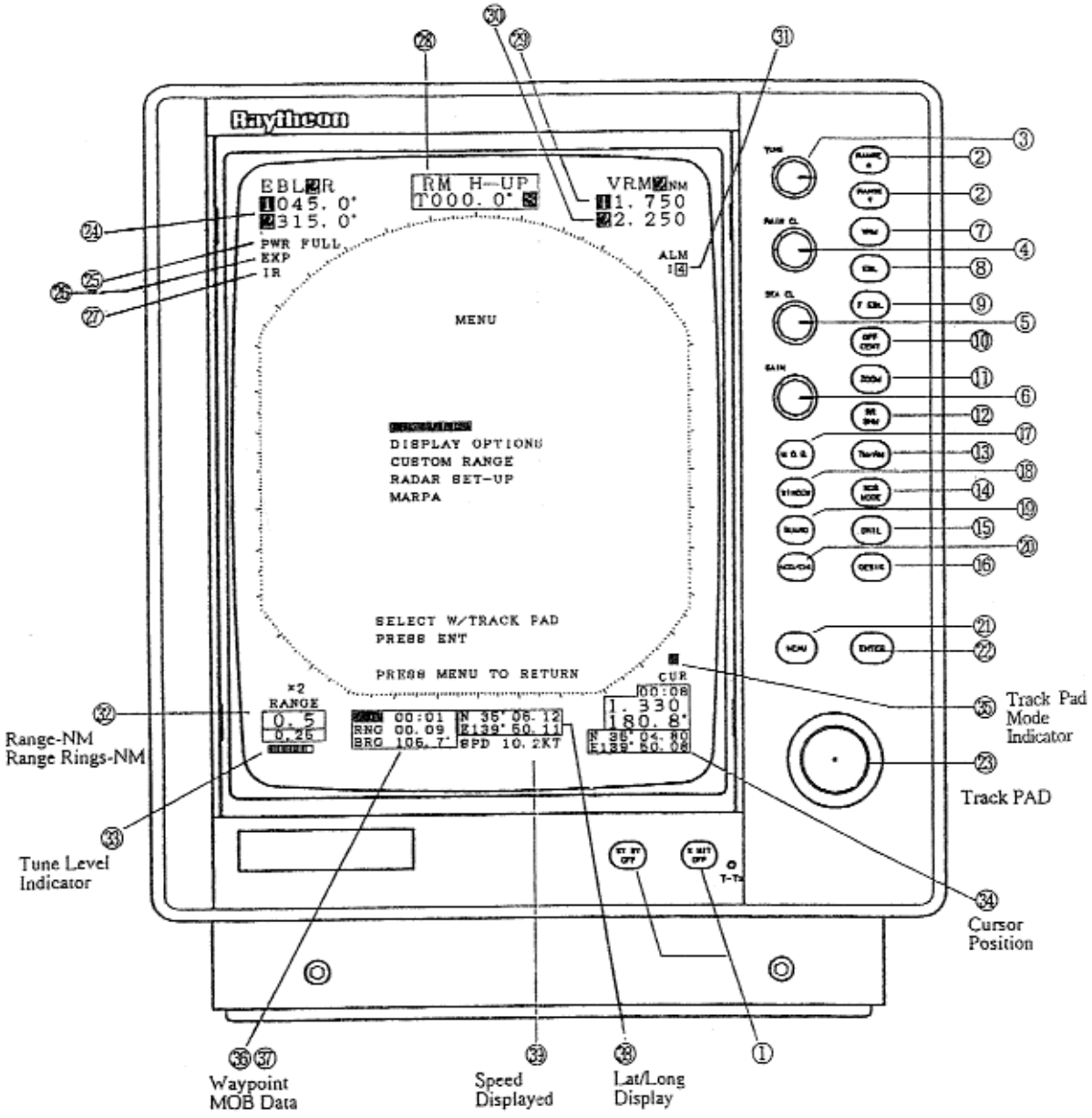
Fig. 3—1 R12O6XXIR121OXX



SECTION 4
TECHNICAL DESCRIPTION

4~1 GENERAL

The theory of operation for the Radar Set R12O6XX and R121OXX is presented here with descriptions following the functional block diagram circuits.

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

4.2 ANTENNA UNIT

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

4.2.1 RADIATOR

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

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

Electrically, the array produces a horizontal beamwidth either of 2 · for the 4' array or 1.2 · for the 6' array at the half power points with a vertical beamwidth of 30 · or 25 · respectively. The direction of the beam (maximum radiated power) is essentially perpendicular to the face of the radiator. Within +1— 10 · of this main beam, the side lobes are reduced by greater than —23 dB. Outside of this area, the sidelobes are reduced by more than —26 dB.

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

Fig. 4-1 RADIATOR

4.2.2 RADIATOR ROTATING MECHANISM

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

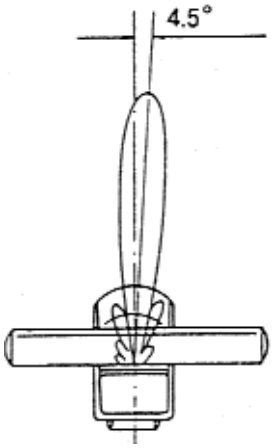
This electrical/mechanical assembly is designed to maintain the antennas rotation in wind speeds up to 100 knots.

4.2.3 MOTOR-ENCODER

The antenna motor also includes a pulse encoder as part of its assembly. The encoder section produces the bearing pulses for display sweep generation, transmitter triggering, and rotation synchronization. A bearing sync pulse is generated every 0.176 degrees of rotation or 2048 pulses per each rotation at 5V amplitude. These pulses (BP) are sent down to the Bearing Pulse circuitry in the display unit via TB1O2 _BP.

4.2.4 **BEARING RESET CIRCUIT**

The Bearing Reference Generator circuit, also known as the ship's heading marker circuit, produces a 5V signal each time a shutter mounted directly on the main gearing breaks the light path of the LED to the photocoupler. CD1 is mounted on the Reference Generator PCB (CCJ – 73). This output pulse is used to synchronize the bearing of the display sweep line with the scanner rotation.



R1200 BLOCK—DIAGRAM

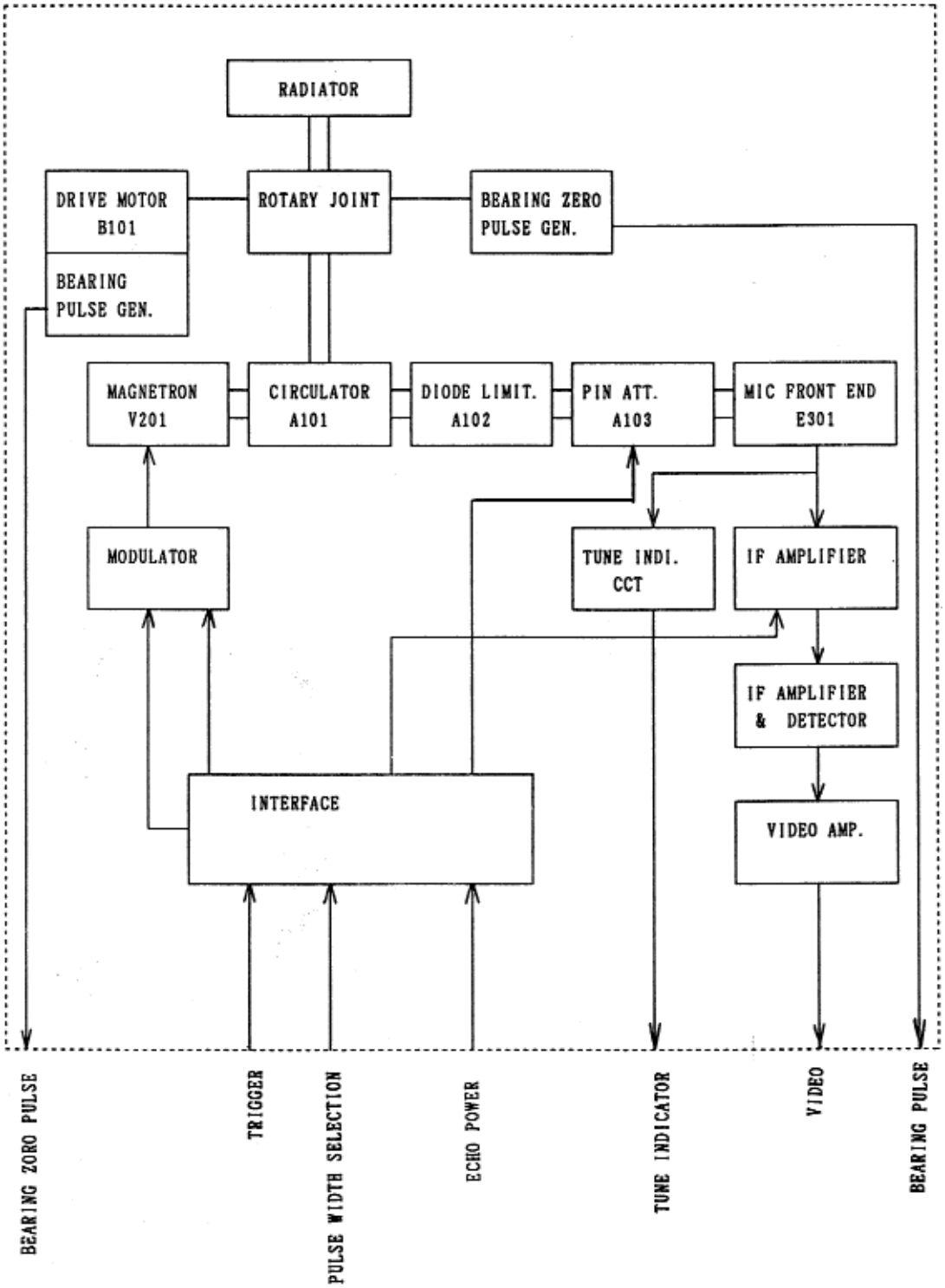


Fig. 4-2 FUNCTIONAL BLOCK DIAGRAM OF OPEN ARRAY ANTENNA UNIT

4.3 TRANSMITTER UNIT

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

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

When setting the X— MIT/OFF key on the indicator control panel at the display unit to ON , the transmitter trigger pulse is sent via the interunit cable from the transmit trigger generator circuit

in the display unit to the modulator.

Generally the pulse width of the pulse generator circuit is controlled by the range key selections on the indicator front panel. Four different pulse lengths:
0.08 ~u sec, 0.4 /2 see, 0.8 ~u sec and 1.2 /2 sec (in accordance with the range scale or menu selections) are provided. The Pulse Repetition Frequency (PRF) changes automatically to match the selected operating pulse length (See Table
4—i).

Upon receiving the positive trigger pulse at its gate, TR7 and TR8 conduct and the charged voltage across capacitors C2 and C3, is immediately discharged through TR7, TR8 and the primary winding of the pulse transformer Ti. Consequently, the pulse in the primary winding of the pulse transformer Ti, is stepped up by more than 10 times by the Ti secondary ~ winding to drive the cathode of the magnetron. The peak pulse voltage on the primary of Ti is —360V, and on the secondary —4.5kV at 6kW output, —5.5kV at 10kW output.

TABLE 4-i RANGE, PULSE LENGTH, AND PRF RELATIONSHIPS
R121OXX TYPE

Range	Pulse Length	PRF
0.125, 0.25, 0.5, 0.75, i.5NM	0.08 /.Z s	2000Hz
3, 6NM	0.4 /.L s	i500Hz
12, 24NM	0.8 ~u s	750Hz
48, [72]*NM	1.2 /.L s	500Hz

4.4 RECEIVER UNIT

The receiver unit consists of the passive Diode Limiter, the PIN Attenuator, the MIC Front End, and the Receiver IF PCB (CAE —323).

The PIN Attenuator includes a PIN diode which limits the RF microwave power in accordance with control current. The current is driven by the control circuit located on the scanner Control PCB (CCB—452).

The MIC Front End (E30i) device consists of low—noise RF amplifier, a double
~ balanced mixer, and the local oscillator. The received radar echo signals at 9410 MHz are first amplified in the low – noise RF amplifier. The signals are then sent into the double balanced mixer of the MIC. The MIC Local Oscillator is tuned by the adjustment of the operator's Tune control on the display unit front panel to be 60MHz higher than the magnetron's operating frequency for maximum target detection. The output is fed into the double balanced mixer. The balanced mixer output of 60 MHz echo signals is then coupled into the 60MHz IF amplifier.

Receiver PCB (PC3O1:CAE—323)

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

IF Amplifier Circuit

The IF amplifier consists *cf* low noise amplifier TRi, and bandwidth selector circuits CDi through CD6.

Th€ bandwidth selectors ar~ controlled by voltages supplied from 1C7 located on the ~(B .452 Scanner Control PCB The voltage enables components to be a(tiv ~ted in the amplifier cm i ut ~( ) the receiver has a 20MHz, 6MHz or a 3MHz bandwidth characteristic. The selection of bandwidth depends on the pulse length ~ selector signal (PW) from th~ ~ Display Unit which will be determined by the range in use.

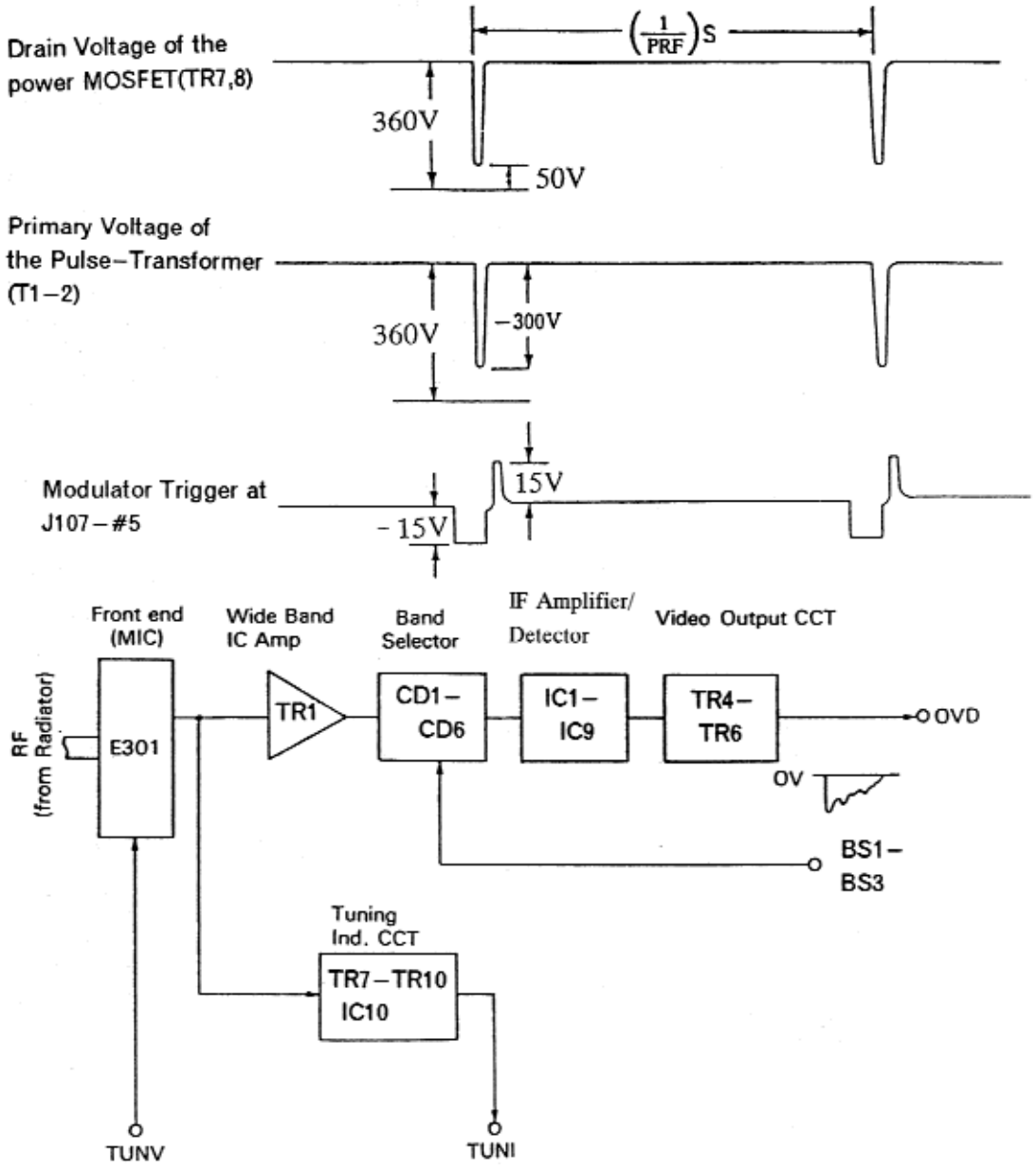
When no pulse length signal is present at CCB —452 Scanner Control PCB , ICi will be OFF and the gates A, B, and C of IC6 will be H . In this condition, the pulse length in operation is 0.08 /2 s and the bandwidth of the receiver is widened to 20MHz. When the pulse length signal is other 0.08 ~U 5, gates of ICi will be turned On . When the input A of 1C6 is H , the bandwidth will become 6MHz. When the input B and C of 1C6 are H , the bandwidth will become narrow at 3MHz.

Video Detector Circuit

ICi through 1C9 at CAE--323 operate as logarithmic amplifiers and video detector to remove the 60MHz IF component from the incoming signals. The negative going signals appear across R36 where the IF component is removed by filter R32, Li3, C4i and C42. The detected signals, now at video frequency rates, are sent to the video output circuit

Fig. 4-3 TIME TABLE OF THE TRANSMITTER

Fig. 4-4 RECEIVER UNIT BLOCK DIAGRAM



Video Output Circuit

The video output circuit at CAE – 323 consists of emitter follower TR4, TR5 and TR6. The emitter follower operates strictly as an impedance transformer to drive the 50 ohms coaxial cable which carries the video signal to the display unit. The video signal is shown in Fig. 4—4.

Tuning Indication Circuit

The tuning indicator circuit at CAE —323 consists of amplifier TR8 and TR9, detector TRiO, and emitter follower TRiO. TRiO discharges C77 to the detected signal voltage. This voltage is sent to the display unit as a tuning indication voltage via buffer amplifier ICiO. The range of the tuning indication voltage varies normally between +4V (detuned) and —0.7V (peaked tuning in long pulse).

SCANNER CONTROL UNIT (CCB-452)

ATT **Driver Circuit**

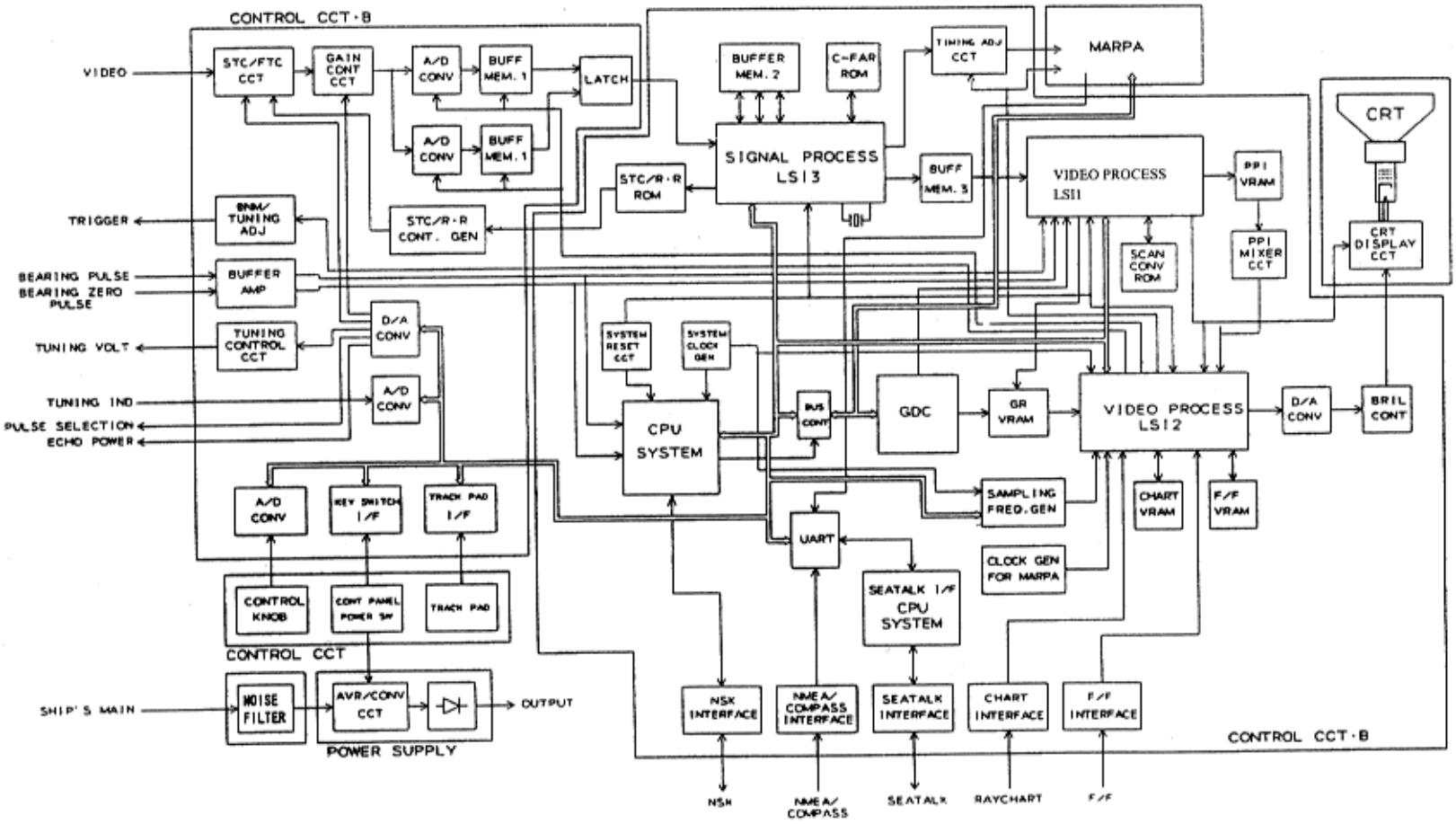
The PIN Attenuator driver 1C7, TR6, TR12 is controlled with DC bias (EPWR) and Main Bang Suppression (MBS) trigger, via TRi2.

This circuit will drive the PIN Diode to control the microwave power fed to the MIC in the receiver unit (to desired level). These levels are controlled to i/i, i,2, 1/4, 1110 of the peak output power, and MBS will always be applied.

Motor Control Circuit

This circuit will drive the scanner motor for constant rotation of the antenna array. After the TX switch on the display unit is set to X—MIT , the MC signal (about +7V), is fed to this circuit. The IC9 ICi2 are active, and TRii will go to ON. The motor will start to rotate and generate the Bearing pulses BP. IC9 and IC1O detect the BP frequency. Variations are sent to ICi2 to control the scanner rotation for a constant BP frequency.

Fig. 4-5 DISPLAY UNIT FUNCTIONAL BLOCK DIAGRAM


CONTROL CCT·B
VIDEO
STC/FTC CCT
GAIN CONT CCT
A/D CONV
BUFF MEM. 1
LATCH
A/D CONV
BUFF MEM. 1
STC/R·R CONT. GEN
STC/R·R ROM
BUFFER MEM. 2
C-FAR ROM
SIGNAL PROCESS LSI3
TIMING ADJ CCT
MARPA
BUFF MEM. 3
VIDEO PROCESS LSI1
PPI VRAM
SCAN CONV ROM
PPI MIXER CCT
CRT
CRT DISPLAY CCT
TRIGGER
BNM/ TUNING ADJ
BEARING PULSE
BEARING ZERO PULSE
BUFFER AMP
TUNING VOLT
TUNING CONTROL CCT
D/A CONV
TUNING IND
PULSE SELECTION
ECHO POWER
A/D CONV
SYSTEM RESET CCT
SYSTEM CLOCK GEN
CPU SYSTEM
BUS CONT
GDC
GR VRAM
VIDEO PROCESS LSI2
D/A CONV
BRIL CONT
A/D CONV
KEY SWITCH I/F
TRACK PAD I/F
SAMPLING FREQ.GEN
CHART VRAM
F/F VRAM
UART
CLOCK GEN FOR MARPA
SEATALK I/F CPU SYSTEM
CONTROL KNOB
CONT PANEL POWER SW
TRACK PAD
CONTROL CCT
SHIP'S MAIN
NOISE FILTER
AVR/CONV CCT
OUTPUT
POWER SUPPLY
NSK INTERFACE
NMEA/ COMPASS INTERFACE
SEATALK INTERFACE
CHART INTERFACE
F/F INTERFACE
CONTROL CCT·B
NSK
NMEA/ COMPASS
SEATALK
RAYCHART
F/F

4.5 DISPLAY UNIT

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

4.5.1 SIMPLIFIED BLOCK DIAGRAM

Fig. 4 – 5 shows the fundamental circuits of the display unit in a simplified functional block diagram. Most system operations within the display unit occur primarily on the Main Control PCBs (CMC—786, CMC—843). It is on these PCBs that most of the signal processing takes place. The following is a brief description of the main circuit functions of the display unit.

4.5.2 MAIN CONTROL PCBS

4.5.2.1 VI DEO I NPUT CIRCUITRY(CMC-843)

The incoming video signals from the receiver in the scanner are first routed through the GAIN and STC circuit components consisting of TRi, TR2 and TR3. The GAIN signal is fed from 1C3, the STC signal is fed from IC4, IC5 and ICi7 and Rain Rate signal is fed from 1C3, IC6 and ICi8 generated by IC47 in CMC – 786. The IC17, ICi8, Ri08 and Ri09 are D/A converters. The data of these ICs are supplied from PROM 1C47. Next stage, video signals are passed through the FTC circuit consisting of CD6, CD7, R29 and R30.

The diode CD6 and CD7 are controlled by the voltage supplied from IC7 which is determined by the front panel RAIN CLUTTER control.
Maximum FTC occurs when the voltage level at CD6/CD7 cathode is about
3VDC.

4.5.2.2 AID CONVERTER(CMC-843)

The A/D converter changes the incoming video signal from analog video signals into 8 bit digital signals. The A/D converter consists of ICi2 – ICi3. Since the conversion must occur at high speed, two A/D converter ICs are used. The digitized video output is then sent to ICi4 to ICi5 the Video buffer memory.

4.5.2.3 BUFFER MEMORY(CMC-843)

ICi4 and ICi5 are buffer memories capable of 2K word x 8 bit dual port input data and output data handling. The buffer memories are used to temporarily store the digitized video input signals according to the clock timing for the range scales in use for the video processor.

4.5.2.4 LSI1(IC60) & LSI2(IC78)/VIDEO MIXER, SAMPLING CLOCK GENERATOR(CMC-786)

The LSI1(IC6O) receive the Bearing Pulse signal (BP) generated by the antenna motor/encoder assembly to synchronize the timing of the scan converter and to control the various cldck inputs and outputs for the video memory and display. When the bearing pulses are received, 1C60 generates the system trigger at TIYLOU and is sent over to LS2(1C78). 1C78 also generates the radar transmit pre—trigger at TffL2. This trigger signal is sent over to IC11 where the 0 – NM delay timing adjustment is applied. The outputs at ICii provide complimentary drive signals to TRi2 and TRi3. These amplifiers boost the output transmit trigger (TRIG) level to +i2VDC in amplitude.

~ The Sampling Clock Generators consist of VCO (Voltage Cont:olled Oscillator), along with 1C83 and 1C84. The VCO operates from 23 MHz t 55 MHz. This is the reason the Variable Range Scale is stepped by 1/2, i/3, i/6 each range scale. Totally R1200XX series radar has O.i25, 0.25, 0.375, 0.5, 0.75, i, 1.25, 1.5, 1.75, 2, 2.25, 2.5, 3, 3.5, 4, 4.5, 5, 6, 7, 8, 9, iO, i2, 14, 16, 18, 20, 24, 28, 32, 36, 40, 48, *56, 64,* 72 NM. R12O6XX has 33 range scales, and

R12iOXX has 36 ranges.

The LSIi and LSI2 can perform additional processing functions on the video signal when activated in menu. They are:Wakes Processing, Zoom Processing, Target Expander Processing, true motion and signal integration.

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

4.5.2.5 LSI3IVIDEO PROCESSOR

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

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

4.5.2.6 VIDEO MEMORY(CMC-786)

The start of the data readout of the video buffer memory is triggered on the trailing edge of the Bearing Pulse from the scanner unit. This clock is used for
data processing in LSI1. The processed video which has passed through LSI1 is now transferred to the video memory IC61 through IC64.
These ICs are VRAM consisting of 512 X 5i2 X 8 memory planes which are used to produce the video picture (including wakes) data.

The address signals used to write into and read out of the video memory are generated in LSi 1 . The output data from the video memory is entered into LSI2(1C78), the video signal mixer/processor.

4.5.2.7 CONTROL PCBs

The XX series radars use two separate Keypad Control PCB assemblies to activate the radar system and control its functions. These Keypad Control PCBs interface directly into the Main Control PCBs via connectors J4ii and J4i2 to 1C37 and path through the I/O port JC25 _ JC26 and the CPU.

Panel B contains 2 of the 20 key switches used by radar. PC403, on the right side of the front panel A, contains the remaining 18 key switches and the four variable controls for the TUNE, GAIN, FTC and STC. Each panel includes LEDs for backlighting the keyboard panels and the LED intensity can be controlled in 8 levels of brightness by the menu selection via the DIM line. The operating voltage for the LEDs originates at IC3i and IC36 on the Main PCB.

4.5.2.8 CPU & GCM (GRAPHIC CONTROL MEMORY)

This radar uses an i6bit CPU (IC1), and a Graphic Display Controller (IC27) to principally control the graphic system of the on—screen display of VRM, EBL, Bearing Scale, Range Markers, and other graphic characters. The CPU receives operating instructions from the 2Mbit EPROM in IC1O and system setting stores data in the i28Kbits of RAM available in ICii. The RAM memory has a battery backup through CD2 so that the settings of Range, EBL, VRM, EXP, and JR will be maintained in memory after each shutdown of power.

The GDC (Graphic Display Controller) paints the various character data, VRM, EBL, Range marker, etc. under direction of the CPU ~ to graphic VRAM memories JC34 _ JC4O.

4.5.2.9 VIDEO OUTPUT

In JC78, data which has been written into the Video Mixer/Processor by the range and sample clock timing signals will now be read out to the CRT monitor in raster scan timing;that is, the

Horizontal frequency of 24KHz and 60Hz Vertical frequency.

The 3 bit digital video signals are reconverted into analog video signals having **8** levels and outputted to the buffer amplifier TR6. The graphic data is also mixed in 1C78. When the brilliance control is changed, the brilliance control signal is outputted from D/A converter IC3i at CMC – 843A and applied to IC85. The CRT brilliance will be varied in 8 steps. The combined video signals (radar targets and display graphics) along with the horizontal (HS) and vertical (VS) synchronization signals are sent to the monitor display. When the Power Save mode is operated, the SAVE signal is applied to the monitor display too.

4.5.2.10 DISPLAY **MONITOR**

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

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

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

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

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

4.5.3 **OPTIONAL INPUTS**

The XX Series radars can receive various input signals from Navaids, Flux Sensors, Fishflnders, Raychart Units, and Seatalk Data networks. The inputs from the Raytheon V850 and V80i0 Fishflnders and from the Raychart Units are digital video and the horizontal/vertical sync signals to drive the XX display. The Inputs from Seatalk, the flux sensor, and Navaids will be digital data conforming to the NMEA 0i83, JRC serial, or Seatalk formats to drive various radar features such as Waypoint Mode or the MARPA.

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

HEADING:
i. GYRO/LOG Data (CMJ—3041304A including the kit of MDLWiO664)
2. Flux Sensor (NMEAO183"HDG, HDM, VHW, MDT' sentence)
3. Seatalk Data (Heading via Autopilot compass)
4. Navaid Data (NMEA 0183 -RMC, RMA, VTG -sentences)

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

SPEED:
i. GYRO/LOG Data (CMJ—304/304A including the kit of MDLWiO664)
2. Navaid Data (NMEA 0183 -RMC, RMA, VTG, JRC FORMAT" sentences)
3. Seatalk Data

WAYPOINT: i. Navaid Data (NMEA 0i83 - RMB, BWC - sentences) 2. Seatalk Data

SEATALK: i. Seatalk Data only

The NAVAID input is connected at J403 pins 1 and 2. The signal is coupled via J409 to ICiO6 (Optical Isolator), to Inverters ICiO2, to the UART 1C92, and finally to the CPU IC1.

The HEADING data input essentially follows a similar route. The signal is connected at J403 Pins 3 and 4, coupled via J409 to ICiO7 (Optical Isolator), Invertors ICiO2, to the UART IC92, and finally to the CPU ICi.

The SEATALK bus provides two—way communication of navigation data between units connected to the bus. The radar can receive External Cursor inputs or Route Plan information, in addition to position, course, heading, speed and other navigation data.

The path for input of Seatalk data is via J405 Pins 2 and 3 to the Seatalk Interface part of CMC-786. This part converts the incoming Seatalk data into NMEA 0183 to feed 1C91, and consists of 1C96 (CPU), 1C97 (ROM) and 1C98 (RAM). 0

The video inputs from Raychart at J406 and the V850/80i0 Color Fishfinders at J404 is routed via J409 to the JC1O8 through ICiii buffer amplifiers and then into the Video Mixer/Processor JC78.

The flshfinder video appears only in the PIP (picture in picture/window) mode.

The Raychart video can appear in either a full screen presentation mode or in PIP (window) mode. The CSEL signal, produced from operation of the Raychart ~ CHT ON ~ key on the Raychart controller unit determines which chart display mode is to be used at CPU IC 1.

4.5.4 **POWER SUPPLY (CBD-1296)**

The Power Supply converts the ship's DC input voltage to the necessary DC voltages to operate the radar system. These output voltages include regulated +25VDC, +15VDC, -15VDC, +5VDC, +3OVDC and +36OVDC.

The power supply can begin operation when the ~ STBY/OFF ~ switch is pressed on the Control PCB. The STBY signal toggles 1C3 – ii output and TR6 conducts. This enables the Vcc supply to the AVR converter circuit. When the ~ X— MIT/OFF~ key is ~ pressed, 1C4 – 13 operates TRiO and TRi5 to enable the OPE output.

The AVR consists of IC1, IC2, as well as TR1 and TR2. IC2 controls the switching of the power FETs TR3 and TR4. Sensing of the AVR output occurs from the output of +5VDC line, sampled via RVi, compared at 1C7 and controlled via ICi – 6 to the AVR. RVi is normally set by monitoring the +5VDC output at TP2 and adjusting for +5VDC, ± 0.iVDC.

When both the $fBY/O~1 and | XMIT/OFFJ keys are pressed together, IC3 resets 1C4 output and shut off the Vcc from the AVR ICi. This will turn the power supply and the radar system to OFF.

4.5.5 **MARPA PCB(CDC-826)**

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

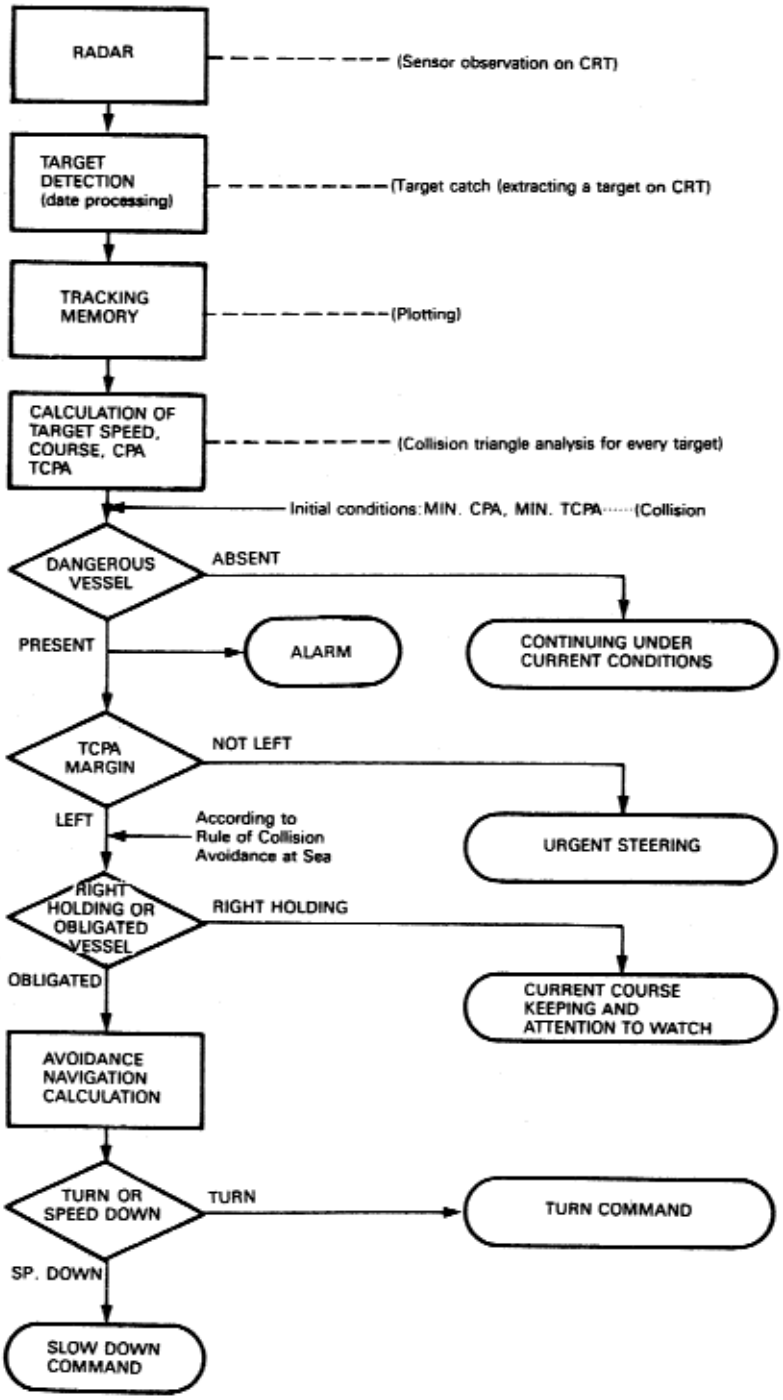
Necessary inputs to the MARPA include:

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

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

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

Fig. 4—8 MARPA LOGIC


RADAR
(Sensor observation on CRT)
TARGET DETECTION (date processing)
(Target catch (extracting a target on CRT)
TRACKING MEMORY
(Plotting)
CALCULATION OF TARGET SPEED, COURSE, CPA TCPA
(Collision triangle analysis for every target)
Initial conditions: MIN. CPA, MIN. TCPA ····· (Collision
DANGEROUS VESSEL
ABSENT
PRESENT
ALARM
CONTINUING UNDER CURRENT CONDITIONS
TCPA MARGIN
NOT LEFT
LEFT
According to Rule of Collision Avoidance at Sea
URGENT STEERING
RIGHT HOLDING OR OBLIGATED VESSEL
RIGHT HOLDING
OBLIGATED
CURRENT COURSE KEEPING AND ATTENTION TO WATCH
AVOIDANCE NAVIGATION CALCULATION
TURN OR SPEED DOWN
TURN
TURN COMMAND
SP. DOWN
SLOW DOWN COMMAND

SECTION 5
MAINTENANCE

5.1 GENERAL

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

Warning

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

5.1.1 PRODUCT AND CUSTOMER SERVICE

In the event that your XX—Series Radar is in need of service, the dealer from whom the radar was purchased, or an authorized Raytheon dealer should be contacted for assistance. The authorized Raytheon dealer is best equipped to handle your inquiries. If, after contacting your dealer, you have further questions and require further assistance, you may contact Raytheon Marine Company directly at 1-800-539-5539.

WARNING

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

5.2 PREVENTIVE MAINTENANCE

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

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

5.2.1 HIGH VOLTAGE ARC PREVENTION

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

5.2.2 INSPECTION (MONTHLY INTERVALS)

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

1. Check all hardware for tightness.
2. Check for evidence of any corrosion on the scanner unit/and display unit, or cable and connectors. Clean as required.
3. Check the cable connections and terminal strip connections for cleanliness and

tightness. Make sure the wiring is free from chafing or abrasions.

5.2.3 **CLEANING (MONTHLY INTERVALS)**

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

WARNING

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

5.2.4 **LUBRICATION**

Pedestal should be lubricated every 6 months as follows.

Pedestal Lubrication (Semi – Annual Intervals)

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

Pedestal Motor Gear Lubrication (Semi – Annual Intervals)

~ De—energize radar equipment at the main breaker panel and place pedestal safety switch to OFF.
2. Remove antenna motor.
3. Apply general bearing grease compound, Moly Kote 33, (RMC P/N 981955— 1) to motor gear and also internal antenna bull gear through motor mounting hole. Rotate antenna array in order to properly coat entire gear.
4. Reassemble antenna motor.
5. Place Pedestal safety switch to ON.
6. Reapply power to the radar equipment.

Fig. 5—i PEDESTAL LUBRICATION

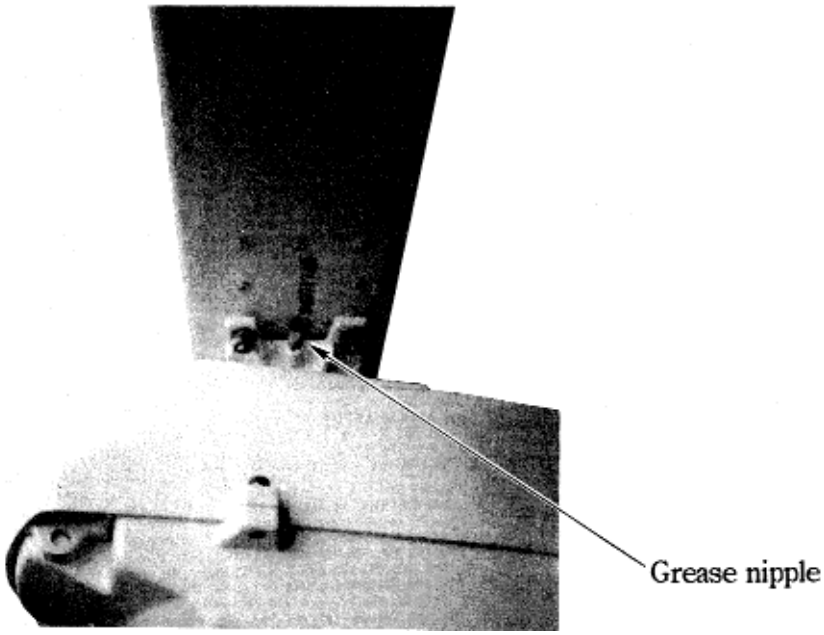
5.2.5 **CONNECTOR MAINTENANCE (SEMI-ANNUAL INTERVALS OR AS REQUIRED)**

During installation and maintenance, it is recommended that Dow Corning Compound #4 silicone grease (RMC PiN 230—iOi4P5) be inserted inside the power and control cable connectors on the rear of the display unit. This silicone grease is an insulator and may be used to protect RF, power, and control connector pins from the corrosive effects of the marine environment.

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

CAUTION

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



5.2.6 **GASKET MAINTENANCE (SEMI-ANNUAL INTERVALS)**

Every 6 months Pedestal gaskets should be carefully lubricated, using silicone grease (Dow Corning #4 RMCPiN23O— iOi4P5). The primary locations to lubricate with this grease are shown in figure *5.2.*

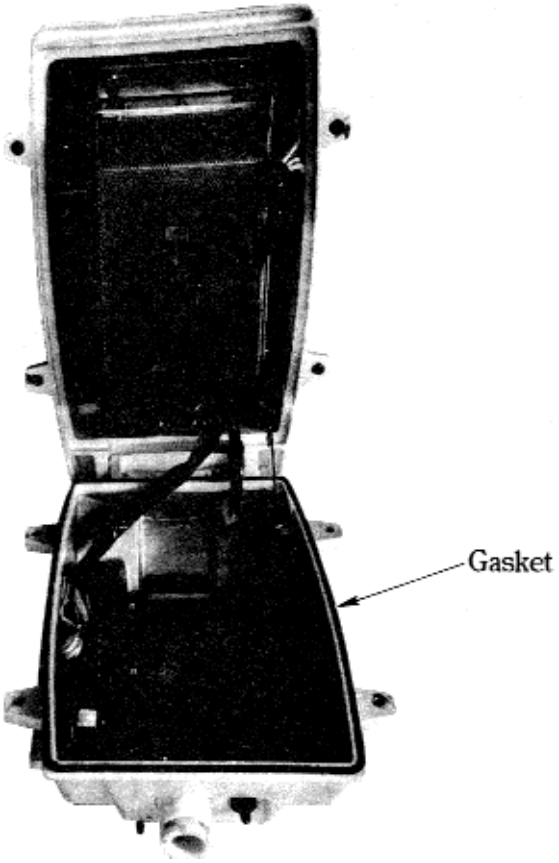
Fig.5-2 GASKET LUBRICATION

5.2.7 ANTENNA PEDESTAL BRUSHES REPLACEMENT **PROCEDURE (ANNUAL)**

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

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

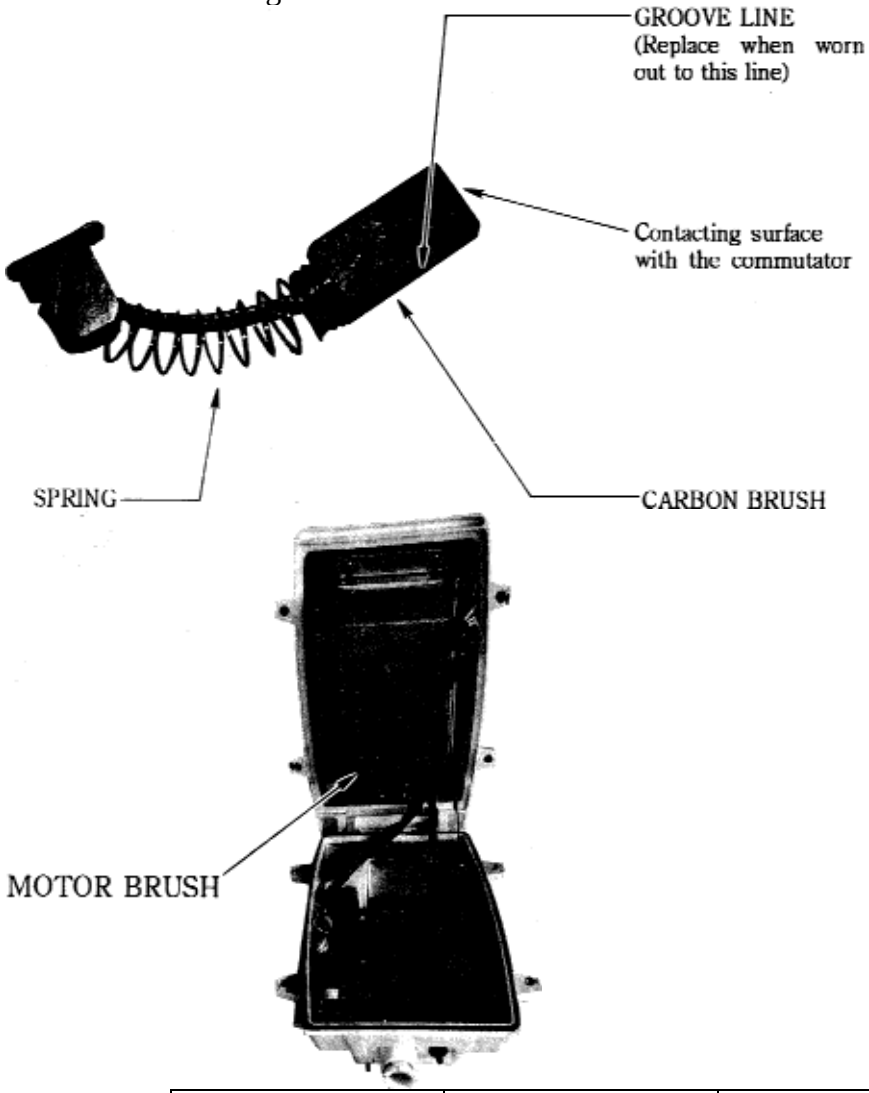
In order to access the motor brushes, unscrew the four securing bolts around the pedestal housing and open the unit. Unscrew the two motor brush holders located on either side of the antenna motor and remove the brushes. Inspect for wear as shown, replace with new brushes if worn to line on the body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



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

NOTE: Before removing the transmitter module, unplug Ji03 from the Scanner Control PCB (Heading ref. generator).

Fig. 5-3 ANTENNA PEDESTAL BRUSH LOCATIONS



Description	Type	Part Number
Motor Brush	S00i52—5C—70	BRXPOO9i8

5.2.8 BATTERY REPLACEMENT (CMC 786) [EVERY 2 YEARS]

The Lithium Battery (BT1) on the Main Control PCB (CMC 786) should be replaced every 2 years or as required when the voltage reaches 2.00 Vdc. The purpose of this onboard battery is to maintain certain memory functions such as the hour meter, last position of Range Rings, EBLs, VRMs, etc., when the radar is switched off. If the Display Unit does not return to the last used condition of those functions (i.e., Range, Range Rings, EBLs, VRMs, etc.) when the unit was turned off, then the Lithium Battery (BT1) should be replaced per the following procedure.

1. De energize the radar equipment by securing the input power to the Display Unit.

2.. Reriove the Display Unit interconnect cable and power cable.

a Remove the Display Unit cover (10 screws) and the Main Control PCB (CMC – 786) from the chassis.

4. With soldering iron and de – soldering tool remove battery BTi from the Main Control PCB. Use caution not to short out battery leads.
5. Install replacement lithium battery (P/N 5ZBAD00089) noting proper battery polarity.

   Check that battery voltage is greater than 3.oo ± .2 Vdc. If less than 2.50 Vdc, the battery may not be used and should be replaced with new battery before voltage drops below 2.00 Vdc.
6. Replace Main Control PCB and rear cover.

5.2.9 CRT SURFACE CLEANING

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

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

5.2.10 FUSE

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

TABLE 5 – 1 shows a table of fuses employed in the equipment.

TABLE 5—i FUSES USED

Location	Part No. Current	Rating circuit	Protective	Type	Remarks
DISPLAY	P401	1OA	Scanner motor	Glass tube	1OA dc 12V
DISPLAY	F401	6.3A	Scanner motor	Glass tube	6.3A dc 24V,32V
DISPLAY	F402	15A	All circuit	Glass tube	15A dc 12V
DISPLAY	F402	8A	All circuit	Glass tube	8A dc 24V,32V

5.2.1 1 RECOMM EN DED TEST EQUI PMENT, TOOLS AND MATERIALS:

Table 5—2 Lists the test equipment, lubricants, and special tools that are useful in maintaining the radar system.

TABLE 5-2

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

* or equivalent

TEST EQUIPMENT			
Multimeter	i	*Simp~on	260
Digital Voltmeter	1	*Fluke	77
Oscilloscope	1	*Tektronix	335
Probe, Oscilloscope,iOX	2	*Tekfronix	P6105
Frequency Counter	1	*Fluke	i900A
Waveguide Termination Kit, X— Band [Dummy Load]	i	Raytheon	G26i472 —1
TOOLS			
Trimpot Adjustment Tool	2	Raytheon	i035670— i

Grease Gun	1	*plews	30—121
MATERIALS			
Grease, General Bearing.			
Dow Coming, Moly Kote 33	i	Raytheon	981955 – i
Grease, Silicone Gasket			
Dow Coming, DC4			
Compound	1	Raytheon	230—iOi4P5
Grease, Silicone Lubrication			
GE—G6987	i	Raytheon	1036383—i
NO – AL— OX	1	Raytheon	1035909 —1

Unit to be checked	Check item	Correct condition	Measuring point
Scanner Unit	a.Ships main Input voltage	Refer to note	TB 102(M+ M—)
	b.Input voltage	+15VDC —15VDC +36OVDC	TB1O1—(+15) VDC TB1O1—(—15) VDC TB1O1-(+360) VDC
	c.Mag.current	12VDC	TB1O1 —(MO)
Display Unit	a.Input voltage	Refer to note	J401—1—3
	b.AVR output voltage	5VDC	TP2—ground(PC5O1)
	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, iO.8VDC—42VDC

5.3 OPERATIONAL CHECKOUT

Turn the radar on.

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

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

Press the ~ X—MJT ~ key and look for the presence of radar targets on the screen.

Checktheoperation of the ~ selection keys for each range scale. Observe that the sweep is the correct length and has the proper number of range rings. Observe that the - ON—SCREEN - characters are positioned and focused properly.

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

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

TABLE 5-3 OPERATION CHECKLIST

5.3.1 POST INSTALLATION SETUP ADJUSTMENTS

Following the operational checks, two alignments A) and B) are normally required for proper operation. The procedure for performing these adjustments are found in 5.4.2.iO (Bearing) and 5.4.2.9 (Display Timing).

They are:

Other adjustments that may reQuire touchun include:

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

5.3.2 TROUBLE-SHOOTING GUIDE

While the i2O6XX/12iOXX Radars are highly reliable systems, early signs and detection of component fatigue can sometimes be spotted during regular operational checks.

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

5.3.3 MASTER RESET

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

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

It should be noted that micro components within the Radar are generally not field replaceable. Therefore, most repairs to the radar typically go to the PC board level only. A replacements parts list for the R12O6XX/R121OXX Radar systam can be found in Section 6.

A) Relative Bearing Adjustment 5.4.2.iO
B) Display Timing Adjustment 5.4.2.9
Video Circuit Adjustment 5.4.2.8
Antenna Height Selection 5.4.2.11
Interlace Adjustment 5.4.2. 12
Buzzer Volume Adjustment ~ 5.4.2.i3

REPLACEMENT ITEM	ADJUSTMENT REQUIRED	See Sect.#
Magnetron V20i	Tuning	5.4.2.8
MIC Frontend E30i	Tuning	5.4.2.8
Cathode—ray tube V50i	Adjusting Centering Magnet	5.4.2.7
Display PCB	Adjusting contrast Adjusting focus	5.4.2.2 5.4.2.3
SHM Unit	Bearing Alignment	5.4.2.10

CAUTION:

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

5.4 ALIGNMENT AND SERVICE

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

The alignments detailed in paragraphs 5.4.2.9 through 5.4.2.ii should normally be accomplished when the radar is installed and/or when necessary.

5.4.1 ANTENNA PEDESTAL RECEIVER ALIGNMENTS

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

NOTE

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

5.4.1.1 **TUNE INDICATOR ADJUSTMENT**

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

1. Select the range scale 3NM above.

2. Adjust RV1 on the Receiver PCB(PC3O1) for the tuning level indication of 6 or 7 on CRT.

5.4.1.2 ~ FACTORY ADJUSTMENTS

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

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

5.4.2 DISPLAY ALIGNMENTS

HIGH VOLTAGE WARNING

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

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

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

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

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

5.4.2.1 DISPLAY AVR VOLTAGE ADJUSTMENT

Ihe tollowing adjustment correctly sets the values of the output voltages on the Display Power Supply PCB (CBD—i296). Refer to FIG. 5—5 below while performing these adjustments.

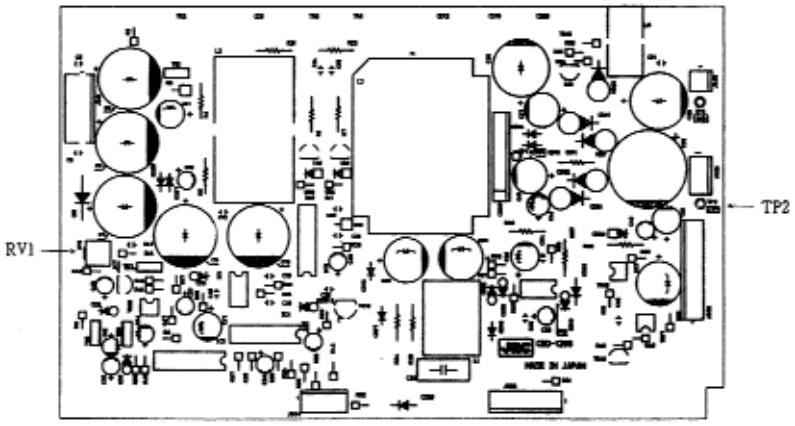
1. Reconnect power to the radar system

2. Place the positive lead of a OVM to TP2 and the negative lead to ground.

3. Adjust RVi so that reading on DVM is +5.i *+1*— .i VDC.

Fig. 5–4

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


RV1
TP2

5.4.2.2 **CONTRAST ADJUSTMENT**

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

5.4.2.3 **FOCUS ADJUSTMENT**

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

5.4.2.4 **HORIZONTAL HOLD ADJUSTMENT**

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

5.4.2.5 **HORIZONTAL SIZE/VERTICAL SIZE ADJUSTMENT**

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

NOTE

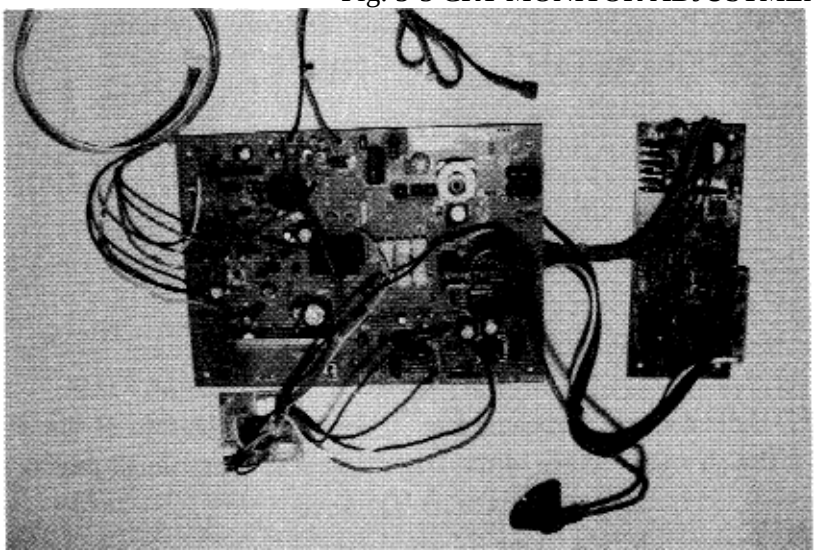
Use a ruler to adjust for equal diameters in the N/S and E/W radius.

5.4.2.6 **VERTICAL LINEARITY ADJUSTMENT** 。Adjust RV3 on CRT Monitor PCB so that the rings are round.

5.4.2.7 **BEAM CENTERING ADJUSTMENT** 。

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

Fig. 5-5 CRT MONITOR ADJUSTMENTS



5.4.2.8 1 NITIAL SETUP ADJUSTM ENTS

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

PANEL

MENU/DISPLAY OPTIONS

Press ~4~UJ, ~A~Q/CNL~ and rGUARDJ keys simultaneously to get "INITIAL SETTING" menu. Use the trackpad to select the desired menu item and press ENTER~

1) Preadjustment

Adjust_the "Indicator Bar" level on the bottom of the screen as follows using the I RANGEA | ~ANGEY | keys.

2) TUNEPRESET ADJUSTMENT

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

Ⓡ Set the radar to the 3NM range scale or above.

Ⓒ Set GAIN for normal noise level on the display.

Ⓒ Set TUNE control of the front panel at mid scale position.

Ⓡ Select "TUNE PRESET" from "INITIAL SETTING".

Ⓡ Adjust the "Indicator Bar" level on the bottom of the screen to get the clearest picture of the targets on searching the all region, using the RANGEZ and RANGEX keys.

Ⓡ Press ENTER key.

Range Scale : 24NM.
[TUNE] knob : Center
[RAIN CL] knob : Full CCW
[SEA CL] knob : Full CCW
[GAIN] knob : Full CW
TUNE : MANUAL
PROCESS : OFF
ECHO PWR : FULL
"ANTENNA HEIGHT" : 5-lOm
"STC MAX LEVEL" : half (indicator bar level)
"GAIN MAX LEVEL" : half (indicator bar level)
"COMPARATOR SET" : quarter (indicator bar level)

3) COMPARATOR SET ADJUSTMENT

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

~:D Set ~ GAIN] and ~ RAIN CL ~ knobs fully clockwise.

Ⓒ Select COMPARATOR SET from INITIAL SETTING

©Adjustthe" Indicator Bar level on the bottom of the screen with the [j~ANGE A] and [iATGE~~J keys. so that the level is three steps down just_before the noise base appears.

Ⓡ Press ~ ENTER ~ key.

4) GAIN MAX LEVEL ADJUSTMENT

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

c:D Set [~AI~1 knob and ~ knob fully clockwise.

© Select -GAIN MAX LEVEL -from -INTIAL SETTING -

© Check the output voltage of TP7 on main control (B) PCB CMC—843 using an oscilloscope.

(& Adjust the -Indicator Bar -level on the bottom of the screen, so that the voltage_difference between the noise base level and the_suppression level by ~ SEA CL ~ control will be about 0.OSV, using ~ RANGE **4~J** and [iANGE 'V keys.

~ Press ~ ENTER$_1$ key.

5) STC MAX LEVEL ADJUSTMENT

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

c:D Set ~AIN~j and ~SEA CL **I** knobs fully clockwise.

© Select -STC MAX LEVEL -from "INITIAL SETI'ING" menu.

© Adjust the -Indicator Bar -level on the bottom of the screen, so that the noise on the screen will disappear at 6NM, using g [iANGE **A** and ~ RANGEY ~ keys.

® Press [~'lTER~ key.

6) READJUSTMENT

~:D Readjust -COMPARATOR SET -.

© Readjust -TUNE PRESET".

5.4.2.9 DISPLAY TIMING ADJUSTMENT ("0" NM ALIGNMENT)

This is the radar timing adjustment to ensure that targets are at their proper range on the display unit. Display timing is most critical on the i/8NM range. i) Set the range at 0.125 NM.

2) Locate a dock, seawall or bridge on the display. Observe whether the radar target is straight on the display. If not, adjustment is indicated.

3) Press LMENi~i + [ACQ/CNL~ + ~UARDJ for the Initial Setting menu. Then select -DISPLAY TIMING -with the Trackpad and press the L~~J key.

4) Adjustthe -Indicator Bar -shown in the lower part on the display using the [RANGE **A** j / rRANGE V ~ keys so that the object appears to be straight on the display. Press the ~ ENTER ~ key when setting is correct.

BANK PUSHING DISPLAY TIMING EARLY | BANK PULLING DISPLAY TIMING LATE | NORMAL

Fig. 5-6 0 NM ALIGNMENT

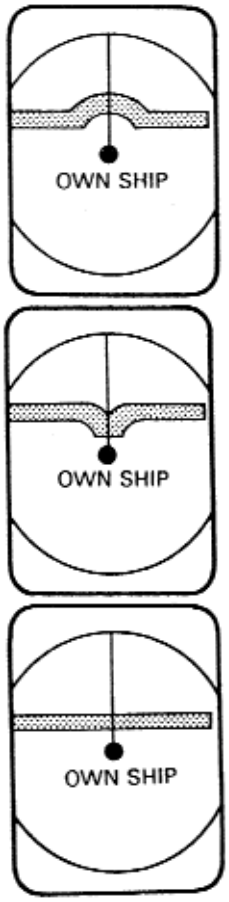
5.4.2.10 **RELATIVE BEARING ADJUSTMENT**

This alignment should be performed when the installation is complete to ensure that target

returns on your display appear at their proper bearing with respect to the ship's bow.

Proceed as follows:

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



5.4.2.11 **ANTENNA HEIGHT SELECTION**

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

The values are 0—5m, 5— i0m, iO—20m, over 20m.

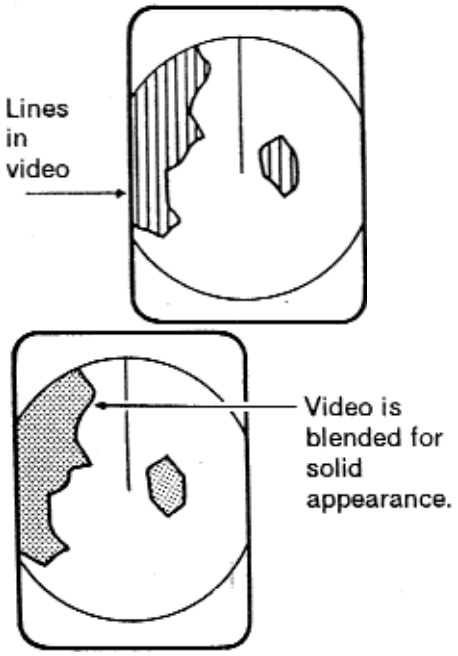
i. Press LM~~i~~i + ~ + ~ GUARD ~ for the initial setting menu.
2. Select - ANTENNA HEIGHT - with the trackpad.
3. Select the desired value using the ~ RANGE A~ ~ RANGE V ~ keys.
4. Press the LENTER ~ key.

5.4.2.12 **INTERLACE (SYNCHRONIZATION) ADJUSTMENT**

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

1. Select ~ MENU ~ + LACQ/CN1~~ ~ + ~ GUARD~ for the initial setting menu and select - INTERLACE ADJ - with the trackpad. Press EI~TT~i
2. Adjust the - Indicator bar - shown in the lower part on the screen using the ~ RANGE **A** ~ ~ RANGE ~ keys so that no separation between the lines (Blends) can be seen. Press ~ ENTER] to end.

POOR INTERLACE SYNCNORMAL (INTERLACE PROPERLY ADJUSTED)



5.4.2.13 BUZZER VOLUME ADJUST

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

1) Select ~ ~ + ~ARDj for the initial setting menu with the trackpad and press ENTER_~ . Select BUZZER VOLUME.
2) Adjust the - Indicator Bar - shown in the lower part of the display using the down key for suitable buzzer sound level.
3) Press ~NT~i~ when finished.

5.4.3 FAULT FINDING PROCEDURES

Often the display on the CRT can help indicate which major circuit is at fault. It may be quicker to check – out the equipment according to the trouble shooting guide that follows (TABLE 5—4).

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

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

TABLE 5—4 is the trouble shooting guide and check—out procedure. TABLE 5 – 5 shows typical voltages and resistances at significant points throughout the equipment. The internal resistance of the voltmeter used in these measurements was 20k ~ / V dc, 8 k 0 / V ac.

TABLE 5-4 TROUBLE SHOOTING GUIDE

	Trouble	Remedy
1.	Does not POWER—UP.	Check: Blown fuse F402 Check input power circuits. Faults of contact on PC404 Faults of power supply circuit on PCSOi Faults of contact on connector of PC5Oi Faults of rectifier diodes on PC5Oi
2.	Scanner fails to rotate.	Check: Fault of SiOi. (Safety Switch OFF) Fault on contact on terminal boards. Fault of MiOi CBP—i25/BiOi. Fault of drive mechanism.
3.	Scanner rotates but rotation of sweep is abnormal.	Fault of cdiinection between CBP— i25/BiOi Check: Fault of encoder (BP/BZ) Fault of main circuit for the Display Unit.
4.	No picture on the screen.	Fault of CRT display unit or its supply voltages. Check: Open heater of CRT. Fault of contact on CRT socket. Fault of contact on CRT cap. Fault of video circuit, and power save circuit.
5.	Only horizontal line screen.	There may be fault in vertical sweep generator, amplifier circuits and deflection coil. Check: Fault in vertical sweep generator, amplifier

		circuit.
6.	Incorrect sweep —Start of sweep is ~ not centered on the screen. _Markers are oval.	Adjust CENTERING MAGNET. Adjust horizontal or vertical hold. Adjust vertical length and luiearity. Adjust height as necessary
7.	Range rings on the screen but no noise and no echoes.	Fault circuit between IF amplifier of receiver unit and input circuit of display unit video amplifier. Check: Fault of GAIN, STC control settings. Fault of receiver unit. Fault of contact on terminal boards and connector.

	Trouble	Remedy
8.	Noise and range on the screen but no echoes. ~	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. CQD-i248, TB1, MO ~ 12VDC Failure of Local Oscillator tuning If transmission appears to be present, carry out the Local Oscillator tuning procedures and check the MIC. Fault of the MIC Mixer. If no transmission is present, ensure the lead wire to magnetron is grounded to chassis. Fault of magnetron.
9.	Poor sensitivity. Dim Echoes.	Check: Reduction of transmitting output power. Fault of magnetron. ~ Check of MAG.I reading on CQD— i248, TB1,MO ~ i2VDC Fault of MIC Frontend. Fault of CRT. Failure of Local Oscillator tuning. Failure of FOCUS adjustment. Failure of INTENSITY ADJ. Fault of video amplifier circuit on PC402. Fault of receiver unit.
10.	No VRM or VRM cannot be controlled.	Check: Fault of PC403. Fault of main circuit (PC4O1).
ii.	NoEBLorEBL cannot be controlled.	Check: Fault of PC403. Fault of main circuit (PC4Oi).
12.	No alarm zone marker, cannot be controlled or no alarm sound.	Check: Fault of PC403. Fault of main circuit (PC4Oi) Fault of Buzzer BZ1.

Measuring	Resistance		Voltage(v)		FUNCTION

Point	(C_)	0.i25.i.5 (NM)	3.6 (NM)	i2 (NM)	
TBiOi					
+360	44K	360	355	360	+360V
TRIG	100	—0.09	—0.06	—0.05	Trigger
PW	12K	0	4.4	6.6	Pulse Width
+15	950	i5.4	15.4	15.5	+i5V
—is	ii.5K	—i6.7	—16.7	—i6.7	—iSV
EPWR	10K	0.4m	0.4m	0.4m	Reduce Power
MO	234	65m	0.2m	O.2m	TX Monitor
xi	7.2	8.06	8.06	8.06	MAG. Heater
TBiO2					
VD	300	—0.i3	—0.i3	—0.13	Video
TNC	4.7K ~	i5.7	15.7	15.7	Tuning Volt
TNI	cx~	5~3	5.3	**5.3**	**Tune Indicator**
BP	0/ co	2.1	2.1	2.i	Bearing Pulse
BZ	0/~X’	5.i	5.i	5.i	Zero Pulse
MC	a~	6.0	6.0	6.0	Motor Control
M-	oo	24.0	24.0	24.0	Ship’s Power
M+	oo				

SCANNER UNIT(Interunit Cable disconnected)

DISPLAY UNIT(Interunit Cable disconnected)

Measuring Point	Resistance : (0)	FUNCTION
TBiOi		
+360	44k	+360V
TRIG	100	TRIGGER
PW	12k	Pulse Width
+15	950	+i5V
—15	28k	—i5V
MO	234	TX Monitor
X i	7.2	MAG. Heater
TB1O2		
E	cx~	Video
VD	4.7k	Tuning Voltage
TNC	cx~	Tuning Indicator
TUI	oo ~	Bearin& Pulse Zero
BP	0/~	Pulse
BZ	0/ ~	Motor Control
MC	co	
M-	co	j Ship’s Power
M±	co	

Measuring Point		Resistance (~)
L402	1	0.i
	2	80 X iO
	3 ~	0.
		1

	4		80	X	iO
	5			0. 1	
o	6		5.6	X	10
	7		77	X	iO
	8			0.i	
	9	2i.6		X	10
	10		2	X	10
	ii		2	X	10
	12		10 i2	X	$i0^3$
	13			X	106
	14		98	X	iO $i0^3$
	15		16	X	
	16 i7		28	0. 1 X	iø~
	18		42	co	$i0^5$
	19		35	X	$i0^3$
	20		i2	X	$i0^2$
	21		30	X	$i0^6$
	22			X	
	23			0.i	
	24			co	

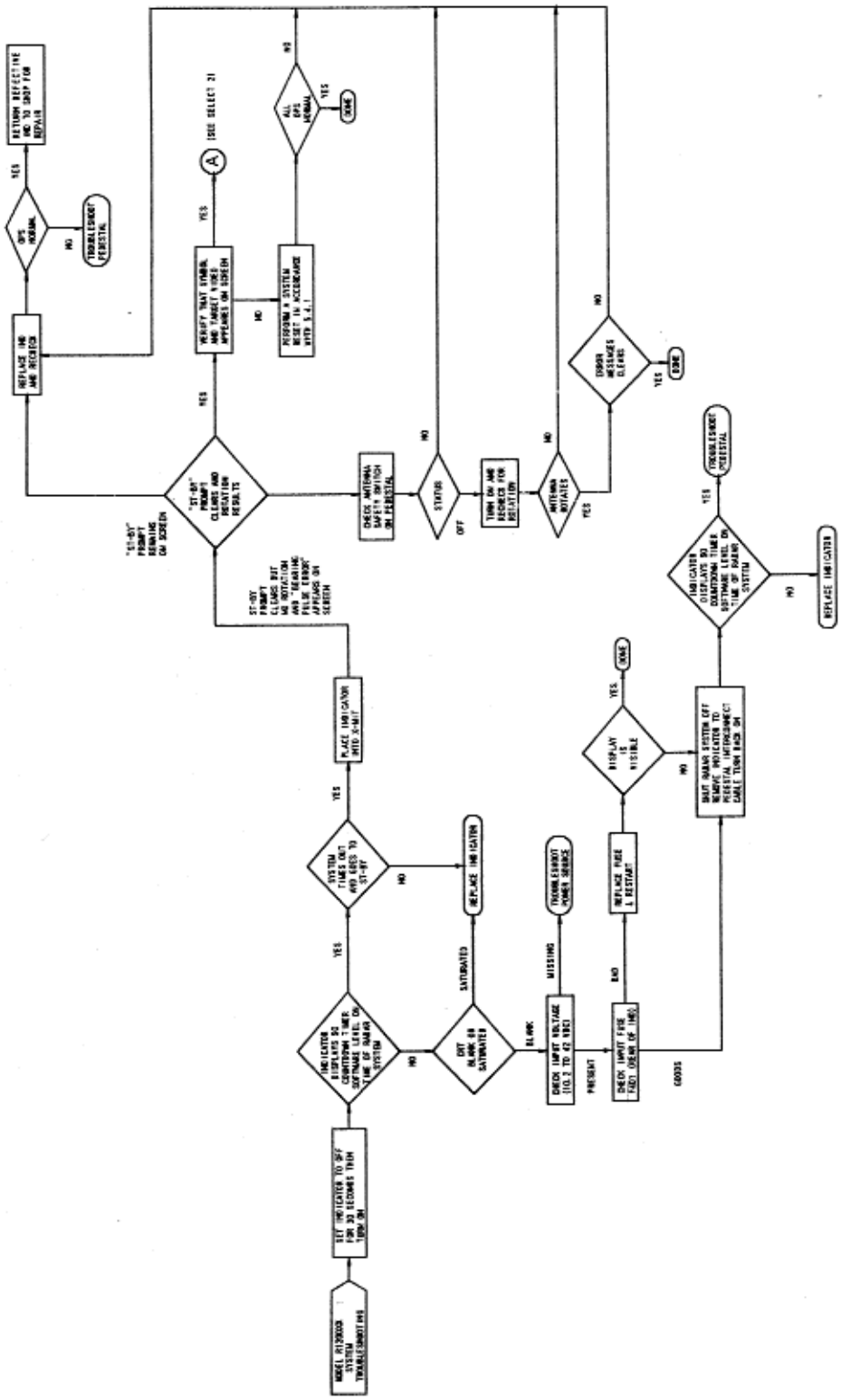
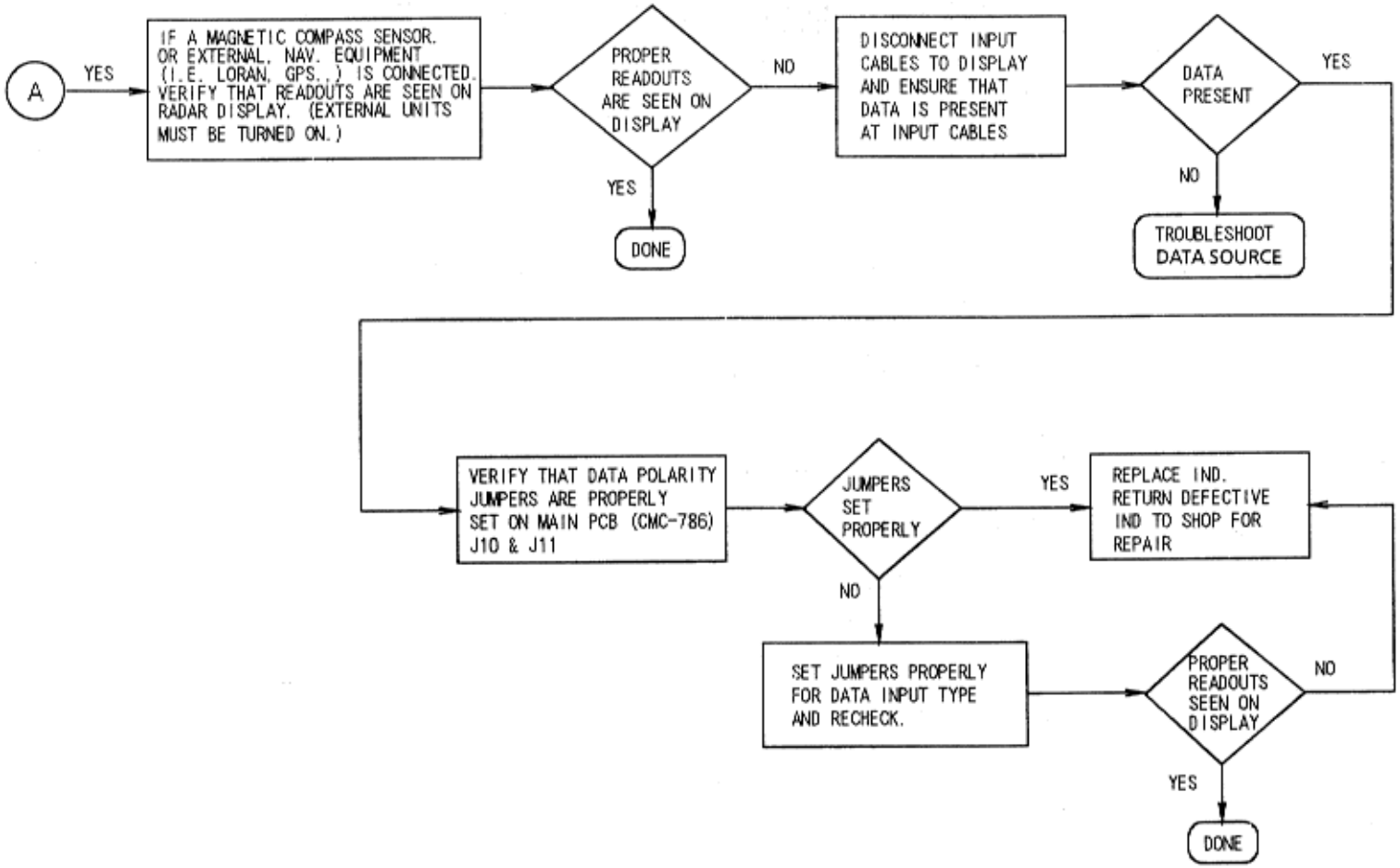


Fig. 5-7 RADAR SYSTEM TROUBLESHOOTING CHART (1 of 2)
Fig. 5-7 RADAR SYSTEM TROUBLESHOOTING CHART (2 of 2)


A
YES
IF A MAGNETIC COMPASS SENSOR, OR EXTERNAL, NAV. EQUIPMENT (I.E. LORAN, GPS.,) IS CONNECTED, VERIFY THAT READOUTS ARE SEEN ON RADAR DISPLAY. (EXTERNAL UNITS MUST BE TURNED ON.)
PROPER READOUTS ARE SEEN ON DISPLAY
NO
YES
DONE
DISCONNECT INPUT CABLES TO DISPLAY AND ENSURE THAT DATA IS PRESENT AT INPUT CABLES
DATA PRESENT
YES
NO
TROUBLESHOOT DATA SOURCE
VERIFY THAT DATA POLARITY JUMPERS ARE PROPERLY SET ON MAIN PCB (CMC-786) J10 & J11
JUMPERS SET PROPERLY
YES
REPLACE IND. RETURN DEFECTIVE IND TO SHOP FOR REPAIR
NO
SET JUMPERS PROPERLY FOR DATA INPUT TYPE AND RECHECK.
PROPER READOUTS SEEN ON DISPLAY
NO
YES
DONE

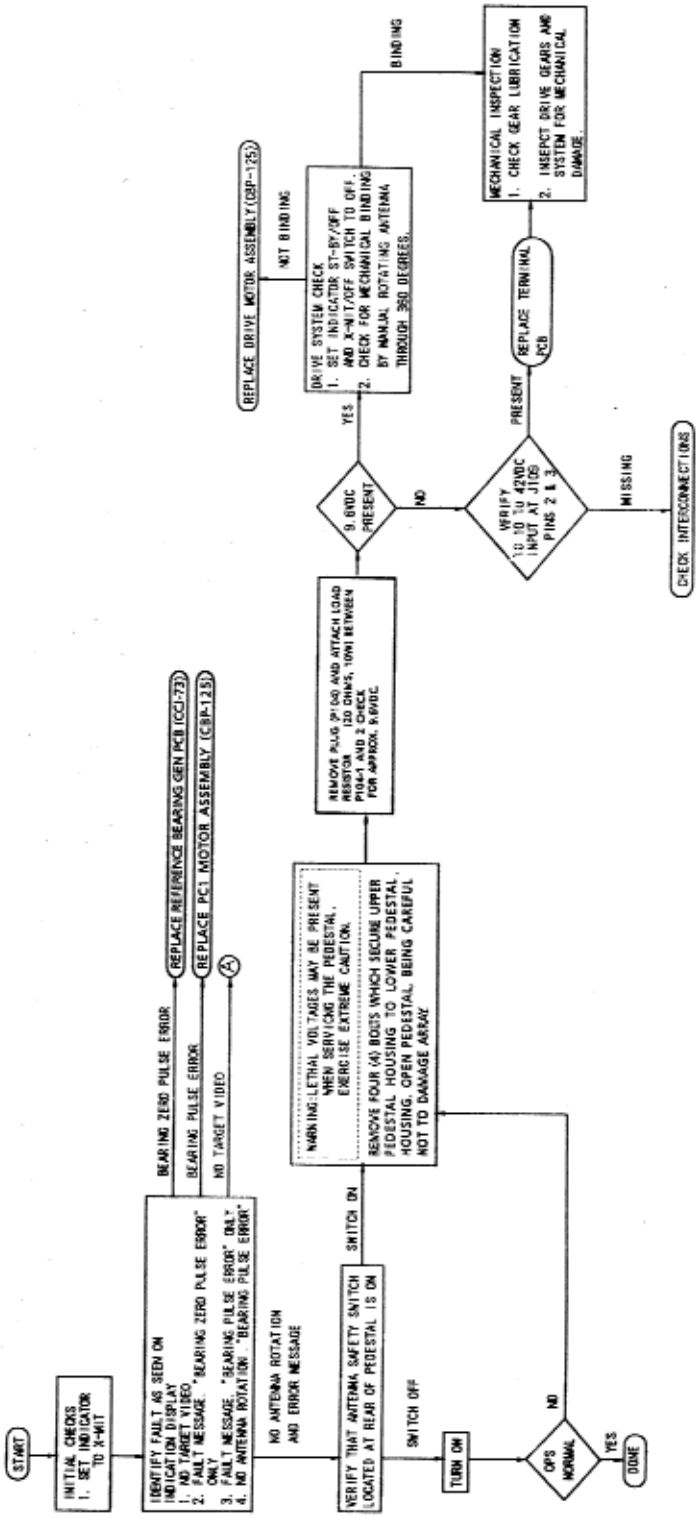


Fig. 5-8 ANTENNA UNIT TROUBLESHOOTING CHART (i of 2)
Fig. 5-8 ANTENNA UNIT TROUBLESHOOTING CHART (2 of 2)

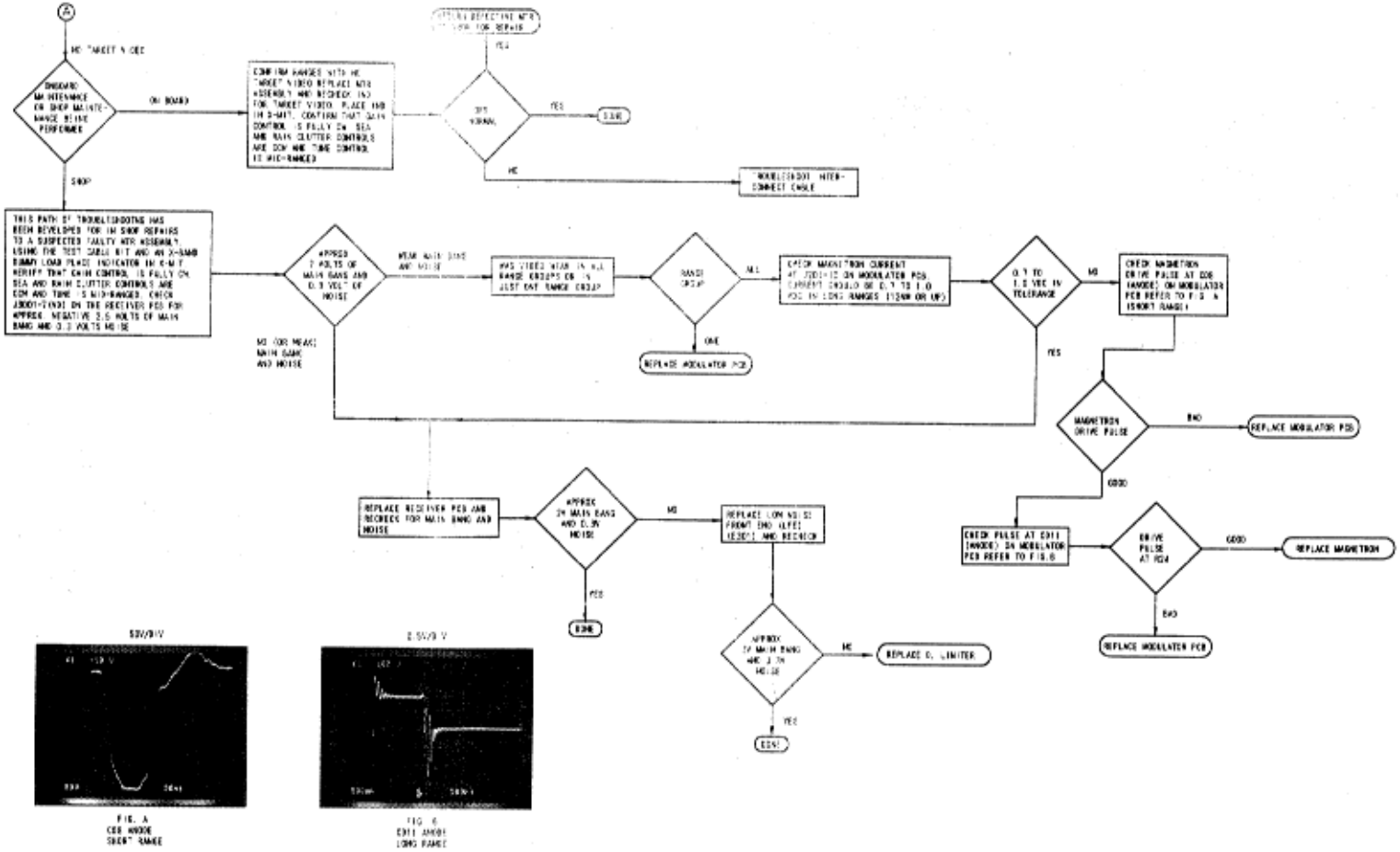


FIG. A
CRT ANODE
SHORT RANGE

FIG. B
E011 ANODE
LONG RANGE

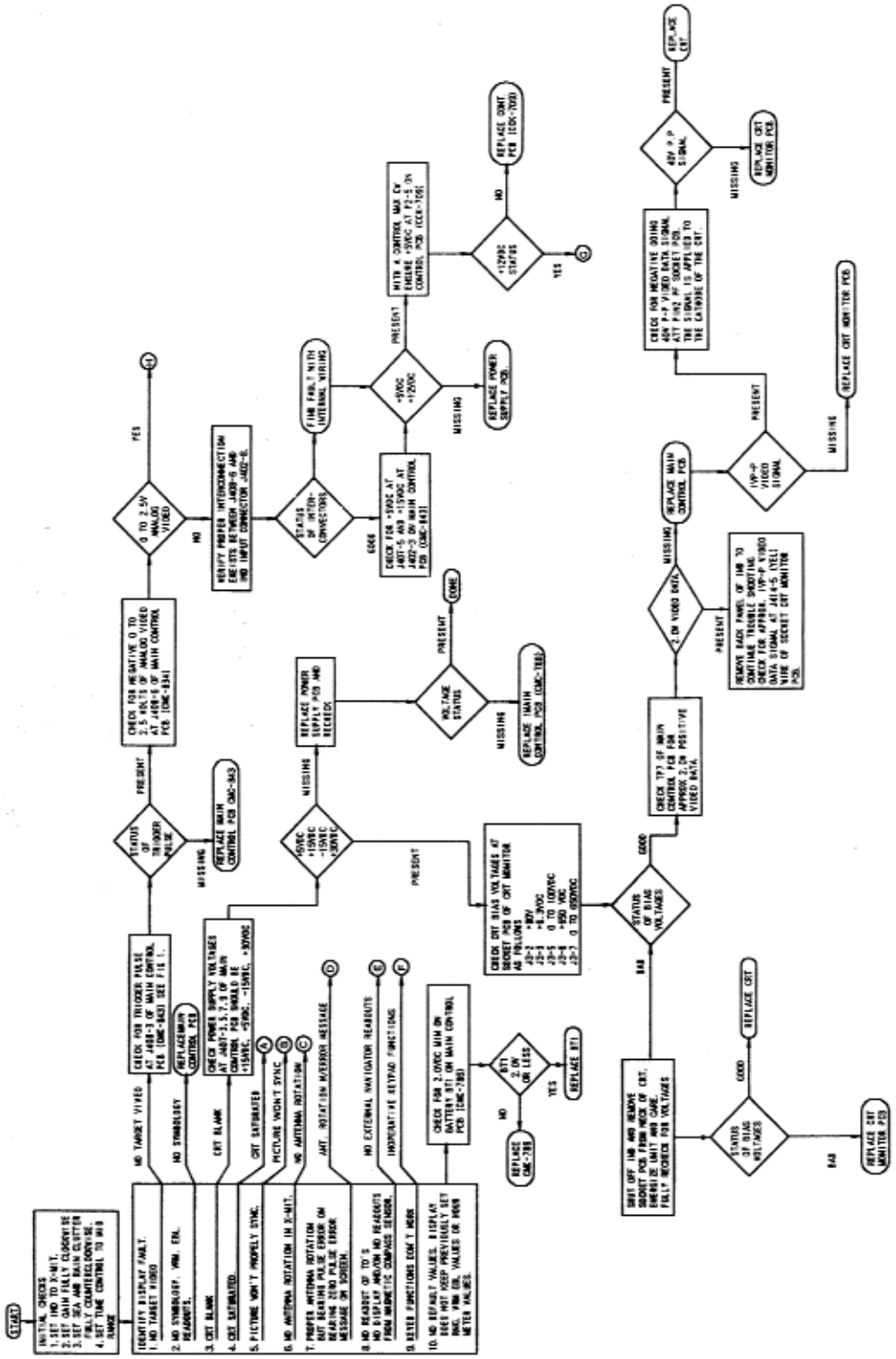


Fig. 5-9 SYSTEM TROUBLESHOOTING CHART (i of 4)
Fig. 5-9 SYSTEM TROUBLESHOOTING CHART (2 of 4)

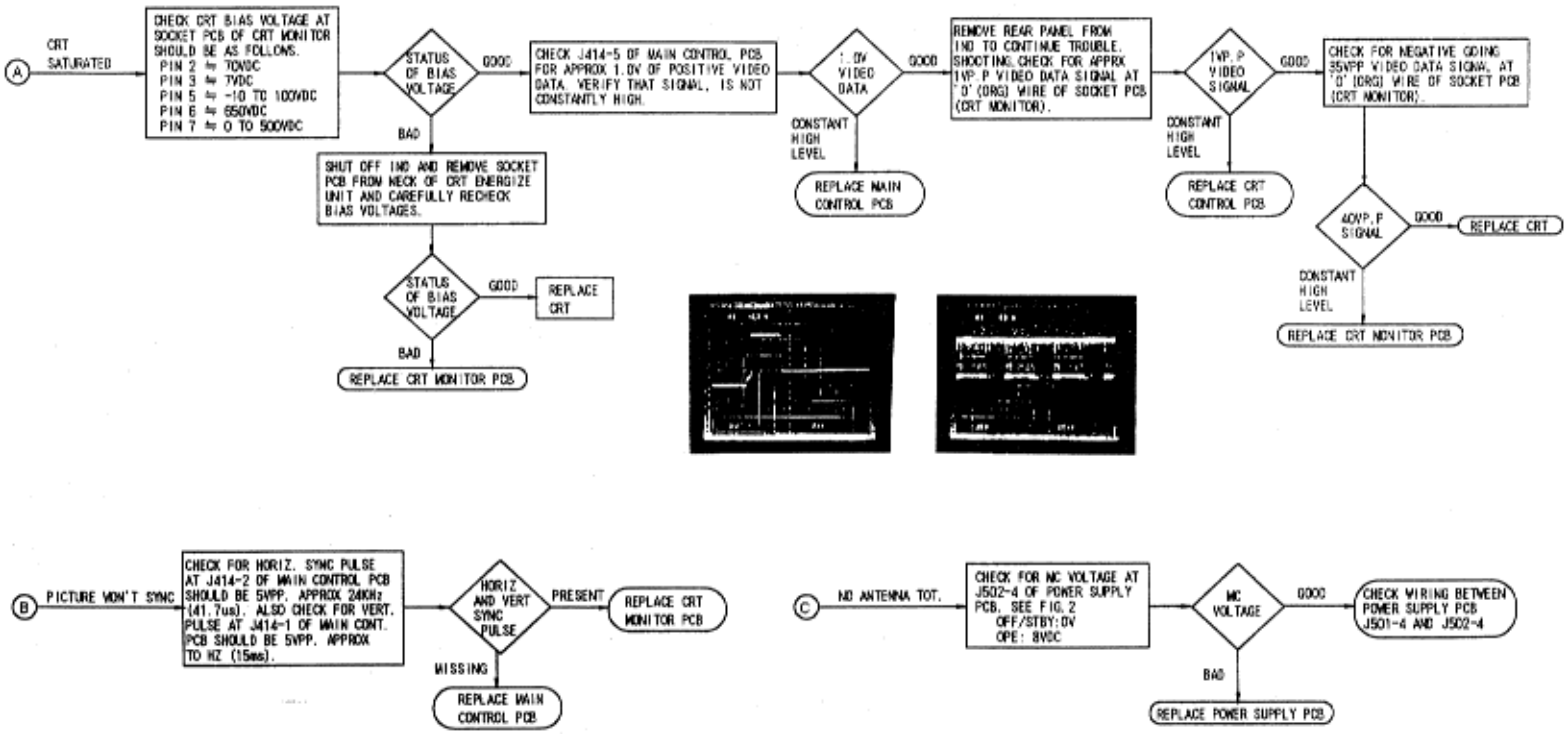

A
CRT SATURATED
CHECK CRT BIAS VOLTAGE AT SOCKET PCB OF CRT MONITOR SHOULD BE AS FOLLOWS.
PIN 2 ⇔ 70VDC
PIN 3 ⇔ 7VDC
PIN 5 ⇔ -10 TO 100VDC
PIN 6 ⇔ 650VDC
PIN 7 ⇔ 0 TO 500VDC
STATUS OF BIAS VOLTAGE
GOOD
BAD
CHECK J414-5 OF MAIN CONTROL PCB FOR APPROX 1.0V OF POSITIVE VIDEO DATA. VERIFY THAT SIGNAL, IS NOT CONSTANTLY HIGH.
1.0V VIDEO DATA
GOOD
CONSTANT HIGH LEVEL
REPLACE MAIN CONTROL PCB
REMOVE REAR PANEL FROM IND TO CONTINUE TROUBLE SHOOTING.CHECK FOR APPRX 1VP.P VIDEO DATA SIGNAL AT 'D'(ORG) WIRE OF SOCKET PCB (CRT MONITOR).
1VP.P VIDEO SIGNAL
GOOD
CONSTANT HIGH LEVEL
REPLACE CRT CONTROL PCB
CHECK FOR NEGATIVE GOING 35VPP VIDEO DATA SIGNAL AT 'D'(ORG) WIRE OF SOCKET PCB (CRT MONITOR).
SHUT OFF IND AND REMOVE SOCKET PCB FROM NECK OF CRT ENERGIZE UNIT AND CAREFULLY RECHECK BIAS VOLTAGES.
STATUS OF BIAS VOLTAGE
GOOD
REPLACE CRT
BAD
REPLACE CRT MONITOR PCB
40VP.P SIGNAL
GOOD
REPLACE CRT
CONSTANT HIGH LEVEL
REPLACE CRT MONITOR PCB
B
PICTURE WON'T SYNC
CHECK FOR HORIZ. SYNC PULSE AT J414-2 OF MAIN CONTROL PCB SHOULD BE 5VPP. APPROX 24KHz (41.7us). ALSO CHECK FOR VERT. PULSE AT J414-1 OF MAIN CONT. PCB SHOULD BE 5VPP. APPROX 70 HZ (15ms).
HORIZ AND VERT SYNC PULSE
PRESENT
REPLACE CRT MONITOR PCB
MISSING
REPLACE MAIN CONTROL PCB
C
NO ANTENNA TOT.
CHECK FOR HC VOLTAGE AT J502-4 OF POWER SUPPLY PCB. SEE FIG.2
OFF/STBY:0V
OPE: 8VDC
HC VOLTAGE
GOOD
CHECK WIRING BETWEEN POWER SUPPLY PCB J501-4 AND J502-4
BAD
REPLACE POWER SUPPLY PCB

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

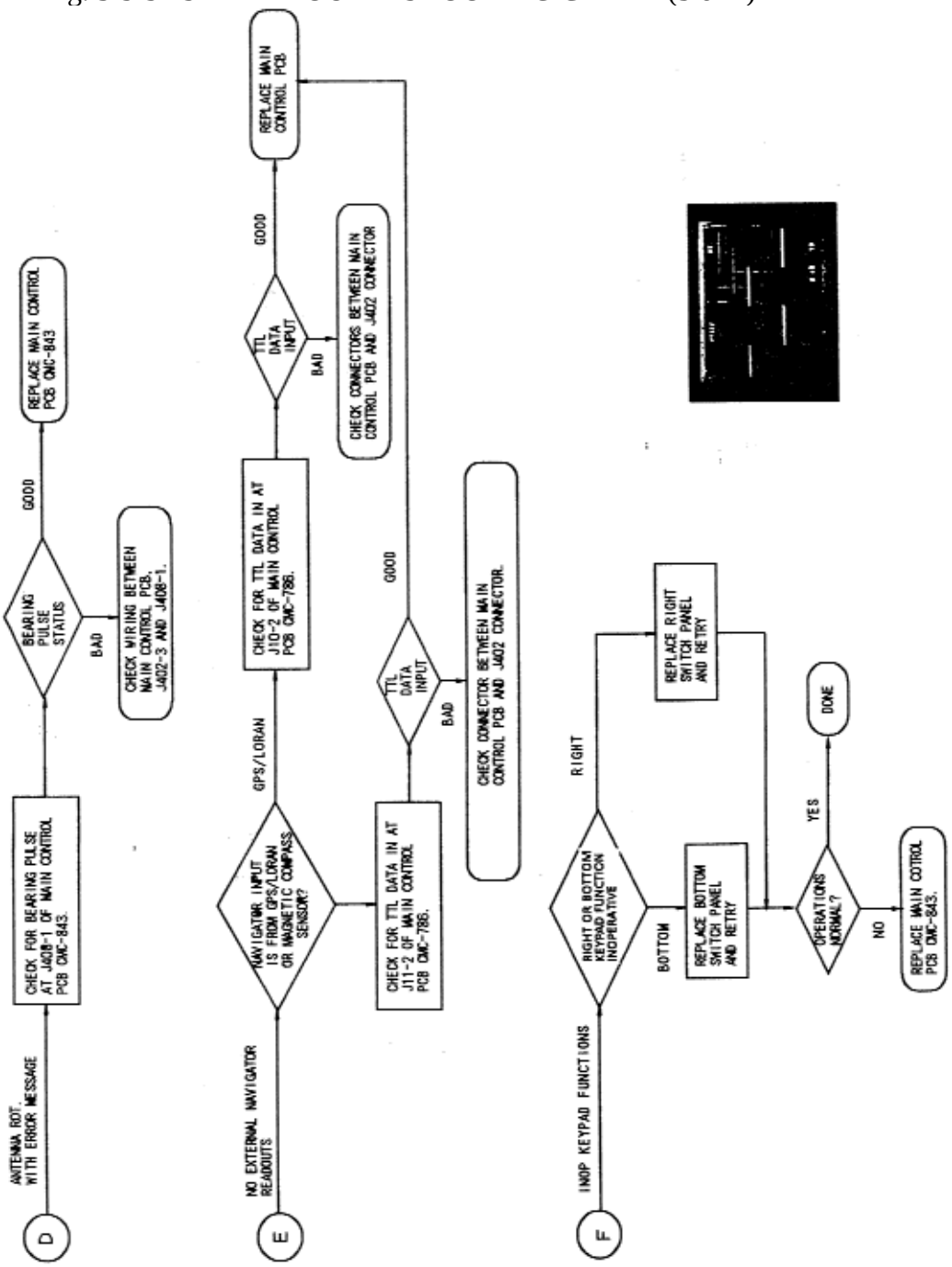
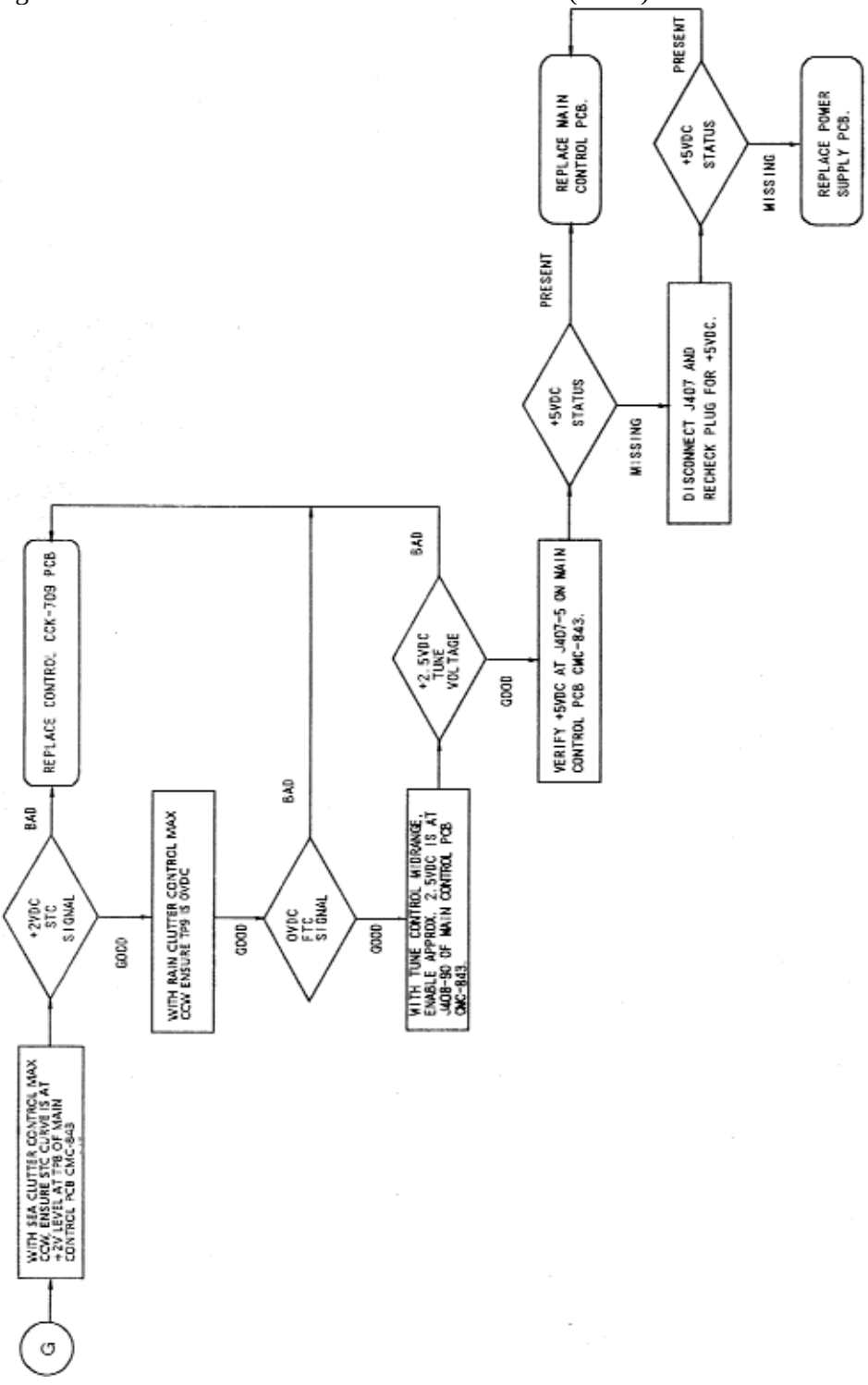


Fig. 5-9 SYSTEM TROUBLESHOOTING CHART (4 of 4)



5.6 MAGNETIC SENSOR COMPENSATION

CAUTION

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

XX Heading Sensor Compensation Adjustment

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

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

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

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

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

XX Heading Sensor – Compensation Procedure (Part 11

Compensating the XX Heading Sensor following installation is very important to ensure its accuracy. The procedure involves turning the boat continuously through two large, lazy circles at a slow speed (the circles may be slightly out of round or elliptical if necessary). During this procedure, it is critical that the boat remains level and slow enough so that the 2 circles take approximately 4 minutes to complete (2 minutes per circle). The vessel cannot go too slowly, but if it goes too quickly at any point while doing the circles, the sensor is programmed to ignore the data to ensure a perfect compensation. Figure out how big a circle the vessel must make to keep at a slow, steady speed through 360 - . Once the conditions for a 2 minute circle are calculated, keep on circling 2 more times in exactly the same manner. The Heading Sensor will latch on to the first good data it gets and won't replace it unless it gets a better set of data.

1. Select a calm day and a clear area without too much current or tide. Watch out for excessive pitching and rolling, as this can make the boat turn in surges faster than the Sensor will accept.

2. Turn the boat continuously through 720 (2 large, lazy circles) in a slow, smooth, and steady turn. Make each full circle take 2 minutes to complete. (Try to time the turn so that it takes about 30 seconds or more to turn 90 degrees).

3. After completing two full circles according to the above parameters, the auto—compensation procedure is now complete.

XX Heading Sensor – Compensation Procedure (part 2)

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

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

1. Slightly loosen the mounting screws securing the sensor to the mounting surface to permit rotation of the housing.

2. If the sensor reads less rotate the housing clockwise.

3. If the sensor reads more rotate the housing counterclockwise.

4. When the headings match correctly, tighten the mounting screws to secure the sensor housing in place.

5. This completes the alignment procedures for the heading sensor.

SECTION 6
PARTS LIST AND DRAWINGS

6.1 INTRODUCTION

This chapter contains schematic diagrams, assembly drawings and parts lists for Radar Set R12O6XX and Ri21OXX. Assembly drawings will assist in identifying and locating components. You will find numbers on the drawings are the same as location numbers in the parts list tables.

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

The generation breakdown Table 6— 1, provides an index of the parts lists and drawings for assemblies and subassemblies of significant importance associated with the Model R12O6XX and R121OXX. The schematic diagram, assembly drawing, and parts list format is repeated for each assembly and subassembly.

WARNING

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

TABLE 6—i
Model R1200XX Generation Breakdown

Description	Part No.	Assembly Dwg. (Fig.)	Parts List (TBL)
MTR Unit			
Modulator Assembly(6KW)	NMA—447		
Modulator Assembly(1OKW)	NMA—448		
Modulator PCB(6KW)	CPA—2ii		
Modulator PCB(1OKW)	CPA—2i0		
Magnetron(6KW)	5VMAA00068		
Magnetron(1OKW)	5VMAA00051		
Receiver Assy	NRG —86		
Receiver PCB	CAE—323		
Low Noise Front End	5EZAA00021		
PIN Attenuator	NJS6926		
Diode Limiter	NJ56930		
Circulator Assy	6AJRD00001		
Motor Assembly	CBP —12~		
SHM PCB	CCJ-73		
Terminal PCB	CQD—1248		
Antenna Safety Switch	5SAABOO68O		
Display Unit(R1200XX)	M92560		
PS.Heat Sink Assy	MTC3001O6		
Power Supply PCB	CBD—i296		
Chassis Assy	CML—45i		
Main Control PCB(A)	CMC—786		
Main Control PCB(B)	CMC—843		
Bezel Assy	CML—45i		
Control PCB A	CCK—709		
Control PCB B	CCK—708		
MARPA PCB	CDC—826		
CRT Assembly			
Consisting of:			
CRT Monitor	CKJ—i2i		
Video PCB	CCN—27i		
Deflection Yoke	7LGRDOO42		
CRT	5VBAB00067		
Track Pad	7HZRD0001		

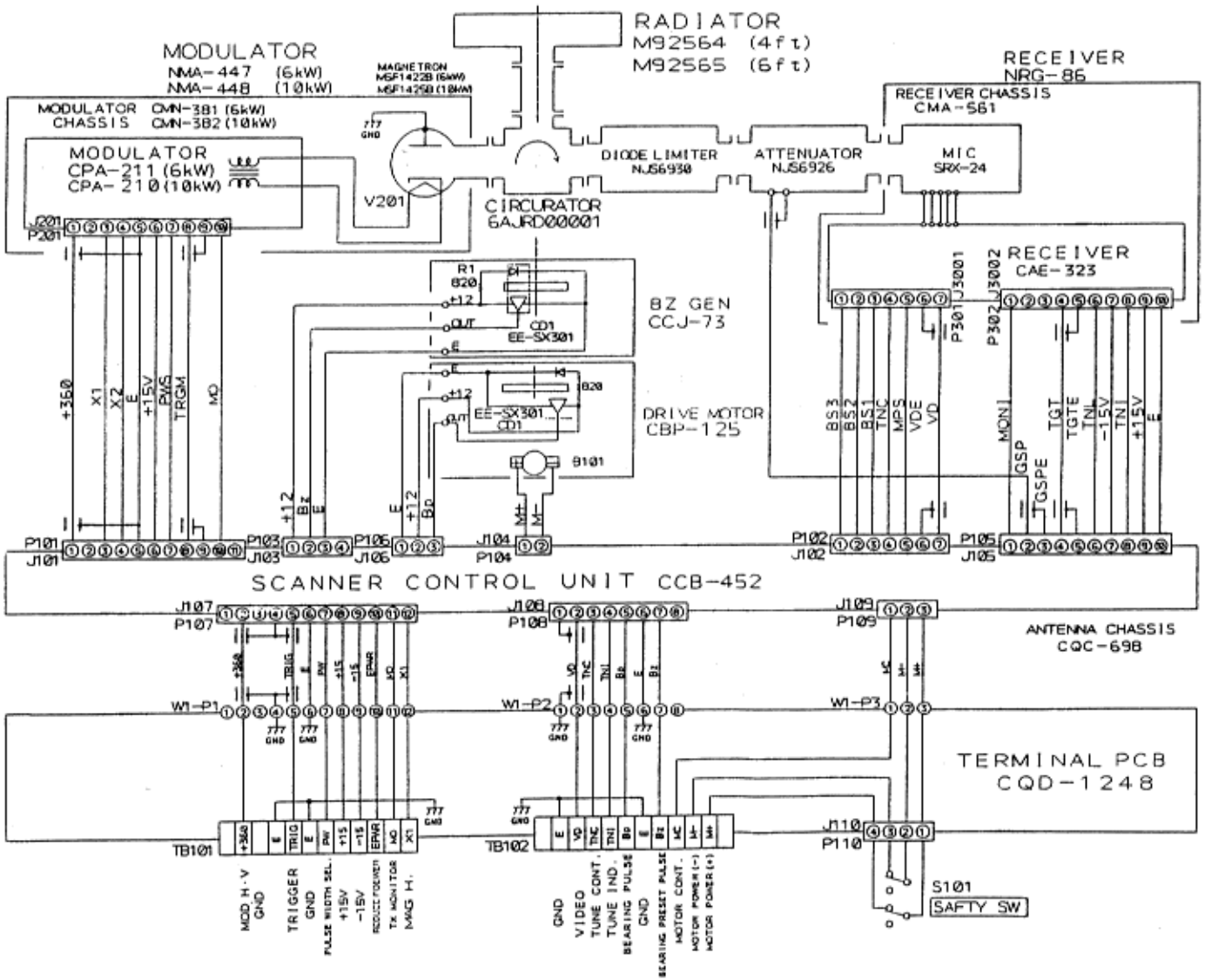

RADIATOR
M92564 (4ft)
M92565 (6ft)
MODULATOR
NMA-447 (6kW)
NMA-448 (10kW)
MAGNETRON
MSF1422B (6kW)
MSF1425B (18kW)
MODULATOR CHASSIS CMN-381 (6kW) CMN-382 (10kW)
MODULATOR
CPA-211 (6kW)
CPA-210 (10kW)
V201
CIRCURATOR
6AJRD00001
DIODE LIMITER
NJS6930
ATTENUATOR
NJS6926
MIC
SRX-24
RECEIVER
NRG-86
RECEIVER CHASSIS
CMA-561
RECEIVER
CAE-323
8Z GEN
CCJ-73
DRIVE MOTOR
CBP-125
SCANNER CONTROL UNIT CCB-452
ANTENNA CHASSIS
CQC-698
TERMINAL PCB
CQD-1248
S101
SAFTY SW
TB101
TB102
MOD H.V
GND
TRIGGER
GND
PULSE WIDTH SEL.
+15V
-15V
REDUCE POWER
Tx MONITOR
MAG H.
GND
VIDEO
TUNE CONT.
TUNE IND.
BEARING PULSE
GND
BEARING PRESET PULSE
MOTOR CONT.
MOTOR POWER (-)
MOTOR POWER (+)

TABLE 6-2
Rep~aceab1e Parts List
Chassis
C Q C - 6 9 8

REF.		TYPE	DESCRIPTION	JRC P/N
AlOl	CIRCULATRO	H~6AJRDOOOOl FCX68		6AJRD00001
A102	DIODE LIMITER ~	NJS6930		5EZAA00024
A103	ATTENUATOR	NJS6926		5ENAC00019
AS202	ACCESSORY	NJC-9929		NJC9929
P101	PLUG	IL-G-11S-S3C2		5J~ADOO375
P102	PLUG	IL-G-7S-S3C2	7P	5J~ADOO23O
P105	PLUG	IL-G-1OS-S3C2		5J~ADOOO71
P110	PLUG	VHR-4N		5JDAH00044
P201	PLUG	IL1OS-S3L-(N)		5J\~ADOOO34
P301	PLUG	IL7S-S3L-(N)		5J\~ADOOO.36
P302	PLUG	IL 1OS-S3L-(N)		5J~ADOOO34
P1101	PIN	IL-G-C2-SC-0001		5J\~ADOO388
PT1O2	PIN ~	IL-G-C2~SC~OOO1		5J~ADOO388
PT1O5	PIN	IL-G-C2-SC-0001		5J\~ADOO388
PT11O	PIN	BVFL21T-l. 1		5JTCDOO155
PT2OI	PIN	IL-C2-000l		5J\~ADOO251
PT3O1	PIN	IL-C2-0001		5J~ADOO25l
PT302	PIN	IL~C2-OOO1		5J\~ADOO251
Slol	SWITCH	S-116-BOl		5SAABOO68O

TABLE 6—3
Replaceable Parts List
Terminal Board
CQD— 1 248

REF.		TYPE	DESCRIPTION	JRC P/N
Jib	CONNECTOR	B4PS-VH		5JDAH00045
PCi	PCB	H-7PCRD1315A		7PCRD1315A
11310 1	TERMINAL BOAD	OTB-136-B-12P	12PIN	
TB1O	TERMIN BO	OTB-136-B-12P	12PIN	

2	AL	A D		
\fl	CABLE ASSY	H-7ZCRDO418B		7ZCRDO418B

REF.		TYPE	DESCRIPTION	JRC P/N
BlOl	MOTOR	H-7BDRDOO32	820 OHM l/4~ J	7BDRDOO32
CD1	PHOTO	EE-SX3O1		5HFAB0 0009
P104	INTERUPTOR	VHR-2N		5JVIAPO O139
P106	CONNECTOR	IL-G-3S-S3C2		5J~ADO OO96
PC1	CONNECTOR	H-6PCRD00633		6PCR00 0633
Ri	PCB RESISTROR	ERD-25PJ821		5RDAA O1156

REF.		TYPE	DESCRIPTION	JRC P/N
CDI	PHOTO	EE-SX3OI	4P	5HFAB0 0009
P103	COUPLER	IL-4S-S3L-(N)		
PCi	PLUG	H~6PCRDOO633	820 OHM 1/4~~’ J	5J~ADO OO32
Ri	PCB RESISTOR	ERD-25PJ821		6PCRD0 0633 5RDAAO 1156

TABLE 6—4
Replaceable Parts List
Motor Assembly
CBP— 125

TABLE 6—5
Replaceable Parts List
SHM PCB
CCJ —73

FIG. 6-2 CIRCUIT DRAWING OF CCB-452 SCANNER CONTROL UNIT

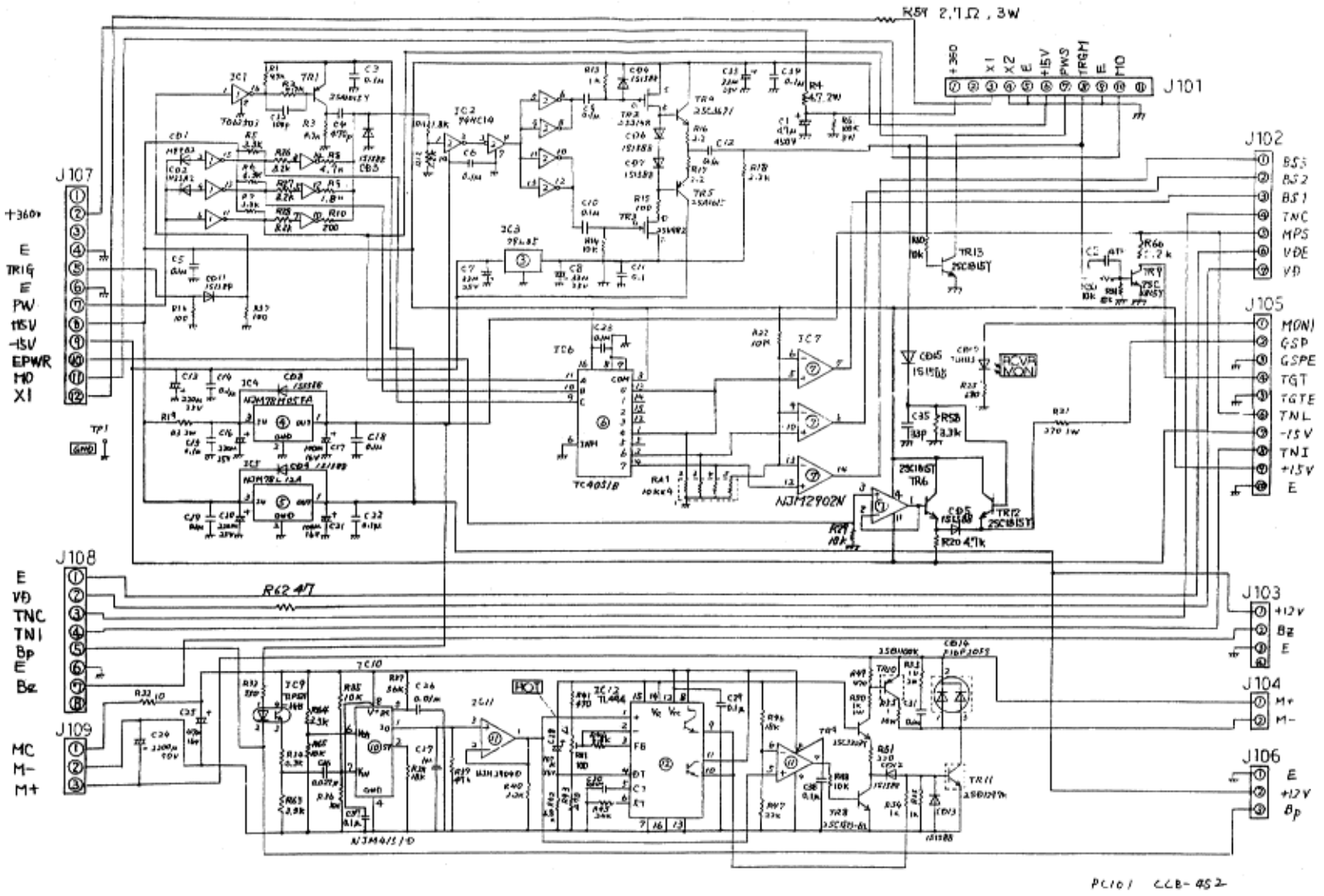

R59 2.7Ω, 3W
J101
J102
J103
J104
J105
J106
J107
J108
J109
J110
+360
X1
X2
E
+15V
PWS
TRGH
E
HO
BS3
BS2
BS1
TNC
MPS
VDE
VD
MONI
GSP
GSPE
TGT
TGTE
TNL
-15V
TNI
+15V
E
+12V
Bz
E
M+
M-
E
+12V
Bp
MC
M-
M+
E
VD
TNC
TNI
Bp
E
Bz
+360
E
TRIG
E
PW
+15V
-15V
EPWR
MD
XI
R62 4.7
PC101 CCB-452

TABLE 6—6
Replaceable Parts List
Antenna Control
CCB—4 52

REF.		TYPE	DESCROPTION	JRC P/N
Cl	CAP,FIX,ELECT	ECE-A2\~U4R7	4.7UF 450V M	5CEAA0 3553
C2	CAP,FIX,CER	DD1O4SIA7OJ5O	47PF 50V J	5CAAAO 1O97
C3	CAP, FIX, FILM	ECQ-V1H1O4JL	0. 1UF 50V J	5CRAAO 132G
C4	CAP,FIX,CER	RPE131CH471J5O	470PF 50V J	5CAAA0 2608
C5	CAP, FIX, FILM	ECQ-V1H1O4JL	0. 1UF 50V J	5CRAAO 1326
C6	CAP, FIX, FILM	ECQ-V1H1O4JL	0. 1UF 50V J	5CRAA0 1326
C7	CAP,FIX,ELECF	ECE-A1EU33O	33UF 25V M	5CEAAO1 8O5
C8	CAP,FIX,ELECT	ECE~A1EU33O	33UF 25V M	5CEAAO 18O5
C9	CAP, FIX, FILM	ECQ-V1H1O4JL	0. 1UF 50V J	5CRAAO 1326
do	CAP,F1X,FILM	ECQ-V1H1O4JL	O.1UF 50V J	5CRAA0 1326
Cli	CAP,FIX,FILM	ECQ-V1H1O4JL	0. 1UF 50V J	5CRAA0 1326
C12	CAP,FIX,FILM	ECQ-V1H1O4JL	O.1UF 50V J	5CRAAO 1326
C13	CAP,FIX,ELECT	ECE-A1EU221	22OUF 25V M	5CEAA0 1844
C14	CAP, FIX, FILM	ECQ-V1H1O4JL	0. 1UF 50V J	5CRAA0 1326
C15	CAP,FIX,FILM	ECQ-V1H1O4JL	O.1UF 50V J	5CRAA0 1326
C16	CAP,FIX,ELECT	ECE-A1EU221	220UF 25V M	5CEAA0 1844
C17	CAP,FIX,ELECT	ECE~A1CU1O1	100UF 16V M	5CEAAO 1800
C18	CAP,FIX,FILM	ECQ-V1H1O4JL	O.1UF 5OV J	5CRAA0 1326
C19	CAP,FIX,FILM	ECQ-V1H1O4JL	O.1UF, 50V J	5CRAA0 1326
C20	CAP,FIX,ELECT	ECE-A1EU221	220UF 25V M	5CEAAO 1844
C21	CAP,FIX,ELECT	ECE-A1CU1O1	100UF 16V M	5CEAAO 1800
C22	CAP, FIX, FILM	ECQ-V1H1O4JL	0.1UF 5OV J	5CRAA0 0364
C23	CAP, FIX, CER	RPE131F1O4Z5O	0. 1UF 50V Z	5CBABO 161 1

C24	CAP,FIX,ELECT	ECE-S1HU222J	2200UF 50V M	5CEAA02234
C25	CAP,FIX,ELECT	ECE-A1CU47O	47UF 16V M	5CEAA01698
C26	CAP,FIX,FILM	ECQ-B1H1O3JF	O.O1UF 50V J	5CRAA01254
C27	CAP,FIX,FILM	ECQ-V1H1O5JL	1UF 50V J	5CRAA01245
C28	CAP,FIX,ELECT	ECE-A1CU1O1	100UF 16V M	5CEAAO1800
C29	CAP,FIX,CER	RPE131F1O4Z5O	0. 1UF 50V Z	5CBABO1611
C30	CAP,FIX,FILM	ECQ-B1H1O2KF	O.OO1UF 50V K	5CRAAO1135
C31	CAP, FIX, FILM	ECQ-V1H1O4JL	0. 1UF 50V J	5CRAA01326
C32	CAP, FIX, CER	DD1O4-63SL101J50		5CAAAO4300
C33	CAP,FIX,ELECT	ECE-A1EU33O	33UF 25V M	5CEAAO18O5
C34	CAP, FIX, FILM	ECQ-V1H1O4JL	0.1UF 5OV J	5CRAAO1326
C36	CAP,FIX,FILM	ECQ-B1H223KF	O.022UF 50V K	5CRAAO137O
C37	CAP,FIX,CER	RPE131F1O4Z5O	O.1UF 5OV Z	5CBABO1611
C38	CAP, FIX, CER	RPE13 1F104Z50	0.1UF 5OV Z	5CBABO161 1
CD1	DIODE	HZ7B-2		5TXAEOO216
CD2	DIODE	HZ5A-2		5TXAEOO136
CD3	DIODE	1S1588		5TXAD0004O
CD4	DIODE	1S1588		5TXA00004O
CD5	DIODE	1S1588		5TXAD0004O
CD6	DIODE	1S1588		5TXAD0004O
CD7	DIODE	1S1588		5TXAD0004O

REF.		TYPE	DESCROPTION	JRC P/N
CD8	DIODE	1S1588		5TXAD0004O
CD9	DIODE	1S1588		5TXAD0004O
CD1O	DIODE	TLR123		5TZADOO1O1
CD11	DIODE	1S1588		5TXAD0004O

CD12	DIODE	1S1588			5TXAD0 004O
CD13	DIODE	1S1588			5TXAD0 004O
CD14	DIODE	F16P2OFS			5TXAG0 0358
CD15	DIODE	1S1588			5TXAD0 004O
IC1	TRANSISTOR ARRAY	TD62503P			5DDAEO O213
IC2	IC	TC74HC14AP	74HC14AP		5DDAE0 1268
IC3	IC	NJM79LO5A	-5V REG.		5DAANO O13O
IC4	IC	NJM78MO5FA	5V REG~		5DAAN0 0375
IC5	IC	NJM78L12A	12V REG.		5DAAN0 0025
IC6	IC	TC4O51BP	4051BP		5DDAE0 0081
IC7	IC	NJM29O2N			5DAAN0 0004
IC9	PHOTO COUPLER	TLP521-1GB	H-5TZADOO212		5DZAD0 004O
IC1O	IC	NJM4151D			5DAAN0 0077
IC11	IC	NJM29O4D			5DAAN0 0045
IC12	IC	TL494CN			5DDAL0 0546
JlOl	CONNECTOR	IL-G-11P-S3T2-E	11P		5JViADO O376
J 102	CONNECTOR	IL-G-7P-S3T2-E			5J~’ADO O1l9
J103	CONNECTOR	IL-4P-S3EN2			5JYiAD0 0038
J104	CONNECTOR	B2P-VH	2P		5J~APO Ol4O
J1O5	CONNECTOR	IL-G-1OP-S3T2-E			5J~~’AD OOO73
J106	CONNECTOR	IL-G-3P-S3T2-E			5J~ADO Ol4O
J107	CONNECTOR	IL-G-12P-S3T2-E			5JL~DO OO82
Jl08	CONNECTOR	IL-G-8P-S312-E	8P		5J~’ADO Oll4
J109	CONNECTOR	B3P-VH			5J~APO O138
PCi	PCB	H-7PCRD13O9A			7PCRD13 O9A
Ri	RESISTOR	ERD-25PJ472	4.7K	l/4~ J	5RDAAO 1183
R2	RESISTOR	ERD-25PJ472	4.7K	l/4~Y J	5RDAAO 1183

R3	RESISTOR	ERD-25PJ472	4.7K l/4V1 J	5RDAA O1183
R4	RESISTOR	2XL-47OHM J	47 OHM 2.5~Y J	5RHAA 01699
R5	RESISTOR	ERD-25PJ332	3.3K l/4~’ J	5RDAA O1168
R6	RESISTOR	ERD-25PJ332	3.3K 1/4~ J	5RDAA O1168
R7	RESISTOR	ERD-25PJ332	3.3K l~/4~’ ~T	5RDAAO 1168
R8	RES ISTOR	ERD-25PJ472	4. 7K l/4V1 J	5RDAAO 1 183
R9	RESISTOR	ERD-25PJ182	1.8K l/4~ J	5R0AA01 163
RiO	RESISTOR	ERD-25PJ201	200 OHM l/4~’ J	5RDAA0 1235
RU	RESISTOR	ERD-25PJ182	1.8K l/4~’ J	5RDAA O1163
Rl2	RESISTOR	ERD-25PJ 122	1. 2K l/4Vi J	5RDAAO 1 142
R13	RESISTOR	ERD-25PJ102	1K l/4~ J	5RDAA O1181
R14	RESISTOR	ERD-25PJ103	10K 1/4w J	5RDAA O1146
R15	RESISTOR	ERD-25PJ 1 01	100 OHM 1/4V1 J	5RDAAO 1 175
R16	RESISTOR	ERD-25PJ2R2	2. 2 OHM l/4~ J	5RDAA O12O1
R17	RESISTOR	ERD-25PJ2R2	2. 2 OHM l/4~ J	5RDAAO 12O1
R18	RESISTOR	ERD-25PJ222	2.2K 1/4w J	5RDAAO 1172
R19	RESISTOR	ERG-2SJ430P	43 OHM 2~ J	5REAG0 4720
R20	RESISTOR	ERD-25PJ472	4.7K 1/4~ J	5RDAAO 1183

REF.		TYPE	DESCROPTION		JRC P/N
R21	RESISTOR	ERG-1SJ271P	270 OHM	lVi J	5REAG02 393
R22	RESISTOR	ERD-25PJ103	10K	1/4Y1 J	5RDAAO 1146
R25	RESISTOR	ERD-25PJ241	240 OHM	1/4w J	5R0AA01 236
R26	RESISTOR	ERD-25PJ822	8.2K	1/4w J	5RDAAO 1149
R27	RES.ISTOR	ERD-25PJ822	8.2K	l/4~ J	5RDAAO 1149
R28	RESISTOR	ERD-25PJ822	8.2K	1/4w J	5RDAA O1149
R29	RESISTOR	ERD-25PJ103	10K	1/4w J	5RDAAO 1146
R30	RESISTOR	ERD-25PJ103	10K	1/4Vi	5RDAA

				J	O1146
R31	RESISTOR	ERD-25PJ103	10K	1/4w J	5RDAAO 1146
R32	RESISTOR	ERD-25PJ100	10 OHM	1/4w J	5RDAAO 1178
R33	RESISTOR	ERD-25PJ751	750 OHM	1/4w J	5RDAA0 1243
R34	RESISTOR	ERD-25PJ332	3.3K	1/4Y1 J	5RDAAO 1I68
R35	RESISTOR	ERD-25PJ103	10K	1/4~ J	5RDAAO 1146
R36	RESISTOR	ERD-25PJ103	10K	1/4Yi J	5RDAAO 1146
R37	RESISTOR	ERD-25PJ563	56K	l/4V1 J	5RDAAO 1169
R38	RESISTOR	ERD~25PJ183	18K	1/4\~ J	5RDAA O1188
R39	RESISTOR	ERD-25PJ473	47K	1/4~ J	5RDAA O1153
R40	RESISTOR	ERD-25PJ222	2.2K	1/4Yi J	5RDAAO 1172
R41	RESISTOR	ERD-25PJ471	470 OHM	l/4V1 J	5RDAAO 1155
R42	RESISTOR	ERD-25PJ682	6.8K	1/4~ J	5RDAAO 1189
R43	RESISTOR	ERD-25PJ471	470 OHM	1/4Y1 J	5RDAAO 1155
R44	RESISTOR	ERD-25PJ682	6.8K	1/4Y 1 .1	5RDAA O1189
R45	RESISTOR	ERD-25PJ243	24K	1/4~ J	5RDAA0 1258
R46	RESISTOR	ERD-25PJ183	18K	1/4Vi J	5RDAAO 1188
R47	RESISTOR	ERD-25PJ223	22K	1/4’N J	5RDAAO 1147
R48	RESISTOR	ERD~25PJlO3	10K	1/4~ J	5RDAAO 1146
R49	RESISTOR	ERD-25PJ471	470 OHM	1/4w J	5RDAAO 1155
R50	RESISTOR	ERG-1SJ1O2P	1K	1~ J	5REAG01 864
R51	RESISTOR	ERD-25PJ221	220 OHM	1/4w J	5RDAAO 1182
R52	RESISTOR	ERF-1OZXK1RO	1 OHM	1O~ K	5RHACO O179
R53	RESISTOR	ERG-2SJ100P	10 OHM	2~ J	5REAG01 388
R54	RESISTOR	ERD-25PJ102	1K	1/4w J	5RDAAO 1181
R55	RESISTOR	ERD~25PJ1O2	1K	1/4Vi J	5RDAAO 1181
R56	RESISTOR	ERD-25PJ101	100 OHM	1/4’II J	5RDAAO 1175
R57	RESISTOR	ERD-25PJ101	100 OHM	1/4Vi	5RDAAO

				J	1175
R59	RESISTOR	ERX-3ANJP2R7S	2.7 OHM	3Y1 J	5REAG0 4721
R60	RESISTOR	ERD-25PJ103	10K ~	1/4w J	5RDAAO 1146
R61	RESISTOR	ERG-3ANJP1O4S	lOOK	3~ J	5REAG04 712
R62	RESISTOR	ERD-25PJ470	47 OHM	1/4V1 J	5RDAAO 1179
R63	RESISTOR	ERD-25PJ332	3.3K	1/4Yi J	5R0AA0 1168
R64	RESISTOR	ERD-25PJ332	3.3K	1/4V1 J	5RDAAO 1168
R65	RESISTOR	ERD-25PJ103	10K	1/4w J	5RDAA O1146
R66	RESISTOR	ERD-25PJ222	2.2K	1/4~N J	5RDAAO 1172
R67	RESISTOR	ERD-25UJ471	470 OHM	1/4Vi J	5RDAA0 1337
RA1	ARRAY RESISTOR	M5-l-103J	10K OHMX4	J1/8~	5RZBT0 004O
RV1	RESISTOR VAR	GFO6P 1000HM	100 OHM		5RMAB0 0062
TP1	TEST PIN	LC-2-G	BLK		5JTC~O OOO1
TR1	TRANSISTOR	2SA1015-Y			5TAAG0 007O
TR2	TRANSISTOR	25J148			5TKABO O119
REF.		TYPE	DESCROPTION		JRC P/N
TR3	TRANSISTOR	2SK982			5TKAA002 23
TR4	TRANSISTOR	2SC3671-B			5TCAFOO9 17
TR5	TRANSISTOR	2SA1615-L			5TAABOO 169
TR6	TRANSISTOR	2SCl8l5~Y			5TCAFOO2 19
TR7	TRANSISTOR	2SC1815-Y			5TCAFOO2 19
TR8	TRANSISTOR	2SC1815-BL			5TCAF002 55
TR9	TRANSISTOR	2SC3303-Y			5TCAF005 25
TRiO	TRANSISTOR	2SB1100-K			5TBABOO 112
TR11	TRANSISTOR	2SD1297K			5TDAB000 58
TR13	TRANSISTOR	2SC18 1 5-V			5TCAFOO2 19
TRS1	THERMAL SHEET	H-7ZSRDOO26			7ZSRDOO2 6

FIG. 6-3 CIRCUIT DRAWING OF NMA-447,’NMA-448 MODULATOR UNIT

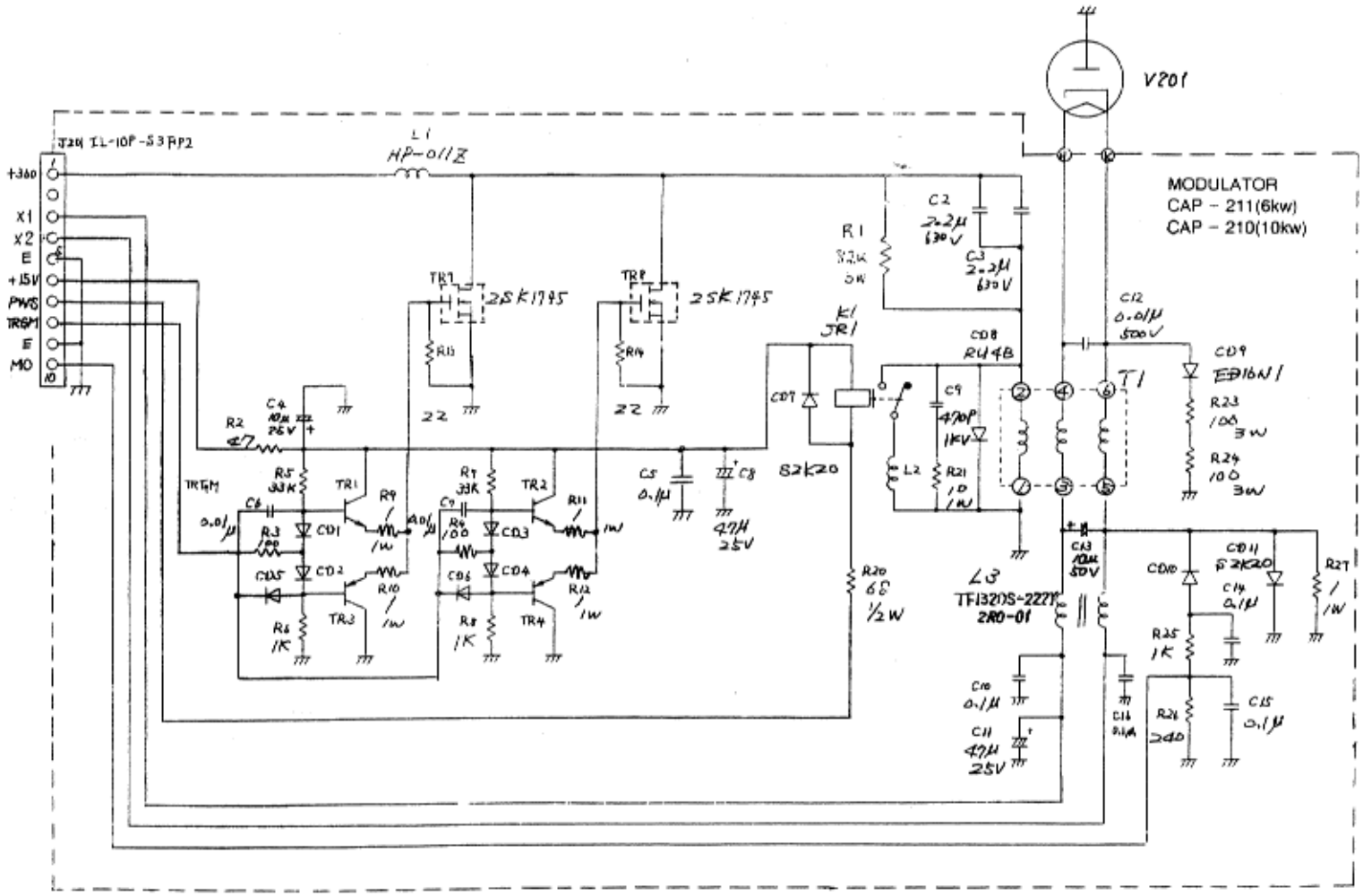

V201
MODULATOR
CAP – 211(6kw)
CAP – 210(10kw)
J201 TL-10P-S3PP2
+360
X1
X2
E
+15V
PWS
TRSM
E
MO
L1
HP-011Z
TR1
2SK1745
TR2
2SK1745
R1
82K
5W
C2
2.2μ
630V
C3
2.2μ
630V
K1
JR1
CD8
RU4B
C12
0.01μ
5000V
CD9
EB16N1
R23
100
3W
R24
100
3W
T1
C4
10μ
25V
R2
47
TRSM
C6
0.01μ
R5
33K
TR1
R9
1W
CD1
R3
100
CD2
R6
1K
TR3
C7
0.01μ
R7
33K
TR2
R11
1W
CD3
R4
100
CD4
R8
1K
TR4
R10
1W
R12
1W
C5
0.1μ
C8
47μ
25V
82K20
R20
68
1/2W
C9
470P
1KV
L2
R21
10
1W
L3
TF1320S-2227
2R0-01
C13
10μ
50V
CD10
CD11
S2K20
C14
0.1μ
R27
1W
R25
1K
R26
240
C15
0.1μ
C10
0.1μ
C11
47μ
25V
C16
0.1μ

TABLE 6-7
Replaceable Part List
Modulator PCB 1Ok~
C P A _2 1 0

REF.		TYPE	DESCRIPTION		JRD P/N
C2	CAP, FIX, FILM	ECQ-E6225JF	2. 2UF	630V J	5CRAA O 1306
C3	CAP, FIX, FILM	ECQ-E6225JF	2. 2UF	630V J	5CRAA O13O6
C4	CAP,FIX,ELECT	ECA1EKF100	1OUF	25V M	5CRAA O1O24
C5	CAP, FIX, CER	RPE13 1F104Z50	0. 1UF	SOY Z	SCBAB O161 1
C6	CAP,FIX,FILM	ECQ-B1H1O3KF	O.O1UF	SOY K	SCRAA O1O86
C7	CAP, FIX, FILM	ECQ-B1H1O3KF	0. O1UF	SOV K	SCRAA O1O86
C8	CAP,FIX,ELECT	ECE-A1EU47O	47UF	25V M	5CEAA O182O
C9	CAP, FIX, CER	DE0705B47 1K1K	47OPF	1KV K	SCBAB OO946
ClO	CAP, FIX, CER	RPE131F1O4ZSO	0. 1UF	SOY Z	5CBAB O161 1
Cil	CAP,FIX,ELECT	ECE-A1EU47O	47UF	25V M	SCEAA O182O
C12	CAP,FIX,CER	DD18-64B1O3KSOO	O.O1UF	SOOV K	SCBAB OO884
C13	CAP, FIX, ELECT	ECE-A1HU1 00	1OUF	SOY M	SCEAA O1931
C14	CAP, FIX, FILM	ECQ-V1H1O4JL	0. 1UF	SOY J	SCRAA O1326
C15	CAP,FIX,FILM	ECQ-VIH1O4JL	O.1UF	SOY 3	SCRAA O1326
C16	CAP,FIX,CER	RPE131F1O4ZSO	O.1UF	SOY Z	SCBAB O1611
CD1	DIODE	151588			STXAD 0004O
CD2	DIODE	151588			5TXAD 0004O
CD3	DIODE	151588			5TXAD 0004O
CD4	DIODE	151588			STXAD 0004O
CDS	DIODE	151588			5TXAD 0004O
CD6	DIODE	151588			STXAD 0004O
CD7	DIODE	52K2O			5TXAC 00075
CD8	DIODE	RU4B			5TXAN OO156
CD9	DIODE	ED16N1			STXAL

					0009O
CD1O	DIODE	151588			STXAD0 004O
CD11	DIODE	52K20			STXAC0 007S
J201	CONNECTOR	IL-1OP~S3EN2	lOP		SJVIAD OO213
Ki	RELAY	AJ~4211 BOl			SKLAD O1OSO
Ll	COIL	HP-O11Z	200UH lA		SLCAL0 0063
L2	COIL	H-7LZRDOO88			7LZR000 88
L3	COIL	TF132OS-222Y2R0-O1	2A 2.2MH		5LRBV0 0006
PC2O 1	PCB	H-7PCRD13 lOB			7PCRD1 3 1 OB
Rl	RESISTOR	ERG-35J823P	82K	3~ J	5REAGO 4484
R2	RESISTOR	ERD-50TJ470	47 OHM	1/2 w J	5R0AA00 803
R3	RESISTOR	ERD-2SPJ1O1	100 OHM	l/4~ J	SRDAAO 117S
R4	RESISTOR	ERD-2SPJ1O1	100 OHM	l/4~ J	SRDAAO 117S
RS	RESISTOR	ERD-25PJ333	33K	l/4~ J	5RDAAO 118O
R6	RESISTOR	ERD-2SPJ1O2	1K	l/4 Vi J	SRDAAO 1181
R7	RESISTOR	ERD-25PJ333	33K	1/4 V1 J	5RDAAO 118O
R8	RESISTOR	ERD~2SPJ1O2	1K	l/4~ J	SRDAAO 1181
R9	RESISTOR	ERX-1SJ1ROP	1 OHM	l~ J	SREAGO 1997
RiO	RESISTOR	ERX-1SJ1ROP	1 OHM	1~ J	SREAGO 1997
Rh	RESISTOR	ERX-1SJ1ROP	1 OHM	l~ J	SREAG O1997
R12	RESISTOR	ERX-1SJ1ROP	1 OHM	l~	SREAGO 1997

TABLE 6—8
Replaceable Parts List
Modulator Chassis 1Ok~Y
CMN— 382

REF.		TYPE ~	DESCRIPTION	JRC P/N
V2O 1	MAGNETRON	MSF142SB 7BN4-6		5VMAD0 0068
VIT1	RUBBER	7BN4-6		116614000
VIT2	TUBE RUBBER			2 116614000

REF.	TUBE	TYPE	DESCRIPTION		2 JRD P/N
R13	RESISTOR	ERD-25PJ22O	22 OHM	1/4w	5RDAAO121
R14	RESISTOR	ERD-25PJ220	22 OHM	J	7
R2O	RESISTOR	ERD-50TJ680	68 OHM	1/4w	5RDAAO121
R21	RESISTOR	ERG-1SJ100P	10 OHM	J	7
R23	RESISTOR	ERG-3SJ1O1P	100 OHM	1/2Y	5RDAAOO8
R24	RESISTOR	ERG-3SJ1O1P	100 OHM	1 J	O7
R25	RESISTOR	ERD-2SPJ 102	1K	l~	5REAG0435
R26	RESISTOR	ERD-25PJ241.	240 OHM	J	0
R27	RESISTOR	ERX-1SJ1ROP	1 OHM	3Yi	SREAGO21
Ti	TRANSFORM	H-7LPRDO1O4		J	38
TIll	ER	2SC3671		3V1	5REAGO21
TR2	TRANSISTOR	25C3671		J	38
TR3	TRANSISTOR	25A1615		1/4Yi	5RDAAO1
TR4	TRANSISTOR	2SA1615		J	181
TR7	TRANSISTOR	2SK1745		1/4~	5RDAAO12
TR8	TRANSISTOR	25K1745		J	36
TRZ	TRANSISTOR	M-30 D-3		1~	SREAGO199
1	THERMAL	M-3O D-3		J	7
TRZ	SHEET				7LP~lJOlO4
2	THERMAL				5TCAF0093
	SHEET				2
					5TCAF0093
					2
					5TAABOO1
					6S
					5TAABOO1
					6S
					5TKAAOO26
					4
					5TKAAOO2
					64
					SZKBG0001
					O
					5ZKBG0001
					O

FIG. 6-4 CIRCUIT DRAWING OF NRG-86 RECEIVER UNIT

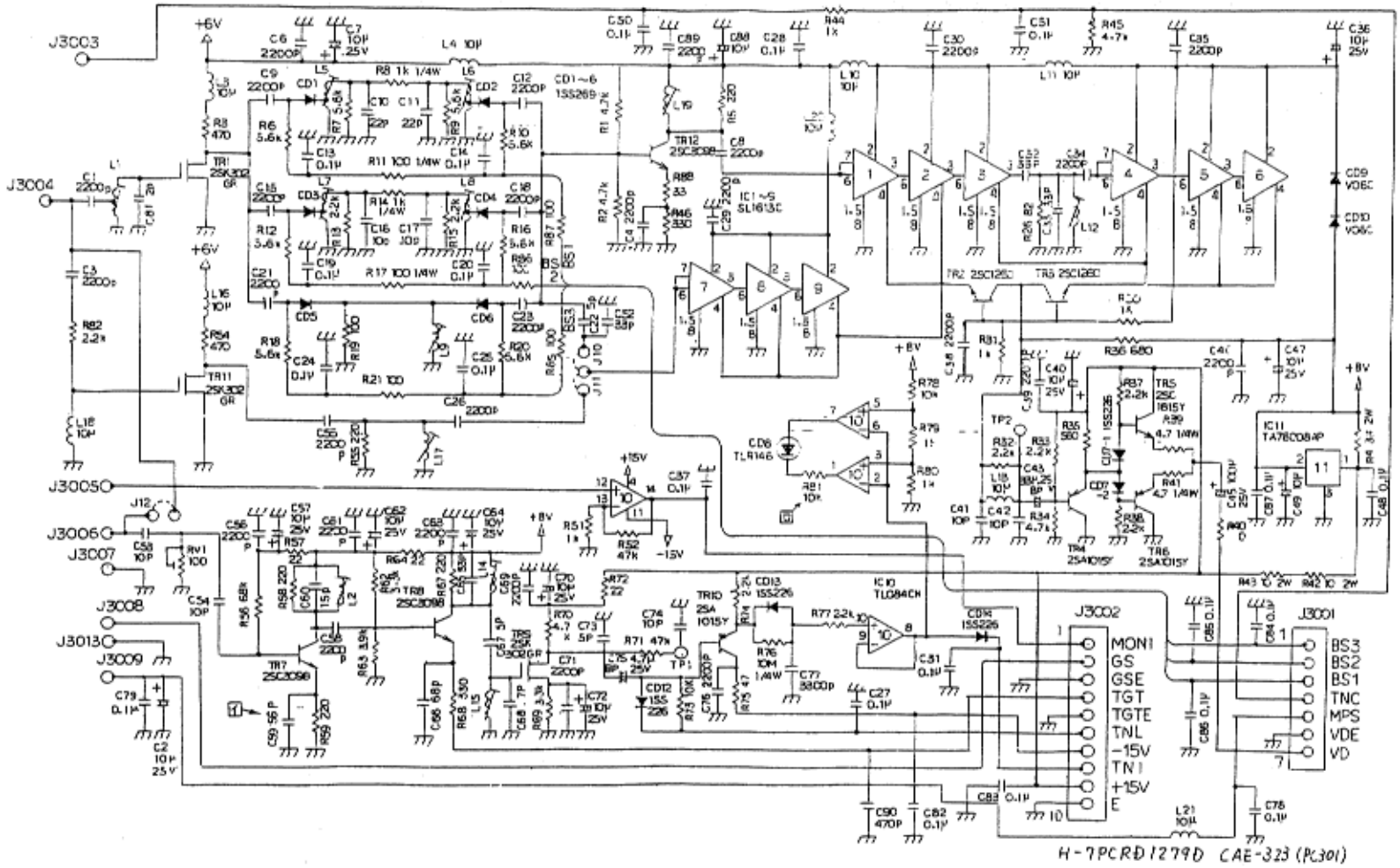

J3003
J3004
J3005
J3006
J3007
J3008
J3013
J3009
J3002
J3001
MON1
GS
GSE
TGT
TGTE
TNL
-15V
TN1
+15V
E
BS3
BS2
BS1
TNC
MPS
VDE
VD
+6V
+8V
+15V
-15V
IC10 TL084CN
IC11 TA78C08AP
IC1~5 SL1613C
TR1 2SK302 GR
TR2 2SC1260
TR5 2SC1260
TR7 2SC3096
TR8 2SC3096
TR10 2SA1015Y
TR11 2SK302 GR
TR12 2SC3096
TR4 2SA1015Y
TR6 2SA1015Y
CD1~6 1SS269
CD7 1SS226
CD8 TLR166
CD9 VD6C
CD10 VD6C
CD11 1SS226
CD12 1SS226
CD13 1SS226
H-7PCRD1279D CAE-323 (PC301)

TABLE 6—9

Replaceable Parts List

Receiver PCB

CAE— 323

REF.		TYPE	DESCRIPT	ION	JRC P/N
Cl	CAP,FXD CER	C3216SL1H222J-E-TP	2200PF	SOV	SCAADOO7
C2	CAP,FIX,ELEC	ECE-A1EKS100	1OUF	J25V	92
C3	T	C3216SL1H222J-E-TP	2200PF	MSO	SCEAAO19
C4	CAP,FXD CER	C32 16SL1 11222J -E-TP	2200PF	V	16
C6	CAP, FXD CER	C3216SL1H222J-E-TP	2200PF	JSOV	SCAADOO
C7	CAP,FXD CER	ECE-A1EKS100	1OUF	JSOV	792
C8	CAP,FIX,ELECT	C3216SL1H222J-ETP	2200PF	J25V	SCAADOO7
C9	CAP,FXD CER	C3216SL1H222J-E-TP	2200PF	MSO	92
ClO	CAP,FXD CER	C3216CH1H27OJ -E-TP	27PF	Y	SCAADOO
Cli	CAP, FXD CER	C3216CH1H270J-E-TP	27PF	JSOY	792
C12	CAP,FXD CER	C3216SL1H222J-E-TP	2200PF	JSOY	SCEAAO191
C13	CAP,FXD CER	C3216JF1H1O4Z~E-TP	0.	J5OV	6
C14	CAP, FXD CER	C321GJF1II1O4Z-E-TP	1UF	JSOY	5CAAD007
C15	CAP, FXD CER	C3216SL1fl222J-E-TP	0.	JSOV	92
Cl 6	CAP,FXD CER	C3216C111H 100D-E-TP	1UF	ZSOV	SCAADOO
Cl 7	CAP, FXD CER	C3216CH 111 100D-E-	2200PF	ZSOY	792
C18	CAP, FXD CER	TP	1OPF	JSOY	SCAADOO7
C19	CAP,FXD CER	C3216SLIH222J-E-TP	1OPF	DSOY	93
C20	CAP, FXD CER	C3216JF1H104Z-E-TP	2200PF	DSOY	SCAADOO7
C21	CAP, FXD CER	C321GJF1H1O4Z-E-TP	0.	JSOY	93
C22	CAP,FXD CER	C3216SL111222J-E-TP	1UF	Z	SCAADOO7
C23	CAP, FXD CER	C3216C11111050C-E-TP	0.	SOY	92
C24	CAP,FXD CER	C3216SL1H222J-E-TP	1UF	Z	SCAADO126
C25	CAP, FX1) CER	C3216JF1H104Z-E-TP	2200PF	SOY J	8
C26	CAP, FXI) CER	C3216JF1H1O4Z-E-TP	SPF	SOY	SCAADO126
C27	CAP,FXI) CER	C3216SL1H222JE-TP	2200PF	C	8
C28	CAP, FXD CER	C3216JF1FI1O4Z-E-TP	0.	SOY J	SCAADOO7
C29	CAP, FXD CER	C3216JF1H1O4Z-E-TP	1UF	50Y Z	92
C30	CAP,FXD CER	C3216SL1H222J-E-TP	0.	SOY	SCAADOO7
C31	CAP,FXD CER	C3216SL1H222J-E-TP	1UF	Z	8S
C32	CAP, FXD CER	C3216JF1H1O4Z-E-TP	2200PF	SOV J	SCAADOO7
C33	CAP,FXD CER	C3216C111H33OJ-E-TP	0.	SOY	85
C34	CAP, FXD ~	C3216CH1H33OJ -E-TP	1UF	Z	SCAADOO7
C35	CER	C3216SL1H222J-E-TP	0.	SOY	92
	CAP,FXD CER	C3216SL1H222J-E-TP	1UF	Z	SCAADO126
C36	CAP,FXD CER	ECE-A1EKS100	2200PF	SOY J	8
C37	CAP,FIX,ELECT	C3216JF1H1O4Z-E-TP	2200PF	SOY	SCAADO126
C38	CAP, FXD CER	C3216SL1H222J-E-TP	0.	J	8
C39	CAP,FXD CER	C3216SL1H222J-E-TP	1UF	SOY	SCAADOO7
C4O	CAP,FXD CER	ECE-A1EKS100	33PF	Z	92
C41	CAP,FIX,ELECT	C3216CH1H100D-E-TP	33PF	SOY J	SCAADOO8
C42	CAP,FXD CER	C3216CH1H 100D-E-TP	2200PF	SOY J	00
C43	CAP, FXD CER	ECE-A1EN33OSB	2200PF	SOY J	SCAADOO7
C4S	CAP,FIX,ELECT	ECE-A1EU1O1	1OUF	SOY J	92
C46	CAP,FIX,ELECT	C32165L1H222J-E-TP	0.	2SY	SCAADO126
	CAP,FXD CER		1UF	M	8
			2200PF	SOY	5CAAD0126
			2200PF	SOY J	8

			1OUF	SOY	5CAADOO7
			IOPF	J	92
			1OPF	2SV	5CAAD0126
			33UF	SOY	8
			100UF	SOY	SCAADO126
			2200PF	2SY	8
				25Y	SCAADOO7
				SOY	92
					SCAADOO7
					92
					SCAADO126
					8
					SCAADOO7
					94
					SCAADOO7
					94
					SCAADOO7
					92
					SCAADOO7
					92
					SCEAAO191
					6
					SCAADO126
					8
					SCAADOO7
					92
					SCAADOO
					792
					M
					SCEAAO191
					6
					D
					SCAADOO7
					8S
					D
					SCAADOO7
					8S
					M
					SCEAAO348
					O
					M
					SCEAAO184
					S
					J
					SCAADOO7
					92

REF.		TYPE	DESCRIPTION		JRC P/N
C47	CAP,FIX,ELECT	ECE-A1EKS100	1OUF	2SY M	SCEAAO 1916
C48	CAP, FXD CER	C3216JF1H1O4Z-E-TP	0. 1UF	SOY Z	SCAAD O1268
C49	CAP,FIX,ELECT	ECE-A1EKS100	1OUF	2SY M	SCEAAO 1916
C5O	CAP, FXD CER	C3216JF1H1O4Z-E-TP	0. 1UF	SOY	SCAAD

				Z	O1268
C51	CAP, FXD CER	C3216JF1H1O4Z-E-TP	0. 1UF	SOY	SCAAD
				Z	O1268
C52	CAP,FXD CER	C3216CH1H33OJ-E-TP	33PF	SOY J	SCAAD
					OO794
C53	CAP, FXD CER	C3216CH1H 100D-E-TP	1OPF	SOY D	SCAAD OO78S
C54	CAP, FXD CER	C3216CH1H 100D-E-TP	1 OPF	SOY D	SCAAD OO78S
C55	CAP,FXD CER	C3216SL1H222J-E-TP	2200PF	SOY J	SCAAD
					OO792
C56	CAP,FXD CER	C3216SL1H222J-E-TP	2200PF	SOY J	SCAAD
					OO792
C57	CAP,FIX,ELECT	ECE-A1EKS100	1OUF	2SY M	SCEAAO 1916
C58	CAP,FXD CER	C3216SL1H222J-E-TP	2200PF	SOY J	SCAAD
					OO792
C59	CAP,FXD CER	C3216CH11156OJ-E-TP	56FF	SOY J	SCAAD OO863
C6O	CAP,FXD CER	C3216CH1H15OJ-E-TP	1SPF	SOY J	SCAAD
					OO787
C61	CAP,FXD CER	C3216SL1H222J-E-TP	2200PF	SOY J	SCAAD
					OO792
C62	CAP, FIX, ELECT	ECE-A 1EKS 100	1OUF	2SY M	SCEAAO 19 16
C63	CAP,FXD CER	C3216SL1H222J-E-TP	2200PF	SOY J	SCAAD
					OO792
C64	CAP,FIX,ELECT	ECE-A1EKS100	1OUF	2SY M	SCEAAO 1916
C65	CAP,FXD CER	C3216CH1H33OJ-E-TP	33PF	SOY J	SCAAD
					OO794
C66	CAP,FXD CER	C3216CH1H68OJ-E-TP	68PF	SOY J	SCAAD
					OO929
C67	CAP, FXD CER	C3216CH1HO5OC-E-TP	SPF	SOY C	SCAAD OO800
C68	CAP, FXD CER	C3216CH1HO7OD-E-TP	7PF	SOY D	SCAAD OO977
C69	CAP,FXD CER	C3216SL1H222J-E-TP	2200PF	SOY J	SCAAD
					OO792
C7O	CAP,FIX,ELECT	ECE-A1EKS100	1OUF	25Y M	SCEAAO 1916
C71	CAP,FXD CER	C3216SL111222J-E-TP	2200PF	SOY J	SCAAD
					OO792
C72	CAP,FIX,ELECT	ECE-A1EKS100	1OUF	2SY M	SCEAAO 1916
C73	CAP,FXD CER	C3216CH1HOSOC-E-TP	SPF	SOY C	SCAAD OO800
C74	CAP,FXD CER	C3216CH1H100D-E-TP	1OPF	SOY D	SCAAD OO78S
C75	CAP,FIX,ELECT	ECE-A1ESN4R7B	4.7UF	25Y M	SCEAAO 2277
C76	CAP,FXD CER	C3216SL1H222J-E-TP	2200PF	SOY J	SCAAD
					OO792
C77	CAP, FIX, FILM	ECQ-B1H332JZ			SCRAAO
					OSS3

C78	CAP, FXD CER	C3216JF1H1O4Z-E-TP	0. 1UF	SOY Z	SCAAD O1268
C79	CAP, FXD CER	C3216JF1H1O4Z-E~TP	0. 1UF	SOY Z	SCAAD O1268
C81	CAP, FXD CER	C32I6CH1HO2OC-E-TP	2PF	SOY C	SCAAD OO798
C82	CAP, FXD CER	C3216JF1H1O4Z-E-TP	0. 1UF	SOY Z	SCAAD O 1268
C83	CAP, FXD CER	C3216JF1H1O4Z-E-TP	0. 1UF	SOY Z	SCAAD O 1268
C84	CAP, FXD CER	C3216JF1H1O4Z-E-TP	0. 1UF	SOY Z	SCAAD O1268
C85	CAP, FXD CER	C3216JF1H1O4Z-E-TP	0. 1UF	SOY Z	SCAAD O1268
C86	CAP, FXD CER	C3216JF1H1O4Z-E-TP	0. 1UF	SOY Z	SCAAD O1268
C87	CAP, FXD CER	C3216JF1H1O4Z-E-TP	0. 1UF	SOY Z	SCAAD O1268
C88	CAP, FIX, ELECT	ECE-A1EKS100	1OUF	2SY M	SCEAAO 19 16
C89	CAP,FXD CER	C3216SL1H222J~E-TP	2200PF	SOY J	SCAAD OO792
C9O	CAP, FXD CER	C3216CH1H471J-E-TP	47OPF	SOY J	SCAAD OO797
CD1	DIODE	1SS269-TE85R			STXADO OS91
CD2	DIODE	1SS269-TE8SR			STXADO OS91
CD3	DIODE	1SS269-TE8SR			STXADO OS91
CD4	DIODE	1S5269-TE8SR			STXAD OOS91
CDS	DIODE	1SS269-TE8SR			STXAD OOS91
CD6	DIODE	1S5269-TE8SR			STXAD OOS91

REF.		TYPE	DESCRIPTION	JRC P/N
CD7	DIODE LED	1SS226-TE85L		STXADOO3 2O
CD8		TLR146		STZADOO 23S
CD9	DIODE	VO6C VO6C		STXAE000 16
CD1O	DIODE			STXAE0001 6
CD12	DIODE	1SS226JE85L		STXADOO3 2O
CD13	DIODE	1SS226TE85L		STXADOO3 2O
CD14	DIODE	1SS226-TE85L		STXADOO3 2O
CD15	DIODE	1SS97(2)		STXAAOO3 13
IC1	IC	SL1613C-DP		SDDAA0002

				1
IC2	IC	SL1613C-DP		SDDAA0002
				1
1C3	IC IC	SL1613C-DP		SDDAA0002
IC4		SL1613C-DP		1
				SDDAA0002
				1
IC5	IC	SL1613C-DP ~		SDDAA0002
				1
IC6	IC	SL16l3C~DP		SDDAA0002
				1
IC7	IC	SL1613C-DP		SDDAA0002
				1
IC8	IC IC	SL1613C-DP		SDDAA000
IC9		SL1613C-DP		21
				5DDAA000
				21
IC1O	IC	TLO84CN		5DDALOO3
				42
IC11	IC	TA78008AP	8V REG	SDAADOOS
				SS
J3001	CONNECTO	IL-7P-S3FP2	7P	SJ~ADOO14
J3002	R	IL-1OP-S3FP2		6
J3003	CONNECTO	171255-1		SJViADOO2
J3004	R	171255-1		13
J3005	CONNECTO	171255-i		BRTE00046
J3006	R	171255-1		BRTE00046
J3007	CONNECTO	171255-1		BRTE00046
J3008	R	171255-i		BRTE00046
J3009	CONNECTO	171255-1		BRTE00046
	R			BRTE00046
	CONNECTO			BRTE00046
	R			
	CONNECTO			
	R			
	CONNECTO			
	R			
	CONNECTO			
	R			
	CONNECTO			
	R			
J3O13	CONNECTO	171255-1		BRTE00046
	R			
Li	COIL	Fl-7LARDO11S		7LARDO11S
L2	COIL	H-7LARDO113A	1OUH	7LARDO113
L3	COIL	LAPO2KR100K	1OUH	A
L4	COIL	LAPO2KR100K		SLCAAOO2
				32
				SLCAAOO2
				32
L5	COIL	H-7LARDO112A	1OUH	7LARDO112
L6	COIL	H-7LARDO112A	1OUH	A
L7	COIL	H-7LARDO114A		7LARDO112
L8	COIL	H-7LARDO114A		A
L9	COIL	H-7LARDO118A		7LARDO114
L1O	COIL	LAPO2KR100K		A

Lii	COIL	LALO4NA-100K		7LARDO114A 7LARDO118A SLCAAOO232 SLCAAOO191
L12	COIL	H-7LARDO117	1OUH	7LARDO117
L13	COIL	LAPO2KR100K		SLCAAOO232
L14	COIL	H-7LARDO116		
L15	COIL	H-7LARDO1 13A	1OUH	7LARDO116
L16	COIL	LAPO2KR100K		7LARDO113A
L17	COIL	H-7LARDO11OA	1OUH	
L18	COIL	LAPO2KR100K	0	SLCAAOO232
L19	COIL	H-7LARDO119A		
L2O	COIL	LAPO2KR100K	1OUH	7LARDO11OA SLCAAOO232 7LARDO119A SLCAAOO232

REF.		TYPE	DESCRIPTION		JRC P/N
L2l	COIL	LAPO2KR100K	1OUH		SLCAAOO232
PC3O1	PCB	H-7PCRD1279E			7PCRD1279E
Ri	RESISTOR	ERJ-8GEYJ472V	4.7K OHM	1/8\~ J	SREAGO1746
R2	RESISTOR	ERJ-8GEYJ472V	4.7K OHM	1/8’N J	SREAGO1746
R3	RESISTOR	ERJ-8GEYJ471Y	470 OHM	1/8~ J	SREAGO1734
R4	RESISTOR	ERG~2SJ33OP	33 OHM	2~ J	SREAGO1492
R5	RESISTOR	ERJ~8GEYJ22lV	220 OHM	1/8~ J	SREAGO173O
R6	RESISTOR	ERJ-8GEYJS62V	5.6K OHM	1/8w J	SREAGO1747
R7	RESISTOR	ERJ-8GEYJ562V	5.6K OHM	1/8~ J	SREAGO1747
R8	RESISTOR	ERD-25P31O2	1K OHM	1/4Vi J	SREAGO1181
R9	RESISTOR	ERJ-~8GEYJ562V	5.6KOHM	l/8~ J	SREAGO1747
RiO	RESISTOR	ERJ-8GEYJ562V	5.6K OHM	i/8~ J	SREAGO1747
Ru	RESISTOR	ERD-25PJ1O1	100 OHM	l/4~ J	SREAGO1175
R12	RESISTOR	ERJ-8GEYJ562Y	5.6K OHM	1/8\~ J	SREAGO1747
R13	RESISTOR	ERJ-8GEYJ222V	2.2K OHM	1/8~	SREAGO

				J	1742
R14	RESISTOR	ERD-25PJ1O2	1K OHM	1/4~	SREAGO
				J	1181
R15	RESISTOR	ERJ-8GEYJ222Y	2.2K OHM	1/8V	SREAGO
				1 J	1742
R16	RESISTOR	ERJ~8GEYJ562V	5.6K OHM	1/8~	SREAGO
				J	1747
R17	RESISTOR	ERD-25PJ1O1	100 OHM	1/4Yi	SREAGO
				J	117S
R18	RESISTOR	ERJ~8GEYJ562V	5.6K OHM	1/8V	SREAGO
				1 J	1747
Ri9	RESISTOR	ERJ-8GEYJ1O1V	100 OHM	1/8~	SREAGO
				J	1726
R2O	RESISTOR	ERJ-8GEYJ562V	5.6K OHM	1/8~	SREAGO
				J	1747
R21	RESISTOR	ERJ-8GEYJ1O1Y	100 OHM	1/8w	SREAGO
				J	1726
R26	RESISTOR	ERJ-8GEYJ82OY	82 OHM	1/8~	SREAGO
				J	172S
R30	RESISTOR	ERJ-8GEYJ1O2V	1K OHM	1/8\~	SREAGO
				J	1738
R31	RESISTOR	ERJ-8GEYJ1O2V	1K OHM	1/8w	SREAGO
				J	1738
R32	RESISTOR	ERJ-8GEYJ222V	2.2K OHM	1/8~	SREAG
				J	O1742
R33	RESISTOR	ERJ~8GEYJ222V	2.2K OHM	i/8~ J	SREAGO
					1742
R34	RESISTOR	ERJ-8GEYJ472V	4.7K OHM	1/8w	SREAGO
				J	1746
R35	RESISTOR	ERJ-8GEYJ561Y	560 OHM	1/8w	SREAGO
				J	173S
R36	RESISTOR	ERJ-8GEYJ681Y	680 OHM	1/8Vi	SREAGO
				J	1736
R37	RESISTOR	ERJ-8GEYJ222Y	2.2K OHM	1/8~’	SREAGO
				J	1742
R38	RESISTOR	ERJ-8GEYJ222Y	2.2K OHM	1/8V	SREAGO
				1 J	1742
R39	RESISTOR	ERD-25PJ4R7	4.7 OHM	1/4w	SRDAAO
				J	12O3
R4O	RESISTOR	ERJ-8GEYOROOY	0 OHM	l/8S~	SREAGO
					177S
R4i	RESISTOR	ERD-25PJ4R7	4. 7 OHM	1/4w	SRDAAO
				J	12O3
R42	RESISTOR	ERG-2SJ100P	10 OHM	2SY J	SREAGO
					1388
R43	RESISTOR	ERG-2SJ100P	10 OHM	2Vi J	SREAG
					O1388
R44	RESISTOR	ERJ-8GEYJ1O2Y	1K OHM	1/8~’	SREAGO
				J	1738
R45	RESISTOR	ERJ-8GEYJ472Y	4.7K OHM	1/8~	SREAGO
				J	1746
R46	RESISTOR	ERJ-8GEYJ331Y	330 OHM	l/8~ J	SREAGO
					1732
R5i	RESISTOR	ERJ-~8GEYJ1O2V	1K OHM	1/8~	SREAGO

				N J	1738
R52	RESISTOR	ERJIGEYJ473Y	47K OHM	1/8~ J	SRSS'AG O17S8
R54	RESISTOR	ERJ-8GEYJ471Y	470 OHM	1/8~ J	SREAGO 1734
R55	RESISTOR	ERJ-8GEYJ221Y	220 OHM	1/8V 1 J	SREAGO 173O
R56	RESISTOR	ERJ-8GEYJ683Y	68K OHM	1/8w J	SREAGO 176O
R57	RESISTOR	ERJ-8GEYJ22OY	22 OHM	1/8w J	SREAGO 1718
R58	RESISTOR	ERJ-8GEYJ221Y	220 OHM	1/8Vi J	SREAGO 173O
R59	RESISTOR	ERJ-8GEYJ221Y	220 OHM	1/8V 1 J	SREAGO 173O

REF.		TYPE	DESCRIPTION		JRC P/N
R62	RESISTOR	ERJ-~8GEYJ332Y	3.3K OHM	1/8w J	SREAGO 1744
R63	RESISTOR	ERJ-8GEYJ392Y	3.9K OHM	1/8w J	SREAGO 17SS
R64	RESISTOR	ERJ-8GEYJ22OY	22 OHM	l/8~ J	SREAGO 1718
R67	RESISTOR	ERJ-8GEYJ221Y	220 OHM	1/8~ J	SREAGO 173O
R68	RESISTOR	ERJ-8GEYJ331Y	330 OHM	1/8w J	SREAGO 1732
R69	RESISTOR	ERJIGEYJ152Y	1.5K OHM	1/8w J	SREAGO 174O
R7 O	RESISTOR	ERJ-8GEYJ821Y	820 OHM	1/8w J	SREAGO 1737
R71	RESISTOR	ERJ-8GEYJ473Y	47K OHM	1/8~ J	SREAGO 17S8
R72	RESISTOR	ERJ-8GEYJ22OY	22 OHM	1/8w J	SREAGO 1718
R73	RESISTOR	ERJ8GEYJ1O3V	10K OHM	1/8w J	SREAGO 17SO
R74	RESISTOR	ERJ~8GEYJ222V	2.2K OHM	1/8~ J	SREAGO 1742
R75	RESISTOR	ERJ8GEYJ47OV	47 OHM	l/8~ J	SREAGO 1722
R76	RESISTOR	HMGL1$_1$'4A 1OMJ	1OM OHM	1/'4\ ~ .1	SREAAO S6O7
R77	RESISTOR	ERJ-8GEYJ222Y	2.2K OHM	1/8w J	SREAGO 1742
R78	RESISTOR	ERJ-8GEYJ1O3Y	10K OHM	1/8V 1 J	SREAGO 17SO
R79	RESISTOR	ERJ-8GEYJ1O2Y	1K OHM	1/8V 1 J	SREAGO 1738
R8 O	RESISTOR	ERJ-8GEYJ1O2Y	1K OHM	1/8~ J	SREAGO 1738
R81 ~	RESISTOR	ERJ-8GEYJ1O3Y	10K OHM	1/8~' .J	SREAGO 17SO
R82	RESISTOR	ERJ-8GEYJ222Y	2.2K OHM	1/8~ J	SREAGO 1742
R85	RESISTOR	ERJ-8GEYJ1O1V	100 OHM	1/8w	SREAGO

				J	1726
R86	RESISTOR	ERJ-8GEYJ1OIY	100 OHM	1/8w	SREAGO
				J	1726
R87	RESISTOR	ERJ-8GEYJ1O1Y	100 OHM	1/8~	SREAGO
				J	1726
R88	RESISTOR	ERJ-8GEYJ33OY	33 OHM	1/8~	SREAGO
				J	172O
R89	RESISTOR	ERD-25PJ471	470 OHM	l/4~’	SRDAAO
				J	11SS
RY 1	RESISTOR VAR	GFO6X 100 OHM	100 OHM		SRMABO O1O2
TP1	TEST PIN	LC-2-G	RED		SJTC~OO O13
TP2	TEST PIN	LC-2-G	RED		SJTC~OO O13
TR1	TRANSISTOR	2SK3O2GR-TE8SL			STKAAO O225
TR2	TRANSISTOR	2SC126O			STCAB00 02S
TR3	TRANSISTOR	2SC1260			STCAB00 02S
TR4	TRANSISTOR	2SA1O1S-Y			STAAGO O294
TR5	TRANSISTOR	2SC1815-Y			STCAFO O781
TR6	TRANSISTOR	2SA1O1S-Y			STAAGO O294
TR7	TRANSISTOR	2SC3098-TE8SL			STCAFO OS29
TR8	TRANSISTOR	2SC3098-TE8SL			STCAFO OS29
TR9	TRANSISTOR	2SK3O2GR-TE8SL			STKAAO O22S
TR1 1	TRANSISTOR	2SK3O2GR-TE8SL			STKAAO O22S
TR1 2	TRANSISTOR	2SC3098-TE8SL			STCAFO OS29
TRi O	TRANSISTOR	2SA1O15-Y			STAAGO O294

FIG. 6-5 CIRCUIT DRAWING OF CMA—56i RECEIVER CHASSIS

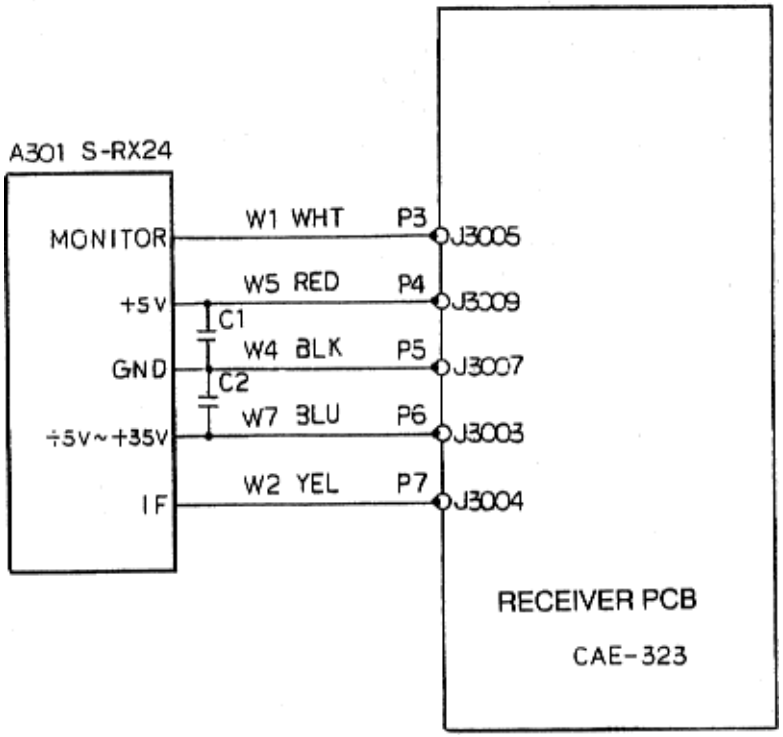

A301 S-RX24
MONITOR
+5V
GND
÷5V~+35V
IF
W1 WHT
W5 RED
W4 BLK
W7 BLU
W2 YEL
P3
P4
P5
P6
P7
J3005
J3009
J3007
J3003
J3004
C1
C2
RECEIVER PCB
CAE-323

TABLE 6—10
Replaceable Parts List
Receiver Chassis
CMA— 5 6 1

REF.		TYPE	DESCRIPTION		JRC P/N
A3O 1	MIC	S-RX24			SZZAX0 0029
Cl	CAP, FIX, CER	FK24YSY1H1 O4Z	0.1UF	SOY Z	SCAAD O2822
C2	CAP,FIX,CER	FK24Y5Y1H1 O4Z	O.1UF	SOY Z	SCAAD O2822
P1	RECEPTACLE	60789-2			SJ~AHO OO86
P2	RECEPTACLE	60789-2			SJ~AHO OO86
P3	RECEF~ACLE	60789-2			SJ~AHO OO86
P4	RECEPTACLE	60789-2			SJYIAH0 0086
P5	RECEPTACLE	60789-2			SJ~AHO OO86
P6	RECEPTACL E	60789-2			SJ~AHO OO86
P7	RECEPTACLE	60789-2			5JYiAH0 0086
~8	~‘iIRE CLAMP	O8432(BL-100)			BRBPOO 131