

Operating Manual

MLA
2500

Dentron

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Introduction

The model MLA-2500 Linear Amplifier is a precision-built, compact, high-performance instrument of advanced design, providing 2000 Watts PEP input on SSB, (USB, LSB) and 1000 Watts DC input on CW, RTTY and SSTV, continuously. The MLA-2500 covers all Amateur bands between 1.8 and 29.7 MHz, and most MARS frequencies without modifications.

The MLA-2500 is constructed modularly. All electronic circuits are wired on easily removed or installed circuit boards.

The amplifier employs two *EIMAC 8875* external-anode ceramic/metal triodes operating in grounded grid, and a continuous-duty built-in power supply. The MLA-2500 has a dual-speed cooling system with automatic override of slow speed when tube plates approach an unsafe temperature.

The MLA-2500 makes an ideal choice for the serious amateur interested in a state-of-the-art instrument. It is a contest machine and perfect for any service requiring a highly reliable, compact operation. Any sophisticated electronic equipment will be damaged if operated incorrectly, and this Amplifier is no exception.

Please read all the operation instructions before putting the MLA-2500 on the air.

The MLA-2500 Linear Amplifier is designed *exclusively* for use by General or above class of Amateur Radio Operator.

DENTRON RADIO CO., INC.

All DenTron products are manufactured in the United States of America

MLA-2500 Design Notes

The MLA-2500 has undergone extensive engineering tests before being released.

Several special transformers were tested before arriving at the present 24½ pound transformer. Close tolerances and an all-out dedication to perfection demanded a specially built transformer. The result is a very high efficiency transformer which has been expressly built for the MLA-2500.

Extensive tests were performed in the tank circuitry. The need was for a small enough coil that would cover the range between 1.8-30 MHz. Many different approaches were tried out including a silver-plated copper tubing. The end result is a new approach to coil design which involves a teflon-covered conductor that contains 19 pieces of silver-plated wire for a greatly improved skin effect performance. This coil allows close windings which in turn effectively improve Harmonic Suppression.

The teflon insulation, (Type E), outside of being a superb Dielectric, also makes an ideal environmental protector. Tests show that operation of the MLA-2500 involving this coil in high humidity environments or salty atmosphere is greatly superior to other types of coils.

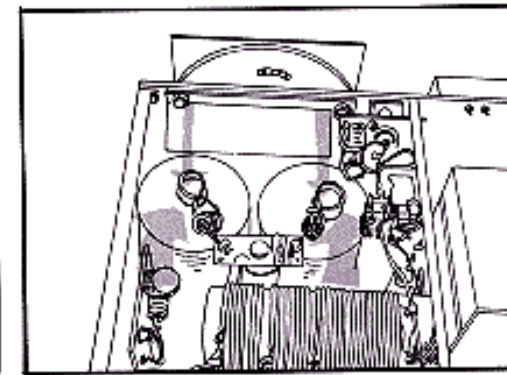
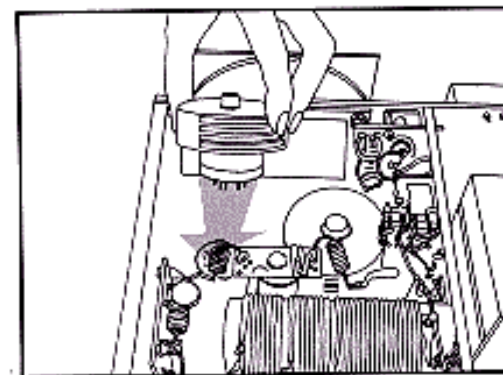
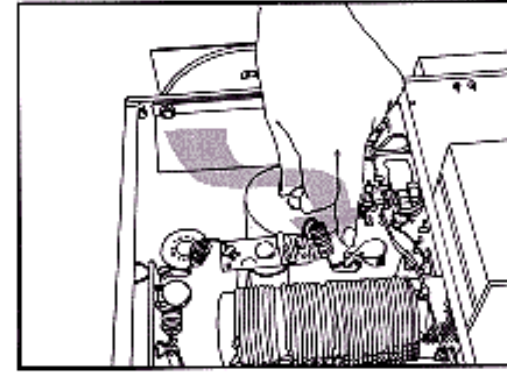
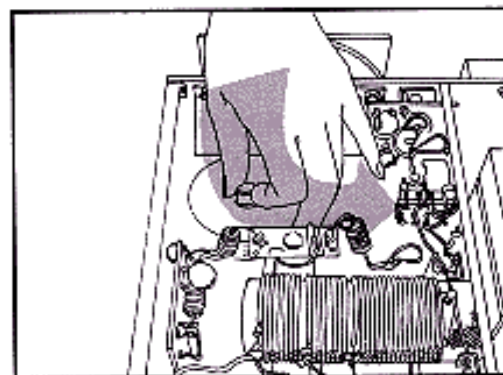
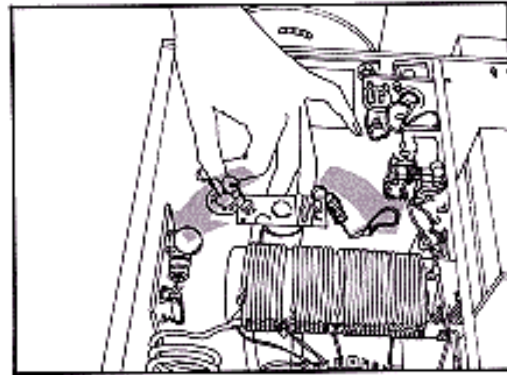
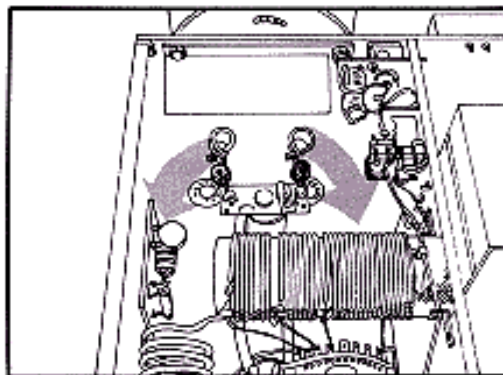
Warning

The MLA-2500 has been factory wired for 234 V AC. Due to many different configurations of power plugs in existence, the MLA-2500 is shipped without power connector. Drawing H on page 14 is designed to help you wire the power cord of the MLA-2500 to a normal household power outlet.

Warning

The MLA-2500 has been shipped from factory without the 8875 tubes, delay tube and control relay. These items are packed separately. Be sure to install these items before turning on the MLA-2500.

Tube Installation Carefully remove the EIMAC tubes from their boxes. Carefully move the two parasitic chokes in the tank compartment of the MLA-2500 out of the way. (Refer to Fig. 1 and 2) Introduce an 8875 tube at left (looking from front) (Refer to Fig. 3). Do not insert tube in this socket. Move tube to socket on the right, carefully guide tube and apply pressure only after you have made sure the tube pins are sitting exactly over the socket. (Refer to Fig. 4) Introduce second tube at left and guide it properly. Only then apply pressure and insert tube. (Refer to Fig. 5) Clamp parasitic chokes to the plates of the 8875.

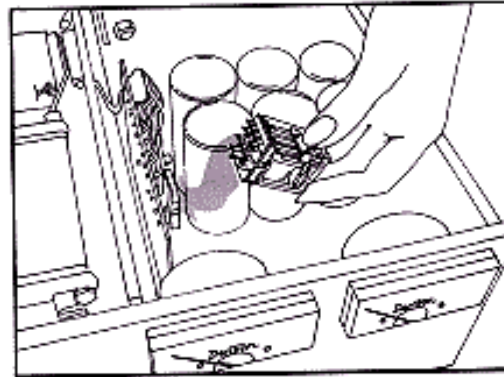
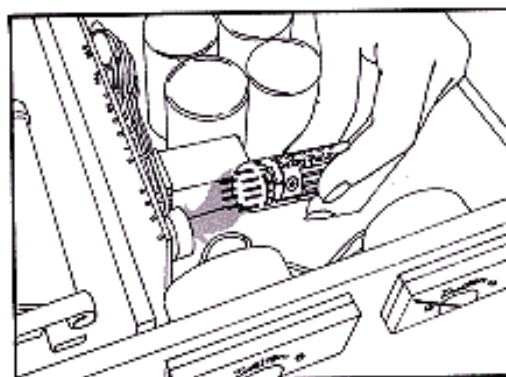


Delay Tube Installation

Refer to Drawing A on page 10 for location PC-1002. Delay tube is located on this board. Be sure to guide the tube before applying pressure to it. (Refer to Fig. 7)

Control Relay Installation

Control relay is located on board PC-1002 next to the delay tube. Insert relay at this location following the right key. (Refer to Fig. 8)



Warning

To take full advantage of the MLA-2500 cooling system, it is highly recommended that the MLA-2500 be raised up with the provided bail under normal operation conditions.

Make sure to *push continuous-duty button* when operating the MLA-2500 in tune, CW · RTTY or SSTV.

Cautions

1. Make no attempt to put the MLA-2500 in service outside of the cabinet. Contact with voltages in this Amplifier can be *fatal to the human body*.
2. Never attempt to operate the MLA-2500 with drive power of more than 120 Watts!
3. Never attempt to operate the MLA-2500 without first connecting it to an antenna with an SWR of less than 2:1, or a 50 Ohm dummy load of sufficient power handling capacity or serious damage may result to the amplifier.
4. Do not, under any circumstances, operate the MLA-2500 from a 117 Volt lighting circuit, because the circuit conductors are not large enough to safely carry this load.
5. Never run Amplifier from an extension cord.
6. Do not attempt to change jumper connections on back of Amplifier without first removing power from the MLA-2500.
7. Never attempt to push more than one of the last three push button switches to the right of the push button selector at any one given time (plate volt, plate current, grid current).. *These switches are positively inter-locked*. Forcing them together will severely damage the switch assembly, meter and associated electronics.
8. Never run the MLA-2500 on frequencies other than specified.
9. Do not run MLA-2500 in CW, RTTY, SSTV or tune without first pushing continuous-duty button.
10. Do not cover the top of the MLA-2500 with books, papers or other pieces of equipment or overheating may result.
11. Do not use different tuning procedures other than indicated in this manual.
12. When cleaning the MLA-2500, never blow high pressure air directly into the fan blades. Spinning the fan at higher speeds than it was designed for can cause damage and freeze the rotor assembly of the fan. Use brush in cleaning fan assembly.

MLA-2500 Specifications

Amateur Frequency Range:

160 Meter Band – 1.8 to 2.5 MHz
80 Meter Band – 3.5 to 4.5 MHz
40 Meter Band – 7.0 to 7.3 MHz
20 Meter Band – 14.0 to 14.350 MHz
15 Meter Band – 21.0 to 21.450 MHz
10 Meter Band – 28.0 to 29.7 MHz

Mode: USB, LSB, CW, RTTY, SSTV

Power Requirements: 234/117
VAC, 50/60 Hz

Plate Power Input: 2000 Watts PEP for SSB operation
1000 Watts DC for CW, RTTY, SSTV

Drive Requirements: For 2KW PEP - approx. 65 Watt
For 1KW DC - 36 Watt

Duty Cycle: 100% at full *legal* power

RF Output Impedance: 25-100 ohms

Wattmeter Accuracy: $\pm 10\%$ full scale into a 50 ohm resistive load.
The Wattmeter will always function as a
relative output meter into any reasonable
antenna load.

Warning

Erroneous readings will occur at high SWR's.

Audio Frequency Response: 400-2600 Hz within - 6 db

Harmonic Radiation (Third-Order): Equal or better than 30 db down from
output signal at full legal power, on
all bands.

Tube and Semiconductor: 2 Tubes
18 Diodes
1 Zener

Size: 5" H x 14" W x 14" D

Weight: 47 lbs.

Accessories: Rack Mounting Kit (Standard 19" Rack)

Front Panel Controls

On-Off Rocker Switch (Illuminated) - Turns power on and off.

Band-Switch - Selects desired ham bands (see frequency coverage).

Plate and Load Knobs - Tuning adjusts Pi-Network capacitors in tank circuit for proper resonance and loading on all bands.

Meter¹ - Monitors exciter output power or amplifier output power (illuminated).

Meter² - Pushbutton selects monitoring either grid current, plate current or plate voltage (illuminated).

Rear Jacks

RF-In - (For connecting to exciter RF output.)

RF-Out - (For connecting the MLA-2500 to an antenna.)

ALC - Controls the exciter, to allow the highest average power without peak clipping.

Relay Controls - Transmit operation of MLA-2500 from exciter. Also allows fan to go in high speed mode (if continuous-duty pushbutton is depressed), while transmitting, and low speed on receive.

INSTALLATION INSTRUCTIONS

The MLA-2500 has been designed incorporating an interlock to prevent dangerous electrical shock.

Make no attempt to put the Amplifier in service outside of the cabinet -contact with voltages in this Amplifier can be fatal.

Unpacking - Carefully remove your MLA-2500 from its packing carton, and examine it closely for signs of shipping damages. Should any damage be apparent, **notify the delivering carrier immediately**, stating the full extent of the damage.

Fill out and mail the enclosed registration card.

Location

In general, the location of the MLA-2500 is not critical, however, there are certain considerations which must be given to insure optimum performance. Extremely hot locations, such as near radiators or heating units should be avoided. Do not cover the top of the Amplifier case with books, papers, or other pieces of equipment, or overheating may occur. The back of the Amplifier case must not be obstructed and should not be placed closer than three inches from a wall or the air inlet for the blower will be blocked and overheating of the Amplifier tubes may occur.

Power Requirements

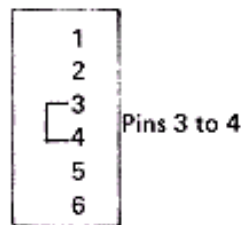
The MLA-2500 has a built-in continuous-duty power supply which can be operated from either 234 V AC or 117 V AC 50-60 Hz. A jumper network is provided in the back of the Amplifier for easy change without removing the cabinet.

The MLA-2500 is shipped from the factory with jumpers connected to operate on 234 V AC. It is highly recommended that the MLA-2500 be operated from its own 234 - 15 A (or greater) circuit. If a 117 V circuit is all that is available, it should be fused for 30 A and circuit conductors should not be less than #10 and no other equipment should be operated from this circuit. Never run Amplifier from an extension cord.

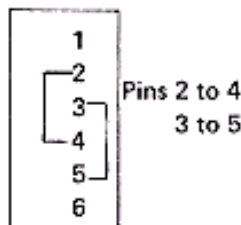
Jumper Connection Diagrams

Below are pictorials of jumper connections located inside power network assembly for both 234 V and 117 V operation. (Refer to Drawing C on page 12 for location of power network assembly.) The jumpers must be connected as shown or severe damage to the MLA-2500 components may result.

234 Volt Operation



117 Volt Operation



Warning

Completely remove power from MLA-2500 before attempting to change jumper connections on back of Amplifier.

Antenna Requirements

The MLA-2500 has been designed for use with antennas resonant at the operation frequency and having approximate impedances within the limits of 25 to 100 ohms.

The nominal output impedance of the MLA-2500 is 50 ohms and the SWR of this load should never exceed 2:1. Although there are many types of antennas which will meet these requirements, the simplest is a one-half ($\frac{1}{2}$) wave dipole center fed with 52 ohm coax. For a detailed discussion on antennas, we suggest referring to an appropriate antenna book.

Most practical antennas exhibit an SWR range over a complete amateur band that exceeds 2:1. For this reason we recommend using an antenna matching network such as the DenTron 160-10 AT 3KW model which will allow the MLA-2500 to work into a 50 ohm resistive load for maximum power transfer into the antenna.

Caution

Never attempt to operate the MLA-2500 without first connecting it to an antenna or 50 Ohm dummy load of sufficient power handling capacity or *serious damage may result*.

Ground Requirements

The MLA-2500 should be attached to a good earth ground through as short and as large a ground strap as possible for best results. A binding post is provided on the rear of the MLA-2500 chassis for this purpose. It is always a good idea to connect the chassis of all associated equipment together and ground them at one point to avoid ground loops. We recommend that all of the equipment in your station be connected together and grounded at the DenTron 160-10 AT 3KW Antenna Tuner.

Exciter Requirements

To operate the MLA-2500 at the maximum legal input, it will be required of the exciter to deliver 65 watts PEP - SSB RF power or 36 watts RF power on CW, RTTY, and Tune.

ALC

An RCA jack on the rear of the MLA-2500 Amplifier is provided for connection to the exciter of a transmitting ALC voltage which controls the gain of the exciter so that any power level can be run up to 2000 Watts PEP without peak clipping. (Refer to Drawing C on page 12 for location of ALC jacks.)

Relay

An RCA jack on the rear of the MLA-2500 is provided for connection to a pair of normally open relay contacts in the exciter which close on transmit and thus cycle the MLA-2500 in transmit. (Refer to Drawing C on page 12 for location of relay jack.)

It also controls the fan speed, should the continuous-duty pushbutton be activated.

Tuning Procedure

Warning

Be sure that the MLA-2500 is connected to a 50 Ohm antenna or a 50 Ohm dummy lead and that the proper jumpers have been installed in the power network to match your AC power requirements (the MLA-2500 is factory-wired for 234 Volt AC.)

For All Modes of Operation

Make sure to activate continuous-duty pushbutton when operating on TUNE, CW, RTTY, or SSTV.

CW, RTTY, SSB, SSTV

1. Band switch to desired band.
2. Load control fully counterclockwise (CCW) on the number one (1) mark.
3. Tune control in the ARC provided for desired band.
4. Pushbutton selector:
 - A. Continuous Duty - Pushed in
 - B. Stand By - Pushed out
 - C. Plate Current - Pushed in
 - D. Plate Volt - Pushed out
 - E. Grid Current - Pushed out

*Note: All functions of the pushbutton assembly are true in the "pushed in" position. EXAMPLE: Machine is in stand-by mode when "stand by" pushbutton is pushed in.

Warning

Do not attempt to push more than one of the last three switches to the right at one time (plate volt, plate current, grid current). Although they are positively interlocked to prevent this, forcing them will severely damage switch assembly, meter and associated electronics. Turn exciter on and insert a small amount of power into the MLA-2500 and adjust the tune control to a maximum reading on the Wattmeter; quickly adjust load control for a higher reading on the Wattmeter. Re-adjust tune control for an even higher reading on the Wattmeter.

Repeat the above operations until there is no longer a noticeable change on the Wattmeter.

Insert full power [*Refer to procedure below for measuring exciter PWR (approx. 36 Watts)] into the MLA-2500 and repeat the above procedure (tune, load, tune, load . . .) until there is no more change in the reading of the Wattmeter.

Warning

Do not use any other procedure for tune-up or erroneous tuning will occur.

Note: Although the MLA-2500 is a continuous-duty machine, the life of the tubes in it is directly proportional to the time length they are being used. In the interest of extended life, energy conservation and no interference to others, the above procedure should be done as quickly as possible. To calculate power input, multiply plate current reading shown on plate current meter with plate volt reading (push plate volt pushbutton) shown on the same meter and add exciter PWR (*Exciter power can be read on Wattmeter by pushing the stand-by button in and activating the exciter.)

$$\text{POWER INPUT} = \text{Plate Volt} \times \text{Plate Current} + \text{RF Drive}$$

Service Data

Extreme caution should be exercised whenever making any adjustments inside the MLA-2500.

Removing Top Cover: After completely disconnecting the MLA-2500 from power, wait 15 minutes so all electrolytic capacitors have discharged through their bleeding resistors. The top cover can then be safely removed by taking out the top row of three screws on both sides of the amplifier.

Removing Bottom Cover: After completely disconnecting the MLA-2500 from power, wait 15 minutes so all electrolytic capacitors have discharged through their bleeding resistors. The bottom cover can then be safely removed by taking out the bottom row of three screws on both sides of the amplifier.

Cleaning Amplifier Compartment Since the Amplifier compartment is forced-air cooled, it will collect particles of dust which must be removed periodically. The frequency of cleaning will be governed by how many hours the MLA-2500 is operated, and by how clean its environment is. When the blower wheel accumulates a large amount of dust, the Amplifier should be cleaned. The best way to clean the MLA-2500 is to remove the top and bottom covers and blow the dust out with compressed air. If compressed air is not available, a soft-bristled one-inch paint brush can be used to brush the Amplifier clean.

Warning

Do not blow air directly into the fan blades. Use brush in cleaning blades of fan.

Tube Replacement

If it becomes necessary to replace the tubes in the MLA-2500, the same brand should be used. A new tube kit is available from DenTron Radio Co.

Trouble Shooting

Careful consideration has been given to the design of the MLA-2500 to keep maintenance problems to a minimum. However, it is possible that some problem will arise which cannot be cured by tube substitution. If this occurs, we suggest that you either return your unit to your dealer, or write directly to our customer service department describing your problem in detail. Include full information concerning external connections, control settings, associated equipment, antenna; and make sure to indicate the serial number of the MLA-2500. Do not return equipment to the factory without prior authorization.

Returning the MLA-2500 to the factory for service:

Obtain a return authorization from the customer service department. DenTron Radio Co. will assume no responsibility if the transportation company refuses to pay a damage claim due to improper packing or lack of insurance.

Alignment

The MLA-2500 has been factory aligned and should provide years of trouble-free service. Should it become necessary to align any of the circuits, the following procedures should be followed.

Meter Adjustments

The two meters on the front panel can be set to zero by adjusting the set screws located on their faces.

Knob Pointer Alignment

When replacing the knobs on the MLA-2500, correct alignment of the Tune Knob, Load Knob and Band Controls Knob is important.

Load Knob

With plates fully meshed, the pointer should be resting on position No. 1 before the set screw is tightened.

Tune Knob

With plates fully meshed, the pointer should be resting in the lowest edge of the 1.8 MHz ARC before the set screw is tightened.

Band Controls Knob

With shaft in 28 MHz position (CCW) make indicator on knob point to 28, then tighten the two screws.

Wattmeter Calibration (Refer to Drawing A on page 10 for location of PC-1001)

The Wattmeter of the MLA-2500 was designed to keep maintenance to a minimum. It is a passive device and it should provide years of service and maintain its factory calibration. If it becomes necessary to calibrate the Wattmeter, the following equipment will be necessary:

1. A 50 Ohm dummy load with an SWR of no more than 1.05:1 through 30 MHz and capable of handling 1 KW
2. An accurate RF Wattmeter or an accurate RF Voltmeter.
3. A transmitter with variable output to 36 Watts CW at 14 MHz.
4. Insulated Screwdriver

Wattmeter Adjustment (Refer to Drawing B on page 11 for location of Wattmeter Control)

Tune MLA-2500 into the dummy load on 14 MHz following the normal tuning procedures described previously in this book. With an accurate RF Wattmeter connected to the output of the MLA-2500 into the dummy load. Increase drive to a reading of 1000 W on this external Wattmeter.

Adjust wattmeter control on top of the Wattmeter board with insulated screwdriver until the reading on Wattmeter on front panel exactly matches the reading on the external Wattmeter. With this procedure the calibration is complete. This Control is accessible through top cover at rear of amp.

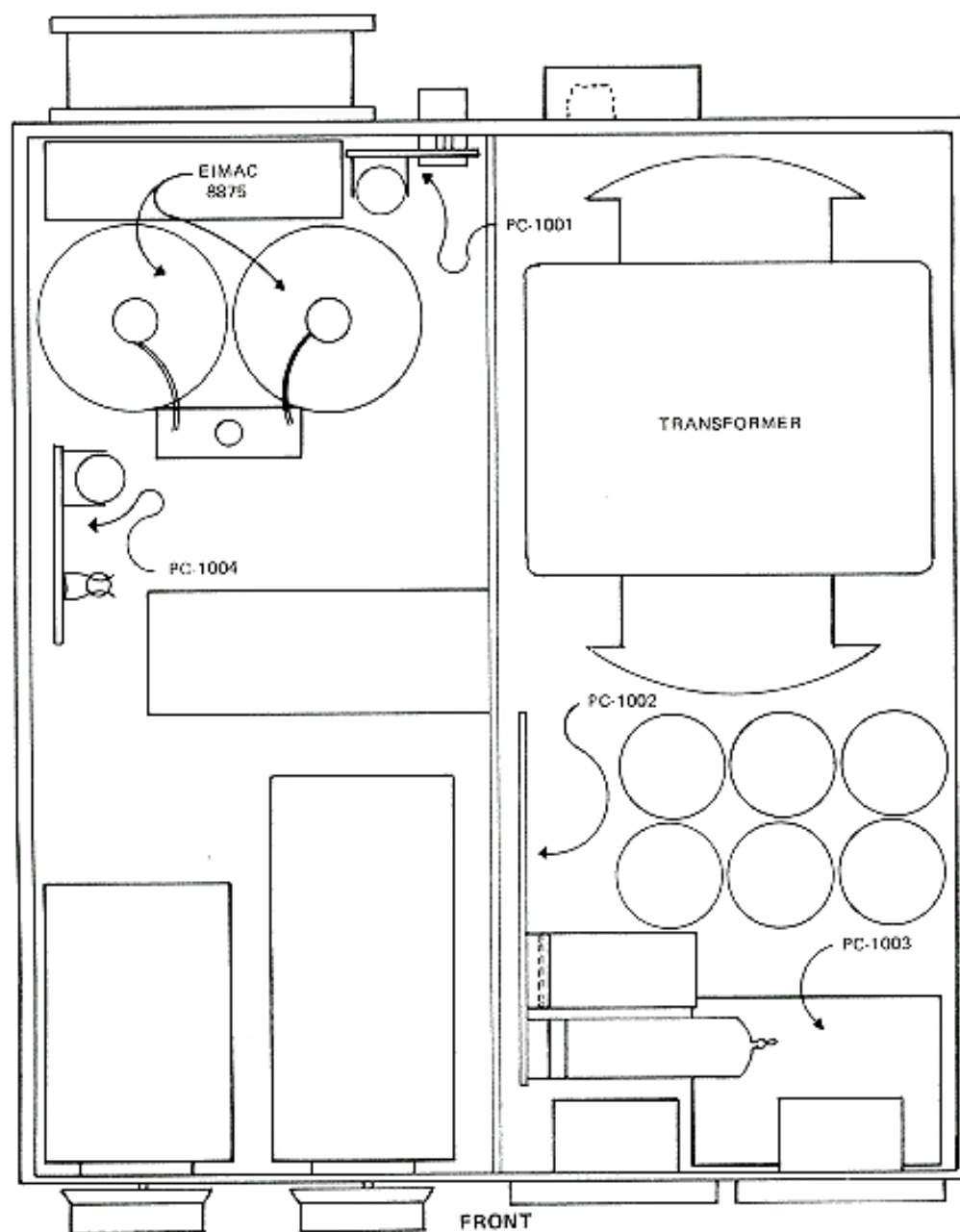
ALC Calibration (Refer to Drawing B on page 11 for location of ALC Control)

ALC has been factory adjusted and should not require adjustment.

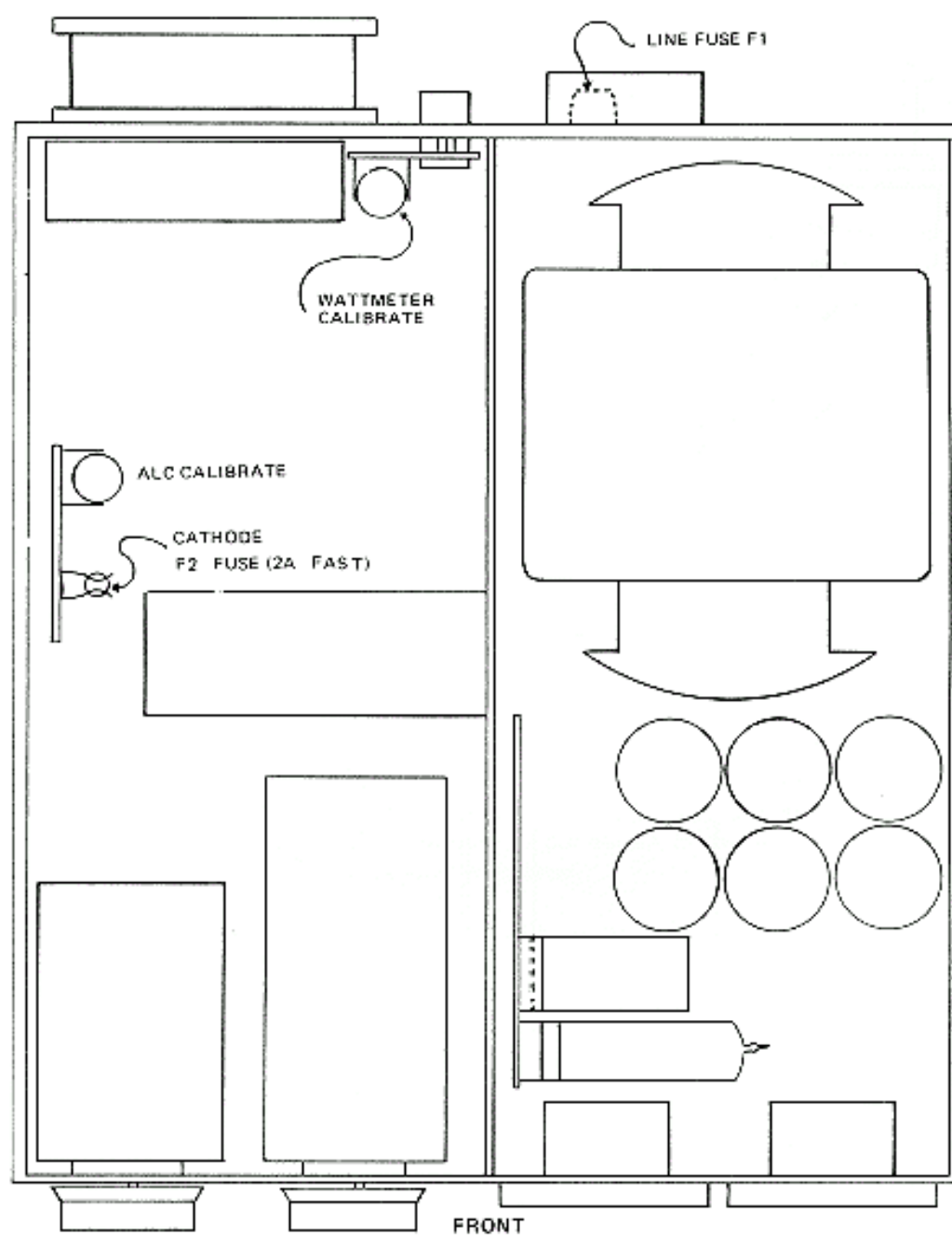
Should it become necessary to re-adjust ALC, a monitoring scope should be used. To keep the highest average power (2000 Watts PEP input) without peak clipping.

Adjust ALC control which is located on ALC Board (PC 1004 - Refer to Drawing A on page 10 for location of PC-1004.) This control is accessible through top cover on left side of the machine.

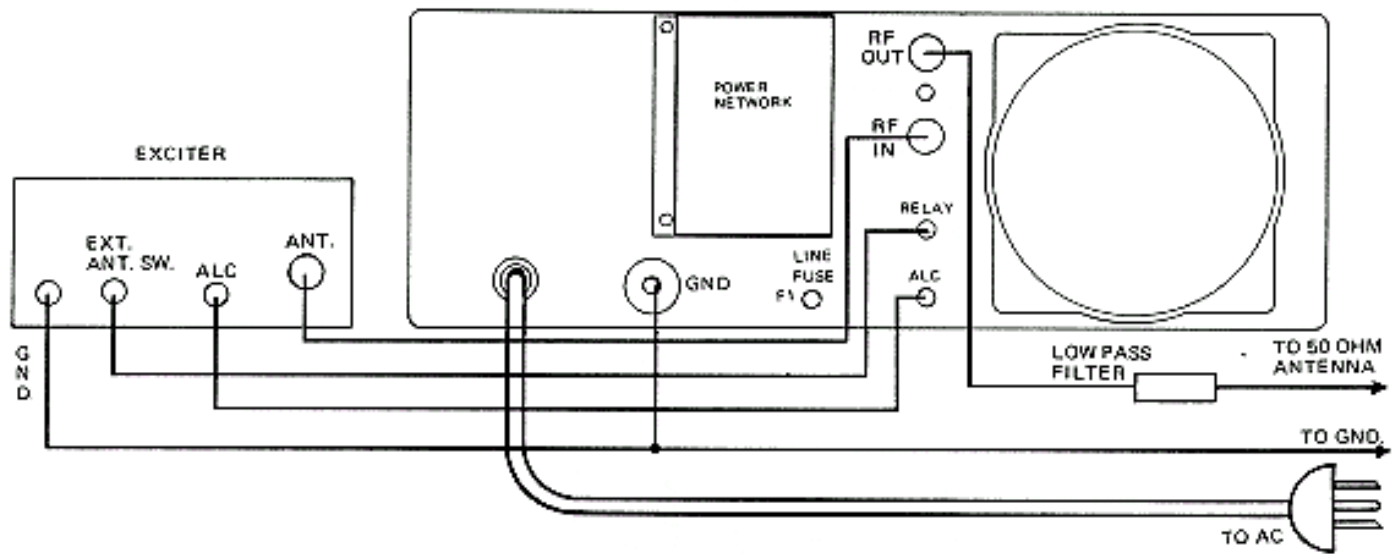
DRAWING A
MLA-2500 Top View / PC Board Location



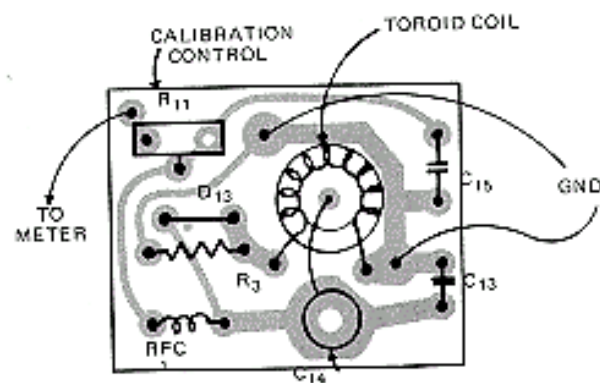
DRAWING B
MLA-2500 Top View / Location of Controls and Fuses



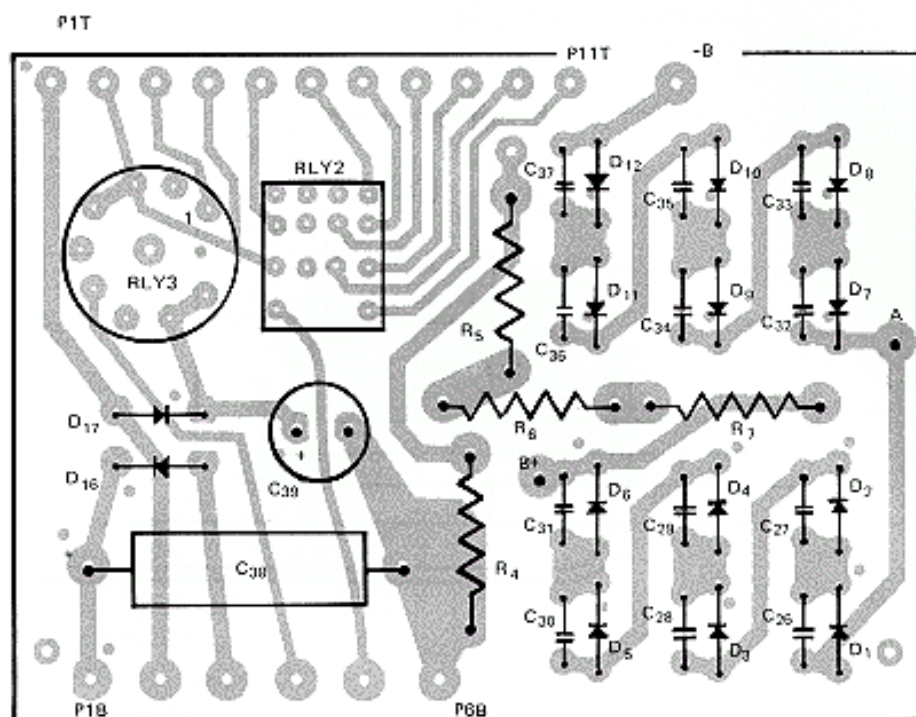
DRAWING C
MLA-2500 Rear View



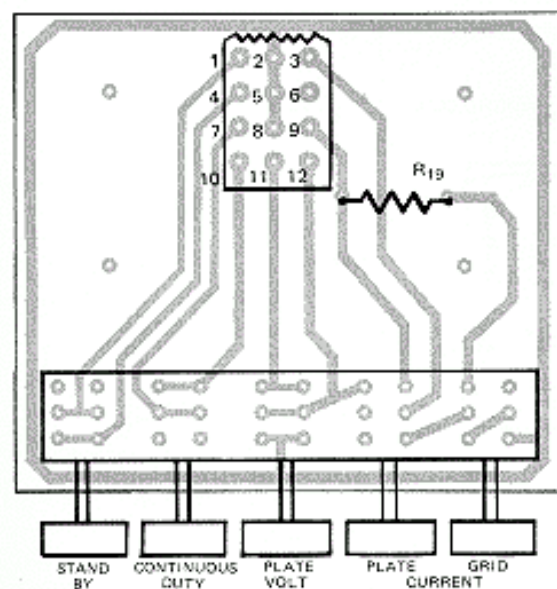
DRAWING D
PC - 1001



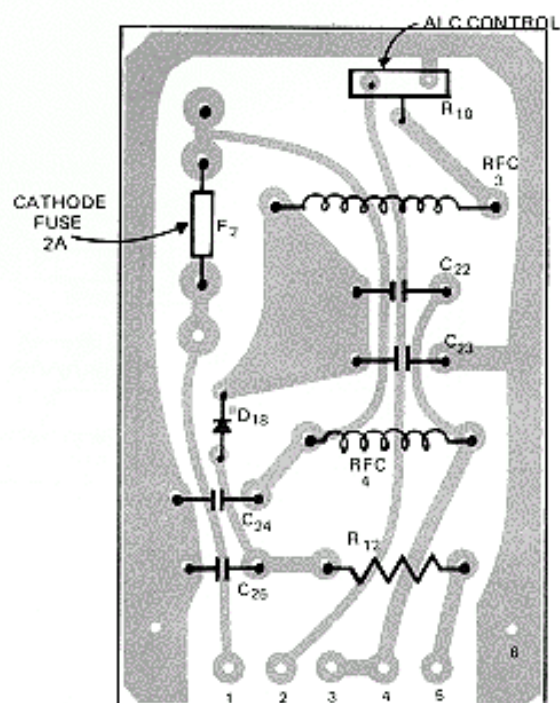
DRAWING E
PC - 1002

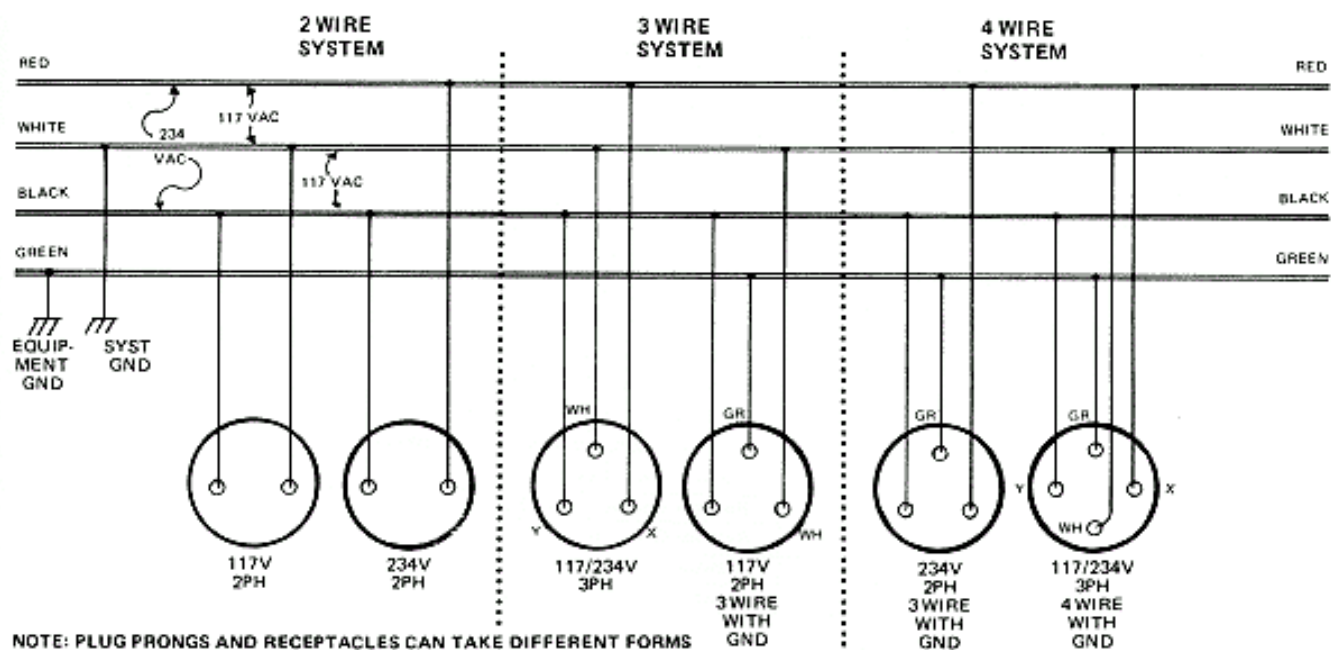


DRAWING F
PC - 1003



DRAWING G
PC - 1004

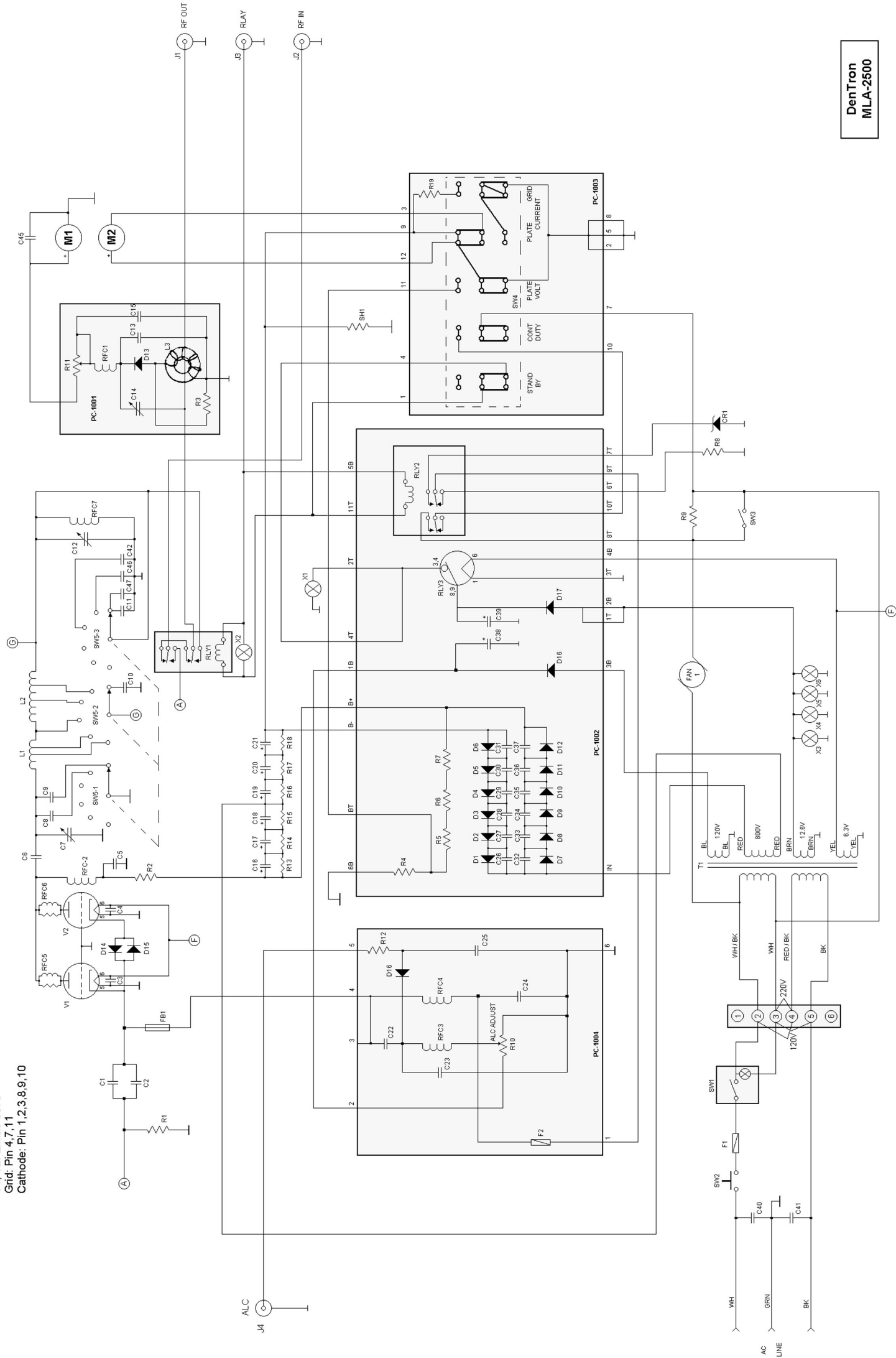




**MLA
2500
PARTS
LIST**

| PART NO. | DESCRIPTION | NO. USED |
|--|--|----------|
| V1, V2 | Tube, 8875 | 2 |
| D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, D14, D15, D16, D17 | Diode 1N4007 | 16 |
| D13 | Diode 1N295 | 1 |
| D18 | Diode 1N4148 | 1 |
| CR1 | Zener 8.1 - 50W | 1 |
| C1, C2 | Capacitor .001 - 1KV | 2 |
| C3, C4, C15, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C40, C41, C45 | Capacitor .01 - 1KV | 20 |
| C5 | Capacitor 500Pf - 5KV | 1 |
| C16, C16, C18, C19, C20, C21 | Capacitor, Electrolytic 150UF - 450V | 6 |
| C22, C23 | Capacitor SM, 47Pf - 150V | 2 |
| C38 | Capacitor, Electrolytic 100UF - 250V | 1 |
| C39 | Capacitor, Electrolytic 600UF - 25V | 1 |
| C6 | Capacitor 500Pf - 7KV | 3 |
| C7 | Capacitor, Variable 140Pf | 1 |
| C8, C42 | Capacitor 100Pf - 5KV | 2 |
| C9 | Capacitor 3X100Pf - 5KV | 3 |
| C10, C11, C41, C46, C47 | Capacitor 100Pf - 7KV | |
| C12 | Capacitor, Variable 500Pf | 1 |
| C13 | Capacitor Sm 220Pf - 150V | 1 |
| C14 | Capacitor Piston Trimer 1-8Pf | 1 |
| R1 | Resistor Swamping Noninductive 100 ohm - 25 W | 1 |
| R2 | Resistor Fuse 1 ohm 1/2 W | 2 |
| R3 | Resistor Composition 47 ohm 1/2 W | 1 |
| R4, R13, R14, R15, R16, R17, R18 | Resistor Composition 100K ohm - 2 W | 7 |
| R5, R6, R7 | Resistor Composition 1M - 2W | 3 |
| R8 | Resistor Composition 47K ohm - 2 W | 1 |
| R9 | Resistor Power 380 ohm - 25 W | 1 |
| R10, R11 | Potentiometer Trimer 100K ohm 1/3 W | 2 |
| R12 | Resistor Composition 27K ohm - 2W | 1 |
| R19 | Resistor Composition 510 ohm - 1/2 W | 1 |
| FAN 1 | Fan | 1 |
| FB1 | Ferite Beed | 1 |
| PC 1001 | Wattmeter Board | 1 |
| PC 1002 | Power Supply, Control Board | 1 |
| PC 1003 | Switch Board | 1 |
| PC 1004 | ALC Board | 1 |
| SH1 | Shunt | 1 |
| RLY 1 | Relay Antenna | 1 |
| RLY 2 | Relay Control | 1 |
| RLY 3 | Relay Dealy 6NO75T | 1 |
| SW1 | Switch Power 117V - 16A | 1 |
| SW2 | Switch Interlock | 1 |
| SW3 | Switch Thermo | 1 |
| X ₁ X ₂ | *330 Lamp, 12 V | 2 |
| X ₃ , X ₄ , X ₅ , X ₆ | Lamp Meter, 12V | 4 |
| T1 | Transformer Power | 1 |
| F1 | Fuse Power 117VAC - 15A SLO; 234 VAC - 10A SLO | 1 |
| F2 | Fuse Cathode 2A | 1 |
| RFC - 1 | Choke 390 ohm H | 1 |
| RFC - 2 | Choke Plate | 1 |
| RFC - 3 | Choke 2.5 MH | 2 |
| RFC - 7 | Choke 2.5 MH | 1 |
| RFC - 4 | Choke 15 MH | 1 |
| RFC - 5-6 | Choke Parasitic | 2 |

V1, V2: Eimac 8875



**DenTron
MLA-2500**