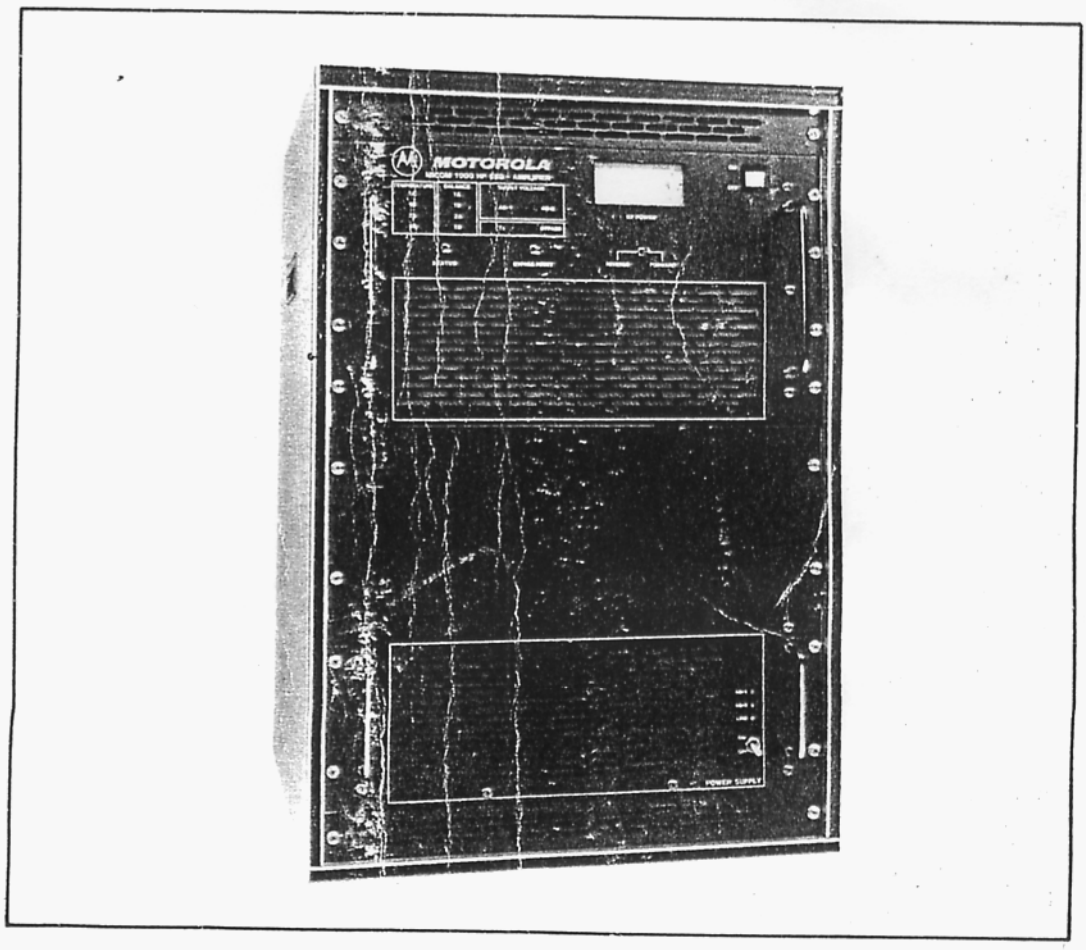
MOTOROLA

MICOM 1000

HF-SSB Linear Power Amplifier

1000 Watts
1.6-30 MHz



Instruction Manual

68P02936G50-O

MOTOROLA INC.
Communications
Sector

MICOM 1000

HF-SSB Linear Power Amplifier

1000 Watts
1.6-30 MHz

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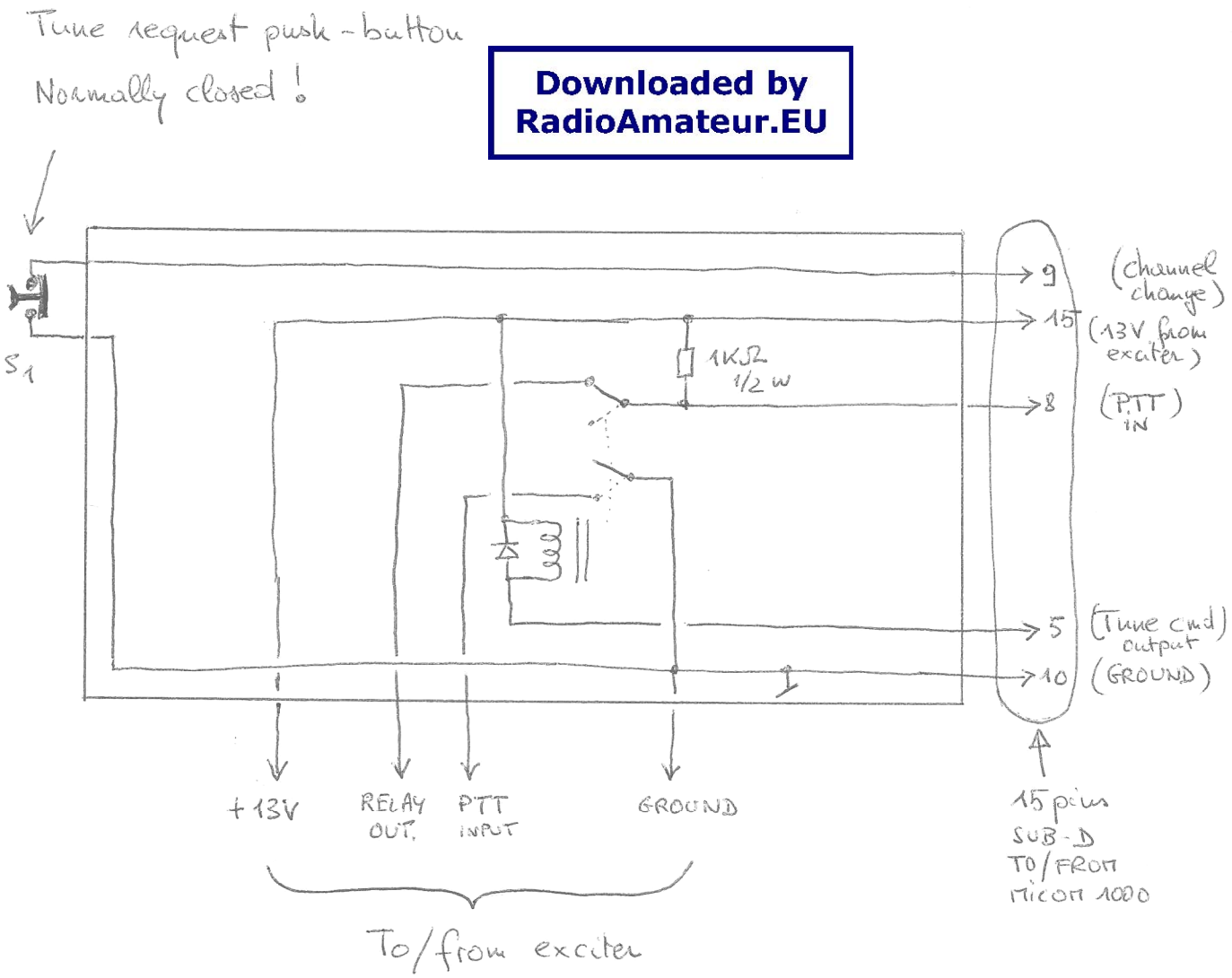
PERFORMANCE SPECIFICATION.

Frequency Range:	1.6 to 30 MHz
Power Output:	1000 watts AVG. and PEP
Power Gain:	20dB
Input Power:	10w
Gain Flatness:	+/-0.5dB over 1.6 to 30 MHz (890-1120 watts)
Intermodulation:	3rd order IM products 32dB below PEP or better. 11th, 13th >73dB below PEP.
Harmonics:	73dBc
ARQ	T/R switching compatible with ARQ operation
Input/Output Impedance:	50 ohm
Load Mismatch:	Unit capable of operating into 2:1 and 3:1 vswr (reduced output) & survive open & shorted load. Stable at any load.
Operating Mode:	Class AB
Cooling:	Forced Air
Physical Characteristics:	HxDxW = 29.7 x 22.6 x20.3 Weight = 150 lbs
Power Requirements:	48V DC, 55a max. in Tx mode and Receive mode
Environment Temperature:	-30 to 60 degree C. Operating -40 to 70 degree C. Storage
Relative Humidity:	0 to 95% operating
Duty Cycle:	Continuous
Line Voltage:	230V + 10% -20%, 50/60 Hz +/- 3Hz 115V + 10% -20%, 50/60 Hz +/- 3Hz

SIMPLE INTERFACE FOR MICOM 1000



NOTES: - FOR TUNING, SELECT FM OR AM WITH ≈10 W out ON THE EXCITER, THEN PRESS S_1

(THE MICOM CLOSES AUTOMATICALLY THE EXCITER PTT, MEASURES THE FREQUENCY, AND SELECTS THE APPROPRIATE OUTPUT FILTER.)

⚠ NEVER DRIVE THE MICOM 1000 WITH MORE THAN 10 W OF POWER (APPROX 1000 W out)

FORWORD

1. SCOPE OF MANUAL

This Manual is intended for use by experienced technicians familiar with similar equipment. The information it contains is current as of the printing date. Subsequent engineering changes are described in supplementary Instruction Manual Revisions (IMRs) issued as needed. The applicable schematic diagram is updated and the changes are described in a revision column printed either on the diagram or next to the corresponding parts list.

2. SERVICE

The Motorola National Service Organization offers one of the finest nationwide installation and maintenance programs available to communications equipment users. This organizatioon comprises approximately 900 Motorola Service Stations located throughout the United States. Each Service Station is independently owned and operated, is staffed by one or more trained, FCC-licensed technicians, and is specially selected and authorized by Motorola.

The administrative staff of the National Service Organization consists of national, area and district representatives, all of whom are Motorola employees. Their objective is continually to improve the service to Motorola customers.

Motorola maintenance is available either on time and material basis, or by means of a service contract your Motorola Service Representative or write to:

National Service Manager
Motorola Communications and Electronics Inc.
1303 E. Algonquin Road
Schaumburg, Illinois 60196

MODEL COMPLEMENTS

F2340A Linear Power Amplifier, 1000 Watts, 1.6 - 30 MHz

FLN1487A Power Amplifier Unit
FPN1606A Power Supply
FHN5524A Cabinet
FKN1601A Cable Kit
FBN5548A Packing Material

3. MODEL AND KIT IDENTIFICATION

Every Motorola product is specifically identified by an overall model number printed on the nameplate. In addition, the assemblies and kits comprising the product usually have kit model numbers stamped on them.

4. REPLACEMENT PARTS ORDERING

Motorola maintains a factory parts center and several area parts centers located throughout the United States. These facilities are equipped to process parts orders, identify part numbers, and otherwise assist in maintenance and repair of Motorola Communications Group products. The addresses of these parts centers are listed on the following page.

Orders for crystals, channel elements, active filters, PROMs, code plugs, and resonant reeds should be sent directly to the factory parts center. Orders for all other parts and for instruction manuals should be sent to the nearest area parts center.

All orders for replacement parts or equipment information should include the complete identification number. This requirements applies to all components, kits and chassis. If the component part number is not known, the order should include the number of the chassis or kit which uses it, and a description of desired component sufficient to identify it.

Orders for crystals and channel elements should specify the crystal or channel element type number, crystal and carrier frequencies, and the model number of the chassis using the part.

Orders for active filters, PROMs, code plugs, and "Vibrasender" and "Vibrasponder" resonant reeds, should specify type number and frequency, and should identify the owner/operator of the communications system utilizing these items.

5. ADDRESSES

5.1 AREA PARTS CENTERS

5.1.1 U.S. Orders

Western Area Parts
1170 Chess Drive, Foster City
San Mateo, California 94404
Telephone: 415-349-3111
TWX: 910-375-3877

Midwest Area Parts
1313 E. Algonquin Road
Schaumburg, Illinois 60196
Telephone: 312-576-7322
TWX: 910-693-0869

Mid-Atlantic Area Parts
7230 Parkway Drive
Hanover, Maryland 20176
Telephone: 301-796-8600
TWX: 710-862-1941

East Central Area Parts
12995 Snow Road
Parma, Ohio 44130
Telephone: 216-267-2210
TWX: 810-421-8845

Eastern Area Parts
85 Harristown Road
Glen Rock, New Jersey 07452
Telephone: 201-447-4000
TWX: 710-988-5602

Gulf States Area Parts
8550 Katy Freeway, Suite 128
Houston, Texas 777024
Telephone: 713-932-8955

Southeastern Area Parts
P.O. Box 368
Decatur, Georgia 30031
Telephone: 504-981-9800
TWX: 810-766-0876

Pacific Southwestern Area Parts
P.O. Box 85036
San Diego, California 92138
Telephone: 714-578-2222
TWX: 910-335-1634

Southwestern Area Parts
P.O. Box 34290
3320 Belt Line Road
Dallas, Texas 75234
TWX: 910-860-5505

5.1.2 Canadian Orders

Motorola Ltd.
National Parts Department
3125 Steeles Avenue
E. Willowdale, Ontaria M2H 2H6
Telephone: 416-499-1441
TWX: 610-492-2713
Telex: 065-25191

5.1.3 All Other Countries

Motorola Inc., or Motorola Americas Inc.
International Parts Dept.
1313 E. Algonquin Road
Schauburg, Illinois 60196 U.S.A.
Telephone: 312-576-6492
TWX: 910-693-0869
Telex: 722443 or 722424
Cable: MOTOL PARTS

5.2 FACTORY PARTS CENTER

5.2.1 Mail Orders

Motorola, Inc.
Component Products Sales and Service
P.O. Box 66191
O'Hare International Airport
Chicago, Illinois 60666

5.2.2. Other Correspondence

Motorola, Inc.
Component Products Sales and Service
2553 N. Edgington Street
Franklin Park, Illinois 60131

5.3 GENERAL OFFICES

Motorola communications and Electronics Inc.
Communications Group Parts Dept.
1313 E. Algonquin Road
Schaumburg, Illinois 60196
Telephone: 312-576-3900

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GENERAL SAFETY INFORMATION

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic energy safety standard which applies to the use of this equipment. Proper use of this radio results in exposure below the OSHA limit. The following precautions are recommended:

Do not operate the transmitter of a mobile radio when someone outside the vehicle is within two feet (0.6 meter) of the antenna.

Do not operate the transmitter of a fixed radio (base station, microwave, and rural telephone rf equipment) or marine radio when someone is within two feet (0.6 meter) of the antenna.

Do not operate the transmitter of any radio unless all rf connectors are secure and any open connectors are properly terminated.

In addition,

Do not operate this equipment near electrical blasting caps or in an exploxive atmosphere.

All equipment must be properly grounded according to Motorola installation instructions for safe operation.

All equipment should be serviced only by a qualified technician.

Additional pertinent safety information is located in appropriate sections of this manual.

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January, 1987

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DESCRIPTION

1. INTRODUCTION

1.1 GENERAL

The MICOM 1000 is a solid state linear MOS FET amplifier capable of delivering a power output of 1000 watts in the frequency range of 1.6 to 30 MHz. It operates from its own separate power supply, and selection of a particular harmonics filters is done automatically by measuring the exciter frequency.

The MICOM 1000 is modularized for ease of maintenance. Adjustments are easily accessible and internal LED indicators monitor performance of critical circuitry.

2. FEATURES

a. Fully compatible with all Micom radios.

b. Microprocessor selection of harmonic filters permits operation with a variety of exiters with minimal interface requirements

c. Large front panel meter shows forward or reflected power

d. Overtemperature indicator and protection

e. Balance indicator shows faulty transistor in particular module.

f. Bypass in case of failure.

g. Continuous duty cycle.

3. OPTIONS

3.1 Shelf and short cable kit for mounting radio inside the enclosure.

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1. GENERAL

1.1 GOVERNMENT REGULATIONS

Ensure that the use of the MICOM 1000 power amplifier satisfies government regulation. In most countries, radio transmitters may be adjusted only by persons holding a suitable government license or by personnel working under their immediate supervision.

Similarly, most countries require that the power output of a transmitter not exceed that required for satisfactory performance considering local conditions and the area to be served.

Also, frequency and power of a basestation transmitter must be checked before it is placed in service, and must be rechecked every year thereafter; the results of these checks must be recorded in a permanent log available for inspection by government personnel.

1.2 INSPECTION

Carefully inspect the MICOM 1000 power amplifier immediately upon receipt thereof, and notify the shipper of any damage incurred in transit.

1.3 PRELIMINARY

Select the mounting location for convenience of access for electrical connections and for maintenance. Keep the antenna cable as short as possible to minimize losses. The selected location should be clean, dry and well ventilated. Do no locate the unit in close proximity to strong electrical fields produced by brush motors and generators, welders, etc.

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The enclosure may be placed on any sturdy, horizontal surface. An accessory mounting tray allows the radio to be mounted inside the enclosure. Refer to the Maintenance chapter of this manual for the procedure, and perform it before proceeding further with the installation procedure.

No preliminary internal wiring connections are required to be effected before installing the power amplifier.

2. INSTALLATION

In locating the housing (See Figure 1), it is required that sufficient space be allowed for air circulation. The air-intake is at the front and the exhaust on the rear. For both intake and exhaust, "free space" in excess of 30cm (12") is recommended.

The FLN 1487A power amplifier is normally used with the FPN 1606A dual power supply. The power supply line voltage will be clearly marked with an orange label located at the AC power input connector.

The AC outlet current requirements are as follows:

115 VAC : 50 A
230 VAC : 25 A

The power supply is normally set for 230V AC input. To switch between 115V AC the power supply must be removed from the enclosure (See Figure 1). Holes on each side of the power supply provide access to the "input select" switch. Removing the top cover exposes the two switching supplies. Each of the two switching supplies have a line fuse (F1) that needs to be changed in accordance with the line voltage selected:

Line Voltage:	115V AC	230V AC
Fuse F1:	25A	12A

F1 is located on the front of the two switching supplies and spare fuses are mounted on the protective plate located in the front, right hand corner of the power supply chassis.

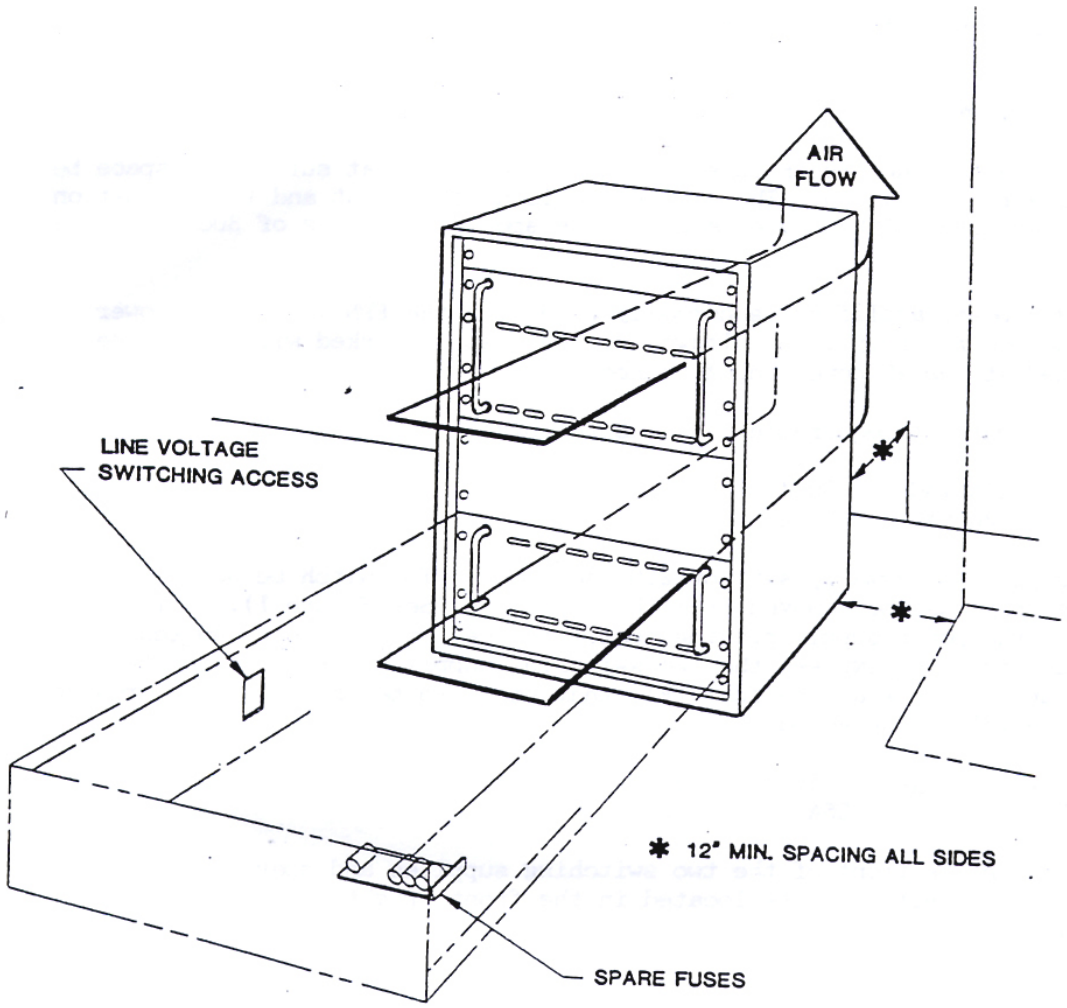

AIR
FLOW
LINE VOLTAGE
SWITCHING ACCESS
* 12" MIN. SPACING ALL SIDES
SPARE FUSES

FIGURE 1

2.1 AC POWER CONNECTION

The AC power cable and connector supplied with the MICOM 1000 enable connection between the AC outlet and the power supply AC input connector (J3) located on the rear panel.

2.2 DC POWER CONNECTION

The DC power cable (including connectors) supplied with the MICOM 1000 enable connection between the DC output connector (J1) located on the rear panel of the power supply and the DC input connector (J2) located on the rear panel of the power amplifier.

2.3 POWER SUPPLY UNIT- AMPLIFIER UNIT - CONTROL CONNECTION

The P.S. control cable supplied with the MICOM 1000, connects between connectors J3 located on the rear panel of the power supply and the power amplifier unit respectively.

For the following system connections, see Figure 2.

2.4 AMPLIFIER UNIT - EXCITER CONNECTIONS

The coax cable supplied with the MICOM 1000 connects between the MICOM Radio Antenna Connector (J105) and the RF in connector (J7) on the Amplifier unit.

The exciter control cable connects between the MICOM Radio connector (J11) plus the Accessory Connector (J10) and the Exciter Control connector (J5) on the amplifier unit.

2.5 AMPLIFIER UNIT - ATU CONNECTIONS

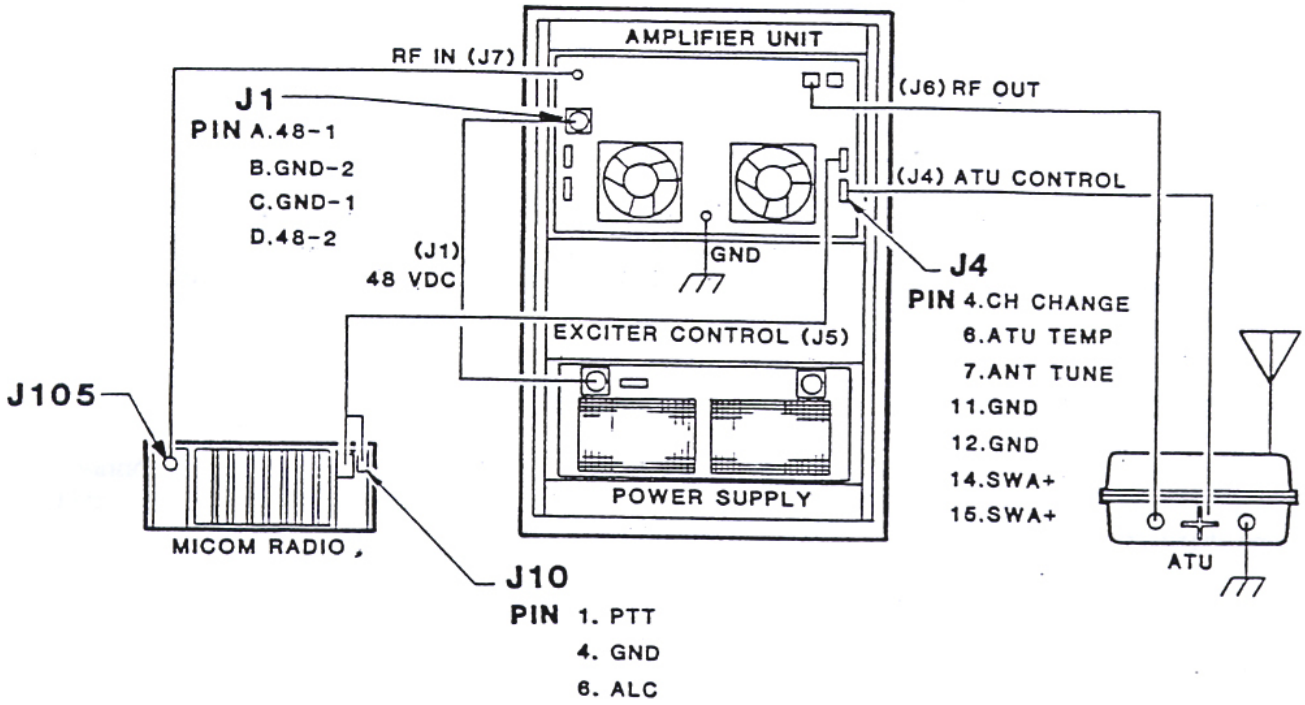
The coax cable supplied with the ATU connects between the RF input connector on the ATU and the RF out connector (J6) on the amplifier unit.

The ATU control cable connects between the ATU control connector and the amplifier unit ATU control connector (J4).

2.6 AMPLIFIER UNIT - ANTENNA CONNECTOR

If an ATU is not used, the amplifier unit is connected directely to the 50 ohm, broadband antenna with the coax cable supplied. No other connections to the antenna are required.

AMPLIFIER W/ATU



AMPLIFIER W/BROAD BAND ANTENNA

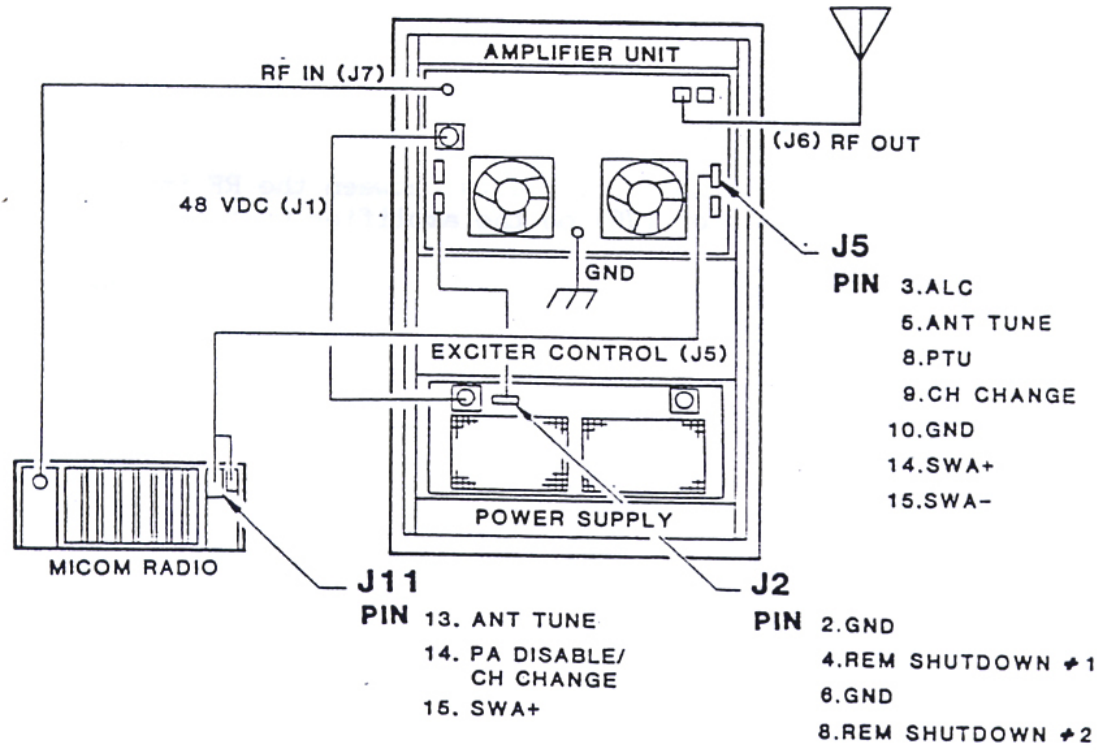


FIGURE 2

2.7 PRELIMINARY OPERATIONAL CHECK

When installation is complete, perform a preliminary check as follows:

a. Make sure the MICOM radio is turned off. Insert a wattmeter (50W) between the MICOM radio and the amplifier unit.

b. Make sure the power amplifier on/off switch is turned off. Then turn on the power supply. Observe that the yellow LED marked "AC" on the power supply is lit indicating the presence of line voltage.

c. Now turn on the power amplifier. The power supply fans should turn on and the two green LEDs marked "48V-1" and "48V-2" on the power supply should be lit indicating the presence of 48V DC at the DC output connector (J1).

d. Turn on the MICOM radio while observing the Wattmeter. The wattmeter should indicate a power of 10 - 14 Watts being fed to the amplifier unit during the initial filter selection process. The TX indicator on the amplifier unit will be turned on and when an ATU is used, the power should remain 10 - 14 Watts during the tuning cycle. If no ATU is used, the power will drop to zero following the filter selection.

   Note: The sequence described above is repeated on every channel change.

e. Select a channel without traffic and key the microphone. Talk or whistle into the microphone while observing the RF power meter on the amplifier unit. Check both FORWARD and REVERSE power. With little or no reverse power indicated it should be possible to obtain 1000 watts of forward power.

f. If VSWR is degraded, as indicated by a reflected power in excess of 100 watts the forward power will be less than 1000 watts. If VSWR is seriously degraded (250 - 350 Watt reflected power) it is recommended that all connection between the amplifier unit and the ATU and/or antenna be inspected.

g. Repeat the above on several channels across the entire operating frequency band of the equipment.

   Note: When operating the equipment under FCC rules the power output below 4 MHz may not exceed 150 watts. On amplifier units prepared to comply with FCC rules the BYPASS mode of operation is automatically selected below 4 MHz as indicated by the BYPASS LED.

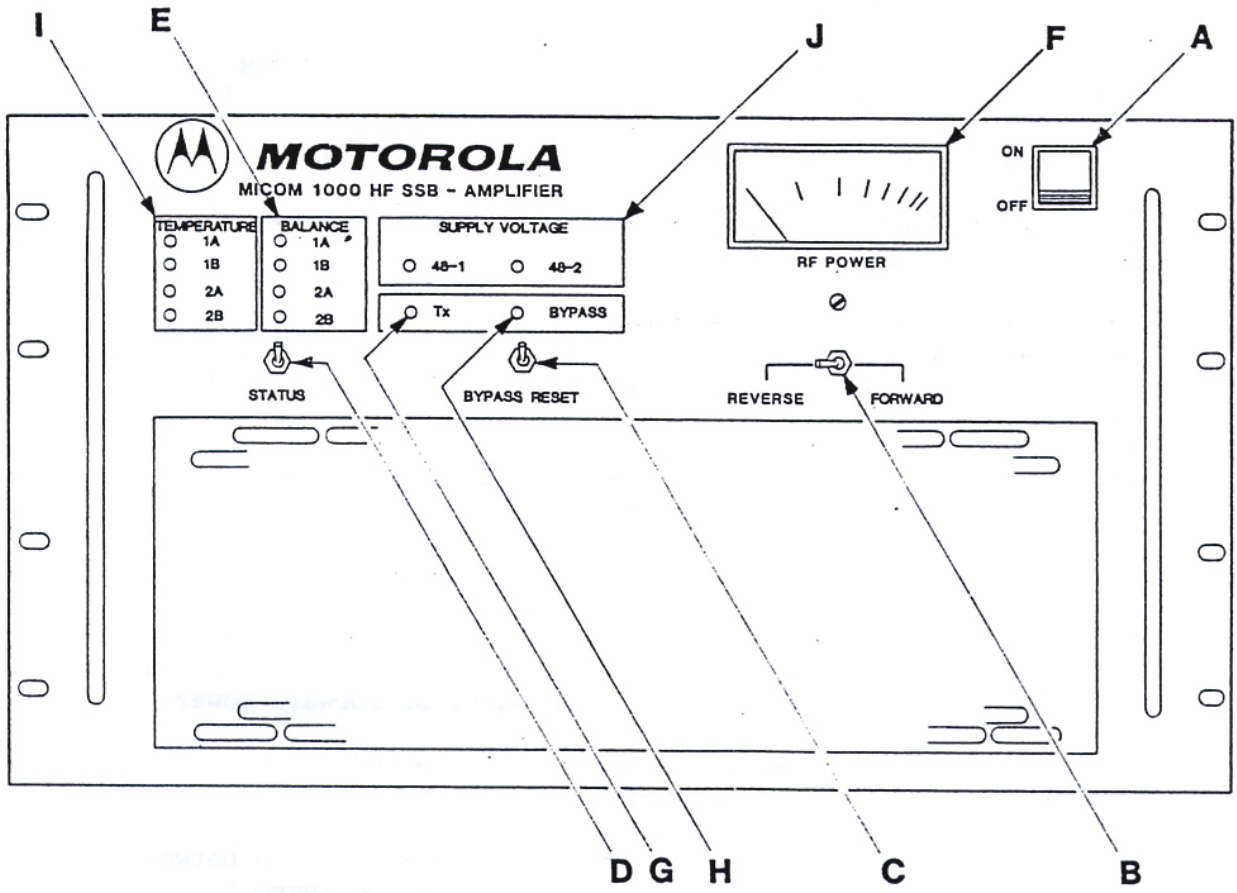


Figure 1. Front Panel Amplifier Unit

1. INTRODUCTION

This section describes the controls, indicators and external connections available to the operator. The letter associated with each paragraph keys it to the corresponding item in Figure 1, 2, 3 or 4.

1.1 CONTROLS AND DISPLAYS (FIGURE 1 AND 3)

1.1.1 The amplifier unit includes the following controls and displays:

A. The on/off switch turns on the power supply and applies 48V DC to the power amplifier.

B. The FORWARD/REVERSE switch selects either FORWARD power or RESERVE power indicated on the RF power meter.

C. The BYPASS RESET switch is a momentary switch that resets the power amplifier following a fail condition. In the event of an internal malfunction of a HARMONIC FILTER or an external problem like excessive VSWR the power amplifier will remain in the BYPASS mode of operation. Activating the BYPASS RESET switch, initiates a new filter selection/tune cycle and reactivates the power amplifier.

Note: In units prepared to comply with FCC requirements of less than 150W of power output below 4 MHz, the BYPASS mode is automatically selected on frequencies < 4 MHz and the BYPASS reset switch is disabled.

D. The STATUS switch applies B+ to the BALANCE LEDs.

E. Balance LEDs lit indicates problem in appropriate 300 W module (soft fail). Operation can continue though output power is reduced to a level corresponding to the severity of the failure.

To perform balance test, proceed as follows:

1- Select a frequency between 10 and 20 MHz.
2- Apply drive signal corresponding to a power outupt of approximately 600 watts. When used with an exciter, whistling into the microphone should suffice.
3- Activate the STATUS SWITCH while observing the BALANCE LEDs. Any LED lit continusly while power is applied signals a problem.

If the BALANCE test is performed by whistling into the microphone, the LED(s) might flash momentarily, especially at lower frequencies.

F. The RF POWER meter indicates forward or reverse power in accordance with FORWARD/REVERSE switch setting. Full scale indicator is 1000 watt.

G. TX LED is lit when in transmit mode.

H. BYPASS LED is lit when in BYPASS mode of operation See also C.

I. Temperature LEDs lit indicates overtemperature of appropriate 300 W module. Power is reduced to safe operating level when one or more LEDs are lit.

J. Supply voltage LEDs indicated low or no supply voltage from either one of the two 48V supplies in the power supply.

If one or both LEDs turn on slightly during voice peaks, it indicates limiting in the appropriate power supply.

W. ALC adjustment of exciter drive power.

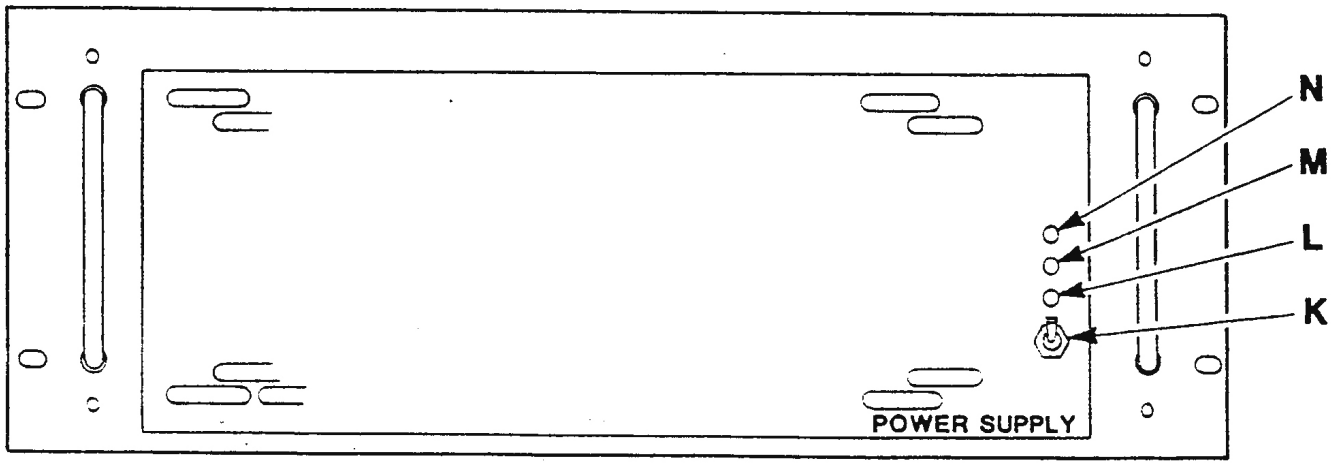


Figure 2. Front Panel, Power Supply Unit

1.1.2 The power supply unit includes the following controls and displays.

K. The ON/OFF switch, a 50A circuit breaker, turns on the AC to the dual power supplies.

L. The AC LED indicates that the power supply is turned on.

M, N. The 48V-1 and the 48V-2 LED - when on - show that the 48V DC has been enabled (by activating the ON/OFF switch on the MICOM 1000 power amplifier).

1.2 CONNECTORS

1.2.1 The amplifier unit includes the following connectors:

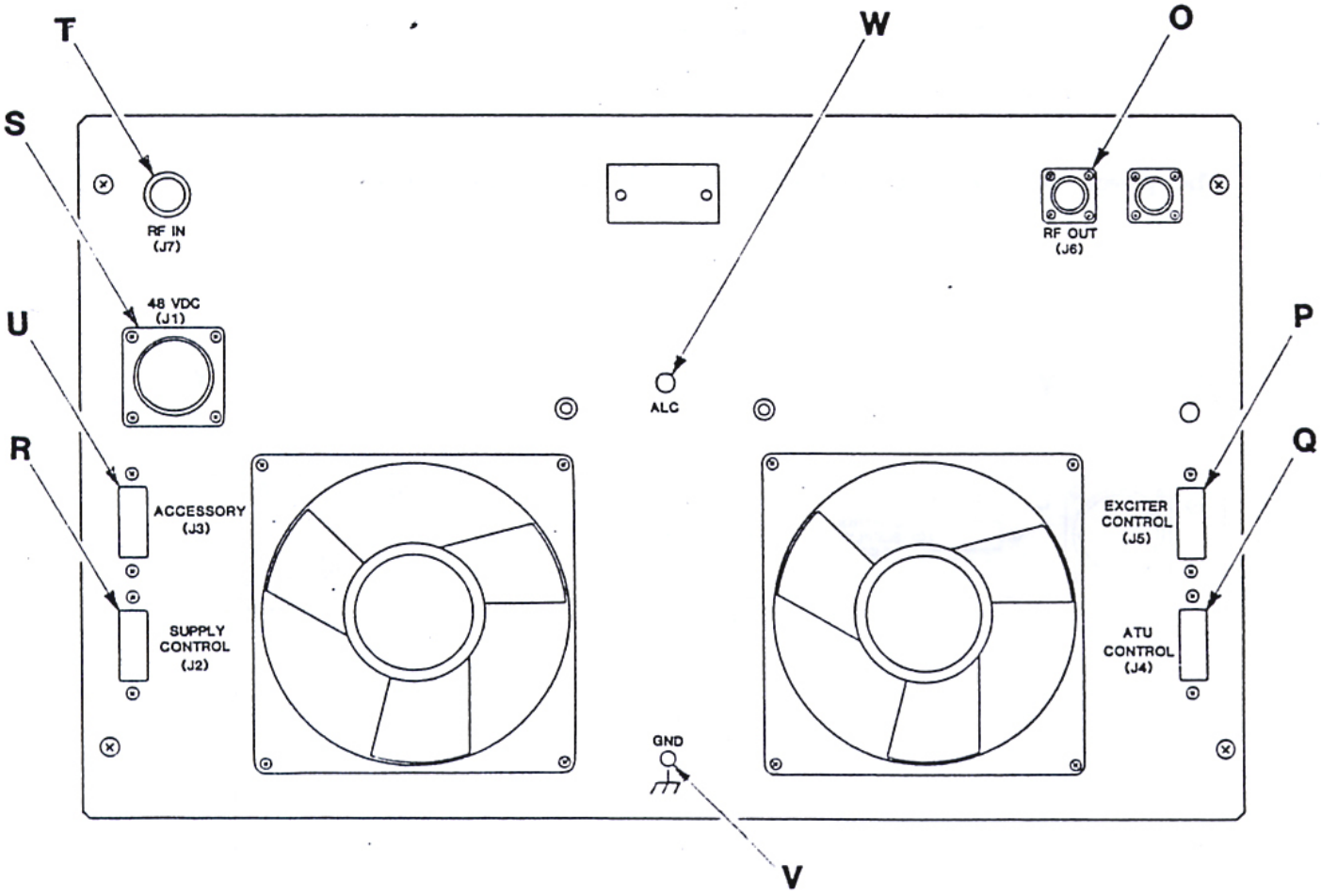


Figure 3. Rear Panel, Amplifier Unit

O. The RF OUT - a standard type N connector - may be connected to an antenna or to an automatic antenna tuner.

P. The EXCITER CONTROL connector is a D-type that connects to the antenna tuner connector on the exciter.

Q. The ATU CONTROL connector is a D-type that connects to an automatic antenna tuner.

R. The SUPPLY CONTROL connector is a D-type that connects to the corresponding connector on the power supply providing "remote" ON/OFF switching of the power supply unit.

S. The 48V DC input connector provides connection between the 48V DC power source and the power amplifier.

T. The RF IN is a standard BNC connector that is connected to the exciter antenna connector.

U. The accessory connector is not used.

V. Chassis ground.

1.2.2 **The power supply unit includes the following connectors:**

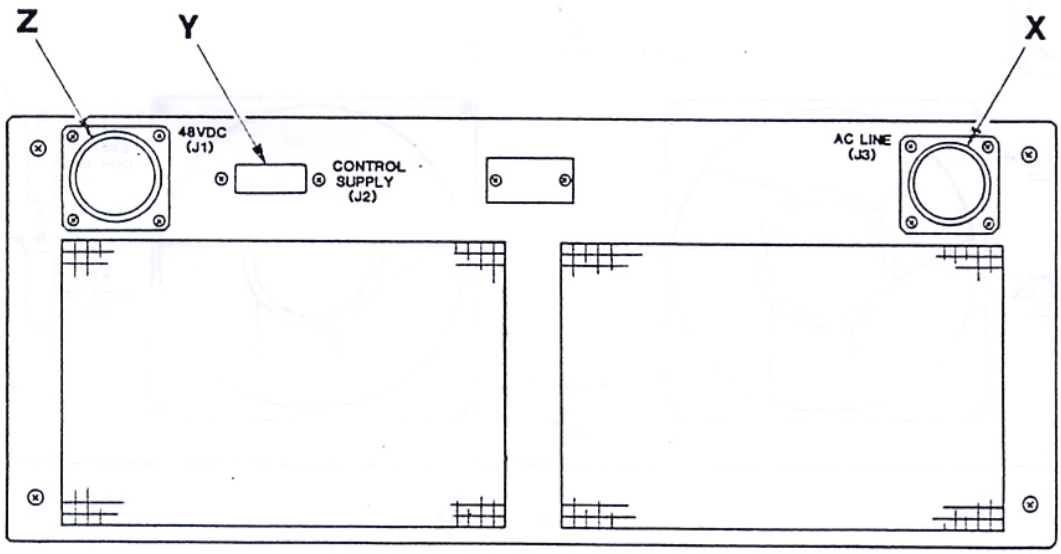


Figure 4. Rear Panel, Power Supply Unit

X. The LINE input connector enables connection to a 115 VAC or 220 VAC power source.

Y. The SUPPLY CONTROL connector connects to the corresponding connector on the MICOM 1000 power amplifier providing remote on/off switching of the power supply unit.

Z. The 48V DC connector provides connection to the 48V DC input on the power amplifier.

2. OPERATING NOTES

The MICOM 1000 can be considered an "extension" of its exciter (transmitter/receiver) and as such, the operation is controlled by - and described as part of - the exciter operation.

To a major degree, the MICOM 1000 is transparent to the operator of the exciter, however, the following should be noted:

A) The exciter will have full control over the antenna tuner when the power supply unit is turned off or when in the BYPASS mode of operation.

B) The MICOM 1000 will adjust its output power to within safe limits in case of excessive heatsink temperature or VSWR independent upon the exciter drive level.

C) The MICOM 1000 will automatically select the particular harmonic filter corresponding to the frequency entered on the exciter. Following selection of a filter, the MICOM 1000 will initiate a tune cycle on the automatic antenna tuner. This tune cycle will be intiated whether or not an antenna tuner is connected. Without an antenna tuner, the MICOM 1000 will "tune-out" in approximately one second. With an antenna tuner connected, the tuning time is entirely determined by the antenna tuner itself.
During the tune cycle the TX LED on the amplifier unit is lit.

D) The BYPASS mode is selected whenever:

   a) The VSWR is >4:1.
   b) The HARMONIC FILTER is inoperative.
   c) The selected frequency is less than 4 MHz and the system must comply with FCC rules.

In cases a) and b), the BYPASS RESET switch will return the MICOM 1000 to normal operation.
In case c) the BYPASS RESET SWITCH is ignored.

In BYPASS MODE of operation, the exciter will transmit at full power.

MICOM 1000
SYSTEM INTERCONNECT

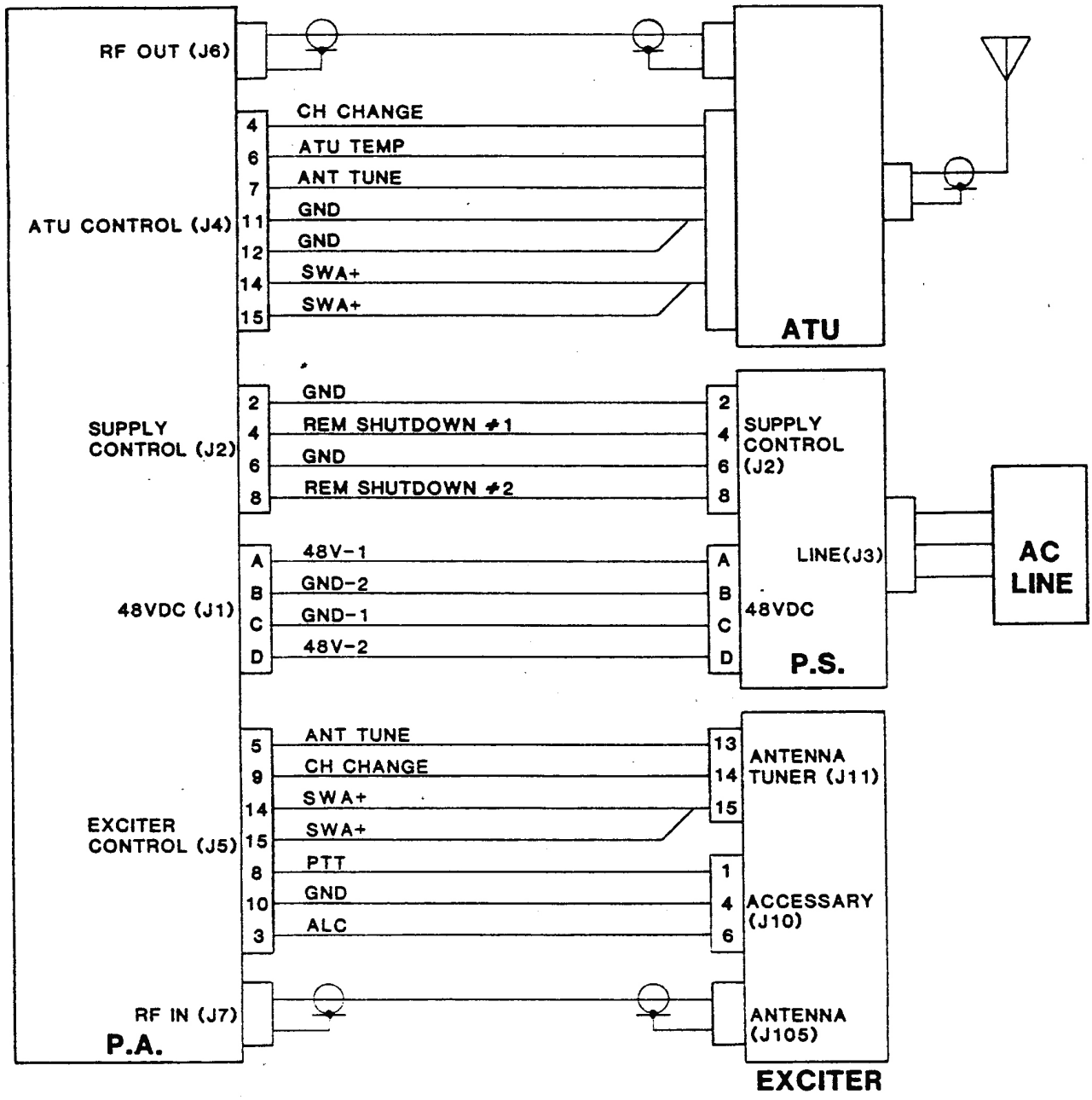


FIGURE 5

FUNCTIONAL DESCRIPTION

1. INTRODUCTION

This chapter describes the function of the various printed circuit boards that comprise the MICOM 1000. It starts with a general description based upon the block diagram after which a more detailed circuit description follows.

2. GENERAL DESCRIPTION

The block diagram, (Fig. 1), illustrates the operation of the MICOM 1000 power amplifier.

The RF input signal (10 W) from the Exciter after being routed throught the BYPASS relays, is applied to the 40W P.A. driver in which the signal is amplified and split into four signals (approximately 10W each) that drive the four 300W POWER AMPS in the two 500W power modules (#1 and #2).

Each 300 W POWER AMP contains circuitry to monitor temperature, In case of overtemperature a signal (TEMP) is applied to the controller and the drive power is reduced. This reduces the final output power to a safe operating level. Overtemperature is indicated on the front panel status display. Each 300 W POWER AMP also contains circuitry to monitor the gain balance of a transistor pair. In case of an unbalance, information is routed to the front panel where LED's pinpoint the faulty module on the STATUS display.

The output from each 300 W POWER AMP is combined to yield the 1000 W output power in the OUTPUT POWER COMBINER.

From the OUTPUT COMBINER, the signal is routed to a "bank" of 13 low pass filters (HARMONIC FILTER/VSWR DET.). Selection of a particular filter is done by measuring the frequency of the exciter input signal.

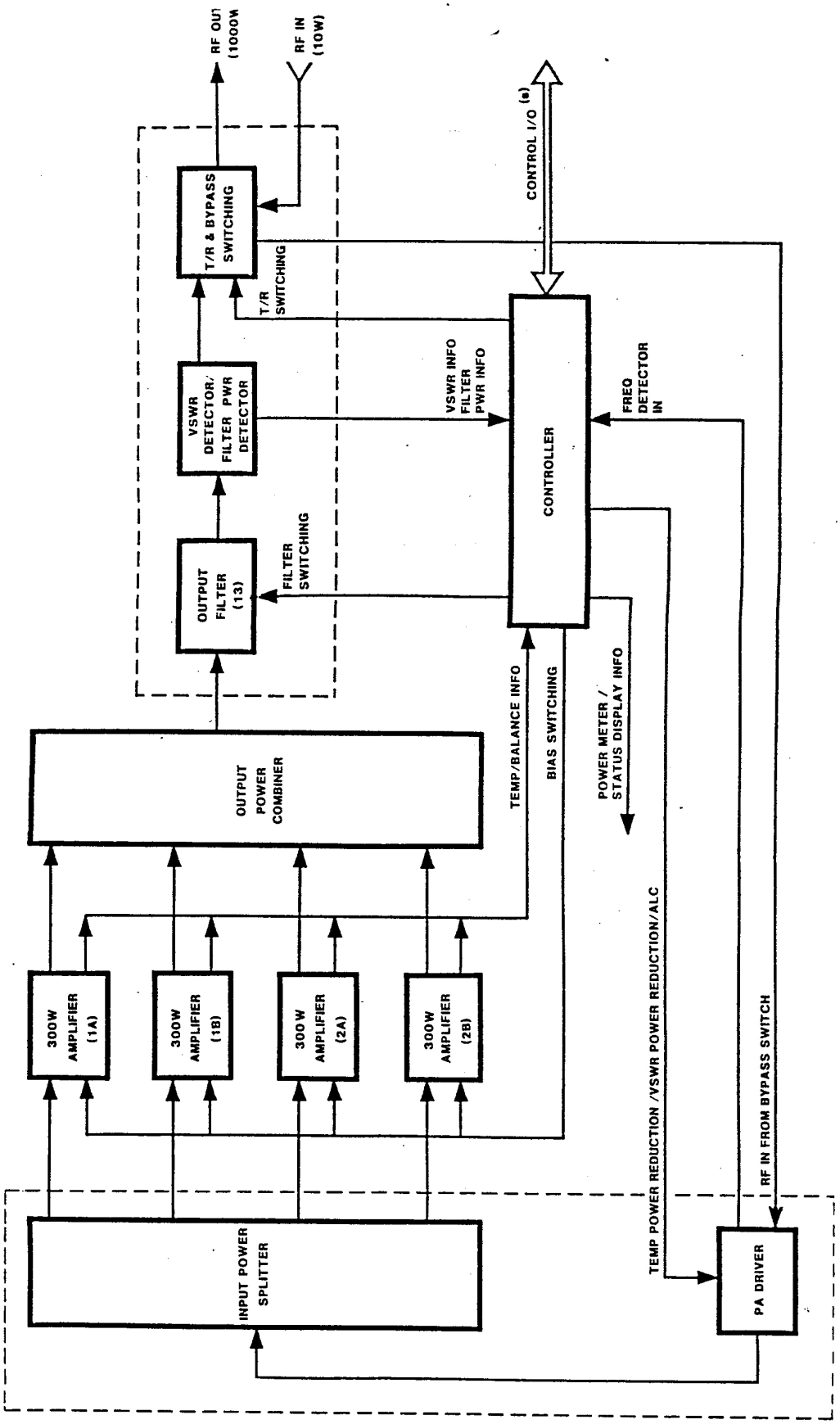

RF OUT (1000W)
RF IN (10W)
CONTROL I/O (8)
T/R & BYPASS SWITCHING
T/R SWITCHING
VSWR DETECTOR/ FILTER PWR DETECTOR
VSWR INFO FILTER PWR INFO
CONTROLLER
FREQ DETECTOR IN
OUTPUT FILTER (13)
FILTER SWITCHING
OUTPUT POWER COMBINER
TEMP/BALANCE INFO
BIAS SWITCHING
POWER METER / STATUS DISPLAY INFO
300W AMPLIFIER (1A)
300W AMPLIFIER (1B)
300W AMPLIFIER (2A)
300W AMPLIFIER (2B)
TEMP POWER REDUCTION /VSWR POWER REDUCTION/ALC
RF IN FROM BYPASS SWITCH
INPUT POWER SPLITTER
PA DRIVER

FIGURE 1

A VSWR DETECTOR measures forward and reflected power.

The VSWR is monitored and in case of excessive VSWR the power is reduced or ultimately (FOR VSWR >4:1) the BYPASS mode of operation is selected.

3. DETAILED CIRCUIT DESCRIPTION

3.1 DRIVER / ALC

The schematic of the DRIVER/ALC is shown in Figure 4.5.

The DRIVER requires 48V to operate the output FET (Q2). In addition, a regulated 5V provides a stable reference for biasing the FET. Since regulating the bias of a FET provides an easy means of turning the FET on and off, a transistor, Q1, has been added for the purpose of bias switching (keying). The normal input drive level of 10 W is attenuated in a resistive attenuator R3-11, R14 to a level suitable for driving Q2 to an output level of 40W. L2, C3, R 16,17 form a frequency compensation circuit that enables the drive signal to increase slightly at higher frequencies to compensate any roll-off in the circuitry that follows.

T1 thru T5 form a 4:1 transformer/power splitter. T1,2 is a balanced to unbalanced 4:1 transformer that provides two out-of-phase signals to T4 and T5 respectively. T4 and T5 split each of these signals into two, equal level, in phase signals that drive the two 300 watt amplifier pairs.

Pin diode, CR1, acting as a variable resistor is used for ALC. CR1 is normally turned on by a voltage applied to J1 pin 4 (ALC) and permits the RF input signal to pass to Q2 with very low attenuation. Lowering the ALC voltage increases the resistance of CR1 and attenuates the RF signal to Q2.

3.2 300 WATT POWER AMPLIFIER

The schematic of the 300 Watt POWER AMP is shown in Figure 4.6.

The amplifier consists of 4 MOS FET transistors, Q4, 5, 6, and 7. The transistors are combined to form two push/pull pairs (Q4, 5, and Q6, 7) that are driven in parallel.

The input signal is split into two 180 degree out-of-phase signals in the Input Power Splitter comprised of T1 and T2. The two transformers form a 4:1 broadband transformation network with balanced outputs.

In the gate of each FET is a resistive/capacitive matching network consisting of two parallel connected 4.7 ohm, 1/2 watt resistors, a 10 ohm, 2 W shunt resistor and a 1000pf series capacitor. The matching network assures that T1 and T2 are correctly terminated over the entire frequency range and that the input signal to each gate is compensated for high frequency roll-off due to the large input capacitance of the FET.

The output from each FET in a push/pull pair is combined in a push/pull combiner (T3, 5 and T4, 6). The supply current is fed to the centertap of T3 and T4 through drain chokes L1 and L2. R76 and 77 are part of the push/pull combiners and serve the purpose of dissipating power in case of unbalance between transistor in a push/pull pair. During normal operation, only minor unbalance occurs and little power is dissipated. If, however, one FET in a push/pull pair fails, one half of the power output from the other FET will be dissipated in the resistors. At 300 watt total output, or 75 Watt per FET, the maximum dissipation will be 37.5 Watt.

Failure indication in the case of a single transistor failing is accomplished by rectifying the voltage across the resistors using CR17, 19.

The output from each push/pull pair of FETs (Q4, 5, and Q6, 7) is combined in the output power combiner T7, T8. Combining the 150 watt output from each push/pull pair results in a maximum of 75 watt being dissipated in R74 in case one whole pair fails. Imbalance is detected in CR18.

Each of the three rectified "imbalance" voltages are fed to a comparator, U1, that drives LED indicators located on the printed circuit board and provides an open collector balance indication output for the module BALANCE LED on the amplifier unit front panel.

Each FET is biased by applying a DC voltage to its gate. This DC voltage is derived from an 8V regulated supply (U3). Following the Bias Regulator is an emitterfollower, Q3. The output voltage of Q3 can be adjusted over a small range by R42 to compensate for gain differences between 300 watt amplifiers. Adjusting the gain by adjusting the bias current is effective only at low bias current levels (Class B or C) and is done only for special applications.

The output voltage from Q3 is applied to the bias adjustment network. Each FET gate voltage is controlled by a potentiometer (R44, 47, 60,64).

The standard bias current is 800 mA per FET.

Thermal protection is accomplished by a thermistor (RT2) mounted on the heatsink. The thermistor is part of a voltage divider network at the noninverting input to the comparator U2. Increased temperature decreases the resistance of RT2 thus decreasing the voltage at U2B, pin 7. When this voltage falls below the voltage at U2B, pin 6 the output U2B, pin 1 goes low. U2C is placed in parallel with U2B in order to increase the current sink capability of the TEMP output for driving an LED.

A low output from U2B/C turns on the TEMP LED on the MICOM 1000 front panel and notifies the microprocessor on the controller printed circuit board that power output must be reduced to a safe level.

RT2 also turns on the fan. The trip voltage for the fan is determined by R22,23. U2D, pin 13 goes high when the turn on temperature is reached. This turns on FETs Q1,2. Normally only one output is used from the 300 W power amplifier to control the fan - however two fans can be driven or, with jumper E1 installed - the current capability of the fan driver can be incresased.

3.3 OUTPUT COMBINER

The schematic of the output COMBINER is shown in Figure 4.7.

The output from Module #1 is combined in the in-phase combiner T1 while the output from Module #2 is combined in the in-phase combiner T3. Power resistors R1 and R2 dissipate the difference in power going in to T1 and T3 respectively.

The resulting signal is combined, out-of-phase in combiner T4. R3 dissipates the difference in power going into T2, 4. R1, 2, 3 are mounted on a heatsink.

RT1 is a thermistor that forms part of the bias network of a FET (Q2) located on the POWER DISTRIBUTION printed circuit board. RT1 is mounted on the heatsink adjacent to R3.

When the heatsink temperature exceeds a certain value, both fans will be turned on by Q1 to assure that air is forced across the heatsink in cases where the fans are not activated by the 300w power amplifier.

3.4 HARMONIC FILTER/VSWR DET.

The schematic of the HARMONIC FILTER/VSWR det. is shown in Figure 4.8.

Using high power relays at the input and output, one of 13 filters can be selected. The filters are all eliptic type, low pass filters.

The signal from the filter is routed through the VSWR detector before being applied to the load. T1 is the pick-up transformer that creates a voltage across R7 and R6 proportional to the forward and reflected current respectively. Balance adjustment is performed using C4 and C9. CR5 and CR6 are detectors.

The forward (VF) and reflected (VR) voltage is routed to the controller printed circuit board where it serves 3 functions

A.) Provide VSWR information to the microprocessor.
B.) Provide ALC control (VF only).
C.) Provide forward and reflected power indication at the front panel meter

3.5 CONTROLLER

The schematic of the CONTROLLER is shown in Figure 4.3.

The CONTROLLER combines various inputs to generate control signals used for display and control of the driver and 300 W power amplifiers.

Forward (VF) and Reverse (VR) voltage from the VSWR detector is buffered by U3A,D and routed to the front panel meter as well as to the ALC amplifier, U3, B, C.

R4 and R8 serve to calibrate the front panel meter.

The ALC amplifier is comprised a non-inverting amplifier U3,C and an inverting amplifier U3,B with a gain of R56/R57 or approximately 18. The ALC action starts at a certain threshold determined by the threshold "voltage at U3 B, pin 5. R54 and potentiometers R48-51 form adjustable voltage dividers that determine this threshold voltage. A lower threshold voltage corresponds to lower output power.

Q3 serves as a buffer driving the pin diode, CR1 on the Driver/ALC. The ALC action is initiated with the detection of RF power in the VSWR detector resulting in an increase in the voltage VF. If VF exceeds the threshold voltage at U3B, pin 5 the output of U3B goes low which in turn lowers the output voltage from the emitter follower Q3. This lowers the current through pin diode attenuator CR1 on the DRIVER/ALC and increases the attenuation of the input signal to Q2 (See 3.1) resulting in a reduction in output power.

U6 is a comparator in which the difference between the forward and reflected voltage (VF, VR) is measured, U6D detects the presense of RF power whether forward or reflected. U6 A,B,C will trigger at a specific VSWR, determined by the resistive divider network comprised of R33, 34, R37, 38, R41, 42. The information is sensed by the microprocessor, U5, and will result in selection of the appropriate ALC level by controlling Q11, Q12.

With a VSWR less than 2:1, Q11 and Q12 are off and ALC is adjusted with R51. Q12 turns on when the VSWR is >2:1, whereby R50 is put in parallel with R51 and can be adjusted for the desired lower level. Q11 turns on - and Q12 turns off - at a VSWR of >3:1. Now R49 is put in parallel with R51 and is used to adjust for a lower output level. At a VSWR of >4:1, the BYPASS mode of operation is selected.

The BYPASS mode is also selected if the FAIL input to the CONTROLLER (J4-3) is low signifing that a problem exist in a HARMONIC FILTER or if the frequency measured by the microprocessor in response to a channel change falls outside the range of 1.6 to 30 MHz.

In the BYPASS mode, Q4 is turned on which turns on the front panel BYPASS LED. Q5 is turned off whereby the exciter is returned to full power operation. The T/R relay is switched to receive mode and the amplifier unit is bypassed entirely. A low on the RESET input (J5-2) from the front panel BYPASS RESET switch re-initializes the microprocessor. The same happens when a channel change request is initiated. The CONTROLLER contains circuitry to assure that the operation of the exciter can continue if the supply voltage to the amplifier unit is turned off.

13.8V DC is applied from the exciter whenever the exciter is turned on. If the amplifier unit is turned off, Q9 will transfer CHAN CHANGE information from the exciter to the ATU, because Q7 is turned off (no 5V) and Q8 is turned on (no high output from microprocessor).

Q6 is turned off (no high output form microprocessor) which enables the TUNE COMMAND from the ATU to be applied to the exciter in response to the CHAN CHANGE signal.

Selecting of a particular harmonic filter is accomplished by measuring frequency. The following sequence of events take place:

a. Upon changing frequency, the exciter sends a CHANNEL CHANGE pulse to the controller (J2, pin 2). J7, pin 2 is normally at a low level whereby Q2 is turned off. The channel change pulse is high level causing Q2 to turn ON. This causes an interrupt in the microprocessor.

b. In response to the interrupt, the microprocessor returns a TUNE COMMAND to the exciter by turning Q6 on. Diode CR14 prevents this command from reaching the automatic antenna tuner.

c. In response to the TUNE COMMAND, the exciter transmits 10 watt tune power. The low signal is attenuated/limited in a network comprised of R12, 13, CR6, 7, 8 with C7 providing high frequency compensation. It is then divided by 500 to provide an input frequency range that can be measured by the microprocessor.

d. After the microprocessor has determined the frequency and filter range it outputs a 4 bit binary code, FILTER SELECT bit 0-3, to the 1 of 16 DECODER, U4, whereby a filter is selected. If due to a malfunction an "out of range" frequency is measured, the microprocessor selects bypass mode. U1, 2 are relay drivers.

e. A 25 ms CHANNEL CHANGE pulse is sent to the automatic antenna tuner by turning off Q8.

f. The microprocessor awaits the antenna tuner response (TUNE COMMAND) by monitoring the PTT input. Following the TUNE COMMAND from the antenna tuner as indicated by PTT IN (J7, pin 8) being a low level, the microprocessor terminates the channel change pulse and returns to its idle state.

   If a TUNE COMMAND has not been received in one second the microprocessor returns to its idle state.

3.6 POWER DISTRIBUTION

The schematic of the Power Distribution circuit is shown in Figure 4.4.

The output from each of the two 48V supplies are combined through a resistor/diode network R2-9, CR4,5. In the event one power supply malfunctions, the DRIVER/ALC as well as the controller will still be operational.

Regulator U1 provides a stable 5V output. Q1 provides a stable voltage of approximately 21V for the ALC amplifiers on the CONTROLLER and also serve to reduce the input voltage to U1 to a safe limit.

Large unwanted transients on the 48V supply line caused by current limiting, are prevented from appearing on the 5V supply through the use of CR1 and C4 and on the 21V supply line through the use CR2 and C5. If the voltage on the emitter of Q1 momentarily drops to zero, both CR1 and CR2 will be back biased and the charge stored in C4, will hold the input to U1 long enough to prevent a transient in the 5V supply line while only a minor and harmless change in the 21V supply line will be observed.

Thermistor RT1 from the OUTPUT COMBINER is part of the bias network for Q2. With increasing heatsink temperature, RT1 will decrease in resistance, thus turning on Q2 whereby both fans turn on.

3.7 POWER SUPPLY

The schematic of the Power Supply is shown in figure 4.9.

The power supply comprises two identical switching power supplies that each supply 48V DC to one half of a 500 W power amplifier module, i.e. 300 W module #1A and #2A are fed from one supply and 300 W module #1B and #2B are fed from the other.

The line voltage is routed through a 50A circuit breaker that also serves as an AC ON/OFF switch. When turned on, front panel LED, CR3, will be lit by rectified AC voltage.

Front panel LEDs CR1, 2 indicate the presence of 48V DC. They will be lit whenever the INHIBIT/REMOTE SHUTDOWN input to the supply is high whereby the power supply is activated. The INHIBIT/REMOTE SHUTDOWN is routed through the supply control connector J2, to the power amplifier supply control connector J2 and from there to the power amplifier ON/OFF switch.

Specification (each supply):

AC input:	115V AC/230V AC switchable
DC output:	48V DC, 25 amp Adjustable +/- 2V min
Current limit:	29A typical

Fuse requirements (each supply):

115V AC:	20A (F1)
230V AC:	12A (F1)

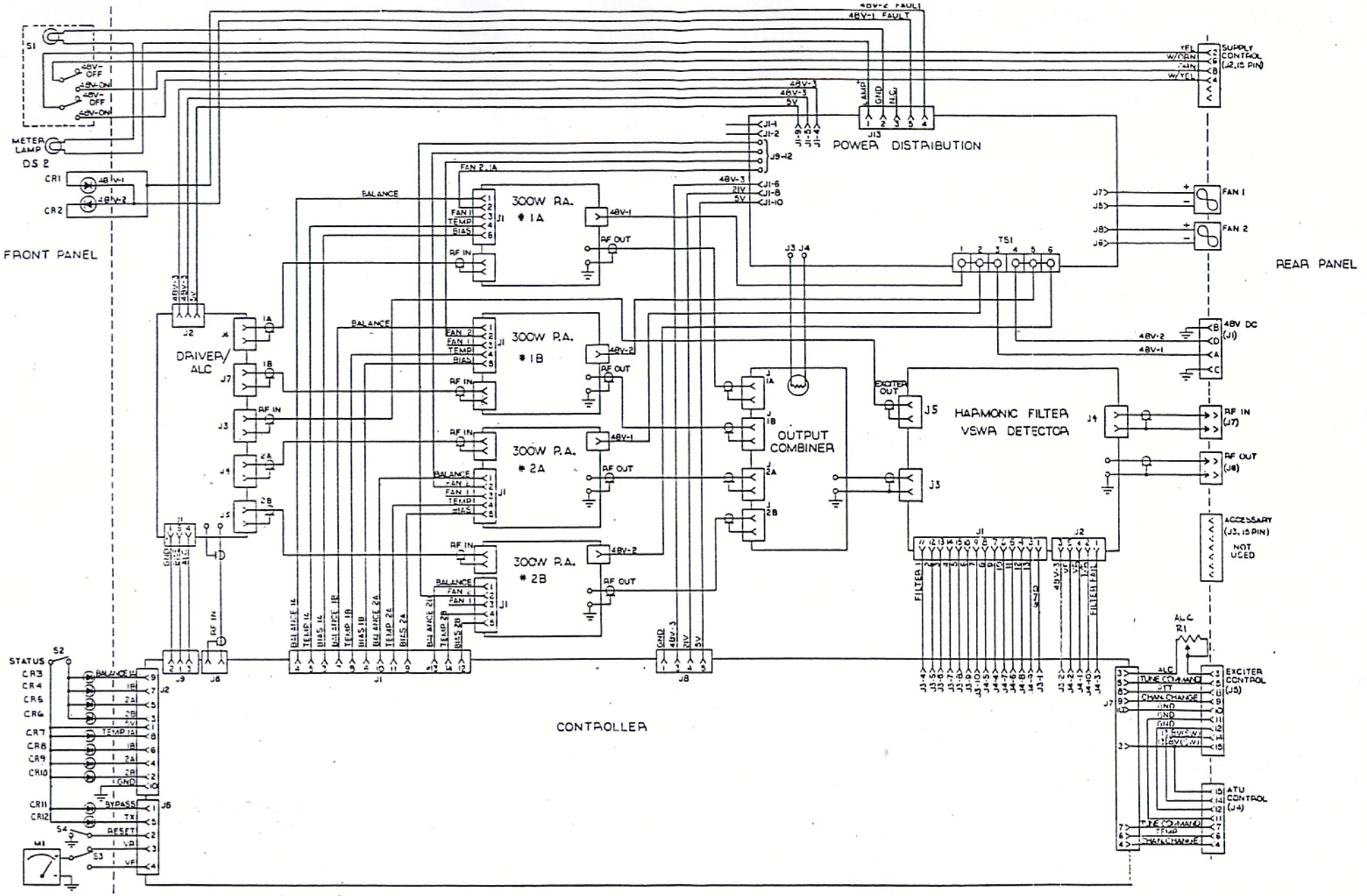
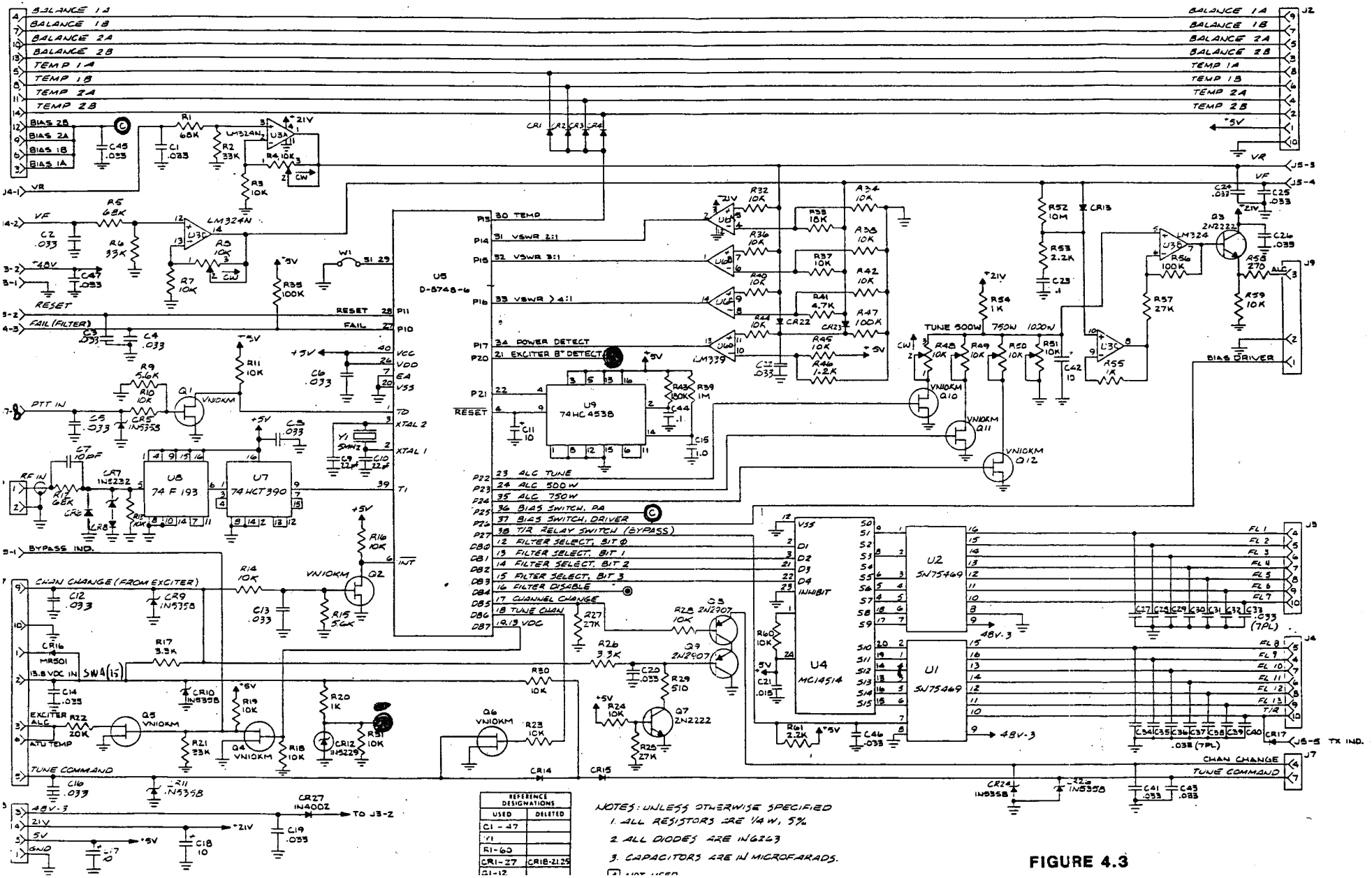


FIGURE 4.2

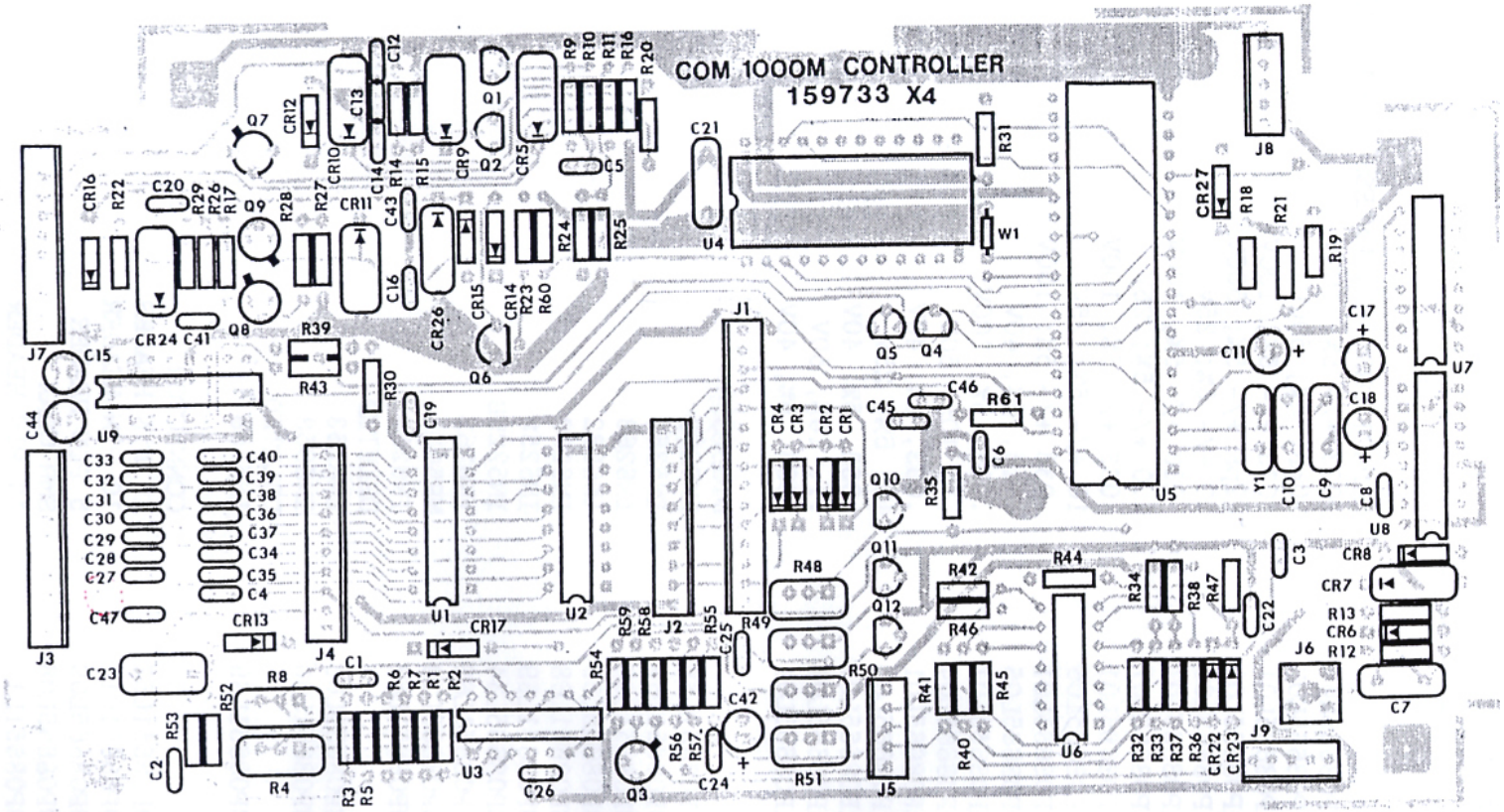
INTERCONNECT WIRING DIAGRAM



REFERENCE DESIGNATIONS	
USED	DELETED
C1 - 47	
Y1	
R1-60	
CR1-27	CR18-21,25
Q1-12	

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE 1/4 W, 5%
2. ALL DIODES ARE IN6263
3. CAPACITORS ARE IN MICROFARADS.

FIGURE 4.3



CONTROLLER

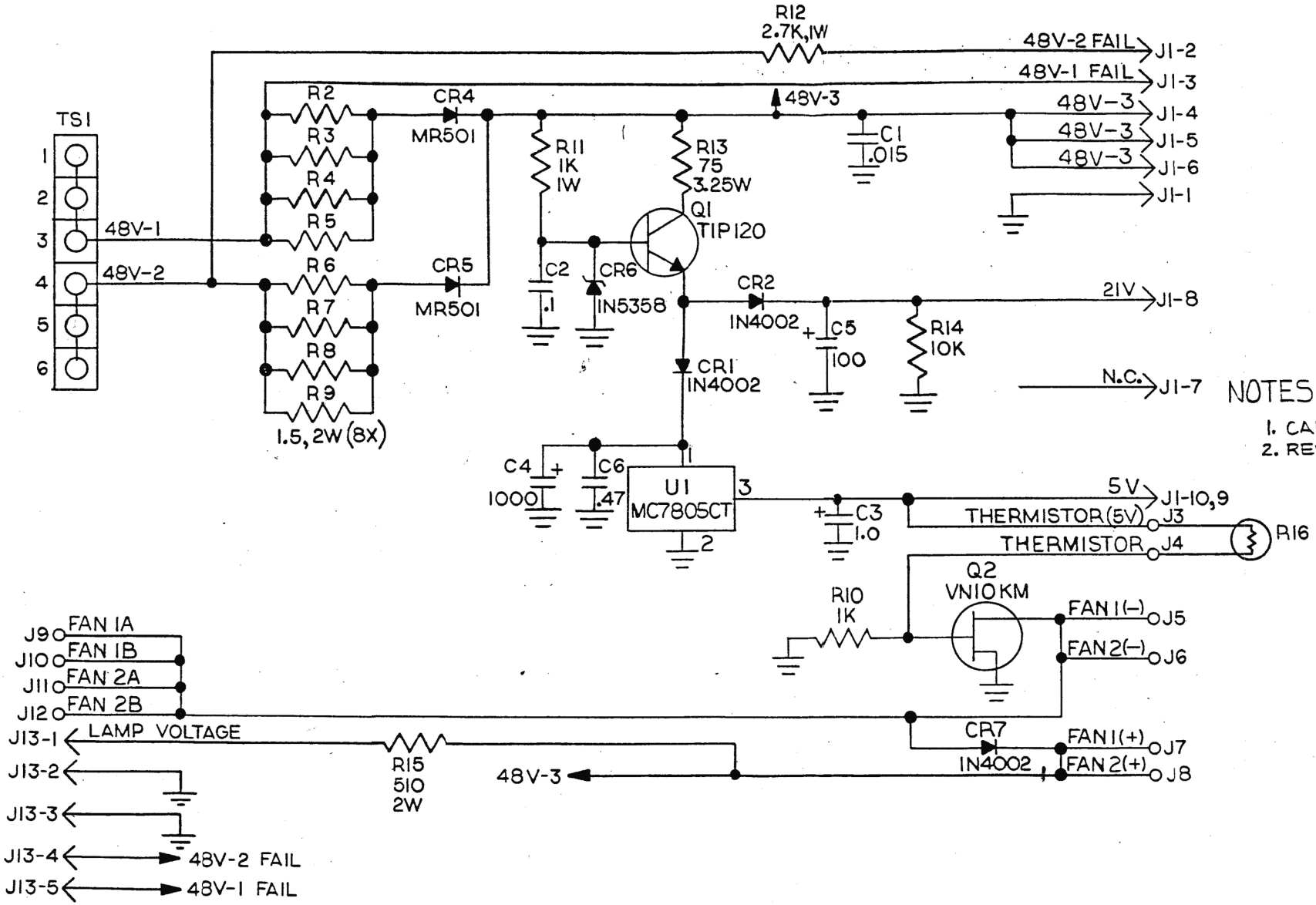
Reference Symbol	Motorola Part No.	Description
		CAPACITORS: uF, UNLESS OTHERWISE STATED
C1-C6	21P08665L01	.033 +/- 5%; 100V
C7	21P08665L02	10pF, 5%; 500V
C8	21P08665L01	.033 +/- 5%; 100V
C9, C10	21P08665L03	22pF +/- 5%; 500V
C11	21P08665L06	10 +/- 5%; 25V
C12-C14	21P08665L01	.033 +/- 5%, 100V
C15	21P08665L07	1.0 +/- 5%; 25V
C16	21P08665L01	.033 +/- 5%; 100V
C17, C18	21P08665L06	10 +/- 5%; 25V
C19, C20	21P08665L01	.033 +/- 5%; 100V
C21	21P08665L05	.015, 5%, 40V
C22	21P08665L01	.033, 5%, 100V
C23	21P08665L04	.1, 10%, 50V
C24-C41	21P08665L01	.033, 5%, 40V
C42	21P08665L06	10, 5%, 25V
C43	21P08665L01	.033, 5%, 40V
C44	21P08665L04	.1, 10%, 50V
C45-C47	21P08665L01	.033, 5%, 40V
		DIODES:
CR1-CR4	48P08651L68	IN6263
CR5	48P08651L69	IN5358
CR6	48P08651L68	IN6263
CR7	48P08665L35	IN5232
CR8	48P08651L68	IN6263
CR9-CR11	48P08651L69	IN5258
CR12	48P08665L34	IN5229B
CR13-CR15	48P08651L68	IN6263
CR16	48P08665L33	MR501
CR17	48P08651L68	IN6263
CR18-CR21		DELETED
CR22, CR23	48P08651L68	IN6263
CR24	48P08651L69	IN5358
CR25		DELETED
CR26	48P08651L69	IN5358
		CONNECTOR:
J1	09P08651L57	15 PIN HEADER
J2-J4	09P08651L11	10 PIN HEADER
J5	09P08665L09	5 PIN HEADER
J6	09P08665L08	SMB COAX
J7	09P08651L11	10 PIN HEADER
J8, J9	09P08665L09	5 PIN HEADER

CONTROLLER FLN 4513A (con't)

Reference Symbol	Motorola Part No.	Description
		TRANSISTOR:
Q1, Q2	48P08651L70	FET, VN10KM
Q3	48P08651L72	2N2222
Q4-Q6	48P08651L70	FET, VN10KM
Q7	48P08651L71	2N2222
Q8, Q9	48P08651L72	2N2907
Q10-Q12	48P08651L70	FET, VN10KM
		RESISTORS: OHMS 1/4W +/- 5% UNLESS OTHERWISE STATED
R1	06P08651L27	68K
R2	06P08651L26	33K
R3	06P08651L61	10K
R4	06P08665L31	VARIABLE 10K
R5	06P08651L27	68K
R6	06P08651L26	33K
R7	06P08651L61	10K
R8	06P08665L31	VARIABLE 10K
R9	06P08665L22	5.6K
R10, R11	06P08651L61	10K
R12	06P08651L27	68K
R13, R14	06P08651L61	10K
R15	06P08665L22	5.6K
R16	06P08651L61	10K
R17	06P08665L20	3.3K
R18, R19	06P08651L61	10K
R20	06P08665L17	1K
R21	06P08651L26	33K
R22	06P08651L24	20K
R23, R24	06P08651L61	10K
R25	06P08651L25	27K
R26	06P08665L20	3.3K
R27	06P08651L25	27K
R28	06P08651L61	10K
R29	06P08665L16	510
R30-R32	06P08651L61	10K
R33	06P08651L23	18K
R34	06P08651L61	10K
R35	06P08651L28	100K
R36-R38	06P08651L61	10K
R39	06P08652L65	1M
R40	06P08651L61	10K
R41	06P08665L21	4.7K
R42	06P08651L61	10K
R43	06P08651L29	180K

CONTROLLER FLN 4513A (con't)

Reference Symbol	Motorola Part No.	Description
R44, R45	06P08651L61	10K
R46	06P08665L18	1.2K
R47	06P08651L28	100K
R48-R51	06P08665L31	VARIABLE, 10K
R52	06P08665L30	10M
R53	06P08665L19	2.2K
R54, R55	06P08665L17	1K
R56	06P08651L28	100K
R57	06P08651L25	27K
R58	06P08665L15	270
R59, R60	06P08651L61	10K
		INTEGRATED CIRCUITS:
U1, U2	51P08665L40	SN75469
U3	51P08665L36	2N2222
U4	51P08665L38	MC14514BCP
U5	51P08665L39	D-8748-6
U6	51P08665L37	LM339
U7	51P08665L42	74HCT390
U8	51P08665L41	74F193PC
U9	51P08665L43	74HC4538
		JUMPERS:
W1	29P08665L14	.250 SPACING
		CRYSTAL:
Y1	48P08665L12	5MHz



NOTES: U.O.S.

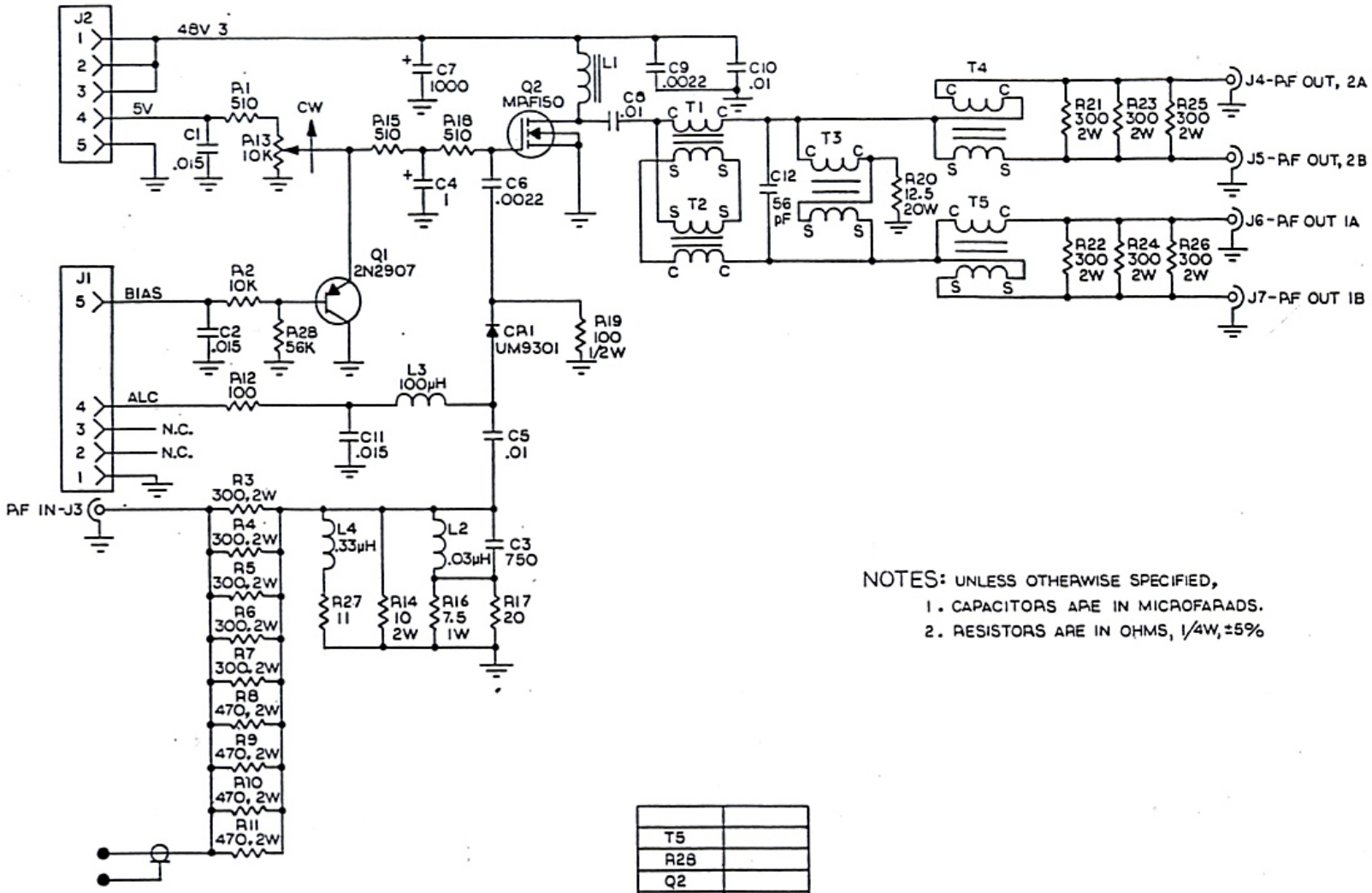
1. CAPACITORS ARE IN MICROFAR
2. RESISTORS ARE IN OHMS, 1/4 W

FIGURE 4.4

POWER DISTRIBUTION FLN 4512A

Reference Symbol	Motorola Part No.	Description
		CAPACITORS: uF UNLESS OTHERWISE STATED
C1	21P08653L04	.015 +/- 5%; 40V
C2	21P08653L05	.1 +/- 5%; 40V
C3	21P08653L07	1.0 +/- 5%; 25V
C4	21P08653L02	1000 +/- 5%; 16V
C5	21P08653L03	100 +/- 5%; 40V
C6	21P08653L06	.47 +/- 5%; 40V
		DIODES:
CR1, CR2	48P08651L67	IN4002
CR3		NOT USED
CR4, CR5	48P08653L21	MR501
CR6	48P08651L69	ZENER, IN5358
		CONNECTORS:
J1	28P08653L10	10 PIN HEADER
J3, J4	09P08653L11	BIFURCATED TERMINAL
J5-J12	43P08653L08	POST, .031x.062
J13	28P08653L09	5 PIN HEADER
TS1	28P08653L12	TERMINAL BLOCK 6 CONTACT
		TRANSISTORS:
Q1	48P08653L23	TIP 120, NPN
Q2	48P08651L70	VN0KM, FET
		RESISTORS: OHMS
R2-R9	06P08653L18	1.5 +/- 5%; 1/4W
R10	06P08653L16	1K +/- 5%; 1/4W
R11	06P08653L14	1K +/- 5%; 1W
R12	06P08653L15	2.7K +/- 5%, 1W
R13	06P08653L20	75 +/- 5%, 3.2W
R14	06P08653L17	10K +/- 5%, 1/4W
R15	06P08653L19	510 +/- 5%, 2W
R16	18P08653L24	THERMISTOR, 10K
		INTEGRATED CIRCUITS:
U1	51P08653L22	IC, MC7805CT
		HARDWARE:
		PRINTED CIRCUIT BOARD

DRIVER - ALC



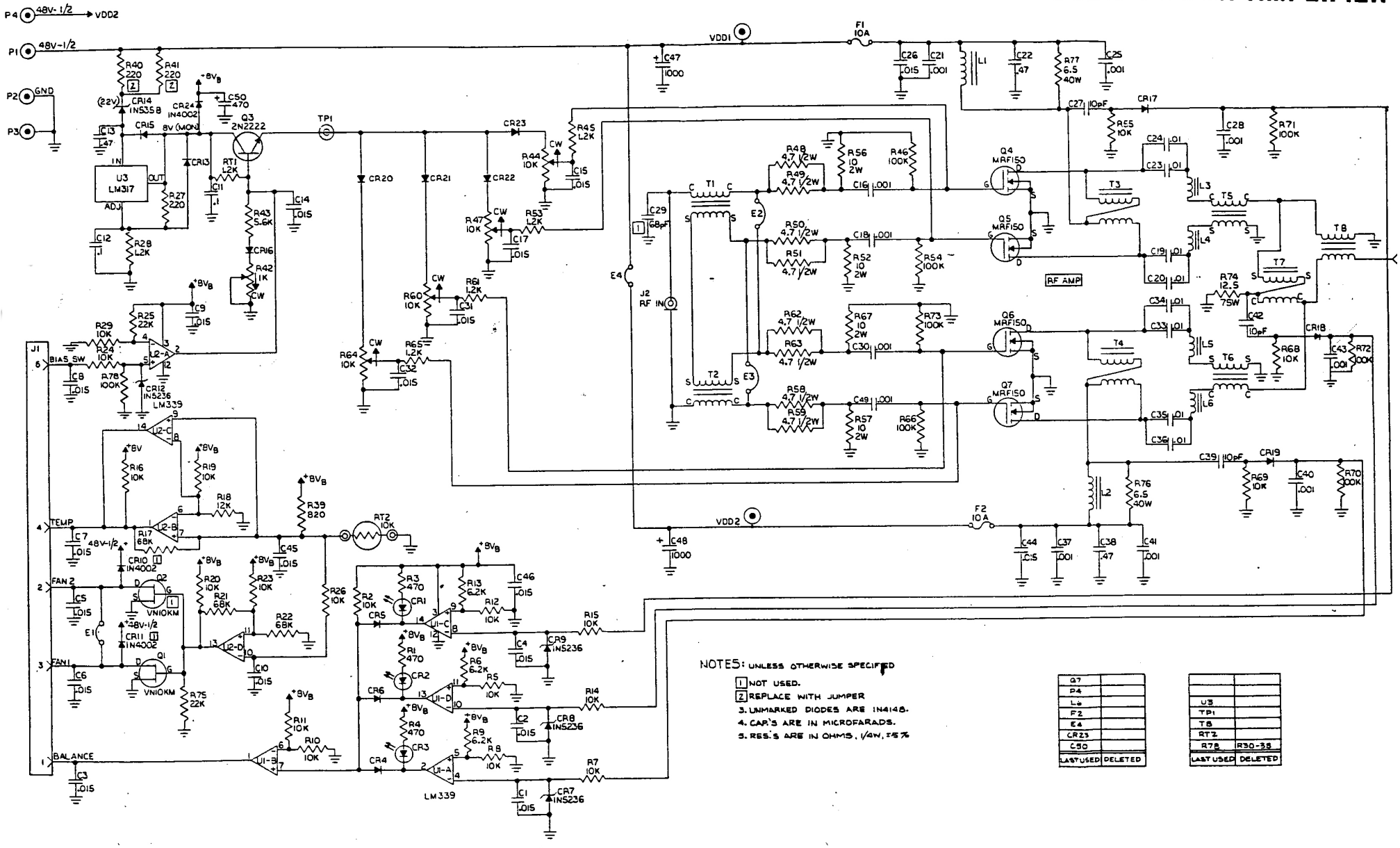
NOTES: UNLESS OTHERWISE SPECIFIED,
1. CAPACITORS ARE IN MICROFARADS.
2. RESISTORS ARE IN OHMS, 1/4W, ±5%

T5	
R28	
Q2	
L4	
J7	
CR1	
C12	
LAST USED	DELETED

FIGURE 4.5

Reference Symbol	Motorola Part No.	Description
		CAPACITORS: uF, UNLESS OTHERWISE STATED
C1, C2	21P08653L04	.015 +/- 5%; 40V
C3	21P08648L05	750pF +/- 5%; 300V
C4	21P08648L06	1.0 +/- 5%; 25V
C5	21P08648L03	.01 +/- 5%; 1KV
C6	21P08648L01	.0022 +/- 20%; 500V
C7	21P08648L04	1000 +/- 5%; 63V
C8	21P08648L03	.01 +/- 5%; 1KV
C9	21P08648L01	.0022 +/- 20%; 500V
C10	21P08648L03	.01 +/- 5%; 1KV
C11	21P08653L04	.015 +/- 5%; 40V
		DIODES:
CR1	48P08648L22	UM9301, PIN
		CONNECTORS:
J1, J2	28P08648L12	5 PIN HEADER
J3-J7	28P08648L11	SMB
		COILS:
L1	24P08648L10	COIL 12 TURNS
L2	24P08652L09	FERRITE CORE INDUCTOR
L3	24P08648L07	CHOKE: 100uH
L4	24P08648L08	CHOKE: .33uH
		TRANSISTORS:
Q1	48P08651L72	2N2907
Q2	48P08648L23	MRF150
		RESISTORS: OHM +/- 5%, 1/4W UNLESS OTHERWISE STATED;
R1	06P08665L16	510
R2	06P08651L61	10K
R3-R7	06P08648L18	300 +/- 5%; 2W
R8-R11	06P08648L19	470 +/- 5%; 2W
R12	06P08648L21	100
R13	06P08665L31	VARIABLE 10K
R14	06P08648L17	10 +/- 5%; 2W
R15	06P08665L16	510
R16	06P08648L14	7.5 +/- 5%; 1W
R17	06P08648L16	20 +/- 5%; 1W
R18	06P08665L16	510
R19	06P08648L13	100 +/- 5%; 1/2W
R20	06P08648L20	12.5
R21-26	06P08648L18	300 +/- 5%; 2W
R27	06P08648L15	11 +/- 5%; 1W
R28	06P08648L24	56K
		TRANSFORMER:
T1-5	25P08648L09	FERRITE CORE 8 TURNS

300W POWER AMPLIFIER

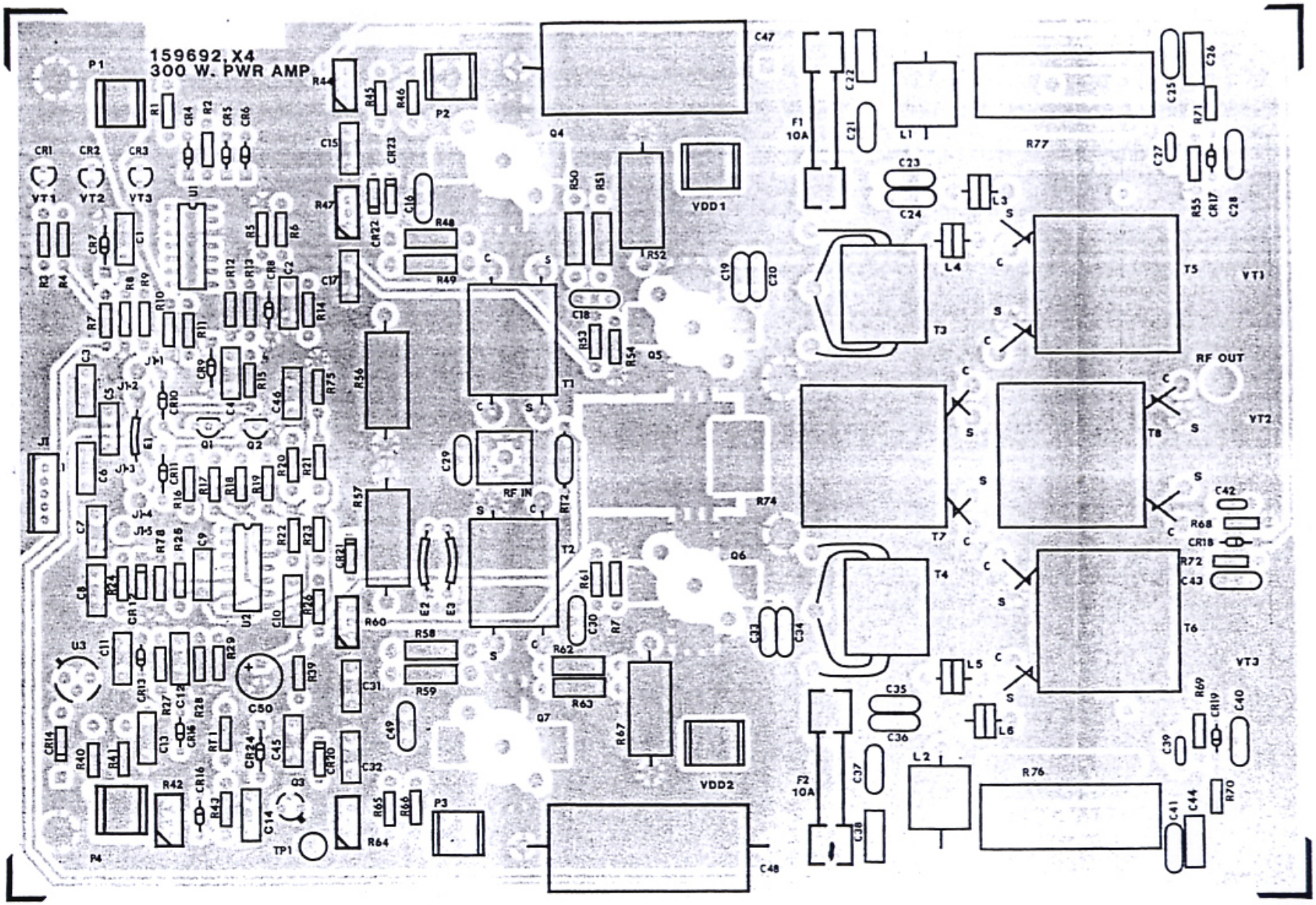


NOTES: UNLESS OTHERWISE SPECIFIED

1. NOT USED.
2. REPLACE WITH JUMPER
3. UNMARKED DIODES ARE IN4148.
4. CAP'S ARE IN MICROFARADS.
5. RES.'S ARE IN OHMS, 1/4W, ±5%

Q7	
P4	
L6	
F2	
E4	
CR23	
C50	
LAST USED	DELETED

U3	
TP1	
T8	
RT2	
R78	R30-38
LAST USED	DELETED

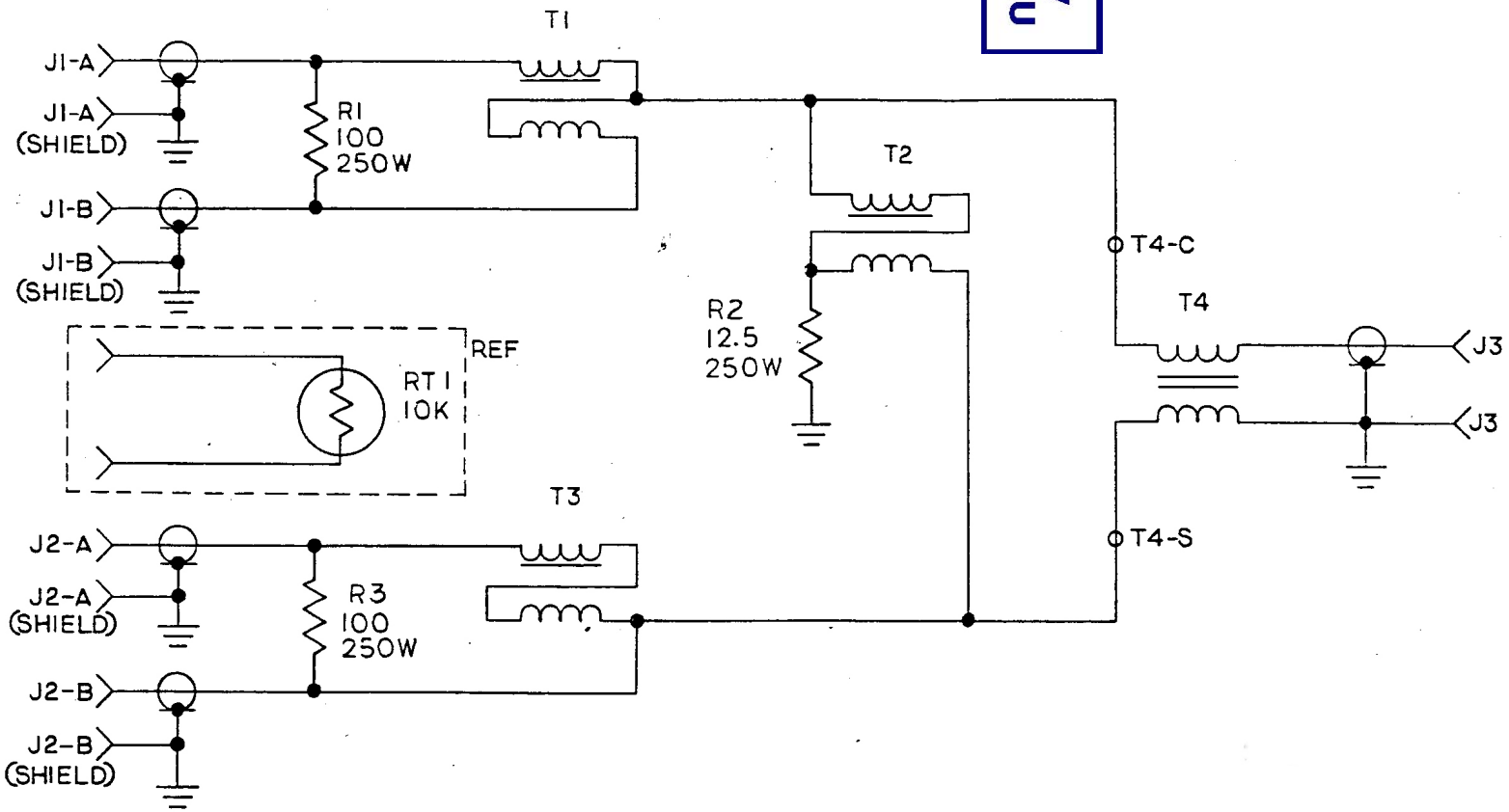


300 WATT POWER AMPLIFIER

Reference Symbol	Motorola Part No.	Description
		CAPACITORS: uF unless otherwise stated
C1-10	21P08652L06	.015 +/- 5%; 40V
C11, C12	21P08652L07	.1 +/- 5%
C13-C15	21P08652L06	.015 +/- 5%; 40V
C16	21P08652L02	.001 +/- 20% 500V
C17	21P08652L06	.015 +/- 5%: 40V
C18	21P08652L02	.001 +/- 20%; 500V
C19, C20	21P08652L03	.01 +/- 10%; 500V
C21	21P08652L02	.001 +/- 20%; 500V
C22	12P08652L08	.47 +/- 5%; 40V
C23, C24	21P08652L03	.01 +/- 10% 500V
C25	21P08652L02	.001+/- 20%; 500V
C26	21P08652L06	.015 +/- 5%; 40V
C27	21P08652L01	10pF +/- 5%; 500V
C28	21P08652L02	.001 +/- 20%; 500V
C29		NOT USED
C30	21P08652L02	.001 +/- 20%; 500V
C31, C32	21P08652L06	.015 +/- 5%; 40V
C33-C36	21P08652L03	.01 +/- 10%; 500V
C37	21P08652L02	.001 +/- 20%; 500V
C38	21P08652L08	.47 +/- 5%; 40V
C39	21P08652L01	10pF +/- 5%; 500V
C40, C41	21P08652L02	.001 +/- 20%; 500V
C42	21P08652L01	10pF +/- 5%; 500V
C43	21P08652L02	.001 +/- 20%; 500V
C44-C46	21P08652L06	.015 +/- 5%: 40V
C47, C48	21P08652L05	1000 +/- 5%; 68V
		DIODES:
CR1-CR3	48P08652L20	LED, RED
CR4-CR6	48P08652L36	IN4148
CR7-CR9	48P08652L37	ZENER IN5236
CR10-CR11	48P08665L32	IN4002
CR12	48P08652L37	ZENER IN5236
CR13	48P08652L36	IN4148
CR14	48P08652L38	ZENER IN5358
CR15-CR23	48P08652L36	IN4148
		FUSES:
F1,F2	65P08652L43	AGC10, 10 AMP

Reference Symbol	Motorola Part No.	Description
		CONNECTOR, RECEPTACLE:
J1	28P08652L16	5 PIN HEADER
J2	28P08652L17	SMB
		COILS:
L1, L2	24P08652L10	RF CHOKE
L3-6	24P08652L09	TORRIOD CORE INDUCTOR
		CONNECTOR, PLUG:
P1-P4	40P08652L19	PUSH-ON TERMINALS
VDD1, VDD2	40P08652L19	PUSH-ON TERMINALS
		TRANSISTORS:
Q1	48P08651L70	VMOS POWER FET VN10KM
Q2		NOT USED
Q3	48P08652L41	2N2222
Q4-Q7	48P08652L42	POWER TMOS, MRF150
		RESISTORS: OHM, 1/4 W +/- 5% UNLESS OTHERWISE STATED
R1	06P08652L28	470
R2	06P08652L31	10K
R3, R4	06P08652L28	470
R5	06P08652L31	10K
R6	06P08652L32	6.2K
R7, R8	06P08652L31	10K
R9	06P08652L32	6.2K
R10-R12	06P08652L31	10K
R13	06P08652L32	6.2K
R14-R16	06P08652L31	10K
R17	06P08665L27	68K
R18	06P08652L33	12K
R19, R20	06P08652L31	10K
R21, R22	06P08665L27	68K
R23, R24	06P08652L31	10K
R25	06P08652L34	22K
R26	06P08652L31	10K
R27	06P08652L27	220
R28	06P08652L30	1.2K
R29	06P08652L31	10K
R30-R38		DELETED
R39	06P08652L29	1K
R40, R41	09P08652L24	JUMPER, .5"
R42	18P08652L35	VARIABLE 1K
R43	06P08665L22	5.6K
R44	06P08665L31	VARIABLE, 10K
R45	06P08652L30	1.2K

Reference Symbol	Motorola Part No.	Description
R46	06P08665L28	100K
R47	06P08665L31	VARIABLE, 10K
R48-R51	06P08652L22	4.7 +/- 5%, 1/2W
R52	06P08652L23	10 +/- 5%, 2W
R53	06P08652L30	1.2K
R54	06P08665L28	100K
R55	06P08652L31	10K
R56, R57	06P08652L23	10 +/- 5%, 2W
R58, R59	06P08652L22	4.7 +/- 5%, 1/2W
R60	06P08665L31	VARIABLE, 10K
R61	06P08652L30	1.2K
R62, R63	06P08652L22	4.7 +/- 5%, 1/2W
R64	06P08665L31	VARIABLE, 10K
R65	06P08652L30	1.2K
R66	06P08665L28	100K
R67	06P08652L23	10 +/- 5%, 2W
R68, R69	06P08652L31	10K
R70-R73	06P08665L28	100K
R74	06P08652L25	12.5 +/- 5%, 75W
R75	06P08652L34	22K
R76, R77	06P08652L26	6.25 +/- 5%, 40W
		THERMISTORS: OHMS
RT1	18P08652L44	1.2K
RT2	19P08652L45	10K
		TRANSFORMER:
T1, T2	25P08652L13	FERRITE CORE - 8 1/2 TURNS
T3, T4	25P08652L14	CODED YEL/BLU
T5-T7	25P08652L11	FERRITE CORE - 4 3/4 TURNS
T8	25P08652L12	FERRITE CORE - 5 3/4 TURNS
		TERMINALS:
TP1, RT2-1, RT2-2	40P08652L18	HOLLOW TURRET
		INTEGRATED CIRCUITS:
U1, U2	51P08652L40	LM339
U3	51P08652L39	LM317H
		HARDWARE:
		JUMPER .5"; 5 USED
		WIRE, 22AWG, BARE, 4"
		FUSE HOLDER; 2 USED
		TRANSIPAD
		BOARD, PRINTED CIRCUIT



NOTES: U.O.S.

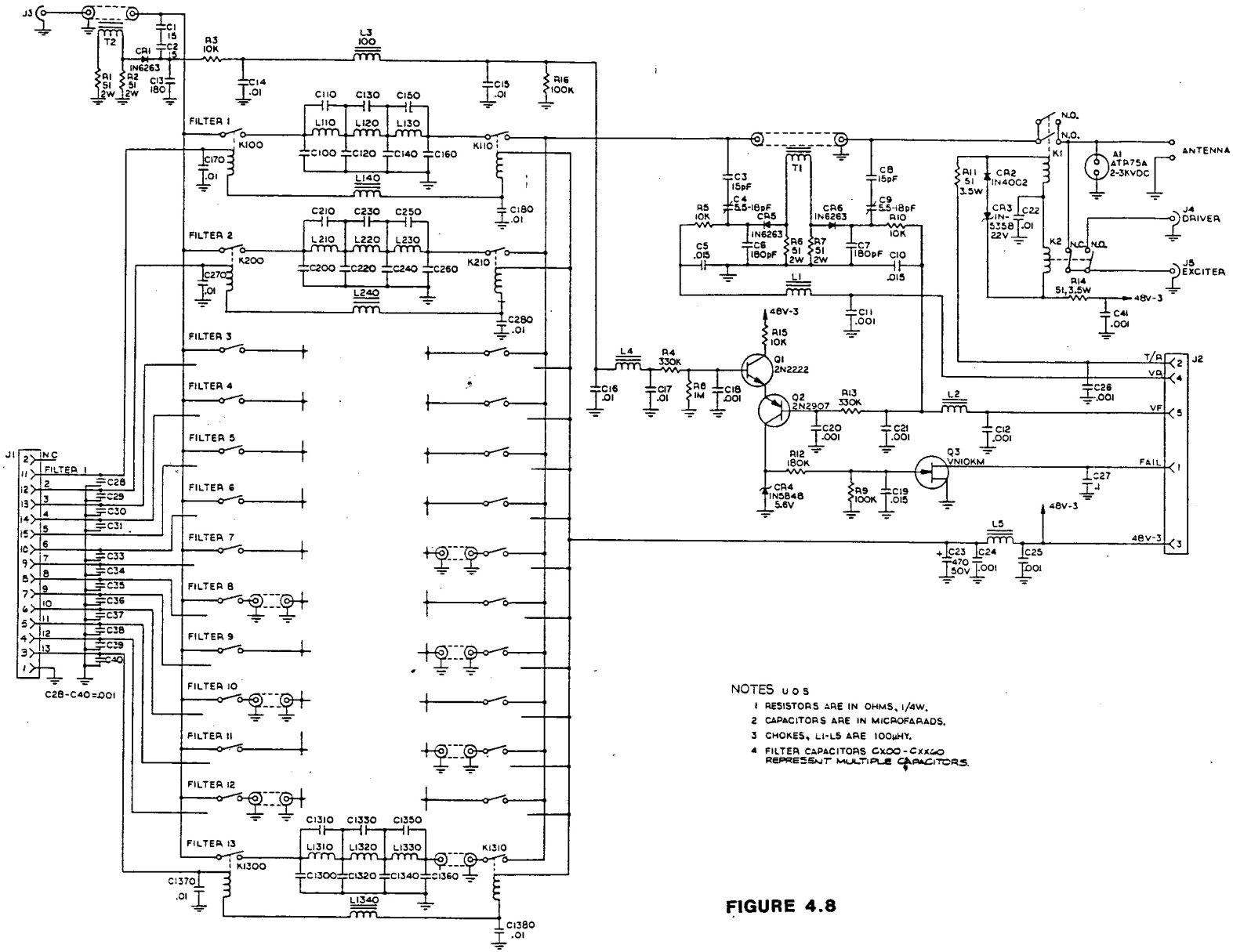
1. RESISTORS ARE IN OHMS.

FIGURE 4.7

Reference Symbol	Motorola Part No.	Description
		CONNECTORS:
J1A, J1B, J2A, J2B	28P08649L05	BNC CABLE CONNECTOR
J3	28P08649L04	N-TYPE PLUG, STRAIGHT, FOR RG-142/U CABLE
		RESISTOR:
R1, R2	06P08649L08	FLANGE MT. 100 OHM, 250W, +/- 5%
R3	06P08649L09	FLANGE MT. 12.5 OHM, 250W, +/- 5%
		TRANSFORMER: OHMS
T1	25P08649L01	50, COAXIAL
T2	25P08649L02	25, COAXIAL
T3	25P08649L01	50, COAXIAL
T4	25P08649L03	50, COAXIAL BALANCE
		HARDWARE: PC BOARD ASSY INCLUDES:
		SCREW, PAN HEAD: 4-40 x 1/4; 4 USED
		6-32 x 5/16; 9 USED
		SCREW, CAP HEAD: 4-40 x 3/8"; 6 USED
		WASHER, #4 LOCK; 4 USED, SPACER; 7 USED
		WIRE, 16 AWG BARE, TYWRAP,
		LOCKING-ROUTING CLAMPS; 2 USED
		HEATSINK, BRACKET MOUNTING; 2 USED

FILTER BOARD FLN 4411A

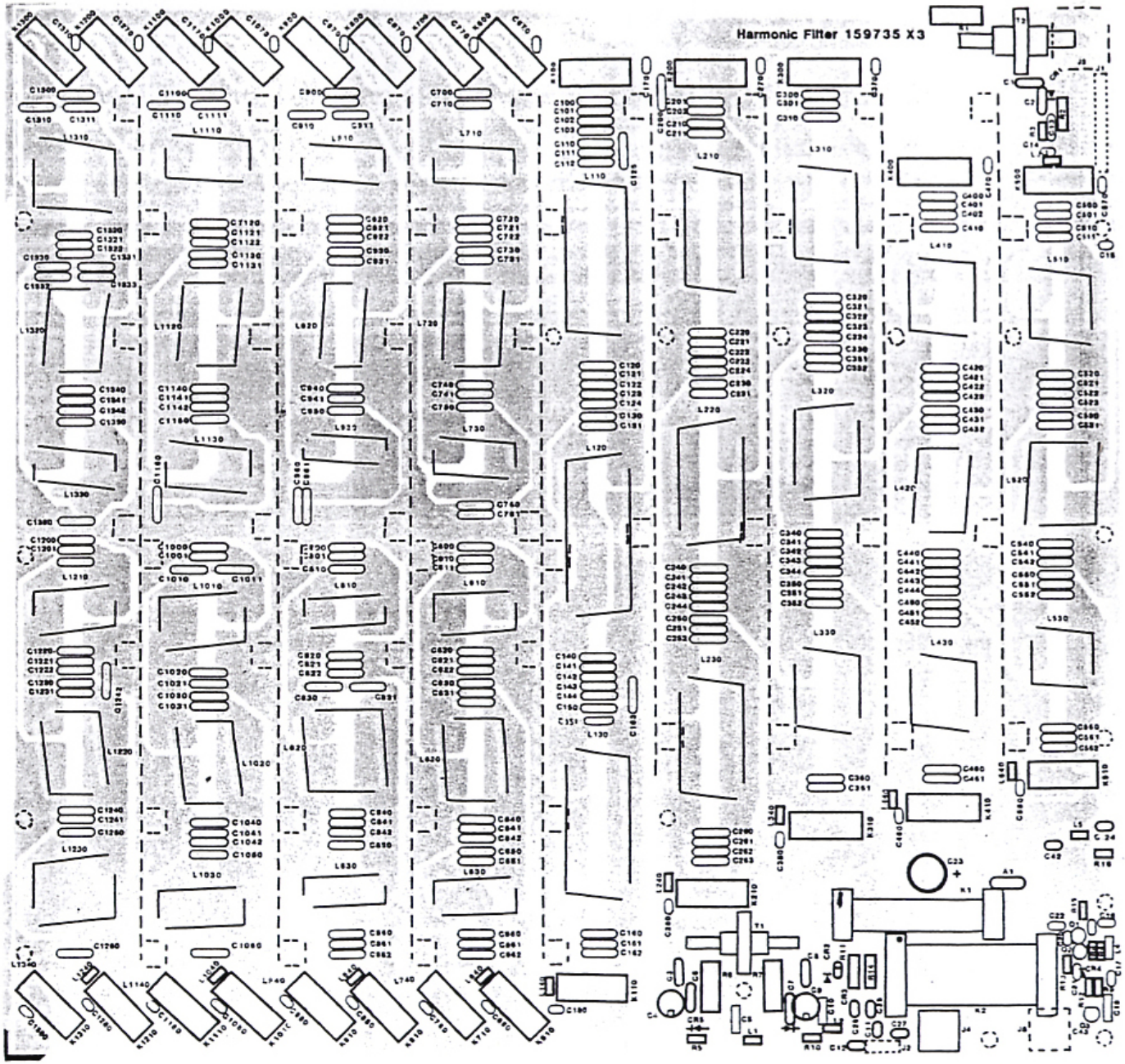
Reference Symbol	Motorola Part No.	Description
		SPARK ARRESTOR:
A1		ATR 75A
		CAPACITORS: uF, +/- 5%
C1-C3	21P08651L75	15pF, 1KV
C4	21P08651L80	5.5-18 VARIABLE
C5	21P08651L79	.015, 40V
C6, C7	21P08651L78	180pF, 500V
C8	21P08651L76	15pF, 1KV
C9	21P08651L80	5.5-18, VARIABLE
C10	21P08651L79	.015, 40V
C11, C12	21P08651L75	.001, 100V +/- 20%
C13	21P08651L78	180pF, 500V
C14-C17	21P08651L01	.01, 50V, +/- 20%
C18	21P08651L75	.001, 100V, +/- 20%
C19	21P08651L79	.015, 40V
C20, C21	21P08651L75	.001, 100V +/- 20%
C22	21P08651L01	.01, 50V +/- 20%
C23	21P08651L77	470, 50V
C24-C40	21P08651L75	.001, 100V, +/- 20%
		DIODES:
CR1	48P08651L68	IN6263
CR2	48P08651L67	IN4002
CR3	48P08651L69	IN5358, 22V
CR4	48P08651L66	IN5848, 5.6V
CR5, CR6	48P08651L68	IN6263
		CONNECTORS:
J1	09P08651L57	15 PIN HEADER
J2	09P08651L58	5 PIN HEADER
J3	09P08651L55	TYPE 'N'
J4, J5	09P08651L56	BNC
		RELAYS:
K1	80P08651L73	DUAL REED SWITCH N.O.
K2	80P08651L74	DUAL REED SWITCH N.C./N.O.
		COILS:
L1-L5	24P08651L81	100uHY 1/2 WATT
		TRANSISTORS:
Q1	48P08651L71	2N2222
Q2	48P08651L72	2N2907
Q3	48P08651L70	VN10KM



NOTES U O S

1 RESISTORS ARE IN OHMS, 1/4W.
2 CAPACITORS ARE IN MICROFARADS.
3 CHOKES, L1-L5 ARE 100μHY.
4 FILTER CAPACITORS CX00-CXX60 REPRESENT MULTIPLE CAPACITORS.

FIGURE 4.8



HARMONIC FILTER VSWR DET

FILTER BOARD FLN 4411A

Reference Symbol	Motorola Part No.	Description
		RESISTORS: OHM, 1/4W +/- 5% UNLESS OTHERWISE STATED
R1, R2	06P08651L59	51, 2W
R3	06P08651L61	10K
R4	06P08651L64	330K
R5	06P08651L61	10K
R6, R7	06P08651L59	51, 2WATT
R8	06P08651L65	1M
R9	06P08651L62	100K
R10	06P08651L61	10K
R11	06P08651L60	51, 3-1/2W
R12	06P08651L63	180K
R13	06P08651L64	330K
R14	06P08651L60	51, 3-1/2W
R15	06P08651L61	10K
		TRANSFORMERS:
T1, T2	24P08651L82	CURRENT SENSE

FILTER 1

		CAPACITORS: pF, 1KV, UNLESS OTHERWISE STATED
C100	21P08651L45	470
C101	21P08651L44	330
C102	21P08651L45	470
C103	21P08651L50	100
C110, C111	21P08651L05	47, 3KV
C112	21P08651L04	33, 3KV
C120	21P08651L28	270, 3KV
C121-C124	21P08651L45	470
C125	21P08651L51	120
C130, C131	21P08651L31	220
C140-C143	21P08651L45	470
C144	21P08651L50	100
C150	21P08651L44	330
C160	21P08651L10	120, 3KV
C161, C162	21P08651L44	330
C163	21P08651L49	68
C170, C180	21P08651L01	.01uF, SUBMINI
		RELAY:
K100, K110	80P08651L09	SPDT, 24VC

FILTER BOARD FLN 4411A

Reference Symbol	Motorola Part No.	Description
		COILS:
L110	24P08651L52	26 TURNS, CCW, #10 AWG
L120	24P08651L53	25 TURNS, CW #10 AWG
L130	24P08651L54	22 TURNS, CCW #10 AWG
L140	24P08651L08	CHOKE 100 uHY
FILTER 2		
		CAPACITORS: pF, 3KV, UNLESS OTHERWISE STATED
C200	21P08651L31	220, 1KV
C201, C202	21P08651L44	330, 1KV
C210	21P08651L10	68
C211	21P08651L04	33
C220	21P08651L20	180
C221-C224	21P08651L44	330, 1KV
C230	21P08651L20	180
C231	21P08651L15	120
C240	21P08651L45	470, 1KV
C241-C243	21P08651L31	222, 1KV
C244	21P08651L28	270
C250	21P08651L10	68
C251, C252	21P08651L24	56
C260-C263	21P08651L15	120
C270, C280	21P08651L08	.01uF, SUBMIN.
		RELAYS:
K200, K210	80P08651L09	SPDT, 24V DC
		COILS:
L210	24P08651L46	19 TURNS, CCW, #10 AWG
L220	24P08651L47	18 TURNS, CW, #10 AWG
L230	24P08654L48	17 TURNS, CCW, #10 AWG
L240	24P08654L08	CHOKE, 100uHY
FILTER 3		
		CAPACITOR: pF, 3KV, UNLESS OTHERWISE STATED
C300	21P08651L15	120
C301	21P08651L41	220, 1KV
C310	21P08651L10	68
C320	21P08651L05	47
C321-C324	21P08651L28	270
C330-C332, C340	21P08651L24	56

FILTER BOARD FLN 4411A

Reference Symbol	Motorola Part No.	Description
C341-C344	21P08651L28	270
C350	21P08651L05	47
C351, C352	21P08651L10	68
C360, C361	21P08651L20	180
C370, C380	21P08651L01	.01uF, SUBMINI
		RELAYS:
K300, K310	80P08651L09	SPDT, 24V DC
		COILS:
L310	24P08651L42	14 TURNS, CCW, #10 AWG
L320	24P08651L43	14 TURNS, CW, #10 AWG
L330		12 TURNS, CCW, #10 AWG
L340	24P08651L08	CHOKE, 100uHY

FILTER 4

		CAPACITOR: pF, 3KV, UNLESS OTHERWISE STATED
C400	21P08651L28	270
C401	21P08651L20	180
C402	21P08651L02	18
C410	21P08651L04	33
C420	21P08651L15	120
C421-C423	21P08651L28	270
C430, C431	21P08651L05	47
C432	21P08651L10	68
C440	21P08651L05	47
C441, C442	21P08651L28	270
C443	21P08651L20	180
C444	21P08651L15	120
C450, C451	21P08651L04	33
C452	21P08651L13	22
C460	21P08651L10	68
C461	21P08651L20	180
C470, C480	21P08651L01	.01uF, SUBMINI
		RELAYS:
K400, K410	80P08651L09	SPDT, 24V DC
		COILS:
L410	24P08651L39	12 TURNS, CCW #10 AWG
L420	24P08651L40	9 TURNS, CCW #8 AWG
L430		11 TURNS, CCW #10 AWG
L440	24P08651L08	CHOKE, 100uHY

FILTER BOARD FLN 4411A

Reference Symbol	Motorola Part No.	Description
FILTER 5		
		CAPACITORS: pF, 3KV, UNLESS OTHERWISE STATED
C500	21P08651L20	180
C501	21P08651L15	120
C510	21P08651L02	18
C520	21P08651L10	68
C521	21P08651L20	180
C522, C523	21P08651L28	270
C530	21P08651L24	56
C531	21P08651L05	47
C540, C541	21P08651L28	270
C542	21P08651L20	180
C550	21P08651L10	68
C551	21P08651L04	33
C552	21P08651L05	47
C560	21P08651L10	68
C561	21P08651L15	120
C570, C580	21P08651L01	.01uF, SUBMINI
		RELAYS:
K500, K510	80P08651L09	SPDT, 24V DC
		COILS:
L510	24P08651L36	11 TURNS, CCW #10 AWG
L520	24P08651L38	8 TURNS CCW #8 AWG
L530	24P08651L37	9 TURNS, CCW #10 AWG
L540	24P08651L08	CHOKE, 100uHY
FILTER 6		
		CAPACITORS: pF, 3KV, UNLESS OTHERWISE STATED
C600	21P08651L31	220, 1KV
C610	21P08651L05	47
C611	21P08651L13	22
C620	21P08651L05	47
C621, C622	21P08651L32	270
C630, C631	21P08651L05	47
C640, C641	21P08651L32	270
C642	21P08651L02	18
C650	21P08651L10	68
C651	21P08651L05	47
C660	21P08651L15	120
C670, C680	21P08651L01	.01uF, SUBMINI

FILTER BOARD FLN 4411A

Reference Symbol	Motorola Part No.	Description
		RELAYS:
K600, K610	80P08651L09	SPDT, 24V DC
		COILS:
L610	24P08651L33	7 TURNS, CW #10 AWG
L620	24P08651L35	8 TURNS, CW #8 AWG
L630	24P08651L34	6 TURNS, CW #10 AWG
L640	24P08651L08	CHOKE 100uHY
FILTER 7		
		CAPACITORS: pF, 3KV, UNLESS OTHERWISE STATED
C700	21P08651L20	180
C710	21P08651L02	18
C720	21P08651L04	33
C721	21P08651L25	150
C722	21P08651L28	270
C730	21P08651L28	39
C731	21P08651L05	47
C740	21P08651L28	270
C741	21P08651L20	180
C750	21P08651L28	39
C760	21P08651L15	120
C761	21P08651L13	22
C770, C780	21P08651L04	.01UF, SUBMINI
		RELAY:
K700, K710	80P08651L09	SPDT, 24V DC
		COILS:
L710	24P08651L29	6 TURNS, CCW #10 AWG
L720	24P08651L30	7 TURNS, CCW #8 AWG
L730	24P08651L29	6 TURNS, CCW #10 AWG
L740	24P08651L08	CHOKE 100uHY
FILTER 8		
		CAPACITOR: pF, 3KV, UNLESS OTHERWISE STATED
C800	21P08651L02	18
C801	21P08651L15	120
C810, C820	21P08651L13	22
C821	21P08651L15	120
C822	21P08651L20	180
C830, C831	21P08651L15	120

FILTER BOARD FLN 4411A

Reference Symbol	Motorola Part No.	Description
C840	21P08651L20	180
C841	21P08651L25	150
C842	21P08651L02	18
C850	21P08651L24	56
C860	21P08651L14	100
C870, C880	21P08651L01	.01uF, SUBMINI
		RELAYS:
K800, K810	80P08651L09	SPDT, 24V DC
		COILS:
L810	24P08651L26	5 TURNS, CW #10 AWG
L820	24P08651L27	6 TURNS, CW #8 AWG
L830	24P08651L26	5 TURNS, CW #10 AWG
L840	24P08651L08	CHOKE, 100uHY

FILTER 9

		CAPACITORS: pF, 3KV, UNLESS OTHERWISE STATED
C900	21P08651L15	120
C910, C911	21P08651L04	33
C920	21P08651L02	18
C921, C922	21P08651L15	120
C930	21P08651L04	33
C931	21P08651L13	22
C940	21P08651L20	180
C941	21P08651L10	68
C950	21P08651L05	47
C960	21P08651L10	68
C961	24P08651L13	22
C970, C980	21P08651L01	.01uF, SUBMINI
		RELAYS:
K900, K910	80P08651L09	SPDT, 24V DC
		COILS:
L910	24P08651L21	5 TURNS, CCW, #10 AWG
L920	24P08651L23	5 TURNS, CCW, #8 AWG
L930	24P08651L22	4 TURNS, CCW, #10 AWG
L940	24P08651L08	CHOKE, 100uHY

Reference Symbol	Motorola Part No.	Description
FILTER 10		
		CAPACITOR: pF, 3KV, UNLESS OTHERWISE STATED
C1000	21P08651L10	68
C1001	21P08651L05	47
C1010	21P08651L02	18
C1011	21P08651L13	22
C1020, C1021	21P08651L15	120
C1030, C1031	21P08651L13	22
C1040	21P08651L15	120
C1041	21P08651L10	68
C1042	21P08651L04	33
C1050	21P08651L13	22
C1060	21P08651L05	47
C1070, C1080	21P08651L01	.01uF, SUBMINI
		RELAYS:
K1000, K1010	80P08651L09	SPDT, 24V DC
		COILS:
L1010, L1020	24P08651L18	5 TURNS, CW, .180 X .05
L1030	24P08651L19	4 TURNS, CW, #8 AWG
L1040	24P08651L08	CHOKE 100uHY
FILTER 11		
		CAPACITOR: pF, 3KV, UNLESS OTHERWISE STATED
C1100	21P08651L15	120
C1110	21P08651L13	22
C1111	21P08651L02	18
C1120	21P08651L10	68
C1121, C1122	21P08651L14	100
C1130, C1131	21P08651L02	18
C1140, C1141	21P08651L15	120
C1142	21P08651L02	18
C1150	21P08651L03	27
C1160	21P08651L15	120
C1170, C1180	21P08651L01	.01uF, SUBMINI
		RELAYS:
K1100, K1110	80P08651L09	SPDT, 24V DC

FILTER BOARD FLN 4411A

Reference Symbol	Motorola Part No.	Description
		COILS:
L1110	24P08651L16	4 TURN, CCW #8 AWG
L1120, L1130	24P08651L17	4 TURN, .180 x .050
L1140	24P08651L08	CHOKE, 100uHY
FILTER 12		
		CAPACITOR: pF, 3KV, UNLESS OTHERWISE STATED
C1200	21P08651L10	68
C1201, C1220	21P08651L05	47
C1221, C1222	21P08651L10	68
C1230, C1231	21P08651L02	18
C1240, C1241	21P08651L10	68
C1242	21P08651L01	33
C1250	21P08651L02	18
C1260	21P08651L10	68
C1270, C1280	21P08651L01	.01uF, SUBMINI
		RELAYS
K1200, K1210	80P08651L09	SPDT, 24V DC
		COILS:
L1210	24P08651L11	4 TURNS, .180 x .05
L1220, L1230	24P08651L12	4 TURNS, .250 x .05
L1240	24P08651L08	CHOKE, 100uHY
FILTER 13		
		CAPACITOR: pF, 3KV, UNLESS OTHERWISE STATED
C1300, C1310, C1311	21P08651L02	18
C1320, C1321	21P08651L05	47
C1322	21P08651L04	33
C1330-C1333	21P08651L03	27
C1340, C1341	21P08651L05	47
C1342	21P08651L03	27
C1350	21P08651L02	18
C1360	21P08651L04	33
C1370, C1380	21P08651L01	.01uF, SUBMINI
		RELAYS:
K1300, K1310	80P08651L09	SPDT, 24V DC
		COILS:
L1310, L1320	24P08651L06	4 TURNS, CCW, .250 x .05
L1330	24P08651L07	3 TURNS, CCW, .180 x .05
L1340	24P08651L08	CHOKE, 100uHY

1. INTRODUCTION

The maintenance chapter contains a list of recommended test equipment, and instructions for mechanical disassembly, for verifying the performance of the amplifier, for routine adjustments, and for aligning the amplifier unit.

2. RECOMMENDED TEST EQUIPMENT

Refer to Table 1 for a list of recommended test equipment.

3. PERIODIC MAINTENANCE

No periodic maintenance is required.

4. MECHANICAL DISASSEMBLY

Disassembly of the power amplifier unit is described in section 4.1 and disassemby of the power supply unit in section 4.2. Unless otherwise noted, reassembly is done in the opposite order of disassembly.

4.1 POWER AMPLIFIER

Refer to figures 1-4 for this section. The numbers in parenthesis correspond to the numbers on the particular figure.

technical writing services
1301 E. Algonquin Road, Schaumburg, Il. 60196

Recommended Test Equipment

Test Equipment	Manufacture
RF Signal Generator	HP Model 8640B
Wattmeter	Bird Model 43 and 4381
50 ohm Load/Attenuator	Bird Model 8327
X10 Attenuator	Microcircuits Model CAT-20
Variable Attenuator	Texscan Model SA-50
Spectrum Analyzer	HP Model 182A/8555B
Distortion Analyzer	HP Model 334A
Oscilloscope	Tectronix Model 2236
Audio Generator	Datapulse Model 401
Frequency Counter	HP Model 5303A
DVM	Fluke Model 75

Table 1

4.1.1 FILTER ASSEMBLY AND PRINTED CIRCUIT BOARD REMOVAL

See figure 1

a. Disconnect exciter input (1) and filter output coax (2).

b. Remove screws (3) securing filter mtg. plate (4) to chassis (5).

c. Tilt filter board up and remove filter input coax (6) and filter select connectors (7).

d. Lift out filter board by pulling up and forward.

e. To remove filter PCB board, remove all screws securing it to the mtg plate.

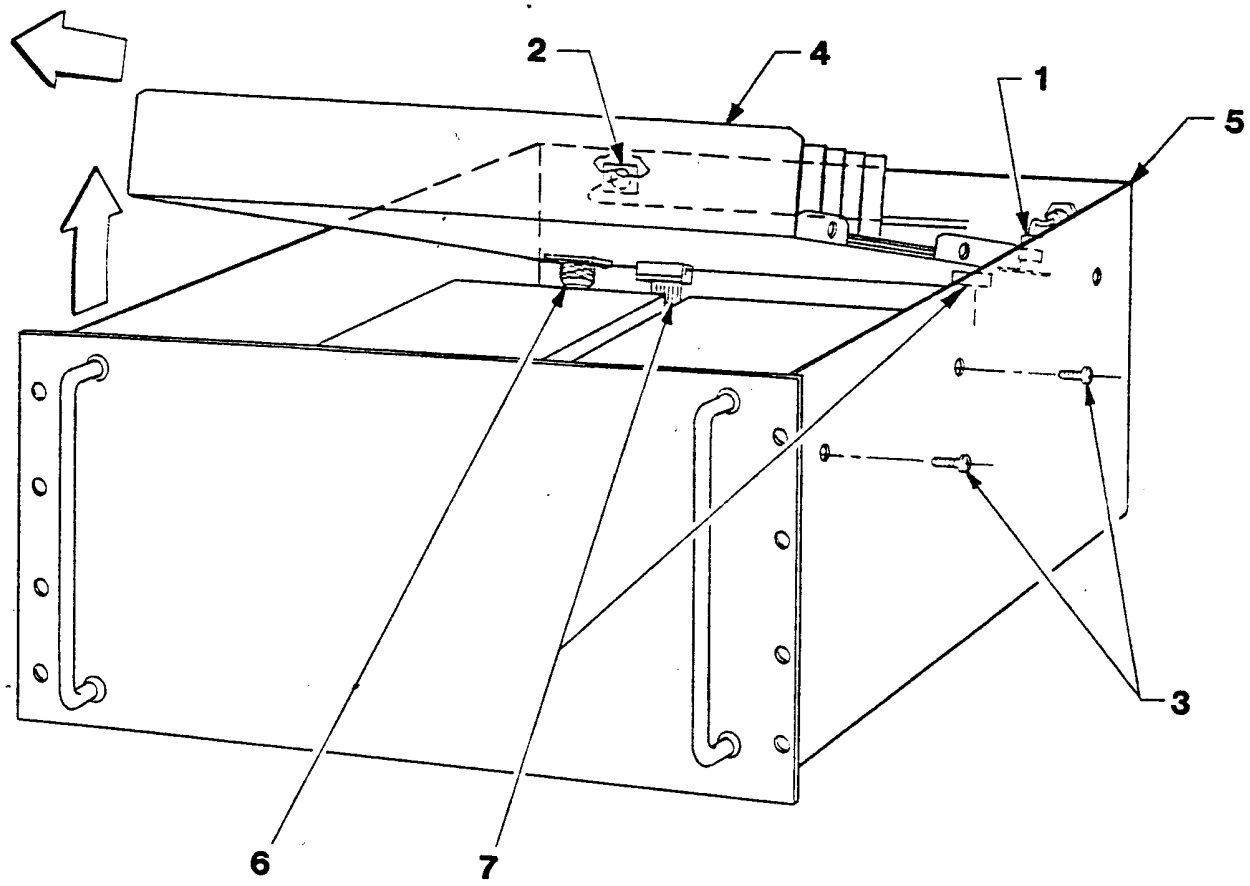


FIGURE 1

4.1.2 500 W MODULE ASSEMBLY REMOVAL

See figure 2.

a. Disconnect the four output coaxes (8) at the OUTPUT COMBINER (9).

b. Disconnect the four input coaxes (10) from the DRIVER/ALC board (11).

c. Disconnect all fan connections (12) and the 48V DC connections (13) on the POWER DISTRIBUTION board (14).

d. Disconnect the four connectors (15, 16, 17 and 18) on the CONTROLLER board (61).

e. Remove the 14 screws (19) from the brackets that secure the dual 500 W module (20) to the main chasis (5) and the front and rear shelves (37, 40) and lift up and out the entire, dual module assembly.

f. To separate the two 500 watt modules, remove the 4 screws (22) from the bracket (23) that holds the modules together (Figure 2).

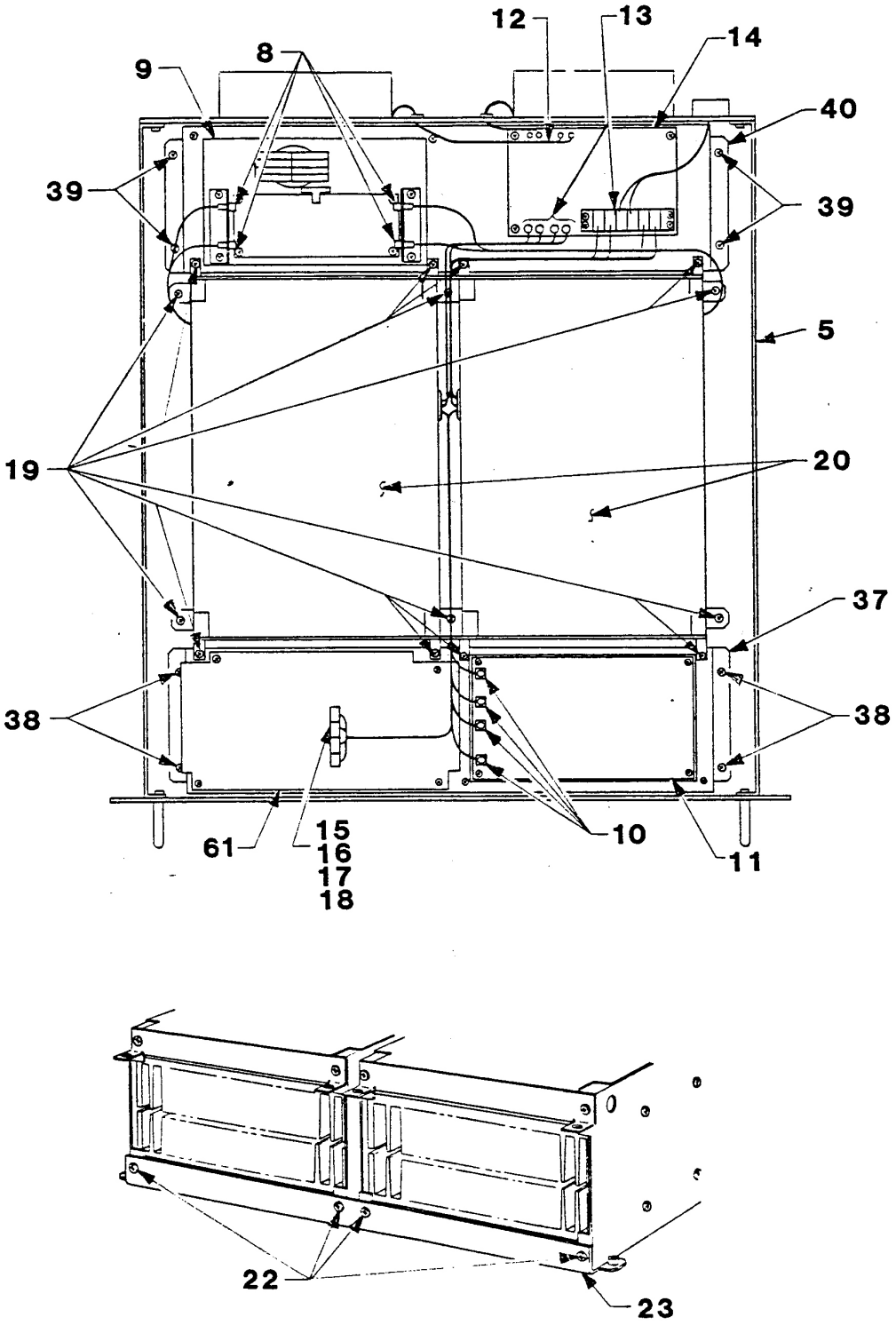


FIGURE 2

4.1.3 300 Watt P.A. Assembly and printed circuit board removal

See Figure 3

a. Remove the 4 screws (24) to remove the cover (25). Unsolder the output coax (26) and pull out.

b. Remove the 2 screws (27) to remove the end plate (28), front and rear.

c. Place the 500W amplifier module on its sideplate (29). Remove the 8 screws (30) to remove the first sideplate. This will expose the heatsinks. Now place the 500W amplifier module on the other side resting on the heatsinks. Remove the 8 screws to remove the second sideplate.

d. To remove the 300 Watt amplifier board from the heatsink first remove all screws (31) holding the FET power transistors (32) and the power resistors (33) to the heatsink.

e. Remove the screw (34) securing the thermistor (35) to the heatsink.

f. Remove the 8 screws (36) that secure the board to the heatsink and lift the board carefully off.

NOTE: when reassembling the 300W P.A. board make sure that each FET POWER transistor and each power resistor has its mounting surface coated with thermal compound before installing.

4.1.4 FRONT AND REAR SHELVE REMOVAL

See figure 2.

The front shelf (37) contains the CONTROLLER board (61) and the DRIVER/ALC board (11). The entire front shelf can be removed as follows:

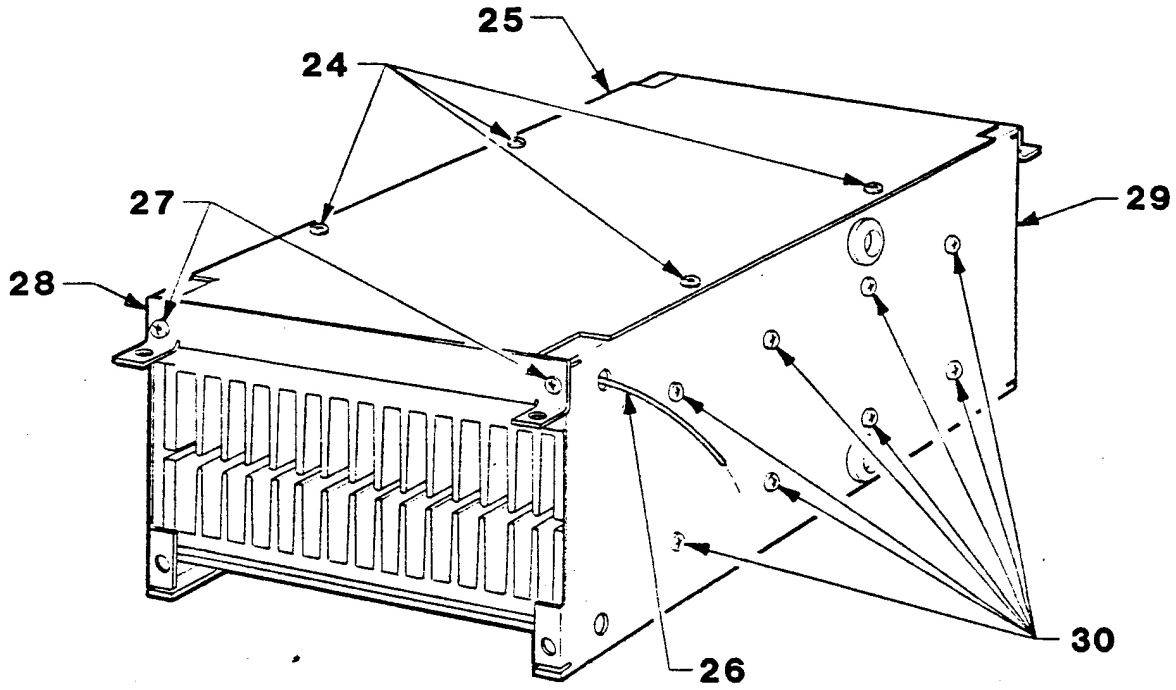
A. Disconnect all coaxes and cable assemblies to the CONTROLLER board (61) and the DRIVER/ALC board (11).

B. Remove the four screws (38) securing the front shelf (37) to the main chassis (5) and lift up and out the entire assembly.

The rear shelf is removed as follows:

A. Disconnect all coaxes and cable assemblies to the OUTPUT COMBINER board (9) and the POWER DISTRIBUTION board (14)as well as the fan connections (12) to the rear panel.

B. Remove the four screws (39) securing the rear shelf (40) to the main chasis (5) and lift up and out the entire assembly.



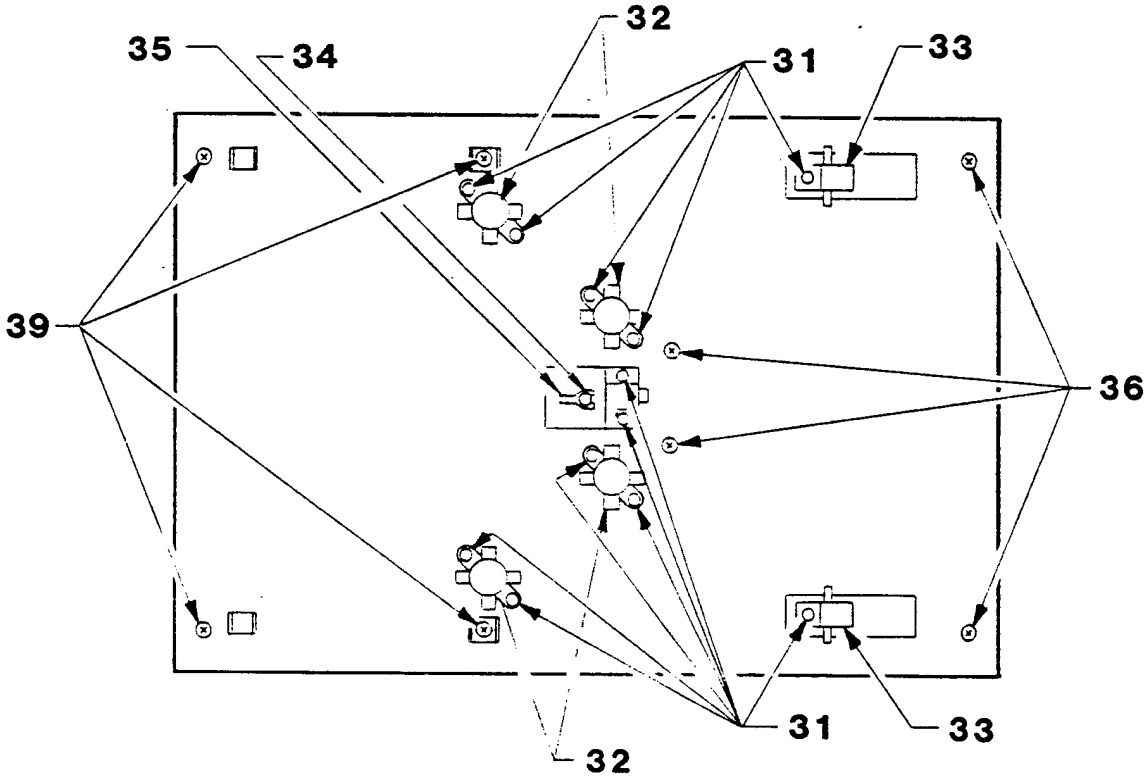


FIGURE 3

4.1.5 FRONT AND REAR SHELF ASSEMBLY REMOVALS

See figure 4.

The following assemblies are mounted on the shelves:

1. CONTROLLER
2. DRIVER/ALC
3. OUTPUT COMBINER
4. POWER DISTRIBUTION

4.1.5.1 CONTROLLER BOARD REMOVAL

a. Remove the six screws (41) that hold the board to the shelf (37). Remove ALC and coax connector to DRIVER/ALC board.

4.1.5.2 DRIVER/ALC BOARD REMOVAL

a. Remove remaining 2 screws (42) that hold heatsink (43) to shelf (37).

b. Remove the three screws (44) that secure the FET (45) and the power resistor (46) to the heatsink .

c. Remove the four screws (47) that hold the board to the heatsink (43).

NOTE: When reassembling the DRIVER/ALC board make sure that the FET POWER transistor and the power resistor has its mounting surface coated with thermal compound.

4.1.5.3 OUTPUT COMBINER

a. Remove the remaining 2 screws (53) that hold the heatsink (52) to the shelf (40).

b. Remove the six screws (48) that secure the three power resistors (49) to the heatsink.

c. Disconnect the four RF input wires (50).

d. Remove the seven screws (51) that hold the board to the heatsink (52).

NOTE: When reassembling the output combiner board make sure that the power resistors have their mounting surface coated with thermal compound.

4.1.5.4. POWER DISTRIBUTION

a. Remove the two screws (54) that secure the voltage regulator and transistor (55) to the shelf.

b. Remove the five screws (56) that hold the board to the shelf.

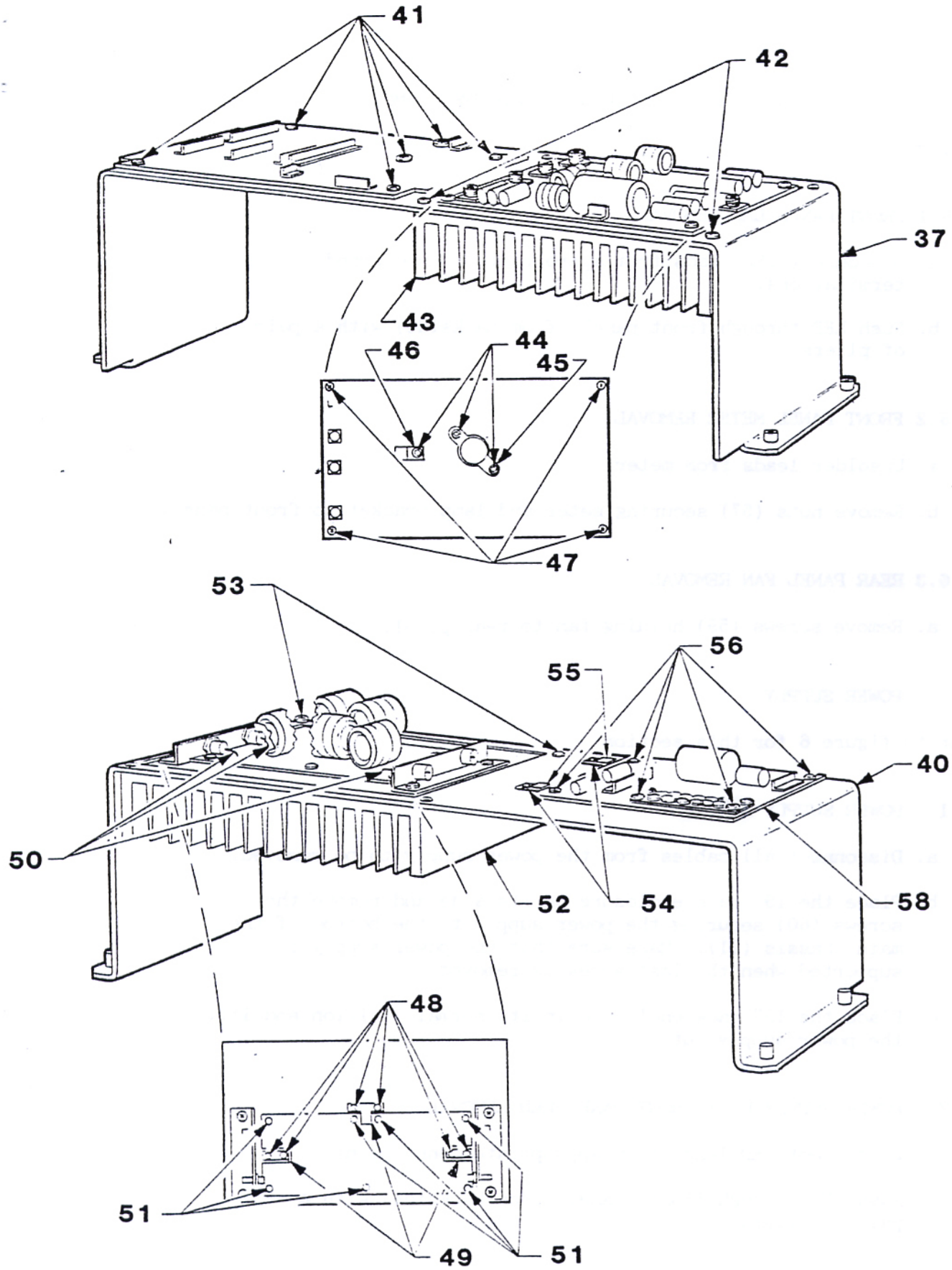


FIGURE 4

4.1.6 AMPLIFIER UNIT FRONT/REAR PANEL COMPONENT REMOVAL

See figure 5.

4.1.6.1 FRONT PANEL LED REMOVAL

a. Disconnect LED leads from appropriate connectorand solder terminations.

b. Push LED through front panel (from backside) with a pair of pliers.

4.1.6.2 FRONT PANEL METER REMOVAL

a. Unsolder leads from meter.

b. Remove nuts (57) securing meter and lamp bracket to front panel.

4.1.6.3 REAR PANEL FAN REMOVAL

a. Remove screws (59) holding fan to rear panel.

4.2 POWER SUPPLY

Refer to figure 6 for this section.

4.2.1 POWER SUPPLY REMOVAL

a. Disconnect all cables from the power supply to be removed.

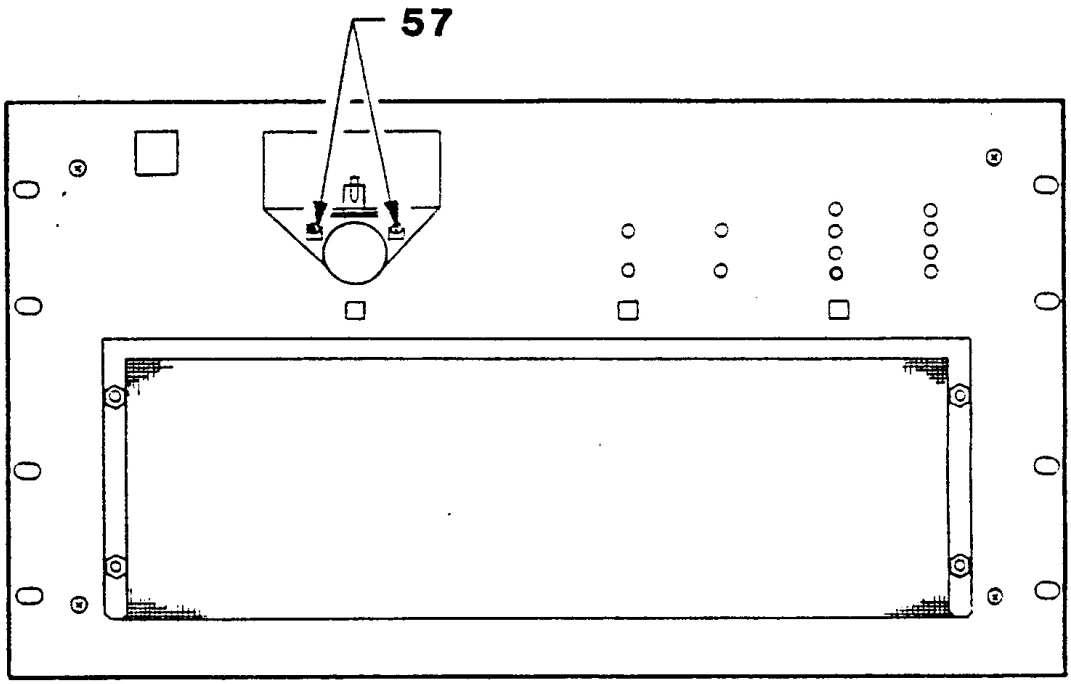
b. Place the 19" rack enclosure on its side and remove the screws (60) securing the power supply to the bottom of the main chassis (21). Make sure that the power supply is supported when the last screw is removed.

c. Place the 19" rack enclosure in its normal position and lift the power supply out.

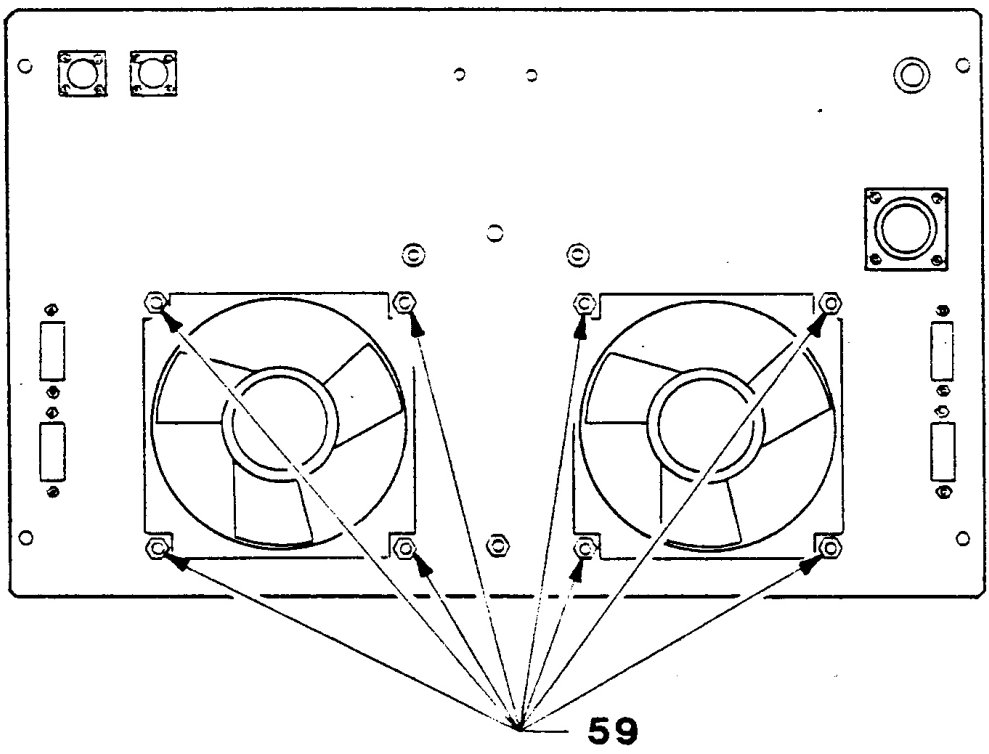
4.2.2 POWER SUPPLY UNIT FRONT PANEL LED REMOVAL

a. Disconnect LED leads from appropriate connections.

b. Push LED through front panel (from backside) with a pair of pliers.

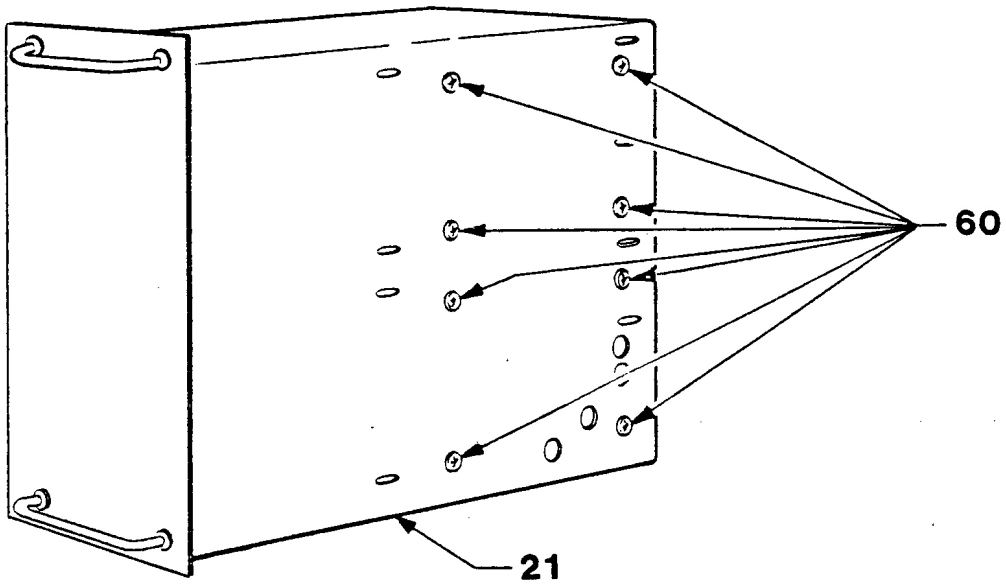


AMPLIFIER UNIT FRONT PANEL
(Inside View)

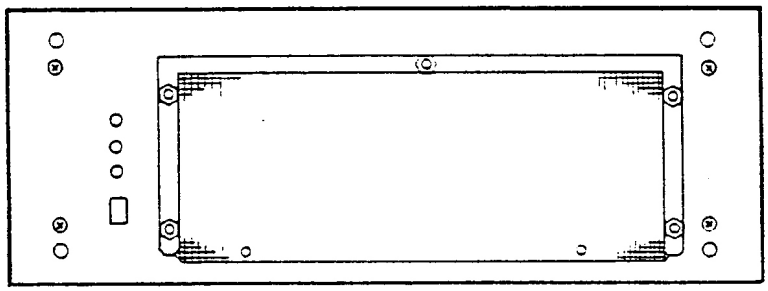


AMPLIFIER UNIT REAR PANEL
(Inside View)

FIGURE 5



POWER SUPPLY UNIT (Bottom/Side View)



POWER SUPPLY UNIT FRONT PANEL

FIGURE 6

5. PERFORMANCE TESTING

5.1 GENERAL

Performance testing serves the purpose of verifiying that specifications are met and assures that all adjustments have been correctly performed. The following tests are performed:

Power Output/Efficiency/Gain (High Power & Tune Power)
Harmonic Distortion

Intermodulation Distortion
Power Output vs VSWR

See figure 7 for test set-up.

Note: Do not change exciter frequency with a microphone audio input signal applied. This can result in erroneous filter selection.

5.2 POWER OUTPUT/EFFICIENCY/GAIN (HIGH POWER AND TUNE POWER)

a. Select a 2 MHz test frequency on the exciter. Use USB mode of operation.

b. Set the tone generator for 1000 Hz and minimum output level.

c. Key the transmitter. Slowly increase the tone generator output power to 300 mVrms.

d. Verify that the power output is 895 - 1120 Watts. Verify that the current observed on the two meters is within 2 amps of each other and less than 25 amps.

e. Verify that the exciter output is 12 W +/- 2 W.

f. Repeat A-E on the frequencies listed below:

Frequency, MHz:	
	2.000
	2.700
	4.300
	5.100
	6.000
	7.300
	8.500
	10.100
	13.000
	15.500
	19.000
	22.000
	28.000
	30.000

If the power output at 30 MHz exceeds 1000 Watts, perform adjustment of the exciter drive power by adjusting the ALC potentiometer on the rear panel of the amplifier unit, (See Section 3, figure 3) such that the final power output is exactly 1000 Watts.

g. Initiate a tune cycle by applying a channel change pulse to the Micom 1000. Approximately 1 second later apply a ground to ATU control (J4) connector pin 7 (See section 3, figure3). This will keep the system in the tune mode and permit measurements of tune power.

h. Measure tune power on the frequencies listed in f. and verify the tune power in 12W +/- 2W.

5.3 HARMONIC DISTORTION

Repeat test 5.2 f. while observing the harmonic content of the signal on the spectrum analyzer.

a. Verify that harmonic attenuation equals or exceeds 73dBc.

5.4 INTERMODULATION DISTORTION

a. Set watt meters for PEP reading.

b. Adjust tone generator to produce a two tone signal (400Hz/1800Hz). Each generator level should be 150 mVrms.

c. Connect output from exciter to RF ATTENUATOR and observe two tone signal on oscillocscope.
Adjust - if necessary - any one of the tone generator input levels to produce the "correct" two tone signal indicated by minimum zero crossing distortion.

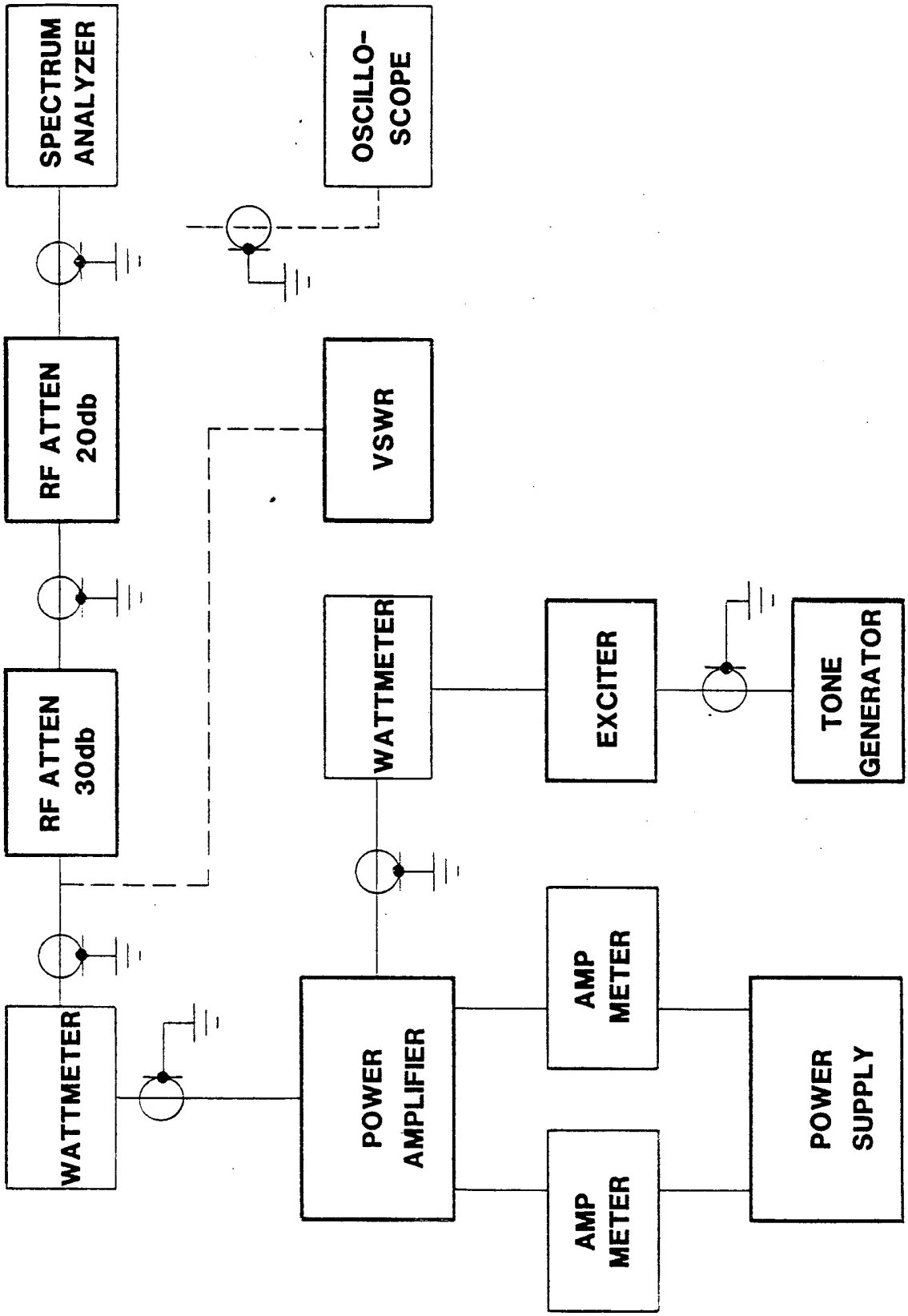


FIGURE 7
TEST SET-UP, PERFORMANCE TESTING

6. ALIGNMENTS

6.1 GENERAL

No periodic adjustments are required.

Following repair and/or replacement of subassemblies the adjustments discribed in this section must be performed.

Perform these adjustments carefully since misalignment adversely affects performance and can cause serious damage. Perform all procedures in the order in which they are listed.

PREALIGNMENT NOTES

Observe the conditions listed below before attempting to align the amplifier unit.

a. Ensure that the ambient temperature is 20 to 25 degrees.

b. Supply 48V DC to power connector J1. Measure this voltage at terminals 1 and 2 of J1 and ensure that it is maintained while the power amplifier is keyed.

c. Select the SSB (A3J emission) mode on the exciter and select USB. Select a frequency of 25MHz.

d. Ensure that the wattmeter is accurately calibrated.

e. Until ALC is set use the minimum audio input level necessary to obtain the required power output level, to ensure that the power amplifier is not overdriven.

f. Until ALC is set, limit transmission time to the minimum required.

g. Preset all controls that,

1) Have been replaced
2) Have been misadjusted
3) Control the bias voltage of a FET that has been replaced

as Follows:

DRIVER/ALC	:	Fully counter clockwise
300W POWER AMP	:	Fully counter clockwise
HARMONIC FILTER/VSWR DET.	:	Midrange
CONTROLLER	:	Midrange
POWER SUPPLY	:	Fully counter clockwise

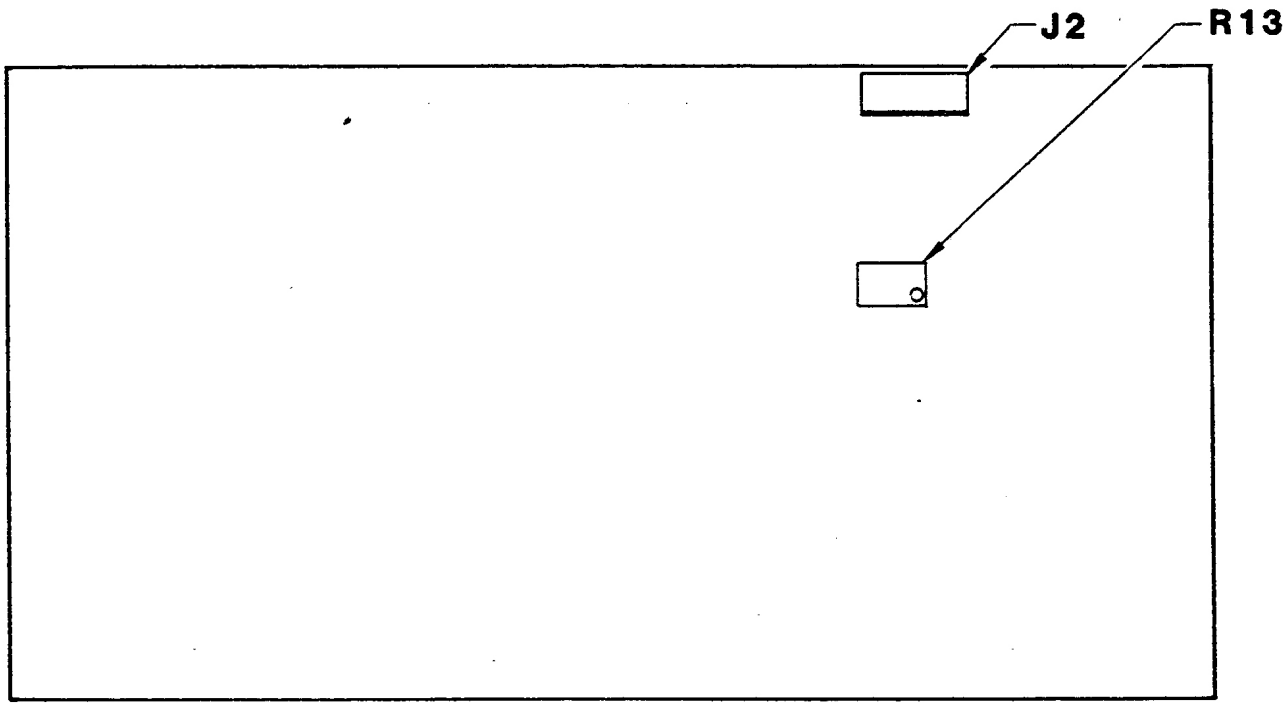
6.2 DRIVER/ALC ALIGNMENT

Adjustment to perform: Bias current (Figure 8).

a. To set bias current, insert an amperemeter in series with the 48V-3 input to J2, pin 1, 2, 3.

b. Remove the tone generator input and RF output to assure that the exciter can be keyed without putting out any RF power.

c. Turn R13 slowly clockwise until the current is 500 mA.



DRIVER ALC

FIGURE 8

6.3 300 W POWER AMP

Adjustments to perform: Bias current (Figure 9).

a. To set bias current, insert an amperemeter in series with the 48V input to P1 (orP4).

b. Without applying RF power, key the exciter. Note the current.

c. Turn R44, 64, 47, 60 in the order mentioned for a current of 800 mA per FET. The total current will be 3.2 ampere + the initial (residual) current observed in b.

Note: Due to the effect of heating, the current may slowly change. This is normal. It is recommended, though, that the bias setting be performed reasonably fast to avoid drastic differences in bias current between FETs. If desired, the exciter can be unkeyed between bias adjustments of each FET, to allow for a cooling off period.

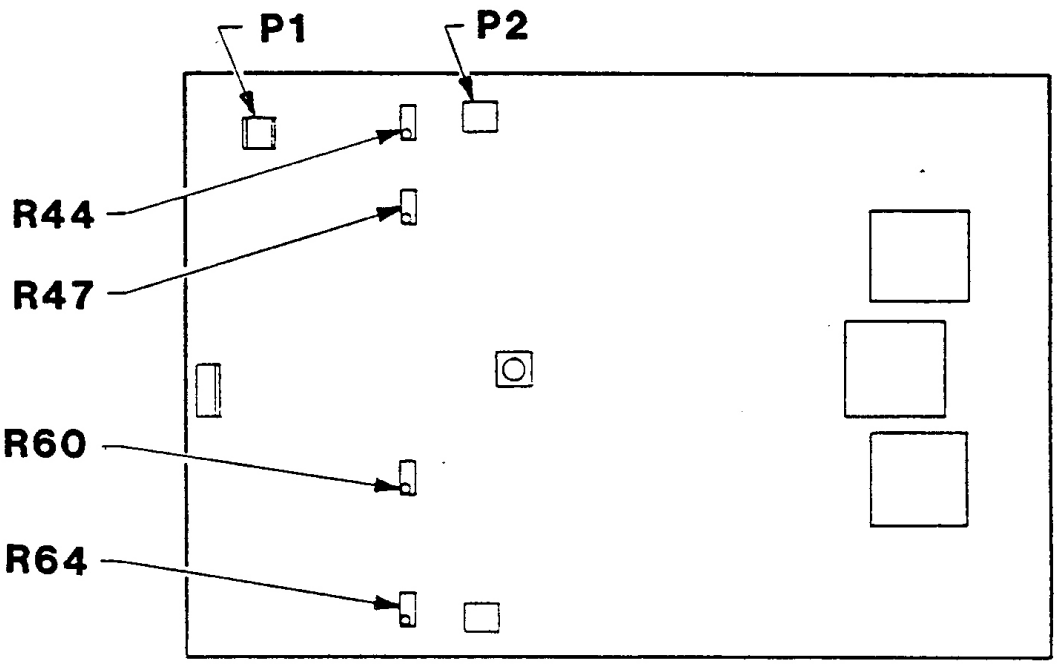


FIGURE 9

6.4 HARMONIC FILTER/VSWR DET.

Adjustments to perform: Forward/Reverse voltage setting (Figure 10).

a. Connect a 50 ohm load to the power amplifier.

b. Adjust the tone generator for a power output from the power amplifier of 1000W.

c. With a voltmeter, measure the reverse voltage, VR on connector J2, pin 4.

d. Adjust C4 for a minimum voltage reading, less than 1 volt.

e. Replace the 50 ohm load with a load that produces a VSWR of 2:1 (25 ohm or 100 ohm).

f. Measure reflected power - adjust the reflected power to 100 W by adjusting to tone generator input level.

g. Measure VR. Then measure forward power and adjust for a forward power 100 W.

h. Measure VF on connector J2 pin 5. Adjust C9 for a value of VF equal to the value of VR measured in G.

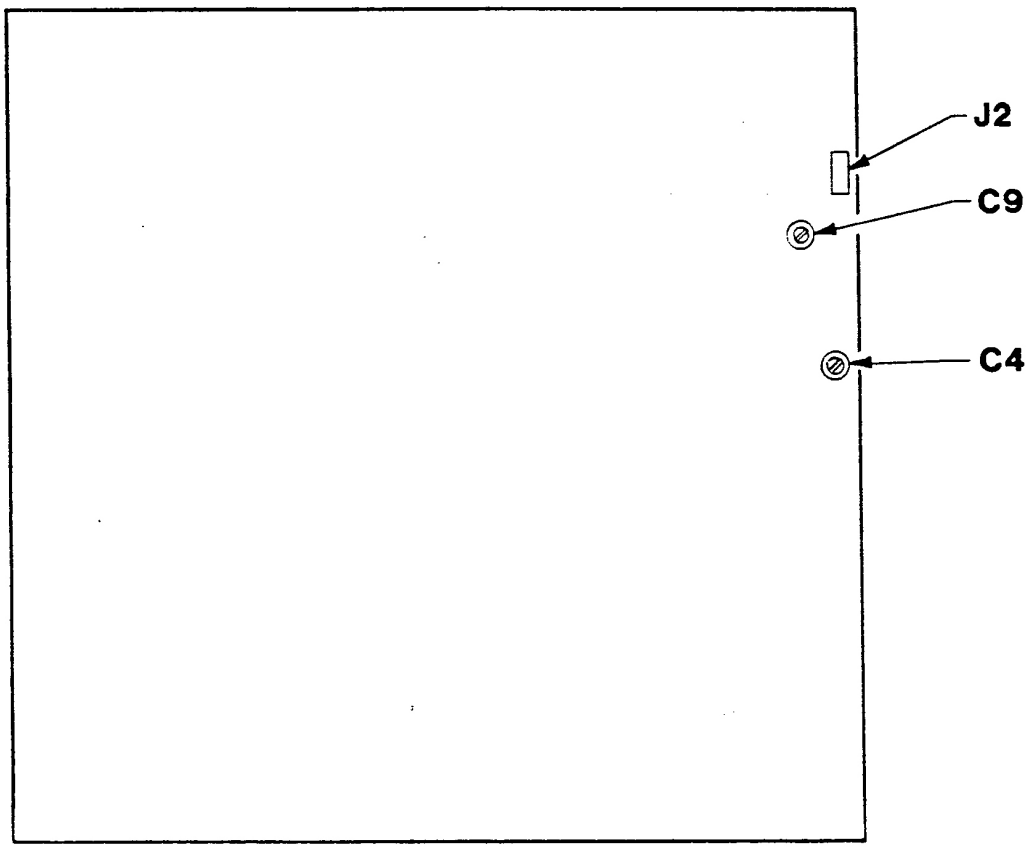


FIGURE 10

6.5 CONTROLLER

Adjustments to perform (Figure 11):

VF and VR
Power out, 1000W
Power out, 750W
Power out, 500W
Power out, Tune

a. With the power amplifier terminated in a 50 ohm load, adjust for a power output of 1000W.

b. Set R8 for a full scale reading on the front panel meter with the switch in FORWARD position. Verify that VF is 10V+10% on J5, pin 4.

c. Set power output to 1050W.

d. Turn R51 (ALC) clockwise until the power drops to 1000 Watt.

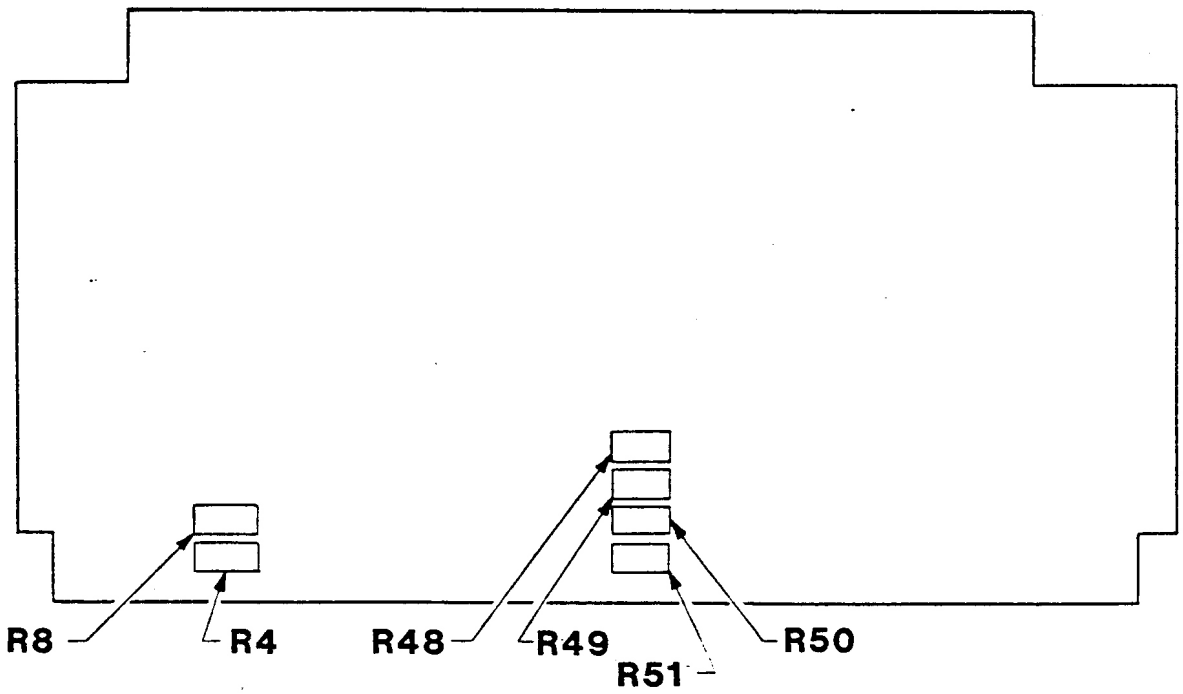


FIGURE 11

e. Replace the 50 ohm load with a load producing a 2:1 VSWR (25 ohm or 100 ohm).

f. Adjust for a power output of 800 W. Measure reflected power.

g. Set R4 for a reflected power output reading on the front panel meter equal to the value measured in f.

h. Turn R50 (ALC) clockwise until the power drops to 750 W.

i. Replace the 2:1 VSWR load with a load producing a VSWR of 3:1 (16.7 ohm or 150 ohm).

j. Adjust for a power output of 550 W.

k. Turn R49 (ALC) clockwise until the power drops to 500 W.

l. Reconnect the 50 ohm load and initiate a TUNE cycle. Verify that the input power is 10W +/- 2 W (See 5-2.g).

m. Turn R48 clockwise until the power drops to 10 Watts.

6.6 POWER SUPPLY

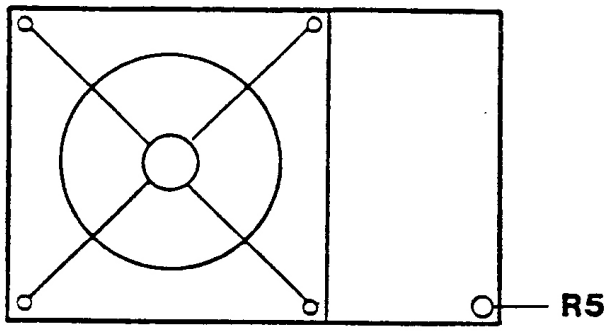
Adjustments to perform: Output Voltage
Current Limit
Overvoltage Trip Point

Note: The two 48V power supplies have been mounted "opposite" in such a way, that the adjustments or line voltage switching required can be performed without removing the supplies from their enclosure.
The output voltage adjustment R5 is located in front of the supply.
Current limit potentiometer, R40, and overvoltage trip potentiometer, R26, are accessible from either the top or the bottom depending upon which supply is in question.

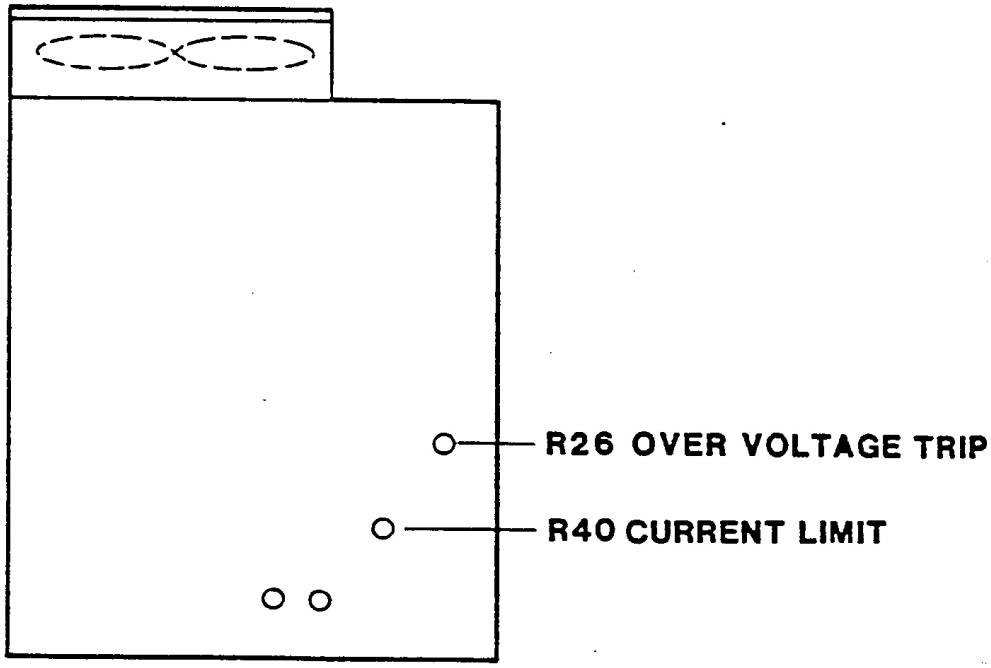
6.6.1 VOLTAGE (See Figure 12)

A. Attach a voltmeter to the 48v output terminals.
B. Turn R5 clockwise to increase the output voltage or counter-clockwise to reduce the voltage.
C. Observing the voltage reading on the meter, turn the control until required voltage is set.

CAUTION - Do not exceed the +/- 5% of nominal voltage limit when the unit is under load. When checking or setting the O.V.P. trip voltage of 2V or 20% above nominal must not be exceeded.



FRONT VIEW



BOTTOM VIEW

FIGURE 12

6.6.2 CURRENT LIMIT

The current limit control R40 on the bottom of the unit (see Fig 5). The current limit is factory set at 110% +/-5% of the 50 degrees C rated current.

a. Connect an appropriate load, for the desired current limit, to the unit.
While monitoring the output with a voltmeter turn the current limit control R40 clockwise until the output voltage drops approximately 1%.

6.6.3 OVERVOLTAGE TRIP POINT

The OVP control R26 is on the bottom of the unit (See Fig 5). The OVP is factory set 10% to 20% above nominal output voltage.

a. With the unit without load, adjust the output voltage (as described previously in 6.1.1) being certain to observe the CAUTION. If the voltage control does not have the required range to reach the desired trip voltage, then a 5 mega ohm variable resistor should be placed between the Remote Program Terminal and the +S terminal. The resistor value should then be slowly decreased until the desired level is reached.

b. Turn the OVP control slowly clockwise until the output voltage drops.

7. TROUBLESHOOTING HINTS

7.1 SYSTEM

System problems are most easily recognized by observing the MICOM 1000 front panel RF power meter and LED's during actual operation. If the forward power is considerably below the normal 1000 watt level, check the reverse power. The power is automatically reduced to 750 Watts if the VSWR exceeds 2:1 and to 500 Watts if the VSWR exceeds 3:1. At 2:1 VSWR, the refleted power is approximately 10% of the forward power. At 3:1 VSWR the reflected power is 25% of the forward power.

If the conditions described above are observed, a problem with the antenna or ATU could exist. If the reflected power is very low, check that exciter output power is within specified limits.

Correct drive power and low or no reflected power points to a problem in the amplifier unit or the power supply. Check if the power supply is current limiting by observing the 48V-1 and 48V-2 LED's on the amplifier unit. If any one or both LED's turn on during transmission current limiting is taking place. A problem may excist in the power supply or the amplifier unit may draw excessive current due to internal problems, possibly the harmonic filter selected.

If the problem remains on any frequency selected, power supply problems can be suspected. If only a limited range of frequencies (one filter range) causes the problem the particular filter must be suspected.

Reduced power output or current limiting at good VSWR conditions can be due to a failure of an FET power transistor. The BALANCE test serves to determine if this is the case. IT is important to note, however, that the test can only provide an indication of a problem when performed correctely and that several frequencies and filter ranges should be checked to verify a faulty module indication.

Serious problems causing system BYPASS can originate from a faulty filter or a VSWR in excess of 4:1. Since, in a BYPASS condition the exciter transmits at full power, observing the exciter output power will tell if the BYPASS condition is caused by VSWR because the exciter will not transmit its full power out if a VSWR conditions excist due to its own VSWR shut down circuit. Once a problem has been pinpointed to the power supply or the amplifier unit a closer investigation can be performed to locate the faulty subassembly. Power supply problems are easily traced by checking for blown fuses and measuring DC voltages and currents.

Amplifier Unit problems can be traced to the various assemblies as follows:

HARMONIC FILTER: Check power output on several filters while measuring current into the amplifier unit. Currents in excess of 27A especially when accompanied with less than normal output power (1000 watts) and found on one filter only point to that particular filter as being faulty. Likewise a BYPASS condition on particular filter identifies that filter as being faulty.

OUTPUT COMBINER: A faulty output combiner will usually cause an unbalance in current on the 48V-1 and 48V-2 supply.

POWER DISTRIBUTION: A serious malfunction as f.ex. complete loss of power output can be caused by problems on the power distribution board. DC voltage measurements will point to the faulty device.

DRIVER/ALC: Loss of output power can be caused by problems in the DRIVER/ALC circuit. Measuring the ALC voltage will assure, that power reduction is not caused by the attenuator pin diode. Without the exciter signal applied the voltage must be approximately 20V DC. With the exciter signal applied, the RF signal can be traced from input to output using an oscilloscope to determine if distortion or loss of gain takes place.

CONTROLLER: Functional problems can usually be traced to the controller or the exciter controller interface. Persistant bypass condition occurring during normal operation into a known good antenna system can be caused by the selection of a wrong filter. A loss of exciter signal to the controller will cause this to occur. Check the RF coax between the exciter and the amplifier unit and verify that exciter signal is present at the controller in order that the signal frequency can be measured to select the corect filter. Problems with ATU operation should be investigated by checking at the controller connections to verify correct operation of the controller circuitry.