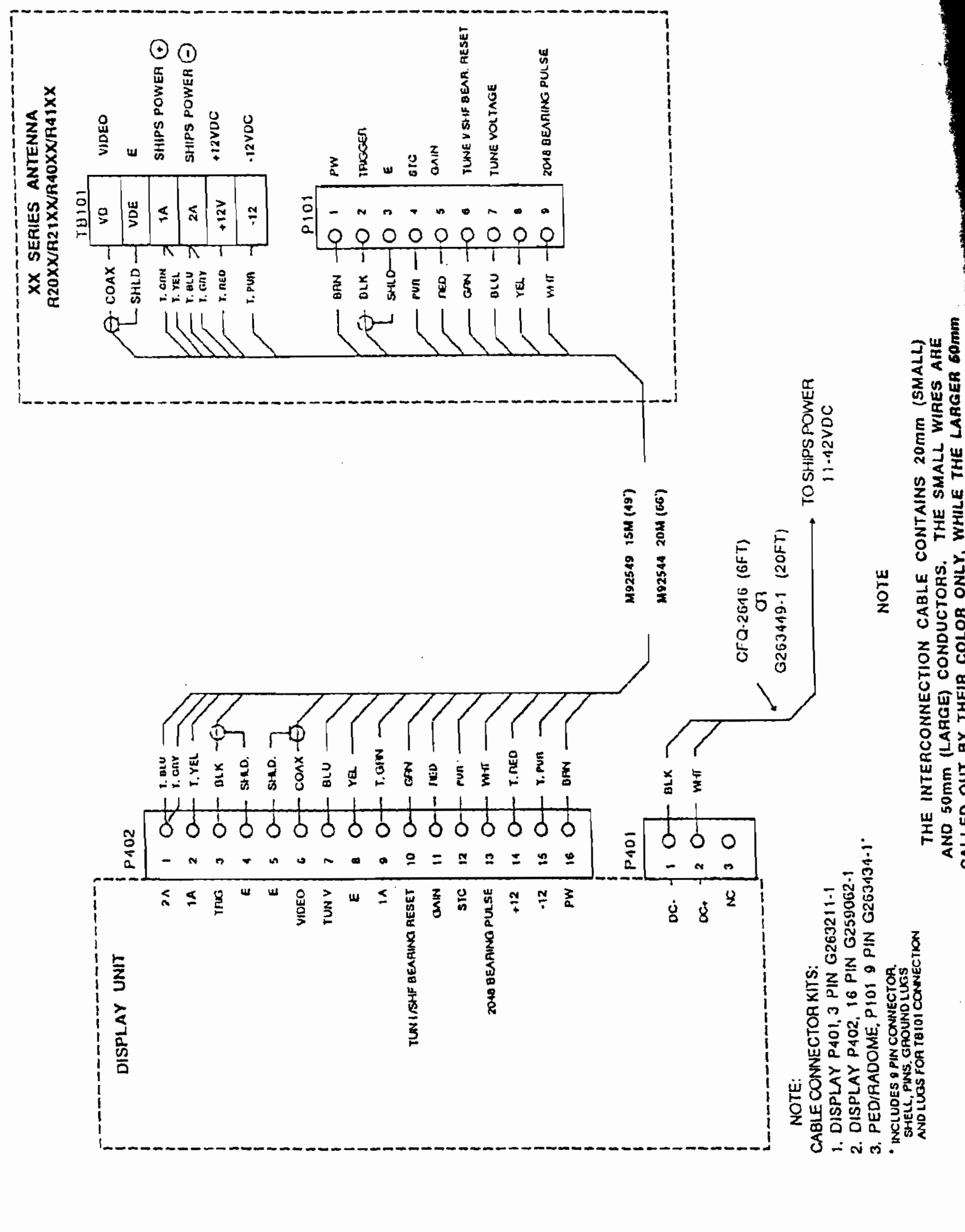


Fig. 2-10 RADAR INTERCONNECTION DIAGRAM

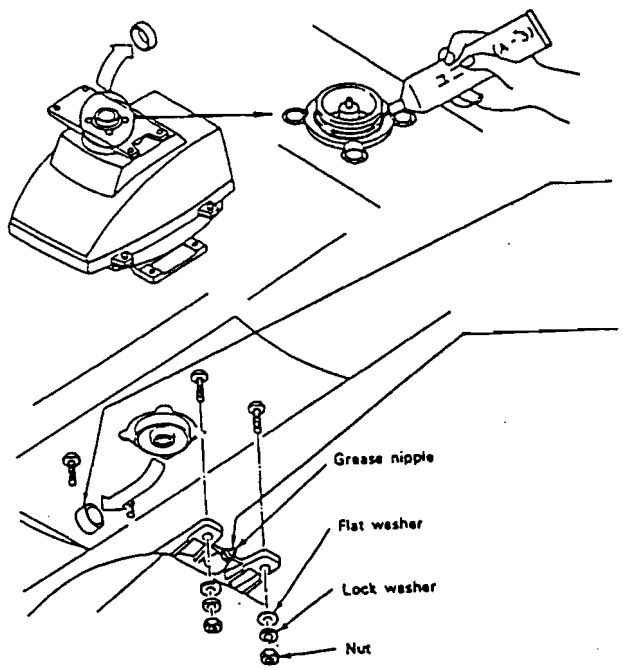
2.4.3 ASSEMBLING THE OPEN ARRAY ANTENNA

Open Array pedestal units are shipped as two separate assemblies, the pedestal and the array.

The following procedure should be followed in assembling the R21XX Array unit onto the pedestal.

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

A. Assembly Procedure



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

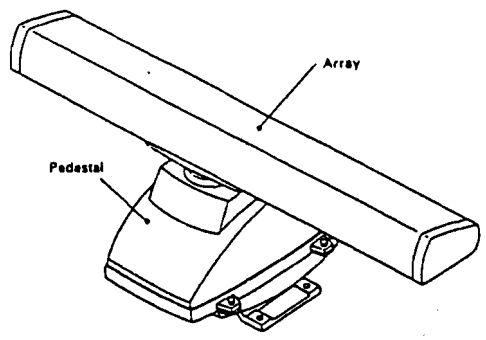
2) Apply the sealing material around the flange as illustrated with a thickness of about 1/8".

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.

The Completely Assembled Scanner Unit



2.4.4 MOUNTING THE OPEN ARRAY ANTENNA UNIT (R21XX)

The R21XX Open Array Antenna Unit mounting considerations should be t as those for the R20XX. When choosing the mounting site, be aware that you w an open area of four feet or more to rotate the antenna array.

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

NOTE:

THE ARRAY SWING CIRCLE IS 48". ASSURE THAT THERE IS ADEQUATE CLEARANCE TO ROTATE THE ARRAY.

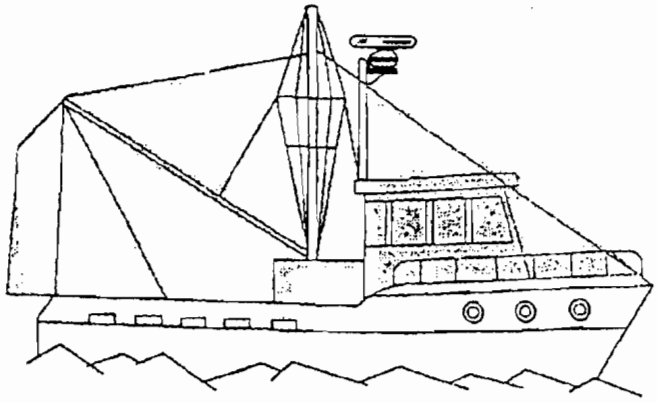


Fig. 2-11 TYPICAL MOUNTING LOCATION

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

NOTE

A mechanical hazard exists from the external rotating antenna. Remain clear o 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. 2-12 as a guide, along with the template provided, 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.

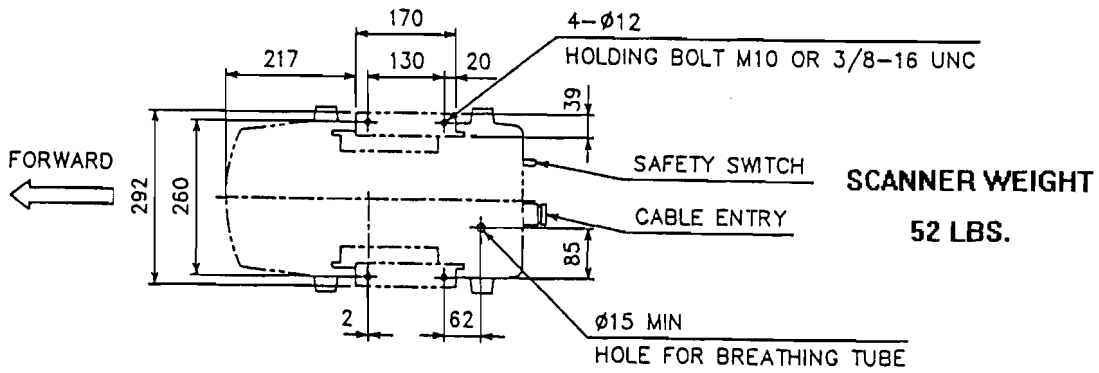


Fig. 2-12 BASE MOUNTING DIMENSIONS

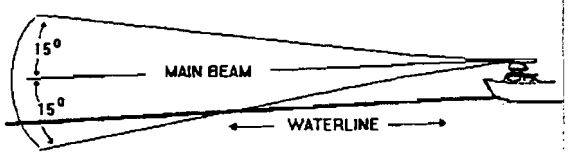
Install the scanner unit onto the mounting platform with the cable entry and safety switch facing "AFT".

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 sufficient height or clearance, a radar mast or pedestal may be used to elevate the unit.

SETTING THE RADIATION PLANE

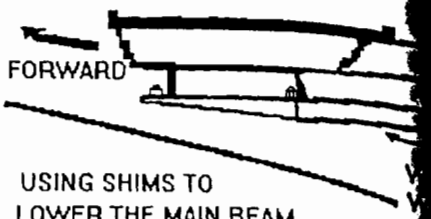
In the standard antenna installation the scanner/pedestal unit is mounted so the array will rotate parallel to the waterline. The beam of the radar is approximately 30° wide in the vertical direction so target detection during the vessel's pitching and rolling will be generally good.



IDEAL RADIATION PLANE

Some vessel's 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 towards the parallel 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.



USING SHIMS TO
LOWER THE MAIN BEAM

WARNING

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

SCANNER UNIT WEIGHT APPROX. 24kg

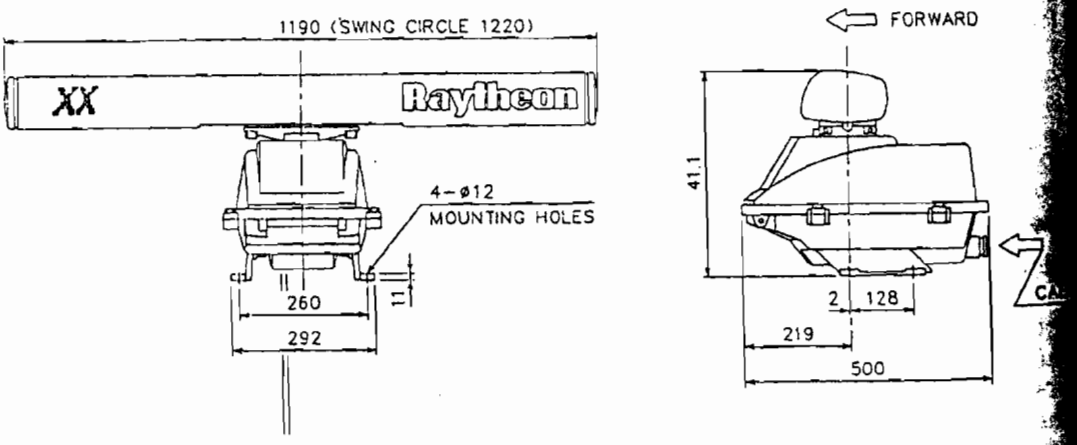


Fig. 2-13 OUTLINE DRAWING - Open Array Antenna

Telepho.

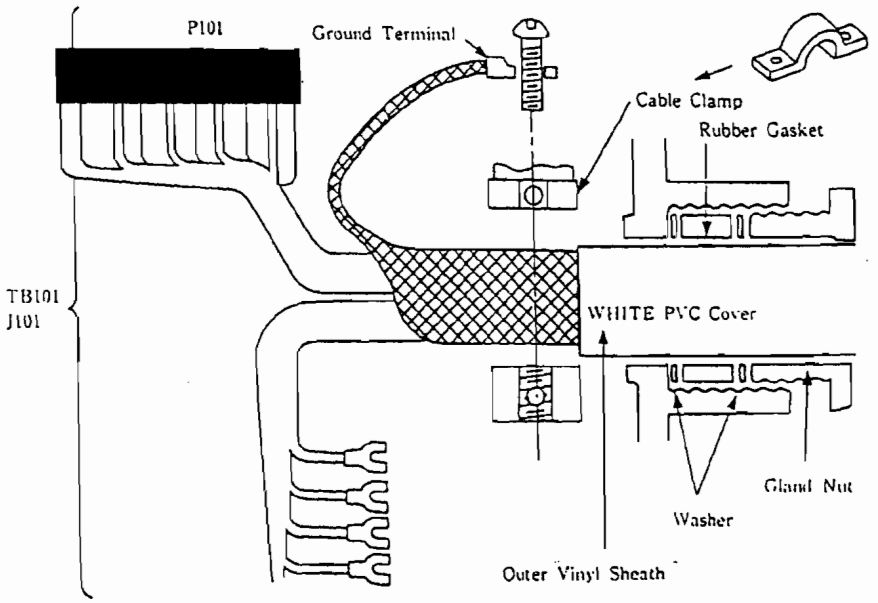


Fig. 2-14 ANTENNA PEDESTAL UNIT CABLE CONNECTION PROCEDURE

2.4.5 CABLING THE R21XX 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. 2-14). Verify whether the interunit cable is already connected at the display unit. If connected, disconnect the 16-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 in the order shown in Fig. 2-14. 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) Plug the 9 pin molex (Note: the plug can only be inserted in one direction) connector on the cable connector J101 located to the right of the cable clamp.

7) Following the wire colors in Fig. 2-15, attach the wires to TB101. After reinstalling the cable clamp to insure that the cable shield is grounded; pull the excess cable from the pedestal.

8) Insert the washers and rubber gasket into the gland and tighten the gland nut.

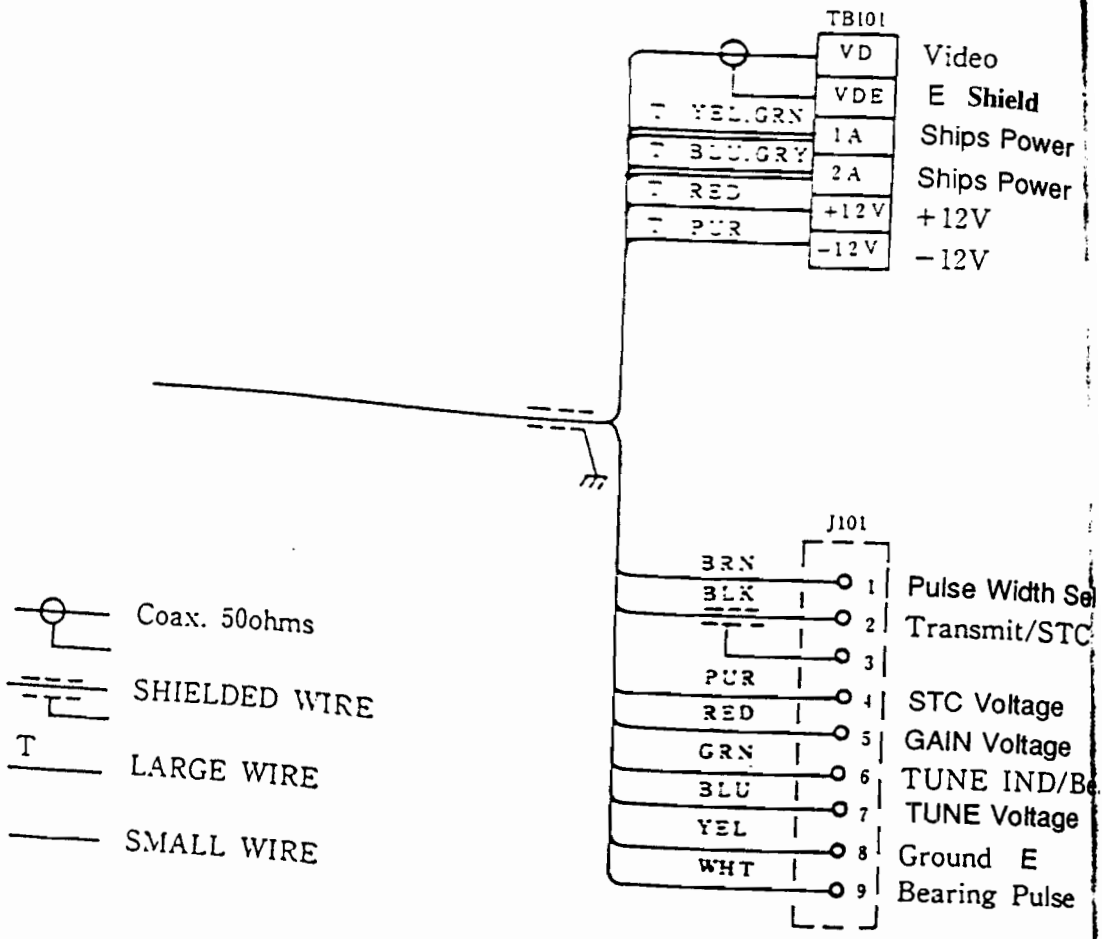


Fig. 2-15 WIRING DIAGRAM FOR XX SERIES OPEN ARRAY PEDESTAL UNIT

NOTE: J101 Connector Kit, P/N G263434-1 is available from the parts department if cutting the radar cable becomes necessary. The kit contains the following:

J101 Connector Kit (G263434-1)

Quantity	Item
1 ea.	9-pin connector J101 consisting of the plug shell and pins
7 ea.	Lugs for #22 AWG connectors
1 ea.	Grounding lug for the cable shield

2.5 ELECTRICAL CONNECTIONS

2.5.1 DC POWER CONNECTION

The R20XX/R21XX is intended for use on DC ships power systems and can operate as long as that DC supply system is maintained from 10.8 to 42 Vdc. 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 6 foot power cable assembly is supplied with your unit and, in many cases, will be adequate to reach the source of DC power. The 3 pin watertight connector plugs into the rear panel receptacle in the lower left corner of the unit marked POWER.

The power leads should normally be routed to the ship's DC power distribution panel. The unit requires approximately 4 Amps of current and is fused at 10 amps. Connection to a 10 amp or a maximum of 15 amp circuit breaker is recommended. On smaller vessels, the power leads may be connected directly to the main battery isolation switch or breaker. For best noise immunity from the other shipboard electronics avoid grouping the radars power connections on the same circuit breaker with the VHF or SSB radio, Fishfinders, or other Navaids, such as Loran C or GPS. The power leads should be separated as much as possible from other devices.

Although the unit's power consumption is approximately 55 watts, (R20XX)/60 watts (R21XX), if the cable leads need to be extended by more than 10 feet, the gauge of the wire leads should be increased accordingly to minimize line losses. For runs of 10-20 feet #14 AWG is recommended. For runs of 20-35 feet use #12 AWG. A 20 foot cable using #14 AWG is available for longer cable runs, (P/N G263449-1).

Confirm that the power leads are connected to the correct terminal polarity! The WHITE wire should be connected to the POSITIVE (+) source terminal; the BLACK wire should be connected to the NEGATIVE (-) source terminal. If the power leads are accidentally reversed, the rear panel fuse will blow. If this happens, recheck the polarity of the power cord connections with a voltmeter (VOM) and, if necessary, reverse the leads for a proper polarity connection. Replace the fuse.

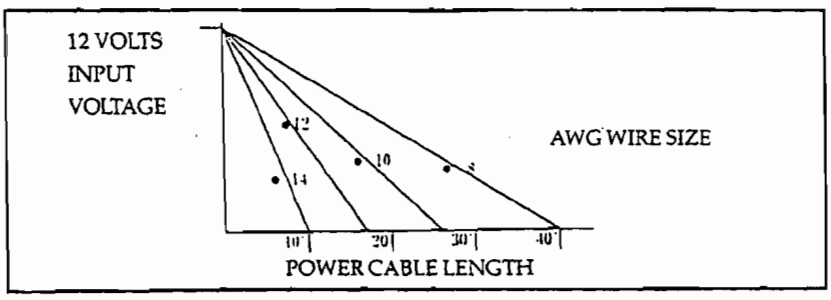


TABLE 2-3 POWER CABLE SIZE VERSUS LENGTH

2.5.2 EXTERNAL SYSTEM INTERFACE

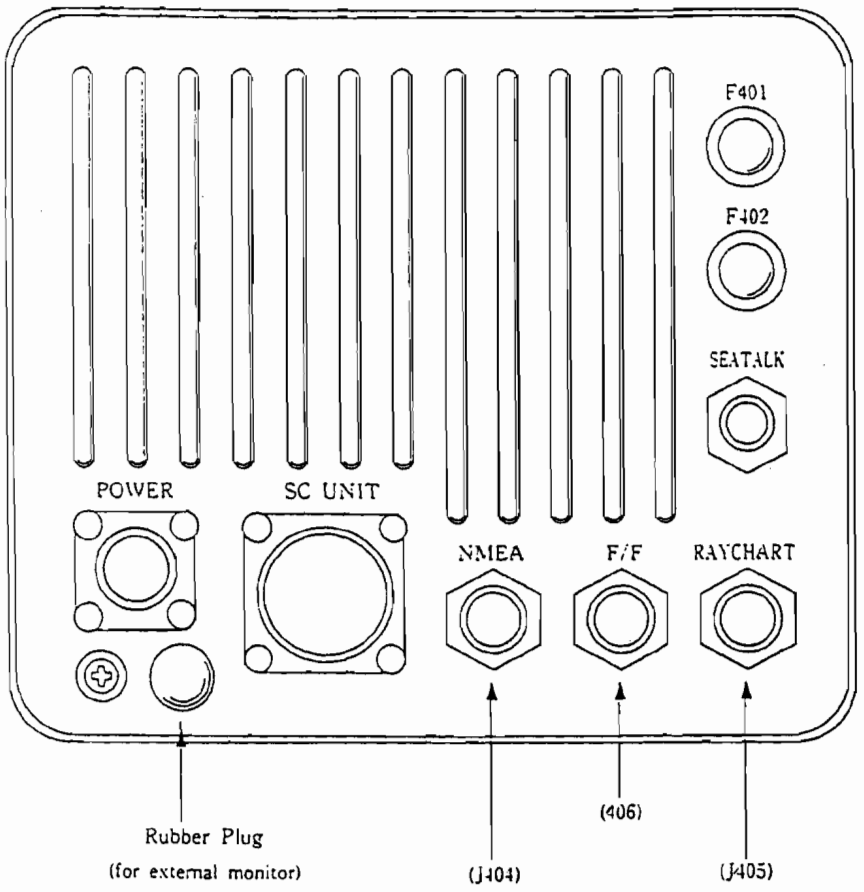


Fig. 2-16 DISPLAY REAR CHASSIS

The XX Series radars can receive various input signals fron Navaids, Fl Sensors, Fishfinders, Raychart Units, and SeaTalk Data networks. The inputs from the Raytheon V850 and V8010 Fishfinders and from the Raychart Units are digital video and the horizontal/vertical sync signals to drive the XX display. The inputs from SeaTalk, the flux sensor, and Navaids will be digital data conforming to the NMEA 0183, JRC serial, o SeaTalk formats to drive various radar features such as Waypoint Mode the MARPA.

If more than one data type is present at the various digital data radar inputs (for example; Flux Sensor and NMEA and SeaTalk) a system priority has been established in the radar's software to respond to the inputs in driving the features.

The assigned priorities are set in this manner:

HEADING:
1. Flux Sensor (NMEA 0183 "HDM, HDT, HSC")
2. SeaTalk Data (Heading via Autopilot compass)
3. Navaid Data (NMEA 0183 "RMC, RMA, VTG")

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

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

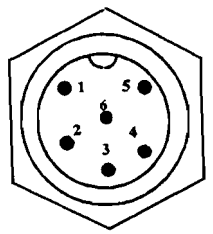
WAYPOINT:
1. Navaid Data (NMEA 0183 "RMB, BWC")
2. SeaTalk Data

SEATALK:
1. SeaTalk Data only

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 its NMEA 0183. The Navaid input should be connected at the NMEA connector J404, Pin 1 (DATA +) and Pin 2 (DATA -).

If for some reason, NMEA 0183 data is not available from any Navaids on the vessel, the radar can still accept and operate in full function with the JRC serial format. The DATA+ and DATA- (return) connections should be connected at Pins 1 and 2 J404 for JRC Data as well.



NMEA CHASSIS CONNECTOR J404
View from the rear of the display.

① NAV+
② NAV -
③ COMPASS + (NMEA DATA)
④ COMPASS - (DATA COMMON)
⑤ COMPASS +12Vdc
⑥ COMPASS E

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

The XX radar can also accept the NMEA 0182 data at NAV the input. The NMEA 0182 data contains only the Latitude/Longitude position of own ship. Speed, Course, or Waypoint data is NOT available and the functions which require this data in the radar will not be enabled.

2.5.2.2 INSTALLING THE XX HEADING SENSOR

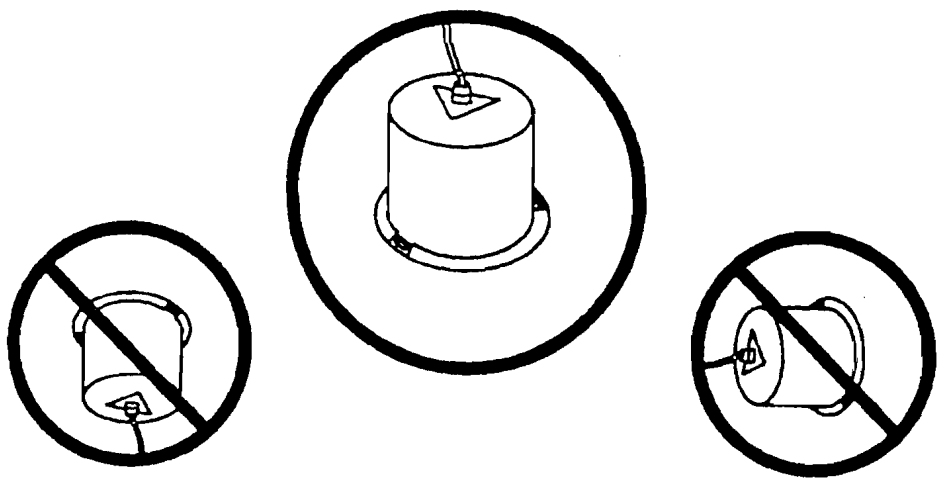
The sensor should be placed in a location on the vessel where magnet interference is minimal and where it will remain undisturbed. The opt mum sensor location is as close as possible to the vessel's center of gravit and subject to minimum pitch and roll such as on a deck close to the wate line. Flying bridge installations are not recommended. On steel vessels how ever, the sensor may need to be mounted above the deck enclosure on mast and between one meter and three meters from the main structure i order to minimize magnetic disturbances.

1. Locate a suitable installation area, resonably free from magnetic interfer ence. Keep away from magnetic devices using coils, transformers or othe types of permanent and electrical magnets. Examples: generators, mo tors, radio or radar receivers and transmitters, loudspeakers and mag netic compasses etc. Minimum mounting distances are shown below.

Minimum Mounting Distances

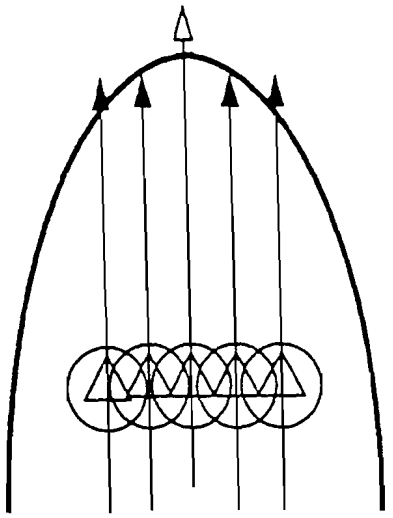
Radios, RDF, Depth Recorders etc.	3ft (1meter)
Power Cables carrying more than 0.5 Amp.	3ft (1 meter)
Radar Magnetrons	9ft (3 meters)
Ships Engines	3ft (1 meter)

2. Each compass is accurately compensated at the factory, so the more care fully you locate the sensor, the less compensation will be required fo heading errors introduced by the installation. Even though the sensor is internally gimbaled, it should be mounted as close to horizontal as pos sible. 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 for the installation.



Tel

3. Before mounting the sensor, carefully align the arrow on the sensor's top 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.

7. It is advisable to connect the sensor through a fused supply or circuit breaker at either an existing switch panel or separate fuse block. Since the current drain is very low, the sensor could be left on with very little battery drain. However, it is best secure power to the sensor when the vessel is not in use. These sensors are not intended for use on "Positive" ground vessels.

2.5.2.3 INTERCONNECTION (XX HEADING SENSOR)

The XX Heading Sensor is intended for use on vessels with 12 Vdc p systems and can operate between 9.5 (min) and 16 Vdc (max). The p system can be "Negative" grounded or have both positive and negative "floating" above ground. The XX Heading Sensor is NOT intended fo on "positive" ground vessels.

A 10 foot shielded cable is supplied with the sensor unit. The cable tains 7 conductors. Two conductors (GRN, ORG) are used to supply h ing data to the radar display and two conductors (RED, BLK) are use supply 12 Vdc ships power to the unit. The unused conductors (WHT, and BLU) should be insulated and tied back. It is suggested that the w terminate on a suitable terminal strip. Refer to Fig. 2-17, below.

When connecting power to the sensor, OBSERVE PROPER POLAR The RED wire should be connected to the Positive (+) source terminal; BLACK wire should be connected to the NEGATIVE (-) source termina the power leads are reversed the sensor will not operate.

If it appears that the sensor is inoperative, check the input voltage pola with a DVM or VOM and if necessary, reverse the wires to correct the er

NOTES

This sensor is designed to output the NMEA 0183 "HDM" sentence 10 times per second to the radar for MARPA operation. The sensor can supply data for up to two (2) external inputs which conform to the NMEA interface requirements.

Ensure that the wiring is as shown in Fig. 2-17, below.

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

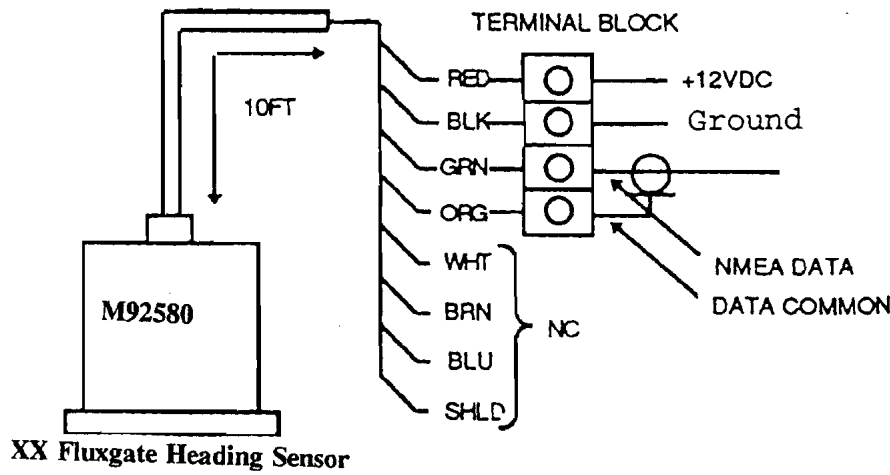


Fig. 2-17 XX HEADING SENSOR INTERCONNECTION

2.5.2.4 INTERCONNECTION (INI-100)

The INI-100 is intended for use on vessels with 12 Vdc power systems and can operate between 8.5 (min) and 28 Vdc (max). The power system can be "Negative" grounded or have both positive and negative lines "floating" above ground. The INI-100 is NOT intended for use on "positive" ground vessels.

A 10 foot shielded cable is supplied with the INI-100 unit. The cable contains 4 conductors. Two conductors (WHT, GRN) are used to supply heading data to the radar display and two conductors (RED, BLK) are used to supply 12 Vdc ships power to the unit. It is suggested that the wiring terminate on a suitable terminal strip. Refer to Fig. 2-18 below.

When connecting power to the sensor OBSERVE PROPER POLARITY the RED wire should be connected to the POSITIVE (+) source terminal; the BLACK wire should be connected to the NEGATIVE (-) source terminal. If the power leads are reversed the sensor will not operate.

If it appears that the sensor is inoperative, check the input voltage polarity with a DVM or VOM and if necessary, reverse the wires to correct the error.

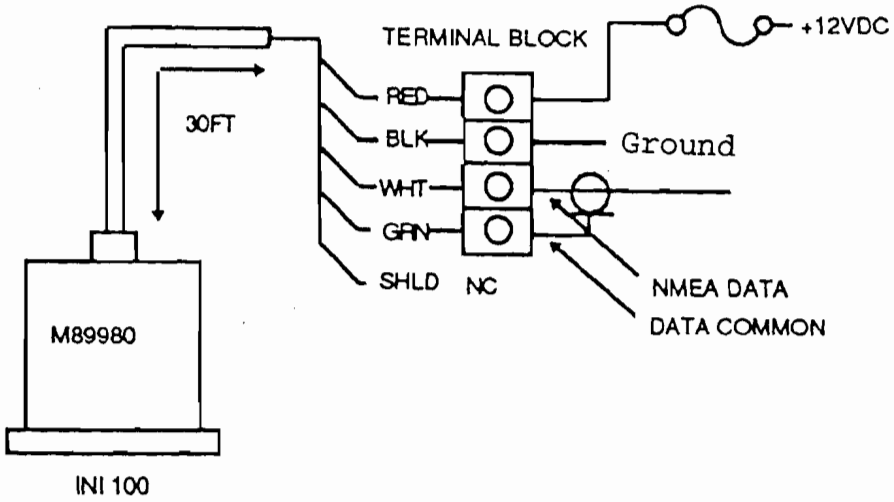


Fig. 2-18 INI-100 WIRING

NOTES

The sensor is designed to output the NMEA 0183 "HDM" sentence for the radar. The sensor can supply data for up to two (2) external inputs which conform to the NMEA interface requirements.

Ensure that the wiring is as shown in Fig. 2-18 above.

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

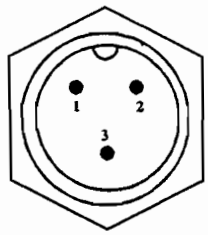
Minimum Mounting Distances

Radios, RDF, Depth Recorders, etc.	1 meter	(3 feet)
Power cables carrying more than 0.5 amp	1 meter	(3 feet)
Radar magnetrons	3 meters	(10 feet)
Ship's Engines	1 meter	(3 feet)

The instructions for calibrating the magnetic sensor unit will be includ
with the magnetic sensor option.

2.5.2.5 SEATALK INTERFACE

SEATALK CHASSIS
CONNECTOR [J407]
View from the rear of the radar display unit.



① Vcc 10-16Vdc

② E

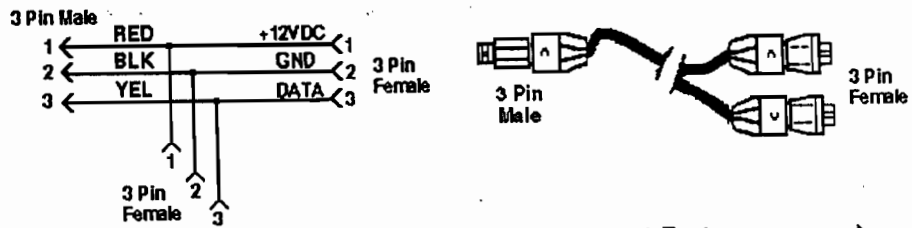
③ TX-RXDATA

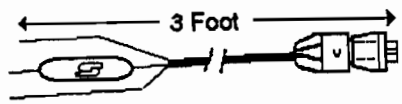
In order to view SeaTalk data in the window on the XX series radar a simple connection to your existing Autohelm equipment is all that is required. Simply "break" the 3 pin SeaTalk bus, and route an interfacing cable into the XX series radar at J409. Standard interfacing cables are available through your local authorized Autohelm or Raytheon Dealer or through Raytheon Marine Company, as well as through Autohelm.

EXTENSION CABLES

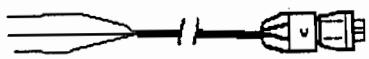
M81169	3 Foot Cable
M81170	10 Foot Cable
M81171	30 Foot Cable

M81172 SEATALK "Y" CONNECTOR

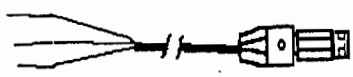




M81174 Power Feed Cable (Female)



M81176 Interface Cable w/o Fuse (Female)



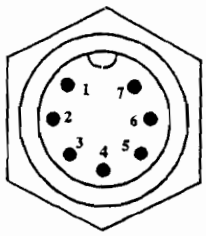
M81175 Interface Cable (Male)

SEATALK CABLE OPTIONS

2.5.2.6 RAYCHART 600A/XX INTERFACE

In order to access the full charting and multi-screen operations of the series radar, a simple connection between your Raychart 600A/XX and display must be made.

RAYCHART CHASSIS
CONNECTOR [J405]
[View is from the rear of the radar display unit]



① C-VD (video)
② C-E (Video return)
③ C-VS (Vertical synch = 60Hz)
④ C-HS (Horizontal synch = 15.75kH
⑤ C-SEL
⑥ Shield Ground
⑦ C-DOTCK (dot clock = 15.0Mhz)

NOTE

*The Raychart 600A has been replaced by the Raychart 600XX. The primary chan in this product is the replacement of the TRACK BALL with the newly designe TRACKPAD.

When the Raychart 600A/XX unit is on, the charting picture can be seer in the PIP (Picture in a Picture) Display selected by the WINDOW key. The Raychart Controller CHT ON key can select full screen display of the charting presentation at any time.

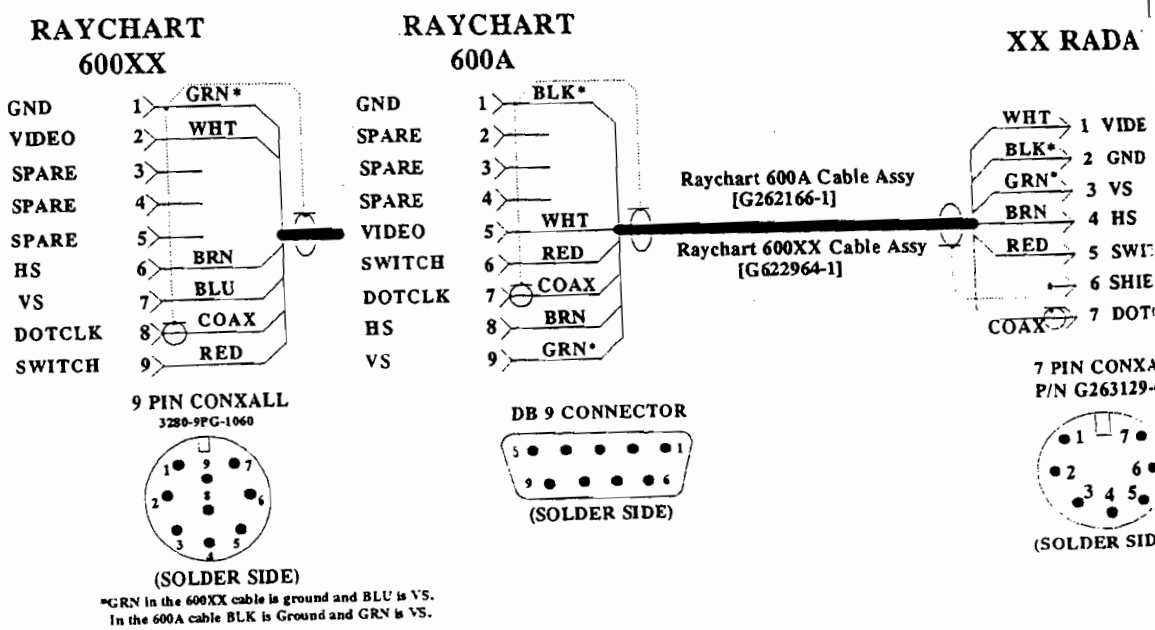
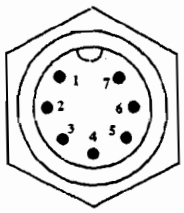


Fig. 2-19 RADAR/RAYCHART INTERCONNECTION

2.5.2.7 V850/V8010 FISHFINDER INTERFACE

In order to see the fishfinder display screen on your XX series radar, interconnect the V850/V8010 Fishfinder to your radar as shown below.

FISHFINDER CHASSIS CONNECTOR [J406]
View is from the rear of the radar display unit.



① F-R (Red Video)
② F-G (Green Video)
③ F-B (Blue Video)
④ F-E (Video return)
⑤ F-VS (Vertical Synch = 60Hz)
⑥ F-HS (Horizontal Synch = 15.75kHz)
⑦ F-DOTCK (dot clock = 5.545Mhz)

When the Fishfinder is interconnected, the fishfinder picture can be displayed in the PIP (Picture in a Picture) panel selected by the window key. The Fishfinder **must be set for the "BLACK" background** when used with the radar display.

The color of the background may be changed in the V850/8010 by pressing the MENU key of the Echosounder. Select FISHFINDER, Press the SCREEN COLORS softkey. Press the BACKGROUND softkey to select "BLACK".

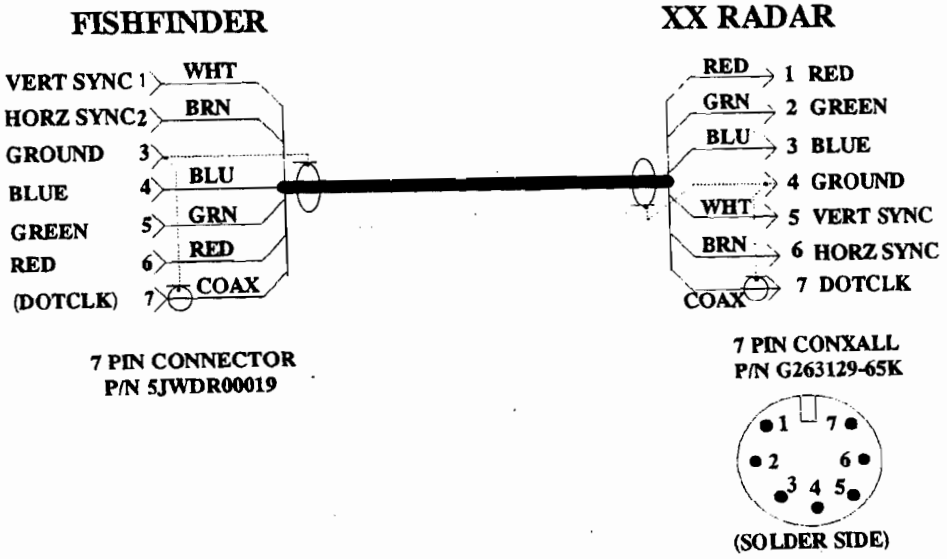


Fig. 2-20 RADAR/FISHFINDER INTERCONNECTION

2.5.2.8 EXTERNAL VIDEO OUTPUT

An external video output connector (J3) is located within the Display Unit on Main Control PCB (CMC-739). This connector supplies the Video, Horizontal Vertical Sync signals to drive a monochrome remote monitor.

The output characteristics of the Sync Signals are:

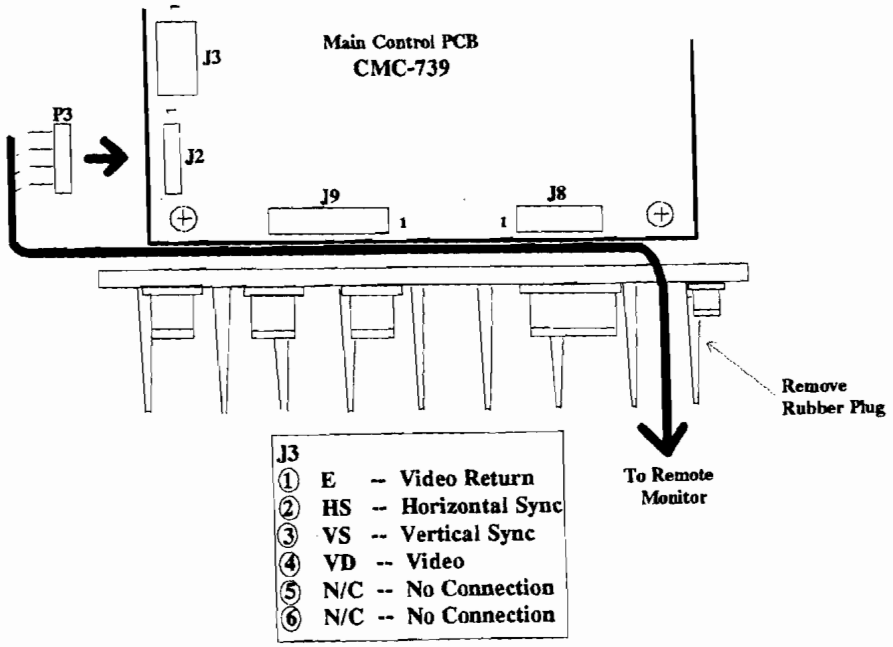
Vertical Sync	= 58.35 Hz
Horizontal Sync	= 15.76 Khz

The Remote Monitor should be capable of having the CRT display presentation o ented in the portrait mode to align with the radars normal orientation. Another R20X 21XX Display may be used as a remote monitor for which the interunit cabling detailed below.

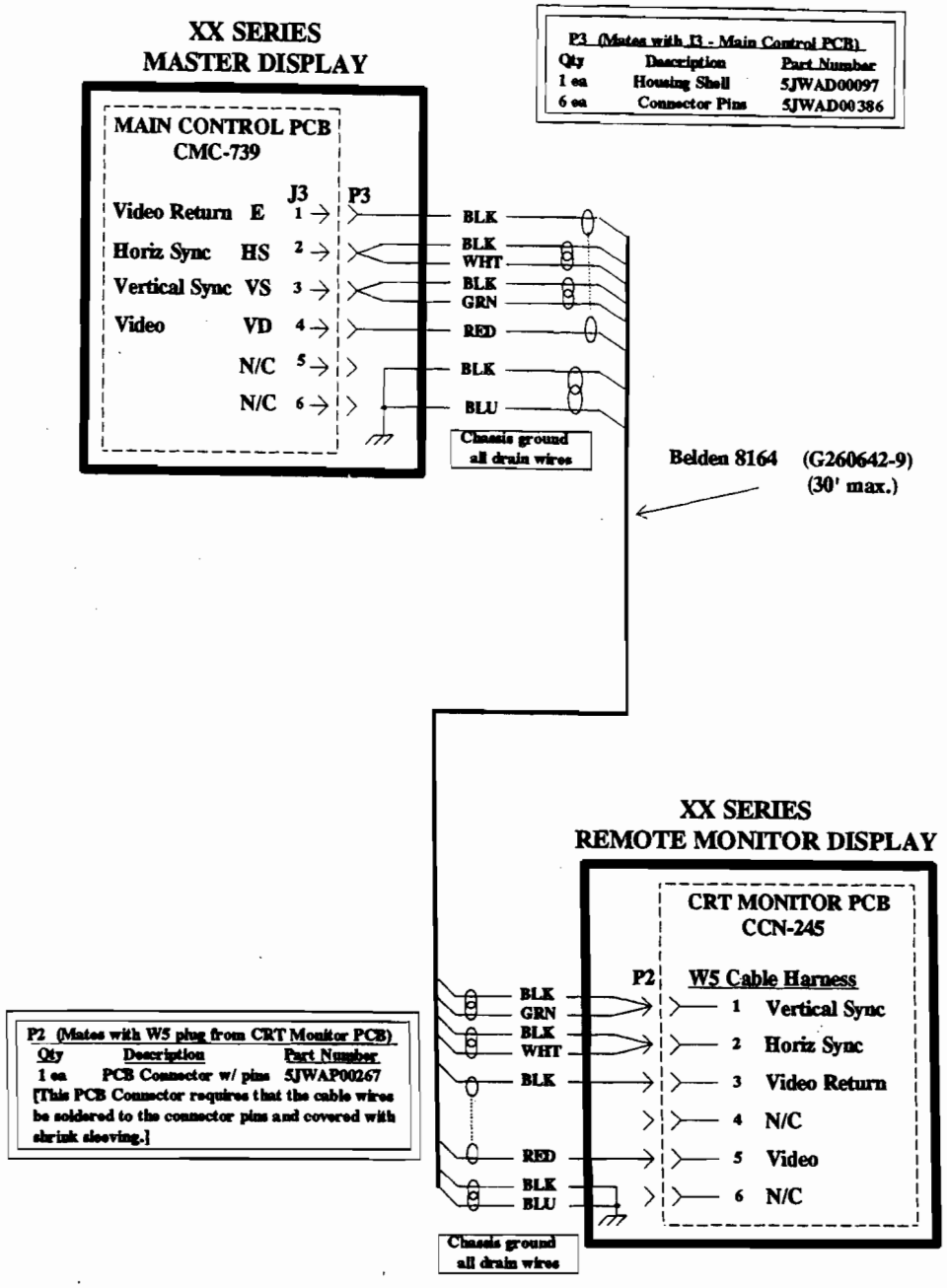
To gain access to the Video Output connector J3, remove the rubber plug located ju under the power connector on the left corner of the display unit's rear panel. Pass t External Video Output Cable part number G260642-9 (Belden 8164) through the ho with the rubber plug. Install connector P3 as detailed in Fig. 2-21 (page 2-31).

The cable is then routed to the remote monitor display. If the remote monitor another XX Display, pass the cable through the small hole just under the power co nector, install connector P2 on the interconnect cable as shown in Fig. 2-21.

The CRT Monitor PCB (CCN-245) must also be modified in the Remote Monito Display. On the CRT Monitor PCB remove transistor TR8 and jumper TR8 Emitte to TR8 Collector. This will bypass the SAVE signal.



Tele



NOTE:

1. **Maximum cable length must not exceed 30 feet.**
2. **Tie all unused conductors and shields to ground.**

Fig. 2-21 CABLE CONNECTIONS FOR MASTER/REMOTE MONITOR OPERATION

2.5.2.9 DUAL (MASTER) DISPLAY CONNECTIONS

In addition to the Remote Monitor configuration previously discussed in this manual, the option of selecting between two separate Master Display Units is available. Refer to Fig. 2-22 through 2-24, Pages 2-33 through 2-35 for proper system configuration and hookup. The Dual Station Junction Box (M89367X) will allow the user to select between one of two Radar Display Units which can be used with one pedestal or radome. The Master Display Unit will primarily be controlled by the DC power selector switch (customer supplied) which will supply 11-42 Vdc to the desired radar system. The Dual Station Junction Box used in this configuration is shipped with a 15 meter (49') cable for connection to the second Display Unit.

To connect the Master Display configuration, perform the following:

1. Remove power to the radar system.

2. Using the Dual Station Junction Box, cut the display to pedestal interconnect cable at the desired point and splice this cable into the junction box. See Fig. 2-22, (Page 2-33).

3. Terminate the supplied interconnect cable within the junction box and then connect the display ends of both cables to the two Display Units. See Fig. 2-23, (Page 2-34).

4. Connect the DC power cables from the A/B select switch to both Display Units.

5. Reapply power to the radar system and verify proper operational results. Be sure to de-energize the equipment prior to switching over to the other Display Unit.

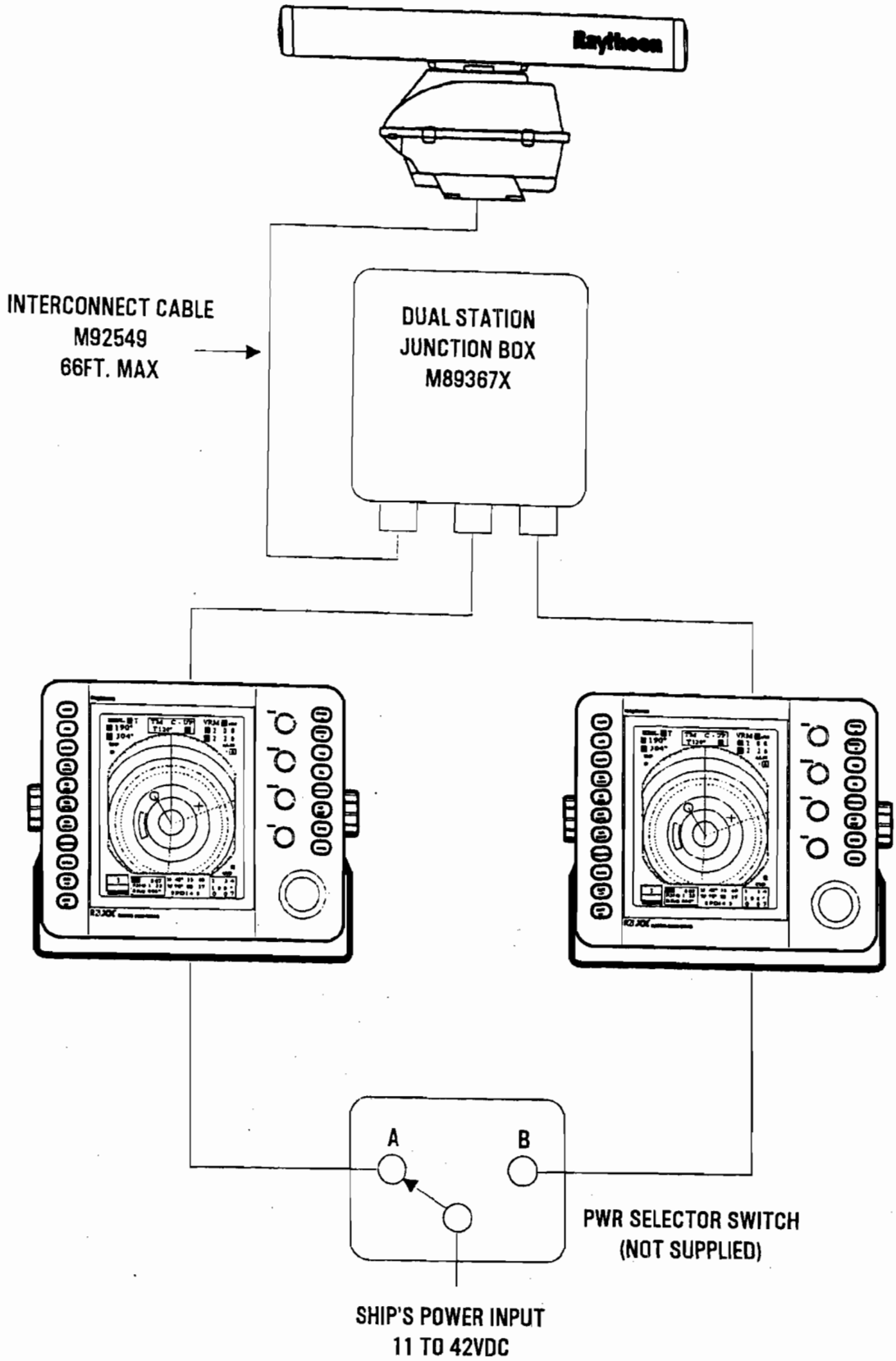


Fig. 2-22 CABLE CONNECTIONS FOR SELECTABLE MASTER OPERATION

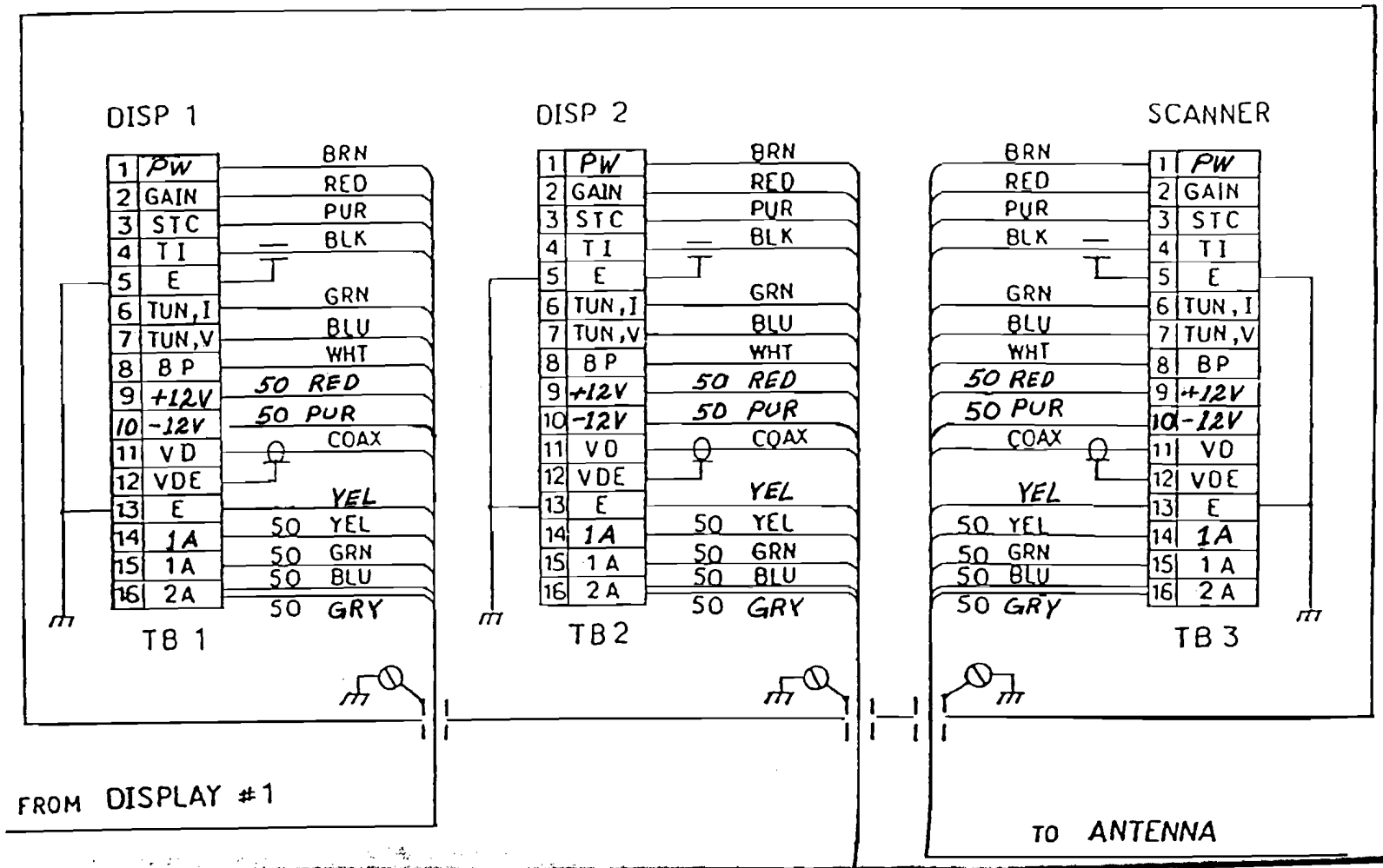


Fig. 2-23 INTERCONNECTIONS, DUAL STATION JUNCTION BOX

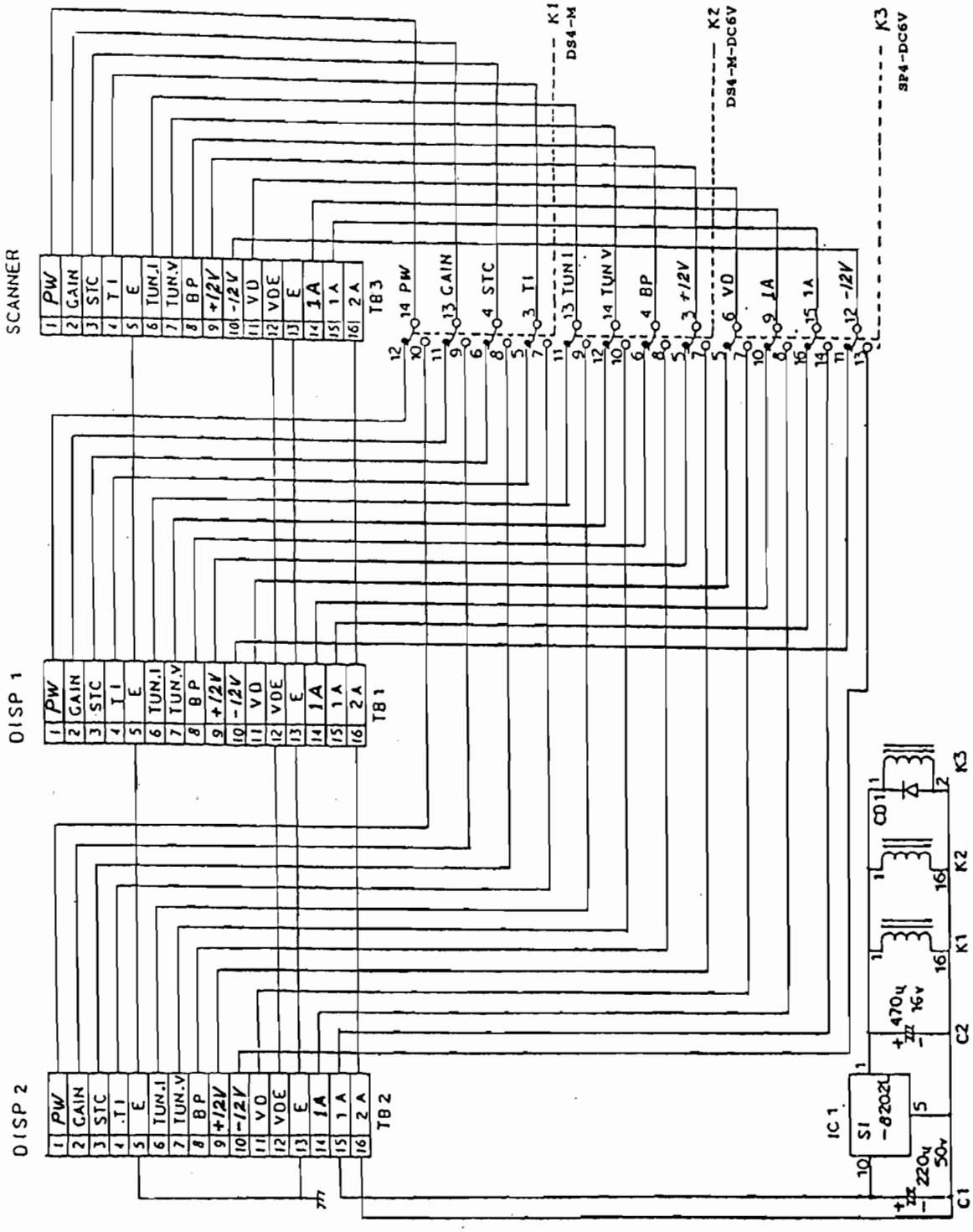


Fig. 2-24 SCHEMATIC DIAGRAM, DUAL STATION JUNCTION BOX

2.5.3 BONDING

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

Bonding practices 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 deck or bulkhead, apply anti-seize compound to screw threads and secure 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

OPERATION

3.1 INTRODUCTION

Congratulations on selecting the Raytheon XX Series Raster Scan Radar to fulfill all of your radar navigation requirements.

The R20XX/R21XX Radar besides being an outstanding Radar System by itself, combines the operations of Fish finding and Chart Plotting with those of Radar Navigation. This section of the manual provides the descriptions and instructions for all of the operations and features within this radar system.

For first time users of Radar, we have included a basic description of the radar presentation with a basic understanding of how the controls affect the radars operation and display. The actual description of the front panel controls along with an explanation of how they work begins on page 3-9 of this section.

This section begins by describing the keypad layout and the various display screens of the R20XX/R21XX Radar. A foldout page with a drawing of the display and locations of all the controls and display data is provided on page 3-16 (Fig. 3-2) and 3-53 for your reference while reading about these controls.

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

To keep the operation of the R20XX/R21XX Radar simple and as automatic as possible, the Radar uses many on-screen menus, messages, and prompts to help guide you through various operations. You should master the unit very quickly and the approach you should take, while becoming familiar with the operations, is one of relaxed confidence.

3.2 RADAR MAP

The radar picture appearing on the 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. The operator may reposition or offset the ship's position up to 66% 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 and landmass is generally depicted in solid filled green echo areas. Other surface vessels, and channel buoys, are displayed as smaller single "pips" or echoes. The radar picture or map can be viewed in many different 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 the short or nearby range scales are selected. The best technique for assessing the radar presentation characteristics 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.

The long range scales (i.e. 3, 6, 12, 24, Nmi) best show the overview of the ship's relationship to land masses, weather fronts, and large ship targets at or beyond view.

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.

3.2.1 MAP ORIENTATION

In the RELATIVE mode, the heading line always appears on the Display Unit at 0° relative according to the on-screen bearing scale, 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 that the targets are appearing on the Radar display at the same relative bearing.

The Electronic Bearing Lines (EBL's) are available radar tools used to measure bearings to radar targets from own ship. The bearing readouts may be in relative, true or magnetic. When in the TRUE mode, EBL readouts give true bearing to targets. The MAGNETIC mode provides magnetic bearings to targets.

A GPS, Loran or Magnetic compass input is required in order to produce magnetic bearings. In order to generate true headings, an NSK Unit operating from a Gyro input, GPS or Loran C set for true bearings may be used.

3.2.2 EFFECT OF SHIP'S MOVEMENT

Radar images can be drawn in two ways on the radar display to show the ship's motion. The type of display modes are called "Relative Motion" and "True Motion". In Relative Motion, the most common radar display mode, own ship is permanently fixed at the center of the 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 own ship's position will always remain at the center of the display.

If the 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 characteristic to remember when maneuvering around nearby vessels, or buoys.

The True Motion Display mode can be compared to your vessel moving on a map or chart. In True Motion mode, the surrounding landmass echoes remain stationary on the screen and 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).

3.2.3 NAVIGATIONAL ECHOES

Echoes displayed on the radar screen may be large or small, bright or faint, depending on the size and shape of the object and its angle relative to your radar antenna. The radar indication is not always the same as an observer's visual indication; a nearby small object may appear to be the same size as a distant large object on the radar. With experience, however, different targets can be identified by the relative size, brightness, and position of their radar echo returns.

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

High coastlines and mountainous coastal regions are often observed at the longest ranges of the radar. However, the first sight of landfall on the radar's

longest ranges may be a mountain several miles inland from the coastline and not the actual coastline. The coastline may not appear on the radar until the vessel has approached land nearer the line of sight distance.

3.2.4 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, particularly in windy weather and in heavy seas. These echoes appear on the radar screen on the very short range scales as multiple small echoes next to own ship. 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 own ship. The radar has a control which can be used to minimize the effects of sea clutter pickup on the screen.

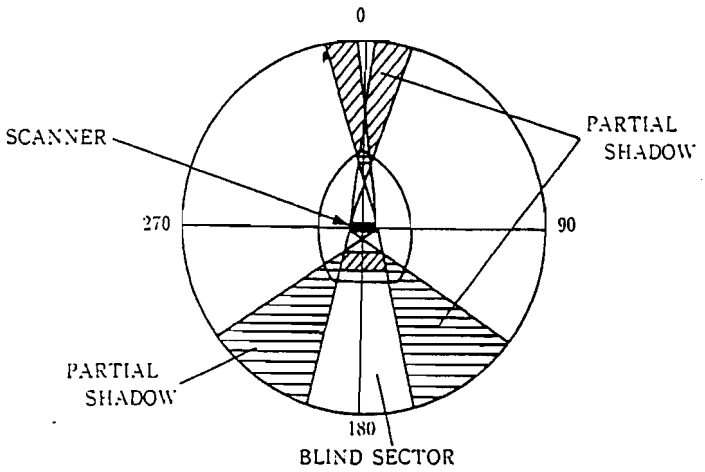
3.2.5 STORM AND RAIN SQUALL RETURNS

The radar can also see echoes from rain or snow. Echoes 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 may be visable at long distances due to their high altitude above the radar horizon and are very helpful for observing potential bad weather conditions. If the returns from storm areas and rain squalls are not desired, the RAIN CLUTTER control can be adjusted to minimize the effect on the radar screen.

3.2.6 BLIND SECTORS OR SHADOW EFFECT

Funnels and masts, (when located near the antenna array) may cause shadows. Shadow areas can be recognized since beyond the obstruction there will be a reduction of targets and noise intensity, although not necessarily a complete cutoff seen on the screen. However, if the shadow angle is more than a few degrees, there will be a blind sector.

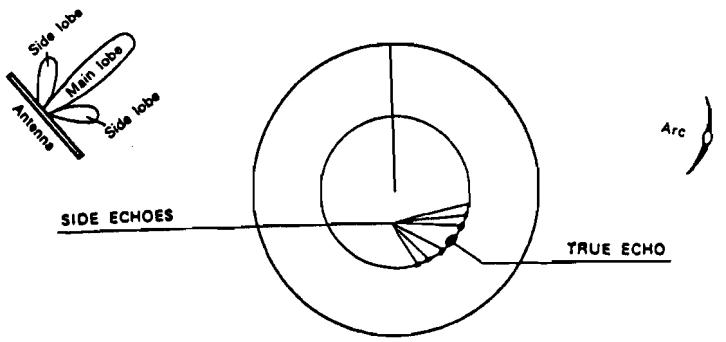
In some shadow sectors the beam intensity may not be sufficient to obtain an echo from a very small object even at close range, despite the fact that a large vessel can be detected at a much greater range. For this reason, the angular width and relative bearing of any shadow sector should be determined at installation. Sometimes shadowing can be seen on the screen by increasing the radar gain until noise is present. Darker 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.



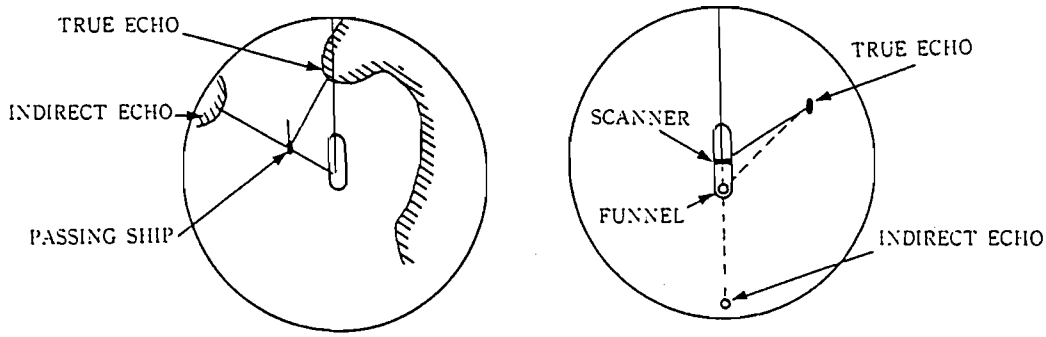
3.2.7 SIDE LOBES

Echoes on the radar screen are not always the direct returns to the radar antenna. There are many types of false 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 the radar operator, through observation, practice, and experience usually can detect these conditions very quickly.

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

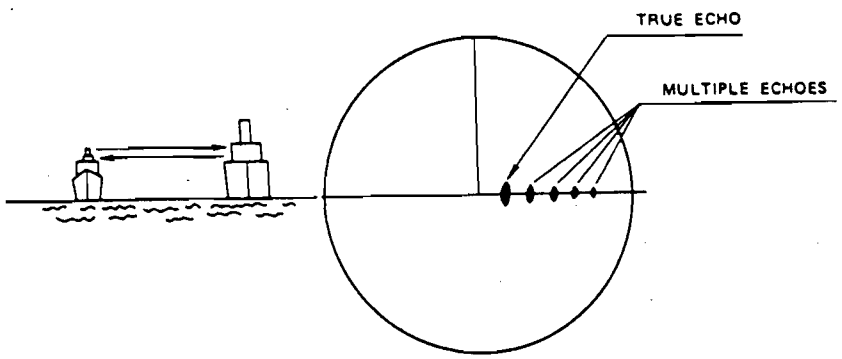


Ghost image sometimes are referred to as indirect echoes. Indirect echoes may appear when there is a large target, such as a passing ship at a short range, or a reflecting surface, such as a funnel or spotlight on your own ship in line with the antenna. The signal, on first striking the smooth side of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



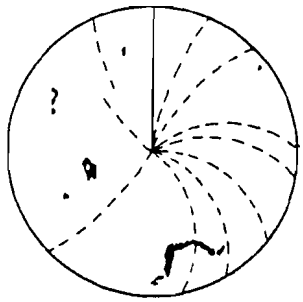
Multiple echoes could appear if there is a large target having a wide vertical surface to your own ship at a comparatively short range. The transmitted signal will be reflected back and forth between the wide vertical surface of the target and your own ship.

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.



3.2.8 RADAR INTERFERENCE

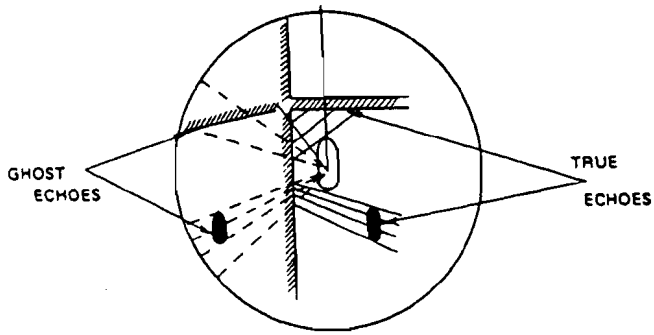
Whenever two or more radar equipped vessels are operating within reception range of each other, mutual interference is likely when the radar's are operating near the same frequencies. This interference usually appears on the screen as a series of small dots. The interference seems to move from the PPI center, sometimes in a straight line, but more often in a long, sweeping curve. This type of interference is more noticeable on longer range scales. This does not, as a rule, impair the effectiveness of the radar as a navigational aid. Since the interference can be completely eliminated by turning IR "ON" on the Display Unit function menu. The IR feature is normally left "on".



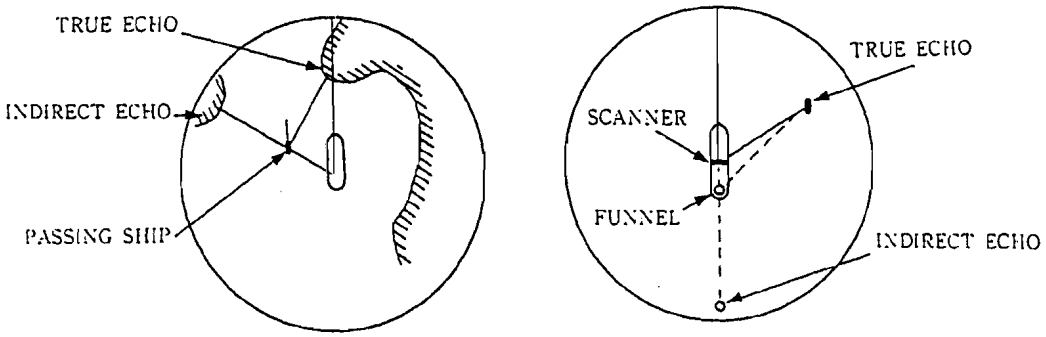
3.2.9 FALSE ECHOES

Occasionally, echoes may appear on the screen at positions where there is no actual target. This type of target is called a False Echo. Sometimes they are known as Ghost Images, Indirect Echoes or Multiple Echoes depending on how they are generated.

Ghost images usually have the appearance of true echoes, but, in general, they are intermittent and poorly defined. A true ghost image retains a fixed relationship with respect to the true image and characteristically produces a more arc-like appearance with a tendency to smear on the screen. Ghost images are sometimes caused by large targets which have a wide, smooth surface as they pass by near your own ship.

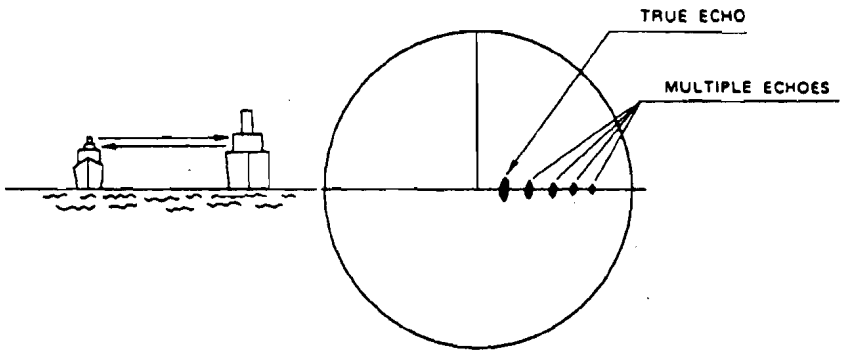


Ghost image sometimes are referred to as indirect echoes. Indirect echoes may appear when there is a large target, such as a passing ship at a short range, or a reflecting surface, such as a funnel or spotlight on your own ship in line with the antenna. The signal, on first striking the smooth side of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



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.



3.2.10 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 in that the radar energy travels in a straight path to the visual horizon but are refracted or bent slightly. This "bending" increases the distance of the radar's "horizon" to slightly beyond the optical horizon (displayed range is correct, however). As Fig. 3-1 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. 3-1 below, provides a convenient method of determining any of the three factors involved when the other two factors are known.

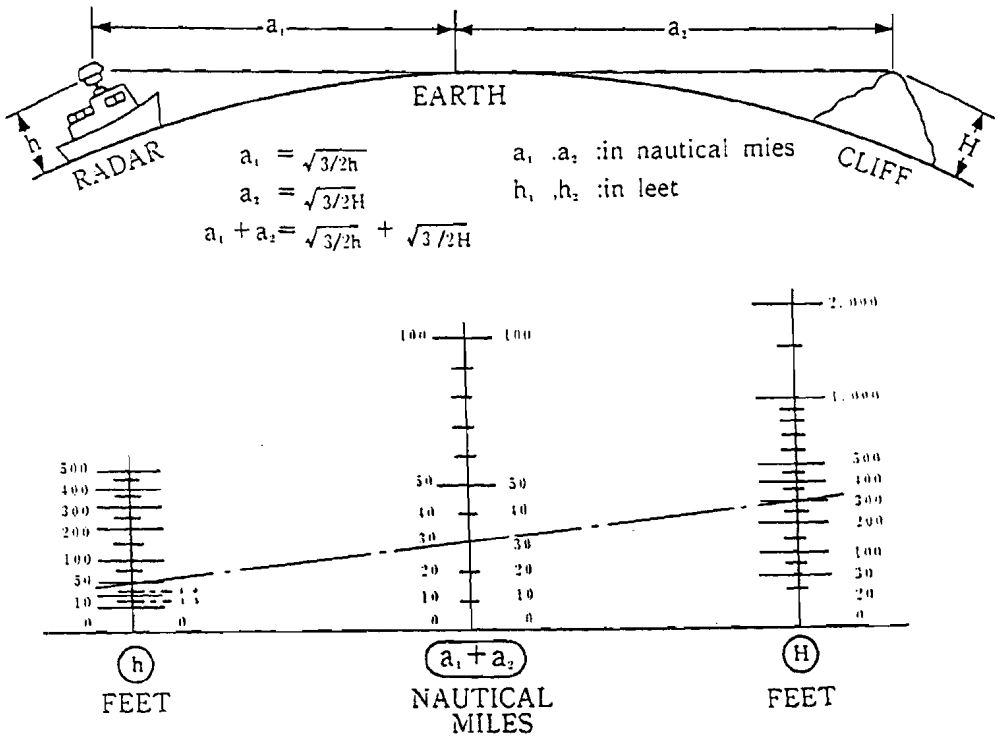


Fig. 3-1 RADAR LINE OF SIGHT RANGE NOMOGRAPH

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

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

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

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

3.3 RADAR CONTROLS

The layout of the controls is shown in Fig. 3-2 (Pg. 3-16 & 3-53)

TABLE 3-1 RADAR CONTROLS

#	Symbol	Description	Function
1	ST BY OFF	Standby/OFF Switch	Turns ON power to Display and Pedestal/ Radome and activates 90 second countdown timer. Press ST BY OFF and X MIT OFF simultaneously to SHUT OFF
		Brilliance Reset	When ST BY OFF and MENU keys are pressed simultaneously, the display automatically resets the brilliance to level 6
1	X MIT OFF	Transmit/OFF Switch	Turns ON transmitter which activates Pedestal/Radome. Press ST BY OFF and X MIT OFF simultaneously to SHUT OFF
2	RANGE σ	Range Scale UP	Increases the range scale in use
2	RANGE τ	Range Scale DOWN	Decreases the range scale in use
3	TUNE	Tune Control	Manually fine tunes receiver by peaking tuning bar in lower left corner (No tuning bar in AUTO tune)
4	RAIN CL	Rain Clutter Control	Reduces rain or snow returns
5	SEA CL	Sea Clutter Control	Reduces sea returns
6	GAIN	Gain Control	Controls strength of target returns
7	VRM	VRM Enable/Select	Enables a VRM for display/A short press, selects a VRM for operation. Press and hold to turn off selected VRM.
8	EBL	EBL Enable/Select	Enables a EBL for display/A short press, selects an EBL for operation. Press and hold to turn off selected EBL.

TABLE 3-1 RADAR CONTROLS (Cont.)

#	Symbol	Description	Function
9	CURSOR	Display CURSOR Enable	Enables cursor for range and relative bear measurements from own ship.
10	OFF CENT	Display OFF Center	Places origin at any point on screen up to 66% of radius. Inop on 24/32 Nmi Range
11	ZOOM	Display ZOOM Enable	Magnifies a selected point of interest on tl display by a factor of X2 Inop on 1/8 NM and in OFF CENTER mo
12	GUARD	GUARD Zone Select	Enables or disables Guard Zone alarm as s with the Trackpad and I or O operation I = Inbound Mode O = Outbound Mode Blank = OFF
13	EBL R-T/M	EBL Bearing Mode Select	Selects EBL Relative or True/Mag Bearing Mode alternately
14	RR SHM	Range Rings ON/OFF and Ship's Heading Marker OFF	Enables or disables the fixed Range Rings alternately Momentarily disable the Heading flash w pressed and held.
15	HDG MODE	Heading Mode Selection	Selects type of Heading Mode C-UP = Course UP N-UP = North UP H-UP = Head UP
16	HDG RESET	Heading Reset	Heading reset in Course UP Mode return heading flash to 000.
17	WINDOW	Dual Screen	Enables and selects the displays within th dual screens: Raychart Fishfinder SeaTalk OFF
18	M.O.B.	Man Over Board	Marks the point where the incident occu
19	ACQ	MARPA Acquistion	Acquires target to be tracked. Press and delete all acquired target.
20	MENU	MENU Recall	Enables MENU for setups and selections

TABLE 3-1 RADAR CONTROLS (Cont.)

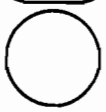
#	Symbol	Description	Function
21	ENTER	ENTER Data	Enters selected data.
22		TRACKPAD	Positions cursor, selects menu items, or makes on screen measurements and selections.

TABLE 3-1 ON SCREEN READOUTS (Cont)

#	Symbol	Description	Location
23	EBL [1] T [1] 190° [2] 304°	EBL Selected EBL Bearing Mode R = Relative Bearing T = True Bearing M = Magnetic Bearing Bearing of EBL 1 & EBL 2	Display Readout, Upper Left
24	EXP	Target Expander ON	Display Readout, Upper Left
24	IR	Interface Rejection ON	Display Readout, Upper Left
25	C-UP T120° [L]	Heading Mode H-UP = Head Up C-UP = Course Up N-UP = North Up Bearing Selected T = True Bearing M = Magnetic Bearing Own Ship's Heading Heading Data Source [M] = Magnetic Sensor [S] = SeaTalk [L] = Loran or GPS	Display Readout, Upper Center Magnetic Heading Magnetic Heading Magnetic or True Heading
26	VRM [2] NM [1] 2.00 [2] 2.26	VRM Selected VRM Range Units NM = Nautical Mile KY = Kiloyard KM = Kilometer Range of VRM1 & VRM2	Display Readout, Upper Right
27	ALM 1 [6]	Guard Zone Alarm ON Guard Zone Mode 1 = In Mode O = Out Mode Sensitivity Level [1] - [7]	Display Readout, Upper Right

TABLE 3-1 ON SCREEN READOUTS (Cont.)

#	Symbol	Description	Location
28	RNG 3 .5	 Range Scale Range Ring Interval	Display Readout, Lower Left
29	[ ][ ][ ][ ][ ][ ]	Manual Tuning Mode (Tuning Indicator)	Display Readout, Lower Left
	AUTO	Auto Tuning Mode	Replaces Tuning Indicator
30	CUR 1.34 190° 0:07	Cursor Position Range NM,KY or KM Bearing (Deg.) Time-To-Go (Min.)	Display Readout, Lower Right
31	[C]	TrackPad Mode Indicator [C] = Cursor [E] = EBL [V] = VRM [O] = Off Center [G] = Guard [F] = Floating EBL [M] = MARPA [Z] = Zoom	Display Readout, Lower Right
32	[WP] 0:07 RNG 1.25 BRG 086°	Waypoint Data ON Time-To-Go (Min.) Range (NM) Bearing (Deg.)	Display Readout, Lower Mid Left
33	[MO] 0:03 RNG 0.34 BRG 175°	MOB Data ON Time-To-Go (Min.) Range (Nmi) Bearing (Deg.)	Display Readout, Lower Mid Left
34	N 41°90.67 W 70°06.04	Own Ship's LL	Display Readout, Lower Mid Right
	[N 42°35.68 W 70°00.37]	Waypoint LL	Display Readout, Lower Mid Right
	[N 42°90.67 W 70°06.04]	MOB Point LL	Display Readout, Lower Mid Right (MOB mod
	[1] 26231.5µs [2] 14454.3µs	Waypoint TD	Display Readout, Lower Mid Right
35	SPD 14.5	Own Ship's Speed	Display Readout, Lower Mid Right

TABLE 3-2 MARPA READOUTS

Item	Description	Notes
RV	Relative Vector	
TV	True Vector	
CRS	Tgt. Course	
(own) SPD	Tgt. or (Own) Ship Speed	
CPA	Closest Point of Approach	
TCPA	Time to Closest Point of Approach	
Intercept	Intercept	Intercept Function "ON"

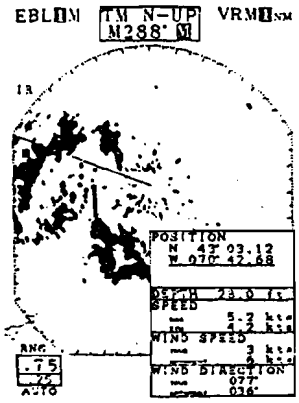
3.4 STARTING OPERATION

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

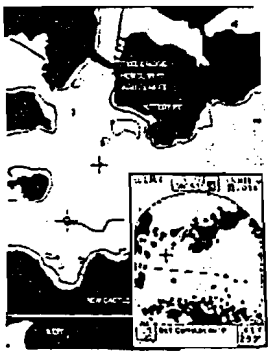
3.4.1 INITIAL DISPLAY SETUP

Before turning the power on to the unit for the first time, the four variable controls should be checked and be set to the following positions:

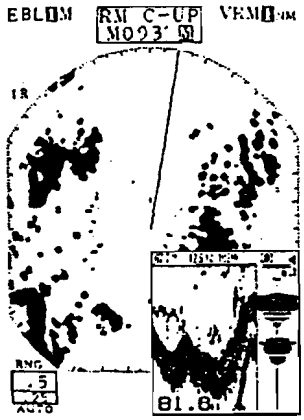
TUNE ③	12 o'clock position
GAIN ⑥	CCW
ANTI-CLUTTER/RAIN ④	CCW
ANTI-CLUTTER/SEA ⑤	CCW



Radar Picture
with SeaTalk Data Window



Raychart Picture
with Radar Window or Reverse



Radar Picture
with Fishfinder Window

3.4.2 TURN ON PROCEDURE

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

1. Press the [ST-BY/OFF] key ① to place the radar in standby. When the countdown has expired, the displayed prompt of "ST-BY" should appear. Pressing the [X-MIT/OFF] key when ST-BY is displayed puts the radar in the transmitting mode.

2. Set the radar range via the [Range ▲] [Range ▼] keys to the 3 Nmi range scale.

3. Turn the GAIN Control ⑥ clockwise until targets appear and a light speckle of background noise is visible.

4. Adjust the TUNE Control ③ to obtain the maximum (strongest pickup) display of targets. (Adjust TUNE in ranges greater than 3Nmi only). If AUTO is displayed in the lower left corner under the range scale, then the tuning is automatic.

5. Reset the [RANGE ▼] key ② down to .75 Nmi

6. Turn the ANTI-CLUTTER/SEA 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 ANTI-CLUTTER/RAIN Control ④ clockwise to reduce or eliminate the rain, while retaining targets for best viewing.

3.4.3 SHUT DOWN PROCEDURE

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

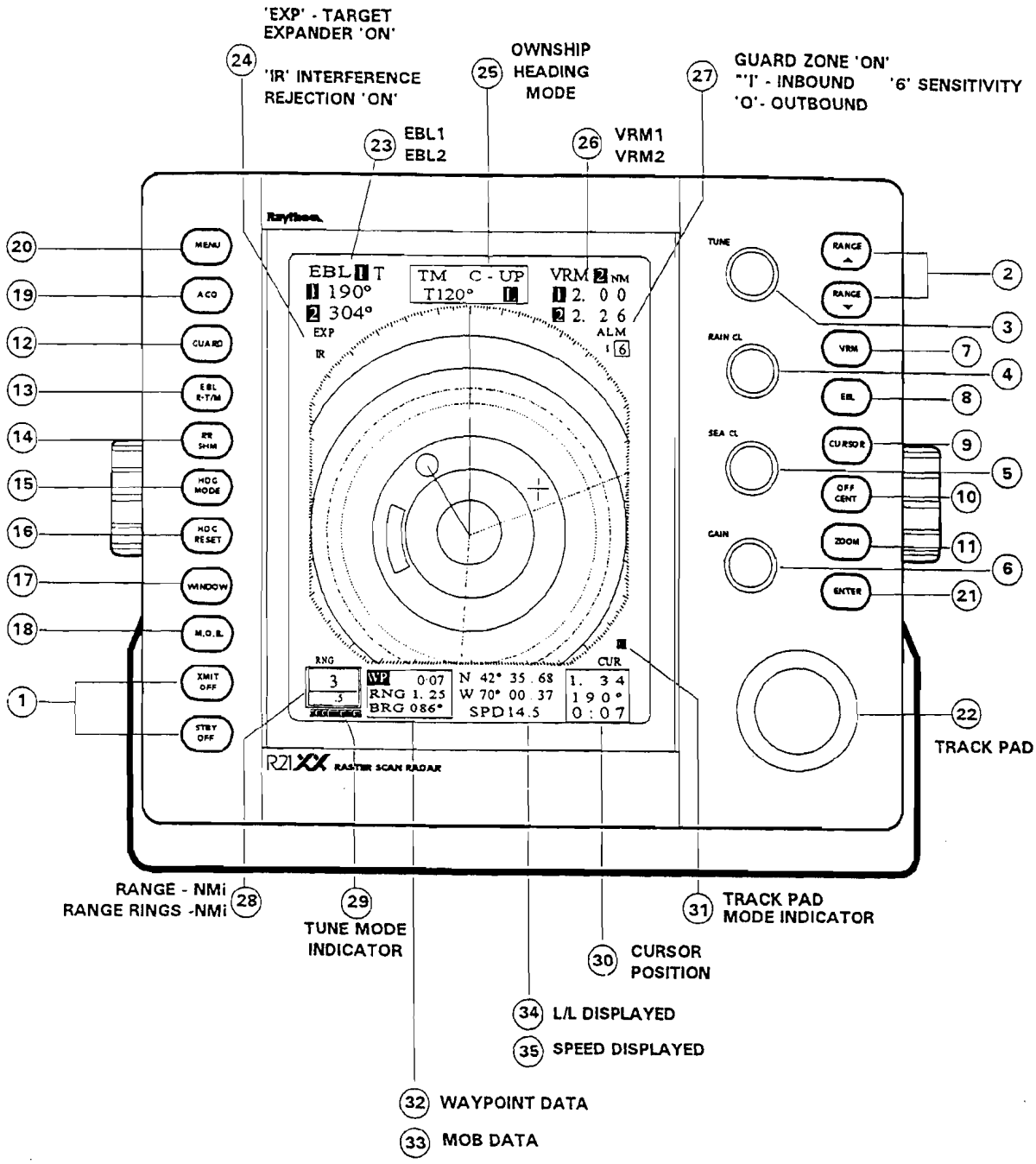


Fig. 3-2 R20XX/R21XX CONTROL LOCATIONS

3.5 FRONT PANEL OPERATION

3.5.1 THE TRACKPAD

Throughout the Operation Section of this manual operating instructions will be given which involve using the Trackpad. The Trackpad operates similar to a Trackball or Computer Mouse except that motion is determined by the pressure that is applied to the Trackpad, while the direction is determined by the location on the Trackpad where the pressure is applied.

To operate the Trackpad, place your thumb in the center of the Trackpad.

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

To move up press your thumb toward the top edge; to move down press your thumb toward the bottom edge of the Trackpad.

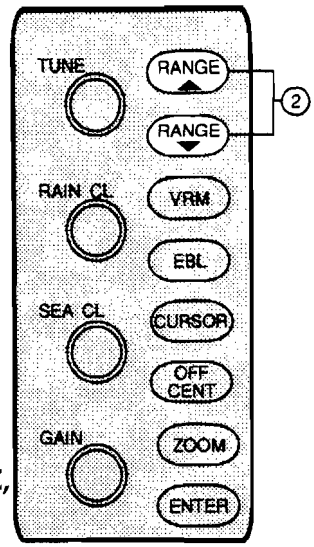
To move on the diagonal direction, press your thumb at the approximate angle in which the cursor should move.

To move slowly, use light pressure. To move more rapidly, use heavy pressure.

When using the Trackpad 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 when it is highlighted or underlined.

Usually on-screen messages indicate the correct operations involving the Trackpad and ENTER key.

3.5.2 RANGE KEYS (2)



Each time the radar is turned ON, the range displayed will be the same range scale that was previously "in use" when the radar was turned OFF. To change ranges press the RANGE▲ or RANGE▼ key, the desired range scale can be selected. 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 3-3 shows this relationship.

TABLE 3-3 RELATION OF RANGE, RINGS AND PULSE LENGTH

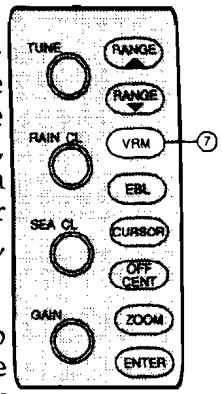
Range (Nmi)	Range Ring Interval (Nmi)	Number of Rings	Pulse Repetition Frequency (Hz)	Transmitting Pulse Length (μs)	Bandwidth of IF Amplifier (MHz)
0.125	0.0625	2	2250	0.08	10
0.25	0.125	2	2250	0.08	10
0.5	0.25	2	2250	0.08	10
0.75	0.25	3	2250	0.08	10
1.5	0.25	6	2250	0.08	10
3	0.5	6	1500	0.35	3
6	1	6	1500	0.35	3
12	2	6	750	0.7	3
24	4	6	750	0.7	3
32	8	4	750	0.7	3

NOTE

Pressing both RANGE keys at the same time while turning the radar to standby 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. Hold down both the RANGE▲ and RANGE▼ keys; then press the ST-BY key to place the unit in ST-BY. Release the RANGE keys. The Master Reset condition is verified by observing that the total hour meter is reset to 0000Hrs.

A Hard Master Reset can also be performed. This type of reset will clear all memory including the radar's initial settings. To perform a hard master reset press RANGE▲ and RANGE▼ and VRM simultaneously. Then press the ST-BY key. Release the ST-BY key and then all other keys in order to Hard Reset the radar.

3.5.3 VRM (VARIABLE RANGE MARKER) KEY (7)



A Variable Range Marker (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 momentarily 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 appear and be displayed but as a dotted circle.

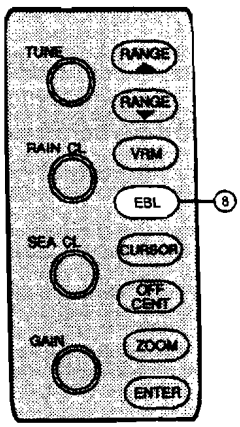
If the [VRM] key is held depressed until the long beep sounds, the selected VRM ring will be turned OFF. The selection of which VRM will be controlled, is made by depressing the [VRM] key momentarily. The VRM being controlled is displayed with a reversed character [1] or [2] after "VRM" in the upper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

The range and numerical readout of the selected VRM can be changed by pressing the top (increase) or bottom (decrease) of the trackpad. In order to be sure you're going to move the VRM with the trackpad, it is necessary to first press the [VRM] key, [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 trackpad and the [V] character next to the trackpad 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.

3.5.4 EBL (Electronic Bearing Mode) KEY (8)

The Electronic Bearing Line (EBL) is used to measure the bearing or angle to radar targets from own ship. There are two EBL's available in this equipment.



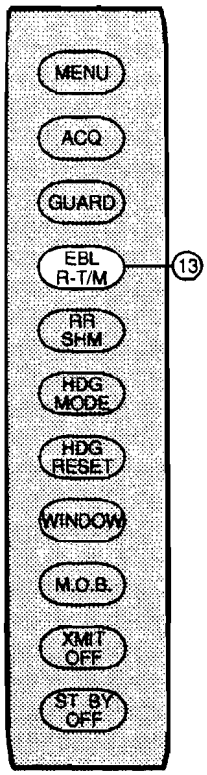
When the EBL key is initially momentarily pressed "EBL1" appears as a "Dashed" Line on the radar screen. The EBL line may be then rotated CCW by putting pressure on the Trackpad left edge and CW putting pressure on the Trackpad right edge. Heavy pressure moves the EBL line faster; lighter pressure moves the line more slowly. The Trackpad will control the EBL only while the "SET EBL with T/P" message is displayed and the letter [E] is displayed 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.

The EBL's can be turned off independently when you press and hold the EBL key while the EBL mode is controlling the EBL to turn off. For example, if EBL2 is the active EBL, pressing and holding the EBL key will turn OFF EBL2.

The EBL bearing readouts appear in the upper left corner of the display. The "Active" EBL can always be identified by the number displayed after the EBL characters.

The bearing readouts for the EBL lines appear under the EBL characters next to the 1 or 2 when the EBL's are on.



3.5.5 EBL (Bearing Mode) KEY (13)

The EBL bearings may be displayed in either degrees Relative "R", True "T" or Magnetic "M" depending on the mode selected with the EBL R-T/M key and the radar's bearing menu selection. The digits of the bearing display will be followed by a "T" when the bearing is "True", an "M" when the bearing is "Magnetic", or an "R" when the bearing is "Relative". It should be noted that a Loran, GPS navigator, or Flux Gate compass (magnetic only) is required in order to display True or Magnetic bearings depending on your selection of MENU-RADAR SETUP where you may select either Magnetic or True bearings.

Each press of the EBL R-T/M key changes the bearing readout in the following sequence: RELATIVE → TRUE or RELATIVE → MAGNETIC →.....

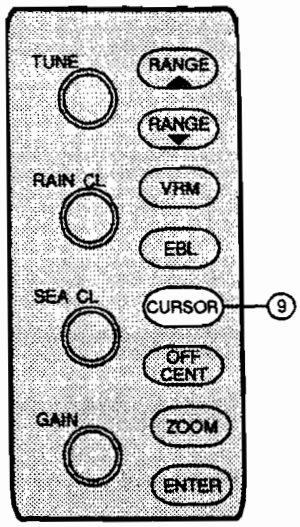
The unit of True bearing or Magnetic bearing is selected by the "RADAR Setup" menu.

Press MENU and select "RADAR SETUP". The "Bearing" selection may be either "Magnetic" or "True". Use the Trackpad to identify the desired type of bearing and press ENTER. Press the EBL R-T/M key to make the selection of True/Magnetic or Relative.

The "True" and "Magnetic" modes all depend on having a Navaid with proper data format connected to the radar system. In addition, the vessel must be underway and generally on a constant heading for several minutes so that the COG (Course Over Ground) information from the Loran or GPS will be valid and useable for the radar display modes.

Pressing the EBL R-T/M key places the radar's EBL information in the "True" mode of operation depending on your setup. In this mode, EBL 1 and EBL 2 bearings are indicated in the True bearing as determined by the NAVAID input. The character "T" will be displayed in the right of the EBL bearing character to indicate the type of bearing input. The ship's COG data from the NAVAID is shown on the radar display directly above the SHM and the vessel's speed is shown in the lower right of the display in this mode. Selecting Magnetic bearings at the radar Setup Menu and then pressing the EBL R-T/M key places the radar's EBL information in the "Magnetic" mode of operation. In this mode, EBL 1 and EBL 2 bearings are indicated in Magnetic bearing as determined by the Navaid or optional compass sensor input. The character "M" will be displayed to the right of the EBL characters to indicate the type of bearing input. When the compass data is used, the "M" character will be displayed in block form M within the heading box readout.

3.5.6 CURSOR KEY (9)



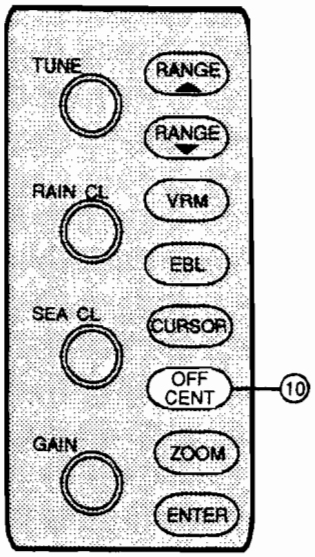
The Cursor feature combines the EBL and VRM functions and can be used to quickly determine the range and bearings from your own ship to any point on the radar screen. The cursor appears on the display as a large (+) character.

To turn ON the Cursor mode, just press the CURSOR key. A blocked character C appears above the CUR characters to let you know that you are in the "Cursor" mode. The cursor may now be positioned by using the Trackpad. 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 bearing type of the cursor position will be the same as that of the EBL as noted by the "R" Relative, "T" True or "M" Magnetic next to the EBL bearing in the upper left corner of the screen. The Time-To-Go readout appears for only about 8 to 10 seconds and will disappear after that time. The Time-To-Go is based on the speed input from the Navaid and the distance measured with the VRM.

If you are interconnected to the Raychart 600A/XX unit and have completed the radar Raychart Seatalk link, the cursor will also appear on the Raychart chart as a "Blinking +" symbol. This feature is especially handy if you are interested in matching objects such as buoys or points of land on the radar screen to the Raychart Cartography.

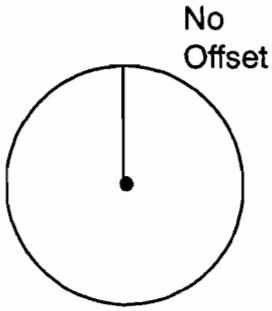
To turn off the cursor, press the CURSOR key again. The cursor will disappear from the Radar Screen and in approximately 15 seconds, will disappear from the Raychart, if connected.



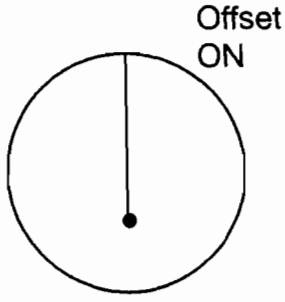
3.5.7 OFF CENTER KEY (10)

The OFF Center Mode lets you position the origin own ship to any point on the screen within 66% of the radius of the display (the center 2/3 of the display). The OFF Center Mode 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/TP" appear on the screen. Position the cursor to the desired starting location for the offset origin by using the Trackpad. Note that when the Trackpad 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 and own ship will be moved to the designated cursor location.

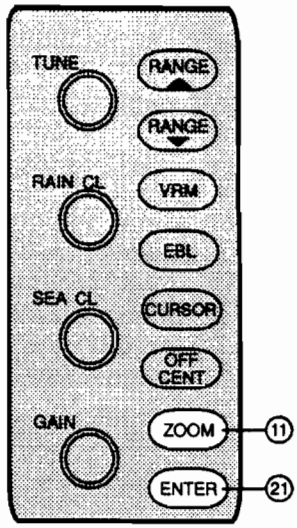


To turn OFF the OFF Center Mode and recenter the origin of own ship back to the center of the display, press the OFF CENT key again. Since off centering cannot be used on the 32/48 Nmi scale, if the range scale is increased to 32 Nmi (R20XX)/48 Nmi (R21XX), the origin of own ship will automatically "cancel" the OFF Center Mode and recenter own ship. If the radar system is turned OFF while OFF Center Mode is on, at next power up the offset mode will still be on.



3.5.8 ZOOM KEY (11)

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 channel entrance, for example, since effectively the Zoom Mode combines switching to the next lower range with automatic offset at the same time.



To operate the Zoom Mode, press the ZOOM key. A blocked character Z will appear in the lower right corner of the screen and the message "SET ORIGIN W/TP" appears in the lower center portion of the display. The Trackpad may now be used to position the cursor to the area of interest. Press the ENTER key to activate the Zoom Mode.

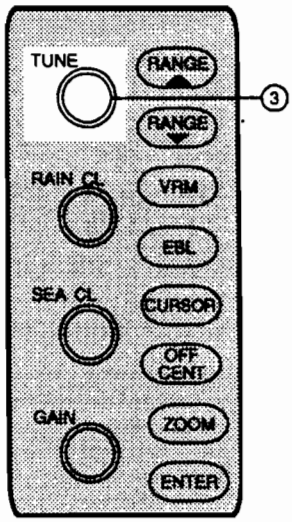
To assist in maintaining proper range perspective, the Fixed Range Rings are turned ON automatically if they were off. Press the ZOOM key to turn OFF the Zoom Mode when desired. The Zoom Mode does not operate on the .125 range.

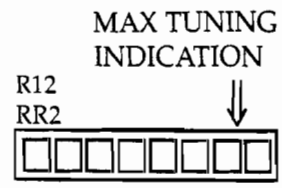
3.5.9 ENTER KEY (21)

The ENTER key activates items set by the the positioning of the cursor in menus or on screen.

3.5.10 TUNE CONTROL (3)

The TUNE Control is a variable control used to tune the receiver in the Pedestal/Radome 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 and is tuned for maximum deflection. Normally, tuning of the radar is performed on the 3 Nmi range scale or higher.

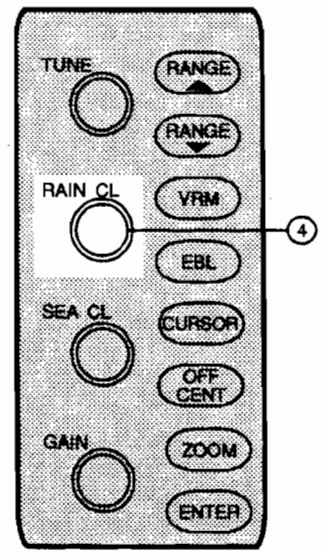




The minimum deflection of the tuning indicator will occur when there are few or no targets. Minor retuning of the radar may be necessary after the radar has warmed up (10 minutes). The 10 minutes accounts for time to allow the magnetron frequency to stabilize.

3.5.10.1 AUTO TUNE MODE

The radar includes an Automatic TUNE feature. In the Automatic mode, the radar tunes itself automatically on all range scales. Auto Tune can be activated by pressing the MENU key (20). Use the Trackpad to select the Function Menu. Press ENTER. Use the Trackpad to Select Tune...Auto with the highlighted Cursor. Press ENTER to activate Auto Tuning Mode. The Manual mode is indicated by the presence of the "Tuning Bar" and the Automatic tuning mode is indicated by "AUTO".



3.5.11 RAIN CLUTTER CONTROL (4)

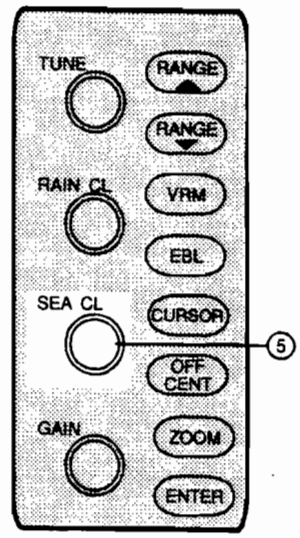
The function of the RAIN CLUTTER Control, also known as Fast Time Constant [FTC], is used to reduce large clutter masses caused by rain or snow and allow targets masked by this clutter to be seen on the radar display. This control differentiates the multitude of small radar returns from rain, effectively 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 tend to 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.

3.5.12 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 control 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

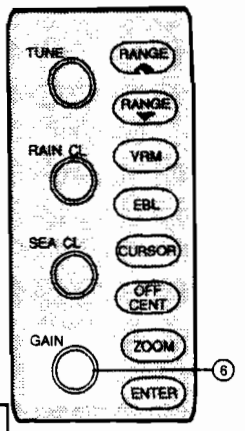
On short range scales, the setting of the SEA CLUTTER Control should never be advanced so high as to obliterate all clutter, since this setting could prevent the detection of close in target echoes.

The SEA CLUTTER Control setting should always be checked and readjusted as necessary after changing ranges or whenever 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 and STC Control may be necessary to obtain the optimum picture and target detection, in varying conditions.

3.5.13 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 Nmi range. The GAIN Control level may be reduced on shorter ranges to improve target definition as necessary and increased on longer ranges.

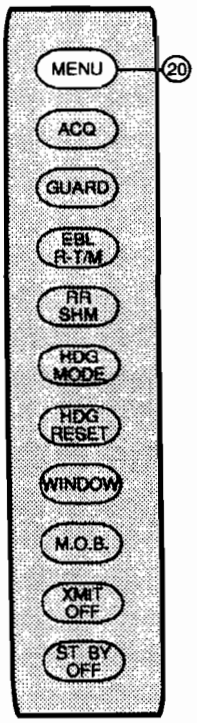


Use some caution when adjusting the GAIN Control. If gain is set too low, small or weak targets may be missed. If the gain is set too high on short ranges, the CRT may become excessively covered with noise speckle making target observation difficult.

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.

3.5.14 MENU KEY (20)



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:

FUNCTION - This selects and enables various functions such as Waypoint Mode, Route On/Off, IR On/Off etc.

RADAR SET UP - Selects various units of measure for operation such as NM,KY or KM ranges; Magnetic or True bearings and settings for language; Keyboard Dimmer, Display Brilliance; etc.

INITIAL SETTING - This Menu accesses initial alignment setups which are necessary when the radar is installed.

MARPA - This Menu selects MARPA criteria for calculation and display of CPA/TCPA, Vector specs, etc.

When the Main Menu is selected by pressing the MENU key, the following Sub menus will be displayed.

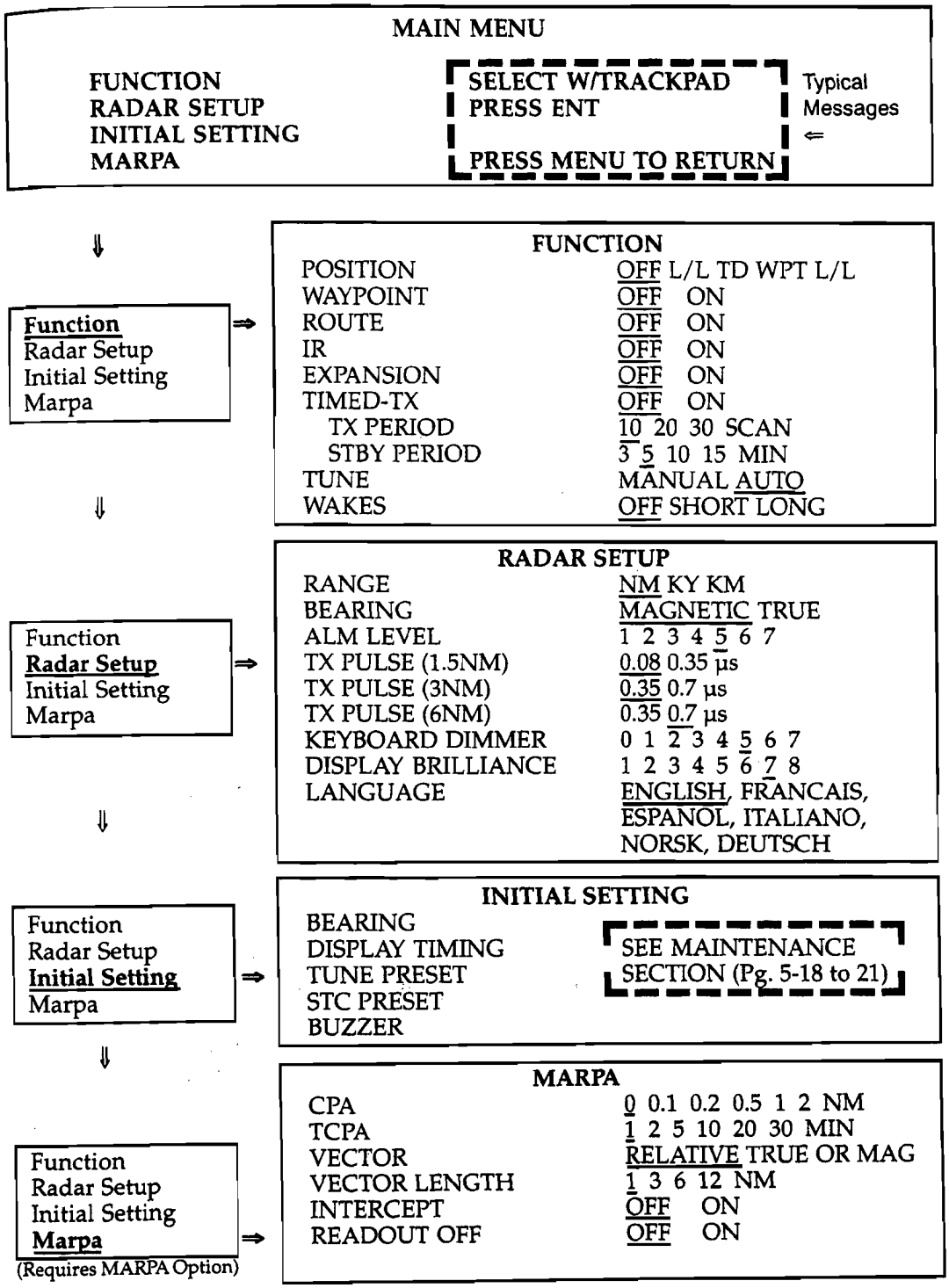


Fig. 3-3 RADAR MENU LAYOUTS (Default Settings Shown)

FUNCTION
RADAR SETUP
INITIAL SETTING
MARPA

SELECT W/TRACKPAD
PRESS ENT

PRESS MENU TO RETURN

The Trackpad is used to select a particular Menu. Use downward pressu on the Trackpad to highlight the desired menu. Once it is highlighted, pre the ENTER key to call up that menu. Now select the data in the men Highlight and press the ENTER key to activate that operation.

NOTE

All settings, except TX PULSE selections, are memorized when the radar is turned OFF.

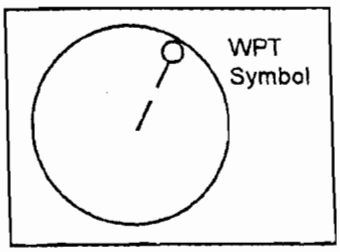
FUNCTION MENU

POSITION

This allows selection of L/L (LAT/LONG), TD (TIME DIFFERENCE) po sition or OFF Displays. In addition you may display Waypoint (WPT) as LAT/LONG position in place of own ship L/L position. LAT/LONG posi tion is located in the lower portion of the display. The position informatio is only available if a Loran C (L/L or TD) or GPS (L/L only) Navaid (o SeaTalk) is connected to the radar.

WAYPOINT

When the WAYPOINT (WP) Mode is turned on and the radar is connecte to a Loran or GPS with the necessary data output, a waypoint symbol at th bearing and range to the selected waypoint can be presented on the rada display. Numeric data, showing the waypoint's bearing and range, and Time To-Go, appears at the bottom of the display. "WP" characters in the upp 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 in Magnetic waypoint bearing data the radar mode must be set to Magnetic for the waypoint mode to operate. If NCT-27 Gyro Interface Unit 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, insure 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)
NCT-27 GYRO	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 (WPT) 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 NMEA 0183 data format. The waypoint information is also available in the JRC format if that format is being used.

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

The radar recalculates the TTG to the waypoint when using the
format. Therefore, due to the rate of sampling data, the display of T
the radar will appear to lag the TTG appearing on the external navig

ROUTE

This Menu Selection allows the radar to display an external route pla
SeaTalk input from the Raychart unit. The route plan consists of the
waypoint, as well as the next four (4) in the route plan. This unique fe
allows you to view route information on your Raychart as well as you
dar.

IR

When IR is on, this function reduces or cancels interference on the di
caused by other radars operating on the same radar frequency band.
type of interference typically appears as long curled spokes or short re
tive hash marks on the display. The interference is most noticeable on lo
ranges. The IR function also effective in reducing the radars backgr
noise.

If you are operating in an area serviced by a RACON beacon, turn OFF
IR Mode to see the RACON beacon signals. IR Mode can cancel Racon
con Signals quite effectively also.

EXPANSION

When ON, this function gives the operator the ability to make small
gets appear bigger on the screen in their depth for better viewing. This fu
tion however enlarges all targets so use of expansion mode might wan
be limited to only certain occasions on the display.

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 a limited radar watch yet minimizing his power consumption. In Timed TX Mode, Display High Voltage and Antenna rotation are disabled during the ST-BY (Sleep) period. To use the Timed TX Mode, proceed as follows:

1. First: select the desired number of radar scans for the transmit period using the trackpad. Then press [ENTER]

2. Next: select the STANDBY period with the trackpad and press [ENTER]

3. Finally: select "TIMED-TX" ON with the trackpad, and then press [ENTER] key to place the Timed Transmit program in operation.

4. To turn "TIMED-TX Mode OFF, select OFF with the trackpad in the menu and then press [ENTER] . The radar returns to its normal operation. Normal operation may also be restored without entering the Menus by pressing the STBY key and then the [XMIT] key.

TUNE

This item selects the receiver tuning method for the Radar. If Manual is selected the Tune Control on the front panel is used and the Tune Bar indicator is present. The AUTO Tuning Mode will automatically tune the radar for optimum whenever the radar is turned ON or ranges changed. Generally, the AUTO Tuning Mode provides unattended operation and should be selected. "AUTO" appears in place of the Tune Bar indicator.

WAKES

This feature allows the operator to see the past history of target movement as an after-glow or "WAKE" behind the moving targets. The OFF selection inhibits this function. "SHORT" enables "WAKES", placing a short after-glow behind the moving targets. "LONG" enables "WAKES" with a longer after-glow.

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

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

RADAR SETUP MENU

RANGE

This Menu item provides selection of the VRM range units. Units can be changed between NM (nautical miles), KY (kiloyards), or KM (kilometers). The selection changes only the VRM range units as indicated by the 2 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".

BEARING

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

TRUE-T-

The TRUE HEADING MODE of operation allows the operator to take EBL bearings referenced to True North. The vessels TRUE Heading is displayed at the top center of the bearing ring T075° L with the LORAN designator just to the right.

NOTE

The TRUE MODE is available only if the LORAN or GPS navigator installed with the R20XX/R21XX display is: "PROGRAMMED FOR TRUE HEADING DATA" or contains True heading information within the NMEA 0183 data stream. The TRUE MODE may also be used if an NCT-27 NSK Gyro Compass interface is connected to the compass input of the Radar.

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 magnetic compass input to the radar will eliminate this effect.

When "T" is displayed at the top of the screen T075° 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. Waypoint bearings will also be provided referenced to True North.

TRUE	HEADING	EBL	WPT
LORAN/GPS (T)	T 075° L	T	T
LORAN/GPS (T) & COMP. SENS.	T 075° L	T	T
COMP. SENS.		REL	N/A
NCT-27 GYRO	T 075°	T	T

NOTE
If no external navigator or compass sensor is connected to the Display Unit, the HEADING readout will read "NO DATA".

MAG-M-

The MAGNETIC HEADING Mode of operation provides the operator with a Magnetic Heading readout M091 L or M as well as with magnetic EBL bearings.

When changing courses, 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 heading changes. We recommend that an optional Compass 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. A XX Heading sensor is highly recommended when MARPA is installed with the radar due to the heading input update requirements.

When an "M" is displayed at the top of the screen M091 and also "M" appears just to the right of the EBL 1 and EBL 2 readouts. This indicates that 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)	M 091° L	M	M
LORAN/GPS (M) & COMP. SENS.	M 091° L	M	M
COMP. SENS.	M 075° M	M	N/A

NOTE

If no external navigator, compass sensor or NSK input is connected to the Display Unit, the HEADING readout box will read NO DATA in True or Relative Modes. Heading information can also be derived from the SeaTalk input (in the absence of a compass input) in which case an S will appear next to the heading readout.

ALM LEVEL

This function sets the Guard Zone Alarm sensitivity where "1" is most sensitive and "7" is least sensitive. This alarm level can be varied to prevent false triggering of the Guard Zone Alarm circuits due to sea clutter or other momentary target echoes. Normally the level is set to "4". p. 3-27

TX PULSE (1.5 NM)

This menu item allows the operator to change the normal 0.08μs pulse length to 0.35μs for greater power output in the 1.5 Nmi range. The longer selection also accents the size of smaller targets on the 1.5 Nmi Ranges. After the radar is switched OFF, this selection will return to 0.08μs when the radar is reenergized.

TX PULSE (3 NM)

This function allows the operator to increase the normal 0.35μs pulse length to 0.7μs for greater power output in the NM range. After the radar is switched OFF, this function returns to 0.35μs when the radar is reenergized.

TX PULSE (6 NM)

This function allows the operator to decrease the normal 0.7μs pulse length to 0.35μs for better definition and detection of targets in heavy rain clutter. After the radar is switched OFF, this function returns to 0.7μs when the radar is reenergized.

KEYBOARD DIMMER

This menu selection sets the desired key illumination intensity from 0 (off) to 7 (Max)

DISPLAY BRILLIANCE

This menu selection sets the desired intensity to the display screen from (1) minimum to (8) maximum. Regardless of setting, if MENU and STBY key are pressed simultaneously at turn on, the brilliance reset unit will default to a level 6 setting. This is Brilliance Reset, the display brilliance to level 6.

LANGUAGE

This menu selection allows the operator to choose one of 6 languages for the radar menus and display prompts. The languages available are English, French, Spanish, Italian, Norwegian and German.

INITIAL SETTING MENU

The Initial Setting menu permits the following initial installation settings which are generally required to be performed by the operator at the time of the initial radar installation. For details on Initial Settings refer to the indicated section of Chapter 5, Maintenance.

ADJUSTMENT	DESCRIPTION	SECTION
BEARING	Aligns the radar picture bearing to the heading line (Relative Mode).	5.4.2.9
DISPLAY TIMING	Sets timing for minimum range.	5.4.2.10
TUNE PRESET	Sets coarse receiver tuning.	5.4.2.11
STC PRESET	Sets the maximum STC Range.	5.4.2.12
BUZZER	Sets buzzer Volume Level.	5.4.2.13

MARPA MENU

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

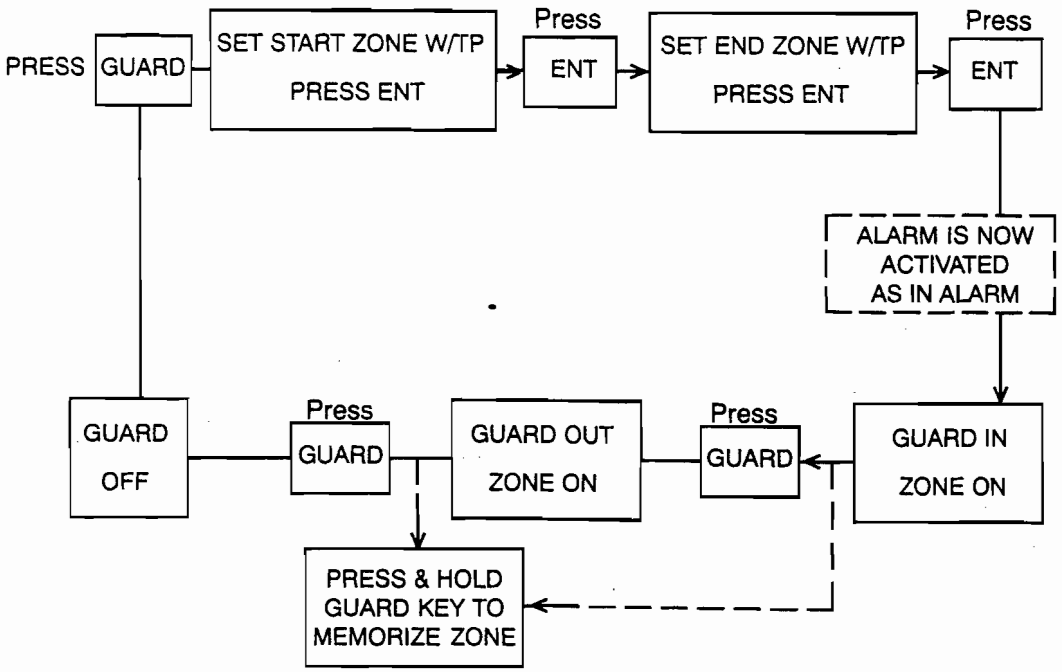
CPA	0	0.1	0.2	0.5	1	2	NM
TCPA	1	2	5	10	29	30	MIN
VECTOR	RELATIVE			TRUE			MAG
VECTOR LENGTH	1	3	6	12	MIN		
INTERCEPT	OFF	ON					

See the MARPA Section 3.7 for details.

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 as an anchor watch, or when pair trawling or towing operations.

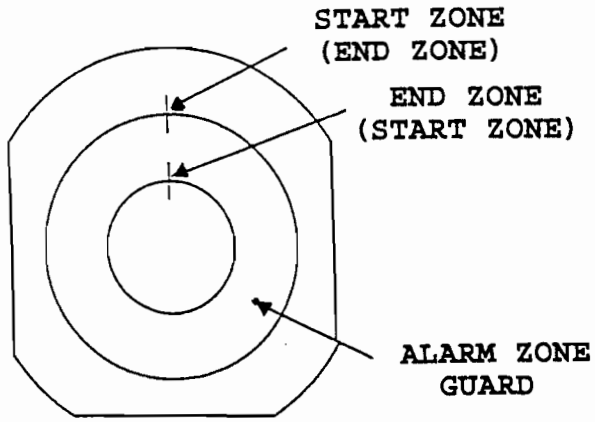
This diagram shows the sequence of steps used in making a Guard Zone. The paragraphs that follow go into greater detail for each type of Guard Zone.



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 you wish the zone to be set. 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 our Guard Zone. Press the ENTER key and we have set up a complete Guard Zone around the vessel within the Guard Rings.

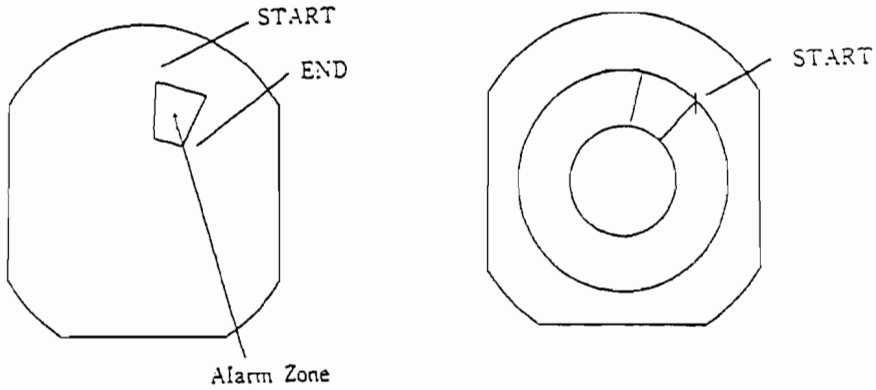


Note that in the upper right corner of the display, the "ALM" indicates that the Guard Zone is activated and below this we have "I 5 " which indicates the "IN" alarm mode is in operation and the alarm target sensitivity is set at "5". If we wish to change the "IN" alarm to "OUT" alarm, press the GUARD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

Pressing the GUARD key again will turn off the Guard Zone.

SETTING A SECTOR ZONE

A sector zone may be drawn around an island or fixed target when you plan to anchor. Set the zone for "OUT" alarm and if the anchor drags, the alarm will sound when the fixed target tries to leave the zone.



To set a sector zone, press the [GUARD] key and set the cursor to the lower left corner of where you wish to start your zone and press [ENTER]. Now move the cursor up to the right to enclose the zone within the trapazoidal area. Press [ENTER] and we now have a sector zone which will alarm if any target enters the zone. If we wish to shift to the "OUT" alarm, press [GUARD] once. The "0[5]" will be displayed in the upper right corner indicating the "OUT" alarm is in use.

SETTING AN 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.

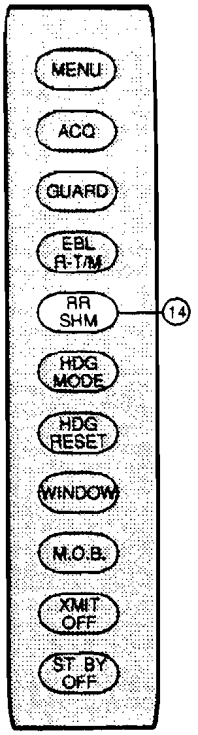
To memorize an alarm zone, first make the zone following the normal procedure. After selecting the target size (if desired) and the alarm "IN" is displayed, press and hold the [GUARD] key until the display beeps and the alarm characters on the screen right side turn into block form. At this time the 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 "ALM O" will be displayed on-screen showing the "OUT" alarm is "in use".

3.5.16 RR/SHM KEY (14)

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 depressed.

When the RR/SHM key is momentarily depressed, the Range Rings will turn ON and OFF. Pressing the RR/SHM key again will turn ON the range rings.



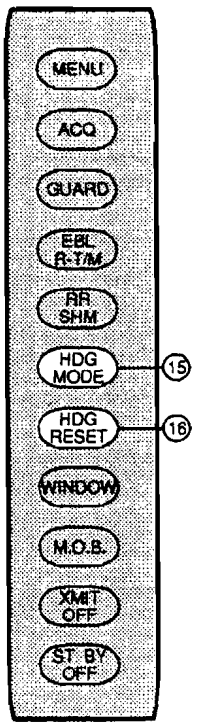
The fixed rings are used to estimate the distances to targets. The interval between range rings is displayed at the lower left of the screen just below the range scale indicator. The ships heading marker is displayed to show own ship's heading (SHM) on the screen.

If the RR/SHM key is held down, the SHM will extinguish until the key is released.

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

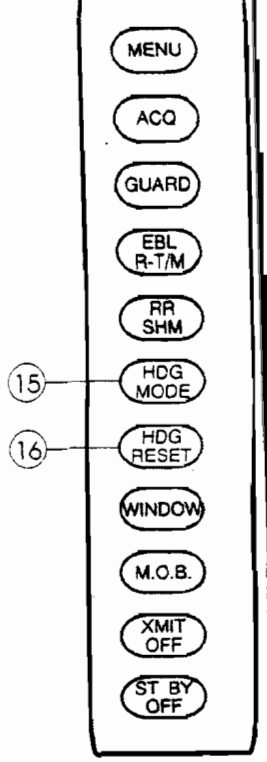
3.5.17 HEADING MODE KEY (15)

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. 0° 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) to point at 0° 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 ships heading changes. This keeps all target plots stable and also provides a clear visual reference to the operator on the impact of the vessels Heading shifts to the targets around his vessel.

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

C-UP> N-UP> H-UP> C-UP> etc.

3.5.18 HEADING/RESET KEY (16)

After a course change, press the HDG RESET key so that the heading marker is reset back to the head of the display.

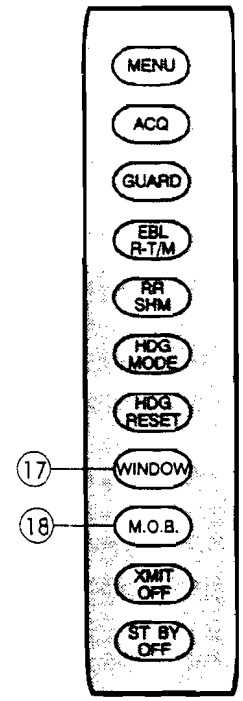
This key functions only when the display mode is in the "Course-UP" display mode.

3.5.19 WINDOW KEY (17)

Each press of the WINDOW key changes the window screen in the following sequence:

RAYCHART screen (in the radar mode) or RADAR screen (in the chart mode) → FISHFINDER screen → DATA screen → WINDOW off → RAYCHART screen or RADAR screen.

Without the Raychart, Fishfinder and SeaTalk inputs connected, the Window presentation will be blank.



3.5.20 MAN OVERBOARD KEY (18)

Pressing the MOB key, will locate a man overboard mark (⚲) over own ship's present location. A course line from own ship to the MOB mark is 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 off; Press and hold the MOB key until a series of beeps are heard.

3.5.21 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.

WARNING

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

5.2.4 Lubrication

Pedestal/Radome should be lubricated as follows every 6 months.

Pedestal Lubrication (Semi-Annual Intervals) [R21XX]

1. Turn off radar equipment at the main breaker panel.
2. Shut off pedestal safety switch.
3. Apply a general bearing grease compound, (Moly Kote 33, RMC P/N 981955-1), using a grease gun, through the grease cap located on the side of the array support bracket. Add grease until it begins to leak out of the seal below the array mounting bracket.
4. Turn on pedestal safety switch and operate radar system in order to verify proper operation.
5. Shut off pedestal safety switch and remove power from system.
6. Wipe up any excess grease or spillage.
7. Place pedestal safety switch ON.
8. Reapply power to the radar equipment.

Pedestal Motor Gear Lubrication (Semi-Annual Intervals) [R21XX]

1. Turn off radar equipment at the main breaker panel and place pedestal safety switch to OFF.
2. Remove antenna motor.
3. Apply general bearing grease compound, Moly Kote 33, (RMC P/N 981955-1) 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 ON.
6. Reapply power to the radar equipment.

Radome Lubrication (Semi-Annual Intervals) [R20XX]

1. Turn off equipment at the main breaker panel.

2. Shut off radome safety switch.

3. Remove radome cover and clean up the old lubrication and any dirt or residue located on the main drive gear.

4. Apply a general bearing grease compound (Moly Kote 33 RMC P/N 981955-1) using an appropriate applicator, to the main drive gear. The main drive gear consists of the main shaft and drive motor gears.

5. Turn on radome safety switch and operate the radar system in order to verify proper operation

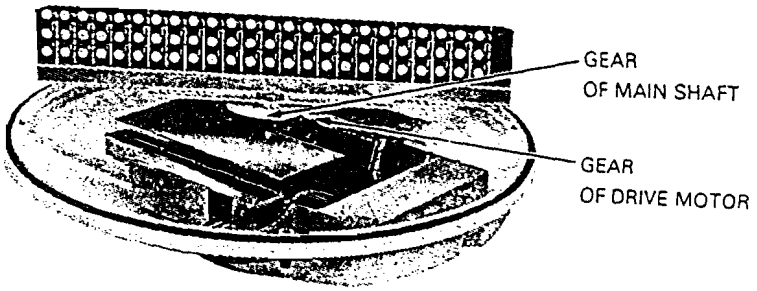


Fig. 5-1 Radome Lubrication

5.2.5 Connector Maintenance (Annual Intervals or as required)

During installation and maintenance, it is recommended that Dow Corning Compound #4 silicone grease (RMC P/N 230-1014P5) 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 (Annual Intervals)

Every year or when the unit is serviced, the Display and Pedestal gaskets should be carefully coated, using silicone grease (Dow Corning #4 RMC P/N 230-1014P5). The primary locations to coat with this grease are shown below.

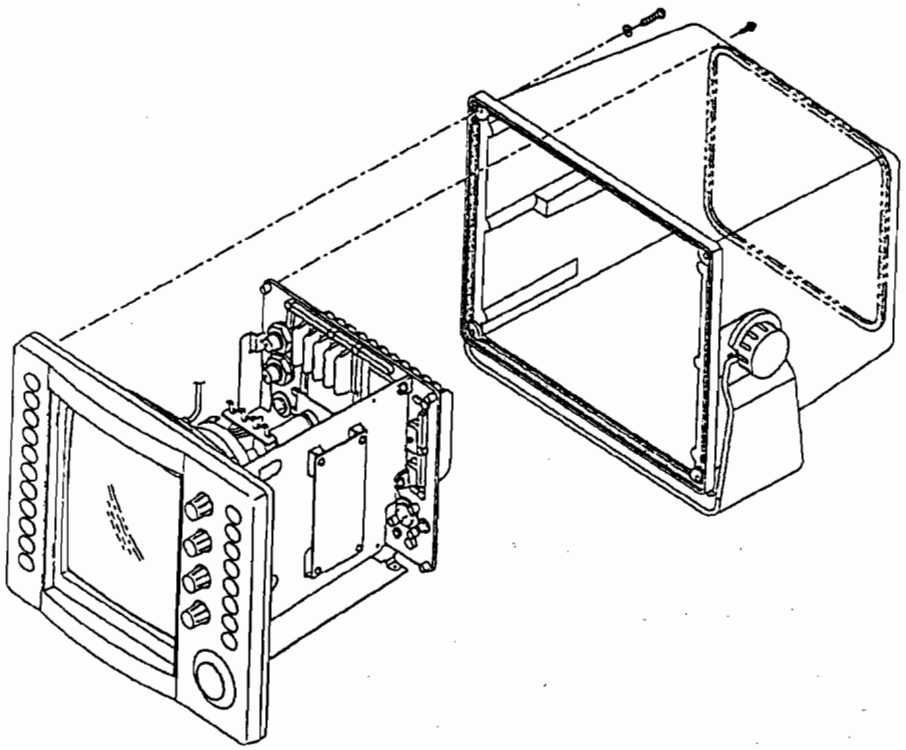
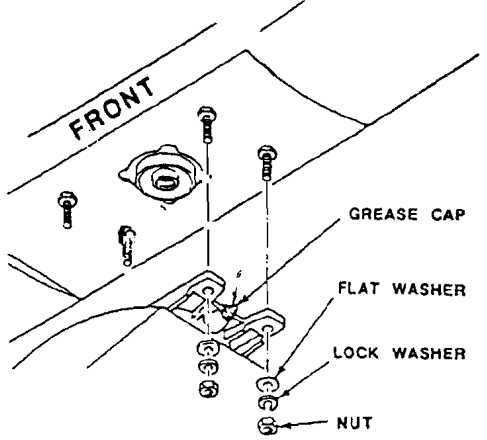


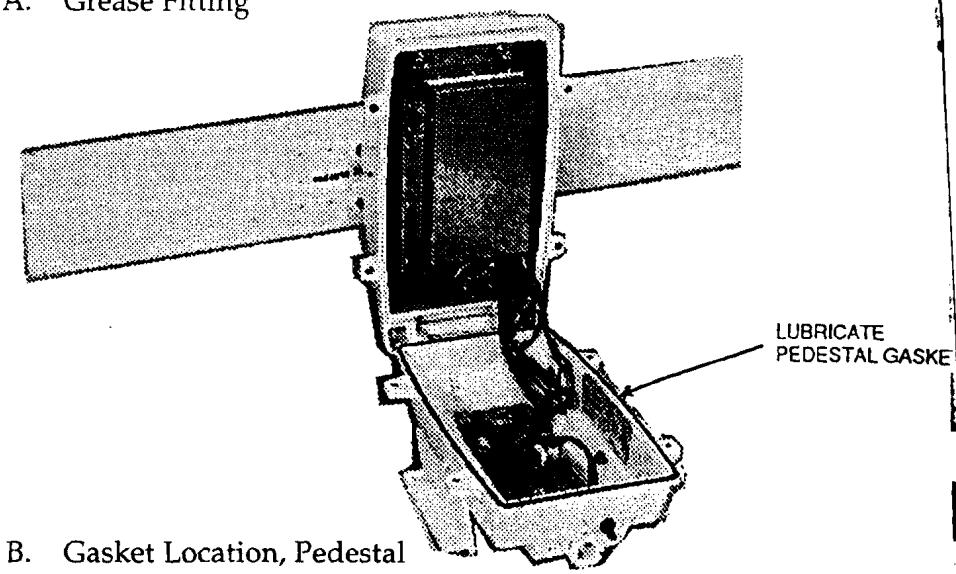
Fig. 5-2 GASKET LOCATIONS, INDICATOR

NOTE

Switch panel gaskets can be accessed by pulling control knobs off of the front panel and removing the chassis and the backlighting PCBs.



A. Grease Fitting



B. Gasket Location, Pedestal

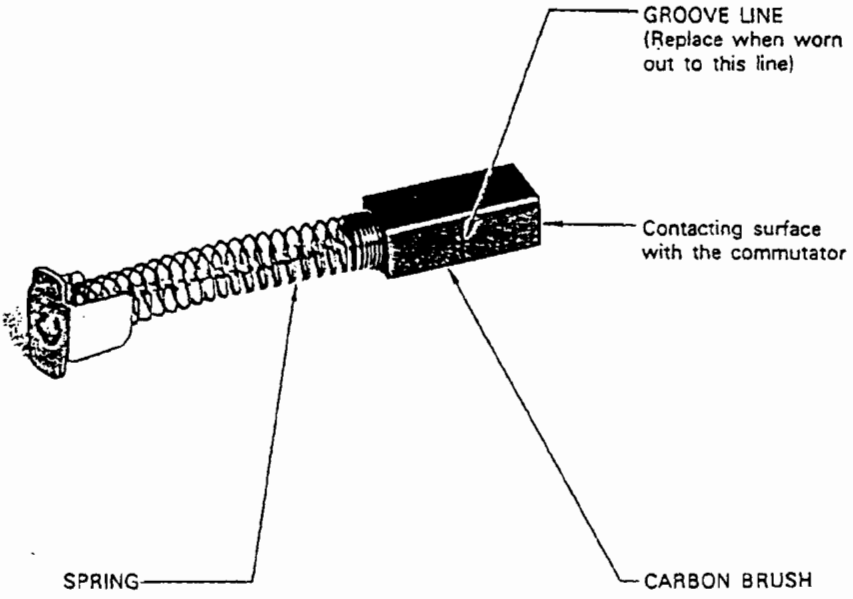
Fig. 5-3 LUBRICATION LOCATION IN PEDESTAL

5.2.7 Pedestal Motor Brush Replacement Procedure

Part of the routine maintenance program should include an annual 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 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 worn brushes. Inspect for wear as shown, replace with new brushes if worn to line indicated below.



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

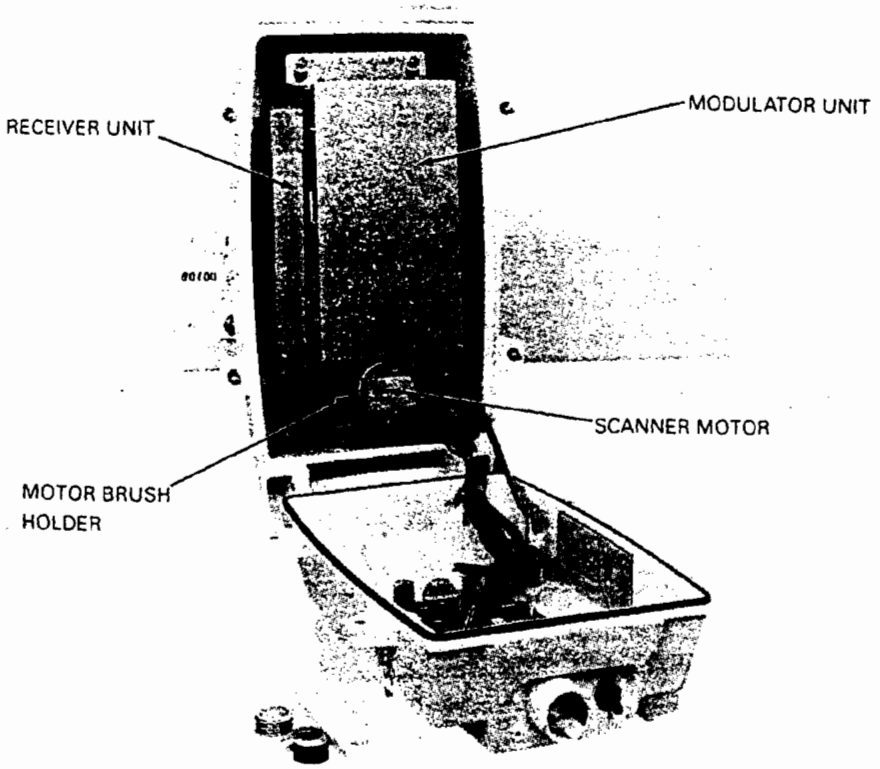


Fig. 5-4 ANTENNA PEDESTAL BRUSH LOCATIONS

5.2.8 Memory Battery Replacement (CMC-739) [Every 2 years]

The Lithium Battery (BT1) on the Main Control PCB (CMC-739) 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 functions in use (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 procedures.

1. Turn off 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 rear cover (10 screws) and the Main Control PCB (CMC-739) from the chassis (4 screws).
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 5ZBAD00096) noting proper battery polarity. Check that battery voltage is greater than 3.00 ±.2 Vdc. If less than 2.50 Vdc, the battery may be used but should be replaced with new battery before voltage drops below 2.00 Vdc.
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, keyboard, and display cabinet.

5.2.10 Fuse

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

TABLE 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	6.3A	All circuit	Glass tube	6.3A 12Vdc
DISPLAY	F401	3.15A	All circuit	Glass tube	3A 24V, 32Vdc
DISPLAY	F402	5 A	Scanner motor	Glass tube	5A 12Vdc
DISPLAY	F402	3.15A	Scanner motor	Glass tube	3.15A 24V, 32Vdc

5.2.11 Recommended Test Equipment, Tools and Materials:

TABLE 5-2

Recommended Test Equipment, Tools, and Materials (Not Supplied)

TEST EQUIPMENT			
Multimeter	1	*Simpson	260
Digital Voltmeter	1	*Fluke	77
Oscilloscope	1	*Tektronix	335
Probe, Oscilloscope, 10X	2	*Tektronix	P6105
Frequency Counter	1	*Fluke	1900A
Waveguide Termination Kit, X-Band [Dummy Load]	1	Raytheon	G261472-1
TOOLS			
Trimpot Adjustment Tool	2	Raytheon	1035670-1
Grease Gun	1	*Plews	30-121
MATERIALS			
Grease, General Bearing Dow Corning, Moly Kote 33	1	Raytheon	981955-1
Grease, Gasket, DC4	1	Raytheon	230-1014P5
Grease, Sil. Lub., GE-G6987	1	Raytheon	1036383-1
NO-AL-OX	1	Raytheon	1035909-1

* or equivalent

5.2.11 Recommended Test Equipment, Tools and Materials:

TABLE 5-2

Recommended Test Equipment, Tools, and Materials (Not Supplied)

TEST EQUIPMENT			
Multimeter	1	*Simpson	260
Digital Voltmeter	1	*Fluke	77
Oscilloscope	1	*Tektronix	335
Probe, Oscilloscope, 10X	2	*Tektronix	P6105
Frequency Counter	1	*Fluke	1900A
Waveguide Termination Kit, X-Band [Dummy Load]	1	Raytheon	G261472-1
TOOLS			
Trimpot Adjustment Tool	2	Raytheon	1035670-1
Grease Gun	1	*Plews	30-121
MATERIALS			
Grease, General Bearing Dow Corning, Moly Kote 33	1	Raytheon	981955-1
Grease, Gasket, DC4	1	Raytheon	230-1014P5
Grease, Sil. Lub., GE-G6987	1	Raytheon	1036383-1
NO-AL-OX	1	Raytheon	1035909-1

* or equivalent

5.3 OPERATIONAL CHECKOUT

Activate the power circuits to the radar and switch the radar into standby (STBY). After 10 seconds, the CRT screen will illuminate and "standby" will appear on the screen. The clock time will count down, showing the remaining warm-up time. After approximately 90 seconds, the unit will beep and "READY" 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.

Press the MENU key and select "RADAR SET-UP". Select Display Brilliance level. Check for changing picture intensity level.

After approximately 10 minutes of operation, check the TUNE control for maximum target returns occuring at the center of the TUNE level range.

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 - Alignments and Service.

TABLE 5-3 OPERATION CHECKLIST

Unit to be checked	Check item	Correct condition	Measuring point
Scanner Unit	a. Input voltage	Refer to Note	TB101-1A-2A
	b. AVR output voltage	7V	CME-196-CD4-K
	c. Mag.current	12V	CBD-1181-TPI or CBD-1168-TPI ground
Display Unit	a. Input voltage	Refer to Note	J401-1-2
	b. AVR output voltage	5V	TP1-ground
	c. Observation of screen sensitivity, Sweep length, sweep linearity, sweep center, ring and illumination.		
	d. Check of the operating controls		

Note: Allowable variation of input voltage, DC10.8V-42V

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 5.4.2.9 (Bearing) and 5.4.2.10 (Display Timing).

They are:

A) Relative Bearing Adjustment	5.4.2.9
B) Display timing (0 nm adjustment)	5.4.2.10

Other adjustments that may require touchup include:

C) Tuning Preset Adjustment	5.4.2.11
D) STC Preset Adjustment	5.4.2.12
E) Buzzer Volume Adjustment	5.4.2.13

All adjustments are made electronically using menu operation "Initial Setting".

5.3.2 Troubleshooting Guide

While the XX-Series Radars 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 MASTER RESET. This can be done by starting with the radar turned OFF. Press and hold the [RANGE▲] and [RANGE▼] keys simultaneously, and while holding these keys, press the [STBY/OFF] key to put the radar to standby. This should be performed anytime a component or PCB within the Radar is replaced. This function will clear the Radar's Ram memory and will return the radar to its 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 R20XX/R21XX 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 ALIGNMENTS 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 5.4.2.14 should normally be accomplished when the radar is installed and/or when necessary.

REPLACEMENT ITEM	ADJUSTMENT REQUIRED	See Sect.#
Magnetron V201	Tuning	5.4.2.11
MIC Frontend E301	Tuning	5.4.2.11
Cathode-ray tube V501	Adjusting Centering Magnet	5.4.2.6
Display PCB	Adjusting intensity	5.4.2.2
	Adjusting focus	5.4.2.3
SHM Unit	Bearing Alignment	5.4.2.9

5.4.1 ANTENNA PEDESTAL RECEIVER ALIGNMENTS

The antenna receiver alignments should be serviced by a qualified technician. The following technical information is included in this manual for the assistance of the technician making the antenna receiver alignment adjustments.

5.4.1.1 Receiver Gain Adjustment

Perform 5.4.2.11 (Pg. 5-19) before completing this alignment.
This adjustment sets the sensitivity level of the Receiver PCB (CAE-313).

1. Set the Radar Display Unit controls as follows:

GAIN	-	MAX CW	TUNE	-	12 o'clock
RAIN CL	-	Fully CCW	RANGE	-	24nm
SEA CL	-	Fully CCW	MODE	-	STBY

2. Place a DVM lead on IC6 pin 7 and adjust GAIN MAX (RV5) for a reading of 6.0±.1 Vdc.

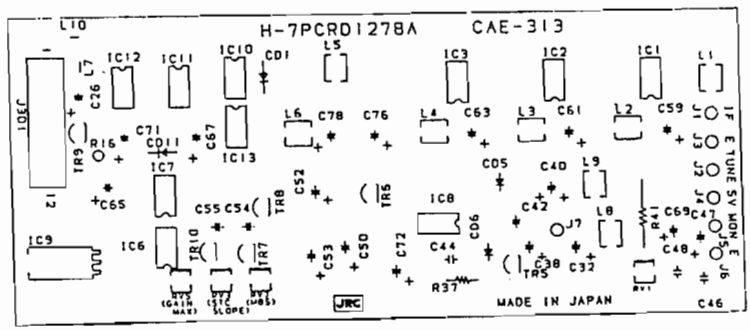


Fig. 5-5 RECEIVER COMPONENT LOCATIONS

NOTE

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

5.4.1.2 Receiver STC Adjustment

This adjustment properly sets the Sensitivity Time Constant of the receiver PCB (CAE-313).

1. Set range scale to 12Nmi.
2. Set [GAIN] and [STC] front panel controls fully CW.
3. Press [MENU] and select "Initial Setting".
4. Select STC Preset. Press [ENTER.]

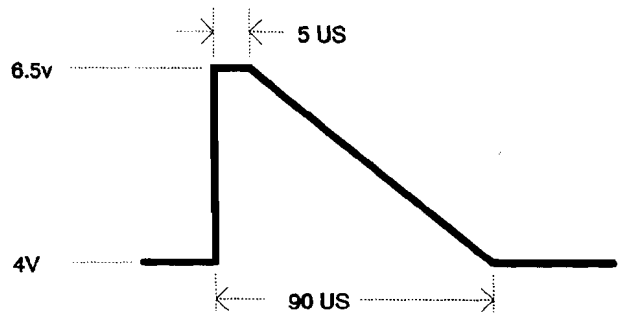
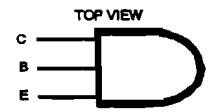


Fig. 5-6 STC Curve, [STC (Front Panel) Fully CW] (TR6 Emitter)

5. Using the [RANGE ▲] key, adjust for maximum deflection of the indicator bar.
6. Connect an oscilloscope probe to the emitter of TR6 (1V/div. 10μs/div).



7. Adjust STC slope (RV3) on the Receiver PCB to obtain a 90 μs ramp as shown in Fig. 5-6.
8. Upon completion of the above alignment, use the [RANGE ▼] key to set the display STC to approximately 4 miles.
9. Press [ENTER.]
10. Set the front panel [SEA CL] control fully CCW or for best short range sea clutter suppression.

5.4.1.3 Receiver Main Bang Suppression Adjustment

1. Set the Display Unit controls as follows:

RANGE	.125Nmi
GAIN	MAX CW
VRM	Set to .012 NM (.022km, or .024 ky)
TUNE	12 o'clock
SEA CL	Set Fully CCW
RAIN CL	Set Fully CCW
MODE	XMIT

2. Select Initial Setting Menu "Display Timing". See 5.4.2.10. Adjust Display Timing for MAX with the [RANGE ▲] key.

3. On the Receiver PCB (CAE-313), set MBS (RV2) to max CCW position.

4. Using the [RANGE ▼] key, bring the inside edge of the video into the center of the screen to the point where the blank hole center spot just disappears.

5. While observing the display, adjust MBS (RV2) such that a blank hole occurs out to 0.012Nmi.

6. Press [ENTER.]

5.4.1.4 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. Connect a voltmeter to pin 8 of J301 connector on the Receiver PCB.

2. While in 3nm or above, place the Radar in X-MIT and adjust the front panel TUNE control knob until a reading of 0.7 Vdc or less is obtained. It may be necessary to adjust the Initial Setting Menu "Tune Preset" (with TUNE at the 12 o'clock position) in order to bring the voltage down to its minimum level.

3. Adjust TUNE-C (L9) on the Receiver PCB for a minimum voltage reading.

4. Adjust MONI/TUNE-L (RV1) for a voltage reading of 0.7 to 0.8 Vdc.

5.4.1.5 Factory Adjustments

It is important to note that the tuning coils located on the Receiver PCB are primarily used to adjust for proper narrow/wideband operation. These components set the IF Amplifier 60 MHz bandwidth and general receiver sensitivity.

These adjustments require specialized test equipment and may be performed only at the factory. These adjustments should not 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 the 6 phillips head screws at the rear of the Display Unit and the 4 phillips head screws on the back of the bezel to remove the rear cover.

Fig. 5-7 details the Power Supply PCB adjustment and Fig. 5-8 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-1167). Refer to Fig. 5-7 below while performing these adjustments.

1. Place a DVM positive lead to TP1 and negative lead to ground.
2. Adjust RV1 so that reading on DVM is +5.0 +/- .1 Vdc.

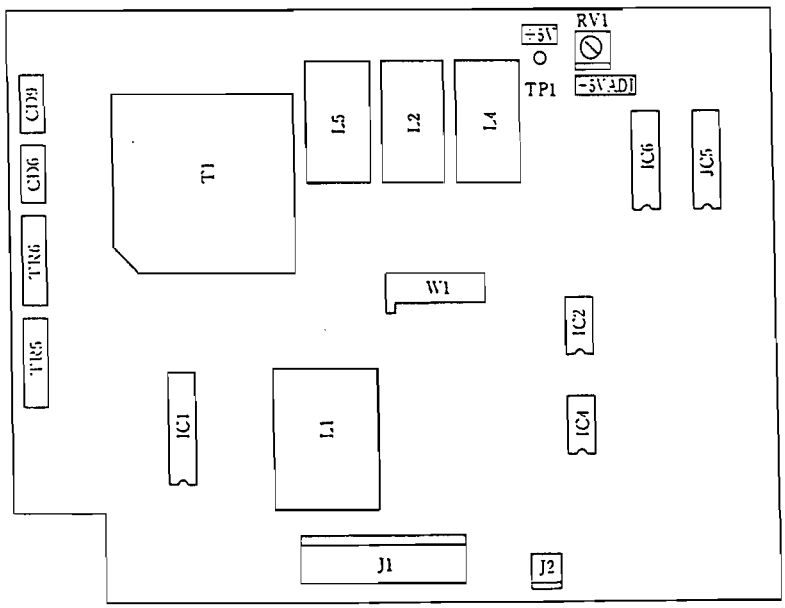


Fig. 5-7 DISPLAY POWER SUPPLY (CBD-1167) TEST POINTS AND ADJUSTMENT LOCATIONS

5.4.2.2 Contrast Adjustment

1. Set Radar Setup Menu on BRILLIANCE to the maximum level.
2. Adjust RV1 on CRT Monitor PCB, 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.

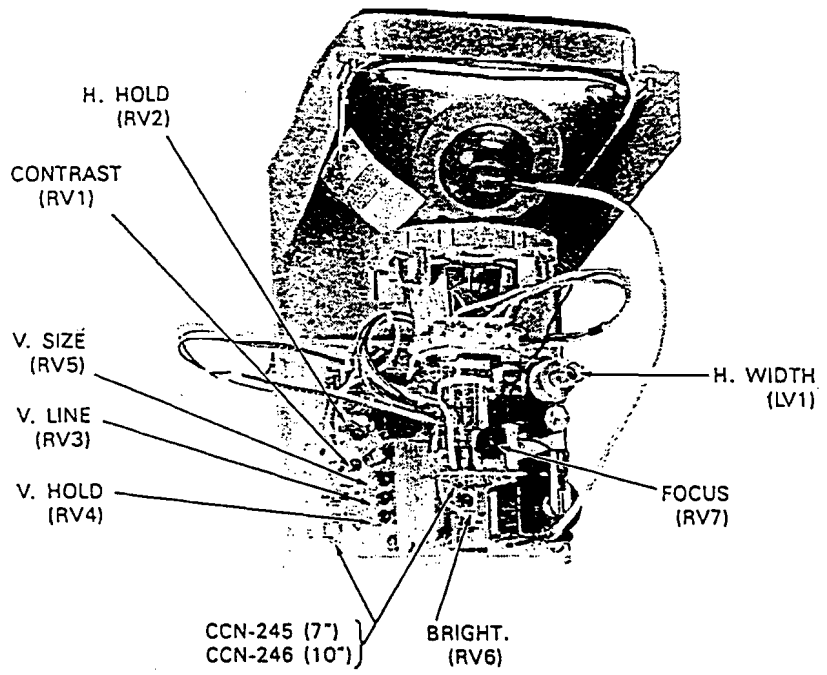


Fig. 5-8 CRT MONITOR ADJUSTMENTS

5.4.2.8 Comparator Adjustment

The following procedure sets the 8 level comparator voltages on the Main Control PCB (CMC-739)

1. These adjustments maybe done with the display in STBY.
2. Measure the DC voltage at IC35-2 with a DVM and adjust RV3 (low level video) for .5 Vdc.
3. Adjust RV2 (high level video) for 3.0 Vdc at IC32-2.
4. Replace the cover to the Display Unit and resecure the 10 screws previously removed.

The following alignments are normally performed after the radar is installed.

5.4.2.9 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.

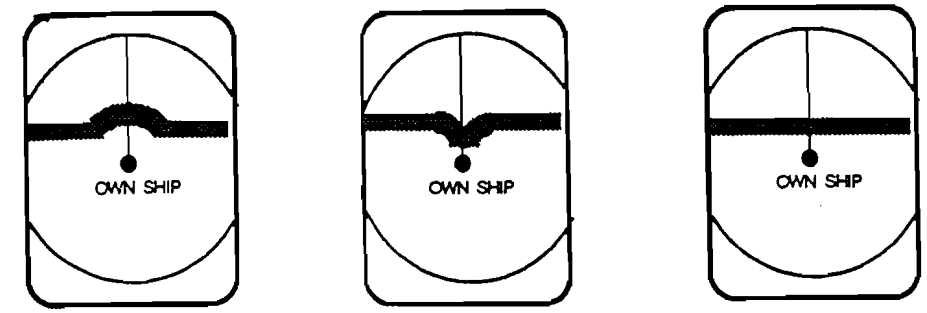
Proceed as follows:

1) Identify a suitable target (e.g., ship or buoy, etc.), preferably between 1.5 and 3 Nmi 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 key. Use Trackpad and the ENTER key to select "Initial settings". Then select "BEARING".
4) Put the EBL 1 marker on the selected target.
5) Press ENTER key
6) Now Move the EBL 1 marker to the desired bearing for the target measured in Step 2.
7) Press ENTER. The targets will now be repositioned as desired on screen.

5.4.2.10 Display Timing Adjustment

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 1/8 Nmi range.

1) Set the range at 0.125 Nmi.
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 then select INITIAL SETTING and 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 up/down keys so that the object appears to be straight on the display. Press the ENTER key when setting is correct.



BANK PUSHING DISPLAY TIMING EARLY

BANK PULLING DISPLAY TIMING LATE

NORMAL

Fig. 5-9 0 NM ALIGNMENT

5.4.2.11 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 radar to 3 Nmi range scale or above.
2) Set GAIN for normal noise level on the display.
3) Set SEA CLUTTER and RAIN CLUTTER to OFF.
4) Set TUNE control of the front panel at its mid scale position.
5) Press [MENU] and use the Trackpad and [ENTER] key to select "INITIAL SETTING" "TUNE PRESET".
6) Adjust the "Indicator Bar" shown in the lower part of the display using the [RANGE ▲] [RANGE ▼] keys very carefully for maximum targets on the CRT Display.
7) Press [ENTER] when maximum targets are observed on the screen.

5.4.2.12 STC Preset Adjustment

The STC Preset controls how far in range the STC gain reduction should be effective. Typically the suppression is visible to approximately 4Nmi. To change this setting perform the following.

1) Set Range to 12 Nmi.
2) Set the Gain and STC front panel controls fully clockwise.
3) Press [MENU] use the Trackpad and press the [ENTER] key to select "INITIAL SETTING" "STC".
4) Adjust the "Indicator Bar" shown in the lower part of the display using the [RANGE ▲] [RANGE ▼] keys so that no background noise appears in the range of 0 to 4nm. In some conditions, the STC action range may be extended for severe sea states.
5) Press [ENTER] when the STC suppression is set for the desired level.

5.4.2.13 Buzzer Volume Adjustment

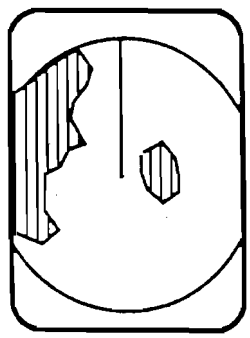
At the time of shipment, the Buzzer sound has been adjusted to the maximum position. If it is necessary to lower the volume, perform the following:

1) Select MENU ⇒ INITIAL SETTING ⇒ BUZZER
2) Adjust the "Indicator Bar" shown in the lower part on the display using the down key for suitable buzzer sound level.
3) Press ENTER.

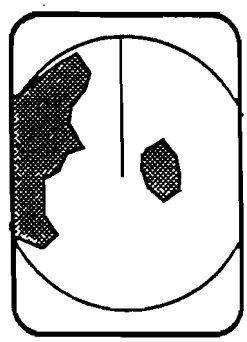
5.4.2.14 Interlace (Synchronization) Adjustment

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 a factory adjustment and should not require field adjustment.

Adjust RV1 on the Main Control PCB (CMC-739)



POOR INTERLACE SYNC



NORMAL (INTERLACE PROPERLY ADJUSTED

5.4.2.15 Fishfinder Window Video Adjustment

This adjustment sets the maximum video level within the fishfinder window. If characters are broken up or video appears very weak, then adjust RV 4 on the Main Control PCB (CMC - 739) for optimum presentation. NOTE: The Fishfinder must be set for "Black" background for proper window presentation.

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 5-3).

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 Troubleshooting 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 20kΩ /V dc, 8kΩ /V ac.

TABLE 5-4 TROUBLESHOOTING GUIDE

	Trouble	Remedy
1.	Does not start at OPERATE switch to STBY.	Check: Blown fuse F401 Check input power circuits. Fault of contact on PC2. Fault of power supply circuit on PC5. Fault of contact on connector of PC5. Fault of rectifier diodes on PC5.
2.	Scanner fails to rotate.	Check: Fault of S101. (Safety Switch OFF) Fault on contact on terminal boards. Fault of M101/B101. Fault of drive mechanism.
3.	Scanner rotates but rotation of sweep is abnormal.	Fault of connection between M101/B101 Check: Fault of encoder (BP) 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.
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.

TABLE 5-4 TROUBLE SHOOTING GUIDE (Cont)

	Trouble	Remedy
8.	Noise and range on the screen but no echoes.	If no transmission is present, check the modulator and magnetron. Check: If transmission appears to be present as indicated by the correct MAG.I reading on Tester. PC101 TP1 = 12Vdc 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, whether the lead wire to magnetron is grounded to chassis. Fault of magnetron.
9.	Poor sensitivity. Dim Echoes.	Check: Reduction of transmitting output power. Fault of magnetron. ⇒ Check of MAG.I reading on PC101-TP1. 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 PC1 (Main Circuit) Fault of receiver unit.
10.	No VRM or VRM cannot be controlled.	Check: Fault of PC3. Fault of main circuit (PC1).
11.	NO EBL or EBL cannot be controlled.	Check: Fault of PC3. Fault of main circuit (PC1).
12.	No alarm zone marker, cannot be controlled or no alarm sound.	Check: Fault of PC3. Fault of main circuit (PC1) Fault of Buzzer BZ401.

TABLE 5-5 TYPICAL VOLTAGES

RADOME RADAR [R20XX] (with Interunit Cable connected)

Measuring Point	Resistance (Ω)	Voltage (V) 0.125 1.5 (nm)	Voltage (V) 3.6 (nm)	Voltage (V) 12 (nm)	FUNCTION
TB101 VD	55	-0.06	-0.06	-0.06	VIDEO
1A to 2A	∞	0	0	0	POWER
+12	.5	11.6	11.5	11.5	+12Vdc
-12	260	-11.9	-11.8	-11.8	-12Vdc
J101 1	3k	0	5.0	10.5	Pulse Width
2	220	-0.027	-0.021	-0.021	Trigger
4	1.4k	2.01	2.01	2.01	STC Control
5	120	11.8	11.8	11.8	Gain Control
6	240	4.17	4.17	4.17	TUNI/SHF
7	6k	10.5	10.5	10.5	TUN V
9	140	2.4	2.4	2.4	2048 BP
8	0	0	0	0	GND

OPEN ARRAY RADAR [R21XX] (with Interunit Cable connected)

Measuring Point	Resistance (Ω)	Voltage (V) 0.125 1.5 (nm)	Voltage (V) 3.6 (nm)	Voltage (V) 12 (nm)	FUNCTION
TB101 VD	55	-0.06	-0.06	-0.06	VIDEO
1A 2A	4	12	12	12	POWER
+12	5	11.7	11.7	11.7	+12Vdc
-12	260	-12.0	-11.9	-11.9	-12Vdc
J101 1	3k	0	5	10.5	Pulse Width
2	220	-0.024	-0.021	-0.017	Trigger
4	1.4k	2.12	2.12	2.12	STC Control
5	13	11.9	11.9	11.9	GAIN Control
6	23	4.2	4.2	4.2	TUNI/SHF
7	4.7k	10.8	10.8	10.8	TUN V
9	12	1.9	1.9	1.9	2048 BP
8	0	0	0	0	GND

TABLE 5-5 TYPICAL VOLTAGES (Cont)

SCANNER UNIT (Interunit Cable connected).

Measuring Point	Radome Resistance (∞)		Open Array Resistence (∞)		FUNCTION
TB101 VD	∞	x10	∞	x10	VIDEO
VDE	0	x10	0	x10	VIDEO RET
1A	∞	x10	∞	x10	POWER
2A	∞	x10	∞	x10	GND
+12	5.5	x10	5.5	x10	+12Vdc
-12	95	x10	95	x10	-12Vdc
J1011 PW	150	x10	150	x10	Pulse Width
2 TRIG	∞	x10	∞	x10	Trigger
3 E	0	x10	0	x10	GND
4 STC	180	x10	180	x10	STC Control
5 GAIN	1.3K	x10	1.3K	x10	GAIN Control
6 TUNI/BR	1K	x10	1K	x10	TUNI/SHF
7 TUNV	∞	x10	∞	x10	TUN V
8 E	0	x10	0	x10	GND
9 BP	8	x10	8	x10	2048 BP

DISPLAY UNIT (Interunit Cable connected).

Measuring Point	R20XX Resistance (∞)	
J402 1	∞	x10
2	∞	x10
3	23	x10
4	0	x10
5	0	x10
6	6	x10
7	54	x10
8	0	x10
9	∞	x10
10	21	x10
11	4	x10
12	1K	x10
13	50	x10
14	3.5	x10
15	42	x10
16	24	x10

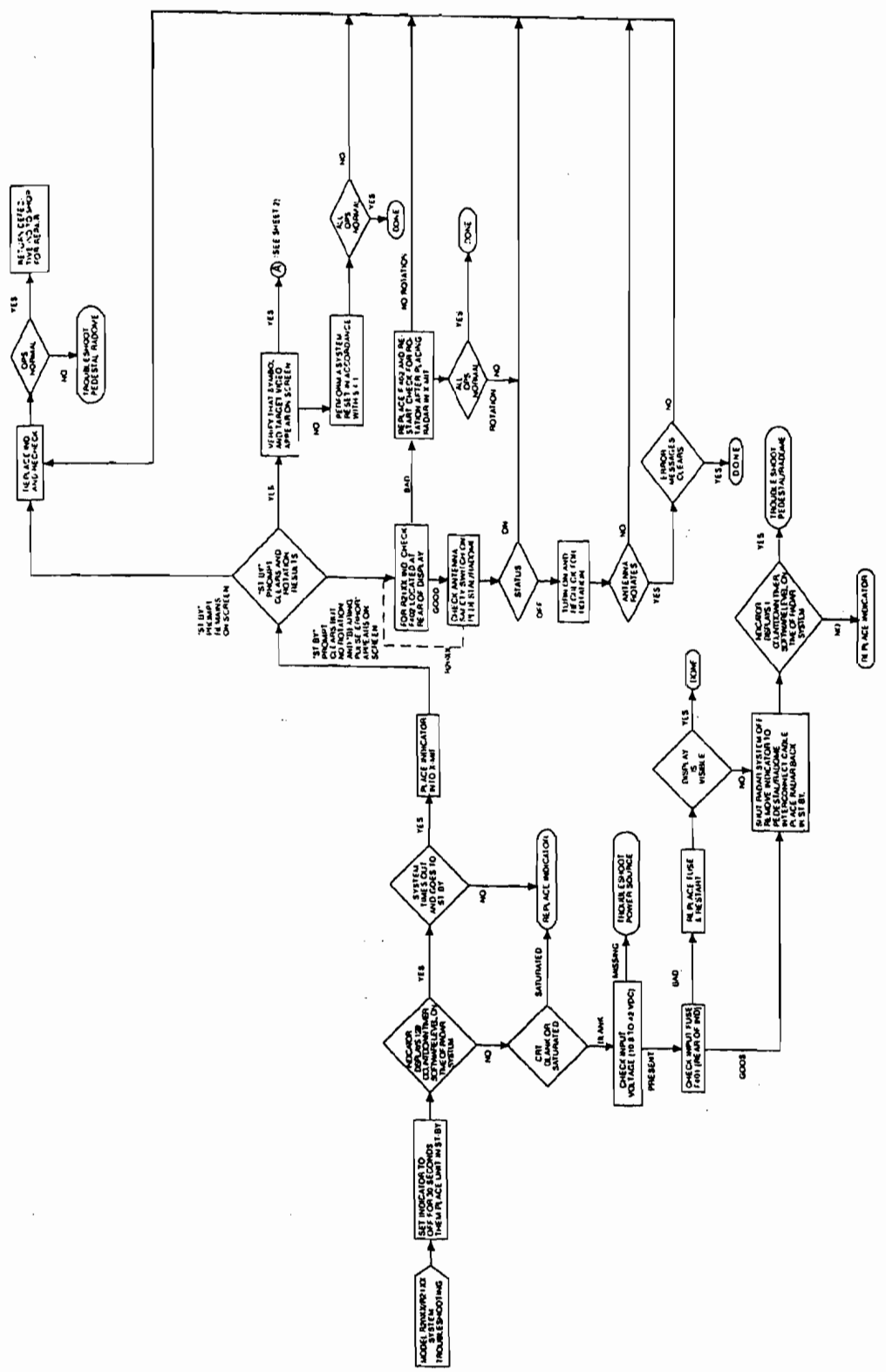


Fig. 5-10 R20XX/R21XX RADAR SYSTEM TROUBLESHOOTING CHART (1 of 2)

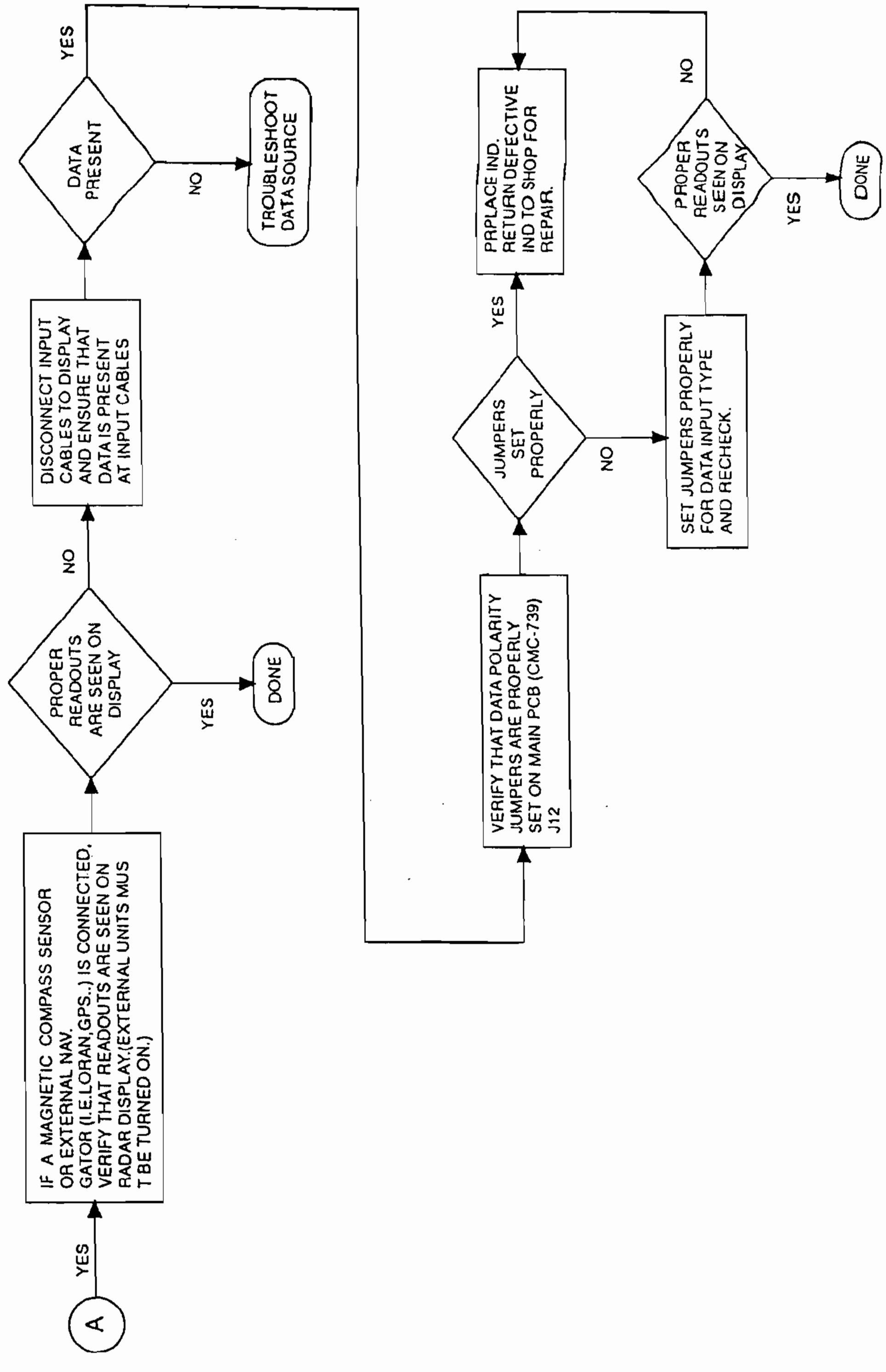


Fig. 5-10 R20XX/R21XX RADAR SYSTEM TROUBLESHOOTING CHART (2 of 2)

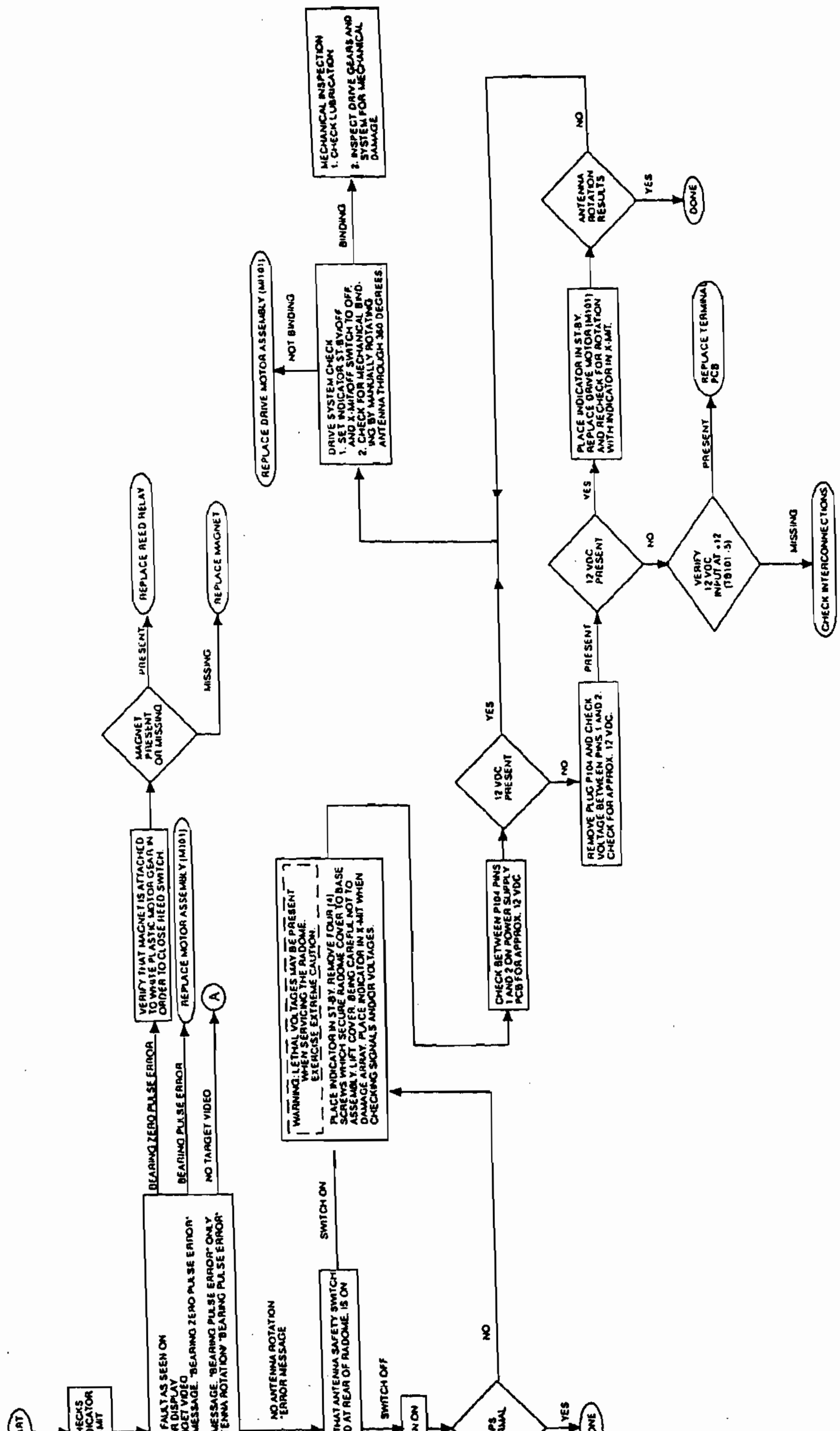


Fig. 5-11 RADOME ANTENNA UNIT TROUBLESHOOTING CHART (1 of 2)

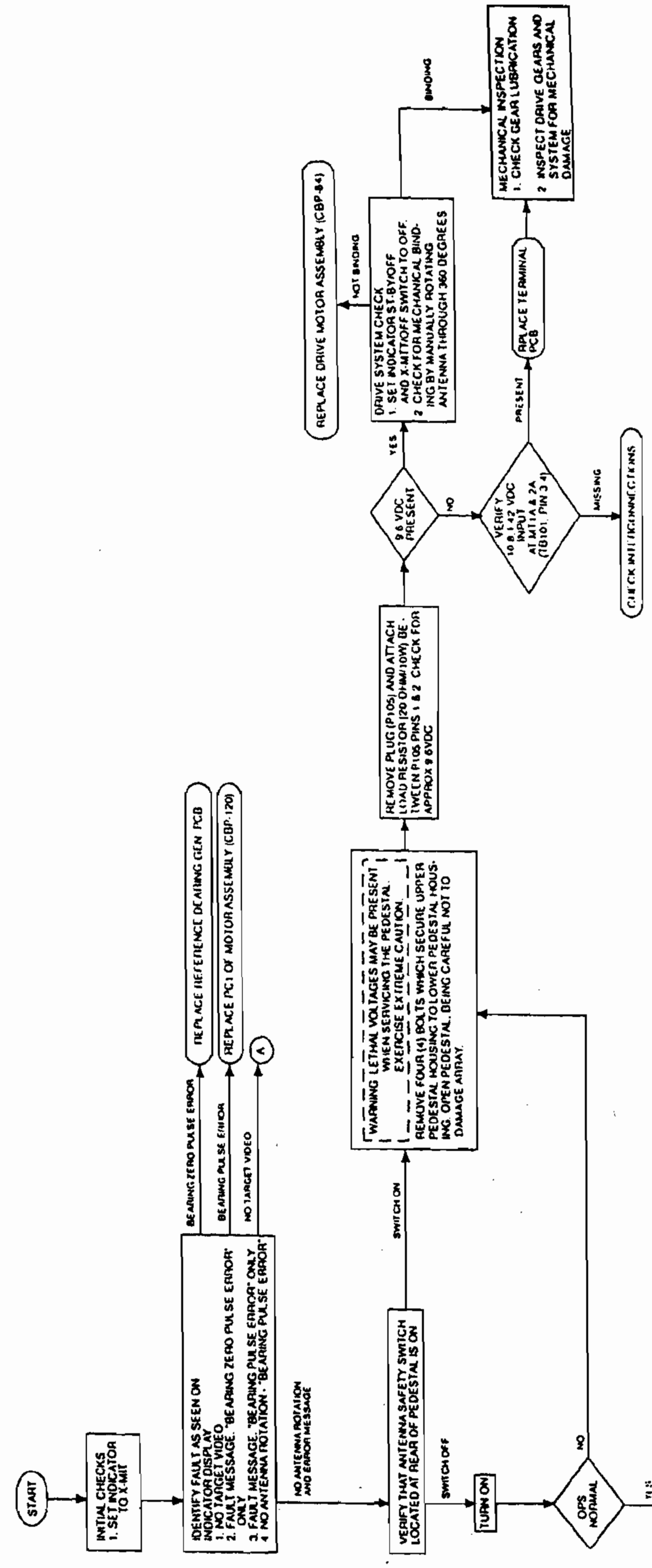


Fig. 5-11 RADOME ANTENNA UNIT TROUBLESHOOTING CHART (2 of 2)

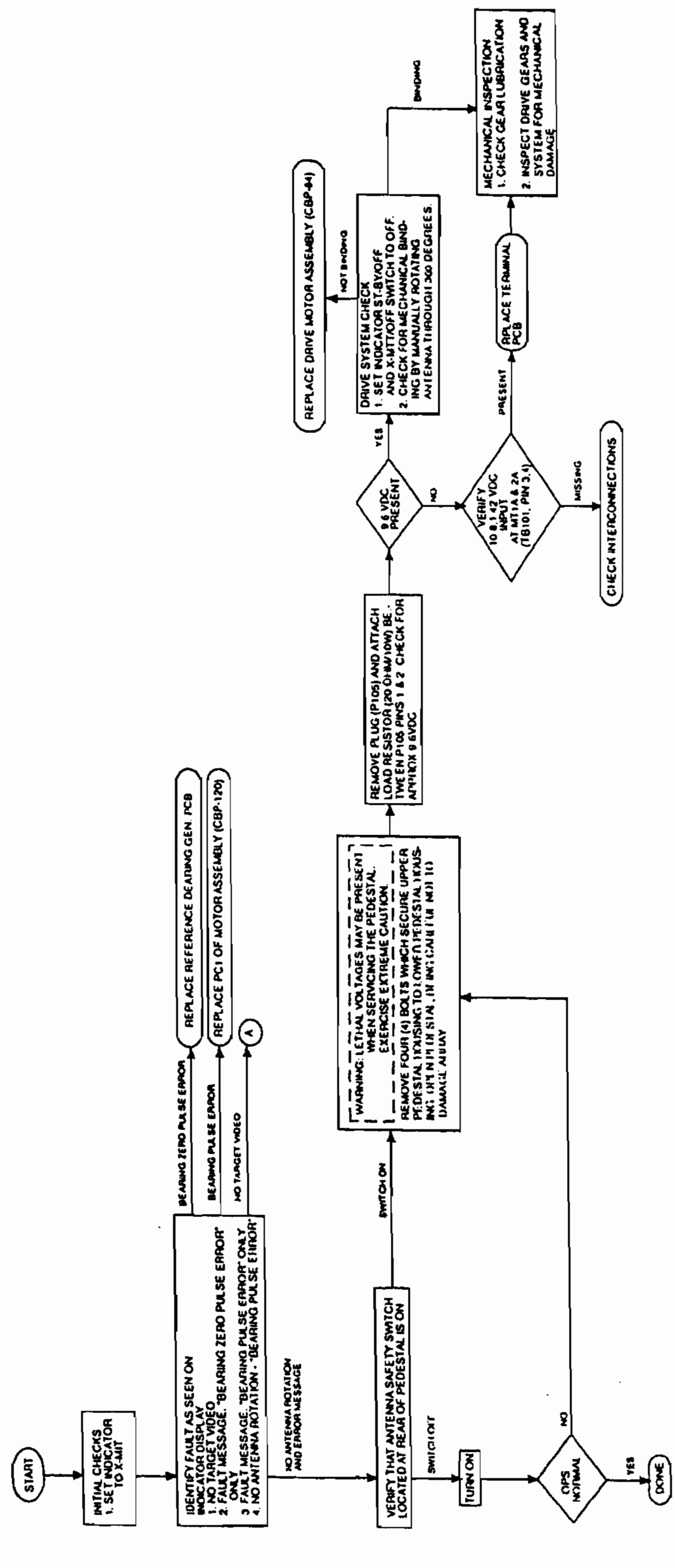


Fig. 5-12 OPEN ARRAY ANTENNA UNIT TROUBLESHOOTING CHART (1 of 2)

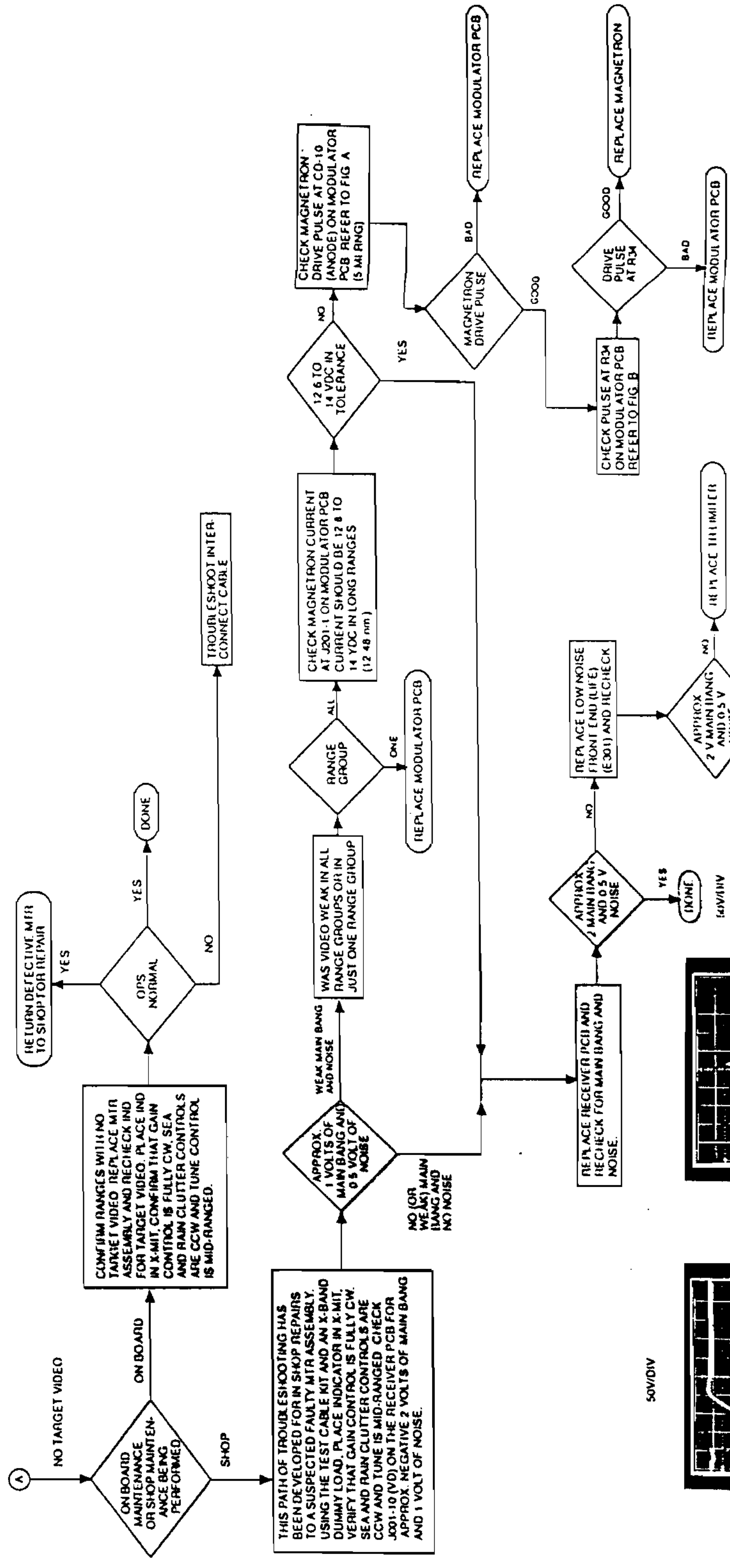


Fig. 5-12 OPEN ARRAY ANTENNA UNIT TROUBLESHOOTING CHART (2 of 2)

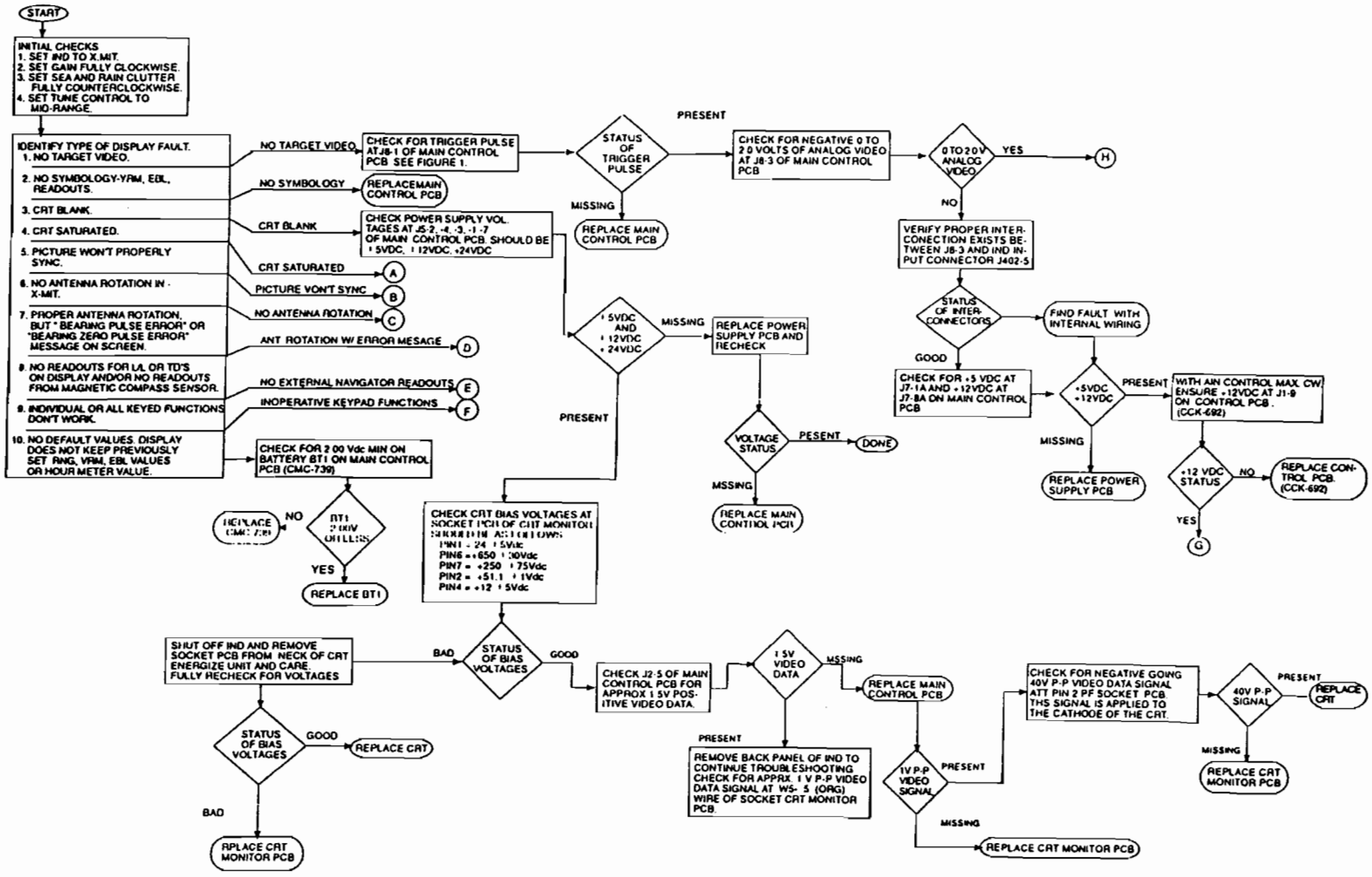


Fig. 5-13 R20XX/R21XX SYSTEM TROUBLESHOOTING CHART (1 of 4)

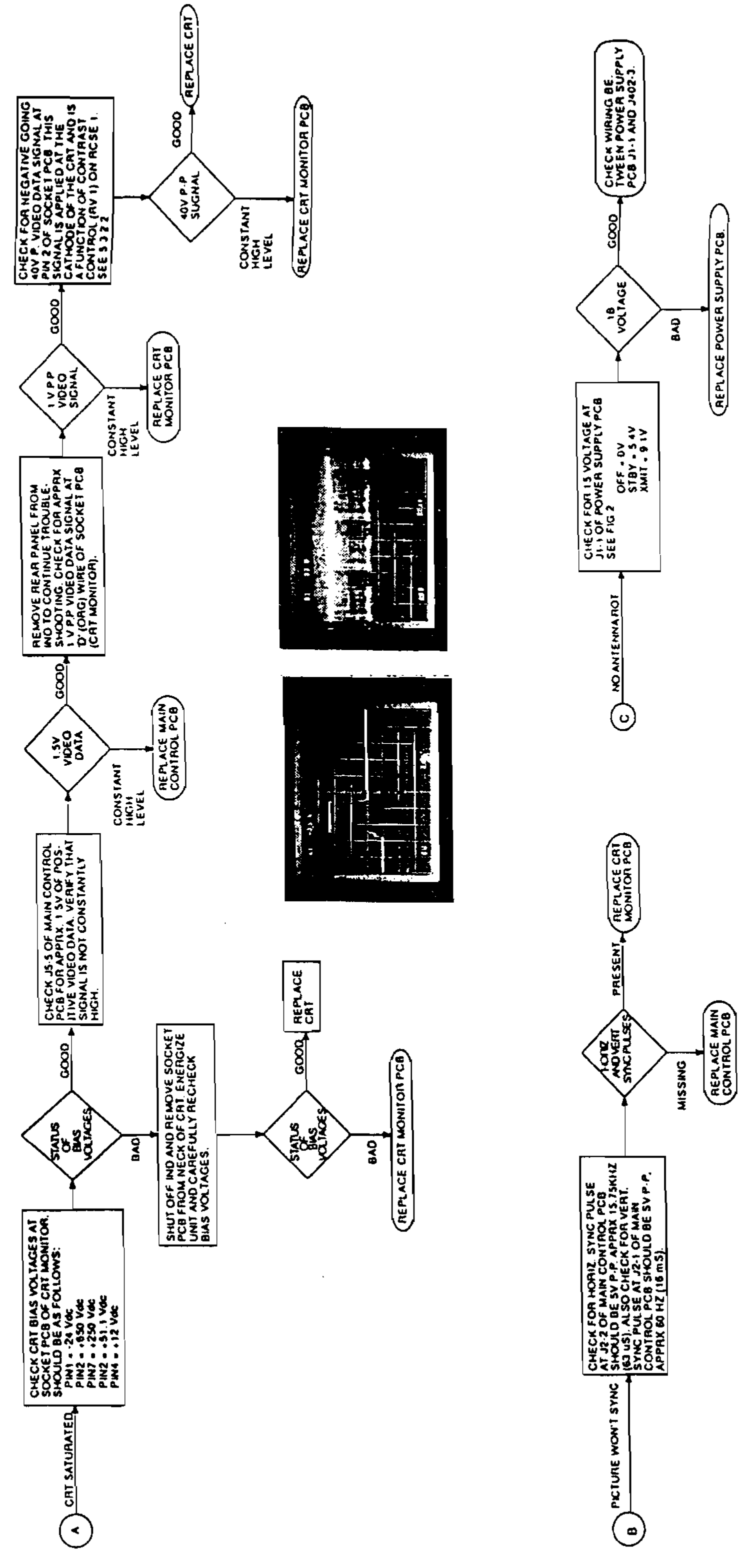


Fig. 5-13 R20XX/R21XX SYSTEM TROUBLESHOOTING CHART (2 of 4)

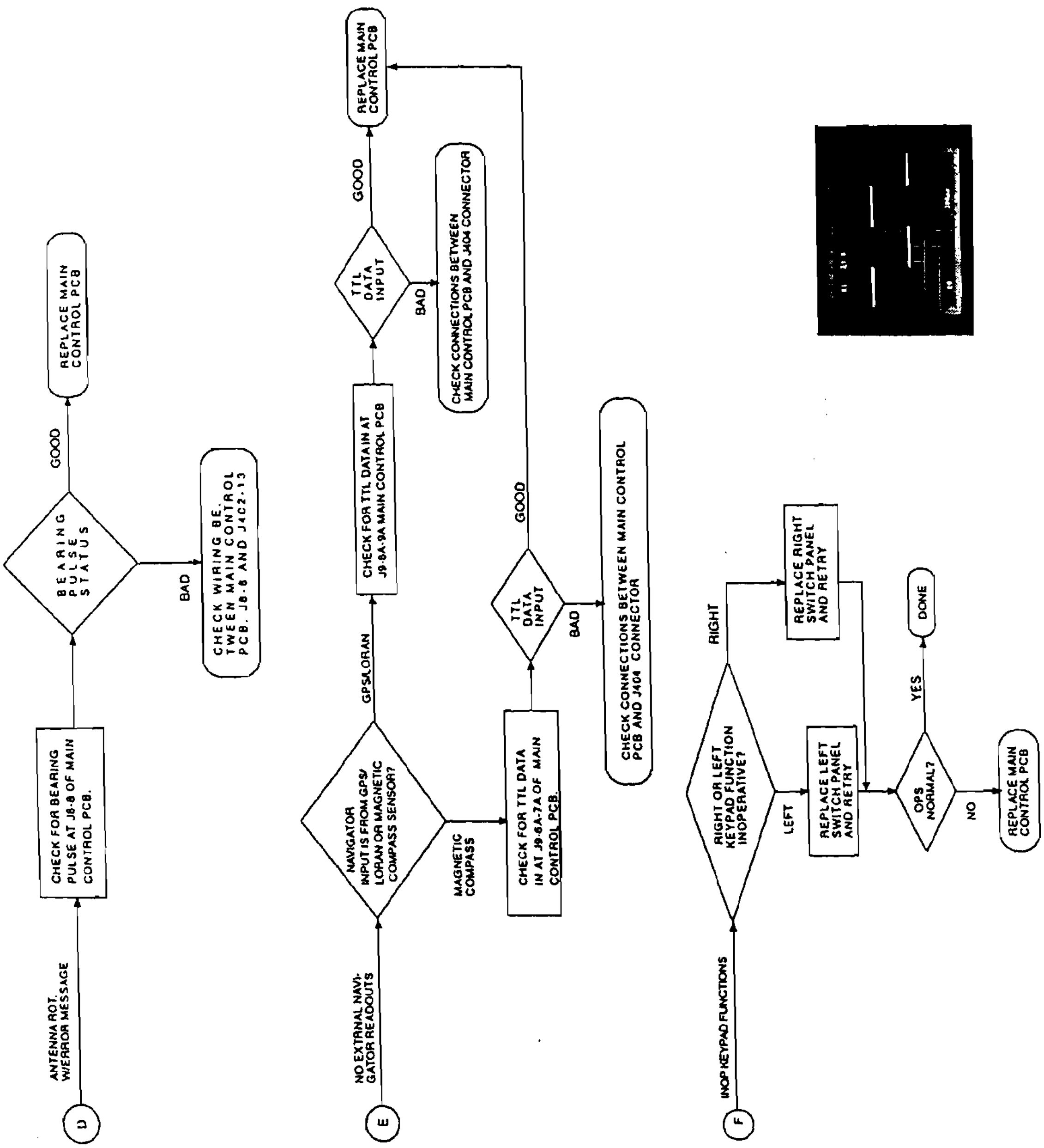


Fig. 5-13 R20XX/R21XX SYSTEM TROUBLESHOOTING CHART (3 of 4)

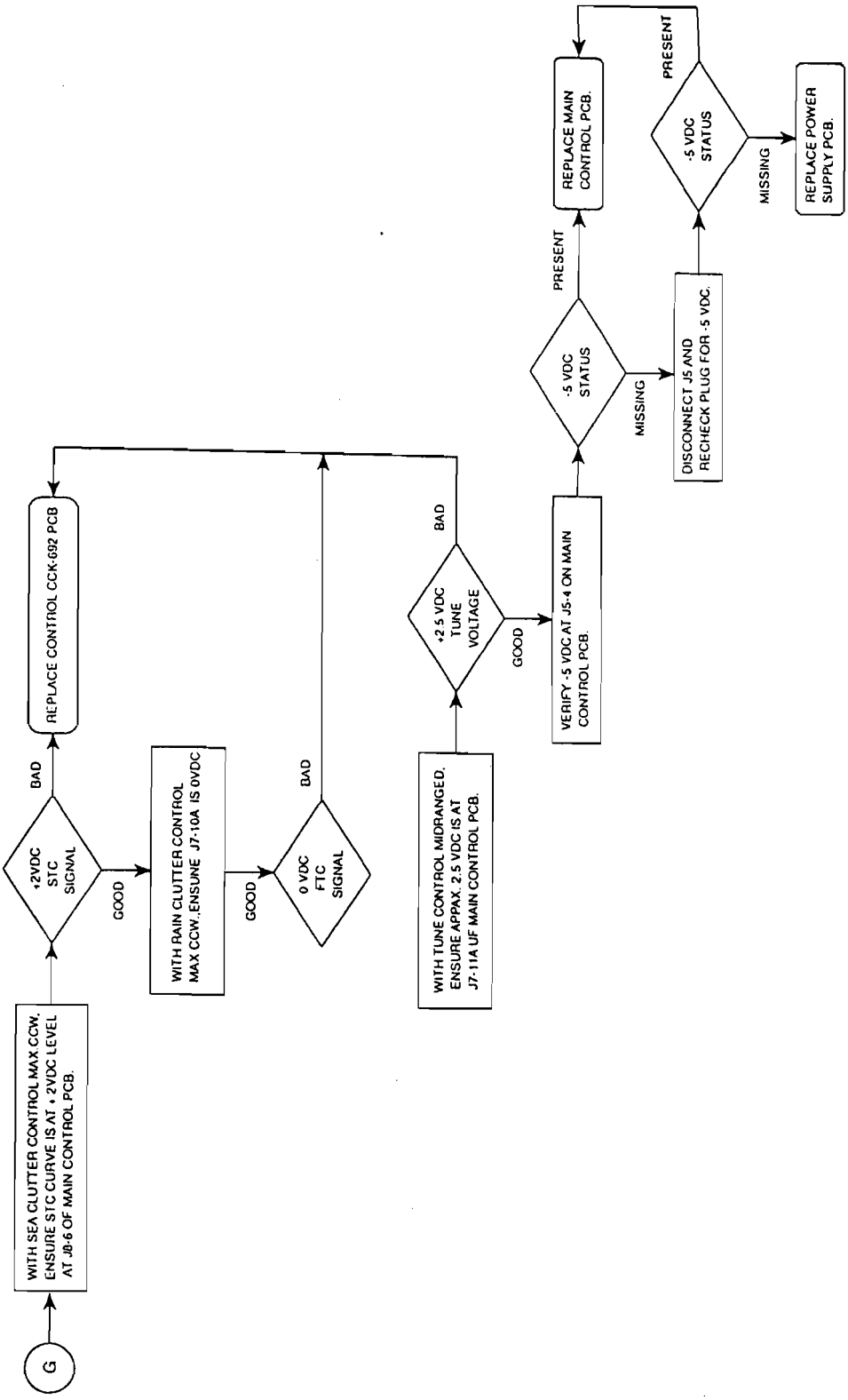


Fig. 5-13 R20XX/R21XX SYSTEM TROUBLESHOOTING CHART (4 of 4)

5.6 MAGNETIC SENSOR COMPENSATION

CAUTION

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

XX HEADING SENSOR Compensation Adjustment

Although each 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 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 (±1°) 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.

Compensation Procedure (Part 1)

Compensating the 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 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.

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 readouts 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 XX Heading Sensor.

INI-100 Compensation Adjustment

Compensation for the INI-100 (like the AutoComp 1000 heading sensor) is the procedure to adjust out errors in the magnetic heading readings (DEVIATIONS) that are a result of the local magnetic effects of the vessel.

CAUTION

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

It will usually be found that the INI-100 does not need compensation when installed properly.

INI-100 Compensation Procedure

1. Before performing any adjustments, put the boat on reference headings of North, South, East, and West. Take the INI-100 readings for each and write them down.

2. Now determine whether or not it is necessary to compensate the sensor. Take the four headings previously recorded and subtract the actual headings from them.

Example 1: Reading - Actual = error

002 - 000 = +2
182 - 180 = +2
092 - 090 = +2
272 - 270 = +2

If the four errors are all the same for all four headings, as shown in Example 1, then it is a simple Alignment ("A") error. Do not use the N/S & E/W compensation adjustments at all. Simply loosen the sensor mounting screws and rotate the entire sensor in the proper direction to cancel out the errors and fasten it down again. In Example 1 the sensor would be rotated left by 2 degrees.

Example 2: Reading - Actual = error

004 - 000 = +4
178 - 180 = -2
093 - 090 = +3
269 - 270 = -3

If all four errors are not the same, then add up the four errors. If the sum of the errors is equal to zero, then it will only be necessary to adjust the N/S & E/W compensation. If the sum of the errors is not equal to zero, then align

ment ("A") and compensation N/S & E/W adjustments will be required.

INI-100 Alignment ("A") Adjustment:

Before any compensation N/S & E/W adjustments are made, the alignment ("A") error must be taken out. In example 2 the sum of the errors is equal to +4 degrees. Divide the sum of the four errors by 4 to determine the average error. In example 2, the average ("A") error is +1 degree. Again, simply loosen the mounting screws and rotate the sensor in the proper direction to cancel out the average error. In Example 2, the unit would be rotated 1 degree to the left (-1 degree).

INI-100 Compensation N/S & E/W Adjustments:

NOTE

These adjustments must be made using a plastic alignment tool or plastic screwdriver.

After adjusting out the alignment error, the N/S & E/W compensation adjustments will be used to cancel out the residual deviations caused by the position of the sensor on the vessel.

After cancelling out the average error ("A") in example 2, the following residual deviations would be left:

Reading - Actual=error-("A") = Dev.

004 - 000 = +4 -1= +3
178 - 180 = -2 -1= -3
093 - 090 = +3 -1 = +2
269 - 270 = -1 -1 = -2

In this Example it is seen that the residual deviation in the N/S direction is a symmetrical 3 degrees (+3-3), and in the E/W direction is a symmetrical 2 degrees (+2-2). Remove the two screws in the cover of the INI-100 sensor that are marked N/S & E/W. Bring the vessel to a North heading, and using the plastic alignment tool or plastic screwdriver, adjust the potentiometer that is below the hole marked N/S until the sensor provides a reading of 000 degrees. This adjustment will cancel out the 3 degrees of error at both the North and South headings. Now bring the vessel to an East heading and adjust the potentiometer that is below the hole marked E/W until the sensor provides a reading of 090. Again, with this adjustment the error at 270 degrees has also been cancelled.

In some cases, the residual deviation is not symmetrical on the N/S or the E/W directions as shown in Example 2. In this case, the error on the nonsymmetrical axis must be evened out to obtain the best accuracy possible.

SECTION 6

PARTS LIST AND DRAWINGS

6.1 INTRODUCTION

This chapter contains schematic diagrams, assembly drawings and parts lists for Radar Set R20XX and R21XX. Assembly drawings will assist in identifying and locating components. Find numbers on the drawings are the same as location numbers in the parts list tables.

On the 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 R20XX and R21XX. The schematic diagram, assembly drawing, parts list format is repeated for each assembly and subassembly. Note that the modulator and receiver sections of the antennas are identical for the Radome and Pedestal style units.

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 servicable parts or adjustments. The operator never should remove the radar unit covers nor attempt to service this equipment.

TABLE 6-1

Model R20XX/R21XX Generation Breakdown

Description	Part No.	Assembly Dwg. (FIG)	Parts List (TBL)
Radome Scanner Unit (R20XX)	M92539	6-2	6-2
Antenna Array Assembly	MPAE00529		
MTR Chassis Assembly	MTC003611		
Modulator PCB	CME-196A	6-5, 6-7	6-5, 6-6
Receiver PCB	CAE-313	6-9	6-7
LNFE Assembly (NJT1946)	5EZAA00021		
Diode Limiter (NJS6930)	5EZAA00024		
Circulator Assembly (30211A25)	5AJAF00010		
Terminal PCB	CBD-1181	6-3	6-4
Motor Assembly	78RRD0023		
Magnetron (MSF1421B)	5VMAA00049		
Antenna Safety Switch (S101)	5SAAB00432		
SHM Switch (S102)	5KRAA00036		
Open Array Radiator Unit (R21XX)	M92543	6-11	6-8
Open Array Scanner Unit (R21XX)	M92542	6-13	6-10
MTR Unit	NTG-80	6-14	6-14
Modulator Assembly	NMA-434		6-15
Modulator PCB	CME-196A	6-5, 6-7	6-5, 6-6
Magnetron (MSF1421B)	5VMAA00049		
Receiver Assembly	NRG-82		6-16
Receiver PCB	CAE-313	6-9	6-7
LNFE Assembly (NJT1946)	5EZAA00021		
Diode Limiter (NJS6930)	5EZAA00024		
Circulator Assembly (30211A25)	5AJAF00010		
Motor Assembly	CBP-120		6-12
SHM PCB	CCJ-68		6-13
Terminal PCB	CBD-1168	6-15	6-17
Antenna Safety Switch (S101)	5SAAB00432		
Display Unit (R20XX/R21XX)	M92538/M92540	6-18	6-18
Pwr. Sup. Heat Sink Assembly	MTC300106		
Power Supply PCB	CBD-1167	6-25	6-23
Main Chassis Assembly	NCD-418		
Main Control PCB	CMC-739	6-19	6-20
Bezel Assembly (R20XX)	MPBC30645		
Bezel Assembly (R21XX)	MPBC30646		
Bezel Control PCB (Left)	CCK-691	6-21	6-21
Bezel Control PCB (Right)	CCK-692	6-23	6-22
MARPA PCB (OPTIONAL)	CDC-780	6-27	6-24
CRT Assembly			
Consisting of:			
CRT Monitor PCB	CCN-245	6-29	6-25
Video PCB	CCN-245	6-29	6-25
Deflection Yoke	CKJ-113	6-29	6-26
CRT	CKJ-113	6-29	6-26
SeaTalk Interface	CMH-1244	6-31	6-27
Track Pad	7HZRD0001		

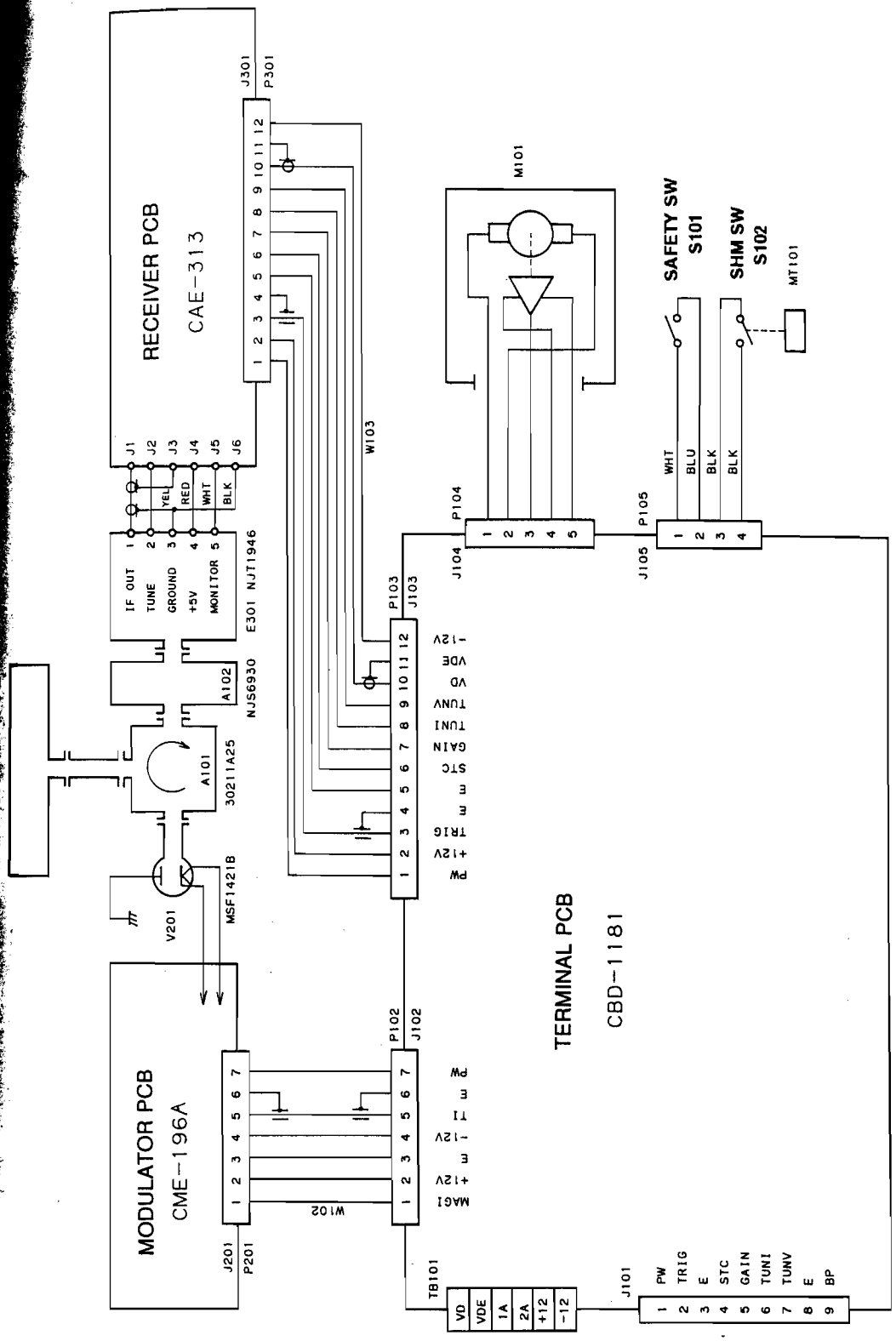


Fig. 6-1 INTERNAL CONNECTION DIAGRAM, R20XX RADOME SCANNER UNIT

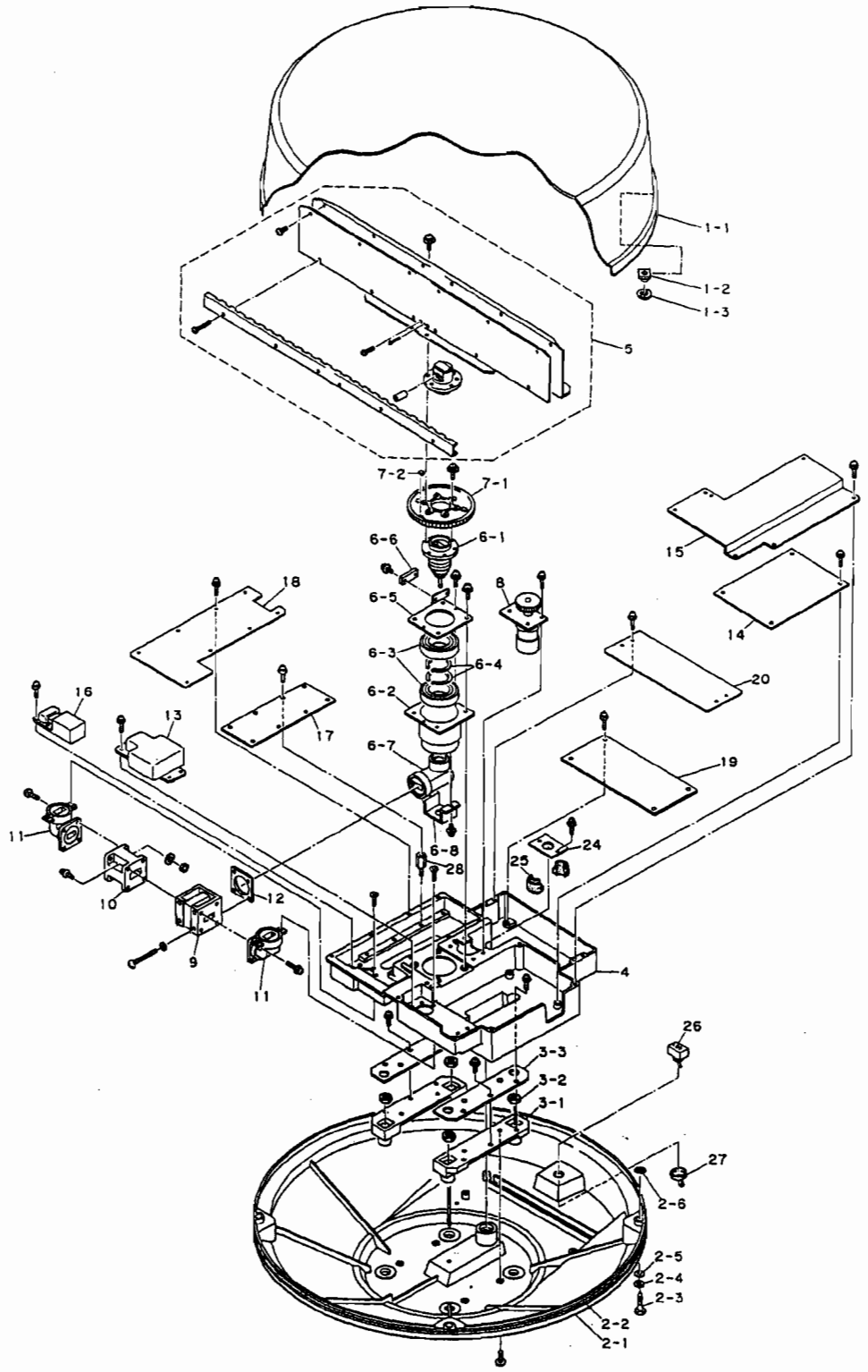


Fig. 6-2 ASSEMBLY DRAWING, R20XX RADOME SCANNER UNIT (M92539)

TABLE 6-2
Parts Location List
R20XX Radome M92539

Location	Description	Symbol	Part Number
1	**Upper Radome Assembly**		MPBX16084A
1-1	Radome		MPBC09205
1-2	Nut, Special		MTL035987A
1-3	Toothed Washer		BRTG03668
2	**Lower Radome Assembly**		MPBX16086A
2-1	Radome		MTV002211A
2-2	Packing		MTT016990A
2-3	Bolt, Special		MPTG02144A
2-4	Washer, Plain		BSFW06000B
2-5	Washer, Rubber		MTT026587
2-6	O-Ring		BRPK00109
3	**Mounting Base Assembly**		MPBP02927
3-1	Mounting Base		MTC003612
3-2	Nut 3/8-16 UNC		BRTG04437
3-3	Plate		MTB186258
4	**Main Chassis**		MTC003611
5	**Antenna Array Assembly**		MPAE00529
5-1	Radiator PCB (CTM-92)		7PCRD0938
6	**Main Shaft Assembly**		MPGK03589
6-1	Rotary Joint		MPAB02055
6-2	Housing		MTC003613
6-3	Bearing		BRGK00165
6-4	C-Ring		BRTG00735
6-5	Plate, Retaining		MTB187261A
6-6	SHM Switch	S102	5KRAA00036
6-7	Connecting Wave Guide		MPAB01766
6-8	Cover		MTB154257
7	**Gear Assembly**		MPGK02946
7-1	Gear		MTV002340
7-2	Magnet	MT101	5MPAB00001
8	Motor Assembly	M101	7BRRD0023
9	Circulator (30211A25)	A101	5AJAF00010
10	Diode Limiter (NJS6930)	A102	5EZAA00024
11	Corner Wave Guide		MTM003700
12	Plate		MTD002559D
13	Magnetron (MSF1421B)	V201	5VMAA00049
14	Modulator PCB	PC201	CME-196A
15	Cover		MTB308167
16	LNFE Assembly (NJT1946)	E301	5EZAA00021
17	Receiver PCB	PC301	CAE-313
18	Cover		MTB307956
19	Terminal PCB	PC501	CBD-1181
20	Cover		MTB186257A
21	Plate		MTB186260

Location	Description	Symbol	Part Number
22	Rubber Sheet		MTT026591
23	Sheet, Radiating		7ZSRD0013
24	Plate		MTB186259A
25	Gasket		MTT026586
26	Toggle Switch	S101	5SAAB00432
27	Switch Cover		MPPK06925
28	Spacer (1st lot only)		MTK000359

TABLE 6-3
Replaceable Parts List
R20XX Radome Scanner Unit Main Chassis Components
M92539

Ref.	Type	Description	Part Number
A101	30211A25	Circulator	5AJAF00010
A102	NJS6930	Diode Limiter	5EZAA00024
E301	NJT1946	LNFE Assembly	5EZAA00021
M101	H-7BDRD0023	Motor Assembly	7BRRD0023
MT101	SRS-1 FM4.9x4.9x6	Magnet	5MPAB00001
P105	IL-G-4S-S3C2	Connector, 4 pin	5JWAD00095
PT105	IL-G-C2-10000	Connector pins	5JWAD00125
S101	S-116	Switch, Ant. Safety	5SAAB00432
S102	NRS-109	Switch, Heading Flash	5KRAA00036
V201	MSF1421B	Magnetron	5VMAA00049
W1	B4-6	Wiring Harness	1166140002
W102	H-7ZCRD0383	Wiring Harness	7ZCRD0383
W103	H-7ZCRD0384	Wiring Harness	7ZCRD0384

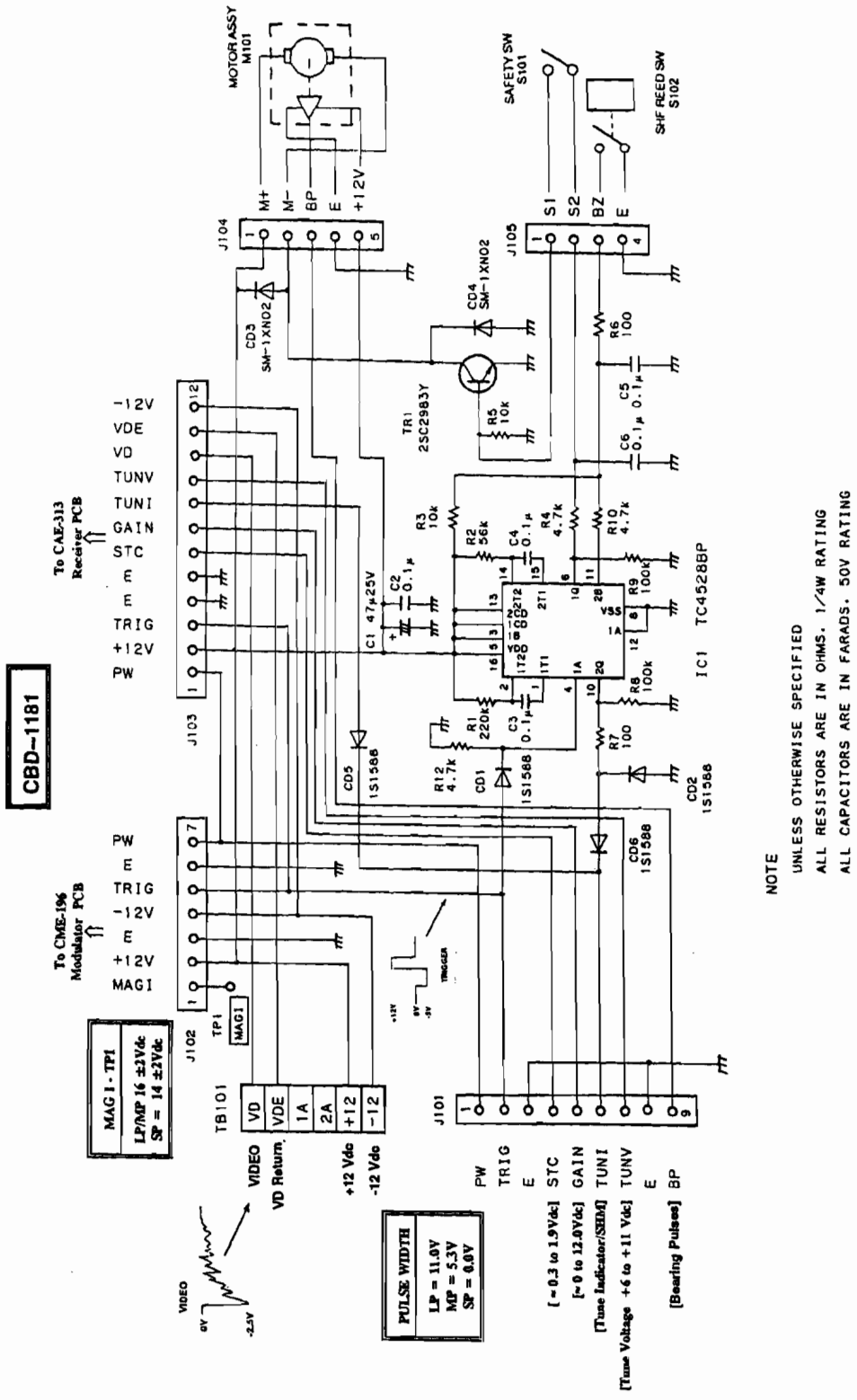


Fig. 6-3 SCHEMATIC DIAGRAM, R20XX TERMINAL PCB (CBD-1181)

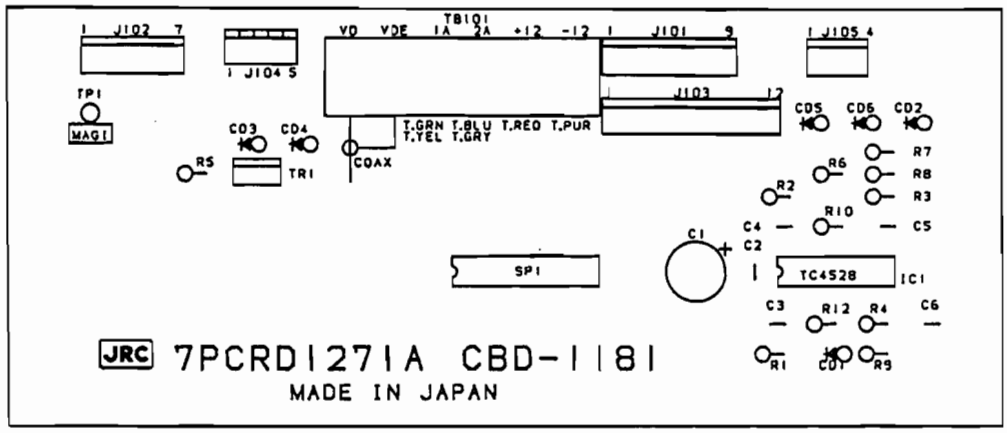


Fig. 6-4 COMPONENT LOCATION DRAWING, R20XX TERMINAL PCB (CBD-1181)

TABLE 6-4
Replaceable Parts List
R20XX Radome Terminal PCB
CBD-1181

Ref.	Type	Description	Part Number
C1	ECE-A1EU470B	Cap, 47μF, 25V	5CEAA01816
C2	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C3	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C4	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C5	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C6	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
CD1	1S1588-TPB2	Diode, 300mW	5TXAD00335
CD2	1S1588-TPB2	Diode, 300mW	5TXAD00335
CD3	SM-1XN02 LFK4	Diode	5TXAL00121
CD4	SM-1XN02 LFK4	Diode	5TXAL00121
CD5	1S1588-TPB2	Diode, 300mW	5TXAD00335
CD6	1S1588-TPB2	Diode, 300mW	5TXAD00335
IC1	TC4528BP	Integrated Circuit	5DDAE00070
J101	IL-G-0P-S3T2-E	Conn, 9 pin	5JWAD00383
J102	IL-G-7P-S3T2-E	Conn, 7 pin	5JWAD00119
J103	IL-G-12P-S3T2-E	Conn, 12 pin	5JWAD00082
J104	B5P-SHF-1AA	Conn, 5 pin	5JWAP00135
J105	IL-G-4P-S3T2-E	Conn, 4 pin	5JWAD00091
R1	ERD-25UJ224T	Res, 220KΩ, ¼W	5RDAA01619
R2	ERD-25UJ563T	Res, 56KΩ, ¼W	5RDAA01588
R3	ERD-25UJ103T	Res, 10KΩ, ¼W	5RDAA01547
R4	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R5	ERD-25UJ103T	Res, 10KΩ, ¼W	5RDAA01547
R6	ERD-25UJ101T	Res, 100Ω, ¼W	5RDAA01599
R7	ERD-25UJ101T	Res, 100Ω, ¼W	5RDAA01599
R8	ERD-25UJ104T	Res, 100KΩ, ¼W	5RDAA01623
R9	ERD-25UJ104T	Res, 100KΩ, ¼W	5RDAA01623
R10	ERD-25UJ104T	Res, 100KΩ, ¼W	5RDAA01623
TB101	TS-121P-6P	Term. Board, 6 pin	5JTAJ00199
TP1	LC-2-G YEL	Test Point	5JTCW00015
TR1	2SC2983-Y	Transistor	5TCAF00578

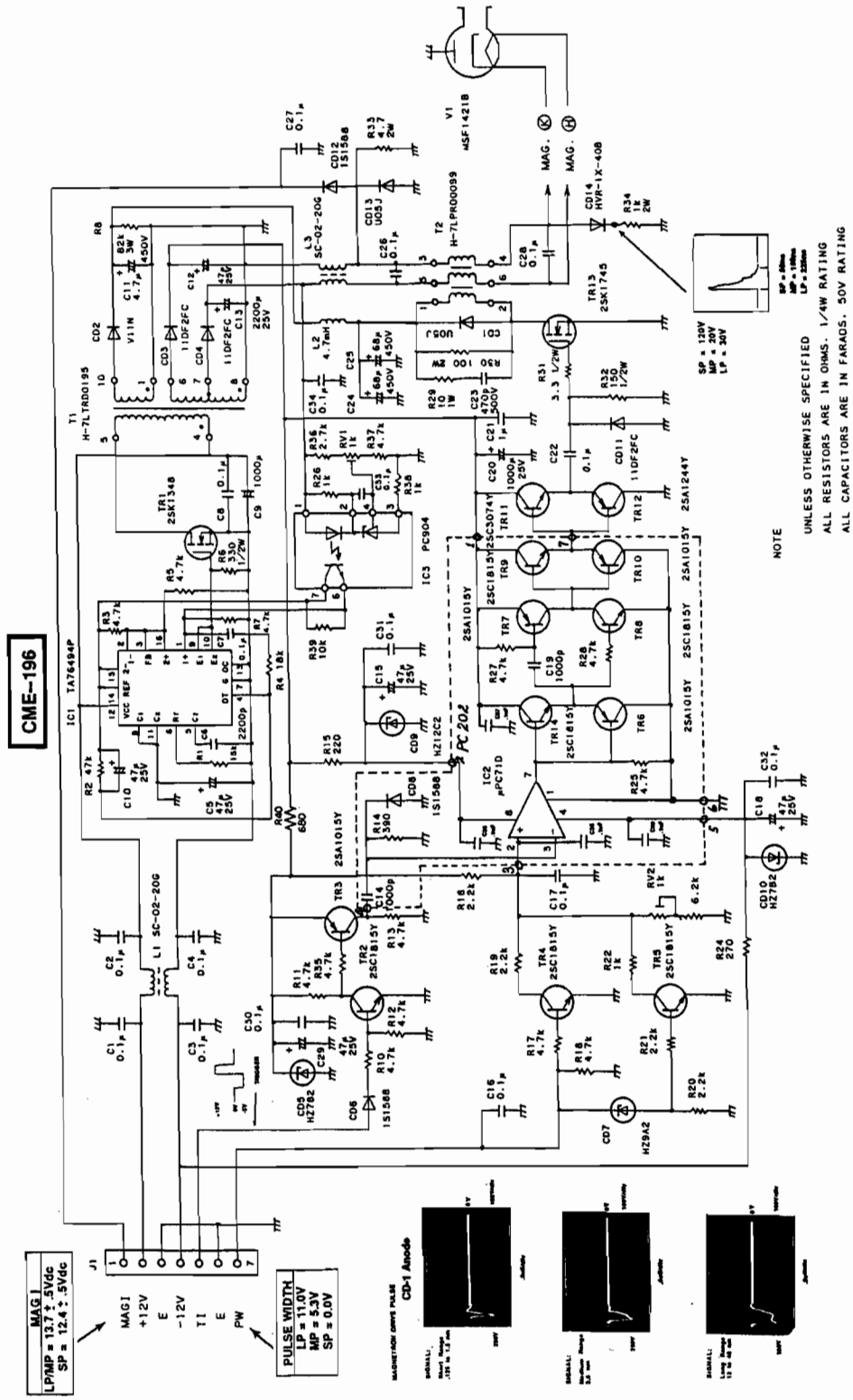


Fig. 6-5 SCHEMATIC DIAGRAM, MODULATOR PCB (CME-196)

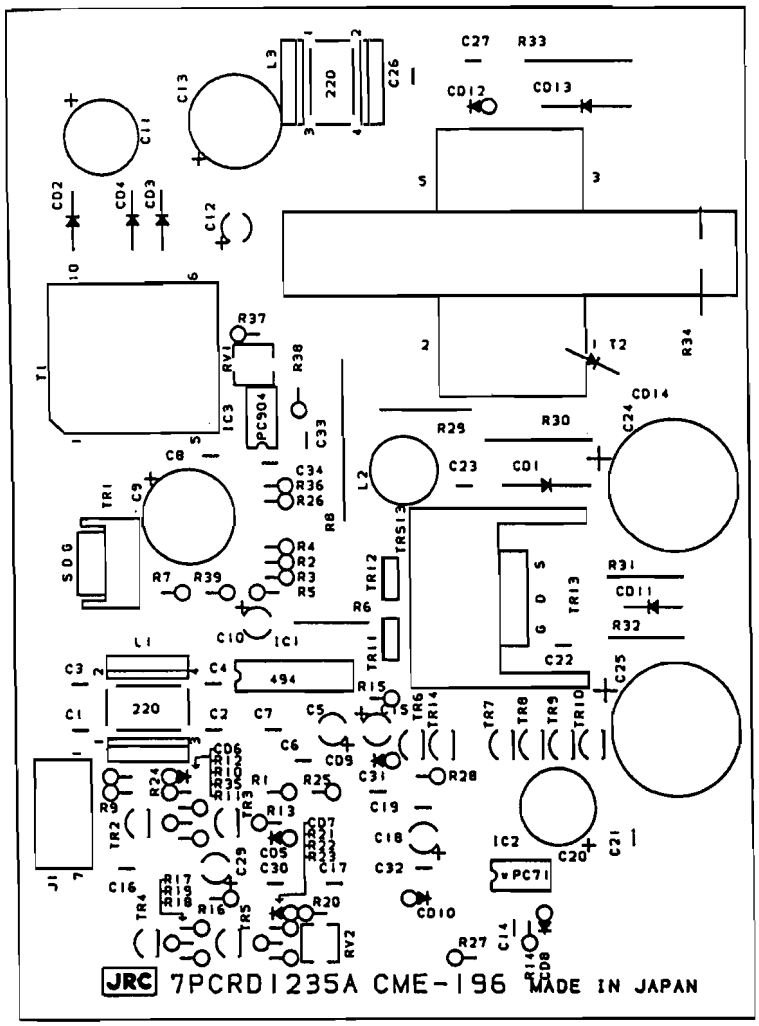


Fig. 6-6 COMPONENT LOCATION DRAWING, MODULATOR PCB (CME-196)

TABLE 6-5
Replaceable Parts List
Radome/Open Array Modulator PCB
CME-196

Ref.	Type	Description	Part Number
C1	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C2	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C3	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C4	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C5	ECE-A1EU470B	Cap, 47μF, 25V	5CEAA01816
C6	ECQ-B1H222KZ3	Cap, 2200pF	5CRAA00954
C7	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C8	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C9	ECE-A1HU102B	Cap, 0.1μF, 50V	5CEAA03363
C10	ECE-A1EU470B	Cap, 47μF, 25V	5CEAA01816
C11	ECE-A2WU4R7B	Cap, 4.7μF, 450V	5CEAA03364
C12	ECE-A1EU470B	Cap, 47μF, 25V	5CEAA01816
C13	ECE-A1EU222B	Cap, 0.1μF, 50V	5CEAA03365
C15	ECE-A1EU470B	Cap, 47μF, 25V	5CEAA01816
C16	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C17	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C18	ECE-A1EU470B	Cap, 47μF, 25V	5CEAA01816
C20	ECE-A1EU102B	Cap, 1000μF, 25V	5CEAA02857
C21	ECQ-V1H105JZ3	Cap, .01μF, 50V	5CRAA00773
C22	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C23	DD05B471K500	Cap, 470pF, 500V	5CBAB00792
C24	ECOS2WG680G	Cap, 68μF, 450V	5CEAA02643
C25	ECOS2WG680G	Cap, 68μF, 450V	5CEAA02643
C26	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C27	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C28	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C29	ECE-A1EU470B	Cap, 47μF, 25V	5CEAA01816
C30	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C31	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C32	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C33	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C34	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C35	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C36	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C37	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617

Ref.	Type	Description	Part Number
C38	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
CD1	U05JTYPE2	Diode, 800V, 2.5A	5TXAE00817
CD2	V11N TYPE2	Diode	5TXAE00683
CD3	11DF2FC	Diode	5TXAG00239
CD4	11DF2FC	Diode	5TXAG00239
CD5	HZ7B2-RE	Diode	5TXAE00613
CD6	1S1588-TPB2	Diode, 300mW	5TXAD00335
CD7	HZ9A2RE	Diode	5TXAE00592
CD9	HZ12C2RE	Diode	5TXAE00966
CD10	HZ7B2-RE	Diode	5TXAE00613
CD11	11DF2FC	Diode	5TXAG00239
CD12	1S1588-TPB2	Diode, 300mW	5TXAD00335
CD13	U05JTYPE2	Diode, 800V, 2.5A	5TXAE00817
CD14	HVR-1X-40B	Diode	5TXAN00243
IC1	TA7649P	Integrated Circuit	5DAAD00691
IC2	μPC71D	Integrated Circuit	
IC3	PC904	Integrated Circuit	5TZAH00294
J1	IL-G-7P-S3L2-E	Conn, 7 pin	5JWAD00473
L1	SC-02-20G	Choke	5LGAB00081
L2	FL-9H472J-H	Choke, 4.7mH	5LCAA00653
L3	SC-02-20G	Choke	5LGAB00081
R1	ERD-25UJ153T	Res, 15KΩ, ¼W	5RDAA01594
R2	ERD-25UJ473T	Res, 47KΩ, ¼W	5RDAA01618
R3	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R4	ERD-25UJ183T	Res, 18KΩ, ¼W	5RDAA01605
R5	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R6	ERD-50TJ331	Res, 330Ω, ½W	5RDAA00823
R7	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R8	REG-3ANJ823H	Res, 82KΩ, 3W	5REAG04123
R9	ERD-25UJ331T	Res, 330Ω, ¼W	5RDAA01480
R10	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R11	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R12	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R13	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R15	ERD-25UJ221T	Res, 220Ω, ¼W	5RDAA01543
R16	ERD-25UJ272T	Res, 2.7KΩ, ¼W	5RDAA01546
R17	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R18	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R19	ERD-25UJ222T	Res, 2.2KΩ, ¼W	5RDAA01548
R20	ERD-25UJ222T	Res, 2.2KΩ, ¼W	5RDAA01548

Ref.	Type	Description	Part Number
R21	ERD-25UJ222T	Res, 2.2KΩ, ¼W	5RDAA01548
R22	ERD-25UJ102T	Res, 1kΩ, ¼W	5RDAA01542
R23	ERD-25UJ622T	Res, 6.2KΩ, ¼W	5RDAA01595
R24	ERD-25UJ271T	Res, 270Ω, ¼W	5RDAA01540
R26	ERD-25TJ102	Res, 1KΩ, ¼W	5RDAA00704
R29	ERG-1ANJP100S	Res, 10Ω, 1W	5REAG03666
R30	ERG-2ANJ101H	Res, 100Ω, 2W	5REAG04018
R31	ERD-50TJ3R3	Res, 3.3Ω, ½W	5RDAA00909
R32	ERD-50TJ151	Res, 150Ω, ½W	5RDAA00815
R33	ERX-2ANJ4R7H	Res, 4.7Ω, 2W	5REAG04021
R34	ERG-2ANJ102H	Res, 1KΩ, 2W	5REAG03091
R35	ERD-25UJ472J	Res, 4.7KΩ, ¼W	5RDAA02375
R36	ERD-25UJ272T	Res, 2.7KΩ, ¼W	5RDAA01546
R37	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R38	ERD-25UJ102T	Res, 1KΩ, ¼W	5RDAA01542
R39	ERD-25UJ103T	Res, 10KΩ, ¼W	5RDAA01547
R40	ERD-25PJ681	Res, 680Ω, ¼W	5RDAA01242
RV1	GF06UT-2-1K Ω	Res, Var, 1KΩ	5RMAB00117
RV2	GF06UT-2-1K Ω	Res, Var, 1KΩ	5RMAB00117
T1	H-7LTRD0195	Transformer	7LTRD0195
T2	H-7LPRD0099	Transformer, Pluse	7LPRD0099
TR1	2SK1348	Transistor	5TKAA00265
TR2	2SC1815Y-TPE2	Transistor	5TCAF00781
TR3	2SA1015Y-TPE2	Transistor	5TAAG00294
TR4	2SC1815Y-TPE2	Transistor	5TCAF00781
TR5	2SC1815Y-TPE2	Transistor	5TCAF00781
TR11	2SC3074-Y	Transistor	5TCAF00899
TR12	2SA1244-Y	Transistor	5TAAG00220
TR13	2SK1745	Transistor	5TKAA00264
TRS1	ES-25-BS-T	Heat Sink	5XKAF00074
TRS13	SP-30-BS-AN-0	Heat Sink	5ZKAF00051
ZS1	M-30-D-1	Mylar Insulator	5ZKBG00011
ZS13	BFG-20 D-6	Mylar Insulator	5ZKAF00075

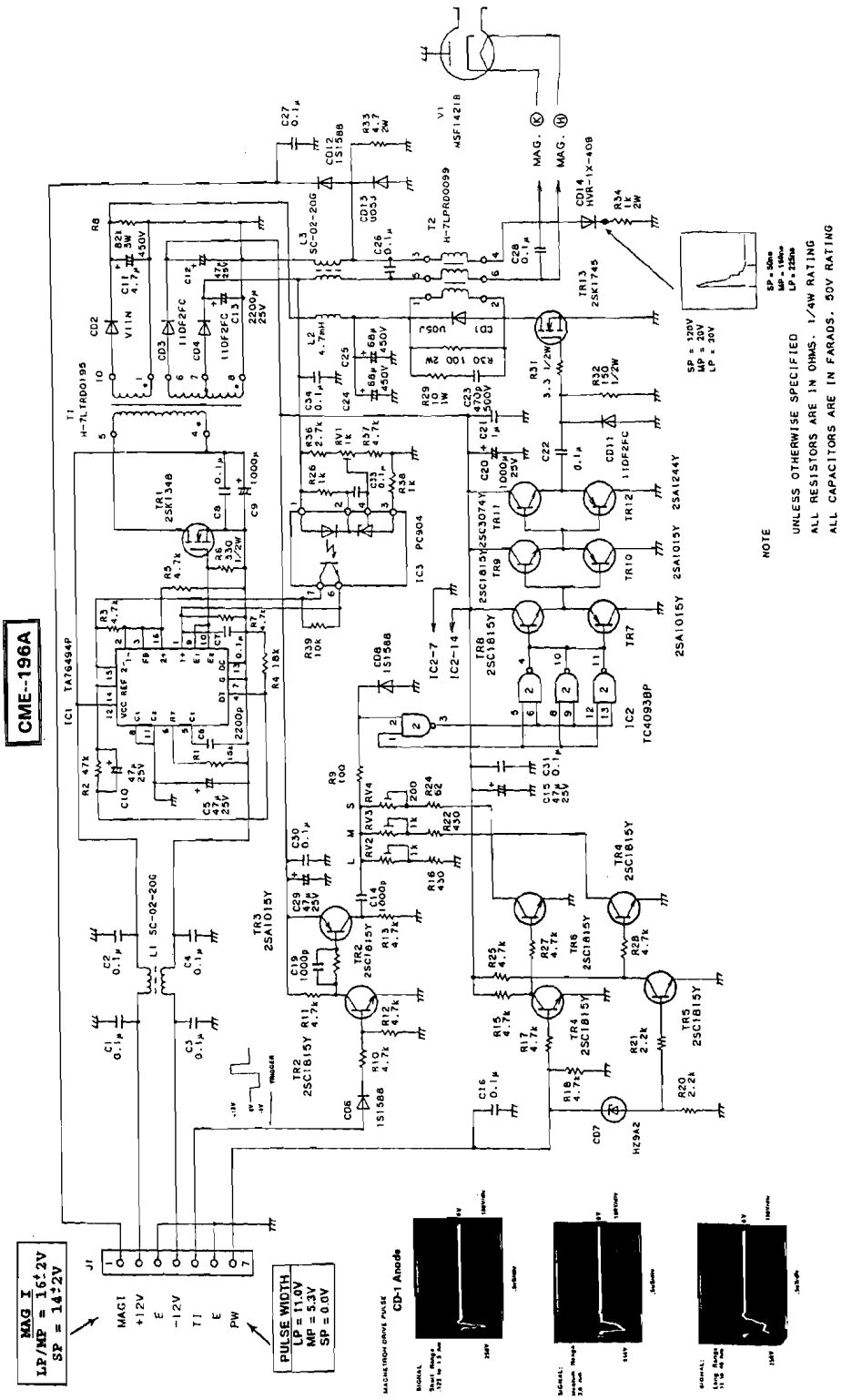


Fig. 6-7 SCHEMATIC DIAGRAM, MODULATOR PCB (CME-196A)

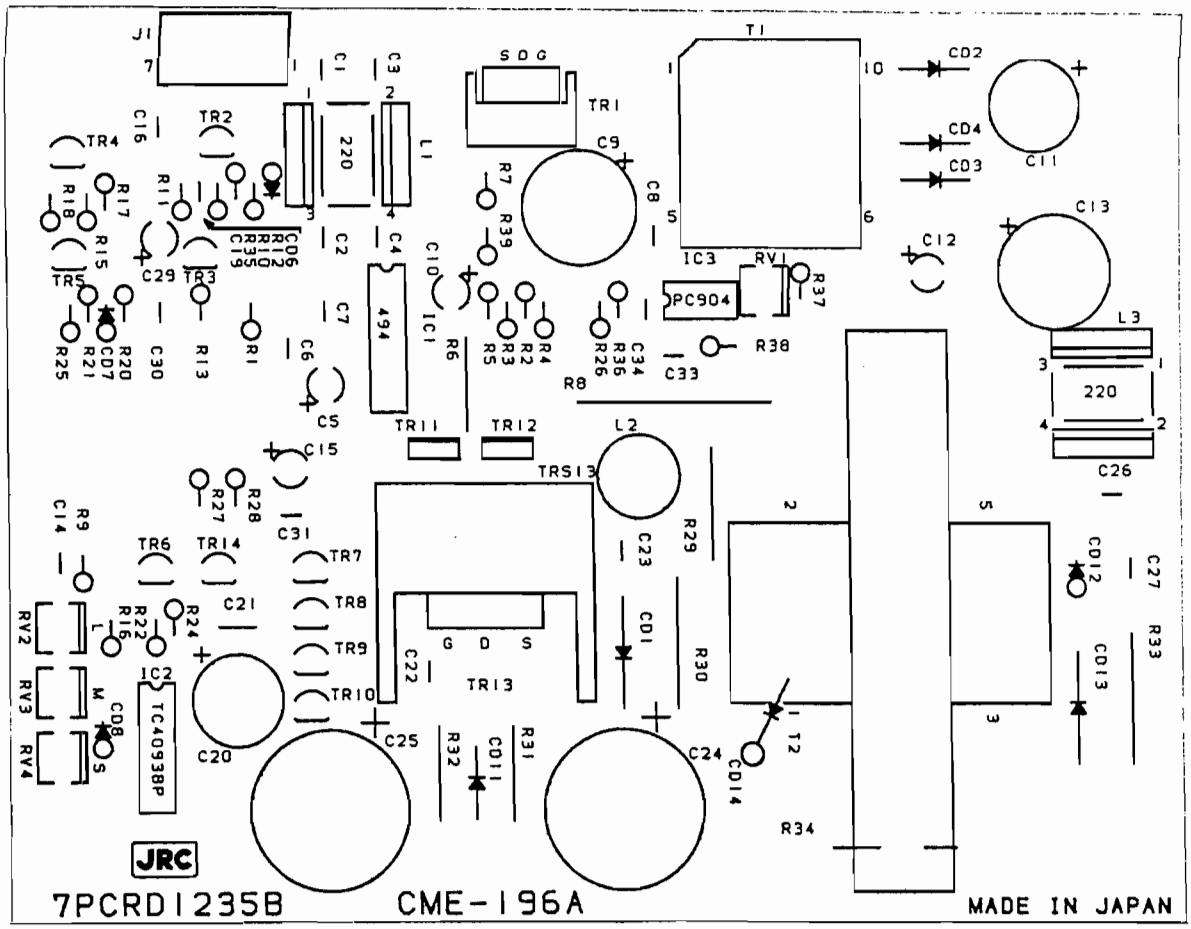


Fig. 6-8 COMPONENT LOCATION DRAWINGS, MODULATOR PCB (CME-196A)

TABLE 6-6
Replaceable Parts List
Radome/Open Array Modulator PCB
CME-196A

Ref.	Type	Description	Part Number
C1	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C2	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C3	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C4	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C5	ECE-A1EU470B	Cap, 47μF, 25V	5CEAA01816
C6	ECQ-B1H222KZ3	Cap, 2200pF	5CRAA00954
C7	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C8	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C9	ECE-A1HU102B	Cap, 0.1μF, 50V	5CEAA03363
C10	ECE-A1EU470B	Cap, 47μF, 25V	5CEAA01816
C11	ECE-A2WU4R7B	Cap, 4.7μF, 450V	5CEAA03364
C12	ECE-A1EU470B	Cap, 47μF, 25V	5CEAA01816
C13	ECE-A1EU222B	Cap, 0.1μF, 50V	5CEAA03365
C14	ECQ-B1H102JZ3	Cap, 1000pF, 50V	5CRAA00585
C15	ECE-A1EU470B	Cap, 47μF, 25V	5CEAA01816
C16	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C19	ECQ-B1H102JZ3	Cap, 1000pF, 50V	5CRAA00585
C20	ECE-A1EU102B	Cap, 1000μF, 25V	5CEAA02857
C21	ECQ-V1H105JZ3	Cap, .01μF, 50V	5CRAA00773
C22	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C23	DD05B471K500	Cap, 470pF, 500V	5CBAB00792
C24	ECOS2WG680G	Cap, 68μF, 450V	5CEAA02643
C25	ECOS2WG680G	Cap, 68μF, 450V	5CEAA02643
C26	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C27	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C28	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C29	ECE-A1EU470B	Cap, 47μF, 25V	5CEAA01816
C30	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C31	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C33	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C34	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
CD1	U05JTYPE2	Diode, 800V, 2.5A	5TXAE00817
CD2	V11N TYPE2	Diode	5TXAE00683
CD3	11DF2FC	Diode	5TXAG00239
CD4	11DF2FC	Diode	5TXAG00239

Ref.	Type	Description	Part Number
CD6	1S1588-TPB2	Diode, 300mW	5TXAD00335
CD7	HZ9A2RE	Diode	5TXAE00592
CD8	1S1588-TPB2	Diode, 300mW	5TXAD00335
CD11	11DF2FC	Diode	5TXAG00239
CD12	1S1588-TPB2	Diode, 300mW	5TXAD00335
CD13	U05JTYPE2	Diode, 800V, 2.5A	5TXAE00817
CD14	HVR-1X-40B	Diode	5TXAN00243
IC1	TA7649P	Integrated Circuit	5DAAD00691
IC2	TC4093BP	Integrated Circuit	5DDAE00118
IC3	PC904	Integrated Circuit	5TZAH00294
J1	IL-G-7P-S3L2-E	Conn, 7 pin	5JWAD00473
L1	SC-02-20G	Choke	5LGAB00081
L2	FL-9H472J-H	Choke, 4.7mH	5LCAA00653
L3	SC-02-20G	Choke	5LGAB00081
R1	ERD-25UJ153T	Res, 15KΩ, ¼W	5RDAA01594
R2	ERD-25UJ473T	Res, 47KΩ, ¼W	5RDAA01618
R3	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R4	ERD-25UJ183T	Res, 18KΩ, ¼W	5RDAA01605
R5	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R6	ERD-50TJ331	Res, 330Ω, ½W	5RDAA00823
R7	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R8	REG-3ANJ823H	Res, 82KΩ, 3W	5REAG04123
R9	ERD-25UJ101T	Res, 100Ω, ¼W	5RDAA01599
R10	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R11	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R12	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R13	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R15	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R16	ERD-25UJ431T	Res, 430Ω, ¼W	5RDAA01629
R17	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R18	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R20	ERD-25UJ222T	Res, 2.2KΩ, ¼W	5RDAA01548
R21	ERD-25UJ222T	Res, 2.2KΩ, ¼W	5RDAA01548
R22	ERD-25UJ431T	Res, 430Ω, ¼W	5RDAA01629
R24	ERD-25UJ620T	Res, 62Ω, ¼W	5RDAA01611
R25	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R26	ERD-25TJ102	Res, 1KΩ, ¼W	5RDAA00704
R27	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R28	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R29	ERG-1ANJP100S	Res, 10Ω, 1W	5REAG03666

Ref.	Type	Description	Part Number
R30	ERG-2ANJ101H	Res, 100Ω, 2W	5REAG04018
R31	ERD-50TJ3R3	Res, 3.3Ω, ½W	5RDAA00909
R32	ERD-50TJ151	Res, 150Ω, ½W	5RDAA00815
R33	ERX-2ANJ4R7H	Res, 4.7Ω, 2W	5REAG04021
R34	ERG-2ANJ102H	Res, 1KΩ, 2W	5REAG03091
R35	ERD-25UJ472J	Res, 4.7KΩ, ¼W	5RDAA02375
R36	ERD-25UJ272T	Res, 2.7KΩ, ¼W	5RDAA01546
R37	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R38	ERD-25UJ102T	Res, 1KΩ, ¼W	5RDAA01542
R39	ERD-25UJ103T	Res, 10KΩ, ¼W	5RDAA01547
RV1	GF06UT-2-1K Ω	Res, Var, 1KΩ	5RMAB00117
RV2	GF06UT-2-1K Ω	Res, Var, 1KΩ	5RMAB00117
RV3	GF06UT-2-1K Ω	Res, Var, 1KΩ	5RMAB00117
RV4	GF06UT-2-200 Ω	Res, Var, 200Ω	5RMAB00129
T1	H-7LTRD0195	Transformer	7LTRD0195
T2	H-7LPRD0099	Transformer, Pluse	7LPRD0099
TR1	2SK1348	Transistor	5TKAA00265
TR2	2SC1815Y-TPE2	Transistor	5TCAF00781
TR3	2SA1015Y-TPE2	Transistor	5TAAG00294
TR4	2SC1815Y-TPE2	Transistor	5TCAF00781
TR5	2SC1815Y-TPE2	Transistor	5TCAF00781
TR6	2SC1815Y-TPE2	Transistor	5TCAF00781
TR7	2SC1815Y-TPE2	Transistor	5TCAF00781
TR8	2SC1815Y-TPE2	Transistor	5TCAF00781
TR9	2SC1815Y-TPE2	Transistor	5TCAF00781
TR10	2SC1815Y-TPE2	Transistor	5TCAF00781
TR11	2SC3074-Y	Transistor	5TCAF00899
TR12	2SA1244-Y	Transistor	5TAAG00220
TR13	2SK1745	Transistor	5TKAA00264
TR14	2SC1815Y-TPE2	Transistor	5TCAF00781
TRS1	ES-25-BS-T	Heat Sink	5XKAF00074
TRS13	SP-30-BS-AN-0	Heat Sink	5ZKAF00051
ZS1	M-30-D-1	Therm. Cond. Sht.	5ZKBG00011
ZS13	BFG-20 D-6	Therm. Cond. Sht.	5ZKAF00075

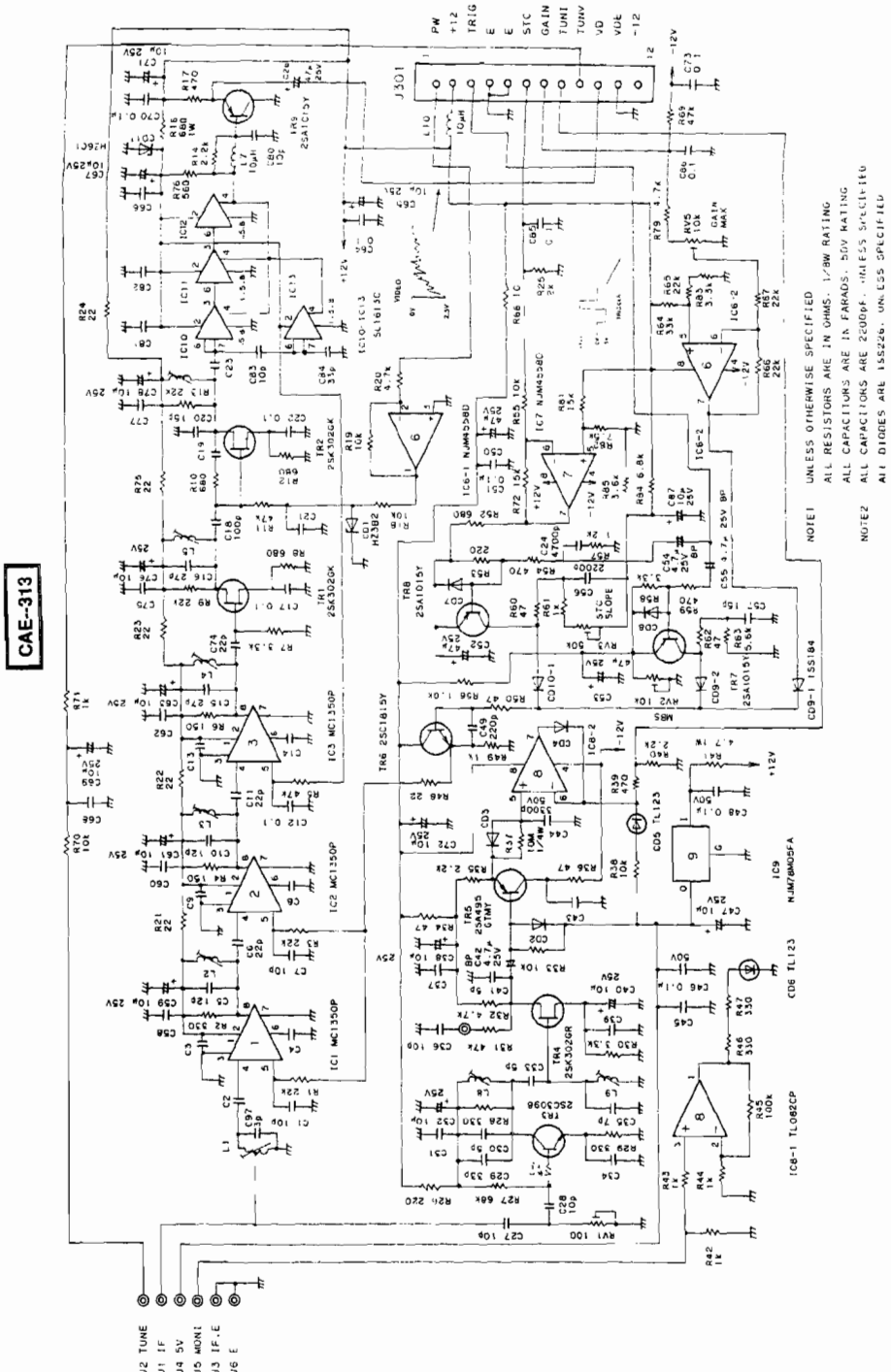


Fig. 6-9 SCHEMATIC DIAGRAM, RECEIVER PCB (CAE-313)

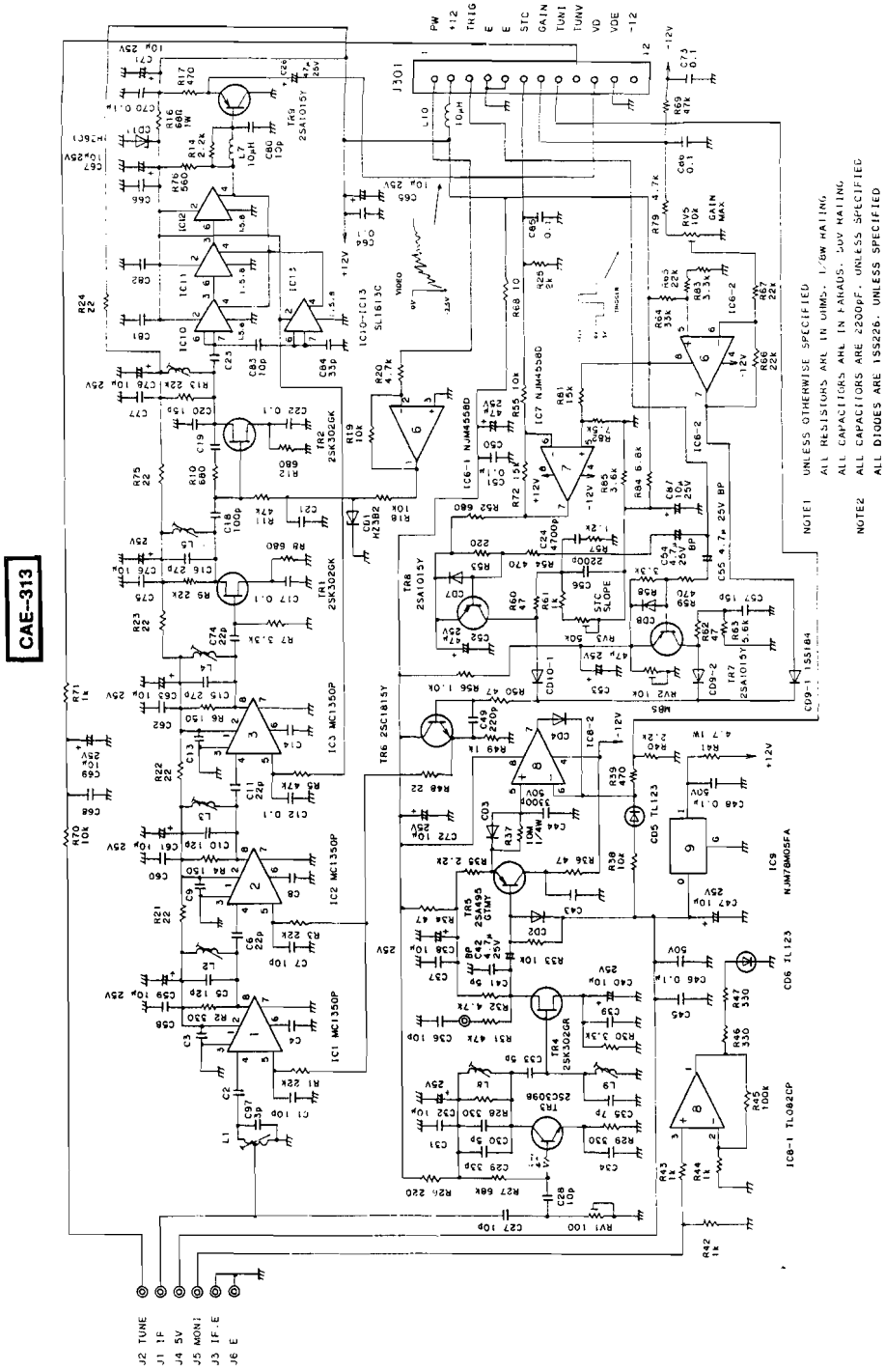


Fig. 6-9 SCHEMATIC DIAGRAM, RECEIVER PCB (CAE-313)

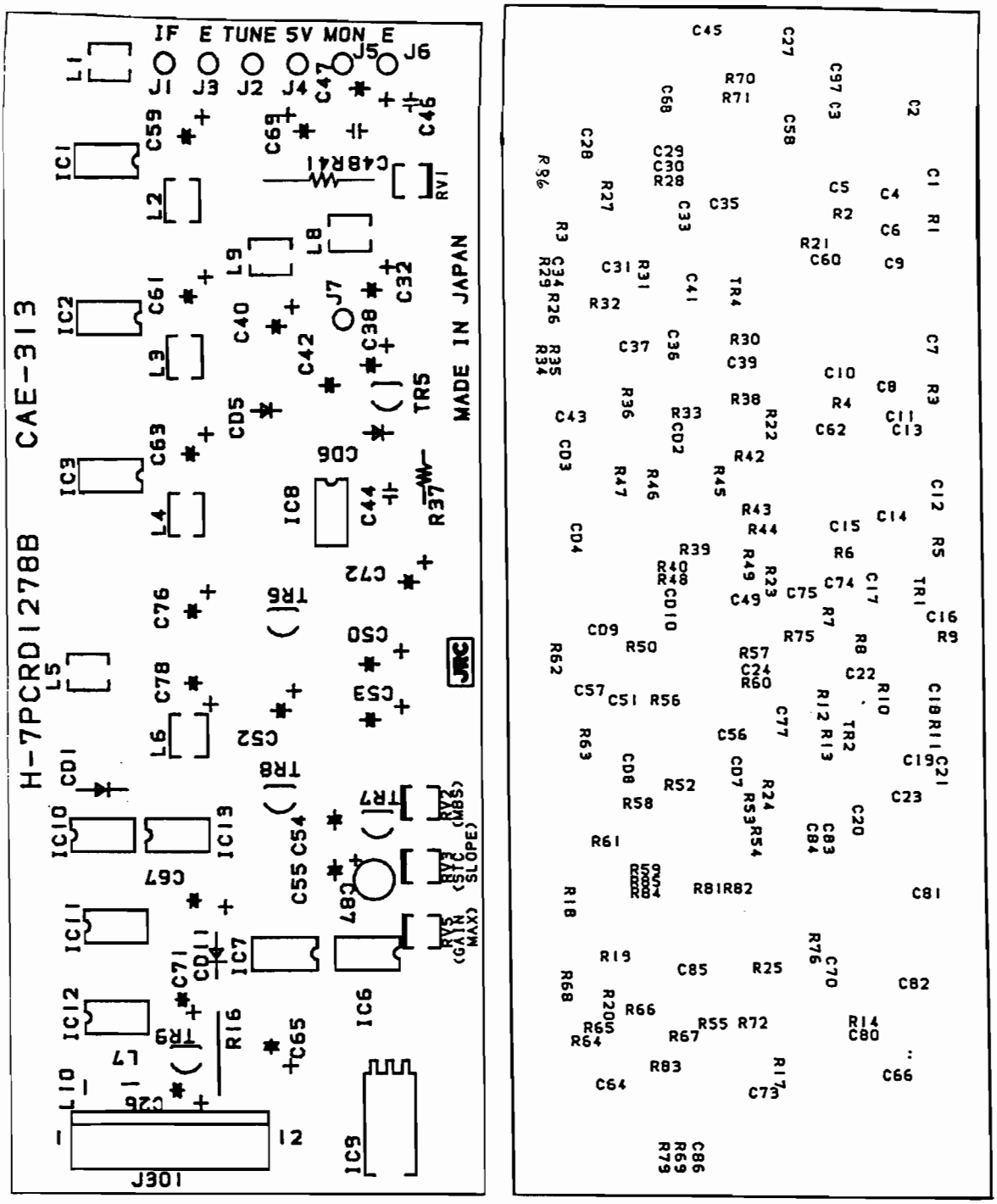


Fig. 6-10 COMPONENT LOCATION DRAWING, RECEIVER PCB (CAE-313)

TABLE 6-7
Replaceable Parts List
Radome/Open Array Receiver PCB
CAE-313

Ref.	Type	Description	Part Number
C1	C3216CH1H100D-E-TP	Cap, 10pF, 50V	5CAAD00785
C2	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C3	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C4	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C5	C3216CH1H120J-E-TP	Cap, 12pF	5CAAD00784
C6	C3216CH1H220J-E-TP	Cap, 22pF, 50V	5CAAD00869
C7	C3216CH1H100J-E-TP	Cap, 10pF, 50V	5CAAD00785
C8	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C9	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C10	C3216CH1H120J-E-TP	Cap, 12pF	5CAAD00784
C11	C3216CH1H220J-E-TP	Cap, 22pF, 50V	5CAAD00869
C12	C3216CH1H100D-E-TP	Cap, 10pF, 50V	5CAAD00785
C13	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C14	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C15	C3216CH1H270J-E-TP	Cap, 27pF, 50V	5CAAD00793
C16	C3216CH1H270J-E-TP	Cap, 27pF, 50V	5CAAD00793
C17	C3216JF1H104Z-E-TP	Cap, 0.1μF, 50V	5CAAD01268
C18	C3216CH1H101J-E-TP	Cap, 100pF, 50V	5CAAD00780
C19	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C20	C3216CH1H150J-E-TP	Cap, 15pF	5CAAD00787
C21	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C22	C3216JF1H104Z-E-TP	Cap, 0.1μF, 50V	5CAAD01268
C23	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C24	ECQ-B1H472KZ	Cap, 0.0047μF, 50V	5CRAA00427
C26	ECE-A1CKS470B	Cap, 47μF	5CEAA01707
C27	C3216CH1H100D-E-TP	Cap, 10pF, 50V	5CAAD00785
C28	C3216CH1H100D-E-TP	Cap, 10pF, 50V	5CAAD00785
C29	C3216CH1H330J-E-TP	Cap, 33pF, 50V	5CAAD00794
C30	C3216CH1H050C-E-TP	Cap, 5pF, 50V	5CAAD00800
C31	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C32	ECE-A1EKS100B	Cap, 10μF, 25V	5CEAA01750
C33	C3216CH1H050C-E-TP	Cap, 5pF, 50V	5CAAD00800
C34	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C35	C3216CH1H070D-E-TP	Cap, 7pF, 50V	5CAAD00977
C36	C3216CH1H100D-E-TP	Cap, 10pF, 50V	5CAAD00785

Ref.	Type	Description	Part Number
C37	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C38	ECE-A1EKS100B	Cap, 10μF, 25V	5CEAA01750
C39	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C40	ECE-A1EKS100B	Cap, 10μF, 25V	5CEAA01750
C41	C3216CH1H050C-E-TP	Cap, 5pF, 50V	5CAAD00800
C42	ECE-A1EKN4R7B	Cap, 4.7μF, 25V	5CEAA01959
C43	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C44	ECQ-B1H332JZ3	Cap, 3300pF, 50V	5CRAA00586
C45	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C46	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C47	ECE-A1EKS100B	Cap, 10μF, 25V	5CEAA01750
C48	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C49	C3216CH1H221J-E-TP	Cap, 220pF, 50V	5CAAD00790
C50	ECE-A1CKS470B	Cap, 47μF	5CEAA01707
C51	C3216JF1H104Z-E-TP	Cap, 0.1μF, 50V	5CAAD01268
C52	ECE-A1CKS470B	Cap, 47μF	5CEAA01707
C53	ECE-A1CKS470B	Cap, 47μF	5CEAA01707
C54	ECE-A1EKN4R7B	Cap, 4.7μF, 25V	5CEAA01959
C55	ECE-A1EKN4R7B	Cap, 4.7μF, 25V	5CEAA01959
C56	C3216SL1H222J-E-TP	Cap, 0.01μF, 50V	5CAAD00792
C57	C3216CH1H150J-E-TP	Cap, 15pF	5CAAD00787
C58	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C59	ECE-A1EKS100B	Cap, 10μF, 25V	5CEAA01750
C60	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C61	ECE-A1EKS100B	Cap, 10μF, 25V	5CEAA01750
C62	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C63	ECE-A1EKS100B	Cap, 10μF, 25V	5CEAA01750
C64	C3216JF1H104Z-E-TP	Cap, 0.1μF, 50V	5CAAD01268
C65	ECE-A1EKS100B	Cap, 10μF, 25V	5CEAA01750
C66	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C67	ECE-A1EKS100B	Cap, 10μF, 25V	5CEAA01750
C68	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C69	ECE-A1EKS100B	Cap, 10μF, 25V	5CEAA01750
C70	C3216JF1H104Z-E-TP	Cap, 0.1μF, 50V	5CAAD01268
C71	ECE-A1EKS100B	Cap, 10μF, 25V	5CEAA01750
C72	ECE-A1EKS100B	Cap, 10μF, 25V	5CEAA01750
C73	C3216JF1H104Z-E-TP	Cap, 0.1μF, 50V	5CAAD01268
C74	C3216CH1H220J-E-TP	Cap, 22pF, 50V	5CAAD00869
C75	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C76	ECE-A1EKS100B	Cap, 10μF, 25V	5CEAA01750

Ref.	Type	Description	Part Number
C77	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C78	ECE-A1EKS100B	Cap, 10μF, 25V	5CEAA01750
C80	C3216CH1H100D-E-TP	Cap, 10pF, 50V	5CAAD00785
C81	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C82	C3216SL1H222J-E-TP	Cap, 2200pF	5CAAD00792
C83	C3216CH1H100D-E-TP	Cap, 10pF, 50V	5CAAD00785
C84	C3216CH1H100D-E-TP	Cap, 10pF, 50V	5CAAD00785
C85	ECQ-V1H104JZ	Cap, 0.1μF, 50V	5CRAA00364
C86	ECQ-V1H104JZ	Cap, 0.1μF, 50V	5CRAA00364
C87	ECE-A1EKS100B	Cap, 10μF, 25V	5CEAA01750
C97	C3216CH1H030D-E-TP	Cap, 3PF	5CAAD01287
CD1	HZ3B2	Zener, 3V, ½W	5TXAE00107
CD2	1SS226 TE85L	Diode	5TXAD00320
CD3	1SS226 TE85L	Diode	5TXAD00320
CD4	1SS226 TE85L	Diode	5TXAD00320
CD5	TLR123	Diode	5TZAD00101
CD6	TLR123	Diode	5TZAD00101
CD7	1SS226 TE85L	Diode	5TXAD00320
CD8	1SS226 TE85L	Diode	5TXAD00320
CD9	1SS184 TE85R	Diode	5TXAD00291
CD10	1SS226 TE85L	Diode	5TXAD00320
CD11	HZ6C1	Zener, 6V, ½W	5TXAE00166
IC1	MC1350P	Integrated Circuit	5DDAS00011
IC2	MC1350P	Integrated Circuit	5DDAS00011
IC3	MC1350P	Integrated Circuit	5DDAS00011
IC6	NJM4558D	Integrated Circuit	5DAAF00027
IC7	NJM4558D	Integrated Circuit	5DAAF00027
IC8	TL082CP	Integrated Circuit	5DDAL00326
IC9	NJM78M05FA	Integrated Circuit	5DAAN00375
IC10	SL1613C	Integrated Circuit	5DDAH00021
IC11	SL1613C	Integrated Circuit	5DDAH00021
IC12	SL1613C	Integrated Circuit	5DDAH00021
IC13	SL1613C	Integrated Circuit	5DDAH00021
J1	171255-1	Pin Jack	BRTE00046
J2	171255-1	Pin Jack	BRTE00046
J3	171255-1	Pin Jack	BRTE00046
J4	171255-1	Pin Jack	BRTE00046
J5	171255-1	Pin Jack	BRTE00046
J6	171255-1	Pin Jack	BRTE00046
J7	171255-1	Pin Jack	BRTE00046

Ref.	Type	Description	Part Number
J301	IL-G-12P-S3T2-E	Conn, 12 pin	5JWAD00082
L1	H-7LARD0103A	Inductor	7LARD0103A
L2	H-7LARD0101A	Inductor	7LARD0101A
L3	H-7LARD0101A	Inductor	7LARD0101A
L4	H-7LARD0102A	Inductor	7LARD0102A
L5	H-7LARD0102A	Inductor	7LARD0102A
L6	H-7LARD0102A	Inductor	7LARD0102A
L7	LHL06TB100K	Inductor	5LAAK00005
L8	H-7LARD0083	Inductor	7LARD0083
L9	H-7LARD0084	Inductor	7LARD0084
L10	LHL06TB100K	Inductor	5LAAK00005
R1	ERJ-8GEYJ223V	Res, 22KΩ, 1/8W	5REAG01754
R2	ERJ-8GEYJ331Y	Res, 330Ω, 1/8W	5REAG01732
R3	ERJ-8GEYJ223V	Res, 22KΩ, 1/8W	5REAG01754
R4	ERJ-8GEYJ151V	Res, 150Ω, 1/8W	5REAG01728
R5	ERJ-8GEYJ473V	Res, 47KΩ, 1/8W	5REAG01758
R6	ERJ-8GEYJ151V	Res, 150Ω, 1/8W	5REAG01728
R7	ERJ-8GEYJ332V	Res, 3.3KΩ, 1/8W	5REAG01744
R8	ERJ-8GEYJ681V	Res, 680Ω, 1/8W	5REAG01736
R9	ERJ-8GEYJ223V	Res, 22kΩ, 1/8W	5REAG01754
R10	ERJ-8GEYJ681V	Res, 680Ω, 1/8W	5REAG01736
R11	ERJ-8GEYJ473V	Res, 47KΩ, 1/8W	5REAG01758
R12	ERJ-8GEYJ681V	Res, 680Ω, 1/8W	5REAG01736
R13	ERJ-8GEYJ223V	Res, 22KΩ, 1/8W	5REAG01754
R14	ERJ-8GEYJ222V	Res, 2.2KΩ, 1/8W	5REAG01742
R16	ERG-1ANJ680	Res, 68Ω, 1/8W	5REAG00032
R17	ERJ-8GEYJ471V	Res, 470Ω, 1/8W	5REAG01734
R18	ERJ-8GEYJ103V	Res, 10KΩ, 1/8W	5REAG01750
R19	ERJ-8GEYJ103V	Res, 10KΩ, 1/8W	5REAG01750
R20	ERJ-8GEYJ472V	Res, 4.7KΩ, 1/8W	5REAG01746
R21	ERJ-8GEYJ220V	Res, 22Ω, 1/8W	5REAG01718
R22	ERJ-8GEYJ220V	Res, 22Ω, 1/8W	5REAG01718
R23	ERJ-8GEYJ220V	Res, 22Ω, 1/8W	5REAG01718
R24	ERJ-8GEYJ220V	Res, 22Ω, 1/8W	5REAG01718
R25	ERD-25PJ202	Res, 2KΩ, ¼W	5RDAA01247
R26	ERJ-8GEYJ221V	Res, 220Ω, 1/8W	5REAG01730
R27	ERJ-8GEYJ683V	Res, 68KΩ, 1/8W	5REAG01760
R28	ERJ-8GEYJ331V	Res, 330Ω, 1/8W	5REAG01732
R29	ERJ-8GEYJ331V	Res, 330Ω, 1/8W	5REAG01732

Ref.	Type	Description	Part Number
R30	ERJ-8GEYJ332V	Res, 3.3KΩ, 1/8W	5REAG01744
R31	ERJ-8GEYJ473V	Res, 47KΩ, 1/8W	5REAG01758
R32	ERJ-8GEYJ472V	Res, 4.7KΩ, 1/8W	5REAG01746
R33	ERJ-8GEYJ103V	Res, 10KΩ, 1/8W	5REAG01750
R34	ERJ-8GEYJ470V	Res, 47Ω, 1/8W	5REAG01722
R35	ERJ-8GEYJ222V	Res, 2.2KΩ, 1/8W	5REAG01742
R36	ERJ-8GEYJ470V	Res, 47Ω, 1/8W	5REAG01722
R37	HMGL¼A-10M Ω J	Res, 10MΩ, ¼W	5REAA05607
R38	ERJ-8GEYJ103V	Res, 10KΩ, 1/8W	5REAG01750
R39	ERJ-8GEYJ471V	Res, 470Ω, 1/8W	5REAG01734
R40	ERJ-8GEYJ222V	Res, 2.2KΩ, 1/8W	5REAG01742
R41	ERG-1SJ470	Res, 4.7KΩ, 1W	5REAG01286
R42	ERJ-8GEYJ102V	Res, 1KΩ, 1/8W	5REAG01736
R43	ERJ-8GEYJ102V	Res, 1kΩ, 1/8W	5REAG01738
R44	ERJ-8GEYJ102V	Res, 1KΩ, 1/8W	5REAG01738
R45	ERJ-8GEYJ104V	Res, 100KΩ, 1/8W	5REAG01762
R46	ERJ-8GEYJ331V	Res, 330Ω, 1/8W	5REAG01732
R47	ERJ-8GEYJ331V	Res, 330Ω, 1/8W	5REAG01732
R48	ERJ-8GEYJ220V	Res, 22Ω, 1/8W	5REAG01718
R49	ERJ-8GEYJ102Y	Res, 1KΩ, 1/8W	5REAG01738
R50	ERJ-8GEYJ470V	Res, 47Ω, 1/8W	5REAG01722
R52	ERJ-8GEYJ681V	Res, 680Ω, 1/8W	5REAG01736
R53	ERJ-8GEYJ221V	Res, 220Ω, 1/8W	5REAG01730
R54	ERJ-8GEYJ471V	Res, 470Ω, 1/8W	5REAG01734
R55	ERJ-8GEYJ103V	Res, 10KΩ, 1/8W	5REAG01750
R56	ERJ-8GEYJ102V	Res, 1KΩ, 1/8W	5REAG01738
R57	ERD-25PJ122	Res, 1.2KΩ, ¼W	5RDAA01142
R58	ERJ-8GEYJ332V	Res, 3.3KΩ, 1/8W	5REAG01744
R59	ERJ-8GEYJ471Y	Res, 470Ω, 1/8W	5REAG01734
R60	ERJ-8GEYJ470V	Res, 47Ω, 1/8W	5REAG01722
R61	ERJ-8GEYJ102V	Res, 1KΩ, 1/8W	5REAG01738
R62	ERJ-8GEYJ470V	Res, 47Ω, 1/8W	5REAG01722
R63	ERJ-8GEYJ562V	Res, 5.6KΩ, 1/8W	5REAG01747
R64	ERJ-8GEYJ333V	Res, 33KΩ, 1/8W	5REAG01756
R65	ERJ-8GEYJ223V	Res, 22KΩ, 1/8W	5REAG01754
R66	ERJ-8GEYJ223V	Res, 22KΩ, 1/8W	5REAG01754
R67	ERJ-8GEYJ223V	Res, 22KΩ, 1/8W	5REAG01754
R68	ERJ-8GEYJ100V	Res, 10Ω, 1/8W	5REAG01714
R69	ERJ-8GEYJ473V	Res, 47KΩ, 1/8W	5REAG01758
R70	ERJ-8GEYJ103V	Res, 10KΩ, 1/8W	5REAG01750

Ref.	Type	Description	Part Number
R71	ERJ-8GEYJ102V	Res, 1KΩ, 1/8W	5REAG01738
R72	ERJ-8GEYJ153V	Res, 15KΩ, 1/8W	5REAG01752
R75	ERJ-8GEYJ220V	Res, 22KΩ, 1/8W	5REAG01718
R76	ERJ-8GEYJ561V	Res, 560Ω, 1/8W	5REAG01735
R79	ERJ-8GEYJ472V	Res, 4.7KΩ, 1/8W	5REAG01746
R81	ERD-25PJ153	Res, 15KΩ, ¼W	5RDAA01174
R82	ERD-25PJ752	Res, 7.5KΩ, ¼W	5RDAA01166
R83	ERJ-8GEYJ332V	Res, 3.3KΩ, 1/8W	5REAG01744
R84	ERD-25PJ682	Res, 6.8KΩ, ¼W	5RDAA01189
R85	ERD-25PJ362	Res, 3.6KΩ, ¼W	5RDAA01249
RV1	GF06UT-2-100 Ω	Res, Var, 100Ω, ½W	5RMAB00149
RV2	GF06UT-2-10K Ω	Res, Var, 10KΩ, ½W	5RMAB00128
RV3	GF06UT-2-50K Ω	Res, Var, 50KΩ, ½W	5RMAB00118
RV4	GF06UT-2-10K Ω	Res, Var, 10KΩ, ½W	5RMAB00128
RV5	GF06UT-2-10K Ω	Res, Var, 10KΩ, ½W	5RMAB00128
RV6	GF06UT-2-10K Ω	Res, Var, 10KΩ, ½W	5RMAB00128
TR1	2SK302-GRTE85L	Transistor	5TKAA00225
TR2	2SK302-GRTE85L	Transistor	5TKAA00225
TR3	2SK3098-TE85R	Transistor	5TKAA00226
TR4	2SK302-GRTE85L	Transistor	5TKAA00225
TR5	2SA495(G)TM-Y-TP2	Transistor	5TAAG00257
TR6	2SC1815Y-TPE2	Transistor	5TCAF00781
TR7	2SA1015Y-TPE2	Transistor	5TAAG00294
TR8	2SA1015Y-TPE2	Transistor	5TAAG00294
TR9	2SA1015Y-TPE2	Transistor	5TAAG00294

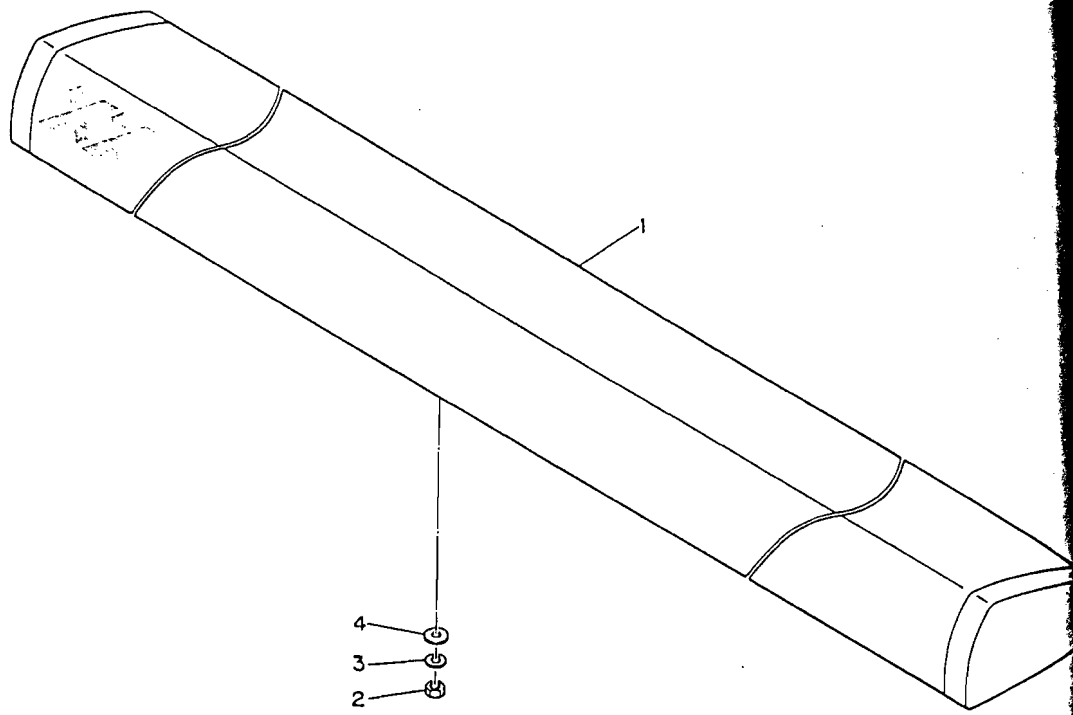


Fig. 6-11 ASSEMBLY DRAWING, R21XX OPEN ARRAY RADIATOR UNIT (M92543)

TABLE 6-8
Parts Location List
R21XX Open Array Antenna Unit
M92543

Location	Description	Part Number
1	Radiator	MDNAX5004
2	Nut, M10-1.5	BRTG00142
3	Washer, Spring, M10	BRTG00404
4	Washer, Flat, M10	BRTG00402

TABLE 6-9
Parts List
R21XX Antenna Array Installation Kit

Qty.	Description	Part Number
1	Sealant Material	230-7223P1
4	Nut M10-1.5	BRTG00142
4	Washer, Lock M10	BRTG00404
4	Washer, Flat M10	BRTG00402

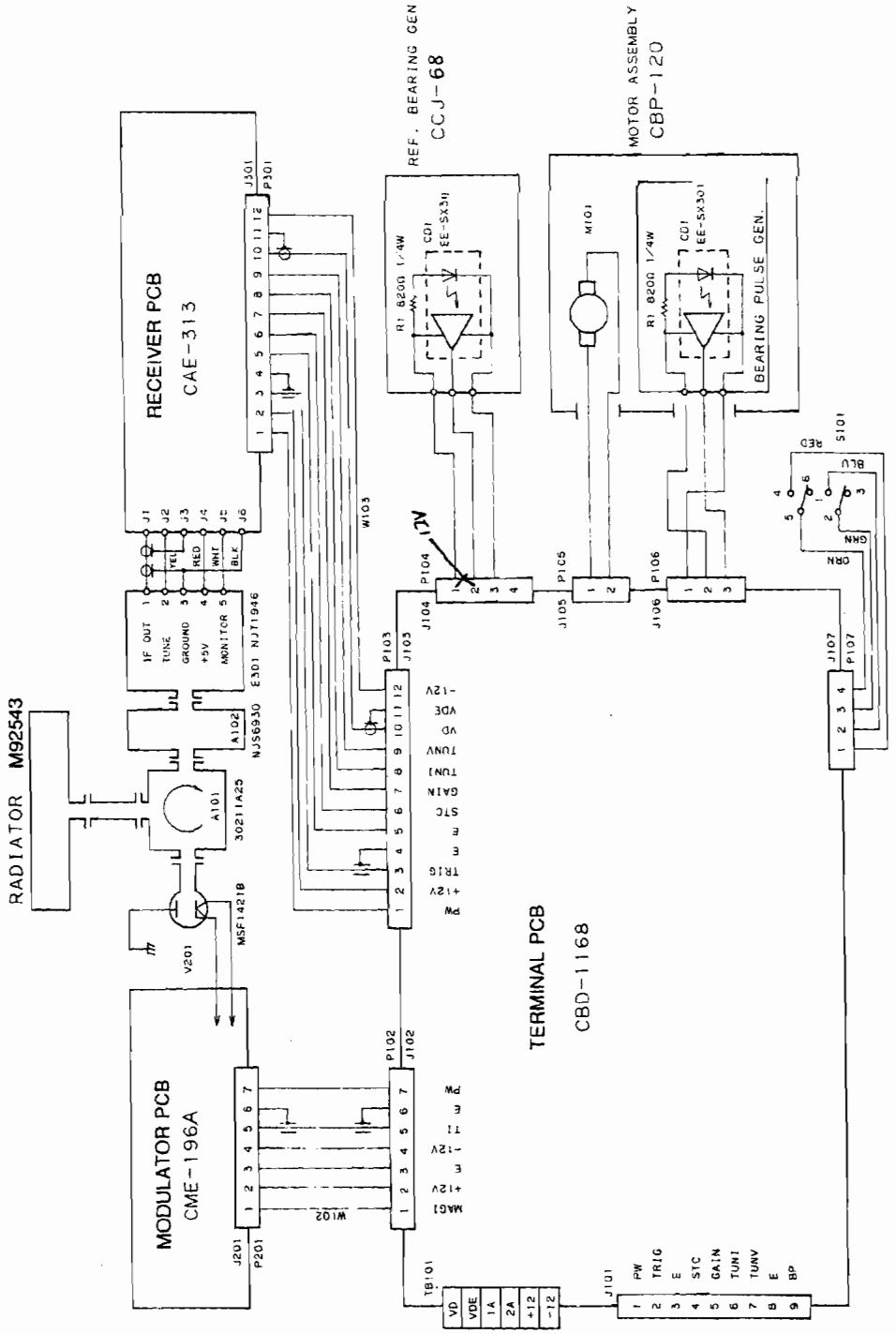


Fig. 6-12 INTERNAL CONNECTION DIAGRAM, R21XX OPEN ARRAY SCANNER UNIT

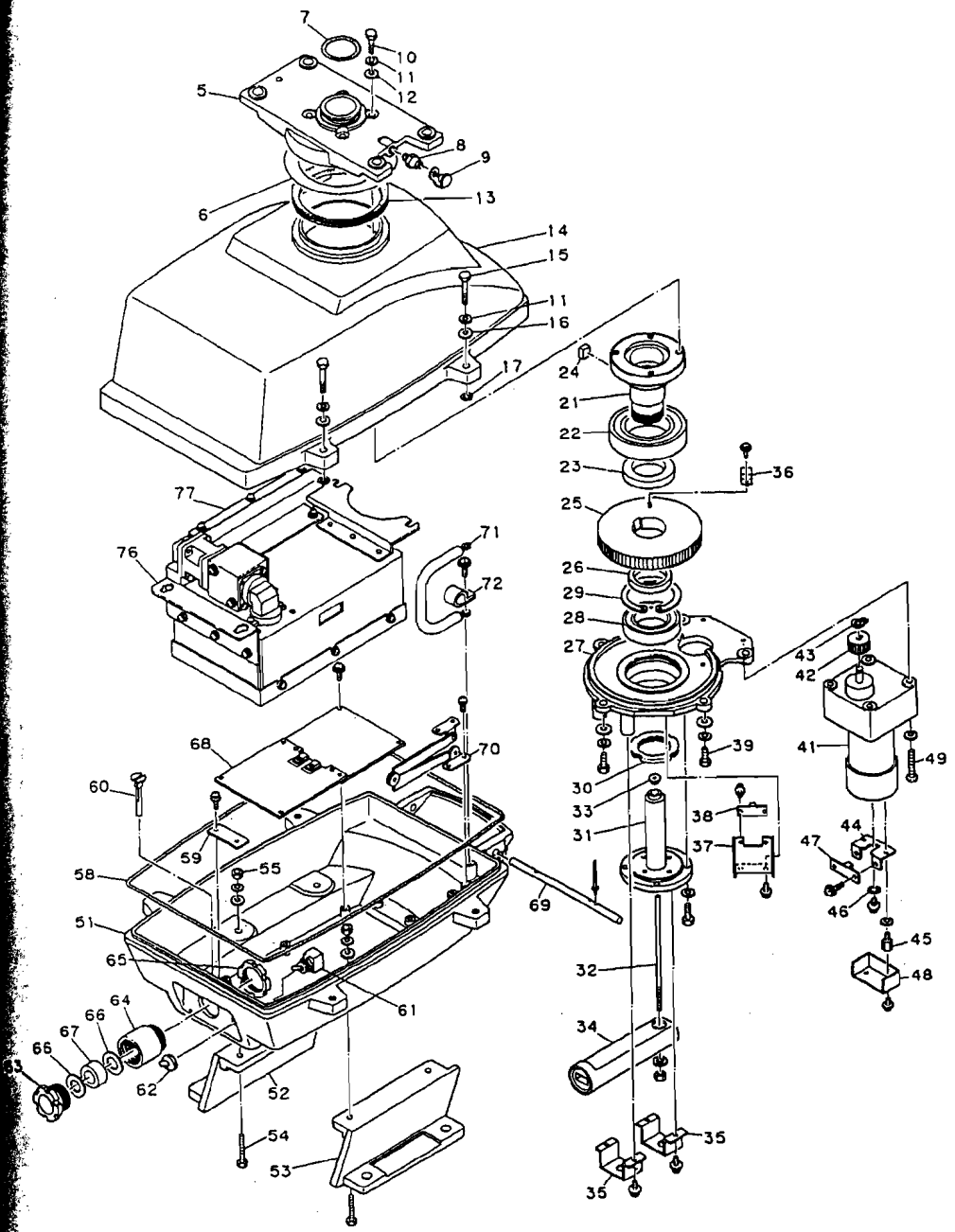


Fig. 6-13 ASSEMBLY DRAWING, R21XX OPEN ARRAY SCANNER UNIT (M92542)

TABLE 6-10
Parts Location List
R21XX Open Array Scanner Unit
M92542

Location	Description		Part Number
	Antenna Support Assembly		MPGK03292
5	Antenna Support		MTC003301A
6	Plate		MTD002498
7	O-Ring		BRPK00054
8	Grease Nipple		BRXL00153
9	Cap		BRPK00265
	Bolt Assembly		MPTG02229
10	Bolt		BRTG000389
11	Washer, Spring	(M8 SUS304)	BRTG00747
12	Seal-Washer		BRPK00322
13	V-Ring		BRPK00189
14	Housing		MTC003302
15	Bolt		MTL006545A
16	Washer, Plain		BRTG00224
17	O-Ring		BRPK00083
	Main Shaft Assembly		MPGK03291
21	Main Shaft		MTC002796A
22	Ball Bearing		BRGK00119
23	Spacer		MTL037731
24	Key		MTK005301
25	Gear		MTG003623A
26	Spacer		MTL037732
27	Bracket		MTC002798A
28	Ball Bearing		BRGK00166
29	Ring, Retaining		BRTG03865
30	Lock Nut		BSAN08000S
31	Wave Guide		MTM003254A
32	Coaxial Rod		MTL017354
33	Insulator		MTV001459
34	Connecting Wave Guide		MPAB01848
35	Plate, Retaining		MTB154257
36	Shutter		MTB163559
37	Plate, Mounting		MTB163560
38	SHM PCB		CCJ-68

ion	Description		Part Number
tor	**Assembly**		CBP-120
	Motor		7BDRD0031 – ?
	Gear		MTG003634
	Ring, Retaining		BRTG03864
aring	**Pulse Generator**		MPLW04069
	Plate, Mounting		MTB167205
	Spacer		MTL029971
	Slitted Plate		MTB124251
	Bearing Pulse Gen PCB		CCJ-68
	Cover		MTB167206
ousing	**Assembly**		MPBX19425
1	Housing		MTC003303A
2	Mounting Leg		MTC003621
3	Mounting Leg		MTC003622
4	Bolt (M8x30 SUS304)		BRTG00677A
5	Nut		BSHN08000S
8	Rubber Seal		MTT024066
9	Plate		MTB163583
0	Breathing Tube		MTV003698
1	Toggle Switch	(S-101)	5SAAB00432
2	Switch Cover		MPPK00925
3	Cramp, Gland		BRTG00881
4	Body, Gland		BRTG01271
5	Nut, Gland		BRTG01272
6	Washer, Gland		BRTG00882
7	Gasket, Gland		MTT026595
8	Terminal PCB		CBD-1168
9	Shaft		MTL042405A
70	Stay		MPDM00675A
71	Ground Cable		MPKC05206A
72	Cable Clamp		BRBP00012
73	Plate		MTB186290
74	Rubber Seat		MTT026597
75	Plate		MTB186291
MTR	**Assembly**		NTG-80
76	Modulator		NMA-434
77	Receiver		NRG-82

TABLE 6-11
Replaceable Parts List
R21XX Open Array Scanner Unit Main Chassis Components
CQD-1157

Ref.	Type	Description	Part Number
P104	IL-G-4S-S3C2	Conn, 4 pin	5JWAD00095
P107	VHR-4N	Conn, 4 pin	5JDAH00044
PT104	IL-G-C2-10000	Conn, pins	5JWAD00125
PT107	BVH-21T-1.1	Conn, pins	5JTCD00155
S101	S-116	Switch, Ant. Safety	5SAAB00432
W102	H-7ZCRD0386	Wiring Harness	7ZCRD0386
W103	H-7ZCRD0387	Wiring Harness	7ZCRD0387

TABLE 6-12
Replaceable Parts List
R21XX Motor Assembly
CBP-120

Ref.	Type	Description	Part Number
B101	H-7BDRD0031	Motor	7BDRD0031
CD1	EE-SX301	Diode	5HFAB00009
P106	IL-G-3S-S3C2	Conn, 3 pin	5JWAD00096
PC1	H-6PCRD00633	Pulse, PCB	CCJ-68
PT106	IL-G-C2-10000	Conn, pins	5JWAD00125
R1	ERD-25PJ821	Res, 820Ω, ¼W	5RDAA01156

TABLE 6-13
Replaceable Parts List
R21XX SHM PCB
CCJ-68

Ref.	Type	Description	Part Number
CD1	EE-SX301	Diode	5HFAB00009
R1	ERD-25PJ821	Res, 820Ω, ¼W	5RDAA01156

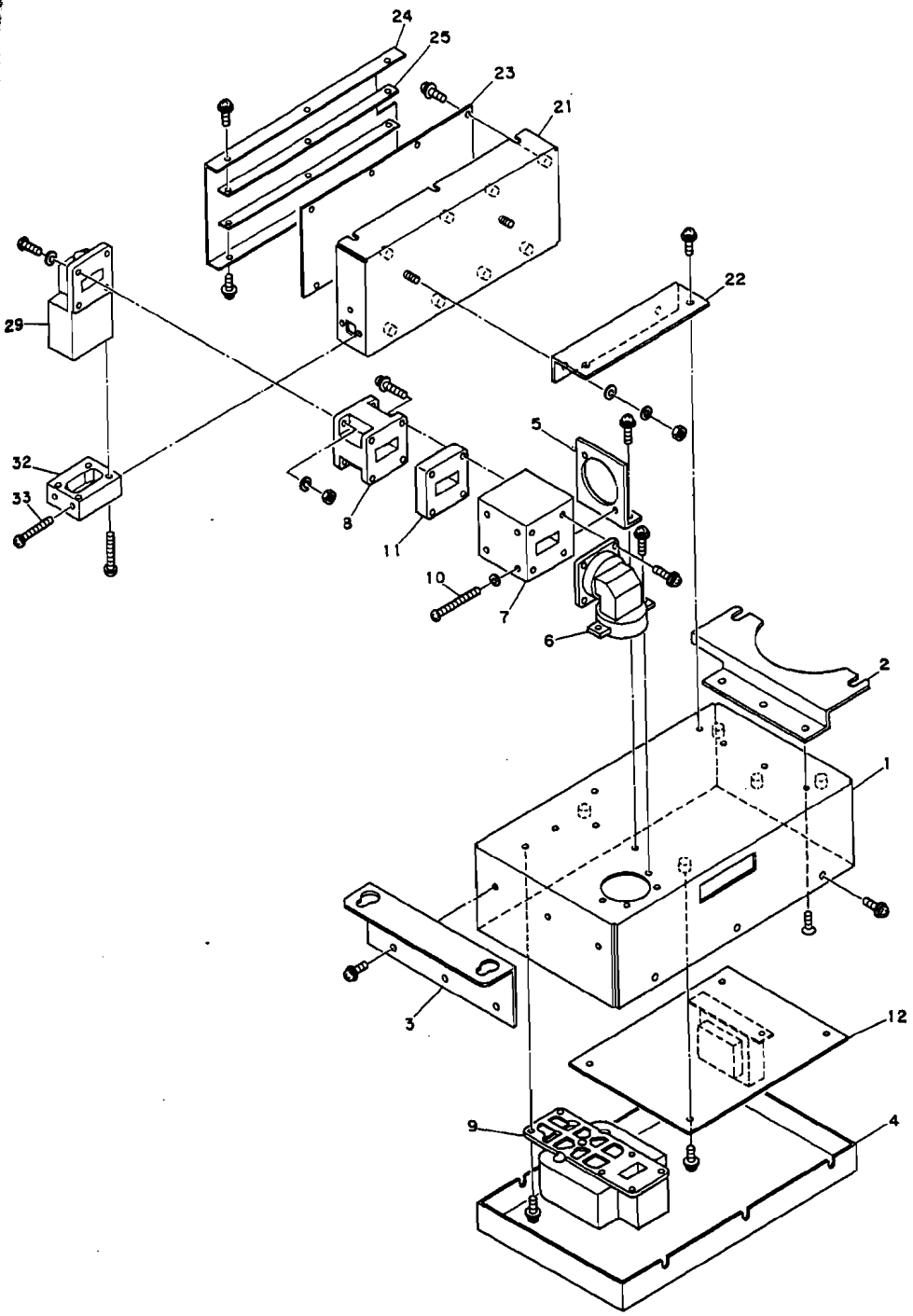


Fig. 6-14 ASSEMBLY DRAWING, R21XX MTR UNIT (NTG-80)

TABLE 6-14
Parts Location List
R21XX MTR Unit
NTG-80

Location	Description	Part Number
Modulator		
1	Chassis	MTB186245C
2	Plate	MTB186321
3	Plate	MTB163557A
4	Cover	MTB186244B
5	Plate	MTB163575B
6	Corner Wave Guide	MTM003256A
7	Circulator (30211A25)	5AJAF00020
8	Diode Limiter (NJS6930)	5EZAA00024
9	Magnetron (MSF1421B)	5VMAA00049
10	Screw, M4 x 55	BRTG02029
11	Connecting Wave Guide	MTM003496
12	Modulator PCB	CME-196A
Receiver		
21	Chassis	MTB186250
22	Plate	MTB186246
23	Receiver, PCB	CAE-313
24	Cover	MTB186248A
25	Plate	MTB186249
29	LNFE Front End Assembly (NJT1946)	5EZAA00021
30	Cover	MTC003358
33	Screw, M3 x 50	BRTG03161

TABLE 6-15
Replaceable Parts List
R21XX Modulator Chassis Assembly
NMA-434

Ref.	Type	Description	Part Number
A101	30211A25	Circulator Assy.	5AJAF00010
A102	NJS6930	Diode Limiter	5EZAA00024
V201	MSF1421B	Magnetron	5VMAA00049
W1	B4-6	Wiring Harness	1166140002
----	----	Modulator, PCB	CME-196A

TABLE 6-16
Replaceable Parts List
R21XX Receiver Chassis Assembly
NRG-82

Ref.	Type	Description	Part Number
E301	NJT1946	LNFE Assembly	5EZAA00021
----	----	Receiver PCB	CAE-313

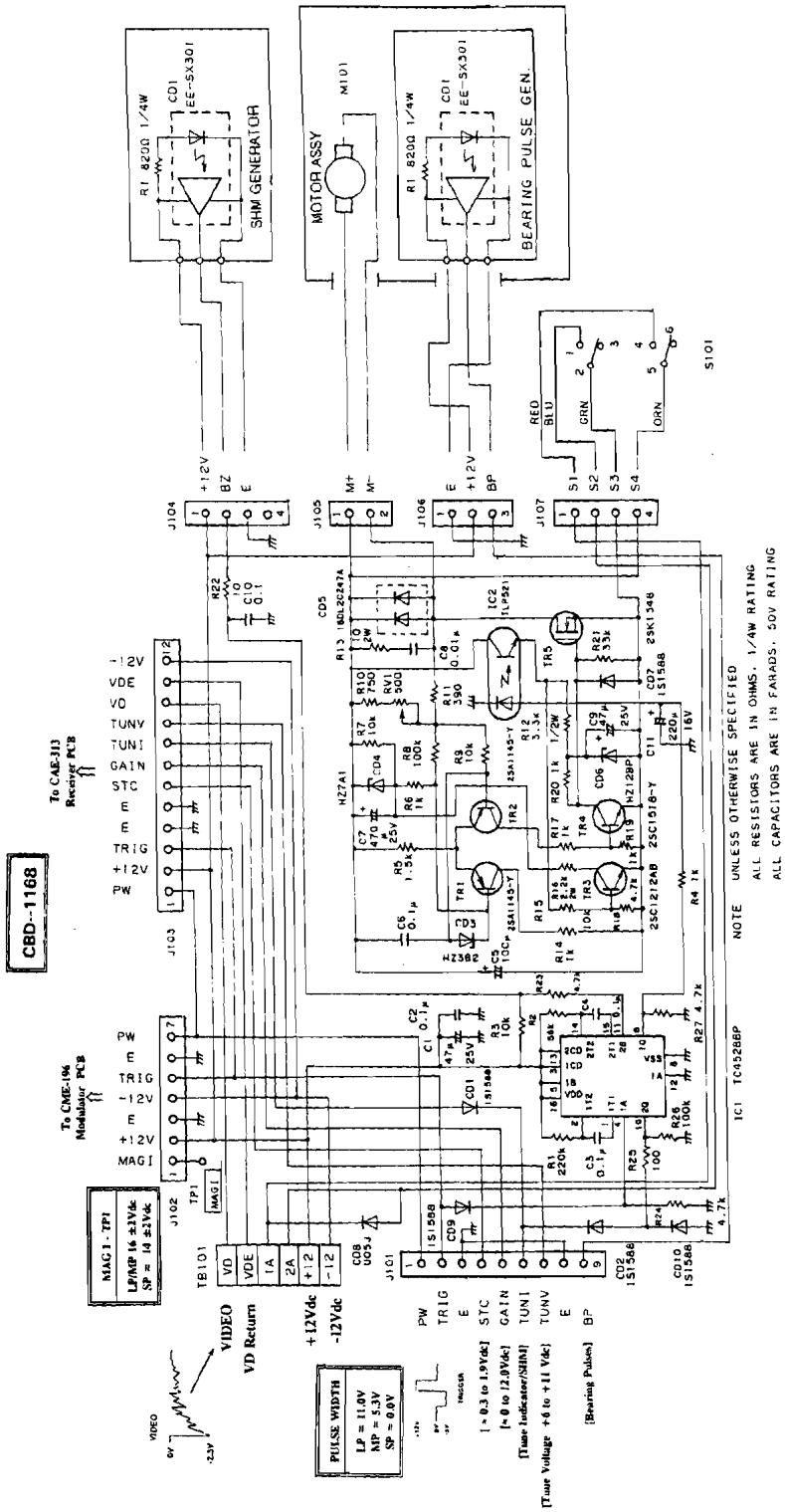


Fig. 6-15 SCHEMATIC DIAGRAM, R21XX TERMINAL PCB (CBD-1168)

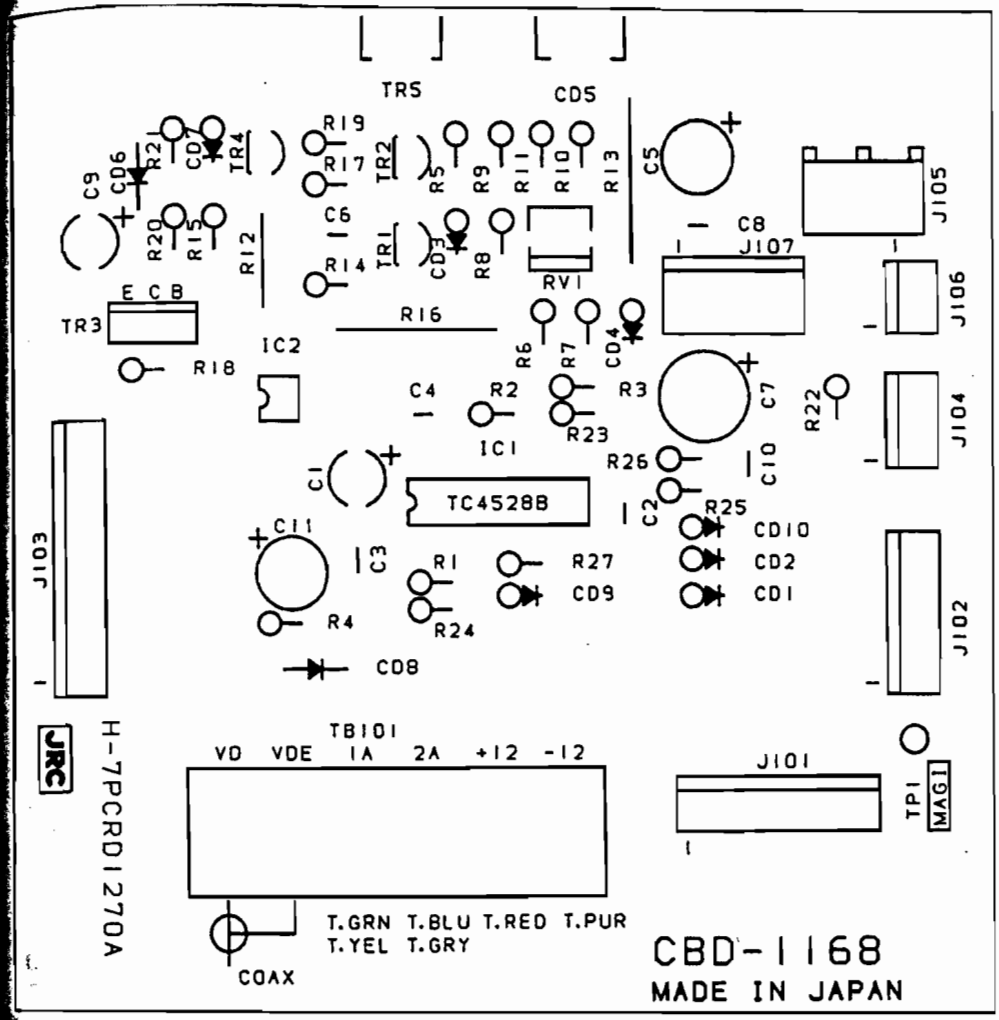


Fig. 6-16 COMPONENT LOCATION DRAWING, R21XX TERMINAL PCB (CBD-1168)

TABLE 6-17
Replaceable Parts List
R21XX Open Array Terminal PCB
CBD-1168

Ref.	Type	Description	Part Number
C1	ECE-A1EU470B	Cap, 47μF, 25V	5CEAA01816
C2	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C3	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C4	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C5	ECEA1HU101B	Cap, 100μF, 50V	5CEAA02306
C6	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C7	ECE-A1EU471B	Cap, 470μF, 25V	5CEAA01865
C8	ECQ-B1H103JZ3	Cap, 0.01μF, 50V	5CRAA00587
C9	ECE-A1EU470B	Cap, 47μF, 25V	5CEAA01816
C10	ECQ-V1H104JZ3	Cap, 0.1μF, 50V	5CRAA00617
C11	ECE-A1CU221B	Cap, 220μF, 16V	5CEAA01834
CD1	1S1588-TPB2	Diode, 300mW	5TXAD00335
CD2	1S1588-TPB2	Diode, 300mW	5TXAD00335
CD3	HZ3B2-RE	Diode	5TXAE00566
CD4	HZ7A1-RE	Diode, 6.5V, ½W	5TXAE00822
CD5	16DL2CZ47A	Diode	5TXAD00769
CD6	HZ12BP	Diode, 12V, 0.8W	5TXAE00473
CD7	1S1588-TPB2	Diode, 300mW	5TXAD00335
CD8	U05JTYPE2	Diode, 800V, 2.5A	5TXAE00817
CD9	1S1588-TPB2	Diode, 300mW	5TXAD00335
CD10	1S1588-TPB2	Diode, 300mW	5TXAD00335
IC1	TC4528BP	Integrated Circuit	5DDAE00070
IC2	TLP521-1-A	Integrated Circuit	5TZAD00197
J101	IL-G-9P-S3T2-E	Connector, 9 Pin	5JWAD00383
J102	IL-G-7P-S3T2E	Connector, 7 Pin	5JWAD00119
J103	IL-G-12P-S3T2-E	Connector, 12 Pin	5JWAD00082
J104	IL-G-4P-S3T2-E	Connector, 4 Pin	5JWAD00091
J105	350428-1	Connector, 2 Pin	5JWAH00136
J106	IL-G-3P-S3T2-E	Connector, 3 Pin	5JWAD00140
J107	B4P-VH	Connector, 4 Pin	5JDAH00043
R1	ERD-25UJ224T	Res, 220KΩ, ¼W	5RDAA01619
R2	ERD-25UJ563T	Res, 56KΩ, ¼W	5RDAA01588
R3	ERD-25UJ103T	Res, 10KΩ, ¼W	5RDAA01547
R4	ERD-25UJ102T	Res, 1KΩ, ¼W	5RDAA01542
R5	ERD-25UJ152T	Res, 1.5KΩ, ¼W	5RDAA01507

Ref.	Type	Description	Part Number
R6	ERD-25UJ102T	Res, 1KΩ, ¼W	5RDAA01542
R7	ERD-25UJ103T	Res, 10KΩ, ¼W	5RDAA01547
R8	ERD-25UJ104T	Res, 100KΩ, ¼W	5RDAA01623
R9	ERD-25UJ103T	Res, 10KΩ, ¼W	5RDAA01547
R10	ERD-25UJ751T	Res, 750KΩ, ¼W	5RDAA01598
R11	ERD-25UJ391T	Res, 390KΩ, ¼W	5RDAA01625
R12	ERD-50TJ332	Res, 10KΩ, ½W	5RDAA00847
R13	ERG-2ANJ100H	Res, 10Ω, 2W	5REAG03991
R14	ERD-25UJ102T	Res, 1KΩ, ¼W	5RDAA01542
R15	ERD-25UJ103T	Res, 10KΩ, ¼W	5RDAA01547
R16	ERG-2ANJ222H		5REAG03992
R17	ERD-25UJ102T	Res, 1KΩ, ¼W	5RDAA01542
R18	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R19	ERD-25UJ102T	Res, 1KΩ, ¼W	5RDAA01542
R20	ERD-25UJ102T	Res, 1KΩ, ¼W	5RDAA01542
R21	ERD-25UJ333T	Res, 33KΩ, ¼W	5RDAA01591
R22	ERD-26UJ100T	Res, 10KΩ, ¼W	5RDAA01576
R23	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R24	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
R25	ERD-25UJ101T	Res, 100KΩ, ¼W	5RDAA01599
R26	ERD-25UJ104T	Res, 100KΩ, ¼W	5RDAA01623
R27	ERD-25UJ472T	Res, 4.7KΩ, ¼W	5RDAA01549
RV1	GF06UT-2-500 Ω	Res, Var, 500Ω, ½W	5RMAB00132
TB101	TS-121P-6P	Terminal Board	5JTAJ00199
TP1	LC-2-G YEL	Test Point	5JTCW00015
TR1	2SA1145YTPE6	Transistor	5TAAG00383
TR2	2SA1145YTPE6	Transistor	5TAAG00383
TR3	2SC1212A-B	Transistor	5TCAA00137
TR4	2SC1815Y-TPE2	Transistor	5TCAF00781
TR5	2SK1348	Transistor	5TKAA00265
ZS1	M-30-D-1		5ZKBG00011
ZS2	M-30-D-1		5ZKBG00011

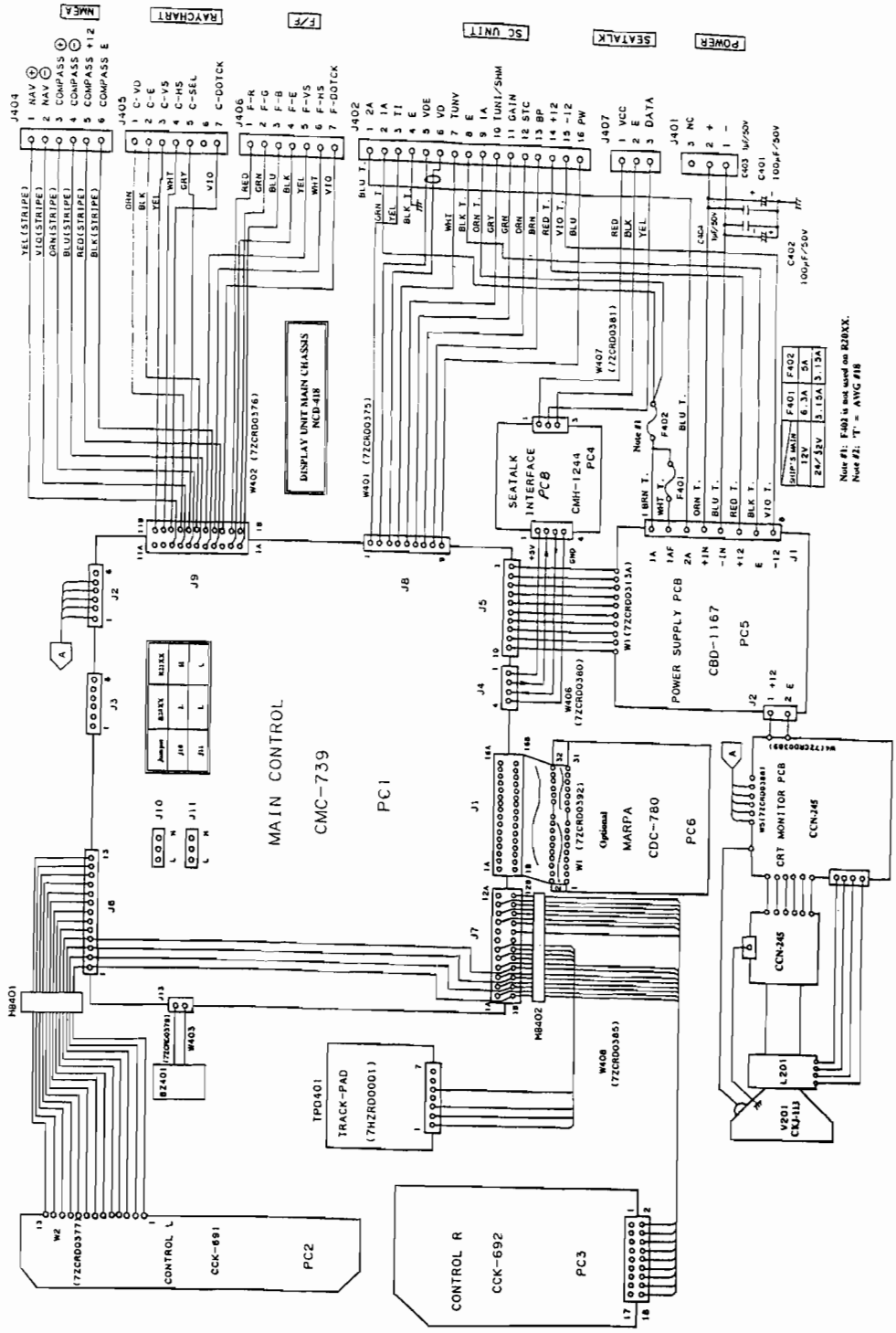


Fig. 6-17 INTERNAL CONNECTION DIAGRAM, R20XX/R21XX DISPLAY UNIT

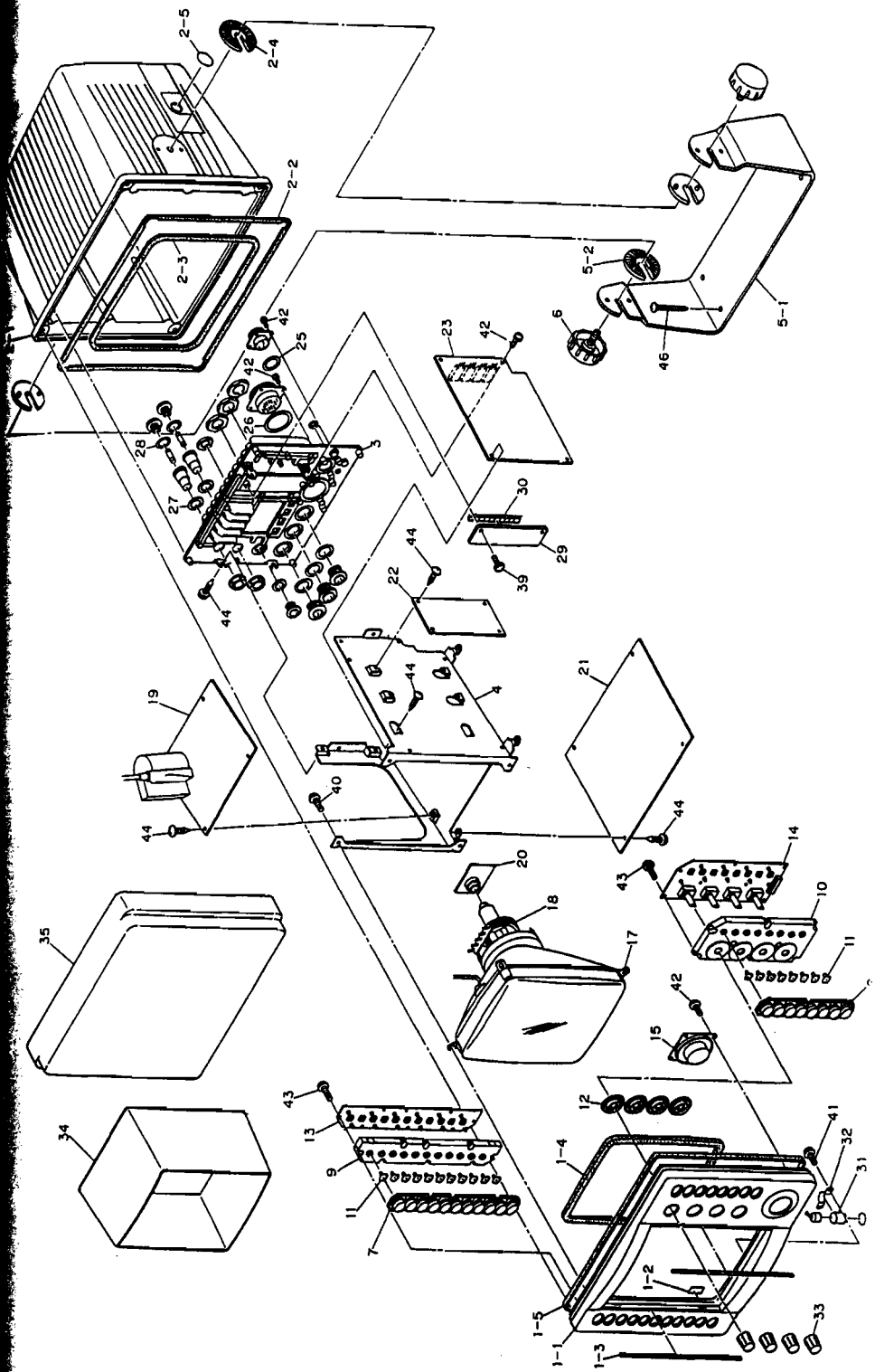


Fig. 6-18 ASSEMBLY DRAWING, R20XX/R21XX DISPLAY UNIT (M92538/M92540)

TABLE 6-18
Parts Location List
Display Unit
M92538 (R20XX)
M92540 (R21XX)

Location	Description	Part Number	Symbol
1	Bezel Assembly (R20XX)	MPBC30645	
	(R21XX)	MPBC30646	
1-1	Front Bezel (R20XX)	MTC300104	
	(R21XX)	MTC300124	
1-2	Rubber Seal	MTT300800	
1-3	Yellow Bar	MTV300365	
1-4	CRT Gasket	MTT300871	
1-5	Packing, Rubber	MTT300836	
1-6	Porous Film	BRPK05033	
2	Cabinet Assembly	MPBX31114	
2-1	Cabinet	MTC300105	
2-2	Front Gasket	MTT300802	
2-3	Rear Gasket	MTT300801	
2-4	Washer, Serration	MTV002834	
2-5	Porous Film	BRPK05034	
3	Heat Sink	MTC300106	
4	Chassis	MPBC30656	
5	Bracket Assembly	MPBX31117	
5-1	Bracket, Yoke	MTB306668	
5-2	Washer, Serration	MTV002834	
6	Knob	MPTG30053	
7	Rubber Key L	MTV300339	
8	Rubber Key R	MTV300340	
9	Light Guide L	MTV300341	
10	Light Guide R	MTV300342	
11	Switch Pin	MTV004652	
12	Grommet	MTV300343	
13	Control PCB, Left	CCK-691	PC2
14	Control PCB, Right	CCK-692	PC3
15	Track Pad	7HZRD0001	TPD401
17	CRT	CKJ-113	V201
18	Deflection Yoke	CKJ-113	L201
19	CRT Monitor PCB	CCN-245	
20	Video PCB	CCN-245	
21	Main Control PCB	CMC-739	PC1
22	Seatalk PCB	CMH-1244	PC4
23	Power Supply PCB	CBD-1167	PC5
25	O-Ring	BRPK05020	
26	O-Ring	BRPK05021	
27	Packing, Rubber	MTT301033	

Location	Description	Part Number	Symbol
28	Packing, Rubber	MTT301170	
29	Plate, Retaining	MTB186295	
30	Spring	MPSR30054	
31	Tube, Buzzer	MTT300835	
32	Plate, Retaining, Buzzer	MTB306569	
33	Knob, Tune, STC, FTC, Gain	MTV300278A	
34	Hood, Sun Shield	MTV300344	
35	Sun Cover	MTV300523	
36	Washer, Rubber	MTT028740A	
37	Washer, Rubber	MTT028741A	
38	Screw, Front	BRTG04497	
39	Screw, Rear	BSNC03010B	
40	Sems Screw	BSNC04012B	
41	Sems Screw	BSNC03006B	
42	Sems Screw	BSNC03008B	
43	Sems Screw	BSNC03012B	
44	Screw, Tapping	BRTG03095	
46	Screw, Tapping	BRTG03217	

CR2032-FT6-1

TABLE 6-19
Replaceable Parts List
R20XX/R21XX Display Unit Main Chassis
CML-418

Ref.	Type	Description	Part Number
BZ401	MEB-12-5	Buzzer	5UBBB00001
C401	ECE-A1HS101	Cap, 100μF, 50V	5CEAA01368
C402	ECE-A1HS101	Cap, 100μF, 50V	5CEAA01368
C403	ECQ-V1H105JZ	Cap, 1μF, 50V	5CRAA00471
C404	ECQ-V1H105JZ	Cap, 1μF, 50V	5CRAA00471
F401	MF51NN-6.3A	Fuse, 6.3A, (12V)	5ZFAD00336
F402	MF51NN-5A	Fuse, 5A, (12V)	5ZFAD00045
F401/402	MF51NN-3.15A	Fuse, 3.15A, (24/32V)	5ZFAD00382
FS401	FH043	Holder, Fuse	5ZFAN00003
FS402	FH043	Holder, Fuse	5ZFAN00003
J401	SRCN2A13-3P	Conn, Pwr. 3 Pin	5JCAC00399
J402	SRCN2A25-16P	Conn, Ant. 16 Pin	5JCA00307
J404	7-282-6PG-300	Conn, NMEA, 6 Pin	5JWHZ00004
J404-1	6295	Cap, Conn.	5ZJWD00001
J405	7-282-7PG-300	Conn, Raychart, 7 Pin	5JWHZ00009
J405-1	6295	Cap, Conn.	5ZJWD00001
J406	7-282-7PG-300	Conn, F/F, 7 Pin	5JWHZ00009
J406-1	6295	Cap, Conn.	5ZJWD00001
J407	17-282-3PG-300	Conn, Seatalk, 3 Pin	5JWHZ00038
J407-1	16295	Cap, Conn.	5JWHZ00050
MB401	8CAT1518-0730	Choke, Ferrite	5MBAA00913
MB402	8CAT2032-0930	Choke, Ferrite	5MBAA00888
TPD401	H-7HZRD0001	Track Pad	7HZRD0001
W401	H-7ZCRD0375	Harness, Ant. Data	7ZCRD0375
W402	H-7ZCRD0376	Harn, NMEA, R/C, FF	7ZCRD0376
W403	H-7ZCRD0379	Harness, Buzzer	7ZCRD0379
W406	H-7ZCRD0380	Harness, Seatalk Data	7ZCRD0380
W407	H-7ZCRD0381	Harness, Seatalk Data	7ZCRD0381
W408	H-7ZCRD0385	Harness, T/P, Controler	7ZCRD0385
PC1		Main Control PCB	CMC-739
PC2		Bezel Control PCB	CCK-691
PC3		Bezel Control PCB	CCK-692
PC4		SeaTalk PCB	CMH-1244
PC5		Power Supply PCB	CBD-1167
PC6		MARPA PCB	CDC-780
PC7		Video/Monitor PCB's	CCN-245
- - -		CRT/Yoke	CKJ-113

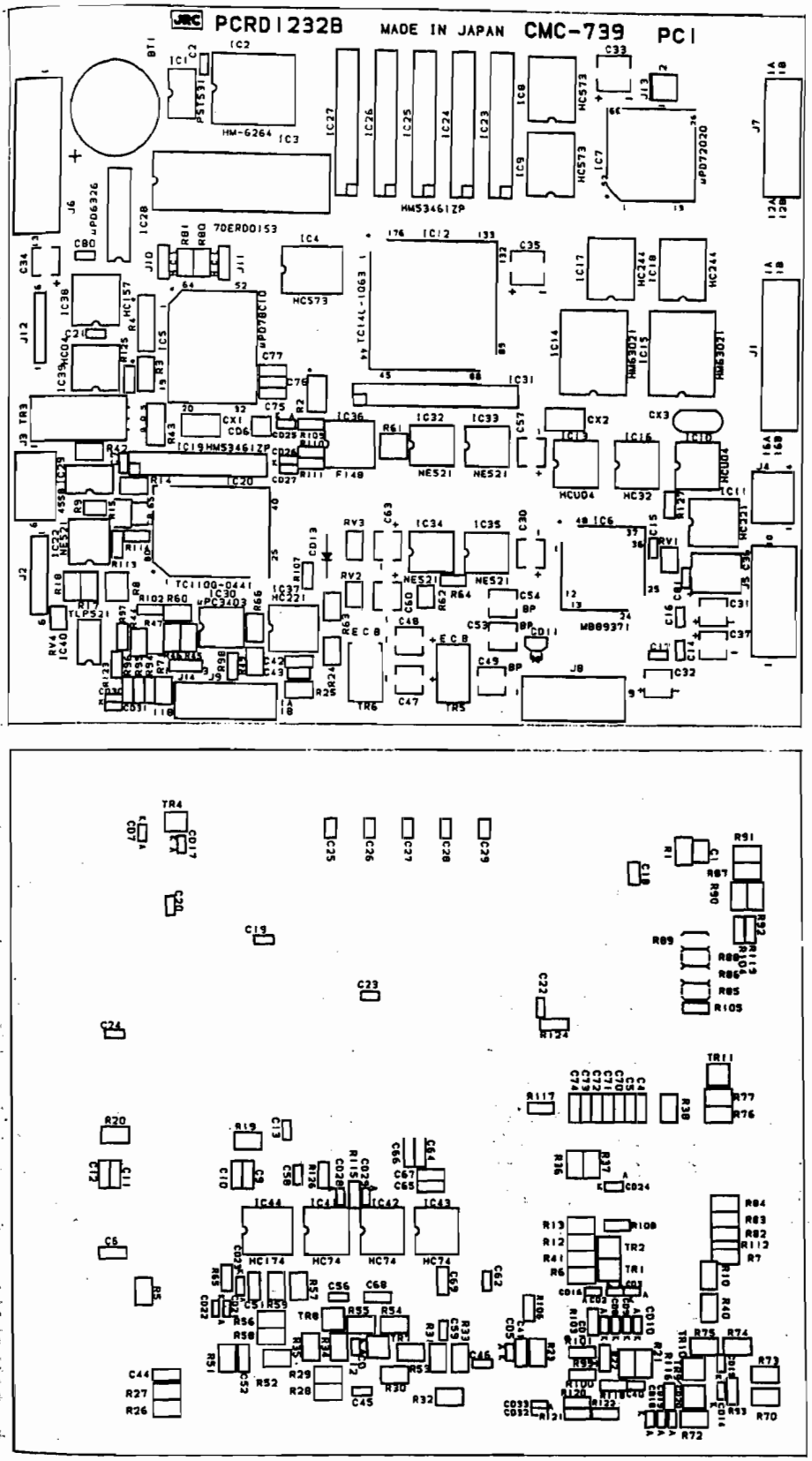


Fig. 6-20 COMPONENT LOCATION DRAWING, MAIN CONTROL PCB (CMC-739)

TABLE 6-20
Replaceable Parts List
Main Control PCB
CMC-739

Ref.	Type	Description	Part Number
BT1	CR2032-FT6-1	Battery, 3.1V	5ZBAD00096
C1	ECHU1C104JB5	Cap, 0.1μF, 16V	5CRAA01238
C2	C2012Y5V1H104ZT	Cap, 0.1μF,	5CAAD02421
C4	C3216SL1H150J	Cap, 15pF	5CAAD00406
C5	C3216SL1H150J	Cap, 15pF	5CAAD00406
C6	ECHU1C472JA5	Cap, 4700pF, 16V	5CBAA00205
C7	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C8	ECHU1C104JB5	Cap, 0.1μF, 16V	5CRAA01238
C9	C3216SL1H050DT	Cap, 5pF	5CAAD02423
C10	C3216SL1H050DT	Cap, 5pF	5CAAD02423
C11	C3216SL1H180JT	Cap, 18pF	5CAAD02422
C12	C3216SL1H180JT	Cap, 18pF	5CAAD02422
C13	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C14	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C15	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C16	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C17	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C18	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C19	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C20	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C21	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C22	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C23	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C24	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C25	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C26	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C27	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C28	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C29	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C30	ECEV1EA330SP	Cap, 33μF, 25V	5CEAA03357
C31	ECEV1EA330SP	Cap, 33μF, 25V	5CEAA03357
C32	ECEV1EA330SP	Cap, 33μF, 25V	5CEAA03357
C33	ECEV1EA330SP	Cap, 33μF, 25V	5CEAA03357
C34	ECEV1EA330SP	Cap, 33μF, 25V	5CEAA03357
C35	ECEV1EA330SP	Cap, 33μF, 25V	5CEAA03357

Ref.	Type	Description	Part Number
C36	ECEV1HA330T	Cap,	5CEAA03382
C37	ECEV1EA330SP	Cap, 33μF, 25V	5CEAA03357
C40	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C41	ECHU1C102JA5	Cap, 1000pF, 16V	5CBAA00213
C42	C2012C0G1H331J-E-TP	Cap, 1000pF	5CAAD00973
C43	C3216PH1H331J	Cap, 330pF	5CAAD02338
C44	C3216SL1H471JT	Cap, 470pF	5CAAD02425
C45	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C46	C2012X7R1H223K	Cap, 0.022μF	5CAAD00291
C47	ECEV1EA330SP	Cap, 33μF, 25V	5CEAA03357
C48	ECEV1EA330SP	Cap, 33μF, 25V	5CEAA03357
C49	ECEV1EAN100P	Cap, 10μF	5CEAA03386
C51	C3216SL1H472J-E-TP	Cap, 4700pF	5CAAD01110
C52	C3216SL1H101J	Cap, 100pF	5CAAD00651
C53	ECEV1EAN4R7P	Cap, 4.7μF, 25V	5CEAA03392
C54	ECEV1EAN4R7P	Cap, 4.7μF, 25V	5CEAA03392
C56	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C57	ECEV1EA330SP	Cap, 33μF, 25V	5CEAA03357
C58	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C59	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C60	ECEV1EA330SP	Cap, 33μF, 25V	5CEAA03357
C62	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C63	ECEV1EA330SP	Cap, 33μF, 25V	5CEAA03357
C64	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C65	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C66	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C67	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C68	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C70	C3216C0G1H471J	Cap, 470pF	5CAAD02334
C71	C3216C0G1H471J	Cap, 470pF	5CAAD02334
C72	C3216C0G1H471J	Cap, 470pF	5CAAD02334
C73	C3216C0G1H471J	Cap, 470pF	5CAAD02334
C74	C3216C0G1H471J	Cap, 470pF	5CAAD02334
C75	C3216C0G1H471J	Cap, 470pF	5CAAD02334
C76	C3216C0G1H471J	Cap, 470pF	5CAAD02334
C77	C3216C0G1H471J	Cap, 470pF	5CAAD02334
C80	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C81	C2012Y5V1H104ZT	Cap, 0.1μF	5CAAD02421
C82	ECQ-B1H223KZ	Cap, 0.022μF	5CRAA00428
C83	DD104CH220J50	Cap, 22μF	5CAAA00850

Ref.	Type	Description	Part Number
C83	DD104CH220J50	Cap, 22pF	5CAAA00850
C84	DD104CH220J50	Cap, 22pF	5CAAA00850
CD1	1SS352-TPHR3	Diode	5TXAD00751
CD2	1SS352-TPHR3	Diode	5TXAD00751
CD3	1SS352-TPHR3	Diode	5TXAD00751
CD5	1SS352-TPHR3	Diode	5TXAD00751
CD6	02CZ9.1Y-TE85L	Diode, Zener, 9.1V	5TXAD00771
CD7	1SS352-TPHR3	Diode	5TXAD00751
CD8	1SS352-TPHR3	Diode	5TXAD00751
CD9	1SS352-TPHR3	Diode	5TXAD00751
CD10	1SS352-TPHR3	Diode	5TXAD00751
CD11	1SV149B	Diode	5TXAD00332
CD12	1SS352-TPHR3	Diode	5TXAD00751
CD13	1K34A	Diode	5TXCH00001
CD14	1SS352-TPHR3	Diode	5TXAD00751
CD15	1SS352-TPHR3	Diode	5TXAD00751
CD16	1SS352-TPHR3	Diode	5TXAD00751
CD17	1SS352-TPHR3	Diode	5TXAD00751
CD18	1SS352-TPHR3	Diode	5TXAD00751
CD19	1SS352-TPHR3	Diode	5TXAD00751
CD20	1SS352-TPHR3	Diode	5TXAD00751
CD21	1SS352-TPHR3	Diode	5TXAD00751
CD22	1SS352-TPHR3	Diode	5TXAD00751
CD23	1SS352-TPHR3	Diode	5TXAD00751
CD24	1SS352-TPHR3	Diode	5TXAD00751
CD25	1SS352-TPHR3	Diode	5TXAD00751
CD26	1SS352-TPHR3	Diode	5TXAD00751
CD27	1SS352-TPHR3	Diode	5TXAD00751
CD28	1SS352-TPHR3	Diode	5TXAD00751
CD29	1SS352-TPHR3	Diode	5TXAD00751
CD30	1SS352-TPHR3	Diode	5TXAD00751
CD31	1SS352-TPHR3	Diode	5TXAD00751
CD32	1SS352-TPHR3	Diode	5TXAD00751
CD33	1SS352-TPHR3	Diode	5TXAD00751
CX1	CSA22.4MX(Z)040	Oscillator, 22.4Mhz	5UNAB00080
CX2	CSACS30.00MX040-TC	Oscillator, 30.0Mhz	5UNAB00106
CX3	TQC-317-6R 22.29MHZ	Oscillator, 22.29Mhz	5XHDX0001
IC1	PST531A	Integrated Circuit	5DZCY00016
IC2	MB8464A-15LPF-EF	Integrated Circuit	5DDAT01196
IC3	H-7DERD0153	Integrated Circuit	7DERD0153

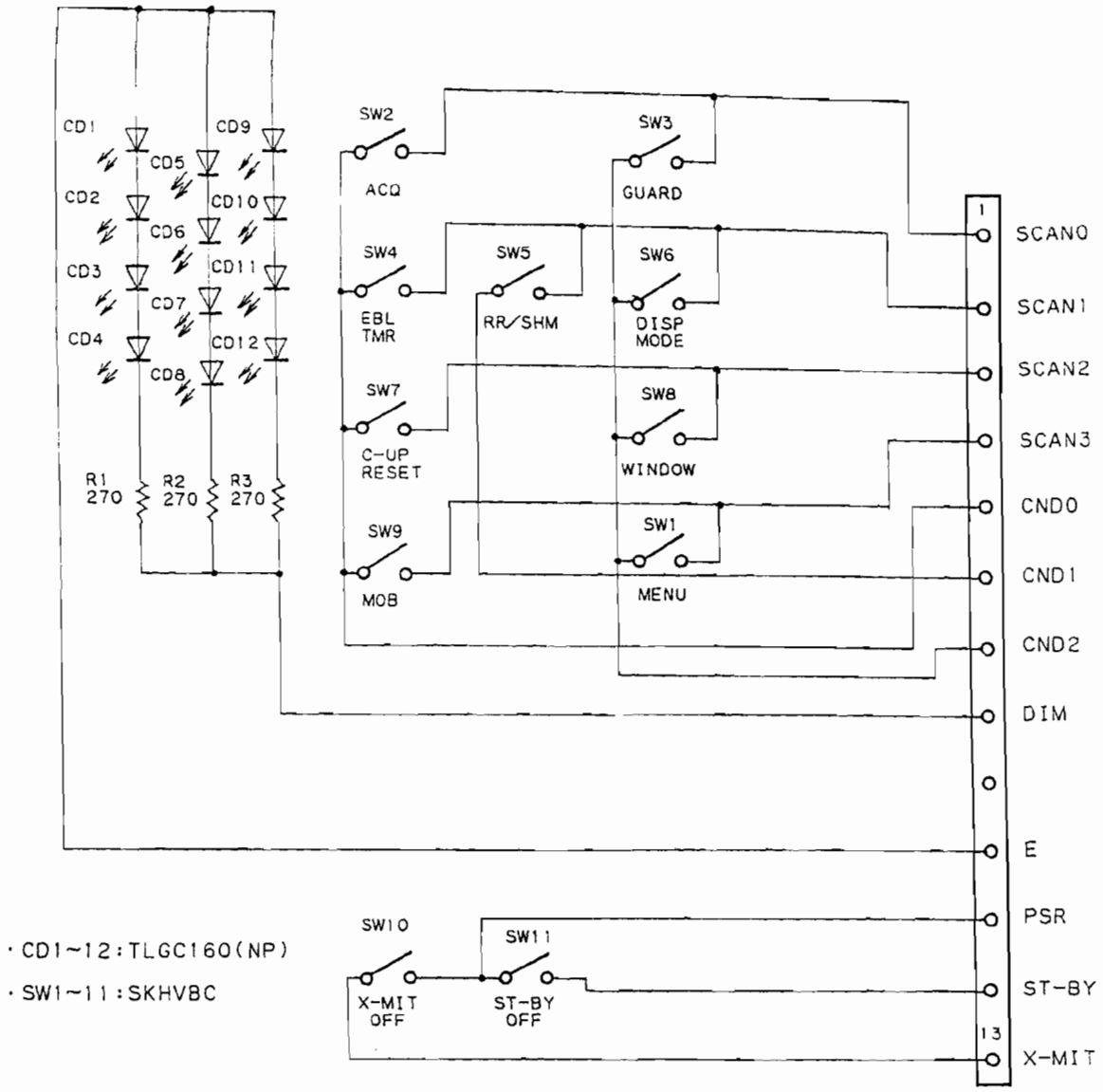
Ref.	Type	Description	Part Number
IC3-1	H-7ZZRD0040	Integrated Circuit	7ZZRD0040
IC4	TC74HC573AF	Integrated Circuit	5DDAE01354
IC5	UPD78C10AGF-3BE	Integrated Circuit	5DDAC00861
IC6	MB89371AHPF	Integrated Circuit	5DDAT01157
IC7	UPD72020GC-8-3B6	Integrated Circuit	5DDAC00829
IC8	TC74HC573AF	Integrated Circuit	5DDAE01354
IC9	TC74HC573AF	Integrated Circuit	5DDAE01354
IC10	TC74HCU04AF	Integrated Circuit	5DDAE01290
IC11	TC74HC221AF	Integrated Circuit	5DDAE01515
IC12	TC14L060AF-1063	Integrated Circuit	5DDAE02304
IC13	TC74HCU04AF	Integrated Circuit	5DDAE01290
IC14	HM63021FP-28	Integrated Circuit	5DAAG00768
IC15	HM63021FP-28	Integrated Circuit	5DAAG00768
IC16	TC74HC32AF	Integrated Circuit	5DDAE01376
IC17	TC74HC245AF	Integrated Circuit	5DDAE01739
IC18	TC74HC245AF	Integrated Circuit	5DDAE01739
IC19	HM53461ZP-12	Integrated Circuit	5DAAG00400
IC20	TC110G08AF-0441	Integrated Circuit	5DDAE02305
IC22	NE521D	Integrated Circuit	5DAAL00302
IC23	HM53461ZP-12	Integrated Circuit	5DAAG00400
IC24	HM53461ZP-12	Integrated Circuit	5DAAG00400
IC25	HM53461ZP-12	Integrated Circuit	5DAAG00400
IC26	HM53461ZP-12	Integrated Circuit	5DAAG00400
IC27	HM53461ZP-12	Integrated Circuit	5DAAG00400
IC28	UPD6326C	Integrated Circuit	5DDAC00496
IC29	NJM4558M	Integrated Circuit	5DAAN00109
IC30	UPC3403G2	Integrated Circuit	5DDAC01026
IC31	TC524256BZ-80	Integrated Circuit	5DDAE02067
IC32	NE521D	Integrated Circuit	5DAAL00302
IC33	NE521D	Integrated Circuit	5DAAL00302
IC34	NE521D	Integrated Circuit	5DAAL00302
IC35	NE521D	Integrated Circuit	5DAAL00302
IC36	MC74F148M	Integrated Circuit	5DAAJ00820
IC37	TC74HC221AF	Integrated Circuit	5DDAE01515
IC38	TC74HC157AF	Integrated Circuit	5DDAE01405
IC39	TC74HC04AF	Integrated Circuit	5DDAE01479
IC40	TLP521-2-GB	Integrated Circuit	5TZAD00234
IC41	TC74HC74AF	Integrated Circuit	5DDAE01289
IC42	TC74HC74AF	Integrated Circuit	5DDAE01289
IC43	TC74HC74AF	Integrated Circuit	5DDAE01289

Ref.	Type	Description	Part Number
IC44	TC74HC174AF	Integrated Circuit	5DDAE01404
ICS3	IC26-3206-GS4	Socket, IC	5ZJAA00495
J1	LY20-32P-DLT1-P5	Conn	5JWAD00498
J2	B6B-EH-A	Conn, 6 Pin	5JWAP00267
J3	IL-G-6P-S3L2-E	Conn, 6 Pin	5JWAD00092
J4	B4B-EH	Conn, 4 Pin	5JWAP00492
J5	IL-G-10P-S3L2-E	Conn, 10 Pin	5JWAD00068
J6	IL-G-13P-S3L2-E	Conn, 13 Pin	5JWAD00482
J7	LY20-24P-DLT1-P5	Conn, 12 Pin	5JWAD00492
J8	IL-G-9P-S3L2-E	Conn, 9 Pin	5JWAD00090
J9	LY20-22P-DLT1-P5	Conn, 22 Pin	5JWAD00495
J10	68931-203	Conn, Jumper Plug	5JWBE00188
J11	68931-203	Conn, Jumper Plug	5JWBE00188
J12	68931-206	Conn, Jumper Plug	5JWBE00181
J13	IL-G-2P-S3L2-E	Conn, 2 Pin	5JWAD00094
J14	68931-203	Conn, Jumper Plug	5JWBE00188
P1	66464-102	Plug, Jumper	5JWAM00127
P2	66464-102	Plug, Jumper	5JWAM00127
P3	66464-102	Plug, Jumper	5JWAM00127
P4	66464-102	Plug, Jumper	5JWAM00127
P5	66464-102	Plug, Jumper	5JWAM00127
R1	ERJ-14YJ563H	Res, 56KΩ, 1/8W	5REAG04122
R2	EXB-H5E103J	Res, 10KΩ,	5RZAS00918
R3	EXB-H5E103J	Res, 10KΩ,	5RZAS00918
R4	EXB-H9E103J	Res, 10KΩ,	5RZAS00923
R5	ERJ-14YJ182H	Res, 1.8KΩ, 1/8W	5REAG02810
R6	ERJ-14YJ391H	Res, 390Ω, 1/8W	5REAG03488
R7	ERJ-14YJ102H	Res, 1KΩ, 1/8W	5REAG03388
R8	CN2B4-TE102J	Res, 1KΩ,	5REAG03996
R9	CN2B2-TE471J	Res, 470Ω,	5REBM00008
R10	ERJ-14YJ152H	Res, 1.5KΩ, 1/8W	5REAG02809
R12	ERJ-14YJ470H	Res, 47Ω, 1/8W	5REAG04102
R13	ERJ-14YJ471H	Res, 470Ω, 1/8W	5REAG03113
R14	ERJ-14YJ472H	Res, 4.7KΩ, 1/8W	5REAG04103
R15	ERJ-14YJ122H	Res, 1.2KΩ, 1/8W	5REAG04104
R17	ERJ-14YJ392H	Res, 3.9KΩ, 1/8W	5REAG04105
R18	ERJ-14YJ473H	Res, 47KΩ, 1/8W	5REAG03760
R19	ERJ-14YJ105H	Res, 1MΩ, 1/8W	5REAG04106
R20	ERJ-14YJ105H	Res, 1MΩ, 1/8W	5REAG04106
R21	ERJ-14YJ471H	Res, 470Ω, 1/8W	5REAG03113

Ref.	Type	Description	Part Number
R22	ERJ-14YJ301H	Res, 300Ω, 1/8W	5REAG04169
R23	ERJ-14YJ432H	Res, 4.3KΩ, 1/8W	5REAG03905
R24	ERJ-14YJ471H	Res, 470KΩ, 1/8W	5REAG03113
R25	ERJ-14YJ682H	Res, 6.8KΩ, 1/8W	5REAG04108
R26	ERJ-14YJ471H	Res, 470Ω, 1/8W	5REAG03113
R27	ERJ-14YJ103H	Res, 1KΩ, 1/8W	5REAG04101
R28	ERJ-14YJ101H	Res, 100Ω, 1/8W	5REAG03969
R29	ERJ-14YJ102H	Res, 1KΩ, 1/8W	5REAG03388
R30	ERJ-14YJ101H	Res, 100Ω, 1/8W	5REAG03969
R31	ERJ-14YJ101H	Res, 100Ω, 1/8W	5REAG03969
R32	ERJ-14YJ102H	Res, 1KΩ, 1/8W	5REAG03388
R33	ERJ-14YJ101H	Res, 100Ω, 1/8W	5REAG03969
R34	ERJ-14YJ102H	Res, 1KΩ, 1/8W	5REAG03388
R35	ERJ-14YJ221H	Res, 220Ω, 1/8W	5REAG02798
R36	ERJ-14YJ104H	Res, 100KΩ, 1/8W	5REAG04109
R37	ERJ-14YJ473H	Res, 47KΩ, 1/8W	5REAG03760
R38	ERJ-14YJ103H	Res, 10KΩ, 1/8W	5REAG04101
R40	ERJ-14YJ132H	Res, 1.3KΩ, 1/8W	5REAG04100
R41	ERJ-14YJ222H	Res, 2.2KΩ, 1/8W	5REAG03805
R42	ERJ-14YJ332H	Res, 3.3KΩ, 1/8W	5REAG04110
R43	ERJ-1WYK5R6H	Res, 5.6Ω, 1W	5REAG04170
R44	ERJ-14YJ223H	Res, 22KΩ, 1/8W	5REAG04111
R45	ERJ-14YJ473H	Res, 47KΩ, 1/8W	5REAG03760
R46	ERJ-14YJ473H	Res, 47KΩ, 1/8W	5REAG03760
R47	ERJ-14YJ164H	Res, 160KΩ, 1/8W	5REAG04112
R51	ERJ-14YJ560H	Res, 56Ω, 1/8W	5REAG04113
R52	ERJ-14YJ821H	Res, 820Ω, 1/8W	5REAG03788
R53	ERJ-14YJ103H	Res, 10KΩ, 1/8W	5REAG04101
R54	ERJ-14YJ102H	Res, 1KΩ, 1/8W	5REAG03388
R55	ERJ-14YJ101H	Res, 100Ω, 1/8W	5REAG03969
R56	ERJ-14YJ681H	Res, 680Ω, 1/8W	5REAG04114
R57	ERJ-14YJ821H	Res, 820Ω, 1/8W	5REAG03788
R58	ERJ-14YJ331H	Res, 330Ω, 1/8W	5REAG02803
R59	ERJ-14YJ242H	Res, 2.4KΩ, 1/8W	5REAG04171
R60	ERJ-14YJ222H	Res, 2.2KΩ, 1/8W	5REAG03805
R61	CN2B4-TE152J	Res, 1.5KΩ, 1/8W	5REBN00001
R62	CN2B2-TE152J	Res, 1.5KΩ, 1/8W	5REAG04097
R63	ERJ-14YJ100H	Res, 10Ω, 1/8W	5REAG03789
R64	ERJ-14YJ102H	Res, 1KΩ, 1/8W	5REAG03388
R65	ERJ-8GEYJ473V	Res, 47KΩ, 1/8W	5REAG01758

Ref.	Type	Description	Part Number
R66	ERJ-8GEYJ363V	Res, 36KΩ,	5REAG02233
R70	ERJ-14YJ682H	Res, 6.8KΩ, 1/8W	5REAG04108
R71	ERJ-14YJ102H	Res, 1KΩ, 1/8W	5REAG03388
R72	ERJ-14YJ220H	Res, 22Ω, 1/8W	5REAG04116
R73	ERJ-14YJ682H	Res, 6.8KΩ, 1/8W	5REAG04108
R74	ERJ-14YJ102H	Res, 1KΩ, 1/8W	5REAG03388
R75	ERJ-14YJ220H	Res, 22Ω, 1/8W	5REAG04116
R76	ERJ-14YJ102H	Res, 1KΩ, 1/8W	5REAG03388
R77	ERJ-14YJ103H	Res, 10KΩ, 1/8W	5REAG04101
R80	ERJ-14YJ332H	Res, 3.3KΩ, 1/8W	5REAG04110
R81	ERJ-14YJ682H	Res, 6.8KΩ, 1/8W	5REAG04108
R82	ERJ-14YJ473H	Res, 47KΩ, 1/8W	5REAG03760
R83	ERJ-14YJ154H	Res, 150KΩ, 1/8W	5REAG04172
R84	ERJ-14YJ243H	Res, 24KΩ, 1/8W	5REAG04173
R85	ERJ-14YJ103H	Res, 1KΩ, 1/8W	5REAG04101
R86	ERJ-14YJ103H	Res, 1KΩ, 1/8W	5REAG04101
R87	ERJ-14YJ103H	Res, 1KΩ, 1/8W	5REAG04101
R88	ERJ-14YJ103H	Res, 1KΩ, 1/8W	5REAG04101
R89	ERJ-14YJ103H	Res, 1KΩ, 1/8W	5REAG04101
R90	ERJ-14YJ103H	Res, 1KΩ, 1/8W	5REAG04101
R91	ERJ-14YJ103H	Res, 1KΩ, 1/8W	5REAG04101
R92	ERJ-14YJ103H	Res, 1KΩ, 1/8W	5REAG04101
R93	ERJ-8GEYJ272V	Res, 2.7KΩ, 1/8W	5REAG01743
R94	ERJ-8GEYJ152V	Res, 1.5KΩ, 1/8W	5REAG01740
R95	ERJ-8GEYJ152V	Res, 1.5KΩ, 1/8W	5REAG01740
R96	ERJ-8GEYJ101V	Res, 100Ω, 1/8W	5REAG01726
R97	ERJ-8GEYJ272V	Res, 2.7KΩ, 1/8W	5REAG01743
R98	ERJ-8GEYJ103V	Res, 1KΩ, 1/8W	5REAG01750
R99	ERJ-8GEYJ682V	Res, 6.8KΩ, 1/8W	5REAG01748
R100	ERJ-8GEYJ152V	Res, 1.5KΩ, 1/8W	5REAG01740
R101	ERJ-8GEYJ101V	Res, 100Ω, 1/8W	5REAG01726
R102	ERJ-8GEYJ473V	Res, 47KΩ, 1/8W	5REAG01758
R103	ERJ-8GEYJ473V	Res, 47KΩ, 1/8W	5REAG01758
R106	ERJ-8GEYJ333V	Res, 33KΩ, 1/8W	5REAG01756
R107	ERJ-8GEYJ152V	Res, 1.5KΩ, 1/8W	5REAG01740
R108	ERJ-8GEYJ152V	Res, 1.5KΩ, 1/8W	5REAG01740
R109	ERJ-8GEYJ562V	Res, 5.6KΩ, 1/8W	5REAG01747
R110	ERJ-8GEYJ562V	Res, 5.6KΩ, 1/8W	5REAG01747
R111	ERJ-8GEYJ562V	Res, 5.6KΩ, 1/8W	5REAG01747
R112	ERJ-8GEYJ823V	Res, 82KΩ, 1/8W	5REAG01761

Ref.	Type	Description	Part Number
R113	ERJ-8GEYJ392V	Res, 3.9KΩ, 1/8W	5REAG01745
R114	ERJ-8GEYJ182V	Res, 1.8KΩ, 1/8W	5REAG01741
R115	ERJ-8GEYJ103V	Res, 1KΩ, 1/8W	5REAG01750
R116	ERJ-8GEYJ104V	Res, 10KΩ, 1/8W	5REAG01762
R117	ERJ-8GEYJ104V	Res, 10KΩ, 1/8W	5REAG01762
R118	ERJ-8GEYJ151V	Res, 150Ω, 1/8W	5REAG01728
R119	ERJ-8GEYJ753V	Res, 75KΩ, 1/8W	5REAG01907
R120	ERJ-8GEYJ161V	Res, 160Ω, 1/8W	5REAG02319
R121	ERJ-8GEYJ471V	Res, 470Ω, 1/8W	5REAG01734
R122	ERJ-8GEYJ471V	Res, 470Ω, 1/8W	5REAG01734
R123	ERJ-8GEYJ104V	Res, 10KΩ, 1/8W	5REAG01762
R124	ERJ-8GEYJ103V	Res, 1KΩ, 1/8W	5REAG01750
R125	ERJ-8GEYJ305V	Res, 3MΩ, 1/8W	5REAG04174
R126	ERJ-8GEYJ682V	Res, 6.8KΩ, 1/8W	5REAG01748
R127	ERJ-8GEYJ103V	Res, 1KΩ, 1/8W	5REAG01750
R128	ERJ-6GEYJ471V	Res, 470Ω, 1/8W	5REAG01827
R129	ERJ-6GEYJ222V	Res, 2.2KΩ, 1/8W	5REAG02011
R130	ERD-25PJ332	Res, 3.3KΩ, 1/8W	5RDAA01168
R131	ERD-25PJ153	Res, 15KΩ, 1/8W	5RDAA01174
RV1	EVM-7JSW30B14	Res, Var, 10KΩ	5RVAB00484
RV2	EVM-7JSW30B52	Res, Var, 500Ω	5RVAB00522
RV3	EVM-7JSW30B52	Res, Var, 500Ω	5RVAB00522
RV4	EVM-7JSW30B14	Res, Var, 10KΩ	5RVAB00484
TR1	2SA1162-GRTE85L	Transistor	5TAAG00200
TR2	2SC2712-GRTE85L	Transistor	5TCAF00585
TR3	2SK532	Transistor	5TKAA00130
TR4	2SA1162-GRTE85L	Transistor	5TAAG00200
TR5	2SA1244YLB	Transistor	5TAAG00321
TR6	2SC3303-Y	Transistor	5TCAF00525
TR7	2SC2712-BLTE85L	Transistor	5TCAF00565
TR8	2SC2712-BLTE85L	Transistor	5TCAF00565
TR9	2SC2712Y TE85L	Transistor	5TAAG00186
TR10	2SC2712Y TE85L	Transistor	5TAAG00186
TR11	2SC2712-BLTE85L	Transistor	5TCAF00565



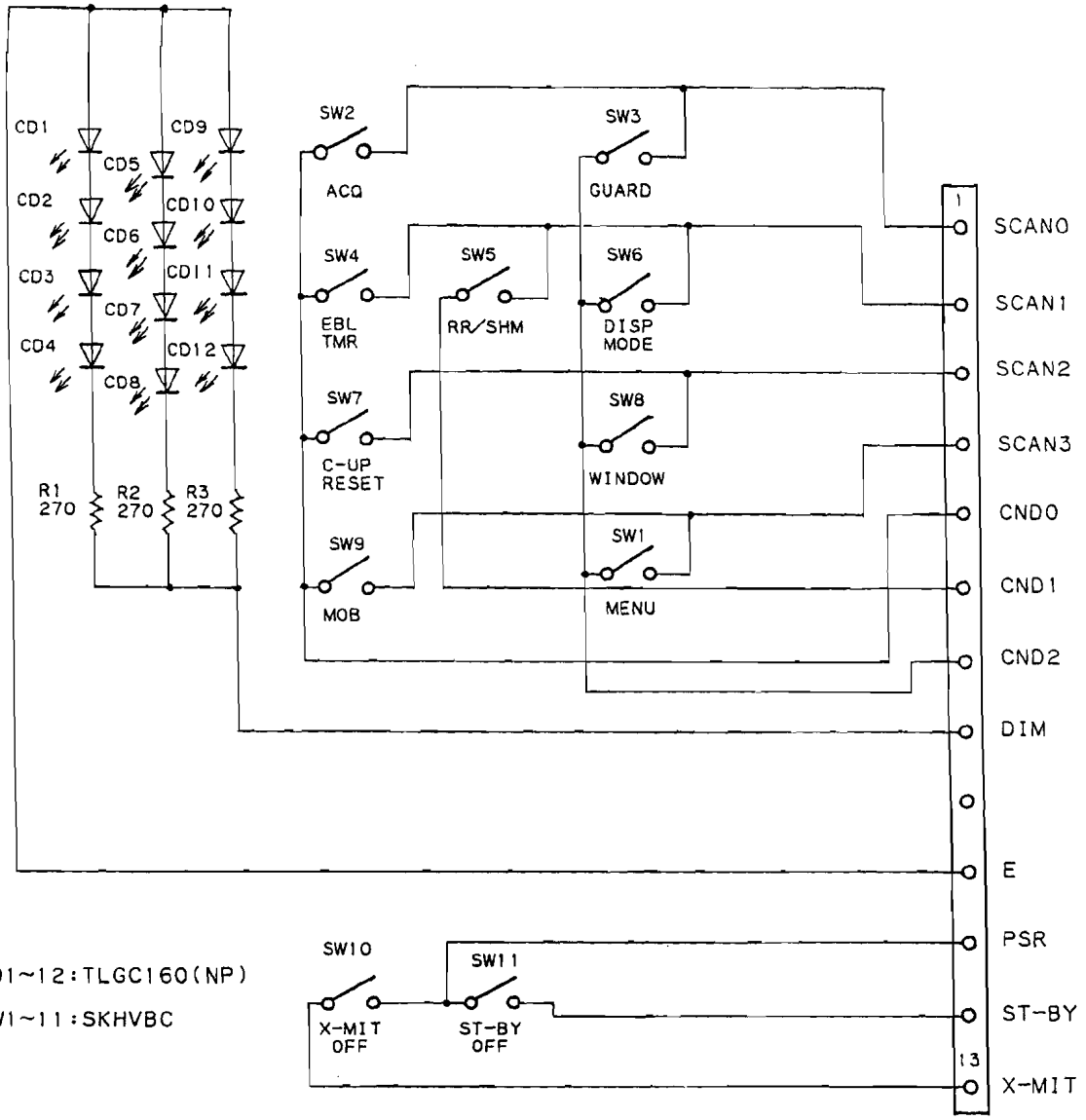
· CD1~12 : TLGC160(NP)

· SW1~11 : SKHV8C

NOTE

UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ARE IN OHMS. 1/4W RATING

Fig. 6-21 SCHEMATIC DIAGRAM, BEZEL CONTROL PCB [left] (CCK-691)



· CD1~12:TLGC160(NP)

· SW1~11:SKHVBC

NOTE

UNLESS OTHERWISE SPECIFIED

ALL RESISTORS ARE IN OHMS. 1/4W RATING

Fig. 6-21 SCHEMATIC DIAGRAM, BEZEL CONTROL PCB [left] (CCK-691)

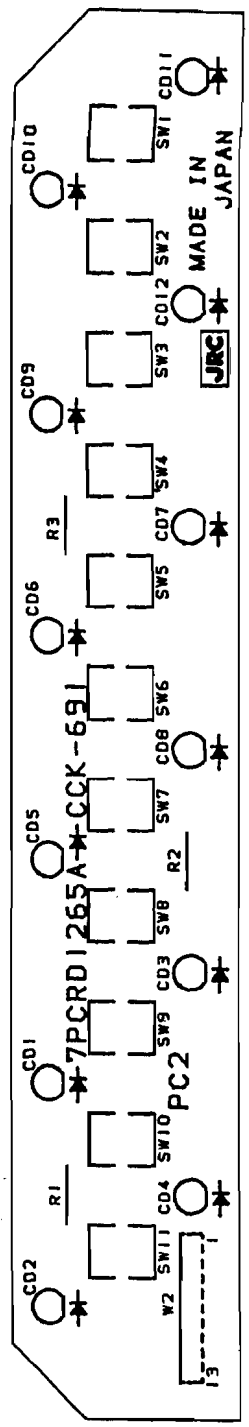
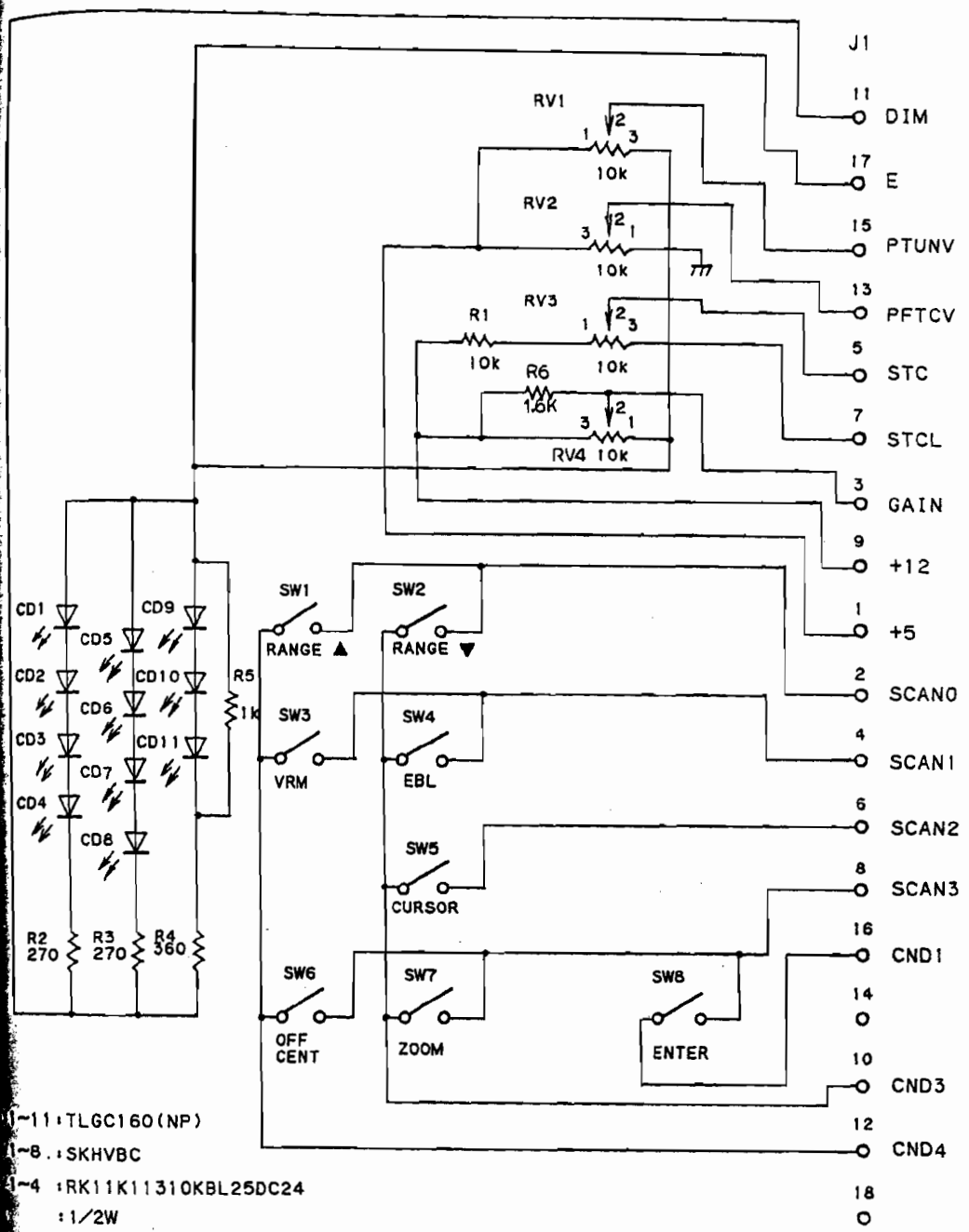


Fig. 6-22 COMPONENT LOCATION DRAWING, BEZEL CONTROL PCB [left] (CCK-691)

TABLE 6-21
Replaceable Parts List
Bezel Control PCB [left]
CCK-691

Ref.	Type	Description	Part Number
CD1	TLGC160(NP)(TPK55)	LED	5TZAD00642
CD2	TLGC160(NP)(TPK55)	LED	5TZAD00642
CD3	TLGC160(NP)(TPK55)	LED	5TZAD00642
CD4	TLGC160(NP)(TPK55)	LED	5TZAD00642
CD5	TLGC160(NP)(TPK55)	LED	5TZAD00642
CD6	TLGC160(NP)(TPK55)	LED	5TZAD00642
CD7	TLGC160(NP)(TPK55)	LED	5TZAD00642
CD8	TLGC160(NP)(TPK55)	LED	5TZAD00642
CD9	TLGC160(NP)(TPK55)	LED	5TZAD00642
CD10	TLGC160(NP)(TPK55)	LED	5TZAD00642
CD11	TLGC160(NP)(TPK55)	LED	5TZAD00642
CD12	TLGC160(NP)(TPK55)	LED	5TZAD00642
R1	ERD-25PJ271	Res, 270Ω, ¼W	5RDAA01161
R2	ERD-25PJ271	Res, 270Ω, ¼W	5RDAA01161
R3	ERD-25PJ271	Res, 270Ω, ¼W	5RDAA01161
SW1	SKHVBC	Switch, MENU	5SCAF00214
SW2	SKHVBC	Switch, ACQ	5SCAF00214
SW3	SKHVBC	Switch, GUARD	5SCAF00214
SW4	SKHVBC	Switch, EBL R-T/M	5SCAF00214
SW5	SKHVBC	Switch, RR/SHM	5SCAF00214
SW6	SKHVBC	Switch, HDG MODE	5SCAF00214
SW7	SKHVBC	Switch, HDG RESET	5SCAF00214
SW8	SKHVBC	Switch, WINDOW	5SCAF00214
SW9	SKHVBC	Switch, MOB	5SCAF00214
SW10	SKHVBC	Switch, XMIT/OFF	5SCAF00214
SW11	SKHVBC	Switch, STBY/OFF	5SCAF00214
W2	H-7ZCRD0377	Cable Harness	7ZCRD0377



1~11 : TLGC160(NP)
1~8 . : SKHVBC
1~4 : RK11K11310KBL25DC24
: 1/2W

NOTE

UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ARE IN OHMS, 1/4W RATING

Fig. 6-23 SCHEMATIC DIAGRAM, BEZEL CONTROL PCB [right] (CCK-692)

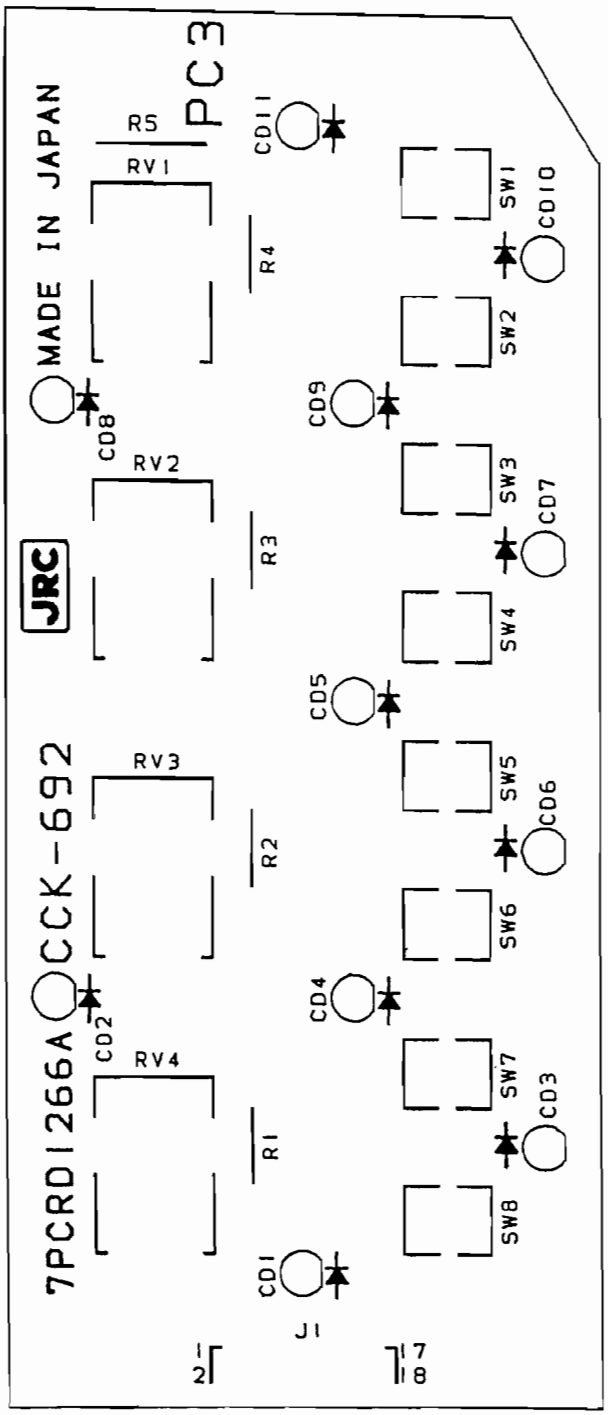


Fig. 6-24 COMPONENT LOCATION DRAWING, BEZEL CONTROL PCB [right] (CCK-692)