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UNCLASSIFIED

9997

TECHNICAL MANUAL

for

LINEAR POWER AMPLIFIER

MODEL PAL-500

TM-6505

MF/HF LINEAR POWER AMPLIFIER



THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N. Y.

OTTAWA, ONTARIO

★
IN 2037

Issue Date: May, 1966

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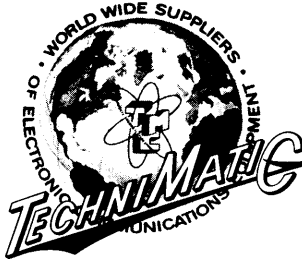
THE TECHNICAL MATERIEL CORPORATION

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OTTAWA, ONTARIO

WARNING

Extremely high voltages (up to 3000V) exist in this equipment. Observe all standard safety procedures and safety procedures noted in this manual.



TMC (*Canada*) LIMITED

TELECOMMUNICATIONS ENGINEERS

MAILING ADDRESS: R.R. No. 5, Ottawa, Ontario

A Subsidiary of The Technical Materiel Corporation, Mamaron ck, N.Y.

W a r r a n t y

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes* fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.
2. That the defect is not the result of damage incurred in shipment from or to the factory.
3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.
4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes*furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

* Electron tubes also include semi-conductor devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

TMC (*Canada*) LIMITED
Engineering Services Department
R.R. No. 5, Ottawa, Ontario
Telegraphic Address: TEPEI, Ottawa.

NOTE

As a special proviso to Department of Transport Order E-6586, File 8E-1957, Req'n. E-32 SRC, dated 16th November 1965, TMC (Canada) Limited accepts that the "Period of One Year" can be from the date of installation, providing a total of two years is not exceeded from the date of delivery, and proof that storage conditions are adequate to ensure no damage will occur.

TECHNICAL MANUAL CHANGE NOTICE

MANUAL AFFECTED: Linear Power Amplifier, Model PAL-500, TM-6505,
MF/HF Linear Power Amplifier

DATE: 4 June 1968

IN:2037

Page 3-1, table 3-1, index 2.

Under "function" change the first sentence to read:
The H.V. Line switch must be switched on before voltage
can be applied to the final plates.

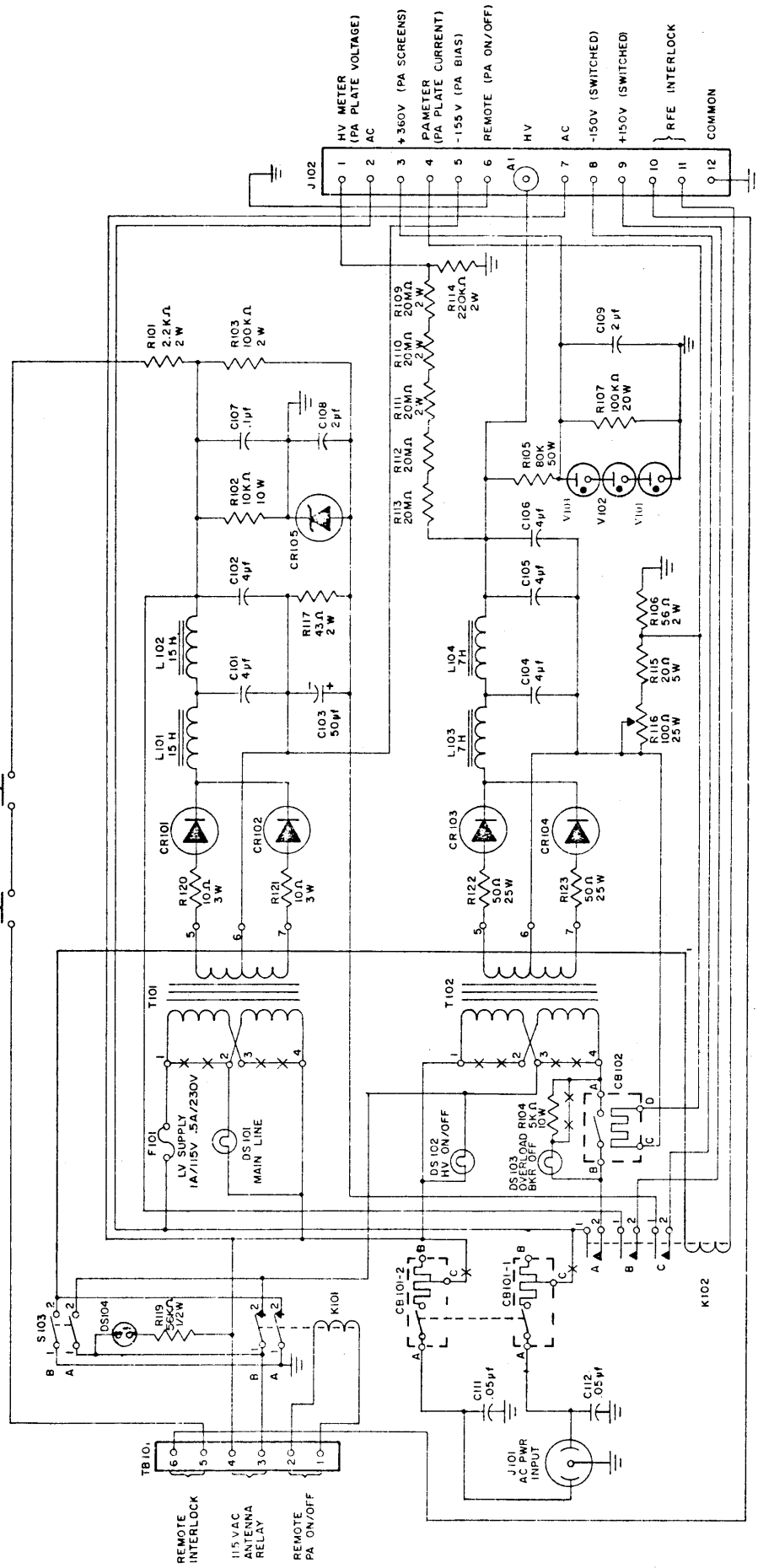
Page 3-1, table 3-1, index 3.

Change the "function" to read:
When in the STANDBY-REMOTE position, the switch keeps
the H.V. Line interlock relay K102 de-energized. The contacts
of relay K101 in parallel with S103 produce the same effect
when K101 is remotely energized. Switching S103 ON or
energizing K101 in turn energizes K102. As a result the high
voltage and screen grid voltage are applied to the final PA
tubes.

Page 7-3, figure 7-3.

Replace with the figure attached.

COVER INTERLOCKS
S101
S102
TOP
BOTTOM



CHANGES NECESSARY TO CONVERT TO 230V OPERATION

T101 REMOVE JUMPERS MARKED *** AND CONNECT JUMPERS BETWEEN TERMINALS 2 & 3.

T102 SAME AS T101.

CB101 REMOVE LEADS FROM TERM "C" AND CONNECT TO TERM "B". (MARKED **)

R104 REMOVE AND DISCARD JUMPER MARKED **.

F101 CHANGE FROM 1AMP TO 1/2 AMP.

NOTES

!- ALL FUSES ARE SLOW BLOW.

2- TB101 TERMINALS 5 & 6 NORMALLY JUMPED UNLESS REMOTE INTERLOCK IS REQUIRED.

ADDENDA

TRANSMITTER PLATES SWITCH.

The operation of this control provides a standby position for the RFE-1. The switch S103 on the front panel of the PSP-500 and the contacts of relay K101 are in parallel (see figure 4-8) so that either may control the amplifier. In the standby position the PA tubes (V203, V204) are biased to cutoff by the removal of the ground connection of the bias control network. The bias changes from about -25v to approximately -150v.

For remote operation with relay K101, switch S103 must be open, in the STANDBY/REMOTE position. Relay K101 is then operated by a direct current passed through terminals 1 and 2 of TB101. Minimum current required is 9ma which can be supplied from a line with a 48vdc source and a resistance of 200 ohms.

CW/SSB SWITCH.

This control changes the mode of operation of the PA from SSB to CW. The PA bias is setup in the SSB position first and then the switch is moved to the CW position.

The switch S206 in the CW position connects resistor R215 into the bottom of the PA bias network, thereby increasing the negative bias on the PA tubes enough to cut off their plate current.

The drive and tuning are adjusted until the values in Table 3-5 are obtained.

The ALDC is removed in this switch position.

INSTRUCTION BOOK CHANGE NOTICE

DATE: 9 FEB., 1971

Manual affected: LINEAR POWER AMPLIFIER MODEL PAL-500

IN-2037.

Page 2-2.

Change "Figure 2-2" to read "Figure 2-1".

Page 3-4, para 3-2.

Add sub-para (7) "CW/SSB SW on rear panel set to the SSB position".

Page 3-5, para 3-3 (14) 2nd and 5th lines.

Change "100 ma" to read "125 ma" and "200 ma" to read "220 ma".

Page 3-5, para 3-3.

Add sub-para 21. "While the unit is fully tuned to some frequency at maximum power (See table 3-3 and 3-4) turn the ALDC adjustment control (R228) on the rear panel slowly clockwise until the output (as observed on the multimeter) drops approximately 10%. The ALDC circuit operates only in the SSB Mode. Do not advance the ALDC control clockwise more than is necessary or clipping will result".

Page 3-5, Table 3-3, SINGLE TONE INPUT.

Under READING column change "Full Scale +" to read "10".

Under VALUE column change "10v+" to read "10v".

Page 3-5.

Under Table 3-3 and 3-4, insert the following table 3-5.

TABLE 3-5. SINGLE TONE
CW MODE

MULTIMETER		
Switch Position	Reading	Value
ISG	-5	-5ma
RF DR	45	45v
RF PL	0.7	700v
RF OUT*	1.2	120v
PA PLATE METER 300ma.		

Page 4-5, Figure 4-4.

Change "V204" to read "V202".

Page 4-7, Figure 4-6.

Change "CR205, 1N67" to read "CR205, 1N645A".

Page 4-8, Figure 4-7.

Change "R215, 82K" to read "R215, 15K".

Page 4-9, Figure 4-8.

Change "115vac ANTENNA RELAY" to read "115vac to ANTENNA RELAY".

Page 5-1, DC voltage chart.

Line 3, change "40 to 70" to read "50 to 110".

Page 6-1, Delete CR-106 and CR107

Add V101, Regulator Tube	0A2
V102, " "	0B2
V103, " "	0B2

Page 6-2, Line 2,

Under Part NO. column change "F1102-3" to read "B1102-3".

Page 6-3, Parts List.

Under description column change R119 from "56K ohms" to "18K ohms".

Under TMC Part NO. column change R119 from "RC20GF563J" to "RC20GF183J"

Page 6-8, Line 5.

Under DESCRIPTION column change "Same as CR204" to read "1N645A" Under PART NO. column add "1N645A".

Page 6-11.

Under DESCRIPTION column change resistor R215, "82K ohm" to read "15K ohm". Under PART NO. column change "RC32GF823J" to read "RC32GF153J".

Page 7-1, Figure 7-1 and Page 7-2, Figure 7-2.

Change the value of resistor R215 from "82K, 1w" to read "15K, 1w".

Page 7-1, Figure 7-1 and Page 7-2, Figure 7-2.

Change CR205 from "1N67" to read "1N645A".

Page 7-3, Figure 7-3 and Page 7-4, Figure 7-4.

Change "S108" to read "S103".

Change "115vac ANTENNA RELAY" to read "115vac TO ANTENNA RELAY".

Change R119 "56K ohm $\frac{1}{2}$ watt" to read "18K ohm $\frac{1}{2}$ watt".

CHANGE NO. 4

INSTRUCTION BOOK CHANGE NOTICE

MANUAL AFFECTED: Linear Power Amplifier, Model PAL-500, TM-6505,
HF/BF Linear Power Amplifier.

DATE: 23 August, 1971.

MANUAL NO. IN2037

Page 6-11, Parts list Model R2H-1

Change R216 Resistor from RA75AAR54X25
to RA75AAR1R0A25

Page 7-1, Fig. 7-1 Schematic Diagram R2E-1

Change value of resistor R216 from "0.5" to "1.0"

TECHNICAL MANUAL CHANGE NOTICE

CHANGE NO. 5

PAL-500

DATE: 24 January 1972

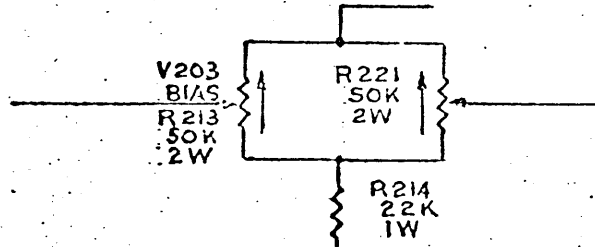
MODEL AFFECTED: LINEAR POWER AMPLIFIER, PAL-500

MANUAL NUMBER: IN2037

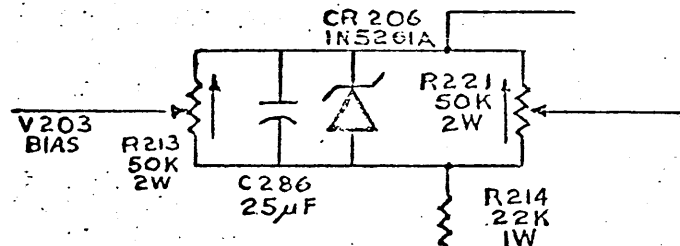
SECTION 4 PRINCIPLES OF OPERATION.

Page 4-8, Figure 4-7

CHANGE: FROM



TO



SECTION 6 PARTS LIST

Page 6-2

CHANGE: The Description of R107 from 100 k ohms to 20 k ohms and part number of R107 from RW110-43 to RW110-44.

Page 6-7

ADD: After C285; C286, CAPACITOR; fixed, electrolytic, 25 RF - 10% + 150 %, 100 WVDC, Reservoir Capacitor, CE-105-25

Page 6-8

ADD: After CR205; CR206, DIODE: Zener, Bias Regulator, IN5261A

SECTION 7 SCHEMATIC DIAGRAM

Figure 7-1 and figure 7-2

CHANGE: FROM

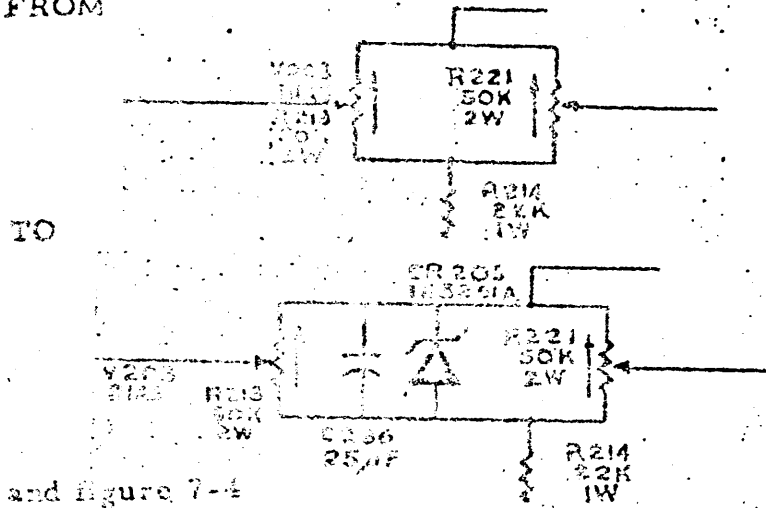


Figure 7-3 and figure 7-4

CHANGE:

The value of R107 from 100 k ohms to 20 k ohms.

TECHNICAL MANUAL CHANGE NOTICE

CHANGE NO. 6

PAL-500

DATE: 1 March 1972

MODEL AFFECTED: LINEAR POWER AMPLIFIER, PAL-500

MANUAL NUMBER: IN2037

SECTION 4 PRINCIPLES OF OPERATION

Page 4-8, Figure 4-7

CHANGE: Part number of CR206 from IN5261A to IN5369A.

SECTION 6 PARTS LIST

Page 6-7

CHANGE: the value of C236 from 25RF to 25uF.

Page 695

CHANGE: the part number of CR206 from IN5261A to IN5369A.

SECTION 7 SCHEMATIC DIAGRAMS

Page 7-1, Figure 7-2

CHANGE: the part number of CR206 from IN5261A to IN5369A.

TECHNICAL MANUAL CHANGE NOTICE

CHANGE No. 7

PAL-500

DATE: 3 April, 1972

Model Affected: Linear Power Amplifier, PAL-500 Manual Number: 1N2037

EXPLANATION OF CHANGE:

The screen regulator circuit in the original model PSP-500 contained gas regulator tubes V101, V102, and V103 which were later replaced by Kit 10046 containing Zener diodes CR106 and CR107. In change number 2 and change number 3 the kit was replaced again by the original tubes. Change No. 7 now replaces the tubes by new modified kit-10046. The following are the procedures for mounting this kit and other changes to the manual.

Installation of Kit 10046

(a) Remove bracket assembly tube mounting complete with tubes V101, V102 and V103. Keep Zener diode CR105.

(b) Mount CR105 on Kit 10046. Place the kit on the existing tube bracket mounting holes and fasten it with the hardware supplied.

(c) Make electrical connections as shown in the interconnection and schematic diagrams below.

Parts List of Kit 10046

<u>REF SYMBOL</u>	<u>DESCRIPTION</u>	<u>TMC PART NO.</u>
CR106, CR107	Diode Zener	1N3014B
CR108, CR109	Diode	1N4007

SECTION 6 PARTS LIST

Page 6-1

ADD: C113 CAPACITOR: fixed paper .1 uF CP1002

SECTION 7 SCHEMATIC DIAGRAMS

Figure 7-4 Page 7-4

ADD: C113 between cathode of CR102 and pin 5 of J102.

CHANGE NO. 8



INSTRUCTION BOOK CHANGE NOTICE

Date September 9, 1972

Manual affected: Linear Power Amplifier, Model PAL-500 IN 2037

1. Page 6-3:

Add the following to PSP-500 parts list:

R124 Resistor, Fixed, Wirewound, 10,000 ohms, 10W RW109-7

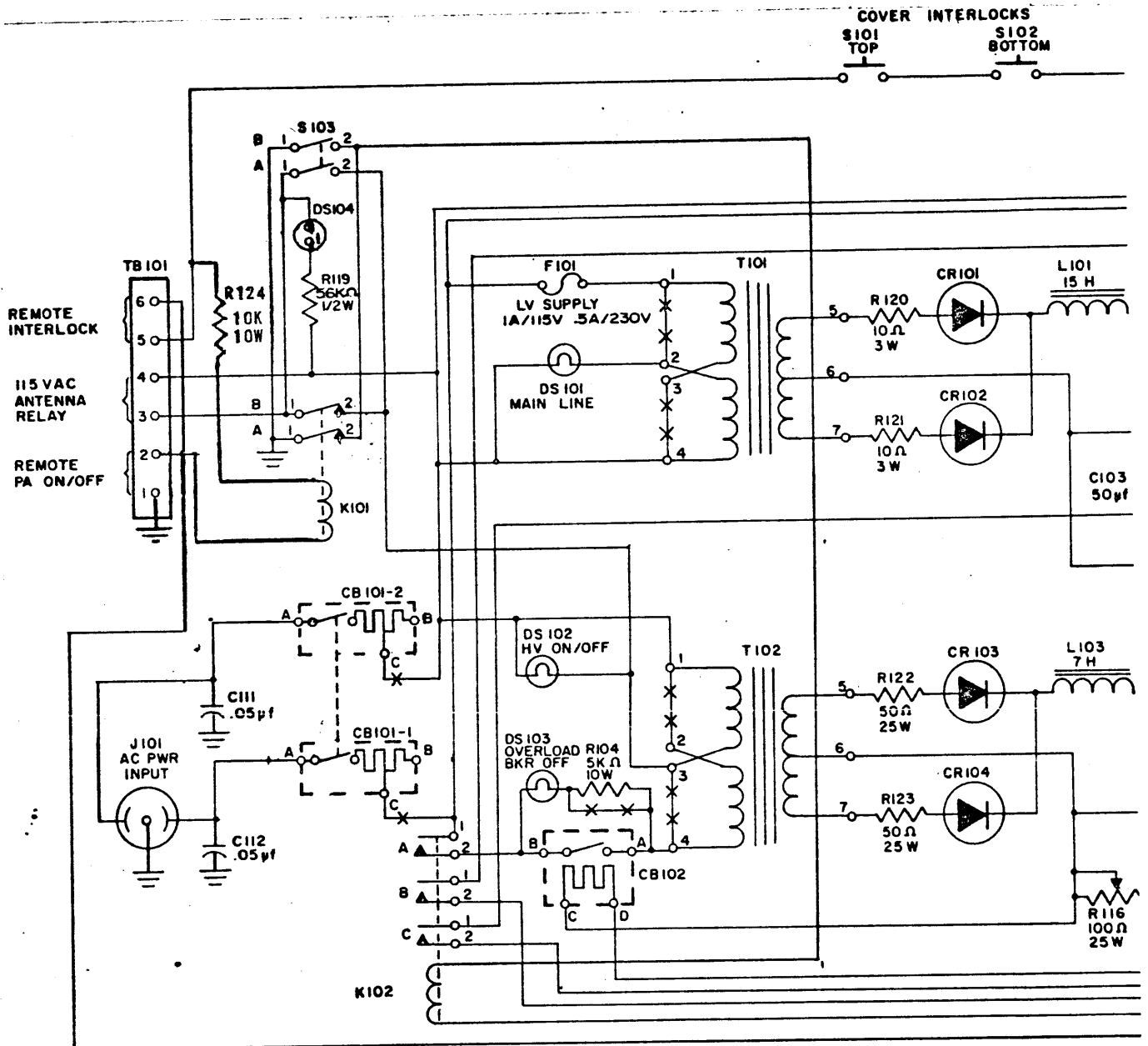
2. Page 7-3:

Please make pen and ink changes to K101 and TB101 as per Figure 1 attached.

SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT:

THE TECHNICAL MATERIEL CORP., 700 Fenimore Road, Mamaroneck, New York

Attn.: Director of Eng. Services.



CHANGES NECESSARY TO CONVERT TO 230V OPERATION

T101 REMOVE JUMPERS MARKED ~~***~~ AND CONNECT JUMPERS BETWEEN TERMINALS 2 & 3.

T102 SAME AS T101.

CB101 REMOVE LEADS FROM TERM "C" AND CONNECT TO TERM "B". (MARKED ~~**~~)

R104 REMOVE AND DISCARD JUMPER MARKED ~~**~~.

F101 CHANGE FROM 1AMP TO 1/2 AMP.

Figure 1

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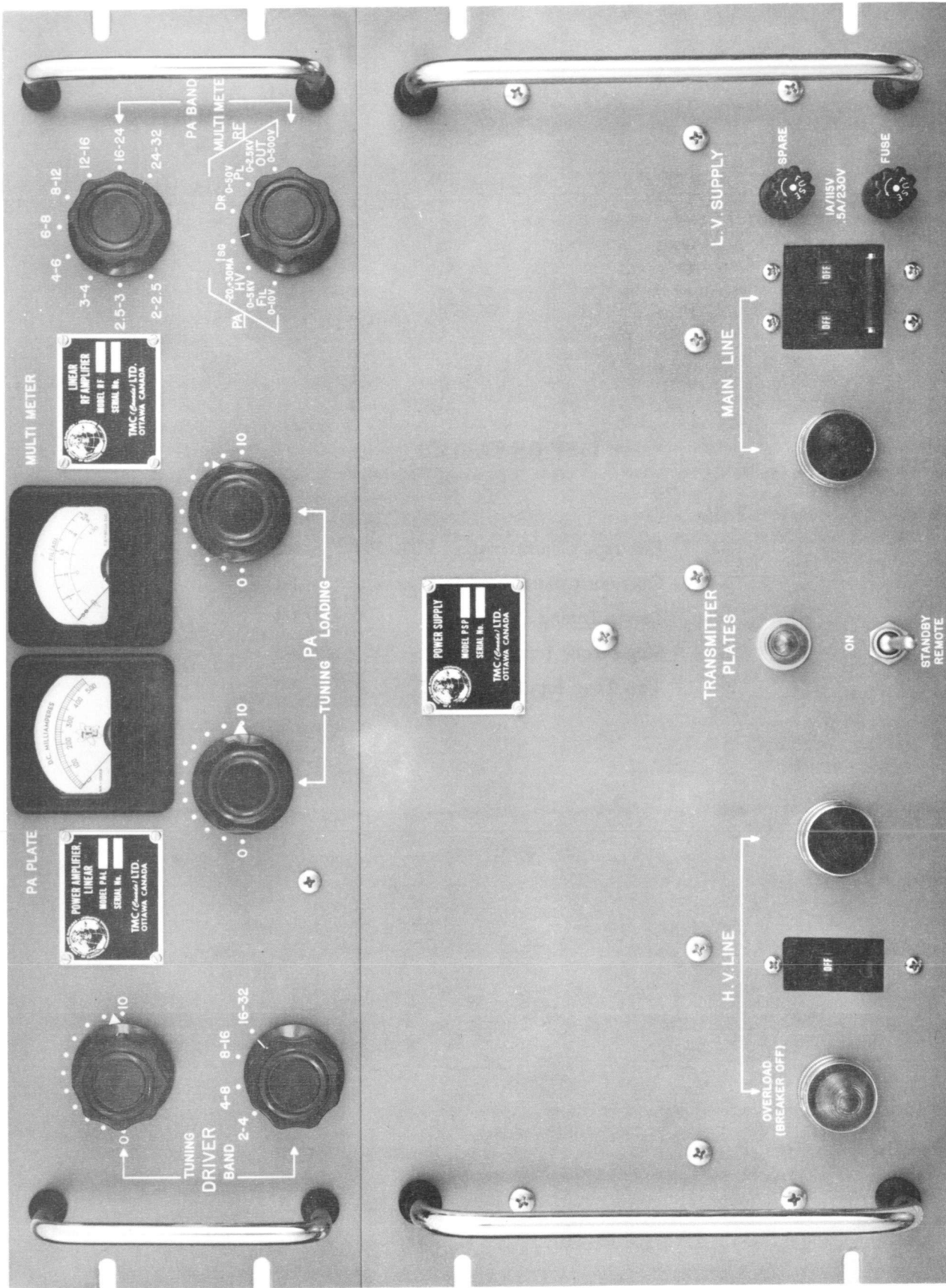


Figure 1-1. Linear Power Amplifier Model PAL-500.



Figure 1-2. Linear Power Amplifier Model RFE-1.

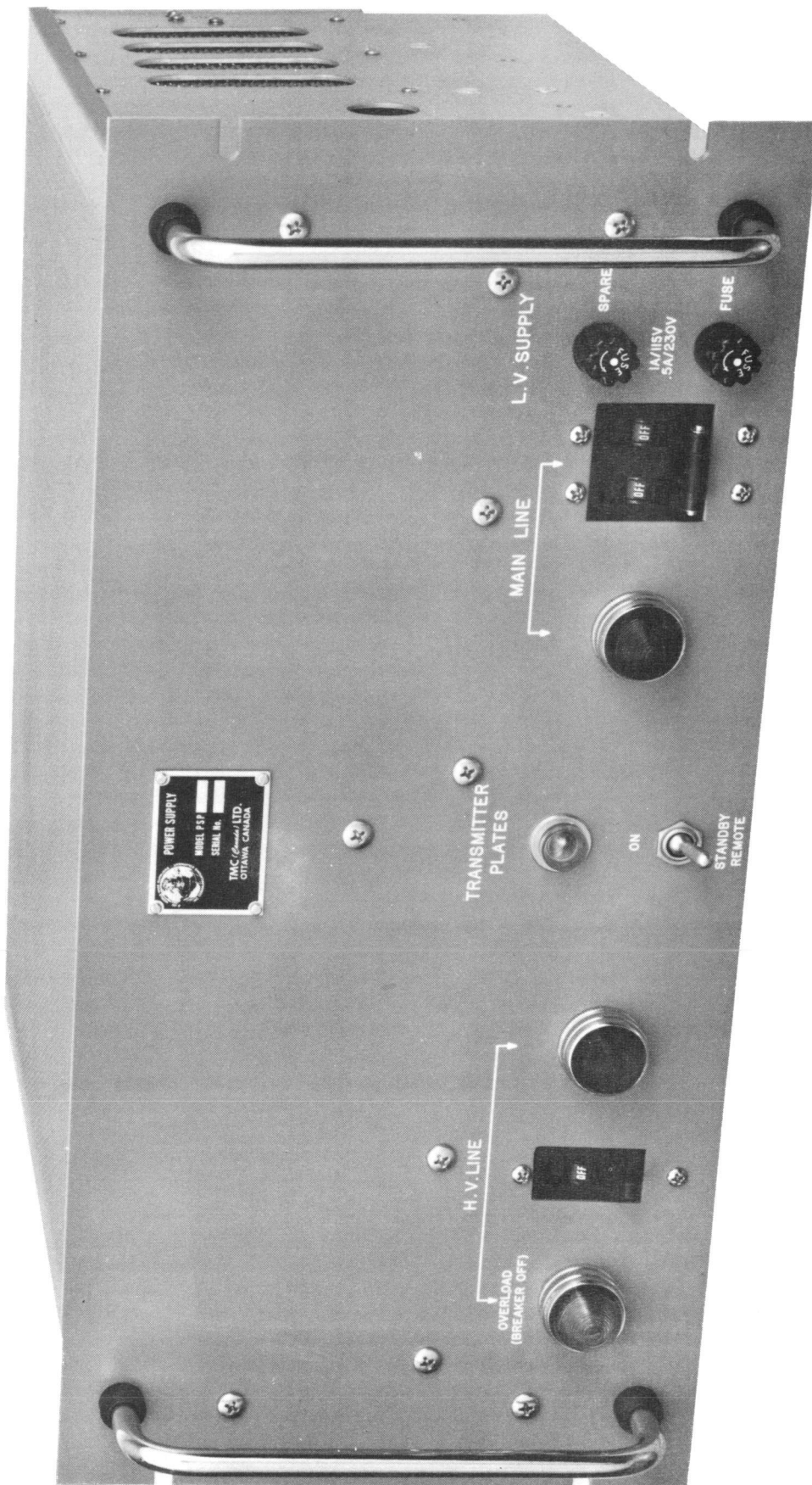


Figure 1-3. Power Supply Model PSP-500.

SECTION 1

GENERAL DESCRIPTION

1-1 PURPOSE

The Model PAL-500, Power Amplifier, Linear, is a conservatively rated general purpose amplifier which provides 500 watts PEP output over the frequency range of 2 to 32 megacycles.

1-2 PHYSICAL DESCRIPTION

The Model PAL-500 is composed of two small and compact units; the Linear Power Amplifier, Model RFE-1 (5¼ inch panel) and the Power Supply, Model PSP-500 (8¾ inch panel). The entire unit occupies only 14 inches of panel space for standard rack mounting which makes it ideal for console, table top, mobile, and shipboard installations.

1-3 FUNCTIONAL DESCRIPTION

The combination of the TMC Model SBE, Mode Selector, Transmitting, and the PAL-500 provides a compact transmitting system capable of producing

single, double or independent sideband signals with any degree of carrier insertion.

The PAL-500 has been carefully designed with no compromise in workmanship or component quality. A pair of 4CX350A Beam Power Amplifier tubes in parallel with a pi network provide unbalanced output from 50 to better than 600 ohms. Particular attention has been given to the suppression of distortion products, amplifier stability, power supply hum content and dynamic impedance. Full interlock, overload and fuse protection have been provided for the safety of the operating personnel and protection of the equipment. A filtered forced air blower system is included as an integral part of the equipment. An effective ALDC (Automatic Load and Drive Control) system has been included to limit the distortion produced when high drive peaks occur.

1-4 TECHNICAL SPECIFICATIONS

See Table 1-1.

TABLE 1-1. TECHNICAL SPECIFICATIONS, PAL-500

ITEM	CHARACTERISTICS
FREQUENCY RANGE:	2 to 32 megacycles continuous, bandswitched.
OUTPUT POWER:	500 watts 2 tone PEP. 300 watts Key down CW or FS.
OPERATING MODES:	With appropriate exciter; CW, MCW, SSB, ISB, DSB, FS or pulse operation.
TUNING:	All tuning and bandswitching controls on front panel. (No plug-in components).
OUTPUT IMPEDANCE:	Will match any unbalanced load from 70 to 150 ohms at ± 20 degrees in the range 2 to 4 megacycles. Will match any unbalanced load from 50 to 600 ohms at ± 45 degrees in the range 4 to 32 megacycles.
OUTPUT CONNECTION:	Type C. coaxial.
INPUT IMPEDANCE:	70 ohms nominal, coaxial.
INPUT REQUIREMENTS:	Less than 100 milliwatts will produce full output.
INPUT CONNECTION:	Type BNC coaxial (RG-59/U).
DISTORTION PRODUCTS:	At full PEP output, 3rd order distortion products are at least 40 db below either tone of a standard two tone test.
HARMONIC SUPPRESSION:	Second — at least 40 db from PEP output. Third — at least 50 db from PEP output.
ALDC:	An Automatic Load and Drive Control is provided to limit distortion during high drive peaks.
PRIMARY POWER REQUIREMENTS:	115/230 volts, 50/60 cycle, single phase, 1150 watts under 500 watts PEP output conditions.
SAFETY:	Full interlock protection. Full overload and fuse protection.
COOLING:	Filtered, forced air blower system.

TABLE 1-1. TECHNICAL SPECIFICATIONS, PAL-500 (Continued)

ITEM	CHARACTERISTICS
TEMPERATURE, HUMIDITY:	Designed to operate in any ambient temperature between 0 degrees and 50 degrees C for any value of relative humidity up to 90%.
RUGGEDNESS:	The unit is designed for mobile application with the addition of shock mounts.
TUBE COMPLEMENT:	<p><i>RFE-1 Linear RF Amplifier</i></p> <p>2 ea. 4CX350A RF Amplifiers</p> <p>1 ea. 6CL6 Controlled Amplifier</p> <p>1 ea. 6146 Driver</p> <p><i>PSP-500 Power Supply</i></p> <p>Completely Solid State</p>
MOUNTING:	Standard WE relay rack.
SIZE: RFE-1 PSP-500	<p>19" wide x 5¼" high x 17" deep</p> <p>19" wide x 8¾" high x 13" deep</p>
WEIGHT: RFE-1 PSP-500	<p>30 lbs.</p> <p>60 lbs.</p>
SHIPPING WEIGHT:	140 lbs. gross.
COMPONENTS AND CONSTRUCTION:	Equipment is manufactured in accordance with JAN/MIL specifications wherever practicable.

SECTION 2

INSTALLATION

2-1 UNPACKING AND HANDLING

The PAL-500 is shipped from the factory in a wooden crate to ensure maximum protection from damage in transit. The inside of the crate contains additional packing material to protect the unit not only from breakage due to shock, but also from the elements. Inspect all packing for parts shipped as loose items.

As soon as the PAL-500 is unpacked, it should be visually inspected to make sure that it is not damaged. This examination should include the testing of each front panel control for ease of operation. All the covers of the units should be removed, and the inside of the units checked carefully for damaged components and loose items. Check all tubes for damage and correct seating in the tube sockets. Replace all covers.

The PAL-500 can be mounted in any standard 19-inch relay rack. The front panels of the RFE-1 and the PSP-500 of which the PAL-500 is comprised are 5- $\frac{1}{4}$ inch and 8- $\frac{3}{4}$ inches high respectively. It is recommended that a minimum of 1- $\frac{3}{4}$ inches of free space be allowed above the RFE-1 unit.

Make cable connections as shown in Figure 2-1.

2-2 POWER REQUIREMENT

The primary power requirement for the PAL-500 is 115/230 volts, 50/60 cycle, single phase, 1500 watts under 500 watts PEP output conditions. Fig. 7-2 illustrates the connections required for 115 vac or 230 vac operation.

2-3 EQUIPMENT LOCATION

Before installing the PAL-500, consideration must be given to its location.

a. **ACCESSIBILITY.** The PAL-500 must be located so that an operator can comfortably reach all of the front panel controls. Sufficient clearance around the unit must be allowed to provide access to the rear panel connections so that the unit may be removed for servicing.

b. **VENTILATION.** The electron tubes inside this unit generate heat. To prevent heat buildup, a filtered, forced air blower system is used for cooling and sufficient clearance around the unit must be allowed to ensure that the air flow is not restricted.

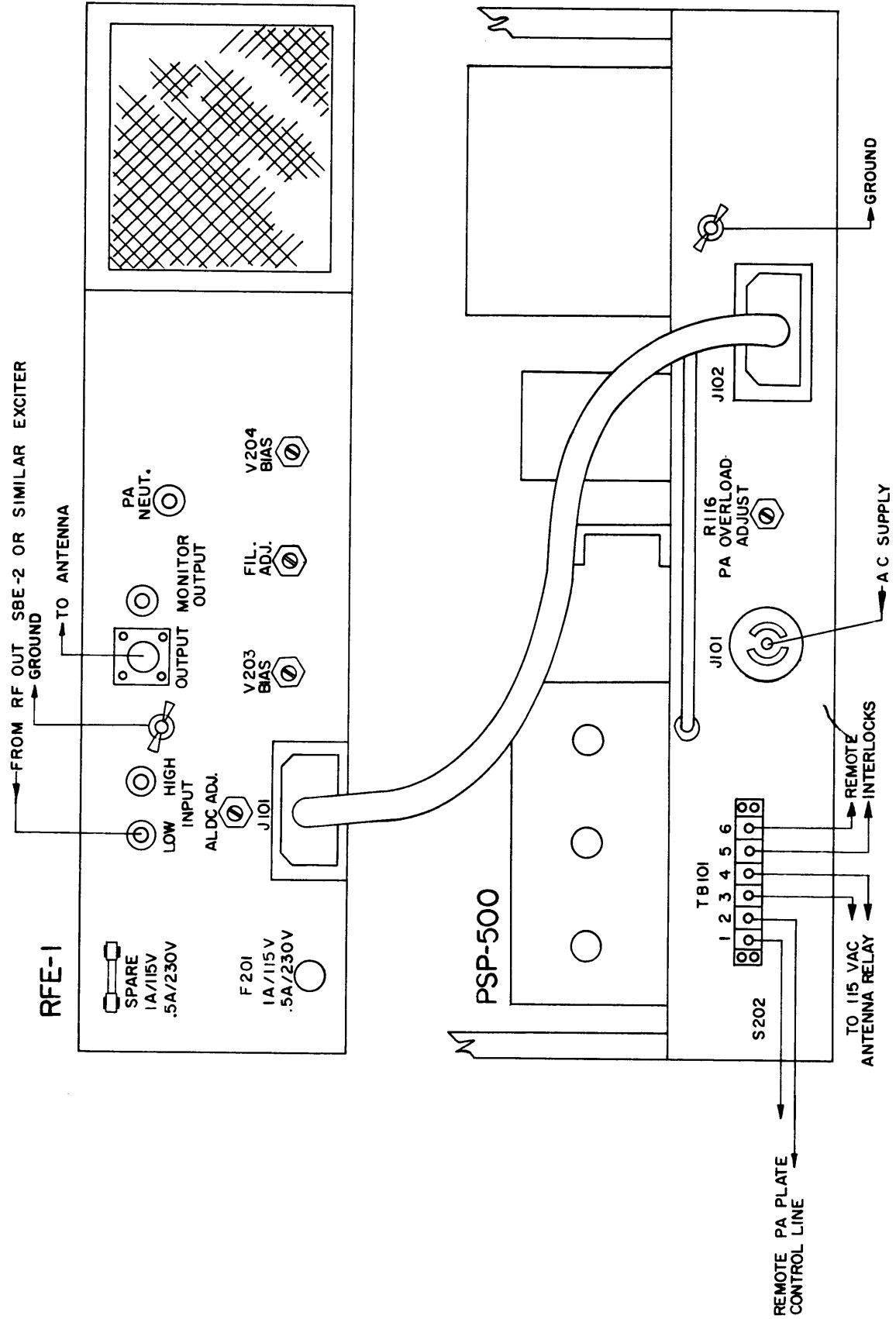


Figure 2-2. Rear Panel Connections and Adjustments.

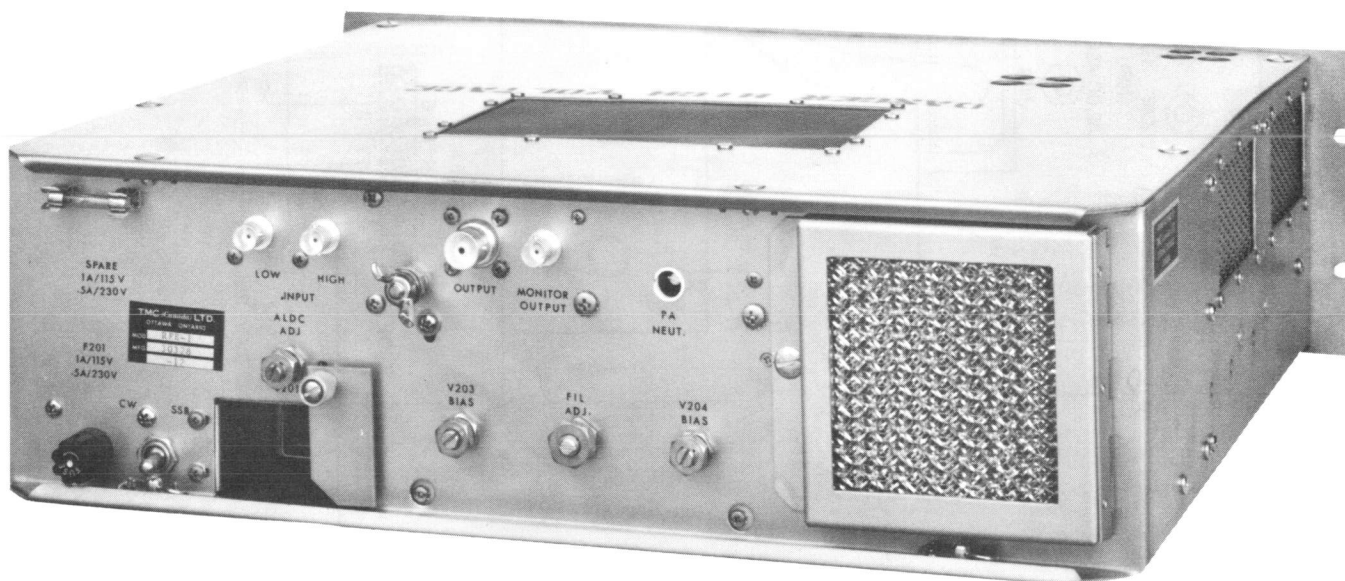


Figure 2-2. Rear View PSP-500. and RFE-1

SECTION 3

OPERATOR'S SECTION

3-1 CONTROLS AND INDICATORS

Before attempting to operate the PAL-500, the operator should become familiar with the controls and indicators listed in table 3-1. The index number listed

in the table are those assigned in figure 3-1. Each description in the table indicates the type of control or indicator and what its purpose is. It is important to stress that the descriptions are not operating procedures.

TABLE 3-1. OPERATOR CONTROLS AND INDICATORS

INDEX NO.	PSP-500 (See Fig. 3-1b) CONTROL OR INDICATOR	FUNCTION
1	MAIN LINE ON/OFF switch and circuit breaker.	In the "ON" position this switch applies ac power to the amplifier and provides line overload protection.
2	H.V. ON/OFF switch and circuit breaker.	With the H.V. Line switch in the "ON" position, voltage is applied to the final plates. It also provides overload protection when tripped by excessive PA plate current.
3	TRANSMITTER PLATES ON/ STANDBY — REMOTE switch.	When in the STANDBY-REMOTE position the switch allows the PA Bias Network to go to —150 v, cutting off the tubes V203 and V204. In the "ON" position the switch grounds the PA Bias Network, providing the preset operating bias for the tubes. The contacts of Relay K101 in parallel with S103 produce the same effect when the relay is energized.
4	MAIN LINE ON/OFF indicator	indicates when the main line switch is on.
5	H.V. LINE ON/OFF indicator	indicates when the H.V. line switch is on.
6	H.V. overload indicator	indicates when the H.V. circuit breaker has tripped due to overload.
7	P.A. PLATES ON/STANDBY indicator	indicates when the H.V. is applied to the final PA tubes.

INDEX NO.	RFE-1 (See Fig. 3-1a) CONTROL OR INDICATOR	FUNCTION
1	DRIVER BAND bandchange switch.	Switches in and out various coils to change the frequency of the driver plate tank.
2	DRIVER TUNING control.	Varies the driver tuning capacitors to resonate the circuit to the desired frequency.
3	PA BAND bandchange switch	Sets the PA tank to the proper band by selecting the appropriate tap on the PA tank coil.
4	PA TUNING control.	Varies the main PA tuning capacitor to resonate the circuit to the desired frequency.
5	PA LOADING control.	Adjusts the amount of coupling to the load.
6	MULTIMETER switch.	Permits selective indication of the PA filament voltage, the PA screen grid current, the PA high voltage, the RF voltage at the output of the driver, the RF voltage at the plate and the output of the power amplifier.
7	PA PLATE meter.	This meter indicates PA plate current.
8	MULTIMETER.	Multimeter scale indications are as follows: ISG — PA screen grid current PA HV — PA high voltage FIL — PA filament voltage DR — RF drive to PA stage RF PL — PA plate voltage OUT — RF output voltage

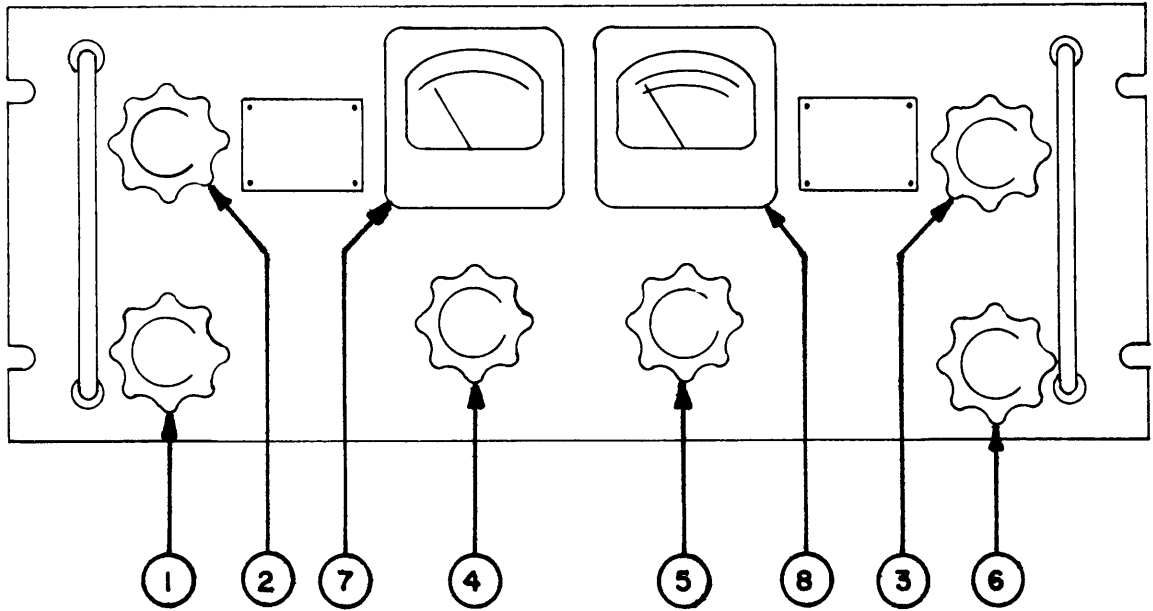


FIG. 3-1a PANEL CONTROLS RFE-1

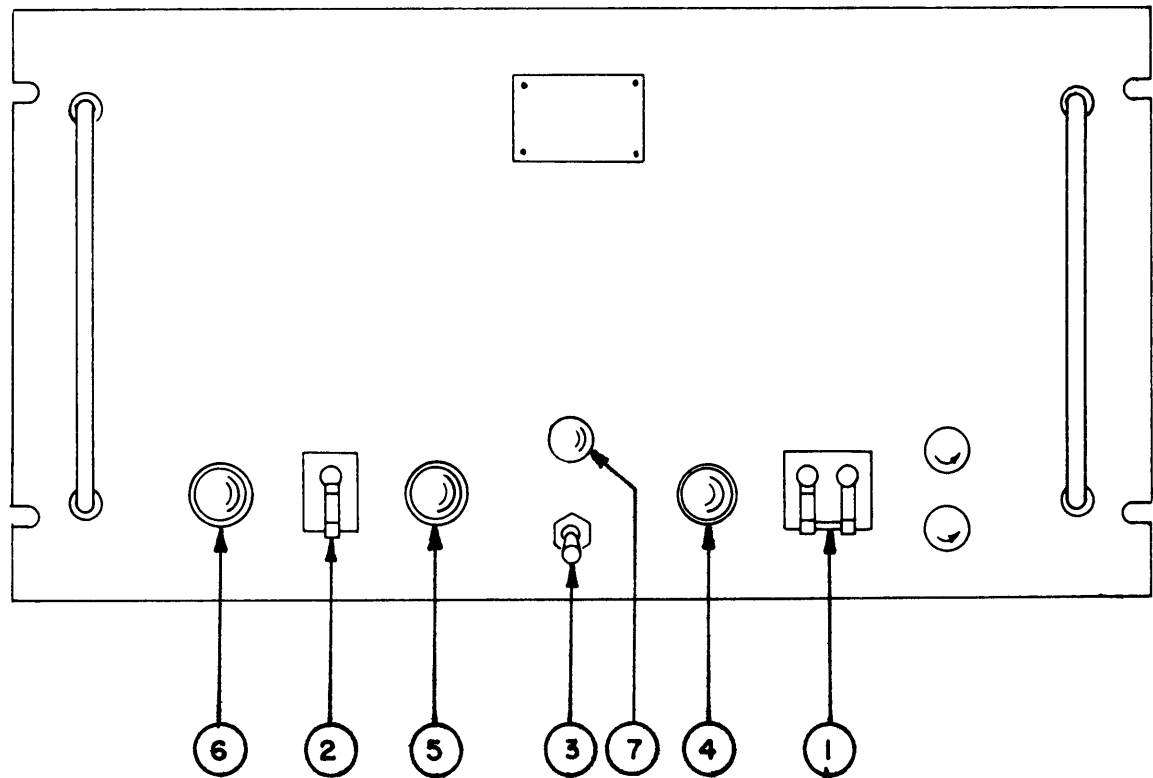


FIG. 3-1b PANEL CONTROLS PSP-500

3-2 INITIAL SET UP

Proceed as follows:

- (1) Turn "H.V. LINE SWITCH" off.
- (2) Turn "TRANSMITTER PLATES" switch to "STANDBY".
- (3) Turn multimeter switch to "PA FIL."
- (4) Turn "MAIN LINE" switch "ON".
- (5) Multimeter needle should point to "FIL.ADJ." mark, equivalent to 6 volts. If not, adjust "FIL. ADJ." control on rear.
- (6) Rotate bias potentiometers R213 and R221 and the ALDC potentiometer R228 to the fully anti-clockwise position. All these controls are located on the rear of the RFE-1 unit. See figure 2-2.

3-3 TUNING PROCEDURE

The tuning of the PAL-500 will be carried out using the following steps:

NOTE

STEPS 13 & 14 APPLY ONLY ON INITIAL TUNE-UP AFTER INSTALLATION. (UNLESS BIAS SETTINGS NEED RE-ADJUSTMENT).

1. Temporarily set the following controls in the positions indicated:

H.V. LINE	— OFF
TRANSMITTER PLATES	— STANDBY
PA TUNING	— O
PA LOADING	— O

2. Turn MAIN LINE switch ON.
3. Turn MULTIMETER switch to PA FIL. Meter needle should point to "FIL.ADJ." mark (equivalent to 6 volts). If it does not, adjust FIL. ADJ. on rear of RFE-1 chassis.
4. Set the DRIVER BAND switch to the range covering the desired output frequency.
5. Set the PA BAND switch to cover the same frequency as above.
6. Set the MULTIMETER switch to RF DR.
7. Turn the associated exciter on and tune to the desired output frequency and mode of operation. Adjust for very low output level. In cases where the Model SBE is to be used consult its accompanying instruction manual.
8. Approximate the DRIVER TUNING control position by use of the table: 3-2:—
9. Turn the TRANSMITTER PLATES switch ON.
10. Adjust the DRIVER TUNING until a peak reading is obtained on the MULTIMETER. Peaks should be kept below a reading of 20 on the meter to assure full range of meter movement. Use the exciter's output control to keep the meter reading within range as the peak tuning is approached.

NOTE

The Driver Tuning is completed. It is essential that these controls are not readjusted unless another frequency is to be tuned.

TABLE 3-2. DRIVER TUNING

DRIVER BAND	0	1	2	3	4	5	6	7	8	9	10
2-4	*	2	2.25	2.5	2.75	3	3.25	3.5	3.75	4	*
4-8	*	4	4.5	5	5.5	6	6.5	7	7.5	8	*
8-16	*	8	9	10	11	12	13	14	15	16	*
16-32	*	16	18	20	22	24	26	28	30	32	*

11. Reduce the exciter output to zero; check to make sure load or antenna is connected to J205. (Output).
12. Turn the high voltage switch on.
13. Switch multimeter to read high voltage. Reading at this point will be 3000 volts approximately.
14. Switch on Plate Switch. Slowly adjust potentiometer R213 until V203 is drawing 100m/a plate current, using plate current meter as the indicator. Adjust R221 until total plate current V203 and V204 is 200 m/a.
15. Apply drive slowly from the exciter while observing the PA PLATE meter. The drive level will be correct when the meter indicates 300 ma of PA plate current.
16. Adjust the PA TUNING control until a dip in the R.F. drive (RFDR) is observed on the MULTIMETER. This does not necessarily coincide with a dip in the PA plate current. Both readings will not dip at the same time until the final stage is properly loaded.
17. Use the PA LOADING control in the following manner: Observe the RFDR on the MULTIMETER as the PA LOADING is increased. As the meter reading increases readjust the PA TUNING for a dip as before. Continue this loading procedure until the values indicated in the chart below are observed. Refer to Table 3-3 if a single tone is applied to the exciter output, Table 3-4 if two tones of equal levels are applied.
18. Before actual operation of the transmitter begins adjust the PA TUNING once again for a dip on the "RF DR".
19. Use the OUTPUT CONTROL of the exciter to keep the "RF PL" reading on the MULTIMETER from ever exceeding 900 volts. This must be done regardless of the various input combinations that may be applied, i.e. speech and/or tones etc.
20. If at any time during the tuning procedure an amplifier shows signs of instability or self oscillation, it should be neutralized as described in the maintenance section of this handbook.

TABLE 3-3. SINGLE TONE INPUT

MULTIMETER:		
SWITCH POSITION	READING	VALUE
ISG	—10	—10 ma
RF DR	Full Scale+	10 V+
RF PL	.7 KV.	700 V
RF OUT*	1.2	120 V

PA PLATE METER 340 m/a

TABLE 3-4. TWO TONE INPUT

MULTIMETER:		
SWITCH POSITION	READING	VALUE
ISG	—8 to —10	—8 to —10 ma
RF DR	8 to 15	8 to 15 V
RF PL	.85 KV.	850 V
RF OUT*	1.6	160 V

PA PLATE METER 380 m/a

*RF output measurements can indicate a wide range of voltages since the actual loading of an antenna may involve a great variety of impedances and reactances. Values are for a 50 ohm load.

3-4 OPERATOR'S MAINTENANCE

CAUTION

NEVER REPLACE A FUSE WITH ONE OF A HIGHER RATING UNLESS BRIEF CONTINUED OPERATION IS MORE IMPORTANT THAN PROBABLE DAMAGE TO THE EQUIPMENT. IF A FUSE BURNS OUT IMMEDIATELY AFTER REPLACEMENT, DO NOT REPLACE IT A SECOND TIME UNTIL THE CAUSE HAS BEEN LOCATED AND CORRECTED.

The PSP-500 Power Supply contains 5 protective devices.

The action of one or more of them will disable all or part of the PAL-500 system. They are as follows:

<i>SYM.</i>	<i>FUNCTION</i>	<i>IND.</i>
CB101	MAIN POWER SWITCH (CIRCUIT BREAKER)	DS101
F101	LV MAIN FUSE HV SWITCH	DS101
CB102	(CIRCUIT BREAKER)	DS103
S101	TOP COVER (INTERLOCK)	DS102-3
S102	BOTTOM COVER (INTERLOCK)	DS102-3

The RFE-1 contains three protective devices:

<i>SYM.</i>	<i>FUNCTION</i>	<i>IND.</i>
S204	TOP COVER INTERLOCK	DS102-3
S205	BOTTOM COVER INTERLOCK	DS102-3
F201	FILAMENT FUSE	All heaters & Blower

In the event that any of the indicator lamps marked IND above should fail to light, check the protective device listed on the corresponding line or lines. If such action does not lead to the source of failure, check the lamp itself.

In most instances where a failure is experienced but not accompanied by a blown fuse or open switch, a faulty tube will be responsible. Troublesome tubes are best found by the substitution method. Do not leave replacement tubes in the equipment unless the originals are proven defective.

WARNING

THE VOLTAGES USED IN THIS EQUIPMENT ARE SUFFICIENTLY HIGH TO ENDANGER LIFE. ALL PERSONNEL ARE ADVISED TO BE THOROUGHLY FAMILIAR WITH THESE UNITS BEFORE TROUBLE-SHOOTING THEM IN A POWER-ON CONDITION. ALWAYS USE CAUTION.

SECTION 4

PRINCIPLES OF OPERATION

4-1 LINEAR POWER AMPLIFIER MODEL RFE-1

The RFE-1, which operates as a class AB1 linear amplifier, uses a pair of 4CX350A beam power amplifiers in parallel to a pi network to provide an unbalanced output of 50 or 70 ohms. The final amplifiers are driven by a pentode driver stage which employs R.F. feedback to improve the linearity. The driver stage is preceded by an automatic load and drive control (ALDC) to limit the distortion produced when high peaks or load changes occur.

The RFE-1 requires less than 100 milliwatts excitation to produce full output. A choice of input connections is provided to accommodate inputs between 100 milliwatts and 1 watt. The output connections on the RFE-1 consist of a type C coaxial connector providing full R.F. output, and a BNC connector providing 1/300th of the R.F. output for monitoring purposes. The monitoring output may be terminated in any resistive load of 50 ohms or higher.

The unit covers a frequency range of 2 to 32 megacycles, and is band-switched. All tuning and operating adjustments are accomplished from the front of the unit. Complete metering facilities are provided by a MULTIMETER and a PA PLATE meter, the functions of which are explained under CONTROLS and INDICATORS, Table 3-1.

Referring to the RFE schematic Figure 7-1 contained at the rear of this manual, it will be seen the drive can be applied to either J202 or J203, depending upon the level of excitation available. The Signal is coupled via C212 to the grid of the control amplifier V201, 6CL6. The screen grid of this amplifier is directly grounded. However, since the cathode is -150 V, with respect to the chassis, and the plate 150 Volts positive, the screen grid is 150 Volts positive with respect to the cathode and 150 Volts negative with respect to the plate. The plate circuit has a parasitic suppressor, PS201, the signal being coupled via C282 to the appropriate tuned circuit selected by S201 A and B for the frequency of operation. Plate voltage for V201 is applied via network L201, L202 and feed-through decoupling capacitor C279. ALDC is applied to this first stage in the form of bias derived from the ALDC rectifier CR202 (See simplified schematic ALDC circuit, Figure 4-5).

Coupling of the driver stage V202 is via C221 to grid of V202. A grid stopper resistor in this grid helps to stabilize the stage. The driver stage plate circuitry is almost identical to the previous stage with the signal

being coupled to the final amplifier tubes V203 and V204 grids via C240 and C243. Neutralization of the driver stage is achieved by feeding back a small amount of signal voltage from the plate of the driver tube V202 via driver neutralizing capacitor C223 to the grid circuit.

The final amplifier is a pair of parallel connected 4CX350A beam tetrodes V203 and V204. The screen grids are operated at a regulated potential of 360 Volts positive. The plates having 2000 Volts positive applied. Bias for each of the two tubes is adjustable by means of R213, R221, from the rear of the unit. The grid leads having parasitic suppressors PS203, PS204 directly at the grid pin of each tube. The plate is tuned by a "PI" Network tank circuit. The output of the unit is brought out through J205. A small portion of the output (1/300th) appears at the monitor output jack J204. This is derived from the capacitive divider C274 and C275. Another capacitive divider across the output comprising C277 and C278 is used for the RF output metering circuit. Other metering of this stage includes metering of RF drive voltage, RF plate voltage, B+ and filament voltages, screen and plate current metering (See simplified metering circuit schematic, Figure 4-6).

The final tubes are forced air cooled by blower B201, through the air system sockets of V203, V204. It is essential to have the R/F section bottom cover in place at all times whilst the unit is operating.

Neutralization of the final amplifier stage is effected by C214 (adjustable from rear of unit).

4-2 POWER SUPPLY MODEL PSP-500

a. HIGH VOLTAGE:

This supply is of a conservative design containing high voltage silicon rectifier stacks. Rectification is full wave and is followed by a choke input filter network providing a plate voltage of 2000 volts to the final RF stage. Excellent regulation of the power supply is maintained due to the low internal impedance of the silicon rectifiers.

b. LOW VOLTAGE:

The lower voltage power supply contains a silicon diode, full wave rectifier. This supply provides a voltage of 150 volts to the plates of the ALDC and driver stages, a voltage of -150 volts (regulated) bias voltage for the final amplifier, and screen voltage to the driver stage.

c. INPUT VOLTAGE:

The equipment is wired for operation on 115 V, 50/60 cycle power line supply. 230 volt, 50/60 cycle operation may be had on special order or by following the instructions provided on the RFE-1 and PSP-500 schematic diagrams.

d. OVERLOAD CONTROL CIRCUIT:

The plate overload breaker removes the high B+ voltage when the current drawn from the high voltage supply becomes excessive, thus protecting the final amplifier tubes.

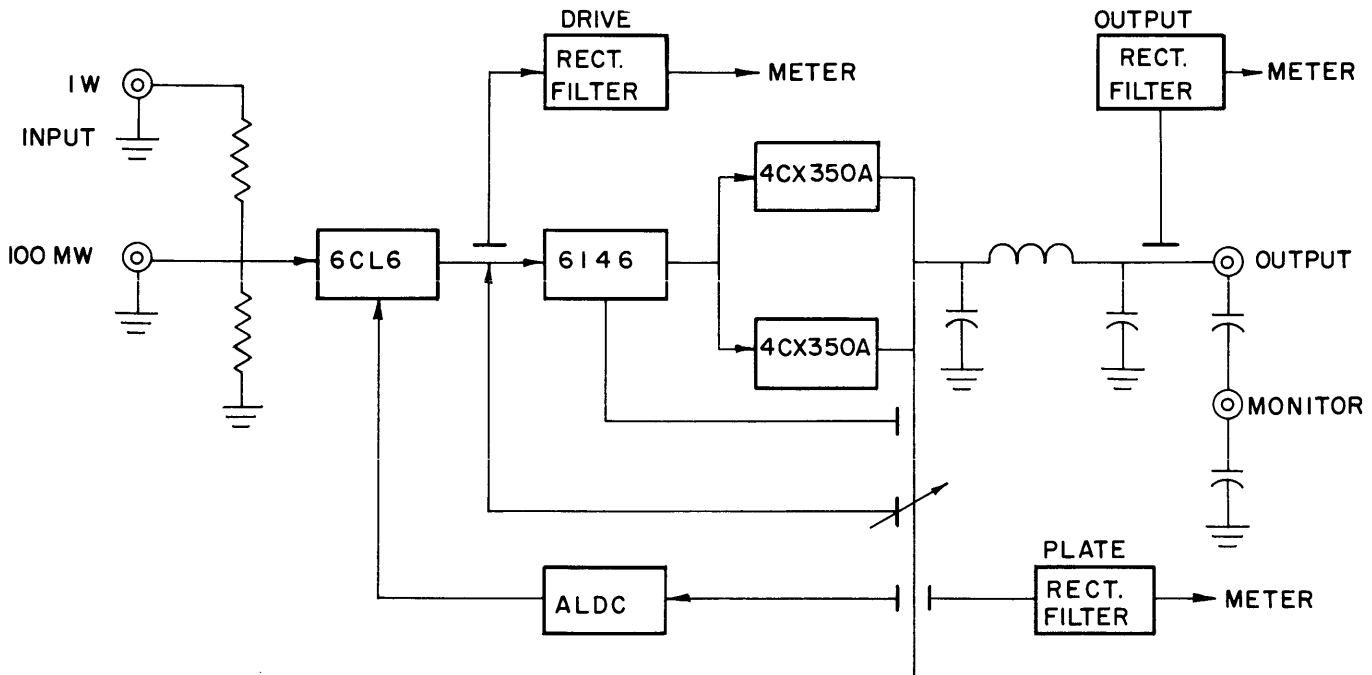


Figure 4-1. Simplified Block Diagram RFE-1.

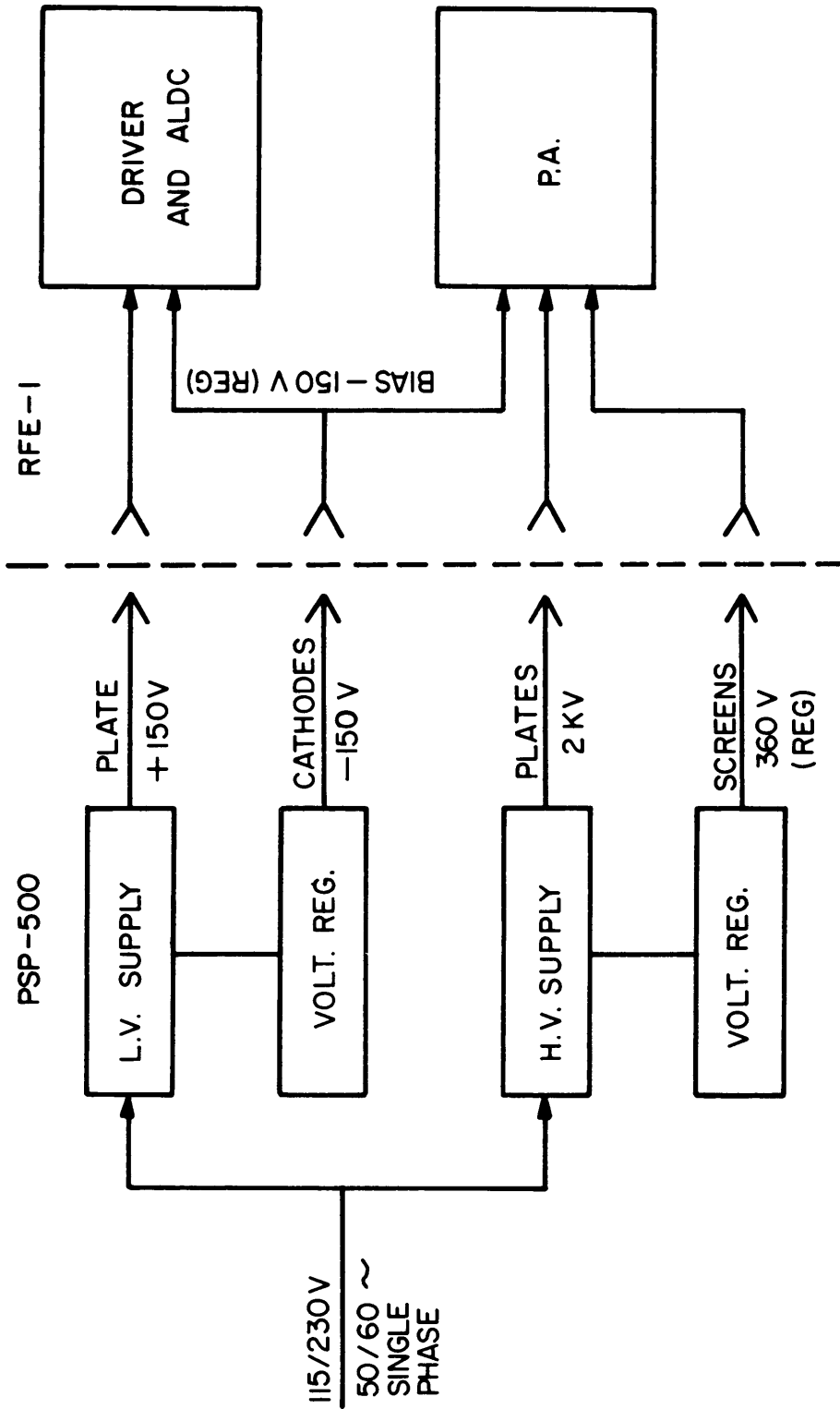


Figure 4-2. Simplified Block Diagram PAL-500.

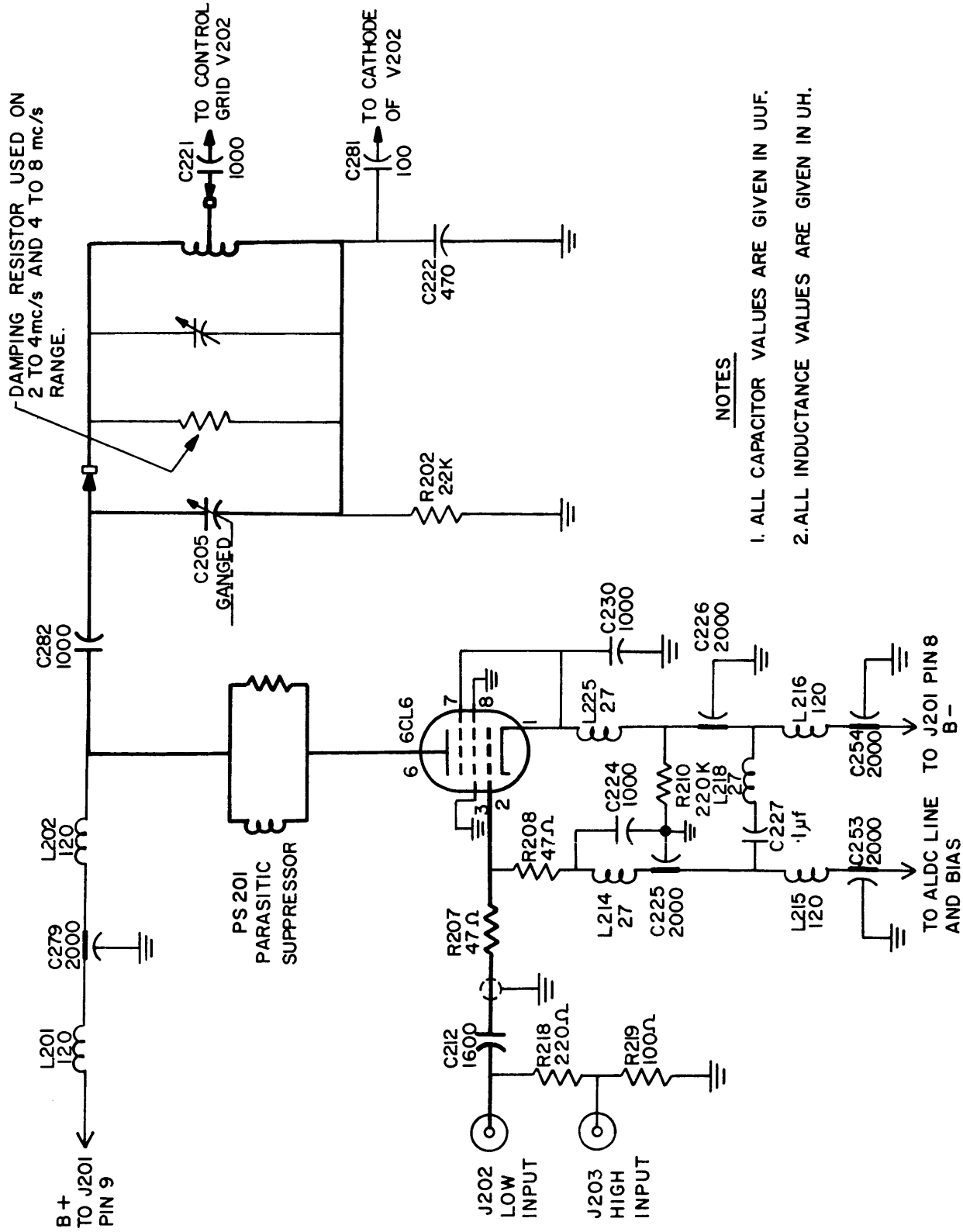


Figure 4-3. Simplified Schematic V201 Amplifier.

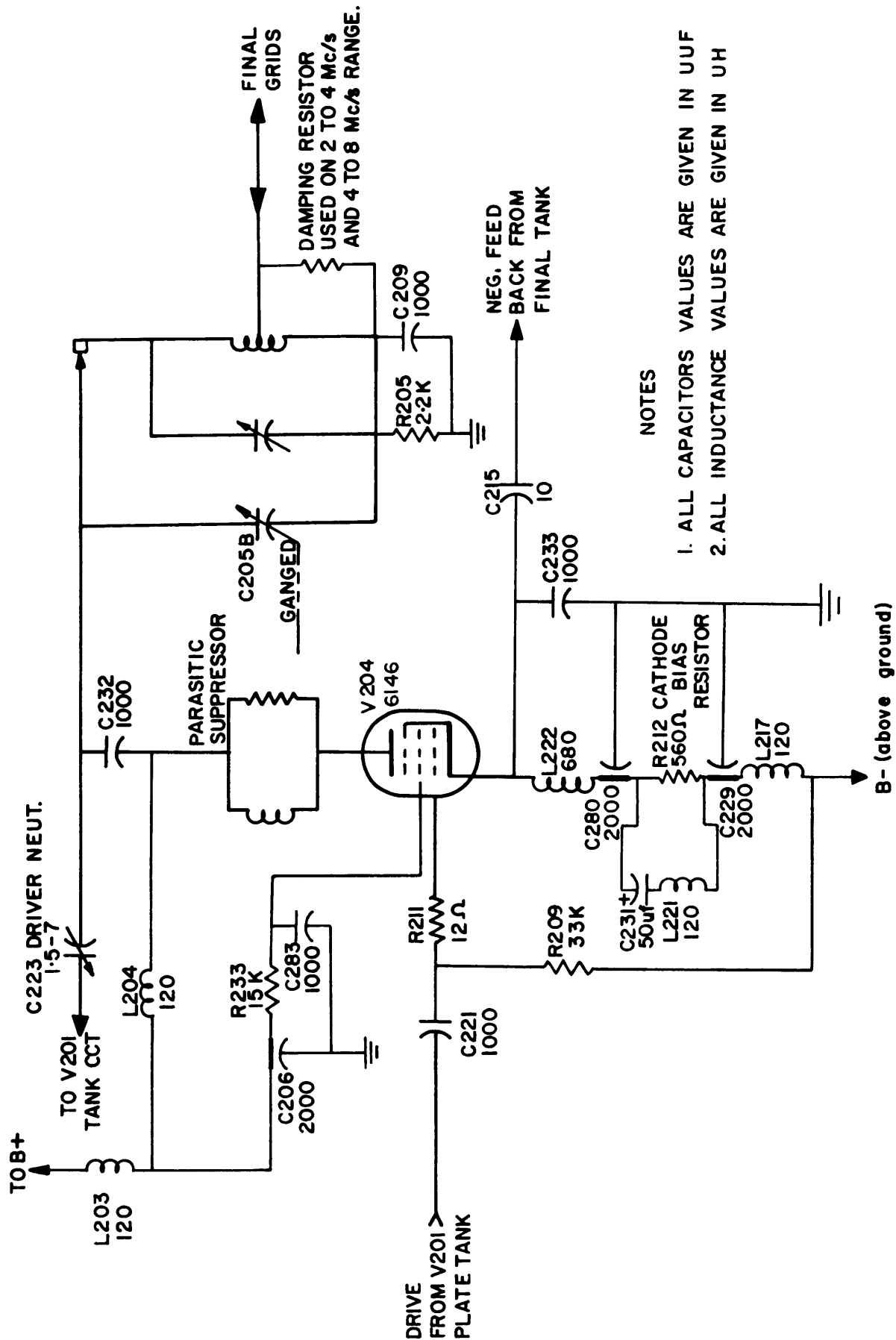


Figure 4-4. Simplified Schematic V202 2nd Amplifier.

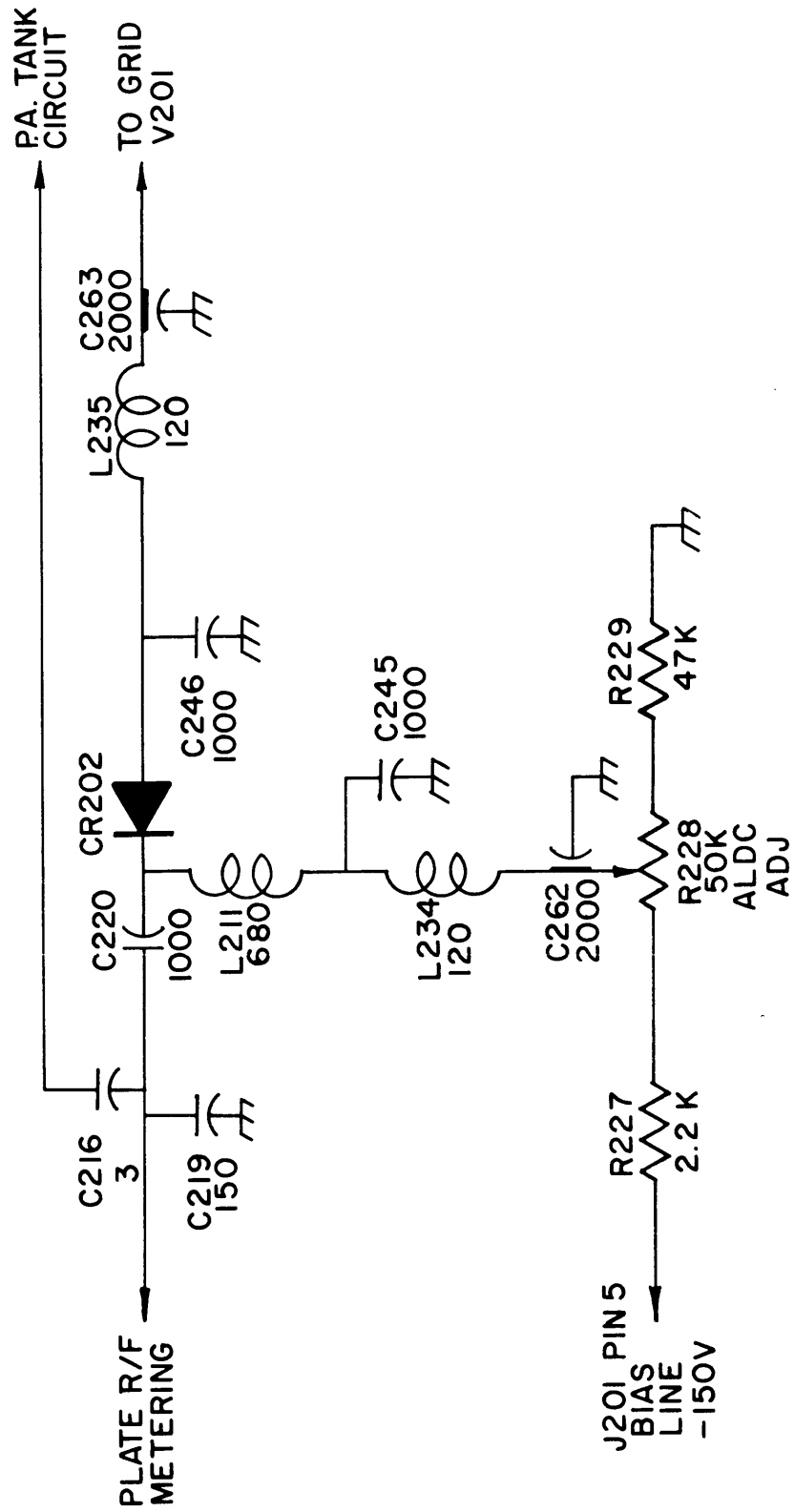
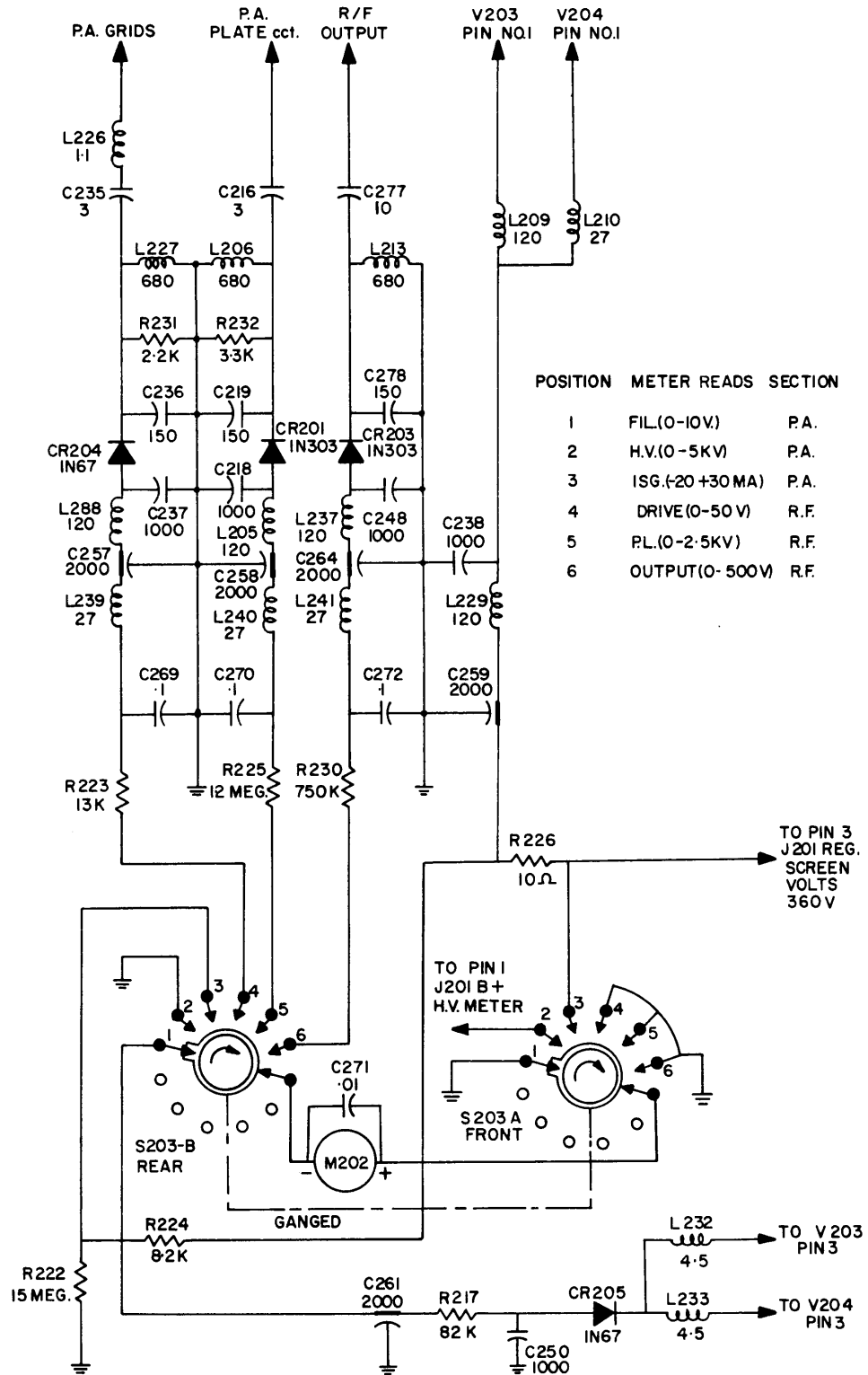
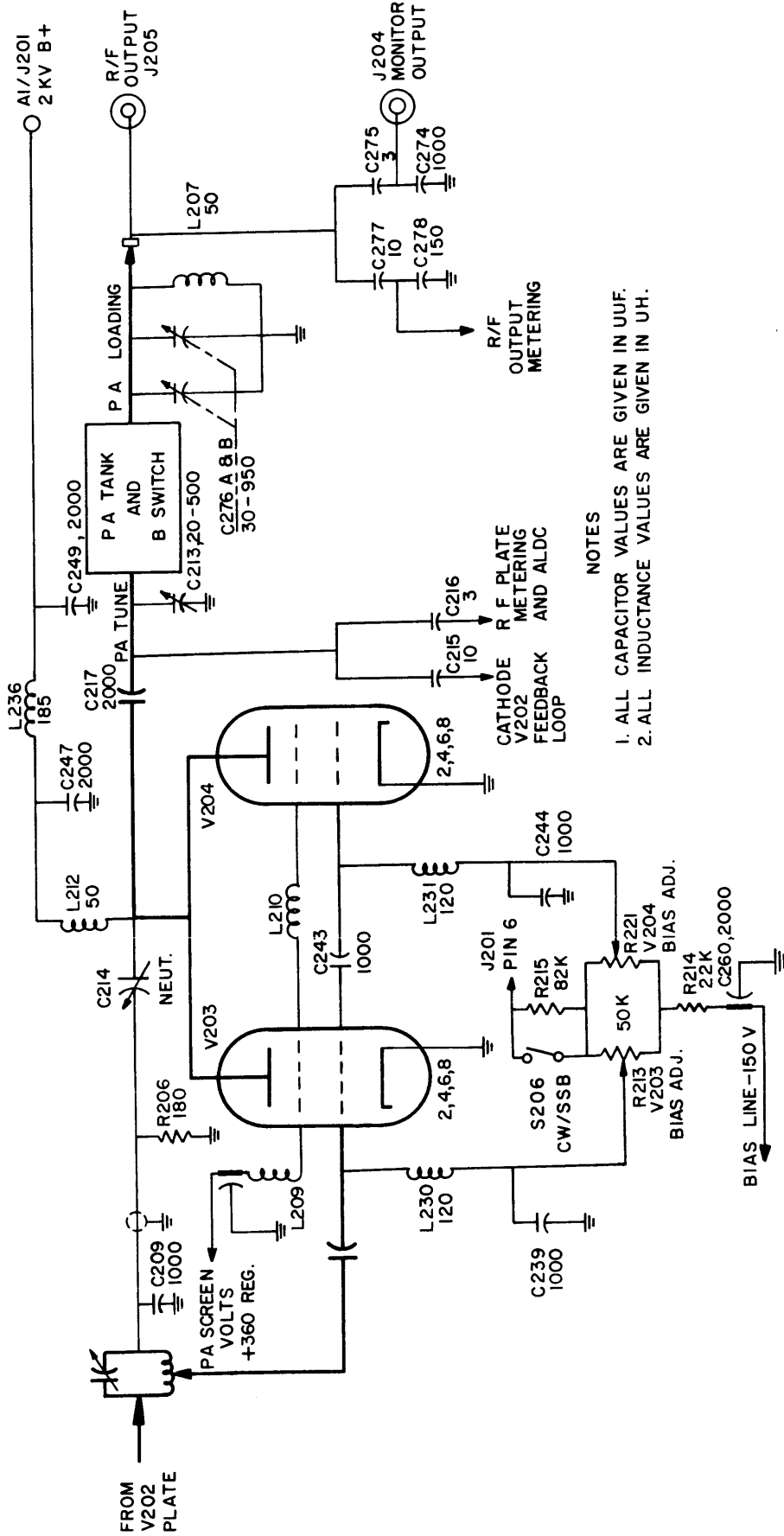


Figure 4-5. Simplified ALDC Circuit.



NOTES:
 1. ALL CAPACITORS VALUES ARE GIVEN IN UUF.
 2. ALL INDUCTANCE VALUES ARE GIVEN IN UH.

Figure 4-6. Simplified Metering Circuits.



- NOTES
1. ALL CAPACITOR VALUES ARE GIVEN IN UUF.
 2. ALL INDUCTANCE VALUES ARE GIVEN IN UH.

Figure 4-7. Simplified PA Schematic.

PSP 500

RFE I

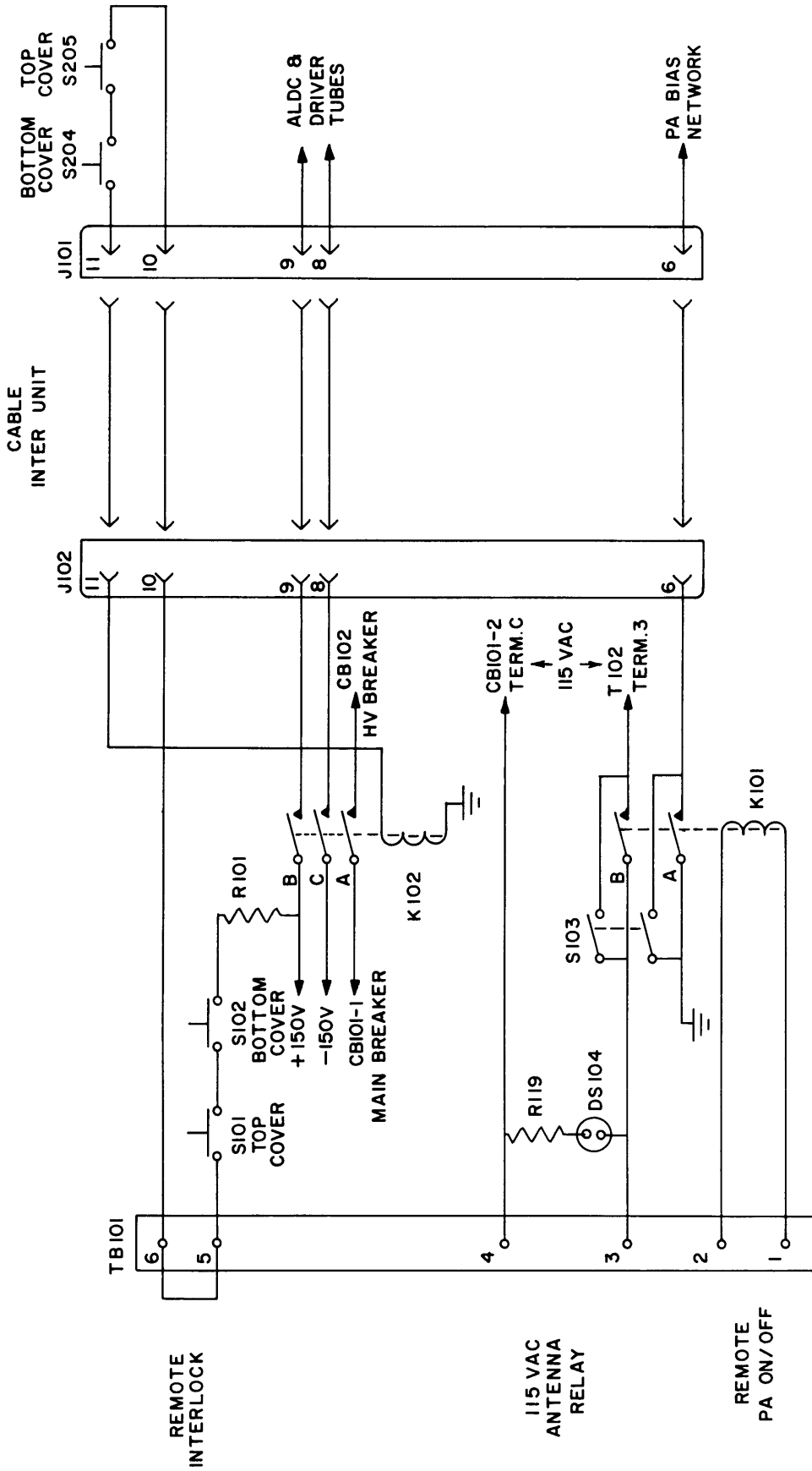


Figure 4-8. Simplified Interlock and Relay Circuit PAL-500.

SECTION 5

MAINTENANCE

5-1 GENERAL

The Model PAL-500 (PSP-500 and RFE-1) is designed to provide trouble-free operation under continuous duty conditions. It is recommended that any necessary maintenance be undertaken by competent technicians familiar with linear RF amplifier-transmitter techniques.

5-2 PREVENTIVE MAINTENANCE

- (1) To prevent failure of the equipment due to corrosion, dust, or other destructive elements, it is recommended that a schedule of preventive maintenance be established and adhered to.
- (2) At periodic intervals (at least every six months) the equipment should be removed from the rack or enclosure for cleaning and inspection. All accessible covers should be removed and all terminal boards, wiring harnesses, tube sockets, etc. should be inspected for dirt, corrosion, charring, or grease. Dust can be removed with a soft brush or vacuum cleaner if one is available. Remove dirt or grease from electrical parts with trichlorethane.
- (3) Carefully inspect soldered connections and machine screw fastenings for looseness and corrosion. Inspect ceramic insulators for cracks and dirt. Never use an acid core solder when making repairs.

5-3 CORRECTIVE MAINTENANCE

a. General

Before any alignment or internal adjustment of the equipment is attempted it should be established that all tubes and fuses are in working order. See OPERATOR'S MAINTENANCE, paragraph 3-4, section 3, for instructions.

b. Initial Power Checks

- (1) Replace covers on the PSP-500 power supply.

- (2) Reconnect cable from PSP-500 to RFE-1.
- (3) Close the interlocks, S204 and S205, of the RFE-1 by pulling their shafts outward.
- (4) Be sure that HV LINE switch is off.
- (5) Turn MAIN LINE breaker ON. See that tube filaments light.
- (6) Rotate the MULTIMETER switch through all its positions. The multimeter pointer should deflect only when switch is in the FIL position.
- (7) Adjust R216, FIL ADJ. pot on the rear skirt of the RFE-1 chassis, if necessary, so that multimeter reading is at the Red Mark.
- (8) Bias controls R213 and R221 must be turned fully counter clockwise.
- (9) Measure the voltage from pin C of V203 to ground. About -50 V DC should be indicated with transmitter plates switch ON.
- (10) Voltage measured from pin 2 of V201 to ground must be -143 to -157 VDC.
- (11) Use a reliable VTVM to see that the following voltages are as indicated:

FROM	TO	DC VOLTAGE
Plate Cap. V202	Ground	90 to 150
Pin 6 of V201	Ground	90 to 150
Pin 3 of V202	Ground	40 to 70
Pin 4 of V202	Ground	-120 to -130
Pin 5 of V202	Ground	-140 to -150
Pin 2 of V201	Ground	-145 to -155
Pin 1 of V201	Ground	-140 to -150

- (12) Turn power off and replace cover on the RFE-1 RF deck.

c. Driver Section Alignment

- (1) Any of the following capacitors which have been replaced or accidentally misadjusted should be set to their center values (approximate): C201, C202, C203, C204, C207, C208, C210, C211 or C223.
- (2) See that TRANSMITTER PLATES and HV LINE switches are OFF. Turn the MAIN LINE switch ON.
- (3) Pull out the Cover Interlock switches (S204, 205) and wait three minutes.
- (4) Turn the MULTIMETER selector switch to the FIL position; adjust R216 if the meter needle is not at the FIL.ADJ. mark.
- (5) Set the MULTIMETER switch to the RF DR position.
- (6) Turn the DRIVER BAND switch to the 2-4 Mc/s range.
- (7) Turn the DRIVER TUNING control to position 1.
- (8) Adjust associated exciter to apply low level drive at 2 Mc/s.
- (9) Tune T201 and T204 of the RFE-1 for a peak reading on the MULTIMETER while adjusting the drive to keep meter readings below 20 V.
- (10) Set the DRIVER TUNING control to position 9.
- (11) Tune trimmers C201 and C207 for peak indication on the MULTIMETER; again maintain a meter reading of less than 20 V by use of the exciter output drive control.
- (12) Remove drive. If the MULTIMETER continues to read, readjust C223 and repeat the last steps beginning with number 7 (above) until there is no sustained reading when drive is removed. This must be repeated until the desired results are achieved.
- (13) Reduce the exciter output level temporarily to minimum.
- (14) Set the DRIVER BAND switch of the RFE-1 to the 4-8 Mc/s range.
- (15) Set DRIVER TUNING to position 1.
- (16) Adjust the exciter to apply low level drive at 4.0 Mc/s.
- (17) Tune T202 and T205 for peak indication on the MULTIMETER while controlling the exciter output to keep meter readings below 20 V as before.
- (18) Set the DRIVER TUNING control to position 9.
- (19) Tune trimmers C202 and C208 for peak indication on the MULTIMETER; maintain less than 20 V on the meter by use of the exciter output drive control.
- (20) Remove drive. If the multimeter continues to read readjust C223 as before and repeat procedure starting with step 7.
- (21) Repeat steps 15 through 19 until no further adjustments are necessary.
- (22) Set the DRIVER BAND switch to the 8-16 Mc/s range.
- (23) Turn the DRIVER TUNING control to point number 1.
- (24) Adjust associated exciter to apply low level drive at 8 Mc/s.
- (25) Tune T203 and T206 of the RFE-1 for a peak reading on the MULTIMETER while adjusting the drive to keep meter readings below 20 V.
- (26) Turn the DRIVER TUNING control to point number 9.
- (27) Tune trimmers C204 and C211 for peak indication on the MULTIMETER; maintain a meter reading of less than 20 V by use of the exciter output drive control.
- (28) Remove drive. If the MULTIMETER continues to read, readjust C223 and repeat procedure beginning with step number 7 (above) until there is no sustained reading when drive is removed.
- (29) Repeat steps 22 through 28 several times until no further adjustment is necessary.
- (30) Set the DRIVER BAND switch to the 16 to 32 Mc/s position.

- (31) Turn the DRIVER TUNING control to point number 1.
- (32) Adjust the associated exciter to apply low level drive at 16 Mc/s.
- (33) Tune L208 and T207 for peak indication on the MULTIMETER while controlling the exciter output drive to keep the meter readings below 20 V.
- (34) Set the DRIVER TUNING control to point number 9.
- (35) Tune trimmers C203 and C210 for a peak indication on the MULTIMETER while again keeping the reading below 20 V by use of the exciter output drive control.
- (36) Remove drive. If MULTIMETER continues to read, readjust C223 and repeat procedure beginning with step number 7 (above) until there is no sustained reading when drive is removed.
- (37) Repeat steps 30 through 36 several times until no further adjustments are necessary.

5-4 NEUTRALIZATION

The neutralization procedures for this transmitter are carried out before shipping, and it should not normally be necessary to readjust in the field. Should it be found necessary for example in the event of a tube change, then the following procedure should be adopted.

It should be noted at this point that there are two stages in the PAL-500 which require neutralizing, i.e. the driver stage V202 and the final stage V203 and V204. The driver stage neutralizing is described fully in the section on driver alignment.

a. NEUTRALIZATION OF P.A.

WARNING

BE CERTAIN, THAT THE HIGH VOLTAGE

OVERLOAD BREAKER STAYS IN OFF POSITION THROUGHOUT THE NEUTRALIZATION PROCESS.

- (1) Turn ALDC ADJ. to extreme counter clockwise position.
- (2) Connect AC VTVM to the plates of power amplifiers.
- (3) Set P.A. loading at point No. 0.
- (4) Disconnect lead from C215. (Feed back loop).
- (5) Short H.V. supply across C249 with a length of wire. Turn on transmitter plates switch.
- (6) Apply drive at 32 Mc/s. (Single tone), tuning the driver stages to the peak meter indication in RF DR position. Adjust the drive control to 20 V on multimeter.
- (7) Set PA bandswitch to 24-32 Mc/s. position.
- (8) Tune P.A. tuning to peak indication on RF VTVM.
- (9) Adjust P.A. neutralizing capacitor C214 each time retuning P.A. tuning to the peak until the reading on VTVM is approximately 0.9 volts RMS.
- (10) Apply drive at 16 Mc/s and tune the driver stages to the peak indication in RF DR position. Adjust the drive control till 20 V on multimeter is obtained.
- (11) Set the P.A. band switch to 16-24 Mc/s. position.
- (12) Tune P.A. tuning to the peak indication on RF VTVM; the reading must not exceed 1 V RMS. If more than 1 V RMS, readjust the neutralizing capacitor C214 and recheck at 32 Mc/s.
- (14) Disconnect VTVM and remove drive.
- (15) Turn off the transmitter plates switch.
- (16) Remove short across H.V. supply.
- (17) Connect the feedback cable to C215.

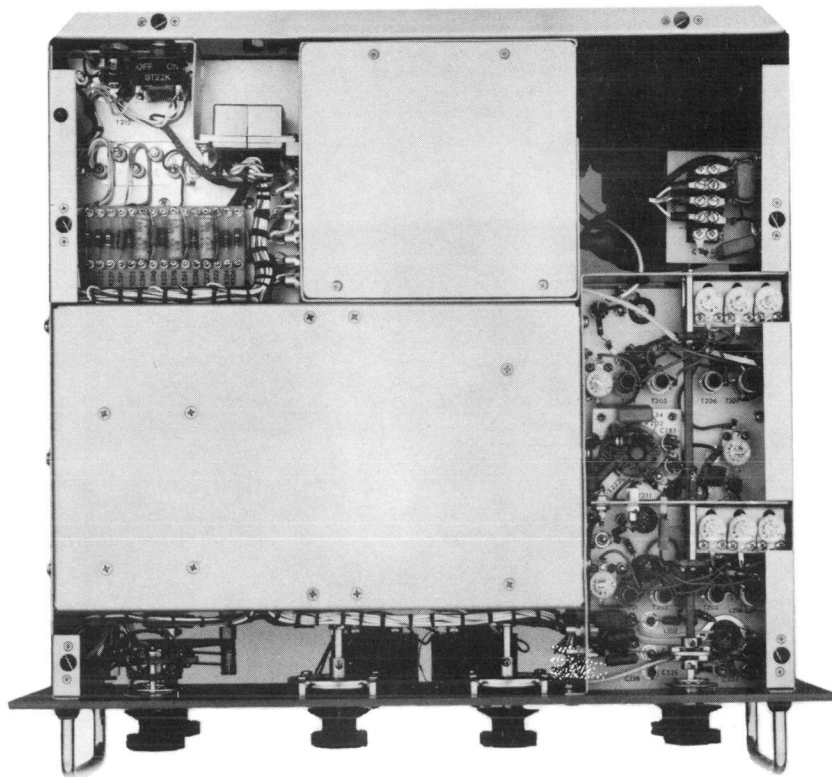
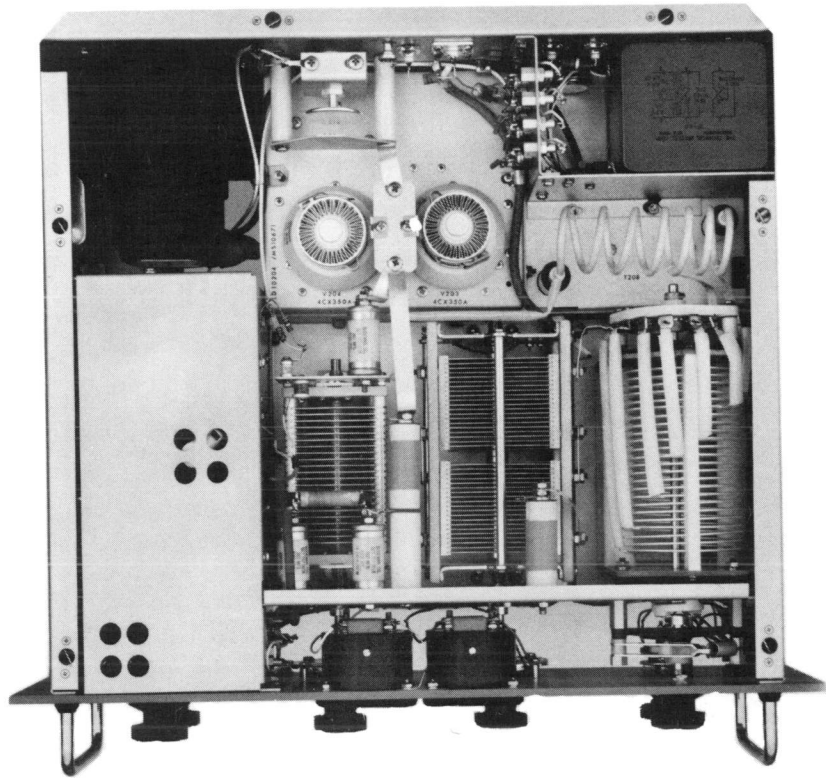


Figure 5-1. Top and Bottom Views RFE-1.

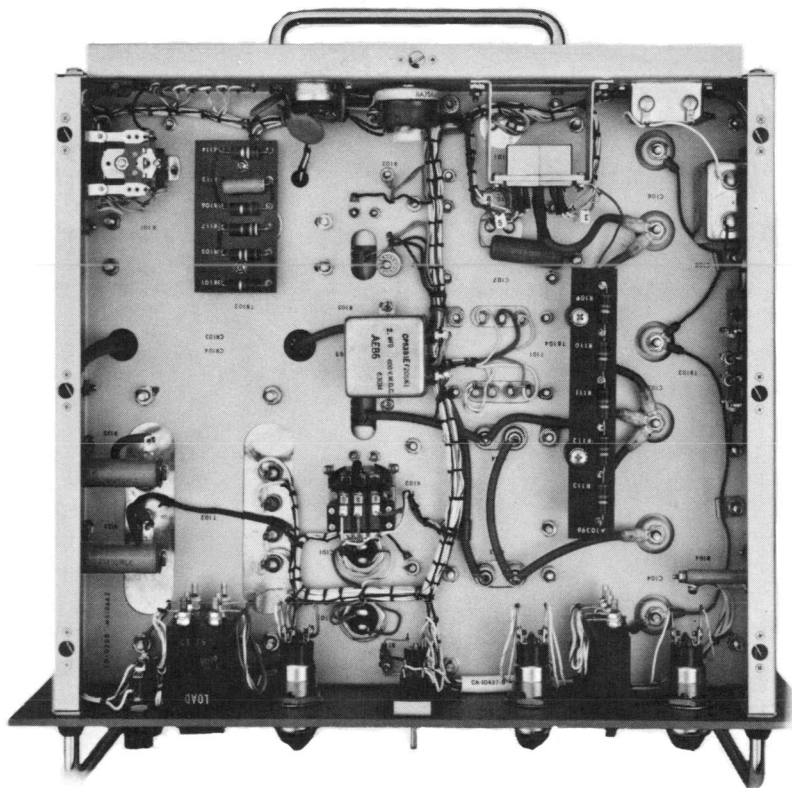
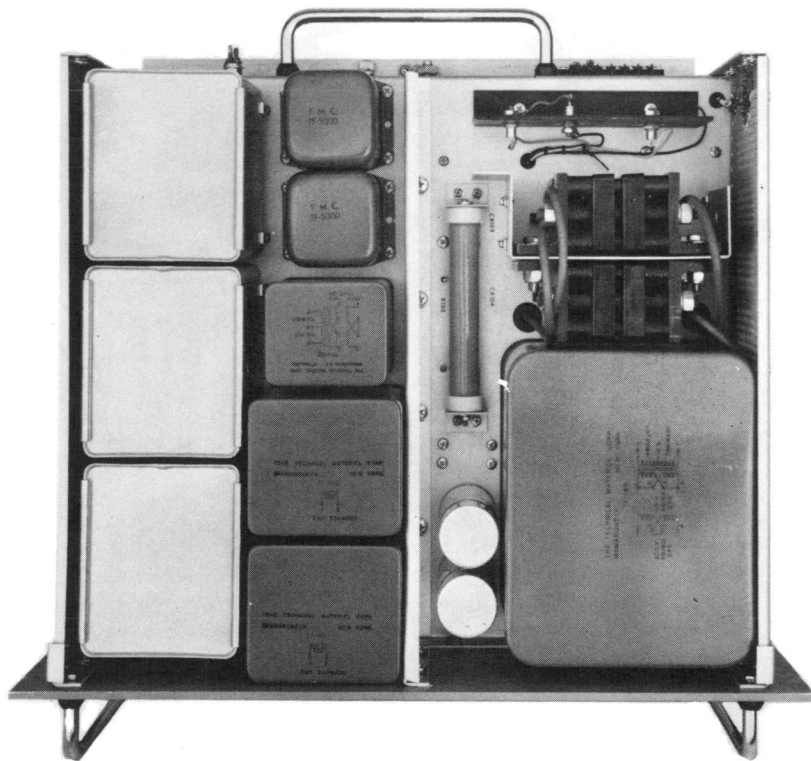


Figure 5-2. Top and Bottom Views PSP-500.

SECTION 6
PARTS LISTS

6-1 PARTS LIST MODEL PSP-500

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
C101	CAPACITOR: fixed, paper 4 uf, 600 VDCW	L.V. Filter	CP41B1FF405K
C102	Same as C101		
C103	CAPACITOR: electrolytic 50 uf, 50 VDCW	Bias Filter	CE63C500G
C104	CAPACITOR: fixed, paper 4 uf, 3000 VDCW	H.V. Filter	CP70E1FL405K
C105	Same as C104		
C106	Same as C104		
C107	CAPACITOR: fixed, 0.1 uf, 600 V.	L.V. Decoupling	CN100-22
C108	CAPACITOR: fixed, paper, 2 uf, 600 V.	L.V. Decoupling	CP53B1EF205K
C109	Same as C108	Screen Supply Decoupling	
C111	CAPACITOR: fixed, disc .05 uf, 600 V.	Line Filter	CC10006
C112	Same as C111		
CB101	CIRCUIT BREAKER: Two Pole, 15/7.5 A.	Main AC Power	SW298
CB102	CIRCUIT BREAKER: Single Pole 100 ma	H.V. Overload	SW215
CR101	RECTIFIER: silicon	L.V. Rectifier	RX10004
CR102	Same as CR101		
CR103	RECTIFIER: High Voltage Stack, 1.5 A, 12 KV PIV	H.V. Rectifier	DD10002
CR104	Same as CR103		
CR105	DIODE: Zener, 150V, 5%, 10 W. Reversed Polarity	Bias Regulator	1N3011RB
CR106	DIODE: Zener, 180V, 5%, 10 W	Screen Regulator	1N3014B
CR107	Same as CR106		
F101	FUSE: Slow Blow, 1/2 A, 250 V.	L.V. Supply Line Fuse (230 VAC)	FU102-.5
F101	FUSE: Slow Blow, 1 A, 250 V.	L.V. Supply Line Fuse (115 VAC)	FU102-1
F101	FUSE: Slow Blow, 1/2 A, 250 V.	Spare	FU102-.5

PARTS LIST MODEL PSP-500

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
F101	FUSE: Slow Blow, 1 A, 250 V.	Spare	FU102-1
DS101	LAMP: Incandescent, D.C. Bayonet, 3 W, 120 V.	Main Line Indicator	FI102-3
DS102	Same as DS101	H.V. On/Off	
DS103	Same as DS101	H.V. Overload	
DS104	LAMP: Neon Glow, miniature, 1/25 W.	P.A. Plates On/ Standby	BI100-51H
J101	RECEPTACLE: Twist Lock, Male	AC Line Input	JJ175
J102	RECEPTACLE: Connector, Female	Interunit Power	JJ158-S
K101	RELAY: Sensitive, 200 mw, 2500 ohms, DPDT	Remote P.A. On/ Off	RL10032
K102	RELAY: Power, 115 VDC, 3 P, NO	Interlock Relay	RL10033
L101	REACTOR: filter, 15 H, 100 ma	L.V. Filter	TF5000
L102	Same as L101		
L103	REACTOR: Filter, 7 H, 300 ma	H.V. Filter	TF190
R101	RESISTOR: fixed, composition, 2200 ohms, 5%, 2 W.	Voltage Dropping Res. K101	RC42GF222J
R102	RESISTOR: fixed, WW 10K ohms, 10 W.	CR101 Series Res.	RW109-34
R103	RESISTOR: fixed, composition, 100K ohms, 5%, 2 W.	L.V. Bleeder	RC42GF104J
R104	RESISTOR: fixed, WW 5000 ohms, 10 W.	DS103 Series Res.	RW109-32
R105	RESISTOR: fixed, WW 80K ohms, 50 W.	Screen Supply Series Resistor	RW105-48
R106	RESISTOR: fixed, composition, 56 ohms, 5%, 2 watt	H.V. Current Meter	RC42GF560J
R107	RESISTOR: fixed, WW, 100K ohms, 20 W.	Screen Supply Bleeder	RW110-43
R109	RESISTOR: fixed, composition, 20 megohms, 5%, 2 watt	H.V. Meter Series	RC42GF206J
R110	Same as R109		

PARTS LIST MODEL PSP-500

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
R111	Same as R109		
R112	Same as R109		
R113	Same as R109		
R114	RESISTOR: fixed, composition, 220K ohms, 5%, 2 watt	H.V. Meter Shunt Resistor	RC42GF224J
R115	RESISTOR: fixed, WW 20 ohms, 5 W.	H.V. Overload Adj. Series Resistor	RW107-11
R116	RESISTOR: variable, WW 100 ohms, 25 W.	H.V. Overload Adjust	RA75AXA101AK25
R117	RESISTOR: fixed, composition, 43 ohms, 5%, 2 watt	Bias Resistor	RC42GF430J
R119	RESISTOR: fixed, composition, 56K ohms, 5%, 1/2 watt	DS104 Ballast Resistor	RC20GF563J
R120	RESISTOR: fixed, WW 50 ohms, 25 W.	Surge Resistor	RW111-7
R121	Same as R120		
R122	RESISTOR: fixed, WW 10 ohms, 3 W.	Surge Resistor	RW123-100J
R123	Same as R122		
S101	SMITCH: Interlock	Top Interlock	SW219
S102	Same as S101	Bottom Interlock	
S103	SWITCH: Toggle DPST	PA Plates Standby/ On	ST22K
T101	TRANSFORMER: Power PRI: 115/230 VAC SEC: 810 VCT, 100 ma	L.V. Transformer	TF10027
T102	TRANSFORMER: Power PRI: 115/230 VAC SEC: 4800 VCT, 300 ma	H.V. Transformer	TF189
XDS101	SOCKET: Lamp, D.C. Bayonet, Green Jewel		TS124-2
XDS102	SOCKET: Lamp, D.C. Bayonet, Red Jewel		TS124-1
XDS103	SOCKET: Lamp, D.C. Bayonet, Yellow Jewel		TS124-6
XDS104	SOCKET: Lamp, Miniature Bayonet, White Jewel		TS10007-9-5
XF101	HOLDER: Fuse		FH103

6-2 PARTS LIST MODEL RFE-1

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
B201	BLOWER: air		BL-100
	FILTER: air		AD102-4
C201	CAPACITOR: trimmer 4-30 uuf	2-4 mc Trimmer	CV-11C300
C202	Same as C201	4-8 mc Trimmer	
C203	Same as C201	16-32 mc Trimmer	
C204	Same as C201	8-16 mc Trimmer	
C205A	CAPACITOR: variable, air, 12.5 — 270 uuf	1st Stage Tuning	CB-139-1
C205B	CAPACITOR: variable, air, 12.5 — 270 uuf	2nd Stage Tuning	CB-139-2
C206	CAPACITOR: fixed, feed thru, 2000 mmf.	R-F Decoupling	CK70AW202M
C207	Same as C201	2-4 mc Trimmer	
C208	Same as C201	4-8 mc Trimmer	
C209	CAPACITOR: button mica, 1000 mmf.	Decoupling	CB21QW102K
C210	Same as C201	16-32 mc Trimmer	
C211	Same as C201	8-16 mc Trimmer	
C212	CAPACITOR: mica, 1600 mmf.	R.F. Inp. Coupling	CM-100-11
C213	CAPACITOR: variable, air, 19-488 uuf.	Output Tune	CB-138-3AN
C215	CAPACITOR: fixed, ceramic HV, 10 mmf	NEG Feedback Coupling	CC-109-6
C216	CAPACITOR, fixed, ceramic HV, 3 mmf	ALDC Coupling	CC-109-2
C217	CAPACITOR: fixed, 2000 mmf	D.C. Blocking	CX102J202M
C218	Same as C209		
C219	CAPACITOR: button mica, 150 mmf	R.F. V/Divider	CB21QW151K
C220	CAPACITOR: mica, 1000 mmf	ALDC Coupling	CM20F102J
C221	Same as 220	R.F. Coupling V202 grid	
C222	CAPACITOR: button mica, 470 mmf	V202 Neut. Circuit	CB21QW471K

PARTS LIST MODEL RFE-1

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
C223	CAPACITOR: trimmer 1.5 — 7 uuf	Driver Neutralizer	CV-11A070
C224	Same as C209	Bias V201 Decoupling	
C225	Same as C206		
C226	Same as C206		
C227	CAPACITOR: Mylar, 0.1 mfd		CN108C1003J
C228	CAPACITOR: mica, .01 mfd	Heater V201 Decoupling	CM35C103J03
C229	Same as C206		
C230	Same as C209	V201 Cathode Decoupling	
C231	CAPACITOR: fixed, electrolytic, 50 mfd		CE63C500G
C232	Same as C220	V202 Plate Coupling	
C233	Same as C209	V202 Cathode Decoupling	
C234	Same as C228	V202 Heater Decoupling	
C235	CAPACITOR: fixed, ceramic, 3 mmf	Meter Coupling	CC21SL030C
C236	Same as C219	R.F. Voltage Div. Grid Metering	
C237	Same as C209	R.F. Decoupling Grid Metering	
C238	Same as C209	R.F. Decoupling Screen Grid PA Metering	
C239	Same as C209	R.F. Decoupling V203 Bias Line	
C240	Same as C220	R.F. Coupling Grid V203	

PARTS LIST MODEL RFE-1

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
C243	Same as C220	R.F. Coupling Grid V203	
C244	Same as C209	R.F. Decoupling V204 Bias Line	
C245	Same as C209	ALDC Decoupling	
C246	Same as C209	ALDC Decoupling	
C247	Same as C217	P.A. B+Decoupling	
C248	Same as C209	R.F. Output Meter Decoupling	
C249	Same as C217	P.A. B+Decoupling	
C250	Same as C209	CR205 Filter	
C251	Same as C228	PA Fils Decoupling	
C252	Same as C206	R.F. Decoupling	
C253	Same as C206	R.F. Decoupling	
C254	Same as C206	R.F. Decoupling	
C255	Same as C206	R.F. Decoupling	
C256	Same as C206	R.F. Decoupling	
C257	Same as C206	R.F. Decoupling	
C258	Same as C206	R.F. Decoupling	
C259	Same as C206	R.F. Decoupling	
C260	Same as C206	R.F. Decoupling	
C261	Same as C206	R.F. Decoupling	
C262	Same as C206	R.F. Decoupling	
C263	Same as C206	R.F. Decoupling	
C264	Same as C206	R.F. Decoupling	
C265	Same as C228	Blower Decoupling	

PARTS LIST MODEL RFE-1

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
C266	Same as C228	Blower Decoupling	
C267	Same as C228	PA Plate Meter Decoupling	
C268	CAPACITOR: paper, 1 mfd.	Blower Running	CP69B1EF105K
C269	Same as C227	Multimeter Cir. Decoupling	
C270	Same as C227	Multimeter Cir. Decoupling	
C271	Same as C228	Multimeter, R.F. Bypass	
C272	Same as C227	Multimeter Circ. Decoupling	
C273	CAPACITOR: fixed, ceramic HV	p/o PA Tank Cct.	CC-109-28
C274	Same as C209	R.F. Monitor Cct.	
C275	CAPACITOR: fixed, ceramic HV, 3 mmf	R.F. Monitor Coupling	CC-109-1
C276A-B	CAPACITOR: variable air, 30-950 uuf	Output Loading	CB-125-A-950X
C277	CAPACITOR: fixed, ceramic HV, 10 mmf	R.F. Outp. Meter Coupling	CC-109-5
C278	Same as C219	R.F. Outp. Meter Circuit	
C279	Same as C206		
C280	Same as C206		
C281	CAPACITOR: mica, 100 mmf.	R.F. Feedback Coupling	CM15F101G03
C282	Same as C220	V201 Plate Coupling	
C283	Same as C209	V202 Screen Decoupling	
C284	Same as C206		
C285	Same as C206		

PARTS LIST MODEL RFE-1

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
CR-201	DIODE: silicon, 1N303	R/F Plate Volts Meter Rectifier	1N-303
CR-202	Same as CR201	ALDC Rectifier	
CR-203	Same as CR201	R/F Outp. Volts Rectifier	
CR-204	DIODE: germanium, 1N67	R/F Grid Volts Meter Rectifier	1N-67
CR-205	Same as CR204	PA Fil. Volts Rectifier	
F201	FUSE: Slow Blow, 1 amp 250V.	T201 Line Fuse (115 VAC)	FU-102-1
F201	FUSE: 1/2 amp. 230V.	T201 Line Fuse (230 VAC)	FU-102-.5
J201	CONNECTOR: receptacle male	Power Cable Interunit	JJ-158-P
J202	CONNECTOR: receptacle, BNC	R/F Input Connector Low	UG625/U
J203	CONNECTOR: receptacle, BNC	R/F Input Connector High	UG625/U
J204	CONNECTOR: receptacle, BNC	R/F Monitor Output	UG625/U
J205	CONNECTOR: receptacle, C	R/F Output	UG568*/U
L201	INDUCTOR: RF, encapsulated, 120 uh	R/F Filtering	CL-10006-6
L202	Same as L201		
L203	Same as L201		
L204	Same as L201		
L205	Same as L201		
L206	INDUCTOR: RF, encapsulated, 680 uh	R/F Filtering	CL-10006-7
L207	COIL: RF, 50 uh		CL-10013
L208	COIL: tunable, 16-32 Mc/s driver	16-32 Driver Coil	CL-10029-1
L209	Same as L201		

PARTS LIST MODEL RFE-1

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
L210	INDUCTOR: RF, encapsulated, 27uh	R/F Filtering	CL-10006-2
L211	Same as L206		
L212	COIL: RF, 50 uh	PA Plate Load	CL-10012
L213	Same as L206		
L214	Same as L210		
L215	Same as L201		
L216	Same as L201		
L217	Same as L201		
L218	Same as L210		
L219	INDUCTOR: RF, encapsulated, 8.5 uh	R/F Filtering	CL-10023-2
L220	Same as L219		
L221	Same as L210		
L222	Same as L206		
L223	Same as L219		
L224	Same as L219		
L225	Same as L210		
L226	INDUCTOR: RF, encapsulated, 1.0 uh	R/F Filtering	CL-10006-3
L227	Same as L206		
L228	Same as L201		
L229	Same as L201		
L230	Same as L201		
L231	Same as L201		
L232	INDUCTOR: RF, encapsulated, 4.5 uh	R/F Filtering	CL-10023-1
L233	Same as L232		
L234	Same as L201		

PARTS LIST MODEL RFE-1

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
L235	Same as L201		
L236	COIL: RF, 185 uh	R/F Filtering	A-1126
L237	Same as L201		
L239	Same as L210		
L240	Same as L210		
L241	Same as L210		
M202	MULTIMETER	Multimeter	MR-10002
M201	METER: 500 ma	PA Plate Current Meter	MR-10003
PS-201	SUPPRESSOR: parasitic		A-1543-2
PS-202	SUPPRESSOR: parasitic		A-1453
PS-203	SUPPRESSOR: parasitic		A-1546-1
PS-204	Same as PS203		
R201	RESISTOR: fixed, composition, 5600 ohm, ± 5%, 1/2 w.		RC20GF562J
R202	RESISTOR: fixed, composition, 2200 ohm, ± 5%, 1/2 w.		RC20GF222J
R203	RESISTOR: fixed, composition, 8200 ohm, ± 5%, 1/2 w.		RC20GF822J
R204	RESISTOR: fixed, composition, 2700 ohm, ± 5%, 1/2 w.		RC20GF272J
R205	Same as R202		
R206	RESISTOR: fixed, composition, 180 ohm, ± 5%, 2 w.		RC42GF181J
R207	RESISTOR: fixed, composition, 47 ohm, ± 5%, 1/2 w.		RC20GF470J
R208	Same as R207		

PARTS LIST MODEL RFE-1

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
R209	RESISTOR: fixed, composition, 33K ohm, ± 5%, 1/2 w.		RC20GF333J
R210	RESISTOR: fixed composition, 220K ohm, ± 5%, 1/2 w.		RC20GF224J
R211	RESISTOR: fixed, composition, 12 ohm, ± 5%, 1/2 w.		RC20GF120J
R212	RESISTOR: fixed, composition, 560 ohm, ± 5%, 1/2 w.		RC42GF561J
R213	RESISTOR: variable, 50,000 ohms	V203 Bias Adj.	RV4LAYS5A503A
R214	RESISTOR: fixed, composition, 22K ohm, ± 5%, 1 w.		RC32GF223J
R215	RESISTOR: fixed, composition, 82K ohm, ± 5%, 1 w.		RC32GF823J
R216	RESISTOR: variable, wirewound	Fil. Adjust	RA75AXAOR5AK25
R217	Same as R215		
R218	RESISTOR: fixed, composition, 220 ohm, ± 5%, 2 w.		RC42GF221J
R219	RESISTOR: fixed, composition, 100 ohm, ± 5%, 2 w.		RC42GF101J
R220	RESISTOR: fixed, composition, 100K ohm, ± 5%, 1/2 w.		RC20GF104J
R221	Same as R213	V204 Bias Adjust	
R222	RESISTOR: fixed, composition, 15 meg ohm, ± 5%, 1/2 w.		RC20GF156J
R223	RESISTOR: fixed, composition, 13000 ohm, ± 5%, 1/2 w.		RC20GF133J
R224	Same as R203		
R225	RESISTOR: fixed, composition, 1.2 meg ohm, ± 5%, 1/2 w.		RC20GF125J
R226	RESISTOR: fixed, composition, 10 ohm, ± 5%, 1/2 w.		RC20GF100J
R227	Same as R202		

PARTS LIST MODEL RFE-1

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
R228	Same as R213		
R229	RESISTOR: fixed, composition, 47K ohm, ± 5%, 1/2 w.		RC20GF473J
R230	RESISTOR: fixed, composition, 750K ohm, ± 5%, 1/2 w.		RC20GF754J
R231	Same as R202		
R232	RESISTOR: fixed, composition, 3300 ohm, ± 5%, 1/2 w.		RC20GF332J
R233	RESISTOR: fixed, composition, 15K ohm, ± 5%, 1 w.		RC32GF153J
R234	Same as R203		
S201A	WAFER: rotary switch, 2 Pole 4 Pos.	Drive Band Sw.	WS-101
S201B	Same as S201A		
S202	SWITCH	PA Bandswitch	SW-218
S203A-B	SWITCH: meter, 2 Pole, 6 Pos.	Multimeter	SW-217
S204	SWITCH: micro	Interlock	SW-219
S205	Same as S204		
S206	SWITCH: Toggle, DPDT.		
T201	COIL: tunable	2-4 mc Driver	CL-10020
T202	COIL: tunable	4-8 mc Driver	CL-10021
T203	COIL: tunable	8-16 mc Driver	CL-10022
T204	Same as T201		
T205	Same as T202		
T206	Same as T203		
T207	COIL: Tunable — tapped	16-32 mc Driver	CL-10029-2
T208	TRANSFORMER: RF, fixed, 16-32 Mc/s	PA Output	TF-10020

PARTS LIST MODEL RFE-1

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
T209	TRANSFORMER: RF, (Part of A-10298)	PA Output	TF-10019
T210	TRANSFORMER: power	Fil. Transformer	TF-180
V201	TUBE 6CL6	1st Amplifier	6CL6
V202	TUBE: driver, 6146	Driver	6146
V203	TUBE: PA 4CX350A	Output Tube	4CX350A
V204	TUBE: PA 4CX350A	Output Tube	4CX350A
XV201	SOCKET: tube, 9 pin	V201 Socket	TS-103-PO1
XV202	SOCKET: tube, octal	V202 Socket	TS-101-PO1
XV203	SOCKET: tube, Air System	V203 Socket	TS-132
XV204	SOCKET: tube, Air System	V204 Socket	TS-132

6-3 PARTS LIST MISCELLANEOUS

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
P101	PLUG: Twist Lock Female	A.C. Line Input	JJ (Part of CA555-3)
P102	CONNECTOR: Plug, Male	Interunit Power	PL160-P (Part of CA10136)
P201	CONNECTOR: Plug, Female	Interunit Power	PL160-5 (Part of CA10136)
P202	CONNECTOR: Plug, BNC	RF Input	UG88*/U
P203	Same as P202		
P204	Same as P202	Monitor Output	
P205	CONNECTOR: Plug	Output	UG573*/U
W101	CABLE: Power		CA555-3
W102	CABLE:	Interunit Power	CA10136-110

DRIVER BAND SWITCH
S 201 - A, B

POS.	BAND (Mcs)
1	2-4
2	4-8
3	8-16
4	16-32

UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ARE IN OHMS, 1/2 WATT.
ALL CAPACITORS ARE IN μ F.
ALL COILS & TRANSFORMERS ARE IN μ H.

CHANGES NECESSARY TO CONVERT TO
230 V OPERATION.

F201 CHANGED FROM 1AMP TO 1/2 AMP.
T201 REMOVE JUMPERS MARKED
CONNECT A JUMPER BETWEEN
TERMINALS 2 & 3.

* C241 & C242 ARE INTEGRAL PARTS
OF V203 & V204 SOCKETS.

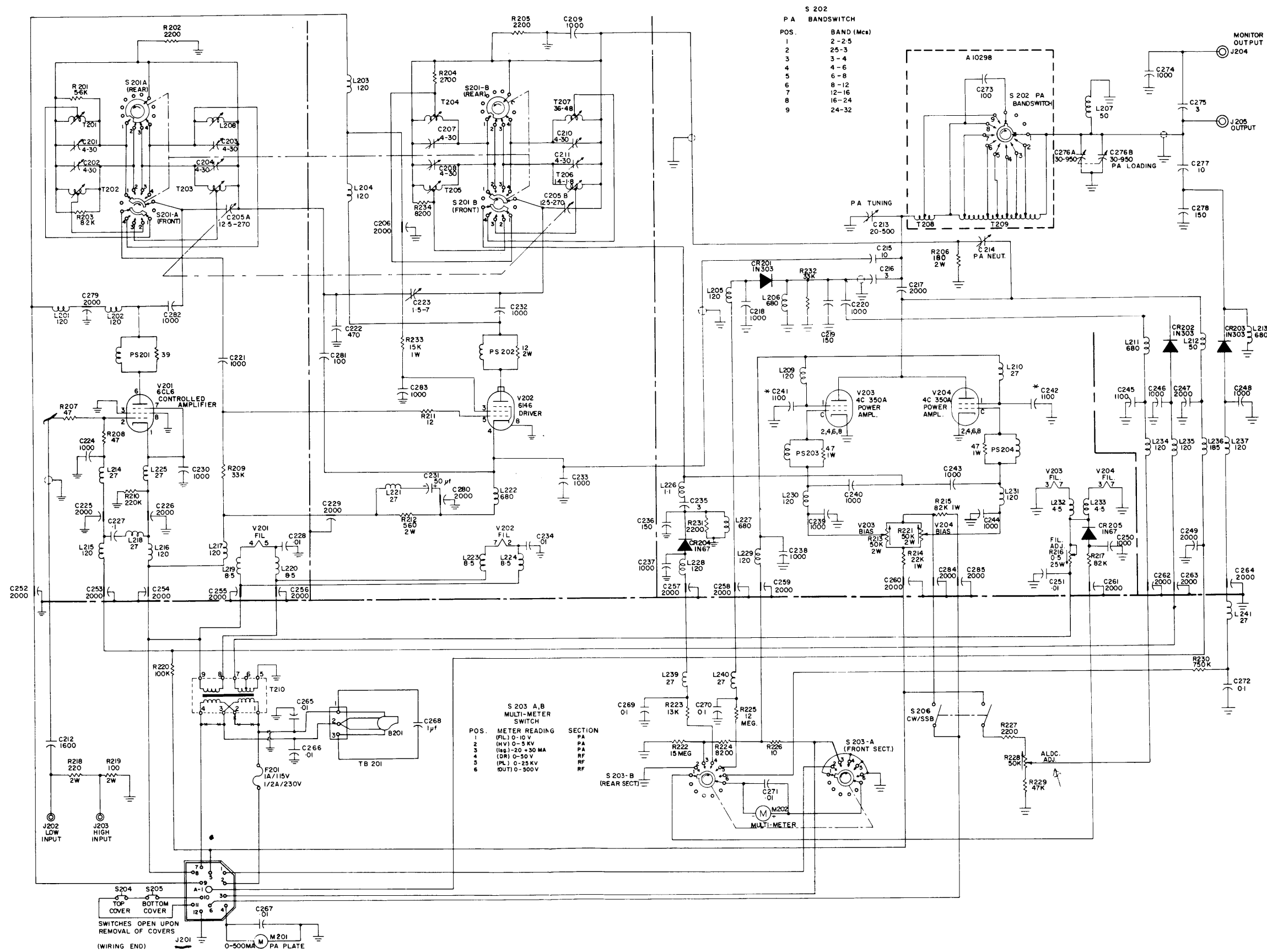


Figure 7-1. Schematic Diagram Model RFE-1.

DRIVER BAND SWITCH
S 201 - A, B

POS.	BAND (Mc)
1	2-4
2	4-8
3	8-16
4	16-32

UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ARE IN OHMS, 1/2 WATT.
ALL CAPACITORS ARE IN μ F.
ALL COILS & TRANSFORMERS ARE IN μ H.

CHANGES NECESSARY TO CONVERT TO
250 V OPERATION.

F201 CHANGED FROM 1AMP TO 1/2 AMP.
T201 REMOVE JUMPERS MARKED \rightarrow
& CONNECT A JUMPER BETWEEN
TERMINALS 2 & 3.

* C 241 & C 242 ARE INTEGRAL PARTS
OF V 203 & V 204 SOCKETS.

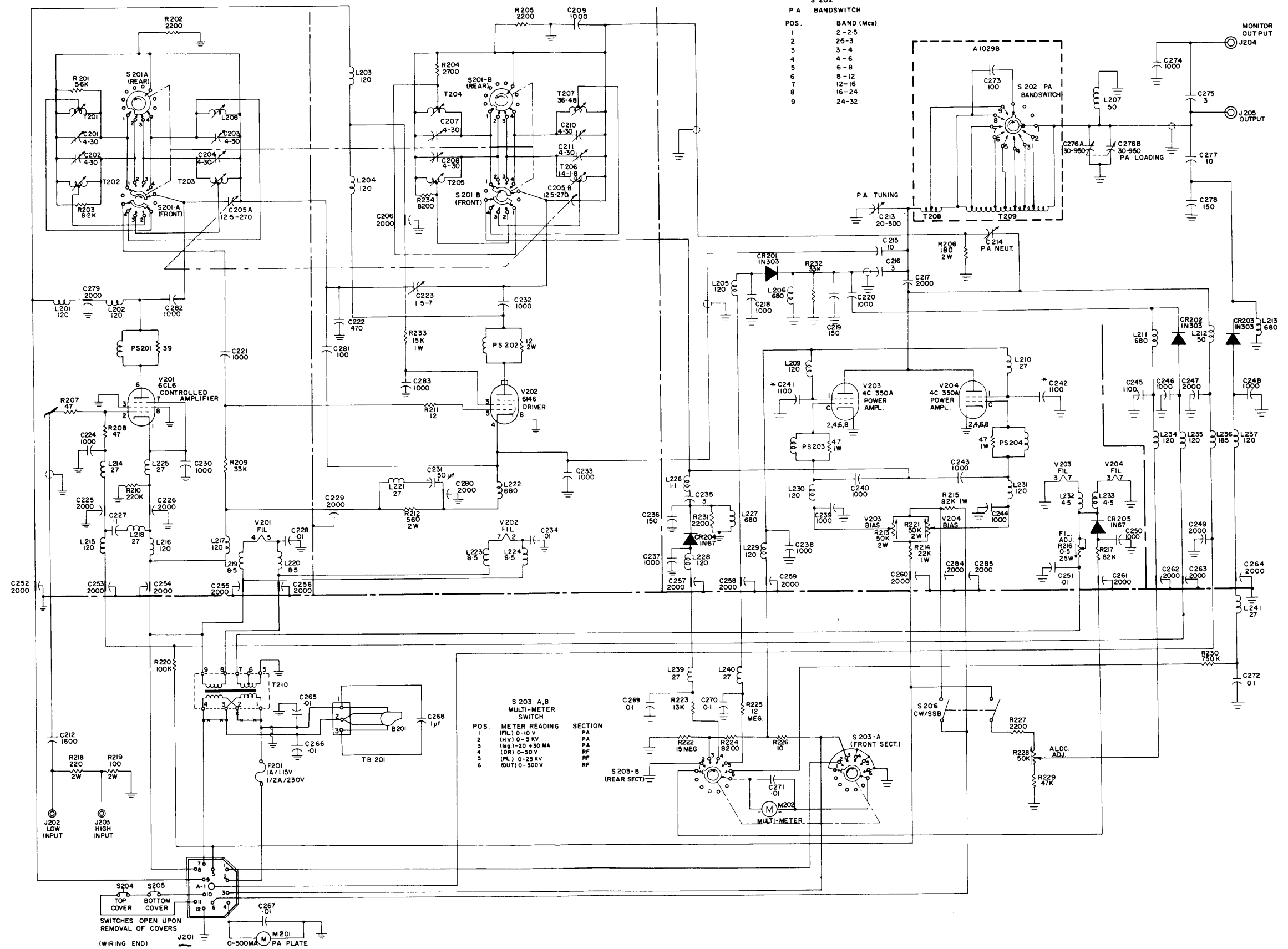
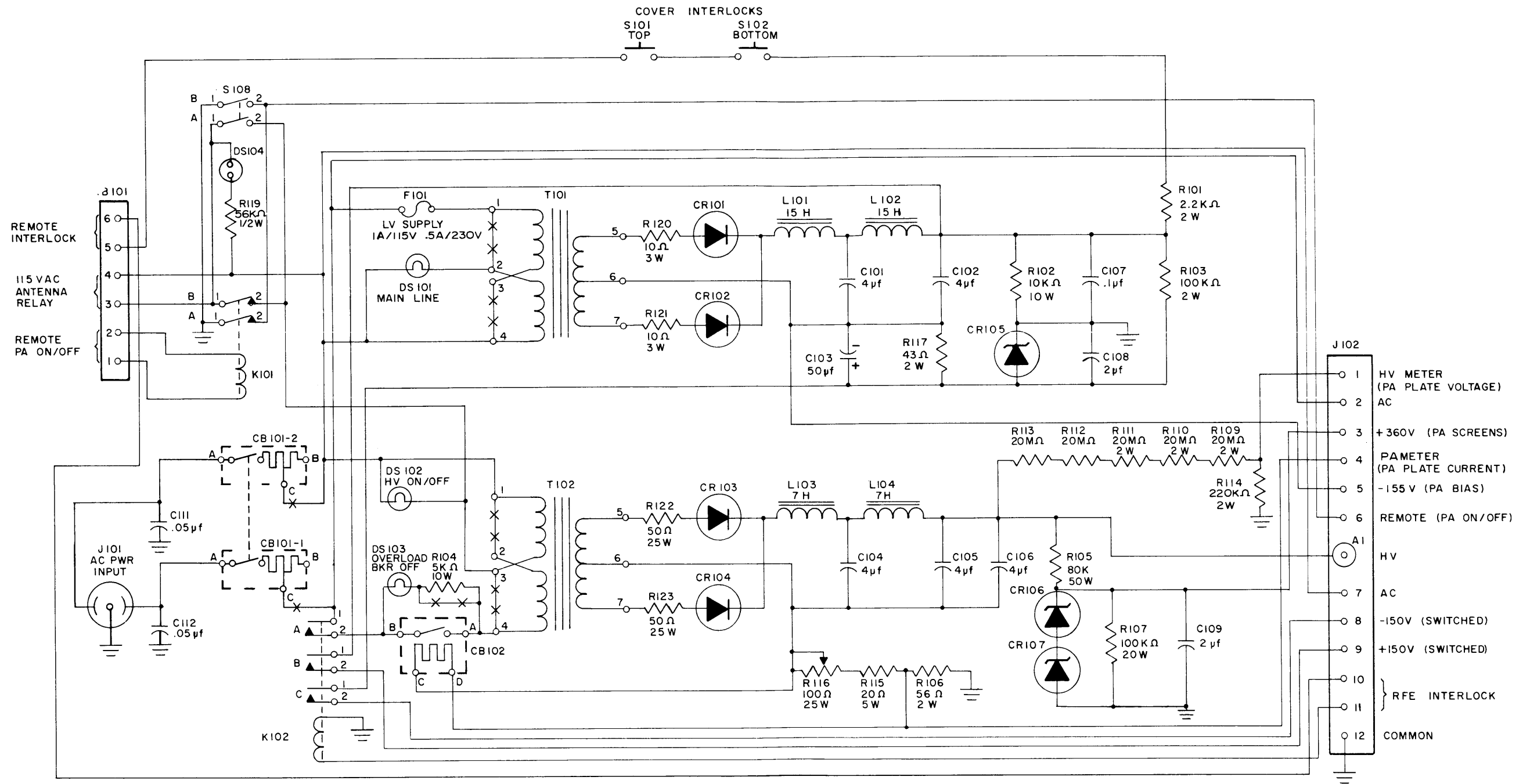


Figure 7-2. Schematic Diagram Model RFE-1 (Working Copy)



CHANGES NECESSARY TO CONVERT TO 230V OPERATION

T101 REMOVE JUMPERS MARKED ~~***~~ AND CONNECT JUMPERS BETWEEN TERMINALS 2 & 3.

T102 SAME AS T101.

CB101 REMOVE LEADS FROM TERM "c" AND CONNECT TO TERM "B". (MARKED ~~✗~~)

R104 REMOVE AND DISCARD JUMPER MARKED ~~✗✗~~.

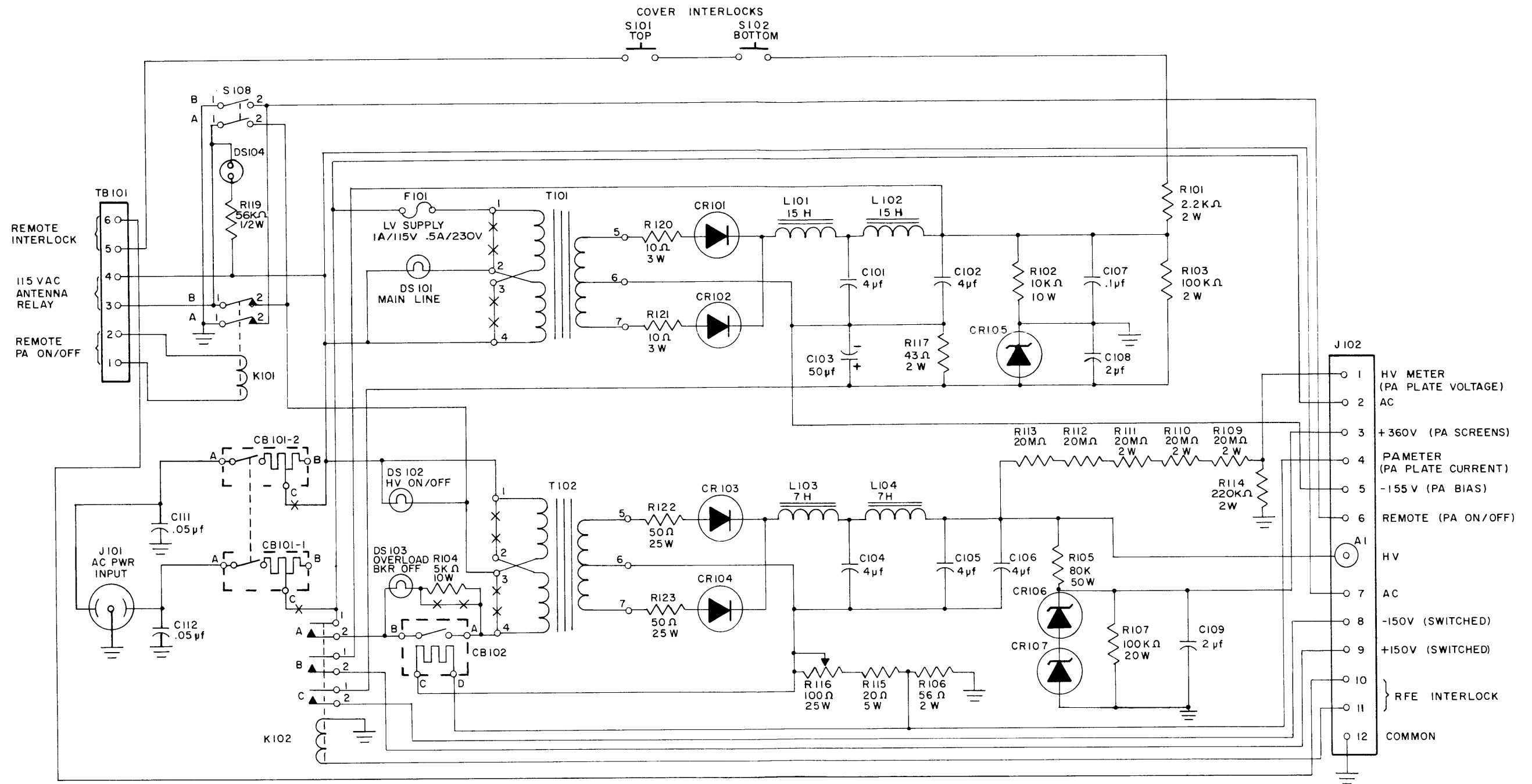
F101 CHANGE FROM 1AMP TO 1/2 AMP.

NOTES

1- ALL FUSES ARE SLOW BLOW.

2- TB101 TERMINALS 5 & 6 NORMALLY JUMPED UNLESS REMOTE INTERLOCK IS REQUIRED.

Figure 7-3. Schematic Diagram Model PSP-500



CHANGES NECESSARY TO CONVERT TO 230V OPERATION

- T101 REMOVE JUMPERS MARKED ~~***~~ AND CONNECT JUMPERS BETWEEN TERMINALS 2 & 3.
- T102 SAME AS T101.
- CB101 REMOVE LEADS FROM TERM "C" AND CONNECT TO TERM "B". (MARKED ~~→~~)
- R104 REMOVE AND DISCARD JUMPER MARKED ~~→~~.
- F101 CHANGE FROM 1AMP TO 1/2 AMP.

NOTES

- 1- ALL FUSES ARE SLOW BLOW.
- 2- TB101 TERMINALS 5 & 6 NORMALLY JUMPED UNLESS REMOTE INTERLOCK IS REQUIRED.

Figure 7-4. Schematic Diagram Model PSP-500 (Working Copy)