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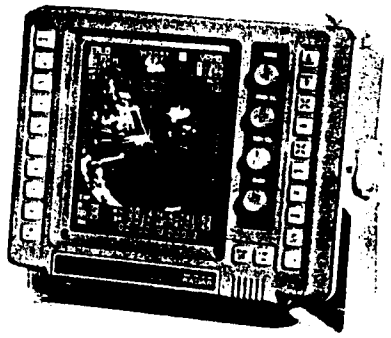
Instruction Manual

Raytheon

Models R10X and R11X
Raster Scan Radar Systems



PURPOSE

THIS MANUAL CONTAINS IMPORTANT INFORMATION ON THE INSTALLATION, OPERATION AND MAINTENANCE OF YOUR EQUIPMENT

RAYTHEON MARINE COMPANY products are supported by a network of Authorized Service Representatives. For product information, you may contact the following regional centers:

** AUTHORIZED FACTORY SERVICE and REPLACEMENT PARTS DISTRIBUTION CENTER

United States..... Raytheon Marine Company **
46 River Road
Hudson, NH 03051
Phone: 603-881-5200

Europe ..... Raytheon Marine Sales & Service Co.
Elizabeth Way, The Pinnacles,
Harlow, Essex,
CM19 5AZ England
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Raytheon

Limited Warranty Certificate

Dealer Distributor / Light Marine Products

Raytheon Marine Company warrants all parts of each new light marine product to be of good materials and workmanship, and will repair or exchange any parts proven to be defective under normal use at no charge for a period of 24 months from the date of sale to end user or 30 months from the date of shipment by Raytheon, whichever expires first, except as provided below. High seas products, (Pathfinder/ST, 12" and 16" Bright Display Radars, Raycas ARPA, Raypath ARPA, Fathometer, Satcom, Doppler Speed Logs, Auto Pilots and Gyro Systems) are covered by a separate warranty policy.

Defects will be corrected by an authorized Raytheon Marine Company dealer. There will be no charge for labor during normal working hours for a period of 12 months from date of sale to end user or 18 months from date of shipment by Raytheon, except as provided below, and during this period Raytheon Marine Company will, for certain products, assume travel costs (auto mileage and tolls only) of its authorized dealers up to a total of 100 round trip miles and two hours travel unless otherwise agreed by Raytheon Marine Company in writing. For service outside normal working hours, the overtime premium portion is not covered by this warranty.

Warranty Limitations

There is no travel allowance for certain products with a suggested retail price below $2500.00. These products must be forwarded to an authorized dealer or service center of Raytheon Marine Company, at owner's expense and will be returned via surface carrier at no cost to the owner. Travel costs other than auto mileage, tolls and two hours travel time are specifically excluded on all products. The excluded travel cost includes but is not limited to: taxi, launch fees, aircraft rental, subsistence, customs, shipping and communication charges.

Raytheon Marine Company warranty policy does not apply to equipment which has been subjected to accident, shipping damage, abuse, incorrect service, alterations, corrosion, or service by non-authorized service personnel, or misuse, or on which the serial number plate has been removed, altered or mutilated.

Except where Raytheon Marine Company or its authorized dealer has performed the installation, it assumes no responsibility for damage incurred during installation.

This warranty does not cover routine system checkout or alignment/calibration, unless required by replacement or part(s) in the area being aligned.

A suitable proof of purchase, showing date, place and serial number must be made available to the authorized Raytheon Marine Company dealer at the time or request for Warranty service.

Magnetrons, cathode ray tubes (CRT), hailer horns and transducers are warranted for 12 months from date of sale. These items must be returned to a Raytheon Marine Company factory service center.

Chart paper, lamps, fuses, batteries, stylii, stylus/drive belts, radar mixer crystals/diodes, snap-in impeller carriers, impellers, impeller bearings and impeller shafts are consumable items, and are specifically excluded from this warranty.

All costs associated with transducer replacement, other than the cost of the transducer itself, are specifically excluded from this warranty.

TO THE EXTENT CONSISTENT WITH STATE AND FEDERAL LAW:

(1) THIS WARRANTY IS STRICTLY LIMITED TO THE TERMS INDICATED HEREIN, AND NO OTHER WARRANTIES OR REMEDIES THEREUNDER SHALL BE BINDING ON RAYTHEON MARINE COMPANY INCLUDING WITHOUT LIMITATION ANY WARRANTIES OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

(2) Raytheon Marine Company shall not be liable for any incidental, consequential or special (including punitive or multiple) damages.

All Raytheon Marine Company products sold or provided hereunder are merely aids to navigation. It is the responsibility of the user to exercise discretion and proper navigational skill independent of any Raytheon equipment.

Document Number 983564 Rev F (3/90)

HIGH VOLTAGE WARNING

Do not open any of the units when the radar is ON; high voltages within the Scanner and Display Unit could be fatal to anyone coming in direct contact with them.

Disconnect ship's power from the Display Unit before attempting any maintenance; otherwise, ship's power will be present at terminals inside the Scanner and Display Unit.

RADIATION HAZARD

Care should be taken to avoid possible harmful effects (particularly to the eyes) of radiation from radar transmissions.

To avoid harmful radiation, the Display OPERATE switch should be turned to the ST-BY or OFF position when working on the Scanner.

"IMPORTANT NOTICE"

THIS DEVICE IS ONLY AN AID TO BOATING SAFETY AND NAVIGATION. ITS PERFORMANCE CAN BE AFFECTED BY MANY FACTORS INCLUDING EQUIPMENT FAILURE OR DEFECT, ENVIRONMENTAL CONDITIONS, AND IMPROPER HANDLING OR USE. IT IS THE USER'S RESPONSIBILITY TO EXERCISE COMMON PRUDENCE AND NAVIGATIONAL JUDGEMENT. THIS DEVICE SHOULD NOT BE RELIED ON AS A SUBSTITUTE FOR SUCH PRUDENCE AND JUDGEMENT.

CONTENTS

RADAR GLOSSARY

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 set area or own ship.
ALM OUT	–	Alarm Out, also known as the exit alarm. For targets exiting or leaving a set area.
CPU	–	Central Processing Unit
CRT	–	Cathode Ray Tube
D/A	–	Digital to Analog Conversion
DEL	–	Delete
DISP	–	Display
EBL	–	Electronic Bearing Line
EXP	–	Expansion
FET	–	Field Effect Transistor
FTC	–	Fast Time Constant, also known as Anti-Clutter Rain
IR	–	Interference Rejection
KM	–	Kilometer
LL	–	Latitude/Longitude
MH	–	Modulator High Voltage
MN	–	Modulator High Voltage Return
NM	–	Nautical Mile
PCB	–	Printed Circuit Board
PPI	–	Plan Position Indicator
P-S	–	Parallel to Serial Conversion
PW	–	Pulse Width (Length)
PWS	–	Pulse Width (Length) Selection
RR	–	Range Rings (Fixed)
SHM	–	Ship's Heading Marker
ST-BY	–	Standby
STC	–	Sensitivity Time Constant, also known as Anti-Clutter Sea
TB	–	Terminal Board
TD	–	Time Difference
TI	–	Trigger
VD	–	Video
VRM	–	Variable Range Marker
WPT	–	Waypoint
X-MIT	–	Transmit

SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

Congratulations on selecting the Raytheon X Series Raster Scan Radar for your radar navigation needs.

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 R10X or R11X Display you will know you are seeing a revolutionary new concept in radar technology at work.

Radar signals are "stored" on a 7-inch diagonal TV-type picture with chart like clarity and detail. A single glance at your Display will give you a complete and accurate 360° radar picture of other vessels, buoys and landfall surrounding your vessel.

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

The Zoom mode gives you a fast 2 times enlargement of the radar presentation in the zone you have designated. A new "Timed TX" mode lets the radar automatically turn its transmitter "on" and "off" for scans of the area around your vessel and saves battery power. Set the target alarm zone to alert you of any radar contacts that have entered your zone, including any that might have escaped your notice.

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

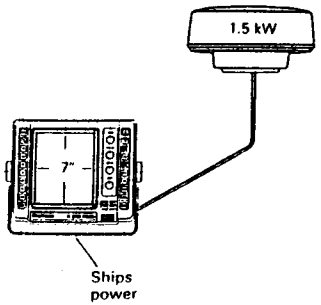
With all of these electronic features and the thoughtful compact and efficient design of this radar, it soon becomes apparent that human engineering and operational simplicity have been foremost considerations in the R10X/R11X product design.

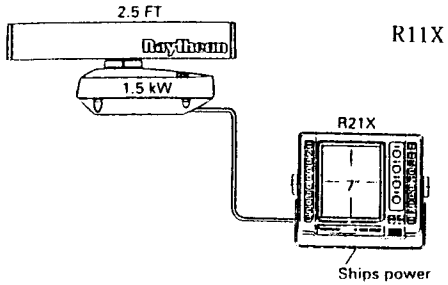
We trust that you will enjoy many years of excellent performance, reliability, and smooth sailing with your new X series radar system.

1.2 SYSTEM DESCRIPTION

The X Series Model configurations are:

R10X A two-piece system consisting of a compact 7" monochrome raster scan display unit and a 1.5 kW X-band transceiver housed in an 18" radome housing.





R11X A two-piece system consisting of the same compact 7" monochrome raster scan display unit as above, with the same 1.5 kW X-band transceiver housed in a pedestal unit and driving a 2.5' open array.

1.2.1 Display Units

The 16 nm R10X and 24 nm R11X display units use a 7" green monochrome monitor enclosed in a compact, rugged, and weather-resistant cabinet.

The front panel contains all of the operating controls for the radar system organized in a combination of rotary controls for precise setting of the Gain, Tuning, Sea-clutter, and Rain-clutter adjustments for clear and detailed radar presentations. Two groups of silicone rubber covered keys assure fast and accurate selections of ancillary operating functions. These keys are logically arranged for the operators convenience and well backlit for nighttime use with bold alphanumerics on-screen.

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

All system set-up adjustments are made at the display front panel, negating any requirement to enter the display units during a standard installation.

The compact design of the display units is made possible by the use of custom LSI components (Large Scale Integrated circuit). This type of "chip" contains, in one package, the equivalent of up to 20 integrated circuits. Thus compact size, power efficiency, and full features at an economical price are all standard with the X series radar systems.

1.2.2 Cable Requirements

The two basic cables in the X series radar systems are the Interunit cable cable assembly and the Power cable assembly. Other cables for interface to optional external equipment are discussed in the installation section of this manual. A brief description of the interunit cable follows:

Interunit Cable

The Antenna and display units are interconnected with a single multiconductor cable using 14 wires. The cable is wrapped with braided shield material for noise protection. A ground terminal is available at the display rear panel for connection to the ship's RF ground system.

1.2.3 Scanner Unit R10X

The antenna and transceiver are combined within the 18 inch radome, which is made of AES plastic and has a single-flange mounting.

R10X SCCANER UNIT

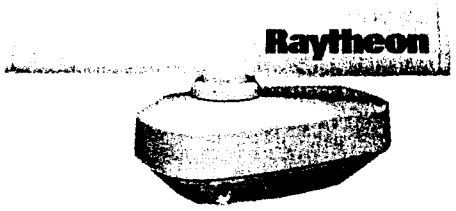
The radome cover is secured to the scanner pan base by four clamping bolts and is provided with a heavy-duty rubber gasket to seal the unit from the weather.

Inside, the radome features a printed-circuit card array. This technically innovative antenna provides a narrow 6° beamwidth for excellent short range resolution and high gain in a very compact antenna package.

The internal X-band transmitter operates at a 1.5 kW peak power, with a low noise micro-integrated circuit frontend at the receiver.

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

1.2.4 Scanner Unit R11X



The Scanner Unit for the R11X system houses the 1.5 kW transmitter, a linear receiver with a low-noise micro frontend, the array drive motor and control circuitry.

The X-band transmitter, which is common in all of these systems, operates with two different pulse lengths and two different PRF's. The magnetron type is a RMC-1, rated at 1.5 kW, driven by the solid state modulator unit.

The open array contains a 2.5 foot PCB array producing 3.3° horizontal and 25° vertical beamwidths for high resolution, super sensitive target pick up and display. The array is turned by a speed-regulated motor at 24 RPM.

The receiver section consists of a passive diode limiter, low noise MIC frontend (NJT 1946), coupled to a 60 MHz dual bandwidth IF amplifier. The bandwidth of the receiver switches between 10 and 3 MHz at designated pulsewidth changeovers keyed to the range scale in use to provide optimum sensitivity.

A power supply PCB assembly provides the operating supply voltages for the transmitter/receiver and for the motor control circuitry.

1.2.5 Basic System Components

A. R10X

The R10X Radar System consists of the following items:

	Item	Raytheon Product Code
1 ea.	Display Unit (16 nm)	50003
1 ea.	Scanner Unit	50004
1 ea.	Cable Assembly (15 Meters)	M89951
1 ea.	Sunshield	MTV003534

B. R11X

The R11X Radar System consists of the following items:

	Item	Raytheon Product Code
1 ea.	Display Unit (24 nm)	50006
1 ea.	Scanner Unit	50007
1 ea.	Cable Assembly (15 Meters)	M89984
1 ea.	Sunshield	MTV003534

C. Options

Other Optional Items

Universal Mast Mount (R10X)	M88390
Magnifier Lens	M89962
Console Mounting Kit	M78843

1.3 SPECIFICATIONS

1.3.1 General

1) Maximum range: 16 nautical miles (R10X).
24 nautical miles (R11X).

2) Minimum range: Better than 35 m on 0.25 n.m.

3) Range Scales:

	Range		Range ring interval		Number of rings
	0.125	nm	0.0625	nm	2
	0.25	nm	0.125	nm	2
	0.5	nm	0.25	nm	2
	0.75	nm	0.25	nm	3
	1.5	nm	0.25	nm	6
	3	nm	0.5	nm	6
	6	nm	1	nm	6
	12	nm	2	nm	6
(R10X)	16	nm	4	nm	4
(R11X)	24	nm	4	nm	6

4) Range discrimination: Better than 30 m.

5) Range ring accuracy: Better than ±1.5% of maximum range of the scale in use, or 22 m, whichever is the greater.

6) Bearing accuracy: Better than ±1 degree.

7) Cathode-ray tube: 7 in. tube.
Effective diameter 104 mm

8) Environmental conditions:
Scanner Units: Temperature −15°C to +50°C (under nominal input voltage)
Humidity Up to 95% at 35°C
Display Units: Temperature −10°C to +50°C
Humidity Up to 95% at 35°C

9) Input power requirements: 11~42V dc

10) Power Consumption: 45 W (R10X): 50 W (R11X)

1.3.2 Scanner Unit R10X

1) Dimensions: Diameter of radome 450 mm
Height 227 mm

2) Weight: Approx. 5.5 kg (12.1 lbs)

3) Polarization: Horizontal

4) Beam width: Horizontal 6° nominal
Vertical 25° nominal

5) Sidelobes: Better than −21 dB

6) Rotation: Approx. 24 RPM

7) Drive motor input voltage: +12 VDC

8) Transmitter frequency: 9445±30 MHz

9) Peak power output: 1.5 kW

10) Transmitter tube: Magnetron (RMC-1)

11) Pulse length/Pulse repetition frequency: 0.08 μs/2250 Hz (0.125, 0.25, 0.5, 0.75, 1.5 nm)
0.5 μs/750 Hz (3, 6, 12, 16 nm)

12) Modulator: Solidstate modulator driving magnetron

13) Duplexer: T-junction with diode limiter

14) Mixer: MIC Low-Noise

15) IF amplifier: Center frequency 60 MHz
Bandwidth 10/3 MHz

16) Overall noise figure: Less than 6 dB

1.3.3 Scanner Unit R11X

1) Dimensions: 323 (H)×swing circle 780 mm

2) Weight: Approx. 10 kg

3) Polarization: Horizontal

4) Beam width: Horizontal 3.3° nominal
Vertical 25° nominal

5) Side lobe level: −23 dB or less

6) Rotation: Approx. 24 rpm

7) Wind velocity: 35 m/s (70 knots), relative

8) Transmitter frequency: 9445±30 MHz

9) Peak power: 1.5 kW

10) Transmitter tube: Magnetron (RMC-1)

11) Pulse length/RPF: 0.08 μs/2250 Hz (0.125, 0.25, 0.5, 0.75, 1.5 nm)
0.7 μs/750 Hz (3, 6, 12, 24 nm)

12) Modulator: Solid state modulator

13) Duplexer: T-junction with diode limiter

14) Mixer: MIC Low-Noise

15) IF Amplifier: Center frequency 60 MHz
Bandwidth 10 MHz/3 MHz

16) Overall noise figure: Less than 6 dB

1.3.4 Display Unit

1)	Dimensions:	Width 268 mm Depth 335 mm Height 228.5 mm
2)	Mounting:	Table, overhead or bulkhead mounting
3)	Weight:	Approx. 5 kg (Approx. 11 lbs)
4)	Cathode-ray tube:	E2871B39-SDHT (Green) 7" Monitor
5)	Video	8 levels quantitized
6)	Range scales:	0.125, 0.25, 0.5, 0.75, 1.5, 3, 6, 12, 16 nautical miles (R10X) 0.125, 0.25, 0.5, 0.75, 1.5, 3, 6, 12, 24 nautical miles (R11X)
7)	Range rings:	0.0625, 0.125, 0.25, 0.25, 0.25, 0.5, 1, 2, 4 nautical miles
8)	Display Resolution:	610×496 lines
9)	Bearing synchronizing system:	Motor Encoder
10)	Tuning:	Manual
11)	Bearing scale:	360° scale graduated at intervals of 5°
12)	Ship's heading marker:	Electrical
13)	VRM:	Digital readout on CRT in the range of 0.00 to 24.0 nm, 3 digit Digital-On-Screen-Display
14)	In/Out connections:	Type
	A. Inter-unit	16-pin Connector
	B. Power DC input	3-pin Connector
	C. Loran C	BNC Connector, isolated
	D. Magnetic sensor	BNC Connector
	E. External alarm output	2-pin Connector (mini-phone)
15)	Interface:	NMEA0182/JRC NMEA0183: Must include GLL, GTD, VTG, BWC or RMA and RMB sentences
16)	EBL:	Digital readout on CRT in the bearing of 0° to 360°, 3 digit Digital-On-Screen-Display
17)	EBL Resolution:	1°
18)	Alarm:	Audible alarm and zone mark on PPI
19)	Off Center	Up to 66% radius (except max. range scale)
20)	Zoom	0.25 nm to max. range

21)	Timed TX	Rotation Period Select 10, 20 or 30 Scans Repetition Period Select 3, 5, 10 or 15 Minutes
22)	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
23)	Controls	Standby Key, ST-BY/OFF Transmit Key, X-MIT/OFF Range UP Key, △ Range DOWN Key, ▽ Variable Range Marker (VRM) Select or ON/OFF Key, VRM VRM Increase Key, VRM Decrease Key, Electric Bearing Line (EBL) Select or ON/OFF Key, EBL Direction arrows on EBL keys, CCW and CW. Off Center Key, OFF CENT Zoom Key, ZOOM Numerical Bearing Display Select Key, MODE LL/TD Select Key, LL/TD Waypoint Key, WPT Alarm Key, ALM Target Expansion Key, EXP Interference Rejection Key, IR Ship's Heading Marker OFF Key, SHM Range Rings OFF Key, RR Timed Transmit Key, TIME CRT Brilliance/Panel Illumination Key, DIM/BRIL Tuning Control, TUNE Anti-Rain Clutter Control, RAIN CL Anti-Sea Clutter Control, SEA CL Gain Control, GAIN

24) Inputs:

Loran-C	NMEA 0182, JRC Format, or NMEA 0183. (NMEA 0183 must include "GLL", "GTD", "VTG", "BWC", or "RMA" and "RMB" sentences for full function.)
Magnetic sensor	NMEA 0183 "HDM" or "HSC". Sentences.
25) Outputs	External Alarm- Contact Closure Limits: 24 VDC maximum 100 ma maximum

1.3.5 Cable Information

The standard interunit cable is 15 m (49 feet) as supplied with the radar. If additional cable is required to complete the installation specific lengths of pre-made cable assemblies are available.

Use	Type of Cable	Standard Length	Maximum Length
Scanner-Display	H-2695110045	15 m	20 m

Cable assemblies are available from Raytheon as follows:

	Length	Product Code
Standard	15 m	M89951 (R10X)
	15 m	M89984 (R11X)
Option	20 m	M89961 (R10X)
	20 m	M89985 (R11X)

SECTION 2

INSTALLATION

Although your X series radar is designed to the highest levels of quality and performance, it can only attain those standards with a proper installation.

This section provides the user with practical guidelines to assist in the planning and installation of the R10X or R11X aboard your vessel.

2.1 UNPACKING AND INSPECTION

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

2.1.1 Equipment Supplied

Table 2.1 indicates a listing of items that are included with your new radar system.

TABLE 2.1 Equipment Supplied

No.	Description	Type	Q'ty	Remark
1	Interunit Cable	M89951	49 feet	R10X
1	Interunit Cable	M89984	49 feet	R11X
2	Power Cable Ass'y	CFQ-2646	1	
3	Sunshield	MTV003534	1	
4	Instruction Manual	7ZPRD0277	1	
5	Bridge Card	7ZPRD0285	1	
6	Standard Spares	(see table)	1	

If you are missing any items, please notify your dealer immediately.

TABLE OF SPARE PARTS

Name of Parts	Type	Quantity	Description		Part Number
Fuse	Glass tube 6.3A	2	F401	Display unit	5ZFAD00336
Fuse	Glass tube 5A	2	F402	Display unit	5ZFAD00045
Fuse	Glass tube 3.15A	4	F101, F102	Display unit	5ZFAD00382
Lamp	AS90140	3	PL1~3	Display unit	5WAAB00258

2.1.2 Planning

The layout for installing the R10X/R11X Radars should be planned to give the best operation and service aboard your particular vessel. In general, the Scanner Unit should be mounted as high as possible above the waterline. The Display Unit should be installed in a convenient viewing position from the helm.

A 15 meter length of Vinyl-covered, shielded, 14 conductor cable is furnished already wired with connectors for interconnecting the two main units (Scanner 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 Scanner Unit to the Display Unit should not exceed 20 meters. (see page 1-10 for 20 m cable assemblies)

A General System diagram is shown below.

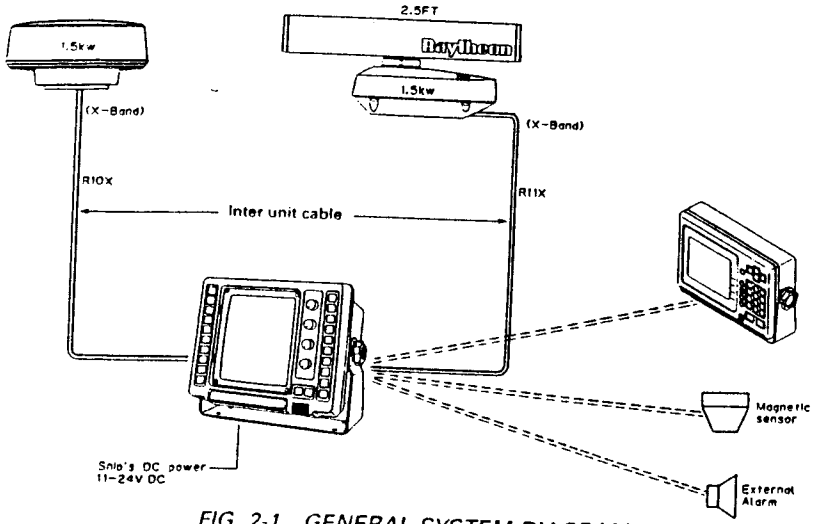


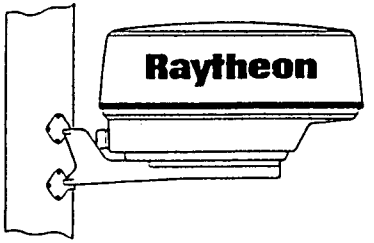
FIG. 2-1 GENERAL SYSTEM DIAGRAM

2.2 INSTALLATION OF RADOME SCANNER

2.2.1 Selecting the Location

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

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



OPTIONAL MAST MOUNT:

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

FIG. 2-2 UNIVERSAL MAST MOUNT

For sailboat installations, Raytheon offers a universal mast mount kit
(Product Code M88390). This optional mount fits masts with diameters from 2 ¼" and larger. When using the mast mount kit appropriately robust hardware should be used for the type and style of mast aboard the vessel.

If there is any doubt concerning the proper type of hardware, consult with your boat dealer or representative for recommendations.

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

2.2.2 Mounting the Scanner Unit

Using the outline drawing of the Scanner base as a guide prepare the mounting surface with the four mounting holes as required. Install the Scanner and secure it to the mounting surface. The correct mounting hardware is stainless steel hexhead bolts 5/16", 1 1/4" long with 18 UNC thread. A flat and lock washers should be used. The Scanner should be parallel to the ship's waterline and oriented so the cable inlet is pointed AFT.

When mounting the Scanner to a platform attached to a fly bridge, or superstructure, avoid placing the Scanner Unit at eye level. Although the radar transmits a 1.5 kW peak power the average power radiated is less than 0.5 watts. Therefore, the hazard from RF radiation levels is virtually nonexistent beyond 2 feet from the Scanner Unit.

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

CAUTION:

When mounting the scanner unit, please observe a minimum thickness of the metal mounting base. If the thickness of the mounting base is too thin, the modulator PCB may damaged (Fig. 2-3). The mounting base should be at least 0.25 inches thick metal.

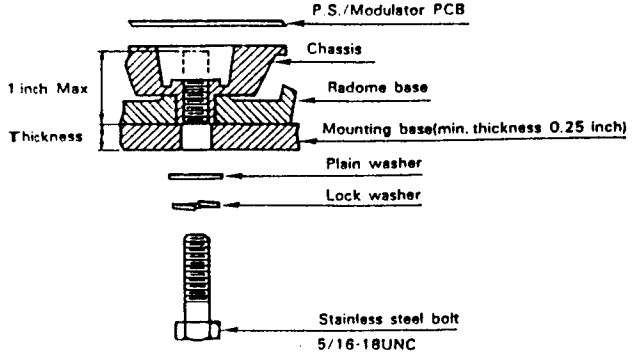
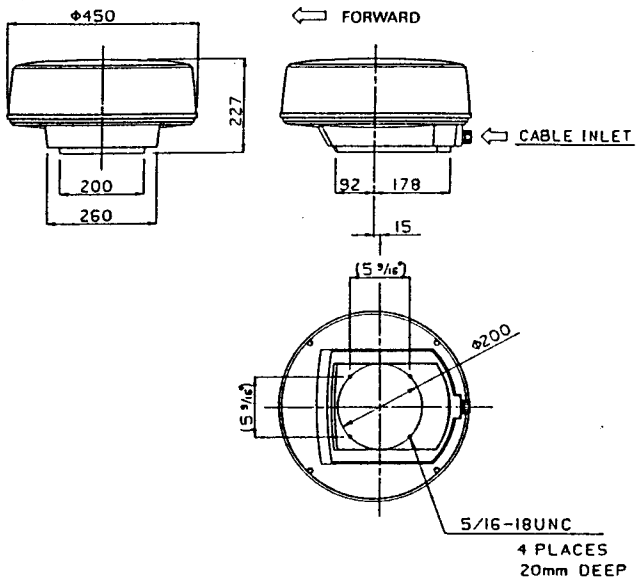


FIG. 2-3



WEIGHT APPROX. 5.5kg (12.1 lbs)

FIG. 2-4 OUTLINE DRAWING OF SCANNER UNIT

2.2.3 Connecting the Cable

A cable entrance is provided at the rear of the scanner unit.

If the unit is mounted on a hollow mast, the cable may be run up inside the mast and then be fed through the radar's cable entrance.

Connect the cable leeds onto terminal board TB101 and connector J101 as shown in Fig 2.5.

Refer to the following steps to connect the cable to the scanner unit. If there is any doubt concerning the connection of the wiring to the radar, a qualified electronics technician should be contracted to ensure proper wiring. Serious damage to sensitive circuitry could result from an inproper installation.

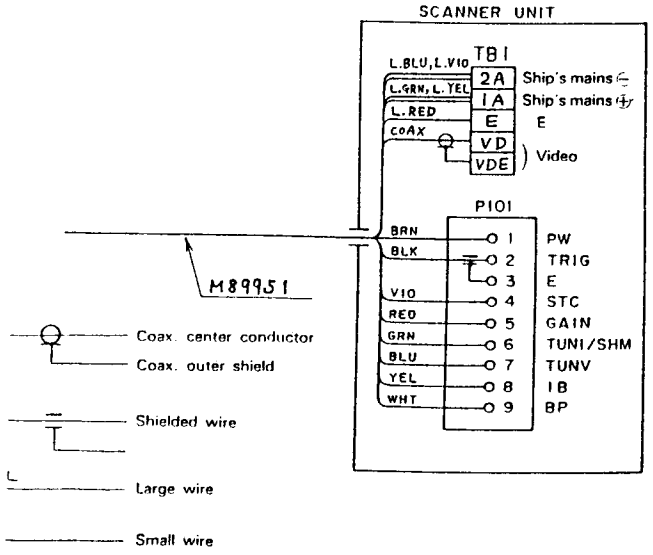
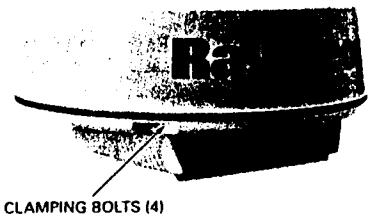
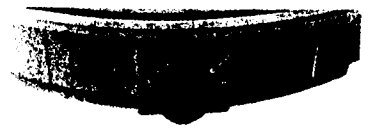


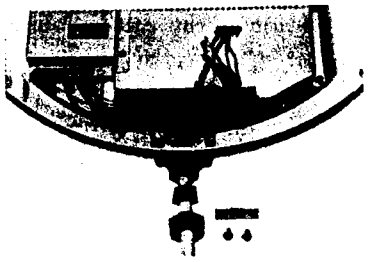
FIG. 2-5 TYPICAL WIRING AT R10X SCANNER



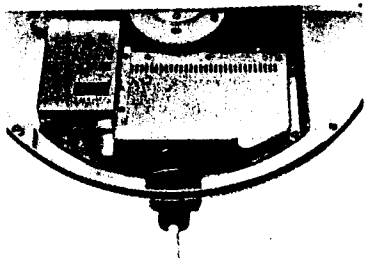
Step 1. Loosen the 4 clamping bolts securing the radome and remove radome.



Step 2. Remove watertight gland where the interconnect cable enters the scanner.



Step 3. Add the rubber grommet and insert the connecting cable. Secure the watertight gland.



Step 4. Connect the cable leads to terminal board TB1 and J101. Ground the shield with the lug to cable clamp bolt provided. Dress the wire harness with cable clamps or tie-raps as necessary for neatness.

FIG. 2-6 CONNECTING PROCEDURE FOR SCANNER UNIT

2.2.4 Interunit cable connectors

The connectors shown below are available from the Raytheon Parts Department and may be useful when installation requirements call for cable extensions or special cable arrangements.

RADAR CABLE CONNECTORS

	TYPE: STANDARD	TYPE: MATING INLINE	TYPE: CHASSIS MOUNT
RAYTHEON P/N:	G259062-1	G259063-1	G259064-1
JRC P/N:	5JCAA00265	5JCAA00421	5JCAA00222

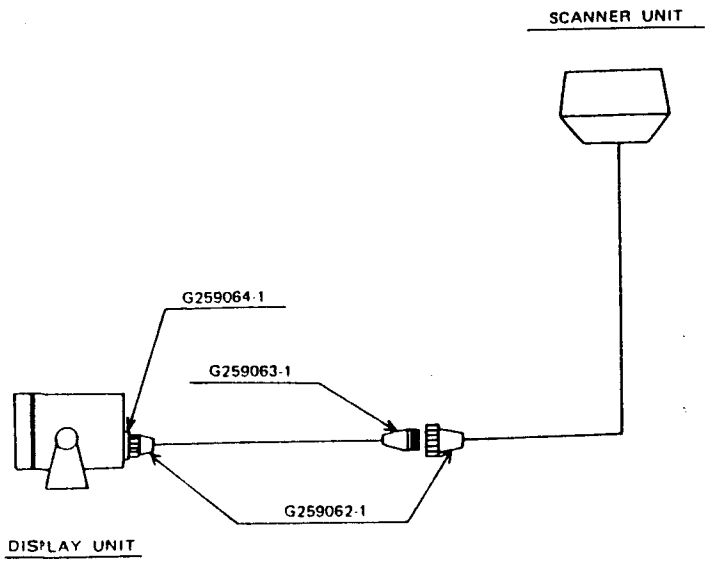


FIG. 2-7 TYPICAL INSTALLATION FOR SAILBOAT SHOWING INLINE CONNECTION AT MAST BASE

2.3 INSTALLATION OF OPEN ARRAY SCANNER UNIT

2.3.1 Selecting the Location

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

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

2.3.2 Mounting the Open Array Scanner Unit

Using the appropriate mounting dimension of Fig. 2-7 as a guide prepare a mounting platform surface on which to mount the radar pedestal unit. Assure that the platform has sufficient strength to support the scanners' 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.

Install the scanner unit onto the mounting platform with the cable entry and safety switch facing "AFT". Secure the scanner with the Proper Stainless Steel hardware to the platform.

If mounting directly to a deck top does not give sufficient height or clearance, a radar mast or pedestal may be used to elevate the unit. Refer to Fig. 2-8.

Note: ARRAY SWING CIRCLE IS 31"
PLEASE ASSURE ADEQUATE
CLEARANCE

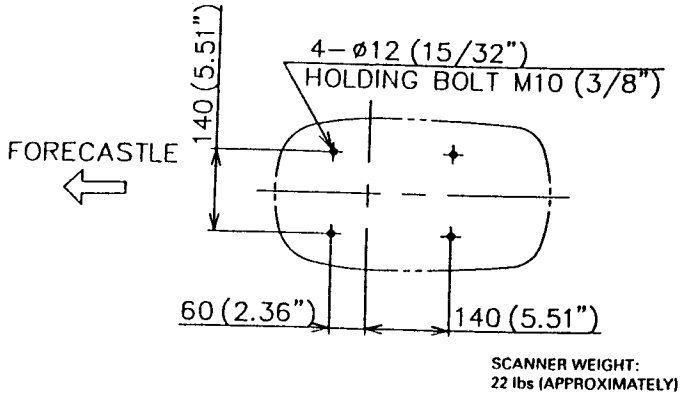


FIG. 2-7 MOUNTING DIMENSIONS

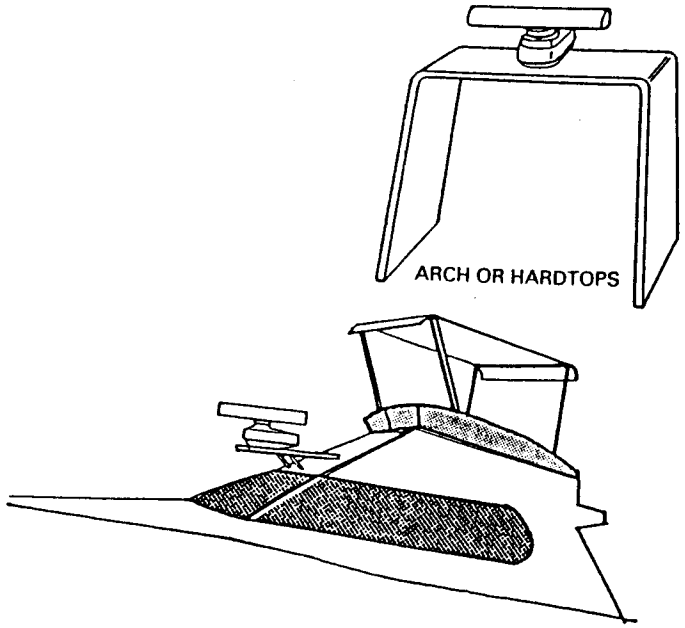
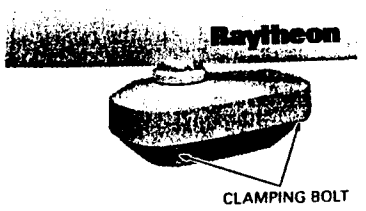


FIG. 2-8 TYPICAL MOUNTING LOCATIONS

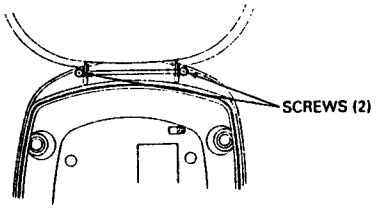
2.3.3 Cabling the Scanner Unit

The cable inlet of the scanner unit is located at the rear of the pedestal base assembly.

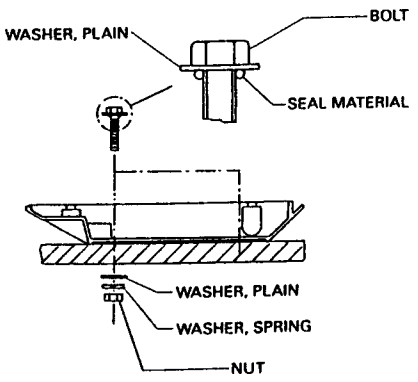
Step 1. Loosen the 4 clamping bolts and open the upper pedestal approximately 90°.



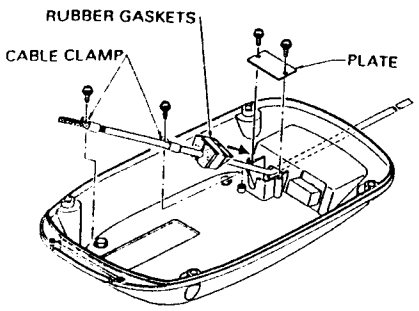
Step 2. Remove 2 screws and remove the upper pedestal.



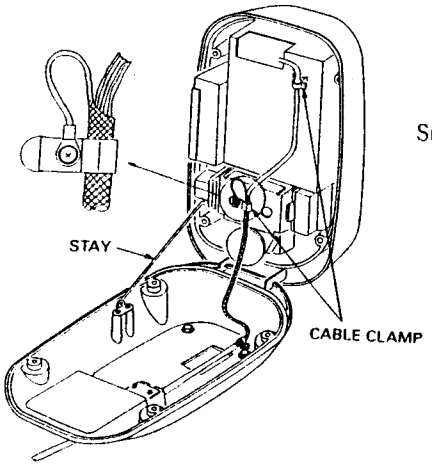
Step 3. To prevent water leakage, apply the seal material to the M10 × 50 bolts, and secure the lower pedestal. The bolts must be inserted from inside the lower housing so that the bolts do not touch the transmitter receiver unit.



Step 4. Reassemble the upper pedestal on the lower pedestal.



Step 5. Remove the 2 screws and remove the plate and the rubber gaskets. Remove 3 screws and remove 3 clamps.
Insert the cable into the pedestal. Add the rubber gaskets, and wind one turn around the rubber gaskets with vinyl tape, and secure the plate. Turn back outer braid and attach to the screw holding the metal cable clamp with a terminal lug.



Step 6. Connect the connectors P102, P103 and P108.

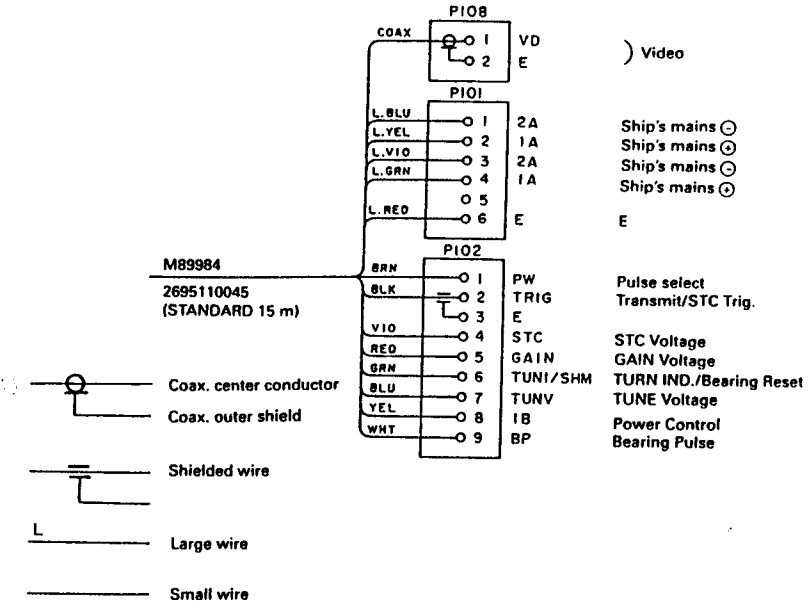


FIG. 2-9 TYPICAL WIRING AT RIIX SCANNER

2.4 INSTALLATION OF DISPLAY UNIT

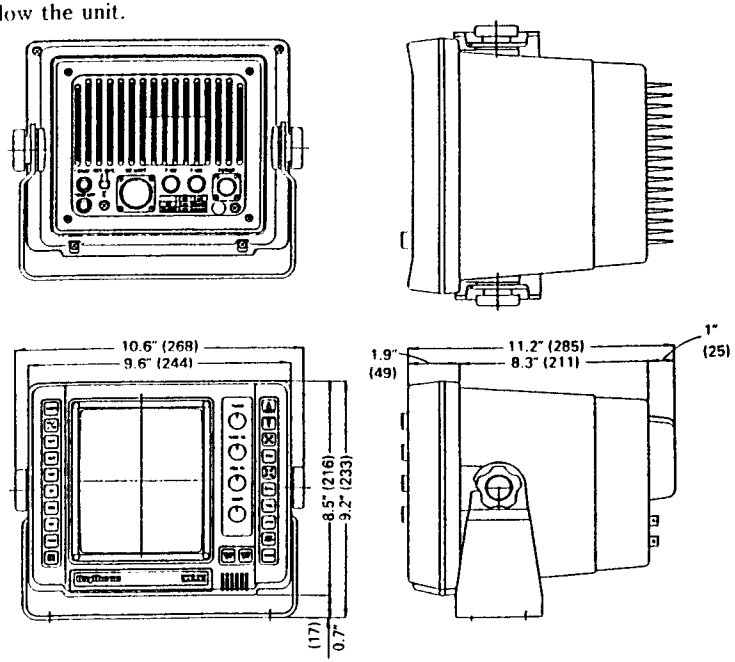
2.4.1 Selecting the Location

Ideally, the Display Unit should be located in the wheelhouse so the radar screen can be viewed when looking forward from the wheel. The Display Unit can be mounted on top of the chart table hung from the overhead, or installed against a bulkhead. If the display is mounted in an exposed over such as a flying bridge it must be protected from direct salt spray.

To minimize interference the location chosen should be at least 1 meter (3 feet) away from the ship's compass and the Loran C receiver.

2.4.2 Mounting the Display Unit

Using the dimensions from the outline drawing for the Display Unit shown below as a guide, install the Display Unit to the desired mounting surface. Note that the yoke of the Display Unit can be attached above or below the unit.



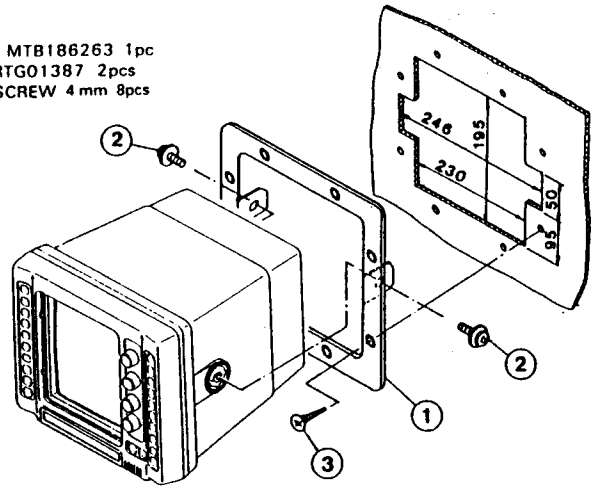
Dimensions are shown in inches (millimeters)

OUTLINE DIMENSIONS

CONSOLE MOUNTING THE DISPLAY UNIT

Mounting instruction For the R10X/R11X console mount kit M78843.

PARTS LIST
1. TRIMRING MTB186263 1pc
2. SCREW BRTG01387 2pcs
3. TAPPING SCREW 4 mm 8pcs



1. Locate a clear flat area at least 12" (H)×12" (W)×15" (deep). Make sure the area behind the cutout is clear of wires or other obstructions before proceeding.
2. Use flat TRIMRING to trace cutout hole. Drill a pilot hole inside the cutout area. Using a proper saw, cut along the inside of the cutout line.
3. Still using flat TRIMRING mark 8 holes for the frame mounting screws. Using a 3/16" bit, drill clearance holes at the 8 locations around the cutout area.
4. Remove the yoke knobs and mounting bracket from the radar.
5. Slide the TRIMRING over the radar as shown in the diagram. Use 6 mm screws (provided) to attach frame at yoke screw mounting holes.
6. Attach power, antenna cables, option cables and ground to the radar and insert the radar into the cutout. Secure the console frame using the eight #3 screws provided onto the panel.

2.4.3 DC Power Connection

A 2 m (6 ft.) power cable assembly is furnished for connecting the DC power to the radar. Longer cable runs may require larger wire sizes to minimize any voltage drop in the cable.

If the distance between the ship's main DC power source and the radar equipment is greater than 10 feet it may be necessary to move the source of the ship's power closer to the radar. In order to properly determine the supply cable wiring size to use, a graph is supplied in TABLE 2-1 for recommending an appropriate cable diameter. Begin by estimating the length of cable you will require between the ship's main power source and the radar. Select the wire size indicated by the distance and input voltage.

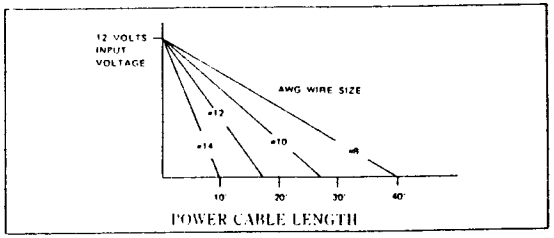


TABLE 2-1 POWER CABLE SIZE VERSUS LENGTH

Table 2-1 is a recommended guide for selecting power cable wire sizes based on the length of the cable to the ships' power connection point.

The Connection should be made at a power distribution panel, isolation switch, or to the battery. Check that all connections are clean and bright. The white wire must be connected to (+) positive battery terminal and the black wire to (−) negative battery terminal. The shielded wire should be connected to the ships RF ground.

Should the power connections be accidently reversed, protective fuse F1 (6.3A), located on the rear panel, will blow. Make sure that the input power leads are connected for correct polarity with a VOM. Replace the fuse.

***Note:** If ships input power is 24 or 32 V dc, F1 should be changed to a 3 amp fuse.*

GROUNDING THE RADAR SYSTEM

It is important for proper operation that an effective RF ground be connected to the radar system. You may elect to ground the radar by connection of the power cable assembly shield to the RF ground system

on your vessel or by connecting a 10 or 12 gauge wire to the ground on the rear of the display to be connected to the nearest ground point of the ship's RF ground system.

2.4.4 Connection to Loran C Receivers

The R10X/R11X display can show your latitude and longitude position (L/L) or time differences (TD's) when connected to a Loran C with the proper data output format.

The display is programmed to accept data from the loran in the N.M.E.A. 0182, N.M.E.A. 0183 formats, or JRC Formats.

The N.M.E.A. 0182 format will only provide a Lat/Long display for the radar. The N.M.E.A. 0183 data standard will, in most cases, provide Lat/Long, TD, Course and Speed data for the radar display.

To display the selected waypoint, the N.M.E.A. format must contain the "BWC" sentence. All of these data are contained in sentences "RMA" and "RMB".

Consult your Loran C manual for directions in obtaining the appropriate data output from the loran for your radar.

The loran connection to the Display Unit is made with a common BNC connector. RG 58 A/U Coax cable (50Ω) of any length may be used to complete the interconnection to the Loran C. Two wire, shielded cable may be used in place of the RG 58 Coax if necessary.

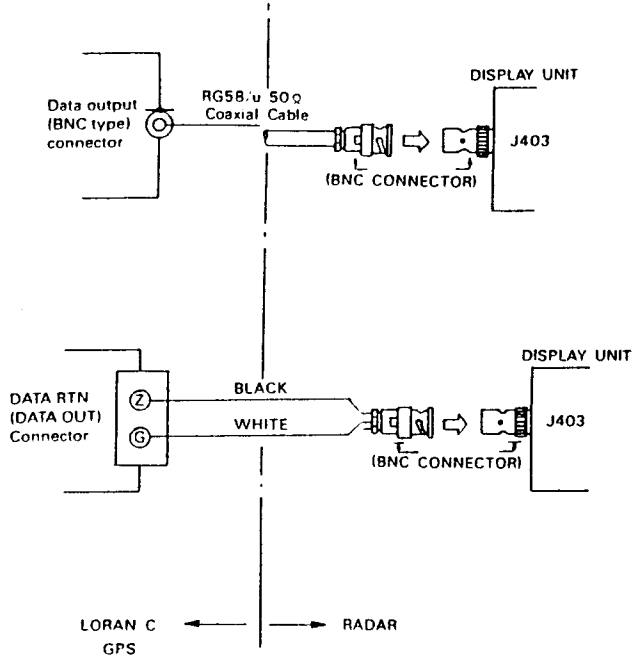


FIG. 2-12 SAMPLE NAVIGATOR CONNECTIONS

2.4.4.1 The BNC Connector Assembly Procedures

The following procedure will be helpful to illustrate how the BNC connector should be installed:

1. Strip and remove the coax outer vinyl cover for about 3/8" (9.6 mm)
2. Slide the BNC connector fastener ① onto the coax. Add the washer ③.
3. Insert the rubber gasket ④ and clamp ⑦ (as shown).
4. Peel back the shield of coax and pull back over the clamp. Trim the excess shield material so that the shield is only covering the clamp.
5. With a knife or other suitable tool, remove 1/8" (3 mm) of dielectric material ⑨. Neatly dress and tin with solder the center conductor of the cable. (Avoid using excessive solder.) Now solder the terminal ⑧ onto the tinned conductor. Again, avoid using any excessive solder.

6. Install the connector shell into the cable and thread the fastener tightly into the connector shell.
   Note: *The shield of the coax should be tightly bonded between the clamp and shell body.*
7. The connection should be checked with a multimeter for possible short circuits and continuity, as a final test.

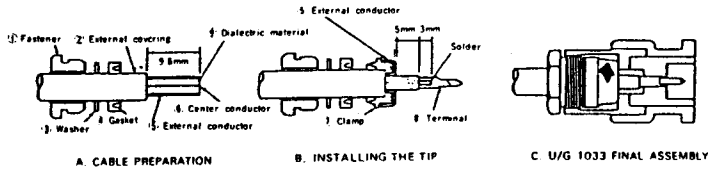


FIG. 2-13 DIAGRAM OF BNC CONNECTOR ASSEMBLY

2.4.5 Installation of the Magnetic Flux Sensor

The sensor should be placed in a location on the vessel where magnetic interference is least and where it will remain undisturbed. The optimum compass location is as close as possible to the vessel's center of pitch and roll. On steel vessels, the sensor may need to be mounted above the deck enclosure on a mast and should be between one meter and three meters from the main structure to avoid magnetic disturbances.

1. Locate a suitable installation area, free from magnetic interference.
2. Fix the sensor to a vertical bulkhead using brass or stainless steel screws.
3. Adjust case of the sensor so the pointer on the top leading edge is in fore and aft direction. Tighten main bracket bolt to lock sensor in place. To re-align through 90 or 180 degrees, remove sensor lid (4 screws), release printed circuit board (PCB) by removal of four pillars and gently rotate PCB assembly until it is fore and aft. Replace pillars and lid with arrow facing forward.
4. The transit screw is located at the base of the sensor. This locks the gimbal during shipment for protection. Ensure transit screw (white nylon screw at center of base) is withdrawn five full turns to allow full mechanical movement of coil assembly. If unit is exposed to the weather remove screw, shorten by 10 mm (3/8"), replace and tighten.

Note: *Only fluxgate sensors which have NMEA0183 output will work with R10X/R11X radars. See your dealer if there is any question of sensor compatibility.*

5. Install a terminal strip or junction box (not supplied by Raytheon) in any convenient place to allow system connection.
6. Even though the sensor is internally fused, it is advisable to connect the system through a fused supply. It may be wired either from an existing switch panel or separately. Always connect via the junction box. As the current drain is low, the compass can be left on with very little battery drain. Wiring details are provided in Fig. 2-14.

Minimum Mounting Distances

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

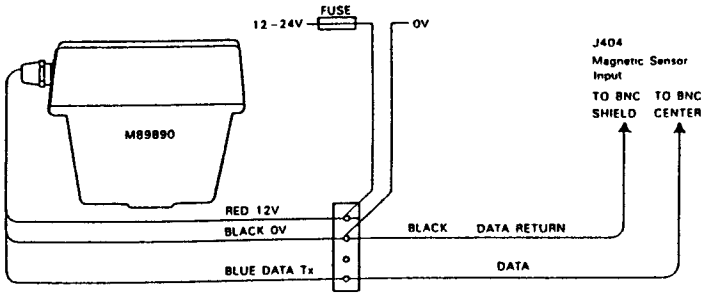
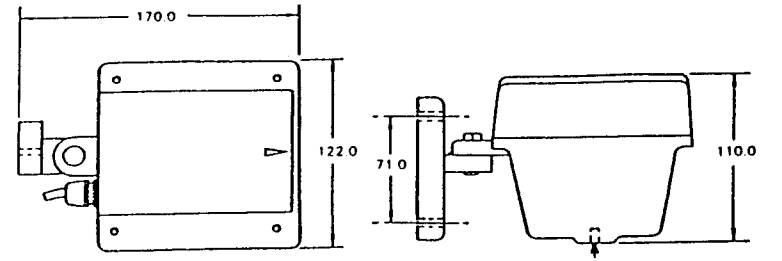
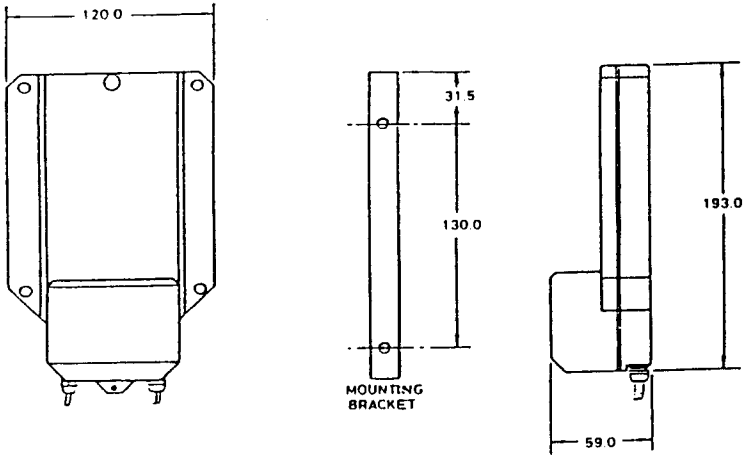


FIG. 2-14 GENERAL MAGNETIC FLUX SENSOR WIRING

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

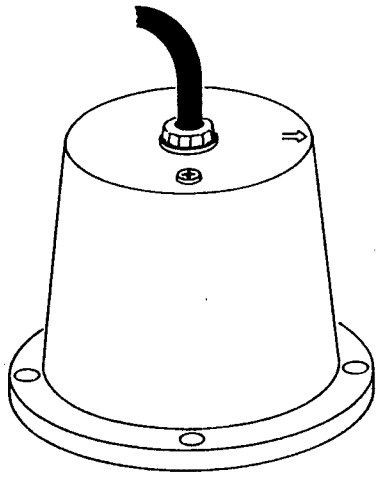


ALLOY HOUSING



PLASTIC HOUSING

FIG. 2-15 TYPICAL MAGNETIC FLUX SENSORS OUTLINE DIAGRAMS

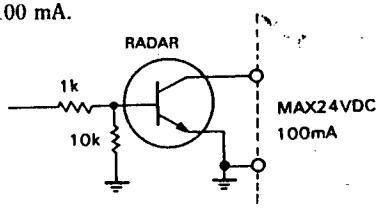


ALTERNATE MAGNETIC SENSOR OUTLINE DIAGRAM

2.4.6 External Alarm

The radar can operate an external alarm device through the connector on the rear panel designated for this purpose. Devices connected to this output are limited to an operating voltage less than 24 VDC and a maximum current of less than 100 mA.

The external alarm drive circuit is shown for reference.



A miniature phono plug is required for inter-connecting to the external alarm connector.

2.5 INITIAL OPERATION AND CHECKOUT

2.5.1 Inspection After the Installation

After completing the installation and prior to energizing the equipment, it's a good idea to recheck that all the steps of the installation have been completed in accordance with the instructions.

In particular, inspect to insure that the cables were not accidently crimped or damaged and that the ships input voltage is connected correctly; that the mounting bolts of the scanner unit are tight; the cable gland is tightly sealed at the Scanner Unit, that the antenna connections are correct, and the cable shield is connected properly to RF ground.

2.5.2 Operational Checkout

Activate the power circuits to the radar and switch the radar into standby (STBY). After approximately 90 seconds "READY" will be displayed on the CRT. During warm up the time will count down to zero.

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

Press the X-MIT switch to "ON" and observe 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 range markers are focused properly.

Operate the [BRIL/DIM] key. Check for multiple picture intensity level operation.

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

If readjustment of the Display Unit is required follow the instructions for alignment in section 5 (pages 1 to 5) adjustment and faultfinding.

2.5.3 Post Installation Set up Adjustments

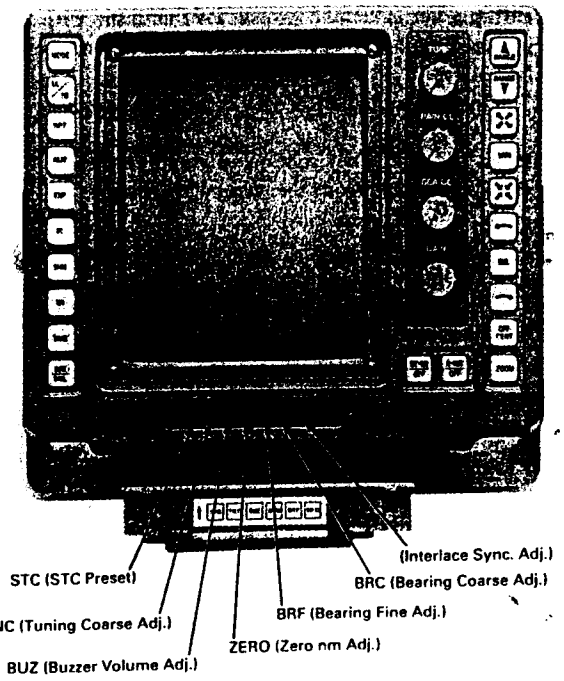
Following the operational check, two alignments A) and B) are normally required for proper operation.

They are: A) Relative Bearing Alignment
B) Display timing (0 nm adjustment)

Other adjustments are:
C) Tuning preset
D) STC (Sea-Clutter preset)
E) Buzzer Volume Adjustment

Access to these adjustments can be made by pressing in lightly on the Logo overlay panel on the display front panel and sliding the panel downward. Remove the rubber protector seal to expose the adjustment controls by grasping the end tab and gently pull the seal from the cutout.

The set-up adjustments will appear as shown on the diagram below.



POST INSTALLATION SET UP ADJUSTMENTS

A) Relative Bearing Alignment [BR.C], [BR.F]

This alignment should be carried out when the installation is complete to ensure that targets on your display appear at their proper bearing with respect to the ship's heading.

Proceed as follows:

① Identify a suitable target (e.g., ship or buoy, etc.) preferably between 1.5 and 3 nm in range on the screen.

(2) Use an accurate visual means to establish the relative bearing of the target (ie., pelorus or lining up bow on target heading).
(3) Put the first EBL marker on the target.
(4) Set BR.F (RV2) at its mid position.
(5) Press the [EXP] key until the buzzer sounds and the display on the screen reads BEARING ADJUST.
(6) By turning the coarse bearing adjustment BR.C (RV1), the first EBL marker is rotated. Adjust RV1 until the EBL is on the bearing to the target ±10 degrees, and the beeper sounds continuously.
(7) Set the fine adjust BR.F (RV2) for the correct bearing to within ±1 degree.
(8) Press the [EXP] key continuously until the words BEARING ADJUST disappear from the screen to restore the normal display mode.

B) Display Timing (0 nm Adjustment) [ZERO]
This is a radar timing adjustment. It is necessary to ensure targets are at their proper range on the display unit. Incorrect timing is mostly noticed on the 1/8 nm.
(1) Set the range at 0.125 nm.
(2) Locate a straight dock, seawall or bridge approximately 0.03–0.1 nm away on the display. Observe whether the radar target is straight on the display. If not, adjustment is indicated.
(3) Adjust [ZERO] (RV3) so that the object appears to be straight on the display.

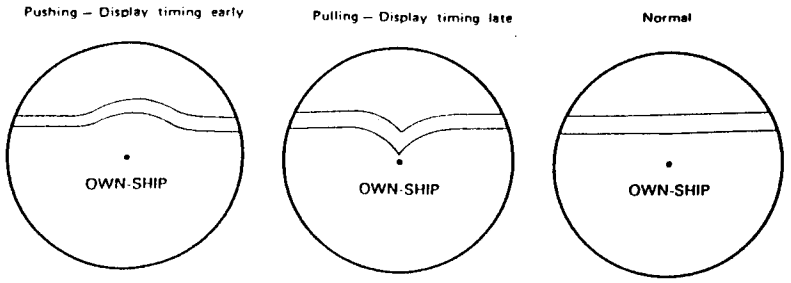


FIG. 2-16 0 NM ADJUSTMENT

The remaining adjustments affect operating conditions that are normally set at the factory and typically will not require any further adjustments. However, these settings should be checked at installation so that optimum operation will be realized.

C) Tuning Preset [TN.C]
Normal tuning of the radar should be indicated on the Radar Display by seeing maximum target returns with the "TUNE" control at its mid scale position.
After about 10 minutes of operation:
(1) Set radar to 6 nm range scale.
(2) Set GAIN for normal operation level.
(3) Set SEA CLUTTER, RAIN CLUTTER, IR to "OFF".
(4) Set TUNE control of the front panel, so that tune control indicator is centered in its range. Adjust RV5 (Coarse Tune) very carefully for maximum target on the CRT Display.

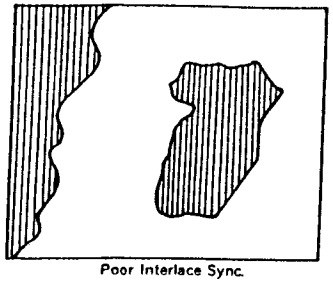
D) STC Preset [STC]
(1) Set Range to 12 nm.
(2) Set the Gain Control fully clockwise.
(3) Turn the Sea-Clutter control fully clockwise and adjust STC (RV6) so that no background noise appears in the range of 0 to 4 nm. In some conditions the STC action range may be extended even further to compensate for severe sea states.

E) Buzzer Volume Adjustment
At the time of shipment, the Buzzer Volume has been adjusted to the maximum position. When it is necessary to lower the volume, adjust [BUZ] (RV4).

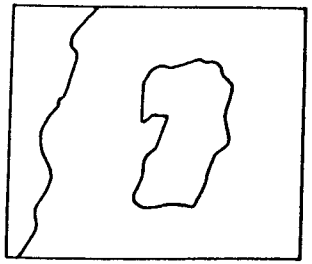
F) AVR Voltage Adjustment
AVR Output Voltage adjustment RV1 is on the PC501 the power supply PCB.
Adjust RV1 so that the voltage between TP1 (positive) and Ground (negative) will be +5.0 V.

G) 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.

Adjust RV7 on the ADJUSTMENT PCB for proper blending while looking at the video pattern.



Poor Interlace Sync.



Proper Adjustment.

H) Comparator level adjustment

① Set the Gain and STC controls on the front panel full counter-clockwise.
② Set the range scale to maximum. (16/24)
③ Set EXP to ON and IR to OFF.
④ Adjust RV2 on the Receive Buffer PCB (CQA-116) so that the noise on the screen just disappears.
⑤ Press EXP switch to OFF.
⑥ Press IR switch to ON.
⑦ Turn the Gain control on the front panel fully clockwise.
⑧ Adjust RV1 on the Receive Buffer PCB (CQA-116) so that the receiver white noise becomes slightly visible.

SECTION 3

OPERATION

3.1 OPERATING CONTROLS

Generally the operation of the R10X/R11X is easy and straight forward. However, the navigator who is most familiar with the panel layout and understands the functions of the various controls will be able to obtain the best performance from his equipment.

3.1.1 Layout of the Controls

The layout of controls is shown in Figure 3-1.

3.1.2 Functions of the Controls

① POWER [ST-BY/OFF], [X-MIT/OFF] KEYS

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 "ready" and available for operation.

Press the [X-MIT/OFF] key (with the word ST-BY displayed), puts the radar into the "transmit" mode. The antenna will begin rotation, and targets will be displayed on the screen.

By pressing the [ST-BY/OFF] key again, the radar will return to the "stand-by" 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 alpha-numeric information on-screen will extinguish.

② RANGE SCALE UP AND DOWN KEYS

By pressing the UP [▲] or DOWN [▼] key, the desired range scale can be selected.

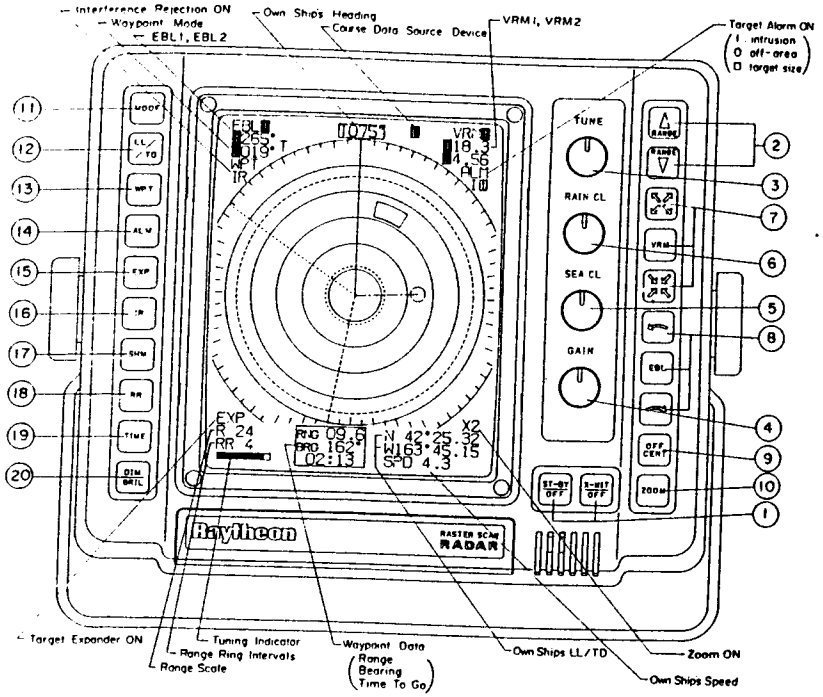


FIG. 3-1 LAYOUT OF DISPLAY AND CONTROLS

When the radar is turned on, the range displayed will be on the same range scale that was previously in use when the radar was turned off. During range changes the UP [▲] and DOWN [▼] 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 3-1 shows this relationship.

TABLE 3-1 RELATION OF RANGE, RINGS AND PULSE LENGTH

Range (nm)	Range Ring Interval (nm)	Number of Rings	Pulse Repetition Frequency (Hz)	Transmitting Pulse Length (μs) R10X	R11X	Bandwidth of IF Amplifier (MHz)
0.125	0.0625	2	2250	0.08	0.08	10
0.25	0.125	2	2250	0.08	0.08	10
0.5	0.25	2	2250	0.08	0.08	10
0.75	0.25	3	2250	0.08	0.08	10
1.5	0.25	6	2250	0.08	0.08	10
3	0.5	6	750	0.5	0.7	3
6	1	6	750	0.5	0.7	3
12	2	6	750	0.5	0.7	3
16 (R10X)	4	4	750	0.5	—	3
24 (R11X)	4	6	750	—	0.7	3

③ TUNE CONTROL

The tune control is a variable control used to tune the receiver in the antenna unit for maximum targets on the display. If there are no targets available, this control can be used to tune for maximum sea clutter. The on-screen indicator will show the tuning peak condition by displaying a maximum of bars. The tuning adjustment of the radar should be normally performed on the longer range scales from 3 to 24 nm but should always be re-checked for peak indication on the range scale you are using.

④ GAIN CONTROL

The variable gain control adjusts the gain of the receiver by increasing or decreasing the strength of the incoming video and noise. The gain control level is usually set for the best target presentation on the range scale selected with a slight noise speckle in the background. The gain control level may be reduced slightly on the short ranges for improved clarity, and increased as necessary on the long ranges for more sensitivity. You should use caution when setting the gain level. If the gain is reduced too much, small or weak targets may be mis-

sed, and if the gain is set too high, the CRT may be saturated with noise, making target observation difficult.

⑤ SEA CLUTTER CONTROL

The variable sea clutter control, also known as (STC), is used on the short ranges to suppress the effects of sea clutter close to own ship by reducing the nearby gain. The sea clutter should be set to the point where nearby clutter is reduced to small noise dots and small target echoes can still be distinguished. If the STC level is set too high, some small, weak targets may be missed.

The Gain and STC should be checked for optimum settings whenever new range scales are selected to assure the best performance in all conditions.

⑥ RAIN CLUTTER CONTROL

The variable rain clutter control, also known as (FTC), is used to reduce large undesirable echoes from clutter such as rain or snow which may obscure smaller echoes in their vicinity. The rain clutter control is normally adjusted to reduce such echoes so that only the leading edges of the larger echoes are displayed, while the smaller echoes are only slightly effected. If the rain clutter is advanced too far. some small, weak targets may be suppressed by the controls effect.

⑦ VARIABLE RANGE MARKER (VRM) CONTROLS

The display unit has 2 VRM's which are used individually to obtain accurate range measurements to targets or land masses. When the [VRM] key is pressed for a short time, VRM1 will be displayed as a dashed ring on-screen and VRM1 will be displayed in the upper right corner of the display. VRM1 is displayed as a "Dashed" ring. By pressing the [Increase] [▲] or "Decrease" [▼] key, the VRM range is changed and the VRM distance will be displayed on the CRT, following the VRM1 characters, in nautical miles. If you wish to move the VRM ring more quickly, press the [VRM] key while pressing the "increase" [▲] or "decrease" [▼] key for faster speed of movement of the VRMs on the screen.

If the [VRM] key is depressed again for a short time, the VRM ring will be turned off. The selection of which VRM will be controlled is made by holding the [VRM] key depressed until the buzzer sounds. The second VRM will become activated. VRM2 is displayed as a "dotted" ring. The VRM being controlled is displayed with a

highlighted block character "1" or "2" after "VRM" in the upper right corner of the display.

⑧ ELECTRONIC BEARING LINE (EBL) CONTROLS

This display unit has 2 EBL's which are used to take accurate bearing measurements to targets or points of land. If the [EBL] key is pressed for a short time, EBL1 will be displayed as a "Dashed" line. The EBL1 bearing can be displayed in Relative, True, or Magnetic degrees depending on the mode selected with the mode key. By pressing the clockwise [↷] or counterclockwise [↶] key, the EBL can be rotated in the corresponding direction, and the bearing of the EBL will be displayed in the window on the screen at the top left side under the EBL characters. If you wish to move the EBL more quickly, press the [EBL] key while still pressing the direction key. The EBL will speed into "overdrive" mode.

The digits of the bearing display will be followed by a "T" when the bearing is "True", an "M" when the bearing is "Magnetic", and, when the bearing is "Relative", will have no letter displayed.

In order to obtain "True" or "Magnetic" bearings, the radar must be connected to a Navaid (Loran C or GPS), or a Magnetic Flux Sensor.

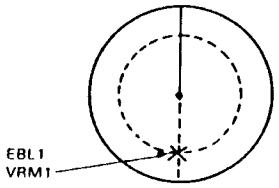
If the [EBL] key is again depressed for a short time, the EBL1 will be turned "off". The selection of which EBL will be controlled is made by holding the [EBL] key depressed until the buzzer sounds. The second EBL will be activated and displayed. EBL2 is displayed as a "dotted" line. The EBL being controlled is displayed after the characters "EBL" in the upper left corner of the display by a highlighted character [1] or [2].

⑨ OFF CENTER KEY

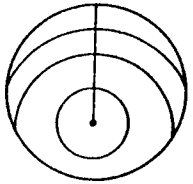
The Off Center Mode lets you position the radar picture center at another point on the display so you can have a greater view in the direction of interest.

When the [OFF CENT] key is pressed, the position of own ship can be set anywhere on the screen up to 66% of the radius. The Off Center Origin is set using the VRM1 and the EBL1. To use the Off Center feature set the EBL1 and VRM1 intersection to the desired location for the Off Center sweep origin. Press the Off Center key to turn "on" the Off Center mode. The origin of the radar sweep will now shift to the intersection point of the EBL1 and VRM1. To turn off Off Center and recenter the sweep, press the [OFF CENT] key again.

The Off Center Mode does not operate on the 16 nm (R10X) or 24 nm (R11X) range and cannot be used together with the Zoom mode.



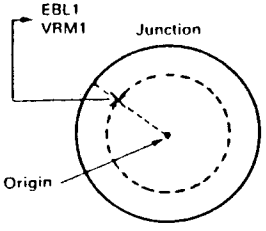
Setting Off Center


Off Center Mode

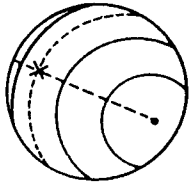
⑩ ZOOM KEY [ZOOM]

The Zoom mode can be used to magnify any designated area of the display by "two times". When the ZOOM key is pressed, "X2" will be displayed on the lower right of the screen. The area between own ship and the designated location can be magnified by a factor of 2 times by using the designated location as the starting point without changing the range in use. The zoom location can be set by using the VRM1 and the EBL1 intersection point. Once you have set the EBL1 and VRM1 intersection, press the [ZOOM] key to turn "ON" Zoom mode. To assist you in maintaining proper range determination, the fixed range rings are also turned "on" automatically.

Zoom mode can provide a quick means of getting a closer look at a channel entrance, for example, but for navigation purposes it is recommended that you choose the next lower range scale and use the Off Center feature for the same effect. By alternately pressing the [ZOOM] key, the function can be turned "on" and "off". Zoom does not operate on the 1/8 nm range and cannot be used together with "OFF CENTER".



Setting Zoom Mode


Zoom Mode On

⑪ MODE KEY [MODE]

When connected to a navigator such as a Loran-C or GPS, the X series radars have three display modes available. They are "Relative", "True" and "Magnetic". The "Relative" mode allows the operator to determine bearing to objects displayed on the radar screen relative to his own heading. These bearings are taken by utilizing the EBL's (Electronic Bearing Lines). All of the bearing data acquired in the relative mode is referenced to the "SHM" (Ship's Heading Marker).

When planning to plot information from the radar display to a chart, it will be helpful to have the bearing information readouts be in True or Magnetic. This data may be obtained directly from the radar by selecting the "True" or "Magnetic" mode. Press the [MODE] key to make the selection of True, Magnetic or Relative by sequential presses of the key.

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 usable for the radar display modes. Pressing the [MODE] key places the radar in the "True" mode of operation. In this mode, EBL1 and EBL2 bearings are indicated in true bearing as determined by the NAVAID input. The character "T" will be displayed to the right of the EBL bearing characters to indicate the type of bearing input. The ship's COG data from the NAVAID is added to the radar display directly above the SHM and the vessel's speed is shown in the lower right of the display in this mode.

Pressing the [MODE] key again places the radar in the "Magnetic" mode of operation. In this mode, EBL1 and EBL2 bearings are indicated in magnetic bearing as determined by the NAVAID or optional magnetic flux sensor input. The character "M" will be displayed to the right of the EBL characters to indicate the type of bearing input. The ship's COG data from the NAVAID is added to the radar display directly above the SHM and the vessel's speed is shown in the lower right of the display.

When the flux sensor data is available, the "M" character will be displayed in highlighted block form [M].

(1) STANDARD MODE
EBL's with on-screen readouts, give relative bearing data.

(2) TRUE MODE
EBL's with on-screen readouts, instantly show true bearings to targets. Own ship's true bearing and own ship's speed are shown.

(3) MAGNETIC MODE
EBL's with on-screen readouts, instantly show magnetic bearings to targets. Own ship's magnetic bearing and own ship's speed are shown. Magnetic bearing data is best when inputted from the optional magnetic flux sensor.

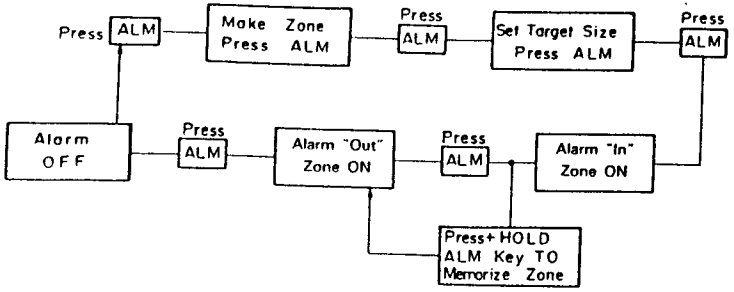
⑫ LL/TD KEY [LL/TD]
The [LL/TD] key is a three position key which selects Latitude/Longitude, Time Difference or OFF for the display. Just press the key for your preference. L/L or TD data can only be displayed if you are connected properly to a Loran C or GPS Receiver.

⑬ WAYPOINT KEY [WPT]
When the WPT (waypoint) key is pressed, and the radar is connected to a NAVAID with the necessary data output, a waypoint symbol at the bearing and range to the selected waypoint can be presented on the radar display. Numeric data, showing the waypoint's Latitude/Longitude, bearing and range, and own ship's speed, appears at the bottom of the display. "WPT" characters in the upper right corner of the display indicate that the waypoint mode is ON.
If the radar is receiving course data from the optional magnetic sensor, the waypoint bearing data from the loran must be in "Magnetic" to enable the mode.
If the optional magnetic sensor is not used, the loran COG (course) data can be in "True" or "Magnetic" as determined by the Loran-C. The waypoint mode will be enabled when the true or magnetic mode matches the loran course input.

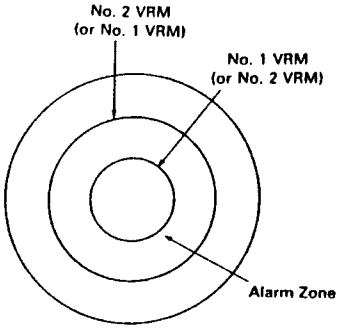
If the waypoint is not within the selected range scale of the radar, only the dashed line indicating the bearing to the waypoint can be displayed. When the waypoint appears on the range scale in use, the waypoint is displayed as a ◌ with the center (own ship) and the waypoint interconnected by a dotted line.
Should data be lost from the heading sensors or from the Loran C, the WPT mode will disabled and the message "NO DATA" will appear on the display.
The Waypoint mode cannot be used if there is no course data from the Loran Navigator, or magnetic sensor or if there is no BWC sentence data available from the Navigator.
When using the WPT mode on higher speed vessels the waypoint symbol will tend to lag behind the actual waypoint. Often this condition is due to the lag in getting data from the Loran and is more noticeable on the shorter range scales.

⑭ THE TARGET ALARM KEY [ALM]
This radar has two types of alarm zones; the IN (approach) alarm and the OUT (leave) alarm. The IN alarm is effective for alerting the operator to targets approaching own ship. An "OUT" alarm is an alarm that sounds when the targets leave a prescribed set zone. The OUT alarm is useful for monitoring anchorage conditions, or when pair trawling, or for towing operations.
The [ALM] key turns the Alarm mode "ON" or "OFF". When the Alarm mode is ON, "ALM I" or "ALM O" is displayed on the upper right side of the screen.
The alarm is preset to detect radar targets above the noise. If sea clutter or incidental weak echoes trip the alarm, the level of targets can be selected by the operator to avoid false alarming.
The alarm zones are set by positioning VRM1 and VRM2 circles at the desired alarm distances from own ship.
When sector alarms are desired, the sectors are formed by positioning EBL1 and EBL2 to define the borders of the desired alarm zone sector areas.

ALARM KEY OPERATION



MAKING THE ALARM ZONE:



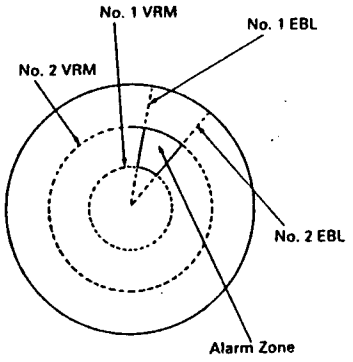
The most simple and effective alarm zone is made by setting VRM1 close to own ship and VRM2 to the outside desired safety zone distance that you wish to maintain. So, just press the [ALM] key. The "MAKE ZONE" menu appears. Turn on VRM1 and set the desired distance. Turn on VRM2 and set that distance. Press the [ALM] key again. The Alarm Zone will now be displayed as solid rings near the VRM ring positions.

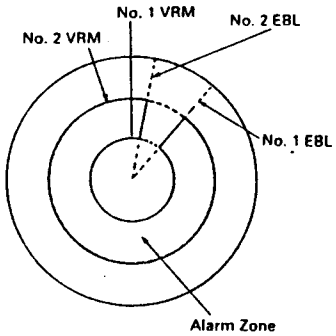
The "SET LEVEL" menu appears. Target level 4 is automatically chosen for you. If you want to select a higher (stronger) level, press the ▲ key to pick target size detection between levels 1 and 7. You can use the ▼ key to choose more sensitive detection levels if you desire. When the selection has been made press the alarm key [ALM] again and the alarm zone is now "on" using the "IN" type of zone. Targets at the programmed level entering into the zone will sound the alarm.

MAKING SPECIAL ZONES (Sectors)

To make sector type zones just turn "on" EBL's 1 and 2 together with VRM's 1 and 2. The only special rule for making sector zones is that the left edge of any sector zone is set by EBL #1. The right side is set by EBL #2. The sector is then the combination of EBL's 1 and 2 and VRM's 1 and 2.

The diagram below demonstrates the area of the alarm zones when EBL1 and EBL2 are reversed.





One use for a sector zone is to draw the zone around an island or fixed target when you plan to anchor. Set the zone for an "OUT" alarm. If the anchor drags, the alarm will sound when the fixed target tries to leave the zone.

ALARM ZONE MEMORY

Most operators prefer to use the same alarm zone most of the time and occasionally will design special alarm zones as the need arises. These radars have a built-in memory to retain the zone that you use most often so that it is not necessary to always remake alarm zones.

MEMORIZING AN 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 alarm key until the display beeps and the alarm characters on the screen right side become highlighted. At this time the zone will have been memorized for use any time.

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

⑮ TARGET EXPANDER KEY [EXP]

The [EXP] (target expand) key, allows the operator the ability to make small targets appear larger on the display for better viewing. By alternately pressing the [EXP] key, the function can be turned on and off.

⑯ INTERFERENCE REJECTION KEY [IR]

The [IR] (interference reject) key, when activated, reduces noise on the display caused by other radars operating nearby in the same frequency band. This function is also effective in reducing some background noise. When active, the "IR" characters are displayed below the EBL characters at upper screen left. By pressing the [IR] key again, the IR function is turned off.

If you are navigating in a port area serviced by a "RACON" beacon you should turn "off" the [IR] mode to see the racon signals.

⑰ SHIP'S HEADING MARKER KEY [SHM]

Normally the ship's heading marker is continuously displayed to show own ship's heading on the radar screen. When the [SHM] (Ship's Heading Marker) key is pressed and held, the ship's heading marker will temporarily not be displayed. When the key is released again, the ship's heading marker will again be displayed. This feature allows small targets, under the Heading Line, to be clearly seen.

⑱ RANGE RINGS KEY [RR]

The [RR] (range rings) key turns on or off the display of the fixed range rings. The fixed range rings are usually used to "estimate" the distances to targets. The interval between the range rings is displayed on the lower left of the screen just below the range scale indicator for your reference.

⑲ TIMED TX KEY [TIME]

The [TIME] key allows the operator to program the radar to automatically transmit for a programmed period and return to standby for a prescribed period. This permits the user to maintain a radar watch while minimizing the power consumption experienced during full transmit operation. To use the Time TX mode, proceed as follows:

(1) Press the [TIME] key
The menu screen displays "SET TX PERIOD 10, 20, 30 SCANS".

(2) Use the range ▲/▼ keys to select the desired number of radar scans during transmit operation. The selected scan period is displayed in highlighted numbers.

(3) Press the [TIME] key again.
The menu screen now displays "SET STBY PERIOD 3, 5, 10, 15 MIN".

(4) Set the standby time using the range ▲ or ▼ key.
The selected standby time is displayed in highlighted numbers.

(5) The menu will disappear after 7 seconds.

TO TURN "TIMED TX" MODE ON

Press and hold the [TIME] key until you hear the beep and the "Timed TX ON" message is displayed.

TO TURN TIMED TX MODE OFF

Press and hold the [TIME] key until the beep is heard and the "Timed Tx OFF" message is displayed. The [TIME] key needs to pressed for only about 3–5 seconds to turn the mode ON or OFF, and the time mode can be turned off any time the operator desires by pressing and holding the [TIME] key until the OFF message appears.

⑳ BRILLIANCE/DIMMER KEY [DIM/BRILL]

This [DIM/BRIL] (DIMMER/BRILLIANCE) key is used to adjust the brilliance of the screen and also the illumination of the front panel. To adjust, the brilliance level proceed as follows:

(1) Press the [DIM/BRIL] key.
The menu screen displays "BRIL (1–8) ▲ ▼".

(2) Press the range [▲] or [▼] keys to adjust to the desired brilliance level 1 (Low) to 8 (Maximum).

(3) Press the [DIM/BRIL] key again to adjust the key panel backlighting.
The menu screen now displays "DIM (0–7) ▲ ▼".
(4) Press range [▲] or [▼] keys to set the desire illumination level. The backlighting level is displayed after DIM characters on the screen between 0 (off) to 7 (maximum).
(5) The menus will disappear after 7 seconds.

3.2 USING THE CONTROLS

3.2.1 TUNE Control

Radar magnetrons, during their aging process, may take several minutes to completely stabilize on frequency. So, after switching to on and tuning initially, the tuning should be rechecked after the first 10 minutes:

Symptoms that the equipment may be out of tune are a lack of distant echoes, or sometimes, the appearance of double echoes (one echo behind the another). Normally it is possible to "fine-tune" the radar by selecting a comparatively weak echo and then set the TUNE control level where the strongest echoes are displayed.

3.2.2 GAIN Control

The correct setting of the GAIN control is for a light background speckle to be just visible on the screen on the long range scales. The equipment is then in its most sensitive condition. Objects will be detected at the greatest possible range. With too little gain, weak targets may be missed and not displayed, with a decrease in detection range. With excessive gain the difference between echoes and background noise will be substantially reduced, making target observation more difficult.

In areas around strong targets (buildings, hills, towers, etc.), the gain might be temporarily reduced to clarify the picture. This should be done with care so important targets will not be missed. With the gain at its normal setting, clutter from rain or snow may obscure the echo from a ship inside a squall or storm. A temporary reduction in gain along with the proper RAIN CL/SEA CL settings will usually permit the stronger and more distinct ship's echo to be distinguished.

Detection of targets beyond the storm may, however, require slightly higher gain than normal, since the storm may have attenuated but not completely obscured the echoes from the targets. The GAIN control should always be reset to the optimum level following range scale changes. In addition, when environmental conditions change, readjustment of the gain may be required.

3.2.3 SEA CLUTTER Control

Whereas the GAIN control affects the strength of echo returns at all ranges, the effect of SEA CLUTTER control is greatest on nearby returns, becoming progressively less as range increases. The SEA CLUTTER control is effective up to a maximum of about three miles.

In particular, the SEA CLUTTER control reduces the strength of the mass of random signals received from waves at short range. The STC level used should be sufficient to reduce the strength of sea clutter while still allowing small nearby targets to be distinguished. The level should never be set so high so as to blank out all nearby returns.

The sensitivity of the SEA CLUTTER control is variable, thus enabling an optimum picture to be obtained under adverse weather conditions.

Maximum reduction in the strength of close-range clutter takes place when the control is set to maximum. When it is set to minimum there is no reduction in the strength of nearby clutter.

The SEA CLUTTER control may be useful to reduce effects from rain or snow clutter in the immediate vicinity of the vessel. A temporary increase in the setting will permit stronger echoes from ships, and some navigational marks inside storms or squalls, to be distinguished.

At close range in crowded regions the control may be temporarily advanced to clear the picture. This should be done with care, so as to avoid missing important target returns.

The SEA CLUTTER control should be always checked and reset to the minimum required level position after any temporary alteration or when environmental conditions improve.

It is important to remember that both GAIN and SEA CLUTTER levels should be checked and adjusted each time a new range scale is selected. This is important to assure that excessive sea clutter or insufficient gain will not cause important targets to be missed or not displayed.

3.2.4 RAIN CLUTTER Control

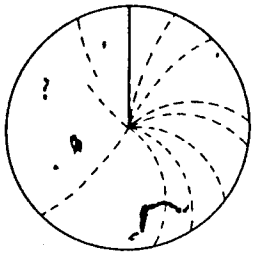
During heavy rain or snow storms the RAIN CLUTTER control may be used to improve the detection between echoes and the storm clutter. When operating the RAIN CLUTTER, you will notice the reduction of background returns from land and large targets. This is normal. The rain storm should be minimized and allow targets to be seen within the storm.

3.2.5 [IR] Interference Rejection

When other radars are using the same frequency band as that of your own radar, interference typically appears arranged in curved spokes as shown in Fig. 3-1. The radar interference is most noticeable on longer range scales.

Activating the [IR] feature will eliminate this type of interference as well as affecting reduction of the background noise.

In general, the IR should be set to "ON" for normal operation to allow maximum target presentations on the radar display.



The IR feature is activated by the [SELECT] and [SET] keys.

FIG. 3-1 RADAR INTERFERENCE

3.2.6 EXPANSION MODE

From time to time, targets may appear too small in size on the display. In this situation, activating the "expansion" mode will allow the displayed targets to be enlarged on the display, providing greater visibility to the operator.

The expansion mode is activated by the [EXP] key.

3.3 NAVIGATION WITH THE RADAR

3.3.1 Obtaining a Position Fix

The Model R10X/R11X Radar is an accurate and reliable navigational aid for determining your ship's position. Figure 3-2 shows examples of alternative methods of using radar sightings from prominent navigational points which can be identified on a chart. A position fix based on two or more navigational points will furnish an accurate fix, especially when the points are separated by close to 90° from each other relative to your ship.

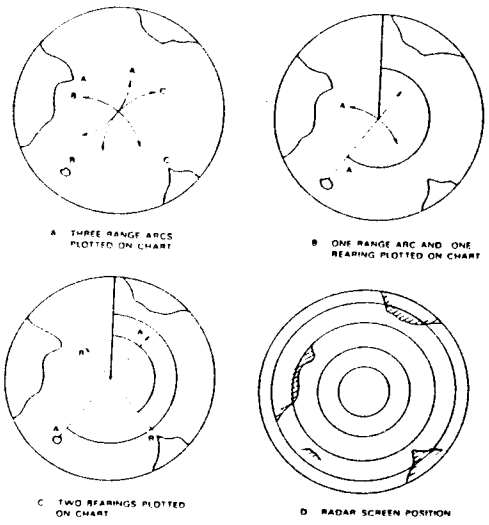


FIG. 3-2 POSITION FIX METHODS

3.3.2 Collision Avoidance Techniques

The moment a new target appears on the screen, its range and relative bearing should be noted. This is best done by putting the target information directly onto a plotting sheet or chart.

As in visual observation, "a target which stays at a constant bearing indicates a collision course."

As soon as a series of plots taken at intervals of 3 minutes indicates a closing range with no significant change in successive bearings, positive course change action should be considered and "The Regulations for Preventing Collisions at Sea" should be observed.

3.3.3 Determining Your Radar Line-of-Sight Range (Target Detection Range)

When searching for distant targets, your radar line-of-sight range to the target can be a limiting factor. Radar waves behave like light waves but they are refracted slightly more, increasing the distance to the radar horizon slightly more than that to the optical horizon (however, displayed range is correct). As Fig. 3-3 shows, the radar line-of-sight range is a combination of the radar horizon of your ship's radar scanner and the radar horizon of the target.

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

$$\text{Distance (nm)} = 2.23\sqrt{h}$$

For example, a scanner at height of 5 meters has a radar horizon of 5 nm.

A 5 meter cliff has a radar horizon of 5 nm. Therefore, under standard conditions, the cliff should begin to appear on the screen when the ship comes nearer than 5+5=10 nm.

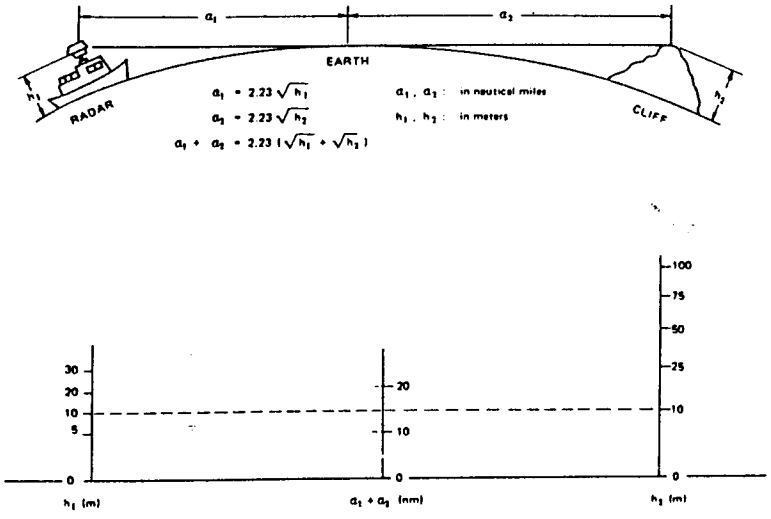


FIG. 3-3 RADAR HORIZON

3.4 FALSE ECHOES

Occasionally, signals appear on the screen at positions where there is no visual target. These targets could be false echoes.
The following conditions are the most common cause of false echoes.

3.4.1 SIDE ECHOES

In your antenna some of the radiation escapes on each side of the main beam of energy and is known as "side lobes". If a large target is very close to your ship, may be reflected by the target and they will be displayed on the screen as an echo. (See Fig. 3-4)
These echoes sometimes appear as arcs, forming echoes at each side of the true echo. Sometimes they are joined together if the side echoes are strong.

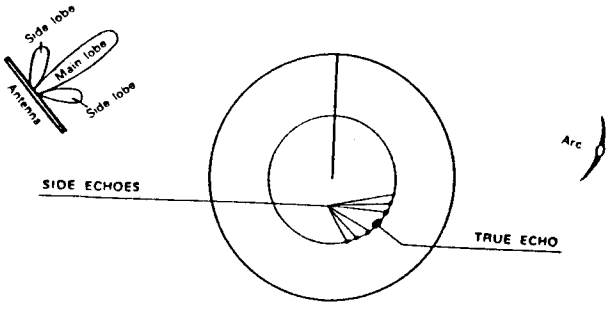


FIG. 3-4 SIDE ECHOES

3.4.2 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 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 the echo returns to the antenna and is shown on the display. However, the same reflection hits other masts or obstacles and then gets picked up by the radar antenna with enough strength to appear as a target on the radar screen.

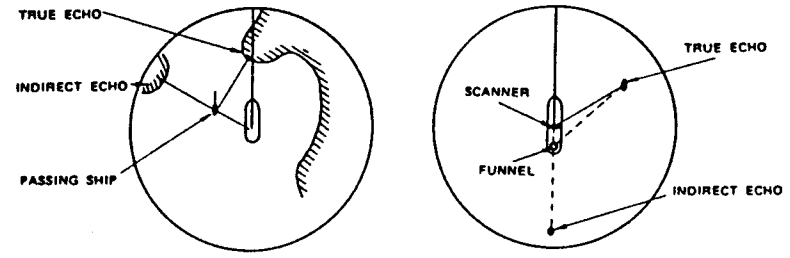


FIG. 3-5 INDIRECT ECHOES

3.4.3 Multiple Echoes

Multiple echoes could appear if there is a large target having a wide vertical surface parallel to your own ship at a comparatively short ranges. The signal will be reflected by the wide vertical surface, then the reflected signal strikes your own ship, and it will return along the same paths to the target. This will be repeated.
Thus, the multiple echoes will appear beyond the true target's echo on the same bearing as shown in Fig. 3-6. This is not very common.

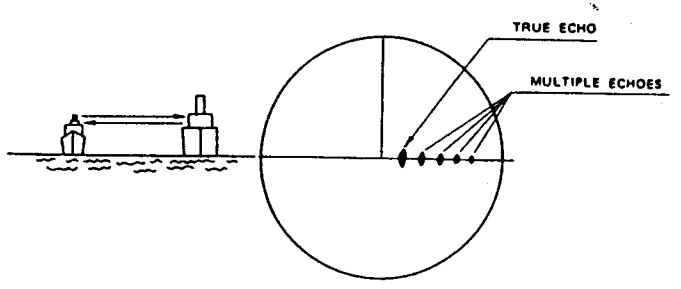


FIG. 3-6 MULTIPLE ECHOES

3.4.4 Ghost Echoes

The ghost echoes may appear if there is a target having a wide smooth surface near your own ship. As shown in Fig. 3-7, the cause of the ghost echoes is similar to that of the indirect echoes.
The ghost echoes appear on the screen as if you saw the target reflected in a mirror.

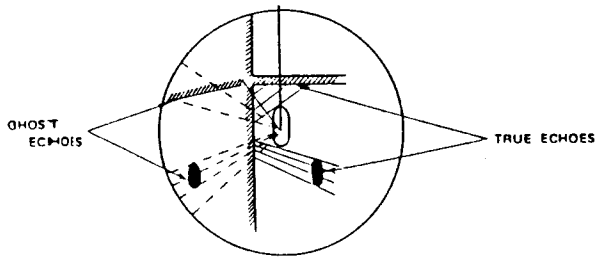


FIG. 3-7 GHOST ECHOES

3.4.5 Shadows

Although the scanner unit should be ideally placed where there is a good all-around view, as far away as possible from any part of the ship's superstructure or rigging to reflect the beam, there may be some obstructions. An obstruction will throw either a complete or partial shadow as shown in Fig. 3-8.

If there are targets in such shadow sector, target's echoes may not be displayed on the screen. Thus, it is important to know the bearings and width of all shadow sectors, and it can be checked by turning the SEA CLUTTER control to zero when light rain clutter covers much of the screen and the sea is calm.

Any shadows will then be shown as dark sectors in the clutter.

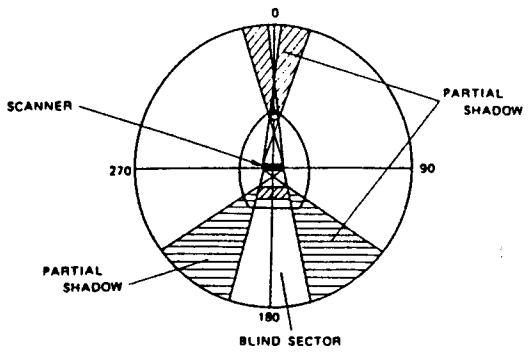


FIG. 3-8 SHADOWS

SECTION 4

MAINTENANCE

4.1 USER PREVENTIVE MAINTENANCE

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

1) Always keep the equipment as clean as possible. Remove dirt, dust, or water-spray from the display and scanner during the boat clean up.

2) During routine ships maintenance, make a thorough inspection of the radar system including the following points:
   a. Check all hardware for tightness.
   b. Check for evidence of any corrosion on the scanner unit, display unit, or its cable and connectors. Clean as required.
   c. Check the cable connections and terminal strip connections for cleanliness and tightness. Make sure the wiring is free from chafing or abrasions.

4.2 RADOME SCANNER

4.2.1 Radome

Wipe the surface of the Radome with a clean, soft cloth. Remove any paint, dirt, or caked salts. Heavy deposits of dirt or caked salt on the surface of the Radome can cause a considerable drop in the radar's performance. Avoid using chemical cleaners or solvents. Alcohol is preferred or light detergent as a cleaning agent.

4.2.2 Lubrication

Periodic replacement of lubricants is recommended.

Locate the main drive gear, clean away old lubrication residue and dirt. Using an appropriate applicator apply a light coating of grease (MOBILUX Grease No. 2 Mobil Oil Company or equivalent) on the gear of the main shaft and the drive motor.

Cleaning and lubrication should be done approximately every six months.

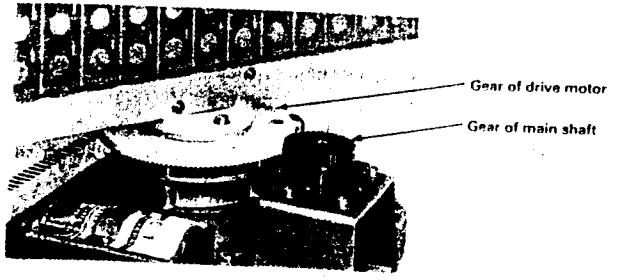


FIG. 4-1 LUBRICATION

4.2.3 Mounting

Check the mounting bolts of the Scanner Unit and tighten if necessary.

4.3 OPEN ARRAY SCANNER

Set the safety switch (S101) of the Scanner Unit to OFF before working on the radar scanner.

4.3.1 The Antenna Array

The face of the radiator should never be painted, however it should be kept clean from built-ups of dirt, dust, caked salt or soot because deposits of these particles can cause a considerable decrease in the radar's performance.

Use a soft wet cloth or a cloth dampened in alcohol when cleaning the array. Never use solvents such as gasoline, benzine, trichlorethylene, or ketone.

4.3.2 Rotating Drive Unit

1) Oil Seal

To lubricate the rotating drive unit seal, remove the grease cap located on the side of the array base plate, and using a grease gun, add grease until it starts to leak out of the seal. This lubrication is required every 6 months. Use Mobiluxe #2 Grease or equivalent.

2) Lubrication to gears

After removing transmitter receiyer unit, apply a light coating of grease (MOBILUX Grease No. 2 Mobil Oil Company or equivalent) into lubricating hole.

Lubrication should be done every six months.

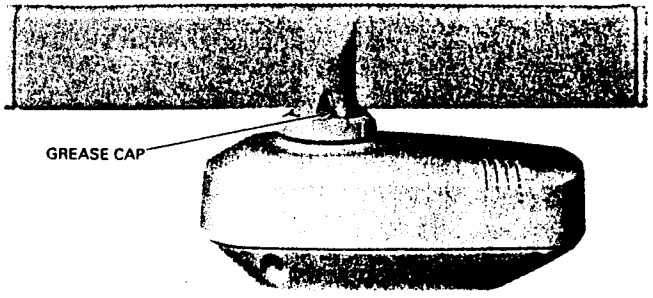


FIG. 2-4 OIL SEAL

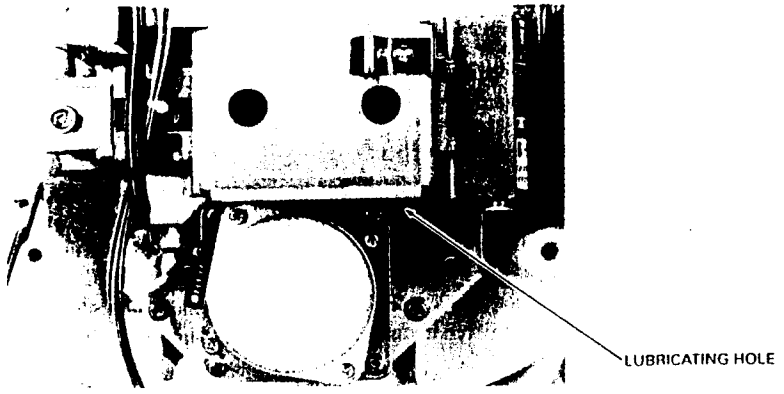


FIG. 4-3 LUBRICATION TO GEARS

4.4 DISPLAY UNIT

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

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

SECTION 5

ADJUSTMENT AND FAULT FINDING

5.1 ADJUSTMENT

5.1.1 Adjustments upon Replacing Components

Although the radar is delivered 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.

NOTE

REPLACEMENT ITEM	ADJUSTMENT REQUIRED	See Sect. #
Magnetron V201	Tuning	2.6.3 c)
MIC Frontend E301	Tuning	2.6.3 c)
Cathode-ray tube V501 Display PCB	Adjusting centering magnet Adjusting intensity Adjusting focus	
Reed SW S101	Bearing Alignment	2.6.3 A)

5.1.2 Display Unit

1) Intensity adjustment (See Fig. 5-1)
   a. Remove the cover from Display Unit.
   b. Set BRILLIANCE for maximum level.
   c. Adjust RV551 on CRT Monitor PCB, so that PPI is of suitable brightness.

2) Focus adjustment (See Fig. 5-1)
   a. Remove the cover from Display Unit.
   b. Adjust RV505 on CRT Monitor PCB so that the sweep line, rings, and targets on the screen are as small and clear as possible.

3) H. HOLD
   Adjust RV503 on CRT Monitor PCB so that horizontal screen is kept in sync.

4) H. SIZE and V. SIZE
Adjust L502 and RV501 on CRT Monitor PCB so that the rings are round.
Note: *Using a ruler, adjust for equal diameters N/S E/W.*

5) V-LINEAR
Adjust RV502 on CRT Monitor PCB so that the rings are round.

6) Beam Centering adjustment on CRT (See Fig. 5-1)
Rotate the two knobs simultaneously or individually so that the beam center coincides with the center of CRT.

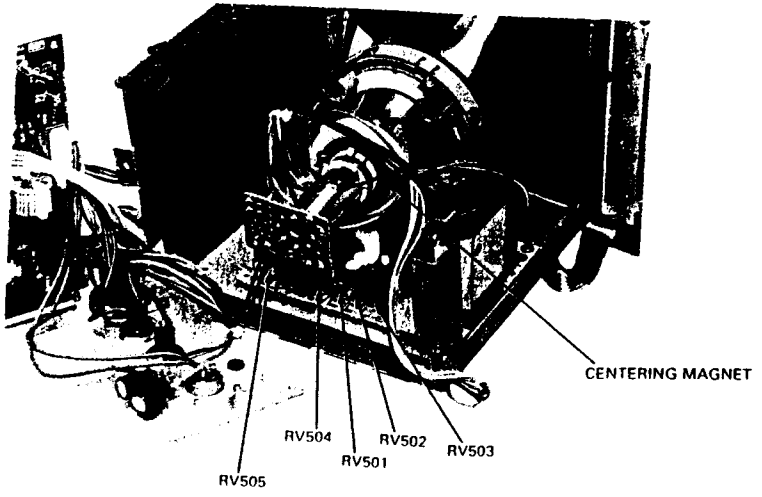


FIG. 5-1 CRT MONITOR ADJUSTMENT

5.1.3 Scanner Uunit

A) AVR voltage adjustment
AVR output voltage adjust RV1 in the PC201 (Power Supply PCB). Adjust the DC voltage between the TP2 [AVR OUT] (positive) and 2A (negative) so that it will be 7.0 V.

B) Tune Indicator Adjustment
Note: *This adjustment has been made at the factory at the time of delivery, however, the adjustment may be required when the receiver, MIC, modulator or magnetron is replaced. When the maximum tuning point agrees with the tune indicator, this adjustment is not necessary.*

a) Adjust the Tune Control on the display unit for maximum target echoes.
b) Connect the voltmeter to J2-7 (R10X) or J301-8 (R11X) as shown in Fig. 5-4 and Fig. 5-5.
c) Adjust RV1 to get a tune indicator output of 0.7–0.8 V.
d) Recheck that the maximum tuning point and the tune indicator maximum agree.

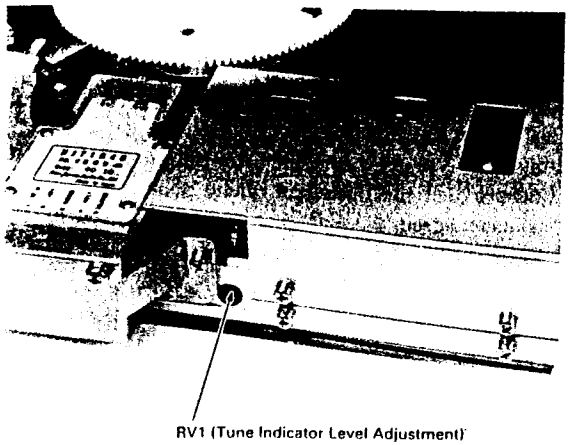


FIG. 5-4 RECEIVER ADJUSTMENT RADOME SCANNER

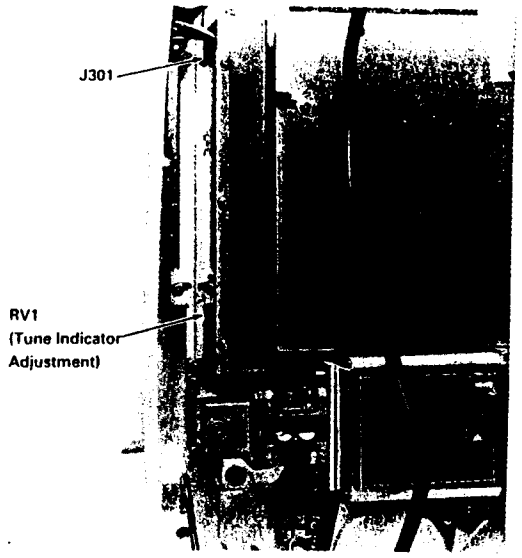


FIG. 5-5 RECEIVER ADJUSTMENT OPEN ARRAY SCANNER

5.2 TROUBLE-SHOOTING

5.2.1 General

While the X-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.

5.2.2 Fault Finding

(1) Regular operational checks
(preventative maintenance)
The electrical performance of the equipment should be evaluated at periodic intervals by qualified Raytheon Technicians and the results recorded. Changes in test results may indicate an aging or failing component. Table 5-1 provides a check list of items.
Whenever an abnormal result is obtained from a test, appropriate corrective maintenance should be employed to prevent serious damage or failure modes.

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

(2) 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 5-2 shows a table of fuses employed in the equipment.

(3) Fault finding procedure
Often the display on the CRT can help indicate which major circuit is at fault. It may be found quicker to check-out the equipment according to the trouble shooting guide (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 procedure, and may prove necessary in some cases.

Table 5-3 is the trouble shooting guide and check-out procedure, Table 5-4 shows typical voltages and resistances at significant points throughout the equipment. The internal resistance of the tester used in measurements was 20 kΩ/V dc, 8 kΩ/V ac.

TABLE 5-1 OPERATION CHECK LIST

Unit to be checked	Check item	Correct condition	Remarks	Measuring point
Scanner Unit	a. Input voltage	Refer to Note		TB1011A~2A
	b. AVR output voltage	7 V		PC501-CD6-K ~ground
	c. Mag. current	12 V		PC501-TP1 ~ground
Display Unit	a. Input voltage	Refer to Note		J401-1~2
	b. AVR output voltage	5 V		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. DC11 V~42 V*

TABLE 5-2 FUSES USED

Location	Part No.	Rating current	Protective circuit	Type	Remarks
Display unit	F401	6.3 A	All circuit	Glass tube 6.3 A	dc 12 V
	F401	3.15 A	All circuit	Glass tube 3.15 A	dc 24 V, 32 V
	F402	5 A	Scanner motor	Glass tube 5 A	dc 12 V
	F402	3.15 A	Scanner motor	Glass tube 3.15 A	dc 24 V, 32 V

TABLE 5-3 TROUBLE SHOOTING GUIDE

Trouble	Remedy
1. Does not start at OPERATE switch to STBY.	Check: o Blown fuse F401. o Check input power circuits. o Fault of contact on S401. o Fault of power supply circuit on PC5. o Fault of contact on connector of PC5. o Fault of rectifier diodes on PC5.
2. Scanner fails to rotate.	Check: o Fault of S102. (Safety Switch OFF) (R11X) o Fault of contact on terminal boards. o Fault of M101. o Fault of drive mechanism.
3. Scanner rotates but rotation of sweep is abnormal	Check: o Fault of encoder M101. o Fault of main circuit for the Display Unit.
4. No picture on the screen.	Fault of CRT display unit or its supply voltages. Check: o Open heater of CRT. o Fault of contact on CRT socket. o Fault of contact on CRT cap. o Fault of video circuit
5. Only horizontal line screen.	There may be fault in vertical sweep generator, amplifier circuits and deflection coil. Check: o Fault in vertical sweep generator, amplifier circuit
6. Incorrect sweep o Start of sweep is not centered on the screen. o Markers are oval.	o Adjust CENTERING MAGNET. o Adjust horizontal or vertical hold. o Adjust vertical length and linearity. o Adjust height as necessary.

Trouble	Remedy
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: o Fault of GAIN, STC control settings. o Fault of receiver unit. o Fault of contact on terminal boards and connector.
8. Noise and range rings 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. PC501 TP1 = 12 VDC o Failure of Local Oscillator tuning. If transmission appears to be present, carry out the Local Oscillator tuning procedures and check the MIC. o Fault of MIC Mixer. If no transmission is present, o Whether the lead wire to magnetron is grounded to chassis. o Fault of magnetron.
9. Poor sensitivity. Dim echoes.	Check: o Reduction of transmitting output power. o Fault of magnetron. → Check of MAG. I reading on PC501-TP1. o Fault of MIC Frontend. o Fault of CRT. o Failure of Local Oscillator tuning. o Failure of FOCUS adjustment. o Failure of INTENSITY ADJ. o Fault of video amplifier circuit on PC6. o Fault of receiver unit.

Trouble	Remedy
10. NO VRM or VRM cannot be controlled.	Check: o Fault of S401. o Fault of main circui (PC1).
13. NO EBL or EBL cannot be controlled.	Check: o Fault of S401. o Fault of main circuit (PC1).
14. No alarm zone marker, cannot be controlled or no alarm sound.	Check: o Fault of S401. o Fault of main circuit (PC1). o Fault of Buzzer BZ1.

Table 5.4 shows typical voltage and resistances at significant points throughout the equipment.

TABLE 5.4 TYPICAL VOLTAGES AND RESISTANCES

(A) Inter-unit terminal board

Note: *Resistance measurements shall be made under the following conditions:*
POWER switch-off S101 -ON.
Resistance values shall be measured between measuring point and ground unless otherwise specified, and negative terminal of the tester is grounded as a rule.
The tester used for this measurement is 20 kΩ/V DC, 8 kΩ/V ac.
Voltage measurements shall be made with the following display control conditions:
POWER switch-ON, RAIN CLUTTER -min, GAIN -max, SEA CLUTTER -min.
Ship's power supply is dc 12 V.

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

RADOME RADAR

Measuring Point	Resistance (Ω)	Voltage (V) 0.125 ~ 1.5 (nm)	Voltage (V) 3, 6, 12, 16 (nm)	Remarks
TB101 VD	6×10	−0.11	−0.11	DC 0.3 V
1 A~2 A	5×10	11.3	11.2	12 V
J101 1	24×10	0	10.5	12 V
2	22×10	−0.015	−0.005	0.3 V
4	300×10	2.65	2.65	3 V
5	4×10	12	12	12 V
6	20×10	0.25	0.25	3 V
7	1.5×10k	17.0	17.0	30 V
8~2 A	140×10	8.7	8.6	12 V
9	7.5×10	2.4	2.4	3 V

OPEN ARRAY RADAR

Measuring Point	Resistance (Ω)	Voltage (V) 0.125 ~ 1.5 (nm)	Voltage (V) 3, 6, 12, 24 (nm)	Remarks
J8-1	6×10	−0.11	−0.11	DC 0.3 V
1 A~2 A	4.5×10	11.0	10.9	12 V
J101 1	24×10	0	10.5	12 V
2	22×10	−0.015	−0.005	0.3 V
4	300×10	2.7	2.6	3 V
5	4.3×10	12	12	12 V
6	20×10	4.2	4.2	12 V
7	1.8×10k	17.0	17.0	30 V
8~2 A	9.5×1k	8.2	8.2	12 V
9	55×10	2.1	2.1	3 V

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

Note: *Refer to Note given in item (A).*

SCANNER UNIT

Measuring Point	RADOME Resistance (Ω)	Measuring Point	OPEN ARRAY Resistance (Ω)
TB101 VD	∞ × 10	J8-1	∞ × 10
VDE	0 × 10	-2	0 × 10
M+	—	J1-2	∞ × 10
1A	∞ × 10	J1-4	∞ × 10
2A	∞ × 10	J1-1, 3	∞ × 10
J1011 PW	170 × 10	J2-1 PW	300 × 10
2 TRIG	∞ × 10	-2 TRIG	∞ × 10
3 E	0 × 10	-3 E	0 × 10
4 STC	1K × 10	-4 STC	1K × 10
5 GAIN	1K × 10	-5 GAIN	1K × 10
6 TUNI/BR	200 × 10	-6 TUNI/BR	200 × 10
7 TUNV	∞ × 10	-7 TUNV	∞ × 10
8 1B	∞ × 10	-8 1B	∞ × 10
9 BP	8 × 10	-9 BP	∞ × 10

DISPLAY UNIT

Measuring Point	Resistance (Ω)
J402 1	∞ × 10
2	∞ × 10
3	23 × 10
4	0 × 10
5	0 × 10
6	5.6 × 10
7	∞ × 10
8	∞ × 10
9	∞ × 10
10	23 × 10
11	4 × 10
12	600 × 10
13	8 × 10
14	0 × 10
15	∞ × 10
16	26 × 10

TABLE 5-5 OF TRANSISTORS USED

TYPE	KIND, USE	SUPPLIER	V_{cbo} (V)	V_{ceo} (V)	V_{beo} (V)	I_c	P_c	h_{fe} min.	h_{fe} max.	ft (MHz)	V_{ce}(V) sat.
2SA495GTM-Y	PNP HF Amp	TOSHIBA	−50	−50	−5	−150 mA	400 mW	120	240	200	−0.4
2SA817-Y	PNP Switching	TOSHIBA	−80	−80	−5	−300 mA	600 mW	120	240	100	−0.4
2SA1010-K	PNP High Speed High Voltage Switching	NEC	−100	−100	−7	−3.5 A	40 W	100	200		−0.6
2SA1015-Y	PNP AF Amp	TOSHIBA	−50	−50	−5	−150 mA	400 mW	120	240	80	−0.3
2SA1145-Y	PNP AF Amp	TOSHIBA	−150	−150	−5	−50 mA	800 mW	120	240	200	−1.0
2SA1242-Y	PNP Switching	TOSHIBA	−35	−20	−8	−5 A	10 W	160	320	170	−1.0
2SA1244-Y	PNP Switching	TOSHIBA	−60	−50	−5	−5 A	20 W	70	240	60	−0.4
2SA1261-K	PNP High Speed High Voltage Switching	NEC	−100	−100	−7	−10 A	60 W	100	200		−0.6
2SB906-Y	PNP AF Power Amp	TOSHIBA	−60	−60	−7	3 A	20 W	100	200	9	−1.0
2SC1627-Y	NPN Voltage Amp	TOSHIBA	80	80	5	300 mA	600 mW	120	240	100	0.5
2SC1675	NPN AF Amp	NEC	50	30	5	30 mA	250 mW	40	180	150	0.3
2SC1815-BL	NPN AF Amp	TOSHIBA	60	50	5	150 mA	400 mW	350	700	80	0.1
2SC1815-Y	NPN AF Amp	TOSHIBA	60	50	5	150 mA	400 mW	120	240	80	0.1
2SC2983-Y	NPN Power Amp	TOSHIBA	160	160	5	1.5 A	15 W	120	240	100	1.5
2SC3098	NPN VHF-UHF LN Amp	TOSHIBA	30	20	3	50 mA	150 mW	30	300	3500	
2SC3303-Y	NPN Switching	TOSHIBA	100	80	7	5 A	20 W	120	240	120	0.4
2SC3187	NPN Video cct.	National	300	300	7	100 mA	750 mW	50	250	70	1.5
2SC3328-Y	NPN Power Amp	TOSHIBA	80	80	5	2 A	900 mW	120	240	100	0.5
2SD1680	NPN H-Deflection Out.	National	330	200	6	7 A	70 W	15	45		1
2SJ142	Pch FET Switching	NEC		−100	∓20	∓13 A	35 W				
2SK302-GR	Nch FET VHF Amp	TOSHIBA		20	±5	30 mA	150 mW				
2SK363	Nch TET AF Amp	TOSHIBA									
2SK525	Nch FET Switching	TOSHIBA		150	±20	±10 A	40 W				
2SK736	Nch FET Switching	NEC		100	±20	±15 A	35 W				
IRF840	Nch FET Switching	IR		500	±20	+8 A	125 W				
IRFZ44	Nch FET Switching	IR		60		+35 A	150 W				

TABLE 5-6 OF DIODES USED

TYPE	KIND USE	SUPPLIER	V_{RM} (V)	V_R (V)	I_{FM}	I_o	P	V_F (V)	t_{rr}	REMARKS
11DF2	F.R.D.	IR	220	200	30 A	1 A		0.98	30 ns	
1K34A	AM Detector	UNIZON	−75	−60	150 mA	60 mA				
1S1588	High Speed Switching	TOSHIBA	35	30	360 mA	120 mA	300 mW	1.3	4 ns	
1SS184	High Speed Switching	TOSHIBA	85	80	300 mA	100 mA	150 mW	0.72*	1.6 ns	*I_F=10 mA
1SS226	High Speed Switching	TOSHIBA		80		100 mA			1.6 ns	
1SV149B	Varactor	TOSHIBA		15						
31DF2	F.R.D.	IR	200			1.6 A		0.98		
5KF20	F.R.D.	IR	220	200	80 A	5 A		0.98	35 ns	
EM1Z	General Purpose	SANKEN	250	200	45 A	1.0 A		0.97		
ERA22-02	F.R.D.	FUJI ELECTRIC		200	10 A	0.5 A		1.5	0.4 μs	
ERA22-08	F.R.D.	FUJI ELECTRIC		800	10 A	0.5 A		1.5	0.4 μs	
ERB44-04	F.R.D.	FUJI ELECTRIC		400	30 A	1.0 A			0.4 μs	
ERB83-004	General Purpose	FUJI ELECTRIC		40	80 A	1.7 A		0.55		
F6P20F	F.R.D.	IR	220	200	60 A	6 A		0.98*	30 ns	* per leg
F6P40F	F.R.D.	IR	440	400	60 A	6 A		1.25*	30 ns	* per leg
F10KF20	F.R.D.	IR	220	200	120 A	10 A		1.03	35 ns	
HZ9C1	Zener V_z=9.3 V	HITACHI					500 mW			
HZ11A3	Zener V_z=10.3 V	HITACHI					500 mW			
HZ3B2	Zener V_z=3.1 V	HITACHI					500 mW			
HZ5C1	Zener V_z=5.1 V	HITACHI					500 mW			
HZ6C1	Zener V_z=6.1 V	HITACHI					500 mW			
HZ15-3	Zener V_z=15.5 V	HITACHI					500 mW			
HZ18BP	Zener V_z=19.1 V	HITACHI					800 mW			
HZ24BP	Zener V_z=25.6 V	HITACHI					800 mW			
TLR123	Gap LED	TOSHIBA		4	20 mA		60 mW	2.8		
SM-1XN02	General Purpose	ORIJIN		200	45 A	1.5 A		1.0*		*I_F=I_O
SRT-7HP	High Voltage	Shindengen	8 K		20 A	0.35 A		14	0.35 μs	
U05C	General Purpose	HITACHI	300	200	100 A	2.5 A		1.1	3.0 μs	
U05J	General Purpose	HITACHI	1000	800	100 A	2.5 A		1.1	3.0 μs	
U06C	General Purpose	HITACHI	300	200	35 A	1.1 A		1.4	3.0 μs	
V11N	F.R.D.	HITACHI	1800	1500		0.4 A		2.5	0.4 μs	

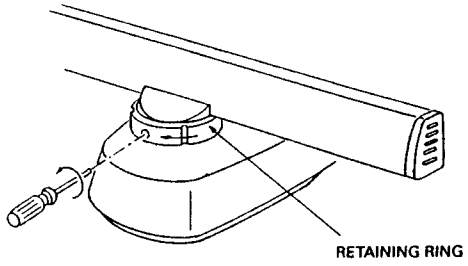
TABLE 5-7 OF INTEGRATED CIRCUITS USED

TYPE	KIND, USE	SUPPLIER	REMARKS
AN5132	VIF Detector	National	V_{CC}=13.8 V, P_D=1.1 W
AN5763	B/W TV V-Defection Sig. Processing and Output Cir.	National	$V_{CC(MAX.)}$=15.6 V, $P_{D(MAX.)}$=1.33 W, $V_{OSC\cdot S(V)}$=5 V, $I_{Y(P\cdot P)}$=715 $mA_{P\cdot P}$
AN5790N	H-Sig. Processing Circuit for CRT Displays	National	$V_{CC(MAX.)}$=13.2 V, $P_{D(MAX.)}$=1.44 W, $V_{CC(MAX.)}$=50 mA, $V_{OSC\cdot S(H)}$=7.5 V, f_{HC}=700 Hz/μs, τ_{HO}=2~40 μs, f_{HO}=14~60 kHz
MC1350P	IF AMP	MOTOROLA	$V^+_{(MAX.)}$=18 V, $V_{AGC(MAX.)}$=V^+, $V_{IN(MAX.)}$=5.0 V, $P_{D(MAX.)}$=625 mW
NE521N	High Speed Comparator	SIGNETICS	$V^+/V^-_{(MAX.)}$=±7 V, $V_{IDR(MAX.)}$=±6 V, $V_{IN(MAX.)}$=±5 V, $P_{D(MAX.)}$=600 mW
NJM4558D	OP. Amp	NJRC	$V_{D(MAX.)}$=±30 V, $P_{D(MAX.)}$=500 mW, SR=1 V/μs (RL≧2 kΩ)
NJM78M05FA	Regulator	NJRC	$V_{IN(MAX.)}$=35 V, $P_{D(MAX.)}$=7.5 W, V_O=5 V
HM53461ZP-12	65536 word×4 bit Video RAM	HITACHI	$V_{T(MAX.)}$=−1.0~+7.0 V, $P_{T(MAX.)}$=1.0 W, V_{CC}=−0.5~+7.0 V, t_{RAC}=120 ns
HM6264ALP-15	8192 word×8 bit SRAM	HITACHI	V_{CC}=5.5 V, P_T=1 W
HM63021P-28	2048 word×8 bit Line Memory	HITACHI	$V_{T(MAX.)}$=−0.5~+7.0 V, $P_{T(MAX.)}$=1.0 W, V_{CC}=5 V, t_{sw}=28 ns
PST532A	System Reset, Battery Backup	Mitsumi	Detect Voltage 4.2 V, Battery Charge Output 50 mA min.
TA78DL05S	Regulator	TOSHIBA	$V_{IN(MAX.)}$=29 V, $P_{D(MAX.)}$=20 W, V_O=5 V
TA78DL12P	Regulator	TOSHIBA	$V_{IN(MAX.)}$=29 V, $P_{D(MAX.)}$=20 W, V_O=12 V
TC524256Z-10	262144 word×4 bit DRAM	TOSHIBA	$V_C{}^C{}_{(MAX.)}$=−1.0~7.0 V, $I_{O(MAX.)}$=50 mA, $P_{D(MAX.)}$=1 W, V_{CC}=5 V
TL082CP	OP. Amp	TI	$V^+/V^-_{(MAX.)}$=±18 V, PD=680 mW, SR=13 V/μs
TL431CLPB	Voltage Regulator	TI	$V_{KA(MAX.)}$=37 V, I_K=−100~150 mA
TL494CN/UPC494C	Switching-V Regulator	TI/NEC	$V_{CC(MAX.)}$=41 V, $V_{IN(MAX.)}$=V_{CC}+0.3 V, $I_{O(MAX.)}$=250 mA
TL499ACP	Switching-V Regulator	TI	$V_{IN1P\cdot IN(MAX.)}$=35 V, $V_{IN2P\cdot IN(MAX.)}$=10 V, $V_{D(MAX.)}$=35 V, $I_{SW(MAX.)}$=1.0 A
TLP521	Photo Coupler	TOSHIBA	[LED]: $I_{F(MAX.)}$=50 mA, $I_{F(P(MAX.)}$=1 A [TR]: $V_{CE(O(MAX.)}$=5.5 V, $V_{EC(O(MAX.)}$=7.0, $I_{C(MAX.)}$=50 mA, $P_{C(MAX.)}$=100 mA [per 1 circuit], $P_{T(MAX.)}$=150 mW [per 1 circuit]
UPD6326C	CMOS 6 bit D/A Converter	NEC	V_{DD}=V_{CC}~15 V, I_{DD}=15 mA
UPD72020GC-8-3B6	G.D.C.	NEC	$V_{I(MAX.)}$=−0.5~+7.0 V, V_I=−0.5~V_{DD}+0.3 V, V_O=−0.5~V_{DD}+0.3 V
UPD78C10G-36	Micro Computer (CPU)	NEC	V_{DD}=7 V, I_{DD}=30 mA

5.3 REPLACEMENT OF OPEN ARRAY SCANNER

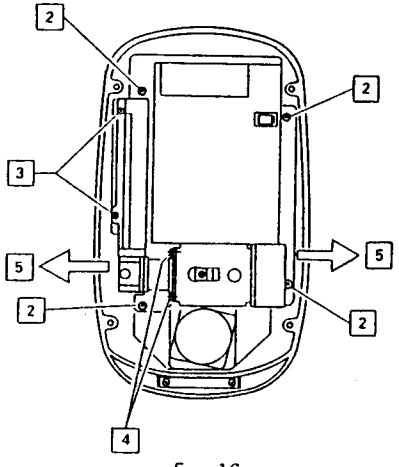
5.3.1 Radiator

1) Loosen the rock screw with the screw driver.
2) Turn the retaining ring clockwise (arrow direction) with holding the radiator.
3) Remove the radiator.
4) To reassemble, reverse the above procedure.



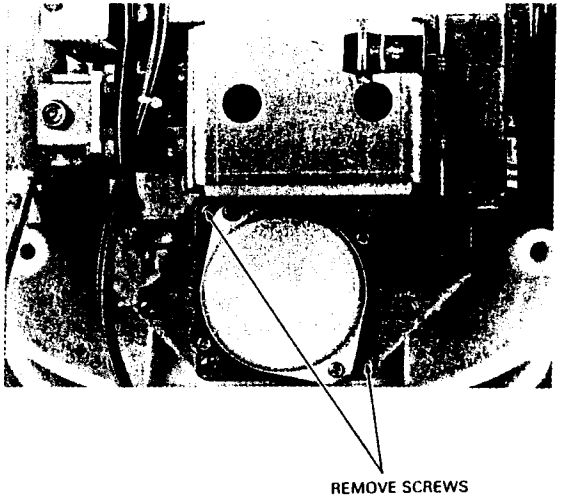
5.3.2 Transmitter Receiver Unit

1) Disconnect connectors on the transmitter receiver unit.
2) Loosen 4 screws holding the transmitter receiver unit.
3) Loosen 2 screws holding the receiver unit.
4) Fully loosen 2 screws at the side of the diode limiter.
5) Remove the transmitter receiver unit while spreading space between the diode limiter and the magnetron.
6) To reassemble, reverse the above procedure.



5.3.3 Drive Motor

1) Remove 2 screws holding the drive motor.
2) Remove the drive motor from turning mechanism plate.
3) To reassemble, reverse the above procedure.



SECTION 6

TECHNICAL DESCRIPTION

6.1 SCANNER UNIT

6.1.1. Radome Scanner

The scanner unit consists of the radiator, the motor-encoder, radiator rotating mechanism, bearing reset sw, transmitter and receiver units and power supply unit. These components are housed within the 18" radome.

1) Radiator

The radiator is horizontally polarized printed array which is constructed on an plastic frame. The radiator, approximately 15" in length, is coupled to the transmitter and receiver via a T-junction and rotary joint.

At half power points horizontal beamwidth is 6° and vertical beamwidth is 25°. Side lobes are reduced by better than −21 dB with respect to the main beam. The direction of maximum radiated power is perpendicular to the radiator. (Figure 6-1)

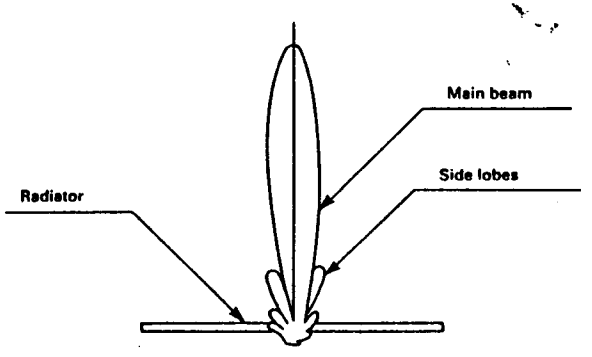


FIG. 6-1 RADIATOR PATTERN

2) Motor-Encoder

A dc motor is used to rotate the radiator. The encoder section of the assembly produces the bearing pulses for rotation synchronization. A bearing sync pulse is generated every 0.176 degrees of rotation (2048 pulses per 360°) at 5 V dc amplitude. These pulses are sent through J1-9 to the Bearing Pulse circuit in the Display Unit.

3) Radiator Rotating Mechanism

Mechanical coupling between the radiator and the motor-encoder is effected by a reduction drive mechanism. The motor rotates at approx. 24 rpm.

4) Bearing Reset Sw

The bearing reset switch produces the signal for the bearing reset circuits when the permanent magnet fitted on the main gear passes across Reed Switch S101. The resulting bearing reset signal is mixing with tune indicator signal (TUNI) and sent to the bearing reset circuit in the Display Unit to synchronize the scanner position on the display.

6.1.2 Open Array Scanner

The open array scanner unit consists of the radiator, the motor-encoder, the radiator rotating mechanism, the bearing reset circuit, the transmitter, and the receiver.

A) Radiator

The radiator is a horizontally polarized, printed array which is constructed on an aluminum frame. The radiator, 2.5 feet in length, is coupled to the transmitter and the receiver through a T-junction and rotary joint. The radiator is driven at 24 rpm by the motor-encoder via a gear reduction mechanism.

At the half power points, the horizontal beamwidth is 3.3 degrees with a vertical beamwidth of 25 degrees.

Side lobes are better than −23 dB with respect to the main beam.

The direction of maximum radiated power is perpendicular to the radiator (Fig. 6-2).

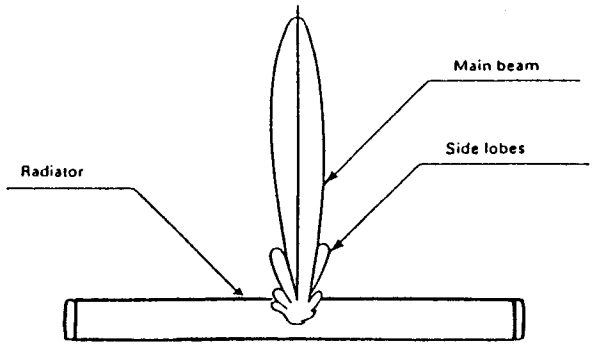


Fig. 6-2 RADIATOR PATTERN

B) Motor-Encoder

A ±13.5 VDC motor is used to rotate the radiator. The encoder section of the assembly produces bearing pulses for the rotation synchronization. A bearing sync pulse is generated every 0.176 degrees of rotation (2048 pulses per 360 degrees) at 5 V amplitude. These pulses are sent to the Bearing Pulse Circuit in the Display Unit.

C) Bearing Reset Sw

The bearing reset switch produces the signal for the bearing reset circuits when the permanent magnet fitted on the main gear passes across Reed Switch S101. The resulting bearing reset signal is mixing with tune indicator signal (TUNI) and sent to the bearing reset circuit in the Display Unit to synchronize the scanner position on the display

6.1.3 Transmitter

The transmitter consists of the solid state modulator circuit and the 1.5 kW magnetron.

A) Modulator

A line-type pulser is used in the modulator and consists of a charging choke, FET switch, pulse transformer and PFN.

By setting the X-MIT/OFF key on the indicator control panel to "ON", the transmitter trigger pulse is fed to the base of TR1 in the modulator from the transmit trigger generator circuit in the display unit.

The modulator high voltage of +220 VDC is fed to the PFN capacitors C7, C8 and C9 via L1. Because of the resonant charging action of L1; the PFN charges to almost twice the input voltage. Since the charging efficiency is about 90% the PFN voltage is nearly +400 V.

Upon receiving the positive pulse at the gate of the FET (TR3), TR3 conducts, and the charged voltage across the PFN capacitors is immediately discharged through TR3 and the pulse transformer T1. Consequently the pulse duration determined by the PFN appears on the primary windings of the pulse transformer T1 and is stepped up to the cathode of the magnetron via T1 secondary. The pulse peak voltage on the primary of T1 is −180 V, and the secondary voltage is −1.8 kV.

The pulse selection relay K1 is controlled by the range keys on the indicator front panel. This will provide two different pulse lengths: 0.08 μsec, and 0.5 μsec (R10X) or 0.08 μsec and 0.7 μsec (R11X) in accordance with the range scale selected. The pulse repetition frequency (PRF) changes automatically according to the operating pulse length. (See Table 6-1).

TABLE 6.1 RANGE, PULSE LENGTH, AND PRF RELATIONSHIPS

Range	Pulse length	PRF
0.125, 0.25, 0.5, 0.75, 1.5 nm	0.08 μs	2250 Hz
3, 6, 12, 16 nm (R10X)	0.5 μs	750 Hz
3, 6, 12, 24 nm (R11X)	0.7 μs	750 Hz

B) Magnetron

While the high voltage pulse is fed to the cathode of the magnetron, the magnetron generates high energy oscillations in the region of 9445 MHz for the duration of the input pulse.

The operating point of the magnetron is at a voltage of −1.8 kV and a current of 2 A.

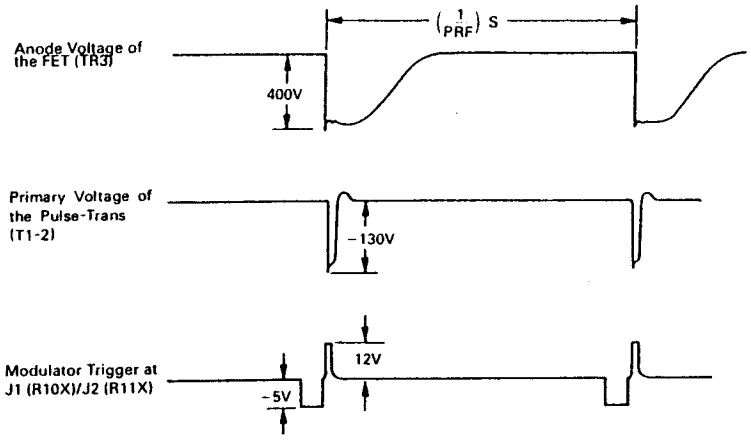


FIG. 6-3 TIME TABLE OF THE TRANSMITTER

C) Power Supply Unit (PC101)

The power supply unit consists of the AVR circuit (IC1, TR5, TR6) and the converter circuit (IC2, TR9, TR10) with rectifier circuits.

AVR Circuit

The AVR circuit is used to perform step down switching and to produce a regulated 7 V dc output from the ship's mains.

Converter Circuit

TR9 and TR10 are FET switches controlled by IC2 which is the power oscillator and driver. The 22.25 kHz square at 7 V wave appears in the primary winding of T1. The secondary output of T1 is fed to the various rectifier circuits. The rectifier circuits produce the +220 V, +13.5 V, −13.5 V and +7 V for the scanner circuits.

6.1.4 Receiver Unit (R10X)

The receiver unit consists of the MIC Frontend and the receiver PCB and STC PCB.

A) MIC Frontend

The MIC Frontend consists of a low-noise RF amplifier, a double balanced mixer and the local oscillator. The received signal is amplified by a low-noise amplifier fed to the double balanced type mixer which presents a good signal-to-noise ratio to the receiver. The mixer output frequency is 60 MHz. The local oscillator tuning is achieved by the adjustment of the operator's tune control on the display control panel.

B) Receiver PCB

1) IF Amplifier Circuit

The IF amplifier consists of a low-noise, gain controlled IC amplifier IC1, IC2 and IC3 and a bandwidth selector circuit TR2.

IC1, IC2 and IC3 are gain controlled by the Gain and STC control signals from the Gain and STC (Anti-Clutter Sea) circuit on the STC PCB. The maximum gain is obtained when voltage of IC1-5, IC2-5 and IC3-5 is 4 volts.

When the gate voltage of TR2 is 0 volt, the bandwidth is wide, 10 MHz. When the gate of TR6 is −4 V the bandwidth will be narrow, 3 MHz.

2) Detector Circuit

The detector circuit IC4 operates as a sensitive detector amplifier. The positive video signal appears IC4-12, the IF component is removed and the video signal is fed to the video circuit.

3) Video Circuit

The video circuit consists of TR7 and TR3. The emitter follower TR3 operates as an impedance transformer to drive the coaxial cable which feeds the video signal to the display unit. The video signal can be checked at TB1-VD.

4) Tuning Indication Circuit-1

The tuning indicator circuit consists of amplifier TR4, detector TR5, emitter follower TR6 which charges C19 (STC PCB) to the detector voltage.

C) STC PCB

1) Tuning Indicator Circuit-2

The detector voltage which charges C19 is sent to the display unit as a tuning indication voltage by buffer amplifier IC8. The range of the tuning indication voltage is +4 V (detuned) and −0.7 V (tuned in long pulse).

2) Gain-STC Circuit

The receiver has a built-in Gain-STC circuit. The gain control voltage from the display unit is 12 volts for maximum sensitivity, and 0 volts for minimum sensitivity.

The STC control circuit consists of TR2 and TR3. This circuit uses only the negative portion of the transmitter trigger as the STC pulse. The positive portion is removed by CD1.

TR2 will be turned "On" with the receipt of the transmit trigger (STC pulse). TR2 will be turned "On" and C12 will charge. When the transmit trigger (STC pulse) ends, TR2 will be turned "Off". C12 will discharge to the 0 V through R17 and RV4. The discharge rate will be determined by the time constant of R17, RV4 and C12. The slope of the STC signal can be varied by the adjustment of RV4. The STC signal is combined with the Gain control voltage and applied to the IC1, IC2 and IC3 (Receiver PCB).

3) Main Bang Suppression (MBS) Circuit

The main bang suppression circuit consists of TR1. This circuit uses only the negative portion of the transmitter trigger as the MBS pulse. The positive portion is removed by CD2. TR1 will be turned "On" with the receipt of the MBS pulse. TR1 will be turned "On" and C17 will charge. When the MBS pulse ends, TR1 will be turned "Off". C17 will discharge to the 0 V through R28. The discharge rate will be determined by the time constant of C17 and R28. The MBS signal is combined with the Gain control voltage and STC signal, and applied to the IC1, IC2 and IC3 (Receiver PCB).

6.1.5 Receiver Unit (R11X)

The receiver unit consists of the MIC Frontend and the receiver PCB.

A) MIC Frontend

The MIC Frontend consists of a low-noise RF amplifier, a double balanced mixer and the local oscillator. The received signal is amplified

by a low-noise amplifier fed to the double balanced type mixer which presents a good signal-to-noise ratio to the receiver. The mixer output frequency is 60 MHz. The local oscillator tuning is achieved by the adjustment of the operator's tune control on the display control panel.

B) Receiver PCB

1) IF Amplifier Circuit

The IF amplifier consists of a low-noise, gain controlled IC amplifier IC1, IC2 and IC3, and a bandwidth selector circuit TR1 and TR2.

IC1, IC2 and IC3 are gain controlled by the Gain and STC control signals from the Gain and STC (Anti-Clutter Sea) circuit. The maximum gain is obtained when voltage of IC1-5, IC2-5 and IC3-5 is 4 volts.

The bandwidth selector IC6 receives the pulse length selector signal PW. When there is no pulse length signal, IC6 will be "Off", the gate voltage of TR2 will be 0 volt, the pulse length is 0.08 μs and the bandwidth is wide, 10 MHz. When the pulse length signal is available (when the pulse length is other than 0.08 μs) IC6 will be turned "On" and the gate of TR2 will be -4 V and the bandwidth will be narrow, 3 MHz.

2) Detector Circuit

The detector circuit IC4 operates as a sensitive detector amplifier. The positive video signal appears across IC4-12, the IF component is removed and the video signal is fed to the video circuit.

3) Video Circuit

The video circuit consists of TR11 and TR9. The emitter follower TR9 operates as an impedance transformer to drive the coaxial cable which feeds the video signal to the display unit. The video signal can be checked at J1-6.

4) Tuning Indication Circuit

The tuning indicator circuit consists of amplifier TR3, detector TR4, emitter follower TR5 which charges C44 to the detector voltage. This detector voltage is sent to the display unit as a tuning indication voltage by buffer amplifier IC8. The range of the tuning indication voltage is +4 V (detuned) and -0.7 V (tuned in long pulse).

5) Gain-STC Circuit

The receiver has a built-in Gain-STC circuit. The gain control voltage from the display unit is 12 volts for maximum sensitivity, and 0 volts for minimum sensitivity.

The STC control circuit consists of TR8 and TR10. This circuit uses only the negative portion of the transmitter trigger as the STC pulse. The positive portion is removed by CD7.

TR8 will be turned "On" with the receipt of the transmit trigger (STC pulse). TR8 will be turned "On" and C56 will charge. When the transmit trigger (STC pulse) ends, TR8 will be turned "Off". C56 will discharge to the 0 V through R61, and RV3. The discharge rate will be determined by the time constant of R61, RV3 and C56. The slope of the STC signal can be varied by the adjustment of RV3. The STC signal is combined with the Gain control voltage and applied to the IC1, IC2 and IC3.

6) Main Bang Suppression (MBS) Circuit

The main bang suppression circuit consists of TR7. This circuit uses only the negative portion of the transmitter trigger as the MBS pulse. The positive portion is removed by CD8. TR7 will be turned "On" with the receipt of the MBS pulse. TR7 will be turned "On" and C57 will charge. When the MBS pulse ends, TR7 will be turned "Off". C57 will discharge to the 0 V through R63. The discharge rate will be determined by the time constant of C57 and R63. The MBS signal is combined with the Gain control voltage and STC signal, and applied to the IC1, IC2 and IC3.

6.2 DISPLAY UNIT

The display unit consists of the Main Control PCB's, the adjustment PCB, the Receive Buffer PCB, the Power Supply PCB, and the CRT and its Display Control PCB.

6.2.1. Main Control PCB

6.2.1.1 Video Input Circuit

The incoming video signal from the receiver in the scanner is first routed to the FTC circuit components consisting of CD1 and C2.

The Varicap diode CD1 is controlled by the voltage supplied from the front panel RAIN CLUTTER Control in the range of +24 V to 0 V dc.

Maximum FTC occurs when the voltage is 0 V dc.

6.2.1.2 A/D Converter

The A to D converter changes the filtered video signal from an analog signal into a 3 bit digital signal. The A/D converter consists of IC's 2-6. Since the conversion must occur at high speed, four comparator ICs are used. The threshold level is set by RV1 (Upper) located on the Receive Buffer PCB (CQA-116). The digitized video output is then sent for storage in the buffer memory.

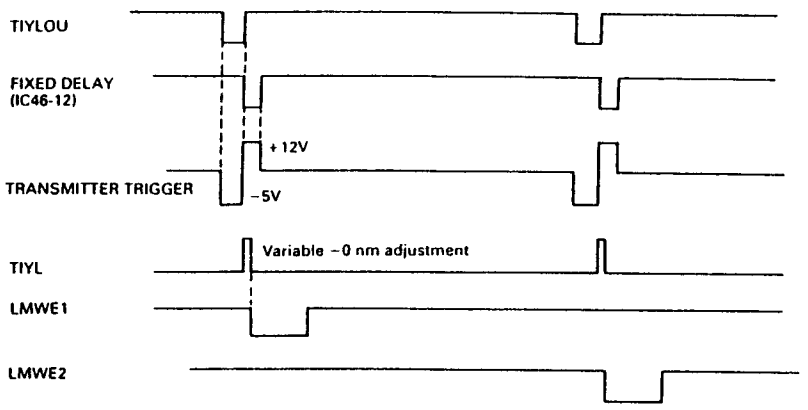
6.2.1.3 Sampling Clock Generator

The Sampling Clock Generator consists of crystals CX2 and CX3, along with IC25 and IC29. The CX2 operates at 30 MHz and CX3 operates at 22.4 MHz. The 22.4 MHz is used to set the timing of the 0.125, 0.25 and 0.5 nm range scales, and the 30 MHz is used the remaining range scales.

6.2.1.4 Buffer Memory

IC30 and IC31 are Buffer Memories, consisting of 2K bit×8 dual port input data and output data using random access. Each IC is written to alternately at each transmission and a read-out is made simultaneously.

The buffer memory timing and transmitter triggering are shown in the figure below.



6.2.1.5 Video Processor Circuit

The Video Processor consists of IC35~IC39, and performs two functions on the video signal.

a. Interference Rejection Processing

b. Expander Processing

The Interference Rejection Processing is performed by comparing the bit-by-bit content of the digital video stored from each successive radar transmission when the IR function is enabled by the operator. The IC35 and IC37 perform the interference rejection in this radar.

Expander Processing is performed by extending one digital video cell to 8 digital video cells. IC35, IC37, IC38 and IC39 perform the expansion in this radar.

6.2.1.6 Video Memory

The start of the data readout of buffer memory is triggered on the trailing edge of the bearing pulse from the scanner unit. The bearing pulse is wave shaped by IC29. This clock is used for data processing of IC28. The video data which has passed through IC28 is transfered to the video memory IC41. IC41 is a DRAM consisting of 256K bit×4. IC41 is used to produce a picture of 4 planes of which 3 will be used.

The address signals used to write into and readout of the video memory are generated in IC28. The output data from the video memory is entered into IC22 the video signal mixer/processor.

6.2.1.7 Graphic Control Memory

This radar use 8 bit CPU (IC7), and the Graphic Display Controller (IC8). IC7 (CPU) and the IC8 (GDC) principally control the graphic system of the on screen display of the VRM, EBL, bearing scale, fixed range markers, and other peripheral parts. The CPU is provided with memory of 512K bit of ROM in IC6 and 64 K bit of RAM in IC5. The RAM memory has battery backup through IC1. The data of range, EBL, VRM, CRT brilliance, EXP, and IR will be maintained after shutdown of power.

The CPU paints the various character data, VRM, EBL, Range Marker, etc. through the GDC and performs processing of the data from the scan converter and from the keys on the control panel.

The content of the memory is read out by parallel-serial converter IC18–IC20 and sent to video output circuit.

6.2.1.8 Video Output

The data which has been converted into raster scan data is read each raster. The 3 bit image signal is digital to analog converted by R8, R9 and IC22, and converted into video signals having 8 levels and outputted to the buffer amplifier TR2. The graphic data is input to TR2 via CD1 and IC22. When the image brilliance control signal is outputted from IC23 and applied to TR1, the CRT brilliance is varied in 8 steps. The video signal along with the HS and VS are sent to the monitor display.

6.2.1.9 Optional Inputs

This radar can be connected to the Loran C and Magnetic Flux Sensor.

A) Loran C

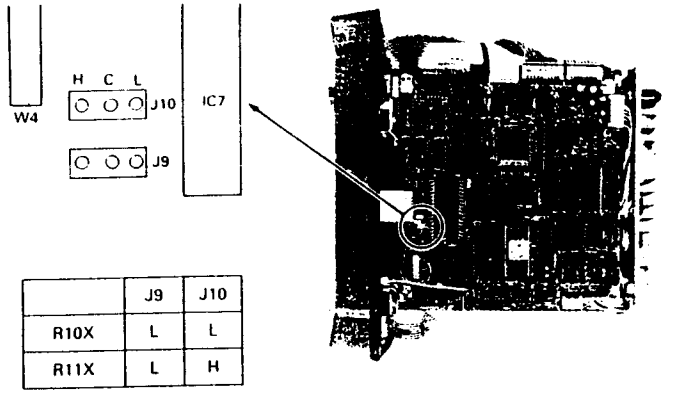
The signal outputted from the Loran C of NMEA0180, 0182, 0183 or JRC standard, will display the LAT/LON or TD's at the bottom of the display screen. For Waypoint data to be displayed, the data must be NMEA0183 or JRC standard. The signal enters at J4, and passes through IC7, IC8 and IC9 (in Receive Buffer PCB) to CPU.

B) Magnetic Sensor

The output from the Magnetic Sensor is displayed at the top of the

display screen. The data enters at J1, passes through IC7, IC8 and IC9 (in Receive Buffer PCB) and is passed to CPU.

[Jumper settings for Main Control PCB]
J9 and J10 determine radar type



	J9	J10
R10X	L	L
R11X	L	H

6.2.2 Control PCB

The control PCB has 4 controls for the TUNE, GAIN, RAIN CLUTTER and SEA CLUTTER. There are 22 keys which perform various functions including turning the radar ON/OFF. The Control Panels are back-lighted in 8 control steps.

There are 6 variable resistors mounted on the adjustment PCB, which are necessary for proper alignment when the installation has been completed.

6.2.3 Power Supply PCB

The AVR converter circuit consists of a duty control AVR converter circuit (IC1–IC3 and TR3, TR4) and power ON/OFF control and X-MIT control circuit (IC2, IC5, IC6, TR5 and TR6).

IC1 controls the switching duty from the error signal of IC2 and drives the switching transistor TR3 and TR4. Consequently, the converter outputs regulated −5V, +5V and +12V dc. IC5 produces the power "ON" signal by depressing ST-BY/OFF switch on the Control Panel and the transmit signal by depressing X-MIT/OFF switch. When the ST-BY/OFF and X-MIT/OFF switches are depressed at the same time, IC5-2 is cleared and the power supply circuit turns off.

6.2.4 Display Monitor

The Display Monitor will operate with +12 V from the power supply, and the HS (Horizontal Sync.), VS (Vertical Sync.), and the video signals. The HS and VS signals are TTL (+) polarity, so the video image will be at maximum brilliance at +3.5 V and with a video signal of 20 MHz bandwidth.

The Display control board has the adjustments for H-Hold, Contrast, V-Hold, V-Gain, V-Size, Focus, Sub-Bright, and H-Size.

The CRT is used in a vertical position, so the horizontal adjustments will effect the vertical, and the vertical adjustments will effect the horizontal.

SECTION 7

PARTS LIST

7.1 ELECTRICAL PARTS LIST

7.1 ELECTRICAL PARTS LIST

RIOX SCANNER UNIT TYPE 50004

MAIN CHASSIS TYPE CQC-537

REF.	TYPE	DESCRIPTION	JRC P/N
J101	NJS6933		5EZAA00020
H101	H-7BDRD0023		7BDRD0023
HT101	SR-1 FM4, 9X4, 9X6		5MPAB00001
H103	640250-2		5JWAH00693
H105	IL-G-2S-S3C2		5JWAD00070
HC101	H-7PCRD0811		7PCRD0811
HT103	640706-1		5JTAN00020
HT105	IL-G-C2-0001		5JWAD00214
S101	NRS-109		5KRAA00036
Y201	RMC-1		5VMAA00059
V1	B4-6		1166140002
ZC101	H-7ZCRD0340A		7ZCRD0340A

MODULATOR PCB TYPE CNM-149

REF.	TYPE	DESCRIPTION	JRC P/N
C1	DD10-979E472P500	500V, 4700PF	5CAAA03534
C2	ECQ-B1H103KZ3	0.01UF 50V	5CRAA00771
C3	DD107-979SL221J50	220PF, 50V	5CBAB02016
C4	ECQ-V1H104JZ3		5CRAA00617
C5	ECEA1EKS330B	25V 33UF	5CEAA01988
C6	ECQ-B1H103K3	0.01UF 50V	5CRAA00771
C7	ECW-H10H153HR		5CRAA00602
C8	ECW-H10H153HR		5CRAA00602
C9	ECW-H10H183HR		5CRAA00882
C10	ECQ-V1H104JZ3		5CRAA00617
C11	DD10-979E472P500	500V, 4700PF	5CAAA03534
C12	ECQ-V1H104JZ3		5CRAA00617
C13	ECQ-V1H104JZ3		5CRAA00617
C14	ECQ-V1H104JZ3		5CRAA00617
C15	ECQ-V1H104JZ3		5CRAA00617
C16	ECE-A1HU222		5CEAA01783

REF.	TYPE	DESCRIPTION	JRC P/N
C17	ECEA1HU101B	50V 100U	5CEAA02306
C18	ECQ-V1H104JZ3		5CRAA00617
C19	ECE-A1HKS100B	50V 10UF	5CEAA02486
C20	ECQ-B1H103KZ3	0.01UF 50V	5CRAA00771
C21	ECE-A1CU472		5CEAA01980
C22	ECQ-B1H222KZ3	2200P	5CRAA00954
C23	ECE-A1CU222	2200UF 16V	5CEAA01757
C24	ECE-A1CU222	2200UF 16V	5CEAA01757
C25	ECE-A1CU222	2200UF 16V	5CEAA01757
C26	ECEA2WU3R3B	450V, 3.3UF	5CEAA03007
C27	ECEA2WU3R3B	450V, 3.3UF	5CEAA03007
C28	ECQ-V1H104JZ3		5CRAA00617
C29	ECE-A1HKS100B	50V 10UF	5CEAA02486
C30	ECEA1EKS330B	25V 33UF	5CEAA01988
C31	ECQ-V1H104JZ3		5CRAA00617
C32	ECQ-V1H104JZ3		5CRAA00617
C33	ECQ-V1H10JZ3		5CRAA00617
C34	ECQ-V1H104JZ3		5CRAA00617
C35	ECQ-V1H104JZ3		5CRAA00617
C36	ECQ-B1H103KZ3	0.01UF 50V	5CRAA00771
C37	ECQ-B1H472KZ3	4700P 50V	
CD1	V11N TYPE2		5TXAE00683
CD2	HZ18BPRE		5TXAE00843
CD3	U05JTYPE2	800V 2.5A	5TXAE00817
CD4	V06C TYPE2		5TXAE00747
CD7	SRT-7HP		5TXDL00005
CD8	1S1588-TPB2		5TXAD00335
CD9	U05JTYPE2	800V 2.5A	5TXAE00817
CD10	U05JTYPE2	800V 2.5A	5TXAE00817
CD11	V06C TYPE2		5TXAE00747
CD12	V06C TYPE2		5TXAE00747
CD13	HZ15-3RE		5TXAE00622
CD14	1S1588-TPB2		5TXAD00335
CD15	F5KF20		5TXAG00321
CD16	1S1588-TPB2		5TXAD00335
CD17	HZ6C1RE		5TXAE00516
CD18	HZ6C1RE		5TXAE00516
CD19	V06C TYPE2		5TXAE00747
CD20	V06C TYPE2		5TXAE00747

REF.	TYPE	DESCRIPTION	JRC P/N
CD21	11DF2FC		5TXAG00239
CD22	11DF2FC		5TXAG00239
CD23	11DF2FC		5TXAG00239
CD24	11DF2FC		5TXAG00239
CD25	11DF2FC		5TXAG00239
CD26	11DF2FC		5TXAG00239
CD27	V11N TYPE2		5TXAE00683
CD28	V11N TYPE2		5TXAE00683
CD29	1S1588-TPB2		5TXAD00335
CD30	1S1588-TPB2		5TXAD00335
CD31	U05JTYPE2	800V 2.5A	5TXAE00817
IC1	UPC494C		5DAAA00136
IC2	UPC494C		5DAAA00136
IC3	TLP521-1-Y		5TZAD00265
IC4	NJM78M05FA		5DAAN00375
ICS4	PRT-807	5ZZAJ00014	
J1	IL-G-9P-S3T2-E		5JWAD00383
J2	IL-G-12P-S3T2-E		5JWAD00082
J3	640388-2		5JWAH00683
J4	B5P-SHF-1AA		5JWAP00135
J5	IL-G-2P-S3T2-E		5JWAD00067
K1	LZ-12		5KLAC00055
L1	H-6LZRD00045		6LZRD00045
L2	H-7LZRD0101		7LZRD0101
L3	H-7LCRD0039		7LCRD0039
L4	H-7LCRD0037		7LCRD0037
L5	SC-02-20G		5LGAB00081
L6	SC-05-100		5LGAB00009
L7	HP-054S		5LGAB00036
PC201	H-7PCRD1151A		7PCRD1151A
R1	NAS1/4 100JRP	1/4W, 10 OHM	5RBAA02776
R2	NAS1/4 102JRP	1/4W, 1K OHM	5RBAA02777
R3	NAS1/4 102JRP	1/4W, 1K OHM	5RBAA02777
R4	NAS1/4 102JRP	1/4W, 1K OHM	5RBAA02777
R5	NAS1/4 471JRP	1/4W, 470 OHM	5RBAA02778
R6	ERG-2SJ221P	2W, 220 OHM	5REAG02604
R7	NAS1/4 472JRP	1/4W, 4.7K OHM	5RBAA02779
R8	NAS1/4 472JRP	1/4W, 4.7K OHM	5RBAA02779
R9	ERG-2ANJP470S	2W 47 OHM	5REAG01258
R10	ERX-2ANJP4R7S		5REAG01357

REF.	TYPE	DESCRIPTION	JRC P/N
R11	NAS1/4 472JRP	1/4W, 4.7K OHM	5RBAA02779
R12	NAS1/4 472JRP	1/4W, 4.7K OHM	5RBAA02779
R13	ERD-50TJ472	1/2W 4.7K OHM	5RDAA00851
R14	NAS1/4 103JRP	1/4W, 10K OHM	5RBAA02780
R15	NAS1/4 562JRP	1/4W, 5.6K OHM	5RBAA02832
R17	NAS1/4 472JRP	1/4W, 4.7K OHM	5RBAA02779
R18	ERD-50TJ332	1/2W 3.3K OHM	5RDAA00847
R19	NAS1/4 472JRP	1/4W, 4.7K OHM	5RBAA02779
R20	NAS1/4 103JRP	1/4W, 10K OHM	5RBAA02780
R21	NAS1/4 102JRP	1/4W, 1K OHM	5RBAA02777
R22	NAS1/4 104JRP	1/4W, 100K OHM	5RBAA02828
R23	NAS1/4 103JRP	1/4W, 10K OHM	5RBAA02780
R24	NAS1/4 222JRP	1/4W, 2.2K OHM	5RBAA02781
R25	NAS1/4 472JRP	1/4W,4.7K OHM	5RBAA02779
R26	NAS1/4 682JRP	1/4W,6.8K OHM	5RBAA02727
R27	ERD-50TJ151	1/2W 150 OHM	5RDAA00815
R28	ERD-50TJ151	1/2W 150 OHM	5RDAA00815
R29	NAS1/4 102JRP	1/4W,1K OHM	5RBAA02777
R30	NAS1/4 102JRP	1/4W,1K OHM	5RBAA02777
R31	ERG-2SJ104P	2W 100K OHM	5REAG01491
R32	NAS1/4 472JRP	1/4W,4.7K OHM	5RBAA02779
R33	NAS1/4 471JRP	1/4W, 470 OHM	5RBAA02778
R34	NAS1/4 103JRP	1/4W, 10K OHM	5RBAA02780
R35	NAS1/4 101JRP	1/4W, 100 OHM	5RBAA02785
R36	NAS1/4 470JRP	1/4W, 47 OHM	5RBAA02819
R37	ERX-1ANJ1R8	1W,1.8OHM	5REAG01422
R38	NAS 1/4 100JRP	1/4W,10OHM	5RBAA02776
R39	ERD-50TJ150	1/2W 15OHM	
RV1	GF06P-1K OHM	1K OHM	5RMAB00059
RV2	GF06P-1K OHM	1K OHM	5RMAB00059
SHT1	M30-TO-220-D-1	TO-220	5ZKBG00002
SHT2	M30-TO-220-D-1	TO-220	5ZKBG00002
SHT3	M30-TO-220-D-1	TO-220	5ZKBG00002
SHT4	M30-TO-220-D-1	TO-220	5ZKBG00002
SHT5	M30-TO-220-D-1	TO-220	5ZKBG00002
T1	H-7LPRD0086		7LPRD0086
T2	H-7LTRD0182		7LTRD0182
TB1	M106D-M-5P		5JTBF00753
TP1	LC-2-G YEL		5JTCW00015
TP2	LC-2-G YEL		5JTCW00015

REF.	TYPE	DESCRIPTION	JRC P/N
TP3	LC-2-G YEL		5JTCW00015
TP4	LC-2-G YEL		5JTCW00015
TP5	LC-2-G YEL		5JTCW00015
TP6	LC-2-G YEL		5JTCW00015
TP7	LC-2-G YEL		5JTCW00015
TR1	2SC1815Y TPE2		5TCAF00781
TR2	2SA1242-Y		5TAAG00238
TR3	IRF840	500V 8A	5TZBE00026
TR4	2SC1815Y TPE2		5TCAF00781
TR5	2SC3328-Y		5TCAF00579
TR6	2SJ142		5TKAD00128
TR7	2SC1627YTPE2		5TCAF00808
TR8	2SA817YTPE2		5TCAF00810
TR9	2SK736		5TKAD00116
TR10	2SK736		5TKAD00116
TR11	2SC2983-Y		5TCAF00578
TRS3	SP-30-BS-AN-0		5ZKAF00051

RECEIVER CHASSIS TYPE CGH-173

REF.	TYPE	DESCRIPTION	JRC P/N
E301	NJT1946		5EZAA00021

RECEIVER PCB TYPE CAE-286

REF.	TYPE	DESCRIPTION	JRC P/N
C1	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C2	C3216CH1H100D-E-TP	10PF	5CAAD00785
C3	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C4	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C5	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C6	ECEA1EKS100I	10U	5CEAA03004
C7	C3216CH1H120J-E-TP	12PF	5CAAD00784
C8	C3216CH1H20J-E-TP	22PF	5CAAD00869
C9	C3216CH1H100D-E-TP	10PF	5CAAD00785
C10	C3216SL1H222J-E-TP	2200PF	5CAAD00792

REF.	TYPE	DESCRIPTION	JRC P/N
C11	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C12	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C13	ECEA1EKS100I	10U	5CEAA03004
C14	C3216CH1H120J-E-TP	12PF	5CAAD00784
C15	C3216CH1H220J-E-TP	22PF	5CAAD00869
C16	C3216CH1H100D-E-TP	10PF	5CAAD00785
C17	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C18	ECEA1EKS100I	10U	5CEAA03004
C19	C3216CH1H330J-E-TP	33PF	5CAAD00794
C20	C3216CH1H101J-E-TP	50V 100PF	5CAAD00780
C21	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C22	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C23	C3216CH1H222J-E-TP	2200PF	5CAAD00792
C24	C3216CH1H330J-E-TP	33PF	5CAAD00794
C25	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C26	ECEA1EKS100I	10U	5CEAA03004
C27	C3216CH1H050C-E-TP	50V 5PF	5CAAD00800
C28	C3216JB1H103K-E-TP	50V 0.01UF	5CAAD00789
C29	C3216CH1H070D-E-TP	7PF	5CAAD00977
C30	C3216JB1H103K-E-TP	50V 0.01UF	5CAAD00789
C31	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C32	ECEA1EKS100I	10U	5CEAA03004
C33	C3216SL1H222-E-TP	2200PF	5CAAD00792
C34	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C35	ECEA1EKS100I	10U	5CEAA03004
C36	ECEA1CKS470I	47U	5CEAA03005
C37	C3216CH1H100D-E-TP	10PF	5CAAD00785
C38	C3216CH1H100D-E-TP	10PF	5CAAD00785
C39	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C40	C3216CH1H330J-E-TP	33PF	5CAAD00794
C41	C3216CH1H050C-E-TP	50V 5PF	5CAAD00800
C42	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C43	ECEA1EKS100I	10U	5CEAA03004
C44	C3216CH1H050C-E-TP	50V 5PF	5CAAD00800
C45	C3216CH1H070D-E-TP	7PF	5CAAD00977
C46	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C47	ECEA1EKS100I	10U	5CEAA03004
C48	C3216CH1H100D-E-TP	10PF	5CAAD00785
C49	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C50	ECEA1EKS100I	10U	5CEAA03004

REF.	TYPE	DESCRIPTION	JRC P/N
C51	C3216CH1H050C-E-TP	50V 5PF	5CAAD00800
C52	ECEA1ESN4R7I	4.7U	5CEAA03006
C53	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C54	ECQ-V1H104JZ3		5CRAA00617
C55	C3216SL1H22J-E-TP	2200PF	5CAAD00792
C56	ECEA1EKS100I	10U	5CEAA03004
C57	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C58	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C59	ECEA1EKS100I	10U	5CEAA03004
C60	C3216CH1H101J-E-TP	50V 100PF	5CAAD00780
CD1	HZ3B2	3V	5TXAE00107
CD2	1SS226 TE85L		5TXAD00320
IC1	MC1350P		5DDAS00011
IC2	MC1350P		5DDAS00011
IC3	MC1350P		5DDAS00011
IC4	AN5132		5DAAR00105
J1	171255-1		BRTE00046
J2	171255-1		BRTE00046
J301	IL-G-3P-S3L2-E		5JWAD00093
L1	H-7LARD0103A		7LARD0103A
L2	H-7LARD0101A		7LARD0101A
L3	H-7LARD0101A		7LARD0101A
L4	H-7LARD0102A		7LARD0102A
L5	H-7LARD0102A		7LARD0102A
L6	H-7LARD0101A		7LARD0101A
L7	H-7LARD0083		7LARD0083
L8	H-7LARD0084		7LARD0084
PC1	H-7PCRD1147C		7PCRD1147C
PD1	H-7PDRD0018A		7PDRD0018A
R1	ERJ-8GEYJ223V	1/8W 22K OHM	5REAG01754
R2	ERJ-8GEYJ151V	1/8W 150 OHM	5REAG01728
R3	ERJ-8GEYJ220V	1/8W 22 OHM	5REAG01718
R4	ERJ-8GEYJ223V	1/8W 22K OHM	5REAG01754
R5	ERJ-8GEYJ151V	1/8W 150 OHM	5REAG01728
R6	ERJ-8GEYJ220V	1/8V 22 OHM	5REAG01718
R7	ERJ-8GEYJ223V	1/8W 22K OHM	5REAG01754
R8	ERJ-8GEYJ473V	1/8W 680 OHM	5REAG01758
R9	ERJ-8GEYJ222V	1/8W 2.2K OHM	5REAG01742
R10	ERJ-8GEYJ220V	1/8W 22 OHM	5REAG01718
R11	ERJ-8GEYJ681V	1/8W 680 OHM	5REAG01736

REF.	TYPE	DESCRIPTION	JRC P/N
R12	ERJ-8GEYJ473V	1/8W 47K OHM	5REAG01758
R13	ERJ-8GEYJ470V	1/8W 47 OHM	5REAG01722
R14	ERJ-8GEYJ332V	1/8W 3.3K OHM	5REAG01744
R15	ERJ-8GEYJ220V	1/8W 22 OHM	5REAG01718
R16	ERJ-8GEYJ332V	1/8W 3.3K OHM	5REAG01744
R17	ERJ-8GEYJ332V	1/8W 3.3K OHM	5REAG01744
R18	ERJ-8GEYJ332V	1/8W 3.3K OHM	5REAG01744
R19	ERJ-8GEYJ331V	1/8W, 330 OHM	5REAG01732
R20	ERJ-8GEYJ561V	1/8W 560 OHM	5REAG01735
R21	ERJ-8GEYJ102V	1/8W 1K OHM	5REAG01738
R22	ERJ-8GEYJ471V	1/8W 470 OHM	5REAG01734
R23	ERJ-8GEYJ100V	1/8W 10 OHM	5REAG01714
R24	ERJ-8GEYJ331V	1/8W, 330 OHM	5REAG01732
R25	ERJ-8GEYJ683V	1/8W 68K OHM	5REAG01760
R26	ERJ-8GEYJ221V	1/8W, 220 OHM	5REAG01730
R27	ERJ-8GEYJ331V	1/8W, 330 OHM	5REAG01732
R28	ERJ-8GEYJ470V	1/8W 47 OHM	5REAG01722
R29	ERJ-8GEYJ332V	1/8W 3.3K OHM	5REAG01744
R30	ERJ-8GEYJ473V	1/8W 47K OHM	5REAG01758
R31	ERJ-8GEYJ472V	1/8W 4.7K OHM	5REAG01746
R32	ERJ-8GEYJ470V	1/8W 47 OHM	5REAG01722
R33	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750
R34	ERJ-8GEYJ222V	1/8W 2.2K OHM	5REAG01742
R35	ERJ-8GEYJ102V	1/8W 1K OHM	5REAG01738
R36	ERJ-8GEYJ100V	1/8W 10 OHM	5REAG01714
R37	ERJ-8GEYJ122V	1/8W 1.2K OHM	5REAG01739
RV1	GF06VT-2-100 OHMM		5RMAB00161
TR1	2SK302-GRTE85L		5TKAA00225
TR2	2SK302-GRTE85L		5TKAA00225
TR3	2SA495GTM-Y (TPE2)		5TAAG00325
TR4	2SC3098-TE85L		5TCAF00529
TR5	2SK302-GRTE85L		5TKAA00225
TR6	2SA495GTM-Y (TPE2)		5TAAG00325
TR7	2SA1015Y-TPE2		5TAAG00294
W301	H-7ZCRD0336		7ZCRD0336

TSC PCB TYPE CCG-125

REF.	TYPE	DESCRIPTION	JRC P/N
C1	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C2	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C3	ECEA1EKS100I	10U	5CEAA03004
C4	202L2502 225K5471	25V 2.2UF	5CSAC00826
C5	ECQ-V1H104JZ3		5CRAA00617
C6	C3216JF1H104Z-E-TP	50V 0.1UF	5CAAD01268
C7	C3216JF1H104Z-E-TP	50V 0.1UF	5CAAD01268
C8	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C9	ECEA1EKS100I	10U	5CEAA03004
C10	ECEA1ESN4R7I	4.7U	5CEAA03006
C11	ECEA1CKS470I	47U	5CEAA03005
C12	C3216JB1H103K-E-TP	50V 0.01UF	5CAAD00789
C13	C3216CH1H221J-E-TP	220PF	5CAAD00790
C14	ECEA1EKS100I	10U	5CEAA03004
C15	ECEA1ESN4R7I	4.7U	5CEAA03006
C16	ECEA1CKS470I	47U	5CEAA03005
C17	C3216CH1H150J-E-TP	15PF	5CAAD00787
C18	ECEA1EKS100I	10U	5CEAA03004
C19	ECQ-B1H332JZ3	3300PF 50V	5CRAA00586
C20	ECEA1CKS470I	47UF	5CEAA03005
C21	C3216JF1H104Z-E-TP	50V 0.1UF	5CAAD01268
C22	C3216JF1H104Z-E-TP	50V 0.1UF	5CAAD01268
CD1	1SS226 TE85L		5TXAD00320
CD2	1SS226 TE85L		5TXAD00320
CD3	1SS184 TE85R		5TXAD00291
CD4	1SS184 TE85R		5TXAD00291
CD5	1SS226 TE85L		5TXAD00320
CD6	TLR123		5TZAD00101
CD7	1SS226 TE85L		5TXAD00320
IC1	TA78DL12P		5DAAD00636
IC2	NJM78M05FA		5DAAN00375
IC3	NJM4558D		5DAAF00027
IC4	NJM4558D		5DAAF00027
IC5	TL082CP		5DDAL00326
J1	IL-G-9P-S3L2-E	9P	5JWAD00090
J2	SGB-XH-A		5JWAP00451
PC1	H-7PCRD1154A		7PCRD1154A
PD1	H-7PDRD0019A		7PDRD0019A

REF.	TYPE	DESCRIPTION	JRC P/N
R1	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750
R2	ERJ-8GEYJ472V	1/8W 4.7K OHM	5REAG01746
R3	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750
R4	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750
R5	ERJ-8GEYJ102V	1/8W 1K OHM	5REAG01738
R6	ERJ-8GEYJ273V	1/8W 27K OHM	5REAG01755
R7	ERJ-8GEYJ223V	1/8W 22K OHM	5REAG01754
R8	ERJ-8GEYJ473V	1/8W 47K OHM	5REAG01758
R9	ERJ-8GEYJ223V	1/8W 22K OHM	5REAG01754
R10	ERJ-8GEYJ473V	1/8W 47K OHM	5REAG01758
R11	ERJ-8GEYJ153V	1/8W 15K OHM	5REAG01752
R12	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750
R13	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750
R14	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750
R15	ERG-1SJ470		5REAG01286
R16	ERJ-8GEYJ391V	1/8W, 390 OHM	5REAG01733
R17	ERJ-8GEYJ183V	1/8W 10K OHM	5REAG01753
R18	ERJ-8GEYJ470V	1/8W 47 OHM	5REAG01722
R19	ERJ-8GEYJ222V	1/8W 2.2K OHM	5REAG01742
R20	ERJ-8GEYJ471V	1/8W 470 OHM	5REAG01734
R21	ERJ-8GEYJ221V	1/8W 220 OHM	5REAG01730
R22	ERJ-8GEYJ122V	1/8W 1.2K OHM	5REAG01739
R23	ERJ-8GEYJ561V	1/8W 560 OHM	5REAG01735
R24	ERJ-8GEYJ471V	1/8W 470 OHM	5REAG01734
R25	ERJ-8GEYJ332V	1/8W 3.3K OHM	5REAG01744
R26	ERJ-8GEYJ102V	1/8W 1K OHM	5REAG01738
R27	ERJ-8GEYJ470V	1/8W 47 OHM	5REAG01722
R28	ERJ-8GEYJ562V	1/8W 5.6K OHM	5REAG01747
R29	ERJ-8GEYJ470V	1/8W 47 OHM	5REAG01722
R30	ERJ-8GEYJ102V	1/8W 1K OHM	5REAG01738
R31	ERJ-8GEYJ220V	1/8W 22 OHM	5REAG01718
R32	HMGL1/4A-10M OHM J		5REAA05607
R33	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750
R34	ERJ-8GEYJ222V	1/8W 2.2K OHM	5REAG01742
R35	ERJ-8GEYJ471V	1/8W 470 OHM	5REAG01734
R36	ERJ-8GEYJ681V	1/8W 680 OHM	5REAG01736
R37	ERJ-8GEYJ332V	1/8W 3.3K OHM	5REAG01744
R38	ERJ-8GEYJ332V	1/8W 3.3K OHM	5REAG01744
R39	ERJ-8GEY0R00V	0OHM	5REAG01775

REF.	TYPE	DESCRIPTION	JRC P/N
R41	ERJ-8GEYJ392V	1/8W 3.9K OHM	5REAG01745
R42	ERJ-8GEYJ182V	1/8W 1.8K OHM	5REAG1741
R43	ERJ-8GEYJ331V	1/8W 330 OHM	5REAG01732
R44	ERJ-8GEYJ470V	1/8W 47 OHM	5REAG01722
RV1	GF06UT-2-1-10K OHM	1/2W 10K OHM	5RMAB00128
RV2	GF06UT-2-10K OHM	1/2W 10K OHM	5RMAB00128
TR1	2SA1015Y-TPE2		5TAAG00294
TR2	2SA1015Y-TPE2		5TAAG00294
TR3	2SC1815Y TPE2		5TCAF00781
TR4	2SC1815Y TPE2		5TCAF00781

RIIX SCANNER UNIT TYPE 50005

RADIATOR TYPE NAX-30

REF.	TYPE	DESCRIPTION	JRC P/N
PC101	H-7PCRD1168		7PCRD1168

MAIN CHASSIS TYPE CQC-549

REF.	TYPE	DESCRIPTION	JRC P/N
A101	NJS6933		5EZAA00020
M101	H-7BDRD0027		7BDRD0027
MT101	SR-1 FM4.9X4.9X6		5MPAB00001
P104	H5P-SHF-AA		5JWAP00144
P105	H4P-SHF-AA		5JDAH00028
P107	IL-G-2S-S3C2		5JWAD00070
PT104	SHF-001T-0.8SS		5JDAH00029
PT105	SHF-001T-0.8SS		5JDAH00029
PT107	IL-G-C2-0001		5JWAD00214
S101	NRS-109		5KRAA00036
S102	S-116		5SAAB00809
ZC101	H-7ZCRD0353		7ZCRD0353

MODULATOR CHASSIS TYPE CMN-287

REF.	TYPE	DESCRIPTION	JRC P/N
P106	640250-2		5JWAH00693
PT106	640706-1		5JTAN00020
V201	RMC-1		5VMAA00059
W1	B4-6		1166140002

MODULATOR PCB TYPE CNM-151

REF.	TYPE	DESCRIPTION	JRC P/N
C1	DD10-979E472P500	500V, 4700PF	5CAAA03534
C2	ECQ-B1H103KZ3	0.01UF 50V	5CRAA00771
C3	DD107-979SL221J50	220PF, 50V	5CBAB02016

REF.	TYPE	DESCRIPTION	JRC P/N
C4	ECQ-V1H104JZ3		5CRAA00617
C5	ECEA1EKS330B	25V 33UF	5CEAA01988
C6	ECQ-B1H103KZ3	0.01UF 50V	5CRAA00771
C7	ECW-H10H153HR		5CRAA00602
C8	ECW-H10H183HR		5CRAA00802
C9	ECW-H10H333HR	1KV, 0.033UF	5CRAA01084
C10	ECQ-V1H104JZ3		5CRAA00617
C11	DD10-979E472P500	500V, 4700PF	5CAAA03534
C12	ECQ-V1H104JZ3		5CRAA00617
C13	ECQ-V1H104JZ3		5CRAA00617
C14	ECQ-V1H104JZ3		5CRAA00617
C15	ECQ-V1H104JZ3		5CRAA00617
C16	ECE-S1HU332K	50V, 3300UF	5CEAA03034
C17	ECEA1HU101B	50V 100U	5CEAA02306
C18	ECQ-V1H104JZ3		5CRAA00617
C19	ECE-A1HKS100B	50V 10UF	5CEAA02486
C20	ECQ-B1H103KZ3	0.01UF 50V	5CRAA00771
C21	ECE-A1CU682		5CEAA02655
C22	ECQ-B1H222KZ3	2200P	5CRAA00954
C23	ECEA2WU3R3B	450V, 3.3UF	5CEAA03007
C24	ECEA2WU3R3B	450V, 3.3UF	5CEAA03007
C25	ECE-A1CU222	2200UF 16V	5CEAA01757
C26	ECE-A1CU222	2200UF 16V	5CEAA01757
C27	ECE-A1CU222	2200UF 16V	5CEAA01757
C28	ECE-A1EU332	25V, 3300UF	5CEAA03035
C29	ECE-A1EU332	25V, 3300UF	5CEAA03035
C30	ECS-F1VZ105BB	1U 35V	5CSAA00274
C31	ECQ-V1H104JZ3		5CRAA00617
C32	ECQ-V1H104JZ3		5CRAA00617
C33	ECQ-V1H104JZ3		5CRAA00617
C34	ECQ-V1H104JZ3		5CRAA00617
C35	ECQ-B1H103KZ3	0.01UF 50V	5CRAA00771
C36	ECQ-B1H103KZ3	0.01UF 50V	5CRAA00771
C37	DD07-979B102P500	1000PF 500V	5CAAA03662
CD1	V11N TYPE2		5TXAE00818
CD2	HZ18BP		5TXAE00347
CD3	U05JTYPE2	800V 2.5A	5TXAE00817
CD4	SM-1XN02 LFK4		5TXAL00121
CD7	SRT-7HP		5TXDL00005

REF.	TYPE	DESCRIPTION	JRC P/N
CD8	1S1588-TPB2		5TXAD00335
CD9	U05JTYPE2	800V 2.5A	5TXAE00817
CD10	U05JTYPE2	800V 2.5A	5TXAE00817
CD11	SM-1XN02 LFK4		5TXAL00121
CD12	SM-1XN02 LFK4		5TXAL00121
CD13	HZ15-3RE		5TXAE00622
CD14	1S1588-TPB2		5TXAD00335
CD15	F10KF20		5TXAG00312
CD16	1S1588-TPB2		5TXAD00335
CD17	HZ6C1RE		5TXAE00516
CD18	V11N TYPE2		5TXAE00818
CD19	V11N TYPE2		5TXAE00818
CD20	11DF2FC		5TXAG00239
CD21	11DF2FC		5TXAG00239
CD22	11DF2FC		5TXAG00239
CD23	11DF2FC		5TXAG00239
CD24	11DF2FC		5TXAG00239
CD25	11DF2FC		5TXAG00239
CD26	31DF2FC		5TXAG00313
CD27	31DF2FC		5TXAG00313
CD28	31DF2FC		5TXAG00313
CD29	31DF2FC		5TXAG00313
CD31	HZ6C1RE		5TXAE00516
CD32	U05JTYPE2	800V 2.5A	5TXAE00817
CD33	1S1588-TPB2		5TXAD00335
CD34	1S1588-TPB2		5TXAD00335
IC1	UPC494C		5DAAA00136
IC2	UPC494C		5DAAA00136
IC3	TLP521-1-Y		5TZAD00265
J1	641986-1		5JWAH00953
J2	IL-G-9P-S3T2-E		5JWAD00383
J3	IL-G-12P-S3T2-E		5JWAD00082
J4	B5P-SHF-1AA		5JWAP00135
J5	B4P-SHF-1AA		5JWAP00089
J6	640388-2		5JWAH00683
J7	IL-G-2P-S3T2-E		5JWAD00067
J8	641983-1		5JWAH01053
K1	LZ-12		5KLAC00055
L1	H-6LZRD00045		6LZRD00045

REF.	TYPE	DESCRIPTION	JRC P/N
L2	H-7LZRD0101		7LZRD0101
L3	H-7LCRD0040A		7LCRD0040A
L4	H-7LCRD0037		7LCRD0037
L5	SC-02-20G		5LGAB00081
L6	SC-10-100		5LGAB00011
L7	HP105Z	10A 180UH	5LGAB00070
PC201	H-7PCRD1155A		7PCRD1155A
R1	NAS1/4 100JRP	1/4W, 10 OHM	5RBAA02776
R2	NAS1/4 102JRP	1/4W, 1K OHM	5RBAA02777
R3	NAS1/4 102JRP	1/4W, 1K OHM	5RBAA02777
R4	NAS1/4 102JRP	1/4W, 1K OHM	5RBAA02777
R5	NAS1/4 471JRP	1/4W,470 OHM	5RBAA02778
R6	ERG-2SJ221P	2W, 220 OHM	5REAG02604
R7	NAS1/4 472JRP	1/4W, 4.7K OHM	5RBAA02779
R8	NAS1/4 472JRP	1/4W, 4.7K OHM	5RBAA02779
R9	ERG-2ANJP470S	2W 47 OHM	5REAG01258
R10	ERX-2ANJP4R7S		5REAG01357
R11	NAS1/4 472JRP	1/4W, 4.7K OHM	5RBAA02779
R12	NAS1/4 472JRP	1/4W, 4.7K OHM	5RBAA02779
R13	ERD-50UJ472		5RDAA01534
R14	NAS1/4 103JRP	1/4W, 10K OHM	5RBAA02780
R15	NAS1/4 752JRP	1/4W, 7.5K OHM	5RBAA02831
R17	NAS1/4 472JRP	1/4W,4.7K OHM	5RBAA02779
R18	ERD-50UJ332	1/2W, 3.3K OHM	5RDAA02197
R19	NAS1/4 472JRP	1/4W, 4.7K OHM	5RBAA02779
R20	NAS1/4 103JRP	1/4W,10K OHM	5RBAA02780
R21	NAS1/4 102JRP	1/4W, 1K OHM	5RBAA02777
R22	NAS1/4 104JRP	1/4W,100K OHM	5RBAA02828
R23	NAS1/4 103JRP	1/4W,10K OHM	5RBAA02780
R24	NAS1/4 222JRP	1/4W, 2.2K OHM	5RBAA02781
R25	NAS1/4 472JRP	1/4W, 4.7K OHM	5RBAA02779
R26	NAS1/4 622JRP	1/4W, 6.2K OHM	5RBAA02817
R27	ERD-50UJ151	1/2W, 150 OHM	5RDAA02198
R28	ERD-50UJ151	1/2W,150 OHM	5RDAA02198
R29	NAS1/4 471JRP	1/4W, 470 OHM	5RBAA02778
R30	ERD-50UJ182	1/2, 1.8K OHM	5RDAA02216
R31	NAS1/4 101JRP	1/4 100 OHM	5RBAA02785
R32	NAS1/4 104JRP	1/4W, 100K OHM	5RBAA02828
R33	NAS1/4 102JRP	1/4W,1K OHM	5RBAA02777

REF.	TYPE	DESCRIPTION	JRC P/N
R34	ERG-1ANJ222U	1W, 2.2K OHM	5RDAA02201
R35	ERX-2ANJR39S	2W,0.39OHM	5REAG03479
R36	NAS1/4 103JRP	1/4W, 10K OHM	5RBAA02780
R37	NAS1/4 101JRP	1/4W, 100 OHM	5RBAA02785
R38	ERG-2ANJP104S	2W 100K OHM	5REAG01247
R39	NAS1/4 100JRP	1/4W, 10 OHM	5RBAA02776
R40	NAS1/4 100JRP	1/4W, 10 OHM	5RBAA02776
R41	NAS1/4 470JRP	1/4W, 47 OHM	5RBAA02819
R42	NAS 1/4 101JRP	1/4W,100OHM	5RBAA02785
R43	ERX-2ANJP5R6S		5REAG01357
RV1	GF06UT-2-1K OHM		5RMAB00117
SHT1	H-7ZSRD0015		7ZSRD0015
SHT3	M30-TO-220-D-1	TO-220	5ZKBG00002
T1	H-7LPRD0086		7LPRD0086
T2	H-7LTRD0183		7LTRD0183
TP1	LC-2-G YEL		5JTCW00015
TP2	LC-2-G YEL		5JTCW00015
TR1	2SC1815Y TPE2		5TCAF00781
TR2	2SA1242-Y		5TAAG00238
TR3	IRF840	500V 8A	5TZBE00026
TR4	2SC1815Y TPE2		5TCAF00781
TR5	2SC3328Y TPE6		5TCAF00815
TR6	2SJ142		5TKAD00128
TR7	2SC1627YTPE2		5TCAF00808
TR8	2SA817YTPE2		5TCAF00810
TR9	IRFZ-44		5TZBE00043
TR10	IRFZ-44		5TZBE00043
TR11	2SA1261-K		5TAAB00097
TR12	2SK363VTPE2		5TCAF00816
TR13	2SC1815Y TPE2		5TCAF00781
TRS3	SP-30-BS-AN-0		5ZKAF00051

RECEIVER CHASSIS TYPE CGH-175

REF.	TYPE	DESCRIPTION	JRC P/N
E301	NJT1946		5EZAA00021
TP1	60789-2		5JWAH00086

REF.	TYPE	DESCRIPTION	JRC P/N
TP2	60789-2		5JWAH00086
TP3	60789-2		5JWAH00086
TP4	60789-2		5JWAH00086
TP5	60789-2		5JWAH00086
TP6	60789-2		5JWAH00086

RECEIVER PCB TYPE CAE-436

REF.	TYPE	DESCRIPTION	JRC P/N
C1	C3216CH1H100D-E-TP	10PF	5CAAD00785
C2	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C3	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C4	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C5	C3216CH1H070D-E-TP	7PF	5CAAD00977
C6	C3216CH1H220J-E-TP	22PF	5CAAD00869
C7	C3216CH1H100D-E-TP	10PF	5CAAD00785
C8	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C9	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C10	C3216CH1H070D-E-TP	7PF	5CAAD00977
C11	C3216CH1H220J-E-TP	22PF	5CAAD00869
C12	C3216CH1H100D-E-TP	10PF	5CAAD00785
C13	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C14	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C15	C3216CH1H220J-E-TP	22PF	5CAAD00869
C16	C3216CH1H270J-E-TP	27PF	5CAAD00793
C17	C3216CH1H101J-E-TP	50V 100PF	5CAAD00780
C18	C3216CH1H101J-E-TP	50V 100PF	5CAAD00780
C19	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C20	C3216CH1H270J-E-TP	27PF	5CAAD00793
C21	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C22	C3216CH1H101J-E-TP	50V 100PF	5CAAD00780
C23	C3216CH1H050C-E-TP	50V 5PF	5CAAD00800
C24	C3216CH1H070D-E-TP	50V 7PF	5CAAD00977
C26	ECE-A1CKS470B	47UF	5CEAA01707
C27	C3216CH1H100D-E-TP	10PF	5CAAD00785
C28	C3216CH1H100D-E-TP	10PF	5CAAD00785
C29	C3216CH1H330J-E-TP	33PF	5CAAD00794
C30	C3216CH1H050C-E-TP	50V 5PF	5CAAD00800

REF.	TYPE	DESCRIPTION	JRC P/N
C31	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C32	ECE-A1EKS100B	10UF 25V	5CEAA01750
C33	C3216CH1H050C-E-TP	50V 5PF	5CAAD00800
C34	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C35	C3216CH1H070D-E-TP	7PF	5CAAD00977
C36	C3216CH1H100D-E-TP	10PF	5CAAD00785
C37	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C38	ECE-A1EKS100B	10UF 25V	5CEAA01750
C39	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C40	ECE-A1EKS100B	10UF 25V	5CEAA01750
C41	C3216CH1H050C-E-TP	50V 5PF	5CAAD00800
C42	ECE-A1EKN4R7B	4.7UF 25V	5CEAA01959
C43	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C44	ECQ-B1H332JZ3	3300PF 50V	5CRAA00586
C45	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C46	ECQ-V1H104JZ3		5CRAA00617
C47	ECE-A1EKS100B	10UF 25V	5CEAA01750
C48	ECQ-V1H104JZ3		5CRAA00617
C49	C3216CH1H221J-E-TP	220PF	5CAAD00790
C50	ECE-A1CKS470B	47UF	5CEAA01707
C51	C3216JF1H104Z-E-TP	50V 0.1UF	5CAAD01268
C52	ECE-A1CKS470B	47UF	5CEAA01707
C53	ECE-A1CKS470B	47UF	5CEAA01707
C54	ECE-A1EKN4R7B	4.7UF 25V	5CEAA01959
C55	ECE-A1EKN4R7B	4.7UF 25V	5CEAA01959
C56	C3216JB1H103K-E-TP	50V 0.01UF	5CAAD00789
C57	C3216CH1H150J-E-TP	15PF	5CAAD00787
C58	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C59	ECE-A1EKS100B	10UF 25V	5CEAA01750
C60	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C61	ECE-A1EKS100B	10UF 25V	5CEAA01750
C62	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C63	ECE-A1EKS100B	10UF 25V	5CEAA01750
C64	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C65	ECE-A1EKS100B	10UF 25V	5CEAA01750
C66	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C67	ECE-A1EKS100B	10UF 25V	5CEAA01750
C68	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C69	ECE-A1EKS100B	10UF 25V	5CEAA01750

REF.	TYPE	DESCRIPTION	JRC P/N
C70	ECQ-V1H104JZ3		5CRAA00617
C71	202L2502 225K5471	25V 2.2UF	5CSAC00826
C72	ECE-A1EKS100B	10UF 25V	5CEAA01750
C73	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C74	C3216CH1H220J-E-TP	22PF	5CAAD00869
C75	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C76	ECE-A1EKS100B	10UF 25V	5CEAA01750
C77	C3216SL1H222J-E-TP	2200PF	5CAAD00792
C78	ECE-A1EKS100B	10UF 25V	5CEAA01750
C79	C3216JB1H103K-E-TP	50V 0.01UF	5CAAD00789
C80	C3216JB1H103K-E-TP	50V 0.01UF	5CAAD00789
CD1	CZ3B2	3V	5TXAE00107
CD2	1SS226 TE85L		5TXAD00320
CD3	1SS226 TE85L		5TXAD00320
CD4	1SS226 TE85L		5TXAD00320
CD5	TLR123		5TZAD00101
CD6	TLR123		5TZAD00101
CD7	1SS226 TE85L		5TXAD00320
CD8	1SS226 TE85L		5TXAD00320
CD9	1SS184 TE85R		5TXAD00291
CD10	1SS184 TE85R		5TXAD00291
IC1	MC1350P		5DDAS00011
IC2	MC1350P		5DDAS00011
IC3	MC1350P		5DDAS00011
IC4	AN5132		5DAAR00105
IC5	TA78DL12P		5DAAD00636
IC6	NJM4558D		5DAAF00027
IC7	NJM4558D		5DAAF00027
IC8	TL082CP		5DDAL00326
IC9	NJM78M05FA		5DAAN00375
J1	171255-1		BRTE00046
J2	171255-1		BRTE00046
J3	171255-1		BRTE00046
J4	171255-1		BRTE00046
J5	171255-1		BRTE00046
J6	171255-1		BRTE00046
J7	171255-1		BRTE00046
J301	IL-G-12P-S3T2-E		5JWAD00082
L1	H-7LARD0103A		7LARD0103A

REF.	TYPE	DESCRIPTION	JRC P/N
L2	H-7LARD0101A		7LARD0101A
L3	H-7LARD0101A		7LARD0101A
L4	H-7LARD0102A		7LARD0102A
L5	H-7LARD0102A		7LARD0102A
L6	H-7LARD0102A		7LARD0102A
L7	H-7LARD0101A		7LARD0101A
L8	LAP02KRR33K		5LCAA00478
L9	H-7LARD0084		7LARD0084
PC1	H-7PDRD0022		7PDRD0022
PC301	H-7PCRD1172		7PCRD1172
R1	ERJ-8GEYJ223V	1/8W 22K OHM	5REAG01754
R2	ERJ-8GEYJ151V	1/8W 150 OHM	5REAG01728
R3	ERJ-8GEYJ223V	1/8W 22K OHM	5REAG01754
R4	ERJ-8GEYJ151V	1/8W 150 OHM	5REAG01728
R5	ERJ-8GEYJ223V	1/8W 22K OHM	5REAG01754
R6	ERJ-8GEYJ151V	1/8W 150 OHM	5REAG01728
R7	ERJ-8GEYJ332V	1/8W 3.3K OHM	5REAG01744
R8	ERJ-8GEYJ681V	1/8W 680 OHM	5REAG01736
R9	ERJ-8GEYJ222V	1/8W 2.2K OHM	5REAG01742
R10	ERJ-8GEYJ681V	1/8W 680 OHM	5REAG01736
R11	ERJ-8GEYJ473V	1/8W 47K OHM	5REAG01758
R12	ERJ-8GEYJ681V	1/8W 680 OHM	5REAG01736
R13	ERJ-8GEYJ222V	1/8W 2.2K OHM	5REAG01742
R14	ERJ-8GEYJ331V	1/8W, 330 OHM	5REAG01732
R16	ERJ-8GEYJ102V	1/8W 1K OHM	5REAG01738
R17	ERJ-8GEYJ471V	1/8W 470 OHM	5REAG01734
R18	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750
R19	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750
R20	ERJ-8GEYJ472V	1/8W 4.7K OHM	5REAG01746
R21	ERJ-8GEYJ220V	1/8W 22 OHM	5REAG01718
R22	ERJ-8GEYJ220V	1/8W 22 OHM	5REAG01718
R23	ERJ-8GEYJ220V	1/8W 22 OHM	5REAG01718
R24	ERJ-8GEYJ220V	1/8W 22 OHM	5REAG01718
R25	ERJ-8GEYJ100V	1/8W 10 OHM	5REAG01714
R26	ERJ-8GEYJ221V	1/8W 220 OHM	5REAG01730
R27	ERJ-8GEYJ683V	1/8W 68K OHM	5REAG01760
R28	ERJ-8GEYJ331V	1/8W, 330 OHM	5REAG01732
R29	ERJ-8GEYJ331V	1/8W, 330 OHM	5REAG01732
R30	ERJ-8GEYJ332V	1/8W 3.3K OHM	5REAG01744

REF.	TYPE	DESCRIPTION	JRC P/N
R31	ERJ-8GEYJ473V	1/8W 47K OHM	5REAG01758
R32	ERJ-8GEYJ472V	1/8W 4.7K OHM	5REAG01746
R33	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750
R34	ERJ-8GEYJ470V	1/8W 47 OHM	5REAG01722
R35	ERJ-8GEYJ222V	1/8W 2.2K OHM	5REAG01742
R36	ERJ-8GEYJ470V	1/8W 47 OHM	5REAG01722
R37	HMGL1/4A-10M OHM J		5REAA05607
R38	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750
R39	ERJ-8GEYJ471V	1/8W 470 OHM	5REAG01734
R40	ERJ-8GEYJ222V	1/8W 2.2K OHM	5REAG01742
R41	ERG-1SJ470		5REAG01286
R42	ERJ-8GEYJ102V	1/8W 1K OHM	5REAG01738
R43	ERJ-8GEYJ102V	1/8W 1K OHM	5REAG01738
R44	ERJ-8GEYJ102V	1/8W 1K OHM	5REAG01738
R45	ERJ-8GEYJ104V	1/8W 100K OHM	5REAG01762
R46	ERJ-8GEYJ331V	1/8W, 330 OHM	5REAG01732
R47	ERJ-8GEYJ331V	1/8W, 330 OHM	5REAG01732
R48	ERJ-8GEYJ220V	1/8W 22 OHM	5REAG01718
R49	ERJ-8GEYJ102V	1/8W 1K OHM	5REAG01738
R50	ERJ-8GEYJ470V	1/8W 47 OHM	5REAG01722
R51	ERJ-8GEYJ561V	1/8W 560 OHM	5REAG01735
R52	ERJ-8GEYJ681V	1/8W 680 OHM	5REAG01736
R53	ERJ-8GEYJ221V	1/8W 220 OHM	5REAG01730
R54	ERJ-8GEYJ471V	1/8W 470 OHM	5REAG01734
R55	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750
R56	ERJ-8GEYJ102V	1/8W 1K OHM	5REAG01738
R58	ERJ-8GEYJ332V	1/8W 3.3K OHM	5REAG01744
R59	ERJ-8GEYJ471V	1/8W 470 OHM	5REAG01734
R60	ERJ-8GEYJ470V	1/8W 47 OHM	5REAG01722
R61	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750
R62	ERJ-8GEYJ470V	1/8W 47 OHM	5REAG01722
R63	ERJ-8GEYJ562V	1/8W 5.6K OHM	5REAG01747
R64	ERJ-8GEYJ393V	1/4W 22K OHM	5REAG01757
R65	ERJ-8GEYJ223V	1/8W 22K OHM	5REAG01754
R66	ERJ-8GEYJ223V	1/8W 22K OHM	5REAG01754
R67	ERJ-8GEYJ473V	1/8W 47K OHM	5REAG01758
R68	ERJ-8GEYJ100V	1/8W 10 OHM	5REAG01714
R69	ERJ-8GEYJ473V	1/8W 47 K OHM	5REAG01758
R70	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750

REF.	TYPE	DESCRIPTION	JRC P/N
R71	ERJ-8GEYJ102V	1/8W 1K OHM	5REAG01738
R72	ERJ-8GEYJ153V	1/8W 15K OHM	5REAG01752
R73	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750
R74	ERJ-8GEYJ103V	1/8W 10K OHM	5REAG01750
R75	ERJ-8GEYJ220V	1/8W 22 OHM	5REAG01718
R76	ERJ-8GEYJ332V	1/8W 3.3K OHM	5REAG01744
R77	ERJ-8GEYJ222V	1/8W 2.2K OHM	5REAG01742
R78	ERJ-8GEYJ391V	1/8W, 390 OHM	5REAG01733
R79	ERJ-8GEYJ472V	1/8W 4.7K OHM	5REAG01746
R80	ERJ-8GEYJ102V	1/8W 1K OHM	5REAG01738
R81	ERJ-8GEYJ102V	1/8W 1K OHM	5REAG01738
R82	ERJ-8GEYJ332V	1/8W 3.3K OHM	5REAG01744
R83	ERD-8GEYJ332V	1/8W 3.3K OHM	5REAG01744
R84	ERJ-8GEYJ821V	1/8W 820OHM	5REAG01737
RV1	GF06UT-2-100 OHM		5RMAB00149
RV2	GF06UT-2-10K OHM	1/2W 10K OHM	5RMAB00128
RV3	GF06UT-2-10K OHM	1/2W 10K OHM	5RMAB00128
RV5	GF06UT-2-10K OHM	1/2W 10K OHM	5RMAB00128
TR1	2SK302-GRTE85L		5TKAA00225
TR2	2SK302-GRTE85L		5TKAA00225
TR3	2SC3098-TE85R		5TKAA00226
TR4	2SK302-GRTE85L		5TKAA00225
TR5	2SA495GTM-Y (TPE2)		5TAAG00325
TR6	2SC1815Y TPE2		5TCAF00781
TR7	2SA1015Y-TPE2		5TAAG00294
TR8	2SA1015Y-TPE2		5TAAG00294
TR9	2SA1015Y-TPE2		5TAAG00294
TR10	2SC1815Y-TPE2		5TCAF00781
TR11	2SA495GTM-Y (TPE2)		5TAAG00325

RIOX/RIIX DISPLAY UNIT TYPE 50003/50006

MAIN CHASSIS TYPE CML-312

REF.	TYPE	DESCRIPTION	JRC P/N
C401	ECE-A1HS101	50V100UF	5CEAA01368
C402	ECE-A1HS101	50V100UF	5CEAA01368
F401	MF51NN-6.3A		5ZFAD00336
F402	MF51NN-5A	250V	5ZFAD00045
FS401	FH043		5ZFAN00003

REF.	TYPE	DESCRIPTION	JRC P/N
FS402	FH043		5ZFAN00003
J401	SRCN2A13-3P		5JCAC00399
J402	SRCN2A25-16P		5JCAC00307
J403	BNC-RM-3510-E	BNC	5ZJUF00004
J404	BNC-RM-3510-E	BNC	5ZJUF00004
J405	SG-8022 # 01		5JJAL00064
S401	MPSW00961A	R-SIDE	MPSW00961A
S402	MPSW00962A	L-SIDE	MPSW00962A
W401	H-7ZCRD0306B		7ZCRD0306B
W402	H-7ZCRD0307A		7ZCRD0307A

MAIN CONTROL PCB TYPE CMC-622

REF.	TYPE	DESCRIPTION	JRC P/N
BT1	CR2032-THB		5ZBBJ00001
C1	ECQ-V1H104JZ3		5CRAA00617
C2	FK26Y5V1H104Z-006		5CAAD01318
C4	DD105-289CH330J50		5CAAA03505
C5	DD105-289CH330J50		5CAAA03505
C6	ECQ-B1H472KZ3	50V, 4700P	5CRAA01004
C7	DD105-289SL101J50		5CAAA03507
C8	ECQ-V1H104JZ3		5CRAA00617
C9	DD104-289CH050C50		5CAAA03503
C10	DD104-289CH050C50		5CAAA03503
C11	DD104-289CH150J50		5CAAA03504
C12	DD104-289CH150J50		5CAAA03504
C13	FK26Y5V1H104Z-006		5CAAD01318
C14	EXF-P8471ZW	470PX8	5CXAD00005
C15	FK26Y5V1H104Z-006		5CAAD01318
C16	FK26Y5V1H104Z-006		5CAAD01318
C17	FK26Y5V1H104Z-006		5CAAD01318
C18	FK26Y5V1H104Z-006		5CAAD01318
C19	FK26Y5V1H104Z-006		5CAAD01318
C20	FK26Y5V1H104Z-006		5CAAD01318
C21	FK26Y5V1H104Z-006		5CAAD01318
C22	FK26Y5V1H104Z-006		5CAAD01318
C23	FK26Y5V1H104Z-006		5CAAD01318
C24	FK26Y5V1H104Z-006		5CAAD01318
C25	FK26Y5V1H104Z-006		5CAAD01318

REF.	TYPE	DESCRIPTION	JRC P/N
C26	FK26Y5V1H104Z-006		5CAAD01318
C27	FK26Y5V1H104Z-006		5CAAD01318
C28	FK26Y5V1H104Z-006		5CAAD01318
C29	FK26Y5V1H104Z-006		5CAAD01318
C30	ECE-A1EU101B		5CEAA01813
C31	ECE-A1EU101B		5CEAA01813
C32	ECE-A1CU470B	16V 47UF	5CEAA01982
C33	ECE-A1CU470B	16V 47UF	5CEAA01982
C40	FK26Y5V1H104Z-006		5CAAD01318
C41	ECQ-B1H102KZ3	50V 1000P	5CRAA00811
C42	DD804-276B102K50		5CAAA03511
C43	RPE132-901CH331K5		5CAAA03512
C44	DD109-989SL471J50		5CAAA03509
C45	ECQ-V1H104JZ3		5CRAA00617
C46	ECQ-B1H223KZ3	50V 0.022V	5CRAA00816
C47	ECE-A1EU330B		5CEAA01822
C48	ECE-A1EU330B		5CEAA01822
C49	ECE-A1EN100SB		5CEAA02975
C51	FK26Y5V1H104Z-006		5CAAD01318
C52	DD104-989SL330J50		5CBAB02769
C54	DD107-989CH680J50		5CAAA03506
C56	DD107-989SL221J50		5CAAA03508
C57	FK26Y5V1H104Z-006		5CAAD01318
C58	DD106-989SL151J50		5CBAB02809
C61	FK26Y5V1H104Z-006		5CAAD01318
C70	FK26Y5V1H104Z-006		5CAAD01318
C72	FK26Y5V1H104Z-006		5CAAD01318
CD1	1S1588-TPB2		5TXAD00335
CD2	1S1588-TPB2		5TXAD00335
CD3	1S1588-TPB2		5TXAD00335
CD5	1S1588-TPB2		5TXAD00335
CD6	HZ9C1	1/2W 9V	5TXAE00303
CD7	1S1588-TPB2		5TXAD00335
CD8	1S1588-TPB2		5TXAD00335
CD9	1S1588-TPB2		5TXAD00335
CD10	1S1588-TPB2		5TXAD00335
CD11	1S1588-TPB2		5TXAD00335
CX1	CSA11. 0MT020		5UNAB00042
CX2	CSA30.0 0MX040		5UNAB00079
CX3	CSA22.4MX040		5UNAB00080

REF.	TYPE	DESCRIPTION	JRC P/N
IC1	PST532A		5DZCY00011
IC2	TC74HC11AP		5DDAE01335
IC3	TC74HC573AP		5DDAE01345
IC4	TC74HC139AP		5DDAE01242
IC5	HM6264ALP-15		5DAAG00380
IC6	H-7DERD0129	AM27C512-155DC	7DERD0129
IC6-1	MPNN24692		MPNN24692
IC7	UPD78C10G-36		5DDAC00574
IC8	UPD72020GC-8-3B6		5DDAC00829
IC9	TC74HC573AP		5DDAE01345
IC10	TC74HC573AP		5DDAE01345
IC11	HM53461ZP-12		5DAAG00400
IC12	HM53461ZP-12		5DAAG00400
IC13	HM53461ZP-12		5DAAG00400
IC14	HM53461ZP-12		5DAAG00400
IC15	HM53461ZP-12		5DAAG00400
IC16	TC74HC157AP		5DDAE01337
IC17	TC74HC32AP		5DDAE01196
IC18	TC74HC195AP		5DDAE01506
IC19	TC74HC195AP		5DDAE01506
IC20	TC74HC195AP		5DDAE01506
IC21	TC74HC74AP		5DDAE00731
IC22	TC74HC08AP		5DDAE01240
IC23	UPD6326C	D/A	5DDAC00496
IC24	TC74HC32AP		5DDAE01196
IC25	TC74HCU04AP		5DDAE01270
IC26	TC74HC221AP		5DDAE01399
IC27	TC74HC32AP		5DDAE01196
IC28	H-7DGRD0007		7DGRD0007
IC29	TC74HCU04AP		5DDAE01270
IC30	HM63021P-28		5DAAG00394
IC31	HM63021P-28		5DAAG00394
IC32	TC74HC175AP		5DDAE01313
IC33	TC74HC157AP		5DDAE01337
IC34	TC74HC157AP		5DDAE01337
IC35	H-7DPRD0067	GAL16V8	7DPRD0067
IC36	TC74HC283AP		5DDAE01326
IC37	H-7DPRD0066	GAL16V8	7DPRD0066
IC38	TC74HC85AP		5DDAE01330
IC39	TC74HC393AP		5DDAE01310

REF.	TYPE	DESCRIPTION	JRC P/N
IC40	NJM4558D		5DAAF00027
IC41	HM534251ZP-10		5DAAG00670
IC42	TC74HC174AP		5DDAE01327
IC46	HD74221P		5DDAF00225
IC47	H-7DPRD0065	GAL16V8	7DPRD0065
IC48	TC74HC08AP		5DDAE01240
ICS1	IC26-2806GS4		5ZJAA00276
J1	68100-012	12P	5JWBE00182
J2	68100-008	8P	5JWBE00216
J3	IL-G-9P-S3L2-E	9P	5JWAD00090
J4	IL-G-6P-S3L2-E	6P	5JWAD00092
J5	B6B-EH-A		5JWAP00267
J6	742J2-10	10P	5JWDW00025
J7	IL-G-10P-S3L2-E	10P	5JWAD00068
J8	IL-G-12P-S3L2-E		5JWAD00084
J9	68931-203	3P	5JWBE00188
J10	68931-203	3P	5JWBE00188
J12	742J2-10	10P	5JWDW00025
P1	66464-102		5JWAM00127
P2	66464-102		5JWAM00127
PC1	H-7PCRD1152A		7PCRD1152A
R1	ERD-25UJ563T	56K OHM 1/4W	5RBAA01588
R2	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R3	IHR-2-103JA		5RZAB00793
R4	MHR-7-103JA		5RZAB00987
R5	ERD-25UJ153T	1/4W 15K OHM	5RBAA01594
R6	ERD-25UJ391T	390 OHM 1/4W	5RBAA01625
R7	ERD-25UJ102T	1K OHM 1/4W	5RDAA01542
R8	MHR-3-102JB	1KX3	5RZAB01345
R9	IHR-2-471JB		5RZAB01376
R10	ERD-25UJ152T		5RBAA01507
R12	ERD-25UJ470T		5RBAA01551
R13	ERD-25UJ471T	470 OHM 1/4W	5RBAA01541
R14	ERD-25UJ472T	4.7K OHM 1/4W	5RBAA01549
R15	ERD-25UJ122T	1.2K OHM 1/4W	5RBAA01539
R16	MHR-8-103JA	10K OHM X8	5RZAB00709
R17	ERD-25UJ472T	4.7K OHM 1/4W	5RBAA01549
R18	ERD-25UJ100T	1/4W 10 OHM	5RBAA01576
R19	ERD-25UJ105T	1/4W 1M OHM	5RBAA01616
R20	ERD-25UJ105T	1/4W 1M OHM	5RBAA01616

REF.	TYPE	DESCRIPTION	JRC P/N
R21	ERD-25UJ471T	470 OHM 1/4W	5RDAA01541
R22	ERD-25UJ912T	9.1K OHM 1/4W	5RDAA01827
R23	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R24	ERD-25UT471T	470 OHM 1/4W	5RDAA01541
R25	ERD-25UJ682T		5RDAA01713
R26	ERD-25UJ471T	470 OHM 1/4W	5RDAA01541
R27	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R28	ERD-25UJ101T	1/4W 100 OHM	5RDAA01599
R29	ERD-25UJ102T	1K OHM 1/4W	5RDAA01542
R30	ERD-25UJ101T	1/4W 100 OHM	5RDAA01599
R31	ERD-25UJ101T	1/4W 100 OHM	5RDAA01599
R32	ERD-25UJ102T	1K OHM 1/4	5RDAA01542
R33	ERD-25UJ101T	1/4W 100 OHM	5RDAA01599
R34	ERD-25UJ102T	1K OHM 1/4W	5RDAA01542
R35	ERD-25UJ221T	220 OHM 1/4W	5RDAA01543
R36	ERD-25UJ104T	100K OHM 1/4W	5RDAA01623
R37	ERD-25UJ473T	1/4W 47K OHM	5RDAA01618
R38	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R39	IHR-3-103JA	10K OHM X3	5RZAB00532
R40	ERD-25UJ132T		5RDAA01742
R41	ERD-25UJ222T	2.2K OHM 1/4W	5RDAA01548
R44	ERG-2SJ150P	2W 15 OHM	5REAG02088
R45	ERG-2SJ560P	2W 56 OHM	5REAG03217
R48	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R49	ERD-25UJ361T	1/4W 360 OHM	5RDAA01610
TR1	2SA1015Y-TPE2		5TAAG00294
TR2	2SC1815Y TPE2		5TCAF00781
TR3	2SC1815Y TPE2		5TCAF00781
TR4	2SC2983		5TCAF00623
TR5	2SA1244-Y		5TAAG00220
TR6	2SC3303-Y		5TCAF00525
TR7	2SA1015Y-TPE2		5TAAG00294
W1	H-7ZCRD0311A	2P	7ZCRD0311A

ADJUSTMENT PCB TYPE CCB-351

REF.	TYPE	DESCRIPTION	JRC P/N
BZ1	MEB-12-5		5UBBB00001
PD1	H-7PDRD0016		7PDRD0016

REF.	TYPE	DESCRIPTION	JRC P/N
R1	ERD-25PJ103T		5RDAA02188
RV1	GF06UT-2-10K OHM	1/2W 10K OHM	5RMAB00128
RV2	GF06UT-2-10K OHM	1/2W 10K OHM	5RMAB00128
RV3	GF06UT-2-20K OHM	1/2W 20K OHM	5RMAB00130
RV4	GF06UT-2-500 OHM	1/2W 500 OHM	5RMAB00132
RV5	GF06UT-2-50K OHM		5RMAB00118
RV6	GF06UT-2-5K OHM		5RMAB00119
RV7	GF06UT-2-50K OHM		5RMAB00118
W1	FS2N101.6A10		5ZCCA00035

RECEIVE BUFFER PCB TYPE CQA-116

REF.	TYPE	DESCRIPTION	JRC P/N
C1	ECQ-B1H472KZ3	50V, 4700P	5CRAA01004
C2	DD105-289SL101J50		5CAAA03507
C3	ECE-A1EN4R7SB		5CEAA03051
C4	ECE-A1EN4R7SB		5CEAA03051
C7	ECE-A1EU101B		5CEAA01813
C8	FK26Y5V1H104Z-006		5CAAD01318
C9	FK26Y5V1H104Z-006		5CAAD01318
C10	ECE-A1CU470B	16V 47UF	5CEAA01982
C11	EXF-P8471ZW	470PX8	5CXAD00005
C12	FK26Y5V1H104Z-006		5CAAD01318
C13	ECE-A1CU470B	16V 47UF	5CEAA01982
C14	FK26Y5V1H104Z-006		5CAAD01318
C16	ECE-A1CU470B	16V 47UF	5CEAA01982
C17	FK26Y5V1H104Z-006		5CAAD01318
C19	FK26Y5V1H104Z-006		5CAAD01318
C20	ECQ-V1H104JZ3		5CRAA00617
CD1	1SV149B		5TXAD00332
CD2	1S1588-TPB2		5TXAD00335
CD3	1K34A		5TXCH00001
CD4	1S1588-TPB2		5TXAD00335
CD5	1S1588-TPB2		5TXAD00335
IC2	NE521N		5DAAL00024
IC3	NE521N		5DAAL00024
IC4	NE521N		5DAAL00024
IC5	NE521N		5DAAL00024

REF.	TYPE	DESCRIPTION	JRC P/N
IC6	MC74F148N		5DAAJ00607
IC7	TC74HC04AP		5DDAE01194
IC8	TLP521-2-A		5TZAD00208
IC9	TC74HC157AP		5DDAE01337
J1	IL-G-6P-S3L2-E	6P	5JWAD00092
J2	68931-206	6P	5JWBE00181
P1	66464-102		5JWAM00127
P2	66464-102		5JWAM00127
PD1	H-7PDRD0014B		7PDRD0014B
R1	ERD-25UJ560T	1/4W 56 OHM	5RDAA01602
R2	ERD-25UJ821T	820 OHM 1/4W	5RDAA01604
R3	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R4	ERD-25UJ102T	1K OHM 1/4	5RDAA01542
R5	ERD-25UJ101T	1/4W 100 OHM	5RDAA01599
R6	ERD-25UJ681T	1/4W 680 OHM	5RDAA01627
R7	ERD-25UJ821T	820 OHM 1/4W	5RDAA01604
R8	ERD-25UJ220T	22 OHM	5RDAA01622
R9	ERD-25UJ331T	1/4W 330 OHM	5RDAA01480
R11	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R12	MHR-6-152JB	1.5K OHM X6	5RZAB01340
R13	ERD-25UJ222T	2.2K OHM 1/4W	5RDAA01548
R14	ERD-25UJ471T	470 OHM 1/4W	5RDAA01541
R15	ERD-25UJ222T	2.2K OHM 1/4W	5RDAA01548
R16	ERD-25UJ471T	470 OHM 1/4W	5RDAA01541
R17	ERD-25UJ102T	1K OHM 1/4	5RDAA01542
R18	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R24	ERD-25UJ681T	1/4W 680 OHM	5RDAA01627
R25	ERD-25UJ222T	2.2K OHM 1/4W	5RDAA01548
R26	ERD-25UJ111T	110 OHM 1/4W	5RDAA01832
RV1	RVG0707V100-10-501M	500 OHM	5RVAF00026
RV2	RVG0707V100-10-501M	500 OHM	5RVAF00026
TR1	2SC1815BLTPE2		5TCAF00780
TR2	2SC1815BLTPE2		5TCAF00780
TR3	2SC1815BLTPE2		5TCAF00780
W3	H-7ZCRD0308A	12P	7ZCRD0308A

CONTROL PCB-A TYPE CCK-591

REF.	TYPE	DESCRIPTION	JRC P/N
J1	IL-G-2P-S3L2-E		5JWAD00094
PD1	H-7PDRD0010		7PDRD0010
PL1	AS90140		5WAAB00258
PL2	AS90140		5WAAB00258
PL3	AS90140		5WAAB00258

CONTROL PCB-B TYPE CCK-592

REF.	TYPE	DESCRIPTION	JRC P/N
PD1	H-7PDRD0011A		7PDRD0011A
PL1	AS90140		5WAAB00258
PL2	AS90140		5WAAB00258
PL3	AS90140		5WAAB00258
PL4	AS90140		5WAAB00258
PL5	AS90140		5WAAB00258
R1	ERD-25PJ472	1/4W 4.7K OHM	5RDAA01183
R2	ERD-25PJ103	1/4W 10K OHM	5RDAA01146
R3	ERD-25PJ683	1/4W 68K OHM	5RDAA01265
RV1	RK11K113 10KB L30 DC24	10K OHM	5RZBG00098
RV2	RK11K113 10KB L30 DC24	10K OHM	5RZBG00098
RV3	RK11K113 10KB L30 DC24	10K OHM	5RZBG00098
RV4	RK11K113 10KB L30 DC24	10K OHM	5RZBG00098
W1	FS2N152.4A10		5ZCCA00036

POWER SUPPLY PCB TYPE CBD-1026

REF.	TYPE	DESCRIPTION	JRC P/N
C1	ECE-A1HU102	50V 1000UF	5CEAA01780
C2	ECE-A1CU101B	100UF 16V	5CEAA01827
C3	ECE-A1CU101B	100UF 16V	5CEAA01827
C4	ECE-A1CU101B	100UF 16V	5CEAA01827
C5	ECQ-B1H222KZ3	2200P	5CRAA00954

REF.	TYPE	DESCRIPTION	JRC P/N
C6	ECQ-B1H103KZ3	0.01UF 50V	5CRAA00771
C7	ECQ-B1H103KZ3	0.01UF 50V	5CRAA00771
C8	ECEA1CU222B	16V 2200UF	5CEAA02870
C9	ECE-A1HU221	50V 220U	5CEAA01843
C10	ECE-A1CU222	2200UF 16V	5CEAA01757
C11	ECQ-V1H104JZ3		5CRAA00617
C12	ECQ-V1H104JZ3		5CRAA00617
C13	ECQ-V1H104JZ3		5CRAA00617
C14	ECQ-V1H104JZ3		5CRAA00617
C15	ECQ-V1H104JZ3		5CRAA00617
C16	ECQ-V1H104JZ3		5CRAA00617
C17	ECQ-V1H104JZ3		5CRAA00617
C18	ECE-A1HU221	50V 220U	5CEAA01843
C19	ECE-A1HU100B	50V 10UF	5CEAA02184
C20	ECE-A1HU100B	50V 10UF	5CEAA02184
C21	ECE-A1HU100B	50V 10UF	5CEAA02184
C22	ECQ-B1H103KZ3	0.01UF 50V	5CRAA00771
CD1	U05C		5TXAE00034
CD2	HZ11A3	1/2W 10V	5TXAE00269
CD3	1S1588		5TXAD00040
CD4	F6P20F		5TXAG00288
CD5	11DF2FC		5TXAG00239
CD6	11DF2FC		5TXAG00239
CD7	F6P40F		5TXAG00289
CD8	HZ5C1	5V 1/2W	5TXAE00130
CD9	1S1588		5TXAD00040
CD10	V06C	200V 1.1A	5TXAE00016
IC1	TL494CN		5DDAL00546
IC2	TLP521-2-GB		5TZAD00234
IC3	TL431CLPB		5DDAL01271
IC4	TL499ACP		5DDAL01290
IC5	TC4013BAP		5DDAE00817
IC6	TC4011BP	MOS	5DDAE00053
J1	B7P-VH		5JWAP00291
J2	B2B-EH		5JWAP00213
L1	SC-05-10J		5LGAB00058
L2	HP-013J		5LGAB00059
L3	FL-9H472J-H	4.7MH	5LCAA00653
L4	HP-013J		5LGAB00059
L5	FL-5H101K	100UH	5LCAA00013

REF.	TYPE	DESCRIPTION	JRC P/N
PC1	H-7PDRD0009A		7PDRD0009A
PC501	H-7PCRD1115A		7PCRD1115A
R1	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R2	ERD-25UJ472T	4.7K OHM 1/4W	5RDAA01549
R3	ERD-25UJ472T	4.7K OHM 1/4W	5RDAA01549
R4	ERD-25UJ222T	2.2K OHM 1/4W	5RDAA01548
R5	ERD-25UJ682T		5RDAA01713
R6	ERD-25UJ472T	4.7K OHM 1/4W	5RDAA01549
R7	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R8	ERD-25UJ472T	4.7K OHM 1/4W	5RDAA01549
R9	ERD-25UJ472T	4.7K OHM 1/4W	5RDAA01549
R10	ERD-25UJ472T	4.7K OHM 1/4W	5RDAA01549
R11	ERD-50TJ331	1/2W 330 OHM	5RDAA00823
R12	ERD-50TJ331	1/2W 330 OHM	5RDAA00823
R13	ERG-2ANJ100	2W 10 OHM	5REAG00048
R14	ERG-2ANJ100	2W 10 OHM	5REAG00048
R15	ERD-25UJ102T	1K OHM 1/4W	5RDAA01542
R16	ERD-25UJ102T	1K OHM 1/4W	5RDAA01542
R17	ERD-25UJ102T	1K OHM 1/4W	5RDAA01542
R18	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R19	ERD-25UJ222T	2.2K OHM 1/4W	5RDAA01548
R20	ERD-25UJ471T	470 OHM 1/4W	5RDAA01541
R21	ERD-25UJ823T		5RDAA01921
R22	ERD-25UJ472T	4.7K OHM 1/4W	5RDAA01549
R23	ERD-25UJ102T	1K OHM 1/4W	5RDAA01542
R24	ERD-25UJ472T	4.7K OHM 1/4W	5RDAA01549
R25	ERD-25UJ472T	4.7K OHM 1/4W	5RDAA01549
R26	ERD 50TJ470	1/2W 47 OHM	5RDAA00803
R27	ERD-25UJ471T	470 OHM 1/4W	5RDAA01541
R28	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R29	ERD-25UJ333T	1/4W 33K OHM	5RDAA01591
R30	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R31	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R32	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R33	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R34	ERD-25UJ471T	470 OHM 1/4W	5RDAA01541
R35	ERD-25UJ471T	470 OHM 1/4W	5RDAA01541
R36	ERD-25UJ471T	470 OHM 1/4W	5RDAA01541
R37	ERD-25UJ222T	2.2K OHM 1/4W	5RDAA01548
RV1	GF06X-1K OHM	1K OHM	5RMAB00105

REF.	TYPE	DESCRIPTION	JRC P/N
T1	H-7LTRD0173		7LTRD0173
TP1	LC-2-G YEL		5JTCW00015
TR1	2SC1627-Y		5TCAF00299
TR2	2SA1010 K		5TAAB00034
TR3	2SK525		5TKAA00160
TR4	2SK525		5TKAA00160
TR5	2SB906Y		5TBAE00088
TR6	2SB906Y		5TBAE00088
W2	H-7ZCRD0313A		7ZCRD0313A
ZS1	H-7ZSRD0012		7ZSRD0012

CRT MONITOR PCB TYPE CCN-199

REF.	TYPE	DESCRIPTION	JRC P/N
C501	ECQ-B1H103KZ3	0.01UF 50V	5CRAA00771
C502	ECQ-B1H223KZ3	50V 0.022U	5CRAA00816
C503	ECS-F1VE334BB	35V, 0.33U	5CSAA00285
C504	ECS-F1VZ475BB	35V, 4.7U	5CSAA00286
C505	ECS-F1VZ475BB	35V, 4.7U	5CSAA00286
C506	ECE-A1EU100	25V 10UF	5CEAA01845
C507	ECE-A1CU330B	33UF 16V	5CEAA01828
C508	ECE-A1CU221B	220UF 16V	5CEAA01834
C509	ECQ-V1H333JZ3		5CRAA00804
C510	ECEA1AU102		5CEAA02175
C511	ECQ-B1H153KZ3	50V, 0.015U	5CRAA01005
C512	ECQ-B1H153KZ3	50V, 0.015U	5CRAA01005
C513	ECCF1H390J		5CAAF00074
C514	ECE-A1VU4R7		5CEAA01898
C515	ECQ-V1H333JZ3		5CRAA00804
C516	ECH-S1H272JZ3	50V, 2700P	5CBAA00179
C517	ECQ-P1H272JZ3	50V 0.0027U	5CRAA01008
C518	ECQ-B1H562KZ3	50V 5600P	5CRAA01002
C519	ECE-A1CU221B	220UF 16V	5CEAA01834
C521	ECQ-B1H472KZ3	50V, 4700P	5CRAA01004
C522	ECW-H10H273KR		5CRAA00777
C523	MMB35K475	35V, 4.7U	5CRAR00134
C524	ECE-A1CU221B	220UF 16V	5CEAA01834
C525	ECE-A1CU222	2200UF 16V	5CEAA01757
C526	ECKD2H103KB5		5CBAA00176

REF.	TYPE	DESCRIPTION	JRC P/N
C527	ECKD2H103KB5		5CBAA00176
C528	ECE-A2AU100B		5CEAA02534
C529			6ZZAB02953
C530	MMHF63K105	63V, 1UF	5CRAR00074
C531	ECE-A2AU100B		5CEAA02534
C533	DD12-63B 272K500	2700, 500V	5CAAA03577
C551	DD109-63SL221J50	50V,220P	5CAAA03639
C552	DD09B222K500		5CBAB00943
C553	ECEA2CU2R2B	2.2U 160V	5CEAA02836
C554	DD106F103Z50	50V 10000PF	5CBAB00400
C555	ECEA2CU4R7B	4.7U 160V	5CEAA02835
CD501	ERB-12-01		5TXAK00131
CD502	1S1588-TPB2		5TXAD00335
CD503	ERB44-04		5TXAK00108
CD504	ERB44-04		5TXAK00108
CD505	ERB83-004		5TXAK00132
CD506	ERA22-08		5TXAK00133
CD507	ERA22-02		5TXAK00134
CD508	ERA22-08		5TXEH00001
CD551	EM1Z	200V 1A	5TXAN00061
CD552	HZ24BP	24V 0.8W	5TXAE00372
CD553	HZ24BP	24V 0.8W	5TXAE00372
IC501	AN5763		5DAAR00049
IC502	AN5790N		5DAAR00050
J501	RTB-1.5-4F	4PIN	5JDAH00066
J551	RT-01N-2.3A		5JTCD00081
L501	H-7LWRD0060		7LWRD0060
L502	H-6LWBS07018		6LWBS07018
L551	LAP02KR3R9K	3.9UH	5LCAA00610
PC501	H-7PCRD1162		7PCRD1162
PC502	H-7PCRD1163		7PCRD1163
PD1	H-7PDRD0017		7PDRD0017
R501	ERD-25UJ472T	4.7K OHM 1/4W	5RDAA01549
R502	ERD-25UJ913T		5RDAA01580
R503	ERD-25UJ683T	68K OHM 1/4W	5RDAA01705
R504	ERD-25UJ6R8T	6.8 OHM 1/4W	5REAG02375
R505	ERD-25UJ1R0T	1 OHM	5RDAA01733
R506	ERD-25UJ153T	1/4W 15K OHM	5RDAA01594
R507	ERD-25UJ4R7T		5RDAA01550
R508	ERD-25UJ471T	470 OHM 1/4W	5RDAA01541

REF.	TYPE	DESCRIPTION	JRC P/N
R509	ERD-25UJ153T	1/4W 15K OHM	5RDAA01594
R510	ERD-25UJ332T	3.3K OHM 1/4W	5RDAA01544
R511		*	6ZZAB10000
R512	ERD-25UJ273T	1/4W 27K OHM	5RDAA01615
R513	ERD-25UJ222T	2.2K OHM 1/4W	5RDAA01548
R514	ERD-25UJ223T	22K OHM 1/4W	5RDAA01545
R515	ERD-25UJ220T	22 OHM	5RDAA01622
R516	ERD-25UJ100T	1/4W 10 OHM	5RDAA01576
R517			6ZZAB02953
R518	ERD-25UJ473T	1/4W 47K OHM	5RDAA01618
R520	ERD-25UJ331T	1/4W 330 OHM	5RDAA01480
R521	ERD-25UJ153T	1/4W 15K OHM	5RDAA01594
R522	ERD-50TJ272	1/2W 2.7K OHM	5RDAA00845
R523	ERD-25UJ331T	1/4W 330 OHM	5RDAA01480
R551	ERD-25UJ221T	220 OHM 1/4	5RDAA01543
R552	ERD-25UJ102T	1K OHM 1/4	5RDAA01542
R553	ERD-50VJ202		5RDAA01574
R554	ERD-25UJ680T	68 OHM 1/4W	5RDAA01587
R555	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R556	ERD-25UJ184T	1/4W 180K	5RDAA01811
R557	ERD-25UJ103T	10K OHM 1/4W	5RDAA01547
R558	ERD-25UJ220T	22 OHM	5RDAA01622
R559	ERD-25UJ101T	1/4W 100 OHM	5RDAA01599
R560	ERD-25UJ183T	18K OHM 1/4W	5RDAA01605
R561	ERD-25UJ101T	1/4W 100 OHM	5RDAA01599
R562	ERD-25UJ221T	220 OHM 1/4	5RDAA01543
R563	ERD-25UJ683T	68K OHM 1/4W	5RDAA01705
R564	HMGL1/2A-22M OHM J		5REAA05621
R565	ERD-25UJ222T	2.2K OHM 1/4W	5RDAA01548
RV501	RVG0707V101-10-104M	100K OHM	5RVAF00140
RV502	RVG0707V101-10-103M	10K	5RVAF00136
RV503	RVG0707V101-10-102M	1K OHM	5RVAF00141
RV504	RVG707V101-10-504M	500K	5RVAF00166
RV505	VG152L7SB2M OHM	B-2M OHM	5RMAC00130
RV506	RVG0707V101-10-303M	30K	5RVAF00157
RV507	RVG0707V101-10-201M	200	5RVAF00135
T501	H-7LPRD0094		7LPRD0094
T502	H-6LRBS00054		6LRBS00054
TH501	ERT-D2WHL333S	33K	5CBAA00178
TR501	2SD1680		5TDAR00019

REF.	TYPE	DESCRIPTION	JRC P/N
TR551	2SC3187		5TCAG00082
TR552	2SC1675-K		5TCAB01389
W501	H-7ZCRD0319A		7ZCRD0319A
W502	H-7ZCRD0310B		7ZCRD0310B
W503	H-7ZCRD0314A		7ZCRD0314A
Z501	OSH2425-SP		5ZKAE00099
Z503	MPNN24734	CCN-199	MPNN24734
Z551	S7-524T-200		5ZJAT00085

CRT UNIT TYPE CKJ-106

REF.	TYPE	DESCRIPTION	JRC P/N
T502	H-7LGRD0040		7LGRD0040
V501	E2871B39-SDHT	CRT only	5VBAB00061
W511	H-7ZCRD0332		7ZCRD0332
W512		*	6ZZAB10000

PARTS LOCATION LIST

Reference to Fig. 122

Assembly Drawing of RIOX Scanner Unit

REF.	TYPE	DESCRIPTION	JRC P/N
1		Radome Assy Containing of No.2	MPBX17317
2		Nut,Special	MTLO33810A
3		Radome	MTV002343
4		Radiator Assy	MPAE00501
5		Gear Assy Containing of No.6	MPGK02946
6	MT101	Magnet SR-1	5MPAB0001
7		Rotary Joint Assy	MPAB01684
8		Bearing	BRGK01325
9		Ring,Retaining	BRTG01192
10		Bearing	BRGK01324
11		Plate,Retaining	MTB144765
12		Housing	MTC002285
13		Main Chassis Assy	MPBC07978
14		Packing,Rubber	MTT020323
15	V201	Magnetron RMC-1	5VMAA00059
16	M101	Motor Assy	7BDRD0023
17		Chassis	MPBC09503
18		RCV PCB Assy	CAE-286
19		STC PCB Assy	CCG-125
20		Cover	MTB194039A
21		Cover	MTB194040A
22	E301	Micro Front End NJT1946	5EZAA00021
23	A101	Diode Limiter NJS6933	5EZAA00020
24		Blank	
25		Cover	MPSC00703
26		Plate,Radiator	MTB144781
27	PC201	Modulator PCB Assy	CNM-149
28	S101	Reed Switch NRS-109	5KRAA00036
29		Cable Clamp	MTC003327
30		Bolt,Special	MPTG02028A
31		Seal Washer	BRTG03190

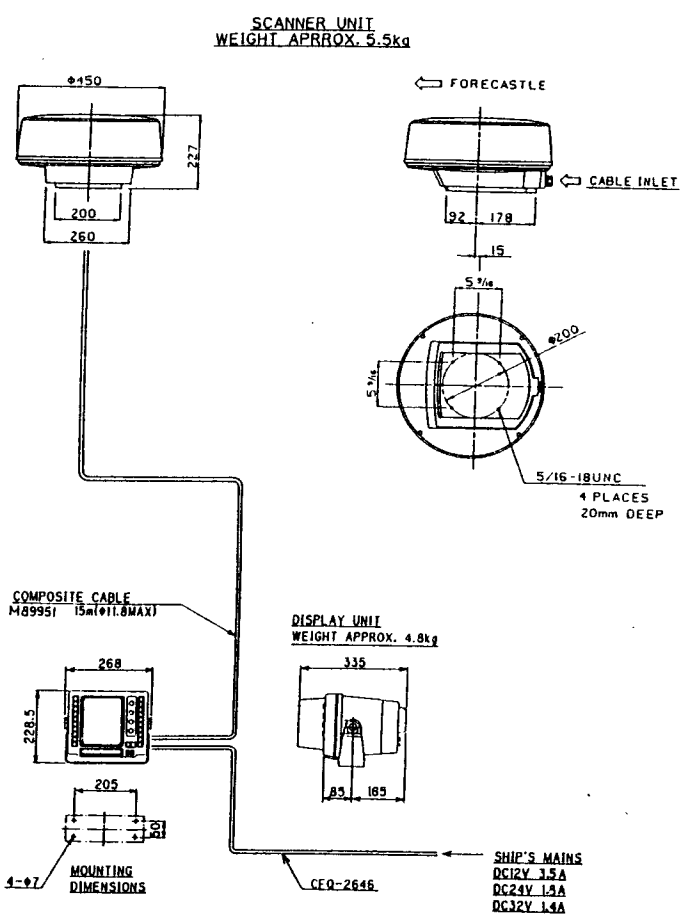
REF.	TYPE	DESCRIPTION	JRC P/N
32		O-Ring	BRPK00019
33		Connector,Cable	BRJD00113
34		Rope	MPXP01279
35		Sems Screw	BSNC04012B
36		Sems Screw	BSNB04010B
37		Sems Screw	BSNC05012B
38		Sems Screw	BSNC04016B
39		Sems Screw	BSNC04020B
40		Sems Screw	BRTG03318
41		Sems Screw	BSNC03006B
42		Sems Screw	BSNC03008B
43		Sems Screw	BSNC03010B
44		Spacer	MTB143380A
45		Spacer	MTD004993
46		Cover	MTC003325
47		Sems Screw	BSNA04020B
48		Spacer	MTK000360

PARTS LOCATION LIST

Reference to Fig123&Fig124

Assembly Drawing of RIIX Scanner Unit

REF.	TYPE	DESCRIPTION	JRC P/N
1	NAX-30	Radiator Assy	MPAE00683
2		Upper Housing Assy	MPBCO9809
2-1		Housing	MTV003667
2-2		Hinge	MTB194255C
2-3		Plate	MTB194256
3		Lower Housing Assy	MPBC09810
3-1		Housing	MTV003668
3-2		Packing	MTT028574
3-3		Shaft	MTL042586B
3-4		Stay	BRDM00446
3-5		Plate	MTB194257A
3-6		Packing	MTT028575B
3-7		Cable Clamp	BRBP00008
3-8		Bolt	BRTG00563
3-9		Washer,Spring	BRTG00747
3-10		Washer,Seal	BRPK00332
3-11		O-Ring	BRPK00083
4		Plate	MTB194254C
5		Motor	
6		SHM Switch	
7		Turning Assy	MPGK03761
7-1		Rotating Joint Assy	MPAB02196
7-2		Gear	MTV003674A
7-3		Cover	MTL042608
7-4		Bearing	BRGK01324
7-5		Ring,Retaining	BRTG00735
7-6		Housing	MTC003613
8		Waveguide,T-Junction	MPAB02197
9		Plate,Retaining	MTB194258
10		V-Ring	BRPK00673
11		Mounting,Ring	MTV003669
12		O-Ring	BRPK00068
13		Guide Pin	MTL042585
14		Switch Cover	MPPK00925

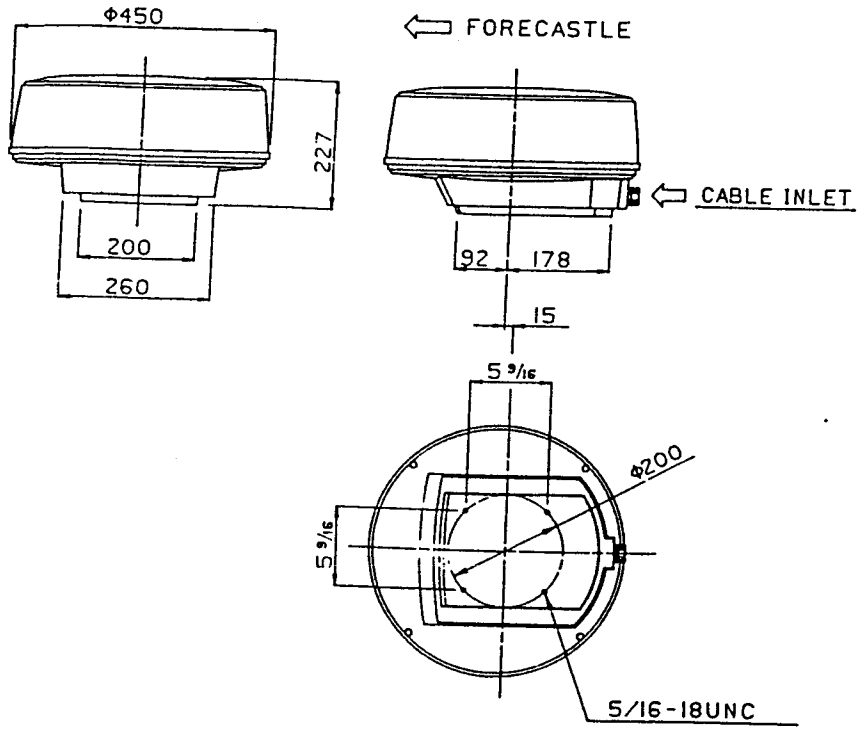


NOTES: 1. THE DISTANCE BETWEEN THE UNITS AS FOLLOWS.

	STANDARD	MAXIMUM
SCANNER UNIT TO DISPLAY UNIT	15m	20 m

2. ELIMINATING THE INTERFERENCE ON FREQUENCIES USED FOR MARINE COMMUNICATIONS AND NAVIGATION DUE TO OPERATION OF THE RADAR. ALL CABLES OF RADAR ARE TO BE RUN AWAY FROM THE CABLES OF RADIO EQUIPMENT (EX. RADIOTELEPHONE, LORAN COMMUNICATIONS RECEIVER AND DIRECTION FINDER ETC.). ESPECIALLY INTER-WIRING CABLES BETWEEN SCANNER UNIT AND DISPLAY UNIT OF THE RADAR SHOULD NOT BE RUN PARALLEL WITH THE CABLES OF RADIO EQUIPMENT.

FIG. 101 GENERAL SYSTEM DIAGRAM R10X



UNLESS OTHERWISE SPECIFIED				
DIMENSION		SPECIFIED		TOLERANCE
0	TO	16		± 1
OVER 16	TO	50		± 2
OVER 50	TO	250		± 4
OVER 250	TO	1000		± 8
OVER 1000	TO	3000		± 12

COLOR WHITE

WEIGHT APPROX. 12.1 lbs (5.5kg)

FIG. 102 OUTLINE DRAWING OF R10X SCANNER UNIT

REF.	TYPE	DESCRIPTION	JRC P/N
15		Toggle Switch	
16	CMN-287	Modulator Assy	MDMW02048
16-1		Chassis	MTB194259C
16-2		Cover	MTB194262B
16-3	CNM-151	PCB	
16-4		Magnetron	
17	CGH-175	Recelver Assy	MDHW01051
17-1		Chassis	MTB194265A
17-2		Cover	MTB194266
17-3	CAE-436	PCB	
17-4		MIC	
17-5		Diord-Limiter	
17-6		Plate	MTB194261A
17-7		Cover	MTL042609A
18		Cable Clamp	MTB06992W
19		Cable Clamp	CKS-10-L
20		Washer,Speciol	BRTG03258
21		Screw	BRTG04671

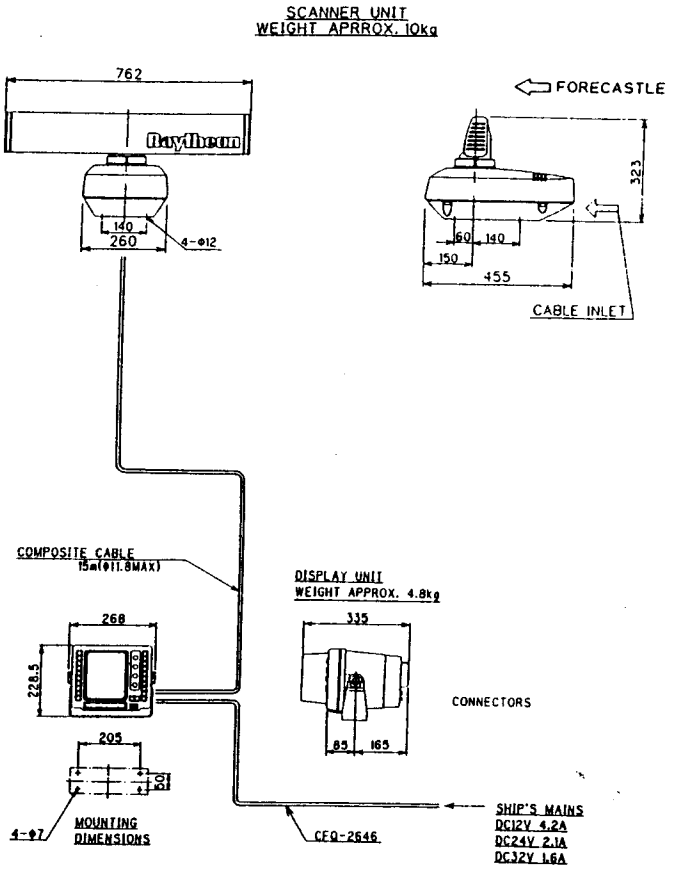
PARTS LOCATION LIST

Reference to Fig.125

Assembly Drawing of RIOX/RIIX Display Unit

REF.	TYPE	DESCRIPTION	JRC P/N
1		Bezel Assy	MPBC08948
1-1		Front Bezel	MPBC08977
1-2		Cap	MPBC09059
1-3		Screw	BRTG03883
1-4		Film	MTZ003059
1-5		Front Panel	MPNM14490
1-6		Packing,Rubber	MPPK01522
1-7		Packing,Rubber	MPPK01524
1-8		Cap,Rubber	MTV003546
1-9		Grommet	MPNG00277
2		Cabinet Assy	MPBX18999
2-1		Cabinet	MTV003531
2-2		Packing Rubber	MTV003560
2-3		Packing Rubber	MPPK01525
2-4		Nut	BSLN06000B
3		Heat Sink	MTC003609A
4		Chassis	MPBC08865
5		Bracket Assy	MPBX19001
5-1		Bracket	MTB183291
5-2		Washer,Serration	MTV003561
6		Knob	MPTG02475
7		Contact Rubber	MTV003584
8		Contact Rubber	MTV003549
9	S401	Panel Switch R-Side	MPSW00961A
10	S402	Panel Switch L-Side	MPSW00962A
11	V501	CRT	
12	T502	Deflection Yoke	
13	PC501	CRT Control PCB Assy	CCN-199
14	PC502	Video PCB Assy	
15	PC1	Main Control PCB Assy	CMC-622
16	PC2	Adjustment PCB Assy	CCB-351
17	PC3	Control PCB Assy A	CCK-591
18	PC4	Control PCB Assy B	CCK-592
19	PC5	Power Supply PCB Assy	CBD-1026

REF.	TYPE	DESCRIPTION	JRC P/N
20	PC6	Receive Buffer PCB Assy	CQA-116
21		Blank	
22		Blank	
23		Bushing,Insulating	MTV003558
24		Cap,Rubber	MPPK01548
25		Cap,Rubber	MPNG00279
26		Packing,Rubber	MTT020295
27		Packing,Rubber	MTT022410
28		Washer	BRTG00553
29		Cap	BRXP00866
30		Plate,Retaining	MTB186295
31		Sheet,Radiating	
32		Hood	MTV003534
33		Knob Assy	MPHD01459
33-1		Knob	MPHD01437A
33-2		Spring,Clamp	BRSR00077
34		Logo Plate (RIOX)	MPNM15207
		Logo Plate (RIIX)	MPNM15208
35		Screw,Tapping	BRTG03437
36		Screw,Tapping	BRTG02970
37		Screw,Tapping	BRTG03100
38		Screw,Tapping	BRTG03095
39		Screw,Tapping	BRTG03848
40		Screw,Tapping	BRTG03616
41		Screw,Tapping	BRTG03217
42		Sems Screw	BSNC03010B
43		Sems Screw	BSNC03012B



NOTES: 1. THE DISTANCE BETWEEN THE UNITS AS FOLLOWS.

	STANDARD	MAXIMUM
SCANNER UNIT TO DISPLAY UNIT	15m	20 m

2. ELIMINATING THE INTERFERENCE ON FREQUENCIES USED FOR MARINE COMMUNICATIONS AND NAVIGATION DUE TO OPERATION OF THE RADAR. ALL CABLES OF RADAR ARE TO BE RUN AWAY FROM THE CABLES OF RADIO EQUIPMENT (EX. RADIOTELEPHONE, COMMUNICATIONS RECEIVER AND DIRECTION FINDER ETC.). ESPECIALLY INTER-WIRING CABLES BETWEEN SCANNER UNIT AND DISPLAY UNIT OF THE RADAR SHOULD NOT BE RUN PARALLEL WITH THE CABLES OF RADIO EQUIPMENT.

FIG. 103 GENERAL SYSTEM DIAGRAM R11X

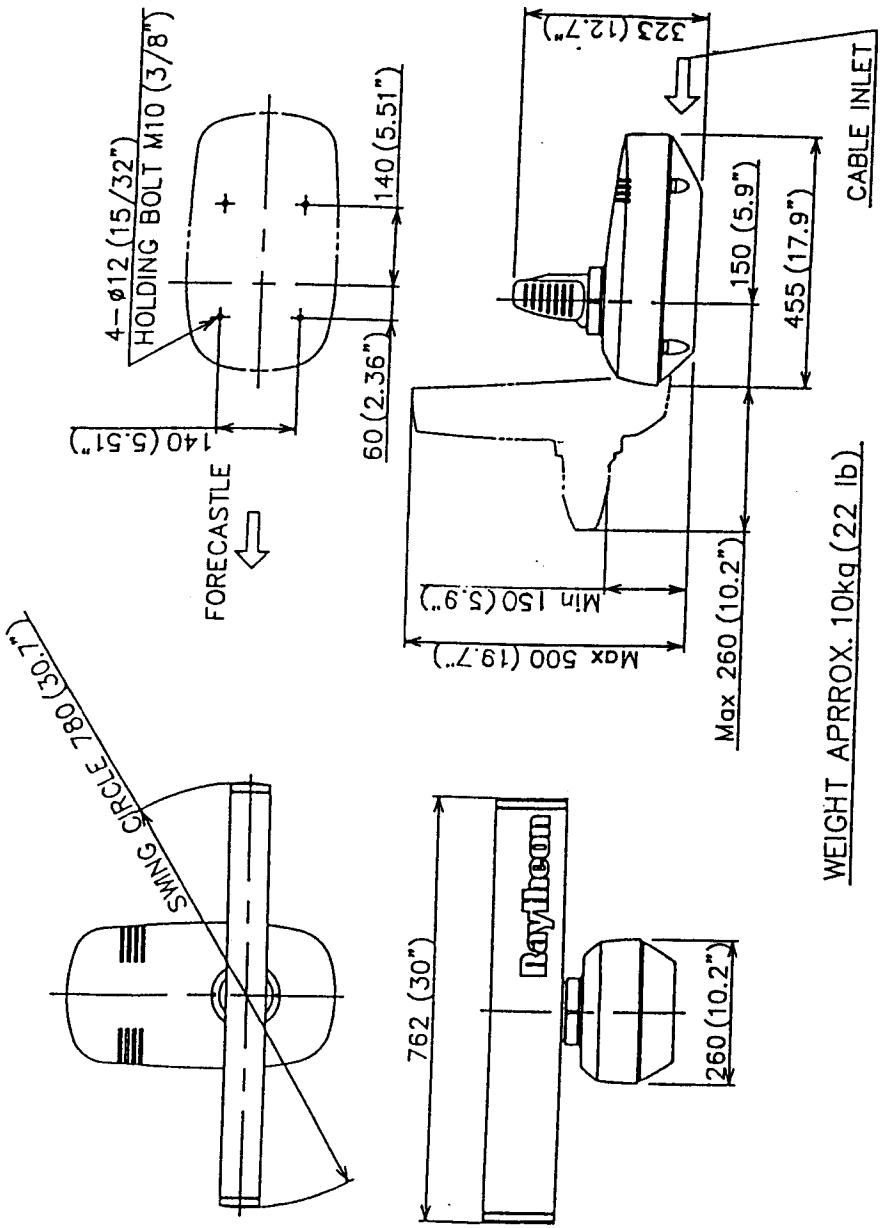
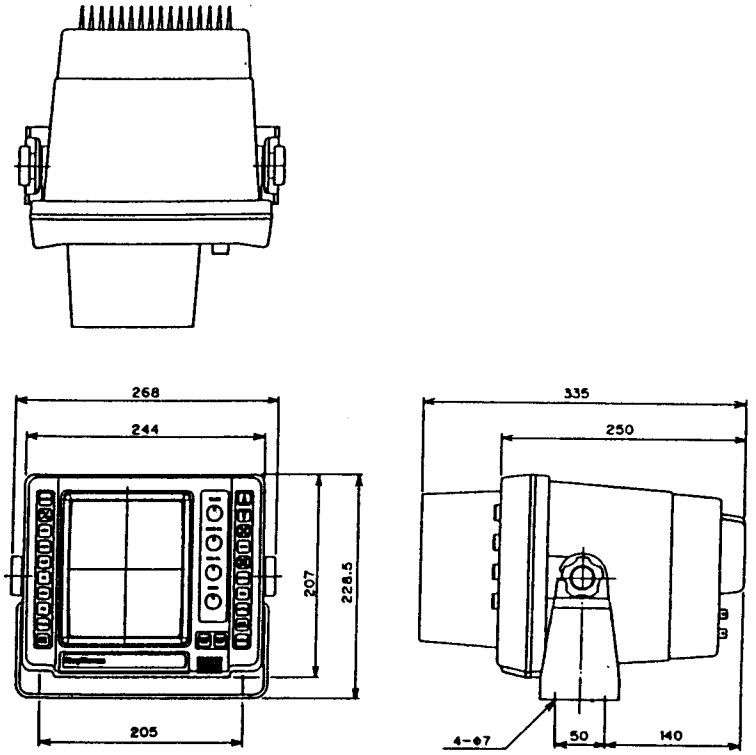


FIG. 104 OUTLINE DRAWING OF R11X SCANNER UNIT



WEIGHT APPROX. 4.8kg

FIG. 105 OUTLINE DRAWING OF R10X/R11X DISPLAY UNIT

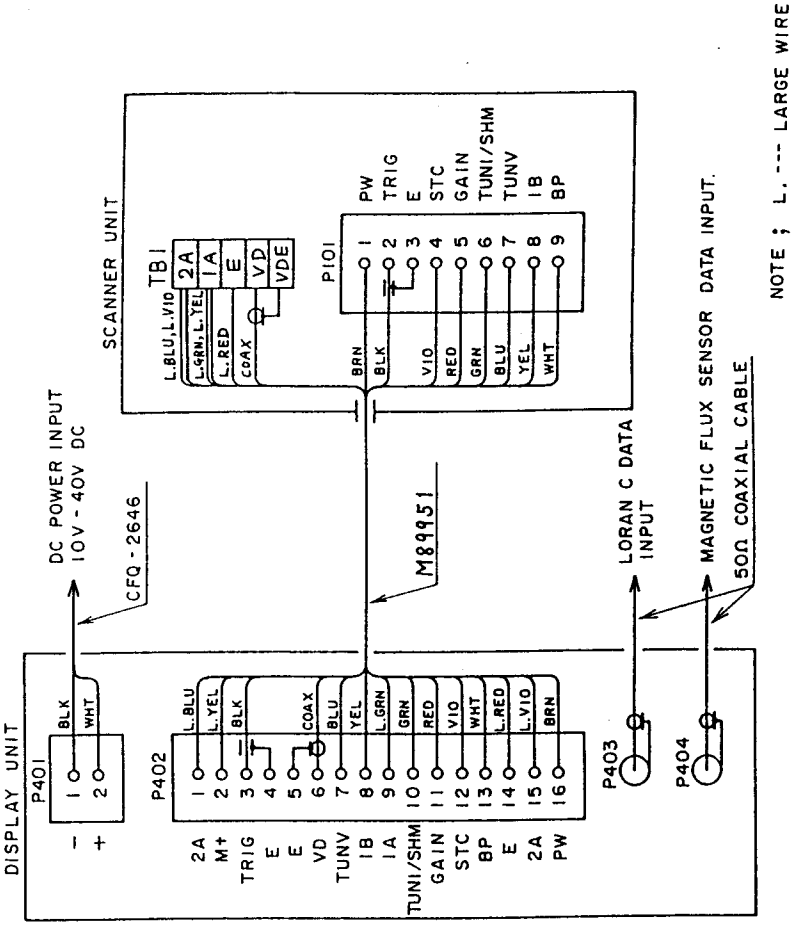


FIG. 106 INTERUNIT WIRING R10X RADAR

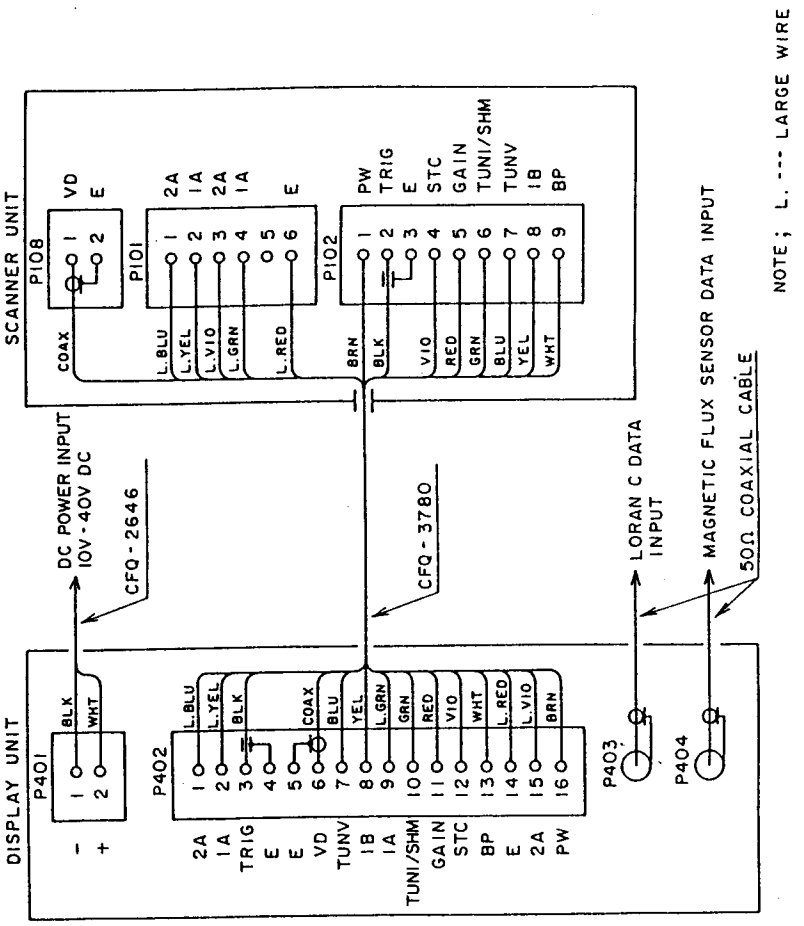


FIG. 107 INTERUNIT WIRING R11X RADAR

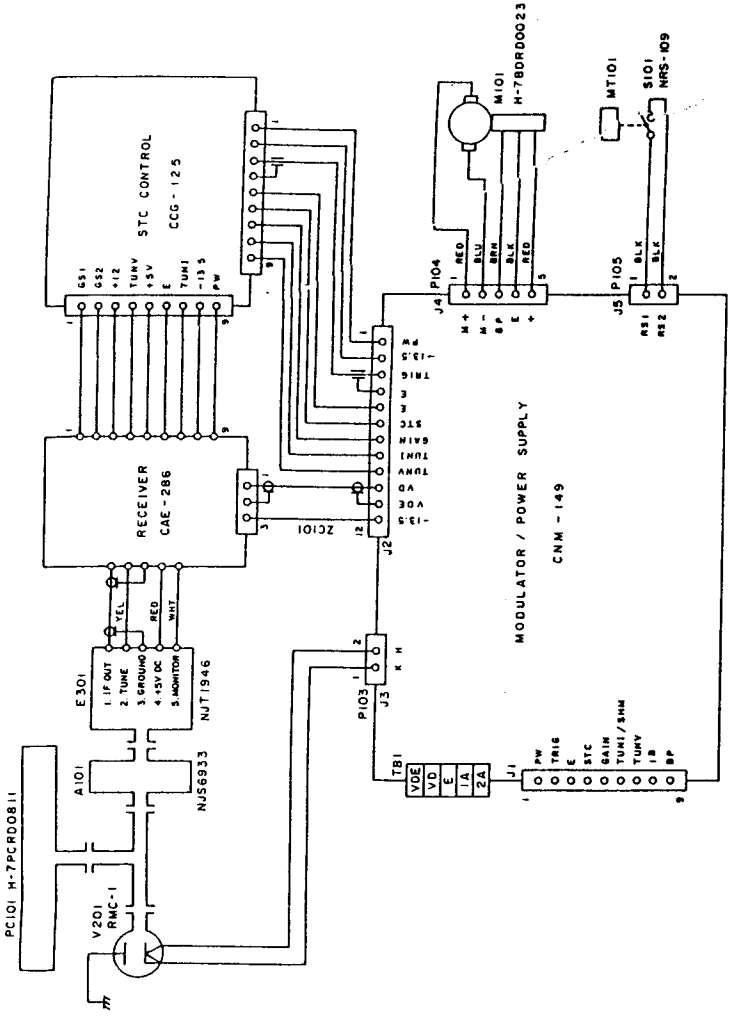


FIG. 108 INTERNAL CONNECTION DIAGRAM FOR R10X S .ANNER UNIT

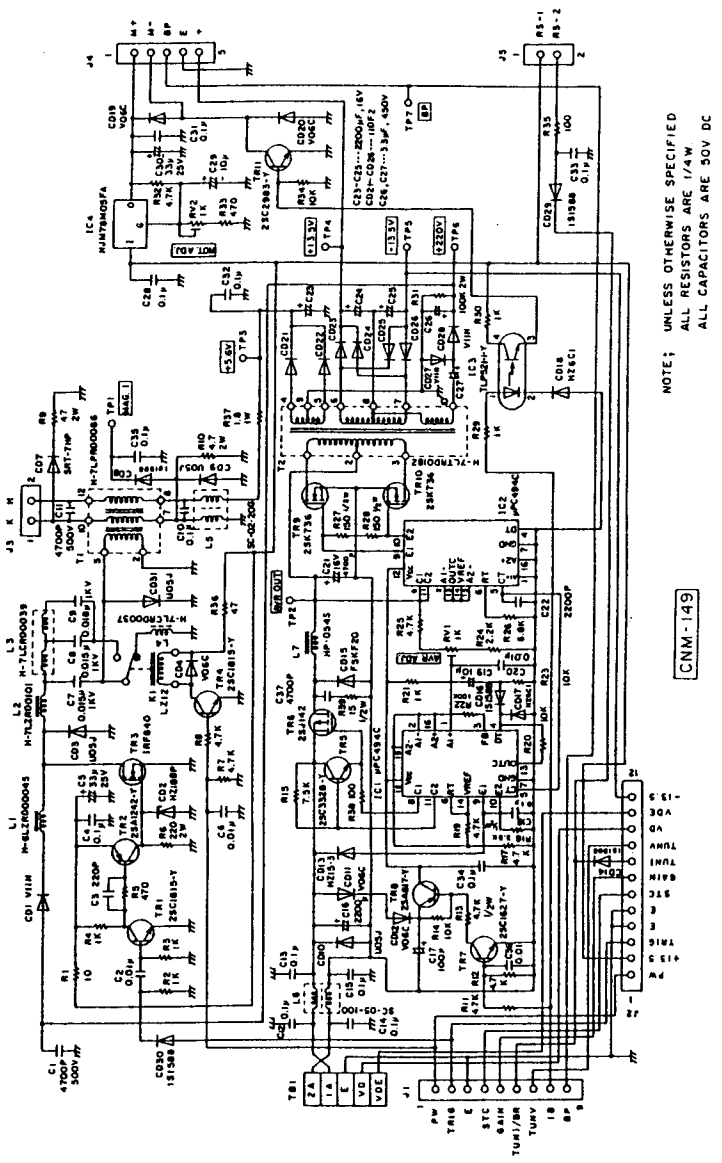


FIG. 109 CIRCUIT DRAWING OF MODULATOR/POWER SUPPLY PCB (CMC-149)

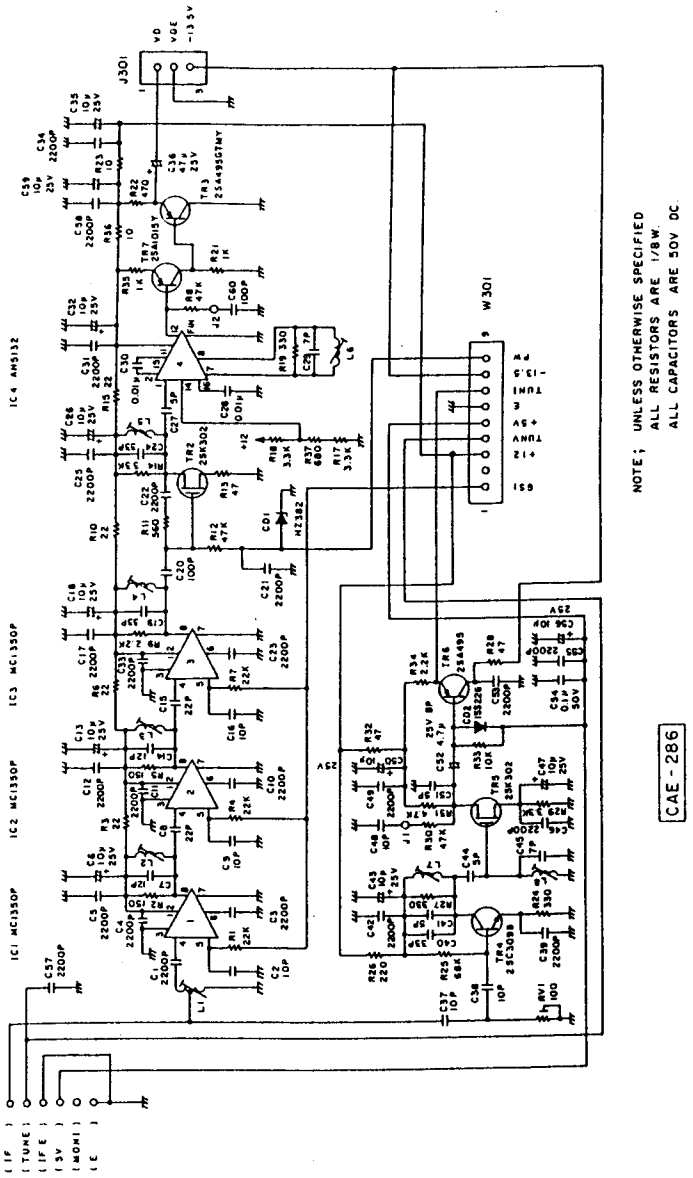


FIG. 110 CIRCUIT DRAWING OF RECEIVER PCB (CAE-286)

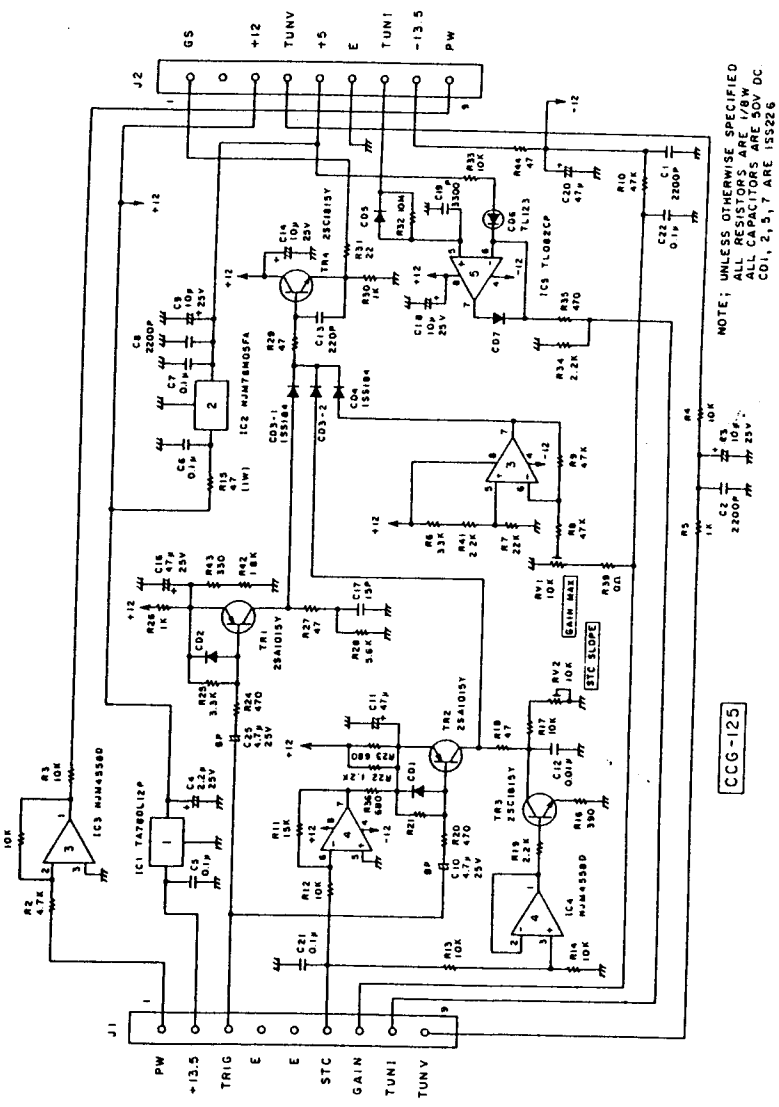


FIG. 111 CIRCUIT DRAWING OF STC CONTROL PCB (CCG-125)

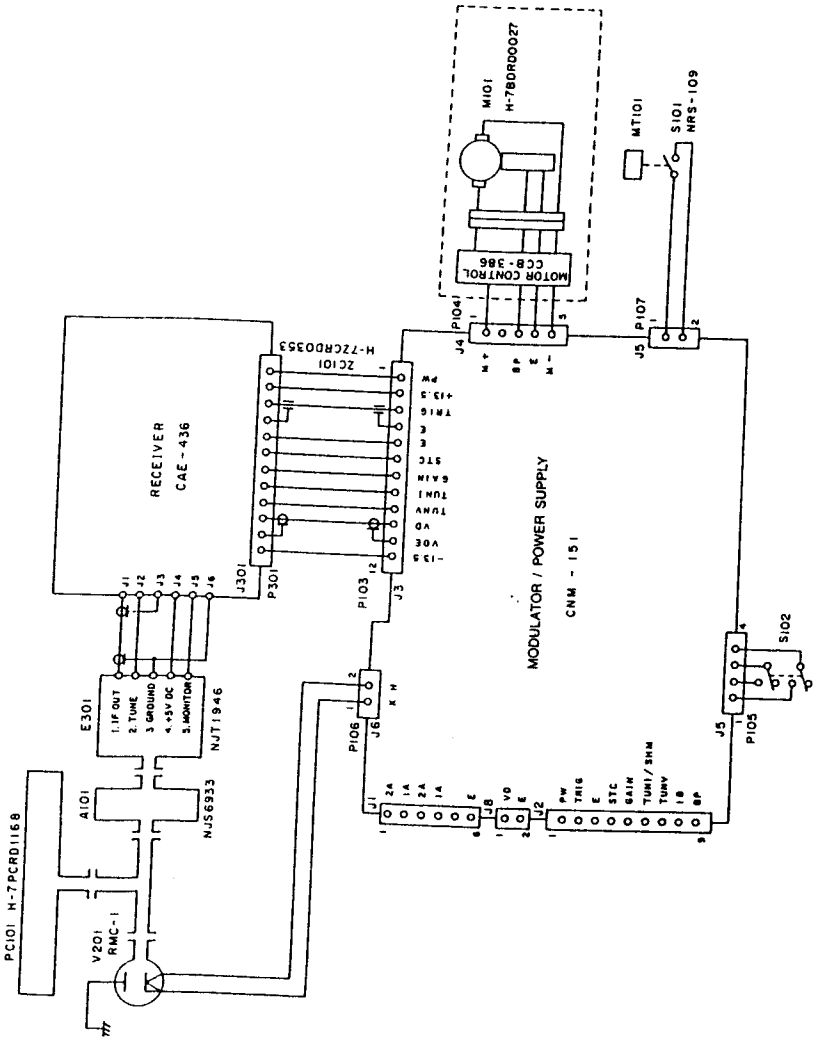


FIG. 112 INTERNAL CONNECTION DIAGRAM FOR R11X SCANNER UNIT

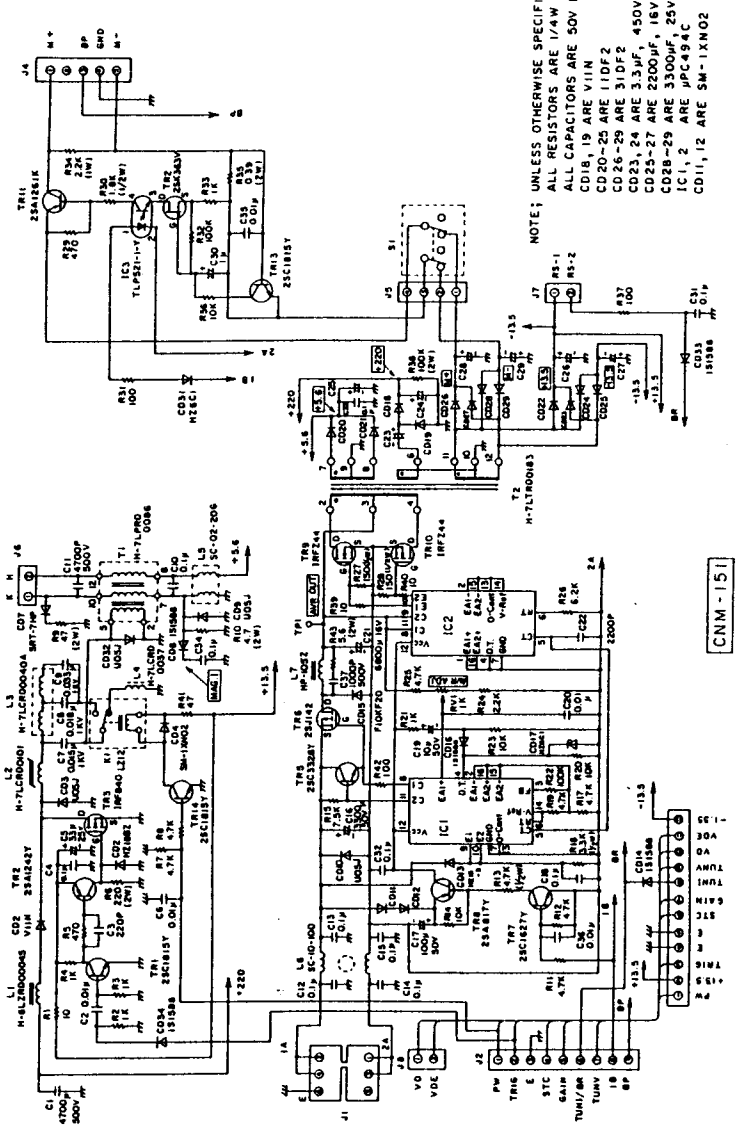


FIG. 113 CIRCUIT DRAWING OF MODULATOR/POWER SUPPLY PCB (CNM-151)

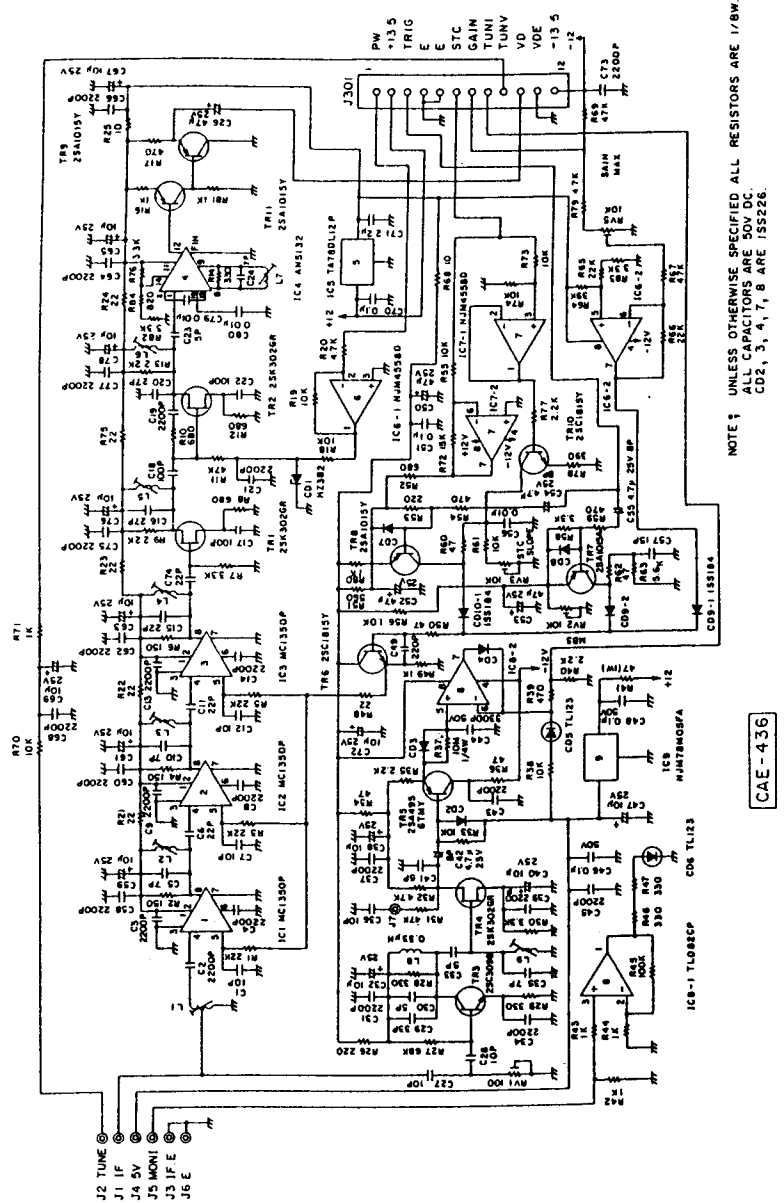


FIG. 114 CIRCUIT DRAWING OF RECEIVER PCB (CAE-436)

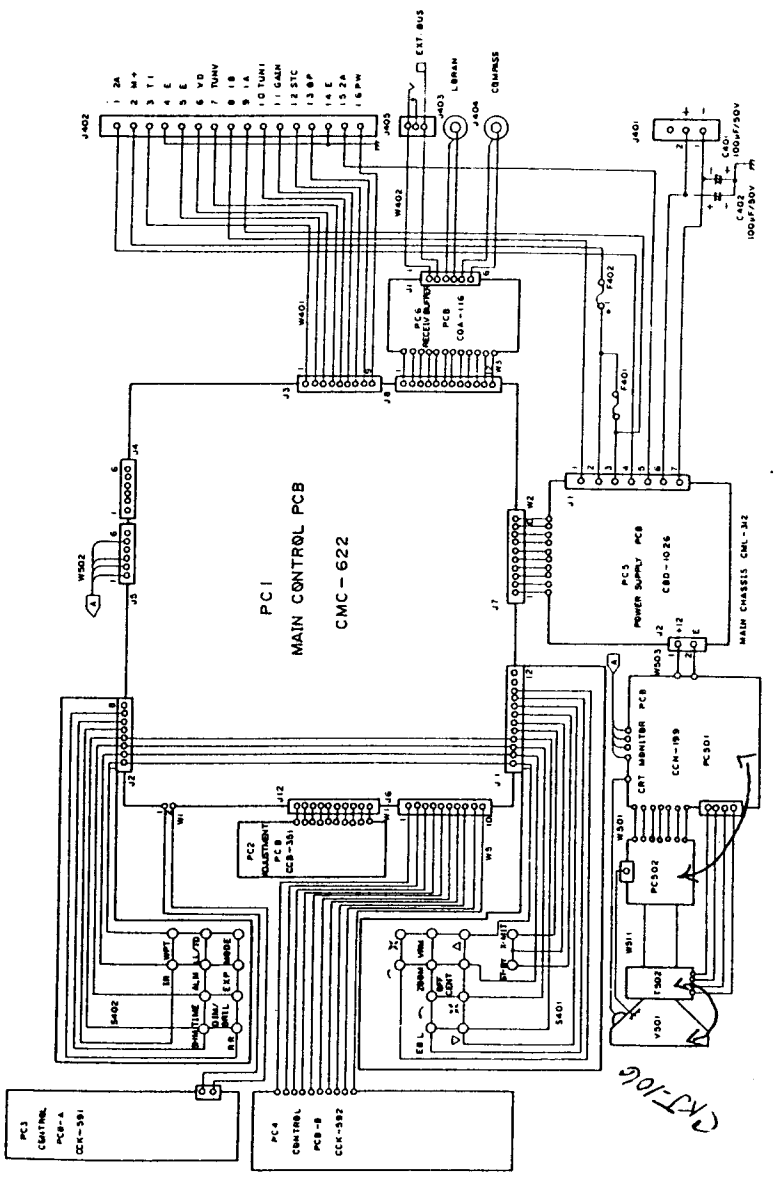


FIG. 115 INTERNAL CONNECTION DIAGRAM FOR R10X/R11X DISPLAY UNIT

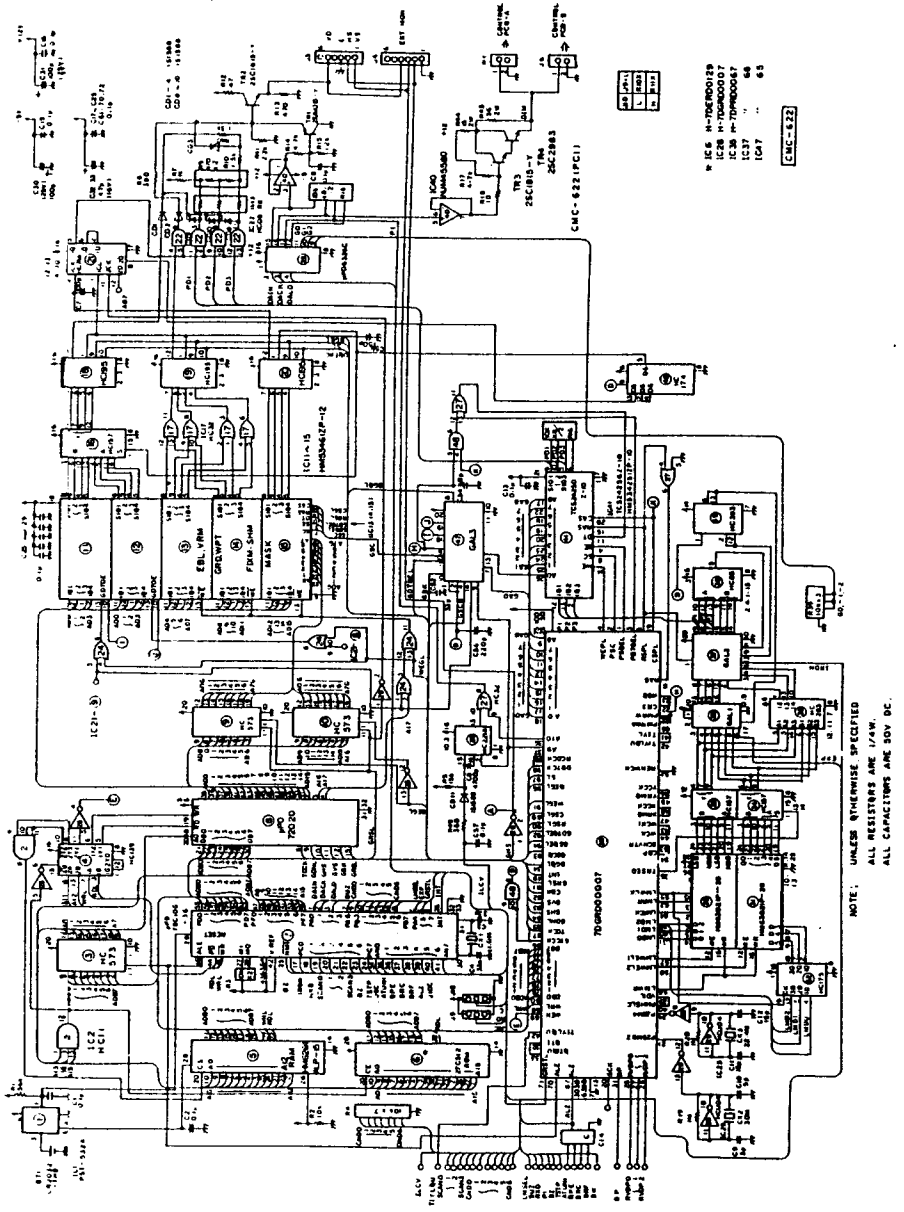


FIG. 116 CIRCUIT DRAWING OF MAIN CONTROL PCB (CMC-622) 1 OF 2

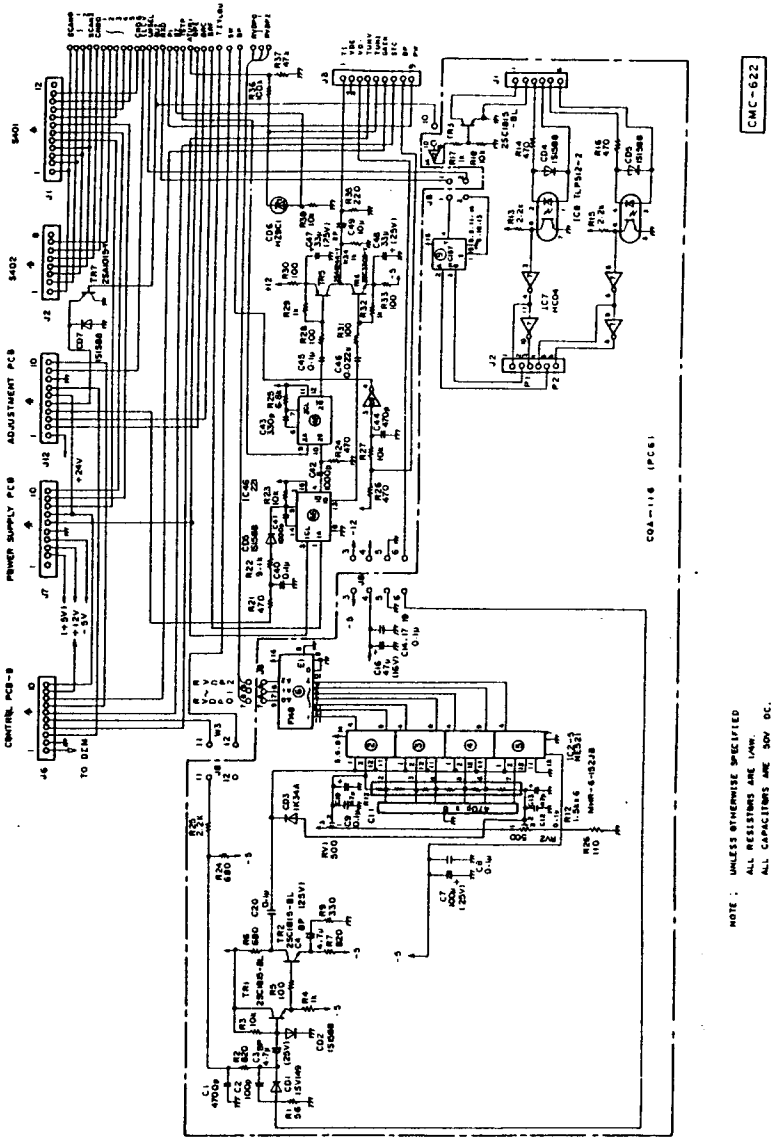


FIG. 117 CIRCUIT DRAWING OF MAIN CONTROL PCB (CMC-622/CQA-116) 2 OF 2

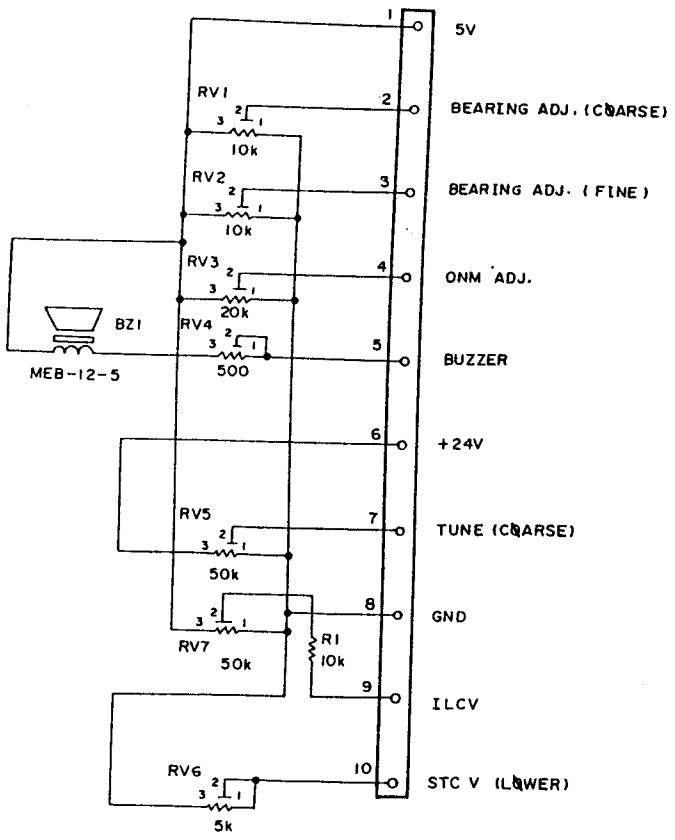


FIG. 118 CIRCUIT DRAWING OF ADJUSTMENT PCB (CCB-351)

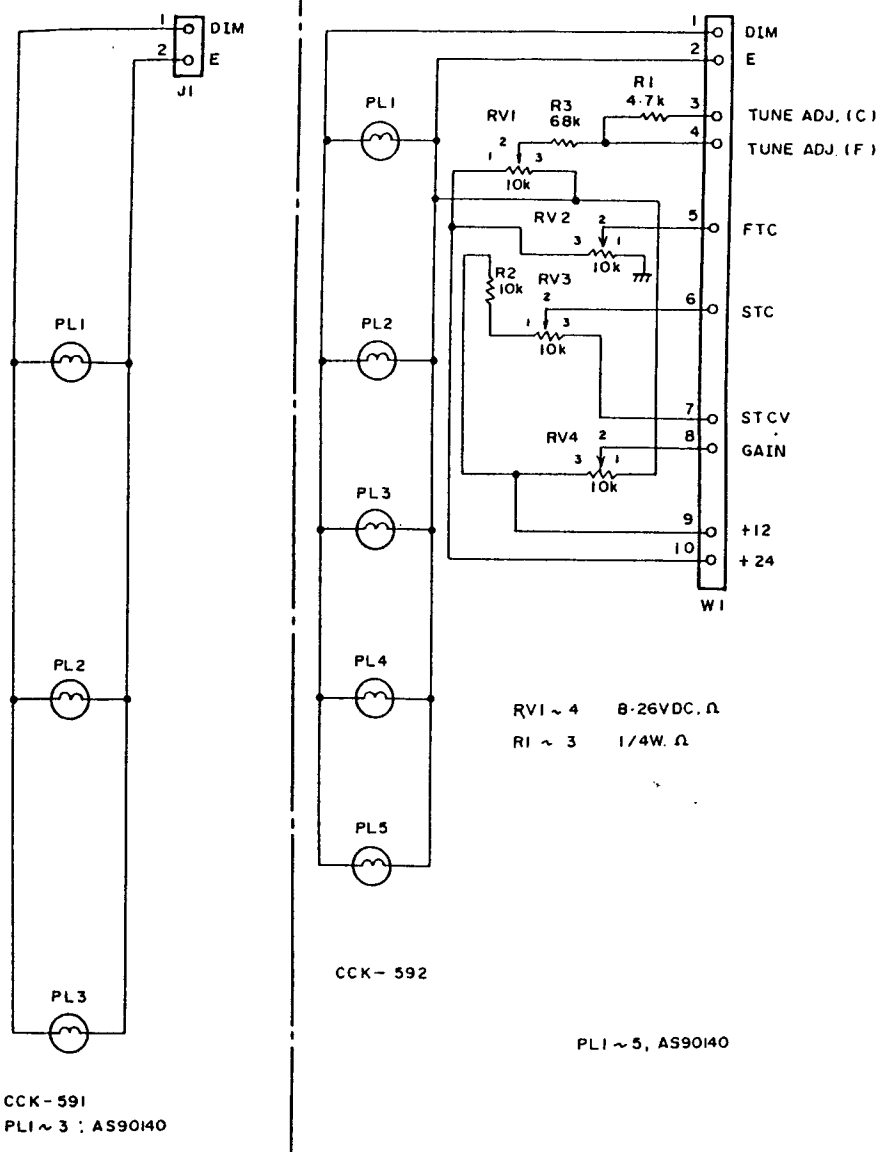


FIG. 119 CIRCUIT DRAWING OF CONTROL PCB (CCK-591/CCK-592)

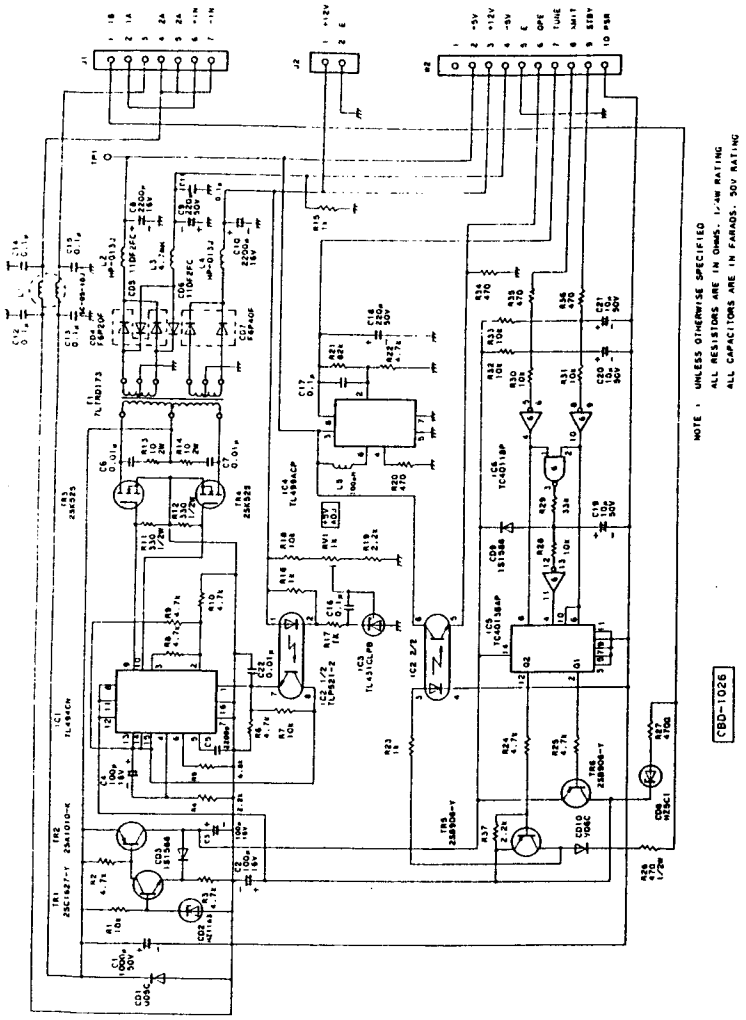


FIG. 120 CIRCUIT DRAWING OF POWER SUPPLY PCB (CBD-1026)

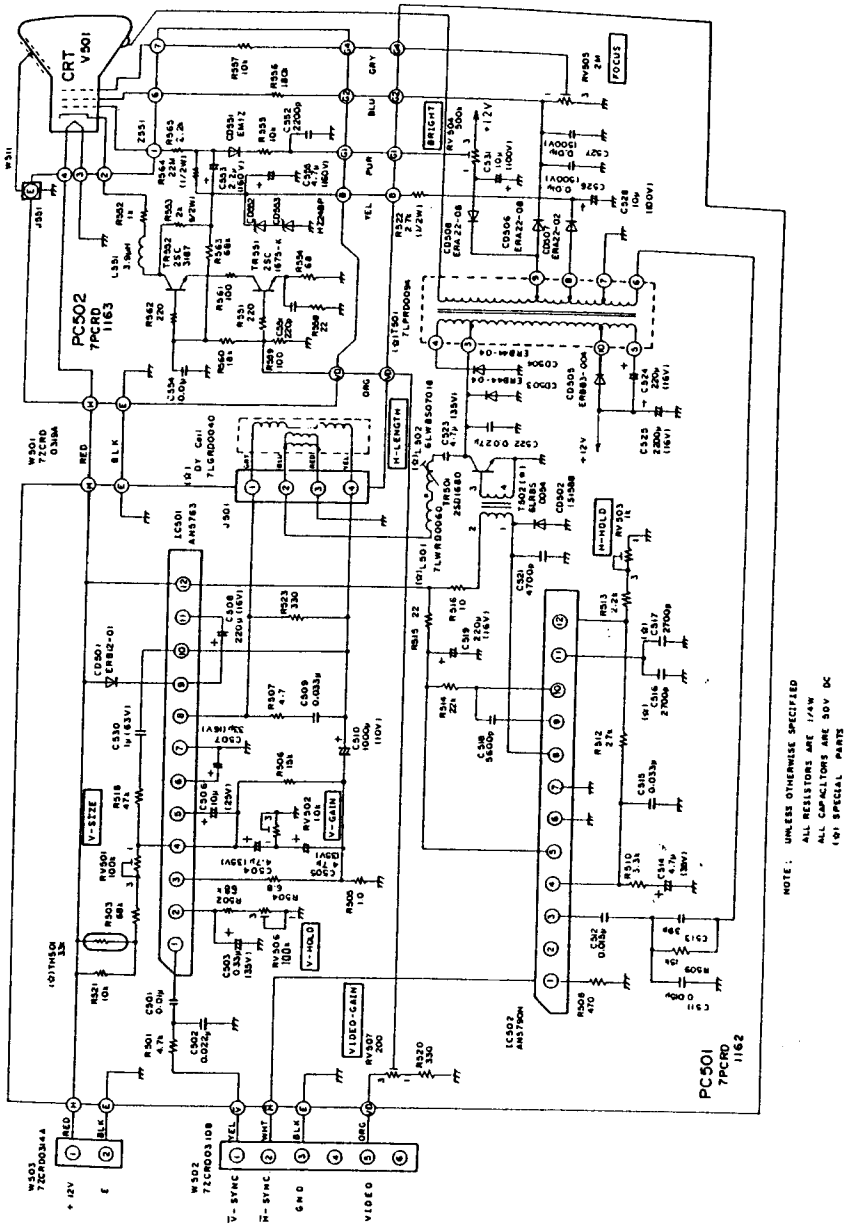


FIG. 121 DISPLAY ASSEMBLY OF 7" DISPLAY UNIT (CCN-199/CKJ-106)

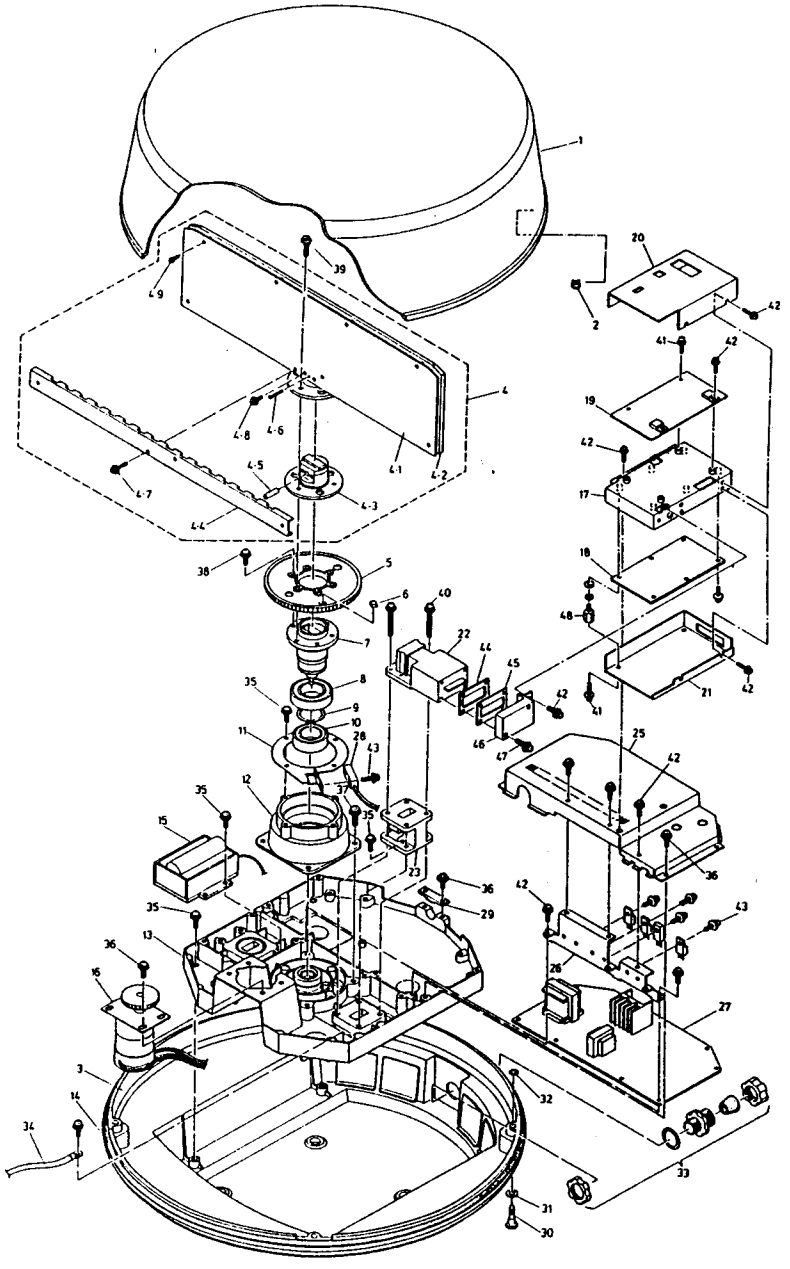


FIG. 122 ASSEMBLY DRAWING OF R10X RADOME SCANNER UNIT

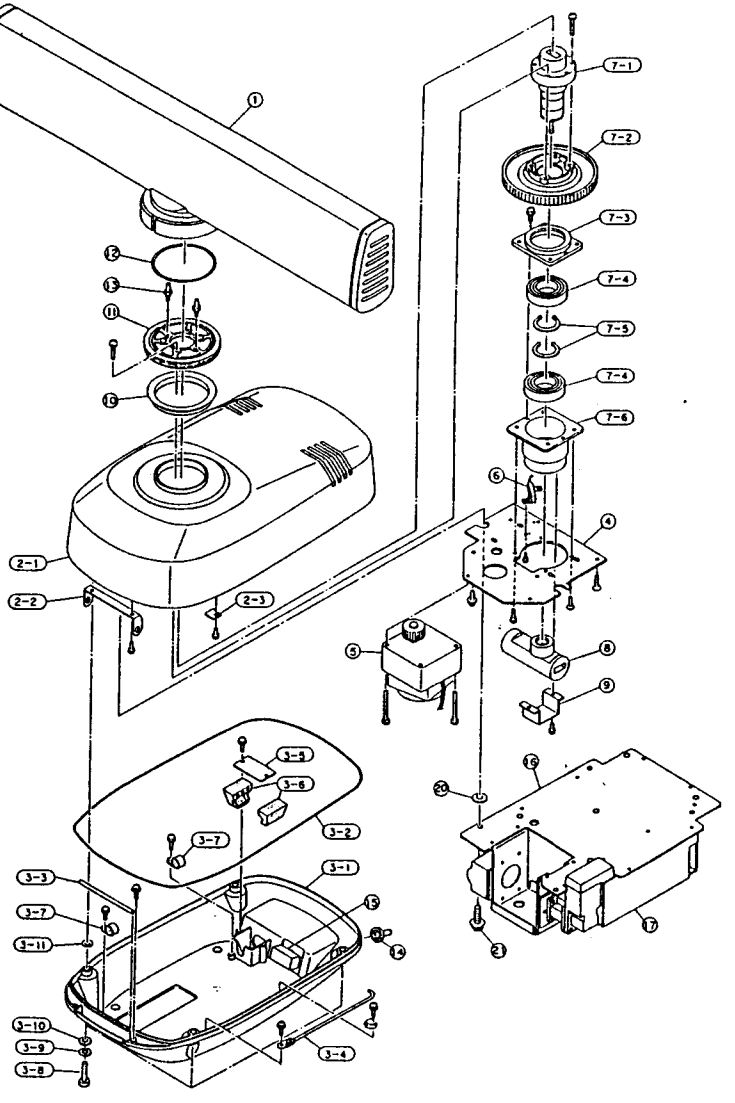


FIG. 123 ASSEMBLY DRAWING OF R11X OPEN ARRAY SCANNER UNIT 1 OF 2

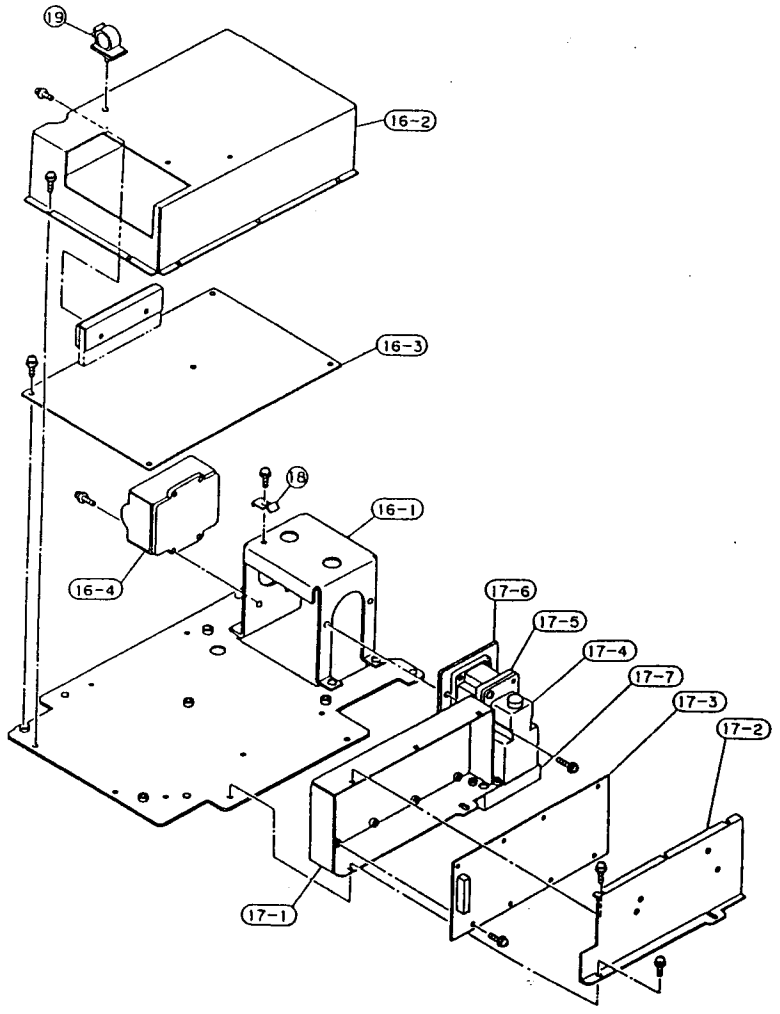


FIG. 124 ASSEMBLY DRAWING OF R11X OPEN ARRAY SCANNER UNIT 2 OF 2

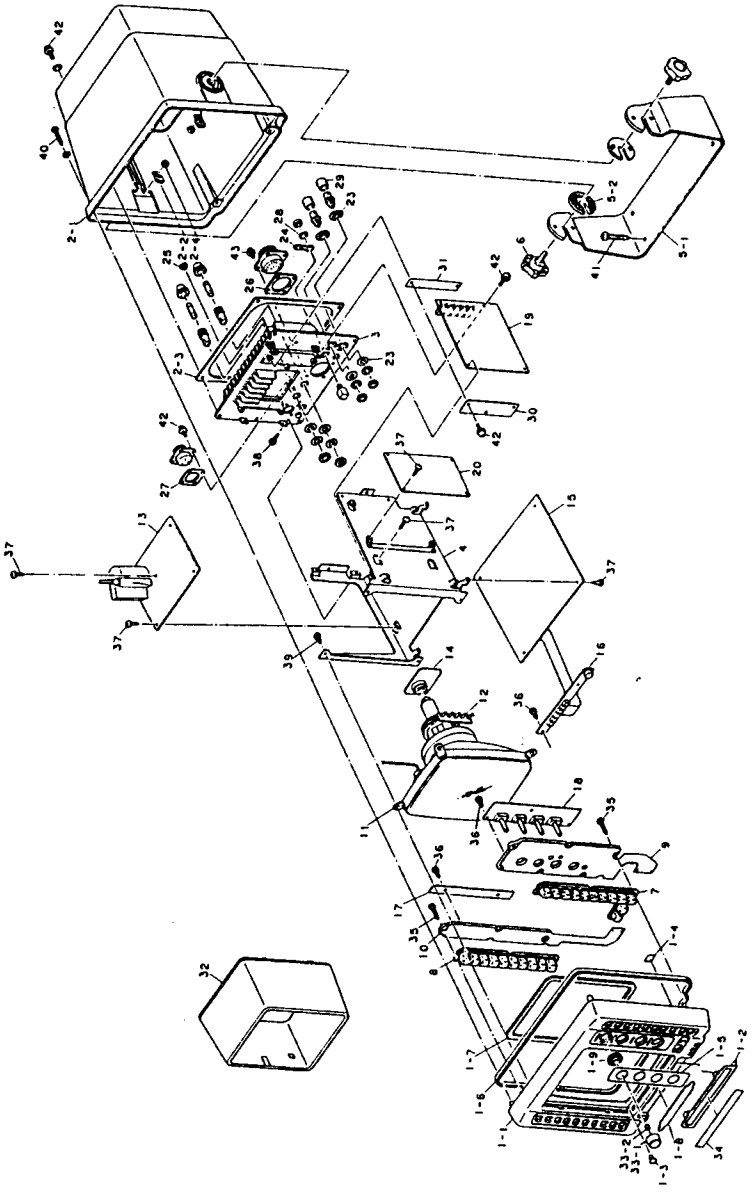


FIG. 125 ASSEMBLY DRAWING OF R10X/R11X DISPLAY UNIT